Air Pollution Dispersion Models:
Applications with the AERMOD Modeling System

AERMET HANDS-ON

COURSE #423

Air Pollution Training Institute | APTI

LEARNING OBJECTIVES

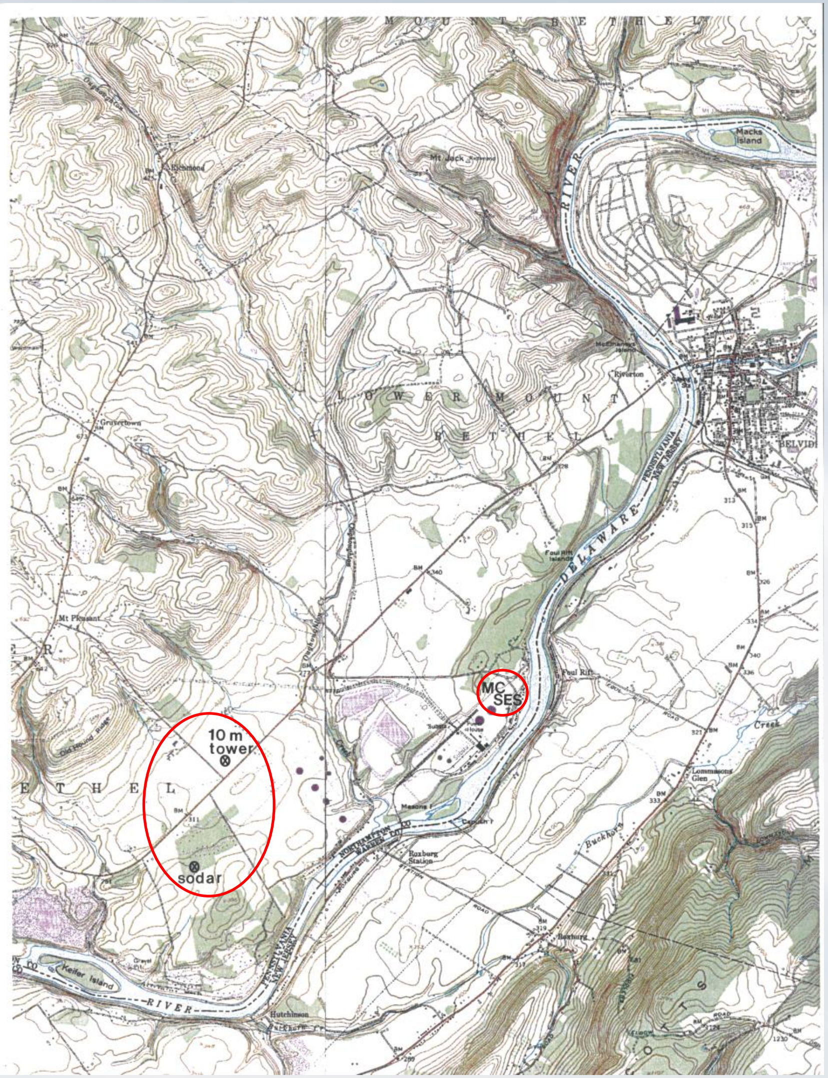
At the end of this lesson the student should be able to:

- Execute AERMET’s three-stage processing
- Download the meteorology needed for the exercises
- Develop the needed input for each stage
- Run each of AERMET’s stages
- Analyze and evaluate the results produced from AERMET

AERMET 3-Stage Processing

- Stage 1: Extract data from archive, format and QA data
- Stage 2:
  - Combine data into 1-day blocks (merge data)
  - Input AERMINUTE output
- Stage 3:
  - Calculate PBL parameters and output results for AERMOD
  - Pass all meteorological observations through to AERMOD
- Each stage is run separately

GEOGRAPHICAL SETTING—MARTINS CREEK



METEOROLOGICAL DATA

- Site Specific:
  - A single level of data from a 10-meter tower
  - 12 levels of data from a nearby sodar
- NWS Data:
  - Surface Data (ISHD): Allentown/Bethlehem – WMO # 14737 (KABE)
  - Upper Air Data (fls): Albany, NY (54775)

HANDS-ON ACTIVITY

- Two AERMET scenarios
  - 1-year (5/1/2011–4/30/2012)
    - Martins Creek site-specific (created from 1992–1993 data) – Primary met data
    - 1-minute ASOS Wind Data (from AERMINUTE) – used for substitution into MC DATA
    - National Weather Service (NWS) ISHD Surface Data – used for substitution into 1- min ASOS DATA
    - NWS upper air
  - 5-year (1/1/2008–12/31/2012)
    - 1-minute ASOS Wind Data (from AERMINUTE) – Primary met data
    - NWS ISHD Surface Data – used for substitution
    - NWS upper air

AERMET—FILES

- The program executable, along with the AERMET user's guide, can be found in the following directory:

  APTI423\Hands-On\AERMET\aermet_64 or _32.exe

- Develop data for two scenarios

1. **1 year with ONSITE data**
   - APTI423\Hands-On\AERMET**1-yr_Onsite**
2. **5 years with NWS data only**
   - APTI423\Hands-On\AERMET**5-yr_NWS**

AERMET—FILES

- Input files for 1-year scenario
  - **1-yr_Onsite\MC_ST1.INP**: *Stage 1 control file*
  - **1-yr_Onsite\MC_ST2.INP**: *Stage 2 control file*
  - **1-yr_Onsite\MC_ST3.INP**: *Stage 3 control file*
  - **1-yr_Onsite\MC_Site-Specific_Data\MCOSPFL_11-12.DAT**: *Onsite observations*
  - **1-yr_Onsite\NWS_Surface_data\.....** (need to download)
  - **1-yr_Onsite\NWS_Upper_Air_data\...** (Download)
  - **1-yr_Onsite\RunMC.BAT**: *Batch file that runs all three stages*

AERMET—FILES

- Input files for 5-year scenario
  - **5-yr_NWS\MC_ST1.INP**: *Stage 1 input*
  - **5-yr_NWS\MC_ST2.INP**: *Stage 2 input*
  - **5-yr_NWS\MC_ST3.INP**: *Stage 3 input*
  - **5-yr_NWS\RunMC.BAT**: Batch file that runs all three stages
  - **5-yr_NWS\NWS_Surface_data\\........** (Download)
  - **5-yr_NWS\NWS_Upper_air_data\\........** (Download)

AERMET—HOURLY OBSERVATIONS

- Download the 2011–2012 data from ftp://ftp.ncdc.noaa.gov/pub/data/noaa
- Click on the year of interest - 2011
  - Locating the file for Allentown/Bethlehem, WMO # **14737**
- Click on the filename and follow the browser's instructions

Save In: APTI423\ Hands-on\AERMET\1yr_Onsite\NWS_Surface_data

- Repeat the process for 2012
- Concatenate the individual files into a single file
- 5 yrs of surface have already been downloaded they are in …\5-yr_NWS\NWS_Surface_data

AERMET—Upper Air

- Download all 5 years from *here*
  - Input Dates (Coordinated Universal Time (UTC) units):
    - From: January 1, 2008, 00Z
    - To: December 31, 2012, 23Z
  - Sounding Specific Information:
    - Hours of Access: All times
    - Data Levels: All levels
    - Wind Units: Knots or tenths of meters per second (either is ok)

AERMET—UPPER AIR

- Select Stations/Data
  - Use option 2 to enter the WBAN station identifier: 54775
  - Select Output Options:
    - Sort Order: Station Series Sort
    - Format: Forecast Systems Laboratory (FSL) format (ASCII text)
- Click on Continue Data Access
  - The data will appear in your browser window—save the data to both: APTI423\Hands-on\AERMET\1-yr_onsite\NWS_Upper_Air_data & …\5-yr_NWS\...

Processing 1yr. Onsite Scenario

Stage 1

Stage 1—Control File Parameters

- Station elevations can be assumed to be 0.0 m
- Hourly Surface Observations
  - Data format: ISHD
  - Station Identifier: 14737
  - Latitude/longitude: 40.65N, 75.43W, Eastern time zone
  - Dates to process: May 1, 2011–April 30, 2012
- Upper Air Soundings
  - Data format: FSL
  - Station Identifier: 54775
  - Latitude/longitude: 42.75N, 73.80W, Eastern time zone
  - Dates to process: May 1, 2011–April 30, 2012
- Site-specific (Onsite) Data
  - Data format: user-specified
  - Station Identifier: user's choice
  - Latitude/longitude: 40.79N, 75.14W, local time
  - Dates to extract: May 1, 2011–April 30, 2012
  - Anemometer starting threshold speed: 0.3 m/s

STAGE 1—CONTROL FILE

- NWS hourly observations—ONSITE pathway
- Keywords
  - **DATA**: File Name
  - **LOCATION**: station ID, latitude/longitude, zone
  - **QAOUT**: output from QA processing
  - **XDATES**: dates to retrieve
  - **READ**: variables, by record, to read
  - **FORMAT**: format, by record
  - **THRESHOLD**: starting threshold of anemometer
  - **RANGE**: modifies default bounds and missing indicator
  - **AUDIT**: adds additional variables to report
  - **NO_MISSING**: do not report if data are missing

Stage 1—Martins Creek Data

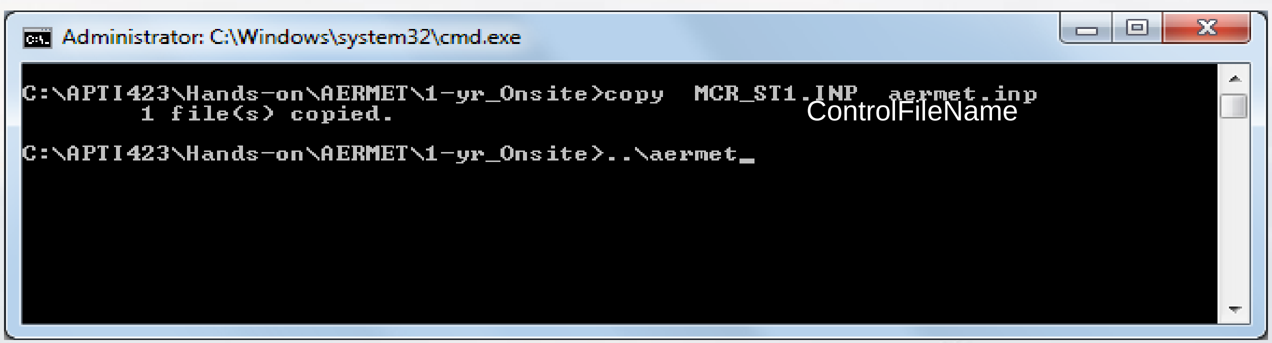
Site-specific observations—ONSITE pathway—sample data

```
0         1         2         3         4         5
12345678901234567890123456789012345678901234567890

2011   5   1   1 122
   10.0000  300.0000    0.3000  999.0000   10.0000
   90.0000   71.0000    1.6000
  120.0000   69.0000    2.1000
  150.0000   67.0000    2.5000
  180.0000   67.0000    2.9000
  210.0000   63.0000    3.0000
  240.0000   58.0000    2.9000
  270.0000   52.0000    3.1000
  300.0000   46.0000    3.2000
  330.0000   44.0000    3.4000
  360.0000   42.0000    3.3000
  390.0000   41.0000    3.5000
  420.0000  999.0000  999.0000
```

```
READ     1  OSYR  OSMO  OSDY  OSHR
READ     2  HT01  WD01  WS01  SA01  TT01
READ     3  HT02  WD02  WS02
READ     4  HT03  WD03  WS03
READ     5  HT04  WD04  WS04
READ     6  HT05  WD05  WS05
READ     7  HT06  WD06  WS06
READ     8  HT07  WD07  WS07
READ     9  HT08  WD08  WS08
READ    10  HT09  WD09  WS09
READ    11  HT10  WD10  WS10
READ    12  HT11  WD11  WS11
READ    13  HT12  WD12  WS12

READ    14  HT13  WD13  WS13
```

RUNNING AERMET STAGE 1

- To run Stage 1 for the Martins Creek 1-year scenario using the site-specific data:
  1. Open a command prompt and set the working directory as the directory where the control file is located, e.g., APTI423\Hands-on\AERMET\1-yr_Onsite
  2. Start AERMET by typing "..\aermet controlFileName" at the command prompt, then hit "Enter"



Stage 1—Message File

MCR_ST1.MES

MCR_ST1for_pres.MES.txt - Notepad

File Edit Format View Help

```
       1 ONSITE     W51 LOCCRD  : NO ONSITE elevation specified on LOCATION keyword, default of 0m assumed;
       2 ONSITE     W51 LOCCRD  :  Recommend specifying station elevation.
         JOB        I19  SETUP  : "END OF FILE" ON UNIT  5 AFTER RECORD #  71
         JOB        I27 OSTEST  : Minimum and maximum ONSITE height level indices derived from data file are:    1  13
         UPPERAIR   I30  UAEXT  : **** UPPER AIR EXTRACTION ****
20110829 UPPERAIR   W36 GETFSL  : SDG SKIPPED: 1st LEVEL NOT TYPE 9, SDG # 2726
         UPPERAIR   I39 GETFSL  : END-OF DATA WINDOW ENCOUNTERED
         UPPERAIR   I39  UAEXT  : 741 SOUNDINGS EXTRACTED
  110501 UPPERAIR   CLM UAQASM  : CALM WINDS FOR HR  07 AT LEVEL  1
  110512 UPPERAIR   CLM UAQASM  : CALM WINDS FOR HR  07 AT LEVEL  1
.
.
  120419 UPPERAIR   CLM UAQASM  : CALM WINDS FOR HR  07 AT LEVEL  1
  120423 UPPERAIR   Q36 UAQASM  : COULD NOT RECOMPUTE HTS. FOR HR  19
  120430 UPPERAIR   CLM UAQASM  : CALM WINDS FOR HR  07 AT LEVEL  1
         UPPERAIR   I39 UAQASM  : EOF AFTER UPPERAIR SOUNDING #   740
         SURFACE    I40  SFEXT  : *** SURFACE OBSERVATION EXTRACTION ***
20110101 SURFACE    W46 RDISHD  : NO SURFACE elev on LOCATION keyword, but elev from ISHD file =    117.0 m;
       2 SURFACE    W46 RDISHD  :  Recommend specifying elev on the LOCATION keyword
         SURFACE    I41 FNDCOMDT: ASOS commission date FOUND for WBAN =  14737; CALL4 = KABE; CALL3 = ABE; CommDate = 19951101
20120501 SURFACE    I49 RDISHD  : End of extract window after record:        17618
         SURFACE    I49 RDISHD  : The # of extracted records is:              8773
         SURFACE    W48 RDISHD  : The # of discarded records is:              2462.  See 'Discarded_ISHD_Records.dat' file.
         SURFACE    W48 RDISHD  : The # of records flagged as calm is:        2801
         SURFACE    W48 RDISHD  : The # of records flagged as variable is:     204
         SURFACE    I49 SFQATM  : End of file after data record:              8773
         SURFACE    I49  SFEXT  :  8773 SURFACE records extracted
         SURFACE    I48  SFEXT  : # ASOS wind data records based on commission date:  11892
  110430 SURFACE    CLM SFQASM  : CALM WINDS FOR HR 22
  110430 SURFACE    CLM SFQASM  : CALM WINDS FOR HR 24
.
.
  120430 SURFACE    Q49 SFQASM  : WDIR MISSING FOR HR 12
         SURFACE    I49 SFQASM  : END OF FILE AFTER HOURLY OBS #  8773
20110501 ONSITE     Q59 OSQACK  : WD   missing for HR:  01; LEVEL : 13
20110501 ONSITE     Q59 OSQACK  : WS   missing for HR:  01; LEVEL : 13
20110501 ONSITE     Q59 OSQACK  : WD   missing for HR:  03; LEVEL :  1
20110501 ONSITE     Q59 OSQACK  : WD   missing for HR:  04; LEVEL :  1
.
.
20120430 ONSITE     Q59 OSQACK  : WS   missing for HR:  21; LEVEL : 10
20120430 ONSITE     Q59 OSQACK  : WS   missing for HR:  21; LEVEL : 11
20120430 ONSITE     Q59 OSQACK  : WS   missing for HR:  21; LEVEL : 12
20120430 ONSITE     Q59 OSQACK  : WS   missing for HR:  21; LEVEL : 13
20120430 ONSITE     Q59 OSQACK  : WD   missing for HR:  23; LEVEL :  1
```

STAGE 1—REPORT FILE

MCR_ST1.RPT

AERMET, A Meteorological Processor for the AERMOD Dispersion Model
Version 19191

Data Processed on 3-MAR-2020 at 11:24:49

Stage 1 Page 1

****
*** AERMET Data Processing Finished Successfully ***
****

1. Job File Names

Listing of Messages: MCR_ST1.MES
Summary (this file): MCR_ST1.RPT

Stage 1—Report File Cont'd

MCR_ST1.RPT

2. Upper Air Data

Site ID	Latitude(deg.)	Longitude(deg.)	Time Adjustment
54775	42.75N	73.80W	5

Data Format: FSL

AERMET Has Determined That Processing For This Pathway Includes:
EXTRACT AND QUALITY ASSESSMENT

Extract Input - OPEN: NWS_UPPER_AIR_DATA\54775_2011-12.FSL
Extract Output- OPEN: ALB_2011-12.IQA
QA Output - OPEN: ALB_2011-12.OQA

The Extract Dates Are: Starting: 1-MAY-11
Ending: 30-APR-12

Upper Air Data Above the First Level Above 5000 Meters Not Extracted
Upper Air Automatic Data Checks Are: OFF

STAGE 1—REPORT FILE CONT'D

MCR_ST1.RPT

3. NWS Surface Data

Site ID	Latitude(deg.)	Longitude(deg.)	Time Adjustment	Elev. (m)
14737	40.65N	75.43W	5	0.0

Data Format: ISHD

AERMET Has Determined That Processing For This Pathway Includes:
EXTRACT AND QUALITY ASSESSMENT

Extract Input - OPEN: NWS_SURFACE_DATA\14737_2011-2012.DAT
Extract Output- OPEN: 14737_2011-12.IQA
QA Output - OPEN: 14737_2011-12.OQA

The Extract Dates Are: Starting: 1-MAY-11
Ending: 30-APR-12

Stage 1—Report File Cont'd

MCR_ST1.RPT

4. On-site Data

Site ID	Latitude(deg.)	Longitude(deg.)	Time Adjustment	Elev. (m)
000001	40.79N	75.14W	0	0.0

AERMET Has Determined That Processing For This Pathway Includes:
QUALITY ASSESSMENT ONLY

Extract Output- OPEN: MC_SITE-SPECIFIC_DATA\MCOSPFL_11-12.DAT
QA Output - OPEN: MCOSPFL_11-12.OQA

The Extract Dates Are: Starting: 1-MAY-11
Ending: 30-APR-12

STAGE 1—REPORT FILE CONT'D

MCR_ST1.RPT

```
     AERMET, A Meteorological Processor for the AERMOD Dispersion Model
                               Version  19191

                   Data Processed on 3-MAR-2020 at 11:24:49


                                 Stage 1                          Page   2

           ********************************************************
           ***   AERMET Data Processing Finished Successfully   ***
           ********************************************************


                    **** SUMMARY OF THE QA AUDIT ****

   THERE IS NO AUDIT TRAIL FOR    SOUNDINGS


SURFACE DATA         |------VIOLATION SUMMARY------|   |-----TEST VALUES-----|
              TOTAL     #     LOWER  UPPER      %      MISSING   LOWER   UPPER
              # OBS  MISSING  BOUND   ACCEPTED           FLAG    BOUND   BOUND
      TMPD    8773        4       0       0     99.95     999.0, -300.0,  400.0
      WDIR    8773      185       0       0     97.89     999.0,    0.0,   36.0
      WSPD    8773        7       0       0     99.92     999.0,    0.0,  500.0

NOTE: Test values were also multiplied by the same factors applied to the data
      (see Appendix B of the AERMET User's Guide)


       In addition, for the  8773 hourly obs, AERMET reports that there are:

          2075 CALM WIND CONDITIONS (WS=0, WD=0)
             0 ZERO WIND SPEEDS WITH NONZERO WIND DIRECTIONS
             0 DEW-POINT GREATER THAN DRY BULB TEMPERATURES

       The date & time of these occurrences can be found in
       the message file  MCR_ST1.MSG
```

STAGE 1—REPORT FILE CONT'D

MCR_ST1.RPT

```
      AERMET, A Meteorological Processor for the AERMOD Dispersion Model
                                 Version  19191

                    Data Processed on  3-MAR-2020 at 11:24:49


                                  Stage 1                          Page   3

            ********************************************************
            ***   AERMET Data Processing Finished Successfully   ***
            ********************************************************


                 **** SUMMARY OF THE QA AUDIT, CONTINUED ****

    THERE IS NO AUDIT TRAIL FOR SITE SCALARS


SITE VECTORS         |------VIOLATION SUMMARY------|   |-----TEST VALUES-----|
              TOTAL     #     LOWER  UPPER      %      MISSING   LOWER   UPPER
              # OBS  MISSING  BOUND   ACCEPTED     FLAG     BOUND
10.00 M
      SA      8784     1403      0      0     84.03      999.0,    0.0,  360.0
      TT      8784       11      0      0     99.87      999.0,  -30.0,   35.0
      WD      8784     1268      0      0     85.56      999.0,    0.0,  360.0
      WS      8784      120      0      0     98.63      999.0,    0.0,   50.0
    90.00 M
      WD      8784      307      0      0     96.51      999.0,    0.0,  360.0
      WS      8784      300      0      0     96.58      999.0,    0.0,   50.0
   120.00 M
      WD      8784      330      0      0     96.24      999.0,    0.0,  360.0
      WS      8784      325      0      0     96.30      999.0,    0.0,   50.0
   150.00 M
      WD      8784      370      0      0     95.79      999.0,    0.0,  360.0
      WS      8784      364      0      0     95.86      999.0,    0.0,   50.0
   180.00 M
      WD      8784      446      0      0     94.92      999.0,    0.0,  360.0
      WS      8784      443      0      0     94.96      999.0,    0.0,   50.0
```

STAGE 1—REPORT FILE CONT'D

MCR_ST1.RPT

```
          AERMET, A Meteorological Processor for the AERMOD Dispersion Model
                                Version  19191

                    Data Processed on  3-MAR-2020 at 11:24:49


                                  Stage 1                          Page    4

                   THE FOLLOWING ON-SITE VALUES ARE IN EFFECT


Number of OBS/HOUR:

    1


Threshold wind speed (m/s):

   0.30


Heights for tower data (m), based on HTnn fields in data file:

  10.00   90.00  120.00  150.00  180.00  210.00  240.00  270.00  300.00  330.00
 360.00  390.00  420.00
```

STAGE 1—REPORT FILE CONT'D

MCR_ST1.RPT

```
                                   Stage 1                          Page   5

                ********************************************************
                ***   AERMET Data Processing Finished Successfully   ***
                ********************************************************

                       EXTRACT AND/OR QA THE METEOROLOGICAL DATA

                        **** AERMET MESSAGE SUMMARY TABLE ****

            0- 9   10-19   20-29   30-39   40-49   50-59   60-69   70-89   TOTAL
         -------------------------------------------------------------------------

    JOB
      E      0       0       0       0       0       0       0       0       0
      W      0       0       0       0       0       0       0       0       0
      I      0       1       1       0       0       0       0       0       2

    UPPERAIR
      E      0       0       0       0       0       0       0       0       0
      W      0       0       0       1       0       0       0       0       1
      I      0       0       0       4       0       0       0       0       4
      Q      0       0       0      14       0       0       0       0      14

    SURFACE
      E      0       0       0       0       0       0       0       0       0
      W      0       0       0       0       5       0       0       0       5
      I      0       0       0       0       8       0       0       0       8
      Q      0       0       0       0     196       0       0       0     196

    ONSITE
      E      0       0       0       0       0       0       0       0       0
      W      0       0       0       0       0       2       0       0       2
      I      0       0       0       0       0       0       0       0       0
      Q      0       0       0       0       0   38561       0       0   38561
         -------------------------------------------------------------------------
             0       1       1      19     209   38563       0       0   38793
```

STAGE 1—REPORT FILE CONCLUDED

MCR_ST1.RPT

```
  ****    ERROR MESSAGES    ****

              ---  NONE  ---


        ****   WARNING MESSAGES   ****
20110829 UPPERAIR   W36 GETFSL  : SDG SKIPPED: 1st LEVEL NOT TYPE 9, SDG # 2726
20110101 SURFACE    W46 RDISHD  : NO SURFACE elev on LOCATION keyword, but elev
from ISHD file =    117.0 m;
       2 SURFACE    W46 RDISHD  :  Recommend specifying elev on the LOCATION
keyword
         SURFACE    W48 RDISHD  : The # of discarded records is:             2462.
See 'Discarded_ISHD_Records.dat' file.
         SURFACE    W48 RDISHD  : The # of records flagged as calm is:        2801
         SURFACE    W48 RDISHD  : The # of records flagged as variable is:     204
       1 ONSITE     W51 LOCCRD  : NO ONSITE elevation specified on LOCATION
keyword, default of 0m assumed;
       2 ONSITE     W51 LOCCRD  :  Recommend specifying station elevation.

    ASOS Commission Date for Surface Station    14737 (YYYYMMDD): 19951101
```

STAGE 1—UPPER AIR OUTPUT

ALB_2011-12.OQA

```
*    AERMET Version  19191
*% UPPERAIR
*    DATA      NWS_UPPER_AIR_DATA\54775_2011-12.FSL  FSL
*    EXTRACT   ALB_2011-12.IQA
*@   LOCATION  54775  42.75N  73.80W  5
*    XDATES    2011/5/1 TO 2012/4/30
*    QAOUT     ALB_2011-12.OQA
*** EOH: END OF UPPERAIR QA HEADERS
 11050107   19
  10150      0     66     15      0      0
  10010    114     82     11    999   9990
  10000    126     82     11    350     15
   9860    242     78    -11    999   9990
   9700    377     94    -26    999   9990
   9460    583     84    -76    999   9990
   9250    769     70    -70    160     20
   9060    938     60    -60    999   9990
   8800   1175     46    -84    999   9990
   8670   1296     52   -298    999   9990
   8500   1460     64   -426     60     51
   8460   1499     68   -422    999   9990
   8120   1833     48   -262    999   9990
   7940   2015     48   -342    999   9990
   7000   3029    -21   -461     20     82
   6190   3990    -89   -489    999   9990
   5780   4514   -137   -467    999   9990
   5530   4848   -149   -539    999   9990
   5020   5569   -213   -563    999   9990
 11050119   24
  10090      0    210    -30    195     15
  10000     82    198    -52    165     36
   9710    333    174   -116    999   9990
   9390    616    148    -82    999   9990
   9250    745    140   -130    165     61
```

STAGE 1—HOURLY SURFACE OBS. OUTPUT

14737_2011-12.OQA

```
*    AERMET Version  19191
*% SURFACE
*@     DATA      NWS_SURFACE_DATA\14737_2011-2012.DAT  ISHD
*      EXTRACT   14737_2011-12.IQA
*      QAOUT     14737_2011-12.OQA
*@     LOCATION  14737   40.65N   75.43W  5
*      XDATES    11/5/1 TO 12/4/30
*  SF      SURFACE DATA QUALITY ASSESSMENT
*** EOH: END OF SURFACE QA HEADERS
 11043020     0 10207 10066   300 00099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160   156   999    11    37    34    15  A
 11043021     0 10217 10076   300 00099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160   144   999    17    41    32    15  A
 11043022     0 10222 10083   300 00099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160   111   999    28    56     0     0  A
 11043023     0 10230 10089   300 00099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160   111   999    33    58     5    21  A
 11043024     0 10238 10096   300 00099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160   100   999    28    60     0     0  A
 11050101     0 10241 10103   300 00099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160    89   999    33    67     0     0  A
 11050102     0 10244 10103   300 00099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160    78   999    39    76     0     0  A
 11050103     0 10248 10106   300 00099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160    78   999    33    73     6    26  A
 11050104     0 10246 10106   300 00099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160    72   999    33    76     5    15  A
 11050105     0 10249 10106   300 00099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160    61   999    39    85     0     0  A
     .
     .
     .
 12043016     0 10224 10083    14 01099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160   172   999     0    30    17    57  A
 12043017     0 10225 10083    12 01099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160   150   999     0    35    18    57  A
 12043018     0 10227 10083     8 01099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160   139   999    28    46    19    41  A
 12043019     0 10224 10083    13 01099 09999 00300 00300 00300 00300
         00300 09999 00000 00099 00999   160   139   999    39    50    19    36  A
```

STAGE 1—SITE-SPECIFIC OUTPUT

MCOSPFL_11-12.OQA

```
*    AERMET Version  19191
*% ONSITE
*    DATA      MC_SITE-SPECIFIC\MCOSPFL_11-12.DAT
*@   LOCATION  000001   40.79N  75.14W  0
*    XDATES    11/5/1  2012/4/30
*    QAOUT     MCOSPFL_11-12.OQA
*$   READ       1  OSYR  OSMO  OSDY  OSHR
*$   READ       2  HT01  WD01  WS01  SA01  TT01
*$   READ       3  HT02  WD02  WS02
*$   READ       4  HT03  WD03  WS03
*$   READ       5  HT04  WD04  WS04
*$   READ       6  HT05  WD05  WS05
*$   READ       7  HT06  WD06  WS06
*$   READ       8  HT07  WD07  WS07
*$   READ       9  HT08  WD08  WS08
*$   READ      10  HT09  WD09  WS09
*$   READ      11  HT10  WD10  WS10
*$   READ      12  HT11  WD11  WS11
*$   READ      13  HT12  WD12  WS12
*$   READ      14  HT13  WD13  WS13
*$   FORMAT     1  ( I4,I4,I4,I4 )
*$   FORMAT     2  ( 5F10.4, )
*$   FORMAT     3  ( 3F10.4 )
*$   FORMAT     4  ( 3F10.4 )
*$   FORMAT     5  ( 3F10.4 )
*$   FORMAT     6  ( 3F10.4 )
*$   FORMAT     7  ( 3F10.4 )
*$   FORMAT     8  ( 3F10.4 )
*$   FORMAT     9  ( 3F10.4 )
*$   FORMAT    10  ( 3F10.4 )
*$   FORMAT    11  ( 3F10.4 )
*$   FORMAT    12  ( 3F10.4 )
*$   FORMAT    13  ( 3F10.4 )
*$   FORMAT    14  ( 3F10.4 )
*$   THRESHOLD 0.3
*$   RANGE     TT    -30 <=  35  999
*$   RANGE     WS      0 <   50  999
*$   RANGE     WD      0 <= 360  999
*$   RANGE     SA      0 <= 360  999
*    AUDIT     SA
*    NO_MISSING TT02,TT03,TT04,TT05,TT06,TT07,TT08, TT09
*    NO_MISSING TT10,TT11,TT12,TT13,TT14, SA01
*  OS     ON-SITE QUALITY ASSESSMENT
*** EOH: END OF ON-SITE QA HEADERS
```

STAGE 1—SITE-SPECIFIC INPUT

MCOSPFL_11-12.DAT

```
2011   5   1   1 122
    10.0000  300.0000    0.3000  999.0000   10.0000
    90.0000   71.0000    1.6000
   120.0000   69.0000    2.1000
   150.0000   67.0000    2.5000
   180.0000   67.0000    2.9000
   210.0000   63.0000    3.0000
   240.0000   58.0000    2.9000
   270.0000   52.0000    3.1000
   300.0000   46.0000    3.2000
   330.0000   44.0000    3.4000
   360.0000   42.0000    3.3000
   390.0000   41.0000    3.5000
   420.0000  999.0000  999.0000
2011   5   1   2 122
 10.0000  240.0000    0.6000  999.0000   10.0000
    90.0000    9.0000    1.3000
   120.0000   20.0000    1.5000
   150.0000   36.0000    1.5000
   180.0000   45.0000    1.5000
   210.0000   45.0000    1.6000
   240.0000   44.0000    1.6000
   270.0000   39.0000    1.8000
   300.0000   31.0000    2.2000
   330.0000   23.0000    2.3000
   360.0000   22.0000    2.4000
   390.0000   24.0000    2.4000
   420.0000   24.0000    2.8000
2011   5   1   3 122
    10.0000  999.0000    0.1500  999.0000   10.0000
    90.0000   85.0000    0.6000
   120.0000   34.0000    0.5000
   150.0000  360.0000    1.1000
   180.0000  358.0000    1.6000
   210.0000    4.0000    1.7000
   240.0000    2.0000    2.0000
   270.0000  359.0000    2.1000
   300.0000  360.0000    2.5000
   330.0000  360.0000    3.0000
   360.0000  359.0000    3.5000
   390.0000  354.0000    4.1000
   420.0000  352.0000    4.4000
```

Stage 2

AERMET Stage 2—Control File

MCR_ST2.INP

```
JOB
   MESSAGES
   REPORT

UPPERAIR
   QAOUT

SURFACE
   QAOUT
   ASOS1MIN

ONSITE
   QAOUT

MERGE
   OUTPUT
   XDATES
```

QAOUT file from Stage 1.

