Development of the Next Generation Air Quality Models for Outer Continental Shelf (OCS) Applications

Final Report: Volume 3
CALPUFF Users Guide

(CALPUFF and Postprocessors)

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Contents

F. CALPUFF MODEL FILES

The CALPUFF model obtains information about sources, receptors, meteorological data, geophysical data, and model control parameters from a series of input files. These files are listed in Table A-4. The model creates several output files, which are listed in Table A-6. Detailed information on the structure and content of each of the input and output files is provided in this section.

Tables A-4 and A-6 show the Fortran unit numbers associated with each file. These unit numbers are specified in the parameter file (PARAMS.PUF). They can be easily modified to accommodate system-dependent restrictions on allowable unit numbers. Any changes to variables in the parameter file are automatically modified throughout the CALPUFF Fortran code. The code must be re-compiled for changes in the parameter file to take effect, since the parameter values are set at the program compilation stage rather than at program execution.

The name and full path of each CALPUFF file (except one) is assigned in the control file (CALPUFF.INP). The exception, the control filename itself, is assigned on the command line. For example, on a DOS system,

```
CALPUFF   d:\CALPUFF\CALPUFF.INP
```

will execute the CALPUFF code (CALPUFF.EXE), and read the input and output filenames for the current run from the file CALPUFF.INP in the directory d:\CALPUFF. If the control filename is not specified on the command line, the default control filename (i.e., CALPUFF.INP in the current working directory) will be used. The path and filename can be up to 70 characters long.

The utility routine that delivers a command line argument is system dependent. The function that provides the system clock time and system CPU time are also system or compiler-specific. All system-dependent or compiler-specific routines in CALPUFF are isolated into a file called DATETM.xxx, where the file extension (.xxx) indicates the system for which the code is designed. For example, DATETM.HP contains code for Hewlett-Packard Unix systems, DATETM.SUN is for Sun Unix systems, DATETM.LAH is for Lahey-compiled PC-applications, and DATETM.MS is for Microsoft-compiled PC applications. By appending the correct system-dependent DATETM file onto the main CALPUFF code, the code should run without any modifications.

F.1 User Control File (CALPUFF.INP)

The selection and control of CALPUFF options are determined by user-specified inputs contained in a file called the control file. This file, which has the default name CALPUFF.INP, contains all of the information necessary to define a model run (e.g., starting date, run length, grid specifications, technical options, output options, etc.). CALPUFF.INP may be created/edited directly using a conventional editor, or it may be created/edited indirectly by means of the PC-based, Windows-compatible Graphical User Interface (GUI) developed for CALPUFF.

The CALPUFF GUI not only prepares the control file, it also executes the model and facilitates file management functions; and it contains an extensive help system that makes much of the information in this manual available to the user on-line. When using the GUI, the source data and receptor information required for a CALPUFF run can be entered through the edit screens or read from external ASCII files (spreadsheet-compatible). Each source type (points, areas, volumes, and lines) contains an external ASCII file format description and sample file in the help system.

Although the model can be set up and run entirely within the GUI system, the interface is designed to always create the ASCII CALPUFF.INP file. This allows runs to be set up on PC-based systems and the control file transferred to a workstation or a mainframe computer for computationally intensive applications. The ASCII CALPUFF.INP file should be directly transportable to virtually any non-PC system.

When CALPUFF is setup and run entirely on a non-PC system, or if the GUI is not used on a PC, the control file CALPUFF.INP may be configured by using a conventional editor. This is facilitated by the extensive self-documenting statements contained in the standard file. As explained further below, more comments can be readily added by the user to document specific parameter choices used in the run. These comments remain in the file, and are reported to the CALPUFF list file when CALPUFF is executed from the command line. Note, however, that the GUI always writes the standard comments to CALPUFF.INP, and ignores any additional text. Furthermore, the control file is always updated by the GUI, even if the GUI is only used to run CALPUFF without altering the technical content of the control file. Thus, the user must save the control file to another filename prior to using the GUI if non-standard comments are to be saved. This feature of the GUI can be used to create a new copy of the standard control file by merely saving a "new file" to disk, so a fresh version of the control file is always available.

The control file is organized into 18 major Input Groups and a variable number of subgroups within several of the major Input Groups. The first three lines of the input file consist of a run title. As shown in Table F-1, the major Input Groups are defined along functional lines (e.g., technical options, output options, subgrid scale, complex terrain inputs, etc.). Each subgroup contains a set of data such as source variables, subgrid scale hill descriptions, or discrete receptor information. The number of subgroups varies with the number of sources, hills, etc., in the model run.

A sample control file is shown in Table F-2. The control file is read by a set of Fortran text processing routines contained within CALPUFF which allow the user considerable flexibility in designing and customizing the input file. An unlimited amount of optional descriptive text can be inserted within the control file to make it self-documenting. For example, the definition, allowed values, units, and default value of each input variable can be included within the control file.

The control file processor searches for pairs of special delimiter characters (!). All text outside the delimiters is assumed to be optional documentation and is echoed back but otherwise ignored by the input module. Only data within the delimiter characters is processed. The input data consists of a leading delimiter followed by the variable name, equals sign, input value or values, and a terminating delimiter (e.g., !XX = 12.5 !). The variable name can be lower or upper case, or a mixture of both (i.e., XX, xx, Xx

are all equivalent). The variable type can be real, integer, logical, or character and it can be an array or a scalar. The use of repetition factors for arrays is allowed (e.g., ! XARRAY = 3 * 1.5 ! instead of ! XARRAY = 1.5, 1.5, 1.5 !). Different values must be separated by commas. Spaces within the delimiter pair are ignored. Exponential notation (E format) for real numbers is allowed. However, the optional plus sign should be omitted (e.g., enter +1.5E+10 as 1.5E10). The data may be extended over more than one line (except for character variables, which must be entirely on one line). The line being continued must end with a comma. Each leading delimiter must be paired with a terminating delimiter. All text between the delimiters is assumed to be data, so no optional documentation is allowed to appear within the delimiters. The inclusion in the control file of any variable that is being assigned its default value is optional. The control file reader expects that logical variables will be assigned using only a one character representation (i.e., 'T' or 'F').

The major Input Groups must appear in order, i.e., Input Group 0 followed by Input Group 1 followed by Input Group 2, etc. However, the variables within an Input Group may appear in any order. The variable names in each Input Group are independent, so that the same name can be repeated in different Input Groups (e.g., as shown in the sample control file, species names (SO2, SO4) are used in several Input Groups). Each Input Group and subgroup must end with an Input Group terminator consisting of the word END between two delimiters (i.e., !END!). Every major Input Group, even blank Input Groups (i.e., one in which no variables are included) must end with an Input Group terminator in order to signal the end of that Input Group and the beginning of another.

The control file module has a list of variable names and array dimensions for each Input Group. Checks are performed to ensure that the proper variable names are used in each Input Group, and that no array dimensions are exceeded. Error messages result if an unrecognized variable name is encountered or too many values are entered for a variable.

As an example, the first group (Group 0) identifies all of the I/O files to be used in the run, except for the control file which is specified on the command line. Each CALPUFF input and output file has a default name and path (i.e., the current working directory). If the filename is not specified, the default name will be assumed. Each filename must be less than or equal to 70 characters long.

All text except that between the delimiters (i.e., ! characters) is treated as optional documentation, and is ignored by the input module. Between the delimiters, the character filename variables (e.g., METDAT, PUFLST, CONDAT, etc.) must be entered as shown in the sample file. The control file reader is case insensitive. The filename is placed between the equals sign and the right delimiter character (!). Files that are not used or are not to be changed from their default names can be omitted from the I/O file.

For example, by replacing the delimiter characters ("!"s) with "*"s, the line becomes a comment, and will not be interpreted by the program as data:

! CONDAT = conc.dat	!	- this line sets the file name of the output concentration file
* CONDAT = conc.old	*	- this line is a comment that does nothing
* PUFLST =	*	- this line is OK (interpreted as a comment)
! PUFLST =	!	- this is not OK (delimiters present, so file must be specified)

Blanks within the delimiters are ignored, and all delimiters must appear in pairs. If the optional CALPUFF GUI is being used, the control file will automatically be correctly formatted and written to disk for use by CALPUFF.

Table F-1
Input Groups in the CALPUFF Control File

Input Group	Description
*	Run title First three lines of control file (up to 80 characters/line)
0	Input and Output filenames
1	General run control parameters Starting date and hour, run length, time step. Number of species. Model restart configuration for making a series of continuation runs. Meteorological data format and averaging time adjustment.
2	Technical options Control variables determining methods for treating chemistry, wet deposition, dry deposition, dispersion, plume rise, complex terrain, and near-field puff sampling methods
3a,b	Species list Species names, flags for determining which species are modeled, advected, emitted, and dry deposited
4	Grid control parameters Specification of meteorological, computational, and sampling grids, number of cells, vertical layers, and reference coordinates.
5	Output options Printer control variables, disk output control variables
6a,b,c	Subgrid scale complex terrain (CTSG) inputs Information describing subgrid scale hill location, shape and height. Complex terrain receptor locations and elevations.
7	Dry deposition parameters - Gases Pollutant diffusivity, dissociation constant, reactivity, mesophyll resistance, Henry's law coefficient

Table F-1 (Concluded)
Input Groups in the CALPUFF Control File

Input Group	Description
8	Dry deposition parameters - Particles Geometric mass mean diameter, geometric standard deviation
9	Miscellaneous dry deposition parameters Reference cuticle and ground resistances, reference pollutant reactivity, vegetation state
10	Wet deposition parameters Scavenging coefficients for each pollutant and precipitation type (liquid and frozen precipitation)
11	Chemistry parameters Control variables for input of ozone data, background ozone and ammonia concentrations, nighttime transformation rates
12	Miscellaneous dispersion parameters and computational parameters Vertical dispersion constants, dispersion rate above the boundary layer, crossover distance to time-dependent dispersion coefficients, land use associated with urban dispersion, site characterization parameters for single-point meteorological data files, sampling constraints, puff-splitting controls, plume path coefficients, wind speed power-law exponents, default temperature gradients and wind speed classes
13a,b,c,d	Point source parameters Point source data including source location, elevation, stack parameters, emissions, units, building dimensions, variable emissions cycle
14a,b,c,d	Area source parameters Area source data including source location, effective height, elevation, initial sigmas, emissions, units, variable emissions cycle
15a,b,c	Line source parameters Buoyant line source data including source location, elevation, line length, buoyancy parameters, release height, emissions, units, variable emissions cycle
16a,b,c	Volume source parameters Volume source data including source location, elevation, effective height, initial size data, emissions, units, variable emissions cycle
17a,b	Non-gridded (discrete) receptor information Receptor coordinates and ground elevation

Table F-2

Sample CALPUFF Control File (CALPUFF.INP)

Input Group 0

```
CALPUFF Example
40 x 40 meteorological grid
All source types represented;  CTSG hill
--------------- Run title (3 lines) ------------------------------------------

                   CALPUFF MODEL CONTROL FILE
                   --------------------------

------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names

--------------
Default Name  Type          File Name
------------  ----          ---------
CALMET.DAT    input    ! METDAT =CALMET.DAT   !
    or
ISCMET.DAT    input    * ISCDAT =             *
    or
PLMMET.DAT    input    * PLMDAT =             *
    or
PROFILE.DAT   input    * PRFDAT =             *
SURFACE.DAT   input    * SFCDAT =             *
RESTARTB.DAT  input    * RSTARTB=             *
------------------------------------------------------------------------------
CALPUFF.LST   output   ! PUFLST =CALPUFF2.LST  !
CONC.DAT      output   ! CONDAT =CONC2.DAT     !
DFLX.DAT      output   ! DFDAT  =DFLX2.DAT     !
WFLX.DAT      output   * WFDAT  =             *

VISB.DAT      output   * VISDAT =             *
TK2D.DAT      output   * T2DDAT =             *
RHO2D.DAT     output   * RHODAT =             *
RESTARTE.DAT  output   * RSTARTE=             *
------------------------------------------------------------------------------
Emission Files
--------------
PTEMARB.DAT   input    * PTDAT  =             *
VOLEMARB.DAT  input    * VOLDAT =             *
BAEMARB.DAT   input    * ARDAT  =             *
LNEMARB.DAT   input    * LNDAT  =             *
------------------------------------------------------------------------------
Other Files
-----------
OZONE.DAT     input    * OZDAT  =             *
VD.DAT        input    * VDDAT  =             *
CHEM.DAT      input    * CHEMDAT=             *
H2O2.DAT      input    * H2O2DAT=             *
HILL.DAT      input    * HILDAT=              *
HILLRCT.DAT   input    * RCTDAT=              *
COASTLN.DAT   input    * CSTDAT=              *
FLUXBDY.DAT   input    * BDYDAT=              *
BCON.DAT      input    * BCNDAT=              *
DEBUG.DAT     output   * DEBUG =              *
MASSFLX.DAT   output   * FLXDAT=              *
MASSBAL.DAT   output   * BALDAT=              *
FOG.DAT       output   * FOGDAT=              *
------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = F !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 70 characters in length
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 0

```
Provision for multiple input files
----------------------------------

     Number of CALMET.DAT files for run (NMETDAT)
                                   Default: 1       ! NMETDAT =   1   !

     Number of PTEMARB.DAT files for run (NPTDAT)
                                   Default: 0       ! NPTDAT =  0  !

     Number of BAEMARB.DAT files for run (NARDAT)
                                   Default: 0       ! NARDAT =  0  !

     Number of VOLEMARB.DAT files for run (NVOLDAT)
                                   Default: 0       ! NVOLDAT =  0  !
!END!

-------------
Subgroup (0a)
-------------

  The following CALMET.DAT filenames are processed in sequence if NMETDAT>1

Default Name  Type          File Name
------------  ----          ---------
 none         input     * METDAT =..\testing\CALMET1.DAT *   *END*
 none         input     * METDAT =CALMET2.DAT            *   *END*


-------------
Subgroup (0b)
-------------

  The following PTEMARB.DAT filenames are processed if NPTDAT>0
  (Any PTEMARB.DAT name provided above is replaced)

Default Name  Type          File Name
------------  ----          ---------
 none         input     * PTDAT =..\testing\PT1.DAT *   *END*
 none         input     * PTDAT = PT2.DAT           *   *END*

-------------
Subgroup (0c)
-------------

  The following BAEMARB.DAT filenames are processed if NARDAT>0
  (Any BAEMARB.DAT name provided above is replaced)

Default Name  Type          File Name
------------  ----          ---------
 none         input     * ARDAT =..\testing\BA1.DAT *   *END*
 none         input     * ARDAT = BA2.DAT           *   *END*

-------------
Subgroup (0d)
-------------

  The following VOLEMARB.DAT filenames are processed if NVOLDAT>0
  (Any VOLEMARB.DAT name provided above is replaced)

Default Name  Type          File Name
------------  ----          ---------
 none         input     * VOLDAT =..\testing\VOL1.DAT *   *END*
 none         input     * VOLDAT = VOL2.DAT           *   *END*
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 1

```
------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

    Option to run all periods found
    in the met. file     (METRUN)   Default: 0       ! METRUN =   0  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in met. file

     Starting date:   Year (IBYR) -- No default       ! IBYR =  1994  !
     (used only if   Month (IBMO) -- No default       ! IBMO =  11  !
      METRUN = 0)      Day (IBDY) -- No default       ! IBDY =  1  !
                      Hour (IBHR) -- No default       ! IBHR =  10  !

     Base time zone        (XBTZ) -- No default       ! XBTZ   = 5. !
        PST = 8., MST = 7.
        CST = 6., EST = 5.

     Length of run (hours) (IRLG) -- No default       ! IRLG =  2  !

     Number of chemical species (NSPEC)
                                  Default: 5       ! NSPEC =  8   !

     Number of chemical species
     to be emitted  (NSE)         Default: 3       ! NSE =  7   !

     Flag to stop run after
     SETUP phase (ITEST)          Default: 2       ! ITEST =  2   !
     (Used to allow checking
     of the model inputs, files, etc.)
           ITEST = 1 - STOPS program after SETUP phase
           ITEST = 2 - Continues with execution of program
                       after SETUP

     Restart Configuration:

        Control flag (MRESTART)   Default: 0       ! MRESTART =  0   !

           0 = Do not read or write a restart file
           1 = Read a restart file at the beginning of
               the run
           2 = Write a restart file during run
           3 = Read a restart file at beginning of run
               and write a restart file during run

        Number of periods in Restart
        output cycle (NRESPD)     Default: 0       ! NRESPD =  0   !

           0 = File written only at last period
          >0 = File updated every NRESPD periods

     Meteorological Data Format (METFM)
                                  Default: 1       ! METFM =  1   !

           METFM = 1 - CALMET binary file (CALMET.MET)
           METFM = 2 - ISC ASCII file (ISCMET.MET)
           METFM = 3 - AUSPLUME ASCII file (PLMMET.MET)
           METFM = 4 - CTDM plus tower file (PROFILE.DAT) and
                       surface parameters file (SURFACE.DAT)

     Meteorological Profile Data Format (MPRFFM)
            (used only for METFM = 1, 2, 3)
                                  Default: 1       ! MPRFFM =  1   !

           MPRFFM = 1 - CTDM plus tower file (PROFILE.DAT)
           MPRFFM = 2 - AERMET tower file (PROFILE.DAT)

     PG sigma-y is adjusted by the factor (AVET/PGTIME)**0.2
     Averaging Time (minutes) (AVET)
                                  Default: 60.0    ! AVET = 60. !
     PG Averaging Time (minutes) (PGTIME)
                                  Default: 60.0    ! PGTIME = 60. !


!END!
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 2

```
------------------------------------------------------------------------------

INPUT GROUP: 2 -- Technical options
--------------

     Vertical distribution used in the
     near field (MGAUSS)                  Default: 1     ! MGAUSS =  1   !
        0 = uniform
        1 = Gaussian

     Terrain adjustment method
     (MCTADJ)                             Default: 3     ! MCTADJ =  0   !
        0 = no adjustment
        1 = ISC-type of terrain adjustment
        2 = simple, CALPUFF-type of terrain
            adjustment
        3 = partial plume path adjustment

     Subgrid-scale complex terrain
     flag (MCTSG)                         Default: 0     ! MCTSG =  1   !
        0 = not modeled
        1 = modeled

     Near-field puffs modeled as
     elongated 0 (MSLUG)                  Default: 0     ! MSLUG =  1   !
        0 = no
        1 = yes (slug model used)

     Transitional plume rise modeled ?
     (MTRANS)                             Default: 1     ! MTRANS =  0   !
        0 = no  (i.e., final rise only)
        1 = yes (i.e., transitional rise computed)

     Stack tip downwash? (MTIP)           Default: 1     ! MTIP =  0  !
        0 = no  (i.e., no stack tip downwash)
        1 = yes (i.e., use stack tip downwash)

     Method used to simulate building
     downwash? (MBDW)                     Default: 1     ! MBDW =  1   !
        1 = ISC method
        2 = PRIME method

     Vertical wind shear modeled above
     stack top? (MSHEAR)                  Default: 0     ! MSHEAR =  0  !
        0 = no  (i.e., vertical wind shear not modeled)
        1 = yes (i.e., vertical wind shear modeled)

     Puff splitting allowed? (MSPLIT)     Default: 0     ! MSPLIT =  0  !
        0 = no (i.e., puffs not split)
        1 = yes (i.e., puffs are split)

     Chemical mechanism flag (MCHEM)      Default: 1     ! MCHEM =  0   !
        0 = chemical transformation not
            modeled
        1 = transformation rates computed
            internally (MESOPUFF II scheme)
        2 = user-specified transformation
            rates used
        3 = transformation rates computed
            internally (RIVAD/ARM3 scheme)
        4 = secondary organic aerosol formation
            computed (MESOPUFF II scheme for OH)

     Aqueous phase transformation flag (MAQCHEM)
     (Used only if MCHEM = 1, or 3)       Default: 0     ! MAQCHEM =  0   !
        0 = aqueous phase transformation
            not modeled
        1 = transformation rates adjusted
            for aqueous phase reactions

     Wet removal modeled ? (MWET)         Default: 1     ! MWET =  1   !
        0 = no
        1 = yes

     Dry deposition modeled ? (MDRY)      Default: 1     ! MDRY =  1   !
        0 = no
        1 = yes
        (dry deposition method specified
         for each species in Input Group 3)
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 2

```
Method used to compute dispersion
coefficients (MDISP)                  Default: 3     ! MDISP =  3   !

   1 = dispersion coefficients computed from measured values
       of turbulence, sigma v, sigma w
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.
   5 = CTDM sigmas used for stable and neutral conditions.
       For unstable conditions, sigmas are computed as in
       MDISP = 3, described above.  MDISP = 5 assumes that
       measured values are read

Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)
(Used only if MDISP = 1 or 5)         Default: 3     ! MTURBVW =  3  !
   1 = use sigma-v or sigma-theta measurements
       from PROFILE.DAT to compute sigma-y
       (valid for METFM = 1, 2, 3, 4)
   2 = use sigma-w measurements
       from PROFILE.DAT to compute sigma-z
       (valid for METFM = 1, 2, 3, 4)
   3 = use both sigma-(v/theta) and sigma-w
       from PROFILE.DAT to compute sigma-y and sigma-z
       (valid for METFM = 1, 2, 3, 4)
   4 = use sigma-theta measurements
       from PLMMET.DAT to compute sigma-y
       (valid only if METFM = 3)

Back-up method used to compute dispersion
when measured turbulence data are
missing (MDISP2)                      Default: 3     ! MDISP2 =  4  !
(used only if MDISP = 1 or 5)
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.

[DIAGNOSTIC FEATURE]
Method used for Lagrangian timescale for Sigma-y
(used only if MDISP=1,2 or MDISP2=1,2)
(MTAULY)                              Default: 0     ! MTAULY =  0   !
   0 = Draxler default 617.284 (s)
   1 = Computed as Lag. Length / (.75 q) -- after SCIPUFF
  10 < Direct user input (s)             -- e.g., 306.9

Method used for Advective-Decay timescale for Turbulence
(used only if MDISP=2 or MDISP2=2)
(MTAUADV)                             Default: 0     ! MTAUADV =  0   !
   0 = No turbulence advection
   1 = Computed (OPTION NOT IMPLEMENTED)
  10 < Direct user input (s)   -- e.g., 800

Method used to compute turbulence sigma-v &
sigma-w using micrometeorological variables
(Used only if MDISP = 2 or MDISP2 = 2)
(MCTURB)                              Default: 1     ! MCTURB =  1   !
   1 = Standard CALPUFF subroutines
   2 = AERMOD subroutines

PG sigma-y,z adj. for roughness?      Default: 0     ! MROUGH =  0  !
(MROUGH)
   0 = no
   1 = yes

Partial plume penetration of          Default: 1     ! MPARTL =  1  !
elevated inversion?
(MPARTL)
   0 = no
   1 = yes
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 2

```
     Strength of temperature inversion     Default: 0     ! MTINV =  0  !
     provided in PROFILE.DAT extended records?
     (MTINV)
        0 = no (computed from measured/default gradients)
        1 = yes

     PDF used for dispersion under convective conditions?
                                           Default: 0     ! MPDF =  0  !
     (MPDF)
        0 = no
        1 = yes

     Sub-Grid TIBL module used for shore line?
                                           Default: 0     ! MSGTIBL = 0  !
     (MSGTIBL)
        0 = no
        1 = yes

     Boundary conditions (concentration) modeled?
                                           Default: 0     ! MBCON =  0  !
     (MBCON)
        0 = no
        1 = yes, using formatted BCON.DAT file
        2 = yes, using unformatted CONC.DAT file

     Note:  MBCON > 0 requires that the last species modeled
            be 'BCON'.  Mass is placed in species BCON when
            generating boundary condition puffs so that clean
            air entering the modeling domain can be simulated
            in the same way as polluted air.  Specify zero
            emission of species BCON for all regular sources.

     Individual source contributions saved?
                                           Default: 0     ! MSOURCE = 0  !
     (MSOURCE)
        0 = no
        1 = yes

     Analyses of fogging and icing impacts due to emissions from
     arrays of mechanically-forced cooling towers can be performed
     using CALPUFF in conjunction with a cooling tower emissions
     processor (CTEMISS) and its associated postprocessors.  Hourly
     emissions of water vapor and temperature from each cooling tower
     cell are computed for the current cell configuration and ambient
     conditions by CTEMISS. CALPUFF models the dispersion of these
     emissions and provides cloud information in a specialized format
     for further analysis. Output to FOG.DAT is provided in either
     'plume mode' or 'receptor mode' format.

     Configure for FOG Model output?
     (MFOG)                                Default: 0     ! MFOG =  0  !
        0 = no
        1 = yes  - report results in PLUME Mode format
        2 = yes  - report results in RECEPTOR Mode format

     Test options specified to see if
     they conform to regulatory
     values? (MREG)                        Default: 1     ! MREG =  0   !
        0 = NO checks are made
        1 = Technical options must conform to USEPA
            Long Range Transport (LRT) guidance
                       METFM    1 or 2
                       AVET     60. (min)
                       PGTIME   60. (min)
                       MGAUSS   1
                       MCTADJ   3
                       MTRANS   1
                       MTIP     1
                       MCHEM    1 or 3 (if modeling SOx, NOx)
                       MWET     1
                       MDRY     1
                       MDISP    2 or 3
                       MPDF     0 if MDISP=3
                                1 if MDISP=2
                       MROUGH   0
                       MPARTL   1
                       SYTDEP   550. (m)
                       MHFTSZ   0
!END!
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 3

```
--------------------------------------------------------------------------------

INPUT GROUP: 3a, 3b -- Species list
-------------------

------------
Subgroup (3a)
------------

  The following species are modeled:

! CSPEC =          SO2 !         !END!
! CSPEC =          NOX !         !END!
! CSPEC =      PMSIZE1 !         !END!
! CSPEC =      PMSIZE2 !         !END!
! CSPEC =      PMSIZE3 !         !END!
! CSPEC =      PMSIZE4 !         !END!
! CSPEC =      PMSIZE5 !         !END!
! CSPEC =      PMSIZE6 !         !END!

                                                    Dry                 OUTPUT GROUP
    SPECIES          MODELED          EMITTED      DEPOSITED              NUMBER
     NAME         (0=NO, 1=YES)    (0=NO, 1=YES)   (0=NO,                (0=NONE,
   (Limit: 12                                        1=COMPUTED-GAS       1=1st CGRUP,
    Characters                                       2=COMPUTED-PARTICLE  2=2nd CGRUP,
    in length)                                       3=USER-SPECIFIED)    3= etc.)

!          SO2  =         1,              1,          1,                  0   !
!          NOX  =         1,              1,          1,                  0   !
!      PMSIZE1  =         1,              1,          2,                  1   !
!      PMSIZE2  =         1,              1,          2,                  1   !
!      PMSIZE3  =         1,              1,          2,                  1   !
!      PMSIZE4  =         1,              1,          2,                  1   !
!      PMSIZE5  =         1,              1,          2,                  1   !
!      PMSIZE6  =         1,              1,          2,                  1   !

!END!

  Note:  The last species in (3a) must be 'BCON' when using the
         boundary condition option (MBCON > 0).  Species BCON should
         typically be modeled as inert (no chem transformation or
         removal).

-------------
Subgroup (3b)
-------------
  The following names are used for Species-Groups in which results
  for certain species are combined (added) prior to output.  The
  CGRUP name will be used as the species name in output files.
  Use this feature to model specific particle-size distributions
  by treating each size-range as a separate species.
  Order must be consistent with 3(a) above.

! CGRUP =         PM10 !     !END!
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 4

```
------------------------------------------------------------------------------

INPUT GROUP: 4 -- Map Projection and Grid control parameters
--------------

     Projection for all (X,Y):
     -------------------------

     Map projection
     (PMAP)                    Default: UTM    ! PMAP = UTM  !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
          PS :  Polar Stereographic
          EM :  Equatorial Mercator
        LAZA :  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                   Default=0.0     ! FEAST  = 0.000  !
     (FNORTH)                  Default=0.0     ! FNORTH = 0.000  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                  No Default      ! IUTMZN =  19   !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                  Default: N      ! UTMHEM = N  !
         N   :  Northern hemisphere projection
         S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
     (RLAT0)                   No Default      ! RLAT0 =  0N  !
     (RLON0)                   No Default      ! RLON0 =  0E  !

         TTM :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping plane
                RLAT0 identifies latitude of tangent-point of mapping plane

     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
     (XLAT1)                   No Default      ! XLAT1 =  0N  !
     (XLAT2)                   No Default      ! XLAT2 =  0N  !

         LCC :  Projection cone slices through Earth's surface at XLAT1 and XLAT2
         PS  :  Projection plane slices through Earth at XLAT1
                (XLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
            letter N,S,E, or W indicating north or south latitude, and
            east or west longitude.  For example,
            35.9  N Latitude  =  35.9N
            118.7 E Longitude = 118.7E


     Datum-region
     ------------

     The Datum-Region for the coordinates is identified by a character
     string.  Many mapping products currently available use the model of the
     Earth known as the World Geodetic System 1984 (WGS-84).  Other local
     models may be in use, and their selection in CALMET will make its output
     consistent with local mapping products.  The list of Datum-Regions with
     official transformation parameters is provided by the National Imagery and
     Mapping Agency (NIMA).
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 4

```
     NIMA Datum - Regions(Examples)
     -------------------------------------------------------------------------------
     WGS-84    WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)
     NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
     NAR-C     NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)
     NWS-84    NWS 6370KM Radius, Sphere
     ESR-S     ESRI REFERENCE 6371KM Radius, Sphere

     Datum-region for output coordinates
     (DATUM)                   Default: WGS-84     ! DATUM = NAS-C  !

METEOROLOGICAL grid:

            No. X grid cells (NX)      No default     ! NX =  40   !
            No. Y grid cells (NY)      No default     ! NY =  40   !
         No. vertical layers (NZ)      No default     ! NZ =  10   !

           Grid spacing (DGRIDKM)      No default     ! DGRIDKM = 0.5 !
                                       Units: km

                Cell face heights
                    (ZFACE(nz+1))      No defaults
                                       Units: m
   ! ZFACE = 0., 20., 50., 100., 200., 400., 600., 1000., 1500., 2000.,
              3000. !

            Reference Coordinates
           of SOUTHWEST corner of
                grid cell(1, 1):

            X coordinate (XORIGKM)     No default     ! XORIGKM = -10. !
            Y coordinate (YORIGKM)     No default     ! YORIGKM = -10. !
                                      Units: km


COMPUTATIONAL Grid:

     The computational grid is identical to or a subset of the MET. grid.
     The lower left (LL) corner of the computational grid is at grid point
     (IBCOMP, JBCOMP) of the MET. grid.  The upper right (UR) corner of the
     computational grid is at grid point (IECOMP, JECOMP) of the MET. grid.
     The grid spacing of the computational grid is the same as the MET. grid.

        X index of LL corner (IBCOMP)      No default     ! IBCOMP =  1   !
                  (1 <= IBCOMP <= NX)

        Y index of LL corner (JBCOMP)      No default     ! JBCOMP =  1   !
                  (1 <= JBCOMP <= NY)


        X index of UR corner (IECOMP)      No default     ! IECOMP =  40   !
                  (1 <= IECOMP <= NX)

        Y index of UR corner (JECOMP)      No default     ! JECOMP =  40   !
                  (1 <= JECOMP <= NY)
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 4

```
SAMPLING Grid (GRIDDED RECEPTORS):

     The lower left (LL) corner of the sampling grid is at grid point
     (IBSAMP, JBSAMP) of the MET. grid.  The upper right (UR) corner of the
     sampling grid is at grid point (IESAMP, JESAMP) of the MET. grid.
     The sampling grid must be identical to or a subset of the computational
     grid.  It may be a nested grid inside the computational grid.
     The grid spacing of the sampling grid is DGRIDKM/MESHDN.

        Logical flag indicating if gridded
        receptors are used (LSAMP)         Default: T     ! LSAMP = T !
        (T=yes, F=no)

        X index of LL corner (IBSAMP)      No default     ! IBSAMP =  1   !
         (IBCOMP <= IBSAMP <= IECOMP)

        Y index of LL corner (JBSAMP)      No default     ! JBSAMP =  1   !
         (JBCOMP <= JBSAMP <= JECOMP)


        X index of UR corner (IESAMP)      No default     ! IESAMP =  40   !
         (IBCOMP <= IESAMP <= IECOMP)

        Y index of UR corner (JESAMP)      No default     ! JESAMP =  40   !
         (JBCOMP <= JESAMP <= JECOMP)


       Nesting factor of the sampling
        grid (MESHDN)                      Default: 1     ! MESHDN =  1  !
        (MESHDN is an integer >= 1)

!END!
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 5

```
------------------------------------------------------------------------------
INPUT GROUP: 5 -- Output Options
--------------
                                        *                         *
     FILE                       DEFAULT VALUE             VALUE THIS RUN
     ----                       -------------             --------------

   Concentrations (ICON)              1                   !  ICON =  1   !
   Dry Fluxes (IDRY)                  1                   !  IDRY =  1   !
   Wet Fluxes (IWET)                  1                   !  IWET =  0   !
   2D Temperature (IT2D)              0                   !  IT2D =  0   !
   2D Density (IRHO)                  0                   !  IRHO =  0   !
   Relative Humidity (IVIS)           1                   !  IVIS =  0   !
    (relative humidity file is
     required for visibility
     analysis)
   Use data compression option in output file?
   (LCOMPRS)                          Default: T          ! LCOMPRS = T !

   *
    0 = Do not create file, 1 = create file

    QA PLOT FILE OUTPUT OPTION:

       Create a standard series of output files (e.g.
       locations of sources, receptors, grids ...)
       suitable for plotting?
       (IQAPLOT)                      Default: 1          ! IQAPLOT =  1  !
         0 = no
         1 = yes

    DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

       Mass flux across specified boundaries
       for selected species reported hourly?
       (IMFLX)                        Default: 0          ! IMFLX =  0  !
         0 = no
         1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames
                  are specified in Input Group 0)

       Mass balance for each species
       reported hourly?
       (IMBAL)                        Default: 0          ! IMBAL =  0  !
         0 = no
         1 = yes (MASSBAL.DAT filename is
              specified in Input Group 0)


    LINE PRINTER OUTPUT OPTIONS:

       Print concentrations (ICPRT)   Default: 0          ! ICPRT =  1   !
       Print dry fluxes (IDPRT)       Default: 0          ! IDPRT =  0   !
       Print wet fluxes (IWPRT)       Default: 0          ! IWPRT =  0   !
       (0 = Do not print, 1 = Print)

       Concentration print interval
       (ICFRQ) in hours               Default: 1          ! ICFRQ =  1   !
       Dry flux print interval
       (IDFRQ) in hours               Default: 1          ! IDFRQ =  1   !
       Wet flux print interval
       (IWFRQ) in hours               Default: 1          ! IWFRQ =  1   !

       Units for Line Printer Output
       (IPRTU)                        Default: 1          ! IPRTU =  1   !
                      for             for
                Concentration    Deposition
           1 =       g/m**3         g/m**2/s
           2 =      mg/m**3        mg/m**2/s
           3 =      ug/m**3        ug/m**2/s
           4 =      ng/m**3        ng/m**2/s
           5 =     Odour Units

       Messages tracking progress of run
       written to the screen ?
       (IMESG)                        Default: 2          ! IMESG = 2 !
         0 = no
         1 = yes (advection step, puff ID)
         2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 5

```
     SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

               ---- CONCENTRATIONS ----   ------ DRY FLUXES ------   ------ WET FLUXES ------   -- MASS FLUX --
    SPECIES
    /GROUP     PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   SAVED ON DISK?
    -------    ----------------------   ----------------------   ----------------------   ---------------
!       SO2 =     1,           1,          0,           1,          0,           0,          0   !
!       NOX =     1,           1,          0,           1,          0,           0,          0   !
!      PM10 =     1,           1,          0,           1,          0,           0,          0   !

  Note:  Species BCON (for MBCON > 0) does not need to be saved on disk.


     OPTIONS FOR PRINTING "DEBUG" QUANTITIES (much output)

       Logical for debug output
       (LDEBUG)                                Default: F     ! LDEBUG = F !

       First puff to track
       (IPFDEB)                                Default: 1     ! IPFDEB =  1  !

       Number of puffs to track
       (NPFDEB)                                Default: 1     ! NPFDEB =  1  !

       Met. period to start output
       (NN1)                                   Default: 1     ! NN1 =  1   !

       Met. period to end output
       (NN2)                                   Default: 10    ! NN2 =  10  !

!END!
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 6

```
------------------------------------------------------------------------------

INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs
------------------------

--------------
Subgroup (6a)
--------------
       Number of terrain features (NHILL)       Default: 0     ! NHILL =  1   !

       Number of special complex terrain
       receptors  (NCTREC)                      Default: 0     ! NCTREC =  9   !

       Terrain and CTSG Receptor data for
       CTSG hills input in CTDM format ?
       (MHILL)                                  No Default     ! MHILL =  2   !
       1 = Hill and Receptor data created
           by CTDM processors & read from
           HILL.DAT and HILLRCT.DAT files
       2 = Hill data created by OPTHILL &
           input below in Subgroup (6b);
           Receptor data in Subgroup (6c)

       Factor to convert horizontal dimensions  Default: 1.0   ! XHILL2M = 1. !
       to meters (MHILL=1)

       Factor to convert vertical dimensions    Default: 1.0   ! ZHILL2M = 1. !
       to meters (MHILL=1)

       X-origin of CTDM system relative to      No Default     ! XCTDMKM = 0.0E00 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

       Y-origin of CTDM system relative to      No Default     ! YCTDMKM = 0.0E00 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

--------------
Subgroup (6b)
--------------

                     1 **
     HILL information


HILL      XC      YC    THETAH  ZGRID  RELIEF   EXPO 1   EXPO 2   SCALE 1   SCALE 2    AMAX1   AMAX2
 NO.     (km)    (km)   (deg.)  (m)     (m)      (m)      (m)       (m)       (m)       (m)     (m)
----     ----    ----   ------  -----  ------   ------   ------   -------   -------    -----   -----
1!HILL =  0.,     0.,     0.,    25.,   100.,     2.,      2.,     800.,     400.,    1132.,   566. ! !END!

--------------
Subgroup (6c)
--------------

    COMPLEX TERRAIN RECEPTOR INFORMATION

                     XRCT         YRCT         ZRCT          XHH
                     (km)         (km)         (m)
                    ------       -----       ------         ----

     1 !CTREC =          -0.2,          0.,      95.0,       1.0 !     !END!
     2 !CTREC =          -0.2,        -0.1,      93.5,       1.0 !     !END!
     3 !CTREC =          -0.2,        -0.2,      89.3,       1.0 !     !END!
     4 !CTREC =          -0.2,        -0.3,      82.9,       1.0 !     !END!
     5 !CTREC =          -0.2,        -0.4,      75.0,       1.0 !     !END!
     6 !CTREC =          -0.2,        -0.5,      66.4,       1.0 !     !END!
     7 !CTREC =          -0.2,        -0.6,      57.8,       1.0 !     !END!
     8 !CTREC =          -0.2,        -0.7,      49.4,       1.0 !     !END!
     9 !CTREC =          -0.2,        -0.8,      41.7,       1.0 !     !END!
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 6

```
------------------
1
     Description of Complex Terrain Variables:
          XC, YC  = Coordinates of center of hill
          THETAH  = Orientation of major axis of hill (clockwise from
                    North)
          ZGRID   = Height of the  0  of the grid above mean sea
                    level
          RELIEF  = Height of the crest of the hill above the grid elevation
          EXPO 1  = Hill-shape exponent for the major axis
          EXPO 2  = Hill-shape exponent for the major axis
          SCALE 1 = Horizontal length scale along the major axis
          SCALE 2 = Horizontal length scale along the minor axis
          AMAX    = Maximum allowed axis length for the major axis
          BMAX    = Maximum allowed axis length for the major axis

          XRCT, YRCT = Coordinates of the complex terrain receptors
          ZRCT    = Height of the ground (MSL) at the complex terrain
                    Receptor
          XHH     = Hill number associated with each complex terrain receptor
                    (NOTE: MUST BE ENTERED AS A REAL NUMBER)

   **
     NOTE: DATA for each hill and CTSG receptor are treated as a separate
           input subgroup and therefore must end with an input group terminator.
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Groups 7, 8 and 9

```
------------------------------------------------------------------------------

INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases
--------------

  SPECIES     DIFFUSIVITY      ALPHA STAR      REACTIVITY    MESOPHYLL RESISTANCE     HENRY'S LAW COEFFICIENT
   NAME        (cm**2/s)                                          (s/cm)                 (dimensionless)
  -------     -----------      ----------      ----------    --------------------     ----------------------

!      SO2 =     0.1509,         1000.,            8.,               0.,                  0.04 !
!      NOX =     0.1656,         1.,               8.,               5.,                  3.5  !

!END!


------------------------------------------------------------------------------


INPUT GROUP: 8 -- Size parameters for dry deposition of particles
--------------

     For SINGLE SPECIES, the mean and standard deviation are used to
     compute a deposition velocity for NINT (see group 9) size-ranges,
     and these are then averaged to obtain a mean deposition velocity.

     For GROUPED SPECIES, the size distribution should be explicitly
     specified (by the 'species' in the group), and the standard deviation
     for each should be entered as 0.  The model will then use the
     deposition velocity for the stated mean diameter.

      SPECIES      GEOMETRIC MASS MEAN        GEOMETRIC STANDARD
       NAME             DIAMETER                 DEVIATION
                        (microns)                (microns)
      -------      -------------------        -----------------
!      PMSIZE1 =          0.05,                     0.   !
!      PMSIZE2 =           0.1,                     0.   !
!      PMSIZE3 =           0.2,                     0.   !
!      PMSIZE4 =           0.4,                     0.   !
!      PMSIZE5 =           0.8,                     0.   !
!      PMSIZE6 =           1.6,                     0.   !

!END!


------------------------------------------------------------------------------


INPUT GROUP: 9 -- Miscellaneous dry deposition parameters
--------------

     Reference cuticle resistance (s/cm)
     (RCUTR)                          Default: 30    !  RCUTR = 30. !
     Reference ground resistance  (s/cm)
     (RGR)                            Default: 10    !    RGR = 10. !
     Reference pollutant reactivity
     (REACTR)                         Default: 8     ! REACTR = 8. !

     Number of particle-size intervals used to
     evaluate effective particle deposition velocity
     (NINT)                           Default: 9     !   NINT =  9  !

     Vegetation state in unirrigated areas
     (IVEG)                           Default: 1     !   IVEG =  1   !
        IVEG=1 for active and unstressed vegetation
        IVEG=2 for active and stressed vegetation
        IVEG=3 for inactive vegetation

!END!
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Groups 10 and 11

```
--------------------------------------------------------------------------------

INPUT GROUP: 10 -- Wet Deposition Parameters
--------------

                     Scavenging Coefficient -- Units: (sec)**(-1)

       Pollutant      Liquid Precip.       Frozen Precip.
       ---------      --------------       --------------
!          SO2 =         3.0E-05,             0.0E00  !
!          NOX =         0.0,                 0.0     !
!      PMSIZE1 =         1.0E-04,             3.0E-05 !
!      PMSIZE2 =         1.0E-04,             3.0E-05 !
!      PMSIZE3 =         1.0E-04,             3.0E-05 !
!      PMSIZE4 =         1.0E-04,             3.0E-05 !
!      PMSIZE5 =         1.0E-04,             3.0E-05 !
!      PMSIZE6 =         1.0E-04,             3.0E-05 !

!END!


--------------------------------------------------------------------------------

INPUT GROUP: 11 -- Chemistry Parameters
--------------

     Ozone data input option (MOZ)     Default: 1            ! MOZ =  0   !
     (Used only if MCHEM = 1, 3, or 4)
        0 = use a monthly background ozone value
        1 = read hourly ozone concentrations from
            the OZONE.DAT data file

     Monthly background ozone concentrations
     (BCKO3) in ppb                    Default: 12*80.       ! BCKO3 = 12*80. !
     (Used only if MCHEM = 1,3, or 4 and
      MOZ = 0 or (MOZ = 1 and all hourly
      O3 data missing)

     Monthly background ammonia concentrations
     (BCKNH3) in ppb                   Default: 12*10.       ! BCKNH3 = 12*10. !

     Nighttime SO2 loss rate (RNITE1)
     in percent/hour                   Default: 0.2          ! RNITE1 = 0.2 !

     Nighttime NOx loss rate (RNITE2)
     in percent/hour                   Default: 2.0          ! RNITE2 = 2. !

     Nighttime HNO3 formation rate (RNITE3)
     in percent/hour                   Default: 2.0          ! RNITE3 = 2. !


     H2O2 data input option (MH2O2)    Default: 1            ! MH2O2 =  0   !
     (Used only if MAQCHEM = 1)
        0 = use a monthly background H2O2 value
        1 = read hourly H2O2 concentrations from
            the H2O2.DAT data file

     Monthly background H2O2 concentrations
     (BCKH2O2) in ppb                  Default: 12*1.        ! BCKH2O2 = 12*1. !
     (Used only if MQACHEM = 1 and
      MH2O2 = 0 or (MH2O2 = 1 and all
      hourly H2O2 data missing)
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 11

```
 --- Data for SECONDARY ORGANIC AEROSOL (SOA) Option
     (used only if MCHEM = 4)

     The SOA module uses monthly values of:
          Fine particulate concentration in ug/m^3 (BCKPMF)
          Organic fraction of fine particulate     (OFRAC)
          VOC / NOX ratio (after reaction)         (VCNX)
     to characterize the air mass when computing
     the formation of SOA from VOC emissions.
     Typical values for several distinct air mass types are:

        Month    1    2    3    4    5    6    7    8    9   10   11   12
                Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

     Clean Continental
        BCKPMF   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.
        OFRAC  .15  .15  .20  .20  .20  .20  .20  .20  .20  .20  .20  .15
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

     Clean Marine (surface)
        BCKPMF  .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5
        OFRAC  .25  .25  .30  .30  .30  .30  .30  .30  .30  .30  .30  .25
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

     Urban - low biogenic (controls present)
        BCKPMF  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.
        OFRAC  .20  .20  .25  .25  .25  .25  .25  .25  .20  .20  .20  .20
        VCNX     4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.

     Urban - high biogenic (controls present)
        BCKPMF  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.
        OFRAC  .25  .25  .30  .30  .30  .55  .55  .55  .35  .35  .35  .25
        VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.

     Regional Plume
        BCKPMF  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.
        OFRAC  .20  .20  .25  .35  .25  .40  .40  .40  .30  .30  .30  .20
        VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.

     Urban - no controls present
        BCKPMF 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
        OFRAC  .30  .30  .35  .35  .35  .55  .55  .55  .35  .35  .35  .30
        VCNX     2.   2.   2.   2.   2.   2.   2.   2.   2.   2.   2.   2.

          Default: Clean Continental    !  BCKPMF =       12*1.0            !
                                        !  OFRAC  = 2*0.15, 9*0.20, 0.15    !
                                        !  VCNX   =       12*50.0           !

!END!
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 12

```
------------------------------------------------------------------------------
INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters
--------------

     Horizontal size of puff (m) beyond which
     time-dependent dispersion equations (Heffter)
     are used to determine sigma-y and
     sigma-z (SYTDEP)                          Default: 550.   ! SYTDEP = 1.0E04 !

     Switch for using Heffter equation for sigma z
     as above (0 = Not use Heffter; 1 = use Heffter
     (MHFTSZ)                                  Default: 0      ! MHFTSZ =  1   !

     Stability class used to determine plume
     growth rates for puffs above the boundary
     layer (JSUP)                              Default: 5      ! JSUP =  5   !

     Vertical dispersion constant for stable
     conditions (k1 in Eqn. 2.7-3)  (CONK1)    Default: 0.01   ! CONK1 = 0.01 !

     Vertical dispersion constant for neutral/
     unstable conditions (k2 in Eqn. 2.7-4)
     (CONK2)                                   Default: 0.1    ! CONK2 = 0.1 !

     Factor for determining Transition-point from
     Schulman-Scire to Huber-Snyder Building Downwash
     scheme (SS used for Hs < Hb + TBD * HL)
     (TBD)                                     Default: 0.5    ! TBD = 0.5 !
        TBD < 0   ==> always use Huber-Snyder
        TBD = 1.5 ==> always use Schulman-Scire
        TBD = 0.5 ==> ISC Transition-point

     Range of land use categories for which
     urban dispersion is assumed
     (IURB1, IURB2)                            Default: 10     ! IURB1 =  10  !
                                                        19     ! IURB2 =  19  !

     Site characterization parameters for single-point Met data files ---------
     (needed for METFM = 2,3,4)

        Land use category for modeling domain
        (ILANDUIN)                             Default: 20     ! ILANDUIN =  20  !

        Roughness length (m) for modeling domain
        (Z0IN)                                 Default: 0.25   ! Z0IN = 0.25 !

        Leaf area index for modeling domain
        (XLAIIN)                               Default: 3.0    ! XLAIIN = 3. !

        Elevation above sea level (m)
        (ELEVIN)                               Default: 0.0    ! ELEVIN = 0. !

        Latitude (degrees) for met location
        (XLATIN)                               Default: -999.  ! XLATIN = 0. !

        Longitude (degrees) for met location
        (XLONIN)                               Default: -999.  ! XLONIN = 0. !

     Specialized information for interpreting single-point Met data files -----

        Anemometer height (m) (Used only if METFM = 2,3)
        (ANEMHT)                               Default: 10.    ! ANEMHT = 10. !

        Form of lateral turbulance data in PROFILE.DAT file
        (Used only if METFM = 4 or MTURBVW = 1 or 3)
        (ISIGMAV)                              Default: 1      ! ISIGMAV =  1  !
            0 = read sigma-theta
            1 = read sigma-v

        Choice of mixing heights (Used only if METFM = 4)
        (IMIXCTDM)                             Default: 0      ! IMIXCTDM =  0  !
            0 = read PREDICTED mixing heights
            1 = read OBSERVED mixing heights
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 12

```
Maximum length of a slug (met. grid units)
(XMXLEN)                                  Default: 1.0    ! XMXLEN = 1. !

Maximum travel distance of a puff/slug (in
grid units) during one sampling step
(XSAMLEN)                                 Default: 1.0    ! XSAMLEN = 1. !

Maximum Number of slugs/puffs release from
one source during one time step
(MXNEW)                                   Default: 99     ! MXNEW =  99   !

Maximum Number of sampling steps for
one puff/slug during one time step
(MXSAM)                                   Default: 99     ! MXSAM =  99   !

Number of iterations used when computing
the transport wind for a sampling step
that includes gradual rise (for CALMET
and PROFILE winds)
(NCOUNT)                                  Default: 2      ! NCOUNT =  2   !

Minimum sigma y for a new puff/slug (m)
(SYMIN)                                   Default: 1.0    ! SYMIN = 1.  !

Minimum sigma z for a new puff/slug (m)
(SZMIN)                                   Default: 1.0    ! SZMIN = 1.  !

Default minimum turbulence velocities sigma-v and sigma-w
for each stability class over land and over water (m/s)
(SVMIN(12) and SWMIN(12))

                ----------  LAND  ----------       ---------  WATER  ----------
   Stab Class :  A    B    C    D    E    F         A    B    C    D    E    F
                 ---  ---  ---  ---  ---  ---       ---  ---  ---  ---  ---  ---
Default SVMIN : .50, .50, .50, .50, .50, .50,      .37, .37, .37, .37, .37, .37
Default SWMIN : .20, .12, .08, .06, .03, .016,     .20, .12, .08, .06, .03, .016

      ! SVMIN = .500, .500, .500, .500, .500, .500,  .370, .370, .370, .370, .370, .370!
      ! SWMIN = .200, .120, .080, .060, .030, .016,  .200, .120, .080, .060, .030, .016!

Divergence criterion for dw/dz across puff
used to initiate adjustment for horizontal
convergence (1/s)
Partial adjustment starts at CDIV(1), and
full adjustment is reached at CDIV(2)
(CDIV(2))                                 Default: 0.0,0.0  ! CDIV = 0., 0. !

Minimum wind speed (m/s) allowed for
non-calm conditions. Also used as minimum
speed returned when using power-law
extrapolation toward surface
(WSCALM)                                  Default: 0.5    ! WSCALM = 0.5 !

Maximum mixing height (m)
(XMAXZI)                                  Default: 3000.  ! XMAXZI = 3000. !

Minimum mixing height (m)
(XMINZI)                                  Default: 50.    ! XMINZI = 50. !

Default wind speed classes --
5 upper bounds (m/s) are entered;
the 6th class has no upper limit
(WSCAT(5))                      Default   :
                                ISC RURAL : 1.54, 3.09, 5.14, 8.23, 10,8 (10.8+)

                           Wind Speed Class :  1     2     3     4     5     6
                                               ---   ---   ---   ---   ---   ---
                                    ! WSCAT = 1.54, 3.09, 5.14, 8.23, 10.80 !
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 12

```
Default wind speed profile power-law
exponents for stabilities 1-6
(PLX0(6))                       Default   : ISC RURAL values
                                ISC RURAL : .07, .07, .10, .15, .35, .55
                                ISC URBAN : .15, .15, .20, .25, .30, .30

                          Stability Class :  A     B     C     D     E     F
                                            ---   ---   ---   ---   ---   ---
                                  ! PLX0 = 0.07, 0.07, 0.10, 0.15, 0.35, 0.55 !

Default potential temperature gradient
for stable classes E, F (degK/m)
(PTG0(2))                       Default: 0.020, 0.035
                                   ! PTG0 = 0.020,   0.035 !

Default plume path coefficients for
each stability class (used when option
for partial plume height terrain adjustment
is selected -- MCTADJ=3)
(PPC(6))                  Stability Class :  A     B     C     D     E     F
                             Default  PPC : .50,  .50,  .50,  .50,  .35,  .35
                                            ---   ---   ---   ---   ---   ---
                                  !  PPC = 0.50, 0.50, 0.50, 0.50, 0.35, 0.35 !

Slug-to-puff transition criterion factor
equal to sigma-y/length of slug
(SL2PF)                            Default: 10.        ! SL2PF = 10. !

Puff-splitting control variables ------------------------

  VERTICAL SPLIT
  --------------

  Number of puffs that result every time a puff
  is split - nsplit=2 means that 1 puff splits
  into 2
  (NSPLIT)                         Default:   3        ! NSPLIT =  3  !

  Time(s) of a day when split puffs are eligible to
  be split once again; this is typically set once
  per day, around sunset before nocturnal shear develops.
  24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00)
  0=do not re-split    1=eligible for re-split
  (IRESPLIT(24))                   Default:  Hour 17 = 1
  !  IRESPLIT = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0 !

  Split is allowed only if last hour's mixing
  height (m) exceeds a minimum value
  (ZISPLIT)                        Default: 100.       ! ZISPLIT = 100. !

  Split is allowed only if ratio of last hour's
  mixing ht to the maximum mixing ht experienced
  by the puff is less than a maximum value (this
  postpones a split until a nocturnal layer develops)
  (ROLDMAX)                        Default: 0.25       ! ROLDMAX = 0.25 !
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 12

```
      HORIZONTAL SPLIT
      ----------------

      Number of puffs that result every time a puff
      is split - nsplith=5 means that 1 puff splits
      into 5
      (NSPLITH)                         Default:   5        ! NSPLITH =  5  !

      Minimum sigma-y (Grid Cells Units) of puff
      before it may be split
      (SYSPLITH)                        Default:  1.0       ! SYSPLITH = 1.0 !

      Minimum puff elongation rate (SYSPLITH/hr) due to
      wind shear, before it may be split
      (SHSPLITH)                        Default:  2.        ! SHSPLITH = 2. !

      Minimum concentration (g/m^3) of each
      species in puff before it may be split
      Enter array of NSPEC values; if a single value is
      entered, it will be used for ALL species
      (CNSPLITH)                        Default:  1.0E-07   ! CNSPLITH = 1.0E-07 !

    Integration control variables ----------------------

      Fractional convergence criterion for numerical SLUG
      sampling integration
      (EPSSLUG)                         Default:   1.0e-04  ! EPSSLUG = 1.0E-04 !

      Fractional convergence criterion for numerical AREA
      source integration
      (EPSAREA)                         Default:   1.0e-06  ! EPSAREA = 1.0E-06 !

      Trajectory step-length (m) used for numerical rise
      integration
      (DSRISE)                          Default:   1.0      ! DSRISE = 1. !

    Boundary Condition (BC) Puff control variables -----------------------

      Minimum height (m) to which BC puffs are mixed as they are emitted
      (MBCON=2 ONLY).  Actual height is reset to the current mixing height
      at the release point if greater than this minimum.
      (HTMINBC)                         Default:   500.     ! HTMINBC = 500. !

      Search radius (km) about a receptor for sampling nearest BC puff.
      BC puffs are typically emitted with a spacing of one grid cell
      length, so the search radius should be greater than DGRIDKM.
      (RSAMPBC)                         Default:   10.      ! RSAMPBC = 15. !

      Near-Surface depletion adjustment to concentration profile used when
      sampling BC puffs?
      (MDEPBC)                          Default:   1        ! MDEPBC = 0. !
         0 = Concentration is NOT adjusted for depletion
         1 = Adjust Concentration for depletion

!END!
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 13

```
------------------------------------------------------------------------------

INPUT GROUPS: 13a, 13b, 13c, 13d -- Point source parameters
-------------------------------

--------------
Subgroup (13a)
--------------

     Number of point sources with
     parameters provided below      (NPT1)  No default  !  NPT1 =  1  !

     Units used for point source
     emissions below                (IPTU)  Default: 1  !  IPTU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (13d)        (NSPT1) Default: 0  !  NSPT1 =  1  !

     Number of point sources with
     variable emission parameters
     provided in external file      (NPT2)  No default  !  NPT2 =  0  !

     (If NPT2 > 0, these point
     source emissions are read from
     the file: PTEMARB.DAT)

!END!

--------------
Subgroup (13b)
--------------
                                    a
          POINT SOURCE: CONSTANT DATA
          ---------------------------
                                                                          b          c
  Source      X UTM     Y UTM     Stack   Base     Stack    Exit  Exit    Bldg.  Emission
   No.     Coordinate Coordinate Height Elevation Diameter  Vel.  Temp.   Dwash   Rates
              (km)      (km)       (m)      (m)       (m)  (m/s) (deg. K)
  ------   ---------- ---------- ------  ------   -------- ----- -------- ----- --------
   1 ! SRCNAM = BLR1 !
   1 ! X =      0.1,      -3.,     40.,   25.,       2.2,   10.,   450.,   1., 1.7E00,  1.0E00, 1.0E-02,
      1.0E-01, 2.0E-01, 2.4E-01, 2.5E-01, 2.0E-01 !
   1 ! SIGYZI =       3.,      1.5   !
   1 ! ZPLTFM = 0. !
   1 ! FMFAC  = 1. !   !END!

--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

     SRCNAM  is a 12-character name for a source
             (No default)
     X       is an array holding the source data listed by the column headings
             (No default)
     SIGYZI  is an array holding the initial sigma-y and sigma-z (m)
             (Default: 0.,0.)
     FMFAC   is a vertical momentum flux factor (0. or 1.0) used to represent
             the effect of rain-caps or other physical configurations that
             reduce momentum rise associated with the actual exit velocity.
             (Default: 1.0  -- full momentum used)
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 13

```
     ZPLTFM  is the platform height (m) for sources influenced by an isolated
             structure that has a significant open area between the surface
             and the bulk of the structure, such as an offshore oil platform.
             The Base Elevation is that of the surface (ground or ocean),
             and the Stack Height is the release height above the Base (not
             above the platform).  Building heights entered in Subgroup 13c
             must be those of the buildings on the platform, measured from
             the platform deck.  ZPLTFM is used only with MBDW=1 (ISC
             downwash method) for sources with building downwash.
             (Default: 0.0)
    b
     0. = No building downwash modeled
     1. = Downwash modeled for buildings resting on the surface
     2. = Downwash modeled for buildings raised above the surface (ZPLTFM > 0.)
     NOTE: must be entered as a REAL number (i.e., with decimal point)    c
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IPTU
     (e.g. 1 for g/s).

--------------
Subgroup (13c)
--------------

           BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH
           -------------------------------------------------------
Source                                                              a
No.       Effective building height, width, length and X/Y offset (in meters)
          every 10 degrees.  LENGTH, XBADJ, and YBADJ are only needed for
          MBDW=2 (PRIME downwash option)
------    ------------------------------------------------------------------

 1    ! SRCNAM  =   BLR1 !
 1    ! HEIGHT  =  45.,   45.,   45.,   45.,   45.,   45.,
                   45.,   45.,   45.,   0.,   0.,   0.,
                   0.,   0.,   0.,   0.,   0.,   0.,
                   45.,   45.,   45.,   45.,   45.,   45.,
                   45.,   45.,   45.,   0.,   0.,   0.,
                   0.,   0.,   0.,   0.,   0.,   0.!
 1    ! WIDTH  =   12.5,   12.5,   12.5,   12.5,   12.5,   12.5,
                   12.5,   12.5,   12.5,   0.,   0.,   0.,
                   0.,   0.,   0.,   0.,   0.,   0.,
                   12.5,   12.5,   12.5,   12.5,   12.5,   12.5,
                   12.5,   12.5,   12.5,   0.,   0.,   0.,
                   0.,   0.,   0.,   0.,   0.,   0.!
!END!
--------
    a
     Building height, width, length, and X/Y offset from the source are treated
     as a separate input subgroup for each source and therefore must end with
     an input group terminator.
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 13

```
--------------
Subgroup (13d)
--------------
                                              a
          POINT SOURCE: VARIABLE EMISSIONS DATA
          -------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 13b.  Factors entered multiply the rates in 13b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use PTEMARB.DAT and NPT2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                 Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12

           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)
 1  ! SRCNAM = BLR1 !
 1  ! IVARY  =  2  !    (12 Months)
 1  ! SO2          = 0.1,0.1,0.5,0.9,2,2.2,
                   2.5,1.5,1.1,0.9,0.5,0.1      !
!END!
--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 14

```
--------------------------------------------------------------------------------

INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters
--------------------------------

--------------
Subgroup (14a)
--------------

     Number of polygon area sources with
     parameters specified below (NAR1)       No default  !  NAR1 =  2   !

     Units used for area source
     emissions below            (IARU)       Default: 1  !  IARU =   1  !
           1 =        g/m**2/s
           2 =       kg/m**2/hr
           3 =       lb/m**2/hr
           4 =     tons/m**2/yr
           5 =     Odour Unit * m/s  (vol. flux/m**2 of odour compound)
           6 =     Odour Unit * m/min
           7 =     metric tons/m**2/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (14d)        (NSAR1) Default: 0  !  NSAR1 =  4  !

     Number of buoyant polygon area sources
     with variable location and emission
     parameters (NAR2)                      No default  !  NAR2 =  0   !
     (If NAR2 > 0, ALL parameter data for
     these sources are read from the file: BAEMARB.DAT)

!END!

--------------
Subgroup (14b)
--------------
                                  a
          AREA SOURCE: CONSTANT DATA
          --------------------------
                                                              b
Source           Effect.    Base      Initial    Emission
 No.             Height   Elevation   Sigma z     Rates
                   (m)       (m)        (m)
-------          ------    ------     --------   ---------

   1! SRCNAM = AREA1 !
   1! X =           1.,      0.,         2.5,   8.5E-01,  0.5E00,  0.0E00,
 0.0E00,  0.0E00,  0.0E00,  0.0E00,  0.0E00 !
!END!
   2! SRCNAM = AREA2 !
   2! X =          1.5,      0.,          3.,    0.0E00,  0.0E00, 1.0E-01,
 0.0E00,  0.0E00, 5.0E-01,  1.0E00,  1.3E00 !
!END!

--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.
    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IARU
     (e.g. 1 for g/m**2/s).
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 14

```
--------------
Subgroup (14c)
--------------

          COORDINATES (UTM-km) FOR EACH VERTEX(4) OF EACH POLYGON
          -------------------------------------------------------
Source                                                          a
 No.      Ordered list of X followed by list of Y, grouped by source
------    ------------------------------------------------------------

 1    ! SRCNAM  =   AREA1 !
 1      !  XVERT = 0.5,    0.51,    0.51,    0.5!
 1      !  YVERT = 1.61,    1.61,    1.6,    1.6!
!END!
 2    ! SRCNAM  =   AREA2 !
 2      !  XVERT = 0.75,    0.76,    0.76,    0.75!
 2      !  YVERT = 1.81,    1.81,    1.8,    1.8!
!END!

--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.


--------------
Subgroup (14d)
--------------
                                          a
         AREA SOURCE: VARIABLE EMISSIONS DATA
         ------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 14b.  Factors entered multiply the rates in 14b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                              Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)


 2  ! SRCNAM = AREA2 !
 2  ! IVARY  =  4  !    (6 speed classes for each stability)
 2  ! PMSIZE1      = 0.1,0.1,0.5,0.9,1,1.5,
                    0.1,0.1,0.5,0.9,1,1.5,
                    0.1,0.1,0.5,0.9,1,1.5,
                    0.1,0.1,0.5,0.9,1,1.5,
                    0.1,0.1,0.5,0.9,1,1.5,
                    0.1,0.1,0.5,0.9,1,1.5      !
!END!
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 14

```
 2  ! SRCNAM = AREA2 !
 2  ! IVARY  =  4  !    (6 speed classes for each stability)
 2  ! PMSIZE4      = 0.1,0.1,0.5,0.9,1.5,2.2,
                   0.1,0.1,0.5,0.9,1.5,2.2,
                   0.1,0.1,0.5,0.9,1.5,2.2,
                   0.1,0.1,0.5,0.9,1.5,2.2,
                   0.1,0.1,0.5,0.9,1.5,2.2      !
!END!

 2  ! SRCNAM = AREA2 !
 2  ! IVARY  =  4  !    (6 speed classes for each stability)
 2  ! PMSIZE5      = 0.1,0.1,0.5,0.9,2,2.5,
                   0.1,0.1,0.5,0.9,2,2.5,
                   0.1,0.1,0.5,0.9,2,2.5,
                   0.1,0.1,0.5,0.9,2,2.5,
                   0.1,0.1,0.5,0.9,2,2.5,
                   0.1,0.1,0.5,0.9,2,2.5      !
!END!
 2  ! SRCNAM = AREA2 !
 2  ! IVARY  =  4  !    (6 speed classes for each stability)
 2  ! PMSIZE6      = 0.1,0.1,0.5,0.9,2,2.5,
                   0.1,0.1,0.5,0.9,2,2.5,
                   0.1,0.1,0.5,0.9,2,2.5,
                   0.1,0.1,0.5,0.9,2,2.5,
                   0.1,0.1,0.5,0.9,2,2.5,
                   0.1,0.1,0.5,0.9,2,2.5      !
!END!

--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 15

```
------------------------------------------------------------------------------

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters
---------------------------

--------------
Subgroup (15a)
--------------

     Number of buoyant line sources
     with variable location and emission
     parameters (NLN2)                          No default  !  NLN2 =  0   !

     (If NLN2 > 0, ALL parameter data for
      these sources are read from the file: LNEMARB.DAT)

     Number of buoyant line sources (NLINES)    No default   ! NLINES =  2  !

     Units used for line source
     emissions below              (ILNU)        Default: 1  !  ILNU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (15c)      (NSLN1) Default: 0  !  NSLN1 =  1  !

     Maximum number of segments used to model
     each line (MXNSEG)                         Default: 7   ! MXNSEG =  7  !

     The following variables are required only if NLINES > 0.  They are
     used in the buoyant line source plume rise calculations.

        Number of distances at which            Default: 6   ! NLRISE =  6  !
        transitional rise is computed

        Average building length (XL)            No default   ! XL = 500. !
                                                (in meters)

        Average building height(HBL)            No default   ! HBL = 22. !
                                                (in meters)

        Average building width (WBL)            No default   ! WBL = 18. !
                                                (in meters)

        Average line source width (WML)         No default   ! WML = 3.2 !
                                                (in meters)

        Average separation between buildings (DXL)  No default   ! DXL = 22. !
                                                (in meters)

        Average buoyancy parameter (FPRIMEL)    No default   ! FPRIMEL = 300. !
                                                (in m**4/s**3)

!END!
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 15

```
--------------
Subgroup (15b)
--------------

          BUOYANT LINE SOURCE: CONSTANT DATA
          ----------------------------------
                                                                                  a
Source     Beg. X      Beg. Y      End. X     End. Y     Release    Base        Emission
 No.     Coordinate  Coordinate  Coordinate Coordinate  Height    Elevation      Rates
            (km)        (km)        (km)       (km)       (m)       (m)
------   ----------  ----------  ---------  ----------  -------   ---------    ---------
   1! SRCNAM = LINE1 !
   1! X =       12.,       35.,      12.5,       35.,    22.000,     0.000, 2.3E00, 1.1E00, 0.0E00,
 0.0E00, 0.0E00, 0.0E00, 0.0E00, 0.0E00 !
!END!
   2! SRCNAM = LINE2 !
   2! X =       12.,    35.022,      12.5,    35.022,    22.000,     0.000, 2.3E00, 1.1E00, 0.0E00,
 0.0E00, 0.0E00, 0.0E00, 0.0E00, 0.0E00 !
!END!

--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by ILNTU
     (e.g. 1 for g/s).

--------------
Subgroup (15c)
--------------
                                                  a
          BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA
          --------------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 15b.  Factors entered multiply the rates in 15b.
     Skip sources here that have constant emissions.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                              Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)


 1  ! SRCNAM = LINE1 !
 1  ! IVARY  =  1  !    (24 Hours)
 1  ! SO2          = 0.1,0.1,0.1,0.2,0.2,0.3,
                   0.3,0.4,0.4,0.5,0.6,1,
                   1,1,1,1,1,1,
                   0.6,0.4,0.3,0.2,0.1,0.1      !
!END!

--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 16

```
------------------------------------------------------------------------------

INPUT GROUPS: 16a, 16b, 16c -- Volume source parameters
---------------------------

--------------
Subgroup (16a)
--------------

     Number of volume sources with
     parameters provided in 16b,c (NVL1)     No default  !  NVL1 =  1   !

     Units used for volume source
     emissions below in 16b       (IVLU)     Default: 1  !  IVLU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (16c)      (NSVL1)    Default: 0  !  NSVL1 =  0  !

     Number of volume sources with
     variable location and emission
     parameters                   (NVL2)     No default  !  NVL2 =  0   !

     (If NVL2 > 0, ALL parameter data for
      these sources are read from the VOLEMARB.DAT file(s) )

!END!

--------------
Subgroup (16b)
--------------
                                      a
           VOLUME SOURCE: CONSTANT DATA
           ----------------------------
                                                                        b
        X UTM      Y UTM      Effect.    Base     Initial    Initial    Emission
     Coordinate  Coordinate   Height   Elevation  Sigma y    Sigma z     Rates
        (km)       (km)         (m)       (m)       (m)       (m)
     ----------  ----------   ------    ------    --------   --------   --------

   1! SRCNAM = VOLS1 !
! X =      -5.6,       -1.2,     10.,       0.,       6.2,       6.2, 2.2E00, 4.0E00, 0.0E00,
 0.0E00, 0.0E00, 0.0E00, 0.0E00, 0.0E00 !
!END!