Created during AERMINUTE hands-on. Be sure to include the path where the file is located.

QAOUT file from Stage 1.

RUNNING AERMET STAGE 2

- To run Stage 2 for the Martins Creek 1-year scenario using the site-specific data:
  1. Open a command prompt and set the working directory as the directory where the control file is located, e.g., APTI423\Hands-on\AERMET\1-yr_Onsite
  2. Start AERMET by typing ..\aermet ControlFileName (for Stage 2)

STAGE 2—MESSAGES OUTPUT

MCR_ST2.MES

```
JOB        I19  SETUP  : "END OF FILE" ON UNIT  5 AFTER RECORD #  17
JOB        I25   TEST  : SUMMARY: NO DATA EXTRACTION FOR UPPERAIR
JOB        I25   TEST  : SUMMARY: NO DATA QA FOR UPPERAIR
JOB        I26   TEST  : SUMMARY: NO DATA QA FOR SURFACE
JOB        I27 OSTEST  : Minimum and maximum ONSITE height level indices derived from data file are:    1  13
JOB        I27   TEST  : SUMMARY: NO DATA QA FOR ONSITE
    75 HEADERS PROCESSED FROM INPUT FILES
MERGE      W66 MERGE   : 1-MIN ASOS winds from AERMINUTE Version 15272  used for WBAN: 14737; Call_ID: KABE
MERGE      I41 FNDCOMDT: ASOS commission date FOUND for WBAN =  14737; CALL4 = KABE; CALL3 = ABE; CommDate = 19951101
MERGE      I66 MERGE   : 1-MIN ASOS WBAN: 14737 matches SURFACE WBAN:    14737
MERGE      I59 OSFILL2 : EOF for ONSITE data after observation #:    8784
```

Stage 2—Report File

MCR_ST2.RPT

```
      AERMET, A Meteorological Processor for the AERMOD Dispersion Model
                                Version  19191

                    Data Processed on 3-MAR-2020 at 10:58:16

                                Stage 2                          Page   1

             ********************************************************
             ***        AERMET Setup Finished Successfully        ***
             ********************************************************

1.   Job File Names

     Listing of Messages: MCR_ST2.MES
     Summary (this file): MCR_ST2.RPT


2.   Upper Air Data

      Site ID    Latitude(deg.)   Longitude(deg.)   Time Adjustment
        54775       42.75N            73.80W               5

     AERMET Has Determined That Processing For This Pathway Includes:
          MERGE ONLY

          QA Output     -    OPEN: ALB_2011-12.OQA


3.   NWS Surface Data

      Site ID    Latitude(deg.)   Longitude(deg.)   Time Adjustment
        14737       40.65N            75.43W               5

     AERMET Has Determined That Processing For This Pathway Includes:
          MERGE ONLY

          QA Output     -    OPEN: 14737_2011-12.OQA
          1-MIN ASOS    -    OPEN: ..\..\AERMINUTE/KABE_2008-2012_1-MIN_HOUR.OUT
```

Stage 2—Report File Cont'd

MCR_ST2.RPT

```
4.  On-site Data

     Site ID    Latitude(deg.)   Longitude(deg.)   Time Adjustment
      000001       40.79N             75.14W                0

    AERMET Has Determined That Processing For This Pathway Includes:
         MERGE ONLY

         QA Output      -     OPEN: MCOSPFL_11-12.OQA


 5.  Merged Data
         Merge Output   -     OPEN: MC_2011-12.MRG
```

STAGE 2—REPORT FILE CONT'D

MCR_ST2.RPT

```
AERMET, A Meteorological Processor for the AERMOD Dispersion Model
                                  Version  19191

                     Data Processed on  3-MAR-2020 at 11:24:49


                                     Stage 2                          Page   2

                        Merging the Meteorological Data

The Merged Dates Are:     Starting:  1-MAY-2011
                            Ending: 30-APR-2012

                  ***** Daily Output Statistics *****
             MO/DY:  5/ 1  5/ 2  5/ 3  5/ 4  5/ 5  5/ 6  5/ 7  5/ 8  5/ 9  5/10
NWS  Upper Air  Sdgs   2     4     4     4     4     4     4     4     4     4
NWS Sfc Observations  24    24    24    24    24    24    24    24    24    24
On-site Observations  24    24    24    24    24    24    24    24    24    24
Ave 1-min ASOS Winds  24    24    24    24    24    24    24    24    24    24

             MO/DY:  5/11  5/12  5/13  5/14  5/15  5/16  5/17  5/18  5/19  5/20
NWS  Upper Air  Sdgs   4     4     4     4     4     4     4     4     4     4
NWS Sfc Observations  24    24    24    24    24    24    24    24    24    24
On-site Observations  24    24    24    24    24    24    24    24    24    24
Ave 1-min ASOS Winds  24    24    24    24    24    24    24    24    24    24

             MO/DY:  5/21  5/22  5/23  5/24  5/25  5/26  5/27  5/28  5/29  5/30
NWS  Upper Air  Sdgs   4     4     4     4     4     5     6     5     4     4
NWS Sfc Observations  24    24    24    24    24    24    24    24    24    24
On-site Observations  24    24    24    24    24    24    24    24    24    24
Ave 1-min ASOS Winds  24    24    24    24    24    24    24    24    24    24
   .
   .
   .

TOTAL OBSERVATIONS READ:
   Upper Air Soundings :    740
   NWS Sfc Observations:   8773
   On-site Observations:   8784
   1-min ASOS Wind Data:  37969

                  ***** MERGE PROCESS COMPLETED *****
```

STAGE 2—REPORT FILE, CONCLUDED

MCR_ST2.RPT

```
      AERMET, A Meteorological Processor for the AERMOD Dispersion Model
                                 Version  19191

                  Data Processed on  3-MAR-2020 at 11:24:49


                                   Stage 2                         Page   7

            ********************************************************
            ***   AERMET Data Processing Finished Successfully   ***
            ********************************************************


                  **** AERMET MESSAGE SUMMARY TABLE ****

        0- 9   10-19   20-29   30-39   40-49   50-59   60-69   70-89   TOTAL
     -----------------------------------------------------------------------

JOB
  E      0       0       0       0       0       0       0       0       0
  W      0       0       0       0       0       0       0       0       0
  I      0       1       5       0       0       0       0       0       6

MERGE
  E      0       0       0       0       0       0       0       0       0
  W      0       0       0       0       0       0       1       0       1
  I      0       0       0       0       1       1       1       0       3
     -----------------------------------------------------------------------
         0       1       5       0       1       1       2       0      10

      ****    ERROR MESSAGES    ****

              ---  NONE  ---


      ****   WARNING MESSAGES   ****
       MERGE      W66 MERGE   : 1-MIN ASOS winds from AERMINUTE Version 15272  used for WBAN: 14737; Call_ID: KABE

  ASOS Commission Date for 1-min ASOS Station    14737 (YYYYMMDD): 19951101
```

Stage 2—Merged Data File

MC_2011-12.MRG

- Merged data file is too large to show (almost 200,000 records)
- Hard to determine where an hour begins and ends for NWS upper air and hourly observations
- Hourly site-specific data are more understandable and more easily identified in the file
- All the header records we saw in Stage 1 plus the control file records of Stage 2 precede the data
- Could be useful if trying to review and understand results after running Stage 3

STAGE 3

Stage 3—Control File Parameters

- Three processing options used in hands-on exercise (METHOD keyword)
  - Substitute NWS data
  - When NWS data are substituted, randomize the wind direction
- Anemometer height: 7.9 meters

Stage 3—Control File

MCR_ST3.INP

```
JOB
  MESSAGES   [        ]
  REPORT     [        ]

METPREP
   DATA   [        ]
   METHOD REFLEVEL  [        ]
   METHOD WIND_DIR  [        ]
   NWS_HGT   [      ]  [      ]

   OUTPUT    [        ]
   PROFILE   [        ]

** Site characteristics generated with AERSURFACE
** 2011 NLCD w/ Impervious and Canopy

   aersurf   [        ]

   aersurf2  [        ]
```

Path and filename of the data file generated in Stage 2 (OUTPUT).

Output file with boundary layer parameters (.SFC)

Output file with profile data (.PFL)

Surface characteristics for **primary** site for data collection (site-specific)

Surface characteristics for **secondary** site (NWS data).

Running AERMET Stage 3

- To run Stage 3 for the Martins Creek 1-year scenario using the site-specific data:

  1. Open a command prompt and set the working directory as the directory where the control file is located, e.g., APTI423\Hands-on\AERMET\1-yr_Onsite
  2. Start AERMET by typing: ..\aermet ControlFileName (for Stage 3) at the command prompt, then hit "Enter"

STAGE 3—REPORT FILE

MCR_ST3.RPT

```
        AERMET, A Meteorological Processor for the AERMOD Dispersion Model
                                   Version  19191

                      Data Processed on  3-MAR-2020 at 11:24:49


                                      Stage 3                         Page   1

              ********************************************************
              ***        AERMET Setup Finished Successfully        ***
              ********************************************************

1.   Job File Names

     Listing of Messages: MCR_ST3.MES
     Summary (this file): MCR_ST3.RPT

2.   Upper Air Data

      Site ID    Latitude(deg.)   Longitude(deg.)   Time Adjustment
        54775       42.75N            73.80W                5

     AERMET Has Determined That Processing For This Pathway Includes:
          NONE, NO DATA TO BE PROCESSED ON THIS PATH

3.   NWS Surface Data

      Site ID    Latitude(deg.)   Longitude(deg.)   Time Adjustment   Elev. (m)
        14737       40.65N            75.43W                5              0.0

     AERMET Has Determined That Processing For This Pathway Includes:
          NONE, NO DATA TO BE PROCESSED ON THIS PATH

          1-MIN ASOS    -    USED: KABE_2011-2012_1-MIN_HOUR.OUT

4.   On-site Data

      Site ID    Latitude(deg.)   Longitude(deg.)   Time Adjustment   Elev. (m)
       000001       40.79N            75.14W                0              0.0

     AERMET Has Determined That Processing For This Pathway Includes:
          NONE, NO DATA TO BE PROCESSED ON THIS PATH
```

STAGE 3—REPORT FILE CONT'D

MCR_ST3.RPT

```
        AERMET, A Meteorological Processor for the AERMOD Dispersion Model
                                   Version  19191

                     Data Processed on  3-MAR-2020 at 11:24:49


                                   Stage 3                         Page   2

           *******************************************************
           ***        AERMET Setup Finished Successfully       ***
           *******************************************************

 1.  Input/Output Files

     MCR_ST3.RPT                                         OPENED SUCCESSFULLY
     MCR_ST3.MES                                         OPENED SUCCESSFULLY
     MC_2011-12.MRG                                      OPENED SUCCESSFULLY
     MC_2011-12.SFC                                      OPENED SUCCESSFULLY
     MC_2011-12.PFL                                      OPENED SUCCESSFULLY

 2.  Dispersion Model for which Data Are Processed

       AERMOD

 3.  Processing Options

        Process       Scheme         Description
        -------       ------         -----------
     WIND DIRECTION   RANDOM      NWS wind directions are RANDOMIZED
     CLOUD COVER      CVR_SUB     Missing CCVR substitutions ARE included
     TEMPERATURE      NOTSUB      Missing TEMP substitutions NOT included
     SBL PROCESSING   UCALST      The default (Holtslag) method is used
     ASOS ADJUSTMENT  ASOS_ADJ    ASOS wind speeds, if present, ARE adjusted for truncation
     SDG SELECTION    00Z/12Z     Sounding selection based on 12Z sdg
                                   Selection window:  -1     1
     REFERENCE LEVEL  SUBNWS      NWS data ARE SUBSTITUTED for missing on-site data
                                   Anemometer height(m):    7.90

 4.  Locations of Meteorological Data

      Data           Site     Longitude   Latitude
     Pathway          ID      (degrees)   (degrees)
     -------         ----     ---------   ---------
     UPPERAIR        54775      73.80W      42.75N
     SURFACE         14737      75.43W      40.65N
     ONSITE         000001      75.14W      40.79N
```

STAGE 3—REPORT FILE CONT'D

MCR_ST3.RPT

5. Primary Site Surface Characteristics from File:

..\..\..\AERSURFACE\MC\COMPLETED_RUN\MC_2011_IMP_CAN.SFC

User Inputs Varied by: Month

Month	Wind Sector Start	Wind Sector End	Albedo	Bowen Ratio	Roughness Length (m)
1	180.	260.	0.17	0.74	0.0280
2	180.	260.	0.54	0.48	0.0130
3	180.	260.	0.54	0.48	0.0130
4	180.	260.	0.15	0.39	0.0380
5	180.	260.	0.15	0.39	0.0380
6	180.	260.	0.15	0.39	0.0380
7	180.	260.	0.18	0.42	0.1650
8	180.	260.	0.18	0.42	0.1650
9	180.	260.	0.18	0.42	0.1650
10	180.	260.	0.17	0.74	0.0280
11	180.	260.	0.17	0.74	0.0280
12	180.	260.	0.17	0.74	0.0280
1	260.	180.	0.17	0.74	0.0320
2	260.	180.	0.54	0.48	0.0160
3	260.	180.	0.54	0.48	0.0160
4	260.	180.	0.15	0.39	0.0440
5	260.	180.	0.15	0.39	0.0440
6	260.	180.	0.15	0.39	0.0440
7	260.	180.	0.18	0.42	0.1840
8	260.	180.	0.18	0.42	0.1840
9	260.	180.	0.18	0.42	0.1840
10	260.	180.	0.17	0.74	0.0320
11	260.	180.	0.17	0.74	0.0320
12	260.	180.	0.17	0.74	0.0320

STAGE 3—REPORT FILE CONT'D

MCR_ST3.RPT

Secondary Site Surface Characteristics from File:

..\..\..\AERSURFACE\KABE\COMPLETED_RUN\KABE_2011_IMP_CAN.SFC

User Inputs Varied by: Month

Month	Wind Sector Start	End	Albedo	Bowen Ratio	Roughness Length (m)
1	60.	235.	0.18	0.90	0.0250
2	60.	235.	0.47	0.49	0.0170
3	60.	235.	0.47	0.49	0.0170
4	60.	235.	0.16	0.60	0.0310
5	60.	235.	0.16	0.60	0.0310
6	60.	235.	0.16	0.60	0.0310
7	60.	235.	0.17	0.67	0.0360
8	60.	235.	0.17	0.67	0.0360
9	60.	235.	0.17	0.67	0.0360
10	60.	235.	0.18	0.90	0.0250
11	60.	235.	0.18	0.90	0.0250
12	60.	235.	0.18	0.90	0.0250
1	235.	320.	0.18	0.90	0.0150
2	235.	320.	0.47	0.49	0.0090
3	235.	320.	0.47	0.49	0.0090
4	235.	320.	0.16	0.60	0.0210
5	235.	320.	0.16	0.60	0.0210
6	235.	320.	0.16	0.60	0.0210
7	235.	320.	0.17	0.67	0.0270
8	235.	320.	0.17	0.67	0.0270
9	235.	320.	0.17	0.67	0.0270
10	235.	320.	0.18	0.90	0.0150
11	235.	320.	0.18	0.90	0.0150
12	235.	320.	0.18	0.90	0.0150

STAGE 3—REPORT FILE CONT'D

MCR_ST3.RPT

1	320.	60.	0.18	0.90	0.0180
2	320.	60.	0.47	0.49	0.0110
3	320.	60.	0.47	0.49	0.0110
4	320.	60.	0.16	0.60	0.0230
5	320.	60.	0.16	0.60	0.0230
6	320.	60.	0.16	0.60	0.0230
7	320.	60.	0.17	0.67	0.0290
8	320.	60.	0.17	0.67	0.0290
9	320.	60.	0.17	0.67	0.0290
10	320.	60.	0.18	0.90	0.0180
11	320.	60.	0.18	0.90	0.0180
12	320.	60.	0.18	0.90	0.0180

6. Input File(s) for AERMOD

Surface Meteorology: MC_2011-12.SFC
Profile Data : MC_2011-12.PFL

STAGE 3—REPORT FILE CONT'D

MCR_ST3.RPT

```
AERMET, A Meteorological Processor for the AERMOD Dispersion Model
                           Version  19191

                    Data Processed on  3-MAR-2020 at 11:24:49


                                Stage 3                          Page   3

            ********************************************************
            ***   AERMET Data Processing Finished Successfully   ***
            ********************************************************

             PROCESSING METEOROLOGICAL DATA FOR DISPERSION MODELING


                    **** AERMET MESSAGE SUMMARY TABLE ****

        0- 9   10-19   20-29   30-39   40-49   50-59   60-69   70-89   TOTAL
     -----------------------------------------------------------------------

JOB
  E      0       0       0       0       0       0       0       0       0
  W      0       0       0       0       0       0       0       0       0
  I      0       1       1       0       0       0       0       0       2

ONSITE
  E      0       0       0       0       0       0       0       0       0
  W      0       0       0       0       0       2       0       0       2
  I      0       0       0       0       0       0       0       0       0

METPREP
  E      0       0       0       0       0       0       0       0       0
  W      0       0       0       0       0       0       0       8       8
  I      0       2       0       0       1       0       0     880     883
  T      0       0       0       0       0       0       0       0       0
     -----------------------------------------------------------------------
         0       3       1       0       1       2       0     883     890
```

STAGE 3—REPORT FILE CONCLUDED

MCR_ST3.RPT

```
****    ERROR MESSAGES    ****

              ---  NONE  ---


       ****   WARNING MESSAGES   ****
      1 ONSITE     W51 LOCCRD  : NO ONSITE elevation specified on LOCATION keyword, default of 0m assumed;
      2 ONSITE     W51 LOCCRD  :  Recommend specifying station elevation.
 110826 METPREP    W73  MPPBL  : No ZICONV - No UA sounding - Julian day: 238
 111006 METPREP    W73  MPPBL  : No ZICONV - No UA sounding - Julian day: 279
 111007 METPREP    W73  MPPBL  : No ZICONV - No UA sounding - Julian day: 280

   ASOS Commission Date for Surface Station    14737 (YYYYMMDD): 19951101



The number of CALM winds  encountered is:      0
The number of VARIABLE WD encountered is:      0
The number of miss CCVR substitutions is:     18
```

STAGE 3—MESSAGE FILE

MCR_ST3.MES

```
      1 ONSITE     W51 LOCCRD  : NO ONSITE elevation specified on LOCATION keyword, default of 0m assumed;
      2 ONSITE     W51 LOCCRD  :  Recommend specifying station elevation.
        METPREP    I88 AERSURF : AERSURF file opened successfully:  .\..\MC_2001_IMP_CAN.SFC
        METPREP    I19 AERSURF : "END OF FILE" on unit   5 after AERSURF file record #  57
        METPREP    I88 AERSURF2: AERSURF2 file opened successfully: ..\..\KABE_2001_IMP_CAN.SFC
        METPREP    I19 AERSURF2: "END OF FILE" on unit   5 after AERSURF2 file record #  70
        JOB        I19  SETUP  : "END OF FILE" ON UNIT  5 AFTER RECORD # 149
        JOB        I27 OSTEST  : Minimum and maximum ONSITE height level indices derived from data file are:    1  13
        METPREP    I41 FNDCOMDT: ASOS commission date FOUND for WBAN =  14737; CALL4 = KABE; CALL3 = ABE; CommDate = 19951101
        METPREP    I83  MPMET  : Anem height found in ASOS list for station    14737: Height from ASOS list (m) is:    7.92
 110501 METPREP    I84  MPPBL  : Upper air sounding selected for this day: 12 Z
 110501 METPREP    I84  MPPBL  : UAID =    1 for HR:   7 LST
 110502 METPREP    I84  MPPBL  : Upper air sounding selected for this day: 12 Z
 110502 METPREP    I84  MPPBL  : UAID =    3 for HR:   7 LST
 110503 METPREP    I84  MPPBL  : Upper air sounding selected for this day: 12 Z
 110503 METPREP    I84  MPPBL  : UAID =    3 for HR:   7 LST
 110504 METPREP    I84  MPPBL  : Upper air sounding selected for this day: 12 Z
 110504 METPREP    I84  MPPBL  : UAID =    3 for HR:   7 LST
 110505 METPREP    I84  MPPBL  : Upper air sounding selected for this day: 12 Z
 110505 METPREP    I84  MPPBL  : UAID =    3 for HR:   7 LST
 110506 METPREP    I81  SUBST  : 1-min ASOS winds used as reference winds for hour:  02
 110506 METPREP    I85  SUBST  : On-site reference temp only (no profile) used with off-site WS for hour:  02
 110506 METPREP    I84  MPPBL  : Upper air sounding selected for this day: 12 Z
 110506 METPREP    I84  MPPBL  : UAID =    3 for HR:   7 LST
 110507 METPREP    I84  MPPBL  : Upper air sounding selected for this day: 12 Z
 110507 METPREP    I84  MPPBL  : UAID =    3 for HR:   7 LST
 110508 METPREP    I84  MPPBL  : Upper air sounding selected for this day: 12 Z
 110508 METPREP    I84  MPPBL  : UAID =    3 for HR:   7 LST
 110509 METPREP    I81  SUBST  : 1-min ASOS winds used as reference winds for hour:  22
 110509 METPREP    I85  SUBST  : On-site reference temp only (no profile) used with off-site WS for hour:  22
 110509 METPREP    I81  SUBST  : 1-min ASOS winds used as reference winds for hour:  24
 110509 METPREP    I85  SUBST  : On-site reference temp only (no profile) used with off-site WS for hour:  24
 110509 METPREP    I84  MPPBL  : Upper air sounding selected for this day: 12 Z
 110509 METPREP    I84  MPPBL  : UAID =    3 for HR:   7 LST
 110510 METPREP    I81  SUBST  : 1-min ASOS winds used as reference winds for hour:  01
 110510 METPREP    I85  SUBST  : On-site reference temp only (no profile) used with off-site WS for hour:  01
```

STAGE 3—PROFILE FILE FOR AERMOD

MC_2011-12.PFL

11	5	1	1	10.0	0	300.0	0.30	10.00	999.00	99.00
11	5	1	1	90.0	0	71.0	1.60	999.00	999.00	99.00
11	5	1	1	120.0	0	69.0	2.10	999.00	999.00	99.00
11	5	1	1	150.0	0	67.0	2.50	999.00	999.00	99.00
11	5	1	1	180.0	0	67.0	2.90	999.00	999.00	99.00
11	5	1	1	210.0	0	63.0	3.00	999.00	999.00	99.00
11	5	1	1	240.0	0	58.0	2.90	999.00	999.00	99.00
11	5	1	1	270.0	0	52.0	3.10	999.00	999.00	99.00
11	5	1	1	300.0	0	46.0	3.20	999.00	999.00	99.00
11	5	1	1	330.0	0	44.0	3.40	999.00	999.00	99.00
11	5	1	1	360.0	0	42.0	3.30	999.00	999.00	99.00
11	5	1	1	390.0	0	41.0	3.50	999.00	999.00	99.00
11	5	1	1	420.0	1	999.0	999.00	999.00	999.00	99.00
11	5	1	2	10.0	0	240.0	0.60	10.00	999.00	99.00
11	5	1	2	90.0	0	9.0	1.30	999.00	999.00	99.00
11	5	1	2	120.0	0	20.0	1.50	999.00	999.00	99.00
11	5	1	2	150.0	0	36.0	1.50	999.00	999.00	99.00
11	5	1	2	180.0	0	45.0	1.50	999.00	999.00	99.00
11	5	1	2	210.0	0	45.0	1.60	999.00	999.00	99.00
11	5	1	2	240.0	0	44.0	1.60	999.00	999.00	99.00
11	5	1	2	270.0	0	39.0	1.80	999.00	999.00	99.00
11	5	1	2	300.0	0	31.0	2.20	999.00	999.00	99.00
11	5	1	2	330.0	0	23.0	2.30	999.00	999.00	99.00
11	5	1	2	360.0	0	22.0	2.40	999.00	999.00	99.00
11	5	1	2	390.0	0	24.0	2.40	999.00	999.00	99.00
11	5	1	2	420.0	1	24.0	2.80	999.00	999.00	99.00
11	5	1	3	10.0	0	999.0	999.00	10.00	999.00	99.00
11	5	1	3	90.0	0	85.0	0.60	999.00	999.00	99.00
11	5	1	3	120.0	0	34.0	0.50	999.00	999.00	99.00
11	5	1	3	150.0	0	360.0	1.10	999.00	999.00	99.00
11	5	1	3	180.0	0	358.0	1.60	999.00	999.00	99.00
11	5	1	3	210.0	0	4.0	1.70	999.00	999.00	99.00
11	5	1	3	240.0	0	2.0	2.00	999.00	999.00	99.00
11	5	1	3	270.0	0	359.0	2.10	999.00	999.00	99.00
11	5	1	3	300.0	0	360.0	2.50	999.00	999.00	99.00
11	5	1	3	330.0	0	360.0	3.00	999.00	999.00	99.00
11	5	1	3	360.0	0	359.0	3.50	999.00	999.00	99.00
11	5	1	3	390.0	0	354.0	4.10	999.00	999.00	99.00
11	5	1	3	420.0	1	352.0	4.40	999.00	999.00	99.00

STAGE 3—SURFACE FILE FOR AERMOD

MC_2011-12.SFC

40.79N 75.14W UA_ID: 54775 SF_ID: 14737 OS_ID: 000001 VERSION: 19191 CCVR_Sub

Yr.	Mo.	Day	jday	Hr	H	u*	w*	$\partial\theta/\partial z$	Z_{ic}	Z_{im}	L	Zo	Bo	α	U	Udir	Zref	Ta	Tref	PT	Amt	RH	P	CC	U Adj?	Met Typ sub-?
11	5	1	121	1	-0.1	0.011	-9.000	-9.000	-999.	3.	1.0	0.0440	0.39	1.00	0.30	300.0	10.0	283.1	10.0	0	0.00	67.	1010.	0	NAD-OS	NoSubs
11	5	1	121	2	-0.5	0.022	-9.000	-9.000	-999.	8.	1.8	0.0380	0.39	1.00	0.60	240.0	10.0	283.1	10.0	0	0.00	76.	1010.	0	NAD-OS	NoSubs
11	5	1	121	3	-0.1	0.016	-9.000	-9.000	-999.	5.	3.4	0.0440	0.39	1.00	0.60	85.0	90.0	283.1	10.0	0	0.00	73.	1011.	0	NAD-OS	NoSubs
11	5	1	121	4	-0.0	0.010	-9.000	-9.000	-999.	3.	2.3	0.0440	0.39	1.00	0.40	90.0	90.0	282.1	10.0	0	0.00	76.	1011.	0	NAD-OS	NoSubs
11	5	1	121	5	-0.0	0.010	-9.000	-9.000	-999.	3.	2.3	0.0440	0.39	1.00	0.40	129.0	90.0	282.1	10.0	0	0.00	85.	1011.	0	NAD-OS	NoSubs
11	5	1	121	6	-0.0	0.010	-9.000	-9.000	-999.	3.	2.6	0.0440	0.39	0.52	0.40	78.0	90.0	282.1	10.0	0	0.00	85.	1011.	0	NAD-OS	NoSubs
11	5	1	121	7	18.4	0.078	0.343	0.011	79.	52.	-2.3	0.0440	0.39	0.27	0.80	27.0	90.0	282.1	10.0	0	0.00	65.	1012.	0	NAD-OS	NoSubs
11	5	1	121	8	56.3	0.199	0.724	0.009	243.	212.	-12.5	0.0440	0.39	0.19	2.20	20.0	10.0	284.1	10.0	0	0.00	50.	1011.	0	NAD-OS	NoSubs
11	5	1	121	9	89.7	0.227	0.912	0.006	305.	260.	-11.8	0.0440	0.39	0.16	2.50	20.0	10.0	286.1	10.0	0	0.00	45.	1011.	0	NAD-OS	NoSubs
11	5	1	121	10	116.0	0.183	1.060	0.005	370.	188.	-4.8	0.0440	0.39	0.15	1.80	350.0	10.0	287.1	10.0	0	0.00	39.	1011.	0	NAD-OS	NoSubs
11	5	1	121	11	134.1	0.149	1.294	0.005	583.	138.	-2.2	0.0440	0.39	0.15	1.30	270.0	10.0	288.1	10.0	0	0.00	36.	1011.	0	NAD-OS	NoSubs
11	5	1	121	12	143.0	0.153	1.509	0.009	867.	144.	-2.3	0.0380	0.39	0.15	1.40	240.0	10.0	289.1	10.0	0	0.00	31.	1011.	0	NAD-OS	NoSubs
11	5	1	121	13	142.9	0.210	1.595	0.013	1025.	231.	-5.8	0.0380	0.39	0.15	2.20	240.0	10.0	290.1	10.0	0	0.00	32.	1011.	0	NAD-OS	NoSubs
11	5	1	121	14	133.6	0.236	1.623	0.013	1155.	275.	-8.8	0.0380	0.39	0.15	2.60	250.0	10.0	291.1	10.0	0	0.00	38.	1010.	0	NAD-OS	NoSubs
11	5	1	121	15	115.0	0.266	1.562	0.012	1196.	330.	-14.8	0.0380	0.39	0.15	3.10	240.0	10.0	291.1	10.0	0	0.00	43.	1010.	0	NAD-OS	NoSubs
11	5	1	121	16	88.3	0.268	1.439	0.012	1216.	333.	-19.6	0.0380	0.39	0.16	3.20	250.0	10.0	291.1	10.0	0	0.00	42.	1010.	0	NAD-OS	NoSubs
11	5	1	121	17	54.7	0.253	1.231	0.011	1228.	305.	-26.6	0.0380	0.39	0.19	3.10	250.0	10.0	291.1	10.0	0	0.00	47.	1009.	0	NAD-OS	NoSubs
11	5	1	121	18	16.9	0.191	0.833	0.011	1232.	202.	-37.2	0.0380	0.39	0.29	2.40	250.0	10.0	291.1	10.0	0	0.00	51.	1009.	0	NAD-OS	NoSubs
11	5	1	121	19	-4.0	0.065	-9.000	-9.000	-999.	56.	6.0	0.0380	0.39	0.56	1.80	250.0	10.0	290.1	10.0	0	0.00	51.	1010.	0	NAD-OS	NoSubs
11	5	1	121	20	-5.4	0.072	-9.000	-9.000	-999.	46.	6.2	0.0380	0.39	1.00	2.00	215.0	10.0	289.1	10.0	0	0.00	56.	1009.	0	NAD-OS	NoSubs
11	5	1	121	21	-1.4	0.036	-9.000	-9.000	-999.	16.	3.1	0.0380	0.39	1.00	1.00	250.0	10.0	288.1	10.0	0	0.00	71.	1010.	0	NAD-OS	NoSubs
11	5	1	121	22	-7.8	0.086	-9.000	-9.000	-999.	61.	7.4	0.0380	0.39	1.00	2.40	240.0	10.0	287.1	10.0	0	0.00	76.	1010.	0	NAD-OS	NoSubs
11	5	1	121	23	-3.8	0.072	-9.000	-9.000	-999.	46.	8.7	0.0380	0.39	1.00	2.00	210.0	10.0	287.1	10.0	0	0.00	73.	1011.	10	NAD-OS	NoSubs
11	5	1	121	24	-2.8	0.061	-9.000	-9.000	-999.	36.	7.4	0.0380	0.39	1.00	1.70	220.0	10.0	286.1	10.0	0	0.00	71.	1010.	10	NAD-OS	NoSubs
11	5	2	122	1	-9.3	0.168	-9.000	-9.000	-999.	165.	45.8	0.0380	0.39	1.00	2.80	210.0	10.0	286.1	10.0	0	0.00	66.	1010.	10	NAD-OS	NoSubs
11	5	2	122	2	-12.1	0.219	-9.000	-9.000	-999.	246.	77.9	0.0380	0.39	1.00	3.40	210.0	10.0	287.1	10.0	0	0.00	71.	1009.	10	NAD-OS	NoSubs
11	5	2	122	3	-12.1	0.219	-9.000	-9.000	-999.	246.	77.9	0.0380	0.39	1.00	3.40	220.0	10.0	287.1	10.0	0	0.00	74.	1010.	10	NAD-OS	NoSubs
11	5	2	122	4	-9.3	0.168	-9.000	-9.000	-999.	166.	46.0	0.0380	0.39	1.00	2.80	230.0	10.0	287.1	10.0	0	0.00	73.	1009.	10	NAD-OS	NoSubs
11	5	2	122	5	-1.4	0.043	-9.000	-9.000	-999.	44.	5.2	0.0380	0.39	1.00	1.20	250.0	10.0	286.1	10.0	0	0.00	76.	1010.	10	NAD-OS	NoSubs
11	5	2	122	6	-5.5	0.119	-9.000	-9.000	-999.	99.	27.7	0.0380	0.39	0.52	2.20	225.0	10.0	286.1	10.0	0	0.00	76.	1010.	10	NAD-OS	NoSubs
11	5	2	122	7	3.7	0.227	0.298	0.016	259.	260.	-289.3	0.0380	0.39	0.27	3.10	235.0	10.0	287.1	10.0	0	0.00	79.	1010.	10	NAD-OS	NoSubs
11	5	2	122	8	13.3	0.263	0.511	0.016	362.	323.	-123.0	0.0380	0.39	0.19	3.50	240.0	10.0	288.1	10.0	0	0.00	76.	1010.	10	NAD-OS	NoSubs
11	5	2	122	9	21.9	0.335	0.638	0.014	427.	465.	-154.5	0.0380	0.39	0.16	4.50	240.0	10.0	290.1	10.0	0	0.00	77.	1010.	10	NAD-OS	NoSubs
11	5	2	122	10	28.9	0.331	0.703	0.014	433.	457.	-113.0	0.0380	0.39	0.15	4.40	240.0	10.0	292.1	10.0	0	0.00	74.	1010.	10	NAD-OS	NoSubs
11	5	2	122	11	67.4	0.343	0.942	0.012	447.	482.	-53.8	0.0380	0.39	0.15	4.40	240.0	10.0	294.1	10.0	0	0.00	71.	1009.	9	NAD-OS	NoSubs
11	5	2	122	12	72.1	0.384	0.975	0.008	462.	571.	-70.6	0.0380	0.39	0.15	5.00	240.0	10.0	296.1	10.0	0	0.00	66.	1008.	9	NAD-OS	NoSubs
11	5	2	122	13	147.6	0.411	1.265	0.007	493.	632.	-42.2	0.0380	0.39	0.15	5.20	240.0	10.0	298.1	10.0	0	0.00	62.	1008.	3	NAD-OS	NoSubs
11	5	2	122	14	136.1	0.363	1.254	0.010	521.	526.	-31.4	0.0380	0.39	0.15	4.50	240.0	10.0	298.1	10.0	0	0.00	58.	1006.	0	NAD-OS	NoSubs

Run All Three Stages with One Click

- Using a batch file, AERMET can be run three separate times without user intervention between each stage

```
aermet mcr_st1.inp
aermet mcr_st2.inp
aermet mcr_st3.inp
```

- You will use this technique in developing the 5-year NWS dataset for AERMOD

On Your Own

- It is important to run the following, so you have a processed 5-year dataset for AERMOD (to examine the results for the new probabilistic 1-hour standards for SO_2 and NO_X)
- Rerun AERMET for the 5-year NWS-only data in
  - APTI423\Hands-on\AERMET**5-yr_NWS**
  - Easiest to use the batch file

On Your Own

- Try rerunning AERMET by modifying the three surface parameters separately to examine their sensitivity to parameters in the .srf file and to the ultimate concentrations predicted by AERMOD at the end of that lesson. Change the three surface parameters below by +50% and -50%.
  - Roughness length
  - Bowen ratio
  - Albedo

Air Pollution Dispersion Models:
Applications with the AERMOD Modeling System

AERMAP

COURSE #423

Learning Objectives

At the end of this lesson the student should be able to:

- Explain what AERMAP does and why it is needed
- Describe AERMAP's data requirements and where to get them
- Describe the structure of AERMAP's Control file

LEARNING OBJECTIVES

At the end of this lesson the student should be able to:

- Run the AERMAP program
- Interpret the results
- Describe some of the issues surrounding AERMAP

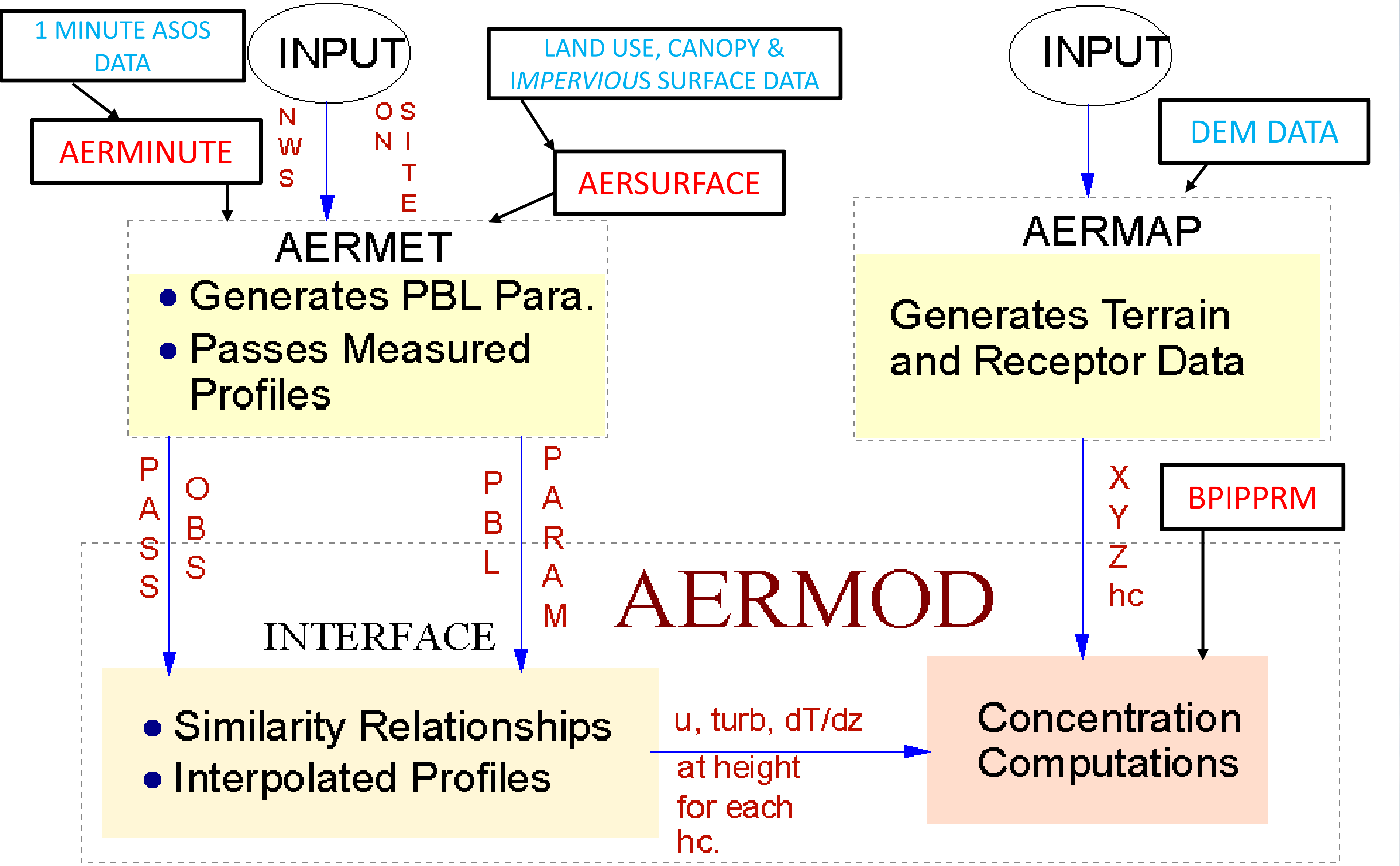
Overview

- Purpose of AERMAP
- Data Products AERMAP Processes
- AERMAP Input Requirements
  - Control File Structure and Options
  - Data
- Running AERMAP and Reviewing Output

AERMAP—PURPOSE

- Develop the **hill height scale** for every receptor
  - Hill height scale – h_c: The terrain height that has the greatest influence on dispersion for each receptor being modeled
  - For each individual receptor, the hill height scale is the highest elevation the rises above a slope line from the receptor of 10%.
  - This is done for all directions within a user defined search domain for each receptor. Independent of wind direction
  - An H_{Crit} is calculated for each h_c and $\therefore$ for each receptor
  - The H_{crit}, for each receptor is used to determine the partitioning the plume mass between the horizontal and terrain responding plume states.
- Develop terrain base elevations for every receptor and source

MODELING SYSTEM STRUCTURE



AERMAP—Input Terrain Data

- AERMAP will accept three Terrain Elevation Data formats (standards):
  - U.S. Geological Survey (USGS) “Blue Book” standard (Digital Elevation Model (DEM))
  - Spatial Data Transfer Standard (SDTS)
  - National Elevation Data (NED): now referred to as “3DEP Seamless DEM”
  - Only the 3DEP Seamless DEM data are available for downloading from USGS

AERMAP—INPUT TERRAIN DATA

- **3DEP Seamless DEM/NED**
  - What are 3DEP Seamless DEM data?
    - High resolution elevation data
    - Available across the United States
    - Provided in a seamless raster (pixel) format
    - 2-arc-second, 1-arc-second, and 1/3-arc-second
    - 60-meter, 30-meter, and 10-meter
  - Format
    - Seamless DEM data are now in GeoTiff format

AERMAP—CONTROL FILE

- Pathway/keyword structure is used
- AERMAP pathways: CO, SO, RE, OU
- Each pathway has its own unique set of keywords
- Record structure
  - *2-character-pathway keyword secondary-keyword/parameters*
- The SO pathway is optional in AERMAP, Either:
  - AERMAP can construct the set of receptors to be modeled w/ their elevation, or
  - manually enter the receptor elevations in AERMOD

AERMAP—CONTROL PATHWAY

** Indicates keyword is required*

- CO STARTING*
  - Indicates that the pathway keywords start with the next record
- CO TITLEONE*
  - Provides a way to identify the model run in the output file(s)
    - TITLEONE *title1*
- CO TITLETWO
  - Provides a second title line in the output file(s)
    - TITLETWO *title2*

AERMAP—CONTROL PATHWAY

- CO RUNORNOT*
  - Instructs AERMAP to run or only check the processing setup without running
    - RUNORNOT <u>RUN</u> or <u>NOT</u>
- CO DATATYPE*
  - Specifies the type of the raw terrain data
    - DATATYPE <u>NED</u> (This is the only presently available data type from USGS)
- CO DATAFILE*
  - Specifies the filename(s) of the raw terrain data input file(s)
    - DATAFILE *nedfile* (<u>TIFFDEBUG</u>) *(ElevUnits)*

AERMAP—Control Pathway

- CO DOMAINXY
  - Specifies the extent, in UTM coordinates, of the search domain
    - DOMAINX *Xdmin Ydmin Zo Xdmax Ydmax Zomax*
  - *Xdmin*, *Ydmin*: Specifies the southwest (lower left) corner of the extent
  - *Zonmin:* UTM zone for the lower left corner
  - *Xdmax*, *Ydmax*: Specifies the northeast (upper right) corner of the extent
  - *Zonmax:* UTM zone for the upper right corner

AERMAP—CONTROL PATHWAY

- CO ANCHORXY*
  - Defines the user-specified coordinate system for receptors in UTM format
    - ANCHORXY *Xauser Yauser Xautm Yautm Zautm (NADA_value)**
  - *Xauser, Yauser:* Location in the user's coordinate system
  - *Xautm, Yautm*: Location of the same point in the UTM coordinate system (i.e., the reference datum being used)
  - *NADA_value:* <u>N</u>orth <u>A</u>merican <u>D</u>atum <u>A</u>nchor point—the horizontal datum used to establish the anchor point and range from zero to six (discussed later) (optional); a value of 4 should be used for Seamless DEM data

AERMAP—CONTROL PATHWAY

- CO DEBUGOPT
  - Specifies whether additional debug output files will be generated for receptors, sources, and/or hill heights
    - DEBUGOPT <u>HILL</u> and/or <u>RECEPTOR</u> and/or <u>SOURCE</u>

AERMAP—Source Pathway

- SO STARTING*
  - Indicates that the pathway keywords which start with the next record
- SO LOCATION
  - Identifies source locations for use in extracting source elevations and/or to define the origin of discrete polar receptors
    - LOCATION *Srcid Srctyp Xs Ys (Zs)*
  - The LOCATION keyword and parameters can be stored in a separate file and referenced using the INCLUDED keyword and filename (discussed on the next slide).

AERMAP—SOURCE PATHWAY

- SO INCLUDED
  - Identifies an external file containing source locations to be included as input to AERMAP (optional)
    - INCLUDED *SrcIncFile*
  - If there are no LOCATION keyword records in the control file, the INCLUDED keyword should be present
- SO FINISHED*
  - Indicates that there are no more pathway keywords to process (mandatory)

Receptor Pathway Keywords

- RE STARTING*
  - Receptor information starts with the next record
- RE ELEVUNIT
  - Input units for receptor elevation (default: METERS)
    - ELEVUNIT METERS or FEET
  - Though optional, when ELEVUNIT is specified in the control file, it **must** be the first keyword following the STARTING keyword

RECEPTOR PATHWAY KEYWORDS

- RE GRIDCART
  - Gridded locations referenced to a Cartesian coordinate system
    - *Netid* STA
    - XYINC *Xinit Xnum Xdelta Yinit Ynum Ydelta*
      or
    - XPNTS *Gridx1 Gridx2 Gridx3 .... GridxN*,
      and
      YPNTS *Gridy1 Gridy2 Gridy3 .... GridyN*
    - ELEV *Row Zelev1 Zelev2 Zelev3 ... ZelevN*
    - FLAG *Row Zflag1 Zflag2 Zflag3 ... ZflagN*
    - END

RECEPTOR PATHWAY KEYWORDS

- RE GRIDPOLR
  - Gridded locations referenced to a polar coordinate system
    - *Netid* STA
    - ORIG *Xinit Yinit* **OR**
      ORIG *SrcID*
    - DIST *Ring1 ... RingN*
    - DIR *Dir1 ... DirN* **OR**
      GDIR *Dirnum Dirini Dirinc*
    - ELEV *Dir Zelev1 ... ZelevN*
    - FLAG *Dir Zflag1 ... ZflagN*
    - END

RECEPTOR PATHWAY KEYWORDS

- RE DISCCART
  - Repeatable discrete locations referenced to a Cartesian system
    - DISCCART *Xcoord Ycoord (Zelev) (Zflag)*
- RE DISCPOLR
  - Repeatable discrete locations referenced to a polar network
    - DISCPOLR *Srcid Dist Direct (Zelev) (Zflag)*
- RE INCLUDED
  - Include data from a separate file
    - INCLUDED *RecIncludeFile*
- RE FINISHED*
  - The pathway keywords have ended

AERMAP—OUTPUT PATHWAY

- OU STARTING*
  - Pathway keywords start with the next record
- OU RECEPTOR*
  - Identifies the output filename for the receptor data
    - RECEPTOR *Recfil*
- OU SOURCLOC
  - Identifies the output filename for the source data
    - SOURCLOC *Srcfil*
- OU FINISHED*
  - The pathway keywords have ended

AERMAP—OUTPUT PATHWAY

- Recall the debug options on the CO pathway
  - HILL, RECEPTOR, SOURCE

- Three debugging output files are available associated with these options
  - DEBUGHIL *HillDebug*
  - DEBUGREC *RecDetail* *RecNDem* *RecElv*
  - DEBUGSRC *SrcDetail* *SrcNDem* *SrcElv*

- Debug output for hill height scale, receptors, and sources, respectively

AERMAP—RUNNING AERMAP

- AERMAP control file must be in same directory as the AERMAP executable
- Control Filename: Either AERMAP.INP (default) or User Defined
- Windows environment
  - Must use default name then double-click aermap.exe
  - Output filename → AERMAP.OUT
- Command prompt environment
  - If using default name, type: aermap then press return; AERMAP.OUT will be produced
  - If using User-Defined name, type: aermap *UserDefined_input_file UserDefined_output_file* then press return*; UserDefined* output file will be produced

AERMAP—REVIEWING THE OUTPUT

- AERMAP.OUT or UserDefined.out
  - Echos control file
  - Indicates whether the SETUP routines finished successfully
  - Number of files and file type,
  - The total number of receptors and sources, automatically generated
  - user-specified debug filenames
  - Summary of fatal, warning, and informational messages

AERMAP—REVIEWING THE OUTPUT

- AERMAP output/AERMOD-ready input

```
** AERMAP - VERSION 11103                                                   10/04/13
**                                                                          16:02:48
**  APTI 423 Receptors
**  ------------------
** A total of       1  NED files were used
** A total of      15  receptors were processed
** No user-specifed DOMAIN; all available data used
** ANCHORXY  XX3955.0  YY68385.0   XX3955.0  YY68385.0  17  4
** Terrain heights were extracted by default

RE ELEVUNIT METERS
   DISCCART     453440.00   4369992.00       1.06       1.06
   DISCCART     453454.63   4369992.00       1.06       1.06
   DISCCART     453469.26   4369992.00       1.06       1.06
   DISCCART     453483.89   4369992.00       1.06       1.06
   DISCCART     453498.52   4369992.00       1.06       1.06
   DISCCART     453513.15   4369992.00       1.06       1.06
   DISCCART     453527.78   4369992.00       1.06       1.06
   DISCCART     453542.41   4369992.00       1.06       1.06
   DISCCART     453557.04   4369992.00       1.06       1.06
   DISCCART     453571.67   4369992.00       1.06       1.06
   DISCCART     453586.30   4369992.00       1.06       1.06
   DISCCART     453600.93   4369992.00       1.06       1.06
   DISCCART     453615.56   4369992.00       1.06       1.06
   DISCCART     453630.19   4369992.00       1.06       1.06
   DISCCART     453644.82   4369992.00       1.06       1.06
```

AERMAP—Reviewing the Output

- AERMAP program includes both automatic and optional (user-specified) debug output files
- Automatic debug files
  - DOMDETAIL.OUT
    - Generated only if DOMAINLL or DOMAINXY is used
    - Information regarding the extent of the user-specified modeling domain, including which old DEM or 3DEP Seamless DEM file contains each corner of the domain
  - MAPDETAIL.OUT
    - Summary of information regarding each old DEM or 3DEP Seamless DEM file based on the results of the DEMCHK or NEDCHK routines
  - MAPPARAMS.OUT
    - Summary of the parameters for each old DEM or 3DEP Seamless DEM

SUMMARY

In this lesson we covered the following topics:

- Purpose of AERMAP
- Data products AERMAP:
  - 3DEP Seamless DEM (the only presently available terrain data from USGS)
- AERMAP input requirements
  - Control file structure and options
  - Data
- Running AERMAP and the output generated

Air Pollution Dispersion Models:
Applications with the AERMOD Modeling System

AERMAP HANDS-ON

COURSE #423

Air Pollution Training Institute | APTI

EPA

LEARNING OBJECTIVES

At the end of this lesson the student should be able to:

- Define the modeling domain
- Learn how to download terrain data
- Develop the input requirements needed to run AERMAP
- Construct an AERMAP control file
- Execute the AERMAP preprocessing program
- Review AERMAP output

MODELING DOMAIN

- Considerations for Defining the Domain:
  - The area containing the sources to be modeled
  - The full receptor area
  - The area that contains all significant terrain elevations
- Also known as the **Search Domain**, because its primary purpose is to determine the proper hill height scale for each receptor
- Can cross Universal Transverse Mercator (UTM) zones
- **All coordinates must be referenced to same zone**

Modeling Domain

- How far should the modeling domain extend?
  - No specific guidance
  - Examine the region beyond the receptor network
  - The domain needs to be large enough for the correct h_c to be found for each receptor
  - Include all terrain close enough to all receptors that can impact the flow in relation to the receptor
  - Do not include extremely high but distant terrain

AERMAP—OBTAINING NED DATA

- It is recommended the "3DEP Seamless Digital Elevation Model (DEM)" (NED) data be used for AERMAP

- 3DEP Seamless DEM data or (NED) can be obtained from:
  - https://viewer.nationalmap.gov/basic
  - Let's take a look at this site
  - Go through how you would download but not actually download – data is provided

AERMAP Hands-on Activity Files

- A completed (MC_aermap.inp) for the AERMAP control file, receptor pathway file (MC_nested.dat), and two executables (aermap_32.exe and aermap_64.exe) can be found in the following directory:

APTI423\Hands-On\AERMAP

- The NED terrain data in GeoTIFF format can be found in:

APTI423\Hand-On\AERMAP\Seamless_DEM

- In addition, the AERMAP User's Guide is provided for your convenience

AERMAP—CONTROL FILE PARAMETERS

- *Data Type*: NED
- *Data File*: Path and filenames for the two downloaded terrain files
- *Anchor Point:* 485000 Easting, 4510000 Northing, NADA value 4
- *Point Source Locations*:
  - MC12 491020 4516237
  - ED2 493350 4528370
  - HL2 494050 4521040

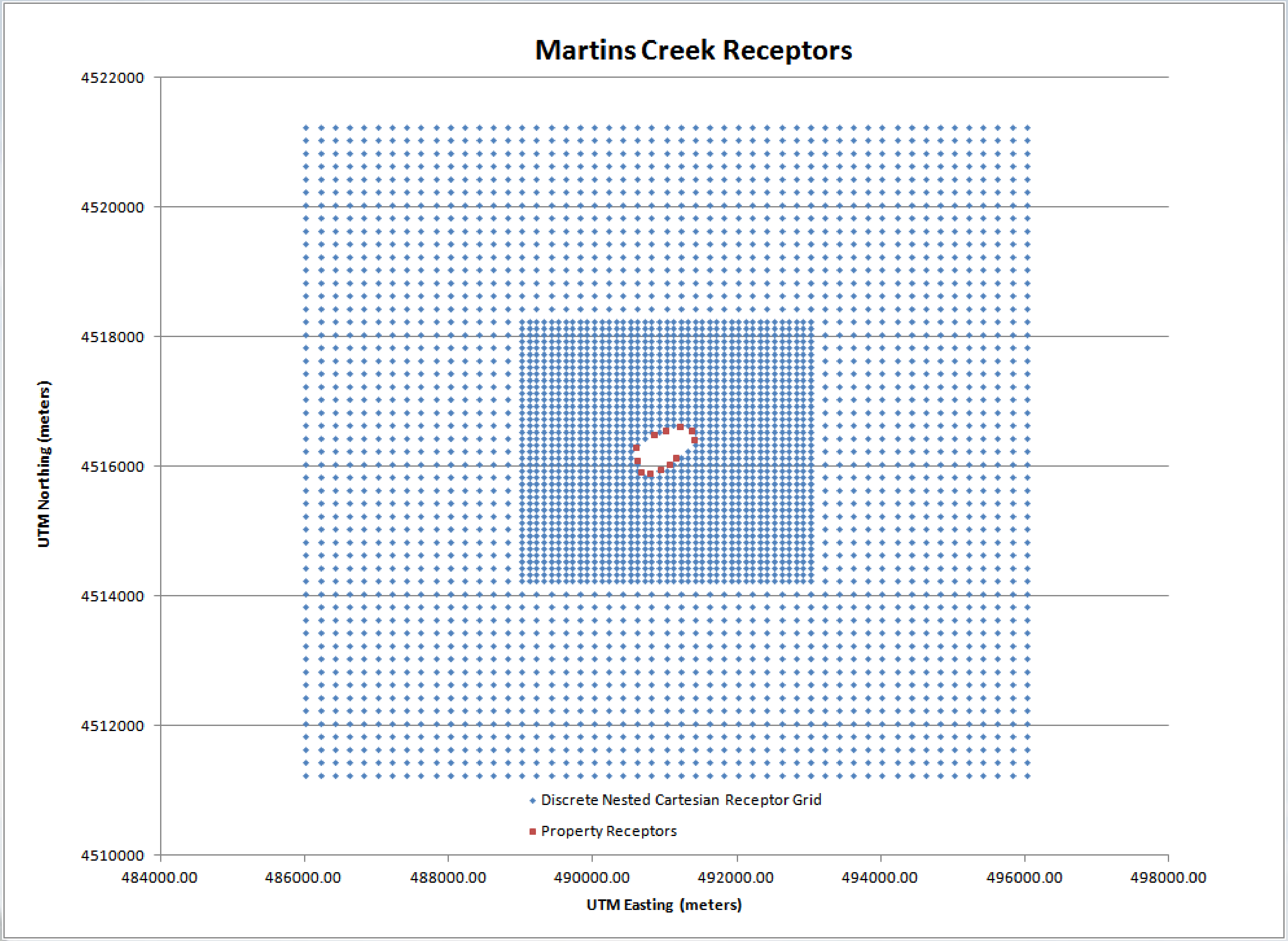
AERMAP—Control File Parameters

- *Restricted Domain for searching:*
  - 476000 4502000 18 506000 4529000 18
- *Receptors*:
  - Included in the file named MC_nested.dat
- *Output files*:
  - Sources: MC_src.src
  - Receptors: MC_nested.rec

Defining Receptor Locations

- Gridded receptors are easier to specify, because only parameters defining the starting point and node spacing are required
- Without a graphical user interface (GUI), discrete receptors are more difficult to specify, especially if there are thousands of receptors
- A discussion of the various receptor networks was covered in the preceding AERMAP session and is also included in the session on AERMOD setup
- In our hands-on exercise we will be using discrete receptors

Defining Receptor Locations



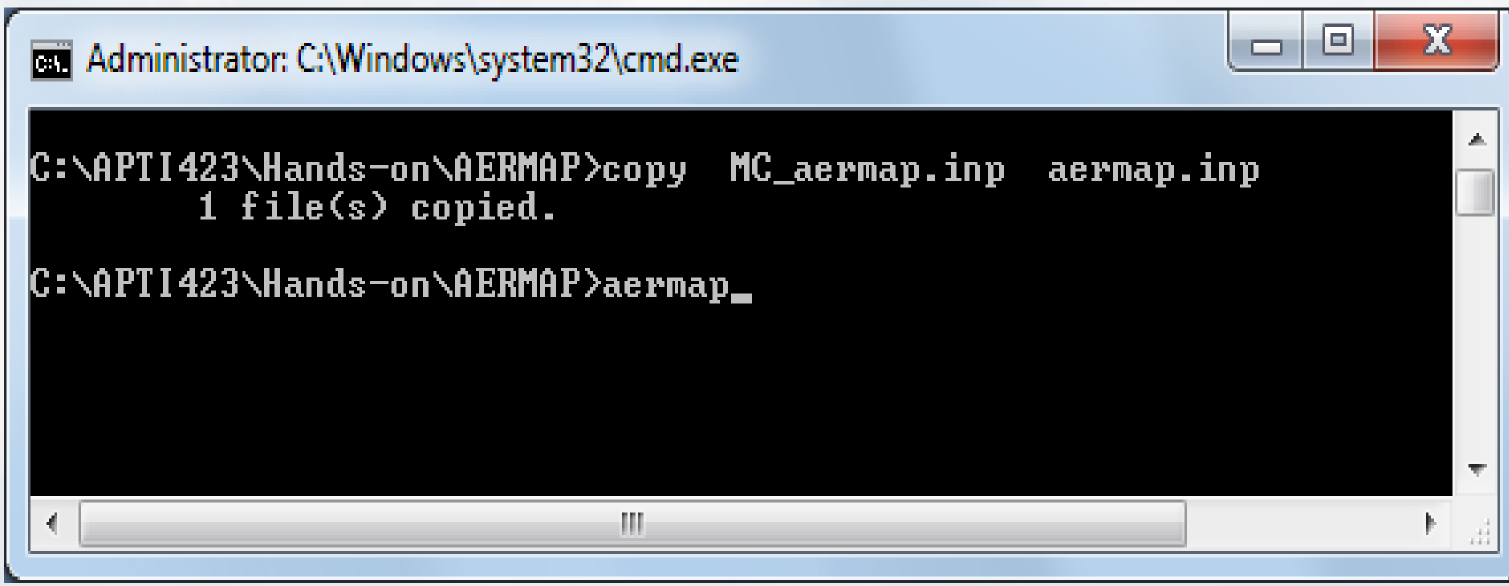
LIMITING THE SEARCH DOMAIN

- Two Seamless DEM files were needed to cover the locations of our receptors and sources
- Limiting the area AERMAP searches for the proper hill height scales reduces run time
- We decided to limit the search domain using the following keyword/parameters:

  DOMAINXY 476000 4502000 18 506000 4529000 18
- This search domain is approximately 10 km larger than the area covering the sources and receptors
- Add this to the CO pathway of your control file

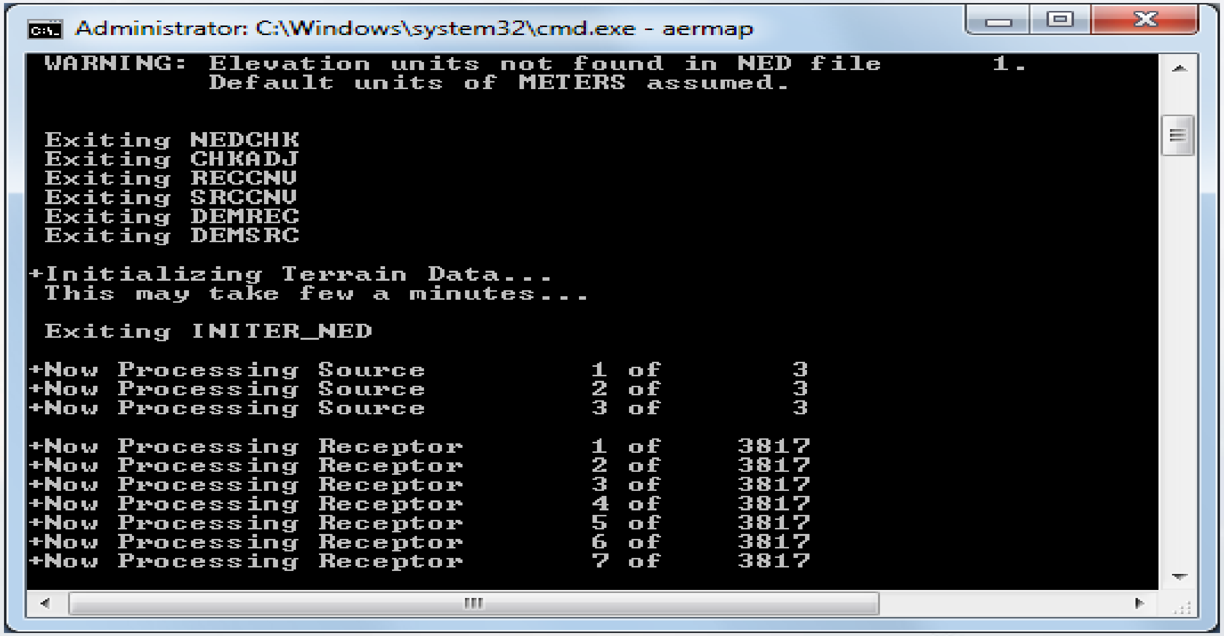
RUNNING AERMAP

- AERMAP control file can be user named (not case sensitive)
- To run AERMAP for this activity, either double click the .exe file or open a command prompt and set the working directory to the folder with the control file



RUNNING AERMAP

- If running AERMAP from a control prompt, progress is displayed on screen for each source/receptor processed
  - The time required to process the data is dependent on
    - Number of receptors
    - Size of domain



AERMAP OUTPUT

- AERMAP produces several output files

  - **AERMAP.OUT**: General summary of the run
  - **MAPDETAIL.OUT**: Summary of information regarding each Seamless DEM file based on the results of the checking routines (for debugging problems)
  - **MAPPARAMS.OUT**: Summary of the parameters for each Seamless DEM file, based on the contents of the header record and documents the adjacency of the files within the application area (for debugging problems)
  - Source and receptor files with terrain elevations (and hill height scale for receptors)

Source File Output

MC_src.src

```
** AERMAP - VERSION 18081                                   04/25/19
**                                                  14:26:29
**  APTI 423: AERMAP Hands-On
**  Martins Creek NED Data File
** A total of      2  NED files were used
** A total of      3  sources were processed
** DOMAINXY  476000  4502000  18  506000   4529000  18
** ANCHORXY  495510  4513680      495510   4513680  18  4
** Terrain heights were extracted by default

SO ELEVUNIT METERS
SO LOCATION  MC12        POINT       491020.00    4516237.00        71.53
SO LOCATION  ED2         POINT       493350.00    4528370.00        97.62
SO LOCATION  HL2         POINT       494050.00    4521040.00        97.40
```

Receptor File Output

MC_nested.rec

```
** AERMAP - VERSION 18081                          04/25/19
**                                        14:26:29
**  APTI 423: AERMAP Hands-On
**  Martins Creek NED Data File
** A total of       2  NED files were used
** A total of    3817  receptors were processed
** DOMAINXY  476000  4502000  18  506000   4529000  18
** ANCHORXY  495510  4513680      495510   4513680  18  4
** Terrain heights were extracted by default

RE ELEVUNIT METERS
   DISCCART    489020.00   4514237.00     60.18     94.59
   DISCCART    489120.00   4514237.00     60.20     94.59
   DISCCART    489220.00   4514237.00     63.46     86.92
   DISCCART    489320.00   4514237.00     68.40     90.66
   DISCCART    489420.00   4514237.00     81.79     81.79
   DISCCART    489520.00   4514237.00     85.53     94.70
   DISCCART    489620.00   4514237.00     90.34     95.77
   DISCCART    489720.00   4514237.00     93.81     98.98
   DISCCART    489820.00   4514237.00     93.80     97.47
   DISCCART    489920.00   4514237.00     92.87     92.87
   DISCCART    490020.00   4514237.00     95.73     95.73
   DISCCART    490120.00   4514237.00     98.74    369.97
   DISCCART    490220.00   4514237.00    105.03    370.10
   DISCCART    490320.00   4514237.00    102.49    370.10
   DISCCART    490420.00   4514237.00     94.09    370.10
   DISCCART    490520.00   4514237.00     84.72    370.10
```