--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IVLU
     (e.g. 1 for g/s).
```

Table F-2 (Continued)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 16

```
--------------
Subgroup (16c)
--------------
                                              a
          VOLUME SOURCE: VARIABLE EMISSIONS DATA
          --------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 16b.  Factors entered multiply the rates in 16b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use VOLEM.DAT and IGRDVL = 1.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                 Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)



--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.
```

Table F-2 (Concluded)
Sample CALPUFF Control File (CALPUFF.INP)
Input Group 17

```
------------------------------------------------------------------------------

INPUT GROUPS: 17a & 17b -- Non-gridded (discrete) receptor information
-----------------------

--------------
Subgroup (17a)
--------------

     Number of non-gridded receptors (NREC)  No default  !  NREC =  3   !

!END!

--------------
Subgroup (17b)
--------------
                                                a
           NON-GRIDDED (DISCRETE) RECEPTOR DATA
           ------------------------------------

                  X UTM       Y UTM        Ground        Height   b
Receptor       Coordinate   Coordinate    Elevation   Above Ground
  No.             (km)         (km)          (m)           (m)
--------       ----------   ----------    ---------   ------------
     1 ! X =          1.,          1.,      12.500,       0.000!   !END!
     2 ! X =         2.5,         4.2,      28.100,       0.000!   !END!
     3 ! X =        2.89,         3.2,      39.600,       0.000!   !END!



-------------
    a
     Data for each receptor are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     Receptor height above ground is optional.  If no value is entered,
     the receptor is placed on the ground.
```

Table F-3
CALPUFF Control File Inputs - Input Group 0
Input File Names

Variable	Type	Description	Default Value
NMETDAT	integer	Number of CALMET files; if more than 1 CALMET file is used, all names must be placed in Subgroup 0a	1
NPTDAT	integer	Number of PTEMARB files placed in Subgroup 0b	0
NARDAT	integer	Number of AREMARB files placed in Subgroup 0c	0
NVOLDAT	integer	Number of VOLEMARB files placed in Subgroup 0d	0
		Input Files	
METDAT	character*70	Meteorological data file created by CALMET	CALMET.DAT
ISCDAT	character*70	Meteorological data file in ISC3 format or extended ISC3 format	ISCMET.DAT
PLMDAT	character*70	Meteorological data file in AUSPLUME format or extended AUSPLUME format	PLMMET.DAT
PRFDAT	character*70	Meteorological data file in CTDM profile format	PROFILE.DAT
SFCDAT	character*70	Meteorological data file in CTDM surface format	SURFACE.DAT
RSTARTB	character*70	Model restart file read at beginning of run	RESTARTB.DAT
PTDAT	character*70	Arbitrarily-varying point source emissions file	PTEMARB.DAT
VOLDAT	character*70	Arbitrarily-varying gridded volume source emissions file	VOLEMARB.DAT
ARDAT	character*70	Arbitrarily-varying buoyant area source emissions file	BAEMARB.DAT
LNDAT	character*70	Arbitrarily-varying buoyant line source emissions file	LNEMARB.DAT
OZDAT	character*70	Hourly ambient ozone measurement file	OZONE.DAT
VDDAT	character*70	User-specified deposition velocity file	VD.DAT
CHEMDAT	character*70	User-specified chemical transformation rate file	CHEM.DAT
H2O2DAT	character*70	User-specified H2O2 measurement file	H2O2.DAT
HILLDAT	character*70	Subgrid-scale terrain (hill) file in CTDM format	HILL.DAT
RCTDAT	character*70	Subgrid-scale terrain receptor file in CTDM format	HILLRCT.DAT
CSTDAT	character*70	Subgrid-scale coastal boundary file	COASTLN.DAT
BDYDAT	character*70	Mass flux boundary file	FLUXBDY.DAT
BCNDAT	character*70	Boundary concentration file	BCON.DAT

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 0
Output File Names

Variable	Type	Description	Default Value
		Output Files	
PUFLST	character*70	CALPUFF list file	CALPUFF.LST
CONDAT	character*70	CALPUFF output concentration file	CONC.DAT
DFDAT	character*70	CALPUFF output dry deposition flux file	DFLX.DAT
WFDAT	character*70	CALPUFF output wet deposition flux file	WFLX.DAT
VISDAT	character*70	Output relative humidity file (needed for visibility calculations in CALPOST)	VISB.DAT
T2DDAT	character*70	Output 2D temperature file	TK2D.DAT
RHODAT	character*70	Output 2D density file	RHO2D.dat
RSTARTE	character*70	Model restart file written during run	RESTARTE.DAT
DEBUG	character*70	Puff-tracking data file (created only if LDEBUG = .TRUE. - see Input Group 5)	DEBUG.DAT
FLXDAT	character*70	Mass flux output (hourly)	MASSFLX.DAT
BALDAT	character*70	Mass balance output (hourly)	MASSBAL.DAT
FOGDAT	character*70	Fogging data output (hourly)	FOG.DAT

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 0
Input and Output File Names

Input Group 0 consists of several parts. The first part contains the control variables NMETDAT, NPTDAT, NARDAT, NVOLDAT, and all of the filenames listed above. The remaining parts, Input Groups 0a through 0d, are only needed when more than one CALMET or variable emissions files are used in the simulation. If a number of separate CALMET simulations are made to span the full modeling period, this feature allows a single application of CALPUFF to use all of the CALMET simulations in sequence. This feature is signaled by an NMETDAT value greater than one. Similarly, having the ability to use multiple emissions files allows you to place source groups with markedly different time-variations into separate files.

If you have no CALMET file (i.e., you are using one of the other options for providing meteorological data to CALPUFF such as ISC meteorological data), set NMETDAT=0:

```
INPUT GROUP: 0 -- Input and Output File Names

--------------
Default Name  Type          File Name
------------  ----          ---------
CALMET.DAT    input    * METDAT =             *
    or
ISCMET.DAT    input    ! ISCDAT = ISCMET.DAT  !

Provision for multiple input files
----------------------------------

     Number of CALMET.DAT files for run (NMETDAT)
                                   Default: 1      ! NMETDAT =   0   !
```

If you have a single CALMET file, set NMETDAT=1:

```
INPUT GROUP: 0 -- Input and Output File Names

--------------
Default Name  Type          File Name
------------  ----          ---------
CALMET.DAT    input    ! METDAT = CALMET.DAT  !
    or
ISCMET.DAT    input    * ISCDAT =             *

Provision for multiple input files
----------------------------------

     Number of CALMET.DAT files for run (NMETDAT)
                                   Default: 1      ! NMETDAT =   1   !
```

If you have 3 CALMET files, set NMETDAT=3:

```
INPUT GROUP: 0 -- Input and Output File Names

--------------
Default Name  Type          File Name
------------  ----          ---------
CALMET.DAT    input    * METDAT =             *
    or
ISCMET.DAT    input    * ISCDAT =             *

Provision for multiple input files
----------------------------------

     Number of CALMET.DAT files for run (NMETDAT)
                                   Default: 1      ! NMETDAT =   3   !
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 0
Input and Output File Names

and provide all of the CALMET file names in Input Group 0a:

```
-------------
Subgroup (0a)
-------------

  The following CALMET.DAT filenames are processed in sequence if NMETDAT>1

Default Name  Type           File Name
------------  ----           ---------
 none         input    ! METDAT= CALMET1.DAT    !        !END!
 none         input    ! METDAT= CALMET2.DAT    !        !END!
 none         input    ! METDAT= CALMET3.DAT    !        !END!
```

Note that each filename entered in Input Group 0a is treated as a separate input subgroup and therefore must end with the input group terminator (!END!). A total of NMETDAT lines assigning the CALMET file names must be present, and the names must be ordered in the proper sequence (e.g., CALMET results for June must not precede CALMET results for February).

For the emissions files, you may either place a single file name in the main section of Group 0, and place no names in the corresponding subsection, or you may place all names in the subsection (any names placed in the subsection replace any name specified in the main Group). Using the point source variable emissions file as an example, if you have 1 file you may either set the name in the main group:

```
INPUT GROUP: 0 -- Input and Output File Names

-------------
Default Name  Type           File Name
------------  ----           ---------
PTEMARB.DAT   input    ! PTDAT  =  pts1.dat        !

Provision for multiple input files
----------------------------------

     Number of PTEMARB.DAT files for run (NPTDAT)
                                  Default: 0       ! NPTDAT =   0   !
-------------
Subgroup (0b)
-------------

  The following PTEMARB.DAT filenames are processed if NPTDAT>0
  (Any PTEMARB.DAT name provided above is replaced)

Default Name  Type           File Name
------------  ----           ---------
 none         input     * PTDAT =             *   *END*
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 0
Input and Output File Names

or set the name in the subgroup:

```
INPUT GROUP: 0 -- Input and Output File Names

--------------
Default Name  Type          File Name
------------  ----          ---------
PTEMARB.DAT   input    * PTDAT  =            *

Provision for multiple input files
----------------------------------

     Number of PTEMARB.DAT files for run (NPTDAT)
                                    Default: 0       ! NPTDAT =   1   !
-------------
Subgroup (0b)
-------------

  The following PTEMARB.DAT filenames are processed if NPTDAT>0
  (Any PTEMARB.DAT name provided above is replaced)

Default Name  Type          File Name
------------  ----          ---------
 none         input     ! PTDAT = pts1.dat   !   !END!
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 1
General Run Control Parameters

Variable	Type	Description	Default Value
METRUN	integer	Control parameter for running all periods in met. file (0=no; 1=yes)	0
IBYR	integer	Starting year of the CALPUFF run (four digits)	-
IBMO	integer	Starting month	-
IBDY	integer	Starting day	-
IBHR	integer	Starting hour (time at end of hour: 00-23)	-
XBTZ	integer	Time zone (PST=8., MST=7., CST=6., EST=5.)	-
IRLG	integer	Length of the run (hours)	-
NSPEC	integer	Total number of species modeled	5
NSE	integer	Number of species emitted	3
ITEST	integer	Flag to stop run after the setup phase (1 = stops the program, 2 = continues with execution after setup)	2
MRESTART	integer	Restart control may direct model to read and/or write a file of puff data which allows a run to be segmented 0 = Do not read or write a restart file 1 = Read a restart file at the beginning of the run 2 = Write a restart file during run 3 = Read a restart file at beginning of run and write a restart file during run	0
NRESPD	integer	Number of periods in restart output cycle; a restart file that is written during the run is refreshed at the end of every cycle 0 = File written only at last period >0 = File updated every NRESPD periods	0
METFM	integer	Meteorological data format 1 = CALMET unformatted file (CALMET.DAT) 2 = ISC3 ASCII file (ISCMET.DAT) 3 = AUSPLUME ASCII file (PLMMET.DAT) 4 = CTDMPLUS tower file (PROFILE.DAT) and surface parameters file (SURFACE.DAT) 5 = AERMET tower file (PROFILE.DAT) and surface parameters file (SURFACE.DAT)	1
MPRFFM	integer	Meteorological Profile Data Format 1 = CTDM plus tower file (PROFILE.DAT) 2 = AERMET tower file (PROFILE.DAT)	1

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 2

Technical Options

Variable	Type	Description	Default Value
AVET	real	Averaging time (minutes) PG - $\mathbf{F}_y$ is adjusted by the equation $(AVET/PGTIME)^{0.2}$	60.0
PGTIME	real	Averaging time (minutes) for PG - $\mathbf{F}_y$	60.0
MGAUSS	integer	Control variable determining the vertical distribution used in the near field (0 = uniform, 1 = Gaussian)	1
MCTADJ	integer	Terrain adjustment method 0 = no adjustment 1 = ISC-type of terrain adjustment 2 = simple, CALPUFF-type of terrain adjustment 3 = partial plume path adjustment	3
MCTSG	integer	CALPUFF subgrid scale complex terrain module (CTSG) flag (0 = CTSG not modeled, 1 = CTSG modeled)	0
MSLUG	integer	Near-field puffs modeled as elongated "slugs" ? (0 = no, 1 = yes)	0
MTRANS	integer	Transitional plume rise modeled ? (0 = only final rise computed, 1 = transitional rise computed) Note: Transitional plume rise is always computed for sources subject to building downwash effects.	1
MTIP	integer	Stack tip downwash modeled ? 0 = no (i.e., no stack tip downwash) 1 = yes (i.e., use stack tip downwash)	1
MBDW	integer	Method used to simulate building downwash? 1 = ISC method 2 = PRIME method	1
MSHEAR	integer	Vertical wind shear above stack top modeled in plume rise? (0 = no, 1 = yes)	0
MSPLIT	integer	Puff splitting allowed ? (0 = no, 1 = yes)	0

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 2

Technical Options

Variable	Type	Description	Default Value
MCHEM	integer	Chemical mechanism flag. 0 = chemical transformation not modeled 1 = transformation rates computed internally (MESOPUFF II scheme) 2 = user specified transformation rates used (If MCHEM = 2, the user must prepare a file (CHEM.DAT) with a diurnal cycle of ransformation rates) 3 = transformation rates computed internally (RIVAD/ARM3 scheme) 4 = secondary organic aerosol formation computed (MESOPUFF II scheme for OH)	1
MAQCHEM	integer	Aqueous phase transformation modeled ? (Used only if MCHEM = 1, or 3) (0 = no, 1 = yes)	0
MWET	integer	Wet removal modeled ? (0 = no, 1 = yes)	1
MDRY	integer	Dry deposition modeled ? (0 = no, 1 = yes) Note: The method used to determine dry deposition velocities is specified by the user on a species-by-species basis in Input Group 3.	1
MTURBVW	integer	Sigma-v/sigma-theta, sigma-w measurements used? (Used only if MDISP = 1 or 5) 1 = use sigma-v or sigma-theta measurements from PROFILE.DAT to compute sigma-y (valid for METFM = 1, 2, 3, 4) 2 = use sigma-w measurements from PROFILE.DAT to compute sigma-z (valid for METFM = 1, 2, 3, 4) 3 = use both sigma-(v/theta) and sigma-w from PROFILE.DAT to compute sigma-y and sigma-z (valid for METFM = 1, 2, 3, 4) 4 = use sigma-theta measurements from PLMMET.DAT to compute sigma-y (valid only if METFM = 3)	3

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 2

Technical Options

Variable	Type	Description	Default Value
MDISP	integer	Method used to compute the horizontal and vertical dispersion coefficients 1 = computed from values of $\mathbf{F}_v$ and $\mathbf{F}_w$ from the PROFILE.DAT file 2 = computed from $\mathbf{F}_v$ and $\mathbf{F}_w$ which are calculated internally from the micrometeorological variables (u_*, w_*, L, etc.) 3 = PG dispersion coefficients used in RURAL areas (computed using the ISCST multi-segment approximation) and MP coefficients used in URBAN areas 4 = same as 3 except PG coefficients computed using the MESOPUFF II equations 5 = CTDM sigmas used for stable and neutral conditions, for unstable conditions, sigmas are computed as in MDISP = 3. MDISP = 5 assumes that $\mathbf{F}_v$ and $\mathbf{F}_w$ are read from PROFILE.DAT file.	3
MDISP2	integer	Back-up method used to compute dispersion when measured turbulence data are missing (used only if MDISP = 1 or 5) 2 = computed from $\mathbf{F}_v$ and $\mathbf{F}_w$ which are calculated internally from the micrometeorological variables (u_*, w_*, L, etc.) 3 = PG dispersion coefficients used in RURAL areas (computed using the ISCST multi-segment approximation) and MP coefficients used in URBAN areas 4 = same as 3 except PG coefficients computed using the MESOPUFF II equations	3
MTAUADV	integer	Method used for Advective-Decay timescale for Turbulence 0 = No turbulence advection 10 < Direct user input (s) -- e.g., 800	0
MCTURB	integer	Method used to compute turbulence sigma-v & sigma-w using micrometeorological variables 1 = Standard CALPUFF subroutines 2 = AERMOD subroutines	1

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 2

Technical Options

Variable	Type	Description	Default Value
MROUGH	integer	PG $\mathbf{F}_y$ and $\mathbf{F}_z$ adjusted for surface roughness ? (0 = no, 1 = yes)	0
MPARTL	integer	Partial plume penetration of elevated inversion? (0 = no, 1 = yes)	1
MTINV	integer	Strength of temperature inversion provided in PROFILE.DAT extended records? (0 = no, computed from gradients; 1= yes)	0
MPDF	integer	Probability Distribution Function method used for dispersion in the convective boundary layer? (0 = no, 1 = yes)	0
MSGTIBL	integer	Subgrid scale TIBL module used for shoreline? (0 = no, 1 = yes)	0
MBCON	integer	Boundary conditions (concentration) modeled? (0 = no, 1 = yes)	0
MSOURCE	integer	Individual source contributions saved? (0 = no, 1 = yes)	0
MFOG	integer	Configure for FOG Model output? (0 = no 1 = yes - report results in PLUME Mode format 2 = yes - report results in RECEPTOR Mode format)	0
MREG	integer	Check options for Regulatory values? 0 = NO checks are made 1 = Technical options must conform to USEPA Long Range Transport (LRT) guidance METFM 1 or 2 AVET 60. (min) PGTIME 60. (min) MGAUSS 1 MCTADJ 3 MTRANS 1 MTIP 1 MCHEM 1 or 3 (if modeling SOx, NOx) MWET 1 MDRY 1 MDISP 2 or 3 MPDF 0 if MDISP=3 1 if MDISP=2 MROUGH 0 MPARTL 1 SYTDEP 550. (m) MHFTSZ 0	1

Table F-3 (Continued)
Control File Inputs - Input Group 3
Species List

Input Group 3 consists of two parts. The first part contains a list of species names and a table with four integer flags for each species. These flags indicate if a pollutant is modeled (0=no, 1=yes), emitted (0=no, 1=yes), dry deposited (0=no, 1=yes, treated as a gas with the resistance model, 2=yes, treated as a particle with the resistance model, or 3=yes, user-specified deposition velocities used), and if the species is to be added to group for output by specifying a group number greater than zero. The second part allows one to name the output species groups, if any are identified in the table.

However, the user must first specify the species names to be modeled. Each species is entered on a separate line with ! CSPEC = XXX ! !END!, where XXX is a species name (up to 12 characters in length), and the variable delimiter and group delimiter (!END!) appears on the line. For example, a five-species SO_x, NO_x run with MCHEM=1 would be:

```
INPUT GROUP: 3a, 3b  --  Species list
-------------------

-------------
Subgroup (3a)
-------------

        ! CSPEC = SO2  ! !END!
        ! CSPEC = SO4  ! !END!
        ! CSPEC = NOX  ! !END!
        ! CSPEC = HNO3 ! !END!
        ! CSPEC = NO3  ! !END!
```

The MESOPUFF II chemical transformation option (MCHEM=1) in CALPUFF is designed to simulate the conversion of SO_2 6 $SO_4^=$ and NO_x 6 HNO_3 : NO_3^-. For this option, five pollutants in CALPUFF are labeled as SO_2, $SO_4^=$, NO_x, HNO_3, and NO_3^-. If the RIVAD/ARM3 transformation option (MCHEM=3) is selected, NO and NO_2 are explicitly treated, and six pollutants are labeled as SO_2, $SO_4^=$, NO, NO_2, HNO_3, and NO_3^-. However, by setting the appropriate flags controlling the various technical options (chemical transformation, deposition, etc.), other reactive or non-reactive pollutants can be simulated.

The user has control over which species are to be emitted and dry deposited in a particular run. If the dry deposition flag is set equal to 3 for any pollutant, a file called VD.DAT must be made available to the model. This file contains a diurnal cycle of 24 user-specified deposition velocities for each pollutant flagged.

The last species in (3a) must be 'BCON' when using the boundary condition option (MBCON > 0). Species BCON does not participate in any chemical transformation mechanism and it should typically be modeled without removal. Mass is placed in species BCON when generating boundary condition puffs so that ‘clean’ air entering the modeling domain can be simulated in the same way as ‘polluted’ air.

Table F-3 (Continued)
Control File Inputs - Input Group 3
Species List

Species-groups can be used to allow mass distributions of particles to be source-specific. In the example provided in Table F-2, we have defined six particle-sizes as individual species:

```
! CSPEC =          SO2 !         !END!
! CSPEC =          NOX !         !END!
! CSPEC =      PMSIZE1 !         !END!
! CSPEC =      PMSIZE2 !         !END!
! CSPEC =      PMSIZE3 !         !END!
! CSPEC =      PMSIZE4 !         !END!
! CSPEC =      PMSIZE5 !         !END!
! CSPEC =      PMSIZE6 !         !END!

                                                    Dry                OUTPUT GROUP
    SPECIES          MODELED          EMITTED      DEPOSITED             NUMBER
     NAME         (0=NO, 1=YES)    (0=NO, 1=YES)   (0=NO,               (0=NONE,
   (Limit: 12                                        1=COMPUTED-GAS       1=1st CGRUP,
    Characters                                       2=COMPUTED-PARTICLE  2=2nd CGRUP,
    in length)                                       3=USER-SPECIFIED)    3= etc.)

!          SO2  =         1,             1,          1,                 0   !
!          NOX  =         1,             0,          2,                 0   !
!      PMSIZE1  =         1,             1,          2,                 1   !
!      PMSIZE2  =         1,             1,          2,                 1   !
!      PMSIZE3  =         1,             1,          2,                 1   !
!      PMSIZE4  =         1,             1,          2,                 1   !
!      PMSIZE5  =         1,             1,          2,                 1   !
!      PMSIZE6  =         1,             1,          2,                 1   !

!END!
```

This allows each size to be modeled separately, each with its own mass emission rate and deposition velocity. Several sources in the run could have been given different emission rates for these "species", thereby producing unique mass distributions for their particulate emissions. Prior to reporting any concentrations or deposition fluxes for these individual "species", however, they must be summed to provide the total particulate concentration or deposition flux. This is done through "grouping":

```
-------------
Subgroup (3b)
-------------

! CGRUP =         PM10 !     !END!
```

Table F-3 (Continued)
Control File Inputs - Input Group 3
Species List

In this case, the species-group name provided to characterize the total concentration is "PM10". Only one group name is required because only one non-zero group number was given in Input Group 3a. This group name must be used later in Input Group 5 when selecting output options for the particulates, and this is the name that will be written to the output files (the list file as well as the concentration/flux files used by the postprocessor). Note that any species not assigned to a non-zero species-group retain the initial species name in the output. Also, the order of names provided in Input Group 3b must be consistent with the group numbers provided in Input Group 3a.

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 4
Map Projection and Grid Control Parameters

Variable	Type	Description	Default Value
PMAP *	char*8	Map projection UTM : Universal Transverse Mercator TTM : Tangential Transverse Mercator LCC : Lambert Conformal Conic PS : Polar Stereographic EM : Equatorial Mercator LAZA : Lambert Azimuthal Equal Area	UTM
FEAST	real	False Easting (km) for PMAP= TTM, LCC, or LAZA	0.0
FNORTH	real	False Easting (km) for PMAP= TTM, LCC, or LAZA	0.0
IUTMZN	integer	UTM zone of coordinates for PMAP=UTM	-
UTMHEM	char*4	Hemisphere (N or S) for PMAP = UTM	N
RLAT0	char*16	Latitude (decimal degrees N or S; e.g., 45.7N) of projection origin for PMAP= TTM, LCC, PS, EM, or LAZA	-
RLON0	char*16	Longitude (decimal degrees E or W; e.g., 75.2E) of projection origin for PMAP= TTM, LCC, PS, EM, or LAZA	-
XLAT1	char*16	Matching parallel #1 of latitude (decimal degrees N or S) for projection (Used only if PMAP= LCC or PS)	-
XLAT2	char*16	Matching parallel #2 of latitude (decimal degrees N or S) for projection (Used only if PMAP= LCC)	-
DATUM	char*8	Datum code for output coordinates	WGS-84
NX	integer	Number of grid cells in the X direction of the meteorological grid	-
NY	integer	Number of grid cells in the Y direction of the meteorological grid	-
NZ	integer	Number of vertical layers	-
DGRIDKM	real	Grid spacing (km) of the meteorological grid	-
ZFACE	real array	Cell face heights (m) for the meteorological grid (NX + 1 values must be entered). Note: Cell center (grid point) height of layer "i" is ((ZFACE(i+1) + (ZFACE(i))/2).	-
XORIGKM	real	Reference X coordinate (km) of the southwest corner of grid cell (1,1) of the meteorological grid	-
YORIGKM	real	Reference Y coordinate (km) of the southwest corner of grid cell (1,1) of the meteorological grid	-

* PMAP = PS, EM, and LAZA is NOT AVAILABLE in CALMET

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 4

Grid Control Parameters

Variable	Type	Description	Default Value
IBCOMP	integer	X index of lower left corner of the computational grid (1 # IBCOMP # NX)	-
JBCOMP	integer	Y index of lower left corner of the computational grid (1 # JBCOMP # NY)	-
IECOMP	integer	X index of upper right corner of the computational grid (IBCOMP # IECOMP # NX)	-
JECOMP	integer	Y index of upper right corner of computational grid (JBCOMP # JECOMP # NY)	-
LSAMP	integer	Flag indicating if an array of gridded receptors (i.e., sampling grid) is used (T = yes, F = no)	T
IBSAMP	integer	X index of lower left corner of the sampling grid (IBCOMP # IBSAMP # IECOMP)	-
JBSAMP	integer	Y index of lower left corner of the sampling grid (JBCOMP # JBSAMP # JECOMP)	-
IESAMP	integer	X index of upper right corner of the sampling grid (IBCOMP # IESAMP # IECOMP)	-
JESAMP	integer	Y index of upper right corner of the sampling gird (JBCOMP # JESAMP # JECOMP)	-
MESHDN	integer	Nesting factor of the sampling grid (MESHDN $ 1). The grid spacing of the sampling grid is DGRIDKM/MESHDN. The number of sampling grid points is NXSAM * NYSAM, where NXSAM = MESHDN * (IESAMP - IBSAMP) + 1 NYSAM = MESHDN * (JESAMP - JBSAMP) + 1	1

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 5

Output Options

Variable	Type	Description	Default Value
ICON	integer	Control variable for creation of an output disk file (CONC.DAT) containing concentration fields (species stored in this file are controlled by the output species table described below). (0 = do not create CONC.DAT, 1 = create CONC.DAT)	1
IDRY	integer	Control variable for creation of an output disk file (DFLX.DAT) containing dry flux fields. (The species stored in this file are controlled by the output species table in Input Group 5 described below.) (0 = do not create DFLX.DAT, 1 = create DFLX.DAT)	1
IWET	integer	Control variable for creation of an output disk file (WFLX.DAT) containing wet flux fields. (The species stored in this file are controlled by the output species table in Input Group 5 described below.) (0 = do not create WFLX.DAT, 1 = create WFLX.DAT)	1
IT2D	integer	Control variable for creation of an output disk file containing 2D temperature fields. (0 = do not create, 1 = create)	0
IRHO	integer	Control variable for creation of an output disk file containing 2D density fields. (0 = do not create, 1 = create)	0
IVIS	integer	Control variable for creation of an output disk file containing relative humidity data required for visibility applications	1
IQAPLOT	integer	Create a standard series of output files (e.g. locations of sources, receptors, grids ...) suitable for plotting? (0 = do not create, 1 = create)	0
LCOMPRS	logical	Control for data compression in the output files (should usually be TRUE)	T
IMFLX	integer	Control variable for creating output disc file (MASSFLX.DAT) for mass flux across user-specified boundaries (0 = do not create MASSFLX.DAT, 1 = create MASSFLX. DAT)	0

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 5

Output Options

Variable	Type	Description	Default Value
IMBAL	integer	Control variable for creating output disk file (MASSBAL.DAT) for mass balance results (0 = do not create MASSBAL.DAT, 1 = create MASSBAL. DAT)	0
ICPRT	integer	Control variable for printing of concentration fields to the output list file (CALPUFF.LST). (0 = do not print any dry fluxes, 1 = print dry fluxes indicated in output table)	0
IDPRT	integer	Control variable for printing of dry flux fields to the output list file (CALPUFF.LST). (0 = do not print any dry fluxes, 1 = print dry fluxes indicated in output table)	0

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 5

Output Options

Variable	Type	Description	Default Value
IWPRT	integer	Control variable for printing of wet flux fields to the output list file (CALPUFF.LST). (0 = do not print any wet fluxes, 1 = print wet fluxes indicated in output table) 0	0
ICFRQ	integer	Printing interval for the concentration fields. Concentrations are printed every "ICFRQ" hours. (Used only if ICPRT = 1.)	1
IDFRQ	integer	Printing interval for the dry flux fields. Dry fluxes are printed every "IDFRQ" hours. (Used only if IDPRT = 1.)	1
IWFRQ	integer	Printing interval for the wet flux fields. Wet fluxes are printed every "IWFRQ" hours. (Used only if IWPRT = 1.)	1
IMESG	integer	Control variable determining if messages tracking the progress of the run are written to the screen 0 = no 1 = yes (advection step, puff ID) 2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)	2
IPRTU	integer	Control variable for selecting units used for concentrations and deposition fluxes reported in the list file Concentration Deposition 1 = g/m**3 g/m**2/s 2 = mg/m**3 mg/m**2/s 3 = ug/m**3 ug/m**2/s 4 = ng/m**3 ng/m**2/s 5 = Odour Units	1
LDEBUG	logical	Control variable for activation of "debug" write statements	F
IPFDEB	integer	Puff ID number to start tracking in debug option (used only if LDEBUG = T)	1
NPFDEB	integer	Number of puffs to track in debug option (used only if LDEBUG = T)	1
NN1	integer	Time period (hour) to begin debug output (used only if LDEBUG = T)	1
NN2	integer	Time period (hour) to stop debug output (used only if LDEBUG = T)	10

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 5
Output Options

In addition to the variables described above, Input Group 5 also contains a table of species with a series of flags indicating if the pollutant's concentration and wet/dry flux fields are to be printed to the output list file (CALPUFF.LST) and/or stored in the output disk files (CONC.DAT, DFLX.DAT, WFLX.DAT, and MASSFLX.DAT).

The format of the species output table is shown below. A value of 0 indicates "no", and a value of 1 indicates "yes". Note that the names provided here must be the ouput species names, which would be the species-group names if any species were grouped in Input Group 4.

```
     SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

                  ---- CONCENTRATIONS ----   ------ DRY FLUXES ------   ------ WET FLUXES ------   -- MASS FLUX --
   SPECIES
   /GROUP         PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   SAVED ON DISK?
   -------        ------------------------   ------------------------   ------------------------   ---------------
!          SO2 =     1,           1,           0,           1,           0,           0,           0   !
!          NOX =     1,           1,           0,           1,           0,           0,           0   !
!         PM10 =     1,           1,           0,           1,           0,           0,           0   !
```

Species BCON, which is required when using the boundary condition option (MBCON > 0), does not need to be saved on disk or written to the list file. Select all zeroes for species BCON to avoid creating output files that are larger than needed:

```
!         BCON =     0,           0,           0,           0,           0,           0,           0   !
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 6
Subgrid Scale Complex Terrain (CTSG) Inputs

Variable	Type	Description	Default Value
		(Input Group 6a - General CTSG Parameters)	
NHILL	integer	Number of subgrid scale terrain features	0
NCTREC	integer	Number of special subgrid scale complex terrain receptors	0
MHILL	integer	Terrain and receptor data for CTSG hills input in CTDM format ? (1 = data created by CTDM processors and read from HILL.DAT and HILLRCT.DAT files; 2 = hill data created by OPTHILL & input below in Subgroup (6b)).	-
XHILL2M	real	Factor to convert horizontal dimensions to meters (used only if MHILL = 1)	1.0
ZHILL2M	real	Factor to convert vertical dimensions to meters (used only if MHILL = 1)	1.0
XCTDMKM	real	X-origin of CTDM system relative to CALPUFF coordinate system, in Kilometers (MHILL = 1)	-
YCTDMKM	real	Y-origin of CTDM system relative to CALPUFF coordinate system, in Kilometers (MHILL = 1)	-
		(Input Group 6b - Hill Information)	
XC	real	UTM X coordinate (km) of the center of the hill on the meteorological grid	-
YC	real	UTM Y coordinate (km) of the center of the hill on the meteorological grid	-
THETAH	real	Orientation of the major axis of the hill (in degrees) clockwise from north	-
ZGRID	real	Height (m) of the "zero-plane" of the grid above mean sea level	-
RELIEF	real	Height (m) of the crest of the hill above the grid elevation	-
EXPO1	real	Hill shape exponent for the major axis of the hill	-
EXPO2	real	Hill shape exponent for the minor axis of the hill	-
SCALE1	real	Horizontal length scale of the hill along the major axis	-
SCALE2	real	Horizontal length scale of the hill along the minor axis	-
AMAX1	real	Maximum allowed axis length of the major axis of the hill	-
AMAX2	real	Maximum allowed axis length of the minor axis of the hill	-

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 6
Subgrid Scale Complex Terrain (CTSG) Inputs

The variables in Input Group 6b are entered for each of the "NHILL" subgrid scale hills treated in the model run. The data for each hill is treated as a separate input subgroup, and therefore must end with an input group terminator (i.e., !END!). The format of Input Group 6b is shown below.

```
------------------
Subgroup (6b)
------------------

                                1 **
     HILL INFORMATION

HILL          XC     YC     THETAH   ZGRID   RELIEF     EXPO 1    EXPO 2    SCALE 1    SCALE 2    AMAX1      AMAX2
 NO.         (km)   (km)    (deg.)    (m)      (m)        (m)       (m)        (m)        (m)       (m)        (m)
-------      -----  -----   ---------  ---------  ----------  ----------  ----------  ----------  ----------  ----------  ----------
 1  ! HILL =  170.5,  3841.0 ,  69. ,    1310. ,   300.  ,    1.91 ,    1.24 ,    1523. ,    2896.  ,    2000.,     1500. !    !END!
 2  ! HILL =  173.0,  3839.0 ,  49. ,    1310. ,   230.  ,    1.50 ,    1.50 ,    3000. ,    1000.  ,    4000.,     2000. !    !END!
```

Note that the hill number is an optional user comment which is outside of the delimiters containing the required data. The data for each hill must follow the opening delimiter and "HILL=". The data for each hill is followed by a closing delimiter and an input group terminator (i.e., !END!).

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 6
Subgrid Scale Complex Terrain (CTSG) Inputs

Variable	Type	Description	Default Value
		(Input Group 6c - CTSG Receptor Data)	
XRCT	real	UTM X coordinate (km) on the meteorological grid system of a CTSG receptor	-
YRCT	real	UTM Y coordinate (km) on the meteorological grid system of a CTSG receptor	-
ZRCT	real	Height (m) of the ground above mean sea level at the CTSG receptor	-
XHH	real	Hill number associated with this CTSG receptor	-

The variables in Input Group 6c are entered for each of the "NCTREC" complex terrain receptors in the model run. The data for each receptor is treated as a separate input subgroup, and therefore must end with an input group terminator (i.e., !END!). The format of Input Group 6c is shown below.

```
------------------
Subgroup (6c)
------------------

                                                    1  **
   COMPLEX TERRAIN RECEPTOR INFORMATION

               XRCT     YRCT       ZRCT       XHH
               (km)     (km)       (m)
              -------  -------    --------    ------
! CTREC =    170.5,    3840.0  ,   1430.  ,    1.   !  !END!
! CTREC =    169.0,    3840.5  ,   1430.  ,    1.   !  !END!
! CTREC =    170.5,    3841.0  ,   1580.  ,    1.   !  !END!
! CTREC =    173.5,    3840.0  ,   1525.  ,    2.   !  !END!
! CTREC =    172.5,    3840.0  ,   1430.  ,    2.   !  !END!


------------------
```

** The data for each CTSG receptor must follow an opening delimiter and "CTREC=". The data for each receptor is followed by a closing delimiter and an input group terminator (i.e., !END!).

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 7
Dry Deposition Parameters - Gases

Input Group 7 consists of a table containing the following five parameters which are required by the resistance deposition model for computing deposition velocities for gases:

- Pollutant diffusivity (cm^2/s)
- Aqueous phase dissociation constant, alpha-star
- Pollutant reactivity
- Mesophyll resistance, r_m (s/cm)
- Henry's Law coefficient, H (dimensionless)

These parameters must be specified for each pollutant with a dry deposition flag of "1" in the species list (Input Group 3) indicating the use of the resistance model for a gas.

The format of the input table is shown below:

```
------------------------------------------------------------------------------------------------------------------------------------------------------------

INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases
-------------------------

SPECIES    DIFFUSIVITY    ALPHA-STAR     REACTIVITY     MESOPHYLL RESISTANCE     HENRY'S LAW COEFFICIENT
 NAME       (cm**2/s)                                        (s/cm)                  (dimensionless)
-----------  ----------  ----------  ----------  ----------------------------  ----------------------------

! SO2  =        0.1509  ,      1.00E3  ,       8.0  ,            0.0  ,                 4.e-2  !
! NOX  =        0.1656  ,      1.00    ,       8.0  ,            5.0  ,                 3.5    !
! HNO3 =        0.1628  ,      1.00    ,      18.0  ,            0.0  ,                 8.e-8  !

!END!
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 8
Dry Deposition Parameters - Particles

Input Group 8 consists of a table containing the geometric mass mean diameter (microns) and the geometric standard deviation (microns) required by the resistance deposition model for computing deposition velocities for particulate matter.

These parameters must be specified for each pollutant with a dry deposition flag of "2" in the species list (Input Group 3) indicating the use of the resistance model for a pollutant deposited as particulate matter.

The format of the input table is shown below:

```
------------------------------------------------------------------------------------------------------------------------------------------------------------------------

INPUT GROUP: 8 -- Size parameters for dry deposition of particles
------------------

SPECIES          GEOMETRIC MASS MEAN          GEOMETRIC STANDARD
 NAME                 DIAMETER                      DEVIATION
                      (microns)                     (microns)
-----------      ---------------------------      ---------------------------
! SO4    =              0.48             ,              2.00     !
! NO3    =              0.48             ,              2.00     !
! PM10 =                0.48             ,              2.00     !

!END!
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 9
Miscellaneous Dry Deposition Parameters

Variable	Type	Description	Default Value
RCUTR	real	Reference cuticle resistance (s/cm)	30.
RGR	real	Reference ground resistance (s/cm)	10.
REACTR	real	Reference pollutant reactivity	8.
NINT	integer	Number of particle-size intervals used to evaluate effective particle deposition velocity	9
IVEG	integer	Flag specifying the state of vegetation in unirrigated areas 1 = vegetation is active and unstressed 2 = vegetation is active and stressed 3 = vegetation is inactive	1

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 10
Wet Deposition Parameters

Input Group 10 consists of a table containing pollutant-dependent values of the scavenging coefficient, **8**, for both liquid and frozen precipitation types. The format of the input table is shown below.

```
------------------------------------------------------------------------------------------
INPUT GROUP: 10 -- Wet Deposition Parameters
--------------------------

                        Scavenging Coefficient -- Units: (sec)-1

     Pollutant          Liquid Precip.        Frozen Precip.
     ------------       ------------------    ------------------
     !  SO2     =         3.0e-5        ,        0.0          !
     !  SO4     =        10.0e-5        ,        3.0e-5       !
     !  NOX     =         0.0           ,        0.0          !
     ! HNO3     =         6.0e-5        ,        0.0          !
     !  NO3     =        10.0e-5        ,        3.0e-5       !

!END!
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 11
Chemistry Parameters

Variable	Type	Description	Default Value
MOZ	integer	Control variable for the input of hourly ozone data used in the chemical transformation module (Used only if MCHEM = 1,3,4) 0 = use a monthly background ozone value in chemistry calculation 1 = use hourly ozone concentrations from the OZONE.DAT data file	1
BCKO3(12)	real array	Monthly background ozone concentration in ppb (Used only if MCHEM=1,3,4 and MOZ = 0 or if (MOZ=1 and all hourly ozone data are missing))	12*80.
BCKNH3(12)	real	Monthly background ammonia concentration in ppb	12*10.
RNITE1	real	Nighttime SO_2 loss rate in percent/hour	0.2
RNITE2	real	Nighttime NO_x loss rate in percent/hour	2.0
RNITE3	real	Nighttime HNO_3 formation rate in percent/hour	2.0
MH2O2	integer	Control variable for the input of hourly ozone data used in the chemical transformation module (Used only if MAQCHEM = 1) 0 = use a monthly background H2O2 value 1 = use hourly H2O2 concentrations from the H2O2.DAT data file	1
BCKH2O2(12)	real array	Monthly background H2O2 concentration in ppb (Used only if MAQCHEM=1 and MH2O2 or if (MH2O2=1 and all hourly H2O2 data are missing))	12*1.
BCKPMF(12)	real array	Monthly fine particulate concentration in ug/m^3 for SOA (Used only if MCHEM=4)	12*1.
OFRAC(12)	real array	Monthly organic fraction of fine particulate for SOA (Used only if MCHEM=4)	2*0.15, 9*0.20, 0.15
VCNX(12)	real array	Monthly VOC / NOX ratio (after reaction) for SOA (Used only if MCHEM=4)	12*50.0

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 12
Dispersion and Computational Parameters

Variable	Type	Description	Default Value
SYTDEP	real	Horizontal size of a puff (m) beyond which the time-dependent dispersion equation of Heffter (1965)	550.
MHFTRZ	integer	Use Heffter formulas for $\mathbf{F}_z$? (0 = no; 1 = yes). If yes, the distance at which the Heffter formula will be applied for $\mathbf{F}_z$ is determined by when $\mathbf{F}_y$ switches to Heffter's eqn. (see SYTDEP).	0
JSUP	integer	Stability class used to determine dispersion rates for puffs above the boundary layer (e.g., 6 = F stability)	5
CONK1	real	Vertical dispersion constant for stable conditions	0.01
CONK2	real	Vertical dispersion constant for neutral/unstable conditions	0.10
TBD	real	Factor for determining transition-point from Schulman-Scire to Huber-Snyder Building Downwash scheme (SS used for Hs < Hb + TBD * HL) TBD < 0 always use Huber-Snyder TBD = 1.5 always use Schulman-Scire TBD = 0.5 ISC transition-point	0.5
IURB1, IURB2	integer	Land use categories associated with urban areas. If MDISP = 3 or 4, MP dispersion coefficients are used when puff is over land use type IURB1 through IURB2	10,19
(Site characterization parameters for single-point met. data files*)			
*ILANDUIN	integer	Land use category for modeling domain	20
*Z0IN	real	Roughness length (m) for modeling domain	0.25
*XLAIIN	real	Leaf area index for modeling domain	3.0
*ELEVIN	real	Elevation (m) above sea level	0.0
*XLATIN	real	North Latitude (deg) of station; positive for the northern hemisphere, negative for the southern hemisphere (used for solar angle in RIVAD/ARM3 chem. transformation)	-999.
*XLONIN	real	West Longitude (deg) of station; positive west of 0.0, negative east of 0.0 (used for solar angle in RIVAD/ARM3 chem. transformation)	-999.
*ANEMHT	real	Anemometer height (m) (used only if METFM = 2,3)	10.0

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 12

Dispersion and Computational Parameters

Variable	Type	Description	Default Value
*ISIGMAV	integer	Form of lateral turbulence data in PROFILE.DAT file (used only if METFM = 4 or MTURBVW = 1 or 3) 0 = read sigma-theta 1 = read sigma-v	1
*IMIXCTDM	integer	Choice of mixing heights (used only if METFM = 4) 0 = read PREDICTED mixing heights 1 = read OBSERVED mixing heights	0
XMXLEN	real	Maximum length of an emitted slug (in met. grid units)	1.0
XSAMLEN	real	Maximum travel distance of a slug or puff (in met. grid units) during one sampling step	1.0
MXNEW	integer	Maximum number of puffs or slugs released from one source during one time step (serves as a cap if XMXLEN is specified too small)	99
MXSAM	integer	Maximum number of sampling steps during one time step for a puff or slug (serves as a cap if XSAMLEN is specified too small)	99
NCOUNT	integer	Number of iterations used when computing the transport wind for a sampling step that includes transitional plume rise (used when METFM=1 or 4)	2
SYMIN	real	Minimum $\mathbf{F}_y$ (m) a new puff or slug	1.0
SZMIN	real	Minimum $\mathbf{F}_z$ (m) a new puff or slug	1.0
SVMIN(12)	real	Minimum turbulence $\mathbf{F}_v$ (m/s) for each stability class, over land and over water	6*0.50, 6*0.37
SWMIN(12)	real	Minimum turbulence $\mathbf{F}_w$ (m/s) for each stability class, over land and over water	2*(0.20, 0.12, 0.08, 0.06, 0.03, 0.016)
CDIV(2)	real	Divergence criterion for dw/dz in met cell used to initiate adjustment for horizontal convergence (l/s). Partial adjustment starts at CDIV(1), and full adjustment is reached at CDIV(2)	0.0, 0.0
WSCALM	real	Minimum wind speed allowed for non-calm conditions. Wind speeds less than WSCALM will be considered as "calm" by the model. WSCALM is also used as the minimum speed returned from the power law extrapolation of the wind speed toward the surface.	0.5
XMAXZI	real	Maximum mixing height (m)	3000.

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 12

Dispersion and Computational Parameters

Variable	Type	Description	Default Value
XMINZI	real	Minimum mixing height (m)	50.
SL2PF	real	Slug-to-puff transition criterion factor (max. σ_y/slug length before transition to puff)	10.
WSCAT(5)	real array	Upper bounds on the first 5 wind speed classes (m/s); The last class has no upper limit	1.54, 3.09, 5.14, 8.23, 10.8
PLX0(6)	real array	Wind speed profile power-law exponents for stabilities A-F	0.07, 0.07, 0.10, 0.15, 0.35, 0.55
PTG0(2)	real array	Potential temperature gradient (deg. k/m) for stability classes E and F	.020, .035
PPC(6)	real array	Default plume path coefficients for each stability class (used when option for partial plume height terrain adjustment is selected, MCTADJ = 3)	0.50, 0.50, 0.50, 0.50, 0.35, 0.35
		(Vertical Puff-Spliting Control Variables *)	
*NSPLIT	integer	Number of puffs that result every time a puff is split; nsplit=2 means that 1 puff splits into 2	3
*IRESPLIT (24)	integer array	Time(s) of a day when split puffs are eligible to be split once again; this is typically set once per day, around sunset before nocturnal shear develops. 24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00) 0=do not re-split; 1=eligible for re-split	17*0, 1, 6*0
*ZISPLIT	real	Split is allowed only if last hour's mixing height (m) exceeds this minimum value	100
*ROLDMAX	real	Split is allowed only if ratio of last hour's mixing ht to the maximum mixing ht experienced by the puff is less than this maximum value (this postpones a split until a nocturnal layer develops)	0.25
		(Horizontal Puff-Spliting Control Variables *)	
*NSPLITH	integer	Number of puffs that result every time a puff is split - nsplith=5 means that 1 puff splits into 5	5
*SYSPLITH	integer	Minimum sigma-y (Grid Cells Units) of puff before it may be split	1.0
*SHSPLITH	integer	Minimum puff elongation rate (SYSPLITH/hr) due to wind shear, before it may be split	2.0

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 12

Dispersion and Computational Parameters

Variable	Type	Description	Default Value
*CNSPLITH (mxspec)	integer array	Minimum concentration (g/m^3) of each species in puff before it may be split. Enter array of NSPEC values; if a single value is entered, it will be used for ALL species	1.0E-07
		(Integration Control Variables *)	
*EPSSLUG	real	Fractional convergence criterion for numerical slug sampling integration	1.0e-04
*EPSAREA	real	Fractional convergence criterion for numerical area source integration	1.0e-06
*DSRISE	real	Trajectory step length (m) for numerical rise integration.	1.0
		(Boundary Condition Puff Control Variables *)	
*HTMINBC	real	Minimum height (m) to which BC puffs are mixed as they are emitted (MBCON=2 ONLY). Actual height is reset to the current mixing height at the release point if greater than this minimum.	500.
*RSAMPBC	real	Search radius (km) about a receptor for sampling nearest BC puff. BC puffs are typically emitted with a spacing of one grid cell length, so the search radius should be greater than DGRIDKM.	10.
*MDEPBC	integer	Near-Surface depletion adjustment to concentration profile used when sampling BC puffs? 0 = Concentration is NOT adjusted for depletion 1 = Adjust Concentration for depletion	0

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 13
Point Source Parameters

Variable	Type	Description	Default Value
(Input Group 13a - General Data)			
NPT1	integer	Number of point sources with constant stack parameters or variable emission rate scale factors	-
IPTU	integer	Units choice for emission rates from point sources 1 = g/s 2 = kg/hr 3 = lb/hr 4 = tons/yr 5 = Odour Unit * m**3/s (vol. flux of compound) 6 = Odour Unit * m**3/min 7 = metric tons/yr	1
NSPT1	integer	Number of source-species with variable emission rate scaling factors provided in 13d	0
NPT2	integer	Number of point sources with arbitrarily-varying emission parameters (If NPT2 > 0, the point source emissions file PTEMARB.DAT must be provided)	-
(Input Group 13b - Point Source Data for Sources with Constant Stack Parameters or Variable Emission Rate Scale Factors)			-
SRCNAM	character*12	Source name, used to coordinate inputs in Subgroups b,c,d	-
XUTM	real	X coordinate (km) of the stack on the meteorological grid	-
YUTM	real	Y coordinate (km) of the stack on the meteorological grid	-
HSTAK	real	Stack height (m)	-
SELEV	real	Stack base elevation (m) above mean sea level	-
DIAM	real	Stack diameter (m)	-
EXITW	real	Stack gas exit velocity (m/s)	-
EXITT	real	Stack gas exit temperature (deg. K)	-
BDOWN	real	Building downwash flag 0. = building downwash not modeled, 1. = building downwash modeled	-
EMS	real array	Emission rate (g/s) of each modeled species Note: "NSPEC" values must be entered	-

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 13

Point Source Parameters

Variable	Type	Description	Default Value
(Optional Variables for Input Group 13b)			
SIGYZI(1)	real	Initial sigma-y (m) associated with the release from this source	0.0 -
SIGYZI(2)	real	Initial sigma-z (m) associated with the release from this source	0.0
FMFAC	real	Vertical momentum flux factor (0. or 1.0) used to represent the effect of rain-caps or other physical configurations that reduce momentum rise associated with the actual exit velocity. FMFAC=1 is full momentum (no obstruction).	1.0
ZPLTFM	real	Platform height (m) for sources influenced by an isolated structure that has a significant open area between the surface and the bulk of the structure, such as an offshore oil platform.	0.0

The variables in Input Group 13b are entered for each of the "NPT1" point sources. The data for each source is treated as a separate input subgroup, and therefore, must end with an input group terminator (i.e., !END!). Note that the source number is an optional user comment which is outside of the delimiter containing the required source data. The data for each source must follow an opening delimiter and "X=". The data for each source is followed by a closing delimiter and an input group terminator.

The first two optional variables may be provided for point sources that have a characteristic distribution much like volume sources. The values are entered in order between delimiters, following "SIGYZI=". The third optional variable is typically used for sources with rain-hats that eliminate the initial vertical momentum of the release. The fourth is for downwash calculations for a structure rests above the surface. These records must be placed before the input group terminates (i.e., !END!) for the point source.

The format of Input Group 13b for a simulation with eight species is shown below.

```
--------------
Subgroup (13b)
--------------                          a
          POINT SOURCE: CONSTANT DATA
          ---------------------------
                                                                                 b          c
  Source      X UTM     Y UTM     Stack   Base     Stack    Exit  Exit    Bldg.  Emission
   No.     Coordinate Coordinate Height Elevation Diameter  Vel.  Temp.   Dwash   Rates
              (km)      (km)       (m)      (m)       (m)  (m/s) (deg. K)
  ------   ---------- ---------- ------  ------   -------- ----- -------- ----- --------
   1 ! SRCNAM = BLR1 !
   1 ! X =      0.1,      -3.,     40.,   25.,       2.2,   10.,   450.,   1., 1.7E00, 1.0E00,
      1.0E-02, 1.0E-01, 2.0E-01, 2.4E-01, 2.5E-01, 2.0E-01 !
   1 ! SIGYZI =       3.,      1.5   !
   1 ! FMFAC  = 1. !
   1 ! ZPLTFM = 0. !
 !END!
--------
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 13
Point Source Parameters

Variable	Type	Description	Default Value
(Input Group 13c - Building Dimension Data)			
SRCNAM	character*12	Source name, used to coordinate inputs in Subgroups b,c,d	-
HEIGHT	real array	Array of 36-direction-specific building heights (m) for flow vectors from 10E-360E in 10E increments	-
WIDTH	real array	Array of 36 direction-specific building widths (m) for flow vectors from 10E-360E in 10E increments	-
LENGTH*	real array	Array of 36 direction-specific building lengths (m) for flow vectors from 10E-360E in 10E increments	-
XBADJ*	real array	Array of 36 direction-specific along-flow offset lengths (m) from the source to the center of the upwind face of the building for flow vectors from 10E-360E in 10E increments	-
YBADJ*	real array	Array of 36 direction-specific cross-flow offset lengths (m) from the source to the center of the upwind face of the building for flow vectors from 10E-360E in 10E increments	-

* LENGTH, XBADJ, and YBADJ are required only for the PRIME downwash option (MBDW=2)

The variables in Input Group 13c are entered for each point source for which IDOWN=1 in Input Group 13b. The data for each point source (i.e., source name, 36 widths and 36 heights, 36 lengths, 36 xb-adjusts, and 36 yb-adjusts) is treated as a separate input subgroup and therefore must end with an input group terminator (i.e., !END!). Once again, the source number is an optional user comment which is outside of the delimiters. The source name is used to place the building information with the correct source. The data for each source must follow an opening delimiter and either "WIDTH=" or "HEIGHT=". The data for each source is followed by a closing delimiter and an input group terminator (i.e., !END!).

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 13
Point Source Parameters

The format of Input Group 13c is shown below.

```
--------------
Subgroup (13c)
--------------

           BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH
           -------------------------------------------------------
Source                                                          a
No.       Effective building height, width, length and X/Y offset (in meters)
           every 10 degrees.  LENGTH, XBADJ, and YBADJ are only needed for
           MBDW=2 (PRIME downwash option)
------     ------------------------------------------------------------

 1    ! SRCNAM  =   BLR1 !
 1    ! HEIGHT  =  45., 45., 45., 45., 45., 45., 45., 45., 45.,  0.,  0.,  0.,
                   0.,  0.,  0.,  0.,  0.,  0., 45., 45., 45., 45., 45., 45.,
                   45., 45., 45.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0. !
 1    ! WIDTH   =   12.5, 12.5, 12.5, 12.5, 12.5, 12.5, 12.5, 12.5, 12.5,  0.,   0.,   0.,
                    0.,   0.,   0.,   0.,   0.,   0.,  12.5, 12.5, 12.5, 12.5, 12.5, 12.5,
                   12.5, 12.5, 12.5,  0.,   0.,   0.,   0.,   0.,   0.,   0.,   0.,   0.  !
 1    ! LENGTH =  82.54,  87.58,  89.95,  89.59,  86.51,  80.80,
                  72.64,  62.26,  50.00,  62.26,  72.64,  80.80,
                  86.51,  89.59,  89.95,  87.58,  82.54,  75.00,
                  82.54,  87.58,  89.95,  89.59,  86.51,  80.80,
                  72.64,  62.26,  50.00,  62.26,  72.64,  80.80,
                  86.51,  89.59,  89.95,  87.58,  82.54,  75.00 !
 1    ! XBADJ  =  -47.35, -55.76, -62.48, -67.29, -70.07, -70.71,
                  -69.21, -65.60, -60.00, -65.60, -69.21, -70.71,
                  -70.07, -67.29, -62.48, -55.76, -47.35, -37.50,
                  -35.19, -31.82, -27.48, -22.30, -16.44, -10.09,
                  -3.43,   3.34,  10.00,   3.34,  -3.43, -10.09,
                  -16.44, -22.30, -27.48, -31.82, -35.19, -37.50 !
 1    ! YBADJ =   34.47,  32.89,  30.31,  26.81,  22.50,  17.50,
                  11.97,   6.08,   0.00,  -6.08, -11.97, -17.50,
                  -22.50, -26.81, -30.31, -32.89, -34.47, -35.00,
                  -34.47, -32.89, -30.31, -26.81, -22.50, -17.50,
                  -11.97,  -6.08,   0.00,   6.08,  11.97,  17.50,
                  22.50,  26.81,  30.31,  32.89,  34.47,  35.00 !
!END!
--------
    a
     Building height, width, length, and X/Y offset from the source are treated
     as a separate input subgroup for each source and therefore must end with
     an input group terminator.
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 13
Point Source Parameters

Variable	Type	Description	Default Value
(Input Group 13d - Variable Emissions Scale Factors)			
SRCNAM	character*12	Source name, used to coordinate inputs in Subgroups b,c,d	-
IVARY	integer	Type of scale factor variation (diurnal, monthly, etc.) 0 = Constant 1 = Diurnal cycle (24 scaling factors: hours 1-24) 2 = Monthly cycle (12 scaling factors: months 1-12) 3 = Hour & Season (4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB) 4 = Speed & Stab. (6 groups of 6 scaling factors, where first group is Stability Class A, and the 6 speed classes have upper bounds (m/s) defined in Group 12) 5 = Temperature (12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)	0
QFAC	real array	Array of emissions scaling factors for this source and the species indicated	-

The variables in Input Group 13d are entered for each point source - species combination indicated by NSPT1 in Input Group 13a (e.g., only NSPT1 combinations are entered). The data for each point source-species combination (i.e., source name, type of variation, and the QFAC array) are treated as a separate input subgroup and therefore must end with an input group terminator (i.e., !END!). Once again, the source number is an optional user comment which is outside of the delimiters. The source name is used to place the scaling factors with the correct source. The data for each source-species combination must follow an opening delimiter and "(cspec)=", where (cspec) is a species name defined in Group 3. The data for each source-species combination is followed by a closing delimiter and an input group terminator (i.e., !END!). If NSPT1=0, no scaling factors should be defined here.

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 13
Point Source Parameters

The format for Input Group 13d is shown below.

```
---------------
Subgroup (13d)
---------------
                                                 a
          POINT SOURCE: VARIABLE EMISSIONS DATA
          -------------------------------------

 1  ! SRCNAM = BLR1 !
 1  ! IVARY  =  2  !    (12 Months)
 1  ! SO2          = 0.1,0.1,0.5,0.9,2,2.2,
                   2.5,1.5,1.1,0.9,0.5,0.1      !
!END!

--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 14
Area Source Parameters

Variable	Type	Description	Default Value
(Input Group 14a - General Area Source Data)			
NAR1	integer	Number of area sources with constant parameters or variable emission rate scale factors	-
IARU	integer	Units choice for emission rates from area sources 1 = g/m**2/s 2 = kg/m**2/hr 3 = lb/m**2/hr 4 = tons/m**2/yr 5 = Odour Unit * m/s (vol. flux/m**2 of compound) 6 = Odour Unit * m/min 7 = metric tons/m**2/yr	1
NSAR1	integer	Number of source-species with variable emission rate scaling factors provided in 14d	0
NAR2	integer	Number of buoyant area sources with arbitrary varying emission parameters	-
(Input Group 14b - Area Source Data for Sources with Constant Parameters or Emissions Scale Factors)			
SRCNAM	character*12	Source name, used to coordinate inputs in Subgroups b,c,d	-
HTEFF	real	Effective height (m) of the area source	-
AELEV	real	Base elevation (m) above mean sea level	-
SIGZI	real	Initial vertical dispersion coefficient ($\mathbf{F}_z$), in meters, of the area source	-
EMIS	real array	Emission rate ($g/s/m^2$) of each modeled species Note: "NSPEC" values must be entered	-

The variables in Input Group 14b are entered for each of the "NAR1" area sources. The data for each source is treated as a separate input subgroup, and therefore, must end with an input group terminator (i.e., !END!). Note that the source number is an optional user comment which is outside of the delimiter containing the required source data. The data for each source must follow an opening delimiter and "X=". The data for each source is followed by a closing delimiter and an input group terminator.

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 14
Area Source Parameters

The format of Input Group 14b for a simulation with eight species is shown below.

```
---------------
Subgroup (14b)
---------------
                                  a
          AREA SOURCE: CONSTANT DATA
          --------------------------
                                                          b
Source           Effect.    Base      Initial    Emission
 No.             Height   Elevation   Sigma z     Rates
                   (m)       (m)        (m)
-------          ------    ------     --------   ---------

   1! SRCNAM = AREA1 !
   1! X =           1.,      0.,         2.5,   8.5E-01,  0.5E00,  0.0E00,
                               0.0E00,  0.0E00,  0.0E00,  0.0E00,  0.0E00 !
    !END!
   2! SRCNAM = AREA2 !
   2! X =          1.5,      0.,          3.,    0.0E00,  0.0E00, 1.0E-01,
                               0.0E00,  0.0E00, 5.0E-01,  1.0E00,  1.3E00 !
    !END!

--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.
    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IARU
     (e.g. 1 for g/m**2/s).
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 14
Area Source Parameters

Variable	Type	Description	Default Value
(Input Group 14c - Vertex Data for Area Sources with Constant Parameters or Emissions Scale Factors)			
SRCNAM	character*12	Source name, used to coordinate inputs in Subgroups b,c,d	-
XVERT	real	X coordinates (km) of each vertex of the area source on the meteorological grid	-
YVERT	real	Y coordinate (km) of each vertex of the area source on the meteorological grid	-

The variables in Input Group 14c are entered for each of the "NAR1" area sources. The data for each source is treated as a separate input subgroup, and therefore, must end with an input group terminator (i.e., !END!). Note that the source number is an optional user comment which is outside of the delimiter containing the required source data. The data for each source must follow an opening delimiter and "X=". The data for each source is followed by a closing delimiter and an input group terminator.

The format of Input Group 14c is shown below.

```
--------------
Subgroup (14c)
--------------

           COORDINATES (UTM-km) FOR EACH VERTEX(4) OF EACH POLYGON
           -------------------------------------------------------
Source                                                          a
 No.       Ordered list of X followed by list of Y, grouped by source
------     ------------------------------------------------------------

 1    ! SRCNAM  =   AREA1 !
 1      !  XVERT = 0.5,    0.51,    0.51,    0.5!
 1      !  YVERT = 1.61,    1.61,    1.6,    1.6!
      !END!
 2    ! SRCNAM  =   AREA2 !
 2      !  XVERT = 0.75,    0.76,    0.76,  0.75!
 2      !  YVERT = 1.81,    1.81,    1.8,    1.8!
      !END!

--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 14
Area Source Parameters

Variable	Type	Description	Default Value
(Input Group 14d - Variable Emissions Scale Factors)			
SRCNAM	character*12	Source name, used to coordinate inputs in Subgroups b,c,d	-
IVARY	integer	Type of scale factor variation (diurnal, monthly, etc.) 0 = Constant 1 = Diurnal cycle (24 scaling factors: hours 1-24) 2 = Monthly cycle (12 scaling factors: months 1-12) 3 = Hour & Season (4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB) 4 = Speed & Stab. (6 groups of 6 scaling factors, where first group is Stability Class A, and the 6 speed classes have upper bounds (m/s) defined in Group 12) 5 = Temperature (12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)	0
QFAC	real array	Array of emissions scaling factors for this source and the species indicated	-

The variables in Input Group 14d are entered for each area source - species combination indicated by NSAR1 in Input Group 14a (e.g., only NSAR1 combinations are entered). The data for each area source-species combination (i.e., source name, type of variation, and the QFAC array) are treated as a separate input subgroup and therefore must end with an input group terminator (i.e., !END!). Once again, the source number is an optional user comment which is outside of the delimiters. The source name is used to place the scaling factors with the correct source. The data for each source-species combination must follow an opening delimiter and "(cspec)=", where (cspec) is a species name defined in Group 3. The data for each source-species combination is followed by a closing delimiter and an input group terminator (i.e., !END!). If NSAR1=0, no scaling factors should be defined here.

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 14
Area Source Parameters

The format of Input Group 14d is shown below.

```
--------------
Subgroup (14d)
--------------
                                                  a
         AREA SOURCE: VARIABLE EMISSIONS DATA
         ------------------------------------

 2  ! SRCNAM = AREA2 !
 2  ! IVARY  =  4  !    (6 speed classes for each stability)
 2  ! PMSIZE1      = 0.1,0.1,0.5,0.9,1,1.5,
                   0.1,0.1,0.5,0.9,1,1.5,
                   0.1,0.1,0.5,0.9,1,1.5,
                   0.1,0.1,0.5,0.9,1,1.5,
                   0.1,0.1,0.5,0.9,1,1.5,
                   0.1,0.1,0.5,0.9,1,1.5      !
!END!

--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 15
Line Source Parameters

Variable	Type	Description	Default Value
(Input Group 15a - General Line Source Data)			
NLN2	integer	Number of buoyant line sources with variable location and emission parameters (all data provided in file LNEMARB.DAT)	0
NLINES	integer	Number of buoyant line sources	-
ILNU	integer	Units choice for line source emissions 1 = g/s 2 = kg/hr 3 = lb/hr 4 = tons/yr 5 = Odour Unit * m**3/s (vol. flux of compound) 6 = Odour Unit * m**3/min 7 = metric tons/yr	1
NSLN1	integer	Number of source-species with variable emission rate scaling factors provided in 15c	0
MXNSEG	integer	Maximum number of line segments into which each line may be divided (if MSLUG=1); Actual number of virtual points which will be used to represent each line (if MSLUG=0)	7
NLRISE	integer	Number of distances at which transitional rise is computed	6
XL	real	Average building length (m)	-
HBL	real	Average building height (m)	-
WBL	real	Average building width (m)	-
WML	real	Average line source width (m)	-
DXL	real	Average separation between buildings (m)	
FPRIMEL	real	Average buoyancy parameter (m^4/s^3)	-
(Input Group 15b - Buoyant Line Source Data) - repeated for each line source			
SRCNAM	character*12	Source name, used to coordinate inputs in Subgroups b,c	-
XBEGL	real	Beginning X coordinate of line source (km)	-
YBEGL	real	Beginning Y coordinate of line source (km)	-
XENDL	real	Ending X coordinate of line source (km)	-
YENDL	real	Ending Y coordinate of line source (km)	-

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 15
Line Source Parameters

Variable	Type	Description	Default Value
HTL	real	Release height (m)	-
ELEVL	real	Base elevation (m)	-
QL	real	Emissions rate (g/s) of each pollutant	-

The variables in Input Group 15b are entered for each of the "NLINES" line sources. The data for each line is treated as a separate input subgroup, and therefore, must end with an input group terminator (i.e., !END!). Note that the line number is an optional user comment which is outside of the delimiter containing the required source data. The data for each line must follow an opening delimiter and "X=". The data for each line is followed by a closing delimiter and an input group terminator.

The format of Input Group 15b for a simulation with eight species is shown below.

```
---------------
Subgroup (15b)
---------------

          BUOYANT LINE SOURCE: CONSTANT DATA
          ----------------------------------
                                                                                  a
Source     Beg. X      Beg. Y      End. X    End. Y     Release    Base        Emission
 No.     Coordinate  Coordinate  Coordinate Coordinate  Height    Elevation      Rates
           (km)        (km)        (km)       (km)       (m)       (m)
------   ----------  ----------  ---------  ----------  -------   ---------    ---------
   1! SRCNAM = LINE1 !
   1! X =       12.,       35.,      12.5,       35.,    22.000,     0.000, 2.3E00, 1.1E00,
0.0E00, 0.0E00, 0.0E00, 0.0E00, 0.0E00, 0.0E00 !
    !END!
   2! SRCNAM = LINE2 !
   2! X =       12.,    35.022,      12.5,    35.022,    22.000,     0.000, 2.3E00, 1.1E00,
0.0E00, 0.0E00, 0.0E00, 0.0E00, 0.0E00, 0.0E00 !
    !END!

--------

    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by ILNTU
     (e.g. 1 for g/s).
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 15
Line Source Parameters

Variable	Type	Description	Default Value
(Input Group 15c - Variable Emissions Scale Factors)			
SRCNAM	character*12	Source name, used to coordinate inputs in Subgroups b,c	-
IVARY	integer	Type of scale factor variation (diurnal, monthly, etc.) 0 = Constant 1 = Diurnal cycle (24 scaling factors: hours 1-24) 2 = Monthly cycle (12 scaling factors: months 1-12) 3 = Hour & Season (4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB) 4 = Speed & Stab. (6 groups of 6 scaling factors, where first group is Stability Class A, and the 6 speed classes have upper bounds (m/s) defined in Group 12) 5 = Temperature (12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)	0
QFAC	real array	Array of emissions scaling factors for this source and the species indicated	-

The variables in Input Group 15c are entered for each line source - species combination indicated by NSLN1 in Input Group 15a (e.g., only NSLN1 combinations are entered). The data for each line source-species combination (i.e., source name, type of variation, and the QFAC array) are treated as a separate input subgroup and therefore must end with an input group terminator (i.e., !END!). Once again, the source number is an optional user comment which is outside of the delimiters. The source name is used to place the scaling factors with the correct source. The data for each source-species combination must follow an opening delimiter and "(cspec)=", where (cspec) is a species name defined in Group 3. The data for each source-species combination is followed by a closing delimiter and an input group terminator (i.e., !END!). If NSLN1=0, no scaling factors should be defined here.

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 15
Line Source Parameters

The format of Input Group 15c is shown below.

```
---------------
Subgroup (15c)
---------------
                                                        a
          BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA
          --------------------------------------------

 1  ! SRCNAM = LINE1 !
 1  ! IVARY  =  1  !    (24 Hours)
 1  ! SO2          = 0.1,0.1,0.1,0.2,0.2,0.3,
                   0.3,0.4,0.4,0.5,0.6,1,
                   1,1,1,1,1,1,
                   0.6,0.4,0.3,0.2,0.1,0.1      !
!END!

--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 16
Volume Source Parameters

Variable	Type	Description	Default Value
(Input Group 16a - General Volume Source Data)			
NVL1	integer	Number of volume sources with constant parameters or variable emission scale factors	-
IVLU	integer	Units choice for volume source emissions 1 = g/s 2 = kg/hr 3 = lb/hr 4 = tons/yr 5 = Odour Unit * m**3/s (vol. flux of compound) 6 = Odour Unit * m**3/min 7 = metric tons/yr	1
NSVL1	integer	Number of source-species with variable emission rate scaling factors provided in 16c	0
NVL2	integer	Number of volume sources with variable location and emission parameters read from file VOLEMARB.DAT	0
(Input Group 16b - Volume Source Data for Sources with Constant Parameters or Variable Emission Scaling Factors (repeated for each volume source (NVL1))			
SRCNAM	character*12	Source name, used to coordinate inputs in Subgroups b,c	-
XVOL	real	X coordinate (km) of center of volume source	-
YVOL	real	Y coordinate (km) of center of volume source	-
HTVOL	real	Effective height (m) of volume source	-
ELEVOL	real	Base elevation (m) of volume source	-
SYVOL	real	Initial $\mathbf{F}_y$ (m) of volume source	-
SZVOL	real	Initial $\mathbf{F}_z$ (m) of volume source	-
QVOL	real	Emission rates (g/s) of each pollutant from volume source	-

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 16
Volume Source Parameters

The variables in Input Group 16b are entered for each of the "NVL1" volume sources. The data for each source is treated as a separate input subgroup, and therefore, must end with an input group terminator (i.e., !END!). Note that the source number is an optional user comment which is outside of the delimiter containing the required source data. The data for each source must follow an opening delimiter and "X=". The data for each source is followed by a closing delimiter and an input group terminator.