Air Pollution Dispersion Models:
Applications with the AERMOD Modeling System

BPIPPRM

COURSE #423

Air Pollution Training Institute | APTI

Learning Objectives

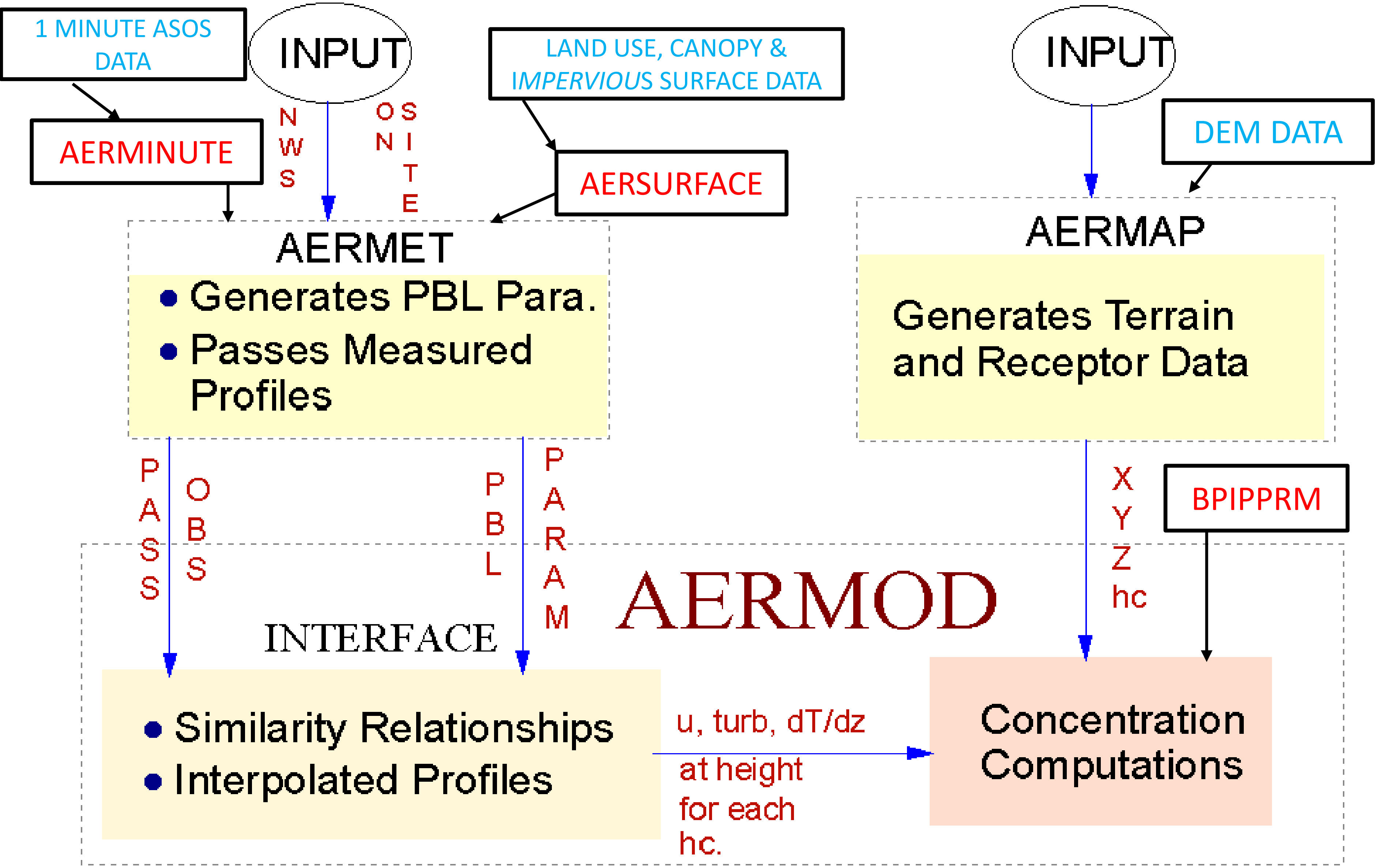
At the end of this lesson the student should be able to:

- Explain why a building analysis is necessary
- Describe the structure of the BPIPRIM's control file
- Describe how to run the BPIPPRM program
- Describe how to interpret the results
- Describe some of the issues surrounding BPIPPRM

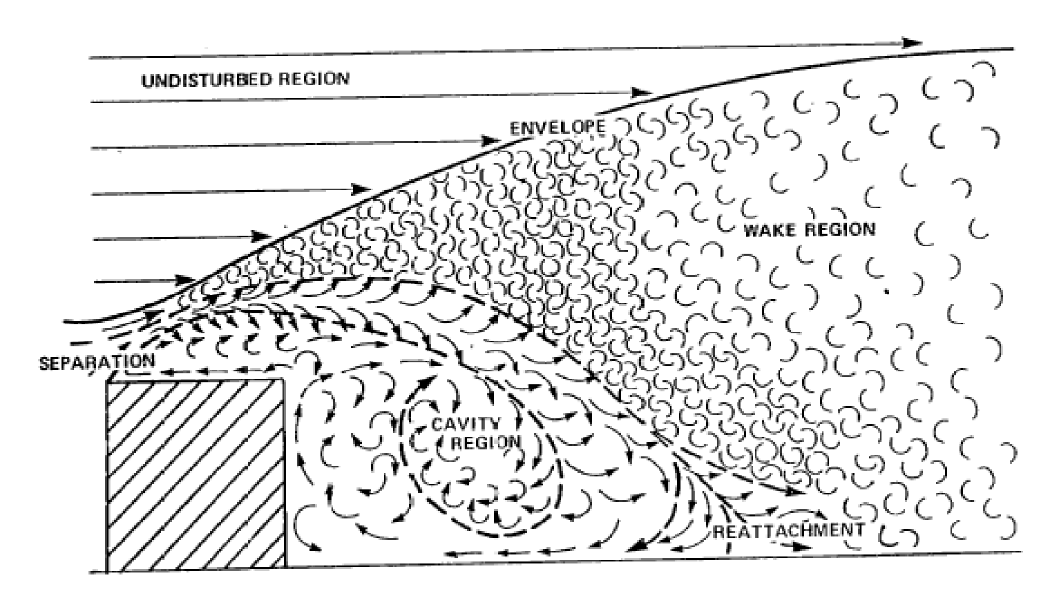
Overview

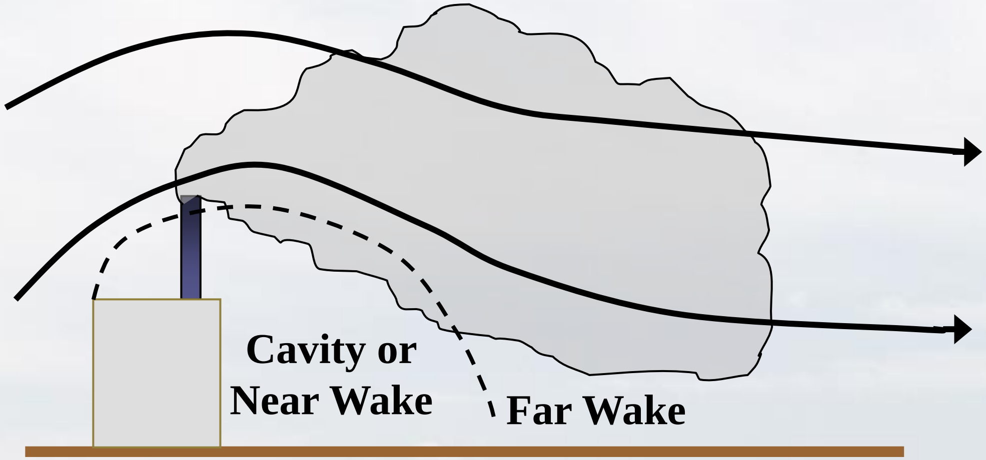
- Review Building Downwash
- BPIPPRM Input Requirements
  - Control File
  - Building Location and Tier Definitions
  - Sources
- Running BPIPPRM and Reviewing Output
- Special Topics and Known Issues

MODELING SYSTEM STRUCTURE



DOWNWASH REFRESHER





Downwash Refresher—Features

- Plume material impacts the ground much sooner than if building was not present
- Area of recirculation develops immediately on the downwind side of the building cavity (near-wake region).
- The cavity's extent is bounded above the roof by the separation streamline and downwind by the reattachment streamline

Downwash Refresher—Features

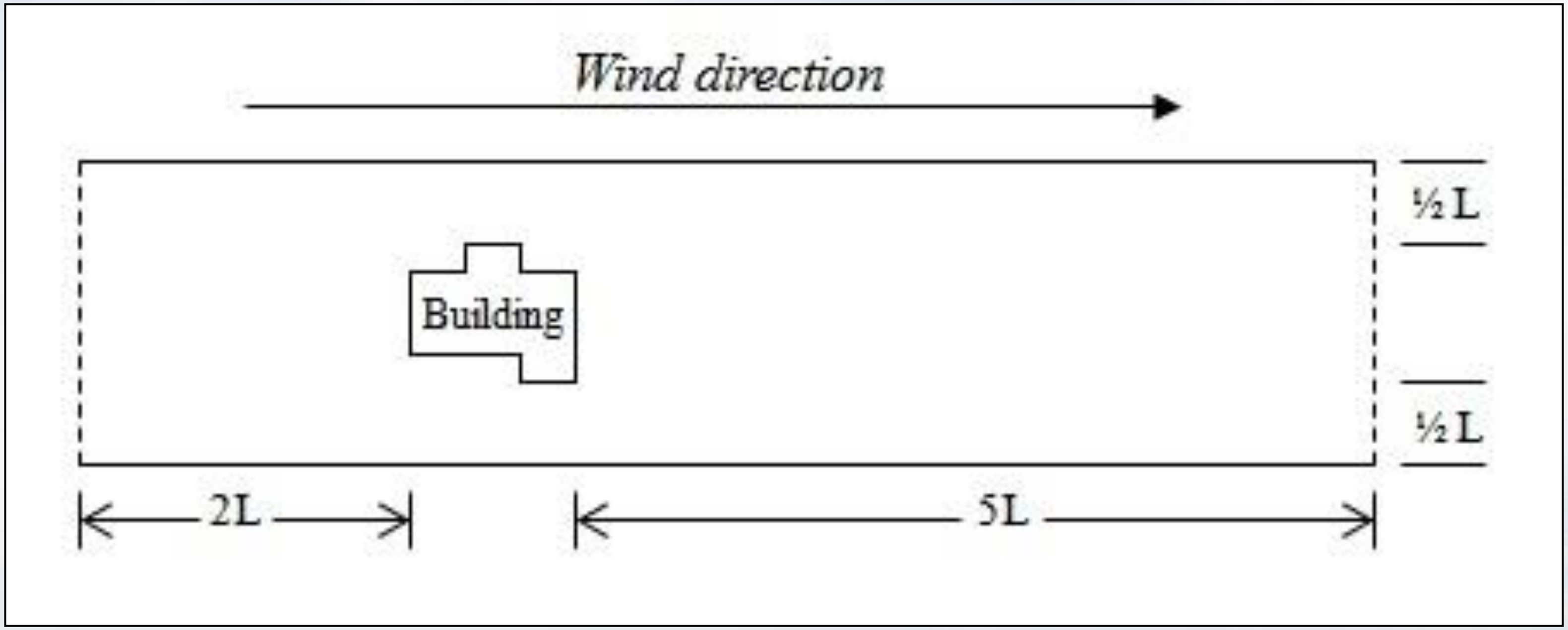
- Enhanced turbulence extends above cavity and beyond the reattachment point into the far wake
- Structure of the cavity and wake is controlled by along-wind and crosswind projected building dimensions & building height
- There is a distance downwind, beyond the far wake, where the flow returns to ambient conditions

Downwash Refresher—GEP

- Good Engineering Practice (GEP) stack height (H_{GEP})
  - Stack height at which the effects from building downwash are thought to be insignificant
  - H_{GEP} = maximum of
    - 65 meters
    - H_b + 1.5 L (a.k.a. EPA formula height)
      - H_b = building height
      - L = min(H_b, maximum projected building width)
  - For stacks in existence on January 12, 1979, GEP is 2.5 times the height of any nearby influencing structure
  - H_{GEP} can also be determined via a wind tunnel study
- Cannot model higher than GEP

DOWNWASH REFRESHER—SIZ

- Structure Influence Zone (SIZ)
  - The direction-specific region in which nearby structures have an influence on a plume



Downwash Refresher—PRIME Features

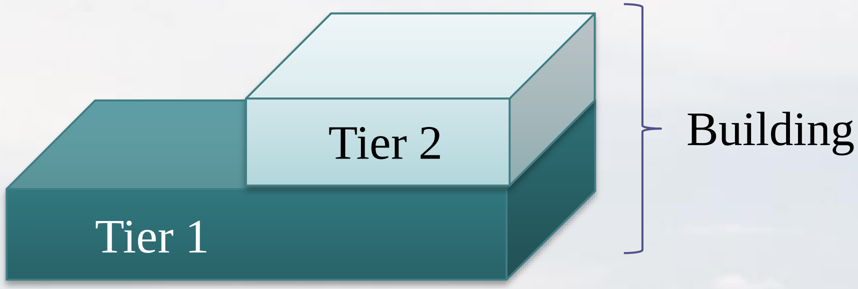
- Plume Rise Model Enhancements (PRIME)
- Considers the position of the stack relative to the building
- PRIME partitions plume mass based on the fraction of the plume mass that enters the cavity
- At the boundary of the cavity region, cavity mass is re-emitted into the far wake region where it combines with the mass that was not captured by the cavity

DOWNWASH REFRESHER—FEATURES

- Major effects of downwash on a plume
  - Enhanced vertical and lateral turbulence
  - Suppression or enhancement of Plume rise
  - Capture of plume material in the cavity
- Magnitude of effects depends on structure(s) size and the location of source relative to structure(s)

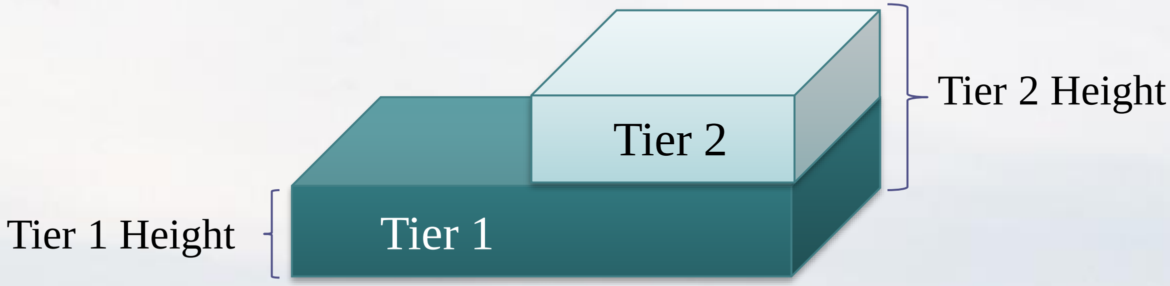
BPIPPRM

- BUILDING: A surface-based structure with three or more vertices
- TIER: A “sub-structure” that sits atop a building or another tier
    - Vertices must be contained within the structure below it
- A single-story facility is a building with a single tier
- Only applies to point sources



BPIPPRM Example Input Control File

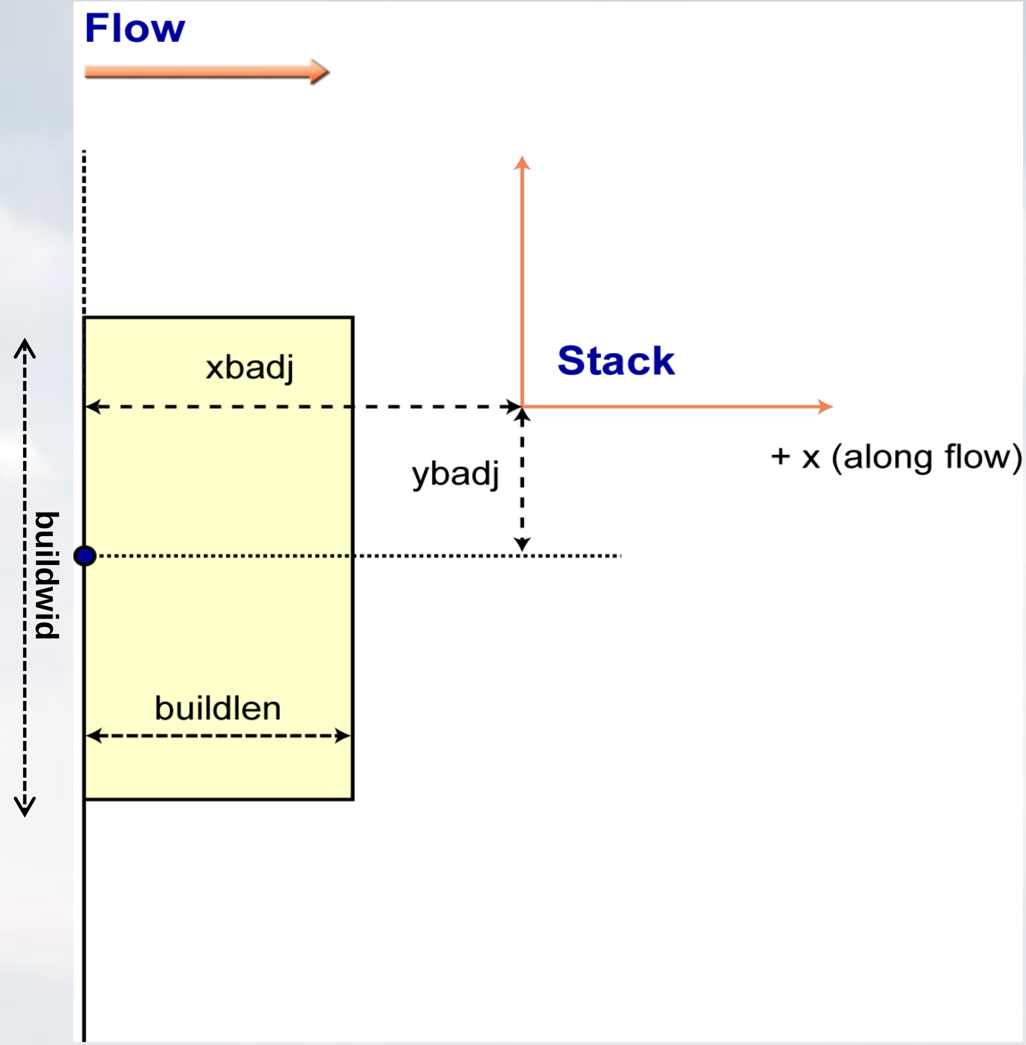
```
'PRIME Test Case'                                ← Title
'P'                                              ← MODEL TYPE: USE 'P' FOR AERMOD
'Meters'   1.000                                 ← INPUT UNITS, CONVERSION FACTOR TO METERS
'UTMN'   0.0000                                  ← UTM FLAG, PLANT NORTH ANGLE
1                                                ← NUMBER OF BUILDINGS
'UNIT1'   1     0.000                            ← FIRST BLDG NAME, NUMBER OF TIERS,
                                                    & BASE ELEVATION
    4         40.000                             ← NUMBER OF CORNERS, TIER HEIGHT
               0.000        0.000                ← X AND Y-COORDINATES OF CORNERS
               0.000       75.000                FOR FIRST BUILDING TIER
              50.000       75.000
              50.000        0.000
1                                                ← NUMBER OF STACKS
STACKID       STACK ELEV.       STACK HEIGHT   STACK X-COORD    STACK Y-COORD
'UNIT1'       0.000             45.000         75.000           0.0
```



RUNNING BPIPPRM

- Must be run from command prompt or batch file
- From a command prompt
  - bpipprm *control_file* *output_file* *summary_file*
- Using a batch file
  - Create a text file with the extension .bat
  - With the line above for the command prompt
  - Double-click the file in a Windows Explorer (or similar file browser)

BPIPPRM—OUTPUT



BPIPPRM—Example Output

```
SO BUILDHGT Stk100     40.00    40.00    40.00    40.00    40.00    40.00
SO BUILDHGT Stk100     40.00    40.00    40.00    40.00    40.00    40.00
SO BUILDHGT Stk100     40.00    40.00    40.00    40.00    40.00     0.00
SO BUILDHGT Stk100     40.00    40.00    40.00    40.00    40.00    40.00
SO BUILDHGT Stk100     40.00    40.00    40.00    40.00    40.00    40.00
SO BUILDHGT Stk100     40.00    40.00    40.00    40.00    40.00     0.00
SO BUILDWID Stk100     66.61    81.19    93.30   102.58   108.74   111.60
SO BUILDWID Stk100    111.07   107.16   100.00   107.16   111.07   111.60
SO BUILDWID Stk100    108.74   102.58    93.30    81.19    66.61     0.00
SO BUILDWID Stk100     66.61    81.19    93.30   102.58   108.74   111.60
SO BUILDWID Stk100    111.07   107.16   100.00   107.16   111.07   111.60
SO BUILDWID Stk100    108.74   102.58    93.30    81.19    66.61     0.00
SO BUILDLEN Stk100    107.16   111.07   111.60   108.74   102.58    93.30
SO BUILDLEN Stk100     81.19    66.61    50.00    66.61    81.19    93.30
SO BUILDLEN Stk100    102.58   108.74   111.60   111.07   107.16     0.00
SO BUILDLEN Stk100    107.16   111.07   111.60   108.74   102.58    93.30
SO BUILDLEN Stk100     81.19    66.61    50.00    66.61    81.19    93.30
SO BUILDLEN Stk100    102.58   108.74   111.60   111.07   107.16     0.00
SO XBADJ    Stk100    -81.96   -91.43   -98.12  -101.83  -102.45   -99.95
SO XBADJ    Stk100    -94.42   -86.02   -75.00   -79.07   -80.74   -79.95
SO XBADJ    Stk100    -76.74   -71.19   -63.48   -53.84   -42.57     0.00
SO XBADJ    Stk100    -25.20   -19.64   -13.48    -6.91    -0.13     6.65
SO XBADJ    Stk100     13.23    19.41    25.00    12.46    -0.45   -13.35
SO XBADJ    Stk100    -25.84   -37.55   -48.12   -57.23   -64.60     0.00
SO YBADJ    Stk100     45.77    40.14    33.30    25.45    16.82     7.68
SO YBADJ    Stk100     -1.69   -11.01   -20.00   -28.38   -35.89   -42.32
SO YBADJ    Stk100    -47.46   -51.16   -53.30   -53.83   -52.71     0.00
SO YBADJ    Stk100    -45.77   -40.14   -33.30   -25.45   -16.82    -7.68
SO YBADJ    Stk100      1.69    11.01    20.00    28.38    35.89    42.32
SO YBADJ    Stk100     47.46    51.16    53.30    53.83    52.71     0.00
```

INCORPORATING RESULTS INTO AERMOD

- Only one method
  - Copy/paste results from *output_file* into the AERMOD control file or a properly formatted file to include with the INCLUDED keyword
  - The necessary records in the *ouput_file* begin after the processing information
  - They meet all the AERMOD requirements except one
    - **In the *output_file*, the records start in column 6** with the pathway SO, whereas AERMOD requires that SO appear in the first two columns

```
1234567890123456
     SO BUILDHGT Stk100  40.00   40.00   40.00   40.00   40.00   40.00
     SO BUILDHGT Stk100  40.00   40.00   40.00   40.00   40.00   40.00
     SO BUILDHGT Stk100  40.00   40.00   40.00   40.00   40.00    0.00
     SO BUILDHGT Stk100  40.00   40.00   40.00   40.00   40.00   40.00
     SO BUILDHGT Stk100  40.00   40.00   40.00   40.00   40.00   40.00
     SO BUILDHGT Stk100  40.00   40.00   40.00   40.00   40.00    0.00
     SO BUILDWID Stk100  66.61   81.19   93.30  102.58  108.74  111.60
```

    - Remove the extra columns; otherwise AERMOD will generate error messages

SOME CONSIDERATIONS

- Include each significant tier on a building, with the tier height referenced to the base elevation of the building (i.e., local elevation)

- Storage tanks
  - Input as multisided polygon

SPECIAL TOPICS

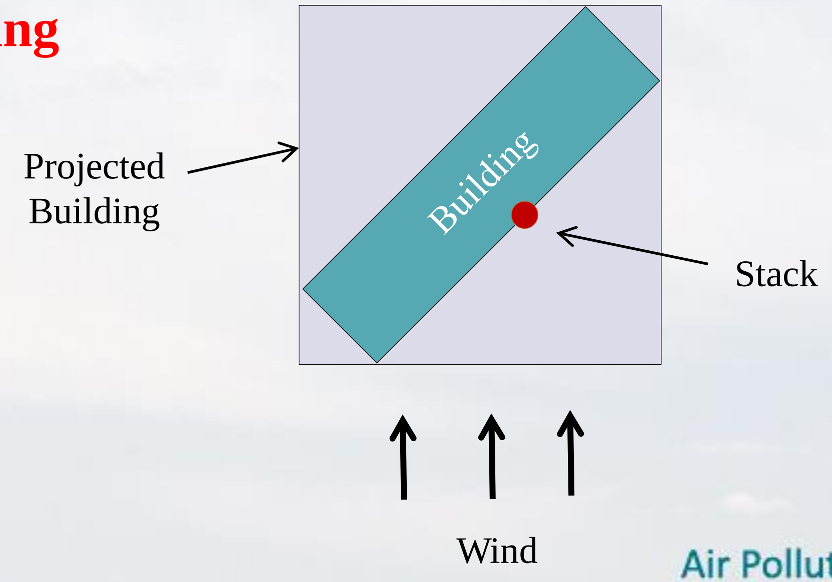
- Combining Structures
  - BPIP will combine structures if they are “sufficiently close” that their separate wakes can be considered as a single wake
  - “Sufficiently close”—closer than the greater of the two structure’s L (lesser of a structure’s height or projected width)
  - Gap between the two structures is treated as if the gap had been filled with a structure equal in height to the <u>lower</u> structure

SPECIAL TOPICS

- Equivalent Building Dimensions (EBDs)
  - For complex building areas, wind tunnel studies have been used to determine EBD
  - EPA is currently reviewing the use of EBDs
  - Current procedures developed for use with previous downwash algorithms might not be appropriate for PRIME downwash
  - October 2011 Model Clearinghouse Memo ttp://www.epa.gov/scram001/guidance/mch/new_mch/11-VII-01_MCResponse_Region7_EBDs_10242011.pdf

Known Issues

- Elongated Narrow Buildings
  - For an elongated structure, winds at 45 degrees to the structure will result in the most unusually large projected building dimensions. This is affected by other angles but less severely.
  - **There is an existing alpha version of BPIPPRM that adjusted the along wind dimensions of the projected bulding**



SUMMARY

In this Section, we covered the following topics:

- Review of building downwash
- BPIPPRM control file
- Buildings and tiers
- How to run BPIPPRM, review the results, and incorporate the results into AERMOD
- Special topics and known issues with BPIPPRM

Air Pollution Dispersion Models:
Applications with the AERMOD Modeling System

BPIPPRM Hands-on

Course #423

Air Pollution Training Institute | APTI

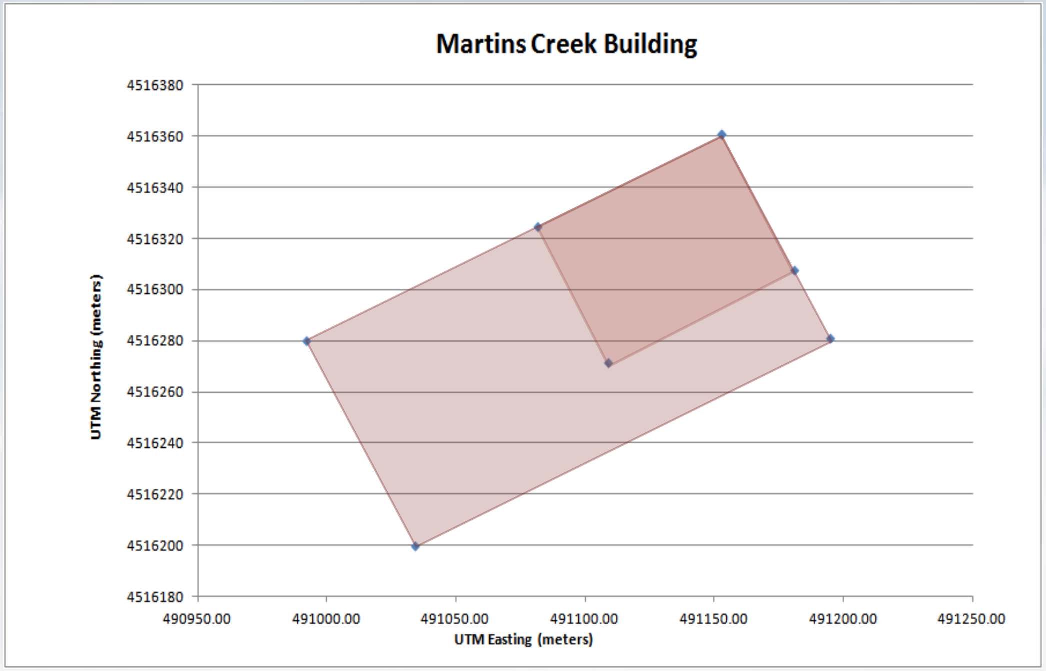
EPA

LEARNING OBJECTIVES

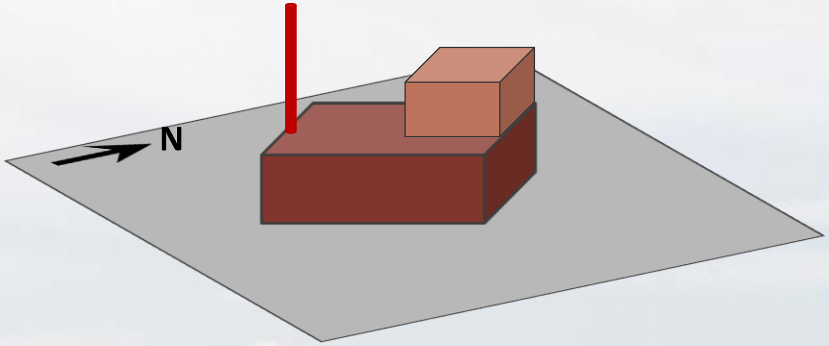
At the end of this lesson the student should be able to:

- ➢Develop the required input to run BPIPPRM
- ➢Execute the BPIPPRM program
- ➢Interpret the results from the BPIPPRIM program
- ➢Import the results from BPIPPRIM into the AERMOD program

STRUCTURE DIAGRAM



Tier 1: 180m x 90m x 60m high
Tier 2: 80m x 60m x 100m high
Stack height = 150m
Stack is 40 m from bldg. face



BPIPPRM—HANDS-ON

- Develop the BPIPPRM control file for the following
  - Model Type: Prime Downwash
  - Number of Buildings: 1
  - Number of Tiers: 2
  - Base Elevation: 0 meters
  - Tier 1 coordinates (in meters):
    - **490992.0 4516280.0**
    - **491034.0 4516200.0**
    - **491195.0 4516281.0**
    - **491153.0 4516361.0**
  - Tier 1 height: 60 meters
  - Tier 2 coordinates (in meters):
    - **491108.912 4516271.644**
    - **491081.474 4516324.737**
    - **491153.000 4516361.000**
    - **491181.029 4516307.682**
  - Tier 2 height: 100 meters
  - Source Information:
    - **Source ID: MC12**
    - **Stack elevation: 0 meters**
    - **Stack height: 182.9 meters**
    - **Location: 491020.0 4516237.0**

BPIPPRM—HANDS-ON FILES

- The BPIPPRM executable file and control file are the only files needed to complete this hands-on activity. They are located in the following directory:

APTI423\Hands-On\BPIPPRM

  - **Bpipprm.exe:** *BPIPPRM program executable file*
  - **MC_bpipprm.inp:** *control file*

BPIPPRM—Control File

MC_bpipprm.inp

```
'Martins Creek - APTI 423 Hands-on'      ← Title
'P'                                      ← MODEL TYPE:
'METERS' 1.000                           ← INPUT UNITS, CONVERSION FACTOR TO METERS
'UTMY'    0.0000                         ← UTM FLAG, PLANT NORTH ANGLE
1                                        ← NUMBER OF BUILDINGS
'BLDG1' 2        0.000                   ← FIRST BLDG NAME, NUMBER OF TIERS,
                                           BASE ELEVATION
   4         60.000                      ← NUMBER OF CORNERS, TIER HEIGHT
         490992.000 4516280.000          ← X AND Y-COORDINATES OF CORNERS
         491034.000 4516200.000            FOR FIRST BUILDING TIER
         491195.000 4516281.000
         491153.000 4516361.000
   4        100.000                      ← NUMBER OF CORNERS, TIER HEIGHT
         491108.912  4516271.644           FOR SECOND BUILDING TIER
         491081.474  4516324.737
         491153.000  4516361.000
         491181.029  4516307.682
                                         ← NUMBER OF STACKS
STACKID     STACK ELEV.     STACK HEIGHT   STACK X-COORD   STACK Y-COORD
'MC12'        0.000          182.900        491020.000      4516237.000
```

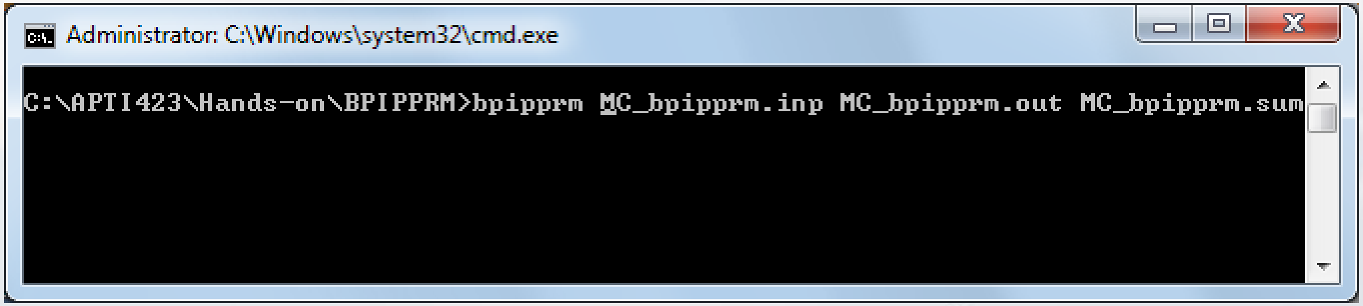
RUNNING BPIPPRM

- Must be run from command prompt or batch file
- To run BPIPPRIM for this hands-on activity, open a command prompt and set the working directory to the folder where the control file is located
- The command-line entry is of the following format:

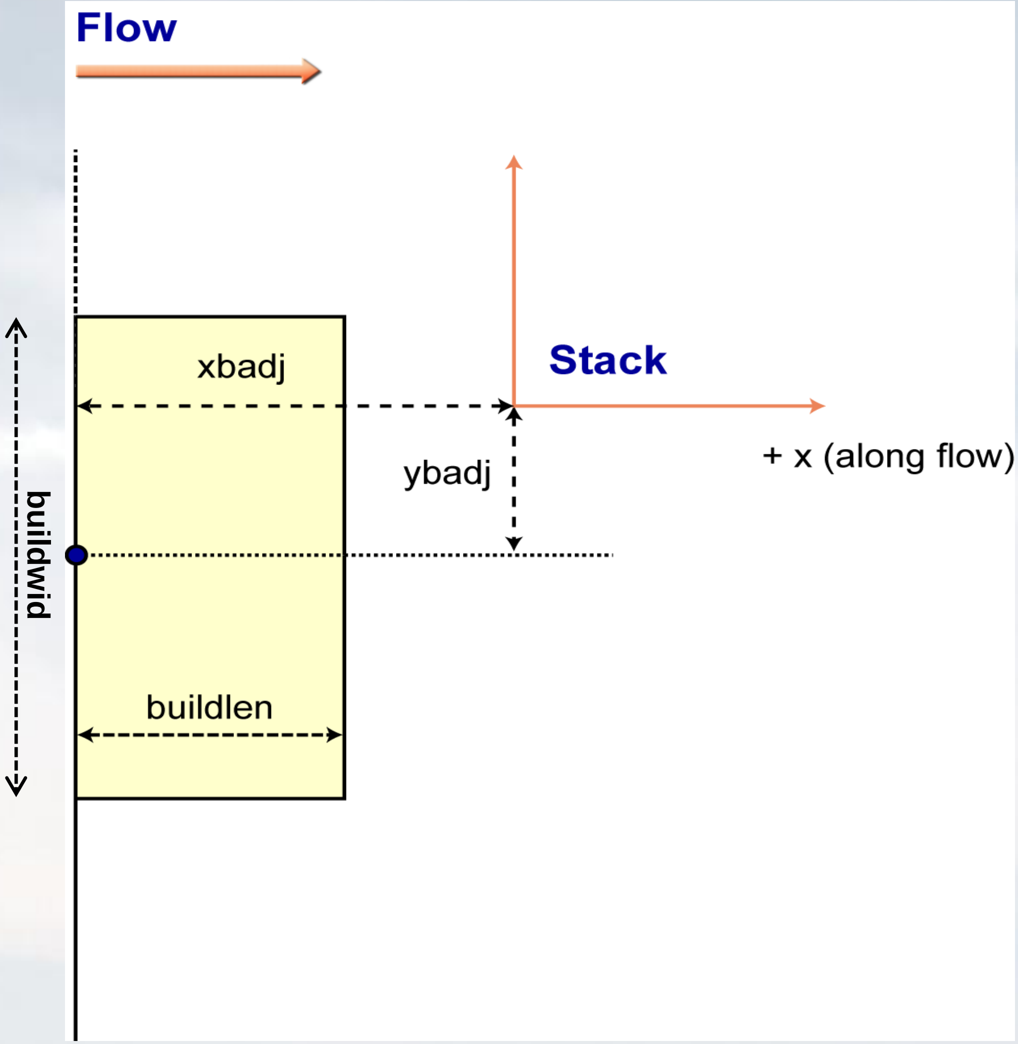
  bpipprm *control_file* *output_file* *summary_file*

- At the command prompt type the following:

  bpipprm MC_bpipprm.inp MC_bpipprm.out MC_bpipprm.sum



BPIPPRM RESULTS



BPIPPRM—HANDS-ON OUTPUT

```
SO BUILDHGT MC12       100.00  100.00  100.00  100.00  100.00  100.00
SO BUILDHGT MC12       100.00  100.00  100.00   60.00   60.00   60.00
SO BUILDHGT MC12        60.00   60.00   60.00   60.00   60.00   60.00
SO BUILDHGT MC12       100.00  100.00  100.00  100.00  100.00  100.00
SO BUILDHGT MC12       100.00  100.00  100.00   60.00   60.00   60.00
SO BUILDHGT MC12        60.00   60.00   60.00   60.00   60.00   60.00
SO BUILDWID MC12        91.14   91.14   91.14   87.23   77.06   64.55
SO BUILDWID MC12        68.89   80.34   89.36  179.22  191.99  198.93
SO BUILDWID MC12       199.82  194.65  183.56  191.10  200.09  203.00
SO BUILDWID MC12        91.14   91.14   91.14   87.23   77.06   64.55
SO BUILDWID MC12        68.89   80.34   89.36  179.22  191.99  198.93
SO BUILDWID MC12       199.82  194.65  183.56  191.10  200.09  203.00
SO BUILDLEN MC12        95.65   99.05   99.43   96.79   91.21   82.86
SO BUILDLEN MC12        87.72   95.08   99.56  199.74  190.42  175.30
SO BUILDLEN MC12       154.86  129.72  100.63  110.59  137.89  161.00
SO BUILDLEN MC12        95.65   99.05   99.43   96.79   91.21   82.86
SO BUILDLEN MC12        87.72   95.08   99.56  199.74  190.42  175.30
SO BUILDLEN MC12       154.86  129.72  100.63  110.59  137.89  161.00
SO XBADJ    MC12        49.56   62.96   74.46   83.69   90.38   94.32
SO XBADJ    MC12        87.77   75.78   61.47  -35.04  -41.02  -45.75
SO XBADJ    MC12       -49.09  -50.94  -51.24  -71.03  -99.02 -124.00
SO XBADJ    MC12      -145.21 -162.01 -173.89 -180.48 -181.59 -177.18
SO XBADJ    MC12      -175.49 -170.86 -161.03 -164.70 -149.40 -129.55
SO XBADJ    MC12      -105.78  -78.78  -49.39  -39.56  -38.87  -37.00
SO YBADJ    MC12       -95.81  -77.45  -56.74  -34.31  -10.83   12.97
SO YBADJ    MC12        36.59   58.85   79.32   55.60   66.02   74.42
SO YBADJ    MC12        80.57   84.27   85.40   83.95   79.94   73.50
SO YBADJ    MC12        95.81   77.45   56.74   34.31   10.83  -12.97
SO YBADJ    MC12       -36.59  -58.85  -79.32  -55.60  -66.02  -74.42
SO YBADJ    MC12       -80.57  -84.27  -85.40  -83.95  -79.94  -73.50
```

Incorporating Results into AERMOD

- The necessary records in the output file begin after the processing information
- This is the only portion used in AERMOD and must be pasted into a separate file or into the control file
- The records meet all the AERMOD requirements except one

In the output file, the SO pathway records start in column six, whereas AERMOD requires that SO appear in the first two columns:

```
1234567890123456
     SO BUILDHGT Stk100  40.00    40.00    40.00    40.00    40.00    40.00
     SO BUILDHGT Stk100  40.00    40.00    40.00    40.00    40.00    40.00
```

The extra leading spaces <u>must be deleted</u> before using the AERMOD control file

Air Pollution Dispersion Models:
Applications with the AERMOD Modeling System

AERMOD SETUP

COURSE #423

Air Pollution Training Institute | APTI

EPA

LEARNING OBJECTIVES

At the end of this lesson the student should be able to:

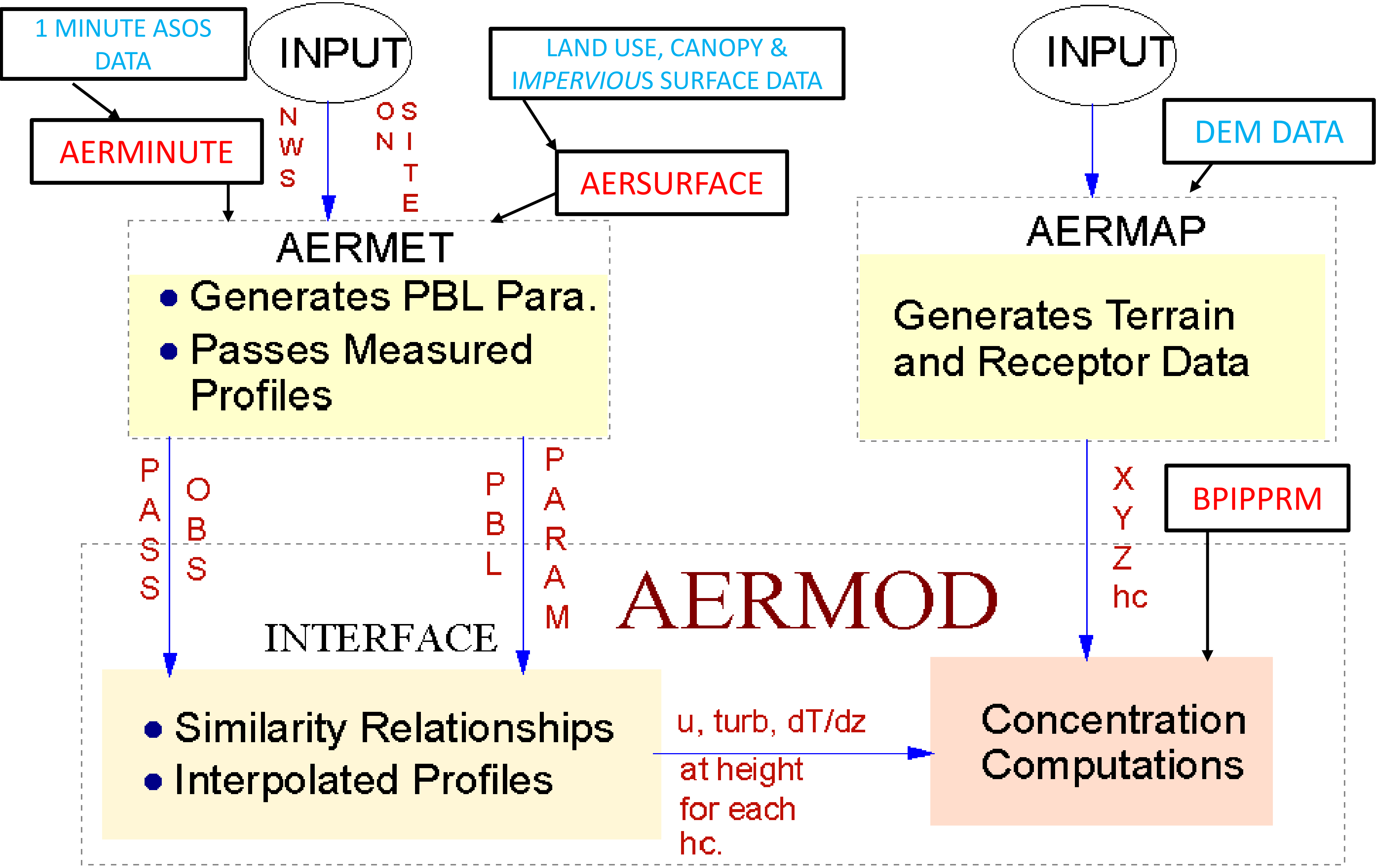
- Explain AERMOD input requirements and output options
- Develop a complete AERMOD control file without the use of a graphical user interface (GUI)
- Run AERMOD and review the results

Overview

This lesson introduces:

- Source types processed by AERMOD
- AERMOD data input requirements
  - Meteorology, source parameters, emissions, building data, receptor data
- Modeling options
- Control file format and structure
  - Pathways and keywords
- Running AERMOD and an overview of the output

MODELING SYSTEM STRUCTURE



Source Types

AERMOD Source Types:

- Point
- Area
- Volume
- Line
- RLINE—Beta option
- RLINEXT—Alpha option
- Buoyant Line
- Open Pit

Source Types

- Point/stationary—stacks and isolated vents
  - Point (POINT)
  - Capped point (POINTCAP)
  - Horizontal (POINTHOR)

Source Types

- Area—low-level and ground releases with no plume rise such as lagoons, storage piles, and mine tailings
  - Rectangular (AREA)
  - Irregular polygon (AREAPOLY)
  - Circular (AREACIRC)

Source Types

- Volume—building roof monitors; conveyor belts; factory doors, windows, and other openings considered as a single source
- Line—roadways, rail lines
- Open Pit—surface mining sites
- Buoyant Line – AL smelter roof monitor emissions

DATA INPUT

- Meteorology
  - Two files
    - Boundary layer parameters calculated by AERMET (SFC)
    - Profile of atmospheric variables (PFL)
      - One or more levels of winds, temperature, and optionally the std. deviation of horizontal wind direction and std. deviation of vertical wind speed
  - Header record in SFC file with station identifiers and a version date
  - Metric units

DATA INPUT

- Source Characteristics
  - Source ID
  - Source type
  - Location (UTM or user-defined (local) coordinates)
    - X, Y required; Z optional
    - Line source defined by two end points
    - AREAPOLY requires the additional keyword AREAVERT to define the vertices
  - Release height (stack height for point source)
  - Source-type-dependent data
    - E.g., Source dimensions, initial dispersion parameters

DATA INPUT

- Emission Parameters
  - Emission Rate (Units are source type dependent)
    - POINT, VOLUME: grams/second
    - AREA, AREAPOLY, AREACIRC: grams/second/square meter
    - OPENPIT: grams/second/square meter
    - LINE: grams/second/square meter
    - BOUYANT LINE: grams/second/line
  - For point sources stack gas temperature, velocity and diameter are needed
  - EMISFACT keyword adjusts the emission rate by season, month, hour of day, or several other options
  - HOUREMIS: file of hourly emission rates

DATA INPUT

- Building Data
  - As developed by BPIPPRM
  - 36 values per keyword (BUILDLEN, BUILDHGT, BUILDWID, XBADJ, YBADJ) usually 6 values per row
  - Associated with source through the source ID
  - Downwash parameters expressed in meters

Data Input

- Receptor Data
  - ELEVUNIT allows input of meters (default) or feet
  - Gridded (Cartesian, polar)
  - Discrete (Cartesian, polar)
  - Can use the INCLUDED keyword to specify a file to read the receptor data rather than explicitly add the receptors to the control files
- Terrain Data
  - Sources: elevation only
  - Receptors: elevation and hill height scale
- AERMAP is an option for defining these values

MODELING OPTIONS

- Regulatory Modeling Options (MODELOPT)
  - DFAULT applies regulatory modeling options and overrides all non-DFAULT options (if any are specified)
  - CONC to calculate concentration
  - DEPOS to calculate total deposition flux
  - DDEP, WDEP to calculate dry, wet deposition flux
  - ELEV assumes elevated terrain is used
  - NO_2 Options: Complete conversion (Tier 1), ARM2 (Tier 2), PVMRM and OLM (Tier 3)
  - Capped and horizontal stacks—specified with the source parameters

MODELING OPTIONS

- Non-regulatory Modeling Options
  - ALPHA: Research/experimental options provided for review and evaluation by the user community (e.g., LOW_WIND and PSDCREDIT)
  - BETA: Options that have been vetted through the scientific community – awaiting promulgation (e.g. RLINE)
  - FLAT assumes flat terrain
  - NOCHKD suspends date checking for non-sequential data files
  - SCREEN runs AERMOD in screening mode

Modeling Options

- Pollutant IDs (POLLUTID)
  - The pollutant ID and averaging period (AVERTIME), in some cases, controls how AERMOD will process the concentration results
    - NO_2 (1-hour)
    - SO_2 (1-hour)
    - $PM_{2.5}$ (24-hour)

CONTROL FILE STRUCTURE

- AERMOD uses a pathway/keyword structure to construct the analysis
- Pathways—2-character
  - CO: control—titles, modeling options, pollutant IDs, averaging times
  - SO: source—source types, locations, and parameters/emissions, building parameters for downwash, and source groups
  - RE: receptors—discrete and gridded receptor locations and elevations
  - ME: meteorology—AERMET-generated input files
  - OU: output—options for printing AERMOD output
  - EV: event processing—analysis of source contributions

CONTROL FILE STRUCTURE

- Keywords—each pathway has its own unique set of keywords
- Record structure
  - *2-character-pathway   keyword(s)   parameter(s)*
- The first keyword for all pathways is STARTING
- The last keyword or all pathways is FINISHED

CONTROL PATHWAY KEYWORDS

- CO
  - TITLE1: provides a way to identify the model run in the output file(s) (mandatory)
    - TITLE1 *title1*
  - MODELOPT: job controls and dispersion options (mandatory)
    - MODELOPT *list_of_model_options*
  - AVERTIME: averaging time(s) to process (mandatory)
  - POLLUTID: identifies the pollutant to be modeled (mandatory)

Control Pathway Keywords

- CO
- RUNORNOT: instructs AERMOD to run or only check the processing setup without running (mandatory)
- DEBUGOPT: Allows the user to request detailed files of intermediate calculations. Essential to understand a concentration prediction

CONTROL PATHWAY KEYWORDS

- CO (some optional keywords)
  - FLAGPOLE: specifies whether to accept receptor heights above local ground level
  - NO2EQUIL, NO2STACK, OZONEFIL, OZONEVAL, O3VALUES ARMRATIO: for processing NO_2 using with PVMRM, OLM and ARM2 options
  - EVENTFIL: generate an input file for an EVENT model run

Control Pathway Example

```
CO STARTING
   TITLEONE  APTI 423: AERMOD Hands-On
   TITLETWO  Martins Creek NWS data only
   MODELOPT  DFAULT  CONC
   AVERTIME  1
   POLLUTID  SO2
   RUNORNOT  RUN
   ERRORFIL  mcrat2.err
CO FINISHED
```

Source Pathway Keywords

- SO
  - LOCATION: source type and location by source ID (mandatory)
    - LOCATION *SrcID Srctyp Xs Ys (Zs)*
      - Elevation (Zs) is optional
      - FLAT: can replace Zs in applications where terrain is not a factor
    - For LINE or BUOYLINE source
      - LOCATION *SrcID Srctyp Xs1 Ys1 Xs2 Ys2 (Zs)*

SOURCE PATHWAY KEYWORDS

- SO
  - SRCPARAM: source characteristics – most source parameters are Type Dependent
  - SRCPARAM *SrcID* *Emis* *Hgt*
    - *SrcID:* unique source identifier
    - *Emis:* emission rate
    - *Hgt:* release height above group
  - POINT, POINTCAP, POINTHOR: *Stktmp* *Stkvel* *Stkdia*
  - VOLUME: *Syinit* *Szinit*
  - AREA: *Xinit* *(Yinit)* *(Angle)* *(Szinit)*
  - OPENPIT: *Xinit* *Yinit* *Pitvol* *(Angle)*

SOURCE PATHWAY KEYWORDS

- SO
  - Keywords and their associated parameters for Downwash:
    - BUILDHG *SrcID* ***or*** *SrcRange* *Dsbh(i), i=1,36 building heights*
    - BUILDWID *SrcID* ***or*** *SrcRange* *Dsbw(i), i=1,36 building widths*
    - BUILDLEN *SrcID* ***or*** *SrcRange* *Dsbl(i), i=1,36 building lengths*
    - XBADJ *SrcID* ***or*** *SrcRange* *Xbadj(i), i=1,36 along-wind distances*
    - YBADJ *SrcID* ***or*** *SrcRange* *Ybadj(i), i=1,36 cross-wind distances*
  - INCLUDED: include data from a separate file (optional)
    - INCLUDED *SrcIncludeFile*
  - SRCGROUP: groups sources (mandatory)
    - SRCGROUP *SrcGrpID* *SrcID's* *SrcRange's*

Source Pathway Keywords

- Some additional keywords (all optional)
  - ELEVUNIT: input units for source elevation (default: meters)
  - EMISFACT: variable emission rate factors
  - EMISUNIT: unit conversion factor for emissions, concentration
  - HOUREMIS: input file of hourly emission rates
  - BACKGRND: specify temporally varying background conc.
  - PARTDIAM, MASSFRAX, PARTDENS: dry deposition parameters

Source Pathway Example

```
SO STARTING
   ELEVUNIT  METERS
**                                 X             Y           Z
SO LOCATION  MC12  POINT  491020.00     4516237.00   71.53
SO LOCATION  ED2   POINT  493350.00     4528370.00   97.62
SO LOCATION  HL2   POINT  494050.00     4521040.00   97.40

** Point Source        QS      HS      TS      VS    DS
** Parameters:       -----   ----    ----    ----   ---
   SRCPARAM  MC12    500.0     182.9  400.0 20.0   5.3
   SRCPARAM  ED2     400.0     121.9  400.0 15.0   3.6
   SRCPARAM  HL2      25.0      59.4  400.0  7.0   2.7

** HOUREMIS  MARTIN.EMI MC12 ED2 HL2

   SRCGROUP  ALL
SO FINISHED
```

Receptor Pathway Keywords

- RE GRIDCART
  - gridded locations referenced to a Cartesian coordinate system
    - *Netid STA*
      - *XYINC* *Xinit Xnum Xdelta Yinit Ynum Ydelta*

        or
      - *XPNTS* *Gridx1 Gridx2 Gridx3 .... GridxN*, and
      - *YPNTS* *Gridy1 Gridy2 Gridy3 .... GridyN*
      - *ELEV* *Row Zelev1 Zelev2 Zelev3 ... ZelevN*
    - *HILL Row Zhill1 Zhill2 Zhill3 ... ZhillN*
    - *FLAG Row Zflag1 Zflag2 Zflag3 ... ZflagN*
    - *END*

RECEPTOR PATHWAY KEYWORDS

- RE GRIDPOLR
  - gridded locations referenced to a polar coordinate system
    - *Netid STA*
    - *ORIG Xinit Yinit* ***OR***
      ORIG SrcID
    - *DIST Ring1 ... RingN*
    - *DDIR Dir1 … DirN* ***OR***
      GDIR Dirnum Dirini Dirinc
    - *ELEV Dir Zelev1 ... ZelevN*
    - *HILL Dir Zhill1 ... ZhillN*
    - *FLAG Dir Zflag1 ... ZflagN*
    - *END*

Receptor Pathway Keywords

- RE DISCCART
  - discrete locations referenced to a Cartesian system
    - DISCCART *Xcoord Ycoord (Zelev) (Zhill) (Zflag)*
- RE DISCPOLR
  - discrete locations referenced to a polar network
    - DISCPOLR *Srcid Dist Direct (Zelev) (Zhill) (Zflag)*
- RE INCLUDED
  - include data from a separate file
    - INCLUDED *RecIncludeFile*

Receptor Exclusion Zone Volume Source

Exclusion Zone Radius:

$$2.15 * \sigma y_{initial} + 1.0\ \textit{meter}$$

For VOLUME sources, AERMOD will not compute concentrations for receptors located in the Exclusion Zone Radius.

Receptor Pathway Example

```
RE STARTING
   ELEVUNIT METERS
**                  XR           YR              ZR          ZHILL
   DISCCART     489020.00   4514237.00         60.18         94.59
   DISCCART     489120.00   4514237.00         60.20         94.59
   DISCCART     489220.00   4514237.00         63.46         86.92
   DISCCART     489320.00   4514237.00         68.40         90.66
   DISCCART     489420.00   4514237.00         81.79         81.79
   DISCCART     489520.00   4514237.00         85.53         94.70
   DISCCART     489620.00   4514237.00         90.34         95.77
   DISCCART     489720.00   4514237.00         93.81         98.98
   DISCCART     489820.00   4514237.00         93.80         97.47
   DISCCART     489920.00   4514237.00         92.87         92.87
   DISCCART     490020.00   4514237.00         95.73         95.73
   DISCCART     490120.00   4514237.00         98.74        369.97
   DISCCART     490220.00   4514237.00        105.03        370.10
RE FINISHED
```

Meteorology Pathway Keywords

- ME
  - SURFFILE: file with surface-based parameters from AERMET (mandatory)
    - SURFFILE *Sfcfil*
  - PROFFILE: file with the profiles of atmospheric variables from AERMET (mandatory)
    - PROFFILE *Prffil*

METEOROLOGY PATHWAY KEYWORDS

- ME
  - SURFDATA: surface meteorology station information (mandatory)
    - SURFDATA *Stanum Year (Name) (Xcoord Ycoord)*
  - UAIRDATA: upper air station information (mandatory)
    - PROFDATA *Stanum Year (Name) (Xcoord Ycoord)*
  - SITEDATA: surface meteorology station information (optional)
    - SITEDATA *Stanum Year (Name) (Xcoord Ycoord)*

Meteorology Pathway Keywords

- ME
  - STARTEND: specifies the start and end date to process; the default is to process all meteorological data (optional)
    - STARTEND *Strtyr Strtmn Strtdy (Strthr) Endyr Endmn Enddy (Endhr)*
  - DAYRANGE: specifies the days or ranges of days to process
    - DAYRANGE *Range1 Range2 ... RangeN*
  - PROFBASE: base elevation to use for computations of the potential temperature profile (in meters) (optional)
    - PROFBASE *BaseElev (Units)*

METEOROLOGY PATHWAY EXAMPLE

```
ME STARTING
   SURFFILE  mc_2008-12.sfc   free
   PROFFILE  mc_2008-12.pfl   free
   SURFDATA  14737  2008  Allentown
   UAIRDATA  54775  2008  Albany
   PROFBASE  73.2
   STARTEND  2008 1 1  2012 12 31
ME FINISHED
```

OUTPUT PATHWAY KEYWORDS

- OU
  - RECTABLE: file with values by receptor (optional)
    - RECTABLE *Aveper 1 2 … 6 … N … 999*
    - ***AND/OR***
    - RECTABLE *Aveper 1ST 2ND … 6TH … 10TH*
    - ***AND/OR***
    - RECTABLE *Aveper FIRST SECOND … SIXTH … TENTH*
    - Use N for the Nth highest for larger values in the last two formats

Output Pathway Keywords

- OU
  - MAXTABLE: summarize overall maximum values (optional)
    - MAXTABLE *Aveper Maxnum*
  - MAXIFILE: file for which events exceeding a threshold value (optional)
    - MAXIFILE *Aveper GrpID Thresh Filnam (Funit)*
  - PLOTFILE: output file based on the averaging period and high value useful for plotting results (optional)
    - PLOTFILE *Aveper GrpID Hivalu Filnam (Funit)*

      and/or
    - PLOTFILE *ANNUAL GrpID Filnam (Funit)*

      or
    - PLOTFILE *PERIOD GrpID Filnam (Funit)*

OUTPUT PATHWAY KEYWORDS

- OU
  - SUMMFILE: a significantly shorter version of the AERMOD.OUT file except the values at all receptors for all source groups is not output
    - SUMMFILE *SummFilnam*
  - NOHEADER: suppresses the file header records that appear on the output files such as found in the PLOTFILE
    - NOHEADER *FileType1* … *FileTypeN*

      or
    - NOHEADER ALL

OUTPUT PATHWAY KEYWORDS

- OU
  - MAXDAILY: output to a file for the specified source group, the daily maximum 1-hour values for each day processed; only applies to 1-hour NO_2 and 1-hour SO_2 NAAQS
    - MAXDAILY *GrpID FileName (FileUnit)*
  - MXDYBYYR: output to a file for the specified source group, the daily maximum 1-hour values by year for each year processed; only applies to 1-hour NO_2 and 1-hour SO_2 NAAQS
    - MXDYBYYR *GrpID FileName (FileUnit)*

OUTPUT PATHWAY EXAMPLE

```
OU STARTING

   RECTABLE  allave first fourth
   MAXTABLE  allave    400

   PLOTFILE  1  all first     mcrat2_1.plt
   PLOTFILE  1  all 4         mcrat2_4.plt
   SUMMFILE  MCR_SUMM.sum

OU FINISHED
```

COMPLETE AERMOD EXAMPLE

Due to space limitations, refer to the AERMOD hands-on activity to view a complete AERMOD control file.

RUNNING AERMOD

- Windows environment—double-click aermod.exe (or whatever the executable is named)
- Command prompt environment—type "aermod," without quotes (or whatever the executable is named) and press return
  - If control file is not named AERMOD.INP, control filename follows "aermod" on the command line

OVERVIEW OF AERMOD OUTPUT

- One or more files are generated, depending on the number of output keywords specified
- At a minimum, the AERMOD.OUT file is generated
  - Echo of input control file records
  - Summary of control file setup messages
  - Summary of inputs
  - Summary of modeling options
  - Summary of source data
  - Summary of receptor data
  - Summary of meteorology data
  - Model results
    - Dependent on the options and keywords on the OU pathway

Reviewing AERMOD Output

- Model results (AERMOD.OUT)
  - Daily results for each averaging period selected for each day processed (if applicable)—**DAYTABLE** keyword
  - PERIOD results for each source group (if applicable)—**PERIOD** parameter on **AVERTIME** keyword
  - Short-term average results (high, second high, etc.) By receptor for each source group (if applicable)—**RECTABLE** keyword
  - Overall maximum short-term average results for each source group (if applicable)—**MAXTABLE** keyword
  - Summary tables of high values for each averaging period and source group (always provided if **PERIOD** averages or the **RECTABLE** keyword are used)
  - Summary of complete model execution messages

SUMMARY

In this section, we covered the following topics:

- Source types that AERMOD can model
- Types of data/information required by AERMOD
- Regulatory and non-regulatory options in AERMOD
- Pollutants processed
- Control file format and structure
  - Pathways
  - Keywords
- How to run AERMOD
- Overview of AERMOD output

Air Pollution Dispersion Models:
Applications with the AERMOD Modeling System

AERMOD—Special Topics

Course #423

Air Pollution Training Institute | APTI

EPA

Learning Objectives

At the end of this lesson the student should be able to:

- Develop an appropriate control file for running AERMOD for several scenarios for the "Martins Creek" example
  - The AERMOD control files will include:
    - Reference to the output of all AERMOD preprocessors for use in the AERMOD run
    - A myriad of option that tell AERMOD: What pollutant is being modeled (NO_2, SO_2, $PM_{2.5}$, and lead are each modeled differently, etc.)
    - What meteorological data are to be use
    - What source types are to be modeled and what are their source parameters
    - Input for considering building downwash
- Run AERMOD for each of the defined scenarios

OVERVIEW

This lesson introduces:

- Modeling for the newer probabilistic NAAQS
- Options for modeling NO_X
- Input/output options related to the newer NAAQS
- Capped and horizontal point sources
- Urban applications
- Dry/wet deposition and depletion

MODELING FOR THE NAAQS: NO_2

- Annual: arithmetic mean
  - Primary and secondary standard
  - 53 ppb or about 100 µg/m^3

- 1-hour: 98th percentile of the 1-hour daily maximum concentrations, averaged over 3 years
  - Primary standard
  - 100 ppb or about 188 µg/m^3

- What is the difference between arithmetic mean and a percentile averaged over N years?