The format of Input Group 16b for a simulation with eight species is shown below.

```
--------------
Subgroup (16b)
--------------
                                      a
          VOLUME SOURCE: CONSTANT DATA
          ----------------------------
                                                                        b
       X UTM      Y UTM      Effect.    Base     Initial    Initial    Emission
     Coordinate  Coordinate   Height   Elevation  Sigma y    Sigma z     Rates
        (km)       (km)        (m)       (m)       (m)        (m)
     ----------  ----------   ------    ------    --------   --------   --------

   1! SRCNAM = VOLS1 !
! X =      -5.6,      -1.2,     10.,       0.,       6.2,       6.2, 2.2E00, 4.0E00, 0.0E00,
                                                     0.0E00, 0.0E00, 0.0E00, 0.0E00, 0.0E00 !
!END!

--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IVLU
     (e.g. 1 for g/s).
```

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 16
Volume Source Parameters

Variable	Type	Description	Default Value
(Input Group 16c - Variable Emissions Scale Factors)			
SRCNAM	character*12	Source name, used to coordinate inputs in Subgroups b,c	-
IVARY	integer	Type of scale factor variation (diurnal, monthly, etc.) 0 = Constant 1 = Diurnal cycle (24 scaling factors: hours 1-24) 2 = Monthly cycle (12 scaling factors: months 1-12) 3 = Hour & Season (4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB) 4 = Speed & Stab. (6 groups of 6 scaling factors, where first group is Stability Class A, and the 6 speed classes have upper bounds (m/s) defined in Group 12) 5 = Temperature (12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)	0
QFAC	real array	Array of emissions scaling factors for this source and the species indicated	-

The variables in Input Group 16c are entered for each volume source - species combination indicated by NSVL1 in Input Group 16a (e.g., only NSVL1 combinations are entered). The data for each volume source-species combination (i.e., source name, type of variation, and the QFAC array) are treated as a separate input subgroup and therefore must end with an input group terminator (i.e., !END!). Once again, the source number is an optional user comment which is outside of the delimiters. The source name is used to place the scaling factors with the correct source. The data for each source-species combination must follow an opening delimiter and "(cspec)=", where (cspec) is a species name defined in Group 3. The data for each source-species combination is followed by a closing delimiter and an input group terminator (i.e., !END!). If NSVL1=0, no scaling factors should be defined here.

Table F-3 (Continued)
CALPUFF Control File Inputs - Input Group 16
Volume Source Parameters

The format of Input Group 16c is shown below.

```
--------------
Subgroup (16c)
--------------
                                                 a
         VOLUME SOURCE: VARIABLE EMISSIONS DATA
         --------------------------------------

 1  ! SRCNAM = VOLS1 !
 1  ! IVARY  =  1  !    (24 Hours)
 1  ! SO2          = 0.1, 0.1, 0.1, 0.2, 0.2, 0.3,
                     0.3, 0.4, 0.4, 0.5, 0.6,   1,
                       1,   1,   1,   1,   1,   1,
                     0.6, 0.4, 0.3, 0.2, 0.1, 0.1  !
!END!

--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.
```

Table F-3 (Concluded)
CALPUFF Control File Inputs - Input Group 17
Non-Gridded (Discrete) Receptor Data

Variable	Type	Description	Default Value
(Input Group 17a - General Discrete Receptor Data)			
NREC	integer	Number of non-gridded receptors	-
(Input Group 17b - Discrete Receptor Data)			
XUTM	real	X coordinate (km) of the discrete receptor on the meteorological grid	-
YUTM	real	Y coordinate (km) of the discrete receptor on the meteorological grid	-
ELEV	real	Ground elevation (m) above mean sea level of the receptor	-
ZREC	real	Height (m) of discrete receptor above the ground	0.0

The variables in Input Group 17b are entered for each of the "NREC" discrete receptors. The data for each receptor is treated as a separate input subgroup, and therefore, must end with an input group terminator (i.e., !END!). The format of Input Group 17b is shown below.

```
--------------
Subgroup (17b)
--------------
                                          a
          NON-GRIDDED (DISCRETE) RECEPTOR DATA
          ------------------------------------

                X UTM       Y UTM        Ground        Height   b
Receptor     Coordinate   Coordinate    Elevation   Above Ground
  No.           (km)         (km)          (m)          (m)
--------     ----------   ----------    ---------   ------------
     1 ! X =         1.,          1.,      12.500,       0.000!   !END!
     2 ! X =        2.5,         4.2,      28.100,       0.000!   !END!
     3 ! X =       2.89,         3.2,      39.600,       0.000!   !END!


-------------
    a
     Data for each receptor are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     Receptor height above ground is optional.  If no value is entered,
     the receptor is placed on the ground.
```

Note that the receptor number is an optional user comment which is outside of the delimiter. The data for each receptor must follow an opening delimiter and "X=". The data for each receptor is followed by a closing delimiter and an input group terminator (i.e., !END!).

F.2 Meteorological Data Files

Four types of meteorological data files can be used to drive the CALPUFF model. In order to take full advantage of the capabilities of the model to simulate the effects spatially-varying meteorological fields, gridded fields of winds, temperatures, mixing heights, and other meteorological variables should be input to CALPUFF through the CALMET.DAT file. The format and contents of this file are described in Section F.2.1.

Alternatively, CALPUFF will accept single station meteorological data in the ISC3 format, CTDMPLUS format, or AUSPLUME format. The ISC3 meteorological data file (ISCMET.DAT) is described in Section F.2.2, the AUSPLUME file (PLMMET.DAT) is described in Section F.2.3, and the CTDMPLUS meteorological data files SURFACE.DAT and PROFILE.DAT are described in Section F.2.4.

F.2.1 CALMET.DAT

The CALMET.DAT file contains gridded meteorological data fields required to drive the CALPUFF model. It also contains certain geophysical fields, such as terrain elevations, surface roughness lengths, and land use types, used by both the CALMET meteorological model and CALPUFF. Although the input requirements of CALPUFF are designed to be directly compatible with CALMET, meteorological fields produced by other meteorological models can be substituted for the CALMET output as long as the required variables are produced and the output is reformatted to be consistent with the CALMET.DAT file specifications described in this section.

CALMET.DAT File - Header Records

The CALMET.DAT file consists of a set of up to fifteen header records, plus a variable number of comment records, followed by a set of hourly data records. The header records contain file identification labels, descriptive titles of the CALMET run (including a complete image of the CALMET control file) as comment records, information including the horizontal and vertical grid systems of the meteorological grid, the number, type, and coordinates of the meteorological stations included in the CALMET run, gridded fields of surface roughness lengths, land use, terrain elevations, leaf area indexes, and a pre-computed field of the closest surface meteorological station number to each grid point.

In addition to the variable number of comment records, the number of header records may also vary because records containing surface, upper air, and precipitation station coordinates are not included if these stations were not included in the run. A description of each variable in the header records is provided in Table F-4.

Sample FORTRAN write statements for the CALMET.DAT header records are:

```
c ---      Header record #1 - File Declaration -- 24 words
           write(iomet) DATASET,DATAVER,DATAMOD

c ---      Header record #2 - Number of comment lines -- 1 word
           write(iomet) NCOM

c ---      Header record #3 to NCOM+2 (Comment record section) -- 33 words each
           write(iomet) COMMENT

c ---      Header record #NCOM+3 - run control parameters -- 37 words
           write(iomet) IBYR,IBMO,IBDY,IBHR,IBTZ,IRLG,IRTYPE,
           1          NX,NY,NZ,DGRID,XORIGR,YORIGR, IWFCOD,NSSTA,
           2          NUSTA,NPSTA,NOWSTA,NLU,IWAT1,IWAT2,LCALGRD
           3          PMAP,DATUM,DATEN,FEAST,FNORTH,UTMHEM,IUTMZN,
           4          RNLAT0,RELON0,XLAT1,XLAT2

c ---      Header record #NCOM+4 - cell face heights (NZ + 1 words)
           write(iomet)CLAB1,IDUM,ZFACEM

c ---      Header records #NCOM+5 & 6 - x, y coordinates of surface stations
c ---      (NSSTA words each record)
           if(nssta.ge.1)then
             write(iomet)CLAB2,IDUM,XSSTA
             write(iomet)CLAB3,IDUM,YSSTA
           endif

c ---      Header records #NCOM+7 & 8 - x, y coordinates of upper air stations
c ---      (NUSTA words each record)
           if(nusta.ge.1)then
             write(iomet)CLAB4,IDUM,XUSTA
             write(iomet)CLAB5,IDUM,YUSTA
           endif

c ---      Header records #NCOM+9 & 10 - x, y coordinates of precipitation stations
c ---      (NPSTA words each record)
           if(npsta.ge.1)then
             write(iomet)CLAB6,IDUM,XPSTA
             write(iomet)CLAB7,IDUM,YPSTA
           endif

c ---      Header record #NCOM+11 - surface roughness lengths (NX * NY words)
           write(iomet)CLAB8,IDUM,Z0

c ---      Header record #NCOM+12 - land use categories (NX * NY words)
           write(iomet)CLAB9,IDUM,ILANDU

c ---      Header record #NCOM+13 - elevations (NX * NY words)
           write(iomet)CLAB10,IDUM,ELEV

c ---      Header record #NCOM+14 - leaf area index (NX * NY words)
           call wrtr2d(iomet,xlai,xbuf,mxnx,mxny,nx,ny,clabel,idum)
           write(iomet)CLAB11,IDUM,XLAI

c ---      Header record #NCOM+15 - nearest surface station no. to each
c ---      grid point (NX * NY words)
           if(nssta.ge.1)then
             write(iomet)CLAB12,IDUM,NEARS
           endif
```

where the following declarations apply:

```
real ZFACEM(nz+1),XSSTA(nssta),YSSTA(nssta),XUSTA(nusta),YUSTA(nusta)
real XPSTA(npsta),YPSTA(npsta)
real Z0(nx,ny),ELEV(nx,ny),XLAI(nx,ny)
```

```
integer ILANDU(nx,ny),NEARS(nx,ny)
character*132 COMMENT(ncom)
character*64 DATAMOD
character*16 DATASET,DATAVER
character*12 DATEN
character*8 PMAP,DATUM
character*8 CLAB1,CLAB2,CLAB3,CLAB4,CLAB5,CLAB6
character*8 CLAB7,CLAB8,CLAB9,CLAB10,CLAB11,CLAB12
character*4 UTMHEM
logical LCALGRD
```

CALMET.DAT File - Data Records

The CALMET.DAT data records include hourly fields of winds and meteorological variables. In addition to the regular CALMET output variables, both CALGRID and CALPUFF require additional three-dimensional fields of air temperature and vertical velocity. The presence of these fields in the CALMET output file is flagged by the header record logical variable, LCALGRD, having a value of TRUE.

The data records contain three-dimensional gridded fields of U, V, and W wind components and air temperature, and two-dimensional fields of PGT stability class, surface friction velocity, mixing height, Monin-Obukhov length, convective velocity scale, precipitation rate (not used by CALGRID), near-surface temperature, air density, short-wave solar radiation, relative humidity, and precipitation type codes (not used by CALGRID). A description of each variable in the data records is provided in Table F-5.

Sample FORTRAN write statements for the CALMET.DAT data records are:

```
c ---     Write U, V, W wind components
          +)))          Loop over vertical layers, k
          *
          *               write(iunit)CLABU,NDATHR,((U(i,j,k),i=1,nx),j=1,ny)
          *               write(iunit)CLABV,NDATHR,((V(i,j,k),i=1,nx),j=1,ny)
          *               if(LCALGRD)write(iunit)CLABW,NDATHR((W(i,j,k+1),i=1,nx),j=1,ny)
          *
          .)))          End loop over vertical layers

c ---     Write 3-D temperature field
          if(LCALGRD.and.irtype.eq.1) then
          +)))          Loop over vertical layers, k
          *
          *               write(iunit)CLABT,NDATHR,((ZTEMP(i,j,k),i=1,nxm),j=1,nym)
          *
          .)))          End loop over vertical layers
          endif

c ---     Write 2-D meteorological fields
          if(irtype.eq.1) then

                    write(iunit)CLABSC,NDATHR,IPGT
                    write(iunit)CLABUS,NDATHR,USTAR
                    write(iunit)CLABZI,NDATHR,ZI
                    write(iunit)CLABL,NDATHR,EL
                    write(iunit)CLABWS,NDATHR,WSTAR
                    write(iunit)CLABRMM,NDATHR,RMM
```

```
            write(iunit)CLABTK,NDATHR,TEMPK
            write(iunit)CLABD,NDATHR,RHO
            write(iunit)CLABQ,NDATHR,QSW
            write(iunit)CLABRH,NDATHR,IRH
            write(iunit)CLABPC,NDATHR,IPCODE

        endif
```

where the following declarations apply:

```
        real U(nx,ny,nz),V(nx,ny,nz),W(nx,ny,nz)
        real ZTEMP(nx,ny,nz)
        real USTAR(nx,ny),ZI(nx,ny),EL(nx,ny)
        real WSTAR(nx,ny),RMM(nx,ny)
        real TEMPK(nx,ny),RHO(nx,ny),QSW(nx,ny)
        integer IPGT(nx,ny)
        integer IRH(nx,ny),IPCODE(nx,ny)
        character*8 CLABU, CLABV, CLABW, CLABT, CLABSC, CLABUS, CLABZI
        character*8 CLABL, CLABWS, CLABRMM, CLABTK, CLABD, CLABQ, CLABRH
        character*8 CLABPC
```

Table F-4
CALMET.DAT file - Header Records

Header Record No.	Variable No.	Variable	Type[a]	Description
1	1	DATASET	char*16	Dataset name (CALMET.DAT)
1	2	DATAVER	char*16	Dataset version
1	3	DATAMOD	char*64	Dataset message field
2	1	NCOM	integer	Number of comment records to follow
3 to NCOM+2	1	COMMENT	char*132	Comment record (repeated NCOM times), each containing an image of one line of the CALMET control file, or other information
NCOM+3	1	IBYR	integer	Starting year of CALMET run
NCOM+3	2	IBMO	integer	Starting month
NCOM+3	3	IBDY	integer	Starting day
NCOM+3	4	IBHR	integer	Starting hour (time at end of hour)
NCOM+3	5	IBTZ	integer	Base time zone (e.g., 05=EST, 06=CST, 07=MST, 08=PST)
NCOM+3	6	IRLG	integer	Run length (hours)
NCOM+3	7	IRTYPE	integer	Run type (0=wind fields only, 1=wind and micrometeorological fields). IRTYPE must be run type 1 to drive CALGRID or options in CALPUFF that use boundary layer parameters
NCOM+3	8	NX	integer	Number of grid cells in the X direction
NCOM+3	9	NY	integer	Number of grid cells in the Y direction
NCOM+3	10	NZ	integer	Number of vertical layers
NCOM+3	11	DGRID	real	Grid spacing (m)
NCOM+3	12	XORIGR	real	X coordinate (m) of southwest corner of grid cell (1,1)
NCOM+3	13	YORIGR	real	Y coordinate (m) of southwest corner of grid cell (1,1)
NCOM+3	14	IWFCOD	integer	Wind field module used (0=objective analysis, 1=diagnostic model)
NCOM+3	15	NSSTA	integer	Number of surface meteorological stations
NCOM+3	16	NUSTA	integer	Number of upper air stations
NCOM+3	17	NPSTA	integer	Number of precipitation stations
NCOM+3	18	NOWSTA	integer	Number of over water stations

[a]char*N = Character*N

Table F-4 (Continued)
CALMET.DAT file - Header Records

Header Record No.	Variable No.	Variable	Type[a]	Description
NCOM+3	19	NLU	integer	Number of land use categories
NCOM+3	20	IWAT1	integer	Range of land use categories
NCOM+3	21	IWAT2	integer	Corresponding to water surfaces (IWAT1 or IWAT2, inclusive)
NCOM+3	22	LCALGRD	logical	Flag indicating if the full set of meteorological parameters required by CALGRID are contained in the file (LCALGRD is normally set to TRUE for CALPUFF applications)
NCOM+3	23	PMAP[b]	char*8	Map projection[b] UTM : Universal Transverse Mercator TTM : Tangential Transverse Mercator LCC : Lambert Conformal Conic PS : Polar Stereographic EM : Equatorial Mercator LAZA : Lambert Azimuthal Equal Area
NCOM+3	24	DATUM	char*8	DATUM Code for grid coordinates
NCOM+3	25	DATEN	char*12	NIMA date (MM-DD-YYYY) for datum definitions
NCOM+3	26	FEAST	real	False Easting (km) for PMAP = TTM, LCC, or LAZA
NCOM+3	27	FNORTH	real	False Northing (km) for PMAP = TTM, LCC, or LAZA
NCOM+3	28	UTMHEM	char*4	Hemisphere for UTM projection (N or S)
NCOM+3	29	IUTMZN	integer	UTM zone for PMAP = UTM
NCOM+3	30	RNLAT0	real	North latitude (degrees) for projection origin (for PMAP= TTM, LCC, PS, EM, or LAZA)
NCOM+3	31	RELON0	real	East longitude (degrees) for projection origin (for PMAP= TTM, LCC, PS, EM, or LAZA)
NCOM+3	32	XLAT1	real	North latitude (degrees) of matching parallel #1 for map projection PMAP= LCC or PS
NCOM+3	33	XLAT2	real	North latitude (degrees) of matching parallel #2 for map projection PMAP= LCC
NCOM+4	1	CLAB1	char*8	Variable label ('ZFACE')
NCOM+4	2	IDUM	integer	Variable not used
NCOM+4	3	ZFACEM	real array	Heights (m) of cell faces (NZ + 1 values)

[a] char*N = Character*N
[b] PMAP = EM, PS, and LAZA is NOT AVAILABLE in CALMET

Table F-4 (Continued)
CALMET.DAT file - Header Records

Header Record No.	Variable No.	Variable	Type[a]	Description
NCOM+5[b]	1	CLAB2	char*8	Variable label ('XSSTA')
NCOM+5[b]	2	IDUM	integer	Variable not used
NCOM+5[b]	3	XSSTA	real array	X coordinates (m) of each surface met. station
NCOM+6[b]	1	CLAB3	char*8	Variable label ('YSSTA')
NCOM+6[b]	2	IDUM	integer	Variable not used
NCOM+6[b]	3	YSSTA	real array	Y coordinates (m) of each surface met. station
NCOM+7[c]	1	CLAB4	char*8	Variable label ('XUSTA')
NCOM+7[c]	2	IDUM	integer	Variable not used
NCOM+7[c]	3	XUSTA	real array	X coordinates (m) of each upper air met. station
NCOM+8[c]	1	CLAB5	char*8	Variable label ('YUSTA')
NCOM+8[c]	2	IDUM	integer	Variable not used
NCOM+8[c]	3	YUSTA	real array	Y coordinate (m) of each upper air met. station
NCOM+9[d]	1	CLAB6	char*8	Variable label ('XPSTA')
NCOM+9[d]	2	IDUM	integer	Variable not used
NCOM+9[d]	3	XPSTA	real array	X coordinate (m) of each precipitation station
NCOM+10[d]	1	CLAB7	char*8	Variable label ('YPSTA')
NCOM+10[d]	2	IDUM	integer	Variable not used
NCOM+10[d]	3	YPSTA	real array	Y coordinate (m) of each precipitation station
NCOM+11	1	CLAB8	char*8	Variable label ('Z0')
NCOM+11	2	IDUM	integer	Variable not used
NCOM+11	3	Z0	real array	Gridded field of surface roughness lengths (m) for each grid cell

[a] char*N = Character*N
[b] Included only if NSSTA > 0
[c] Included only if NUSTA > 0
[d] Included only if NPSTA > 0

Table F-4 (Concluded)
CALMET.DAT file - Header Records

Header Record No.	Variable No.	Variable	Type[a]	Description
NCOM+12	1	CLAB9	char*8	Variable label ('ILANDU')
NCOM+12	2	IDUM	integer	Variable not used
NCOM+12	3	ILANDU	integer array	Gridded field of land use category for each grid cell
NCOM+13	1	CLAB10	char*8	Variable label ('ELEV')
NCOM+13	2	IDUM	integer	Variable not used
NCOM+13	3	ELEV	real array	Gridded field of terrain elevations for each grid cell
NCOM+14	1	CLAB11	char*8	Variable label ('XLAI')
NCOM+14	2	IDUM	integer	Variable not used
NCOM+14	3	XLAI	real array	Gridded field of leaf area index for each grid cell
NCOM+15	1	CLAB12	char*8	Variable label ('NEARS')
NCOM+15	2	IDUM	integer	Variable not used
NCOM+15	3	NEARS	integer array	Nearest surface meteorological station to each grid point

[a]char*N = Character*N

Table F-5
CALMET.DAT file - Data Records

Record Type	Variable No.	Variable Name	Type[a]	Description
1	1	CLABU	char*8	Variable label ('U-LEVxxx', where xxx indicates the layer number)
1	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
1	3	U	real array	U-component (m/s) of the winds at each grid point
2	1	CLABV	char*8	Variable label ('V-LEVxxx', where xxx indicates the layer number)
2	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
2	3	V	real array	V-component (m/s) of the winds at each grid point
3[b]	1	CLABW	char*8	Variable label ('WFACExxx"), where xxx indicates the layer number)
3[b]	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
3[b]	3	W	real array	W-component (m/s) of the winds at each grid point
(Record types 1,2,3 repeated NZ times (once per layer) as a set)				
4[b]	1	CLABT	char*8	Variable label ('T-LEVxxx', where xxx indicates the layer number)
4[b]	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
4[b]	3	ZTEMP	real array	Air temperature (deg. K) at each grid point
(Record type 4 repeated NZM times (once per layer))				

[a] char*8 = Character*8
[b] Record types 3 and 4 are included only if LCALGRD is TRUE

Table F-5 (Continued)
CALMET.DAT file - Data Records

Record Type	Variable No.	Variable Name	Type[a]	Description
5	1	CLABSC	char*8	Variable label ('IPGT')
5	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
5	3	IPGT	integer array	PGT stability class at each grid point
6	1	CLABUS	char*8	Variable label ('USTAR')
6	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
6	3	USTAR	real array	Surface friction velocity (m/s)
7	1	CLABZI	char*8	Variable label ('ZI')
7	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
7	3	ZI	real array	Mixing height (m)
8	1	CLABL	char*8	Variable label ('EL')
8	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
8	3	EL	real array	Monin-Obukhov length (m)
9	1	CLABWS	char*8	Variable label ('WSTAR')
9	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
9	3	WSTAR	real array	Convective velocity scale (m/s)
10	1	CLABRMM	char*8	Variable label ('RMM')
10	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
10	3	RMM	real array	Precipitation rate (mm/hr). Not used by CALGRID.

[a] char*8 = Character*8

Table F-5 (Concluded)
CALMET.DAT file - Data Records

Record Type	Variable No.	Variable Name	Type[a]	Description
11	1	CLABTK	char*8	Variable label ('TEMPK')
11	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
11	3	TEMPK	real array	Near-surface temperature (deg. K)
12	1	CLABD	char*8	Variable label ('RHO')
12	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
12	3	RHO	real array	Near-surface air density (kg/m^3)
13	1	CLABQ	char*8	Variable label ('QSW')
13	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
13	3	QSW	real array	Short-wave solar radiation (W/m^2)
14	1	CLABRH	char*8	Variable label ('IRH')
14	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
14	3	IRH	integer array	Near-surface relative humidity (percent)
15	1	CLABPC	char*8	Variable label ('IPCODE')
15	2	NDATHR	integer	Year, Julian day and hour in the form YYYYJJJHH (or YYJJJHH)
15	3	IPCODE	integer array	Precipitation type code (not used by CALGRID) 0 - no precipitation 1 to 18 - liquid precipitation 19 to 45 - frozen precipitation

[a] char*8 = Character*8

F.2.2 ISCMET.DAT

CALPUFF can be driven by a single-station standard ISC3-type of meteorological file, compatible with the earlier ISC2 version of the model, or the augmented ISC3-type of meteorological file. In addition, the ISCMET.DAT file used by CALPUFF can accommodate an extended data record that includes the augmented ISC3 data plus variables not found in either a standard ISC3 data record, or the augmented ISC3 data record. In the description to follow, we refer to the standard ISC3 file as the "base" ISC3 format.

CALPUFF is normally run with a full three-dimensional wind field and temperature field, as well as two-dimensional fields of mixing heights and other meteorological variables (see CALMET.DAT in Section F.2.1). However, in some near-field applications, when spatial variability of the meteorological fields may not be significant (e.g., uniform terrain and land use), the single-station data file may be used. The model uses the data in the ISCMET.DAT file to fill the 2-D or 3-D arrays with the scalar values read from the file. In single-station mode, CALPUFF assigns the single value of each variable read from the ISCMET.DAT file to all grid points, resulting in a spatially uniform gridded field. However, the model does not assume that the meteorological conditions are steady-state, which allows the important effects of causality to be simulated even with the single-station meteorological data. For example, the time required for plume material to reach a receptor is accounted for in the puff formulation, and curved trajectories and variable dispersion and stability conditions over multiple hours of transport will result even when using the single-station meteorological data. However, in general, the preferred mode for most applications of CALPUFF is to use the spatially variable fields generated by CALMET.

The minimum data required in the ISCMET.DAT file includes hourly values of the vector flow direction, wind speed, temperature, stability class, and mixing height (urban or rural), which are found in the "base" ISC3 format. In addition, if dry or wet deposition are being modeled, or if turbulence-based dispersion coefficients are to be computed based on micrometeorological parameters, hourly values of the surface friction velocity (u_*), Monin-Obukhov length (L), a time-varying surface roughness length (z_o), precipitation rate, and precipitation type code are entered on an extended record. These additional variables are contained in the augmented ISC3 meteorological file. If chemical transformation is being modeled, hourly values of short-wave solar radiation and relative humidity can also be included in the extended record. In addition, hourly values of the potential temperature lapse rate ($\partial\theta/\partial z$) and power law profile exponent (p) can be entered. Non-missing values of the basic meteorological variables (i.e., vector wind direction, wind speed, temperature, stability class, and mixing height) must be provided for all applications. The data fields for the extended record variables (u_*, L, etc.) may be left blank if the CALPUFF options are set so that they are not needed (e.g., no wet or dry deposition, no chemical transformation, no computation of turbulence-based dispersion coefficients). However, if the CALPUFF model options are set to require them, the model assumes that valid values of the extended record variables will be provided for every hour. The only exceptions are $\partial\theta/\partial z$ and p, which can be entered for some hours and not others. If values of $\partial\theta/\partial z$ or p are missing (i.e., blank) for a given hour, the model will use its default or user-specified stability-dependent values (see the PLX0 and PTG0 variables in

Input Group 12 of the control file).

Sample ISCMET.DAT files are shown in Tables F-6(a) and F-6(b). Part (a) of the table shows the "base" ISC3 meteorological data record. The fully extended data record is shown in Part (b) of the table. Table F-7 lists the contents of the ISCMET.DAT header records, and Table F-8 describes the data records.

Note that other data associated with the meteorological data in ISCMET.DAT are provided in the CALPUFF.INP control file. These data include the anemometer height, surface roughness length, land use type, elevation, and leaf area index of the modeling region. The anemometer height is required in the vertical power law extrapolation of the wind speed. The roughness length is used if turbulence-based dispersion coefficients are selected, and in the calculation of dry deposition velocities, when the hourly value is missing. The land use category is used to determine if urban or rural dispersion coefficients are appropriate when the Pasquill-Gifford/McElroy-Pooler dispersion coefficients are used. Also see the variables IURB1 and IURB2 in Input Group 12 of the control file. They define the range of land use categories that are to be considered urban (i.e., if the value of the land use category in the ISCMET.DAT file is between IURB1 and IURB2, inclusive, the modeling domain will be consider urban). Otherwise, it will be considered rural. The leaf area index is only used by the model if dry deposition velocities are being computed. The elevation is used to fill the 2-D terrain elevation array in CALPUFF that is normally filled from the CALMET file. This array is used to determine, through interpolation, the elevation of the *gridded* receptors generated by the model as an option. Because a single value is available when the ISCMET.DAT file is used, all of the gridded receptors will be assigned this elevation. Receptor-specific elevations are assigned to each *discrete* receptor by the user in the CALPUFF control file (see Input Group 17).

Table F-6
Sample ISCMET.DAT files

(a) Base Data Records

```
 94728     90  14735     90
90 1 1 1  81.0000   3.0866 280.9 5  881.5   53.0
90 1 1 2  98.0000   1.5433 279.8 6  904.6   53.0
90 1 1 3 114.0000   2.5722 279.8 5  927.8   53.0
90 1 1 4 113.0000   4.1155 280.4 4  951.0  951.0
90 1 1 5 103.0000   3.0866 279.8 5  974.2   53.0
90 1 1 6 102.0000   5.1444 280.4 4  997.4  997.4
90 1 1 7 105.0000   4.6300 280.4 4 1020.6 1020.6
90 1 1 8  73.0000   2.5722 280.4 4 1043.8 1043.8
90 1 1 9 117.0000   4.1155 280.9 4 1067.0 1067.0
90 1 110 141.0000   3.6011 283.7 3 1090.2 1090.2
 8 8 8 8        8        8    8   8    8      8
yr  dy     WD vect      WS  Temp    rural  urban
  mo  hr                      stab   zi     zi
```

(b) Extended Data Records

```
 94728     90  14735     90
90 1 1 1  81.0000   3.0866 280.9 5  881.5   53.0     0.33      355.    0.25    0    0.0      .020  .35       0. 77
90 1 1 2  98.0000   1.5433 279.8 6  904.6   53.0     0.17      122.    0.25    0    0.0      .035  .55       0. 68
90 1 1 3 114.0000   2.5722 279.8 5  927.8   53.0     0.28      259.    0.25    0    0.0            .30       0. 72
90 1 1 4 113.0000   4.1155 280.4 4  951.0  951.0     0.45      655.    0.25    0    0.0            .15       0. 74
90 1 1 5 103.0000   3.0866 279.8 5  974.2   53.0     0.33      355.    0.25    0    0.0      .022            0. 75
90 1 1 6 102.0000   5.1444 280.4 4  997.4  997.4     0.56     1025.    0.25    1    .25            .18       0. 73
90 1 1 7 105.0000   4.6300 280.4 4 1020.6 1020.6     0.50    -1005.    0.25    0    0.0            .17      70. 71
90 1 1 8  73.0000   2.5722 280.4 4 1043.8 1043.8     0.28     -355.    0.25    1    .75                    120. 65
90 1 1 9 117.0000   4.1155 280.9 4 1067.0 1067.0     0.45     -395.    0.25    2   2.64            .22     180. 68
90 1 110 141.0000   3.6011 283.7 3 1090.2 1090.2     0.39     -148.    0.25    0    0.0            .12     240. 62
 8 8 8 8        8        8    8  8     8      8       8         8       8     8      8        8     8       8   8
yr  dy     WD vect      WS  Temp    rural  urban      u*        L      zo     p   precip.   d2/dz    p      SW  rh
  mo  hr                      stab   zi     zi                                code    amt.                   rad. %
```

Table F-7
ISCMET.DAT File - Header Record

Record 1. Surface and mixing height station numbers, and years.

Record	Columns	Variable	Type	Description
1	1-6	*	integer	Surface station number.
1	8-13	*	integer	Surface station year.
1	15-20	*	integer	Mixing height station number.
1	22-27	*	integer	Mixing height station year.

* These variables are not interpreted in CALPUFF

Table F-8
ISCMET.DAT File - Data Records
(One record per hour)

Records 2,3,4,... Hourly meteorological data.

Columns	Variable	Type	Description
	Base Data		
1-2	IY	integer	Year of data in record
3-4	IM	integer	Month
5-6	ID	integer	Day
7-8	IH	integer	Hour (ISC3 convention (1-24) at end of hour)
9-17	FVEC	real	Flow vector (deg.)
18-26	WSPD	real	Wind speed (m/s)
27-32	TMPK	real	Temperature (deg. K)
33-34	KST	integer	Stability class (1-6)
35-41	RMIX	real	Rural mixing height (m)
42-48	UMIX	real	Urban mixing height (m)
	Extended data		
49-57	USTR	real	Friction velocity (m/s)
58-67	XMON	real	Monin-Obukhov length (m)
68-75	Z0M	real	Surface roughness length (m)
76-79	IPC	integer	Precipitation type code
			0 - no precipitation
			1 to 18 - liquid precipitation
			19 to 45 - frozen precipitation
80-86	PMMHR	real	Precipitation rate (mm/hr)
87-96	DTHTD	real	Potential temperature lapse rate (deg. K/m)
97-101	PLAW	real	Wind speed power law exponent
102-110	QSWRAD	real	Short-wave solar radiation (W/m^2)
111-113	IRH	integer	Relative humidity (%)

F.2.3 PLMMET.DAT

In addition to the capability to use three-dimensional wind fields generated by CALMET, a single-station meteorological file can also be used by CALPUFF as its source of meteorological data. One form of single station data accepted by CALPUFF is the AUSPLUME (Lorimer, 1976) type of data file. The standard AUSPLUME data file can be used without modification, although some CALPUFF options require additional meteorological variables that must be added as part of an extended data record.

CALPUFF is normally run with a full three-dimensional wind field and temperature field, as well as two-dimensional fields of mixing heights and other meteorological variables (see CALMET.DAT in Section F.2.1). However, in some near-field applications, when spatial variability of the meteorological fields may not be significant (e.g., uniform terrain and land use), the single-station data file may be used. In single station mode, CALPUFF assigns the single value of each variable read from the PLMMET.DAT file to all grid points, resulting in a spatially uniform gridded field. However, the model does not assume the meteorological conditions are steady-state, which allows the important effects of causality to be simulated even with the single-station meteorological data. For example, the time required for plume material to reach a receptor is accounted for in the puff formulation, and curved trajectories and variable dispersion and stability conditions over multiple hours of transport will result even when using the single-station meteorological data. However, in general, the preferred mode for most applications of CALPUFF is to use the spatially variable fields generated by CALMET.

The PLMMET.DAT file includes the basic hourly data required by CALPUFF, including the wind direction, wind speed, temperature, stability class, and mixing height. Note that PLMMET.DAT uses *wind direction* in the usual meteorological convention (i.e., winds from the west blowing toward the east has a value of 270E), while ISCMET.DAT uses *flow vector* (i.e., winds from the west toward the east have a vector direction of 90E). The PLMMET.DAT format also contains data for the horizontal component of turbulence ($\mathbf{F_2}$). If both components of turbulence are available, they should be entered through the use of the PROFILE.DAT data file (see Section F.2.4). Also, CALPUFF contains several options for modeling chemical transformation that do not involve the use of a decay constant.

The PLMMET.DAT format does not contain micrometeorological variables (the surface friction velocity and Monin-Obukhov length), precipitation data, solar radiation, or relative humidity. The Monin-Obukhov length is inferred from the stability class and the surface roughness length using the Golder (1972) relations. The friction velocity can then be estimated from the surface-layer similarity wind profile equation. The remaining variables must be added to the standard file in an exended data record. These fields may remain blank if they are not needed for the CALPUFF options selected. Precipitation is needed for wet deposition modeling, and the solar radiation and humidity data are needed for chemical transformation calculations.

Sample PLMMET.DAT files are shown in Tables F-9(a) and F-9(b). Part (a) of the table shows the standard AUSPLUME meteorological data record. The extended data record is shown in Part (b) of the

table. A description of the contents of the header record is provided in Table F-10, and the data records are described in Table F-11. The header record contains an 80-character title of the data set.

Note that other data associated with the PLMMET.DAT are provided in the CALPUFF.INP control file. These data include the anemometer height, surface roughness length, land use type, elevation, and leaf area index of the modeling region. The anemometer height is required in the vertical power law extrapolation of the wind speed. The roughness length is used to estimate the micrometeorological variables, the turbulence-based dispersion coefficients (when selected), and in the calculation of dry deposition velocities. The land use category is used to determine if urban or rural dispersion coefficients are appropriate when the Pasquill-Gifford/McElroy-Pooler dispersion coefficients are used. Also see the variables IURB1 and IURB2 in Input Group 12 of the control file. They define the range of land use categories that are to be considered urban (i.e., if the value of the land use category in the PLMMET.DAT file is between IURB1 and IURB2, inclusive, the modeling domain will be consider urban). Otherwise, it will be considered rural. The leaf area index is only used by the model if dry deposition velocities are being computed. The elevation is used to fill the 2-D terrain elevation array in CALPUFF that is normally filled from the CALMET file. This array is used to determine, through interpolation, the elevation of the *gridded* receptors generated by the model as an option. Because a single value is available here, all of the gridded receptors will be assigned this elevation. Receptor-specific elevations are assigned to each *discrete* receptor by the user in the CALPUFF control file (see Input Group 17).

Table F-9
Sample PLMMET.DAT file

(a) Base Data Records

```
Sample PLMMET.DAT data file.  Min. ws=1.0 m/s
94010101 19  1.0 270 F  100  17. 0.55 .035        0.
94010102 19  1.2 270 F  122  22.      .030        0.
94010103 20  1.5 270 F  132  18.                  0.
94010104 19  3.2 270 E  256      0.35            0.
94010105 20  1.8 270 F  103      0.45 .031       0.
94010106 20  3.3 270 E  201      0.32 .024       0.
94010107 21  5.0 270 D  284      0.25            0.
94010108 21  4.6 270 D  301  12.                 0.
94010109 22  3.5 270 D  525  11.                 0.
94010110 22  3.9 270 C  658  16. 0.19            0.
 8 8 8 8  8    8   8 8    8    8    8    8         8
yr  dy   Temp WS  WD     zi   F₂    p  d2/dz   decay
  mo  hr           stab
```

(b) Extended Data Records

```
Sample PLMMET.DAT data file.  Min. ws=1.0 m/s
94010101 19  1.0 270 F  100  17. 0.55 .035        0.  0      0.0       0. 65
94010102 19  1.2 270 F  122  22.      .030        0.  0      0.0       0. 69
94010103 20  1.5 270 F  132  18.                  0.  0      0.0       0. 65
94010104 19  3.2 270 E  256      0.35            0.  0      0.0       0. 66
94010105 20  1.8 270 F  103      0.45 .031       0.  0      0.0       0. 69
94010106 20  3.3 270 E  201      0.32 .024       0.  0      0.0       0. 73
94010107 21  5.0 270 D  284      0.25            0.  1     1.80      11. 78
94010108 21  4.6 270 D  301  12.                 0.  1      .95      82. 76
94010109 22  3.5 270 D  525  11.                 0.  0      0.0     116. 58
94010110 22  3.9 270 C  658  16. 0.19            0.  0      0.0     250. 55
 8 8 8 8  8    8   8 8    8    8    8    8         8  8        8         8  8
yr  dy   Temp WS  WD     zi   F₂    p  d2/dz   decay  p   precip.      SW rh
  mo  hr           stab                          code   amount      rad. %
```

Table F-10
PLMMET.DAT File - Header Record

Record 1. Title.

Record	Columns	Variable	Type	Description
1	1-80	TITLE	character*80	Title of file.

Table F-11
PLMMET.DAT File - Data Records
(One record per hour)

Records 2,3,4,... Hourly meteorological data.

Columns	Variable	Type	Description
	Base Data		
1-2	IY	integer	Year of data in record
3-4	IM	integer	Month
5-6	ID	integer	Day
7-8	IH	integer	Hour (1-24) time at end of hour
9-11	TMPC	real	Temperature (deg. C)
12-16	WSPD	real	Wind speed (m/s)
17-20	IWD	integer	Wind direction (deg.)
21-22	KST *	character	Stability class (A-F)
23-27	ZMIX	real	Mixing height (m)
28-32	SIGTHA	real	$\mathbf{F_2}$ (deg.). Or use PROFILE.DAT file for turbulence measurements.
33-37	PLEXP	real	Wind speed power law exponent
38-42	PTGDF	real	Potential temperature gradient (deg. K/m)
43-52	DECAY	real	Decay constant (s^{-1}). Not used by CALPUFF.
	Extended Data		
53-55	IPC	integer	Precipitation type code 0 - no precipitation 1 to 18 - liquid precipitation 19 to 45 - frozen precipitation
56-64	PMMHR	real	Precipitation rate (mm/hr)
65-73	QSWRAD	real	Short-wave solar radiation (W/m^2)
74-76	IRELHUM	integer	Relative humidity (%)

* KST is converted from character (A-F) to integer (1-6)

F.2.4 SURFACE.DAT and PROFILE.DAT

In addition to the capability to use three-dimensional wind fields generated by CALMET, a single-station meteorological file can also be used by CALPUFF as its source of meteorological data. One form of single station data accepted by CALPUFF is the CTDMPLUS (Perry et al., 1989) form. The standard meteorological data files SURFACE.DAT and PROFILE.DAT can be used without modification, although some CALPUFF options require additional meteorological variables that must be added as part of an extended data record to SURFACE.DAT. Unlike the other two types of single-station data described above, the PROFILE.DAT file contains a vertical profile of data each hour, rather than measurements made at a single height above ground. In this way, more detailed data from an on-site tower with supporting remote measurement platforms (e.g., SODAR) can be used to define the vertical structure of the flow. SURFACE.DAT contains calculated micrometeorological variables and the mixing height.

CALPUFF is normally run with a full three-dimensional wind field and temperature field, as well as two-dimensional fields of mixing heights and other meteorological variables (see CALMET.DAT in Section F.2.1). However, in some near-field applications, when spatial variability of the meteorological fields may not be significant (e.g., uniform terrain and land use), the single-station data file may be used. In single station mode, CALPUFF assigns the single value of each variable read from the file to all grid points, resulting in a spatially uniform gridded field. However, the model does not assume the meteorological conditions are steady-state, which allows the important effects of causality to be simulated even with the single-station meteorological data. For example, the time required for plume material to reach a receptor is accounted for in the puff formulation, and curved trajectories and variable dispersion and stability conditions over multiple hours of transport will result even when using the single-station meteorological data. However, in general, the preferred mode for most applications of CALPUFF is to use the spatially variable fields generated by CALMET.

SURFACE.DAT is created by the CTDMPLUS meteorological preprocessor, and the user should consult the CTDMPLUS documentation to learn of its use and requirements. SURFACE.DAT includes hourly mixing height, surface friction velocity, Monin-Obukhov length, and surface roughness. PROFILE.DAT is created directly by the user. In standard form, it includes the hourly wind direction, wind speed (vector and scalar), temperature, and turbulence ($\mathbf{F}_w$, and either $\mathbf{F}_v$ or $\mathbf{F_2}$) at each measurement level. Note that PROFILE.DAT uses *wind direction* in the usual meteorological convention (i.e., winds from the west blowing toward the east has a value of 270E).

As an option, a non-standard, or extended version of PROFILE.DAT can also be used to provide the temperature jump across an inversion above a mixed layer. This jump is used as a measure of the strength of the temperature inversion when assessing the ability of a buoyant plume to penetrate the top of the mixed layer (for the partial penetration option: MPARTL = 1). When a positive temperature difference is provided at the end of the first record for the hour, CALPUFF will recognize it and use it. Otherwise, available temperature gradient data are used to estimate the inversion strength.

Precipitation data, solar radiation, and relative humidity are not required in CTDMPLUS. They may be added to SURFACE.DAT in an exended data record. These fields may remain blank if they are not needed for the CALPUFF options selected. Precipitation is needed for wet deposition modeling, and the solar radiation and humidity data are needed for chemical transformation calculations.

Other data associated with the SURFACE.DAT and PROFILE.DAT are provided in the CALPUFF.INP control file. These data include the land use type, elevation, and leaf area index of the modeling region, and two control variables (ISIGMAV and IMIXCTDM). The land use category is used to determine if urban or rural dispersion coefficients are appropriate when the Pasquill-Gifford/McElroy-Pooler dispersion coefficients are used during convective regimes. Also see the variables IURB1 and IURB2 in Input Group 12 of the control file. They define the range of land use categories that are to be considered urban (i.e., if the value of the land use category is between IURB1 and IURB2, inclusive, the modeling domain will be consider urban). Otherwise, it will be considered rural. The leaf area index is only used by the model if dry deposition velocities are being computed. The elevation is used to fill the 2-D terrain elevation array in CALPUFF that is normally filled from the CALMET file. This array is used to determine, through interpolation, the elevation of the *gridded* receptors generated by the model as an option. Because a single value is available here, all of the gridded receptors will be assigned this elevation. Receptor-specific elevations are assigned to each *discrete* receptor by the user in the CALPUFF control file (see Input Group 17). ISIGMAV indicates the form of the lateral turbulence data, and IMIXCTDM indicates which mixing height field (observed or calculated) is to be used.

Sample SURFACE.DAT files are shown in Tables F-12(a) and F-12(b). Part (a) of the table shows the standard SURFACE.DAT data record. The extended data record is shown in Part (b) of the table. A sample PROFILE.DAT file is shown in Table F-13. Data records for SURFACE.DAT are described in Table F-14, and data records for PROFILE.DAT are described in Table F-15. Note that the year may be specified in either a YY (e.g., 94) or YYYY (e.g., 1994) format. The YY format is the original CTDM PLUS format.

The PROFILE.DAT file may also be used in conjunction with the other meteorological data options in CALPUFF to provide measured turbulence data, or to provide the strength of the temperature inversion. When turbulence data are supplied, wind speeds should be provided in the file as well as the turbulence, so that conversions between $\mathbf{F}_v$ and $\mathbf{F_2}$ can be made.

Table F-12
Sample SURFACE.DAT file

(a) Base Data Records

```
94  1  1   1  1          658.       30.     0.047      15.7  0.500E+00
94  1  1   1  2          658.       37.     0.067      15.7  0.500E+00
94  1  1   1  3          658.       35.     0.060      15.7  0.500E+00
94  1  1   1  4          658.       33.     0.053      15.7  0.500E+00
94  1  1   1  5          658.       30.     0.047      15.7  0.500E+00
94  1  1   1  6          658.       35.     0.060      15.7  0.500E+00
94  1  1   1  7          658.      125.     0.202      61.1  0.500E+00
94  1  1   1  8           61.       44.     0.093      15.7  0.500E+00
94  1  1   1  9          160.       44.     0.093      15.7  0.500E+00
94  1  1   1 10          260.      858.     0.285    -143.0  0.500E+00
 8  8  8   8  8            8         8         8          8          8
Yr    Dy Jul Hr        Ziobs     Zipre     Ustar     Monin         Zo
   Mo     Dy                                        Obukhov
```

(b) Extended Data Records

```
94  1  1   1  1          658.       30.     0.047      15.7  0.500E+00  0      0.0       0. 65
94  1  1   1  2          658.       37.     0.067      15.7  0.500E+00  0      0.0       0. 69
94  1  1   1  3          658.       35.     0.060      15.7  0.500E+00  0      0.0       0. 65
94  1  1   1  4          658.       33.     0.053      15.7  0.500E+00  0      0.0       0. 66
94  1  1   1  5          658.       30.     0.047      15.7  0.500E+00  0      0.0       0. 69
94  1  1   1  6          658.       35.     0.060      15.7  0.500E+00  0      0.0       0. 73
94  1  1   1  7          658.      125.     0.202      61.1  0.500E+00  1     1.80       0. 78
94  1  1   1  8           61.       44.     0.093      15.7  0.500E+00  1      .95       0. 76
94  1  1   1  9          160.       44.     0.093      15.7  0.500E+00  0      0.0       6. 58
94  1  1   1 10          260.      858.     0.285    -143.0  0.500E+00  0      0.0     250. 55
 8  8  8   8  8            8         8         8          8          8  8       8         8  8
Yr    Dy Jul Hr        Ziobs     Zipre     Ustar     Monin         Zo  p   precip.       SW rh
   Mo     Dy                                        Obukhov          code  amount       rad. %
```

Table F-13
Sample PROFILE.DAT file

(a) Base Data Records

```
94  1  1  1   2. 0 -999.9  -9.9  259.6  -99.9 -9.90 -999.9
94  1  1  1  10. 0  156.4   0.7  263.2   42.5  0.01 -999.9
94  1  1  1  40. 0 -999.9  -9.9  265.4  -99.9 -9.90 -999.9
94  1  1  1  70. 0  177.9   2.4  266.0   18.3  0.16 -999.9
94  1  1  1 100. 0  207.1   3.0  266.3   23.9  0.20 -999.9
94  1  1  1 120. 0  218.0   2.8 -999.9  -99.9 -9.90 -999.9
94  1  1  1 150. 0  233.0   4.3 -999.9  -99.9 -9.90 -999.9
94  1  1  1 180. 0  238.0   6.0 -999.9  -99.9 -9.90 -999.9
94  1  1  1 210. 1  242.0   7.2 -999.9  -99.9 -9.90 -999.9
94  1  1  2   2. 0 -999.9  -9.9  258.9  -99.9 -9.90 -999.9
94  1  1  2  10. 0  162.9   1.0  262.1   28.8  0.01 -999.9
94  1  1  2  40. 0 -999.9  -9.9  263.9  -99.9 -9.90 -999.9
94  1  1  2  70. 0  155.6   2.2  265.4    8.9  0.09 -999.9
94  1  1  2 100. 0  179.1   1.8  266.0   10.5  0.10 -999.9
94  1  1  2 120. 0  191.0   1.8 -999.9  -99.9 -9.90 -999.9
94  1  1  2 150. 0  224.0   2.2 -999.9  -99.9 -9.90 -999.9
94  1  1  2 180. 0  246.0   3.2 -999.9  -99.9 -9.90 -999.9
94  1  1  2 210. 0  259.0   4.7 -999.9  -99.9 -9.90 -999.9
94  1  1  2 240. 0  265.0   6.1 -999.9  -99.9 -9.90 -999.9
94  1  1  2 270. 0  268.0   7.3 -999.9  -99.9 -9.90 -999.9
 8  8  8  8    8 8      8     8      8      8     8      8
Yr Mo Dy Hr    Z Ilast WD    WS   Temp     Fv    Fw     WS
                          Scalar                    Vector
```

(b) Extended Data Records

```
94  1  1 13   2. 0 -999.9  -9.9  275.8  -99.9 -9.90 -999.9    .18
94  1  1 13  10. 0  162.9   0.9  275.6   51.6  0.03 -999.9
94  1  1 13  40. 0 -999.9  -9.9  274.6  -99.9 -9.90 -999.9
94  1  1 13  70. 0  176.5   2.6  274.4    8.9  0.11 -999.9
94  1  1 13 100. 0  185.3   2.7  274.1   14.0  0.10 -999.9
94  1  1 13 120. 0  194.0   2.0 -999.9  -99.9 -9.90 -999.9
94  1  1 13 150. 0  225.0   1.8 -999.9  -99.9 -9.90 -999.9
94  1  1 13 180. 0  259.0   2.3 -999.9  -99.9 -9.90 -999.9
94  1  1 13 210. 1  269.0   3.5 -999.9  -99.9 -9.90 -999.9
94  1  1 14   2. 0 -999.9  -9.9  275.8  -99.9 -9.90 -999.9
94  1  1 14  10. 0  162.9   0.9  275.6   51.6  0.03 -999.9
94  1  1 14  40. 0 -999.9  -9.9  274.6  -99.9 -9.90 -999.9
94  1  1 14  70. 0  176.5   2.6  274.4    8.9  0.11 -999.9
94  1  1 14 100. 0  185.3   2.7  274.1   14.0  0.10 -999.9
94  1  1 14 120. 0  194.0   2.0 -999.9  -99.9 -9.90 -999.9
94  1  1 14 150. 0  225.0   1.8 -999.9  -99.9 -9.90 -999.9
94  1  1 14 180. 0  259.0   2.3 -999.9  -99.9 -9.90 -999.9
94  1  1 14 210. 1  269.0   3.5 -999.9  -99.9 -9.90 -999.9
94  1  1 15   2. 0 -999.9  -9.9  275.8  -99.9 -9.90 -999.9    .5
94  1  1 15  10. 0  162.9   0.9  275.6   51.6  0.03 -999.9
94  1  1 15  40. 0 -999.9  -9.9  274.6  -99.9 -9.90 -999.9
94  1  1 15  70. 0  176.5   2.6  274.4    8.9  0.11 -999.9
94  1  1 15 100. 0  185.3   2.7  274.1   14.0  0.10 -999.9
 8  8  8  8    8 8      8     8      8      8     8      8        8
Yr Mo Dy Hr    Z Ilast WD    WS   Temp     Fv    Fw     WS     )T at
                          Scalar                    Vector  Inversion
```

Table F-14
SURFACE.DAT File - Data Records
(One record per hour)

Records 1,2,3,... Hourly meteorological data.

Columns	Variable	Type	Description
	Base Data		
*	IY	integer	Year of data in record (YY or YYYY format)
*	IM	integer	Month
*	ID	integer	Day
*	IJUL	integer	Julian day (1-366)
*	IH	integer	Hour (1-24) at end of hour
*	ZIOBS	real	Observed mixing height (m)
*	ZIPRE	real	Calculated mixing height (m)
*	USTR	real	Surface friction velocity (m/s)
*	XMON	real	Monin-Obukhov length (m)
*	Z0M	real	Hourly surface roughness length (m)
	Extended Data		
*	IPC	integer	Precipitation type code 0 - no precipitation 1 to 18 - liquid precipitation 19 to 45 - frozen precipitation
*	PMMHR	real	Precipitation rate (mm/hr)
*	QSWRAD	real	Short-wave solar radiation (W/m^2)
*	IRELHUM	integer	Relative humidity (%)

* Free format

Table F-15
PROFILE.DAT File - Data Records
(One or more records per hour)

Records 1,2,3,... Hourly meteorological data.

Columns	Variable	Type	Description
	Base Data		
*	IY	integer	Year of data in record (YY or YYYY format)
*	IM	integer	Month
*	ID	integer	Day
*	IH	integer	Hour (1-24) time at end of hour
*	ZPRF	real	Height of measurement above ground (m)
*	ILAST	integer	0 if not the highest (last) level; otherwise 1
*	WDPRF	real	Wind direction (deg.)
*	SSPRF	real	Scalar wind speed (m/s)
*	TPRF	real	Ambient dry bulb temperature (K)
*	SVPRF	real	$\mathbf{F_2}$ (deg.) or $\mathbf{F}_v$ (m/s)
*	SWPRF	real	$\mathbf{F}_w$ (m/s)
*	WSPRF	real	Vector wind speed (m/s)
	Extended Data		
*	DPTINV	real	Increase in potential temperature across the inversion at the top of the mixed layer (K); only on first record each hour

* Free format, one record per height in ascending order

F.3 Point Source Emissions File With Arbitrarily Varying Emissions (PTEMARB.DAT)

The PTEMARB.DAT file contains point source emissions data for sources with detailed, arbitrarily varying emissions parameters. In the PTEMARB.DAT file, values for the stack parameters and emission rates can be specified for each time step in the run. Plume rise is computed within the CALPUFF model for each source.

PTEMARB.DAT may be provided as either a sequential unformatted data file, or as a free-formatted ASCII data file (see Table F-16 for an example). Both of these use the same record structure consisting of four header records, followed by a set of data records containing time-invariant source information, and a set of records for the time-varying data. The time-invariant records contain the stack height, diameter, coordinates, building downwash flag, vertical momentum flux factor, one user-defined optional descriptive code for each source, and controlling building heights and widths (36 values for every 10E) for each source identified by the building downwash flag. The time varying emissions and stack parameter data follow in subsequent records. One data record per source is required for each time period (e.g.,usually at hourly intervals).

Multiple PTEMARB.DAT files may be provided if groups of sources possess very different time-variability. For example, group 1 may require hourly data records for the entire simulation period, while group 2 may produce emissions for only a few weeks during the simulation. Using a second file for group 2 is more economical to prepare because a single data record can be used to prescribe a long period with no (or constant) emissions. Each such file must cover the entire modeling period, no source may appear in more than one file, and the species list must be identical among these files.

The data in the PTEMARB.DAT file are independent of the horizontal and vertical grid systems being used in the model. The horizontal coordinates are specified in terms of the meteorological grid projection (UTM or Lambert conformal coordinates). The vertical layers receiving the emissions of the source are based on the plume rise of the source computed internally by the model. However, the PTEMARB.DAT file does contain time-dependent data specifying the emission parameters for a particular time period.

NOTE: There are structural differences between the PTEMARB.DAT file accepted by the current version of CALPUFF and that accepted by earlier versions, so anyone familiar with the previous versions must be certain to review the contents of the next few pages! CALPUFF will test the variable VRS2 contained in the header of PTEMARB.DAT to see that it identifies the correct version. If the file uses an older format, changing VRS2 to the correct value will disable this check, and the results of the CALPUFF application may be in error. Do not use an "old" version of this data file unless you are certain that the format is correct.

Table F-16
Sample PTEMARB.DAT file

```
'PTEMARB'      3     2    16   1988011       1   1988012       0    '5.4'    'EXAMPLE'
'30.0N'               '60.0N'        '40.5N'    '90.0W'
'POL1'    'POL2'
      30.000      30.000
'Source 1'      0.13489    0.00360  18.600   9.754   88.70    1.00  1.00    0.00
   18.590   18.590   18.590   27.430   28.960   14.330
   18.590   18.590   18.590   18.590   28.960   18.590
   18.590   18.590   18.590   18.590   18.590   18.590
   18.590   18.590   18.590   27.430   28.960   28.960
   28.960   28.960   28.960   28.960   28.960   18.590
   18.590   18.590   18.590   18.590   18.590   18.590
   19.010   26.080   22.550   96.020   88.200   14.330
   14.200   18.480   22.160   25.660   85.390   20.820
   21.590   21.690   22.250   22.320   21.720   20.450
   19.010   26.080   22.550   53.360   88.200   87.590
   84.330   85.190   87.930   88.000   85.390   20.820
   21.590   21.690   22.250   22.320   21.720   20.450
'Source 2'      0.07380   -0.00280  50.100   4.251   88.70    0.00   1.0    0.00
'Source 3'      0.01272   -0.00919  35.850   3.100   88.70    0.00   1.0    0.00
   1988011       1   1988011                 1
'Source 1'    280.55      8.66 0.0   0.0    0.468814E+01  0.202236E+02
'Source 2'    380.4       8.66 0.0   0.0    610.          120.
'Source 3'    280.55      2.66 0.0   0.0    0.468814E+01  0.202236E+02
   1988011       2   1988011                 2
'Source 1'    279.27      8.50 0.0   0.0    0.449538E+01  0.204942E+02
'Source 2'    380.4       8.66 0.0   0.0    0.0           0.0
'Source 3'    279.27      2.66 0.0   0.0    0.449538E+01  0.204942E+02
   1988011       3   1988011                 3
'Source 1'    279.26      8.50 0.0   0.0    0.449753E+01  0.204895E+02
'Source 2'    380.4       8.66 0.0   0.0    0.0
'Source 3'    279.26      2.66 0.0   0.0    0.449753E+01  0.204895E+02
   1988011       4   1988011                23
'Source 1'    277.97      8.41 0.0   0.0    0.430570E+01  0.207542E+02
'Source 2'    380.4       8.66 0.0   0.0    0.0           0.0
'Source 3'    277.97      2.66 0.0   0.0    0.430570E+01  0.207542E+02
   1988012       0   1988012                 0
'Source 1'    285.82      8.90 0.0   0.0    0.553510E+01  0.189712E+02
'Source 2'    380.4       8.66 0.0   0.0    610.          120.
'Source 3'    285.82      2.66 0.0   0.0    0.553510E+01  0.189712E+02
```

PTEMARB.DAT File - Header Records

The header records of the PTEMARB.DAT file (see Table F-17) contain the number of sources, starting and ending time periods of data in the file, and a list of the emitted species. Sample Fortran read statements for the unformatted file are:

```
  READ(iunit)FNAME2,NSRC2,NSE2,IUTMZ2,IBDAT2,IBTIM2,IEDAT2,
 1 IETIM2,VRS2,LABEL2
  READ (iunit)CLAT1,CLAT2,CLAT0,CLON0

  READ(iunit)CSLST2
  READ(iunit)XMWEM2
```

where the following declarations apply:

```
  CHARACTER*12 FNAME2,VRS2,LABEL2,CSLST2(nse2)
  CHARACTER*16 CLAT1,CLAT2,CLAT0,CLON0
  REAL XMWEM2(nse2)
```

Table F-17
PTEMARB.DAT - Header Record 1 - General Data

No.	Variable	Type[a]	Description	Sample Values
1	FNAME2	C*12	Data set name	PTEMARB
2	NSRC2	integer	Number of sources in the file	10
3	NSE2	integer	Number of species emitted	3
4	IUTMZ2	integer	UTM zone in which source coordinates are specified (enter 0 if using Lambert conformal coordinates)	11
5	IBDAT2	integer	Date of beginning of data in the file (YYYYJJJ, where YYYY=year, JJJ=Julian day)	1984220
6	IBTIM2	integer	Hour of beginning of data in the file (00-23, LST; end of hour)	00
7	IEDAT2	integer	Date of end of data in the file (YYYYJJJ, where YYYY=year, JJJ=Julian day)	1984224
8	IETIM2	integer	Hour of end of data in the file (00-23, LST; end of hour)	23
9	VRS2	C*12	Data set version	5.4
10	LABEL2	C*12	Data set label	Major pts.

[a] C*12 = Character*12

(Note: YYJJJ date format formerly used is also accepted.)

Table F-17 (Continued)
PTEMARB.DAT - Header Record 2 - Lambert Conformal Data

No.	Variable	Type[a]	Description	Sample Values
1	CLAT1	C*16	Standard parallel #1 for LC map (degrees latitude)	30.0N
2	CLAT2	C*16	Standard parallel #2 for LC map (degrees latitude)	60.0N
3	CLAT0	C*16	Latitude (degrees) of origin of LC map	40.5N
4	CLON0	C*16	Longitude (degrees) of origin of LC map	90.0W

[a] C*16 = Character*16

Table F-17 (Continued)
PTEMARB.DAT - Header Record 3 - Species List

No.*	Type[a]	Description	Sample Values
1	C*12	Species identifier for species 1	SO2
2	C*12	Species identifier for species 2	SO4
.	.	.	.
.	.	.	.
.	.	.	.
NSE2	C*12	Species identifier for species "NSE2"	NOX

* "NSE2" elements of CSLST2 array
[a] C*12 = Character*12

Table F-17 (Concluded)
PTEMARB.DAT - Header Record 4 - Molecular Weights

No.*	Type[a]	Description	Sample Values
1	real	Molecular weight for species 1	64. (SO2)
2	real	Molecular weight for species 2	96. (SO4)
.	.	.	.
.	.	.	.
.	.	.	.
NSE2	real	Molecular weight for species "NSE2"	46. (NOX as NO2)

* "NSE2" elements of XMWEM2 array

PTEMARB.DAT File - Data Records

The PTEMARB.DAT file contains two types of data records. A set of time-invariant records (see Table F-18) are read after the header records. These records specify the time-invariant source parameters, including the source coordinates, stack height, diameter, momentum flux factor, and building data for sources subject to building downwash. The vertical momentum flux factor may be either 1.0 (full vertical momentum flux), or 0.0 (no vertical momentum). Use 0.0 to simulate the effect of stack structures like rainhats. A set of time-varying data follows (see Table F-19). The time-varying records contain the stack temperature, exit velocity, initial plume size ($\mathbf{F}_y$ and $\mathbf{F}_z$), and emission rate for each species.

Sample Fortran read statements for time-invariant data records in the unformatted file are:

```
+)))QLoop over sources
*
*           READ(iunit)CID,TIDATA
*           READ(iunit)BHT (only if TIDATA(6) = 1)
*           READ(iunit)BWD (only if TIDATA(6) = 1)
*
.)))QEnd loop over sources
```

where the following declarations apply:

```
CHARACTER*16 CID

REAL TIDATA(8), BHT(36), BWD(36)
```

Sample Fortran read statements for time-varying data records in the unformatted file are:

```
+)))QLoop over time periods
*
*       READ(iunit)IBDAT,IBTIM,IEDAT,IETIM
*
*       +)))QLoop over sources
*       *
*       *           READ(iunit)CID,TEMPK,VEXIT,SIGY,SIGZ,QEMIT
*       *
*       .)))QEnd loop over sources
*
.)))QEnd loop over time periods
```

where the following declarations apply:

```
CHARACTER*16 CID
REAL QEMIT(nse2)
```

Table F-18
PTEMARB.DAT - Time-Invariant Data Record Contents
(Repeated for each source)

Data Record No.	Variable No.	Variable	Type[a]	Description
1	1	CID	C*16	Source identifier (16 characters = 4 words)
1	2	TIDATA(1)	real	Easting UTM or Lambert conformal coordinate (km) of the source
1	3	TIDATA(2)	real	Northing UTM or Lambert conformal coordinate (km) of the source
1	4	TIDATA(3)	real	Stack height (m)
1	5	TIDATA(4)	real	Stack diameter (m)
1	6	TIDATA(5)	real	Stack base elevation (m)
1	7	TIDATA(6)	real	Building downwash flag (0 = no, 1 = yes)
1	8	TIDATA(7)	real	Vertical momentum flux factor (0.0 or 1.0) to simulate structures like rain hats
1	9	TIDATA(8)	real	User defined flag (e.g., fuel code)
2[b]	1-36	BHT	real	Controlling building heights (m) for each 10E flow direction, starting 10E from North
3[b]	1-36	BWD	real	Controlling building width (m) for each 10E flow direction, starting 10E from North

[a] C*16 = Character*16
[b] Time-invariant data Records 2 and 3 are provided only for those sources identified as being subject to building downwash

Table F-19
PTEMARB.DAT - Time-Varying Data Record Contents
(First record of "NSRC2"+1 records required for each time period)

No.	Variable	Type	Description
1	IBDAT	integer	Beginning date for which data in this set is valid (YYYYJJJ, where YYYY=year, JJJ=Julian day)
2	IBTIM	integer	Beginning hour for which data in this set is valid (00-23, LST; end of hour)
3	IEDAT	integer	Ending date for which data in this set is valid (YYYYJJJ, where YYYY=year, JJJ=Julian day)
4	IETIM	integer	Ending hour for which data in this set is valid (00-23, LST; end of hour)

Example:

Data on each record is valid for 1 hour:

IBDAT=1989183,IBTIM=00,IEDAT=1989183,IETIM=00
IBDAT=1989183,IBTIM=01,IEDAT=1989183,IETIM=01
IBDAT=1989183,IBTIM=02,IEDAT=1989183,IETIM=02

Data on each record is valid for 3 hours:

IBDAT=1989183,IBTIM=00,IEDAT=1989183,IETIM=02
IBDAT=1989183,IBTIM=03,IEDAT=1989183,IETIM=05
IBDAT=1989183,IBTIM=06,IEDAT=1989183,IETIM=08

(Note: YYJJJ date format formerly used is also accepted.)

Table F-19 (Concluded)
PTEMARB.DAT - Time-Varying Data Record Contents
(Next "NSRC2" records)

No.	Variable	Type[a]	Description
1	CID	C*16	Source identifier (must match values in time-invariant records)
2	TEMPK	real	Exit temperature (deg. K)
3	VEXIT	real	Exit velocity (m/s)
4	SIGY	real	Initial sigma-y (m) for source
5	SIGZ	real	Initial sigma-z (m) for source
Next NSE2	QEMIT	real array	Emission rates (g/s) for each species in the order specified in Header Record 2

[a]C*16 = Character*16

F.4 Buoyant Area Source Emissions File With Arbitrarily Varying Emissions (BAEMARB.DAT)

The BAEMARB.DAT file contains buoyant area source emissions data for sources with detailed, arbitrarily varying emissions parameters. This file can be generated from the output of the Forest Service's Emissions Production Model (EPM) using a reformatting and preprocessing program provided with CALPUFF. In the BAEMARB.DAT file, values for the source parameters and emission rates can be specified for each time step in the run. Plume rise is computed within the CALPUFF model for each source using the numerical plume rise algorithm.

BAEMARB.DAT is a free-formatted ASCII data file (see Table F-20 for an example) consisting of four header records, followed by a set of data records containing source information. The time-invariant data records contain character source identifiers and units labels . The time varying emissions and source parameter data follow in subsequent records. One data record per source is required for each time period (e.g.,usually at hourly intervals).

Multiple BAEMARB.DAT files may be provided if groups of sources possess very different time-variability. For example, group 1 may require hourly data records for the entire simulation period, while group 2 may produce emissions for only a few weeks during the simulation. Using a second file for group 2 is more economical to prepare because a single data record can be used to prescribe a long period with no (or constant) emissions. Each such file must cover the entire modeling period, no source may appear in more than one file, and the species list must be identical among these files.

The data in the BAEMARB.DAT file are independent of the horizontal and vertical grid systems being used in the model. The horizontal coordinates are specified in terms of UTM or Lambert conformal coordinates. The vertical layers receiving the emissions of the source are based on the plume rise of the source computed internally by the model. However, the BAEMARB.DAT file does contain time-dependent data specifying the emission parameters for a particular time period.

NOTE: There are structural differences between the BAEMARB.DAT file accepted by the current version of CALPUFF and that accepted by earlier versions, so anyone familiar with the previous versions must be certain to review the contents of the next few pages! CALPUFF will test the variable VRS3 contained in the header of BAEMARB.DAT to see that it identifies the correct version. If the file uses an older format, changing VRS3 to the correct value will disable this check, and the results of the CALPUFF application may be in error. Do not use an “old” version of this data file unless you are certain that the format is correct.