MODELING FOR THE NAAQS: SO_2

- 3-hour standard: not to be exceeded more than once per year
  - A secondary standard
  - 0.5 ppm or about 1,309 µg/m^3
- 1-hour standard: 99th percentile of the 1-hour daily maximum concentrations, averaged over 3 years
  - Primary standard
  - 75 ppb or about 196 µg/m^3
- The 24-hour and annual standards revoked June 2010

MODELING FOR THE NAAQS: $PM_{2.5}$

- Annual Primary
  - Annual mean, averaged over 3 years
  - 12 $\mu g/m^3$
- Annual Secondary
  - Annual mean, averaged over 3 years
  - 15 $\mu g/m^3$
- 24-hour: 98th percentile, averaged over 3 years
  - Primary and secondary standard
  - 35 $\mu g/m^3$
  - Integer value determined by rounding
  - Need to consider secondary particulates (e.g., $(NH_4)_2SO_4$)

Modeling for the NAAQS: Lead

- Rolling 3-month average—not to be exceeded
  - Primary and secondary standard
  - 0.15 µg/m^3

NAAQS Compliance: Modeling the 1-Hour NO_2 Standard

- Not deterministic, e.g., high-second-high
- "Probabilistic"—percentile based on an average over several years
- The modeled design value is based on the 98th percentile of the maximum daily 1-hour values across 5 years (NWS) or the 98th percentile of the maximum daily 1-hour value for one year (site-specific), or the maximum daily 1-hour values across 3 years (prognostic)
- The eighth-highest of the daily maximum 1-hour values across a year is an unbiased surrogate for the 98th percentile

MODELING FOR THE NAAQS: NO_2

- Speciation Methods—Tiered Screening Approach
  - Tier 1: Assume Total conversion of NO to NO_2
  - Tier 2: ARM2
    - Use of the Ambient Ratio Method version 2
  - Tier 3: Speciation Methods - PVMRM or OLM
    - Detailed analysis on a case-by-case basis
    - Uses background O_3 concentrations.

TIER 3 APPROACHES

- MODELOPT keyword "OLM" or "PVMRM"
- Key model inputs for both techniques:
  - In-stack ratio of NO_2/NO_X
    - No default value—justify and get approval
    - Database of ratios available at http://www.epa.gov/ttn/scram/no2_isr_database.htm —updated as new data are submitted
    - Use CO NO2STACK keyword for ratio that applies to all sources or SO NO2RATIO to apply on a source-by-source basis
  - NO_2/NO_X ambient equilibrium ratio (NO2EQUIL)
    - Default value of 0.9 for both OLM and PVMRM
  - Hourly ambient ozone concentration
    - Must be concurrent with meteorological data
    - Can use a single representative value but could be overly conservative
    - Check a state's modeling website or call modeling contact

Modeling for the NAAQS: NO_2

- Speciation Methods—Tiered Screening Approach
- Example for PVMRM

```
CO STARTING
   TITLEONE AERMOD-PVMRM Test Case - 35m Stack, 50g/s
   MODELOPT CONC  FLAT  PVMRM
   AVERTIME 1  Annual
   POLLUTID NO2
   OZONEVAL 40.  PPB
   OZONEFIL ozone.dat  ppb  (i2,3i3,f9.3)
   NO2STACK 0.10
   RUNORNOT RUN
CO FINISHED
```

MODELING FOR THE NAAQS: NO_2

- Modeling Increment Credits
  - **PSDCREDIT** option—an ALPHA option
  - Use the PSDCREDIT option, along with the PVMRM option, to correctly apply credits for NO_2 modeling with PVMRM
  - Analysis can involve identification of three groups of sources:
    - Increment-consuming sources
    - Retired (increment-expanding) baseline sources
    - Existing, non-retired, baseline sources

NAAQS Compliance: 1-Hour NO_2 Standard

- To get the modeled value corresponding to the standard from AERMOD, specify the following:
  - CO pathway
    - CO POLLUTID NO2
    - CO AVERTIME 1
  - OU pathway
    - OU RECTABLE 1 8
- If you add any additional averaging times to the AVERTIME keyword, AERMOD WILL NOT calculate the correct form of the standard for NO_2

NAAQS Compliance: 1-Hour SO_2 Standard

- Not deterministic
- “Probabilistic”—percentile based on an average over several years
- The modeled design value is based on the 99th percentile of the maximum daily 1-hour values across 5 years (NWS) or the 99th percentile of the maximum daily 1-hour value for one year (site-specific), or the maximum daily 1-hour values across 3 years (prognostic)
- The fourth-highest of the daily maximum 1-hour values across a year is an unbiased surrogate for the 99th percentile

NAAQS COMPLIANCE: 1-HOUR SO_2 STANDARD

- To get the modeled value corresponding to the 1-hour NAAQS from AERMOD, specify the following:
  - CO pathway
    - CO POLLUTID SO2
    - CO AVERTIME 1
  - OU pathway
    - OU RECTABLE 1 4 (aveper high value)
- If you add any additional averaging times to the AVERTIME keyword, AERMOD WILL NOT calculate the correct form of the standard for SO_2

NAAQS Compliance: 24-Hour $PM_{2.5}$ Standard

- Not deterministic
- "Probabilistic"—percentile based on an average over several years
- For a first-tier modeling analysis, the modeled design value is based on the 98th percentile of the 24-hour values across 5 years (NWS) or the 98th percentile of the 24-hour value for one year (site-specific), or the 98th percentile of the 24-hour value for 3 years (prognostic data)
- The eighth-highest of the 24-hour values across a year is an unbiased surrogate for the 98th percentile

NAAQS Compliance: 24-Hour $PM_{2.5}$ Standard

- To get the modeled value corresponding to the 24-hour NAAQS from AERMOD, specify the following:
  - CO pathway
    - CO POLLUTID PM25
    - Alternate forms of POLLUTID: PM-2.5, PM2.5, or PM-25
    - CO AVERTIME 24
  - OU pathway
    - OU RECTABLE 24 8 (aveper high value)
- If you add any additional averaging times, AERMOD WILL NOT calculate the correct form of the standard for $PM_{2.5}$

NAAQS COMPLIANCE: LEAD STANDARD

- 3-month rolling average
- Requires LEADPOST—a post-processing tool
- Computes the design value from MONTHLY AERMOD output
- LEADPOST reads two file types:
  - 1) AERMOD POSTFILEs with a monthly averaging period, or
  - 2) User-created simple text files
  - All files must be of the same type

Capped/Horizontal Stacks or Vents

Per the *AERMOD Implementation Guide* (April 2018)

(Document has been provided with the course

- Sources **NOT** subject to building downwash that are capped or horizontal should be modeled based on the guidance provided in the Guide

AERMOD now has an ability to apply the procedures found in the Guide by using the following regulatory source type options:

- For capped stacks, define the source type as: POINTCAP
- For horizontal stacks, define the source type as: POINTHOR

CAPPED/HORIZONTAL STACKS OR VENTS

Per the *AERMOD Implementation Guide* (April 2018)

- For capped and horizontal sources subject to building downwash
  - The regulatory options in AERMOD have been adapted to account for the PRIME algorithm as follows:
    - For the POINTHOR option:
      - AERMOD sets the initial plume trajectory angle to horizontal
    - For the POINTCAP option:
      - AERMOD assigns the initial diameter of the plume to be two times the actual stack diameter
      - AERMOD also assigns the initial horizontal velocity of the plume to be the initial exit velocity specified by the user divided by four

URBAN APPLICATIONS

- AERMOD incorporates the effects of increased surface heating from an urban area on pollutant dispersion under stable atmospheric conditions
  - CO URBANOPT *urbanpop (urbname) (urbroughness)*
- AERMOD includes the option to specify multiple urban areas within the same model run
  - CO URBANOPT urbID *urbanpop (urbname) (urbroughness)*
- The urban roughness length is defaulted to 1.0 meter
- For tall stacks located near a small urban area, AERMOD has been modified to address issues related to overpredictions found for such sources

URBAN APPLICATIONS

- Identify urban sources on the SO pathway using the URBANSRC keyword
  - SO URBANSRC *srcid'*s and/or *srcrng*'s or ALL

Dry/Wet Deposition

- AERMOD includes algorithms for both dry and wet deposition of both particulate and gaseous emissions
- Two methods for particle deposition
  - Method 1: User-specified particle distribution
    - Can be applied with the regulatory DFAULT option
  - Method 2: User-defined mass of fine particles (<2.5μm) and a representative mass mean diameter
    - ALPHA option
- Gaseous Deposition: The user must define seasonal categories for each of the calendar months, direction-specific land use categories, and several pollutant-specific parameters
  - ALPHA option

Dry/Wet Deposition

Pollutant Type	Model Output Type (CO MODELOPT)	Required Keywords (SO Pathway)	Allowed under DFAULT?
Particulate Method 1	• CONC w/dry and/or wet depletion • DEPOS • DDEP • WDEP	• SO PARTDIAM, • SO PARTDENS, and • SO MASSFRAX	Yes
Particulate Method 2 (fine particles)	• CONC w/dry and/or wet depletion • DEPOS • DDEP • WDEP • ALPHA	• SO METHOD_2	No

Dry/Wet Deposition

Pollutant Type	Model Output Type	Required Keywords	Allowed under DFAULT?
Gaseous	• Concentration w/dry depletion • DDEP	• CO MODELOPT ALPHA • CO GASDEPVD or CO GDSEASON, • CO GDLANUSE, and • SO GASDEPOS	No
Gaseous	• CONC w/wet depletion • WDEP	• CO MODELOPT ALPHA • SO GASDEPOS	No
Gaseous	• CONC w/dry and wet depletion • DEPOS	• CO MODELOPT ALPHA • CO GDSEASON, • CO GDLANUSE, and • SO GASDEPOS	No

EPA

APTI

Dry/Wet Deposition

- Additional keywords
  - GDSEASON (CO pathway)
    - Definition of seasons for gaseous deposition
      - Seasonal Category 1: Midsummer with lush vegetation
      - Seasonal Category 2: Autumn with unharvested cropland
      - Seasonal Category 3: Late autumn after frost and harvest, or winter with no snow
      - Seasonal Category 4: Winter with snow on ground (with generally continuous snow cover)
      - Seasonal Category 5: Transitional spring with partial green coverage or short annuals
  - GDLANUSE (CO pathway)
    - Definition of land use by 10-degree <u>flow vector sectors</u>, like the definitions for the building downwash parameters
    - Nine land use categories

Dry/Wet Deposition

- Additional keywords
  - GASDEPDF (CO pathway)
    - Overrides default parameters for reactivity factor and fraction of green leaf area index for autumn/unharvested cropland and for transitional spring for the gas dry deposition algorithms
  - GASDEPOS (SO pathway)
    - Controls input of several source parameters for dry and wet deposition of gaseous pollutants
  - GASDEPVD (CO pathway)
    - Specify the dry deposition velocity for gaseous emissions
    - Only one value per model run
    - Computation of deposition velocity for gaseous pollutants is by-passed

SUMMARY

In this section, we covered the following topics:

- Modeling for the newer probabilistic NAAQS
- Options for modeling NO_X
- Understanding output options
- Horizontal and capped point sources
- Urban applications
- Dry/wet deposition and depletion

Air Pollution Dispersion Models:
Applications with the AERMOD Modeling System

AERMOD HANDS-ON

COURSE #423

Air Pollution Training Institute | APTI

LEARNING OBJECTIVES

At the end of this lesson the student should be able to:

- Properly input all the data produced from AERMOD's preprocessors to run AERMOD for the Martins Creek example
- Develop the AERMOD Control file to run the example case
- Run AERMOD on the example case
- Review the Martins Creek output

AERMOD HANDS-ON—FILES

- AERMOD program executable and 1-year hourly emissions files can be found in:

  APTI423\Hands-on\AERMOD

  - **Aermod-32 or _64.exe:** *AERMOD program executable file*
  - **MARTIN.EMI:** *Martins Creek hourly emissions file*

- Meteorology
  - Surface and profile file in AERMET hands-on

- Four modeling scenarios
  - 3-hour, 24-hour, Annual SO_2 w/1-year site-specific and NWS
  - 1-hour SO_2 w/1-year site-specific and NWS
  - 3-hour, 24-hour, Annual SO_2 w/5 years NWS only (separate run for each year)
  - 1-hour SO_2 w/5 years NWS (single run)

AERMOD HANDS-ON—FILES

- **3-24hr-Ann_SO2_1-yr_Site_Specific and NWS**
  - MCR_AERMOD.INP
- **1hr_SO2_1-yr_Site _Specific and NWS **
  - MCR_AERMOD.INP
- **3-24hr-Ann_SO2_5-yr_NWS**
  - MCR_AERMOD_**08**.INP --- MCR_AERMOD_**12**.INP
  - RunMC.bat
- **1hr_SO2_5-yr_NWS**
  - MCR_AERMOD.INP

SO_2 STANDARDS

Averaging Time	Standard ($\mu g/m^3$)	Form of the Standard
Annual Revoked	20	Annual arithmetic average (highest)
24-hour Revoked	91	Not to be exceeded more than once per year (H2H)
3-hour Secondary	512	Not to be exceeded more than once per year (H2H)
1-hour	196	3-year average of the annual 99th percentile of 1-hour daily maximum concentrations

Control File parameters 1-Year Site-specific; 3-Hour, 24-Hour, Annual

- *Model options*: Default regulatory options, concentrations only
- *Averaging times:* 3, 24, annual
- *Pollutant*: SO_2
- *Elevation units*: Meters
- *Point sources*:

ID	X	Y	Z	Emission Rate	Stack Height	Exit Temp	Exit Velocity	Inside Diam
	meters	meters	meters	grams/ second	meters	K	meters/ second	meters
MC12	491020	4516237	71.53	0.0	182.9	0.0	0.0	5.3
ED2	493350	4528370	97.62	0.0	121.9	0.0	0.0	3.6
HL2	494050	4521040	97.40	0.0	59.4	0.0	0.0	2.7

- *Hourly emissions*: MARTIN.EMI, apply to all point sources
- *Source groups*: All sources as one single source group

Control File Parameters—cont'd 1-Year Site-specific; 3-Hour, 24-Hour, Annual

- *Receptors*: MC_nested.rec in the AERMAP folder
- *Meteorology*: Files generated by AERMET, free format
- *SURFDATA:* Station ID: *14737*
- *UAIRDATA:* Station ID: *54775*
- *Profile base:* 73.2 meters
- *Start date*: May 1, 2011
- *End date*: April 30, 2012
- Recommended output:
  - RECTABLE for first high and second high, 3- and 24-hour averages
  - PLOTFILEs
  - SUMMFILE

1-YEAR SITE-SPECIFIC CONTROL FILE

3-HOUR, 24-HOUR, ANNUAL, SO PATHWAY

3-24hr-Ann_SO2_1-yr_Site\MCR_AERMOD.INP

```
SO HOUREMIS 11  5  1  1 MC12          386.91     389.8     11.45
SO HOUREMIS 11  5  1  1 ED2           322.00     397.4     13.00
SO HOUREMIS 11  5  1  1 HL2            25.55     464.3      7.46
SO HOUREMIS 11  5  1  2 MC12          405.35     389.3     11.54
SO HOUREMIS 11  5  1  2 ED2           319.90     396.3     13.00
SO HOUREMIS 11  5  1  2 HL2            25.55     464.3      7.46
SO HOUREMIS 11  5  1  3 MC12          386.43     388.7     11.00
SO HOUREMIS 11  5  1  3 ED2           310.50     395.2     12.50
SO HOUREMIS 11  5  1  3 HL2            25.55     464.3      7.46
SO HOUREMIS 11  5  1  4 MC12          357.80     388.7     10.18
SO HOUREMIS 11  5  1  4 ED2           318.80     395.8     13.00
SO HOUREMIS 11  5  1  4 HL2            25.55     464.3      7.46
SO HOUREMIS 11  5  1  5 MC12          361.11     388.7     10.27
SO HOUREMIS 11  5  1  5 ED2           314.50     396.3     12.80
SO HOUREMIS 11  5  1  5 HL2            25.55     464.3      7.46
SO HOUREMIS 11  5  1  6 MC12          761.92     393.2     20.90
SO HOUREMIS 11  5  1  6 ED2           312.50     396.3     12.70
SO HOUREMIS 11  5  1  6 HL2            25.55     464.3      7.46
SO HOUREMIS 11  5  1  7 MC12          899.94     405.4     25.63
SO HOUREMIS 11  5  1  7 ED2           501.10     397.4     21.00
SO HOUREMIS 11  5  1  7 HL2            25.55     464.3      7.46
SO HOUREMIS 11  5  1  8 MC12          790.73     402.6     22.81
SO HOUREMIS 11  5  1  8 ED2           766.60     401.9     32.90
SO HOUREMIS 11  5  1  8 HL2            25.55     464.3      7.46
```

1-Year Site-specific Control File

3-Hour, 24-Hour, Annual, RE Pathway

3-24hr-Ann_SO2_1-yr_Site\MCR_AERMOD.INP

```
RE STARTING
   INCLUDED
RE FINISHED
```

```
RE ELEVUNIT METERS
   DISCCART     489020.00    4514237.00        60.18        94.59
   DISCCART     489120.00    4514237.00        60.20        94.59
   DISCCART     489220.00    4514237.00        63.46        86.92
   DISCCART     489320.00    4514237.00        68.40        90.66
   DISCCART     489420.00    4514237.00        81.79        81.79
   DISCCART     489520.00    4514237.00        85.53        94.70
   DISCCART     489620.00    4514237.00        90.34        95.77
   DISCCART     489720.00    4514237.00        93.81        98.98
   DISCCART     489820.00    4514237.00        93.80        97.47
   DISCCART     489920.00    4514237.00        92.87        92.87
   DISCCART     490020.00    4514237.00        95.73        95.73
   DISCCART     490120.00    4514237.00        98.74       369.97
   DISCCART     490220.00    4514237.00       105.03       370.10
   DISCCART     490320.00    4514237.00       102.49       370.10
   DISCCART     490420.00    4514237.00        94.09       370.10
```

RUNNING AERMOD

1-YEAR SITE-SPECIFIC: 3-HOUR, 24-HOUR, ANNUAL

- To run the 1-year site-specific multi-average SO_2 scenario:
  1. Open a command prompt and set the working directory as the directory where the control file template is located, e.g., APTI423\Hands-on\AERMOD\ _SO2_1-yr_Site_Specific- 3-24hr-Ann
  2. Copy the control file, MCR_AERMOD.INP, to "aermod.inp" or a user-defined input filename
  3. Start AERMOD by typing "..\aermod_64 or 32" at the command prompt, then hit "Enter"—If you choose to name the input file something other than "aermod.inp" then you must type the name of the file and the directory in which it is located after typing "../aermod"

Running AERMOD

SO_2: 1-Year Site-specific: 3-Hour, 24-Hour, Annual

Administrator: C:\Windows\system32\cmd.exe - ..\aermod

```
C:\APTI423\Hands-on\AERMOD\3-24hr-Ann_SO2_1-yr_Site>copy MCR_AERMOD.INP aermod.i
np
        1 file(s) copied.

C:\APTI423\Hands-on\AERMOD\3-24hr-Ann_SO2_1-yr_Site>..\aermod
+Now Processing SETUP Information
+Now Processing Data For Day No.  121 of 2011
+Now Processing Data For Day No.  122 of 2011
+Now Processing Data For Day No.  123 of 2011
+Now Processing Data For Day No.  124 of 2011
+Now Processing Data For Day No.  125 of 2011
+Now Processing Data For Day No.  126 of 2011
+Now Processing Data For Day No.  127 of 2011
```

AERMOD OUTPUT

- AERMOD produces several output files, with all but AERMOD.OUT under the control of the user
  - AERMOD.OUT: General summary of the run and includes the high ranked values, RECTABLE, MAXTABLE
  - The presence of other output files depend on the output options specified in the control file

AERMOD.OUT

```
 *** AERMOD - VERSION  18081 ***   ***  APTI 423: AERMOD Hands-On                                     ***        10/02/19
*** AERMET - VERSION  19191 ***   ***  Martins Creek 1-yr Site-specific and NWS, Multi-average       ***        13:09:28
                                                                                                               PAGE   1
*** MODELOPTs:    RegDFAULT  CONC  ELEV  RURAL

                                            ***     MODEL SETUP OPTIONS SUMMARY       ***
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

**Model Is Setup For Calculation of Average CONCentration Values.

  --  DEPOSITION LOGIC  --
**NO GAS DEPOSITION Data Provided.
**NO PARTICLE DEPOSITION Data Provided.
**Model Uses NO DRY DEPLETION.  DRYDPLT  =  F
**Model Uses NO WET DEPLETION.  WETDPLT  =  F

**Model Uses RURAL Dispersion Only.

**Model Uses Regulatory DEFAULT Options:
        1. Stack-tip Downwash.
        2. Model Accounts for ELEVated Terrain Effects.
        3. Use Calms Processing Routine.
        4. Use Missing Data Processing Routine.
        5. No Exponential Decay.

**Other Options Specified:
        CCVR_Sub - Meteorological data includes CCVR substitutions

**Model Assumes No FLAGPOLE Receptor Heights.

**The User Specified a Pollutant Type of:  SO2

**NOTE: Special processing requirements applicable for the 1-hour SO2 NAAQS have been disabled!!!
        User has specified non-standard averaging periods:    3-HR  24-HR
        High ranked 1-hour values are NOT averaged across the number of years modeled, and
        complete years of data are NOT required.

**Model Calculates  2 Short Term Average(s) of:   3-HR  24-HR
    and Calculates ANNUAL Averages

**This Run Includes:      3 Source(s)
```

AERMOD.OUT

```
 **The AERMET Input Meteorological Data Version Date:  19191

**Output Options Selected:
         Model Outputs Tables of ANNUAL Averages by Receptor
         Model Outputs Tables of Highest Short Term Values by Receptor (RECTABLE Keyword)
         Model Outputs Tables of Overall Maximum Short Term Values (MAXTABLE Keyword)
         Model Outputs External File(s) of High Values for Plotting (PLOTFILE Keyword)
         Model Outputs Separate Summary File of High Ranked Values (SUMMFILE Keyword)

**NOTE:  The Following Flags May Appear Following CONC Values:  c for Calm Hours
                                                                m for Missing Hours
                                                                b for Both Calm and Missing Hours

**Misc. Inputs:  Base Elev. for Pot. Temp. Profile (m MSL) =    73.20 ;  Decay Coef. =    0.000     ;  Rot. Angle =     0.0
                 Emission Units = GRAMS/SEC                                ;  Emission Rate Unit Factor =   0.10000E+07
                 Output Units   = MICROGRAMS/M**3

**Approximate Storage Requirements of Model =      4.1 MB of RAM.

**Input Runstream File:          aermod.inp

**Output Print File:             aermod.out

**Detailed Error/Message File:   mcr.err

**File for Summary of Results:   MCR_SUMM.sum
```

AERMOD.OUT

```
*** AERMOD - VERSION  18081 ***   ***  APTI 423: AERMOD Hands-On                                            ***        10/02/19
*** AERMET - VERSION  19191 ***   ***  Martins Creek 1-yr Site-specific and NWS, Multi-average              ***        13:09:28
                                                                                                                       PAGE 304
*** MODELOPTs:    RegDFAULT  CONC  ELEV  RURAL

*** Message Summary : AERMOD Model Execution ***

 --------- Summary of Total Messages --------

A Total of            0 Fatal Error Message(s)
A Total of           18 Warning Message(s)
A Total of           63 Informational Message(s)

A Total of         8784 Hours Were Processed

A Total of            0 Calm Hours Identified

A Total of           63 Missing Hours Identified (  0.72 Percent)


   ******** FATAL ERROR MESSAGES ********
              ***  NONE  ***
```

AERMOD.OUT

```
   ******** FATAL ERROR MESSAGES ********
               ***  NONE  ***
    ********   WARNING MESSAGES   ********
 SO W320      22         PPARM: Input Parameter May Be Out-of-Range for Parameter           QS
 SO W320      23         PPARM: Input Parameter May Be Out-of-Range for Parameter           QS
 SO W320      24         PPARM: Input Parameter May Be Out-of-Range for Parameter           QS
 CN W305       9       WAKFLG: Stack height > or = EPA formula height for SRCID:          MC12
 MX W403     217       PFLCNV: Turbulence data is being used w/o ADJ_U* option       SigA Data
 MX W402     217       PFLCNV: Turbulence data being used with ADJ_U* w/o DFAULT        Option
 MX W403     217       PFLCNV: Turbulence data is being used w/o ADJ_U* option       SigA Data
 MX W403     217       PFLCNV: Turbulence data is being used w/o ADJ_U* option       SigA Data
 MX W403     217       PFLCNV: Turbulence data is being used w/o ADJ_U* option       SigA Data
 MX W403     217       PFLCNV: Turbulence data is being used w/o ADJ_U* option       SigA Data
 MX W403     217       PFLCNV: Turbulence data is being used w/o ADJ_U* option       SigA Data
 MX W403     217       PFLCNV: Turbulence data is being used w/o ADJ_U* option       SigA Data
 MX W403     217       PFLCNV: Turbulence data is being used w/o ADJ_U* option       SigA Data
 MX W403     217       PFLCNV: Turbulence data is being used w/o ADJ_U* option       SigA Data
 MX W403     217       PFLCNV: Turbulence data is being used w/o ADJ_U* option       SigA Data
 MX W403     217       PFLCNV: Turbulence data is being used w/o ADJ_U* option       SigA Data
 MX W403     217       PFLCNV: Turbulence data is being used w/o ADJ_U* option       SigA Data
 MX W403     217       PFLCNV: Turbulence data is being used w/o ADJ_U* option       SigA Data

    ************************************
    *** AERMOD Finishes Successfully ***
    ************************************
```

ANNUAL SO_2 CONCENTRATIONS

```
 *** AERMOD - VERSION  18081 ***   ***  APTI 423: AERMOD Hands-On                                     ***        09/02/20
 *** AERMET - VERSION  19191 ***   ***  Martins Creek 1-yr Site-specific and NWS, Multi-average       ***        14:14:02
                                                                                                                 PAGE 301
 *** MODELOPTs:    RegDFAULT  CONC  ELEV  RURAL

                                  *** THE SUMMARY OF MAXIMUM ANNUAL RESULTS AVERAGED OVER   1 YEARS ***


                                   ** CONC OF SO2      IN MICROGRAMS/M**3                          **

                                                                                                        NETWORK
GROUP ID                       AVERAGE CONC               RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)  OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL       1ST HIGHEST VALUE IS       9.50114 AT (  492820.00,  4513837.00,   363.47,   368.60,    0.00)  DC
          2ND HIGHEST VALUE IS       9.20534 AT (  493020.00,  4514037.00,   360.42,   369.66,    0.00)  DC
          3RD HIGHEST VALUE IS       9.03559 AT (  493020.00,  4513837.00,   362.73,   362.73,    0.00)  DC
          4TH HIGHEST VALUE IS       8.94380 AT (  492820.00,  4513637.00,   358.42,   369.97,    0.00)  DC
          5TH HIGHEST VALUE IS       8.81008 AT (  493220.00,  4513837.00,   365.40,   365.40,    0.00)  DC
          6TH HIGHEST VALUE IS       8.52673 AT (  493220.00,  4514037.00,   354.40,   354.40,    0.00)  DC
          7TH HIGHEST VALUE IS       8.47087 AT (  493420.00,  4514037.00,   357.07,   359.32,    0.00)  DC
          8TH HIGHEST VALUE IS       8.31194 AT (  492620.00,  4513637.00,   346.48,   370.10,    0.00)  DC
          9TH HIGHEST VALUE IS       8.25290 AT (  494220.00,  4513637.00,   383.81,   383.81,    0.00)  DC
         10TH HIGHEST VALUE IS       8.18058 AT (  494420.00,  4513637.00,   385.73,   385.73,    0.00)  DC


 *** RECEPTOR TYPES:  GC = GRIDCART
                      GP = GRIDPOLR
                      DC = DISCCART
                      DP = DISCPOLR
```

24-Hour SO_2 Concentrations

```
*** AERMOD - VERSION  18081 ***   ***  APTI 423: AERMOD Hands-On                                         ***        09/02/20
*** AERMET - VERSION  19191 ***   ***  Martins Creek 1-yr Site-specific and NWS, Multi-average           ***        14:14:02
                                                                                                                    PAGE 303
*** MODELOPTs:    RegDFAULT  CONC  ELEV  RURAL

                                                  *** THE SUMMARY OF HIGHEST 24-HR RESULTS ***


                                      ** CONC OF SO2      IN MICROGRAMS/M**3                          **

                                                      DATE                                                                NETWORK
GROUP ID                          AVERAGE CONC     (YYMMDDHH)             RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL      HIGH   1ST HIGH VALUE IS     161.95840  ON 12031124: AT (  493020.00,  4514037.00,   360.42,   369.66,    0.00)  DC
         HIGH   2ND HIGH VALUE IS     101.24679  ON 11101924: AT (  492820.00,  4513837.00,   363.47,   368.60,    0.00)  DC


*** RECEPTOR TYPES:  GC = GRIDCART
                     GP = GRIDPOLR
                     DC = DISCCART
                     DP = DISCPOLR
```

3-HOUR SO_2 CONCENTRATIONS

```
 *** AERMOD - VERSION  18081 ***   ***  APTI 423: AERMOD Hands-On                                        ***        09/02/20
 *** AERMET - VERSION  19191 ***   ***  Martins Creek 1-yr Site-specific and NWS, Multi-average          ***        14:14:02
                                                                                                                    PAGE 302
 *** MODELOPTs:    RegDFAULT  CONC  ELEV  RURAL

                                               *** THE SUMMARY OF HIGHEST  3-HR RESULTS ***


                                   ** CONC OF SO2      IN MICROGRAMS/M**3                          **

                                                 DATE                                                                     NETWORK
GROUP ID                          AVERAGE CONC     (YYMMDDHH)             RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL      HIGH   1ST HIGH VALUE IS     877.54756  ON 12031221: AT (  491820.00,  4520237.00,   174.18,   204.37,    0.00)  DC
         HIGH   2ND HIGH VALUE IS     474.07364  ON 12030921: AT (  494620.00,  4513837.00,   366.37,   375.20,    0.00)  DC


 *** RECEPTOR TYPES:  GC = GRIDCART
                      GP = GRIDPOLR
                      DC = DISCCART
                      DP = DISCPOLR
```

1-Year Site-specific Results for SO_2

Averaging Time	Standard ($\mu g/m^3$)	Value ($\mu g/m^3$)
Annual	20 Annual arithmetic average (highest)	9.5
24-hour	91 Not to be exceeded more than once per year (H2H)	101
3-hour	512 Not to be exceeded more than once per year (H2H)	474
1-hour	196 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations	?