Table F-20
Sample BAEMARB.DAT file

```
'BAEMARB'    3   3   0   1995001   0    1995142  12  '5.4'   'NOX_FIRE_RUN'
'30.0N'               '60.0N'        '40.5N'    '90.0W'
'SO2'  'NO'   'NO2'
    64.0000        30.0000        46.0000
'Fire_Number_1'   'g/s'      '0.0'      '0.0'
'Fire_Number_2'   'g/s'      '0.0'      '0.0'
'Fire_Number_3'   'g/s'      '0.0'      '0.0'
       1995001          0      1995142          10
'Fire_Number_1'   -84.8600       -84.7423       -84.7423       -84.8600
   -254.620       -254.620       -254.502       -254.502        1.00000
    2259.00        1126.35        5.76000        7.98000        10.0000
   0.000000       0.000000       0.000000
'Fire_Number_2'   -167.190       -167.029       -167.029       -167.190
    29.0900        29.0900        29.2514        29.2514        1.00000
    1545.00        1126.35        2.97000        20.5500        10.0000
   0.000000       0.000000       0.000000
'Fire_Number_3'   -65.0600       -64.9668       -64.9668       -65.0600
   -88.9500       -88.9500       -88.8568       -88.8568        1.00000
    1527.00        1126.35        19.1300        3.92000        10.0000
   0.000000       0.000000       0.000000
       1995142          11       1995142          11
'Fire_Number_1'   -84.8600       -84.7423       -84.7423       -84.8600
   -254.620       -254.620       -254.502       -254.502        1.00000
    2259.00        1126.35        5.76000        7.98000        10.0000
   0.000000        3.94435       0.672000
'Fire_Number_2'   -167.190       -167.029       -167.029       -167.190
    29.0900        29.0900        29.2514        29.2514        1.00000
    1545.00        1126.35        2.97000        20.5500        10.0000
   0.000000        155.367        26.4700
'Fire_Number_3'   -65.0600       -64.9668       -64.9668       -65.0600
   -88.9500       -88.9500       -88.8568       -88.8568        1.00000
    1527.00        1126.35        19.1300        3.92000        10.0000
   0.000000       0.000000       0.000000
       1995142          12       1995142          12
'Fire_Number_1'   -84.8600       -84.6562       -84.6562       -84.8600
   -254.620       -254.620       -254.416       -254.416        1.00000
    2259.00        1126.35        5.76000        11.2800        10.0000
   0.000000        11.8389        2.01700
'Fire_Number_2'   -167.190       -166.910       -166.910       -167.190
    29.0900        29.0900        29.3695        29.3695        1.00000
    1545.00        1126.35        2.97000        29.0600        10.0000
   0.000000        466.102        79.4100
'Fire_Number_3'   -65.0600       -64.9668       -64.9668       -65.0600
   -88.9500       -88.9500       -88.8568       -88.8568        1.00000
    1527.00        1126.35        19.1300        3.92000        10.0000
   0.000000       0.000000       0.000000
```

BAEMARB.DAT File - Header Records

The header records of the BAEMARB.DAT file (see Table F-21) contain the number of sources, starting and ending time periods of data in the file, and a list of the emitted species. Sample Fortran read statements are:

```
      READ(iunit,*)FNAME3,NSRC3,NSE3,IUTMZ3,IBDAT3,IBTIM3,IEDAT3,
     1 IETIM3,VRS3,LABEL3

      READ(iunit,*)CLAT1,CLAT2,CLAT0,CLON0
      READ(iunit,*)CSLST3
      READ(iunit,*)XMWEM3
```

where the following declarations apply:

```
      CHARACTER*12 FNAME3,VRS3,LABEL3,CSLST3(nse3)
      CHARACTER*16 CLAT1,CLAT2,CLAT0,CLON0
      REAL XMWEM3(nse3)
```

Table F-21
BAEMARB.DAT - Header Record 1 - General Data

No.	Variable	Type[a]	Description	Sample Values
1	FNAME3	C*12	Data set name	BAEMARB
2	NSRC3	integer	Number of sources in the file	10
3	NSE3	integer	Number of species emitted	3
4	IUTMZ3	integer	UTM zone in which source coordinates are specified (enter 0 is using Lambert conformal coordinates)	11
5	IBDAT3	integer	Date of beginning of data in the file (YYYYJJJ, where YYYY=year, JJJ=Julian day)	1984220
6	IBTIM3	integer	Hour of beginning of data in the file (00-23, LST; end of hour)	00
7	IEDAT3	integer	Date of end of data in the file (YYYYJJJ, where YYYY=year, JJJ=Julian day)	1984224
8	IETIM3	integer	Hour of end of data in the file (00-23, LST; end of hour)	23
9	VRS3	C*12	Data set version	5.4
10	LABEL3	C*12	Data set label	Burn #1

[a] C*12 = Character*12

(Note: YYJJJ date format formerly used is also accepted.)

Table F-21 (Continued)
BAEMARB.DAT - Header Record 2 - Lambert Conformal Data

No.	Variable	Type[a]	Description	Sample Values
1	CLAT1	C*16	Standard parallel #1 for LC map (degrees latitude)	30.0N
2	CLAT2	C*16	Standard parallel #2 for LC map (degrees latitude)	60.0N
3	CLAT0	C*16	Latitude (degrees) of origin of LC map	40.5N
4	CLON0	C*16	Longitude (degrees) of origin of LC map	90.0W

[a] C*16 = Character*16

Table F-21 (Continued)
BAEMARB.DAT - Header Record 3 - Species List

No.*	Type[a]	Description	Sample Values
1	C*12	Species identifier for species 1	PM
2	C*12	Species identifier for species 2	PM10
.	.	.	.
.	.	.	.
.	.	.	.
NSE3	C*12	Species identifier for species "NSE3"	PM25

* "NSE3" elements of CSLST3 array
[a] C*12 = Character*12

Table F-21 (Concluded)
BAEMARB.DAT - Header Record 4 - Molecular Weights

No.*	Type[a]	Description	Sample Values
1	real	Molecular weight for species 1	200.
2	real	Molecular weight for species 2	200.
.	.	.	.
.	.	.	.
.	.	.	.
NSE3	real	Molecular weight for species "NSE3"	200.

* "NSE3" elements of XMWEM3 array

BAEMARB.DAT File - Data Records

The BAEMARB.DAT file contains two types of data records. A set of time-invariant records (see Table F-22) are read after the header records. These records specify the time-invariant source names and the emissions units for each source. The units must be either 'g/m2/s' or 'g/s', no other character strings will be accepted. Two additional fields are read as real variables, but are not used in the current version of the model. A set of time-varying data follows (see Table F-23). The time-varying records contain the coordinates of four vertices that define the perimeter of the source, effective release height, ground elevation, temperature, effective vertical velocity, effective radius, initial vertical spread, and an emission rate for each species. Note that the four vertices must be centered in sequence around the perimeter; all four "x" coordinates followed by all four "y" coordinates.

Sample Fortran read statements for time-invariant data records are:

```
+)))QLoop over sources
*
*     READ(iunit,*)CID,BAEMUNIT,TIDATA
*
.)))QEnd loop over sources
```

where the following declarations apply:

```
CHARACTER*16 CID,BAEMUNIT
REAL TIDATA (2)
```

Sample Fortran read statements for time-varying data records are:

```
+)))QLoop over time periods
*
*       READ(iunit,*)IBDAT,IBTIM,IEDAT,IETIM
*
*       +)))QLoop over sources
*       *
*       *          READ(iunit,*)CID,VERTX,VERTY,HT,ELEV,TEMPK,WEFF,REFF,SIGZ,QEMIT
*       *
*       .)))QEnd loop over sources
*
.)))QEnd loop over time periods
```

where the following declarations apply:

```
CHARACTER*16 CID
REAL VERTX(4),VERTY(4)
REAL QEMIT(nse3)
```

Table F-22
BAEMARB.DAT - Time-Invariant Data Record Contents
(Repeated for each source)

No.	Variable No.	Variable	Type[a]	Description
1	1	CID	C*16	Source identifier (16 characters = 4 words)
1	2	BAEMUNIT	C*16	Source Emission Rate Units (`g/m2/sr or `g/sr)
1	3	TIDATA(1)	real	User defined flag (not used)
1	4	TIDATA(2)	real	User defined flag (not used)

[a] C*16 = Character*16

Table F-23
BAEMARB.DAT - Time-Varying Data Record Contents
(First record of "NSRC3"+1 records required for each time period)

No.	Variable	Type	Description
1	IBDAT	integer	Beginning date for which data in this set is valid (YYYYJJJ, where YYYY=year, JJJ=Julian day)
2	IBTIM	integer	Beginning hour for which data in this set is valid (00-23, LST; end of hour)
3	IEDAT	integer	Ending date for which data in this set is valid (YYYYJJJ, where YYYY=year, JJJ=Julian day)
4	IETIM	integer	Ending hour for which data in this set is valid (00-23, LST; end of hour)

Example:

Data on each record is valid for 1 hour:

IBDAT=1989183,IBTIM=00,IEDAT=1989183,IETIM=00
IBDAT=1989183,IBTIM=01,IEDAT=1989183,IETIM=01
IBDAT=1989183,IBTIM=02,IEDAT=1989183,IETIM=02

Data on each record is valid for 3 hours:

IBDAT=1989183,IBTIM=00,IEDAT=1989183,IETIM=02
IBDAT=1989183,IBTIM=03,IEDAT=1989183,IETIM=05
IBDAT=1989183,IBTIM=06,IEDAT=1989183,IETIM=08

(Note: YYJJJ date format formerly used is also accepted.)

Table F-23 (Concluded)
BAEMARB.DAT - Time-Varying Data Record Contents
(Next "NSRC3" records)

No.	Variable	Type[a]	Description
1	CID	C*16	Source identifier (must match values in time-invariant records)
2–5	VERTX	real array	X-coordinate (km) of each of the four vertices defining the perimeter of the area source
6–9	VERTY	real array	Y-coordinate (km) of each of the four vertices defining the perimeter of the area source
10	HT	real	Effective height (m) of the emissions above the ground
11	ELEV	real	Elevation of ground (m MSL)
12	TEMPK	real	Temperature (deg. K)
13	WEFF	real	Effective rise velocity (m/s)
14	REFF	real	Effective radius (m) for rise calculation
15	SIGZ	real	Initial vertical spread (m)
Next NSE3	QEMIT	real array	Emission rates (g/s or $g/m^2/s$) for each species in the order specified in Header Record 2

[a]C*16 = Character*16

F.5 Line Source Emissions File With Arbitrarily Varying Emissions (LNEMARB.DAT)

The LNEMARB.DAT file contains line source emissions data for sources with detailed, arbitrarily varying emissions parameters. In the LNEMARB.DAT file, values for the source parameters and emission rates can be specified for each time step in the run. Plume rise is computed within the CALPUFF model for groups of line sources using the buoyant line source algorithm.

LNEMARB.DAT is a free-formatted ASCII data file (see Table F-24 for an example) consisting of three header records, followed by a set of data records containing source information. The time-invariant data records contain character source identifiers for each of the individual lines, and parameters that control how all lines are processed. The time varying emissions and source parameter data follow in subsequent records. One data record per line source in each group is required for each time period (e.g., usually at hourly intervals). CALPUFF interprets the times obtained from the LNEMARB.DAT file as marking the end of the hour (e.g., 89104, hour 00 denotes the last hour of Julian day 103 in the year 1989.)

The data in the LNEMARB.DAT file are independent of the horizontal and vertical grid systems being used in the model. The horizontal coordinates are specified in terms of UTM or Lambert conformal coordinates. The vertical layers receiving the emissions of the source are based on the plume rise of the source computed internally by the model. However, the LNEMARB.DAT file does contain time-dependent data specifying the emission parameters for a particular time period.

Table F-24
Sample LNEMARB.DAT file

```
'LNEMARB'   2    1   12    1988001 01  1989001  00   '5.4'  'Example'
'30.0N'               '60.0N'        '40.5N'    '90.0W'
'SO2'
64.
7  6
'Line_Source_1'  'Line_Source_2'
1988001  01  1988001 07
1
2  500.  22.  18.  3.2  22.  100.
'Line_Source_1'     1.  3.     1.5  3.     22.  0.  1.3
'Line_Source_2'     1.  3.022  1.5  3.022  22.  0.  3.1
1988001  08  1988001 13
1
2  500.  22.  18.  3.2  22.  300.
'Line_Source_1'     1.  3.     1.5  3.     22.  0.  2.3
'Line_Source_2'     1.  3.022  1.5  3.022  22.  0.  2.3
1988001  14  1988001 23
1
2  500.  22.  18.  3.2  22.  150.
'Line_Source_1'     1.  3.     1.5  3.     22.  0.  1.3
'Line_Source_2'     1.  3.022  1.5  3.022  22.  0.  3.1
1988002  00  1989001 00
1
2  500.  22.  18.  3.2  22.  150.
'Line_Source_1'     1.  3.     1.5  3.     22.  0.  1.3
'Line_Source_2'     1.  3.022  1.5  3.022  22.  0.  3.1
```

LNEMARB.DAT File - Header Records

The header records of the LNEMARB.DAT file (see Table F-25) contain the maximum number of lines in the group, starting and ending time periods of data in the file, and a list of the emitted species. Sample Fortran read statements are:

```
      READ(iunit,*)FNAME5,NSRC5,NSE5,IUTMZ5,IBDAT5,IBTIM5,IEDAT5,
     1 IETIM5,VRS5,LABEL5

      READ(iunit,*)CLAT1, CLAT2, CLAT0, CLON0
      READ(iunit,*)CSLST5
      READ(iunit,*)XMWEM5
```

where the following declarations apply:

```
      CHARACTER*12 FNAME5,VRS5,LABEL5,CSLST5(nse5)
      CHARACTER*16 CLAT1, CLAT2, CLAT0, CLON0
      REAL XMWEM5(nse5)
```

Table F-25
LNEMARB.DAT - Header Record 1 - General Data

No.	Variable	Type[a]	Description	Sample Values
1	FNAME5	C*12	Data set name	LNEMARB
2	NSRC5	integer	Maximum number of lines in any period	10
3	NSE5	integer	Number of species emitted	3
4	IUTMZ5	integer	UTM zone in which source coordinates are specified (enter 0 is using Lambert conformal coordinates)	11
5	IBDAT5	integer	Date of beginning of data in the file (YYYYJJJ, where YYYY=year, JJJ=Julian day)	1984220
6	IBTIM5	integer	Hour of beginning of data in the file (00-23, LST; end of hour)	00
7	IEDAT5	integer	Date of end of data in the file (YYYYJJJ, where YYYY=year, JJJ=Julian day)	1984224
8	IETIM5	integer	Hour of end of data in the file (00-23, LST; end of hour)	23
9	VRS5	C*12	Data set version	5.4
10	LABEL5	C*12	Data set label	Daily

[a] C*12 = Character*12

(Note: YYJJJ date format formerly used is also accepted.)

Table F-25 (Continued)
LNEMARB.DAT - Header Record 2 - Lambert Conformal Data

No.	Variable	Type[a]	Description	Sample Values
1	CLAT1	C*16	Standard parallel #1 for LC map (degrees latitude)	30.0N
2	CLAT2	C*16	Standard parallel #2 for LC map (degrees latitude)	60.0N
3	CLAT0	C*16	Latitude (degrees) of origin of LC map	40.5N
4	CLON0	C*16	Longitude (degrees) of origin of LC map	90.0W

[a] C*16 = Character*16

Table F-25 (Continued)
LNEMARB.DAT - Header Record 3 - Species List

No.*	Type[a]	Description	Sample Values
1	C*12	Species identifier for species 1	PM
2	C*12	Species identifier for species 2	PM10
.	.	.	.
.	.	.	.
.	.	.	.
NSE5	C*12	Species identifier for species "NSE5"	PM25

* "NSE5" elements of CSLST5 array
[a] C*12 = Character*12

Table F-25 (Concluded)
LNEMARB.DAT - Header Record 4 - Molecular Weights

No.*	Type[a]	Description	Sample Values
1	real	Molecular weight for species 1	200.
2	real	Molecular weight for species 2	200.
.	.	.	.
.	.	.	.
.	.	.	.
NSE5	real	Molecular weight for species "NSE5"	200.

* "NSE5" elements of XMWEM5 array

LNEMARB.DAT File - Data Records

The LNEMARB.DAT file contains two types of data records. A set of time-invariant records (see Table F-26) are read after the header records, to specify parameters used in modeling all line sources in the file, and the number of time-invariant names used to identify each line source. A set of time-varying data follows (see Table F-27). The first record in this group identifies the time period. The second identifies the number of groups of active line sources. Thereafter, a block of records must be supplied for each active group. The first of these identifies the number of active lines, and the average characteristics of this group of active lines. The remaining time-varying records in the block complete the description for each active line: the character name given to the line, the coordinates of the end-points, the release height, the elevation of the ground, and an emission rate for each species.

Sample Fortran read statements for time-invariant data records are:

```
      READ(iunit,*)MXNSEG,NLRISE

+)))QLoop over maximum number of lines (NSRC5) comprising all groups
*
*     READ(iunit,*)CID
*
.)))QEnd loop over lines
```

where the following declarations apply:

```
      CHARACTER*16 CID
```

Sample Fortran read statements for time-varying data records are:

```
+)))QLoop over time periods
*
*       READ(iunit,*)IBDAT,IBTIM,IEDAT,IETIM
*       READ(iunit,*)NGROUPS
*
*       +)))QLoop over groups
*       *
*       *     READ(iunit,*)NLINES,XL,HBL,WBL,WML,DXL,FPRIMEL
*       *
*       *     +)))QLoop over active lines (NLINES)
*       *     *
*       *     *       READ(iunit,*)CID,XBEGL,YBEGL,XENDL,YENDL,HTL,ELEVL,QL
*       *     *
*       *     .)))QEnd loop over active lines
*       *
*       .)))QEnd loop over groups
*
.)))QEnd loop over time periods
```

where the following declarations apply:

```
      CHARACTER*16 CID
      REAL QL(nse5)
```

Table F-26
LNEMARB.DAT - Time-Invariant Data Record Contents

No.	Variable	Type[a]	Description
1	MXNSEG	integer	Maximum number of segments used to model one line
2	NLRISE	integer	Number of distances at which transitional rise is tabulated
Next NSRC5	CID	C*16	Source identifier (16 characters = 4 words)

[a] C*16 = Character*16

Table F-27
LNEMARB.DAT - Time-Varying Data Record Contents
(First record required for each time period)

No.	Variable	Type	Description
1	IBDAT	integer	Beginning date for which data in this set is valid (YYYYJJJ, where YYYY=year, JJJ=Julian day)
2	IBTIM	integer	Beginning hour for which data in this set is valid (00-23, LST; end of hour)
3	IEDAT	integer	Ending date for which data in this set is valid (YYYYJJJ, where YYYY=year, JJJ=Julian day)
4	IETIM	integer	Ending hour for which data in this set is valid (00-23, LST; end of hour)

Example:

Data on each record is valid for 1 hour:

IBDAT=1989183,IBTIM=00,IEDAT=1989183,IETIM=00
IBDAT=1989183,IBTIM=01,IEDAT=1989183,IETIM=01
IBDAT=1989183,IBTIM=02,IEDAT=1989183,IETIM=02

Data on each record is valid for 3 hours:

IBDAT=1989183,IBTIM=00,IEDAT=1989183,IETIM=02
IBDAT=1989183,IBTIM=03,IEDAT=1989183,IETIM=05
IBDAT=1989183,IBTIM=06,IEDAT=1989183,IETIM=08

(Note: YYJJJ date format formerly used is also accepted.)

Table F-27 (Continued)
LNEMARB.DAT - Time-Varying Data Record Contents
(Second record required for each time period)

No.	Variable	Type	Description
1	NGROUPS	integer	Number of groups of line sources active this time period

Table F-27 (Continued)
LNEMARB.DAT - Time-Varying Data Record Contents
(First record required for each group, each time period)

No.	Variable	Type	Description
1	NLINES	integer	Number of active lines
2	XL	real	Average building length (m)
3	HBL	real	Average building height (m)
4	WBL	real	Average building width (m)
5	WML	real	Average line source width (m)
6	DXL	real	Average separation between buildings (m)
7	FPRIMEL	real	Average buoyancy parameter (m^4/s^3)

Table F-27 (Concluded)
LNEMARB.DAT - Time-Varying Data Record Contents
(Next "NLINES" records)

No.	Variable	Type[a]	Description
1	CID	C*16	Source identifier (must match one of the values in time-invariant records)
2,3	XBEGL,YBEGL	real	X,Y-coordinates (km) of beginning of line
4,5	XENDL,YENDL	real	X,Y-coordinates (km) of end of line
6	HTL	real	Release height (m) of the emissions above the ground
7	ELEVL	real	Base elevation (m)
Next NSE5	QL	real array	Emission rates for each species in the order specified in Header Record 2

[a]C*16 = Character*16

F.6 Volume Source Emissions File with Arbitrarily Varying Emissions (VOLEMARB.DAT)

The VOLEMARB.DAT file contains volume source data for sources with detailed, arbitrarily varying characteristics in time (as resolved by the 1-hour timestep of CALPUFF). Such volume sources may have time-varying emission rates, time-varying initial size, and time-varying location (they may move).

VOLEMARB.DAT may be provided as either a sequential unformatted data file, or as a free-formatted ASCII data file (see Table F-28 for an example). Both of these use the same record structure consisting of four header records, followed by a set of data records containing time-invariant source information, and a set of records for the time-varying data. The time-invariant records contain a source identifier and one user-defined flag for each source. The time varying emissions and source characterization data follow in subsequent records. One data record per source is required for each time period (e.g.,usually at hourly intervals).

Multiple VOLEMARB.DAT files may be provided if groups of sources possess very different time-variability. For example, group 1 may require hourly data records for the entire simulation period, while group 2 may produce emissions for only a few weeks during the simulation. Using a second file for group 2 is more economical to prepare because a single data record can be used to prescribe a long period with no (or constant) emissions. Each such file must cover the entire modeling period, no source may appear in more than one file, and the species list must be identical among these files.

The data in the VOLEMARB.DAT file are independent of the horizontal and vertical grid systems being used in the model. The horizontal coordinates are specified in terms of the meteorological grid projection (UTM or Lambert conformal coordinates). The vertical layers receiving the emissions of the source are based on the effective source height provided in the file.

NOTE: There are substantial differences between the VOLEMARB.DAT file accepted by CALPUFF (Version 5.4) and the VOLEM.DAT file accepted by earlier versions, so anyone familiar with the previous versions must be certain to review the contents of the next few pages! CALPUFF (5.4) will test the variables FNAME4 and VRS4 contained in the header of VOLEMARB.DAT to see that it identifies the correct file. Do not use an "old" VOLEM.DAT data file -- its format is no longer supported!

Table F-28
Sample VOLEMARB.DAT file

```
'VOLEMARB'      3     2    16   1988011       1   1988012       0  '5.4'    'EXAMPLE'
'30.0N'               '60.0N'        '40.5N'    '90.0W'
'POL1'    'POL2'
     30.000      30.000
'Source 1'      0
'Source 2'      0
'Source 3'      0
   1988011       1   1988011       1
'Source 1'  151.034  4661.448 10.0   110.8  14.6  2.4   0.468814E+01  0.202236E+02
'Source 2'  151.652  4661.412  7.0   115.8  10.6  3.9   610.          120.
'Source 3'  151.111  4661.374  9.0   121.2  10.0  10.0  0.468814E+01  0.202236E+02
   1988011       2   1988011       2
'Source 1'  151.034  4661.448 10.0   110.8  14.6  2.4   0.449538E+01  0.204942E+02
'Source 2'  151.652  4661.412  7.0   115.8  10.6  3.9   0.0           0.0
'Source 3'  151.115  4661.374  9.0   121.2  10.0  10.0  0.468814E+01  0.202236E+02
   1988011       3   1988011       3
'Source 1'  151.034  4661.448 10.0   110.8  14.6  2.4   0.449753E+01  0.204895E+02
'Source 2'  151.652  4661.412  7.0   115.8  10.6  3.9   0.0           0.0
'Source 3'  151.120  4661.374  9.0   121.2  10.0  10.0  0.468814E+01  0.202236E+02
   1988011       4   1988011      23
'Source 1'  151.034  4661.448 10.0   110.8  14.6  2.4   0.430570E+01  0.207542E+02
'Source 2'  151.652  4661.412  7.0   115.8  10.6  3.9   0.0           0.0
'Source 3'  151.131  4661.374  9.0   121.2  10.0  10.0  0.468814E+01  0.202236E+02
   1988012       0   1988012       0
'Source 1'  151.034  4661.448 10.0   110.8  14.6  2.4   0.553510E+01  0.189712E+02
'Source 2'  151.652  4661.412  7.0   115.8  10.6  3.9   610.          120.
'Source 3'  151.131  4661.374  9.0   121.2  10.0  10.0  0.468814E+01  0.202236E+02
```

VOLEMARB.DAT File - Header Records

The header records of the VOLEMARB.DAT file (see Table F-29) contain the number of sources, starting and ending time periods of data in the file, and a list of the emitted species. Sample Fortran read statements for the unformatted file are:

```
      READ(iunit)FNAME4,NSRC4,NSE4,IUTMZ4,IBDAT4,IBTIM4,IEDAT4,
     1 IETIM4,VRS4,LABEL4

      READ(iunit)CLAT1, CLAT2, CLAT0, CLON0                READ(iunit)CSLST4
      READ(iunit)XMWEM4
```

and sample Fortran read statements for the formatted file are:

```
      READ(iunit,*)FNAME4,NSRC4,NSE4,IUTMZ4,IBDAT4,IBTIM4,IEDAT4,
     1 IETIM4,VRS4,LABEL4

      READ(iunit,*)CSLST4
      READ(iunit,*)XMWEM4
```

where the following declarations apply:

```
      CHARACTER*12 FNAME4,VRS4,LABEL4,CSLST4(nse4)
      CHARACTER*16 CLAT1, CLAT2, CLAT0, CLON0
      REAL XMWEM4(nse4)
```

When more than one file is used, the species information (NSE4, CSLST4, and XMWEM4) in each file must be the same. The number of sources (NSRC4) must identify the number of sources in the file, and the sum of the NSRC4 values from all files must equal the total number of sources (NVL2) provided in Subgroup (16a) of the control file.

Table F-29
VOLEMARB.DAT - Header Record 1 - General Data

No.	Variable	Type[a]	Description	Sample Values
1	FNAME4	C*12	Data set name	VOLEMARB[b]
2	NSRC4	integer	Number of sources in the file	10
3	NSE4	integer	Number of species emitted	3
4	IUTMZ4	integer	UTM zone in which source coordinates are specified (enter 0 if using Lambert conformal coordinates)	11
5	IBDAT4	integer	Date of beginning of data in the file (YYYYJJJ, where YYYY=year, JJJ=Julian day)	1984220
6	IBTIM4	integer	Hour of beginning of data in the file (00-23, LST; end of hour)	00
7	IEDAT4	integer	Date of end of data in the file (YYYYJJJ, where YYYY=year, JJJ=Julian day)	1984224
8	IETIM4	integer	Hour of end of data in the file (00-23, LST; end of hour)	23
9	VRS4	C*12	Data set version	5.4[b]
10	LABEL4	C*12	Data set label	Scenario1

[a] C*12 = Character*12
[b] These values must be provided as shown.

Table F-29 (Continued)
VOLEMARB.DAT - Header Record 2 - Lambert Conformal Data

No.	Variable	Type[a]	Description	Sample Values
1	CLAT1	C*16	Standard parallel #1 for LC map (degrees latitude)	30.0N
2	CLAT2	C*16	Standard parallel #2 for LC map (degrees latitude)	60.0N
3	CLAT0	C*16	Latitude (degrees) of origin of LC map	40.5N
4	CLON0	C*16	Longitude (degrees) of origin of LC map	90.0W

[a] C*16 = Character*16

Table F-29 (Continued)
VOLEMARB.DAT - Header Record 3 - Species List

No.*	Type[a]	Description	Sample Values
1	C*12	Species identifier for species 1	SO2
2	C*12	Species identifier for species 2	SO4
.	.	.	.
.	.	.	.
.	.	.	.
NSE4	C*12	Species identifier for species "NSE4"	NOX

* "NSE4" elements of CSLST4 array
[a] C*12 = Character*12

Table F-29 (Concluded)
VOLEMARB.DAT - Header Record 4 - Molecular Weights

No.*	Type	Description	Sample Values
1	real	Molecular weight for species 1	64. (SO2)
2	real	Molecular weight for species 2	96. (SO4)
.	.	.	.
.	.	.	.
.	.	.	.
NSE4	real	Molecular weight for species "NSE4"	46. (NOX as NO2)

* "NSE4" elements of XMWEM4 array

VOLEMARB.DAT File - Data Records

The VOLEMARB.DAT file contains two types of data records. A set of time-invariant records (see Table F-30) are read after the header records. These records specify the source names, and a user-defined index (read but not used). A set of time-varying data follows (see Table F-31). The time-varying records contain the source location, its effective height above ground, the elevation (MSL) at the location, the initial $\mathbf{F}_y$ and $\mathbf{F}_z$, and the emission rate for each species.

Sample Fortran read statements for time-invariant data records in the unformatted file are:

```
+)))QLoop over sources
*
*           READ(iunit)CID,TIDATA
*
.)))QEnd loop over sources
```

and sample Fortran read statements for time-invariant data records in the formatted file are:

```
+)))QLoop over sources
*
*           READ(iunit,*)CID,TIDATA
*
.)))QEnd loop over sources
```

where the following declarations apply:

```
CHARACTER*16 CID

REAL TIDATA
```

Sample Fortran read statements for time-varying data records in the unformatted file are:

```
+)))QLoop over time periods
*
*       READ(iunit)IBDAT,IBTIM,IEDAT,IETIM
*
*       +)))QLoop over sources
*       *
*       *           READ(iunit)CID,XKM,YKM,HTAGL,ELMSL,SIGYI,SIGZI,QEMIT
*       *
*       .)))QEnd loop over sources
*
.)))QEnd loop over time periods
```

and sample Fortran read statements for time-varying data records in the formatted file are:

```
+)))QLoop over time periods
*
*       READ(iunit,*)IBDAT,IBTIM,IEDAT,IETIM
*
*       +)))QLoop over sources
*       *
*       *           READ(iunit,*)CID,XKM,YKM,HTAGL,ELMSL,SIGYI,SIGZI,QEMIT
*       *
*       .)))QEnd loop over sources
*
.)))QEnd loop over time periods
```

where the following declarations apply:

```
CHARACTER*16 CID
REAL QEMIT(nse4)
```

Table F-30
VOLEMARB.DAT - Time-Invariant Data Record Contents
(Repeated for each source)

Data Record No.	Variable No.	Variable	Type[a]	Description
1	1	CID	C*16	Source identifier (16 characters = 4 words)
1	2	TIDATA	real	User defined flag (e.g., fuel code)

[a] C*16 = Character*16

Table F-31
VOLEMARB.DAT - Time-Varying Data Record Contents
(First record of "NSRC4"+1 records required for each time period)

No.	Variable	Type	Description
1	IBDAT	integer	Beginning date for which data in this set are valid (YYYYJJJ, where YYYY=year, JJJ=Julian day)
2	IBTIM	integer	Beginning hour for which data in this set are valid (00-23, LST; end of hour)
3	IEDAT	integer	Ending date for which data in this set are valid (YYYYJJJ, where YYYY=year, JJJ=Julian day)
4	IETIM	integer	Ending hour for which data in this set are valid (00-23, LST; end of hour)

Example:

Data on each record is valid for 1 hour:

IBDAT=1989183,IBTIM=00,IEDAT=1989183,IETIM=00
IBDAT=1989183,IBTIM=01,IEDAT=1989183,IETIM=01
IBDAT=1989183,IBTIM=02,IEDAT=1989183,IETIM=02

Data on each record is valid for 3 hours:

IBDAT=1989183,IBTIM=00,IEDAT=1989183,IETIM=02
IBDAT=1989183,IBTIM=03,IEDAT=1989183,IETIM=05
IBDAT=1989183,IBTIM=06,IEDAT=1989183,IETIM=08

Table F-31 (Concluded)
VOLEMARB.DAT - Time-Varying Data Record Contents
(Next "NSRC4" records)

No.	Variable	Type[a]	Description
1	CID	C*16	Source identifier (must match values in time-invariant records)
2	XKM	real	X-coordinate (km) for source
3	YKM	real	Y-coordinate (km) for source
4	HTAGL	real	Effective height above ground (m)
5	ELMSL	real	Elevation of ground (m MSL) at source
6	SIGYI	real	Initial $\mathbf{F}_y$ (m)
7	SIGZI	real	Initial $\mathbf{F}_z$ (m)
Next NSE4	QEMIT	real array	Emission rates (g/s) for each species in the order specified in Header Record 2

[a]C*16 = Character*16

F.7 Boundary Concentration Module File (BCON.DAT)

The impact of significant regional pollution transport on concentrations and deposition fluxes computed within the modeling domain can be included in a CALPUFF analysis either by adding a spatially uniform (and either constant in time or varying by hour) field at the post-processing step with CALPOST, or by selecting the boundary concentration (BCON) module within CALPUFF. The latter choice is preferable if there are known spatial gradients in regional concentrations outside the modeling domain, or if chemical transformation and removal processes associated with the regional pollution must be explicitly modeled.

Regional air-mass characteristics are defined and assigned to segments along each boundary of the computational domain when the boundary concentration module is used. A segment is equivalent to the length of one side of a grid cell. The number of air-mass types can be equal to the number of cells along the perimeter of the domain if sufficient information exists on this scale, or the number can be far fewer in typical applications where an entire side of the domain is characterized by a single air-mass. Air-mass characteristics include the concentration of each species advected into the domain and the thickness of the layer that contains these species. These concentrations are used to initialize puffs that are well-mixed in the vertical and the horizontal. The vertical depth of a puff is the thickness of the layer assigned to the air-mass, and the radius of the puff is related to the length of the segment and the component of the transport wind that is perpendicular to the segment (the mass flux into the domain and the initial concentration are conserved). The concentration of each species for each air-mass type may be scaled by factors that vary in one of the following ways: by hour of the day (24 factors); by month (12 factors); by hour and season (96 factors); by wind speed and stability class (36 factors); or by temperature (12 factors). These are the same factors provided for sources specified in the CALPUFF control file. If more detailed variation is needed for one or more air-mass types, air-mass characteristics for these can be provided hourly. When this method is used, the layer thickness may change as well as the concentrations. Otherwise, the layer thickness is constant for each air-mass type.

The configuration of the boundary properties is provided to CALPUFF in a "BCON.DAT" file. Two formats are available for this file. The first is a formatted file prepared specifically for use with the BCON option (MBCON = 1). It is constructed using the CALPUFF control file conventions. A sample file is shown in Table F-32, and a description of the input parameters is provided in Table F-33. The second (MBCON = 2) is a standard CALPUFF unformatted “CONC.DAT” output concentration file. Receptors in this file must lie along the boundary of the modeling region, providing near-surface concentrations for the air mass transported across the boundary into the modeling domain. This format may be chosen if CALPUFF results from a larger domain are available.

Input Group 1 in the BCON.DAT file identifies the grid information for the computational domain, the units for the concentrations that are provided, the number of air-mass types, and the type of temporal variation used in describing air-mass properties. Four air-mass types are used in this example. Three of these use the temporal variation factors provided in Input Group 3 and one uses an explicit sequence of

values in time provided in Input Group 5. Note that the temporal variation factors are specific to both the species and the air mass. Input Group 2 names the six species that will be emitted along the boundary of the computational domain.

Input Group 3 defines the properties of each air-mass that is either constant, or that uses the factored time variation. In subgroup 3a, each air-mass is given a name and an index, followed by the thickness of the layer associated with the air-mass, and the concentration of each species. The name is used to identify air-mass properties in subsequent sections of the file, and the index is used to associate each air-mass type with specific cells along each boundary of the domain. Concentrations are entered in the order defined in Input Group 2. Here we have used generic names to suggest the characteristics of each air-mass, and have provided concentrations for each species. This is only intended to illustrate the structure of the BCON.DAT file, and should not be interpreted as typical values suitable for any application.

Subgroup 3b provides the temporal variation factors for the number of species/air-mass combinations indicated in Input Group 1 (NSBC). Only SO_2 for each of three air-masses (clean, urban, and model) is given a temporal variation here.

Input Group 4 assigns the air-mass types to cells along each boundary, using index values assigned in subgroups 3a and 5a. All cells along the north boundary and the south boundary are assigned to names NORTH and SOUTH, respectively. The cells along the west and east boundaries are entered in pairs, assigned to the variable name WEST-EAST. All of these assignments should be oriented to produce a "map-like" representation of the domain, with north at the top.

Input Group 5 defines any remaining air-mass types with properties that may vary hourly. Subgroup 5a assigns the air-mass name and index, and subgroup 5b identifies the time-period that is included in the data records. The input group terminator (!END!) for 5b must be followed immediately by the data records. The first record of each time period defines the range of hours for which the concentration data are valid by listing the beginning date(YYYYJJJ) and hour(HH), and the ending date and hour. The hour is denoted by the time at the end of the hour (00-23 LST).

For example, a 3-hour period would be:

```
1987056  23  1987057  01
```

and a 1-hour period would be:

```
1987056  23  1987056  23
```

Subsequent records of each time period provide the data for each air-mass. Each record contains the air-mass name (in single quotes), the layer-top (m), and the concentration of each species (units specified by IBCU).

Table F-32
Boundary Condition File (BCON.DAT)

```
------------------------------------------------------------------------
               CALPUFF Boundary Condition Data File
------------------------------------------------------------------------

INPUT GROUP: 1 -- General Specifications
--------------
                        a
     Dataset documentation

        Dataset version           (VRSBC)  No default  !  VRSBC =  5.4 !
        Dataset label             (LBLBC)  No default  !  LBLBC =  example !


     Number of segments along boundaries of computational domain

        North and South            (NBCX)  No default  !  NBCX =  17 !
        East and West              (NBCY)  No default  !  NBCY =  17 !

     Units for boundary concentrations
     provided below                (IBCU)  Default: 1  !  IBCU =   2  !
           1 =     g/m**3
           2 =     ug/m**3
           3 =     ppm
           4 =     ppb

     Number of air-mass types:

          Constant or factored
          variation [Group 3]    (NTYPEBC1) No Default  ! NTYPEBC1 =  3 !

          Arbitrary time
          variation [Group 5]    (NTYPEBC2) No Default  ! NTYPEBC2 =  1 !


     Number of air-mass species  (NSPECBC)  No Default  ! NSPECBC =  5 !

     Number of air-mass type / species
     combinations with variable
     concentration scaling factors
     provided below in (3b)         (NSBC)  Default: 0  !  NSBC =  3  !

--------
    a
     The form of the BCON file may change in the future.  Identify
     this file as being consistent with the version of CALPUFF for
     which it was prepared.
     (NOTE: The dataset label is processed as a 12-character name)


!END!
------------------------------------------------------------------------------

INPUT GROUP: 2 -- Species list
--------------

  Concentrations for the following species are provided at the boundary,
  in the following order:

    ! CSPEC =         HNO3 !         !END!
    ! CSPEC =          NO3 !         !END!
    ! CSPEC =          SO4 !         !END!
    ! CSPEC =          NOX !         !END!
    ! CSPEC =          SO2 !         !END!


  Molecular weight (g/mole) for each species
  (used ONLY if IBCU=3,4 to convert to mass concentration)

    *        SO2  =         *
    *        SO4  =         *

*END*
------------------------------------------------------------------------
```

Table F-32 (Continued)
Boundary Condition File (BCON.DAT)

```
INPUT GROUP: 3 -- Air-Mass Types (Constant or factored variation)
--------------

-------------
Subgroup (3a)
-------------
                            a
          AIR-MASS DEFINITION
          -------------------
            b                              c
        Type       Top of      Pollutant
         No.        Layer     Concentration(s)
                     (m)
       ------    ---------- -----------------------------------
 ! AIRMASS = clean !
 ! X =   1,         3000.,    1.1, 1.2, 1.3, 1.4, 1.5 ! !END!
 ! AIRMASS = urban !
 ! X =   3,         1500.,    5.1, 5.2, 5.3, 5.4, 5.5 ! !END!
 ! AIRMASS = model !
 ! X =   4,         3000.,    2.1, 2.2, 2.3, 2.4, 2.5 ! !END!

--------
    a
     Data for each air-mass type are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An INTEGER from 1 to NTYPEBC1+NTYPEBC2, with no duplications; used
     for mapping air-mass types to boundary of computational grid.

    c
     A concentration must be entered for every species listed in Group 2,
     and in the order presented in Group 2.
     Units are specified by IBCU (e.g. 1 for g/m**3).


-------------
Subgroup (3b)
-------------
                                  a
          VARIABLE AIR-MASS FACTORS
          -------------------------

     Use this subgroup to describe temporal variations in the concentrations
     for one or more air-mass types given in Group 3a.  Factors entered multiply
     the concentrations in Group 3a.  Skip air-mass type / species combinations
     that have constant concentrations.  For more elaborate variations in
     air-mass properties, provide specific records in Input Group 5.

     IVARY determines the type of variation, and is air-mass specific:
     (IVARY)                                  Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)
```

Table F-32 (Continued)
Boundary Condition File (BCON.DAT)

```
    ! AIRMASS = clean  !
    ! IVARY   =    2   !      (12 Months)
    ! SO2     =   0.1,   0.1,   0.5,   0.9,   1.0,   1.0,
                  1.0,   1.0,   1.0,   0.9,   0.5,   0.1        !
    !END!

    ! AIRMASS = urban  !
    ! IVARY   =    2   !      (12 Months)
    ! SO2     =   0.1,   0.1,   0.5,   0.9,   2.0,   2.2,
                  2.5,   1.5,   1.1,   0.9,   0.5,   0.1        !
    !END!

    ! AIRMASS = model  !
    ! IVARY   =    1   !      (24 Hours)
    ! SO2     =   0.1,   0.1,   0.5,   0.9,   2.0,   2.2,
                  2.5,   2.6,   2.7,   2.8,   2.9,   3.0,
                  2.9,   2.8,   2.7,   2.6,   2.5,   2.4,
                  2.2,   2.0,   1.5,   0.9,   0.5,   0.1        !
    !END!


--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.

------------------------------------------------------------------------

INPUT GROUP: 4 -- Air-Mass Map
--------------

     Use this Input Group to assign an air-mass type to each segment
     along the perimeter of the computational grid.  The North boundary
     is listed first, then the West-East segment pairs should be listed
     from North to South, followed by the South boundary.  Within a row,
     segments are provided from West to East.


   ! NORTH     = 7*1,  10*2 !   !END!
   ! WEST_EAST = 1,                          2   ! !END!
   ! WEST_EAST = 1,                          2   ! !END!
   ! WEST_EAST = 4,                          2   ! !END!
   ! WEST_EAST = 4,                          2   ! !END!
   ! WEST_EAST = 4,                          2   ! !END!
   ! WEST_EAST = 4,                          2   ! !END!
   ! WEST_EAST = 4,                          2   ! !END!
   ! WEST_EAST = 4,                          2   ! !END!
   ! WEST_EAST = 4,                          2   ! !END!
   ! WEST_EAST = 4,                          2   ! !END!
   ! WEST_EAST = 4,                          2   ! !END!
   ! WEST_EAST = 4,                          2   ! !END!
   ! WEST_EAST = 4,                          2   ! !END!
   ! WEST_EAST = 3,                          2   ! !END!
   ! WEST_EAST = 3,                          2   ! !END!
   ! WEST_EAST = 3,                          2   ! !END!
   ! WEST_EAST = 3,                          2   ! !END!
   ! SOUTH     = 6*3,  11*2 !   !END!


------------------------------------------------------------------------
```

Table F-32 (Continued)
Boundary Condition File (BCON.DAT)

```
INPUT GROUP: 5 -- Air-Mass Types (Arbitrary time variation)
--------------

     Use this Input Group to describe temporal variations in all air-mass
     properties for air-mass types NOT given in Input Group 3.


-------------
Subgroup (5a)
-------------

                              a
          AIR-MASS DEFINITION
          -------------------

             Type
              No.
            ------
 ! AIRMASS = regional !
 !       X =     2 !       !END!


--------
    a
     Data for each air-mass type are treated as a separate input subgroup
     and therefore must end with an input group terminator.
     The TYPE is an INTEGER from 1 to NTYPEBC1+NTYPEBC2, with no duplications;
     used for mapping air-mass types to boundary of computational grid.

-------------
Subgroup (5b)
-------------

          EXPLICIT TIME-VARYING AIR-MASS PROPERTIES
          ----------------------------------------

     Records following the final group terminator below provide the
     layer-top and concentration(s) for each air-mass type identified
     in Subgroup (5a), for the simulation period identified below.
     The concentration for each species listed in Input Group 2 must
     be provided in order, for each air-mass.

     Simulation Period
     -----------------
     The date is a combined year and Julian day (YYYYJJJ).
     The hour is identified by the time at the END of the hour (00-23 LST).

         Starting date :   (IBDAT) -- No default    ! IBDAT = 1988189 !
         Starting hour :   (IBHH)  -- No default    ! IBHH  = 01      !
         Ending date   :   (IEDAT) -- No default    ! IEDAT = 1988190 !
         Ending hour   :   (IEHH)  -- No default    ! IEHH  = 00      !


     Data Record Structure
     ---------------------
     The first record of each time period defines the range of hours
     for which the concentration data are valid by listing the beginning
     date(YYYYJJJ) and hour(HH), and the ending date and hour.  The hour
     is denoted by the time at the end of the hour (00-23 LST).

     For example, a 3-hour period would be:
     1987056  23  1987057  01

     and a 1-hour period would be:
     1987056  23  1987056  23
```

Table F-32 (Concluded)
Boundary Condition File (BCON.DAT)

```
     Subsequent records of each time period provide the data for each
     air-mass.  Each record contains the air-mass name (in single quotes),
     the layer-top (m), and the concentration of each species (units
     specified by IBCU).

------------------------------------------------------------------------
!END!     (Data records must follow immediately)
     1988189  01  1988189  03
'regional'     3000.,    1.11, 1.21, 1.31, 1.41, 1.51
     1988189  04  1988189  06
'regional'     3000.,    1.12, 1.22, 1.32, 1.42, 1.52
     1988189  07  1988189  09
'regional'     3000.,    1.13, 1.23, 1.33, 1.43, 1.53
     1988189  10  1988189  12
'regional'     3000.,    1.14, 1.24, 1.34, 1.44, 1.54
     1988189  13  1988189  15
'regional'     3000.,    1.15, 1.25, 1.35, 1.45, 1.55
     1988189  16  1988189  18
'regional'     3000.,    1.16, 1.26, 1.36, 1.46, 1.56
     1988189  19  1988189  21
'regional'     3000.,    1.17, 1.27, 1.37, 1.47, 1.57
     1988189  22  1988190  00
'regional'     3000.,    1.18, 1.28, 1.38, 1.48, 1.58
```

Table F-33
BCON.DAT File Inputs

Variable	Type	Description	Sample Values
(Input Group 1 - General Specifications)			
VRSBC	character *12	Dataset version	5.4
LBLBC	character *12	Dataset label	SAMPLE
NBCX	integer	Number of segments along north or south boundary of the computational domain	50
NBCY	integer	Number of segments along east or west boundary of the computational domain	50
IBCU	integer	Units for boundary concentrations 1 = g/m**3 2 = ug/m**3 3 = ppm 4 = ppb	2
NTYPEBC1	integer	Number of air-mass types that are treated as constant, or that are varied using temporal factors (Group 3)	3
NTYPEBC2	integer	Number of air-mass types that are varied hourly (Group 5)	2
NSPECBC	integer	Number of species in each air-mass	5
NSBC	integer	Number of air-mass type / species combinations with variable concentration scaling factors provided in (3b)	10
(Input Group 2 - Species List)			
CSPEC	character *12	Species name (NSPECBC records are required). These names are passed into the data dictionary for later use when assigning properties for particular species.	SO2
XMWTBC (mxspec)	real array	Molecular weight (g/mole) for each species (used ONLY if IBCU=3,4 to convert to mass concentration), assigned by species dictionary name	64., ...

Table F-33 (Continued)
BCON.DAT File Inputs

Variable	Type	Description	Sample Values
(Input Group 3a - Air-Mass Definiton)			
AIRMASS	character *12	Air-mass name, used to coordinate inputs	urban
IAM	integer	Air-mass index, used to store properties	1
HTBC(IAM)	real array	Top of layer for air-mass type	1500.
CONBC (1 to NSPECBC, IAM)	real array	Concentration of each species for Air-mass type	.1, .11., .34, .52,.6
(Input Group 3b - Variable Air-Mass Concentration Factors)			
AIRMASS	character *12	Air-mass name, used to coordinate inputs	urban
IVARY	integer	Type of scale factor variation (diurnal, monthly, etc.) 0 = Constant 1 = Diurnal cycle (24 scaling factors: hours 1-24) 2 = Monthly cycle (12 scaling factors: months 1-12) 3 = Hour & Season (4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB) 4 = Speed & Stab. (6 groups of 6 scaling factors, where first group is Stability Class A, and the 6 speed classes have upper bounds (m/s) defined in Group 12) 5 = Temperature (12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)	2
QFAC	real array	Array of concentration scaling factors for this air-mass and the species indicated	-

The variables in Input Group 3b are entered for the number of air-mass / species combination indicated by NSBC in Input Group 1. The data for each combination (i.e., air-mass name, type of variation, and the QFAC array) are treated as a separate input subgroup and therefore must end with an input group terminator (i.e., !END!). The data for each source-species combination must follow an opening delimiter and "(cspec)=", where (cspec) is a species name defined in Group 2. The data for each combination is followed by a closing delimiter and an input group terminator (i.e., !END!). If NSBC=0, no scaling factors should be defined here.

Table F-33 (Concluded)
BCON.DAT File Inputs

Variable	Type	Description	Sample Values
(Input Group 4 - Air-Mass Map)			
NORTH	integer array	Air-mass type index for each cell along the northern boundary of the computational grid	7*1,3, ...
WEST-EAST	integer array	Air-mass type index for the first (west) and last (east) cell of one row of the computational grid. Records should progress from north to south, starting with the second row from the 'top', and ending with the next-to-last row from the 'bottom'.	1, 2
SOUTH	integer array	Air-mass type index for each cell along the southern boundary of the computational grid	4,1,8*2, ...
(Input Group 5a - Air-Mass Definition)			
AIRMASS	character *12	Air-mass name, used to coordinate inputs	regional
IAM	integer	Air-mass index, used to store properties	2
(Input Group 5b - Explicit Time-Varying Air-Mass Properties)			
IBDAT	integer	Starting date (YYYYJJJ)	2000153
IBHH	integer	Starting hour (HH), identified by the time at the END of the hour (00-23 LST)	01
IEDAT	integer	Ending date (YYYYJJJ)	2000345
IEHH	integer	Ending hour (HH), identified by the time at the END of the hour (00-23 LST)	00

Data records follow Input Group 5b (after the !END! terminator)

The first record of each time period defines the range of hours for which the concentration data are valid by listing the beginning date(YYYYJJJ) and hour(HH), and the ending date and hour. Subsequent records of each time period provide the data for each air-mass listed in Input Group 5a. Each record contains the air-mass name (in single quotes), the layer-top (m), and the concentration of each species (units specified by IBCU).

F.8 User-Specified Deposition Velocity Data File (VD.DAT)

The CALPUFF model requires that the user specify the method for determining dry deposition velocities for each species. In Input Group 3 of the control file, one of the following flags must be specified for each pollutant.

0 =no dry deposition (deposition velocities set to zero)
1 =resistance model used - pollutant deposited as a gas
2 =resistance model used - pollutant deposited as a particle
3 =user-specified deposition velocities used

Note that different methods can be used for different pollutants in the same CALPUFF run.

If any species are flagged as using "user-specified" deposition velocities, CALPUFF reads a formatted user-prepared data file with a 24-hour diurnal cycle of deposition velocities for each species flagged. The 24 values correspond to hours 01-24 (LST) of the simulated day. Twenty-four values must be entered for each flagged pollutant, even if the model run is for less than a full diurnal cycle. The units of the deposition velocities are m/s.

An example of a user-specified VD.DAT file is shown in Table F-34. The VD.DAT file uses a control file format (see Section F.1). All text outside the delimiters (!) is considered as user comment information and is echoed back but otherwise ignored by the input module. Each data line consists of a delimiter followed by the species name, 24 deposition velocities, and a terminating delimiter. The data may extend over more than one line. The line being continued must end with a comma. The control file format allows the use of repetition factors (e.g., 3 * 1.0 instead of 1.0, 1.0, 1.0). The order in which the species are entered in the file is not important. However, the file must end with an input group terminator (i.e., !END!).

The model checks that values have been entered for each species flagged as using user-specified deposition velocities. An error message is printed and execution of the run is terminated if any values are missing. The run will also terminate with an error message from the input routine if too many values are entered (i.e., more than 24 values for a particular pollutant). The species names must match those used in the chemical mechanism of the model.

Table F-34
Sample User-Specified Deposition Velocity File for Two Species

```
       DEPOSITION VELOCITY FILE (VD.DAT)
       ---------------------------------

VD.DAT contains 24-hour diurnal cycle of deposition velocities for each species flagged as using
user-specified values in the control file (CALPUFF.INP).

The first value correspond to the period from 0:00 to 1:00, and the 24th value corresponds to
23:00-0:00.

NOTE: Units are in m/s.
-----------------------


SPECIES
 NAME               Deposition Velocities (m/s)
-------             ---------------------------

!  HNO3      =      5*1.5e-2, 4*1.7e-2, 3*1.8e-2, 3*1.9e-2, 3*1.7e-2, 6*1.5e-2       !
!  SO2       =      5*0.8e-2, 13*1.0e-2, 6*0.8e-2                                    !


!END!
```

F.9 Hourly Ozone Data File (OZONE.DAT)

If the MESOPUFF II or RIVAD/ARM3 chemical mechanism is used to simulate the chemical transformation of SO_2 6 $SO_4^=$ and NO_x 6 HNO_3 ： NO_3^-, estimates of background ambient ozone concentration levels are required to compute the hourly conversion rates. CALPUFF provides two options for the user to provide these data: (1) a single, typical background value appropriate for the modeling region, or (2) hourly ozone data from one or more ozone monitoring stations. The selection of Option 2 requires that a file called OZONE.DAT be created with the necessary data.

OZONE.DAT is a sequential, formatted data file containing three types of records: single header record, time-invariant data records, and hourly ozone data records. A sample OZONE.DAT file is shown in Table F-35. The header record contains information on the number of stations in the data set, the time period of the data, and descriptive information regarding the file. The time-invariant records contain the coordinates of each of the ozone stations. The time-varying data consists of hourly ozone concentrations at each of the ozone stations.

Table F-35
Sample Hourly Ozone Data File (OZONE.DAT)

```
'OZONE', 3, 11, 1980001, 0, 1980002, 0, '5', 'Test'
'STATION 1',   168.000,       3840.000
'STATION 2',   200.000,       3880.000
'STATION 3',   180.000,       3860.000
1980,   001,    0,     9999.,    62.,    50.
1980,   001,    1,     9999.,  9999.,  9999.
1980,   001,    2,       68.,    61.,  9999.
1980,   001,    3,       66.,  9999.,  9999.
1980,   001,    4,     9999.,  9999.,    53.
1980,   001,    5,     9999.,  9999.,  9999.
1980,   001,    6,     9999.,  9999.,  9999.
1980,   001,    7,     9999.,  9999.,  9999.
1980,   001,    8,       69.,    68.,    60.
1980,   001,    9,       72.,    75.,    65.
1980,   001,   10,       74.,    78.,    69.
1980,   001,   11,       87.,    85.,    74.
1980,   001,   12,      102.,    99.,    84.
1980,   001,   13,      109.,   105.,    92.
1980,   001,   14,      120.,   118.,   102.
1980,   001,   15,      116.,   116.,    95.
1980,   001,   16,      103.,   100.,    97.
1980,   001,   17,       98.,    90.,    88.
1980,   001,   18,       89.,    82.,    83.
1980,   001,   19,     9999.,  9999.,    80.
1980,   001,   20,     9999.,  9999.,    78.
1980,   001,   21,     9999.,  9999.,    74.
1980,   001,   22,     9999.,  9999.,    69.
1980,   001,   23,     9999.,  9999.,    69.
1980,   002,   00,     9999.,  9999.,    68.
```

OZONE.DAT File - Header Record

The header records of the OZONE.DAT file contain the name, version, and label of the data set, the number of ozone stations, and starting and ending time periods of data in the file (see Table F-36). A sample Fortran read statement for the header record is:

```
 READ(iunit,*)FNAMEO,NOZSTA,IUTMOZ,IBDATO,IBTIMO,IEDATO,
1 IETIMO,VRSOZ,LABOZ
```

where the following declaration applies:

```
CHARACTER*12 FNAMEO,VRSOZ,LABOZ.
```

Table F-36
OZONE.DAT - Header Record - General Data

No.	Variable	Type[a]	Description	Sample Values
1	FNAMEO	C*12	Data set name	OZONE
2	NOZSTA	integer	Number of ozone stations in the file	3
3	ITUMOZ	integer	UTM zone in which ozone station coordinates are specified (enter 0 if using Lambert conformal coordinates)	11
4	IBDATO	integer	Date of beginning of data in the file (YYYYJJJ, where YYYY=year, JJJ=Julian day)	1980001
5	IBTIMO	integer	Hour of beginning of data in the file (00-23, LST; end of hour)	00
6	IEDATO	integer	Date of end of data in the file (YYYYJJJ, where YYYY=year, JJJ=Julian day)	1980002
7	IETIMO	integer	Hour of end of data in the file (00-23, LST; end of hour)	00
8	VRSOZ	C*12	Data set version = CALPUFF version	5
9	LABOZ	C*12	Data set label	Test

[a]C*12 = Character*12

(Note: YYJJJ date format formerly used is also accepted.)

OZONE.DAT File - Data Records

The OZONE.DAT file contains two types of data records. A set of time-invariant records are read after the header records. These records specify the coordinates of each ozone station (see Table F-37). A set of time-varying data follows, which contain the hourly ozone concentration (in ppb) for each station (see Table F-38).

Sample Fortran read statements for time-invariant data records are:

```
+)))  Loop over stations
*
*     READ(iunit,*)CID,XOZ,YOZ
*
.)))  End loop over stations
```

where the following declaration applies:

```
CHARACTER*16 CID
```

Sample Fortran read statements for time-varying data records are:

```
+)))  Loop over hours
*
*     READ(iunit,*)IYR,IJUL,IHR,OZCONC
*
.)))  End loop over hours
```

where the following declaration applies:

```
REAL OZCONC(nozsta)
```

Table F-37
OZONE.DAT - Time-Invariant Data Record Contents
(Repeated for each station)

No.	Variable	Type[a]	Description
1	CID	C*16	Station identifier (16 characters = 4 words)
2	XOZ	real	X coordinate (km) of the ozone station
3	YOZ	real	Y coordinate (km) of the ozone station

[a]C*16 = Character*16

Table F-38
OZONE.DAT - Time-Varying Data Record Contents
(One record per hour)

No.	Variable	Type	Description
1	IYR	integer	Year of data (four digits)
2	IJUL	integer	Julian day
3	IRH	integer	Hour of data (00-23 LST; end of hour)
Next "NOZSTA"	OZCONC	real array	Ozone concentration (ppb) at each ozone station (in the same order as the station coordinates in the time-invariant records; missing value indicator is 9999.)

(Note: two-digit year format formerly used is also accepted.)

F.10 User-Specified Chemical Transformation Rate Data File (CHEM.DAT)

If chemical conversion is to be considered by CALPUFF, the user must specify a variable in the control file, MCHEM, which determines how chemical transformation rates are computed. The options for MCHEM are:

0 = chemical transformation is not modeled
1 = the MESOPUFF II chemical scheme is used to compute transformation rates
2 = user-specified 24-hour cycles of transformation rates are used
3 = the RIVAD/ARM3 chemical scheme is used to compute transformation

If MCHEM is set equal to 2, CALPUFF reads a formatted user-prepared data file with 24-hour diurnal cycles of transformation rates k_1, k_2, k_3. The nature of the equilibrium relationship assumed between pollutants 4 and 5 (e.g., HNO_3 and NO_3^-) precludes the use of a user-specified conversion rate between these pollutants. If NO_3 is being modeled, the NH_4NO_3 dissociation constant is determined as a function of temperature and relative humidity.

A sample user-specified CHEM.DAT file is shown in Table F-39. The CHEM.DAT file uses a control file format (see Section F.1). All text outside the delimiters (!) is considered as user comment information and is echoed back but otherwise ignored by the input module. Each data line consists of a delimiter followed by the species name, 24 conversion rates, and a terminating delimiter. The data may extend over more than one line. The line being continued must end with a comma. The control file format allows the use of repetition factors (e.g., 3 * 1.0 instead of 1.0, 1.0, 1.0). The order in which the species are entered in the file is not important. However, the file must end with an input group terminator (i.e., !END).

The model checks that the proper number of values have been entered for each conversion rate. An error message is printed and execution of the run is terminated if any values are missing. The run will also terminate with an error message from the input routine if too many values are entered (i.e., more than 24 values).

Table F-39
Sample User-Specified Chemical Transformation Rate Data File (CHEM.DAT)

```
                    CHEMICAL TRANSFORMATION RATE FILE (CHEM.DAT)
                    ----------------------------------------


CHEM.DAT contains a 24-hour diurnal cycle of chemical transformation
rates for the chemical transformation of SO2 to SO4, and NOx to HNO3/PAN.

          k1 = SO2 to SO4 transformation rate(percent/hour)

          k2 = NOx to HNO3 + PAN transformation rate (percent/hour)

          k3 = NOx to HNO3 (only) transformation rate (percent/hour)

The first value correspond to the period from 0:00 to 1:00, and the 24th value corresponds to
23:00-0:00.



                TRANSFORMATION RATE (percent/hour)
                ----------------------------------

! K1          =   7*0.2, 0.4, 0.8, 1.2, 1.6, 3*2.0,   1.6,  1.2, 0.8, 0.4, 6*0.2 !
! K2          =   7*2.0, 4.0, 8.0,12.0,15.0, 3*20.0, 15.0, 12.0, 8.0, 4.0, 6*2.0 !
! K3          =   7*2.0, 3.0, 6.0, 8.0,11.0, 3*15.0, 11.0,  8.0, 6.0, 3.0, 6*2.0 !

!END!
```

F.11 Site-Specific Turbulence Data (PROFILE.DAT)

CALPUFF provides several options for computing the dispersion coefficients, $\mathbf{F}_y$ and $\mathbf{F}_z$. In Input Group 2 of the control file, the user specifies a value for the dispersion method flag, MDISP:

1 = dispersion coefficients computed from values of $\mathbf{F}_v$ and $\mathbf{F}_w$ read from a data file (PROFILE.DAT),

2 = dispersion coefficients determined from internally computed values of $\mathbf{F}_v$ and $\mathbf{F}_w$ based on similarity scaling relationships,

3 = PG coefficients (computed using the ISCST multi-segment approximation) used for rural areas and MP coefficients used in urban areas,

4 = same as 3 except that the PG coefficients are computed using the MESOPUFF II equations.

5 = CTDMPLUS dispersion coefficients computed from $\mathbf{F}_v$ and $\mathbf{F}_w$ for neutral/stable.

If Option 1 or Option 5 is selected, the user must prepare a data file with hourly values of $\mathbf{F}_v$ and $\mathbf{F}_w$. This option is intended primarily for application to a single source or facility with onsite measurements of $\mathbf{F}_v$ and $\mathbf{F}_w$. Therefore, only one set of observations are allowed in the data base and they are assumed to apply over the entire computational region.

The CTDMPLUS meteorological data file PROFILE provides for measurements of turbulence as well as wind speed, wind direction, and temperature at one or more heights on a tower. Because the PROFILE.DAT file is one of the meteorological formats accepted by CALPUFF, it may also be used for entering turbulence measurements for use with any of the other options. Its structure is documented in Section F.2.4.

F.12 CTDMPLUS Terrain Feature Description and Receptors (HILL.DAT, HILLRCT.DAT)

CALPUFF allows two ways of specifying the characteristics of terrain features modeled by CTSG. The first is by means of the OPTHILL processor described in Section F.16, which provides the parameters to be entered in the control file CALPUFF.INP. The second approach allows the use of the terrain preprocessing programs provided with CTDMPLUS (Mills et al., 1987). If a user is familiar with the terrain preprocessor, then this may be the preferred option because the standard terrain file used in CTDMPLUS, "TERRAIN", can be read by CALPUFF without modification. CTDMPLUS subroutines that read and process the terrain data have been incorporated in CALPUFF. Similarly, CTSG receptors may either be entered directly into the control file, or may be read from the corresponding CTDMPLUS "RECEPTOR" file. Note however that any CTSG receptors that are not located on one of the hill features (designated by a hill ID of 0) are ignored in CALPUFF. The default filenames in CALPUFF for TERRAIN and RECEPTOR are HILL.DAT and HILLRCT.DAT, respectively, and they are used together so that both must be used if the CTDMPLUS input option is selected.

Table F-40 illustrates a typical HILL.DAT file for one hill. This one is defined by ellipse/polynomial shapes determined for a range of 10 "critical elevations" from 25 m to 115 m above the base of the hill. After the header record, the first group of 10 records provides the ellipse parameters at each "critical elevation", and the second group of 10 records provides the parameters for the corresponding inverse polynomial shape profile fit to the portion of the hill above it. Refer to Mills et al. (1987) for more detailed information. Table F-41 shows a typical HILLRCT.DAT file. Data for each CTSG receptor are placed in one record, and identify the location, hill number (ID), ground elevation, and receptor height above the ground. Note that CALPUFF places all receptors on the ground. The structure of the data records is defined in Table F-42 (HILL.DAT) and F-43 (HILLRCT.DAT).

Other data associated with the HILL.DAT and HILLRCT.DAT are provided in the CALPUFF.INP control file, in Input Group 6. These reference the coordinate system used to prepare the CTDMPLUS simulation to the system chosen for the CALPUFF simulation. XHILL2M and ZHILL2M are the conversion factors that scale the CTDMPLUS "user units" in the horizontal and vertical, respectively, to meters. XCTDMKM and YCTDMKM define the location of the origin of the CTDMPLUS coordinate system in the CALPUFF coordinate system. The units used for this are kilometers. Hence, if UTM coordinates are used for both simulations, the origins of the two system are the same, and XCTDMKM=YCTDMKM=0.

Table F-40
Sample CTDMPLUS Terrain Feature File (HILL.DAT)

1 20	.5000E+03	CTSG Test Hill				
.000	.5000E+04 .2067E-02	180.000	2498.000	2498.000		
24.000	.5000E+04 .1071E-02	180.000	2242.000	2242.000		
48.000	.5000E+04 .8304E-03	180.000	1986.000	1986.000		
72.000	.5000E+04 .4369E-03	180.000	1820.000	1820.000		
96.000	.5000E+04 .7918E-03	180.000	1692.000	1692.000		
120.000	.5000E+04 .3501E-03	180.000	1493.000	1493.000		
144.000	.5000E+04-.1282E-03	180.000	1410.000	1410.000		
168.000	.5000E+04 .1463E-03	180.000	1334.000	1334.000		
192.000	.5000E+04 .7370E-04	180.000	1263.000	1263.000		
216.000	.5000E+04 .3210E-03	180.000	1196.000	1196.000		
240.000	.5000E+04-.2209E-03	180.000	1071.000	1071.000		
264.000	.5000E+04 .1904E-03	180.000	1011.000	1011.000		
288.000	.5000E+04-.7684E-03	180.000	951.700	951.700		
312.000	.5000E+04 .7754E-03	180.000	893.300	893.300		
336.000	.5000E+04 .5356E-04	180.000	835.000	835.000		
360.000	.5000E+04 .5811E-03	180.000	716.400	716.400		
384.000	.5000E+04-.1251E-03	180.000	654.800	654.800		
408.000	.5000E+04-.1892E-04	180.000	590.400	590.400		
432.000	.5000E+04 .2414E-03	180.000	521.900	521.900		
456.000	.5000E+04 .7710E-04	180.000	446.900	446.900		
.000	.5000E+04 .2430E-03	180.000	2.859	2.859	959.101	959.101
24.000	.5000E+04 .1997E-03	180.000	3.039	3.039	914.047	914.047
48.000	.5000E+04 .1903E-03	180.000	3.232	3.232	872.399	872.399
72.000	.5000E+04 .1296E-03	180.000	3.472	3.472	832.424	832.424
96.000	.5000E+04 .1485E-03	180.000	3.853	3.853	792.979	792.979
120.000	.5000E+04 .8714E-04	180.000	3.281	3.281	779.560	779.560
144.000	.5000E+04 .1015E-03	180.000	3.439	3.439	743.594	743.594
168.000	.5000E+04 .1086E-03	180.000	3.639	3.639	707.754	707.754
192.000	.5000E+04 .9029E-04	180.000	3.920	3.920	671.777	671.777
216.000	.5000E+04 .1062E-03	180.000	4.416	4.416	635.301	635.301
240.000	.5000E+04 .1061E-03	180.000	3.541	3.541	620.841	620.841
264.000	.5000E+04 .5922E-04	180.000	3.727	3.727	584.737	584.737
288.000	.5000E+04 .2187E-03	180.000	3.981	3.981	547.935	547.935
312.000	.5000E+04 .2005E-03	180.000	4.371	4.371	510.250	510.250
336.000	.5000E+04 .9593E-04	180.000	5.127	5.127	471.649	471.649
360.000	.5000E+04 .6310E-04	180.000	3.752	3.752	449.211	449.211
384.000	.5000E+04 .1081E-03	180.000	4.012	4.012	406.554	406.554
408.000	.5000E+04 .1295E-03	180.000	4.418	4.418	361.177	361.177
432.000	.5000E+04 .1997E-03	180.000	5.163	5.163	312.371	312.371
456.000	.5000E+04 .7139E-04	180.000	6.957	6.957	259.205	259.205

Table F-41
Sample CTDMPLUS Receptor File (HILLRCT.DAT)

CTSG	**11**	**5057.00**	**1819.00**	**0.00**	**60.00**	**1**
CTSG	**12**	**6110.92**	**1441.86**	**0.00**	**60.00**	**1**
CTSG	**13**	**6744.54**	**518.94**	**0.00**	**60.00**	**1**
CTSG	**14**	**6718.43**	**-600.22**	**0.00**	**60.00**	**1**
CTSG	**15**	**6041.93**	**-1492.11**	**0.00**	**60.00**	**1**
CTSG	**16**	**4971.64**	**-1819.50**	**0.00**	**60.00**	**1**
CTSG	**17**	**3911.83**	**-1459.18**	**0.00**	**60.00**	**1**
CTSG	**18**	**3263.93**	**-546.19**	**0.00**	**60.00**	**1**
CTSG	**19**	**3272.78**	**573.16**	**0.00**	**60.00**	**1**
CTSG	**20**	**3934.60**	**1476.13**	**0.00**	**60.00**	**1**
CTSG	**31**	**5044.00**	**1410.00**	**0.00**	**140.00**	**1**
CTSG	**32**	**5860.32**	**1116.84**	**0.00**	**140.00**	**1**
CTSG	**33**	**6351.35**	**402.11**	**0.00**	**140.00**	**1**
CTSG	**34**	**6331.27**	**-464.92**	**0.00**	**140.00**	**1**
CTSG	**35**	**5807.34**	**-1156.04**	**0.00**	**140.00**	**1**
CTSG	**36**	**4978.05**	**-1410.00**	**0.00**	**140.00**	**1**
CTSG	**37**	**4157.13**	**-1130.30**	**0.00**	**140.00**	**1**
CTSG	**38**	**3655.12**	**-423.18**	**0.00**	**140.00**	**1**
CTSG	**39**	**3661.76**	**444.07**	**0.00**	**140.00**	**1**
CTSG	**40**	**4174.62**	**1143.51**	**0.00**	**140.00**	**1**
CTSG	**51**	**5036.00**	**1132.00**	**0.00**	**220.00**	**1**
CTSG	**52**	**5691.56**	**896.77**	**0.00**	**220.00**	**1**
CTSG	**53**	**6085.89**	**322.53**	**0.00**	**220.00**	**1**
CTSG	**54**	**6069.21**	**-373.86**	**0.00**	**220.00**	**1**
CTSG	**55**	**5648.17**	**-928.84**	**0.00**	**220.00**	**1**
CTSG	**56**	**4982.05**	**-132.50**	**0.00**	**220.00**	**1**
CTSG	**57**	**4322.81**	**-907.74**	**0.00**	**220.00**	**1**
CTSG	**58**	**3919.67**	**-339.71**	**0.00**	**220.00**	**1**
CTSG	**59**	**3925.21**	**356.75**	**0.00**	**220.00**	**1**
CTSG	**60**	**4337.13**	**918.50**	**0.00**	**220.00**	**1**
CTSG	**71**	**5028.00**	**893.00**	**0.00**	**300.00**	**1**
CTSG	**72**	**5856.38**	**254.71**	**0.00**	**300.00**	**1**
CTSG	**73**	**5511.36**	**-732.35**	**0.00**	**300.00**	**1**
CTSG	**74**	**4465.87**	**-716.09**	**0.00**	**300.00**	**1**
CTSG	**75**	**4151.82**	**281.47**	**0.00**	**300.00**	**1**
CTSG	**86**	**5016.00**	**521.70**	**0.00**	**420.00**	**1**
CTSG	**87**	**5499.93**	**148.95**	**0.00**	**420.00**	**1**
CTSG	**88**	**5299.01**	**-427.66**	**0.00**	**420.00**	**1**
CTSG	**89**	**4688.11**	**-418.57**	**0.00**	**420.00**	**1**
CTSG	**90**	**4504.92**	**164.14**	**0.00**	**420.00**	**1**
CTSG	**96**	**5000.00**	**0.00**	**0.00**	**500.00**	**1**

Table F-42
HILL.DAT File - Record Group Structure

Record Group *	Columns	Variable	Type	Description
1	6-7	NH	integer	Hill ID number
1	9-10	NZ	integer	Number of critical elevations
1	21-30	HTP	real	Elevation of top of feature (user units)
1	31-45	HNAME	character	Hill name
2 **	1-10	ZH	real	Critical elevation (user units)
2	11-20	XHW	real	X-coordinate of ellipse centroid (user units)
2	21-30	YHW	real	Y-coordinate of ellipse centroid (user units)
2	31-40	MAJORW	real	Orientation (deg) of major axis from North
2	41-50	MAJAXW	real	Semi-major axis length (user units)
2	51-60	MINAXW	real	Semi-minor axis length (user units)
3 **	1-10	ZH	real	Critical elevation (again)
3	11-20	L(1)	real	X-coordinate of cut-off hill (user units)
3	21-30	L(2)	real	Y-coordinate of cut-off hill (user units)
3	31-40	MAJORL	real	Orientation (deg) of major axis of cut-off hill from North
3	41-50	EXPOMA	real	Inverse polynomial exponent for major axis
3	51-60	EXPOMI	real	Inverse polynomial exponent for minor axis
3	61-70	SCALMA	real	Inverse polynomial length scale for major axis
3	71-80	SCALMI	real	Inverse polynomial length scale for minor axis

* Record groups are repeated for each hill in the file

** There are NZ records for group 2 followed by NZ records for group 3

Table F-43
HILLRCT.DAT File - Data Records
(One record per CTSG receptor)

Columns	Variable	Type	Description
1-16	RNAME	character	Receptor name
21-30	XR	real	X-coordinate (user units)
31-40	YR	real	Y-coordinate (user units)
41-50	ZR	real	Height above ground (user units)
51-60	GE	real	Ground-level elevation (user units)
61-65	NH *	integer	ID number of hill under this receptor

* Receptors with NH=0 are ignored

F.13 Subgrid Scale Coastal Boundary Data File (COASTLN.DAT)

CALPUFF contains an option to treat subgrid scale coastal effects such as the development of a Thermal Internal Boundary Layer (TIBL) within an individual grid cell. The subgrid scale coastal module is controlled by the MSGTIBL variable in Input Group 2 of the control file. If MSGTIBL = 1, CALPUFF will introduce a subgrid scale TIBL along a coastal boundary specified in an external file (COASTLN.DAT) when appropriate meteorological conditions exist. The COASTLN.DAT file contains a set of points that serve to define the coastline. Multiple coastlines (up to "MXCOAST", see the PARAMS.PUF file) are allowed within a single file.

The COASTLN.DAT file is a sequential, formatted data file (see Table F-44 for an example) consisting of two types of records: a single header record and a variable number of sets of data records. Each set of data records includes a record indicating the location of the water body relative to the coastline (i.e., left or right of the line as one travels in the direction of the data points in the file) and a variable number of records containing the coordinates of each point defining the coastline.

Table F-44
Sample Subgrid Scale Coastal Boundary Data File (COASTLN.DAT)

```
'COASTLN', 2, 19, '5', 'test'
'WR','Atlantic'
242., 4568.
264., 4588.
270., 4574.
286., 4584.
298., 4602.
308., 4634.
316., 4646.
340., 4610.
354., 4624.
390., 4630.
370., 4648.
340., 4700.
356., 4738.
346., 4744.
394., 4822.
410., 4860.
454., 4862.
474., 4864.
'WL','Large Lake'
200., 4500.
176., 4588.
```

COASTLN.DAT File - Header Record

The header record of the COASTLN.DAT file contain the name, version, and label of the data set, the UTM zone of the coordinates, and the number of coastlines defined in the file (see Table F-45). A sample Fortran read statement for the header record is:

```
READ(iunit,*)FNAMEC,NCOAST,IUTMCST,VRSCST,LABCST
```

where the following declaration applies:

```
CHARACTER*12 FNAMEC,VRSCST,LABCST.
```

Table F-45
COASTLN.DAT - Header Record - General Data

No.	Variable	Type[a]	Description	Sample Values
1	FNAMEC	C*12	Data set name	COASTLN
2	NCOAST	integer	Number of coastlines in the file	2
3	ITUMCST	integer	UTM zone in which coastline coordinates are specified (enter 0 if using Lambert conformal coordinates)	19
4	VRSCST	C*12	Data set version = CALPUFF version	5
5	LABCST	C*12	Data set label	Test

[a]C*12 = Character*12

COASTLN.DAT File - Data Records

The COASTLN.DAT file contains "NCOAST" groups of coastal coordinates and related data. Each group of records consists of a single data header record (see Table F-46) followed by a variable number of data records (see Table F-47) containing the X and Y coordinates of each point used to define the coastline. The number of coastlines (NCOAST) must not exceed the maximum number specified in the parameter file (MXCOAST), and the number of points used to define a coastline must not exceed its maximum (MXPTCST). See the PARAMS.PUF file for the specification of the MXCOAST and MXPTCST variables.

Sample Fortran read statements for COASTLN.DAT data records are:

```
+)))   Loop over "NCOAST" coastlines (i)
*
*        READ(iunit,*)ADIR, ALABEL
*
*       +)))   Loop over data points (j)
*       *
*       *        READ(iunit,*)XKM(i,j), YKM(i,j)
*       *
*       .)))     End loop over data points
*
.)))   End loop over coastlines
```

where the following declarations apply:

```
REAL XKM(mxcoast,mxptcst),YKM(mxcoast,mxptcst)
CHARACTER*2 ADIR
CHARACTER*12 ALABEL
```

Table F-46
COASTLN.DAT - Data Header Record Contents
(Data header and data point set repeated for each coastline)

No.	Variable	Type[a]	Description
1	ADIR	C*2	Flag indicating which side of the coastline water is located as one moves in the direction of the data points in the file (WR indicates water is on right side, WL indicates water is on left side).
2	ALABEL	C*16	Character identifier or name of the water body

[a]C*2 = Character*2
C*16= Character*16

Table F-47
COASTLN.DAT - Data Record Contents
(Data header and data point set repeated for each coastline)

No.	Variable	Type	Description
1	XKM	real array	X coordinate (km) of point defining coastline
2	YKM	real array	Y coordinate (km) of point defining coastline

F.14 Mass Flux Boundary Data File (FLUXBDY.DAT)

When the IMFLX variable in Input Group 5 of the control file is 1, CALPUFF will compute the hourly mass that crosses boundaries specified in the external file FLUXBDY.DAT. This file contains a set of points that serve to define one or more boundaries that separate regions. The mass is said to either pass into or out of a region depending on how the user defines "in" and "out" for each boundary. Multiple boundaries (up to "MXBNDRY", see the PARAMS.PUF file) are allowed within a single file.

The FLUXBDY.DAT file is a sequential, formatted data file (see Table F-48 for an example) consisting of two types of records: a single header record and a variable number of sets of data records. Each set of data records includes one record that establishes which side of the boundary is considered "in" and provides a name for the boundary, and a variable number of records containing the coordinates (km) of each point defining the boundary.

The side of the boundary that is considered "in" may lie either to the left or the right of the boundary as one travels in the direction of the data points provided in the file. The choice is made by specifying either IR to indicate that the region to the right is inside, or by specifying IL to indicate that the region to the left is inside.

Table F-48
Sample Mass Flux Boundary Data File (FLUXBDY.DAT)

```
'FLUXBDY', 4, 19, '  5  ', 'test '
'IR','Square 1KM Box'
298., 4629.
298., 4631.
300., 4631.
300., 4629.
298., 4629.
'IL','Diamond 1KM Box'
299., 4629.
298., 4630.
299., 4631.
300., 4630.
299., 4629.
'IR','Square 5KM Box'
294., 4625.
294., 4635.
304., 4635.
304., 4625.
294., 4625.
'IL','Diamond 5KM Box'
299., 4625.
294., 4630.
299., 4635.
304., 4630.
299., 4625.
```

FLUXBDY.DAT File - Header Record

The header record of the FLUXBDY.DAT file contains the name, version, and label of the data set, the UTM zone of the coordinates, and the number of boundaries defined in the file (see Table F-49). A sample Fortran read statement for the header record is:

```
READ(iunit,*)DATATYPE,NBNDRY,IUTMBDY,VRSBDY,LABBDY
```

where the following declaration applies:

```
CHARACTER*12 DATATYPE,VRSBDY,LABBDY.
```

Table F-49
FLUXBDY.DAT - Header Record - General Data

No.	Variable	Type[a]	Description	Sample Values
1	DATATYPE	C*12	Data set name	FLUXBDY
2	NBNDRY	integer	Number of boundaries in the file	2
3	ITUMBDY	integer	UTM zone in which boundary coordinates are specified (enter 0 if using Lambert conformal coordinates)	19
4	VRSBDY	C*12	Data set version	"5"
5	LABBDY	C*12	Data set label	"Test"

[a]C*12 = Character*12

FLUXBDY.DAT File - Data Records

The FLUXBDY.DAT file contains "NBNDRY" groups of boundary coordinates and related data. Each group of records consists of a single data header record (see Table F-50) followed by a variable number of data records (see Table F-51) containing the X and Y coordinates of each point used to define the boundary. The number of boundaries (NBNDRY) must not exceed the maximum number specified in the parameter file (MXBNDRY), and the number of points used to define a boundary must not exceed its maximum (MXPTBDY). See the PARAMS.PUF file for the specification of the MXBNDRY and MXPTBDY variables.

Sample Fortran read statements for FLUXBDY.DAT data records are:

```
+)))  Loop over "NBNDRY" boundaries (i)
*
*       READ(iunit,*)ADIR, ALABEL
*
*       +)))  Loop over data points (j)
*       *
*       *       READ(iunit,*)XKM(i,j), YKM(i,j)
*       *
*       .)))     End loop over data points
*
.)))  End loop over boundaries
```

where the following declarations apply:

```
REAL XKM(mxbndry,mxptbdy),YKM(mxbndry,mxptbdy)
CHARACTER*2 ADIR
CHARACTER*12 ALABEL
```

Table F-50
FLUXBDY.DAT - Data Header Record Contents
(Data header and data point set repeated for each boundary)

No.	Variable	Type[a]	Description
1	ADIR	C*2	Flag indicating which side of the boundary is considered "in" as one moves in the direction of the data points in the file (IR indicates "in" is on right side, IL indicates "in" is on left side).
2	ALABEL	C*16	Character identifier or name of the boundary

[a]C*2 = Character*2
C*16= Character*16

Table F-51
FLUXBDY.DAT - Data Record Contents
(Data header and data point set repeated for each boundary)

No.	Variable	Type	Description
1	XKM	real array	X coordinate (km) of point defining boundary
2	YKM	real array	Y coordinate (km) of point defining boundary

F.15 CALPUFF Output Files

F.15.1 List File (CALPUFF.LST)

The general list file for your CALPUFF run, CALPUFF.LST, is an ASCII text file that may be viewed by any standard text editor, or printed to any standard printer. It provides the primary means of documenting the CALPUFF application, and it also contains all warning messages that may have been generated by the application. Note that some problems detected by CALPUFF result in fatal error messages (the requested modeling period is not simulated), while other problems are not severe enough to halt the run, and warning messages are written to the list file. Warning messages may be located throughout the file, whereas fatal error messages are at the end (because the run is halted). Therefore, the list file should always be reviewed.

The contents of the control file are echoed to the first part of the list file, and header records from each external data file for the run follow. In the case of CALMET.DAT, the header records include all of the time-invariant data fields, so that the file can become quite large when large CALMET grids are used. The remainder of the list file contains any hourly concentrations and deposition fluxes that are selected for output to the "printer". This selection is made in Input Group 5 (see Section F.1) where ICPRT, IDPRT, and IWPRT identify the types of data selected; ICFRQ, IDFRQ, and IWFRQ identify the interval (in hours) between the data written to the list file; and IPRTU identifies the units used for this output. The species written are also explicitly selected here. Because the primary data files produced by CALPUFF are CONC.DAT, DFLX.DAT. and WFLX.DAT, which are processed by CALPOST, any data sent to the list file are generally for making spot-checks prior to the post-processing step, or for viewing the results of very short runs.

The debug option, controlled by LDEBUG, IPFDEB, NPFDEB, NN1, and NN2 in Input Group 5, also places a good deal of information in the list file. Much of this uses internal parameter names, and is most useful for those who are tracing the treatment of a few specific puffs through the many CALPUFF subroutines, or for those who are preparing a run and want to obtain more information during the setup phase (use ITEST=1 in Input Group 1 to stop the run before going into the computational phase). If many puffs are traced (NPFDEB) over many modeling periods (NN1 to NN2), the list file will become huge. A limited set of puff information is also written to DEBUG.DAT each sampling step when the debug option is selected. This file is described in Section F.15.7.

F.15.2 Restart File (RESTARTE.DAT)

Information for all puffs that are still within the computational grid at the end of a CALPUFF run can be saved to disk in RESTARTE.DAT to initialize a continuation run. This allows CALPUFF to properly account for "old" material within the modeling domain at the start of the continuation run. This restart file may also be refreshed periodically during a run, as configured by NRESPD in Input Group 1 of the control file (see Section F.1). RESTARTE.DAT is an unformatted data file that contains information

about the modeling grid, the date and time at the end of the period simulated, and all of the internal puff array data at the end of the simulation. Note that this file becomes the RESTARTB.DAT input file for the continuation run, and that all CALPUFF output files for the continuation run are "new". For example, if a full year is simulated in four quarterly CALPUFF runs with three restart files, there will be four concentration files rather than one.

F.15.3 Concentration File (CONC.DAT)

The CONC.DAT file is an unformatted data file containing concentrations of one or more species simulated by CALPUFF at each receptor, for each period in the run. The creation and contents of the CONC.DAT file are controlled by user-specified inputs in Input Group 5 of the control file (see Section F.1). The control file variable ICON must be set equal to one in order to create the CONC.DAT file, and the file will contain only those species that are specifically "saved on disk".

CONC.DAT File - Header Records

The CONC.DAT file consists of as many as NCOM+15 header records followed by a set of data records. The header records contain information describing the version of the model used in the run creating the file, horizontal and vertical grid data, a user-input title, a list of the species combinations stored in the output file, receptor information, and source names (see Table F-52). NCOM, provided in record 2, defines the number of comment records that are present. Comment records are used to transfer the image of CALMET and CALPUFF control files used in the simulation for documentation and QA purposes.

Sample FORTRAN read statements for the header records are:

```
  READ(iunit) DATASET,DATAVER,DATAMOD
  READ(iunit) NCOM
  DO n=1,NCOM
    READ(iunit) COMMENT
  ENDDO
  READ(iunit)CMODEL,VER,LEVEL,IBYR,IBJUL,IBHR,IBSEC,XBTZ,
 1 IRLG,IAVG,NSECDT,NXM,NYM,DXKM,DYKM,IONE,XORIGKM,YORIGKM,NSSTA,IBCOMP,IECOMP,
 2 JBCOMP,JECOMP,IBSAMP,JBSAMP,IESAMP,JESAMP,MESHDN,NPT1,NPT2,NAR1,NAR2,NLN1,NLN2,
 3 NVL1,NVL2,MSOURCE,NREC,NCTREC,LSAMP,NSPOUT,LCOMPR,
 4 I2DMET,IUTMZN,FEAST,FNORTH,RNLAT0,RELON0,
 5 XLAT1,XLAT2,PMAP,UTMHEM,DATUM,DATEN,
 6 CLAT0,CLON0,CLAT1,CLAT2
  READ(iunit)TITLE
  READ(iunit)CSOUT
  IF(NDREC.GT.0) READ(iunit)XREC,YREC,ZREC
  IF(NCTREC.GT.0) READ(iunit)XRCT,YRCT,ZRCT,IHILL
  IF(NPT1.GT.0) READ(iunit)ISTYPE,CNAMPT1
  IF(NPT2.GT.0) READ(iunit)ISTYPE,CNAMPT2
  IF(NAR1.GT.0) READ(iunit)ISTYPE,CNAMAR1
  IF(NAR2.GT.0) READ(iunit)ISTYPE,CNAMAR2
  IF(N LN1.GT.0) READ(iunit)ISTYPE,CNAMLN1
  IF(NLN2.GT.0) READ(iunit)ISTYPE,CNAMLN2
  IF(NVL1.GT.0) READ(iunit)ISTYPE,CNAMVL1
  IF(NVL2.GT.0) READ(iunit)ISTYPE,CNAMVL2
```

where the following declarations apply:

```
Character*132 COMMENT
Character*80 TITLE(3)
Character*64 DATAMOD
Character*16 DATASET, DATAVER, CLAT0, CLON0, CLAT1, CLAT2
Character*16 CNAMPT1(MXPT1),CNAMPT2(MXPT2), CNAMAR1(MXAREA),CNAMAR2(MXAREA)
Character*16 CNAMLN1(MXLINES),CNAMLN2(MXLNGRP), CNAMVL1(MXVOL),CNAMVL2(MXVOL)
Character*15 CSOUT(NSPOUT)
Character*12 CMODEL,VER,LEVEL, DATEN
Character*8 PMAP, DATUM
Character*4 UTMHEM

Real XREC(NREC),YREC(NREC),ZREC(NREC)
Real XRCT(NCTREC),YRCT(NCTREC),ZRCT(NCTREC)

Integer IHILL(NCTREC)

Logical LCOMPR
```

Table F-52
Unformatted CONC.DAT file - Header

Header Record 1 – Dataset Definition

No.	Variable	Type	Description	Sample Values
1	DATASET	Character*16	Dataset name	CONC.DAT
2	DATAVER	Character *16	Dataset version	2.1
3	DATAMOD	Character *64	Dataset message field	-

Header Record 2 to (NCOM+2) – Comments

No.	Variable	Type	Description	Sample Values
1	NCOM	integer	Number of comment records to follow	-
1	COMMENT	Character *132	Comment (repeated NCOM times)	-

Table F-52 (Continued)
Unformatted CONC.DAT file - Header Record NCOM+3 - General Data

No.	Variable	Type[a]	Description	Sample Values
1	CMODEL	C*12	Model name	CALPUFF
2	VER	C*12	Model version number	5.72
3	LEVEL	C*12	Model level number	031017
4	IBYR	integer	Starting year of the run	1980
5	IBJUL	integer	Starting Julian day	183
6	IBHR	integer	Time at start of first period (hour 00-23 LST)	8
7	IBSEC	integer	Time at start of first period (second 0000-3599)	0000
8	XBTZ	real	Base time zone (LST+XBTZ=UTC)	6.0
9	IRLG	integer	Length of run (timesteps)	10
10	IAVG	integer	Averaging time (timesteps) of output concentrations	2
11	NSECDT	integer	Length of a timestep (seconds)	1800
12	NXM	integer	Number of grid points in meteorological grid (X direction)	20
13	NYM	integer	Number of grid points in meteorological grid (Y direction)	20
14	DXKM	real	Grid spacing (km) in the X direction	5.
15	DYKM	real	Grid spacing (km) in the Y direction	5.
16	IONE	integer	Number of receptor layers (must be equal to one for CALPUFF runs)	1
17	XORIGKM	real	Reference X coordinate (km) of the southwest corner of grid cell (1,1) of the meteorological grid	190.
18	YORIGKM	real	Reference Y coordinate (km) of the southwest corner of grid cell (1,1) of the meteorological grid	440.
19	NSSTA	integer	Number of surface meteorological stations	5
20	IBCOMP	integer	Start of computational grid in X direction	1
21	IECOMP	integer	End of computational grid in X direction	20
22	JBCOMP	integer	Start of computation grid in the Y direction	1
23	JECOMP	integer	End of computational grid in Y direction	20
24	IBSAMP	integer	Start of sampling grid in X direction	1
25	JBSAMP	integer	Start of sampling grid in Y direction	1

[a]C*12 = Character*12

Table F-52 (Continued)
Unformatted CONC.DAT file - Header Record NCOM+3 - General Data

No.	Variable	Type[a]	Description	Sample Values
26	IESAMP	integer	End of sampling grid in X direction	20
27	JESAMP	integer	End of sampling grid in Y direction	20
28	MESHDN	integer	Sampling grid spacing factor	1
29	NPT1	integer	Number of point sources (control file)	2
30	NPT2	integer	Number of point sources (variable emissions file)	0
31	NAR1	integer	Number of area sources (control file)	0
32	NAR2	integer	Number of area sources (variable emissions file)	0
33	NLN1	integer	Number of line sources (control file)	0
34	NLN2	integer	Number of line sources (variable emissions file)	0
35	NVL1	integer	Number of volume sources (control file)	0
36	NVL2	integer	Number of volume sources (variable emissions file)	0
37	MSOURCE	integer	Individual source contribution flag : 0 = report just the total 1 = report individual contributions and the total	0
38	NDREC	integer	number of discrete receptors	0
39	NCTREC	integer	Number of complex terrain receptors	0
40	LSAMP	logical	Sampling grid flag (T = gridded receptors used, F = no gridded receptors)	T
41	NSPOUT	integer	Number of output species	5
42	LCOMPR	logical	Flag indicating if concentration data are compressed (T=yes, F=no)	T
43	I2DMET	integer	RH data flag: 0 = relative humidity at surface stations (1D) 1 = relative humidity at grid points (2D)	1
44	IUTMZN	integer	UTM zone (1-60)	19
45	FEAST	real	False Easting of map projection (km)	0.0
46	FNORTH	real	False Northing of map projection (km)	0.0
47	RNLAT0	real	N. latitude of origin of map projection (degrees)	45.8
48	RELON0	real	E. longitude of origin of map projection (degrees)	-75.2
49	XLAT1	real	Matching N. latitude #1 of map projection (degrees)	30.0
50	XLAT2	real	Matching N. latitude #2 of map projection (degrees)	60.0

[a] C*N = Character*N

Table F-52 (Continued)
Unformatted CONC.DAT file - Header Record NCOM+3 - General Data

No.	Variable	Type[a]	Description	Sample Values
51	PMAP	C*8	Map projection	UTM
52	UTMHEM	C*4	Hemisphere (N or S) for UTM projection	N
53	DATUM	C*8	Datum code	WGS-84
54	DATEN	C*12	NIMA date (MM-DD-YYYY) for datum definitions	10-10-2002
55	CLAT0	C*16	Latitude of origin of map projection	45.8N
56	CLON0	C*16	Longitude of origin of map projection	75.2W
57	CLAT1	C*16	Matching latitude #1 of map projection	30N
58	CLAT2	C*16	Matching latitude #2 of map projection	60N

[a] C*N = Character*N

Table F-52 (Continued)
Unformatted CONC.DAT file - Header

Header Record NCOM+4 - Run Title

No.	Variable	Type[a]	Description
1	TITLE (3)	C*80	User-specified run title (three lines of up to 80 characters/line)

[a] C*80 = Character*80

Header Record NCOM+5 - List of Species in Output File

No.	Variable	Type[a]	Description
1-NSPEC	CSOUT array	C*15	Species name (characters 1-12) and layer (characters 13-15) of concentrations stored in the output file. For example [b], "SO2..........1" indicates SO_2 concentrations in Layer 1; "DIOXINP......1" indicates dioxin in particulate form in Layer 1. CALPUFF concentrations are always computed at ground-level, so therefore are labeled as Layer 1, but there can be up to NZ layers in CALGRID.).

[a] C*15 = Character*15
[b] Dots (....) indicate spaces.

Table F-52 (Continued)
Unformatted CONC.DAT file - Header

Header Record NCOM+6 - Discrete Receptors
(Included only if NDREC > 0)

No.	Variable	Type	Description
1	XREC	real array	X-coordinate (km) of each discrete receptor
2	YREC	real array	Y-coordinate (km) of each discrete receptor
3	ZREC	real array	Ground level elevation (m) of each discrete receptor

Header Record NCOM+7 - Complex Terrain Receptors
(Included only if NCTREC > 0)

No.	Variable	Type	Description
1	XRCT	real array	X-coordinate (km) of each complex terrain receptor
2	YRCT	real array	Y-coordinate (km) of each complex terrain receptor
3	ZRCT	real array	Ground level elevation (m) of each complex terrain receptor
4	IHILL	integer array	Hill number associated with this receptor

Table F-52 (Continued)
Unformatted CONC.DAT file - Header

Header Record NCOM+8 – Point Source Names (Control File)
(Included only if NPT1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (1)
2	CNAMPT1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+9 - Point Source Names (Variable Emissions File)
(Included only if NPT2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (2)
2	CNAMPT2	C*16 array	Source names

C*16 = Character*16

Table F-52 (Continued)
Unformatted CONC.DAT file - Header

Header Record NCOM+10 – Area Source Names (Control File)
(Included only if NAR1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (3)
2	CNAMAR1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+11 - Area Source Names (Variable Emissions File)
(Included only if NAR2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (4)
2	CNAMAR2	C*16 array	Source names

C*16 = Character*16

Table F-52 (Continued)
Unformatted CONC.DAT file - Header

Header Record NCOM+12 – Line Source Names (Control File)
(Included only if NLN1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (5)
2	CNAMLN1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+13 - Line Source Names (Variable Emissions File)
(Included only if NLN2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (6)
2	CNAMLN2	C*16 array	Source names

C*16 = Character*16

Table F-52 (Concluded)
Unformatted CONC.DAT file - Header

Header Record NCOM+14 – Volume Source Names (Control File)
(Included only if NVL1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (7)
2	CNAMVL1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+15 - Volume Source Names (Variable Emissions File)
(Included only if NVL2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (8)
2	CNAMVL2	C*16 array	Source names

C*16 = Character*16

CONC.DAT File - Data Records

The CONC.DAT data records consist of "NSPOUT+2" sets of records for each hour of the CALPUFF run and for each source for each hour of the CALPUFF run if the source contribution option is selected (NSPOUT is the number of output species in the CALPUFF run). The first record of each set contains the date and time period, and the second contains the identity of the source of the data in the records which follow it. The next "NSPOUT" record groups contain the predicted concentrations in g/m^3, for each species flagged for output in the control file. If the source contribution option is active, there will be one output record set for each source, followed by an additional record set for the total due to all sources. The source name used for the total due to all sources is “TOTAL”, the type is “0”, and the number is “1”. Table F-53 describes the variables.

Sample FORTRAN read statements for one data record set (in uncompressed format) are:

```
      READ(iunit)nyrb,njulb,nhrb,nsecb,nyre,njule,nhre,nsece
      READ(iunit) istype,isnum,sname,sxkm,sykm

+) )  LOOP OVER OUTPUT SPECIES
*
*     GRIDDED RECEPTOR CONCENTRATIONS
*     IF(LSGRID)READ(iunit)CSPECG,CONCG
*
*     DISCRETE RECEPTOR CONCENTRATIONS
*     IF(NDREC.GT.0)READ(iunit)CSPECD,CONCD
*
*     COMPLEX TERRAIN RECEPTOR CONCENTRATIONS
*     IF(NCTREC.GT.0)READ(iunit)CSPECCT,CONCCT
*
.) )  END LOOP OVER OUTPUT SPECIES
```

where the following declarations apply:

```
      Character*15 CSPECG,CPSECD,CSPECCT
      Character*16 SNAME
      Real CONCG(nxg,nyg),CONCD(NDREC),CONCCT(NCTREC)
```

and

```
      nxg = IESAMP - IBSAMP+1
      nyg = JESAMP - JBSAMP+1
```

CALPUFF contains an option to compress the data by replacing strings of zeroes with a coded repetition factor. The factor is a negative number whose absolute value indicates the number of consecutive zeroes that have been replaced by the repetition factor. This method is especially useful in reducing the size of the output file when large segments of the receptor arrays lie upwind of the puffs during an hour, thereby producing long strings of zeroes in the output arrays. For example, the following record with data for 20 receptors requires 20 unpacked words:

0.0, 0.0, 0.0, 0.0, 0.0, 1.2, 3.5, 0.0, 0.0, 0.0,
0.0, 0.0, 0.0, 0.7, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0

These data in packed form would be represented in six words:

-5., 1.2, 3.5, -6., 0.7, -6.

Table F-53
Unformatted CONC.DAT File - Data Records
(Records 1 and 2 of each set)

No.	Variable	Type	Description (Record 1)
1	NYRB	integer	Year (4 digits) at start of averaging period
2	NJULB	integer	Julian day at start of averaging period
3	NHRB	integer	Hour (00-23 LST) at start of averaging period
4	NSECB	integer	Second (0000-3599 LST) at start of averaging period
5	NYRE	integer	Year (4 digits) at end of averaging period
6	NJULE	integer	Julian day at end of averaging period
7	NHRE	integer	Hour (00-23 LST) at end of averaging period
8	NSECE	integer	Second (0000-3599 LST) at start of averaging period

No.	Variable	Type[a]	Description (Record 2)
1	ISTYPE	integer	Source type
2	ISNUM	integer	Source number of this type
3	SNAME	C*16	Source name
4	SXKM	real	Source X-coordinate (km) in the modeling map projection
5	SYKM	real	Source Y-coordinate (km) in the modeling map projection

[a] C*16 = Character*16

(Next Data Record)
(Included only if LSAMP = TRUE)

No.	Variable	Type[a]	Description
1	CSPECG	C*15	Species name (characters 1-12) and layer (characters 13-15) of the concentrations in this record. For example [b], "SO2..........1" indicates SO_2 concentrations in Layer 1; "DIOXINP.......1" indicates dioxin in particulate form in Layer 1. (Note: Layer is always 1 in CALPUFF output, but can be up to NZ in CALGRID.)
Next NXG*NYG	CONCG	real array	"IAVG" - hour averaged concentrations (g/m^3) for each sampling grid point.

[a] C*15 = Character*15

[b] Dots (....) indicate spaces.

Table F-53 (Concluded)
Unformatted CONC.DAT File - Data Records

(Next Data Record)
(Included only if NDREC > 0)

No.	Variable	Type[a]	Description
1	CSPECD	C*15	Species name (characters 1-12) and layer (characters 13-15) of the concentrations in this record. For example [b], "SO2..........1" indicates SO_2 concentrations in Layer 1; "DIOXINP.......1" indicates dioxin in particulate form in Layer 1. (Note: Layer is always 1 in CALPUFF output, but can be up to NZ in CALGRID.)
Next NDREC	CONCD	real array	"IAVG" - hour averaged concentrations (g/m^3) for each discrete receptor

[a] C*15 = Character*15

(Next Data Record)
(Included only if NCTREC > 0)

No.	Variable	Type	Description
1	CSPECCT	C*15	Species name (characters 1-12) and layer (characters 13-15) of the concentrations in this record. For example [b], "SO2..........1" indicates SO_2 concentrations in Layer 1; "DIOXINP.......1" indicates dioxin in particulate form in Layer 1. (Note: Layer is always 1 in CALPUFF output, but can be up to NZ in CALGRID.)
Next NCTREC	CONCCT	real array	"IAVG" - hour averaged concentrations (g/m^3) at each complex terrain (CTSG) receptor

[a] C*15 = Character*15
[b] Dots (....) indicate spaces.

F.15.4 Dry Flux File (DFLX.DAT)

The DFLX.DAT file is an unformatted data file containing dry deposition fluxes of one or more species simulated by CALPUFF at each receptor, for each period in the run. The creation and contents of the DFLX.DAT file are controlled by user-specified inputs in Input Group 5 of the control file (see Section F.1).

The control file variable IDRY must be set equal to one in order to create the DFLX.DAT file. The species saved in the output file are also controlled by the user by setting flags in the output species table in Input Group 5 of the control file. The model checks that only deposited species are flagged for output into the DFLX.DAT file. The effects of dry deposition on ambient concentrations can be evaluated without saving the dry fluxes in the output file if the actual values of the deposition fluxes are not of interest.

DFLX.DAT File - Header Records

The DFLX.DAT file consists of NCOM+7 header records followed by a set of data records. The header records contain information describing the version of the model used in the run creating the file, horizontal and vertical grid data, a user-input title, a list of the species combinations stored in the output file, and receptor information (see Table F-54). NCOM, provided in record 2, defines the number of comment records that are present. Comment records are used to transfer the image of CALMET and CALPUFF control files used in the simulation for documentation and QA purposes.

Sample FORTRAN read statements for the header records are:

```
  READ(iunit) DATASET,DATAVER,DATAMOD
  READ(iunit) NCOM
        DO n=1,NCOM
          READ(iunit) COMMENT
        ENDDO
   READ(iunit)CMODEL,VER,LEVEL,IBYR,IBJUL,IBHR,IBSEC,XBTZ,
 1 IRLG,IAVG,NSECDT,NXM,NYM,DXKM,DYKM,IONE,XORIGKM,YORIGKM,NSSTA,IBCOMP,IECOMP,
 2 JBCOMP,JECOMP,IBSAMP,JBSAMP,IESAMP,JESAMP,MESHDN,NPT1,NPT2,NAR1,NAR2,NLN1,NLN2,
 3 NVL1,NVL2,MSOURCE,NREC,NCTREC,LSAMP,NDFOUT,LCOMPR,
 4 I2DMET,IUTMZN,FEAST,FNORTH,RNLAT0,RELON0,
 5 XLAT1,XLAT2,PMAP,UTMHEM,DATUM,DATEN,
 6 CLAT0,CLON0,CLAT1,CLAT2
    READ(iunit)TITLE
    READ(iunit)CDFOUT
   IF(NDREC.GT.0) READ(iunit)XREC,YREC,ZREC
   IF(NCTREC.GT.0) READ(iunit)XRCT,YRCT,ZRCT,IHILL
   IF(NPT1.GT.0) READ(iunit)ISTYPE,CNAMPT1
   IF(NPT2.GT.0) READ(iunit)ISTYPE,CNAMPT2
   IF(NAR1.GT.0) READ(iunit)ISTYPE,CNAMAR1
   IF(NAR2.GT.0) READ(iunit)ISTYPE,CNAMAR2
   IF(N LN1.GT.0) READ(iunit)ISTYPE,CNAMLN1
   IF(NLN2.GT.0) READ(iunit)ISTYPE,CNAMLN2
   IF(NVL1.GT.0) READ(iunit)ISTYPE,CNAMVL1
    IF(NVL2.GT.0) READ(iunit)ISTYPE,CNAMVL2
```

where the following declarations apply:

```
Character*132 COMMENT
Character*80 TITLE(3)
Character*64 DATAMOD
Character*16 DATASET, DATAVER, CLAT0, CLON0, CLAT1, CLAT2
Character*16 CNAMPT1(MXPT1),CNAMPT2(MXPT2), CNAMAR1(MXAREA),CNAMAR2(MXAREA)
Character*16 CNAMLN1(MXLINES),CNAMLN2(MXLNGRP), CNAMVL1(MXVOL),CNAMVL2(MXVOL)
Character*15 CSOUT(NDFOUT)
Character*12 CMODEL,VER,LEVEL, DATEN
Character*8 PMAP, DATUM
Character*4 UTMHEM

Real XREC(NREC),YREC(NREC),ZREC(NREC)
Real XRCT(NCTREC),YRCT(NCTREC),ZRCT(NCTREC)

Integer IHILL(NCTREC)

Logical LCOMPR
```

Table F-54
Unformatted DFLX.DAT file - Header

Header Record 1 – Dataset Definition

No.	Variable	Type	Description	Sample Values
1	DATASET	Character*16	Dataset name	DFLX.DAT
2	DATAVER	Character *16	Dataset version	2.1
3	DATAMOD	Character *64	Dataset message field	-

Header Record 2 to (NCOM+2) – Comments

No.	Variable	Type	Description	Sample Values
1	NCOM	integer	Number of comment records to follow	-
1	COMMENT	Character *132	Comment (repeated NCOM times)	-

Table F-54 (Continued)
Unformatted DFLX.DAT file - Header Record NCOM+3 - General Data

No.	Variable	Type[a]	Description	Sample Values
1	CMODEL	C*12	Model name	CALPUFF
2	VER	C*12	Model version number	5.72
3	LEVEL	C*12	Model level number	031017
4	IBYR	integer	Starting year of the run	1980
5	IBJUL	integer	Starting Julian day	183
6	IBHR	integer	Time at start of first period (hour 00-23 LST)	8
7	IBSEC	integer	Time at start of first period (second 0000-3599)	0000
8	XBTZ	real	Base time zone (LST+XBTZ=UTC)	6.0
9	IRLG	integer	Length of run (timesteps)	10
10	IAVG	integer	Averaging time (timesteps) of output concentrations	2
11	NSECDT	integer	Length of a timestep (seconds)	1800
12	NXM	integer	Number of grid points in meteorological grid (X direction)	20
13	NYM	integer	Number of grid points in meteorological grid (Y direction)	20
14	DXKM	real	Grid spacing (km) in the X direction	5.
15	DYKM	real	Grid spacing (km) in the Y direction	5.
16	IONE	integer	Number of receptor layers (must be equal to one for CALPUFF runs)	1
17	XORIGKM	real	Reference X coordinate (km) of the southwest corner of grid cell (1,1) of the meteorological grid	190.
18	YORIGKM	real	Reference Y coordinate (km) of the southwest corner of grid cell (1,1) of the meteorological grid	440.
19	NSSTA	integer	Number of surface meteorological stations	5
20	IBCOMP	integer	Start of computational grid in X direction	1
21	IECOMP	integer	End of computational grid in X direction	20
22	JBCOMP	integer	Start of computation grid in the Y direction	1
23	JECOMP	integer	End of computational grid in Y direction	20
24	IBSAMP	integer	Start of sampling grid in X direction	1
25	JBSAMP	integer	Start of sampling grid in Y direction	1

[a]C*12 = Character*12

Table F-54 (Continued)
Unformatted DFLX.DAT file - Header Record NCOM+3 - General Data

No.	Variable	Type[a]	Description	Sample Values
26	IESAMP	integer	End of sampling grid in X direction	20
27	JESAMP	integer	End of sampling grid in Y direction	20
28	MESHDN	integer	Sampling grid spacing factor	1
29	NPT1	integer	Number of point sources (control file)	2
30	NPT2	integer	Number of point sources (variable emissions file)	0
31	NAR1	integer	Number of area sources (control file)	0
32	NAR2	integer	Number of area sources (variable emissions file)	0
33	NLN1	integer	Number of line sources (control file)	0
34	NLN2	integer	Number of line sources (variable emissions file)	0
35	NVL1	integer	Number of volume sources (control file)	0
36	NVL2	integer	Number of volume sources (variable emissions file)	0
37	MSOURCE	integer	Individual source contribution flag : 0 = report just the total 1 = report individual contributions and the total	0
38	NREC	integer	number of discrete receptors	0
39	NCTREC	integer	Number of complex terrain receptors	0
40	LSAMP	logical	Sampling grid flag (T = gridded receptors used, F = no gridded receptors)	T
41	NDFOUT	integer	Number of output species	5
42	LCOMPRS	logical	Flag indicating if concentration data are compressed (T=yes, F=no)	T
43	I2DMET	integer	RH data flag: 0 = relative humidity at surface stations (1D) 1 = relative humidity at grid points (2D)	1
44	IUTMZN	integer	UTM zone (1-60)	19
45	FEAST	real	False Easting of map projection (km)	0.0
46	FNORTH	real	False Northing of map projection (km)	0.0
47	RNLAT0	real	N. latitude of origin of map projection (degrees)	45.8
48	RELON0	real	E. longitude of origin of map projection (degrees)	-75.2
49	XLAT1	real	Matching N. latitude #1 of map projection (degrees)	30.0
50	XLAT2	real	Matching N. latitude #2 of map projection (degrees)	60.0

[a] C*N = Character*N

Table F-54 (Continued)
Unformatted DFLX.DAT file - Header Record NCOM+3 - General Data

No.	Variable	Type[a]	Description	Sample Values
51	PMAP	C*8	Map projection	UTM
52	UTMHEM	C*4	Hemisphere (N or S) for UTM projection	N
53	DATUM	C*8	Datum code	WGS-84
54	DATEN	C*12	NIMA date (MM-DD-YYYY) for datum definitions	10-10-2002
55	CLAT0	C*16	Latitude of origin of map projection	45.8N
56	CLON0	C*16	Longitude of origin of map projection	75.2W
57	CLAT1	C*16	Matching latitude #1 of map projection	30N
58	CLAT2	C*16	Matching latitude #2 of map projection	60N

[a] C*N = Character*N

Table F-54 (Continued)
Unformatted DFLX.DAT file - Header

Header Record NCOM+4 - Run Title

No.	Variable	Type[a]	Description
1	TITLE (3)	C*80	User-specified run title (three lines of up to 80 characters/line)

[a] C*80 = Character*80

Header Record NCOM+5 - List of Species-Layers in Output File

No.	Variable	Type[a]	Description
1-NDFOUT	CDFOUT array	C*15	Species name (characters 1-12) and variable flag (characters 13-15) of data stored in the output file. The variable flag for dry fluxes is " DF". For example [b], "SO2.....DF" corresponds to SO_2 dry fluxes.

[a] C*15 = Character*15
[b] Dots (....) indicate spaces.

Table F-54 (Continued)
Unformatted DFLX.DAT file - Header

Header Record NCOM+6 - Discrete Receptors
(Included only if NDREC > 0)

No.	Variable	Type	Description
1	XREC	real array	X-coordinate (km) of each discrete receptor
2	YREC	real array	Y-coordinate (km) of each discrete receptor
3	ZREC	real array	Ground level elevation (m) of each discrete receptor

Header Record NCOM+7 - Complex Terrain Receptors
(Included only if NCTREC > 0)

No.	Variable	Type	Description
1	XRCT	real array	X-coordinate (km) of each complex terrain receptor
2	YRCT	real array	Y-coordinate (km) of each complex terrain receptor
3	ZRCT	real array	Ground level elevation (m) of each complex terrain receptor
4	IHILL	integer array	Hill number associated with this receptor

Table F-54 (Continued)
Unformatted DFLX.DAT file - Header

Header Record NCOM+8 – Point Source Names (Control File)
(Included only if NPT1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (1)
2	CNAMPT1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+9 - Point Source Names (Variable Emissions File)
(Included only if NPT2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (2)
2	CNAMPT2	C*16 array	Source names

C*16 = Character*16

Table F-54 (Continued)
Unformatted DFLX.DAT file - Header

Header Record NCOM+10 – Area Source Names (Control File)
(Included only if NAR1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (3)
2	CNAMAR1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+11 - Area Source Names (Variable Emissions File)
(Included only if NAR2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (4)
2	CNAMAR2	C*16 array	Source names

C*16 = Character*16

Table F-54 (Continued)
Unformatted DFLX.DAT file - Header

Header Record NCOM+12 – Line Source Names (Control File)
(Included only if NLN1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (5)
2	CNAMLN1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+13 - Line Source Names (Variable Emissions File)
(Included only if NLN2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (6)
2	CNAMLN2	C*16 array	Source names

C*16 = Character*16

Table F-54 (Concluded)
Unformatted DFLX.DAT file - Header

Header Record NCOM+14 – Volume Source Names (Control File)
(Included only if NVL1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (7)
2	CNAMVL1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+15 - Volume Source Names (Variable Emissions File)
(Included only if NVL2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (8)
2	CNAMVL2	C*16 array	Source names

C*16 = Character*16

DFLX.DAT File - Data Records

The DFLX.DAT data records consist of a set of "NDFOUT+1" records for each hour of the CALPUFF runs (NDFOUT is the number of species flagged as being stored in the output file). The first record of each set contains the date and hour of the data in the records which follow it. The next "NDFOUT" records contain predicted one-hour averaged dry deposition fluxes in $g/m^2/s$ for each relevant species (see Table F-55).

Sample FORTRAN read statements for the data records (in uncompressed format) are:

```
      READ(iunit)nyrb,njulb,nhrb,nsecb,nyre,njule,nhre,nsece
      READ(iunit) istype,isnum,sname,sxkm,sykm

+) )  LOOP OVER DRY DEPOSITED SPECIES STORED ON DISK
*
*     GRIDDED RECEPTOR DRY FLUXES
*           IF(LSGRID)READ(iunit)CDFG,DFLXG
*
*     DISCRETE RECEPTOR DRY FLUXES
*           IF(NDREC.GT.0)READ(iunit)CDFD,DFLXD
*
.) )  END LOOP OVER DRY DEPOSITED SPECIES STORED ON DISK
```

where the following declarations apply:

```
      Character*15 CDFG,CDFD
      Real DFLXG(nxg,nyg),DFLXD(NDREC)
```

and

```
      nxg = IESAMP - IBSAMP+1
      nyg = JESAMP - JBSAMP+1
```

CALPUFF contains an option to compress the data by replacing strings of zeroes with a coded repetition factor. The factor is a negative number whose absolute value indicates the number of consecutive zeroes that have been replaced by the repetition factor. This method is especially useful in reducing the size of the output file when large segments of the receptor arrays lie upwind of the puffs during an hour, thereby producing long strings of zeroes in the output arrays. For example, the following record with data for 20 receptors requires 20 unpacked words:

0.0, 0.0, 0.0, 0.0, 0.0, 1.2, 3.5, 0.0, 0.0, 0.0,
0.0, 0.0, 0.0, 0.7, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0

These data in packed form would be represented in six words:

-5., 1.2, 3.5, -6., 0.7, -6.

Table F-55
Unformatted DFLX.DAT File - Data Records
(Records 1 and 2 of each set)

No.	Variable	Type	Description (Record 1)
1	NYRB	integer	Year (4 digits) at start of averaging period
2	NJULB	integer	Julian day at start of averaging period
3	NHRB	integer	Hour (00-23 LST) at start of averaging period
4	NSECB	integer	Second (0000-3599 LST) at start of averaging period
5	NYRE	integer	Year (4 digits) at end of averaging period
6	NJULE	integer	Julian day at end of averaging period
7	NHRE	integer	Hour (00-23 LST) at end of averaging period
8	NSECE	integer	Second (0000-3599 LST) at start of averaging period

No.	Variable	Type[a]	Description (Record 2)
1	ISTYPE	integer	Source type
2	ISNUM	integer	Source number of this type
3	SNAME	C*16	Source name
4	SXKM	real	Source X-coordinate (km) in the modeling map projection
5	SYKM	real	Source Y-coordinate (km) in the modeling map projection

[a] C*16 = Character*16

(Next Data Record)
(Included only if LSAMP = TRUE)

No.	Variable	Type	Description
1	CDFG	C*15	Species name (characters 1-12) and variable flag (characters 13-15) of the data in this record. For example [b], `"SO2.........DF"` corresponds to SO_2 dry flux.
Next NXG*NYG	DFLXG	real array	"IAVG" - hour averaged dry deposition fluxes ($g/m^2/s$) for each gridded receptor

Table F-55 (Concluded)
Unformatted DFLX.DAT File - Data Records

(Next Data Record)
(Included only if NDREC > 0)

No.	Variable	Type[a]	Description
1	CDFD	C*15	Species name (characters 1-12) and dry flux flag (characters 13-15) of the data in this record. For example, "SO2.....DF" corresponds to SO_2 dry fluxes.
Next NDREC	DFLXD	real array	"IAVG" - hour averaged dry deposition fluxes ($g/m^2/s$) for each discrete receptor

[a] C*15 = Character*15
[b] Dots (....) indicate spaces.

F.15.5 Wet Flux File (WFLX.DAT)

The WFLX.DAT file is an unformatted data file containing wet deposition fluxes of one or more species simulated by CALPUFF at each receptor, for each period in the run. The creation and contents of the WFLX.DAT file are controlled by user-specified inputs in Input Group 5 of the control file (see Section F.1).

The control file variable IWET must be set equal to one in order to create the WFLX.DAT file. The species saved in the output file are also controlled by the user by setting flags in the output species table in Input Group 5 of the control file. The model checks that only deposited species are flagged for output into the WFLX.DAT file. The effects of wet deposition on ambient concentrations can be evaluated without saving the wet fluxes in the output file if the actual values of the deposition fluxes are not of interest.

WFLX.DAT File - Header Records

The WFLX.DAT file consists of NCOM+7 header records followed by a set of data records. The header records contain information describing the version of the model used in the run creating the file, horizontal and vertical grid data, a user-input title, a list of the species combinations stored in the output file, and receptor information (see Table F-56). NCOM, provided in record 2, defines the number of comment records that are present. Comment records are used to transfer the image of CALMET and CALPUFF control files used in the simulation for documentation and QA purposes.

Sample FORTRAN read statements for the header records are:

```
  READ(iunit) DATASET,DATAVER,DATAMOD
  READ(iunit) NCOM
        DO n=1,NCOM
          READ(iunit) COMMENT
        ENDDO
   READ(iunit)CMODEL,VER,LEVEL,IBYR,IBJUL,IBHR,IBSEC,XBTZ,
 1 IRLG,IAVG,NSECDT,NXM,NYM,DXKM,DYKM,IONE,XORIGKM,YORIGKM,NSSTA,IBCOMP,IECOMP,
 2 JBCOMP,JECOMP,IBSAMP,JBSAMP,IESAMP,JESAMP,MESHDN,NPT1,NPT2,NAR1,NAR2,NLN1,NLN2,
 3 NVL1,NVL2,MSOURCE,NREC,NCTREC,LSAMP,NWFOUT,LCOMPR,
 4 I2DMET,IUTMZN,FEAST,FNORTH,RNLAT0,RELON0,
 5 XLAT1,XLAT2,PMAP,UTMHEM,DATUM,DATEN,
 6 CLAT0,CLON0,CLAT1,CLAT2
    READ(iunit)TITLE
    READ(iunit)CWFOUT
   IF(NDREC.GT.0) READ(iunit)XREC,YREC,ZREC
   IF(NCTREC.GT.0) READ(iunit)XRCT,YRCT,ZRCT,IHILL
   IF(NPT1.GT.0) READ(iunit)ISTYPE,CNAMPT1
   IF(NPT2.GT.0) READ(iunit)ISTYPE,CNAMPT2
   IF(NAR1.GT.0) READ(iunit)ISTYPE,CNAMAR1
   IF(NAR2.GT.0) READ(iunit)ISTYPE,CNAMAR2
   IF(N LN1.GT.0) READ(iunit)ISTYPE,CNAMLN1
   IF(NLN2.GT.0) READ(iunit)ISTYPE,CNAMLN2
   IF(NVL1.GT.0) READ(iunit)ISTYPE,CNAMVL1
    IF(NVL2.GT.0) READ(iunit)ISTYPE,CNAMVL2
```

where the following declarations apply:

```
Character*132 COMMENT
Character*80 TITLE(3)
Character*64 DATAMOD
Character*16 DATASET, DATAVER, CLAT0, CLON0, CLAT1, CLAT2
Character*16 CNAMPT1(MXPT1),CNAMPT2(MXPT2), CNAMAR1(MXAREA),CNAMAR2(MXAREA)
Character*16 CNAMLN1(MXLINES),CNAMLN2(MXLNGRP), CNAMVL1(MXVOL),CNAMVL2(MXVOL)
Character*15 CWFOUT(NWFOUT)
Character*12 CMODEL,VER,LEVEL, DATEN
Character*8 PMAP, DATUM
Character*4 UTMHEM

Real XREC(NREC),YREC(NREC),ZREC(NREC)
Real XRCT(NCTREC),YRCT(NCTREC),ZRCT(NCTREC)

Integer IHILL(NCTREC)

Logical LCOMPR
```

Table F-56
Unformatted WFLX.DAT file - Header

Header Record 1 – Dataset Definition

No.	Variable	Type	Description	Sample Values
1	DATASET	Character*16	Dataset name	WFLX.DAT
2	DATAVER	Character *16	Dataset version	2.1
3	DATAMOD	Character *64	Dataset message field	-

Header Record 2 to (NCOM+2) – Comments

No.	Variable	Type	Description	Sample Values
1	NCOM	integer	Number of comment records to follow	-
1	COMMENT	Character *132	Comment (repeated NCOM times)	-

Table F-56 (Continued)
Unformatted WFLX.DAT file - Header Record NCOM+3 - General Data

No.	Variable	Type[a]	Description	Sample Values
1	CMODEL	C*12	Model name	CALPUFF
2	VER	C*12	Model version number	5.72
3	LEVEL	C*12	Model level number	031017
4	IBYR	integer	Starting year of the run	1980
5	IBJUL	integer	Starting Julian day	183
6	IBHR	integer	Time at start of first period (hour 00-23 LST)	8
7	IBSEC	integer	Time at start of first period (second 0000-3599)	0000
8	XBTZ	real	Base time zone (LST+XBTZ=UTC)	6.0
9	IRLG	integer	Length of run (timesteps)	10
10	IAVG	integer	Averaging time (timesteps) of output concentrations	2
11	NSECDT	integer	Length of a timestep (seconds)	1800
12	NXM	integer	Number of grid points in meteorological grid (X direction)	20
13	NYM	integer	Number of grid points in meteorological grid (Y direction)	20
14	DXKM	real	Grid spacing (km) in the X direction	5.
15	DYKM	real	Grid spacing (km) in the Y direction	5.
16	IONE	integer	Number of receptor layers (must be equal to one for CALPUFF runs)	1
17	XORIGKM	real	Reference X coordinate (km) of the southwest corner of grid cell (1,1) of the meteorological grid	190.
18	YORIGKM	real	Reference Y coordinate (km) of the southwest corner of grid cell (1,1) of the meteorological grid	440.
19	NSSTA	integer	Number of surface meteorological stations	5
20	IBCOMP	integer	Start of computational grid in X direction	1
21	IECOMP	integer	End of computational grid in X direction	20
22	JBCOMP	integer	Start of computation grid in the Y direction	1
23	JECOMP	integer	End of computational grid in Y direction	20
24	IBSAMP	integer	Start of sampling grid in X direction	1
25	JBSAMP	integer	Start of sampling grid in Y direction	1

[a]C*12 = Character*12

Table F-56 (Continued)
Unformatted WFLX.DAT file - Header Record NCOM+3 - General Data

No.	Variable	Type[a]	Description	Sample Values
26	IESAMP	integer	End of sampling grid in X direction	20
27	JESAMP	integer	End of sampling grid in Y direction	20
28	MESHDN	integer	Sampling grid spacing factor	1
29	NPT1	integer	Number of point sources (control file)	2
30	NPT2	integer	Number of point sources (variable emissions file)	0
31	NAR1	integer	Number of area sources (control file)	0
32	NAR2	integer	Number of area sources (variable emissions file)	0
33	NLN1	integer	Number of line sources (control file)	0
34	NLN2	integer	Number of line sources (variable emissions file)	0
35	NVL1	integer	Number of volume sources (control file)	0
36	NVL2	integer	Number of volume sources (variable emissions file)	0
37	MSOURCE	integer	Individual source contribution flag : 0 = report just the total 1 = report individual contributions and the total	0
38	NREC	integer	number of discrete receptors	0
39	NCTREC	integer	Number of complex terrain receptors	0
40	LSAMP	logical	Sampling grid flag (T = gridded receptors used, F = no gridded receptors)	T
41	NWFOUT	integer	Number of output species	5
42	LCOMPRS	logical	Flag indicating if concentration data are compressed (T=yes, F=no)	T
43	I2DMET	integer	RH data flag: 0 = relative humidity at surface stations (1D) 1 = relative humidity at grid points (2D)	1
44	IUTMZN	integer	UTM zone (1-60)	19
45	FEAST	real	False Easting of map projection (km)	0.0
46	FNORTH	real	False Northing of map projection (km)	0.0
47	RNLAT0	real	N. latitude of origin of map projection (degrees)	45.8
48	RELON0	real	E. longitude of origin of map projection (degrees)	-75.2
49	XLAT1	real	Matching N. latitude #1 of map projection (degrees)	30.0
50	XLAT2	real	Matching N. latitude #2 of map projection (degrees)	60.0

[a] C*N = Character*N

Table F-56 (Continued)
Unformatted WFLX.DAT file - Header Record NCOM+3 - General Data

No.	Variable	Type[a]	Description	Sample Values
51	PMAP	C*8	Map projection	UTM
52	UTMHEM	C*4	Hemisphere (N or S) for UTM projection	N
53	DATUM	C*8	Datum code	WGS-84
54	DATEN	C*12	NIMA date (MM-DD-YYYY) for datum definitions	10-10-2002
55	CLAT0	C*16	Latitude of origin of map projection	45.8N
56	CLON0	C*16	Longitude of origin of map projection	75.2W
57	CLAT1	C*16	Matching latitude #1 of map projection	30N
58	CLAT2	C*16	Matching latitude #2 of map projection	60N

[a] C*N = Character*N

Table F-56 (Continued)
Unformatted WFLX.DAT file - Header

Header Record NCOM+4 - Run Title

No.	Variable	Type[a]	Description
1	TITLE (3)	C*80	User-specified run title (three lines of up to 80 characters/line)

[a] C*80 = Character*80

Header Record NCOM+5 - List of Species-Layers in Output File

No.	Variable	Type[a]	Description
1-NWFOUT	CWFOUT array	C*15	Species name (characters 1-12) and variable flag (characters 13-15) of data stored in the output file. The variable flag for wet fluxes is " WF". For example [b], "SO2.....WF" corresponds to SO_2 wet fluxes.

[a] C*15 = Character*15
[b] Dots (....) indicate spaces.

Table F-56 (Continued)
Unformatted WFLX.DAT file - Header

Header Record NCOM+6 - Discrete Receptors
(Included only if NDREC > 0)

No.	Variable	Type	Description
1	XREC	real array	X-coordinate (km) of each discrete receptor
2	YREC	real array	Y-coordinate (km) of each discrete receptor
3	ZREC	real array	Ground level elevation (m) of each discrete receptor

Header Record NCOM+7 - Complex Terrain Receptors
(Included only if NCTREC > 0)

No.	Variable	Type	Description
1	XRCT	real array	X-coordinate (km) of each complex terrain receptor
2	YRCT	real array	Y-coordinate (km) of each complex terrain receptor
3	ZRCT	real array	Ground level elevation (m) of each complex terrain receptor
4	IHILL	integer array	Hill number associated with this receptor

Table F-56 (Continued)
Unformatted WFLX.DAT file - Header

Header Record NCOM+8 – Point Source Names (Control File)
(Included only if NPT1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (1)
2	CNAMPT1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+9 - Point Source Names (Variable Emissions File)
(Included only if NPT2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (2)
2	CNAMPT2	C*16 array	Source names

C*16 = Character*16

Table F-56 (Continued)
Unformatted WFLX.DAT file - Header

Header Record NCOM+10 – Area Source Names (Control File)
(Included only if NAR1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (3)
2	CNAMAR1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+11 - Area Source Names (Variable Emissions File)
(Included only if NAR2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (4)
2	CNAMAR2	C*16 array	Source names

C*16 = Character*16

Table F-56 (Continued)
Unformatted WFLX.DAT file - Header

Header Record NCOM+12 – Line Source Names (Control File)
(Included only if NLN1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (5)
2	CNAMLN1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+13 - Line Source Names (Variable Emissions File)
(Included only if NLN2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (6)
2	CNAMLN2	C*16 array	Source names

C*16 = Character*16

Table F-56 (Concluded)
Unformatted WFLX.DAT file - Header

Header Record NCOM+14 – Volume Source Names (Control File)
(Included only if NVL1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (7)
2	CNAMVL1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+15 - Volume Source Names (Variable Emissions File)
(Included only if NVL2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (8)
2	CNAMVL2	C*16 array	Source names

C*16 = Character*16

WFLX.DAT File - Data Records

The WFLX.DAT data records consist of a set of "NWFOUT+1" records for each hour of the CALPUFF runs (NWFOUT is the number of species flagged as being stored in the output file). The first record of each set contains the date and hour of the data in the records which follow it. The next "NWFOUT" records contain predicted one-hour averaged wet deposition fluxes in $g/m^2/s$ for each relevant species (see Table F-57).

Sample FORTRAN read statements for the data records (in uncompressed format) are:

```
      READ(iunit)nyrb,njulb,nhrb,nsecb,nyre,njule,nhre,nsece
      READ(iunit) istype,isnum,sname,sxkm,sykm

+) ) LOOP OVER WET DEPOSITED SPECIES STORED ON DISK
*
*
*     GRIDDED RECEPTOR WET FLUXES
*           IF(LSGRID)READ(iunit)CWFG,WFLXG
*
*
*     DISCRETE RECEPTOR WET FLUXES
*           IF(NDREC.GT.0)READ(iunit)CWFD,WFLXD
*
*
.) ) END LOOP OVER WET DEPOSITED SPECIES STORED ON DISK
```

where the following declarations apply:

```
Character*15 CWFG,CWFD
Real WFLXG(nxg,nyg),WFLXD(NDREC)
```

and

```
nxg = IESAMP - IBSAMP+1
nyg = JESAMP - JBSAMP+1
```

CALPUFF contains an option to compress the data by replacing strings of zeroes with a coded repetition factor. The factor is a negative number whose absolute value indicates the number of consecutive zeroes that have been replaced by the repetition factor. This method is especially useful in reducing the size of the output file when large segments of the receptor arrays lie upwind of the puffs during an hour, thereby producing long strings of zeroes in the output arrays. For example, the following record with data for 20 receptors requires 20 unpacked words:

0.0, 0.0, 0.0, 0.0, 0.0, 1.2, 3.5, 0.0, 0.0, 0.0,
0.0, 0.0, 0.0, 0.7, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0

These data in packed form would be represented in six words:

-5., 1.2, 3.5, -6., 0.7, -6.

Table F-57
Unformatted WFLX.DAT File - Data Records
(Record 1 of each set)

No.	Variable	Type	Description (Record 1)
1	NYRB	integer	Year (4 digits) at start of averaging period
2	NJULB	integer	Julian day at start of averaging period
3	NHRB	integer	Hour (00-23 LST) at start of averaging period
4	NSECB	integer	Second (0000-3599 LST) at start of averaging period
5	NYRE	integer	Year (4 digits) at end of averaging period
6	NJULE	integer	Julian day at end of averaging period
7	NHRE	integer	Hour (00-23 LST) at end of averaging period
8	NSECE	integer	Second (0000-3599 LST) at start of averaging period

No.	Variable	Type[a]	Description (Record 2)
1	ISTYPE	integer	Source type
2	ISNUM	integer	Source number of this type
3	SNAME	C*16	Source name
4	SXKM	real	Source X-coordinate (km) in the modeling map projection
5	SYKM	real	Source Y-coordinate (km) in the modeling map projection

[a] C*16 = Character*16

(Next Data Record)
(Included only if LSAMP = TRUE)

No.	Variable	Type	Description
1	CWFG	C*15	Species name (characters 1-12) and wet flux flag (characters 13-15) of the data in this record. For example [b], "SO2.........WF" corresponds to SO_2 wet fluxes.
Next NXG*NYG	DWLXG	real array	"IAVG" - hour averaged wet deposition fluxes ($g/m^2/s$) for each gridded receptor

Table F-57 (Concluded)
Unformatted WFLX.DAT File - Data Records

(Next Data Record)
(Included only if NDREC > 0)

No.	Variable	Type[a]	Description
1	CWFD	C*15	Species name (characters 1-12) and wet flux flag (characters 13-15) of the data in this record. For example [b], "SO2.....WF" corresponds to SO_2 wet fluxes.
Next NDREC	WFLXD	real array	"IAVG" - hour averaged wet deposition fluxes ($g/m^2/s$) for each discrete receptor

[a] C*15 = Character*15
[b] Dots (....) indicate spaces.

F.15.6 Relative Humidity File for Visibility Processing in CALPOST (VISB.DAT)

The VISB.DAT file is an unformatted data file containing relative humidity data at each surface meteorological station, for each period in the run. It is required if CALPOST will be used to assess visibility. The variable IVIS in Input Group 5 of the control file (see Section F.1) must be set equal to one in order to create the VISB.DAT file.

VISB.DAT File - Header Records

The VISB.DAT file consists of at least either NCOM+7 or NCOM+10 header records followed by a set of data records. The header records contain information describing the version of the model used in the run creating the file, horizontal and vertical grid data, a user-input title, a list of the species combinations stored in the output file, and receptor information (see Table F-58). NCOM, provided in record 2, defines the number of comment records that are present. Comment records are used to transfer the image of CALMET and CALPUFF control files used in the simulation for documentation and QA purposes.

Sample FORTRAN read statements for the header records are:

```
  READ(iunit) DATASET,DATAVER,DATAMOD
  READ(iunit) NCOM
        DO n=1,NCOM
          READ(iunit) COMMENT
        ENDDO
   READ(iunit)CMODEL,VER,LEVEL,IBYR,IBJUL,IBHR,IBSEC,XBTZ,
 1 IRLG,IAVG,NSECDT,NXM,NYM,DXKM,DYKM,IONE,XORIGKM,YORIGKM,NSSTA,IBCOMP,IECOMP,
 2 JBCOMP,JECOMP,IBSAMP,JBSAMP,IESAMP,JESAMP,MESHDN,NPT1,NPT2,NAR1,NAR2,NLN1,NLN2,
 3 NVL1,NVL2,MSOURCE,NREC,NCTREC,LSAMP,NVSOUT,LCOMPR,
 4 I2DMET,IUTMZN,FEAST,FNORTH,RNLAT0,RELON0,
 5 XLAT1,XLAT2,PMAP,UTMHEM,DATUM,DATEN,
 6 CLAT0,CLON0,CLAT1,CLAT2
    READ(iunit)TITLE
    READ(iunit)CVSOUT
   IF(NDREC.GT.0) READ(iunit)XREC,YREC,ZREC
   IF(NCTREC.GT.0) READ(iunit)XRCT,YRCT,ZRCT,IHILL
   IF(NPT1.GT.0) READ(iunit)ISTYPE,CNAMPT1
   IF(NPT2.GT.0) READ(iunit)ISTYPE,CNAMPT2
   IF(NAR1.GT.0) READ(iunit)ISTYPE,CNAMAR1
   IF(NAR2.GT.0) READ(iunit)ISTYPE,CNAMAR2
   IF(N LN1.GT.0) READ(iunit)ISTYPE,CNAMLN1
   IF(NLN2.GT.0) READ(iunit)ISTYPE,CNAMLN2
   IF(NVL1.GT.0) READ(iunit)ISTYPE,CNAMVL1
    IF(NVL2.GT.0) READ(iunit)ISTYPE,CNAMVL2
```

where the following declarations apply:

```
Character*132 COMMENT
Character*80 TITLE(3)
Character*64 DATAMOD
Character*16 DATASET, DATAVER, CLAT0, CLON0, CLAT1, CLAT2
Character*16 CNAMPT1(MXPT1),CNAMPT2(MXPT2), CNAMAR1(MXAREA),CNAMAR2(MXAREA)
Character*16 CNAMLN1(MXLINES),CNAMLN2(MXLNGRP), CNAMVL1(MXVOL),CNAMVL2(MXVOL)
Character*15 CVSOUT(NVSOUT)
Character*12 CMODEL,VER,LEVEL, DATEN
Character*8 PMAP, DATUM
Character*4 UTMHEM
```

```
Real XREC(NREC),YREC(NREC),ZREC(NREC)
Real XRCT(NCTREC),YRCT(NCTREC),ZRCT(NCTREC)

Integer IHILL(NCTREC)

Logical LCOMPR
```

Table F-58
Unformatted VISB.DAT file - Header

Header Record 1 – Dataset Definition

No.	Variable	Type	Description	Sample Values
1	DATASET	Character*16	Dataset name	VISB.DAT
2	DATAVER	Character *16	Dataset version	2.1
3	DATAMOD	Character *64	Dataset message field	-

Header Record 2 to (NCOM+2) – Comments

No.	Variable	Type	Description	Sample Values
1	NCOM	integer	Number of comment records to follow	-
1	COMMENT	Character *132	Comment (repeated NCOM times)	-

Table F-58 (Continued)
Unformatted VISB.DAT file - Header Record NCOM+3 - General Data

No.	Variable	Type[a]	Description	Sample Values
1	CMODEL	C*12	Model name	CALPUFF
2	VER	C*12	Model version number	5.72
3	LEVEL	C*12	Model level number	031017
4	IBYR	integer	Starting year of the run	1980
5	IBJUL	integer	Starting Julian day	183
6	IBHR	integer	Time at start of first period (hour 00-23 LST)	8
7	IBSEC	integer	Time at start of first period (second 0000-3599)	0000
8	XBTZ	real	Base time zone (LST+XBTZ=UTC)	6.0
9	IRLG	integer	Length of run (timesteps)	10
10	IAVG	integer	Averaging time (timesteps) of output concentrations	2
11	NSECDT	integer	Length of a timestep (seconds)	1800
12	NXM	integer	Number of grid points in meteorological grid (X direction)	20
13	NYM	integer	Number of grid points in meteorological grid (Y direction)	20
14	DXKM	real	Grid spacing (km) in the X direction	5.
15	DYKM	real	Grid spacing (km) in the Y direction	5.
16	IONE	integer	Number of receptor layers (must be equal to one for CALPUFF runs)	1
17	XORIGKM	real	Reference X coordinate (km) of the southwest corner of grid cell (1,1) of the meteorological grid	190.
18	YORIGKM	real	Reference Y coordinate (km) of the southwest corner of grid cell (1,1) of the meteorological grid	440.
19	NSSTA	integer	Number of surface meteorological stations	5
20	IBCOMP	integer	Start of computational grid in X direction	1
21	IECOMP	integer	End of computational grid in X direction	20
22	JBCOMP	integer	Start of computation grid in the Y direction	1
23	JECOMP	integer	End of computational grid in Y direction	20
24	IBSAMP	integer	Start of sampling grid in X direction	1
25	JBSAMP	integer	Start of sampling grid in Y direction	1

[a]C*12 = Character*12

Table F-58 (Continued)
Unformatted VISB.DAT file - Header Record NCOM+3 - General Data

No.	Variable	Type[a]	Description	Sample Values
26	IESAMP	integer	End of sampling grid in X direction	20
27	JESAMP	integer	End of sampling grid in Y direction	20
28	MESHDN	integer	Sampling grid spacing factor	1
29	NPT1	integer	Number of point sources (control file)	2
30	NPT2	integer	Number of point sources (variable emissions file)	0
31	NAR1	integer	Number of area sources (control file)	0
32	NAR2	integer	Number of area sources (variable emissions file)	0
33	NLN1	integer	Number of line sources (control file)	0
34	NLN2	integer	Number of line sources (variable emissions file)	0
35	NVL1	integer	Number of volume sources (control file)	0
36	NVL2	integer	Number of volume sources (variable emissions file)	0
37	MSOURCE	integer	Individual source contribution flag : 0 = report just the total 1 = report individual contributions and the total	0
38	NREC	integer	number of discrete receptors	0
39	NCTREC	integer	Number of complex terrain receptors	0
40	LSAMP	logical	Sampling grid flag (T = gridded receptors used, F = no gridded receptors)	T
41	NVSOUT	integer	Number of output species	5
42	LCOMPRS	logical	Flag indicating if concentration data are compressed (T=yes, F=no)	T
43	I2DMET	integer	RH data flag: 0 = relative humidity at surface stations (1D) 1 = relative humidity at grid points (2D)	1
44	IUTMZN	integer	UTM zone (1-60)	19
45	FEAST	real	False Easting of map projection (km)	0.0
46	FNORTH	real	False Northing of map projection (km)	0.0
47	RNLAT0	real	N. latitude of origin of map projection (degrees)	45.8
48	RELON0	real	E. longitude of origin of map projection (degrees)	-75.2
49	XLAT1	real	Matching N. latitude #1 of map projection (degrees)	30.0
50	XLAT2	real	Matching N. latitude #2 of map projection (degrees)	60.0

[a] C*N = Character*N

Table F-58 (Continued)
Unformatted VISB.DAT file - Header Record NCOM+3 - General Data

No.	Variable	Type[a]	Description	Sample Values
51	PMAP	C*8	Map projection	UTM
52	UTMHEM	C*4	Hemisphere (N or S) for UTM projection	N
53	DATUM	C*8	Datum code	WGS-84
54	DATEN	C*12	NIMA date (MM-DD-YYYY) for datum definitions	10-10-2002
55	CLAT0	C*16	Latitude of origin of map projection	45.8N
56	CLON0	C*16	Longitude of origin of map projection	75.2W
57	CLAT1	C*16	Matching latitude #1 of map projection	30N
58	CLAT2	C*16	Matching latitude #2 of map projection	60N

[a] C*N = Character*N

Table F-58 (Continued)
Unformatted VISB.DAT file - Header

Header Record NCOM+4 - Run Title

No.	Variable	Type[a]	Description
1	TITLE (3)	C*80	User-specified run title (three lines of up to 80 characters/line)

[a] C*80 = Character*80

Header Record NCOM+5 - List of Species-Layers in Output File

No.	Variable	Type[a]	Description
1-NVSOUT	CVSOUT array	C*15	Data name (characters 1-15) for data stored in the output file (always ' REL HUM (%) ').