The 1-Hour SO_2 Standard

- The standard is met when the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations does not exceed 75 ppb or about 196 μg/m^3
- This definition does not preempt or alter the Appendix W requirement for use of 5 years of NWS meteorological data, 3 years of prognostic data, or at least 1 year of site-specific data
- The surrogate for the 99th percentile of the maximum daily 1-hour values for 1 year is the fourth highest maximum daily 1-hour value

Modeling for the 1-Hour SO_2 Standard 1-Year Site-specific Data

- A few things to note about the control file:
  - AVERTIME must be 1 with no other averaging times specified
  - The POLLUTID must be SO_2
  - The RECTABLE must include "4" or "4th" or "fourth"—this will report the first highest of the maximum fourth highest maximum daily 1-hour result averaged over N years, where N = 1 in this example

Running AERMOD

1-Year Site-specific: 1-Hour SO_2

- To run the 1-year site-specific scenario for 1-hour SO_2:

1. Open a command prompt and set the working directory as the directory where the control file template is located, e.g., APTI423\Hands-on\AERMOD\ 1hr_SO2_1-yr_Site
2. Copy the control file, MCR_AERMOD.INP, to "aermod.inp" or a user-defined input filename
3. Start AERMOD by typing "..\aermod" at the command prompt, then hit "Enter"—If you choose to name the input file something other than "aermod.inp" then you must type the name of the file and the directory in which it is located after typing "../aermod"

1-Hour Standard: Maximum Fourth Highest 1-Hour SO_2 Concentration

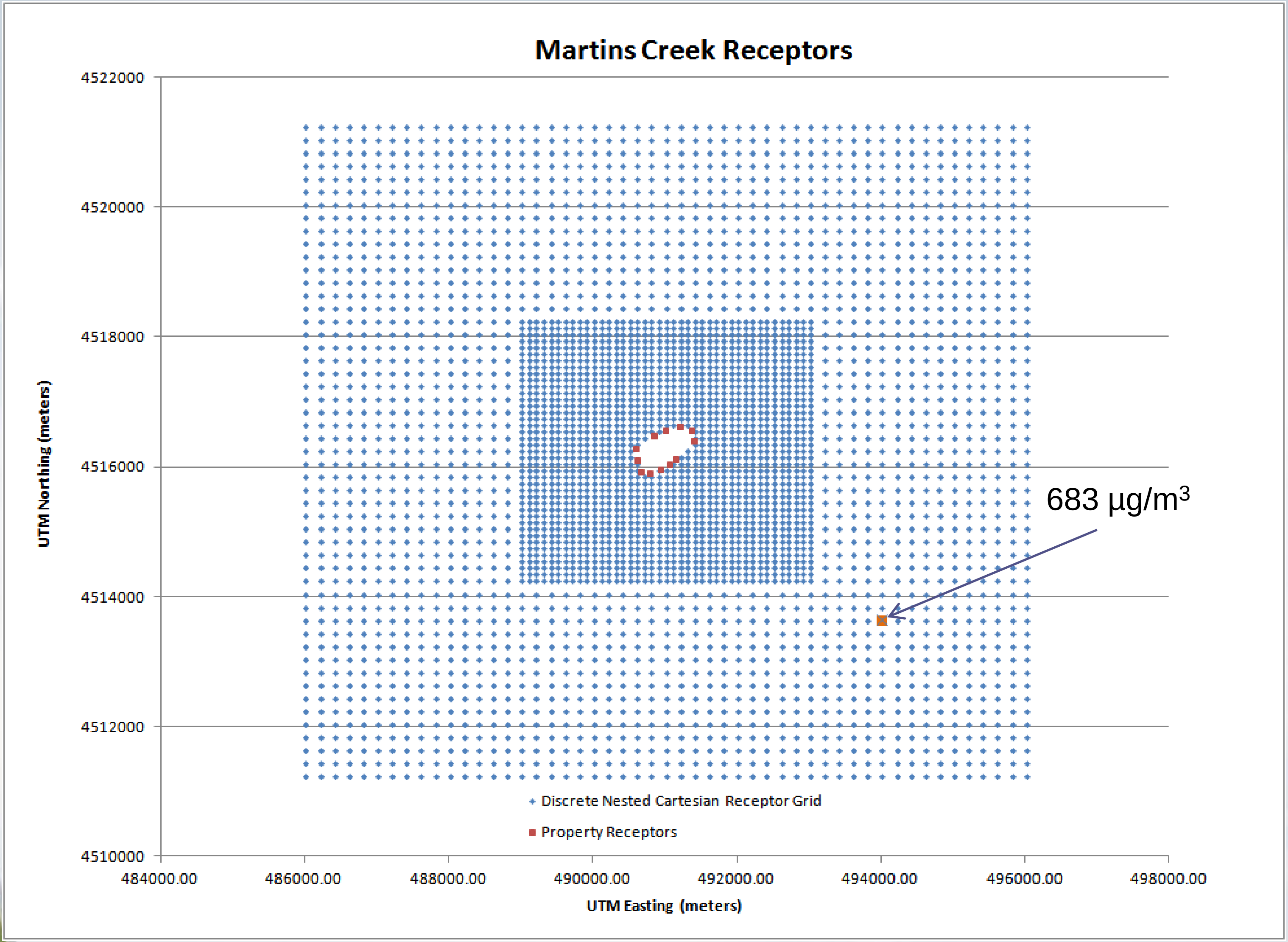
```
 *** AERMOD - VERSION  18081 ***   *** APTI 423: AERMOD Hands-On                                              ***       09/02/20
 *** AERMET - VERSION  19191 ***   *** Martins Creek, 1-yr Site-specific and NWS, 1-hr SO2                    ***       13:39:44
                                                                                                                         PAGE 456
 *** MODELOPTs:    RegDFAULT  CONC  ELEV  RURAL

                        *** THE SUMMARY OF MAXIMUM   4TH-HIGHEST MAX DAILY  1-HR RESULTS AVERAGED OVER   1 YEARS ***

                                   ** CONC OF SO2      IN MICROGRAMS/M**3                          **

                                                                                                              NETWORK
GROUP ID                        AVERAGE CONC                  RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)  OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL       1ST HIGHEST VALUE IS     683.08369 AT (  494020.00,  4513637.00,   375.35,   375.35,    0.00)  DC
          2ND HIGHEST VALUE IS     638.79021 AT (  494420.00,  4513637.00,   385.73,   385.73,    0.00)  DC
          3RD HIGHEST VALUE IS     616.97627 AT (  494220.00,  4513437.00,   375.96,   375.96,    0.00)  DC
          4TH HIGHEST VALUE IS     616.83281 AT (  493020.00,  4513837.00,   362.73,   362.73,    0.00)  DC
          5TH HIGHEST VALUE IS     599.14565 AT (  495420.00,  4515437.00,   355.39,   366.61,    0.00)  DC
          6TH HIGHEST VALUE IS     595.48900 AT (  494220.00,  4513637.00,   383.81,   383.81,    0.00)  DC
          7TH HIGHEST VALUE IS     590.93144 AT (  493420.00,  4514037.00,   357.07,   359.32,    0.00)  DC
          8TH HIGHEST VALUE IS     588.44689 AT (  493020.00,  4514037.00,   360.42,   369.66,    0.00)  DC
          9TH HIGHEST VALUE IS     584.53770 AT (  495620.00,  4514437.00,   365.08,   365.08,    0.00)  DC
         10TH HIGHEST VALUE IS     582.96995 AT (  495220.00,  4515437.00,   356.02,   369.49,    0.00)  DC

MC12      1ST HIGHEST VALUE IS     683.08369 AT (  494020.00,  4513637.00,   375.35,   375.35,    0.00)  DC
          2ND HIGHEST VALUE IS     638.79021 AT (  494420.00,  4513637.00,   385.73,   385.73,    0.00)  DC
          3RD HIGHEST VALUE IS     616.97627 AT (  494220.00,  4513437.00,   375.96,   375.96,    0.00)  DC
          4TH HIGHEST VALUE IS     595.48900 AT (  494220.00,  4513637.00,   383.81,   383.81,    0.00)  DC
          5TH HIGHEST VALUE IS     590.84463 AT (  493420.00,  4514037.00,   357.07,   359.32,    0.00)  DC
          6TH HIGHEST VALUE IS     573.67241 AT (  495220.00,  4515437.00,   356.02,   369.49,    0.00)  DC
          7TH HIGHEST VALUE IS     555.32751 AT (  492820.00,  4513637.00,   358.42,   369.97,    0.00)  DC
          8TH HIGHEST VALUE IS     554.97408 AT (  493020.00,  4514037.00,   360.42,   369.66,    0.00)  DC
          9TH HIGHEST VALUE IS     554.23597 AT (  494620.00,  4513837.00,   366.37,   375.20,    0.00)  DC
         10TH HIGHEST VALUE IS     552.34629 AT (  492820.00,  4513837.00,   363.47,   368.60,    0.00)  DC
```

Source Contributions

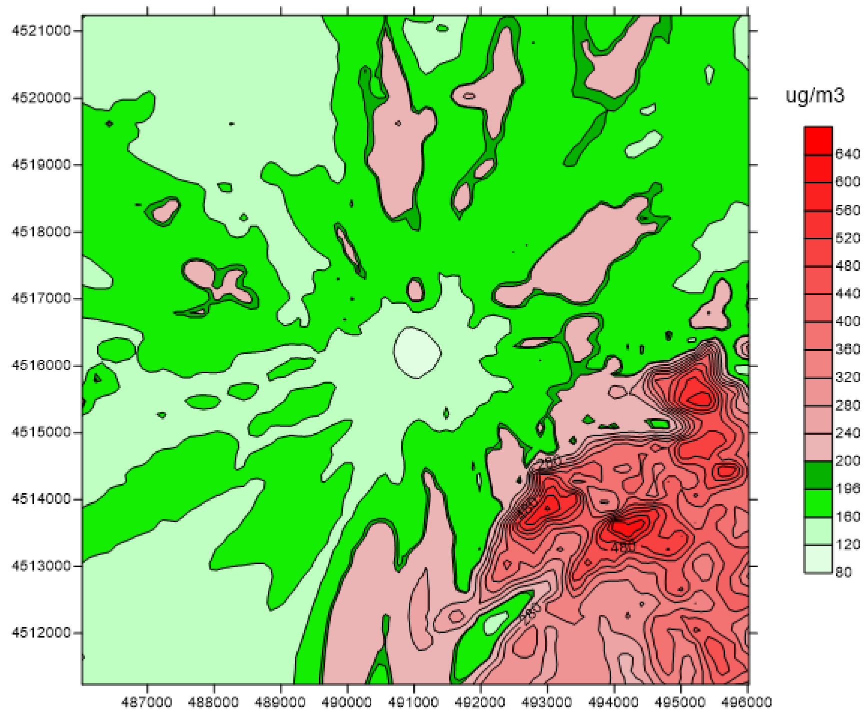
mcr_1hr_4th.mdc

```
* AERMOD ( 18081):  APTI 423: AERMOD Hands-On                                                07/16/20
* AERMET ( 19191):                                                                           16:34:44
* MODELING OPTIONS USED:   RegDFAULT  CONC  ELEV  RURAL
*         MAXDCONT FILE OF   4TH-HIGHEST MAX DAILY  1-HR VALUES AVERAGED OVER   1 YEARS FOR SOURCE GROUP: ALL
*         FOR A TOTAL OF   3817 RECEPTORS AND    4 SOURCE GROUPS;  WITH CONTRIBUTIONS FROM OTHER SOURCE GROUPS PAIRED IN TIME & SPACE
*         FORMAT: (3(1X,F13.5),3(1X,F8.2),2X,A6,2X,A8,2X,A5,5X,A8,2X,   4(F13.5,2X:))
*        X             Y      AVERAGE CONC    ZELEV    ZHILL    ZFLAG    AVE     GRP       RANK     NET ID  CONT ALL       CONT MC12      CONT ED2       CONT HL2
* ____________ ____________ ____________  ______   ______   ______   ______  ________  ________  ________ _____________  _____________  _____________  _____________
  489020.00000 4514237.00000    172.03213    60.18    94.59     0.00    1-HR  ALL          4TH                   172.03213      167.34675        0.95506        3.73032
  489120.00000 4514237.00000    176.45373    60.20    94.59     0.00    1-HR  ALL          4TH                   176.45373      171.98155        0.92529        3.54689
  489220.00000 4514237.00000    186.98114    63.46    86.92     0.00    1-HR  ALL          4TH                   186.98114      148.43869       34.74706        3.79539
  489320.00000 4514237.00000    183.81684    68.40    90.66     0.00    1-HR  ALL          4TH                   183.81684      180.68394        2.82148        0.31142
  489420.00000 4514237.00000    166.89680    81.79    81.79     0.00    1-HR  ALL          4TH                   166.89680      163.01051        0.87679        3.00950
  489520.00000 4514237.00000    164.62777    85.53    94.70     0.00    1-HR  ALL          4TH                   164.62777      163.67592        0.75122        0.20064
.
  493420.00000 4513637.00000    413.64835   350.50   350.50     0.00    1-HR  ALL          4TH                   413.64835      413.64835        0.00000        0.00000
  493620.00000 4513637.00000    408.06252   347.72   379.83     0.00    1-HR  ALL          4TH                   408.06252      407.98771        0.07477        0.00004
  493820.00000 4513637.00000    474.97989   361.92   380.28     0.00    1-HR  ALL          4TH                   474.97989      474.97989        0.00000        0.00000
  494020.00000 4513637.00000    683.08369   375.35   375.35     0.00    1-HR  ALL          4TH                   683.08369      683.08369        0.00000        0.00000
  494220.00000 4513637.00000    595.48900   383.81   383.81     0.00    1-HR  ALL          4TH                   595.48900      595.48900        0.00000        0.00000
  494420.00000 4513637.00000    638.79021   385.73   385.73     0.00    1-HR  ALL          4TH                   638.79021      638.79021        0.00000        0.00000
  494620.00000 4513637.00000    499.21727   368.12   386.15     0.00    1-HR  ALL          4TH                   499.21727      488.03622       11.18105        0.00000
```

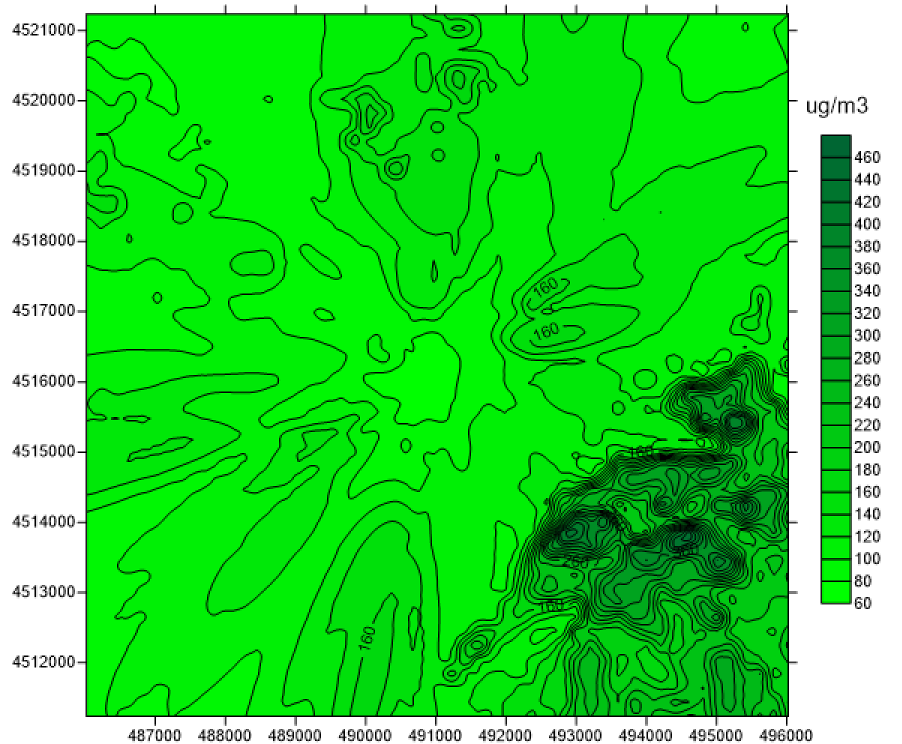
1-HOUR SO_2, 1-YEAR SITE-SPECIFIC

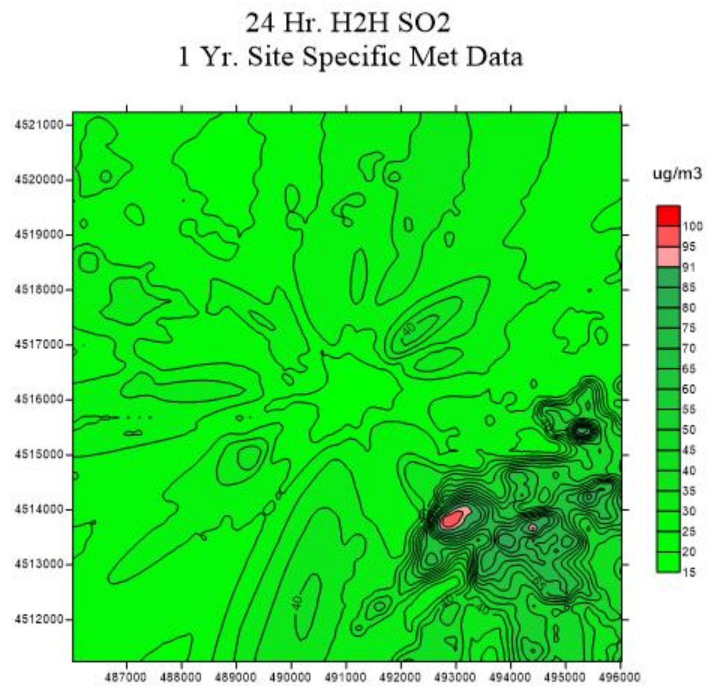


1 Hr. SO2
1 Yr. On Site Met Data

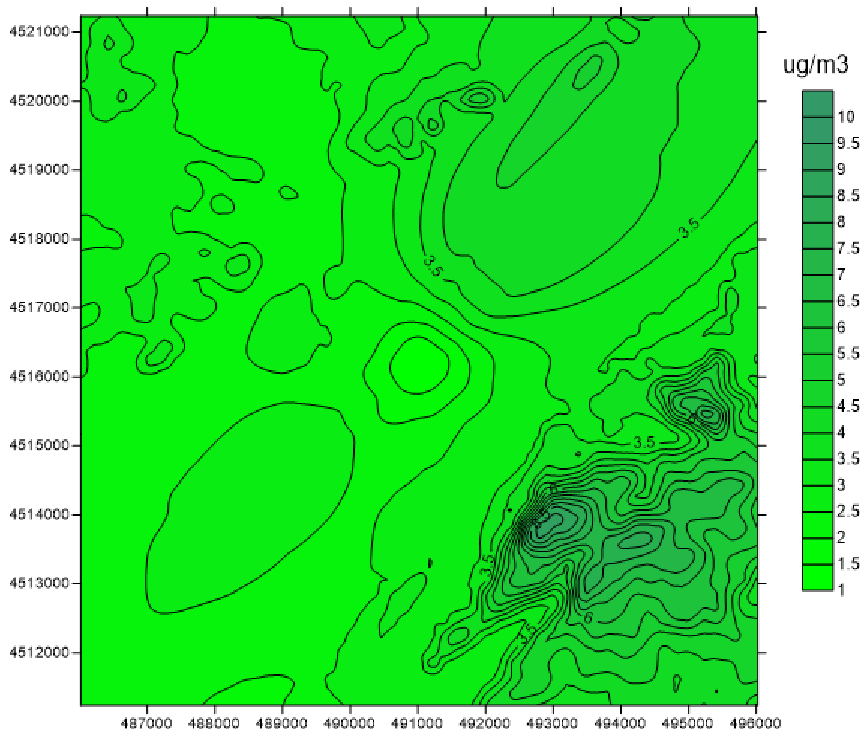


3 Hr H2H SO2
1 Yr Site Specific Met Data




24 Hr. H2H SO2
1 Yr. Site Specific Met Data
4521000
4520000
4519000
4518000
4517000
4516000
4515000
4514000
4513000
4512000
487000
488000
489000
490000
491000
492000
493000
494000
495000
496000
ug/m3
100
95
91
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15

Annual SO2
1 Yr Site Specific Met Data



1-Year Site-specific Results

Averaging Time	Standard ($\mu g/m^3$)	Value ($\mu g/m^3$)
Annual	20 Annual arithmetic average (highest)	9.5
24-hour	91 Not to be exceeded more than once per year (H2H)	**102**
3-hour	512 Not to be exceeded more than once per year (H2H)	474
1-hour	196 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations	**683**

Modeling for the 1-Hour SO_2 Standard 5 Years, NWS Data Only

- The following notes apply to this scenario
  - AVERTIME must be 1 hour with no other averaging times specified
  - The RECTABLE must include “4” or “4th” or “fourth”—this will calculate the first highest of the 5-year average of the maximum fourth highest maximum daily 1-hour value
  - The POLLUTID is SO_2
  - If the STARTEND keyword is used, be sure the full 5 years is specified
  - Adjust the starting year on the SURFDATA and UAIRDATA keywords as needed
- Appendix W requires use of 5 years of NWS meteorological data

CONTROL FILE PARAMETERS 5-YEAR NWS DATA ONLY; 1-HOUR

- *Model options*: Default regulatory options, concentrations only
- *Averaging time:* 1
- *Pollutant*: SO_2
- *Elevation units*: Meters
- *Point sources*:

ID	X	Y	Z	Emission Rate	Stack Height	Exit Temp	Exit Velocity	Inside Diam
	meters	meters	meters	grams/ second	meters	K	meters/ second	meters
MC12	491020	4516237	71.53	500	182.9	400	20.0	5.3
ED2	493350	4528370	97.62	400	121.9	400	15.0	3.6
HL2	494050	4521040	97.40	20	59.4	400	7.0	2.7

- *Source groups*: A single source group

Control File Parameters—cont'd 5-Year NWS Data only; 1-Hour

- *Receptors*: MC_nested.rec
- *Meteorology*: Files generated by AERMET, free format
- *SURFDATA:* Station ID 14737
- *UAIRDATA:* Station ID 54775
- *Profile base:* 73.2 meters
- *Start date*: January 1, 2008
- *End date*: December 31, 2012
- Recommended output:
  - RECTABLE that includes the fourth highest
  - PLOTFILEs
  - SUMMFILE

RUNNING AERMOD

5-YEAR NWS: 1-HOUR SO_2

- By now, you should be able to run AERMOD for this scenario without instruction
- The control file is in:

  APTI423\Hands-on\AERMOD\ 5-yr_1hr_NWS\

FOURTH HIGHEST—1-HOUR ONLY MODELED

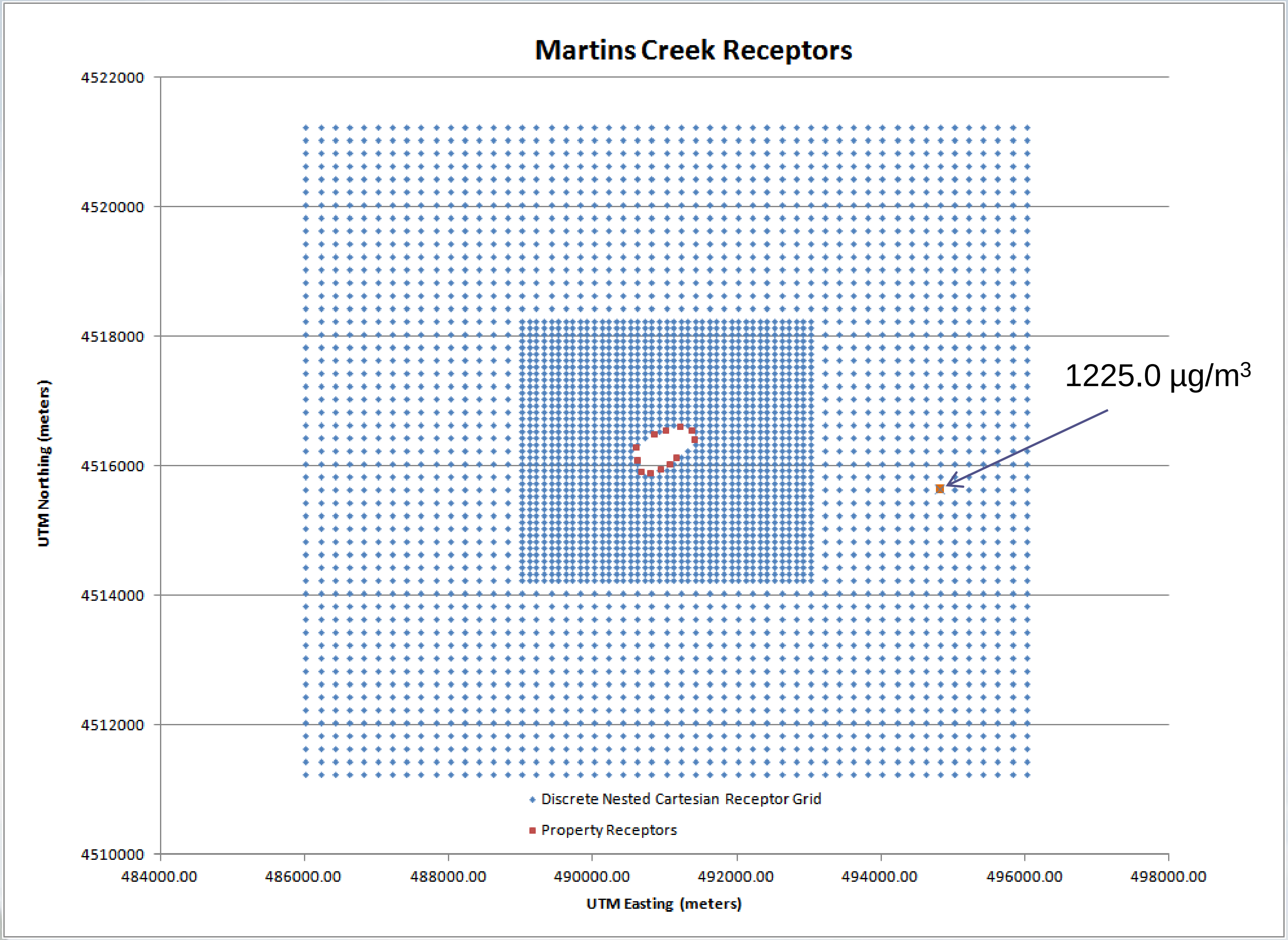
```
 *** AERMET - VERSION  19191 ***   ***  Martins Creek, 5-yr NWS data only, 1-hr SO2                 ***         14:55:40
                                                                                                               PAGE 455
 *** MODELOPTs:    RegDFAULT  CONC  ELEV  RURAL

                    *** THE SUMMARY OF MAXIMUM   4TH-HIGHEST MAX DAILY  1-HR RESULTS AVERAGED OVER   5 YEARS ***


                                 ** CONC OF SO2       IN MICROGRAMS/M**3                             **

                                                                                                             NETWORK
GROUP ID                       AVERAGE CONC                RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)  OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL       1ST HIGHEST VALUE IS    1225.16328 AT (  494820.00,  4515637.00,   322.01,   369.49,    0.00)  DC
          2ND HIGHEST VALUE IS    1216.55344 AT (  495220.00,  4515837.00,   312.69,   369.49,    0.00)  DC
          3RD HIGHEST VALUE IS    1203.88523 AT (  495020.00,  4515437.00,   315.86,   369.49,    0.00)  DC
          4TH HIGHEST VALUE IS    1199.93761 AT (  495420.00,  4515637.00,   317.64,   369.49,    0.00)  DC
          5TH HIGHEST VALUE IS    1195.77465 AT (  495020.00,  4515637.00,   329.48,   369.49,    0.00)  DC
          6TH HIGHEST VALUE IS    1176.40715 AT (  494220.00,  4514437.00,   311.84,   390.71,    0.00)  DC
          7TH HIGHEST VALUE IS    1171.86358 AT (  495020.00,  4515837.00,   301.64,   369.49,    0.00)  DC
          8TH HIGHEST VALUE IS    1160.93130 AT (  495220.00,  4515637.00,   328.70,   369.49,    0.00)  DC
          9TH HIGHEST VALUE IS    1152.36368 AT (  495220.00,  4516037.00,   301.94,   369.49,    0.00)  DC
         10TH HIGHEST VALUE IS    1144.56532 AT (  494820.00,  4515437.00,   303.43,   369.49,    0.00)  DC

MC12      1ST HIGHEST VALUE IS    1005.84876 AT (  492820.00,  4513837.00,   363.47,   368.60,    0.00)  DC
          2ND HIGHEST VALUE IS     973.85968 AT (  493020.00,  4514037.00,   360.42,   369.66,    0.00)  DC
          3RD HIGHEST VALUE IS     973.54990 AT (  493220.00,  4513837.00,   365.40,   365.40,    0.00)  DC
          4TH HIGHEST VALUE IS     964.84231 AT (  494420.00,  4513637.00,   385.73,   385.73,    0.00)  DC
          5TH HIGHEST VALUE IS     964.35710 AT (  494220.00,  4513637.00,   383.81,   383.81,    0.00)  DC
          6TH HIGHEST VALUE IS     949.92505 AT (  493020.00,  4513837.00,   362.73,   362.73,    0.00)  DC
          7TH HIGHEST VALUE IS     913.16942 AT (  494020.00,  4513637.00,   375.35,   375.35,    0.00)  DC
          8TH HIGHEST VALUE IS     900.18696 AT (  493620.00,  4513037.00,   378.32,   378.32,    0.00)  DC
          9TH HIGHEST VALUE IS     890.42082 AT (  494020.00,  4513437.00,   376.72,   376.72,    0.00)  DC
         10TH HIGHEST VALUE IS     863.70405 AT (  494220.00,  4513437.00,   375.96,   375.96,    0.00)  DC
```

Source Contributions

mcr_1hr_4th.mdc

```
* AERMOD ( 18081):  APTI 423: AERMOD Hands-On                                            07/20/20
* AERMET ( 19191):                                                                       14:55:40
* MODELING OPTIONS USED:   RegDFAULT  CONC  ELEV  RURAL
*         MAXDCONT FILE OF   4TH-HIGHEST MAX DAILY  1-HR VALUES AVERAGED OVER   5 YEARS FOR SOURCE GROUP: ALL
*         FOR A TOTAL OF   3817 RECEPTORS AND    4 SOURCE GROUPS;  WITH CONTRIBUTIONS FROM OTHER SOURCE GROUPS PAIRED IN TIME & SPACE
*         FORMAT: (3(1X,F13.5),3(1X,F8.2),2X,A6,2X,A8,2X,A5,5X,A8,2X,   4(F13.5,2X:))
*        X             Y      AVERAGE CONC     ZELEV    ZHILL    ZFLAG    AVE     GRP       RANK     NET ID   CONT ALL       CONT MC12      CONT ED2       CONT HL2
* ____________ ____________ ____________ ______ ______ ______ ______ ________ ________ ________ _____________ _____________ _____________ _____________
  489020.00000 4514237.00000    168.97437    60.18    94.59     0.00    1-HR  ALL       4TH               168.97437     131.52619      34.56911       2.87907
  489120.00000 4514237.00000    165.52701    60.20    94.59     0.00    1-HR  ALL       4TH               165.52701     153.76780       5.91467       5.84454
  489220.00000 4514237.00000    166.40223    63.46    86.92     0.00    1-HR  ALL       4TH               166.40223     157.78915       4.20273       4.41034
  489320.00000 4514237.00000    168.89979    68.40    90.66     0.00    1-HR  ALL       4TH               168.89979     144.69363      18.73214       5.47402
  489420.00000 4514237.00000    175.54246    81.79    81.79     0.00    1-HR  ALL       4TH               175.54246     105.57084      65.25527       4.71635
  489520.00000 4514237.00000    178.26536    85.53    94.70     0.00    1-HR  ALL       4TH               178.26536     154.24671      16.82263       7.19602.
.
.
  494220.00000 4515637.00000    431.74291   259.45   369.49     0.00    1-HR  ALL       4TH               431.74291       0.00397     431.73888       0.00006
  494420.00000 4515637.00000    574.54295   267.08   369.49     0.00    1-HR  ALL       4TH               574.54295       0.00888     574.53405       0.00002
  494620.00000 4515637.00000    860.17892   281.13   369.49     0.00    1-HR  ALL       4TH               860.17892       0.02373     860.15519       0.00000
  494820.00000 4515637.00000   1225.16328   322.01   369.49     0.00    1-HR  ALL       4TH              1225.16328       0.30857    1224.85471       0.00000
  495020.00000 4515637.00000   1195.77465   329.48   369.49     0.00    1-HR  ALL       4TH              1195.77465       0.47704    1195.29760       0.00000
  495220.00000 4515637.00000   1160.93130   328.70   369.49     0.00    1-HR  ALL       4TH              1160.93130       0.38639    1160.54491       0.00000
```

1-HOUR SO_2, 5-YEAR NWS



3-Hour, 24-Hour and Annual SO_2 Standard 5 Years, NWS Data Only

- Based on the form of the standards, we can combine all three averaging periods
- However, we will need to run each year separately
- **Recall:**
  - **3-hour:** Not to be exceeded more than once per year
    - Get 3-hour H2H each year
    - Find max value from the 5 yearly values
  - **24-hour:**
    - Same as procedure as 3-hour but with 24-hour H2H
  - **Annual:** Highest annual arithmetic average
    - Get max annual H1H each year
    - Find max value from the 5 yearly values

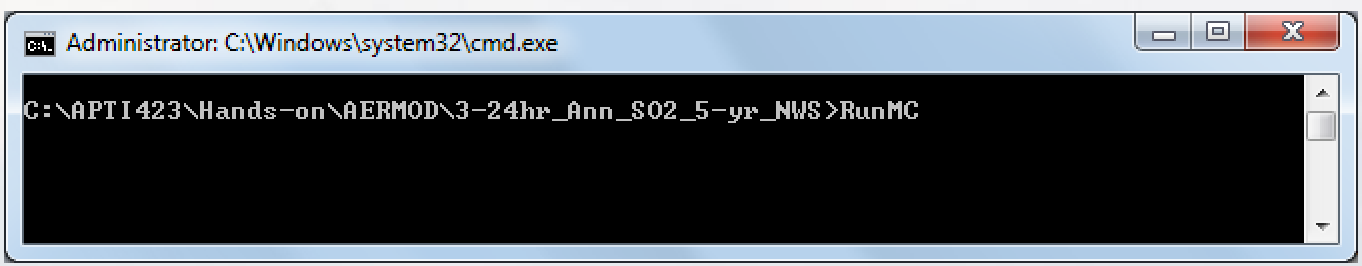
RUNNING AERMOD

5-YEAR NWS: 3-HOUR, 24-HOUR, ANNUAL

- Batch file to simplify running 5 years individually
- The control files and batch file are in:

  APTI423\Hands-on\AERMOD\3-24hr_Ann_SO2_5-yr_NWS\

- Open a command prompt and set the working directory to the directory where the batch file is located
- At the command prompt, type: RunMC