[a] C*15 = Character*15
[b] Dots (....) indicate spaces.

Table F-58 (Continued)
Unformatted VISB.DAT file - Header

Header Record NCOM+6 - Discrete Receptors
(Included only if NDREC > 0)

No.	Variable	Type	Description
1	XREC	real array	X-coordinate (km) of each discrete receptor
2	YREC	real array	Y-coordinate (km) of each discrete receptor
3	ZREC	real array	Ground level elevation (m) of each discrete receptor

Header Record NCOM+7 - Complex Terrain Receptors
(Included only if NCTREC > 0)

No.	Variable	Type	Description
1	XRCT	real array	X-coordinate (km) of each complex terrain receptor
2	YRCT	real array	Y-coordinate (km) of each complex terrain receptor
3	ZRCT	real array	Ground level elevation (m) of each complex terrain receptor
4	IHILL	integer array	Hill number associated with this receptor

Table F-58 (Continued)
Unformatted VISB.DAT file - Header

Header Record NCOM+8 – Point Source Names (Control File)
(Included only if NPT1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (1)
2	CNAMPT1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+9 - Point Source Names (Variable Emissions File)
(Included only if NPT2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (2)
2	CNAMPT2	C*16 array	Source names

C*16 = Character*16

Table F-58 (Continued)
Unformatted VISB.DAT file - Header

Header Record NCOM+10 – Area Source Names (Control File)
(Included only if NAR1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (3)
2	CNAMAR1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+11 - Area Source Names (Variable Emissions File)
(Included only if NAR2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (4)
2	CNAMAR2	C*16 array	Source names

C*16 = Character*16

Table F-58 (Continued)
Unformatted VISB.DAT file - Header

Header Record NCOM+12 – Line Source Names (Control File)
(Included only if NLN1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (5)
2	CNAMLN1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+13 - Line Source Names (Variable Emissions File)
(Included only if NLN2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (6)
2	CNAMLN2	C*16 array	Source names

C*16 = Character*16

Table F-58 (Concluded)
Unformatted VISB.DAT file - Header

Header Record NCOM+14 – Volume Source Names (Control File)
(Included only if NVL1 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (7)
2	CNAMVL1	C*16 array	Source names

C*16 = Character*16

Header Record NCOM+15 - Volume Source Names (Variable Emissions File)
(Included only if NVL2 > 0)

No.	Variable	Type	Description
1	ISTYPE	integer	Source type (8)
2	CNAMVL2	C*16 array	Source names

C*16 = Character*16

VISB.DAT File - Data Records

The VISB.DAT data records consist of a set of "NVSOUT+1" records for each hour of the CALPUFF runs (where NVSOUT is always one). The first record of each set contains the date and hour of the data in the records which follow it. The next "NVSOUT" records contain the relative humidity reported in % at each meteorological surface station if I2DRH=0, or at each sampling grid cell if I2DRH=1 (see Table F-59).

Sample FORTRAN read statements for the data records are:

```
READ(iunit)nyrb,njulb,nhrb,nsecb,nyre,njule,nhre,nsece
READ(iunit) istype,isnum,sname,sxkm,sykm

IF(I2DRH.EQ.0) THEN
  READ(iunit)CNAME,IRHSS
ELSE
  READ(iunit)CNAME,IRH2D
ENDIF
```

where the following declarations apply:

```
Character*15 CNAME
Integer IRHSS(NSSTA)
Integer IRH2D(nxm,nym)
```

Table F-59
Unformatted VISB.DAT File - Data Records

(Record 1 of each set)

No.	Variable	Type	Description (Record 1)
1	NYRB	integer	Year (4 digits) at start of averaging period
2	NJULB	integer	Julian day at start of averaging period
3	NHRB	integer	Hour (00-23 LST) at start of averaging period
4	NSECB	integer	Second (0000-3599 LST) at start of averaging period
5	NYRE	integer	Year (4 digits) at end of averaging period
6	NJULE	integer	Julian day at end of averaging period
7	NHRE	integer	Hour (00-23 LST) at end of averaging period
8	NSECE	integer	Second (0000-3599 LST) at start of averaging period

No.	Variable	Type[a]	Description (Record 2)
1	ISTYPE	integer	Source type
2	ISNUM	integer	Source number of this type
3	SNAME	C*16	Source name
4	SXKM	real	Source X-coordinate (km) in the modeling map projection
5	SYKM	real	Source Y-coordinate (km) in the modeling map projection

[a] C*16 = Character*16

Table F-59 (Concluded)
Unformatted VISB.DAT File - Data Records
(Next Record)

No.	Variable	Type[a]	Description
1	CNAME	C*15	' REL HUM (%) '
Next NSSTA (if I2DRH = 0)	IRHSS	integer array	Relative humidity (%) reported as an integer for each surface meteorological station
Next NXM*NYM (if I2DRH = 1)	IRH2D	integer array	Relative humidity (%) reported as an integer for each CALMET meteorological grid cell

[a] C*15 = Character*15

F.15.7 Debug Puff-Tracking File (DEBUG.DAT)

CALPUFF contains a debug option to report much information about each selected puff as it is transported and sampled over a number of modeling periods. Most of this extra information is written to the CALPUFF list file (see Section F.15.1). A limited set of puff information is also written to DEBUG.DAT each sampling step when the debug option is selected. The purpose of this file is to provide puff characteristics at the end of each sampling step so that its location and size can be reviewed to visualize the combined effects of transport and diffusion at specific times.

The DEBUG.DAT file is a sequential, formatted data file (see Table F-60 for an example) consisting of two types of records: two header records and a variable number of sets of data records. The header records name the variables that are reported in the data records (see Table F-61). Each data record provides information about a single puff at the end of a single sampling step. While there may be many sampling steps over the course of an hour, the time reported for each is the end-time of the current hour.

A series of nested loops controls the sequence in which the data records are written to the file. The outermost loop is over the number of modeling periods (hours) for which debug output is selected. Within this is a loop over the range of puffs that has been selected. The innermost loop is over the sampling steps for each of these puffs. Because the puff ID and the date and time are included in each record, this structure is readily discerned.

Records for individual puffs are written during the selected modeling period only while that puff exists on the computational grid. It is not tracked before it is emitted, and it is not tracked once it leaves the modeling domain.

Table F-60
Sample Debug Puff-Tracking File (DEBUG.DAT)

				---- PUFF/ Old SLUG end ---------										
YYYYJJJHH	ipnum	cd	zfnl	x(metG)	y(metG)	sigyB	sigzB	QM	QU	zimax	rflctn	dpbl	jdstab	Length
198818922	1	1	119.7	3.0080	2.4482	954.5	190.5	1.8000E+04	0.0000E+00	815.6	815.6	815.6	4	
198818922	1	1	119.7	3.3639	3.1576	1854.5	268.9	1.8000E+04	0.0000E+00	790.8	790.8	790.8	4	
198818922	2	1	119.7	3.0080	2.4482	954.5	190.5	1.8000E+04	0.0000E+00	815.6	815.6	815.6	4	
198818922	3	1	100.9	4.2533	3.7418	950.3	189.6	1.8000E+04	0.0000E+00	685.5	685.5	685.5	4	
198818922	3	1	100.9	4.6753	4.3929	1850.3	969.4	1.8000E+04	0.0000E+00	665.6	665.6	665.6	4	
198818923	1	1	119.7	3.5188	3.7123	2454.5	862.1	1.8000E+04	0.0000E+00	898.4	898.4	898.4	4	
198818923	1	1	119.7	3.7095	3.9935	3054.5	1084.2	1.8000E+04	0.0000E+00	898.4	898.4	898.4	4	
198818923	1	1	119.7	3.9002	4.2746	3654.5	1091.4	1.8000E+04	0.0000E+00	898.4	898.4	829.2	4	
198818923	2	1	119.7	3.1453	3.0027	1554.5	250.4	1.8000E+04	0.0000E+00	941.2	941.2	941.2	4	
198818923	2	1	119.7	3.2974	3.5544	2154.5	851.3	1.8000E+04	0.0000E+00	898.4	898.4	898.4	4	
198818923	2	1	119.7	3.4881	3.8355	2754.5	1075.4	1.8000E+04	0.0000E+00	898.4	898.4	898.4	4	
198818923	3	1	100.9	5.0467	4.8309	2750.3	1295.1	1.8000E+04	0.0000E+00	798.3	798.3	798.3	4	
198818923	3	6	100.9	5.4990	5.2454	3650.3	1295.1	1.5955E+04	2.0452E+03	798.3	707.6	707.6	4	
198819000	1	1	119.7	4.2947	4.4464	4554.5	1108.1	1.8000E+04	0.0000E+00	898.4	898.4	466.0	5	
198819000	1	1	119.7	4.7226	4.5824	5454.5	1125.2	1.8000E+04	0.0000E+00	898.4	898.4	466.0	5	
198819000	2	1	119.7	3.8793	4.0499	3654.5	1092.9	1.8000E+04	0.0000E+00	898.4	898.4	538.1	5	
198819000	2	1	119.7	4.2736	4.2213	4554.5	1109.6	1.8000E+04	0.0000E+00	898.4	898.4	466.0	5	
198819000	3	6	100.9	6.0656	5.4060	4550.3	1295.1	9.6942E+03	8.3058E+03	798.3	429.9	429.9	5	
198819000	3	6	100.9	6.6832	5.5231	5450.3	1295.1	1.0735E+04	7.2646E+03	798.3	476.1	476.1	4	

Table F-61
DEBUG.DAT - Data Record

No.	Variable	Description
1	YYYYJJJHH	Year-Julian Day-Hour for modeling period
2	IPNUM	Puff ID number
3	CD	Puff Code 1 = Puff within mixed layer & Gaussian 2 = Puff within mixed layer & uniform 3 = Puff above mixed layer & Gaussian 4 = Puff above mixed layer & uniform 5 = Puff currently above mixed layer (but previously below) & Gaussian 6 = Puff currently above mixed layer (but previously below) & uniform 11 = Slug within mixed layer & Gaussian 12 = Slug within mixed layer & uniform 13 = Slug above mixed layer & Gaussian 14 = Slug above mixed layer & uniform 15 = Slug currently above mixed layer (but previously below) & Gaussian 16 = Slug currently above mixed layer (but previously below) & uniform 99 = Puff/slug off computational grid
4	ZFNL	Puff height (m) at final rise
5	X	X-coordinate of puff or old slug-end (Met Grid Units)
6	Y	Y-coordinate of puff or old slug-end (Met Grid Units)
7	SIGYB	Sigma-y of puff or old slug-end (m)
8	SIGZB	Sigma-z of puff or old slug-end (m)
9	QM	Puff mass (g) of species 1 below mixing lid
10	QU	Puff mass (g) of species 1 above mixing lid
11	ZIMAX	Largest mixing height (m) for this puff (10000 m used for unlimited mixing)
12	RFLCTN	Reflecting lid height (m) for Gaussian distribution (10000 m used for unlimited mixing)
13	DPBL	Current surface boundary layer height (m)
14	JDSTAB	Stability class
15	Length	Emitted slug length (m)

F.15.8 Mass Flux List File (MASSFLX.DAT)

Mass flux results for those species selected in the control file are reported to the list file MASSFLX.DAT for each boundary that is contained in the boundary file FLUXBDY.DAT. MASSFLX.DAT is a formatted text file that identifies the CALPUFF version and level, echoes the 3-line title of the CALPUFF simulation, identifies the output as mass flux (g/s), sets out column headings to label each variable listed, and then reports the mass fluxes for each hour in the simulation. The boundaries are identified by the names provided in FLUXBDY.DAT, and for each boundary, the mass flux in and out across the boundary is reported. The date and time of each output record marks the time at the end of the hour, where midnight is hour zero of the new day (CALPUFF convention).

An example list file is provided in Table F-62. The four boundaries are identified using the names provided in the boundary data file. Note that these boundaries do not surround a source, and enclose small regions so that the fluxes produced across each boundary are frequently both in and out as the puffs in this example pass through the enclosed regions.

Table F-62
Sample Mass Flux List File (MASSFLX.DAT)

```
                                    CALPUFF        Version: 5.2            Level: 991104
*************************************************************************************************************************************

CALPUFF test case run - 3 point sources
24-Hour Simulation using CALMET met. data
Gridded receptors on 17x17 20-km met grid

                           --------------
                              Mass Flux
                                (g/s)
                           --------------

                           Square 1KM Box          Diamond 1KM Box         Square 5KM Box          Diamond 5KM Box
  Yr Day Hr   Species      In        Out           In        Out           In        Out           In        Out

1988 189  1 SO2          0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00
1988 189  2 SO2          0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00
1988 189  3 SO2          0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00
1988 189  4 SO2          0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.50000E+01 0.00000E+00 0.00000E+00 0.00000E+00
1988 189  5 SO2          0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.50000E+01 0.10000E+02 0.10000E+02 0.10000E+02
1988 189  6 SO2          0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00
1988 189  7 SO2          0.25000E+01 0.25000E+01 0.25000E+01 0.25000E+01 0.50000E+01 0.50000E+01 0.50000E+01 0.50000E+01
1988 189  8 SO2          0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.25000E+01 0.25000E+01 0.25000E+01 0.25000E+01
1988 189  9 SO2          0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.50000E+01 0.00000E+00 0.00000E+00 0.50000E+01
1988 189 10 SO2          0.25000E+01 0.25000E+01 0.25000E+01 0.25000E+01 0.50000E+01 0.75000E+01 0.50000E+01 0.00000E+00
1988 189 11 SO2          0.50000E+01 0.50000E+01 0.00000E+00 0.00000E+00 0.50000E+01 0.25000E+01 0.00000E+00 0.50000E+01
1988 189 12 SO2          0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.50000E+01 0.50000E+01 0.00000E+00
```

F.15.9 Mass Balance List File (MASSBAL.DAT)

Mass balance results for all species in the run are reported to the list file MASSBAL.DAT. MASSBAL.DAT is a formatted text file that identifies the CALPUFF version and level, echoes the 3-line title of the CALPUFF simulation, identifies the output as hourly mass balance (g), sets out column headings to label each variable listed, and then reports changes in the mass of each species in the entire modeling domain for each hour in the simulation. The date and time of each output record marks the time at the end of the hour, where midnight is hour zero of the new day (CALPUFF convention).

An example list file is provided in Table F-63. The first five columns after the species name identify the hourly change in mass due to emissions, transport out of the domain, chemical transformation, and depletion (wet and dry deposition). The last three columns report the current mass totals at the end of the hour, and the portion that is in the surface mixed layer, and above the mixed layer. A single record is written for each species and each hour of the simulation.

Table F-63
Sample Mass Balance List File (MASSBAL.DAT)

```
                                    CALPUFF        Version: 5.2           Level: 991104
*****************************************************************************************************************************************

 CALPUFF test case run - 3 point sources
 24-Hour Simulation using CALMET met. data
 Gridded receptors on 17x17 20-km met grid

                          ----------------------
                            Hourly Mass Balance
                                   (g)
                          ----------------------

                                          Advected                    Wet          Dry         Domain       Domain       Domain
 Yr  Day Hr   Species      Emitted          Out       Transformed    Depletion    Depletion       Total       Surface       Aloft

1988 189  1 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  1.08000E+05  1.08000E+05  0.00000E+00
1988 189  2 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  2.16000E+05  2.16000E+05  0.00000E+00
1988 189  3 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  3.24000E+05  3.24000E+05  0.00000E+00
1988 189  4 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  4.32000E+05  4.32000E+05  0.00000E+00
1988 189  5 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  5.40000E+05  5.40000E+05  0.00000E+00
1988 189  6 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  6.48000E+05  6.48000E+05  0.00000E+00
1988 189  7 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  7.56000E+05  7.55506E+05  4.94406E+02
1988 189  8 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  8.64000E+05  7.67561E+05  9.64391E+04
1988 189  9 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  9.72000E+05  9.03347E+05  6.86530E+04
1988 189 10 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  1.08000E+06  1.04017E+06  3.98287E+04
1988 189 11 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  1.18800E+06  1.13525E+06  5.27460E+04
1988 189 12 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  1.29600E+06  1.23078E+06  6.52167E+04
1988 189 13 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  1.40400E+06  1.32007E+06  8.39310E+04
1988 189 14 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  1.51200E+06  1.42405E+06  8.79461E+04
1988 189 15 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  1.62000E+06  1.54313E+06  7.68674E+04
1988 189 16 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  1.72800E+06  1.65073E+06  7.72731E+04
1988 189 17 SO2          1.08000E+05  3.60000E+04  0.00000E+00  0.00000E+00  0.00000E+00  1.80000E+06  1.68879E+06  1.11212E+05
1988 189 18 SO2          1.08000E+05  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  1.90800E+06  1.76439E+06  1.43614E+05
1988 189 19 SO2          1.08000E+05  1.80000E+04  0.00000E+00  0.00000E+00  0.00000E+00  1.99800E+06  1.82506E+06  1.72942E+05
1988 189 20 SO2          1.08000E+05  7.20000E+04  0.00000E+00  0.00000E+00  0.00000E+00  2.03400E+06  1.62398E+06  4.10020E+05
1988 189 21 SO2          1.08000E+05  3.60000E+04  0.00000E+00  0.00000E+00  0.00000E+00  2.10600E+06  1.64662E+06  4.59384E+05
1988 189 22 SO2          1.08000E+05  9.00000E+04  0.00000E+00  0.00000E+00  0.00000E+00  2.12400E+06  1.63884E+06  4.85155E+05
1988 189 23 SO2          1.08000E+05  7.20000E+04  0.00000E+00  0.00000E+00  0.00000E+00  2.16000E+06  1.55585E+06  6.04154E+05
1988 190  0 SO2          1.08000E+05  1.62000E+05  0.00000E+00  0.00000E+00  0.00000E+00  2.10600E+06  1.42564E+06  6.80359E+05
```

F.16 OPTHILL

When the subgrid scale complex terrain (CTSG) option of the CALPUFF model is invoked, two groups of additional data must be prepared by the user: CTSG receptor and terrain information. These data may be provided in external files in the format used by CTDMPLUS (Section F.12), or they may be entered into the CALPUFF control file. The purpose of the optimizer program OPTHILL is to provide the user with the means for calculating the set of terrain data that best characterizes each feature when these data are entered into the control file.

F.16.1 CTSG Terrain Information

CTSG requires information on the location, orientation, size, and shape of each terrain feature being modeled. The variables that contain this information are:

xc,yc	coordinates (km) of the center of the hill
thetah	orientation (deg) of major axis of hill (clockwise from north)
zgrid	height (m) of "grid-plane" of grid above mean sea level
relief	height (m) of crest of hill above the "grid-plane" elevation
expo (1)	hill-shape exponent for major axis
expo (2)	hill-shape exponent for minor axis
scale(1)	horizontal length scale (m) along major axis
scale(2)	horizontal length scale (m) along minor axis
axmax(1)	maximum allowed axis length (m) for major axis
axmax(2)	maximum allowed axis length (m) for minor axis

The profile of the terrain along each axis of the feature is prescribed by the following equation:

$$ht(x) = \left[\frac{1 - (x/axmax)^{expo}}{1 + (x/scale)^{expo}} \right] * relief \qquad \text{(F-1)}$$

where ht(x) is the height of the profile above the base of the feature, at a distance x from the peak (Figure F-1).

The terrain profile-optimizing program (OPTHILL) computes the hill shape exponent (EXPO) and horizontal terrain length scale (SCALE) parameters from a user-entered terrain profile along each of two axes. This terrain profile defines the height of the surface of the hill at a number of distances from the center of the hill, along each axis. The OPTHILL program performs computations for one axis (i.e., major or minor axis) of the terrain feature at a time. Therefore, two runs of OPTHILL are necessary for each subgrid scale terrain feature.

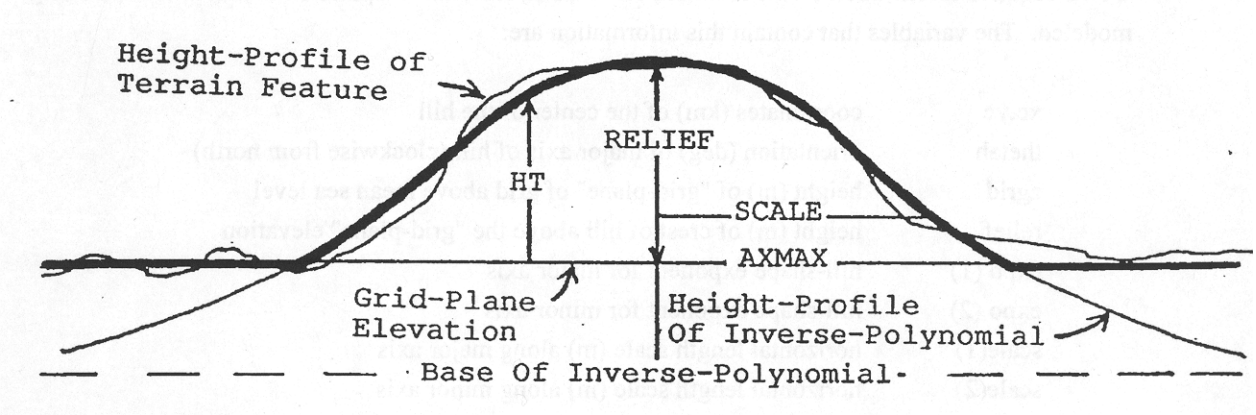

Figure F-1. Profile of a terrain feature along one of its two axes. A best-fit inverse polynomial function describes this profile to CTSG.

The following procedure is recommended to determine the terrain inputs for the CALPUFF CTSG algorithm from a topographic map.

a. Identify the sub-grid terrain features to be modeled.

Such features will generally be small enough that they could be contained within one grid-square. This does not mean that they cannot straddle two or more squares. The features should be prominent, and possibly lie near source regions so that the additional computations required by CTSG are warranted in resolving important pollutant impact areas.

b. Decide on the orientation of the feature.

The orientation of the feature is generally evident if the feature is longer in one direction than another. If there is no dominant direction to the feature, model it as a symmetric feature, and choose an orientation of north.

c. Obtain height-profiles along each axis of the feature.

Choose an approximate center for the feature and draw axes through it (one axis should lie along the direction of orientation). Along each axis, measure the distance between approximate intersections of the axis with marked contours. The distances so measured should extend from the contour furthest to the south to the same contour furthest to the north (for a north-south axis). Divide each of these distances by two, and tabulate the results.

d. Identify the maximum elevation of the feature.

Take the peak elevation directly from the map.

e. Identify the elevation at the base of the feature.

Generally, the base of the feature will be that point at which the feature becomes indistinguishable from terrain variations around it.

f. Convert all elevations that were tabulated to heights above the base of the feature.

g. Use optimizer program (OPTHILL) to obtain shape parameters.

The "relief" parameter is just the peak elevation less the base elevation. The "axmax" value for each axis should be representative of the maximum extent of the feature along each axis at the elevation of the base of the feature. With these two variables fixed for each axis, the height-profile data from step c. can be put through OPTHILL to obtain "expo" and "scale" for each axis.

Table F-64 summarizes the OPTHILL input and output filenames. OPTHILL requires a single input file (OPTHILL.INP) which contains the user's inputs describing the terrain profile, each height, and maximum axis length. The computed values of EXPO and SCALE for one axis of the hill are listed in the output list file (OPTHILL.LST). The format and contents of the OPTHILL control file are explained in Table F-65.

F.16.2 Example OPTHILL Application

The OPTHILL program is an optimization that takes a value of "relief" and "axmax," and a sequence of pairs of (x,ht) values along an axis, and returns a value of "expo" and "scale" that prescribes the profile function that best matches the (x,ht) pairs. Its use is illustrated by the following example.

Figure F-2 shows the terrain surrounding the site of EPA's "Full-Scale Plume Study" (FSPS) that was performed in the Truckee River Valley near Reno, NV (Strimaitis et al., 1985), as part of the Complex Terrain Model Development Program. Nocturnal flow in this valley is frequently channeled by the high terrain to the north and south of the Tracy power plant. Elevations typical of nocturnal plume heights (4600-4800 ft. MSL) are emphasized on the figure. Given the predominant flow to the east during stable conditions, there is potential for plume impact on the feature just northeast of the plant. This feature, marked by axes in Figure F-2, was named "Beacon Hill" during the study.

Following the procedures outlined above, axes were drawn over the feature and distances between fixed contour elevations were tabulated. After subtracting the elevation above sea level of the base of the feature (the floor of the river valley), these data were entered into two files. Table F-66 displays the contents of both files. The files (axis1.inp and axis2.inp) contain "relief" and the value for "axmax" for each axis of the hill, followed by five pairs of (x,ht) values. The first record of each file is reserved for comments to identify the data. Values for "relief" and "axmax" are free-format, and should be entered anywhere in the open space provided on the next two lines. Pairs of (x,ht) should be entered right after the next comment record.

OPTHILL must be invoked separately for each of the two axes of the hill. This is accomplished by renaming one input file (e.g., axis1.inp) to the OPTHILL input control file name (OPTHILL.INP), executing the program, renaming the output file (OPTHILL.LST) to a new name (e.g., axis1.lst), and then repeating these steps for the second axis of the hill. The output files produced by OPTHILL for the current example are presented in Table F-67 and F-68. The output file lists the final values of the profile parameters, and it also lists the profile data provided by the user along with the corresponding data computed from the profile parameters.

Table F-64
OPTHILL Input and Output Files

Unit	File Name	Type	Format	Description
5	OPTHILL.INP	input	formatted	Control file containing user inputs
6	OPTHILL.LST	output	formatted	List file (line printer output file)

Table F-65
OPTHILL Control File Inputs (OPTHILL.INP)

Record	Variable No.	Variable Name	Columns	Type of Format	Description
1	1	TITLE(15)	1-60	15A4	60 character title
2	1	RELIEF	*	real	Height (m) of the crest of the hill above the grid elevation
3	1	AXMAX	*	real	Maximum allowed axis length (m) for the axis (major or minor) being evaluated
4	1	-	*	-	This record is skipped by the program. May contain optional text data (see example)
5	1	DIST	*	real	Distance-height pairs describing the profile of the terrain. Units: m
5	2	HGT	*	real	Distance-height pairs describing the profile of the terrain. Units: m

* Entered in FORTRAN free format.

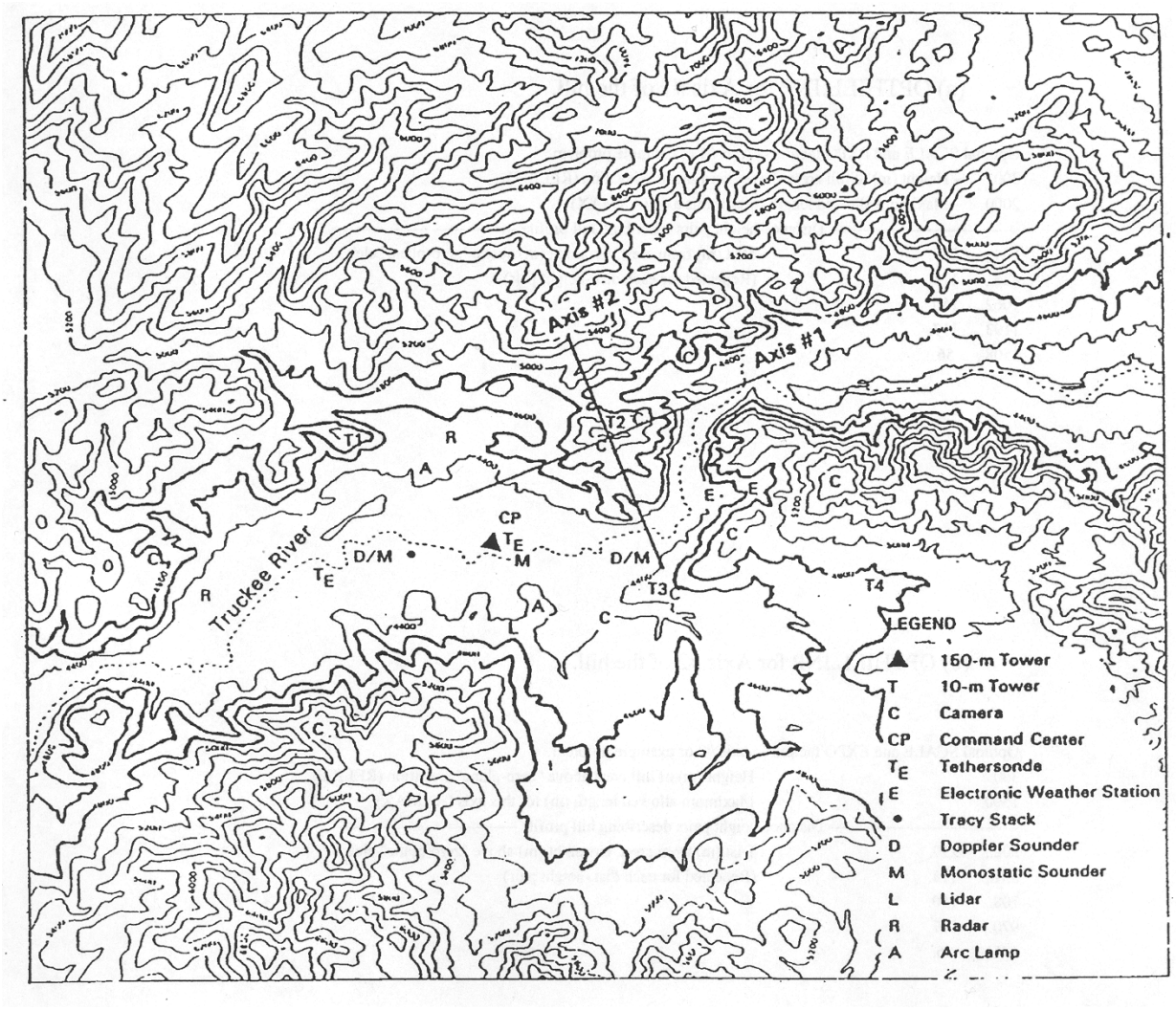

Figure F-2 Map of terrain surrounding the site of the FSPS, illustrating the selection and characterization of a terrain feature for CTSG modeling.

Table F-66
Sample OPTHILL Input Files

(a) OPTHILL.INP for Axis #1 of the hill.

```
Optimal SCALE and EXPO factors -- Axis #1 of example problem
300.      - Height (m) of hill crest above "zero-plane" elevation (RELIEF)
2000.     - Maximum allowed length (m) for this axis (AXMAX)
---------------------------------- Distance-height pairs describing hill profile ------------------------------
564.,     239.                          - Dist.(m) from crest, terrain ht (m) above "zero-plane" elev.
826.,     178.                            (Repeated for each dist.-height pair)
1062.,    150.
1193.,    117.
1508.,     56.
```

(b) OPTHILL.INP for Axis #2 of the hill.

```
Optimal SCALE and EXPO factors -- Axis #2 of example problem
300.                                    - Height (m) of hill crest above "zero-plane" elevation (RELIEF)
1500.                                   - Maximum allowed length (m) for this axis (AXMAX)
---------------------------------- Distance-height pairs describing hill profile ------------------------------
302.,     239.                          - Dist.(m) from crest, terrain ht (m) above "zero-plane" elev.
551.,     178.                            (Repeated for each dist.-height pair)
708.,     150.
970.,     117.
1311.,     56.
```

Table F-67
OPTHILL Output File for Axis #1 of Sample Hill

```
***  Optimal SCALE and EXPO factors -- Axis #1 of example problem ***

        EVOL TIME LIMIT =       60. SECONDS        SKIP = 10

NUMBER OF PARAMETERS FOR THIS STUDY :  4

PARAMETER        START VALUE      STEP CONTROL     LOWER LIMIT      UPPER LIMIT
---------        -----------      ------------     -----------      -----------

1 RELIEF         0.3000E+03       0.0000E+00       0.3000E+03       0.3000E+03
2 AXMAX          0.2000E+04       0.0000E+00       0.2000E+04       0.2000E+04
3 EXPO           0.2000E+01       0.2000E+01       0.1000E+00       0.1000E+02
4 SCALE          0.2000E+04       0.1000E+04       0.2000E+02       0.2000E+06


CALCULATIONS STARTED



RETURN VALUE:  2 NORMAL RETURN    FUNCTION VALUE: 0.50303

PARAMETER VALUES:
            RELIEF   =    300.00000
            AXMAX    =   2000.00000
            EXPO=       1.90651
            SCALE    =   1522.94500


Distance  Height    Fitted Value

  564.0    239.0      237.4
  826.0    178.0      186.4
 1062.0    150.0      139.9
 1193.0    117.0      115.5
 1508.0     56.0       63.0
```

Table F-68
OPTHILL Output File for Axis #2 of Sample Hill

```
.***  Optimal SCALE and EXPO factors -- Axis #2 of example problem ***

          EVOL TIME LIMIT =       60. SECONDS        SKIP = 10

NUMBER OF PARAMETERS FOR THIS STUDY :  4

PARAMETER  START VALUE   STEP CONTROL  LOWER LIMIT   UPPER LIMIT
---------- -----------   -----------   ----------    -----------

1 RELIEF   0.3000E+03    0.0000E+00    0.3000E+03    0.3000E+03
2 AXMAX    0.1500E+04    0.0000E+00    0.1500E+04    0.1500E+04
3 EXPO     0.2000E+01    0.2000E+01    0.1000E+00    0.1000E+02
4 SCALE    0.1500E+04    0.7500E+03    0.1500E+02    0.1500E+06



CALCULATIONS STARTED



RETURN VALUE:  2         NORMAL RETURN              FUNCTION VALUE: 2.17504

PARAMETER VALUES:
           RELIEF  =    300.00000
           AXMAX   =   1500.00000
           EXPO    =      1.23912
           SCALE   =   2895.90200


Distance  Height    Fitted Value

  302.0    239.0      244.0
  551.0    178.0      189.1
  708.0    150.0      154.7
  970.0    117.0       99.5
 1311.0     56.0       33.5
```

This process is simplified somewhat if a batch file is used to manage the filenames. One such batch file for DOS (RUNOPT.BAT) is included with the testcase. It requires three filenames as arguments:

```
RUNOPT   file1  file2  file3
```

where

file1	OPTHILL.EXE	executable program file
file2	user.inp	input file
file3	user.out	output file

The batch file copies file2 to OPTHILL.INP, runs OPTHILL.EXE which creates OPTHILL.LST, then renames OPTHILL.LST to the name supplied as file3. For the example above, axis #1 would be processed by typing the command:

```
RUNOPT  OPTHILL.EXE   AXIS1.INP   AXIS1.LST
```

With these results, hill information that is independent of the choice of coordinate system and the modeling grid for the wind model can be specified:

xc,yc (m)	(depends on choice of coordinates)
thetah (deg)	69E
zgrid (m)	(depends on grid for wind model)
relief (m)	300.
expo (1)	1.91
expo (2)	1.24
scale (1) (m)	1523.
scale (2) (m)	2896.
axmax (1) (m)	2000.
axmax (2) (m)	1500.

Note that scale(2) is almost twice scale(1), even though axis 1 corresponds to the longer axis of the hill. This can occur because the "scale" parameter is a property of the entire inverse-polynomial function (Equation F-1), rather than just the portion of the function that is fit to the profile of the terrain. In Figure F-1, the shape of the terrain might best conform to the upper 10% of the polynomial function, in which case the "scale" parameter would exceed "axmax." In this example application of the OPTHILL program, we see that axmax(2) is substantially less than axmax(1), whereas scale(2) exceeds scale(1), indicating that a comparatively smaller portion of the polynomial function represents the terrain profile along the minor axis.

G. POSTPROCESSORS

The CALMET meteorological model generates a large unformatted meteorological data file which includes hourly gridded wind fields and temperature at multiple levels and hourly gridded surface meteorological fields such as PGT (Pasquill-Gifford-Turner) stability class, friction velocity, Monin-Obukhov length, mixing height, convective velocity scale, and precipitation rate. A postprocessor is designed to access this file:

PRTMET is a postprocessor intended to aid in the analysis of the CALMET output data file by allowing the user to display selected portions of the meteorological data.

After making one or more CALPUFF simulations, hourly concentrations and/or deposition fluxes for each species at each receptor exist in several unformatted data files. A single CALPUFF application can produce four such files: CONC.DAT (concentrations in g/m^3); WFLUX.DAT (wet deposition fluxes in $g/m^2/s$); DFLUX.DAT (dry deposition fluxes in $g/m^2/s$); and VISB.DAT (relative humidity for visibility analyses). When a period is simulated as a sequence of shorter-period CALPUFF applications, as when a year is simulated in chunks of about four weeks, for example, each of the shorter runs produces its own set of files. When certain groups of sources need to be characterized separately, individual CALPUFF applications are required for each group, again producing a set of data files for each application. Similarly, certain species may be modeled separately, producing more output data files. Data in all of these files must be processed to obtain results that can be used to characterize air quality impacts in terms of multiple-hour averages, increment consumption, threshold exceedences, visibility reduction, total deposition, and so forth. Postprocessors designed for this work include:

APPEND is a postprocessor which appends two or more sequential CALPUFF concentration, wet flux, dry flux or relative humidity (visibility) files in time.

CALSUM is a postprocessor which sums and scales concentrations or wet/dry fluxes from two or more source groups from different CALPUFF runs.

POSTUTIL is a postprocessor which operates on one or more CALPUFF concentration and wet/dry flux files to create new species as weighted combinations of modeled species; to sum wet and dry deposition fluxes; to merge species from different runs into a single output file; to sum and scale results from different runs; to repartition nitric acid/nitrate based on total available sulfate and ammonia; and to add time/space-varying background.

CALPOST is a postprocessor which operates on one CALPUFF concentration or wet/dry deposition flux file to perform visibility calculations; to average and summarize concentrations and deposition fluxes; to determine ranked concentration/ flux/light extinction values; and to create list files and plot files.

G.1 PRTMET Meteorological Display Program

The CALMET meteorological model generates a large, binary meteorological file which includes hourly gridded wind fields at multiple levels and hourly gridded surface meteorological fields such as PGT (Pasquill-Gifford-Turner) stability class, friction velocity, Monin-Obukhov length, mixing height, convective velocity scale, and precipitation rate. For many typical applications, this output file will be several megabytes or more in volume. The PRTMET program is a postprocessor intended to aid in the analysis of the CALMET output data base by allowing the user to display selected portions of the meteorological data.

PRTMET has the following capabilities and options.

- Option to print or suppress printing of the gridded hourly meteorological fields (wind fields and surface meteorological variables).
- User-selected levels of the wind fields printed.
- Option to display wind fields as U, V components or as wind speed and wind direction.
- User-selected wind speed conversion factor for changing units (default units: m/s).
- Option to print plot files of all the meteorological variables (horizontal slices), in a format compatible with SURFER (contour plots and/or vector plots).
- Option to print time-series of any number of variables at a single grid point, in a separate file compatible with Excel (column format)
- Option to produce plot files of snapshots and/or average fields.
- Option to print or suppress printing of the gridded geophysical variables (surface roughness lengths, land use categories, terrain elevations).
- Option to print plot files of the gridded geophysical variables.
- Option to print or suppress printing of X, Y coordinates of surface stations, upper air stations, and precipitation stations used in the modeling.
- Option to print or suppress printing of the CALMET run control variables stored in the header records of the CALMET output file.

- User-selected portion of horizontal grid printed for all gridded meteorological fields. Options include printing entire grid, subset of grid, or a single data point.

- User-selected time period(s) printed.

- User-selected printing time interval.

- User-selected format for display of gridded meteorological fields (self-scaling exponential format or fixed format).

Two input files are read by PRTMET: a user-input control file and the unformatted meteorological data file containing the gridded wind and micrometeorological fields generated by CALMET. The output file PRTMET.LST contains the printed data selected by the user. PRTMET also produces a user defined number of plot files. A time-series output file is created whenever a single grid point is selected for processing. Table G-1 contains a summary of the input files and output files for PRTMET.

The format of the PRTMET control input file follows the same rules as those used in the CALMET.INP file (refer to the CALMET section for details). Only data within the delimiter characters (!) are processed. The input data consist of a leading delimiter followed by the variable name, equals sign, input value or values, and a terminating delimiter (e.g., !XX = 12.5!). PRTMET.INP may be created/edited directly using a conventional editor, or it may be created/edited indirectly by means of the PC-based, Windows-compatible Graphical User Interface (GUI) developed for the geophysical preprocessors (CALPRO). A sample input file is presented in Table G-2. A description of each of the inputs is provided in Table G-3.

PRTMET extracts and prints the data selected by the user from the CALMET data file. A sample output file is shown in Table G-4. A sample contour plot file and a sample vector plot file are shown in Table G-5 and Table G-6, respectively. A sample time-series output file is shown in Table G-7.

Table G-1

PRTMET Input and Output Files

Unit	File Name	Type	Format	Description
5	PRTMET.INP	input	formatted	Control file containing user inputs
6	PRTMET.LST	output	formatted	List file (line printer output file)
7	CALMET.DAT	input	unformatted	Unformatted CALMET output file containing meteorological and geophysical data to be printed.
8	-	output	formatted	Plot file. As many files as specified in PRTMET.INP.
1	PRTTIME.TXT	output	formatted	Time-series file. Created if a single grid point is processed.

Table G-2
PRTMET Control File Inputs (PRTMET.INP)

Input group	Variable	Type	Description
(0)	METDAT	character*132	Unformatted CALMET output file containing the meteorological and geophysical data to be printed
	RUNLST	character*132	List file name.
	PRTTIME	Character*132	Time-series file name
	LCFILES	Logical	Convert filename to upper (F) or lower (T) case
(1)	IBYR	Integer	Starting year of data to print (four digit)
	IBMO	Integer	Starting month
	IBDAY	Integer	Starting day
	IBHR	Integer	Starting hour (00-23)
	IEYR	Integer	Ending year of data to print (four digit)
	IEMO	Integer	Ending month
	IEDAY	Integer	Ending day
	IEHR	Integer	Ending hour (00-23)
	ICHR	Integer	Printing interval (hours) for printing/plotting field
	NBX	Integer	X grid cell of lower left corner of grid to print
	NBY	Integer	Y grid cell of lower left corner of grid to print
	NEX	Integer	X grid cell of upper right corner of grid to print
	NEY	Integer	Y grid cell of upper right corner of grid to print
(2)	LHDV	Logical	Control variable for printing of CALMET run variables stored in header records of output file. (F=do not print, T=print)
	LMETCF	Logical	Control variable for printing full CALMET control file image. (F=do not print, T=print)
	LSFC	Logical	Control variable for printing of X,Y surface station coordinates. (F=do not print, T=print)
	LUPC	Logical	Control variable for printing of X,Y upper air station coordinates. (F=do not print, T=print)
	LPRC	Logical	Control variable for printing of X,Y precipitation station coordinates. (F=do not print, T=print)
	LNEARS	Logical	Control variable for printing of nearest surface station number to each grid point. (F=do not print, T=print)

Table G-2 (Continued)
PRTMET Control File Inputs (PRTMET.INP)

Input group	Variable	Type	Description
(2a)	LSURF	logical	Control variable for printing of surface station number to each grid point. (F=do not print, T=print)
	LLI	logical	Control variable for printing of leaf area index field. (F=do not print, T=print)
	LLU	logical	Control variable for printing of gridded land use categories. (F=do not print, T=print)
	LTE	logical	Control variable for printing of terrain elevations. (F=do not print, T=print)
	LZ0	logical	Control variable for printing of gridded surface roughness lengths. (F=do not print, T=print)
	FLI	integer	Output format for leaf area index. (0=self-scaling exponential format, 1=fixed format).
	FLU	integer	Output format for land use categories. (0=self-scaling exponential format, 1=fixed format).
	FTE	integer	Output format for terrain elevations. (0=self-scaling exponential format, 1=fixed format).
	FZ0	integer	Output format for surface roughness lengths. (0=self-scaling exponential format, 1=fixed format).
	LSTAB	logical	Control variable for printing of PGT stability class. (F=do not print, T=print)
	LUSTR	logical	Control variable for printing of friction velocity. (F=do not print, T=print)
	LMONL	logical	Control variable for printing of Monin-Obukhov length. (F=do not print, T=print)
	LWSTR	logical	Control variable for printing of convective velocity scale. (F=do not print, T=print)
	LMXHT	logical	Control variable for printing of mixing height. (F=do not print, T=print)
	LPRAT	logical	Control variable for printing of precipitation rates. (F=do not print, T=print)

Table G-2 (Continued)
PRTMET Control File Inputs (PRTMET.INP)

Input group	Variable	Type	Description
(2a)	FSTAB	integer	Output format for PGT stability class. USED ONLY IF IPSC=1. (0=self-scaling exponential format, 1=fixed format)
	FUSTR	integer	Output format for friction velocity. USED ONLY IF IFV=1. (0=self-scaling exponential format, 1=fixed format)
	FMONL	integer	Output format for Monin-Obukhov length. USED ONLY IF IMOL=1. (0=self-scaling exponential format, 1=fixed format)
	FWSTR	integer	Output format for the convective velocity scale. USED ONLY IF ICVS=1. (0=self-scaling exponential format, 1=fixed format)
	FMXHT	integer	Output format for mixing height. USED ONLY IF IMH=1. (0=self-scaling exponential format, 1=fixed format)
	FPRAT	integer	Output format for precipitation rates. USED ONLY IF IPR=1. (0=self-scaling exponential format, 1=fixed format)
	IPWS	integer	Control variable for display of wind field. (0=U,V components, 1=wind speed, wind direction)
	WSFAC	real	Wind speed units conversion factor. (1.0 for m/s, 1.944 for knots, 2.237 for miles/hour)
	FWS	integer array element	Output format for wind speeds. (0=self-scaling exponential format, 1=fixed format)
	N3D	integer	Number of layers of 3-D met data printed
(2b)	X (N3D entries)	Integer arrays	Data for each layer printed: layer # , horizontal wind, vertical velocity, temperature (1: print, 0: do not pring)

Table G-2 (Concluded)
PRTMET Control File Inputs (PRTMET.INP)

Input group	Variable	Type	Description
(3a)	LVECT	logical	Create plot files of wind vectors for each CALMET layer each hour (T: Yes ; F: No)
	LTEMP	Logical	Create plot files of temperature for each CALMET layer each hour (T: Yes ; F: No)
	LWSPE	Logical	Create plot files of wind speed for each CALMET layer each hour (T: Yes ; F: No)
	LPREC	Logical	Create plot files of precipitation for each CALMET layer each hour (T: Yes ; F: No)
	LMIXH	Logical	Create plot files of mixing height for each CALMET layer each hour (T: Yes ; F: No)
	LIPGT	logical	Create plot files of PGT class for each CALMET layer each hour (T: Yes ; F: No)
	NSNAP	integer	Number of snapshot plot files to be created.
NSNAP x 2-line entries	FILESNAP	Character*132	Output file name
	XXXX	Char*4= Integer, integer	Layer number, time (hour) for variable XXXX to plot. Variable XXXX options: VECT (wind field, vector plot), UVEL (u-component of wind velocity, VVEL (v-component of wind velocity),WVEL(w-component of wind velocity),, TEMP (temperature),WDIR (Wind direction), WSPE(wind speed), IPGT (PGT class), USTA(Friction velocity), MONL(Monin-Obukhov length, WSTA(convective velocity), MIXH (mixing height), PREC(precipitation rate)
(4a)	NMEAN	integer	Number of averaged field plot files to be created.
	IBEGAV	integer	Beginning hour of the averaging period (IBEGIN=1 corresponds to IYR, IMO, IDAY, IHR)
	IENDAV	integer	Ending hour of the averaging period.
(4b)	FILEMEAN	Character*132	Output file name (average fields)
NMEAN x 2-line entries	XXXX	Char*4 = integer	Variable to plot (same variable options as for snapshots), layer number

Table G-3

Sample PRTMET Control File (PRTMET.INP)

```
--------------------------------------------------------------------------------

                PRTMET PROCESSOR CONTROL FILE
                -----------------------------

  PRTMET reads the binary meteorological data file produced by CALMET
  (CALMET.DAT), and reports selected information in formats amenable to
  quantitative analysis, QA review, or visualization.

--------------------------------------------------------------------------------
                                      a
INPUT GROUP: 0 -- Input and Output Files
--------------

     Default Name  Type          File Name
     ------------  ----          ---------
     CALMET.DAT    input     ! METDAT  =met1.dat   !
     PRTMET.LST    output    ! RUNLST  =prtmet1.lst  !
     PRTTIME.DAT   output    ! PRTTIME  =oct1_all_hours.dat  !

     Note: PRTTIME is a time-series file created only if a single point is
     selected for processing/printing in Input Group 1.  2D and 3D variables
     specified in Input Group 2 are written each period for this point.

     All file names will be converted to lower case if LCFILES = T
     Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
     (LCFILES)                 Default: T      ! LCFILES = F !
        T = lower case
        F = UPPER CASE

     NOTE: File/path names can be up to 132 characters in length

-------------
    a
     Additional output files may be defined in Input Groups 3 and 4 when
     specific snapshot plots or average field plots are requested.

!END!

--------------------------------------------------------------------------------

INPUT GROUP: 1 -- Run control parameters
--------------

 --- Processing Period ---

     Starting date:   Year (IBYR) -- No default       ! IBYR = 1990  !
                     Month (IBMO) -- No default       ! IBMO =  7  !
                       Day (IBDY) -- No default       ! IBDY =  8  !
              [00-23] Hour (IBHR) -- No default       ! IBHR =  18 !

     Ending date:     Year (IEYR) -- No default       ! IEYR = 1990  !
                     Month (IEMO) -- No default       ! IEMO =  7  !
                       Day (IEDY) -- No default       ! IEDY =  9  !
              [00-23] Hour (IEHR) -- No default       ! IEHR =  6  !

     ---------------
     NOTE:  The hour is defined by the time at the end of the hour


 --- Processing Options ---

     Time interval between printed/plotted fields (hr)
     Enter 1 to print every hour, enter 2 to
     print every second hour, etc.
     (ICHR)                    Default: 1      ! ICHR = 1  !

     Portion of meteorological grid to print/plot
     Enter beginning (NBX,NBY) and ending (NEX,NEY)
     cell indices (enter 0 to indicate entire grid).
     (NBX)                     Default: 0      ! NBX = 0  !
     (NBY)                     Default: 0      ! NBY = 0  !
     (NEX)                     Default: 0      ! NEX = 0  !
     (NEY)                     Default: 0      ! NEY = 0  !


     Note: If only one gridpoint is specified, variables selected in
     Input Group 2 are written to a separate time-series output file
     defined in Input Group 0.

!END!

--------------------------------------------------------------------------------

INPUT GROUP: 2 -- Listfile Output Options
--------------

-------------
Subgroup (2a)
-------------
```

Table G-3
Sample PRTMET Control File (PRTMET.INP)

```
     Print CALMET header run variables
     (e.g., grid definition, ...)?
     (LHDV)                    Default: T      ! LHDV = T !

     Print full CALMET control file image?
     (LMETCF)                  Default: F      ! LMETCF = F !

     Print meteorological station (X,Y)
     coordinates?
     (LSFC)  surface           Default: F      ! LSFC = F !
     (LUPC)  upper air         Default: F      ! LUPC = F !
     (LPRC)  precipitation     Default: F      ! LPRC = F !

     Print nearest surface station ID for
     each grid point?
     (LNEARS)                  Default: F      ! LNEARS = F !

     Print surface meteorological data?
     (temp, rho, SW rad, rh, precip code)
     (LSURF)                   Default: F      ! LSURF = F !

     Print 2-D gridded domain characteristics?
     (LLI)  Leaf Area Index    Default: F      ! LLI = F !
     (LLU)  Landuse            Default: F      ! LLU = F !
     (LTE)  Terrain            Default: F      ! LTE = F !
     (LZ0)  Roughness          Default: F      ! LZ0 = F !

     Format used when printing gridded domain characteristics
     (used only if corresponding LLI,LLU,LTE,LZ0 is true)
        0 = use self-scaling exponential format
        1 = use fixed decimal format
     (FLI)  Leaf Area Index    Default: 0      ! FLI = 0 !
     (FLU)  Landuse            Default: 0      ! FLU = 0 !
     (FTE)  Terrain            Default: 0      ! FTE = 0 !
     (FZ0)  Roughness          Default: 0      ! FZ0 = 0 !

     Print 2-D gridded meteorological data?
     (LSTAB)  PG stability     Default: F      ! LSTAB = F !
     (LUSTR)  u-star           Default: F      ! LUSTR = F !
     (LMOLN)  Monin-Obukhov L  Default: F      ! LMOLN = F !
     (LWSTR)  w-star           Default: F      ! LWSTR = F !
     (LMXHT)  mixing ht        Default: F      ! LMXHT = F !
     (LPRAT)  precip. rate     Default: F      ! LPRAT = F !

     Format used when printing 2-D gridded meteorological data
     (used only if corresponding LSTAB,LUSTR,LMOLN,LWSTR,LMXHT,LPRAT
      is true)
        0 = use self-scaling exponential format
        1 = use fixed decimal format
     (FSTAB)  PG stability     Default: 0      ! FSTAB = 0 !
     (FUSTR)  u-star           Default: 0      ! FUSTR = 0 !
     (FMOLN)  Monin-Obukhov L  Default: 0      ! FMOLN = 0 !
     (FWSTR)  w-star           Default: 0      ! FWSTR = 0 !
     (FMXHT)  mixing ht        Default: 0      ! FMXHT = 0 !
     (FPRAT)  precip. rate     Default: 0      ! FPRAT = 0 !

     Present wind data as speed and direction?
     (IPWS)                    Default: 1      ! IPWS = 1  !
        0 = present as U,V components
        1 = present as wind speed, direction

     Scale factor to convert wind speed from m/s to other units
     (WSFAC)                   Default: 1.0    ! WSFAC = 1.0  !
        1.0   = m/s
        1.944 = to knots
        2.237 = to mph

     Format used when printing wind speeds
        0 = use self-scaling exponential format
        1 = use fixed decimal format
     (FWS)                     Default: 0      ! FWS = 0 !

     Number of layers of 3-D meteorological data printed
     (Identify data for each layer in Subgroup 2b)
     (N3D)                     Default: 0      ! N3D = 0  !

!END!

-------------
Subgroup (2b)
-------------
                                                    a,b
           DATA FOR EACH LAYER PRINTED (N3D entries)
           ----------------------------------------
                     c
                  U,V
                   or
```

Table G-3

Sample PRTMET Control File (PRTMET.INP)

```
       LAYER     WS,WD       W    TEMPERATURE
       -----     -----     -----     -----
* X =    3,        1,        0,        0      *  *END*

-------------
    a
     0 = do not print this variable for this layer
     1 = print this variable for this level
    b
     Each line is treated as a separate input subgroup and therefore
     must end with an input group terminator.
    c
     U,V or WS,WD format is selected by variable IPWS

------------------------------------------------------------------------------

INPUT GROUP: 3 -- Snapshot Output Plotfiles
--------------

-------------
Subgroup (3a)
-------------

     Snapshot plotfiles can be created automatically for each CALMET layer, and
     each hour in the processing period identified in Group 1.  The plotfiles
     are compatible with the SURFER graphics system and are given names that
     include the date-time and model layer.  Filenames are of the form
     YYYY_JJJ_HHMM(UTC+HHMM)_LZZ.*
     YYYY = Year (Local Standard Time, LST)
     JJJ = Julian Day (LST)
     HHMM = Hour & minute (LST)
     (UTC+HHMM) = LST definition (e.g. EST = UTC-0500)
     ZZ = CALMET layer (00 for 2D variables)


     Create plotfiles for each hour?
        (LVECT)  Wind Vectors  (*.wsp,*.wdr)    Default: F      ! LVECT = F !
                     -- or --  (*.usp,*.vsp)
                     -- or --  (*.vec)
        (LTEMP)  Temperature   (*.deg)          Default: F      ! LTEMP = F !
        (LPREC)  Precipitation (*.prc)          Default: F      ! LPREC = F !
        (LMIXH)  Mixing Height (*.mix)          Default: F      ! LMIXH = F !
        (LIPGT)  PGT Stability (*.pgt)          Default: F      ! LIPGT = F !

     Force snapshot files to be ASCII (text), otherwise files
     containing non-integer data will be written as BINARY
     to reduce file size.
     (LSNAPTXT)                                 Default: T      ! LSNAPTXT = F !

     Type of file created for the Wind Vector option
     (MVECT)                                    Default: 0      ! MVECT = 1 !
        0   = *.vec        (SURFER POST file)
        1   = *.wsp, *.wdr (speed and direction SURFER GRD files)
        2   = *.usp, *.vsp (U and V speed SURFER GRD files)

     Number of layers of 3-D meteorological data written to plot files.
     (Identify layers in Subgroup 3b)
     If set to 0, only layer 1 is provided.
     (NZPLOT)                                   Default: 0      ! NZPLOT = 0 !



     Specific snapshot plotfiles can be created for selected CALMET layers and
     hours in the processing period identified in Group 1.  The plotfiles
     are compatible with the SURFER graphics system and are given names by the
     user.

     Number of snapshot plotfiles explicitly defined in Subgroup 3c
     (NSNAP)                                    Default: 0      ! NSNAP = 0 !


!END!

-------------
Subgroup (3b)
-------------
                                           a,b
           LAYERS PLOTTED (NZPLOT entries)
           ----------------------------------

       LAYER     WIND     TEMPERATURE
       -----     ----     -----------
* X =    3,        1,          0      *  *END*

-------------
    a
     0 = do not print this variable for this layer
     1 = print this variable for this level
```

Table G-3
Sample PRTMET Control File (PRTMET.INP)

```
    b
     Each line is treated as a separate input subgroup and therefore
     must end with an input group terminator.


-------------
Subgroup (3c)
-------------
                                                          a,b
           SNAPSHOT DEFINITION (NSNAP 2-line entries)
           ------------------------------------------

             Layer  Hour (position in processing period)
             -----  ----

* FILESNAP =   mixht1.grd  *
* MIXH     =   1,     3    *  *END*


-------------
    a
     Enter information for each of the NSNAP plotfiles in 2-line groups.
     One line identifies the filename (FILESNAP = outfile), and the
     other line defines the type of snapshot and the layer & time.
     The type (e.g., MIXH =) must be one of the following:
         VECT = wind field (vector plot)
         UVEL = u-component of the wind (contour plot)
         VVEL = v-component of the wind (contour plot)
         WVEL = w-component of the wind (contour plot)
         TEMP = temperature (contour plot)
         WDIR = wind direction (contour plot)
         WSPE = wind speed (contour plot)
         IPGT = PG stability class (contour plot)
         USTA = friction velocity u-star (contour plot)
         MONL = Monin-Obukhov length (contour plot)
         WSTA = convective velocity w-star (contour plot)
         MIXH = mixing height (contour plot)
         PREC = precipitation rate (contour plot)
    b
     Each pair of lines is treated as a separate input subgroup and
     therefore must end with an input group terminator.

--------------------------------------------------------------------------------

INPUT GROUP: 4 -- Average Field Output Plotfiles
--------------

-------------
Subgroup (4a)
-------------

     Number of average field plotfiles
     (NMEAN)                    Default: 0      ! NMEAN = 0 !

     Time period to begin averaging
     (position within processing period)
     (IBEGAV)                   Default: 1      ! IBEGAV = 1 !

     Time period to end averaging
     (position within processing period)
     (IENDAV)                   Default: 1      ! IENDAV = 1 !


!END!

-------------
Subgroup (4b)
-------------
                                                        a,b
           AVERAGE PLOT DEFINITION (NMEAN 2-line entries)
           ----------------------------------------------

             Layer
             -----

* FILEMEAN =   t1_20.grd    *
* TEMP     =   1            *  *END*

-------------
    a
     Enter information for each of the NMEAN plotfiles in 2-line groups.
     One line identifies the filename (FILEMEAN = outfile), and the
     other line defines the type of average and the layer.
     The type (e.g., MIXH =) must be one of the following:
         VECT = wind field (vector plot)
         UVEL = u-component of the wind (contour plot)
         VVEL = v-component of the wind (contour plot)
         WVEL = w-component of the wind (contour plot)
```

Table G-3

Sample PRTMET Control File (PRTMET.INP)

```
      TEMP = temperature (contour plot)
      WDIR = wind direction (contour plot)
      WSPE = wind speed (contour plot)
      IPGT = PG stability class (contour plot)
      USTA = friction velocity u-star (contour plot)
      MONL = Monin-Obukhov length (contour plot)
      WSTA = convective velocity w-star (contour plot)
      MIXH = mixing height (contour plot)
      PREC = precipitation rate (contour plot)
b
 Each pair of lines is treated as a separate input subgroup and
 therefore must end with an input group terminator.
```

Table G-4

Sample PRTMET List File (PRTMET.LST)

```
                PRTMET OUTPUT SUMMARY
           VERSION:  4.31         LEVEL:  050128


 ------------------------------------------------
 NOTICE: Starting year in control file sets the
         expected century for the simulation.  All
         YY years are converted to YYYY years in
         the range:  1940 2039
 ------------------------------------------------


 -------------------------
     SETUP Information
 -------------------------


 Control File Used -----
 prtmet.inp

 Input MET File    -----
metdat  : ..\calpuff\cmet.dat
 Output List File  -----
runlst  : prtmet.lst
 Domain Plot Files -----
terrain elevations : qaterr.grd
land use           : qaluse.grd
surface roughness  : qaz0.grd
leaf area index    : qalai.grd
surface stations   : qassta.dat
precip. stations   : qapsta.dat
upper-air stations : qausta.dat
met grid           : qametg.bna
land use color     : luse.clr
PGT Class color    : pgt.clr

 Processing Options -----

                                Beginning year             1990
                                Beginning month               1
                                Beginning day                 9
                                Beginning Julian day          9
                                Beginning hour (00 to 23)     5
                                Total number of hours         4
                                Print interval (hours)        1

                                        Beginning X point   28
                                        Beginning Y point   48
                                        Ending X point      34
                                        Ending Y point      54

              Display X-Y coordinates of surface sta. ?   F
              Display X-Y coordinates of upper air sta. ? F
              Display X-Y coordinates of precip. sta. ?   F
              Display nearest surface station array ?     F
              Display surface roughness length ?          F     Fixed format ?   0
              Display land use categories ?               F     Fixed format ?   0
              Display terrain elevations ?                T     Fixed format ?   0
              Display leaf area index ?                   F     Fixed format ?   0

             Control variables for printing of 3-D fields.
                    LEVEL         U,V        W     TEMP ?
                      1            0         0       0
                      2            0         0       0
```

Table G-4

Sample PRTMET List File (PRTMET.LST)

```
 3          1          0          0
 4          0          0          0
 5          0          0          0
 6          0          0          0
 7          0          0          0
 8          0          0          0
 9          0          0          0
10          0          0          0
11          0          0          0
12          0          0          0
13          0          0          0
14          0          0          0
15          0          0          0
16          0          0          0
17          0          0          0
18          0          0          0
19          0          0          0
20          0          0          0
21          0          0          0
22          0          0          0
23          0          0          0
24          0          0          0
25          0          0          0
26          0          0          0
27          0          0          0
28          0          0          0
29          0          0          0
30          0          0          0
31          0          0          0
32          0          0          0
33          0          0          0
34          0          0          0
35          0          0          0
36          0          0          0
37          0          0          0
38          0          0          0
39          0          0          0
40          0          0          0
41          0          0          0
42          0          0          0
43          0          0          0
44          0          0          0
45          0          0          0
46          0          0          0
47          0          0          0
48          0          0          0
49          0          0          0
50          0          0          0
51          0          0          0
52          0          0          0
53          0          0          0
54          0          0          0
55          0          0          0
56          0          0          0
57          0          0          0
58          0          0          0
59          0          0          0
60          0          0          0

      Wind components (U, V) converted to WS, WD ?   1
      Display wind field in fixed format ?           1

   Multiplicative factor for wind units:         1.0000
(If the factor is 1.0 then units will remain in m/s)

      Display PGT stability class ?               F     Fixed format ?   0
```

Table G-4

Sample PRTMET List File (PRTMET.LST)

```
               Display friction velocity ?                F     Fixed format ?   0
               Display Monin-Obukhov length ?             F     Fixed format ?   0
               Display mixing height ?                    T     Fixed format ?   0
               Display convective velocity scale ?        F     Fixed format ?   0
               Display precipitation rate ?               F     Fixed format ?   0

               Display surface met. station variables ?   F


 Snapshot Options -----

 Automatic snapshot files selected:
    Wind Vectors  (*.VEC)         F    (MVECT = 0)
    Temperature   (*.DEG)         F
    Precipitation (*.PRC)         F
    Mixing Height (*.MIX)         F
    PGT Stability (*.PGT)         F

    All snapshot files are ASCII? T

                   Control variables for ploting 3-D fields.
                       LEVEL        WIND      TEMP ?
                         1            1         1
                         2            0         0
                         3            0         0
                         4            0         0
                         5            0         0
                         6            0         0
                         7            0         0
                         8            0         0
                         9            0         0
                        10            0         0
                        11            0         0
                        12            0         0
                        13            0         0
                        14            0         0
                        15            0         0
                        16            0         0
                        17            0         0
                        18            0         0
                        19            0         0
                        20            0         0
                        21            0         0
                        22            0         0
                        23            0         0
                        24            0         0
                        25            0         0
                        26            0         0
                        27            0         0
                        28            0         0
                        29            0         0
                        30            0         0
                        31            0         0
                        32            0         0
                        33            0         0
                        34            0         0
                        35            0         0
                        36            0         0
                        37            0         0
                        38            0         0
                        39            0         0
                        40            0         0
                        41            0         0
                        42            0         0
                        43            0         0
                        44            0         0
```

Table G-4
Sample PRTMET List File (PRTMET.LST)

```
                          45            0         0
                          46            0         0
                          47            0         0
                          48            0         0
                          49            0         0
                          50            0         0
                          51            0         0
                          52            0         0
                          53            0         0
                          54            0         0
                          55            0         0
                          56            0         0
                          57            0         0
                          58            0         0
                          59            0         0
                          60            0         0

 Number of specific snapshot files: 0

 Average Field Options -----

 Number of average field files: 0


 ---------------------------------------------------------------------------------------------
---------------------------------------------------------------------------------------------

  Data read from header records of CALMET file:
 ..\calpuff\cmet.dat


CALMET.DAT      2.0             No-Obs file structure with embedded control file

 Internal Coordinate Transformations  ---  COORDLIB   Version: 1.95   Level: 0501
 1 km resolution CALMET simulation for 4 hours from 5AM January 9, 1990
 with MM4 data, 5 surface met stations, 1 overwater station,

Produced by CALMET Version: 5.55  Level: 050217

  Input Group #0 parameters ---
  NUSTA   =  3
  NOWSTA  =  1

  Input Group #1 parameters ---
  IBYR    =  1990
  IBMO    =  1
  IBDY    =  9
  IBHR    =  5
  IBTZ    =  5
  IRLG    =  4
  IRTYPE  =  1
  LCALGRD =  T

  Input Group #2 parameters ---
  PMAP    = UTM
  DATUM   = NAS-C
  NIMADATE= 02-21-2003
  FEAST   =  0.00000000E+00
  FNORTH  =  0.00000000E+00
  IUTMZN  =  19
  UTMHEM  = N
  NX      =  99
  NY      =  99
  DGRID   =  1000.00000
```

Table G-4

Sample PRTMET List File (PRTMET.LST)

```
 XORIGR  =  310000.000
 YORIGR  =  4820000.00
 NZ      =  10
ZFACE  =     0.000,    20.000,    40.000,    80.000,   160.000,   300.000,   600.000,  1000.000,
1500.000,  2200.000,
3000.000,

 Land Use parameters from GEO.DAT ---
 NLU     =  14
 IWAT1   =  50
 IWAT2   =  55

 Input Group #4 parameters ---
 NSSTA   =  5
 NPSTA   =  16

 Input Group #5 parameters ---
 IWFCOD  =  1

Terrain heights (m)                                          ELEV

Multiply all values by 10 **  -1

 54 I 1365  1372  1398  1876  1878  1492  1442
    I    +     +     +     +     +     +     +
 53 I 1533  1502  1665  1808  1757  1497  1344
    I    +     +     +     +     +     +     +
 52 I 1764  1566  1624  1817  1804  1535  1335
    I    +     +     +     +     +     +     +
 51 I 1961  1822  1663  1570  1548  1601  1391
    I    +     +     +     +     +     +     +
 50 I 1915  2087  1861  1587  1523  1498  1347
    I    +     +     +     +     +     +     +
 49 I 2109  2806  2808  1892  1542  1727  1748
    I    +     +     +     +     +     +     +
 48 I 2253  3474  3649  2477  1825  1754  1766
    I    +     +     +     +     +     +     +
    ---------------------------------------
        28    29    30    31    32    33    34


 ------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------


  No W levels were selected, therefore no W data will be displayed.

  No temperature levels were selected, therefore no temperature data will be displayed.

 Wind Speed (m/s) -- Level:   3                                      year: 1990  month:  1
day:  9  Julian day:   9  hour:  5

 54 I 3.0  3.0  2.9  2.8  2.9  3.0  3.0
    I   +    +    +    +    +    +    +
 53 I 3.0  2.9  2.6  2.4  2.7  2.9  3.0
    I   +    +    +    +    +    +    +
 52 I 2.9  2.8  2.4  2.3  2.6  2.9  3.0
    I   +    +    +    +    +    +    +
 51 I 2.8  2.8  2.6  2.6  2.7  2.9  2.9
    I   +    +    +    +    +    +    +
 50 I 2.8  2.8  2.8  2.8  2.9  2.9  2.9
    I   +    +    +    +    +    +    +
 49 I 2.7  2.8  2.9  2.9  2.9  2.8  2.7
```

Table G-4

Sample PRTMET List File (PRTMET.LST)

```
     I   +    +    +    +    +    +    +
  48 I 2.6  2.6  2.8  2.9  2.8  2.7  2.6
     I   +    +    +    +    +    +    +
     ---------------------------------
        28   29   30   31   32   33   34

 Wind Direction (deg.) -- Level:   3                          year: 1990  month:  1
day:  9  Julian day:   9  hour:  5

  54 I233. 229. 223. 226. 233. 236. 238.
     I   +    +    +    +    +    +    +
  53 I230. 227. 220. 223. 233. 236. 237.
     I   +    +    +    +    +    +    +
  52 I225. 226. 226. 235. 239. 238. 238.
     I   +    +    +    +    +    +    +
  51 I218. 227. 232. 243. 244. 240. 238.
     I   +    +    +    +    +    +    +
  50 I213. 227. 233. 240. 241. 239. 237.
     I   +    +    +    +    +    +    +
  49 I214. 228. 234. 237. 238. 238. 239.
     I   +    +    +    +    +    +    +
  48 I220. 233. 237. 237. 239. 243. 249.
     I   +    +    +    +    +    +    +
     ---------------------------------
        28   29   30   31   32   33   34

 Mixing height (m)                                            year: 1990  month:  1
day:  9  Julian day:   9  hour:  5

 Multiply all values by 10 **  -1

  54 I 1561  1590  1483  1483  1736  1987  2088
     I    +     +     +     +     +     +     +
  53 I 1623  1625  1448  1407  1625  1866  1968
     I    +     +     +     +     +     +     +
  52 I 1618  1685  1508  1388  1531  1588  1659
     I    +     +     +     +     +     +     +
  51 I 1513  1693  1694  1560  1504  1609  1701
     I    +     +     +     +     +     +     +
  50 I 1353  1522  1683  1762  1620  1562  1517
     I    +     +     +     +     +     +     +
  49 I 1221  1236  1390  1624  1640  1436  1206
     I    +     +     +     +     +     +     +
  48 I 1003  1037  1116  1370  1547  1358  1240
     I    +     +     +     +     +     +     +
     ---------------------------------------
        28    29    30    31    32    33    34

 Wind Speed (m/s) -- Level:   3                               year: 1990  month:  1
day:  9  Julian day:   9  hour:  6

  54 I 3.0  2.9  2.8  2.7  2.9  2.9  2.9
     I   +    +    +    +    +    +    +
  53 I 2.9  2.8  2.6  2.4  2.7  2.9  3.0
     I   +    +    +    +    +    +    +
  52 I 2.9  2.8  2.4  2.2  2.6  2.9  2.9
     I   +    +    +    +    +    +    +
  51 I 2.8  2.8  2.6  2.5  2.7  2.9  2.9
     I   +    +    +    +    +    +    +
  50 I 2.8  2.8  2.9  2.8  2.9  2.9  2.9
     I   +    +    +    +    +    +    +
  49 I 2.8  2.8  2.9  2.9  2.9  2.8  2.7
     I   +    +    +    +    +    +    +
  48 I 2.7  2.7  2.8  2.9  2.9  2.7  2.6
     I   +    +    +    +    +    +    +
     ---------------------------------
```

Table G-4

Sample PRTMET List File (PRTMET.LST)

```
       28   29   30   31   32   33   34

 Wind Direction (deg.) -- Level:   3                                  year: 1990  month:  1
day:  9  Julian day:   9  hour:  6

  54 I232. 228. 222. 225. 232. 235. 237.
     I   +    +    +    +    +    +    +
  53 I229. 226. 219. 222. 232. 235. 236.
     I   +    +    +    +    +    +    +
  52 I224. 225. 225. 234. 238. 238. 237.
     I   +    +    +    +    +    +    +
  51 I217. 226. 232. 242. 243. 239. 237.
     I   +    +    +    +    +    +    +
  50 I212. 225. 232. 239. 240. 238. 237.
     I   +    +    +    +    +    +    +
  49 I212. 225. 232. 236. 237. 238. 238.
     I   +    +    +    +    +    +    +
  48 I214. 224. 232. 235. 238. 243. 248.
     I   +    +    +    +    +    +    +
     ---------------------------------
        28   29   30   31   32   33   34

 Mixing height (m)                                                    year: 1990  month:  1
day:  9  Julian day:   9  hour:  6

 Multiply all values by 10 **  -1

  54 I 1351  1383  1277  1274  1495  1730  1825
     I    +     +     +     +     +     +     +
  53 I 1433  1429  1284  1236  1405  1612  1694
     I    +     +     +     +     +     +     +
  52 I 1443  1500  1344  1226  1330  1376  1436
     I    +     +     +     +     +     +     +
  51 I 1357  1523  1512  1373  1303  1406  1498
     I    +     +     +     +     +     +     +
  50 I 1223  1382  1538  1580  1442  1394  1361
     I    +     +     +     +     +     +     +
  49 I 1125  1137  1269  1475  1489  1306  1118
     I    +     +     +     +     +     +     +
  48 I  954   982  1024  1256  1418  1252  1139
     I    +     +     +     +     +     +     +
     ---------------------------------------
         28    29    30    31    32    33    34

 Wind Speed (m/s) -- Level:   3                                       year: 1990  month:  1
day:  9  Julian day:   9  hour:  7

  54 I 3.0  3.0  2.9  2.8  2.9  3.0  3.0
     I   +    +    +    +    +    +    +
  53 I 3.0  2.9  2.6  2.4  2.7  2.9  3.0
     I   +    +    +    +    +    +    +
  52 I 2.9  2.8  2.4  2.3  2.7  2.9  3.0
     I   +    +    +    +    +    +    +
  51 I 2.9  2.8  2.7  2.6  2.8  2.9  2.9
     I   +    +    +    +    +    +    +
  50 I 2.8  2.9  2.9  2.9  2.9  2.9  2.9
     I   +    +    +    +    +    +    +
  49 I 2.8  2.8  2.9  2.9  2.9  2.9  2.7
     I   +    +    +    +    +    +    +
  48 I 2.7  2.7  2.8  2.9  2.9  2.8  2.6
     I   +    +    +    +    +    +    +
     ---------------------------------
        28   29   30   31   32   33   34

 Wind Direction (deg.) -- Level:   3                                  year: 1990  month:  1
day:  9  Julian day:   9  hour:  7
```

Table G-4

Sample PRTMET List File (PRTMET.LST)

```
  54 I231. 227. 222. 225. 231. 234. 236.
     I   +    +    +    +    +    +    +
  53 I228. 225. 219. 222. 231. 234. 235.
     I   +    +    +    +    +    +    +
  52 I223. 225. 225. 234. 238. 237. 236.
     I   +    +    +    +    +    +    +
  51 I217. 225. 231. 242. 243. 238. 236.
     I   +    +    +    +    +    +    +
  50 I212. 225. 232. 238. 240. 237. 236.
     I   +    +    +    +    +    +    +
  49 I212. 224. 231. 235. 237. 237. 238.
     I   +    +    +    +    +    +    +
  48 I214. 223. 231. 234. 237. 242. 248.
     I   +    +    +    +    +    +    +
     ---------------------------------
        28   29   30   31   32   33   34

 Mixing height (m)                                              year: 1990  month:  1
day:  9  Julian day:   9  hour:  7

 Multiply all values by 10 **  -1

  54 I 1398  1435  1357  1381  1533  1746  1845
     I    +     +     +     +     +     +     +
  53 I 1480  1486  1329  1259  1415  1630  1708
     I    +     +     +     +     +     +     +
  52 I 1488  1549  1379  1292  1343  1383  1449
     I    +     +     +     +     +     +     +
  51 I 1401  1573  1560  1407  1314  1418  1513
     I    +     +     +     +     +     +     +
  50 I 1266  1431  1589  1615  1468  1415  1381
     I    +     +     +     +     +     +     +
  49 I 1164  1184  1299  1505  1515  1329  1134
     I    +     +     +     +     +     +     +
  48 I  979   998  1049  1267  1437  1260  1154
     I    +     +     +     +     +     +     +
     ---------------------------------------
         28    29    30    31    32    33    34

 Wind Speed (m/s) -- Level:   3                                 year: 1990  month:  1
day:  9  Julian day:   9  hour:  8

  54 I 3.0  2.9  2.8  2.7  2.8  2.9  2.9
     I   +    +    +    +    +    +    +
  53 I 2.9  2.8  2.6  2.4  2.7  2.9  2.9
     I   +    +    +    +    +    +    +
  52 I 2.9  2.7  2.4  2.2  2.6  2.9  2.9
     I   +    +    +    +    +    +    +
  51 I 2.8  2.8  2.6  2.5  2.7  2.9  2.9
     I   +    +    +    +    +    +    +
  50 I 2.8  2.8  2.8  2.8  2.8  2.9  2.9
     I   +    +    +    +    +    +    +
  49 I 2.8  2.8  2.9  2.9  2.9  2.8  2.7
     I   +    +    +    +    +    +    +
  48 I 2.7  2.7  2.8  2.9  2.9  2.7  2.6
     I   +    +    +    +    +    +    +
     ---------------------------------
        28   29   30   31   32   33   34

 Wind Direction (deg.) -- Level:   3                            year: 1990  month:  1
day:  9  Julian day:   9  hour:  8

  54 I231. 227. 222. 225. 231. 234. 236.
     I   +    +    +    +    +    +    +
  53 I228. 225. 219. 222. 231. 234. 235.
     I   +    +    +    +    +    +    +
```

Table G-4

Sample PRTMET List File (PRTMET.LST)

```
  52 I224. 225. 225. 234. 238. 237. 236.
     I   +    +    +    +    +    +    +
  51 I217. 225. 231. 242. 243. 239. 236.
     I   +    +    +    +    +    +    +
  50 I212. 225. 232. 238. 240. 237. 236.
     I   +    +    +    +    +    +    +
  49 I212. 224. 232. 235. 237. 237. 238.
     I   +    +    +    +    +    +    +
  48 I214. 224. 231. 235. 237. 242. 248.
     I   +    +    +    +    +    +    +
     ---------------------------------
        28   29   30   31   32   33   34

 Mixing height (m)                                                  year: 1990  month:  1
day:  9  Julian day:   9  hour:  8

 Multiply all values by 10 **  -1

  54 I 1202  1240  1179  1211  1351  1555  1649
     I    +     +     +     +     +     +     +
  53 I 1275  1289  1169  1121  1238  1439  1521
     I    +     +     +     +     +     +     +
  52 I 1283  1345  1220  1144  1176  1216  1287
     I    +     +     +     +     +     +     +
  51 I 1208  1373  1363  1240  1163  1241  1356
     I    +     +     +     +     +     +     +
  50 I 1100  1253  1401  1424  1293  1258  1239
     I    +     +     +     +     +     +     +
  49 I 1026  1043  1145  1330  1347  1182  1028
     I    +     +     +     +     +     +     +
  48 I  883   903   908  1118  1278  1130  1042
     I    +     +     +     +     +     +     +
     ---------------------------------------
         28    29    30    31    32    33    34


  End of run -- Clock time: 18:15:51
                    Date: 02-21-2005

        Elapsed Clock Time:        1.0 (seconds)

                  CPU Time:        1.0 (seconds)
```

Table G-5
Sample contour plot file

```
DSAA
         5           5
   340.000     349.000
   4710.00     4719.00
   100.000     104.844
   101.275     104.844     100.187     100.156     100.151
   100.678     101.440     100.574     100.321     100.113
   100.402     100.498     100.289     100.200     100.179
   100.235     100.234     100.164     100.132     100.133
   100.137     100.000     100.000     100.094     100.102
```

Table G-6

Sample vector plot file

x	y	arrow	angle(-wd)	length(ws)
341.000	4719.000	symbol:175	-151.88	2.12
343.000	4719.000	symbol:175	-162.69	2.13
345.000	4719.000	symbol:175	-166.83	2.07
347.000	4719.000	symbol:175	-173.53	2.08
349.000	4719.000	symbol:175	-173.07	2.26
341.000	4717.000	symbol:175	-151.82	2.23
343.000	4717.000	symbol:175	-160.90	2.10
345.000	4717.000	symbol:175	-164.80	2.01
347.000	4717.000	symbol:175	-170.83	2.07
349.000	4717.000	symbol:175	-169.59	2.22
341.000	4715.000	symbol:175	-151.44	2.14
343.000	4715.000	symbol:175	-156.37	1.95
345.000	4715.000	symbol:175	-160.66	1.83
347.000	4715.000	symbol:175	-166.37	1.95
349.000	4715.000	symbol:175	-162.93	2.06
341.000	4713.000	symbol:175	-150.30	2.00
343.000	4713.000	symbol:175	-151.21	1.91
345.000	4713.000	symbol:175	-156.01	1.85
347.000	4713.000	symbol:175	-163.65	1.97
349.000	4713.000	symbol:175	-164.07	2.04
341.000	4711.000	symbol:175	-151.51	2.04
343.000	4711.000	symbol:175	-149.66	2.03
345.000	4711.000	symbol:175	-151.89	2.08
347.000	4711.000	symbol:175	-159.34	2.14
349.000	4711.000	symbol:175	-160.90	2.15

Table G-7

Sample time-series file

Timeseries at gridpoint (50 , 50)

YEAR	MONTH	DAY	HOUR	U (m/s) Layer 1	V (m/s) Layer 1	T (K) Layer 1	W (cm/s) Layer 1	U (m/s) Layer 3	V (m/s) Layer 3	T (K) Layer 5	PG class	U* (m/s)	Lmo (m)	W* (cm/s)	Prec.Rate (mm/hr)	Mix.Hgt (m)
1999	5	5	0	-1.03	1.05	302.60	-0.01	-1.36	1.94	300.01	6.00	0.06	9.61	0.00	0.00	50.00
1999	5	5	1	-1.43	1.37	302.00	-0.01	-1.83	2.22	299.85	6.00	0.08	9.61	0.00	0.00	50.73
1999	5	5	2	-1.48	1.45	302.00	0.01	-2.19	2.42	299.84	6.00	0.08	9.61	0.00	0.00	52.61
1999	5	5	3	-1.60	1.55	300.90	0.01	-2.37	2.57	299.85	6.00	0.09	9.61	0.00	0.00	57.44
1999	5	5	4	-2.78	0.50	300.40	0.04	-3.96	0.97	301.07	6.00	0.16	22.12	0.00	0.00	101.91
1999	5	5	5	-3.22	0.68	300.90	0.04	-4.33	1.33	301.16	6.00	0.22	40.23	0.00	0.00	150.01
1999	5	5	6	-3.44	0.65	300.40	0.05	-4.74	1.51	301.24	5.00	0.24	48.60	0.00	0.00	171.50
1999	5	5	7	-3.11	0.76	302.00	0.08	-4.57	1.39	301.35	4.00	0.28	-83.34	54.80	0.00	385.96
1999	5	5	8	-0.97	0.99	305.90	-0.02	-1.58	1.60	302.04	2.00	0.17	-3.23	141.88	0.00	835.39
1999	5	5	9	0.14	0.87	308.10	-0.04	0.17	1.42	303.36	2.00	0.14	-0.99	166.22	0.00	1083.80
1999	5	5	10	1.30	0.90	309.30	-0.05	1.76	1.36	304.53	2.00	0.21	-2.32	226.88	0.00	1478.73
1999	5	5	11	2.29	1.24	310.40	-0.04	3.16	1.82	305.45	1.00	0.29	-6.18	259.44	0.00	1866.50
1999	5	5	12	3.05	1.49	310.40	-0.03	4.25	2.20	306.06	2.00	0.34	-13.50	247.61	0.00	2080.49
1999	5	5	13	3.39	2.02	300.39	-0.02	4.83	2.92	306.38	2.00	0.39	-15.35	286.77	0.00	2420.36
1999	5	5	14	3.88	2.00	310.40	-0.05	5.42	2.94	306.48	2.00	0.42	-19.66	294.99	0.00	2685.48
1999	5	5	15	3.87	2.07	309.30	-0.09	5.45	3.00	306.28	3.00	0.41	-29.08	250.31	0.00	2648.14
1999	5	5	16	3.60	1.95	300.90	-0.11	5.17	2.79	305.69	3.00	0.39	-24.09	253.93	0.00	2694.18
1999	5	5	17	3.23	1.09	309.30	-0.08	4.55	1.59	304.82	3.00	0.33	-21.79	217.85	0.00	2588.50
1999	5	5	18	2.28	0.64	307.60	-0.04	3.25	0.93	303.19	4.00	0.22	-28.73	130.22	0.00	2331.39
1999	5	5	19	0.66	-0.13	288.80	-0.04	1.08	-0.27	301.87	6.00	0.05	31.67	0.00	0.00	50.00
1999	5	5	20	-0.63	-1.41	305.90	0.00	-0.94	-2.06	301.86	6.00	0.06	9.61	0.00	0.00	50.14
1999	5	5	21	-1.65	-2.33	287.50	0.01	-2.09	-3.42	302.20	6.00	0.16	20.73	0.00	0.00	85.46
1999	5	5	22	-1.90	-2.69	305.40	0.03	-2.68	-3.92	302.71	6.00	0.22	41.12	0.00	0.00	136.69
1999	5	5	23	-2.00	-2.24	303.10	0.07	-2.65	-3.38	303.15	6.00	0.19	29.48	0.00	0.00	109.32
1999	5	6	0	-1.76	-1.68	302.60	0.10	-2.38	-2.51	303.25	5.00	0.16	35.06	0.00	0.00	113.73
1999	5	6	1	-2.02	-1.10	300.90	0.11	-2.55	-1.76	303.23	6.00	0.09	9.61	0.00	0.00	63.34
1999	5	6	2	-2.15	-0.80	300.90	0.11	-3.00	-1.15	303.20	6.00	0.09	9.61	0.00	0.00	63.78
1999	5	6	3	-2.52	-0.42	300.40	0.11	-3.56	-0.56	303.10	6.00	0.10	9.61	0.00	0.00	75.10
1999	5	6	4	-2.97	-0.10	300.40	0.09	-4.21	-0.05	303.02	6.00	0.18	27.49	0.00	0.00	116.24
1999	5	6	5	-3.34	0.21	300.40	0.07	-4.70	0.45	303.13	5.00	0.22	42.23	0.00	0.00	160.20
1999	5	6	6	-3.45	0.49	299.30	0.06	-4.80	0.92	303.12	5.00	0.24	47.43	0.00	0.00	170.29
1999	5	6	7	-3.20	0.77	300.40	0.10	-4.44	1.39	302.92	4.00	0.29	-92.25	48.46	0.00	337.95
1999	5	6	8	-0.38	1.36	305.90	0.05	-0.62	1.99	302.78	2.00	0.17	-3.38	160.81	0.00	1212.65
1999	5	6	9	0.41	1.20	308.10	0.01	0.60	1.93	303.38	2.00	0.17	-2.26	182.36	0.00	1428.56
1999	5	6	10	1.72	1.00	307.00	-0.01	2.33	1.54	304.25	2.00	0.24	-3.92	236.80	0.00	1698.22
1999	5	6	11	2.58	1.23	307.00	-0.02	3.54	1.84	305.16	2.00	0.31	-7.72	261.82	0.00	1942.90

G.2 APPEND

The APPEND program is designed to combine a set of sequential CALPUFF output data files into a single file with the same format, covering the entire period of the original collection of files. The files combined must be of the same type, containing either concentrations, wet deposition fluxes, dry deposition fluxes, or relative humidity data. The periods contained in the files should either overlap, or meet exactly (files start with the time period that follows the last period in the preceding file).

Table G-8 lists the input and output files for one application of APPEND. Both the control file name (APPEND.INP) and the list file name (APPEND.LST) are set in the program, so the user cannot change these. All CALPUFF output file names must be provided by the user, and these are placed in the control file. The control file structure is listed in Table G-9, and a sample control file is listed in Table G-10.

To run this program, place the executable and the control file (edited to reflect your application) in the same directory or folder, and enter the following command-line:

```
APPEND
```

The program will open the control file for your application, and follow the instructions. Messages appear on the screen as the program runs, and full documentation for the run is written to the list file. A sample list file is presented in Table G-11.

Table G-8
APPEND Input and Output Files

Unit	File Name	Type	Format	Description
io5	APPEND.INP	input	formatted	Control file containing user inputs
io6	APPEND.LST	output	formatted	List file containing APPEND application information
io10	MODEL.DAT	output	unformatted	CALPUFF output data file containing modeled concentration or deposition flux or relative humidity data, containing all periods
io21	MODEL1.DAT	input	unformatted	First sequential CALPUFF output data file containing modeled concentration or deposition flux or relative humidity data
io21 +(n-1)	MODELn.DAT	input	unformatted	Last of "n" sequential CALPUFF output data files containing modeled concentration or deposition flux or relative humidity data

Table G-9
APPEND Control File Structure

Record No.	Variable No.	Variable	Type	Description	Sample Values
1	1	ITYPE	integer	File type (1=concentration/flux, 2=relative humidity/visibility)	1
2	1	NFILES	integer	Number of files to append	3
3	1	CFILE (1)	character*70 array	File name for first CALPUFF data file in the sequence that will be appended	RUN1.CON
4	1	NSKIP (1)	integer array	Number of periods to skip over at the start of file 1	0
4	2	NHRS (1)	integer array	Total number of periods to read from file 1 (including NSKIP)	240
...	...	...	...	...	...
1+2* NFILES	1	CFILE (NFILES)	character*70 array	File name for last CALPUFF data file in the sequence that will be appended	RUN3.CON
2+2* NFILES	1	NSKIP (NFILES)	integer array	Number of periods to skip over at the start of the last file	0
2+2* NFILES	2	NHRS (NFILES)	integer array	Total number of periods to read from the last file (including NSKIP)	240
3+2* NFILES	1	CFILOUT	character*70 array	File name for the new CALPUFF data file (all periods)	CONC.DAT
4+2* NFILES	1	TITLEO (1)	character*80 array	Title record #1 for output data file	-
5+2* NFILES	1	TITLEO (2)	character*80 array	Title record #2 for output data file	-
6+2* NFILES	1	TITLEO (3)	character*80 array	Title record #3 for output data file	-

Table G-10

Sample APPEND Control File (APPEND.INP)

```
1                 - File type (1=conc/flux files, 2=RH/visibility files)
2                 - Number of input data files
cpuf.con
0, 2
cpuf2.con
2, 4
cpufapp.con
APPEND Demonstration
Reconstructing CALPUFF concentration file
Combine 2 hours from first and 2 hours from second file
```

Table G-11

Sample APPEND List File (APPEND.LST)

```
APPEND -- Version: 2.2        Level: 030402

  Number of input files (NFILES) =  2

  Names of input files:

     No.   1   Filename: cpuf.con
     No.   2   Filename: cpuf2.con


 Output Filename: cpufapp.con

  Title lines on new output file:
     APPEND Demonstration
     Reconstructing CALPUFF concentration file
     Combine 2 hours from first and 2 hours from second file

  Title lines from file No.:  1
     CALPUFF Demonstration Run



  Title lines from file No.:  2
     CALPUFF Demonstration Run



  Selected header record data
    CMODEL: CALPUFF
    VER:     5.7
    LEVEL:   030402
    IBYR:     1990
    IBJUL:    9
    IBHR:     5
    IRLG:     4
    IAVG:     1
    PMAP:    UTM
    DATUM:   NAS-C
    NX:       99
    NY:       99
    DXKM:     1.00000000
    DYKM:     1.00000000
    IONE:     1
    XORIGKM:  310.000000
    YORIGKM:  4820.00000
    NSSTA:    5
    IBCOMP:   1
    IECOMP:   99
    JBCOMP:   1
    JECOMP:   99
    IBSAMP:   29
    IESAMP:   48
    JBSAMP:   40
    JESAMP:   70
```

Table G-11 (Concluded)
Sample APPEND List File (APPEND.LST)

```
   MESHDN:   1
   NREC:     0
   NCTREC:   0
   LSGRID:   T
   NSPOUT:   7

 File      NPTS     NAREAS     NLINES     NVOLS
   1         1          0          0         0
   2         1          0          0         0

 SPECIES: SO2           1  SO4           1  NO            1  NO2           1  HNO3          1
NO3           1  PM10          1

  File:  1  Skipping:  0  Writing:  2
  File:  2  Skipping:  2  Writing:  2
 Skipping YR,DAY,HR =  1990 9 5  in File:  2
 Skipping YR,DAY,HR =  1990 9 6  in File:  2

 Number of hours processed:  4
```

G.3 CALSUM

The CALSUM program is designed to combine a set of CALPUFF output data files for individual sources or source groups into a single file with the same format. The concentrations or deposition fluxes in each file may be scaled using a linear operator of the form (a*X+b), where 'X' represents either the concentration or the flux, "a" is the multiplicative constant, and "b" is the additive constant (g/m^3 or $g/m^2/s$). The files combined must be of the same type, containing either concentrations, wet deposition fluxes, or dry deposition fluxes. The periods contained in the files must be identical.

Table G-12 lists the input and output files for one application of CALSUM. Both the control file name (CALSUM.INP) and the list file name (CALSUM.LST) are set in the program, so the user cannot change these. All CALPUFF output file names must be provided by the user, and these are placed in the control file. The control file structure is listed in Table G-13, and a sample control file is listed in Table G-14.

To run this program, place the executable and the control file (edited to reflect your application) in the same directory or folder, and enter the following command-line:

```
CALSUM
```

The program will open the control file for your application, and follow the instructions. Messages appear on the screen as the program runs, and full documentation for the run is written to the list file. A sample list file is presented in Table G-15.

Table G-12
CALSUM Input and Output Files

Unit	File Name	Type	Format	Description
io5	CALSUM.INP	input	formatted	Control file containing user inputs
io6	CALSUM.LST	output	formatted	List file containing CALSUM application information
io10	MODEL.DAT	output	unformatted	CALPUFF output data file containing modeled concentration or deposition flux data for all sources
io21	MODEL1.DAT	input	unformatted	First CALPUFF output data file containing modeled concentration or deposition flux data for first group of sources
io21 +(n-1)	MODELn.DAT	input	unformatted	Last of "n" CALPUFF output data files containing modeled concentration or deposition flux data for source group "n"

Table G-13
CALSUM Control File Structure

Record No.	Variable No.	Variable	Type	Description	Sample Values
1	1	NFILES	integer	Number of files to combine	3
2	1	CFILE (1)	character*70 array	File name for first CALPUFF data file that will be combined	SRC1.CON
...	...	...	...	...	...
1+ NFILES	1	CFILE (NFILES)	character*70 array	File name for last CALPUFF data file that will be combined	SRC3.CON
2+ NFILES	1	CFILOUT	character*70 array	File name for the new CALPUFF data file (all sources)	CONC.DAT
3+ NFILES	1	LCOMPRO	logical	Data compression used in output file? (T/F)	T
4+ NFILES	1	NSPEC	integer	Number of species in each of the files	3
4+ NFILES +1	1 to 2*NSPEC	ASCALE, BSCALE	real array	Scaling factors a,b for each species for the first file that will be combined (B in g/m^3 or $g/m^2/s$)	2.0,0.0001, 2.0,0.0001, 2.0,0.0001
...	...	...	...	...	...
4+2* NFILES	1 to 2*NSPEC	ASCALE, BSCALE	real array	Scaling factors a,b for each species for the last file that will be combined (B in g/m^3 or $g/m^2/s$)	1.0,0.000, 1.0,0.000, 1.0,0.000
5+2* NFILES	1	TITLEO (1)	character*80 array	Title record #1 for output data file	-
6+2* NFILES	1	TITLEO (2)	character*80 array	Title record #2 for output data file	-
7+2* NFILES	1	TITLEO (3)	character*80 array	Title record #3 for output data file	-

Table G-14
Sample CALSUM Control File (CALSUM.INP)

```
2                                                                    - Number of files
cpuf.con                                                             - INPUT file name
cpuf2.con                                                            - INPUT file name
cpufsum.con                                                          - OUTPUT file name
T                              - Compression flag for OUTPUT file (T, F)
7                              - Number of species
.5 .0 .5 .0 .5 .0 .5 .0 .5 .0 .5 .0 .5 .0    - Scaling factors (aX+b) for each species and file
.5 .0 .5 .0 .5 .0 .5 .0 .5 .0 .5 .0 .5 .0    - Scaling factors (file #2)
CALSUM output file - Example CALPUFF Application
Sum of concentrations from 2 identical CALPUFF Files
                               Scale values by 0.5 before summing
```

Table G-15
Sample CALSUM List File (CALSUM.LST)

```
CALSUM -- Version: 1.2        Level: 030402
NFILES =  2

Names of input files:

    No.   1   Filename: cpuf.con
    No.   2   Filename: cpuf2.con

Name of output file:

       Output Filename: cpufsum.con

Output file compressed? (LCOMPRO) =  T


Scaling factors (of form X(new) = X(old)*ASCALE + BSCALE) for each species

No. species (NSPEC) =      7
File:     1(ASCALE, BSCALE):
     5.00000E-01       0.00000E+00 5.00000E-01       0.00000E+00 5.00000E-01       0.00000E+00
     5.00000E-01       0.00000E+00 5.00000E-01       0.00000E+00 5.00000E-01       0.00000E+00
     5.00000E-01       0.00000E+00
File:     2(ASCALE, BSCALE):
     5.00000E-01       0.00000E+00 5.00000E-01       0.00000E+00 5.00000E-01       0.00000E+00
     5.00000E-01       0.00000E+00 5.00000E-01       0.00000E+00 5.00000E-01       0.00000E+00
     5.00000E-01       0.00000E+00

BSCALE is in grams/m**3

NOTE: When using BSCALE to add a constant background concentration
      this is normally done by apply BSCALE to one CALPUFF
      output file only, with SCALE=0 for the other files

Title lines on new output file:
    CALSUM output file - Example CALPUFF Application
    Sum of concentrations from 2 identical CALPUFF Files
    Scale values by 0.5 before summing

Title lines from file No.:  1
    CALPUFF Demonstration Run



Title lines from file No.:  2
    CALPUFF Demonstration Run
```

Table G-15 (Concluded)
Sample CALSUM List File (CALSUM.LST)

```
 Data from header records of File #1
    CMODEL: CALPUFF
    VER:     5.7
    LEVEL:   030402
    IBYR:     1990
    IBJUL:    9
    IBHR:     5
    IRLG:     4
    IAVG:     1
    PMAP:    UTM
    DATUM:   NAS-C
    NX:       99
    NY:       99
    DXKM:     1.00000000
    DYKM:     1.00000000
    IONE:     1
    XORIGKM:  310.000000
    YORIGKM:  4820.00000
    NSSTA:    5
    IBCOMP:   1
    IECOMP:   99
    JBCOMP:   1
    JECOMP:   99
    IBSAMP:   29
    IESAMP:   48
    JBSAMP:   40
    JESAMP:   70
    MESHDN:   1
    NREC:     0
    NCTREC:   0
    LSGRID:   T
    NSPOUT:   7

 File      NPTS     NAREAS     NLINES     NVOLS
    1         1          0          0         0
    2         1          0          0         0

 SPECIES: SO2           1  SO4           1  NO            1  NO2           1  HNO3          1
NO3           1  PM10          1

 Number of hours processed:  5
```

G.4 POSTUTIL

POSTUTIL operates on one or more CALPUFF concentration or wet/dry deposition flux files to create a new file that can be analyzed by CALPOST. Species in the new file may include all species in these files, they may be a subset of these, or they may be new species constructed as weighted combinations of the modeled species. If nitrates are modeled, the partition between nitric acid and nitrate can be recalculated based on total available sulfate and ammonia. Specific capabilities and options include:

- User-selected processing period.
- User-selected chemical species to process.
- User-selected chemical species to output.
- User-defined (new) chemical species to construct and output (e.g., total S and Total N deposition).
- Option to sum wet and dry deposition fluxes to a total flux species.
- Option to repartition nitric acid/nitrate based on total available sulfate and ammonia.
- Option to scale all concentration/deposition flux data by means of a linear function of the form: a*X + b (where X is concentration or deposition, and a,b are user-supplied constants).
- Option to add an hourly, receptor-specific background concentration/deposition flux.

Typical uses for POSTUTIL include:

- Scaling and summing results obtained from CALPUFF applications to different source groups. This is similar to CALSUM, but the files that are combined do not need to contain the same species. Negative scale factors can be used to obtain difference fields suitable for assessing increment consumption.
- Combining species sets modeled in different CALPUFF applications, as when MESOPUFF II chemical transformation is modeled in one CALPUFF application, and secondary organic aerosol (SOA) formation is modeled in another CALPUFF application (both would be needed in one file to assess visibility).
- Summing wet and dry deposition fluxes to obtain the total deposition flux as a new species.
- Computing the total sulfur and the total nitrogen deposition flux associated with ammonium sulfate and ammonium nitrate.
- Repartitioning nitrates to be consistent with the total available sulfate and ammonia due to all sources and background, prior to assessing visibility with CALPOST.

Table G-9 lists the default name of each input and output file associated with POSTUTIL.

Table G-16
POSTUTIL Input and Output Files

Unit	Default File Name	Type	Format	Description
in2	POSTUTIL.INP	input	formatted	Control file containing user inputs
in1	CALPUFF.DAT	input	unformatted	First CALPUFF format data file containing modeled concentration or deposition flux data
in1 +(n-1)	(none)	input	unformatted	Last of "n" CALPUFF format data files containing modeled concentration or deposition flux data
in4	MET.DAT	input	unformatted	Optional file of meteorological data from CALMET
io1	POSTUTIL.LST	output	formatted	List file containing POSTUTIL application information
io2	MODEL.DAT	output	unformatted	Data file containing POSTUTIL results (CALPUFF format)

The name and full path of each file (except one) is assigned in the control file. The exception, the control filename itself, is assigned on the command line. For example, on a DOS system,

```
POSTUTIL   d:\MYWORK\UTIL1.INP
```

will execute the POSTUTIL code in the current working directory, and read the input and output filenames for the current run from the control file UTIL1.INP in the directory d:\MYWORK. If the control filename is not specified on the command line, the default control filename (i.e., POSTUTIL.INP in the current working directory) will be used. The total number of characters in the path and filename can be up to 70 characters.

The POSTUTIL control file is configured using any standard text editor (e.g., NOTEPAD). It uses the general CALPUFF control file structures, containing several input groups with module inputs set within a pair of special delimiter characters (!). All documentation associated with these inputs is written outside of these delimiters. A description of each input variable is shown in Table G-17.

A sample control file that illustrates a common POSTUTIL application for obtaining total sulfur and total nitrogen deposition fluxes is provided in Table G-18. The top of the control file contains three lines that are reserved for identifying the application. These lines are written to the output file, and become part of the documentation in subsequent processing.

Input Group: 0

Input Group 0 identifies the input and output files for the application. The output consists of a list file that documents how this application of POSTUTIL is configured, and a data file that is identical in form to the binary data files created by CALPUFF. In this sample, the data file is given the generic name 'cpuf.flx' (!UTLDAT = CPUF.FLX!) to indicate that wet and dry fluxes are summed, and that total sulfur and total nitrogen are added the list of species in the file. The list file is given the default name (!UTLLST = POSTUTIL.LST!). More specific names should be used in typical applications.

Input files include one or more CALMET meteorological data files and one or more CALPUFF binary files. A CALMET file is not needed for this application because no nitrate partitioning will be calculated (MNITRATE=0), but is included in the control file to illustrate the format. Two CALPUFF binary files are needed for this application: one for the dry deposition flux, and one for the wet deposition flux. Therefore !NFILES = 2! and two filenames are provided in Subgroup 0b:

```
! MODDAT =WFLX.DAT   !   !END!
! MODDAT =DFLX.DAT   !   !END!
```

Table G-17
POSTUTIL Control File Inputs - Input Group 0
Input and Output File Names

Variable	Type	Description	Default
UTLLST	character*70	File name of list file of information output from POSTUTIL application, including path if desired	POSTUTIL.LST
UTLDAT	character*70	File name of CALPUFF format data file created by POSTUTIL application, including path if desired	MODEL.DAT
NMET	integer	Number of CALMET data files input for processing	0
NFILES	integer	Number of CALPUFF data files input for processing	1
LCFILES	logical	Control flag for converting file names to lower case if T, or to upper case if F	T
UTLMET	character*70	NMET file names of CALMET data files needed by POSTUTIL application, including path if desired (used only if MNITRATE = 1)	MET.DAT
MODDAT	character*70	NFILES file names of CALPUFF data files processed by POSTUTIL application, including path if desired	CALPUFF.DAT

Table G-17 (Continued)
POSTUTIL Control File Inputs - Input Group 1
General Run Control Parameters

Variable	Type	Description	Default
ISYR	integer	Starting year of data to process (four digits)	-
ISMO	integer	Starting month	-
ISDY	integer	Starting day	-
ISHR	integer	Starting hour (0-23). Uses ending hour convention (e.g., Hour 1 refers to the period from 0:00 - 1:00).	-
NPER	integer	Number of periods to process	-
NSPECINP	integer	Number of modeled species to process from input CALPUFF data files	-
NSPECOUT	integer	Number of species to write to output CALPUFF format data file	-
NSPECCMP	integer	Number of new species computed from the modeled species that are processed (must be no greater than NSPECOUT)	-
MDUPLCT	integer	Stop run if any of the NSPECINP species names are found in more than one data file 0 = no (i.e., duplicate species are summed) 1 = yes (i.e., run is halted)	0
NSCALED	integer	Number of input CALPUFF data files for which scaling factors are provided in Group 2d by species (must be no greater than NFILES)	0
MNITRATE	integer	Option to repartition HNO3/NO3 concentrations prior to performing other actions (does not alter deposition fluxes) 0 = no 1 = yes, for all sources combined (requires MET.DAT) 2 = yes, for a source group, based on ratio of species HNO3ALL/NO3ALL	0
BCKNH3	real	Background ammonia concentration (ppb) used to repartition nitrates when ammonia is NOT a modeled species (used only when MNITRATE=1)	10.

Table G-17 (Concluded)
POSTUTIL Control File Inputs - Input Group 2
Species Processing Information

Variable	Type	Description	Default
ASPECI	character*12	Subgroup 2a: Input species names to process (NSPECINP names)	-
ASPECO	character*12	Subgroup 2b: Output species names (NSPECOUT names)	-
CSPECCMP	character*12	Subgroup 2c: (if NSPECCMP > 0) Names for new species created (NSPECCMP names), followed by the scaling factor for each of the NSPECINP species that are processed (use species names to assign scaling factors)	-
MODDAT	character*70	Subgroup 2d: (if NSCALED > 0) File name for each input CALPUFF data file that is scaled before being processed (NSCALED names must be a subset of the MODDAT file names provided in Group 0)	-
A,B	real	Subgroup 2d: (if NSCALED > 0) Scaling constants for linear scaling of the form (A*x+B). Provide NSCALED groups of A,B values, one group per input CALPUFF data file that is scaled. Each group consists of the MODDAT identifying the file, and the pair of scaling parameters for each species in the file.	1.0, 0.0

Table G-18
Sample POSTUTIL Control File (POSTUTIL.INP)
Input Group 0

```
Example application for total deposition fluxes (wet & dry)
Nitrogen deposition due to NO, NO2, HNO3, NH4NO3, and (NH4)2SO4
Sulfur deposition due to SO2, (NH4)2SO4
---------------- Run title (3 lines) ------------------------------------------
                   POSTUTIL MODEL CONTROL FILE
                   --------------------------
------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

-------------
Subgroup (0a)
-------------

Output Files
------------

 File            Default File Name
 ----            -----------------
 List File       POSTUTIL.LST       ! UTLLST =POSTUTIL.LST   !
 Data File       MODEL.DAT          ! UTLDAT =CPUF.FLX       !

Input Files
-----------
 Meteorological data files are needed for the HNO3/NO3 partition option.
 The met data file is the 'CALMET.DAT' format file used in the CALPUFF
 simulation.  If multiple CALMET files had been used in sequence, you
 may list all of these files in subgroup 0b.  Specify the total number
 of CALMET files runs you need to use, and provide the filename for each
 in subgroup 0b.

     Number of CALMET data files (NFILES)
                                    Default: 0       ! NMET    = 1   !

 A number of CALPUFF data files may be processed in this application.
 The files may represent individual CALPUFF simulations that were made
 for a specific set of species and/or sources.  Specify the total number
 of CALPUFF runs you wish to combine, and provide the filename for each
 in subgroup 0b.

     Number of CALPUFF data files (NFILES)
                                    Default: 1       ! NFILES  = 2   !

 All filenames will be converted to lower case if LCFILES = T
 Otherwise, if LCFILES = F, filenames will be converted to UPPER CASE

     Convert filenames to lower case?  Default: T     ! LCFILES = T !
         T = lower case
         F = UPPER CASE
!END!
------------------------------------------------------------
 NOTE: file/path names can be up to 70 characters in length
------------------------------------------------------------
```

Table G-18 (Continued)
Sample POSTUTIL Control File (POSTUTIL.INP)
Input Group 0

```
-------------
Subgroup (0b)
-------------

NMET CALMET Data Files:

Input File      Default File Name
----------      -----------------
   1            MET.DAT            ! UTLMET =CALMET.DAT  ! !END!


Input File      Default File Name
----------      -----------------
   1            CALPUFF.DAT        ! MODDAT =CPUF.WET    ! !END!
   2            (none)             ! MODDAT =CPUF.DRY    ! !END!


-------------
Note:  provide NMET lines of the form   * UTLMET = name * *END*
       and NFILES lines of the form     * MODDAT = name * *END*
       where the * should be replaced with an exclamation point,
       the special delimiter character.
```

Table G-18 (Continued)
Sample POSTUTIL Control File (POSTUTIL.INP)
Input Group 1

```
------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

     Starting date:    Year  (ISYR) --    No default   ! ISYR  =  1990 !
                       Month (ISMO) --    No default   ! ISMO  = 1   !
                       Day   (ISDY) --    No default   ! ISDY  = 9   !
                       Hour  (ISHR) --    No default   ! ISHR  = 5   !

     Number of periods to process
                               (NPER) -- No default   ! NPER  = 4   !

     Number of species to process from CALPUFF runs
                           (NSPECINP) -- No default   ! NSPECINP = 7 !

     Number of species to write to output file
                           (NSPECOUT) -- No default   ! NSPECOUT = 3 !

     Number of species to compute from those modeled
     (must be no greater than NSPECOUT)
                           (NSPECCMP) -- No default   ! NSPECCMP = 2 !


 When multiple files are used, a species name may appear in more than
 one file.  Data for this species will be summed (appropriate if the
 CALPUFF runs use different source groups).  If this summing is not
 appropriate, remove duplicate species from the file(s).

     Stop run if duplicate species names
     are found? (MDUPLCT)            Default: 0       ! MDUPLCT  =  0  !
        0 = no  (i.e., duplicate species are summed)
        1 = yes (i.e., run is halted)

 Data for each species in a CALPUFF data file may also be scaled as
 they are read.  This can be done to alter the emission rate of all
 sources that were modeled in a particular CALPUFF application.
 The scaling factor for each species is entered in Subgroup (2d), for
 each file for which scaling is requested.

     Number of CALPUFF data files that will be scaled
     (must be no greater than NFILES)
     (NSCALED)                       Default: 0       ! NSCALED = 0 !
```

Table G-18 (Continued)
Sample POSTUTIL Control File (POSTUTIL.INP)
Input Group 1

```
Option to recompute the HNO3/NO3 concentration partition prior to
performing other actions.  This option will NOT alter any deposition
fluxes contained in the CALPUFF file(s).  Two partition selections
are provided.  The first (MNITRATE=1) computes the partition for the
TOTAL (all sources) concentration fields (SO4, NO3, HNO3; NH3), and
the second (MNITRATE=2) uses this partition (from a previous application
of POSTUTIL) to compute the partition for individual source groups.

Required information for MNITRATE=1 includes:
          species NO3, HNO3, and SO4
          NH3 concentration(s)
          met. data file for RH and T

Required information for MNITRATE=2 includes:
          species NO3 and HNO3 for a source group
          species NO3ALL and HNO3ALL for all source groups, properly
                  partitioned

    Recompute the HNO3/NO3 partition for concentrations?
    (MNITRATE)                    Default: 0       ! MNITRATE  =  0  !
       0 = no
       1 = yes, for all sources combined
       2 = yes, for a source group

    Ammonia concentrations may be available as a modeled species in
    the CALPUFF files.  When NH3 is listed as a processed species in
    Subgroup (2a) (as one of the NSPECINP ASPECI entries), the
    modeled values will be used in the chemical equilibrium calculation.
    If NH3 is not on this list, the default background value listed
    below will be used.
    Default ammonia concentration (ppb) used for HNO3/NO3 partition:
    (BCKNH3) in ppb               Default: 10.     ! BCKNH3 = 1. !

!END!
```

Table G-18 (Concluded)
Sample POSTUTIL Control File (POSTUTIL.INP)
Input Group 2

```
INPUT GROUP: 2 -- Species Processing Information
--------------

-------------
Subgroup (2a)
-------------

  The following NSPECINP species will be processed:

! ASPECI =          SO2 !         !END!
! ASPECI =          SO4 !         !END!
! ASPECI =          NO  !         !END!
! ASPECI =          NO2 !         !END!
! ASPECI =         HNO3 !         !END!
! ASPECI =          NO3 !         !END!
! ASPECI =         PM10 !         !END!

-------------
Subgroup (2b)
-------------

  The following NSPECOUT species will be written:

! ASPECO =            N !         !END!
! ASPECO =            S !         !END!
! ASPECO =         PM10 !         !END!

-------------
Subgroup (2c)
-------------

  The following NSPECCMP species will be computed by scaling and summing
  one or more of the processed input species.  Identify the name(s) of
  the computed species and provide the scaling factors for each of the
  NSPECINP input species (NSPECCMP groups of NSPECINP+1 lines each):

! CSPECCMP =        N !
!     SO2  =     0.0 !
!     SO4  =     0.291667 !
!     NO   =     0.466667 !
!     NO2  =     0.304348 !
!    HNO3  =     0.222222 !
!     NO3  =     0.451613 !
!    PM10  =     0.0 !
!END!

! CSPECCMP =        S !
!     SO2  =     0.500000 !
!     SO4  =     0.333333 !
!     NO   =     0.0 !
!     NO2  =     0.0 !
!    HNO3  =     0.0 !
!     NO3  =     0.0 !
!    PM10  =     0.0 !
!END!

-------------
Subgroup (2d)
-------------

  Each species in NSCALED CALPUFF data files may be scaled before being
  processed (e.g., to change the emission rate for all sources modeled
  in the run that produced a data file).  For each file, identify the
  file name and then provide the name(s) of the scaled species and the
  corresponding scaling factors (A,B where x' = Ax+B).

              A(Default=1.0)      B(Default=0.0)
              --------------      --------------
* MODDAT =NOFILES.DAT    *
*     SO2  =      1.1,                0.0   *
*     SO4  =      1.5,                0.0   *
*    HNO3  =      0.8,                0.0   *
*     NO3  =      0.1,                0.0   *
*END*
```

Note the location of the input terminator !END!. This terminator signals the end of a group or a subgroup in the control file, and it also signals the end of an assignment for variables such as MODDAT that appear multiple times.

Input Group: 1

Input Group 1 identifies the period to process, and sets parameters that configure POSTUTIL. Note that there is no "run all periods" option as in CALPUFF or CALPOST, so that the period must be explicitly stated.

Three "nspec" variables are set:
NSPECINP identifies the number of species that are stored as the input data files are read.
NSPECOUT identifies the number of species that are written to the output data file.
NSPECCMP identifies the number of new species that are computed from those that are stored.

For example, you may wish to store 7 of 12 species from the input files, and you may wish to compute 3 new species from these 7, and write the 3 new species plus 5 of the stored species to the output data file for analysis with CALPOST. In this sample, the 6 chemical transformation species are stored, plus the PM10 (! NSPECINP = 7 !), because all 6 are needed to compute the 2 new species (! NSPECCMP = 2 !), the total sulfur and the total nitrogen fluxes. The original PM10 plus the 2 new species are written to the output data file (! NSPECOUT = 3 !) so that the sum of the wet and dry fluxes are available for further analysis.

Input Group: 2

The NSPECINP species that are stored for processing are named in Subgroup 2a. Species names must match those used in the CALPUFF runs, but may be entered in any order. Each is read into the data dictionary variable ASPECI.

Similarly, the NSPECOUT species are named in Subgroup 2b. These names include the original PM10 species, plus the two new species for total sulfur (S) and total nitrogen (N). Each is read into the data dictionary variable ASPECO.

Subgroup 2c provides the information required to compute the new species. New species concentrations or deposition fluxes are constructed using a weighted sum of the concentrations or deposition fluxes of all of the stored species. The weight for each species is entered here. Only SO_2 and SO_4 contribute sulfur mass. Nitrogen mass is contributed by SO_4 (CALPUFF tracks ammonium sulfate as SO_4), NO, NO_2, HNO_3, and NO_3 (CALPUFF tracks ammonium nitrate as NO3). The atomic weights for the constituent elements are sulfur = 32, oxygen = 16, nitrogen = 14, and hydrogen = 1. The molecular formula for ammonium sulfate is $(NH_4)_2SO_4$ and ammonium nitrate is $(NH_4)NO_3$. Therefore:

1 g of SO_2	contributes 0.500000 g of S
1 g of SO_4	contributes 0.333333 g of S
1 g of SO_4	contributes 0.291667 g of N
1 g of NO	contributes 0.466667 g of N
1 g of NO_2	contributes 0.304348 g of N
1 g of HNO_3	contributes 0.222222 g of N
1 g of NO_3	contributes 0.452623 g of N

As illustrated in the sample control file, each new species is identified by name using the data dictionary variable CSPECCMP, and then each species weight is assigned by name. These species names must match those NSPECINP names already provided in subgroup 2a. The !END! terminates each of the NSPECCMP groups.

Subgroup 2d is not used in this sample, and could have been deleted from the file. Its structure is similar to that of subgroup 2c. There must be NSCALED groups provided, and each group is closed with the !END! terminator. Within each group, the file that is scaled is identified by name, assigned to the data dictionary variable MODDAT. This name must match one of the file names provided in subgroup 0b. After the file is identified, the scaling parameters are assigned to each species by name. Again, the species names must match those NSPECINP names assigned in subgroup 2a.

A sample list file is shown in Table G-19. The top part of the file repeats the records from the control file. The remainder of the file restates the major selections, reports any warning messages, lists information from the header of each CALPUFF data file that is processed, and it reports the full species names that are read and written.

Table G-19
Sample POSTUTIL List File (POSTUTIL.LST)
(Partial Listing)

```
*************************************************************************************************************
                                        POSTUTIL Version 1.3          Level 030402
*************************************************************************************************************

  POSTUTIL Control File Input Summary -----------------------

                      Run starting date -- year: 1990
                                         month:    1
                                           day:    9
                                     Julian day:    9
                 time beginning  -  hour(0-23):    4
                                 -      second:    0
                           Run length (periods):    4


 Note: the length of a period is controlled by
       the averaging time selected in the model

 Partition between HNO3 and NO3 is NOT computed

       Species needed from input file --
                             SO2
                             SO4
                             NO
                             NO2
                             HNO3
                             NO3
                             PM10

       Species written to output file --
                             N
                             S
                             PM10

  Species computed from input species --

                             N            =
                               0.0000E+00 * SO2
                               0.2917E+00 * SO4
                               0.4667E+00 * NO
                               0.3043E+00 * NO2
                               0.2222E+00 * HNO3
                               0.4516E+00 * NO3
                               0.0000E+00 * PM10

                             S            =
                               0.5000E+00 * SO2
                               0.3333E+00 * SO4
                               0.0000E+00 * NO
                               0.0000E+00 * NO2
                               0.0000E+00 * HNO3
                               0.0000E+00 * NO3
                               0.0000E+00 * PM10
```

Table G-19 (Continued)
Sample POSTUTIL List File (POSTUTIL.LST)
(Partial Listing)

```
 PROCESSED MODEL FILE ---------- Number  1

 CALPUFF     5.7         030402

 CALPUFF Demonstration Run

Averaging time for values reported from model:
       1    HOUR

 Number of averaging periods in file from model:
       4

 Chemical species names for each layer in model:
 SO2          WF
 SO4          WF
 NO           WF
 NO2          WF
 HNO3         WF
 NO3          WF
 PM10         WF

  msyr,mjsday      = 1990 9
  mshr,mssec       = 4 0
  nsecdt (period)  = 3600
  mnper,nszout,mavgpd = 4 7 1
  xorigkm,yorigkm,nstas =  310.000000 4820.00000 5
  ielmet,jelmet = 99 99
  delx,dely,nz = 1.00000000 1.00000000 1
  iastar,iastop,jastar,jastop = 1 99 1 99
  isastr,isastp,jsastr,jsastp = 29 48 40 70
  (computed) ngx,ngy  = 20 31
  meshdn,npts,nareas  = 1 1 0
  nlines,nvols        = 0 0
  ndrec,nctrec,LSGRID = 0 0 T


 PROCESSED MODEL FILE ---------- Number  2

 CALPUFF     5.7         030402

 CALPUFF Demonstration Run


 Averaging time for values reported from model:
       1    HOUR

 Number of averaging periods in file from model:
       4

 Chemical species names for each layer in model:
 SO2          DF
 SO4          DF
 NO           DF
 NO2          DF
 HNO3         DF
 NO3          DF
 PM10         DF
```

Table G-19 (Continued)
Sample POSTUTIL List File (POSTUTIL.LST)
(Partial Listing)

```
 msyr,mjsday      = 1990 9
 mshr,mssec       = 4 0
 nsecdt (period)  = 3600
 mnper,nszout,mavgpd = 4 7 1
 xorigkm,yorigkm,nstas =  310.000000 4820.00000 5
 ielmet,jelmet = 99 99
 delx,dely,nz = 1.00000000 1.00000000 1
 iastar,iastop,jastar,jastop = 1 99 1 99
 isastr,isastp,jsastr,jsastp = 29 48 40 70
 (computed) ngx,ngy  = 20 31
 meshdn,npts,nareas  = 1 1 0
 nlines,nvols        = 0 0
 ndrec,nctrec,LSGRID = 0 0 T



**************   WARNING   ***************
Requested input species name exists in more
than one data file. Species will be summed
  Species Name: SO2

**************   WARNING   ***************
Requested input species name exists in more
than one data file. Species will be summed
  Species Name: SO4

**************   WARNING   ***************
Requested input species name exists in more
than one data file. Species will be summed
  Species Name: NO

**************   WARNING   ***************
Requested input species name exists in more
than one data file. Species will be summed
  Species Name: NO2

**************   WARNING   ***************
Requested input species name exists in more
than one data file. Species will be summed
  Species Name: HNO3

**************   WARNING   ***************
Requested input species name exists in more
than one data file. Species will be summed
  Species Name: NO3

**************   WARNING   ***************
Requested input species name exists in more
than one data file. Species will be summed
  Species Name: PM10


 Chemical species names written to new file:
 N            TF
 S            TF
 PM10         TF
```

Table G-19 (Concluded)
Sample POSTUTIL List File (POSTUTIL.LST)
(Partial Listing)

```
-------------------------------------------------------------------------------------------------------------
         INPUT FILES

Default Name     Unit No.     File Name and Path
------------     --------     ------------------
POSTUTIL.INP         5        postutil.inp
 CALPUFF.DAT        10        cpuf.wet
     (none)         11        cpuf.dry


-------------------------------------------------------------------------------------------------------------
         OUTPUT FILES

Default Name     Unit No.     File Name and Path
------------     --------     ------------------
POSTUTIL.LST         7        postutil.lst
   MODEL.DAT         8        cpuf.flx
```

G.5 CALPOST

The CALPOST program is a postprocessor designed to average and report concentration or wet/dry deposition flux results based on the hourly data contained in the CALPUFF output file. If the CALPUFF application had been configured to provide concentrations needed to assess visibility, CALPOST can also compute extinction coefficients for visibility-related impacts. A range of averaging times may be selected, and the results may be reported in a number of different formats (e.g. rank tables and plots; exceedance tables and plots). Capabilities and options include:

- User-selected processing period.
- User-selected averaging times, including option for one defined by the user.
- User-selected chemical species.
- User-selected units for reporting concentrations or deposition fluxes.
- Option to include gridded receptors, discrete receptors, and complex terrain receptors in any combination.
- Option to specify subsets of the gridded and discrete receptors.
- Option to report results by ring.
- Option to produce tables of the "top-50" average concentration/deposition flux data (includes time and receptor information) for specified averaging times.
- Option to produce tables of up to four "top-N" (user specifies the number N) ranked average concentration/deposition flux data at the selected receptors for specified averaging times.
- Option to produce tables of the number of exceedances of user-specified threshold values at the selected receptors for specified averaging times.
- Option to produce a table of the annual (or length-of-run) average concentration/deposition flux at the selected receptors.
- Option to print concentration/deposition flux averages for selected days.
- Option to produce a file of time-series of concentration/deposition flux averages for selected days.
- Option to produce files of time-series of the peak concentration/deposition flux average over all selected receptors for each selected averaging period. Each output file contains one averaging period.
- Option to produce plot-files in addition to the selected tables for the top N concentrations or deposition fluxes, the number of exceedances of the user-specified thresholds, and the concentration/deposition flux fields for a particular day.
- Option to scale all concentration/deposition flux data by means of a linear function of the form: a*X + b (where X is concentration or deposition, and a,b are user-supplied constants).
- Option to add an hourly background concentration/deposition flux from an external file.
- Option to produce visibility parameters, signaled by setting the species name to VISIB. Requires that CALPUFF is configured for visibility computations.

When CALPOST is directed to perform visibility calculations, most of the preceding options remain valid and determine how the computed extinction coefficients are averaged and reported. Additional options are provided to configure how the extinction coefficients are computed:

- Option to select which modeled species (sulfate, nitrate, fine/coarse particulate matter) are included in the extinction coefficient.
- Option to include background extinction when forming ranked tabulations, top-50 tabulations, or exceedance tabulations.
- Option to specify the extinction efficiency for each modeled species.
- User-selected method for obtaining the background extinction coefficients (non-speciated extinction coefficient, monthly speciated extinction coefficients, measured hourly extinction coefficients)

Whenever visibility processing is selected, the peak daily percent change in extinction and the corresponding change in deciview are always tabulated and reported in addition to the tables and plot-files selected to characterize the extinction coefficient results.

Table G-20 lists the default name of each input and output file associated with CALPOST. The plot-files are named automatically, with the user able to specify a pathname and character string to make the file names unique. The name and full path of each file (except one) is assigned in the control file. The exception, the control filename itself, is assigned on the command line. For example, on a DOS system,

```
CALPOST   d:\CALPUFF\CALPOST.INP
```

will execute the CALPOST code, and read the input and output filenames for the current run from the control file CALPOST.INP in the directory d:\CALPUFF. If the control filename is not specified on the command line, the default control filename (i.e., CALPOST.INP in the current working directory) will be used. The total number of characters in the path and filename can be up to 70 characters.

The utility routine that delivers a command line argument is system dependent. The function that provides the system clock time and system CPU time is also system or compiler-specific. All system-dependent or compiler-specific routines in CALPOST are isolated into a file called DATETM.xxx, where the file extension (.xxx) indicates the system for which the code is designed. For example, DATETM.HP contains code for Hewlett-Packard Unix systems, DATETM.SUN is for Sun Unix systems, DATETM.LAH is for Lahey FORTRAN-compiled PC-applications, and DATETM.MS is for Microsoft FORTRAN-compiled PC applications. By appending the correct system-dependent DATETM file onto the main CALPOST code, the code should run without any modifications.

Table G-20
CALPOST Input and Output Files

Unit	File Name	Type	Format	Description
in2	CALPOST.INP	input	formatted	Control file containing user inputs
in1	MODEL.DAT	input	unformatted	CALPUFF output file containing modeled concentration or deposition flux data
in3	VISB.DAT	input	unformatted	CALPUFF output file containing relative humidity data (required only for visibility applications)
in4	BACK.DAT	input	formatted	Optional file of hourly background concentrations
in5	VSRN.DAT	input	formatted	Optional file of hourly background extinction coefficients from transmissometer or nephelometer
io1	CALPOST.LST	output	formatted	List file containing CALPOST tables and other generated data
iot (1,3,24,n)	TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT	ouput	formatted	Time-series of (1,3,24,N)-hour averages
iop (1,3,24,n)	PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT	ouput	formatted	Time-series of PEAK (1,3,24,N)-hour average at selected receptors
mapu	RANK(ALL)_ASPEC_ttHR_CONC_TUNAM.DAT RANK(ii)_ASPEC_ttHR_CONC_TUNAM.GRD	output	formatted	Top Nth Rank Plot File in DATA format Top Nth Rank Plot File in GRID format

Filenames for optional files are constructed using a template that includes a pathname, optional user-supplied character(s), and automatically generated characters, where

tt = averaging period (e.g. 03)

ii = rank (e.g. 02)

DAT = DATA format (comma-delimited ASCII file in x, y, value1, value2, ... , value4 format)

GRD = GRID format (only for gridded receptors) compatible with Surfer plotting software

Table G-20 (concluded)
CALPOST Input and Output Files

Unit	File Name	Type	Format	Description
mapu	EXCEED_ASPEC_ttHR_CONC_XUNAM.DAT	output	formatted	Exceedance Plot File in DATA format
	EXCEED_ASPEC_ttHR_CONC_XUNAM.GRD			Exceedance Plot File in GRID format
mapu	yyyy_Mmm_Ddd_hh00(UTCszzzz)_L00_ASPEC_ttHR_CONC.DAT	output	formatted	Echo Plot File in DATA format
	yyyy_Mmm_Ddd_hh00(UTCszzzz)_L00_ASPEC_ttHR_CONC.GRD			Echo Plot File in GRID format
mapu	DAILY_VISIB_VUNAM.DAT	output	formatted	Daily Peak Summary of Visibility

Filenames for optional files are constructed using a template that includes a pathname, optional user-supplied character(s), and automatically generated characters, where

tt = averaging period (e.g. 03)

yyyy = year mm = month dd = day hh = ending hour (00-23)

szzzz = time added to UTC to obtain base time (szzzz = -0500 for time zone 5)

DAT = DATA format (comma-delimited ASCII file in x, y, value1, value2, ... , value4 format)

GRD = GRID format (only for gridded receptors) compatible with Surfer plotting software

CALPOST generates an output list file (default name: CALPOST.LST) and a set of optional files. The names for the optional files follow a fixed template, with one or more characters reserved for the user to specify in order to distinguish output from multiple applications. For example, a plot-file in GRID format containing the highest second-high 24-hour average concentration of species ASPEC at each receptor would be called:

RANK(02)_ASPEC_24HR_CONC_TEST1.grd

where "TEST1" is the user-specified run identifier. If the user does not enter a run identifier, the file would be called:

RANK(02)_ASPEC_24HR_CONC.grd

A plot-file in DATA format containing the number of exceedances of a 3-hour concentration threshold specified by the user for species ASPEC with a run identifier "TEST2" would be called:

EXCEED_ASPEC_03HR_CONC_TEST2.dat

Plot-files in GRID format containing 8-hour average concentrations of species ASPEC for Julian Day 112 in 1995 (April 22) in base time zone 5 (EST in the USA) would be called

1995_M04_D22_hh08(UTC-0500)_L00_ASPEC_08HR_CONC.GRD
1995_M04_D22_hh16(UTC-0500)_L00_ASPEC_08HR_CONC.GRD
1995_M04_D23_hh00(UTC-0500)_L00_ASPEC_08HR_CONC.GRD

A visibility analysis with a run identifier "TOTAL" would generate the plot-file:

DAILY_VISIB_TOTAL.DAT

As with CALPUFF and CALMET, CALPOST is configured by means of a parameter file, called PARAMS.PST, in which all of the array dimensions related to the number of gridded, discrete, and complex terrain receptors, the number of "top N" tables allowed, and the Fortran unit numbers associated with each input and output file are specified. If for a particular application, the user needs to increase the number of discrete receptors, for example, beyond the current maximum, a change to the value of the discrete receptor parameter in PARAMS.PST will automatically re-size all arrays related to this parameter upon recompilation of the CALPOST code.

G.6 CALPOST Input Files

G.6.1 User Control File (CALPOST.INP)

User-specified inputs to CALPOST are read from a control file whose default name is CALPOST.INP. A description of each input variable is shown in Table G-21, and a sample input file is presented in Table G-22. This control file uses the same self-documenting control file format as CALPUFF. See Section F.1 for a description of the control file input conventions. Selections may be made by either editing an existing control file, or by using the CALPOST GUI. Note that you can generate a new control file with all of the standard options and comments by saving the NEW.INP file from the GUI to disk.

G.6.2 CALPUFF Output Files (MODEL.DAT and VISB.DAT)

The program reads the concentration/deposition flux data from an unformatted data file (default name: MODEL.DAT) that is generated by the CALPUFF model (or CALGRID). CALPUFF also generates a file containing relative humidity data (default name: VISB.DAT), which is read by CALPOST if needed for the visibility option selected. The structure of these files is described in Section F-13.

G.6.3 Background Concentrations/Deposition Fluxes (BACK.DAT)

As an option, a spatially uniform, hourly background concentration/deposition flux can be added to modeled concentrations/deposition fluxes before averages are processed in CALPOST. These values are provided in a formatted ASCII file (default name: BACK.DAT) prepared by the user. Table G-23 lists the record structure for this file, and a partial listing of a sample file is presented in Table G-24.

Units for the background values may be different from those requested from CALPOST. Therefore, the scaling factor placed in the header record is an important feature. It converts the native units for the background concentrations to g/m^3 , or it converts the native units for background deposition fluxes to $g/m^2/s$. These are the internal units used in the CALPUFF output file. Any units conversion specified in the control file (parameter IPRTU) can then be applied uniformly to both the CALPUFF and background values. Note that the multiplicative and additive scaling factors (A, B) are not applied to the background values.

G.6.4 Visibility Measurements (VSRN.DAT)

CALPOST allows the use of visibility measurements to establish hourly background extinction for use in assessing the change in visibility resulting from modeled emissions. Two formats are supported for these data, and both are taken from the data files available on CD-ROM from the Interagency Monitoring of Protected Visual Environments (IMPROVE) program. When background extinction method number 4 is selected in the control file (MVISBK = 4), transmissometer measurements must be provided in the

IMPROVE format. Example records for this file are listed in Table G-25. When background extinction method number 5 is selected in the control file (MVISBK = 5), nephelometer measurements must be provided in the IMPROVE format. Example records for this file are listed in Table G-26.

CALPOST uses the content of one field in the file header record to identify which type of file is provided (it must be consistent with the MVISBK selection). The first 26 characters are read, and the characters in position 24-26 must be INS for the nephelometer data file. Subsequent data records are read using the following statements, where the variable meas is the extinction coefficient (Mm^{-1}):

```
Transmissometer Data
     read(in5,102) iyr,ijday,ihr,meas,ivflag,irh
102  format(7x,i2,5x,i3,1x,i2,2x,i5,22x,i2,17x,i2)

Nephelometer Data
     read(in5,101) iyr,ijday,ihr,meas,ivflag,rh
101  format(7x,i2,5x,i3,1x,i2,8x,i6,8x,i2,40x,40x,40x,11x,f7.2)
```

If similar measurements are available from other sources, they may be used in CALPOST by adhering to this file structure. Note that the transmissometer measurements are assumed to provide the total extinction coefficient, whereas the nephelometer measurements provide just the extinction coefficient due to particle scattering.

Table G-21
CALPOST Control File Inputs - Input group 0
Input and Output File Names

Variable	Type	Description	Default
MODDAT	character*132	File name of modeled concentration/deposition data file, including full path if desired	MODEL.DAT
VISDAT	character*132	File name of input relative humidity data file, including full path if desired (for visibility)	VISB.DAT
BACKDAT	character*132	File name of input hourly background concentration or deposition flux data file, including full path if desired	BACK.DAT
VSRDAT	character*132	File name of input hourly background light extinction data, including full path if desired	VSRN.DAT
PSTLST	character*132	File name of list file of output from CALPOST, including full path if desired	CALPOST.LST
TSPATH	character*132	Pathname for time-series files (optional: must not be blank if supplied)	(blank)
PLPATH	character*132	Pathname for plot-files (optional: must not be blank if supplied)	(blank)
TSUNAM	character*8	User-supplied characters for Time-series file names (optional: must not be blank if supplied)	(blank)
TUNAM	character*8	User-supplied characters for Top-N plot-file names (optional: must not be blank if supplied)	(blank)
XUNAM	character*8	User-supplied characters for Exceedance plot-file names (optional: must not be blank if supplied)	(blank)
EUNAM	character*8	User-supplied characters for Echo plot-file names (optional: must not be blank if supplied)	(blank)
VUNAM	character*8	User-supplied characters for Visibility plot-file names (optional: must not be blank if supplied)	(blank)
DVISDAT	character*132	File name for auxiliary visibility output , including full path if desired	DELVIS.DAT
LCFILES	logical	Control flag for converting file names to lower case if T, or to upper case if F	T

Table G-21 (Continued)
CALPOST Control File Inputs - Input Group 1
General Run Control Parameters

Variable	Type	Description	Default
METRUN	integer	Option to run all periods in CALPUFF file (0,1) 0 = no, run the period defined by ISYR, ISMO, ISDY, ISHR, and NHRS 1 = yes, run all periods found in the file instead of any period defined by ISYR, ISMO, ISDY, ISHR, and NHRS	0
ISYR	integer	Starting year of data to process (four digits)	-
ISMO	integer	Starting month [a]	-
ISDY	integer	Starting day [a]	-
ISHR	integer	Starting hour [a] (0-23). Uses ending hour convention (e.g., Hour 1 refers to the period from 0:00 - 1:00).	-
NHRS	integer	Number of hours to process [a]	-
NREP	integer	Process every "NREPth "hour of data 1 = process every hour 2 = process every 2nd hour 5 = process every 5th hour	1
ASPEC	character*12	Name of "species" to process [b]	-
ILAYER	integer	Code indicating layer of concentrations (always "1" when processing concentrations from CALPUFF, "-1" for dry deposition fluxes, "-2" for wet deposition fluxes, and "-3" for total deposition fluxes)	1
A	real	Multiplicative scaling factor applied to modeled concentrations or deposition fluxes (not applied if A = B = 0.0)	0.0
B	real	Additive factor applied to modeled concentrations or deposition fluxes (not applied if A = B = 0.0)	0.0
LBACK	logical	Add background concentrations/deposition fluxes from external file?	F

[a] Used only if METRUN = 0.

[b] Sample values of ASPEC: SO2, SO4, NOX, HNO3, NO3. For visibility calculations, the species name must be entered as VISIB, which is not a species name actually used in the CALPUFF run: the species included in the visibility calculations are selected by the LVSO4, LVNO3, etc. parameters.

Table G-21 (Continued)
CALPOST Control File Inputs - Input Group 1
General Run Control Parameters

Variable	Type	Description	Default
MSOURCE	integer	0 = Process only total reported contributions 1 = Sum all individual source contributions and process 2 = Run in TRACEBACK mode to identify source contributions at a SINGLE receptor	0
LG	logical	Process Gridded receptors?	F
LD	logical	Process Discrete receptors?	F
LCT	logical	Process CTSG complex terrain receptors?	F
LDRING	logical	Report results by receptor ring? (Used only if LD= T)	F
NDRECP	integer aray	Select specific discrete receptors (used only if LD=T) -1 = process ALL discrete receptors[c] 0 = discrete receptor not processed 1 = discrete receptor processed (Enter NREC values using repeated-value notation)[d]	-1
IBGRID	integer	X grid index of lower left corner of subset of gridded receptors to process if LG = T (-1[e] or 1 to NX)	-1[c]
JBGRID	integer	Y grid index of lower left corner of subset of gridded receptors to process if LG = T (-1[e] or 1 to NY)	-1[c]
IEGRID	integer	X grid index of upper right corner of subset of gridded receptors to process if LG = T (-1[e] or IBGRID to NX)	-1[c]
JEGRID	integer	Y grid index of upper right corner of subset of gridded receptors to process if LG = T (-1[e] or JBGRID to NY)	-1[c]
NGONOFF	integer	Number of gridded receptor rows provided in Subgroup 1a to identify specific gridded receptors to process	0
		(Optional Input Group 1a - Specific Gridded Receptors)	
NGXRECP	integer array	Sequence of 0,1 values (one for each gridded receptor in a row of the sampling grid) used to select individual gridded receptors 0 = gridded receptor not processed 1 = gridded receptor processed (Repeated value notation may be used)[f]	1

[c] Use -1 for the first discrete receptor to signal the use of all discrete receptors in the CALPUFF file.

[d] Explicitly turn each discrete receptor on/off (1/0). NREC receptors were used in the CALPUFF run, so NREC entries are needed in this array. These may be entered in groups: 3*1,2*0 is equivalent to 1,1,1,0,0.

[e] Use -1 for all 4 grid cell indices to signal the use of all gridded receptors.

[f] Enter NGONOFF lines which represent rows of the sampling grid, starting with the northernmost row that contains receptors to be excluded and ending with row 1 to the south (none may be skipped).

Table G-21 (Continued)
CALPOST Control File Inputs - Input Group 2
Visibility Parameters

Variable	Type	Description	Default
BTZONE	real	Base Time Zone for the CALPUFF simulation	0.
MFRH	integer	1 = IWAQM (1998) f(RH) curve (originally used with MVISBK=1) 2 = FLAG (2000) f(RH) tabulation 3 = EPA (2003) f(RH) tabulation	2
RHMAX	real	Maximum relative humidity (%) used in the particle growth equation for visibility processing	98
LVSO4	logical	Include modeled sulfate in extinction (T/F)	T
LVNO3	logical	Include modeled nitrate in extinction (T/F)	T
LVOC	logical	Include modeled organic carbon in extinction (T/F)	T
LVPMC	logical	Include modeled coarse particulates in extinction (T/F)	T
LVPMF	logical	Include modeled fine particulates in extinction (T/F)	T
LVEC	logical	Include modeled elemental carbon (T/F)	T
LVBK	logical	Include background in extinction when ranking for top-n, top-50, or exceedance tables (T/F)	T
SPECPMC	character*12	Species name for coarse particulates in MODEL. DAT	PMC
SPECPMF	character*12	Species name for coarse particulates in MODEL. DAT	PMF
		----- Extinction Efficiencies (m^2/g) -----	
EEPMC	real	Modeled coarse particulates	0.6
EEPMF	real	Modeled fine particulates	1.0
EEPMCBK	real	Background coarse particulates	0.6
EESO4	real	Ammonium Sulfate	3.0
EENO3	real	Ammonium Nitrate	3.0
EEOC	real	Organic Carbon	4.0
EESOIL	real	Soil Dust	1.0
EEEC	real	Elemental Carbon (soot)	10.0

Table G-21 (Continued)
CALPOST Control File Inputs - Input Group 2
Visibility Parameters

Variable	Type	Description	Default
LAVER	logical	Method used for the 24h-average of percent change of light extinction: Hourly ratio of source light extinction / background light extinction is averaged?	F
MVISBK	integer	Method used to obtain background extinction: 1 = Supply single light extinction and hygroscopic fraction - IWAQM (1993) RH adjustment applied to hygroscopic background and modeled sulfate and nitrate 2 = Compute extinction from speciated PM measurements (A) - Hourly RH adjustment applied to observed and modeled sulfate and nitrate - RH factor is capped at RHMAX 3 = Compute extinction from speciated PM measurements (B) - Hourly RH adjustment applied to observed and modeled sulfate and nitrate - Receptor-hour excluded if RH>RHMAX - Receptor-day excluded if fewer than 6 valid receptor-hours 4 = Read hourly transmissometer background extinction data - Hourly RH adjustment applied to modeled sulfate and nitrate - Hour excluded if measurement invalid (missing, interference, or large RH) - Receptor-hour excluded if RH>RHMAX - Receptor-day excluded if fewer than 6 valid receptor-hours 5 = Read hourly nephelometer background extinction measurements - Rayleigh extinction value (BEXTRAY) added to measurement - Hourly RH adjustment applied to modeled sulfate and nitrate - Hour excluded if measurement invalid (missing, interference, or large RH) - Receptor-hour excluded if RH>RHMAX 6 = Compute extinction from speciated PM measurements - FLAG RH adjustment factor applied to observed and modeled sulfate and nitrate. 7 = Use observed weather or prognostic weather information for background extinction during weather events; otherwise, use Method 2 - Hourly F(RH) adjustment applied to modeled sulfate and nitrate - F(RH) factor is capped at F(RHMAX) - During observed weather events, compute Bext from visual range if using an observed weather data file, or - During prognostic weather events, use Bext from the prognostic weather file - Use Method 2 for hours without a weather event	2

		----- Additional MVISBK = 1 Inputs -----	
BEXTBK	real	Background light extinction coefficient (Mm^{-1})	-
RHFRAC	real	Percentage of particles affected by relative humidity	-
		----- Additional MVISBK = 6 Inputs -----	
RHFAC (12)	integer array	Monthly relative humidity factors for adjusting extinction coefficients for hygroscopic species	-
		----- Additional MVISBK = 7 Inputs -----	
IDWSTA	integer	Station ID	-
TZONE	real	Time Zone	-

Table G-21 (Continued)
CALPOST Control File Inputs - Input Group 2
Visibility Parameters

Variable	Type	Description	Default
		----- Additional MVISBK = 2,3,6,7 Inputs -----	
BKSO4 (12)	real array	Monthly Background Ammonium Sulfate Concentration ($\mu g/m^3$)	-
BKNO3 (12)	real array	Monthly Background Ammonium Nitrate Concentration ($\mu g/m^3$)	-
BKPMC (12)	real array	Monthly Background Coarse Particulate Concentration ($\mu g/m^3$)	-
BKOC (12)	real array	Monthly Background Organic Carbon Concentration ($\mu g/m^3$)	-
BKSOIL (12)	real array	Monthly Background Soil Dust Concentration ($\mu g/m^3$)	-
BKEC (12)	real array	Monthly Background Elemental Carbon Concentration ($\mu g/m^3$)	-
		----- Additional MVISBK = 2,3,5,6,7 Inputs -----	
BEXTRAY	real	Extinction due to Rayleigh Scattering (Mm^{-1})	10.

Table G-21 (Continued)
CALPOST Control File Inputs - Input Group 3
Output Options

Variable	Type	Description	Default
LDOC	logical	Documentation records contained in the header of the CALPUFF output file may be written to the list file. Print documentation image?	F
IPRTU	integer	Output units flag: (always Mm^{-1} for extinction) For concentrations / For deposition fluxes 1 = g/m^3 / $g/m^2/s$ 2 = mg/m^3 / $mg/m^2/s$ 3 = ug/m^3 / $ug/m^2/s$ 4 = ng/m^3 / $ng/m^2/s$ 5 = odour units / -	1
L1HR	logical	Report 1-hr averages?	T
L3HR	logical	Report 3-hr averages?	T
L24HR	logical	Report 24-hr averages?	T
LRUNL	logical	Report length-of-run averages?	T
NAVG	integer	User-specified averaging time (hours)	0
LT50	logical	Produce top 50 tables?	T
LTOPN	logical	Produce top N tables?	F
NTOP	integer	Number of "top" values at each receptor (must be # 4)	4
ITOP(4)	integer array	Specific ranks of "top" values reported (e.g., values of 1, 2, 5 and 48 would produce the highest, 2nd highest, 5th highest, and 48th highest concentrations at each receptor)	1,2,3,4
LEXCD	logical	Produce exceedance tables?	F
THRESH1	real	Exceedance threshold (output units) for 1-hr averages	-1[g]
THRESH3	real	Exceedance threshold (output units) for 3-hr averages	-1[g]
THRESH24	real	Exceedance threshold (output units) for 24-hr averages	-1[g]
THRESHN	real	Exceedance threshold (output units) for NAVG-hr averages	-1[g]

[g] Exceedance processing is only performed for selected averaging times with thresholds greater than or equal to zero.

Table G-21 (Concluded)
CALPOST Control File Inputs - Input Group 3
Output Options

Variable	Type	Description	Default
		----- Multiple Exceedance Processing -----	
NDAY	integer	Number of days to accumulate exceedance counts when reporting violations (NDAY > 0 activates this processing option)	0
NCOUNT	integer	Number of exceedances allowed in a single NDAY period	1
LECHO	logical	Output selected averages on selected days?	F
IECHO(366)	integer array	Array of days selected to print data for all selected averaging times (0 = do not print, 1 = print)	366*0
LTIME	logical	Output time-series for all selected receptors for all selected days for all selected averaging times?	F
LPEAK	logical	Output time-series of peak over all selected receptors for all selected days for all selected averaging times?	F
LPLT	logical	Generate plot-file output?	F
LGRD	logical	Write plot-files in GRID[h] format when available?	F
MDVIS	integer	Output file with the visibility change at each receptor?	0
LDEBUG	logical	Activate special debug output statements?	F
LVEXTHR	logical	Output hourly extinction information to REPORT.HRV?	F

[h] GRID format is compatible with the Surfer plotting software. Only processed values obtained at gridded receptors are written in this format. If the GRID option is not selected, processed values obtained at all receptors are written in the comma-delimited DATA format (x, y, value1, value2, ... , value4).

Table G-22
Sample CALPOST Control File (CALPOST.INP)

```
CALPUFF Demonstration


---------------- Run title (3 lines) ------------------------------------------

                   CALPOST MODEL CONTROL FILE
                   --------------------------

--------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

Input Files
-----------

File                       Default File Name
----                       -----------------
Conc/Dep Flux File         MODEL.DAT           ! MODDAT =CPUF.CON   !
Relative Humidity File     VISB.DAT            * VISDAT =   *
Background Data File       BACK.DAT            * BACKDAT =   *
Transmissometer or         VSRN.DAT            * VSRDAT =   *
Nephelometer Data File      or
DATSAV Weather Data File    or
Prognostic Weather  File

Output Files
------------

File                       Default File Name
----                       -----------------
List File                  CALPOST.LST         ! PSTLST =CPST.LST   !

Pathname for Timeseries Files   (blank)       * TSPATH =   *
(activate with exclamation points only if
providing NON-BLANK character string)

Pathname for Plot Files   (blank)             * PLPATH =   *
(activate with exclamation points only if
 providing NON-BLANK character string)

User Character String to augment default filenames
(activate with exclamation points only if
 providing NON-BLANK character string)

Timeseries           TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT
Peak Value           PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT

                                            * TSUNAM =   *
Top Nth Rank Plot    RANK(ALL)_ASPEC_ttHR_CONC_TUNAM.DAT
                or   RANK(ii)_ASPEC_ttHR_CONC_TUNAM.GRD

                                            * TUNAM =   *
Exceedance Plot       EXCEED_ASPEC_ttHR_CONC_XUNAM.DAT
                  or  EXCEED_ASPEC_ttHR_CONC_XUNAM.GRD

                                            * XUNAM =   *
Echo Plot
(Specific Days)
           yyyy_Mmm_Ddd_hh00(UTCszzzz)_L00_ASPEC_ttHR_CONC.DAT
     or    yyyy_Mmm_Ddd_hh00(UTCszzzz)_L00_ASPEC_ttHR_CONC.GRD


Visibility Plot      DAILY_VISIB_VUNAM.DAT   ! VUNAM =VTEST   !
(Daily Peak Summary)

Auxiliary Output Files
----------------------

File                       Default File Name
----                       -----------------
Visibility Change          DELVIS.DAT           ! DVISDAT = deciview.dat  !
```

Table G-22 (Continued)

Sample CALPOST Control File (CALPOST.INP)

```
------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case              ! LCFILES = T !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 132 characters in length
NOTE: (2) Filenames for ALL PLOT and TIMESERIES FILES are constructed
          using a template that includes a pathname, user-supplied
          character(s), and context-specific strings, where
             ASPEC = Species Name
              CONC = CONC Or WFLX Or DFLX Or TFLX
                tt = Averaging Period (e.g. 03)
                ii = Rank (e.g. 02)
                hh = Hour(ending) in LST
             szzzz = LST time zone shift (EST is -0500)
              yyyy = Year(LST)
                mm = Month(LST)
                dd = day of month (LST)
          are determined internally based on selections made below.
          If a path or user-supplied character(s) are supplied, each
          must contain at least 1 non-blank character.

!END!
------------------------------------------------------------------------------
INPUT GROUP: 1 -- General run control parameters
-------------

     Option to run all periods found
     in the met. file(s)  (METRUN)        Default: 0   ! METRUN =   1  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in CALPUFF data file(s)

     Starting date:    Year  (ISYR) --    No default   ! ISYR  =  1990   !
     (used only if     Month (ISMO) --    No default   ! ISMO  =  0   !
      METRUN = 0)      Day   (ISDY) --    No default   ! ISDY  =  0   !
                       Hour  (ISHR) --    No default   ! ISHR  =  0   !

     Number of hours to process (NHRS) -- No default   ! NHRS  =  0  !

     Process every hour of data?(NREP) -- Default: 1   ! NREP  =  1  !
      (1 = every hour processed,
       2 = every 2nd hour processed,
       5 = every 5th hour processed, etc.)

Species & Concentration/Deposition Information
----------------------------------------------

      Species to process (ASPEC)       -- No default   ! ASPEC = SO2  !
      (ASPEC = VISIB for visibility processing)

      Layer/deposition code (ILAYER)   -- Default: 1   ! ILAYER =  1  !
        '1'  for CALPUFF concentrations,
        '-1' for dry deposition fluxes,
        '-2' for wet deposition fluxes,
        '-3' for wet+dry deposition fluxes.

      Scaling factors of the form:     -- Defaults:    ! A =  0.0    !
            X(new) = X(old) * A + B         A = 0.0    ! B =  0.0    !
        (NOT applied if A = B = 0.0)        B = 0.0

      Add Hourly Background Concentrations/Fluxes?
                              (LBACK)  -- Default: F   ! LBACK =  F !

Source information
------------------

  Option to process source contributions:
         0 =  Process only total reported contributions
         1 =  Sum all individual source contributions and process
         2 =  Run in TRACEBACK mode to identify source
              contributions at a SINGLE receptor
                           (MSOURCE) -- Default: 0   ! MSOURCE =  0  !
```

Table G-22 (Continued)

Sample CALPOST Control File (CALPOST.INP)

```
Receptor information
--------------------

  Gridded receptors processed?    (LG) -- Default: F   ! LG  = T  !
  Discrete receptors processed?   (LD) -- Default: F   ! LD  = F  !
  CTSG Complex terrain receptors processed?
                                 (LCT) -- Default: F   ! LCT = F  !

--Report results by DISCRETE receptor RING?
  (only used when LD = T)     (LDRING) -- Default: F   ! LDRING = F  !

--Select range of DISCRETE receptors (only used when LD = T):

  Select ALL DISCRETE receptors by setting NDRECP flag to -1;
                               OR
  Select SPECIFIC DISCRETE receptors by entering a flag (0,1) for each
     0 = discrete receptor not processed
     1 = discrete receptor processed
  using repeated value notation to select blocks of receptors:
     23*1, 15*0, 12*1
  Flag for all receptors after the last one assigned is set to 0
  (NDRECP) -- Default: -1
                                              ! NDRECP =  -1  !

--Select range of GRIDDED receptors (only used when LG = T):

       X index of LL corner (IBGRID) -- Default: -1     ! IBGRID = -1  !
           (-1 OR 1 <= IBGRID <= NX)

       Y index of LL corner (JBGRID) -- Default: -1     ! JBGRID = -1  !
           (-1 OR 1 <= JBGRID <= NY)

       X index of UR corner (IEGRID) -- Default: -1     ! IEGRID = -1  !
           (-1 OR 1 <= IEGRID <= NX)

       Y index of UR corner (JEGRID) -- Default: -1     ! JEGRID = -1  !
           (-1 OR 1 <= JEGRID <= NY)

  Note: Entire grid is processed if IBGRID=JBGRID=IEGRID=JEGRID=-1

--Specific gridded receptors can also be excluded from CALPOST
  processing by filling a processing grid array with 0s and 1s.  If the
  processing flag for receptor index (i,j) is 1 (ON), that receptor
  will be processed if it lies within the range delineated by IBGRID,
  JBGRID,IEGRID,JEGRID and if LG=T. If it is 0 (OFF), it will not be
  processed in the run.  By default, all array values are set to 1 (ON).

  Number of gridded receptor rows provided in Subgroup (1a) to
  identify specific gridded receptors to process
                           (NGONOFF) -- Default: 0      ! NGONOFF =  0  !

!END!

--------------
Subgroup (1a) -- Specific gridded receptors included/excluded
--------------

    Specific gridded receptors are excluded from CALPOST processing
    by filling a processing grid array with 0s and 1s.  A total of
    NGONOFF lines are read here.  Each line corresponds to one 'row'
    in the sampling grid, starting with the NORTHERNMOST row that
    contains receptors that you wish to exclude, and finishing with
    row 1 to the SOUTH (no intervening rows may be skipped).  Within
    a row, each receptor position is assigned either a 0 or 1,
    starting with the westernmost receptor.
       0 = gridded receptor not processed
       1 = gridded receptor processed

    Repeated value notation may be used to select blocks of receptors:
       23*1, 15*0, 12*1

    Because all values are initially set to 1, any receptors north of
    the first row entered, or east of the last value provided in a row,
    remain ON.

    (NGXRECP) -- Default: 1
```

Table G-22 (Continued)
Sample CALPOST Control File (CALPOST.INP)

```
INPUT GROUP: 2 -- Visibility Parameters (ASPEC = VISIB)
-------------

    Identify the Base Time Zone for the CALPUFF simulation
                           (BTZONE) -- No default   * BTZONE =  0.*

    Particle growth curve f(RH) for hygroscopic species
                            (MFRH) -- Default: 2   ! MFRH   =  2  !

         1 =  IWAQM (1998) f(RH) curve (originally used with MVISBK=1)
         2 =  FLAG (2000) f(RH) tabulation
         3 =  EPA (2003) f(RH) tabulation

    Maximum relative humidity (%) used in particle growth curve
                            (RHMAX) -- Default: 98  ! RHMAX  = 95.0 !

    Modeled species to be included in computing the light extinction
     Include SULFATE?          (LVSO4) -- Default: T   ! LVSO4  = T  !
     Include NITRATE?          (LVNO3) -- Default: T   ! LVNO3  = T  !
     Include ORGANIC CARBON?   (LVOC)  -- Default: T   ! LVOC   = F  !
     Include COARSE PARTICLES? (LVPMC) -- Default: T   ! LVPMC  = F  !
     Include FINE PARTICLES?   (LVPMF) -- Default: T   ! LVPMF  = F  !
     Include ELEMENTAL CARBON? (LVEC)  -- Default: T   ! LVEC   = T  !

    And, when ranking for TOP-N, TOP-50, and Exceedance tables,
     Include BACKGROUND?       (LVBK)  -- Default: T   ! LVBK   = T  !

    Species name used for particulates in MODEL.DAT file
                   COARSE    (SPECPMC) -- Default: PMC ! SPECPMC = PMC !
                   FINE      (SPECPMF) -- Default: PMF ! SPECPMF = PMF !

Extinction Efficiency (1/Mm per ug/m**3)
---------------------------------------
    MODELED particulate species:
               PM  COARSE      (EEPMC) -- Default: 0.6 ! EEPMC  = 0.6 !
               PM  FINE        (EEPMF) -- Default: 1.0 ! EEPMF  = 1.0 !
    BACKGROUND particulate species:
               PM  COARSE    (EEPMCBK) -- Default: 0.6 ! EEPMCBK = 0.6 !
    Other species:
              AMMONIUM SULFATE (EESO4) -- Default: 3.0 ! EESO4  = 3.0 !
              AMMONIUM NITRATE (EENO3) -- Default: 3.0 ! EENO3  = 3.0 !
              ORGANIC CARBON   (EEOC)  -- Default: 4.0 ! EEOC   = 4.0 !
              SOIL             (EESOIL)-- Default: 1.0 ! EESOIL = 1.0 !
              ELEMENTAL CARBON (EEEC)  -- Default: 10. ! EEEC   = 10.0 !

Background Extinction Computation
---------------------------------

    Method used for the 24h-average of percent change of light extinction:
    Hourly ratio of source light extinction / background light extinction
    is averaged?              (LAVER) -- Default: F   ! LAVER = F  !


    Method used for background light extinction
                           (MVISBK) -- Default: 2   ! MVISBK =  2  !

         1 =  Supply single light extinction and hygroscopic fraction
              - Hourly F(RH) adjustment applied to hygroscopic background
                and modeled sulfate and nitrate
         2 =  Compute extinction from speciated PM measurements (A)
              - Hourly F(RH) adjustment applied to observed and modeled sulfate
                and nitrate
              - F(RH) factor is capped at F(RHMAX)
         3 =  Compute extinction from speciated PM measurements (B)
              - Hourly F(RH) adjustment applied to observed and modeled sulfate
                and nitrate
              - Receptor-hour excluded if RH>RHMAX
              - Receptor-day excluded if fewer than 6 valid receptor-hours
         4 =  Read hourly transmissometer background extinction measurements
              - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
              - Hour excluded if measurement invalid (missing, interference,
                or large RH)
              - Receptor-hour excluded if RH>RHMAX
              - Receptor-day excluded if fewer than 6 valid receptor-hours
```

Table G-22 (Continued)
Sample CALPOST Control File (CALPOST.INP)

```
     5 =  Read hourly nephelometer background extinction measurements
          - Rayleigh extinction value (BEXTRAY) added to measurement
          - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
          - Hour excluded if measurement invalid (missing, interference,
            or large RH)
          - Receptor-hour excluded if RH>RHMAX
          - Receptor-day excluded if fewer than 6 valid receptor-hours
     6 =  Compute extinction from speciated PM measurements
          - FLAG monthly RH adjustment factor applied to observed and
            modeled sulfate and nitrate
     7 =  Use observed weather or prognostic weather information for
          background extinction during weather events; otherwise, use Method 2
          - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
          - F(RH) factor is capped at F(RHMAX)
          - During observed weather events, compute Bext from visual range
            if using an observed weather data file, or
          - During prognostic weather events, use Bext from the prognostic
            weather file
          - Use Method 2 for hours without a weather event

Additional inputs used for MVISBK = 1:
--------------------------------------
 Background light extinction (1/Mm)
                         (BEXTBK) -- No default   ! BEXTBK = 12.0 !
 Percentage of particles affected by relative humidity
                         (RHFRAC) -- No default   ! RHFRAC = 10.0 !

Additional inputs used for MVISBK = 6:
--------------------------------------
 Extinction coefficients for hygroscopic species (modeled and
 background) are computed using a monthly RH adjustment factor
 in place of an hourly RH factor (VISB.DAT file is NOT needed).
 Enter the 12 monthly factors here (RHFAC).  Month 1 is January.

 (RHFAC)  -- No default     ! RHFAC = 0.0, 0.0, 0.0, 0.0,
                                      0.0, 0.0, 0.0, 0.0,
                                      0.0, 0.0, 0.0, 0.0 !
Additional inputs used for MVISBK = 7:
--------------------------------------
 The weather data file (DATSAV abbreviated space-delimited) that
 is identified as VSRN.DAT may contain data for more than one
 station.  Identify the stations that are needed in the order in
 which they will be used to obtain valid weather and visual range.
 The first station that contains valid data for an hour will be
 used.  Enter up to MXWSTA (set in PARAMS file) integer station IDs
 of up to 6 digits each as variable IDWSTA, and enter the corresponding
 time zone for each, as variable TZONE (= UTC-LST).

 A prognostic weather data file with Bext for weather events may be used
 in place of the observed weather file.  Identify this as the VSRN.DAT
 file and use a station ID of IDWSTA = 999999, and TZONE = 0.

 NOTE:  TZONE identifies the time zone used in the dataset.  The
        DATSAV abbreviated space-delimited data usually are prepared
        with UTC time rather than local time, so TZONE is typically
        set to zero.

 (IDWSTA)   -- No default   * IDWSTA = 000000 *
 (TZONE)    -- No default   * TZONE =      0. *

Additional inputs used for MVISBK = 2,3,6,7:
--------------------------------------------
 Background extinction coefficients are computed from monthly
 CONCENTRATIONS of ammonium sulfate (BKSO4), ammonium nitrate (BKNO3),
 coarse particulates (BKPMC), organic carbon (BKOC), soil (BKSOIL), and
 elemental carbon (BKEC).  Month 1 is January.
 (ug/m**3)

 (BKSO4)  -- No default     ! BKSO4 = 0.0, 0.0, 0.0, 0.0,
                                      0.0, 0.0, 0.0, 0.0,
                                      0.0, 0.0, 0.0, 0.0 !
 (BKNO3)  -- No default     ! BKNO3 = 0.0, 0.0, 0.0, 0.0,
                                      0.0, 0.0, 0.0, 0.0,
                                      0.0, 0.0, 0.0, 0.0 !
```

Table G-22 (Continued)
Sample CALPOST Control File (CALPOST.INP)

```
     (BKPMC)  -- No default     ! BKPMC = 0.0, 0.0, 0.0, 0.0,
                                          0.0, 0.0, 0.0, 0.0,
                                          0.0, 0.0, 0.0, 0.0 !
     (BKOC)   -- No default     ! BKOC  = 0.0, 0.0, 0.0, 0.0,
                                          0.0, 0.0, 0.0, 0.0,
                                          0.0, 0.0, 0.0, 0.0 !
     (BKSOIL) -- No default     ! BKSOIL= 0.0, 0.0, 0.0, 0.0,
                                          0.0, 0.0, 0.0, 0.0,
                                          0.0, 0.0, 0.0, 0.0 !
     (BKEC)   -- No default     ! BKEC  = 0.0, 0.0, 0.0, 0.0,
                                          0.0, 0.0, 0.0, 0.0,
                                          0.0, 0.0, 0.0, 0.0 !

    Additional inputs used for MVISBK = 2,3,5,6,7:
    ----------------------------------------------
     Extinction due to Rayleigh scattering is added (1/Mm)
                           (BEXTRAY) -- Default: 10.0 ! BEXTRAY = 10.0 !
!END!
------------------------------------------------------------------------------

INPUT GROUP: 3 -- Output options
--------------

Documentation
-------------

    Documentation records contained in the header of the
    CALPUFF output file may be written to the list file.
    Print documentation image?
                                (LDOC) -- Default: F   !  LDOC = F !
Output Units
------------
    Units for All Output       (IPRTU) -- Default: 1   ! IPRTU =  3   !
                     for           for
                Concentration    Deposition
       1 =         g/m**3         g/m**2/s
       2 =        mg/m**3        mg/m**2/s
       3 =        ug/m**3        ug/m**2/s
       4 =        ng/m**3        ng/m**2/s
       5 =      Odour Units

    Visibility: extinction expressed in 1/Mega-meters (IPRTU is ignored)

Averaging time(s) reported
--------------------------

    1-hr averages           (L1HR) -- Default: T   !   L1HR = T  !

    3-hr averages           (L3HR) -- Default: T   !   L3HR = F  !

    24-hr averages         (L24HR) -- Default: T   !  L24HR = F  !

    Run-length averages    (LRUNL) -- Default: T   !  LRUNL = F  !

    User-specified averaging time in hours - results for
    an averaging time of NAVG hours are reported for
    NAVG greater than 0:
                            (NAVG) -- Default: 0   !   NAVG =  0  !

Types of tabulations reported
-----------------------------

   1) Visibility: daily visibility tabulations are always reported
                  for the selected receptors when ASPEC = VISIB.
                  In addition, any of the other tabulations listed
                  below may be chosen to characterize the light
                  extinction coefficients.
                  [List file or Plot/Analysis File]


   2) Top 50 table for each averaging time selected
      [List file only]
                            (LT50) -- Default: T   !   LT50 = F  !
```

Table G-22 (Continued)
Sample CALPOST Control File (CALPOST.INP)

```
3) Top 'N' table for each averaging time selected
   [List file or Plot file]
                      (LTOPN) -- Default: F   !  LTOPN = T  !

     -- Number of 'Top-N' values at each receptor
        selected (NTOP must be <= 4)
                       (NTOP) -- Default: 4   ! NTOP =  1   !

     -- Specific ranks of 'Top-N' values reported
        (NTOP values must be entered)
              (ITOP(4) array) -- Default:     ! ITOP =  1   !
                                 1,2,3,4

4) Threshold exceedance counts for each receptor and each averaging
   time selected
   [List file or Plot file]
                      (LEXCD) -- Default: F   !  LEXCD = T  !

     -- Identify the threshold for each averaging time by assigning a
        non-negative value (output units).

                               -- Default: -1.0
        Threshold for  1-hr averages   (THRESH1) !  THRESH1 = 1.000E01 !
        Threshold for  3-hr averages   (THRESH3) !  THRESH3 = -1.0  !
        Threshold for 24-hr averages  (THRESH24) ! THRESH24 = -1.0  !
        Threshold for NAVG-hr averages (THRESHN) !  THRESHN = -1.0  !


     -- Counts for the shortest averaging period selected can be
        tallied daily, and receptors that experience more than NCOUNT
        counts over any NDAY period will be reported.  This type of
        exceedance violation output is triggered only if NDAY > 0.

        Accumulation period(Days)
                        (NDAY) -- Default: 0   !    NDAY =  0  !
        Number of exceedances allowed
                      (NCOUNT) -- Default: 1   !  NCOUNT =  1  !


5) Selected day table(s)

   Echo Option -- Many records are written each averaging period
   selected and output is grouped by day
   [List file or Plot file]
                      (LECHO) -- Default: F   !  LECHO = F  !

   Timeseries Option -- Averages at all selected receptors for
   each selected averaging period are written to timeseries files.
   Each file contains one averaging period, and all receptors are
   written to a single record each averaging time.
   [TSttUUUU.DAT files]
                      (LTIME) -- Default: F   !  LTIME = F  !

   Peak Value Option -- Averages at all selected receptors for
   each selected averaging period are screened and the peak value
   each period is written to timeseries files.
   Each file contains one averaging period.
   [PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT files]
                      (LPEAK) -- Default: F   !  LPEAK = F  !
     -- Days selected for output
                 (IECHO(366)) -- Default: 366*0
        ! IECHO  = 366*0  !
        (366 values must be entered)
```

Table G-22 (Concluded)
Sample CALPOST Control File (CALPOST.INP)

```
Plot output options
-------------------

     Plot files can be created for the Top-N, Exceedance, and Echo
     tables selected above.  Two formats for these files are available,
     DATA and GRID.  In the DATA format, results at all receptors are
     listed along with the receptor location [x,y,val1,val2,...].
     In the GRID format, results at only gridded receptors are written,
     using a compact representation.  The gridded values are written in
     rows (x varies), starting with the most southern row of the grid.
     The GRID format is given the .GRD extension, and includes headers
     compatible with the SURFER(R) plotting software.

     A plotting and analysis file can also be created for the daily
     peak visibility summary output, in DATA format only.

     Generate Plot file output in addition to writing tables
     to List file?
                               (LPLT) -- Default: F   ! LPLT  = F !

     Use GRID format rather than DATA format,
     when available?
                               (LGRD) -- Default: F   ! LGRD  = F !

Auxiliary Output Files (for subsequent analyses)
------------------------------------------------

      Visibility

      A separate output file may be requested that contains the change
      in visibility at each selected receptor when ASPEC = VISIB.  This
      file can be processed to construct visibility measures that are
      not available in CALPOST.

      Output file with the visibility change at each receptor?
                              (MDVIS) -- Default: 0   ! MDVIS  = 0 !

           0 =  Do Not create file
           1 =  Create file of DAILY (24 hour) Delta-Deciview
           2 =  Create file of DAILY (24 hour) Extinction Change (%)
           3 =  Create file of HOURLY Delta-Deciview
           4 =  Create file of HOURLY Extinction Change (%)

Additional Debug Output
-----------------------

   Output selected information to List file
    for debugging?
                               (LDEBUG) -- Default: F  ! LDEBUG  = F !

   Output hourly extinction information to REPORT.HRV?
    (Visibility Method 7)
                              (LVEXTHR) -- Default: F  ! LVEXTHR = F !

!END!
```

Table G-23
BACK.DAT Record Structure

Header Record

Record No.	Variable	Type	Description	Sample Values
1	CONFACT	real	Multiplicative factor to convert background concentrations to g/m^3, or to convert background deposition fluxes to $g/m^2/s$. For example, CONFACT = .000001 indicates that the background values are in either $\mu g/m^3$ or $\mu g/m^2/s$.	.000001

Data Records (free format)

Variable No.	Variable	Type	Description	Sample Values
1	NYR	integer	Year for record (YYYY)	1994
2	NJDAY	integer	Julian Day for record (JJJ)	210
3	NHR	integer	Hour for record (00-23, time ending)	13
4	XMHBU	real	Background Concentration/Deposition Flux	32.8

Table G-24

Sample Background Concentration File (BACK.DAT)

```
0.000001
1994   2   1   23.57
1994   2   2   20.95
1994   2   3   20.95
1994   2   4   15.71
1994   2   5   23.57
1994   2   6   28.81
1994   2   7   28.81
1994   2   8   26.19
1994   2   9   31.43
1994   2  10   23.57
1994   2  11   20.95
1994   2  12   18.33
1994   2  13   15.71
1994   2  14   15.71
1994   2  15   13.09
1994   2  16   13.09
1994   2  17   13.09
1994   2  18   10.48
1994   2  19   13.09
1994   2  20   15.71
1994   2  21   13.09
1994   2  22   10.48
1994   2  23   10.48
1994   3   0   13.09
```

Table G-25
Sample Transmissometer File (VSRN.DAT)
(Partial Listing)

SITE	YYYYMMDD	JD	HHMM	BEXT	UC	#	#	UT	DT	MAX	V	A	AT	U	C	RH	U	C	DV
YOSE	19890317	76	0	19	2	1	0	-99	-991105	0			0	1	0	78	5	0	64
YOSE	19890317	76	100	17	2	1	0	-99	-991105	0			-1	1	0	84	5	0	53
YOSE	19890317	76	200	16	2	1	0	-99	-991105	0			0	1	0	80	5	0	47
YOSE	19890317	76	300	14	2	1	0	-99	-991105	0			1	1	0	65	5	0	34
YOSE	19890317	76	400	18	2	1	0	-99	-991105	0			-1	1	0	76	5	0	59
YOSE	19890317	76	500	16	2	1	0	-99	-991105	0			-1	1	0	79	5	0	47
YOSE	19890317	76	600	12	2	1	0	-99	-991105	0			-1	1	0	71	5	0	18
YOSE	19890317	76	700	16	2	1	0	-99	-991105	0			1	1	0	67	5	0	47
YOSE	19890317	76	800	16	2	1	0	-99	-991105	0			4	1	0	48	5	0	47
YOSE	19890317	76	900	20	2	1	0	-99	-991105	0			11	1	0	34	5	0	69
YOSE	19890317	76	1000	21	2	1	0	-99	-991105	0			9	1	0	32	5	0	74
YOSE	19890317	76	1100	25	2	1	0	-99	-991105	0			10	1	0	30	5	0	92
YOSE	19890317	76	1200	33	2	1	0	-99	-991105	0			9	1	0	45	5	0	119
YOSE	19890317	76	1300	45	2	1	0	-99	-991105	0			9	1	0	51	5	0	150
YOSE	19890317	76	1400	55	2	1	0	-99	-991105	0			10	1	0	58	5	0	170
YOSE	19890317	76	1500	67	2	1	0	-99	-991105	0			10	1	0	62	5	0	190
YOSE	19890317	76	1600	99	2	1	0	-99	-991105	0			8	1	0	70	5	0	229
YOSE	19890317	76	1700	60	2	1	0	-99	-991105	0			9	1	0	74	5	0	179
YOSE	19890317	76	1800	42	2	1	0	-99	-991105	0			6	1	0	84	5	0	144
YOSE	19890317	76	1900	37	2	0	1	-99	-991105	1	A		5	1	0	92	5	0	131
YOSE	19890317	76	2000	33	2	1	0	-99	-991105	0			6	1	0	82	5	0	119
YOSE	19890317	76	2100	29	2	1	0	-99	-991105	0			6	1	0	82	5	0	106
YOSE	19890317	76	2200	32	2	1	0	-99	-991105	0			6	1	0	83	5	0	116
YOSE	19890317	76	2300	30	2	1	0	-99	-991105	0			6	1	0	83	5	0	110
YOSE	19890318	77	0	35	2	1	0	-99	-991105	0			7	1	0	80	5	0	125

Field	Description
SITE	Site abbreviation
YYYYMMDD	Date (4-digit year/month/day)
JD	Julian Date
HHMM	Time using a 24-hour clock in hour/minute format
BEXT	bext (Mm^{-1})
UC	bext uncertainty (Mm^{-1})
#	Number of readings in average
#	Number of readings not in average due to weather
UT	Uncertainty threshold (Mm^{-1})
DT	threshold (Mm^{-1})
MAX	Maximum threshold (Mm^{-1})
V	bext validity code (0=valid, 1=interference, 2=invalid, 9=suspect)
A	bext validity interference subcode
AT	Temperature (^{o}C)
U	Temperature uncertainty (^{o}C)
C	Temperature validity code
RH	Relative humidity (%)
U	Relative humidity uncertainty (%)
C	Relative humidity validity code (0=valid, 2=invalid, 9=suspect)
DV	Haziness (deciview x 10)

Table G-26
Sample Nephelometer File (VSRN.DAT)
(Partial Listing)

SITE	YYYYMMDD	JD	HHMM	INS	BSP	PREC	V	A	RAW-M	RAW-SD	#	N/A	SD/M	DEL	MAX	RH	0123456789mPM0T	YINTER	SLOPE	AT	AT-SD	#	AT-PR	CT	CT-SD	#	CT-PR	RH	RH-SD	#	RH-PR	N/A
MOZ2	19941009	282	0000	048	22	0.140	0		43.33	1.60	12	-99.0	10.0	50	5000	90	0C0000000000000	-18.9	1.12	-3.58	0.19	12	1.00	-3.01	0.14	12	1.00	85.17	1.06	12	2.00	XXXX
MOZ2	19941009	282	0100	048	17	0.140	0		38.87	1.36	12	-99.0	10.0	50	5000	90	0C0000000000000	-18.9	1.12	-3.67	0.23	12	1.00	-2.79	0.10	12	1.00	82.03	0.93	12	2.00	XXXX
MOZ2	19941009	282	0200	048	18	0.140	0		40.24	0.71	12	-99.0	10.0	50	5000	90	0C0000000000000	-18.8	1.12	-3.94	0.10	12	1.00	-2.94	0.05	12	1.00	84.49	0.72	12	2.00	XXXX
MOZ2	19941009	282	0300	048	19	0.140	0		40.54	1.47	12	-99.0	10.0	50	5000	90	0C0000000000000	-18.7	1.12	-4.07	0.07	12	1.00	-3.06	0.04	12	1.00	84.49	1.40	12	2.00	XXXX
MOZ2	19941009	282	0400	048	16	0.140	0		38.57	1.72	10	-99.0	10.0	50	5000	90	0A2000000000003	-18.7	1.12	-4.30	0.11	12	1.00	-3.19	0.09	9	1.00	82.56	0.84	12	2.00	XXXX
MOZ2	19941009	282	0500	048	18	0.140	0		39.50	1.40	12	-99.0	10.0	50	5000	90	0C0000000000000	-18.7	1.12	-4.40	0.21	12	1.00	-3.33	0.13	12	1.00	82.87	1.13	12	2.00	XXXX
MOZ2	19941009	282	0600	048	15	0.140	0		37.24	1.04	12	-99.0	10.0	50	5000	90	0C0000000000000	-18.7	1.12	-4.16	0.16	12	1.00	-3.05	0.20	12	1.00	79.12	1.44	12	2.00	XXXX
MOZ2	19941009	282	0700	048	13	0.140	0		35.60	1.34	12	-99.0	10.0	50	5000	90	0C0000000000000	-18.7	1.12	-3.62	0.43	12	1.00	-2.23	0.41	12	1.00	76.14	2.20	12	2.00	XXXX
MOZ2	19941009	282	0800	048	10	0.140	0		32.62	1.26	12	-99.0	10.0	50	5000	90	0C0000000000000	-18.7	1.12	-2.02	0.48	12	1.00	-0.29	0.63	11	1.00	69.82	1.82	12	2.00	XXXX
MOZ2	19941009	282	0900	048	10	0.140	0		32.75	1.42	12	-99.0	10.0	50	5000	90	0C0000000000000	-18.7	1.12	-0.69	0.31	12	1.00	1.32	0.33	12	1.00	65.75	1.18	12	2.00	XXXX
MOZ2	19941009	282	1000	048	10	0.140	0		32.94	1.73	10	-99.0	10.0	50	5000	90	0A2000000000003	-18.7	1.12	0.24	0.30	12	1.00	2.03	0.40	9	1.00	63.34	1.71	12	2.00	XXXX
MOZ2	19941009	282	1100	048	15	0.140	0		37.18	1.47	12	-99.0	10.0	50	5000	90	0C0000000000000	-18.8	1.12	1.23	0.29	12	1.00	3.13	0.28	12	1.00	66.90	1.48	12	2.00	XXXX
MOZ2	19941009	282	1200	048	15	0.140	0		37.44	1.76	12	-99.0	10.0	50	5000	90	0C0000000000000	-19.1	1.12	2.13	0.23	12	1.00	4.27	0.27	12	1.00	64.31	1.93	12	2.00	XXXX
MOZ2	19941009	282	1300	048	12	0.140	0		35.03	1.17	12	-99.0	10.0	50	5000	90	0C0000000000000	-19.3	1.12	2.74	0.32	12	1.00	4.74	0.35	12	1.00	57.82	4.01	10	2.00	XXXX
MOZ2	19941009	282	1400	048	9	0.140	0		32.69	0.83	12	-99.0	10.0	50	5000	90	0C0000000000000	-19.6	1.12	3.86	0.34	12	1.00	5.73	0.34	12	1.00	51.25	2.95	12	2.00	XXXX
MOZ2	19941009	282	1500	048	10	0.140	0		33.59	0.98	12	-99.0	10.0	50	5000	90	0C0000000000000	-19.8	1.12	4.35	0.17	12	1.00	5.94	0.20	12	1.00	50.14	1.11	12	2.00	XXXX
MOZ2	19941009	282	1600	048	10	0.140	0		34.10	1.64	12	-99.0	10.0	50	5000	90	0C0000000000001	-20.1	1.12	3.82	0.22	12	1.00	5.25	0.23	11	1.00	51.88	1.66	12	2.00	XXXX
MOZ2	19941009	282	1700	048	11	0.140	0		34.78	1.66	10	-99.0	10.0	50	5000	90	0A2000000000002	-20.3	1.12	2.18	0.75	12	1.00	3.46	0.93	10	1.00	57.44	2.77	12	2.00	XXXX
MOZ2	19941009	282	1800	048	11	0.140	0		35.13	0.73	12	-99.0	10.0	50	5000	90	0C0000000000000	-20.4	1.12	1.12	0.22	12	1.00	2.01	0.23	12	1.00	58.90	1.04	12	2.00	XXXX
MOZ2	19941009	282	1900	048	10	0.140	0		34.22	0.96	12	-99.0	10.0	50	5000	90	0C0000000000000	-20.4	1.12	0.71	0.13	12	1.00	1.56	0.11	12	1.00	56.36	1.23	12	2.00	XXXX
MOZ2	19941009	282	2000	048	10	0.140	0		34.27	1.51	12	-99.0	10.0	50	5000	90	0C0000000000000	-20.4	1.12	0.02	0.13	12	1.00	0.89	0.16	12	1.00	56.45	0.99	12	2.00	XXXX
MOZ2	19941009	282	2100	048	9	0.140	0		33.52	0.64	12	-99.0	10.0	50	5000	90	0C0000000000000	-20.4	1.12	-0.17	0.06	12	1.00	0.61	0.06	12	1.00	55.21	0.41	12	2.00	XXXX
MOZ2	19941009	282	2200	048	9	0.140	0		33.48	0.89	12	-99.0	10.0	50	5000	90	0C0000000000000	-20.5	1.12	-0.33	0.04	12	1.00	0.43	0.03	12	1.00	54.33	1.55	12	2.00	XXXX
MOZ2	19941009	282	2300	048	8	0.140	0		32.90	0.77	10	-99.0	10.0	50	5000	90	0A2000000000003	-20.5	1.12	-0.26	0.08	12	1.00	0.50	0.07	9	1.00	47.41	0.78	12	2.00	XXXX
MOZ2	19941010	283	0000	048	8	0.140	0		32.44	0.63	12	-99.0	10.0	50	5000	90	0C0000000000000	-20.4	1.12	-0.42	0.16	12	1.00	0.41	0.11	12	1.00	48.51	1.46	12	2.00	XXXX

Field	Description
SITE	Site Abbreviation
YYYYMMDD	Date (4-digit year/month/day)
JD	Julian Date
HHMM	Time using a 24-hour clock in hour/minute format
INS	Nephelometer Serial Number
BSP	bsp (Mm^{-1}) **C** Particle scattering coefficient = Total - Rayleigh
PREC	bsp Estimated Precision (%/100)
V	bsp Validity Code(0=valid, 1=interference, 2=invalid, 9=suspect)
A	bsp Interference Code
RAW-M	Raw Nephelometer Hourly Average (Counts)
RAW-SD	Standard Deviation of Raw Nephelometer Average (Counts)
#	Number of Data Points in Hourly Nephelometer Average
N/A	(Not Used)
SD/M	Standard Deviation/Mean Interference Threshold
DEL	bsp Rate of Change Interference Threshold
MAX	Maximum bsp Interference Threshold
RH	Relative Humidity Interference Threshold
0123456789mPMOT	Composite Nephelometer Code Summary
YINTER	Y-intercept of Calibration Line Used to Calculate bsp
SLOPE	Slope of Calibration Line Used to Calculate bsp
AT	Average Ambient Temperature (ºC)
AT-SD	Standard Deviation of Hourly AT Average
#	Number of Data Points in Hourly AT Average
AT-PR	Estimated Precision of Ambient Temperature
CT	Average Nephelometer Chamber Temperature (ºC)
CD-SD	Standard Deviation of Hourly CT Average
#	Number of Data Points in Hourly CT Average
CT-PR	Estimated Precision of Chamber Temperature
RH	Average Relative Humidity (%)
RH-SD	Standard Deviation of Hourly RH Average
#	Number of Data Points in Hourly RH Average
RH-PR	Estimated Precision of Relative Humidity

G.7 CALPOST Output Files

G.7.1 List File (CALPOST.LST)

The list file has four logical sections. The first section contains an image of the control file inputs; the second section contains a summary of these inputs and it documents the content of the CALPUFF output file that is processed; the third section contains the tabulations of CALPOST results requested by the user; and the fourth section reports the peak value(s) obtained for each averaging time processed. An example list file is shown in Table G-27, with the first logical section removed (the input file for this example was shown in Table G-22).

Each table contains specific reference to the averaging time, the pollutant species (CALPOST processes a single species at a time), concentration/deposition units, receptor locations, and the date and time (marked at the end of the averaging period). When visibility is assessed, the modeled extinction in inverse megameters (1/Mm) is processed and reported just like concentration or deposition. In addition, the peak daily average visibility reduction is reported for each day processed, characterized as either a percent change in extinction (from background), or as a change in deciview.

G.7.2 Visibility File (DAILY_VISIB_VUNAM.DAT)

When visibility processing is selected and plot-files are requested, the peak daily average visibility reduction tabulations written to the list file are written to disk as a visibility file as well. This facilitates the use of subsequent analysis tools, such as spreadsheets. The record format is the same as that used in the list file. The user may accept the default filename (V24.DAT), or augment the default name with up to five additional characters.

G.7.3 Plot-file(s)

CALPOST can generate a set of optional plot-files containing the "top N" highest concentrations/deposition fluxes at each receptor, the number of exceedances of user-specified threshold values at each receptor and averaging time, or the values of concentration/deposition flux for user-specified time periods. Two formats are available for these plot-files. The first, called DATA format, is of the form: receptor (X, Y), value1, ... , value4 as described in Table G-28. This comma-delimited format is suitable for both gridded and discrete receptor data. It is compatible with many of the popular PC-based graphics and analysis packages. An example of this format is shown in Table G-29. The second format, called the GRID format is appropriate for gridded receptor fields only. It is directly compatible with the contouring option of the Surfer plotting package (i.e., it bypasses the need to first interpolate the data to a regular rectangular grid by the plotting package). Its record structure is described in Table G-30, and an example is shown in Table G-31.

G.7.4 Time-series File(s)

CALPOST can generate a set of optional time-series files for the concentration, deposition flux, or extinction coefficient identified in the CALPOST control file, at each receptor selected, for each averaging time selected. Each averaging time is placed in a separate file, so there may be as many as four time-series files generated (1-hour, 3-hour, 24-hour and N-hour averages). The period covered by the time-series is controlled by the selected day option as well as the period processed. No time-series output is generated if no days are selected. All averages in the period processed are written to the time-series file(s) if all days are selected.

For a given time (e.g, the 3-hour period ending at 0900 on Julian day 310), the current averages for all selected receptors are written as a single "record". The length of the record grows as the number of receptors increases. Therefore, the time-series option should be used with a manageable subset of the receptors contained in the CALPUFF simulation.

The format of the time-series file is described in Table G-32. The file contains a number of header records that identify the parameter that is reported, its units and averaging time, and the number of receptors included. The location of each receptor is provided. Data records follow, with a single record for each time period. An example time-series file for 1-hour averages of SO_2 at two gridded receptors for a single 24-hour period is shown in Table G-33.

Table G-27

Sample CALPOST Output File (CALPOST.LST)

(Partial Listing)

```
*****************************************************************************************************************************
                                        CALPOST  Version 5.2           Level 991104d
*****************************************************************************************************************************

  CALPOST Control File Input Summary -------------------------

     Replace run data with data in Puff file 1=Y:    0
                       Run starting date -- year: 1988
                                           month:    7
                                             day:    7
                                       Julian day:  189
         Time at beginning of run  -  hour(0-23):    0
                                   -      second:    0
                              Run length (hours):   24

 Every hour of data processed -- NREP = 1

  Species & Concentration/Deposition Information
                                         Species: VISIB
                         Layer of processed data:    1
    (>0=conc, -1=dry flux, -2=wet flux, -3=wet & dry flux)
                   Multiplicative scaling factor: 0.0000E+00
                         Additive scaling factor: 0.0000E+00
                  Hourly background values used?: F

  Receptor information
                   Gridded receptors processed?: T
                  Discrete receptors processed?: F
      CTSG Complex terrain receptors processed?: F

  Gridded Receptors Processed

                                    Begin at ix:   10.00
                                      End at ix:   15.00
                                    Begin at iy:   10.00
                                      End at iy:   15.00

  Visibility Processing Selected

  Extinction Computation includes:
                               SULFATES
                               NITRATES
              Max. RH % for particle growth (%):  95.000

  Extinction Efficiency (1/Mm per ug/m**3)
                                 ammonium sulfate:    3.00
                                 ammonium nitrate:    3.00
                                   organic carbon:    4.00
                                             soil:    1.00
                                 elemental carbon:   10.00
                                MODELED coarse PM:    0.60
                                MODELED   fine PM:    1.00
                               BACKGRND coarse PM:    0.60

  Background Extinction Calculation Method 2
           Rayleigh scattering extinction (1/Mm):   10.00
              Monthly background conc. (ug/m**3):

      (NH4)2SO4   (NH4)NO3       PM-C         OC        SOIL         EC
   1  .2000E+00  .1000E+00  .1000E+01  .0000E+00  .2000E+01  .0000E+00
   2  .3000E+00  .2000E+00  .1000E+01  .0000E+00  .3000E+01  .0000E+00
   3  .3000E+00  .2000E+00  .2000E+01  .0000E+00  .3000E+01  .0000E+00
   4  .4000E+00  .2000E+00  .2000E+01  .0000E+00  .3000E+01  .0000E+00
   5  .4000E+00  .3000E+00  .2000E+01  .0000E+00  .4000E+01  .0000E+00
   6  .4000E+00  .3000E+00  .1000E+01  .0000E+00  .4000E+01  .0000E+00
   7  .3000E+00  .2000E+00  .2000E+01  .0000E+00  .3000E+01  .0000E+00
   8  .3000E+00  .2000E+00  .3200E+01  .0000E+00  .3000E+01  .0000E+00
   9  .3000E+00  .2000E+00  .4000E+01  .0000E+00  .4000E+01  .0000E+00
  10  .2000E+00  .1000E+00  .3330E+01  .0000E+00  .3000E+01  .0000E+00
  11  .2000E+00  .1000E+00  .2000E+01  .0000E+00  .2000E+01  .0000E+00
  12  .2000E+00  .1000E+00  .1000E+01  .0000E+00  .2000E+01  .0000E+00

  Output options
                        Units requested for output:   (1/Mega-m)
  Averaging time(s) selected
      User-specified averaging time (NAVG hours):     0
                                    1-hr averages:     T
                                    3-hr averages:     F
                                   24-hr averages:     F
                                  NAVG-hr averages:     F
                            Length of run averages:     F
  Output components selected
                                        Top-50:     F
                     Top-N values at each receptor:     T
```

Table G-27 (Continued)
Sample CALPOST Output File (CALPOST.LST)
(Partial Listing)

```
             Exceedance counts at each receptor:     F
       Output selected information for debugging:     F
                  Echo tables for selected days:     F
                  Time-series for selected days:     F

  Top "n" table control
         Number of "top" values at each receptor:     1
         Specific ranks of "top" values reported:   1


  Plot file option
                              Plot files created:     F

IDENTIFICATION OF PROCESSED MODEL FILE ----------

CALPUFF     5.4         000602_5

CALPUFF test case run - 3 point sources : Visibility Test Case
24-Hour Simulation using CALMET met. data
Gridded receptors on 17x17 20-km met grid

Averaging time for values reported from model:
                1   HOUR

Number of averaging periods in file from model:
               24

Chemical species names for each layer in model:
SO2           1
SO4           1
NOX           1
HNO3          1
NO3           1

------------------------------------------------------------------------------------------------------------------------------------------
          INPUT FILES

 Default Name     Unit No.     File Name and Path
 ------------     --------     ------------------
  CALPOST.INP         5        CALPOST.INP
    MODEL.DAT         4        puffvis.con
     VISB.DAT         9        visb.dat


------------------------------------------------------------------------------------------------------------------------------------------
          OUTPUT FILES

 Default Name     Unit No.     File Name and Path
 ------------     --------     ------------------
  CALPOST.LST         8        postvis.lst

**************************************************************************************************************************************
                                          CALPOST  Version 5.2           Level 991104d
**************************************************************************************************************************************

                                                  VISIB   ___SN__

1 RANKED     1   HOUR AVERAGE   EXTINCTION   VALUES AT EACH GRIDDED RECEPTOR  (YEAR,DAY,ENDING TIME)  (1/Mega-m)

RECEPTOR     COORDINATES (km)            1 RANK
  10, 10     310.000  4760.000   3.2424E-03 (1988,189,2000)
  10, 11     310.000  4780.000   1.0802E-03 (1988,189,2000)
  10, 12     310.000  4800.000   5.0049E-04 (1988,189,2000)
  10, 13     310.000  4820.000   8.9414E-05 (1988,189,2000)
  10, 14     310.000  4840.000   0.0000E+00 (1988,189,0100)
  10, 15     310.000  4860.000   0.0000E+00 (1988,189,0100)
  11, 10     330.000  4760.000   1.7837E-02 (1988,189,2000)
  11, 11     330.000  4780.000   7.6053E-03 (1988,189,2000)
  11, 12     330.000  4800.000   2.9004E-03 (1988,189,2000)
  11, 13     330.000  4820.000   1.1043E-03 (1988,189,2000)
  11, 14     330.000  4840.000   1.2986E-04 (1988,189,2000)
  11, 15     330.000  4860.000   0.0000E+00 (1988,189,0100)
  12, 10     350.000  4760.000   4.0898E-02 (1988,189,2000)
  12, 11     350.000  4780.000   1.9738E-02 (1988,189,2000)
  12, 12     350.000  4800.000   9.2857E-03 (1988,189,1500)
  12, 13     350.000  4820.000   6.3993E-03 (1988,189,1600)
  12, 14     350.000  4840.000   1.8964E-03 (1988,189,1600)
  12, 15     350.000  4860.000   4.3928E-04 (1988,189,2100)
  13, 10     370.000  4760.000   2.3526E-01 (1988,189,1300)
  13, 11     370.000  4780.000   9.0363E-01 (1988,189,0500)
  13, 12     370.000  4800.000   1.0855E+00 (1988,189,1800)
```

Table G-27 (Continued)
Sample CALPOST Output File (CALPOST.LST)
(Partial Listing)

```
 13, 13     370.000  4820.000   1.3992E+00 (1988,189,2000)
 13, 14     370.000  4840.000   4.6041E-02 (1988,189,1700)
 13, 15     370.000  4860.000   1.7141E-02 (1988,189,1700)
 14, 10     390.000  4760.000   9.0232E-01 (1988,189,0700)
 14, 11     390.000  4780.000   2.9995E+00 (1988,189,0500)
 14, 12     390.000  4800.000   3.3975E-01 (1988,189,1500)
 14, 13     390.000  4820.000   1.4699E+00 (1988,190,0000)
 14, 14     390.000  4840.000   7.3541E-01 (1988,189,2200)
 14, 15     390.000  4860.000   2.8335E-01 (1988,189,2300)
 15, 10     410.000  4760.000   7.6574E-01 (1988,189,0800)
 15, 11     410.000  4780.000   2.3780E+00 (1988,189,0600)
 15, 12     410.000  4800.000   5.2013E-01 (1988,189,0400)
 15, 13     410.000  4820.000   4.4443E-01 (1988,189,2200)

  1 - RANK HIGHEST VALUES FOR PERIOD

Multiply all values by 10 **  -3

 15 I    0     0     0    17   283  1156
    I    +     +     +     +     +     +
 14 I    0     0     2    46   735   860
    I    +     +     +     +     +     +
 13 I    0     1     6  1399  1470   444
    I    +     +     +     +     +     +
 12 I    1     3     9  1085   340   520
    I    +     +     +     +     +     +
 11 I    1     8    20   904  3000  2378
    I    +     +     +     +     +     +
 10 I    3    18    41   235   902   766
    I    +     +     +     +     +     +
    ----------------------------------
        10    11    12    13    14    15

*****************************************************************************************************************************************************
                                                CALPOST  Version 5.2           Level 991104d
*****************************************************************************************************************************************************

                                                  24HR VISIBILITY

                                                  VISIB   ___SN__

                                                           (1/Mega-m)

                                                                                                                                  Modeled Extinction by Species

YEAR DAY HR  RECEPTOR    COORDINATES (km)  TYPE BEXT(Model) BEXT(BKG) BEXT(Total) %CHANGE  F(RH)  bxSO4  bxNO3   bxOC   bxEC
bxPMC  bxPMF
1988 190  0    15, 11    410.000  4780.000   G      0.370     18.023     18.392     2.05   2.548  0.210  0.159  0.000  0.000
0.000  0.000

 --- Number of days with Extinction Change  =>   5.0 % :         0
 --- Number of days with Extinction Change  =>  10.0 % :         0
 ---             Largest Extinction Change  =                 2.05 %


*****************************************************************************************************************************************************
                                                CALPOST  Version 5.2           Level 991104d
*****************************************************************************************************************************************************

                                                  Run-Length VISIBILITY

                                                  VISIB   ___SN__

                                                    (1/Mega-m)

            RECEPTOR    COORDINATES (km)  TYPE BEXT(Model) BEXT(BKG) BEXT(Total) %CHANGE  F(RH)


              15, 11    410.000  4780.000   G      0.370     18.023     18.392     2.05   2.548


 --- Number of recs with Extinction Change  >    1.0 % :         5
 ---             Largest Extinction Change  =                 2.05 %
```

Table G-27 (Concluded)
Sample CALPOST Output File (CALPOST.LST)
(Partial Listing)

```
**********************************************************************************************************************************
                                                CALPOST  Version 5.2           Level 991104d
**********************************************************************************************************************************

                                                  24HR VISIBILITY
                                                  VISIB   ___SN__

                                                  (deciview)
                                                                                    % of Modeled Extinction by Species
YEAR DAY HR  RECEPTOR    COORDINATES (km)  TYPE  DV(Total)    DV(BKG)  DELTA DV  F(RH)  %_SO4  %_NO3   %_OC   %_EC  %_PMC  %_PMF

1988 190  0    15, 11    410.000  4780.000   G      6.093      5.890      0.203  2.548  56.92  43.08   0.00   0.00   0.00   0.00


 --- Number of days with Delta-Deciview  =>   0.50:         0
 --- Number of days with Delta-Deciview  =>   1.00:         0
 ---             Largest Delta-Deciview  =              0.203

**********************************************************************************************************************************
                                                CALPOST  Version 5.2           Level 991104d
**********************************************************************************************************************************

                                                Run-Length VISIBILITY

                                                   VISIB   ___SN__

                                                   (deciview)


            RECEPTOR    COORDINATES (km)  TYPE  DV(Total)    DV(BKG)  DELTA DV  F(RH)

              15, 11    410.000  4780.000   G      6.093      5.890      0.203  2.548


 --- Number of recs with Delta-Deciview  >    0.10:         5
 ---             Largest Delta-Deciview  =              0.203
**********************************************************************************************************************************
                                              CALPOST  Version 5.2           Level 991104d
**********************************************************************************************************************************

                                                 SUMMARY SECTION

                                                VISIB   ___SN__

                                                  (1/Mega-m)

 RECEPTOR     COORDINATES (km)    TYPE      PEAK (YEAR,DAY,ENDING TIME)     FOR RANK    FOR AVERAGE PERIOD

  14, 11     390.000  4780.000   GRIDDED    2.9995E+00 (1988,189,0500)       RANK  1          1   HOUR
```

Table G-28
Plot-File DATA Record Structure

Header Records

Record No.	Variable	Type	Description
1	Line 1	character	Title line identifying averaging time, type of output, and units
2	(blank)		
3	Line 2	character	Species Processed
4	(blank)		
5	Line 3	character	Column Headings
6	(blank)		

Data Records (free format)

Variable No.	Variable	Type	Description	Sample Values
1	X	real	X-coordinate of receptor (km)	94.02
2	Y	real	Y-coordinate of receptor (km)	210.89
3	V1	real	Value 1	213.8
4	V2	real	Value 2 (optional)	132.6
5	V3	real	Value 3 (optional)	16.88
6	V4	real	Value 4 (optional)	.009

Table G-29
Sample DATA Plot-File
(Partial Listing)

```
 2 RANKED       1-HOUR AVERAGE  CONCENTRATION VALUES AT EACH RECEPTOR  ( g/m**3)

       SO2          1

    RECEPTOR (x,y) km        1 RANK        2 RANK

    270.000  4720.000     7.8952E-09    1.9814E-09
    290.000  4720.000     5.9128E-08    1.5432E-08
    310.000  4720.000     8.2049E-08    3.7027E-08
    330.000  4720.000     7.2441E-08    5.9440E-08
    350.000  4720.000     7.9033E-08    5.8254E-08
    370.000  4720.000     7.0579E-08    4.8233E-08
    390.000  4720.000     1.3587E-07    9.4182E-08
    410.000  4720.000     4.7199E-08    4.6522E-08
    270.000  4740.000     4.6755E-12    1.6541E-12
    290.000  4740.000     9.4266E-10    6.2788E-10
    310.000  4740.000     7.0272E-09    3.6496E-09
    330.000  4740.000     1.8139E-08    1.2038E-08
    350.000  4740.000     3.8828E-08    1.9662E-08
    370.000  4740.000     5.8562E-08    4.9597E-08
    390.000  4740.000     5.3909E-08    5.2398E-08
    410.000  4740.000     4.5306E-07    2.8328E-07
    270.000  4760.000     0.0000E+00    0.0000E+00
    290.000  4760.000     1.7201E-10    1.2712E-10
    310.000  4760.000     1.3340E-09    1.1862E-09
    330.000  4760.000     4.5722E-09    4.4274E-09
    350.000  4760.000     1.0541E-08    1.0369E-08
    370.000  4760.000     3.2621E-07    6.5301E-08
    390.000  4760.000     8.6671E-07    4.7615E-07
    410.000  4760.000     5.4748E-07    4.4530E-07
    270.000  4780.000     0.0000E+00    0.0000E+00
    290.000  4780.000     1.8996E-11    1.7348E-11
    310.000  4780.000     5.3253E-10    5.0730E-10
    330.000  4780.000     2.2485E-09    2.2173E-09
    350.000  4780.000     6.2623E-09    6.2032E-09
    370.000  4780.000     1.0701E-06    1.6573E-07
    390.000  4780.000     6.4020E-07    6.0337E-07
    410.000  4780.000     6.3429E-07    4.6677E-07
    270.000  4800.000     0.0000E+00    0.0000E+00
    290.000  4800.000     0.0000E+00    0.0000E+00
    310.000  4800.000     1.9163E-10    1.6276E-10
    330.000  4800.000     1.1810E-09    9.1738E-10
    350.000  4800.000     2.6353E-08    4.7434E-09
    370.000  4800.000     1.2015E-06    1.0502E-06
    390.000  4800.000     2.4910E-07    1.9500E-07
    410.000  4800.000     2.9590E-07    2.0784E-07
    270.000  4820.000     0.0000E+00    0.0000E+00
    290.000  4820.000     0.0000E+00    0.0000E+00
```

Table G-30
Plot-File GRID Record Structure

Header Records (free format)

Record No.	Variable No.	Variable	Type	Description	Sample Values
1	1	ID	character	File type code (must be DSAA for ASCII file)	DSAA
2	1	NX	integer	Number of receptors in easting direction	34
2	2	NY	integer	Number of receptors in northing direction	51
3	1	XBEG	real	X-coordinate (km) of first gridded receptor (southwest)	213.75
3	2	YBEG	real	Y-coordinate (km) of first gridded receptor (southwest)	439.00
4	1	XEND	real	X-coordinate (km) of last gridded receptor (northeast)	222.00
4	2	YEND	real	Y-coordinate (km) of last gridded receptor (northeast)	451.50
5	1	VMIN	real	Minimum value in grid	0.001
5	2	VMAX	real	Maximum value in grid	159.0

Data Records (free format)

Record No.	Variable	Type	Description
1	V1	real array	NX values in first row of grid (southernmost row)
2	V2	real array	NX values in second row of grid
...	...	...	
NY	VNY	real array	NX values in last row of grid (northernmost row)

Table G-30 (Concluded)
Plot-File GRID Record Structure

Footer Records

Record No.	Variable	Type	Description
1-5	(blank)		
6	Line 1	character	Title line identifying averaging time, type of output, and units
7	(blank)		
8	Line 2	character	Species Processed or other information (varies with type of data)
9	(blank)		
10	Line 3	character	Species Processed or other information (varies with type of data)

Table G-31
Sample GRID Plot-File

```
DSAA
           8           8
     270.000     410.000
    4720.000    4860.000
  0.0000E+00  0.1202E-05
7.8952E-09  5.9128E-08  8.2049E-08  7.2441E-08  7.9033E-08  7.0579E-08  1.3587E-07  4.7199E-08
4.6755E-12  9.4266E-10  7.0272E-09  1.8139E-08  3.8828E-08  5.8562E-08  5.3909E-08  4.5306E-07
0.0000E+00  1.7201E-10  1.3340E-09  4.5722E-09  1.0541E-08  3.2621E-07  8.6671E-07  5.4748E-07
0.0000E+00  1.8996E-11  5.3253E-10  2.2485E-09  6.2623E-09  1.0701E-06  6.4020E-07  6.3429E-07
0.0000E+00  0.0000E+00  1.9163E-10  1.1810E-09  2.6353E-08  1.2015E-06  2.4910E-07  2.9590E-07
0.0000E+00  0.0000E+00  5.6655E-11  5.0676E-10  5.7000E-09  8.0446E-07  6.8545E-07  2.5748E-07
0.0000E+00  0.0000E+00  0.0000E+00  2.0870E-10  2.1584E-09  3.1430E-08  5.1841E-07  2.4384E-07
0.0000E+00  0.0000E+00  0.0000E+00  6.9000E-11  4.3005E-10  1.0159E-08  1.3561E-07  3.3995E-07



          1-HOUR AVERAGE  CONCENTRATION VALUES AT EACH RECEPTOR  ( g/m**3)

        SO2           1

        RANK          1
```

Table G-32
Time-series File Record Structure

Header Records

Record No.	Variable	Type	Description
1	Line 1	character	Title line identifying file type and species processed
2	(blank)		
3	Line 2	character	Averaging time, type of output, and units
4	Line 3	character	Number of receptors processed
5	(blank)		
6	Line 4	character	Receptor type for each receptor processed
7	Line 5	character	Receptor ID or Easting cell index for each receptor processed
8	Line 6	character	Northing cell index for each receptor processed
9	Line 7	character	Easting coordinate (km) for each receptor processed
10	Line 8	character	Northing coordinate (km) for each receptor processed
11	(blank)		
12	Line 9	character	Heading for year, day, time columns
13	(blank)		

Data Records (free format)

Variable No.	Variable	Type	Description	Sample Values
1	IYR	integer	Year (YYYY format)	1996
2	JDAY	integer	Julian Day (JJJ format)	216
3	ITIME	integer	Time at end of averaging period (HHMM format)	0800
4 to NREC+3	V	real array	Value for each of the NREC receptors processed	5.473498E-07

Table G-33
Sample Time-series File

```
TIMESERIES Output  --------  SO2          1

       1   HOUR Average  CONCENTRATION Values at Selected Receptors  ( g/m**3)
       2   Receptors are Included

          Type:          GRID          GRID
            ix:             6             8
            iy:             4             5
          x(km):  2.300000E+02  2.700000E+02
          y(km):  4.640000E+03  4.660000E+03

 YYYY JDY HHMM

 1988 189 0100    0.000000E+00  0.000000E+00
 1988 189 0200    1.916138E-08  0.000000E+00
 1988 189 0300    3.400294E-07  0.000000E+00
 1988 189 0400    3.968533E-07  0.000000E+00
 1988 189 0500    1.251997E-07  0.000000E+00
 1988 189 0600    5.473498E-07  0.000000E+00
 1988 189 0700    4.170044E-08  1.020110E-09
 1988 189 0800    0.000000E+00  8.213156E-10
 1988 189 0900    0.000000E+00  0.000000E+00
 1988 189 1000    0.000000E+00  0.000000E+00
 1988 189 1100    3.724512E-08  0.000000E+00
 1988 189 1200    9.805949E-08  6.046957E-09
 1988 189 1300    9.109576E-08  2.053027E-08
 1988 189 1400    8.968187E-08  3.515141E-08
 1988 189 1500    1.855247E-07  4.744752E-08
 1988 189 1600    2.432677E-07  6.169984E-08
 1988 189 1700    1.831459E-07  9.404808E-08
 1988 189 1800    9.832471E-08  1.438350E-07
 1988 189 1900    3.688035E-08  1.607274E-07
 1988 189 2000    4.669193E-09  1.218663E-07
 1988 189 2100    1.730192E-10  5.904977E-08
 1988 189 2200    3.505524E-11  2.744583E-08
 1988 189 2300    0.000000E+00  4.535747E-09
 1988 190 0000    0.000000E+00  3.198288E-10
```

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