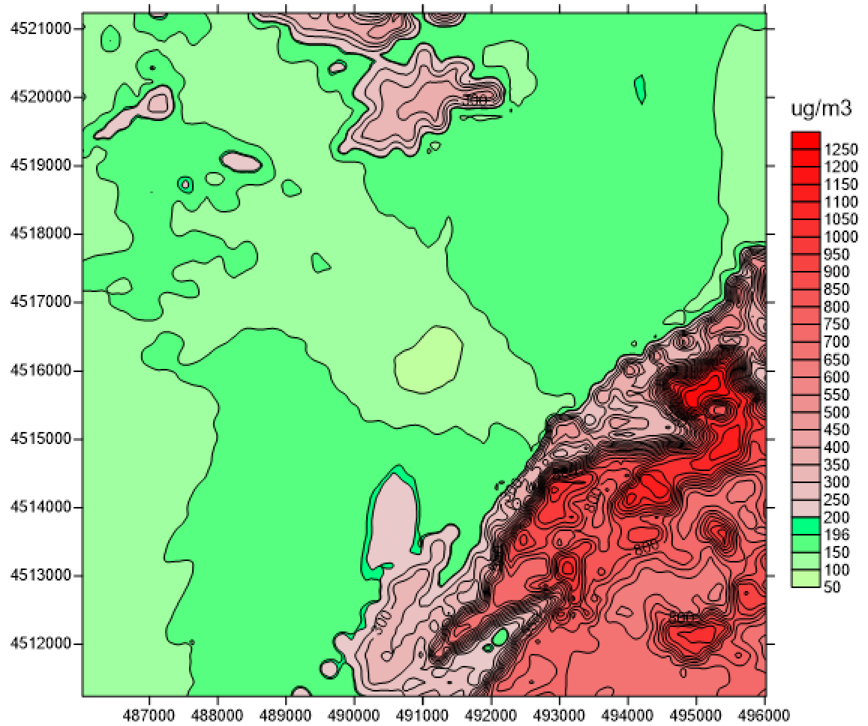
3-Hour, 24-Hour, and Annual Results
5-Year NWS

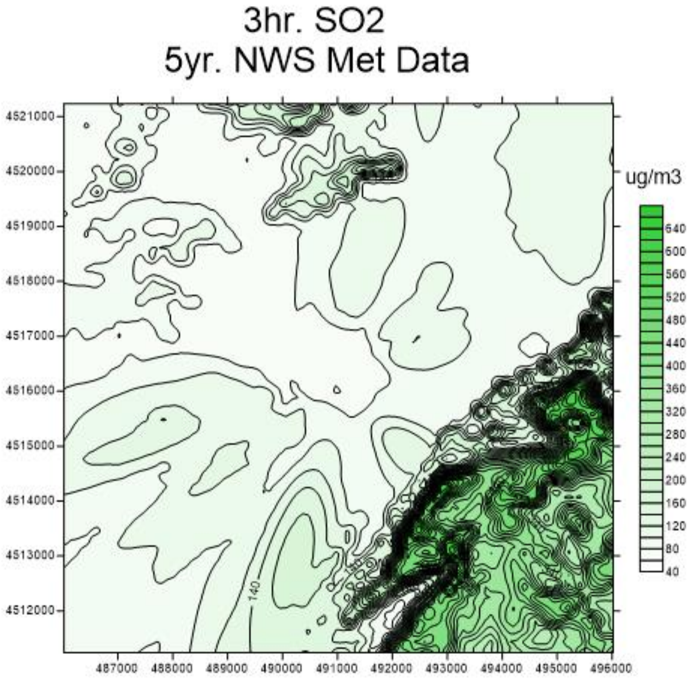
Year	Annual—H1H ($\mu g/m^3$)	24-hour—H2H ($\mu g/m^3$)	3-hour—H2H ($\mu g/m^3$)
2008	14.7	100	610
2009	14.4	108	663
2010	**16.5**	125	657
2011	15.4	123	599
2012	15.5	**128**	**711**

5-Year NWS Results

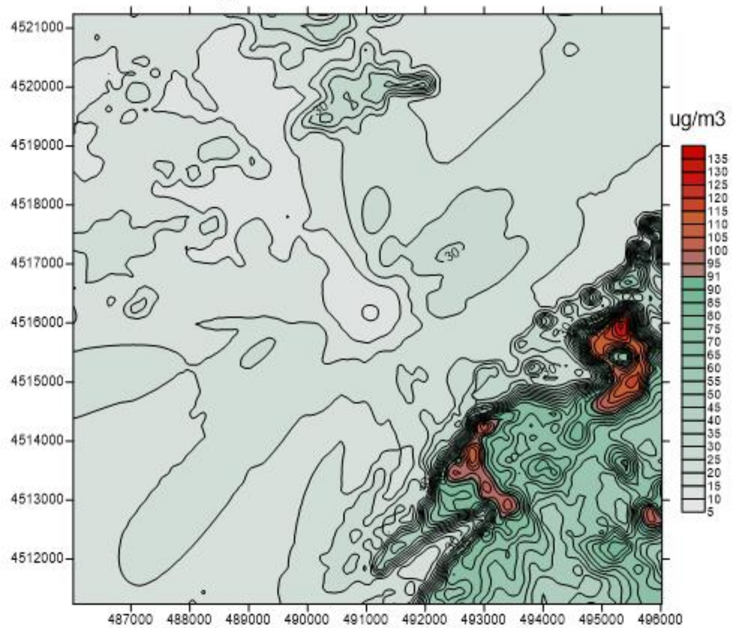
Averaging Time	Standard ($\mu g/m^3$)	Value ($\mu g/m^3$)
Annual	20 Annual arithmetic average (highest)	16.5
24-hour	91 Not to be exceeded more than once per year (H2H)	**128**
3-hour	512 Not to be exceeded more than once per year (H2H)	**711**
1-hour	196 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations	**1225**

1Hr. SO2
5Yrs. NWS Meteorology

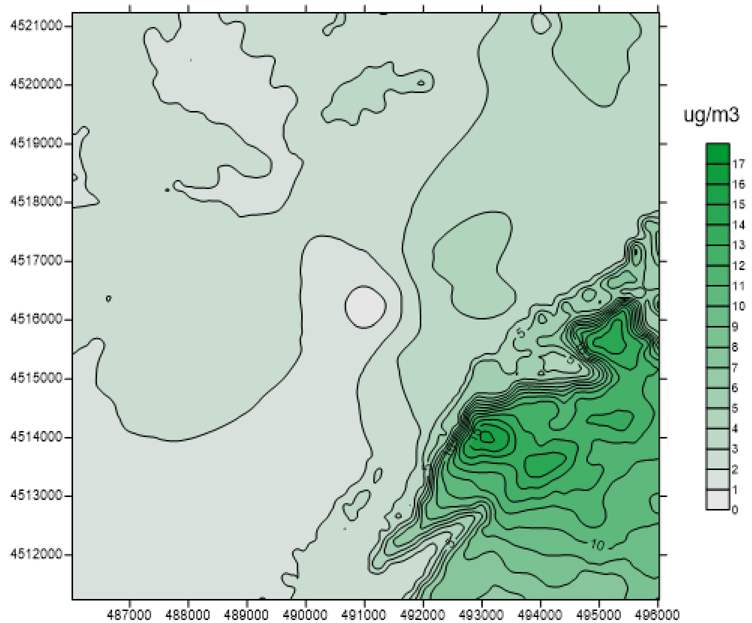



3hr. SO2
5yr. NWS Met Data
ug/m3
640
600
560
520
480
440
400
360
320
280
240
200
160
120
80
40
140
4521000
4520000
4519000
4518000
4517000
4516000
4515000
4514000
4513000
4512000
487000
488000
489000
490000
491000
492000
493000
494000
495000
496000

24hr. SO2
5yr. NWS Met Data



Annual SO2
5yr. NWS Met Data



1-Year Site and 5-Year NWS Results

Avg Time	Standard ($\mu g/m^3$)	1-year Site Value (µg/m3)	5-year NWS Value ($\mu g/m^3$)
Annual	20 Annual arithmetic average (highest)	9.5	16.5
24-hour	91 Not to be exceeded more than once per year (H2H)	**102**	**133**
3-hour	512 Not to be exceeded more than once per year (H2H)	474	**712**
1-hour	196 n-year average of the annual 99th percentile of 1-hour daily maximum concentrations	**683**	**1225**

Air Pollution Dispersion Models:
Applications with the AERMOD Modeling System

AERSCREEN

COURSE #423

Air Pollution Training Institute | APTI

EPA

LEARNING OBJECTIVES

At the end of this lesson the student should be able to:

- Explain the need for AERSCREEN
- Describe the input data requirements of AERSCREEN
- Input data from other associated programs needed to run AERSCREEN
- Run the AERSCREEN program
- Interpret the results from AERSCREEN

OVERVIEW

- Purpose and Regulatory Basis for AERSCREEN
- AERSCREEN Fundamentals
- Prompt-driven Input
- Running AERSCREEN/Reviewing Output

Status as Screening Model

- Prior to the 2017 revisions to the guidelines SCREEN3 was recommended
- Beta version of AERSCREEN was made available for review and comment in August 2010
- AERSCREEN was released on March 11, 2011 and made available on the EPA SCRAM website
- Post 2017: AERSCREEN became recommended near-field screening model
- AERSCREEN Version 16216 is what we will be using in this course

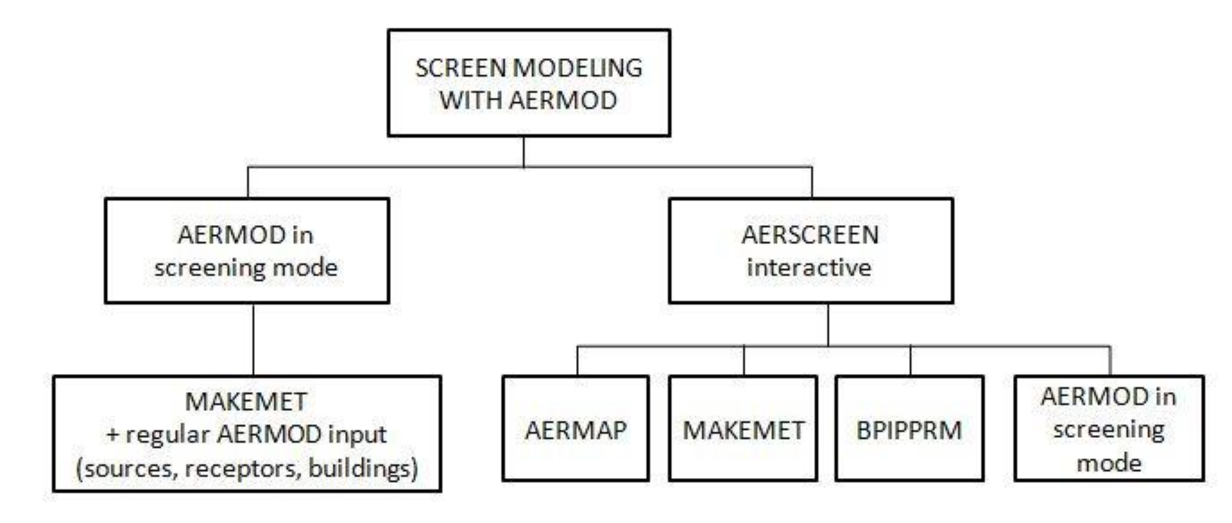
AERSCREEN FUNDAMENTALS

- Two ways to perform screening modeling
  - Using AERSCREEN system in a prompt-response interactive mode to generate all or most of the necessary input

OR

  - Developing meteorology with MAKEMET and running AERMOD in its screening mode

  - Focus will be on "AERSCREEN Interactive"



AERSCREEN FUNDAMENTALS

- Runs AERMOD in a screening mode for a single source
- Receptors on the plume's centerline only
- Meteorological data is generated through MAKEMET.
- Calculates only 1-hour averages; but scales them to 3hr, 8hr, 24 hr, and annual.
- Provides DOS interface to run AERMOD in SCREEN mode
- Includes calls to MAKEMET, BPIPPRM, and AERMAP to generate necessary AERMOD input
- Incorporates output from AERSURFACE, but does not call/run AERSURFACE

AERSCREEN FUNDAMENTALS

- AERMOD, MAKEMET, AERMAP, and BPIPPRM program executable files must be accessible to AERSCREEN.
- If programs are not in working directory, user is prompted for their location
- demlist.txt must be in working directory or with AERSCREEN.EXE

AERSCREEN Fundamentals—Sources

- AERSCREEN can only model one source at a time
- Source types
  - POINT, including capped and horizontal
  - AREA, including AREACIRC but not AREAPOLY
    - Unlike emission rate entered as $g/s/m^2$ in AERMOD, enter as g/s in AERSCREEN (or lb/hr, depending on units entered at the prompt)
  - VOLUME
  - OPENPIT
  - FLARE
  - LINE, BUOYLINE, and RLINE, new in AERMOD since 2017 (presently not available in AERSCREEN)

AERSCREEN FUNDAMENTALS—METEOROLOGY

- MAKEMET—generates a matrix of meteorology based on responses to prompts
- Three options to specify the surface characteristics
  - User-specified without spatial or temporal variation
    - Single value for each
  - Seasonally varying for generic land use based on tables in the AERMET User's Guide
  - Input a name of an AERSURFACE output file containing the surface characteristics—allows for temporal and spatial variations
- Wind direction is set to a constant 270 degrees

AERSCREEN FUNDAMENTALS—DOWNWASH

- AERSCREEN runs BPIPPRM for point sources and flares if the downwash option is elected
- Two options
  - Respond to a series of prompts for a single building
  - Use existing BPIPPRM output for a more refined analysis

AERSCREEN FUNDAMENTALS—RECEPTORS

- AERSCREEN creates a regularly spaced line of receptors at discrete distances out to the "probe" distance
  - Probe distance is the maximum downwind distance to estimate impacts
- User can specify probe distance or use defaults: 5,000 m (no terrain) or 10,000 m (with terrain)
- Receptor placement begins at fence line and every 25 m beginning with the next multiple of 25, out to 5,000 m
- If the probe distance exceeds 5,000 m, the incremental distance between receptors changes
  - Increment = (Probe Distance – 5,000)/100

AERSCREEN FUNDAMENTALS—RECEPTORS

- Option to specify up to 10 discrete receptor locations (e.g., schools, hospital, other distance of interest) in a file
- If a file of discrete receptors is used, the first record MUST identify the units the distances are reported in
- Option to specify flagpole height for all receptors

AERSCREEN FUNDAMENTALS—TERRAIN

- DEMLIST.TXT
  - Identifies elevation data file(s)
  - Must reside in working directory or the directory with the AERSCREEN executable
  - Includes location of datum shift files (.las and .los)
- Terrain elevations can be derived by AERMAP for all sources except <u>rectangular</u> area sources

AERSCREEN Fundamentals—Other Options

- Adjust U* to address potential overpredictions under stable low wind conditions
- Estimate concentrations if the condition of "inversion break-up fumigation" occurs
- Estimate concentration under conditions of shoreline fumigation
- Turn on the debug

AERSCREEN FUNDAMENTALS—RESULTS

- Default filename with maximum impact results—AERSCREEN.OUT or user-specified (response to prompt)
  - If a user-specified name is provided, the extension MUST be *.out*
- Output format
  - Summary of stack parameters
  - Summary of building downwash parameters
  - Flow sector analysis
  - Meteorological parameters
  - Impacts by automated distance
  - Maximum 1-hour impact and scaled 3-hour, 8-hour, 24-hour, and annual impacts
    - The scaling factors are: 1.0, 0.9, 0.6, and 0.1 (respectively)

AERSCREEN INPUT
A CLOSER LOOK

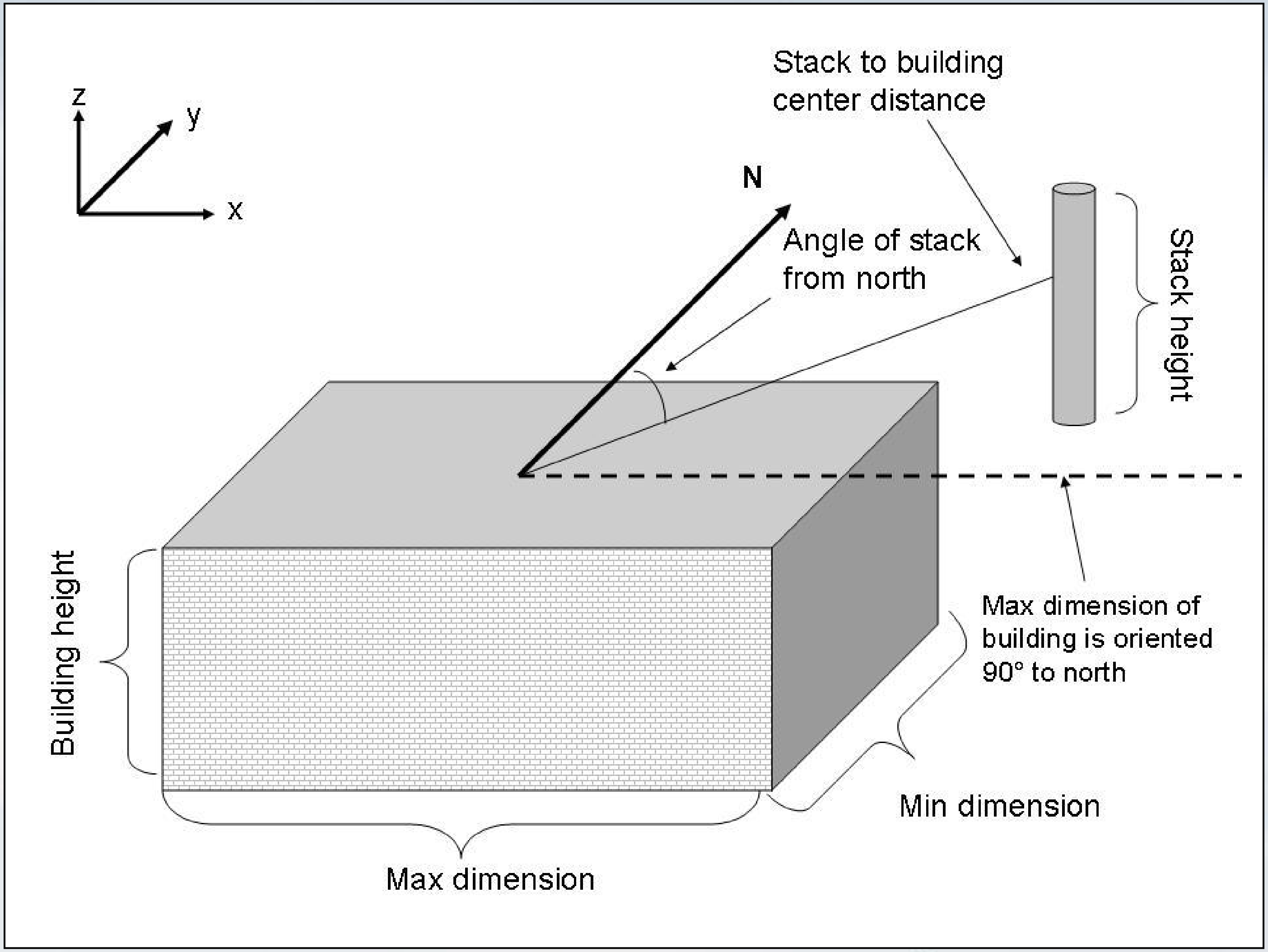
AERSCREEN INPUT

- AERSCREEN prompts for rural/urban and distance to fence line (ambient air)
- AERSCREEN has the capability to perform limited NO_X chemistry
- NO_X chemistry option: OLM or PVMRM
  - NO_2/NO_X in-stack ratio (0.0–1.0)
  - Representative background ozone
- NO_2/NO_X ambient equilibrium ratio is set to 0.9 and cannot be overridden

AERSCREEN INPUT—BUILDING DOWNWASH

- AERSCREEN provides two choices:
  1. Simple rectangular building—prompts:
     - Building height
     - Maximum horizontal building dimension
     - Minimum horizontal building dimension
     - Angle, in degrees from north, of maximum horizontal dimension (0–179)
     - Angle, in degrees from north, of the stack relative to building center (0–360)
     - Distance from stack to center of building
  2. More complex building structure
     - Specify BPIPPRIM output file

AERSCREEN Input—Simple Rectangular Building



AERSCREEN INPUT—METEOROLOGY

- Prompts for Running MAKEMET
  - Minimum temperature (default: 250 K)
  - Maximum temperature (default: 310 K)
  - Minimum wind speed (default: 0.5 m/s)
  - Anemometer height (default: 10 meters)
  - Type of input for surface characteristics
    - Single user-specified values for albedo, Bowen ratio, and surface roughness length
    - AERMET seasonal tables
    - Specify AERSURFACE output file

AERSCREEN INPUT—METEOROLOGY

- Prompts for surface characteristics for MAKEMET
  - Albedo (1)
  - Bowen ratio (1)
  - Surface roughness, in meters (1)
  - Land use type for surface characteristics (2)
  - Climatology type (2)
  - External surface characteristics filename (3)

AERSCREEN INPUT—METEOROLOGY

- Prompts for MAKEMET as a stand-alone program

1: ENTER SFC MET FILE NAME
2: ENTER PFL MET FILE NAME
3: ENTER MIN. WS (M/S)
4: ENTER ANEM HT (M)
5: ENTER NUMBER OF WIND DIRECTIONS
If the user enters one for the number of wind directions
6: ENTER WIND DIRECTION
Otherwise
7: ENTER STARTING WIND DIRECTION
8: ENTER CLOCKWISE WIND DIRECTION INCREMENT
9: ENTER MIN AND MAX AMBIENT TEMPS IN KELVIN
10: ENTER ALBEDO
11: ENTER BOWEN RATIO
12: ENTER SURFACE ROUGHNESS LENGTH IN METERS
13: DO YOU WANT TO GENERATE ANOTHER MET SET THAT WILL BE APPENDED TO CURRENT FILE?
[TYPE EITHER "Y" OR "y" FOR YES; OR HIT "ENTER" TO EXIT
If ("Y" or "y") then the program loops through prompts 7 through 12 for each additional dataset (e.g., seasonal).

AERSCREEN INPUT—TERRAIN

- Prompts for terrain effects
  - Include terrain processing
  - (y(es) = include terrain, n(o) = do not include terrain effects)
  - Probe distance (meters)
  - Source elevation or use AERMAP to determine source elevation
- The following prompts are displayed if the response to including terrain effects is "yes"
  - Source coordinates (geographic latitude/longitude or Universal Transverse Mercator (UTM))
  - UTM zone (if UTM coordinates entered)
  - North American Datum (NAD) datum (NAD 27 or 83)

AERSCREEN Input—Terrain

DEMLIST.TXT format

Record	Contents
1	Data file type (NED or DEM)
2	Delineator between file type and list (e.g., --------)
3	Location of *.las and *.los files
4 .. EOF	List of filenames; optional terrain units can be specified for NED files (e.g., File1.tif METERS)

Example:

```
NED
  ----------------------------------------------------
NADGRIDS:   .\
.\NED_75872377.tif
```

AERSCREEN INPUT—TERRAIN

- DEMLIST.TXT
  - List of NED or DEM files for AERMAP to process
  - Mandatory if terrain effects are included
  - MUST be in working folder or folder where the AERSCREEN executable resides
  - AERSCREEN will STOP if it cannot find the file

AERSCREEN INPUT—RECEPTORS

- AERSCREEN creates a regularly spaced single line of receptors at discrete distances from the ambient boundary to the probe distance
  - Probe distance—the maximum downwind distance to estimate impacts—default values
    - 10,000 meters if terrain effects included
    - 5,000 meters if no terrain
  - User can specify other probe distances
- Impacts begin at fence line and every 25 m beginning with the next multiple of 25, extending to the lesser of probe distance or 5,000 m (no terrain) or 10,000 m (with terrain)
- Increment beyond 5,000 m
  - (Probe Distance – 5,000)/100

AERSCREEN INPUT—RECEPTORS

- A file with up to 10 discrete receptors can be input
  - Sensitive populations or other locations of interest
  - Only processes receptors that are between the ambient air boundary and probe distance
  - Discrete distances must be entered in a separate file
  - Format of the file

Record	Description
1	Units: *distance_units*
2.. 11 (max)	Distance from source in *distance_units*

Example:

```
units: METERS
160
215
```

AERSCREEN Input—Miscellaneous

- Additional input prompts or options:
  - Urban area
    - Prompted for population
  - Flagpole receptors
    - Prompted for a flagpole height
    - This height will be used for all receptors

AERSCREEN INPUT—OUTPUT

- AERSCREEN generates many output files, including
  - Log file (.*log* extension)—details of the data processing
  - Output file (.*out* extension) with maximum impacts
  - Concentration by receptor (with associated meteorology)
  - MAKEMET output
  - BPIPPRM, AERMAP, AERMOD output files
  - Profile and surface files for input to AERMOD

AERSCREEN FUNDAMENTALS—RESULTS

- Example of MAKEMET summary (in the *.out* file)

```
----------------------------------------------------------------------------
*********************  MAKEMET METEOROLOGY PARAMETERS  ********************
----------------------------------------------------------------------------

MIN/MAX TEMPERATURE:    250.0 / 310.0 (K)

MINIMUM WIND SPEED:       0.5 m/s

ANEMOMETER HEIGHT:     10.000 meters

SURFACE CHARACTERISTICS INPUT: USER ENTERED

ALBEDO:                  0.18
BOWEN RATIO:             0.55
ROUGHNESS LENGTH:       0.100 (meters)


       METEOROLOGY CONDITIONS USED TO PREDICT OVERALL MAXIMUM IMPACT
       -------------------------------------------------------------

 YR MO DY JDY HR
 -- -- -- --- --
 10 03 13  13 01

    H0     U*     W*  DT/DZ ZICNV ZIMCH  M-O LEN    Z0  BOWEN ALBEDO  REF WS
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 -3.71  0.065 -9.000  0.020 -999.  191.      5.7 0.100   0.55   0.18    1.50

    HT  REF TA     HT
- - - - - - - - - - - -
  10.0   250.0    2.0

ESTIMATED FINAL PLUME HEIGHT (non-downwash):    475.2 meters
```

AERSCREEN FUNDAMENTALS—RESULTS

- Example of maximum impact summary (in the *.out* file)

```
------------------------------------------------------------------------------
********************  AERSCREEN MAXIMUM IMPACT SUMMARY  ********************
------------------------------------------------------------------------------

                       MAXIMUM       SCALED       SCALED       SCALED       SCALED
                        1-HOUR       3-HOUR       8-HOUR      24-HOUR       ANNUAL
  CALCULATION            CONC         CONC         CONC         CONC         CONC
   PROCEDURE           (ug/m3)      (ug/m3)      (ug/m3)      (ug/m3)      (ug/m3)
---------------     ----------   ----------   ----------   ----------   ----------
ELEVATED TERRAIN      4.034        4.034        3.631        2.421        0.4034

DISTANCE FROM SOURCE       3000.00 meters directed toward 140 degrees
RECEPTOR HEIGHT     290.93 meters



IMPACT AT THE
AMBIENT BOUNDARY    0.2584       0.2584       0.2325       0.1550       0.2584E-01

DISTANCE FROM SOURCE        170.00 meters directed toward  80 degrees
RECEPTOR HEIGHT       0.64 meters
```

SUMMARY

In this session, we covered the following topics:

- Regulatory status
- Fundamentals
- Some of the specific prompts and responses
  - The example focused on a point source
- A brief look at the output

Air Pollution Dispersion Models:
Applications with the AERMOD Modeling System

AERSCREEN HANDS-ON

COURSE #423

DAY 4 MORNING

Day 4 Morning: AERSCREEN Hands-On

Learning Objectives

At the end of this lesson the student should be able to:

- Respond to the prompts for an interactive session with AERSCREEN
- Produce output and know where to find the results
- Rerun AERSCREEN without responding to all the prompts again

Before Running AERSCREEN

- AERSCREEN will use the programs:
  - MAKEMET
  - AERMAP
  - BPIPPRM
  - AERMOD
- If the executable files are not located in the working directory, you will be prompted to enter the path **and filename**
- "demlist.txt" must be located either in the folder with the AERSCREEN executable or in the working directory

Before Running AERSCREEN

demlist.txt

```
NED
     -----------------------------------------------------------
..\AERMAP\Seamless_Dem\MC_NED_76.tiff
..\AERMAP\Seamless_Dem\MC_NED_75.tiff
```

RUNNING AERSCREEN

- AERSCREEN will be run in interactive mode for this hands-on activity, so there is no control file
- To run AERSCREEN, navigate to the directory that contains the AERSCREEN executable (the working directory)

  APTI423\Hands-On\AERSCREEN\

- Double-click on aerscreen.exe to open a command window and execute AERSCREEN
- The program will pause at the first prompt waiting for your input

RUNNING AERSCREEN

- Enter a Title (e.g., AERSCREEN Hands-on)
- Next indicate if you are working in **E**nglish or **M**etric units—enter “M” (or “m”) for **M**etric
- Enter the source type—enter “P” for point source

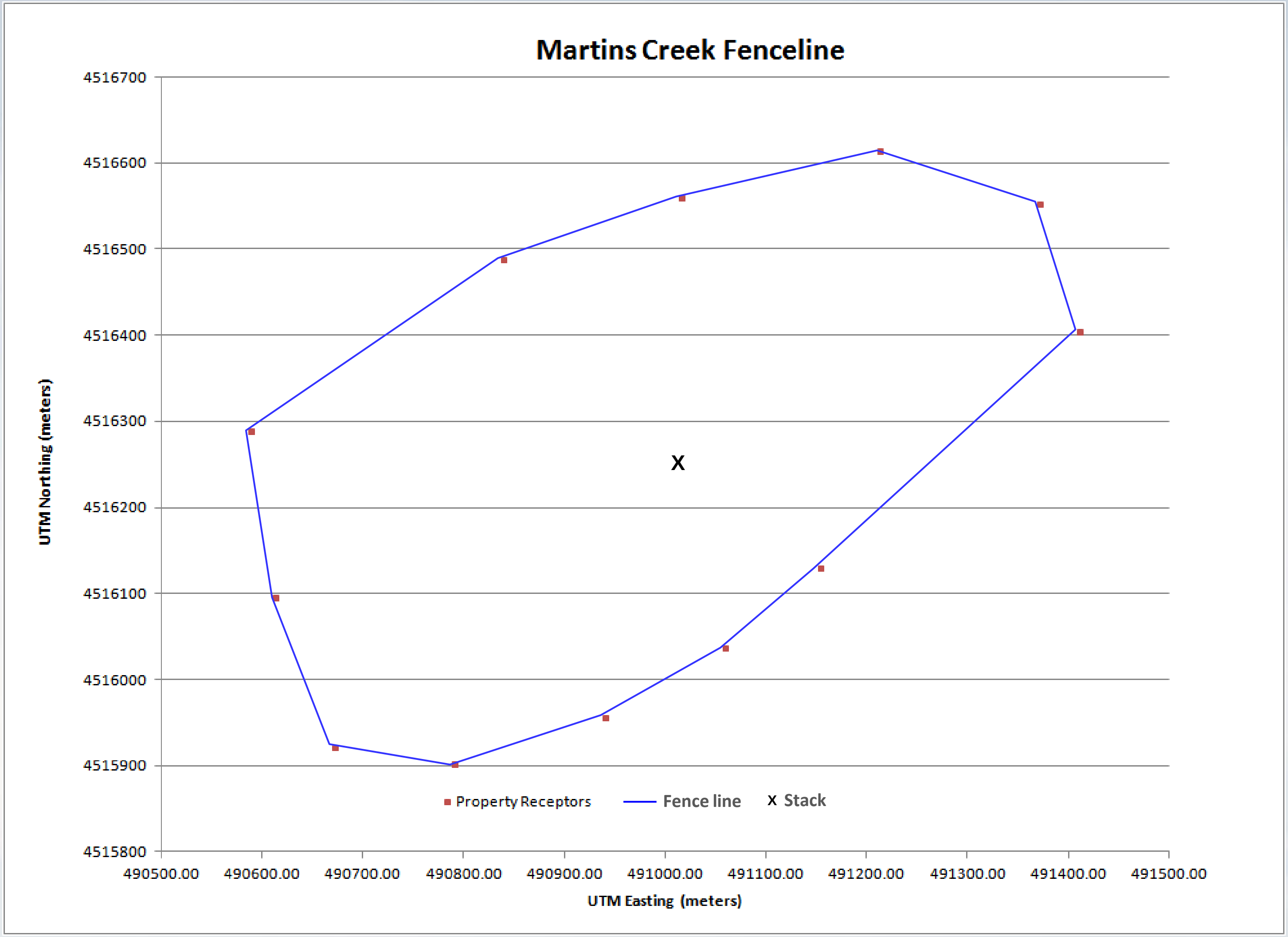
RUNNING AERSCREEN

- The screen will clear and prompts for a point source are displayed—we will use physical parameters like values for one of the stacks modeled with AERMOD
- Enter **1.0** for emission rate (in grams/second)
- Enter **182.9** (meters) for the stack height
- Enter **5.3** (meters) for the inside stack diameter
- Enter **400** (kelvin) for exit temperature
- Enter **1** for the option to enter the exit velocity in meters/second
- Enter **11.0** (meters/second) for the exit velocity
- Enter **R** for rural land use

RUNNING AERSCREEN

- Enter **170** (meters) for the distance to ambient air
- The next prompt is for NO_2 chemistry; because we are not using the Ozone Limiting Model (OLM) nor Plume Volume Ratio Method (PVMRM), enter **1** (no chemistry)

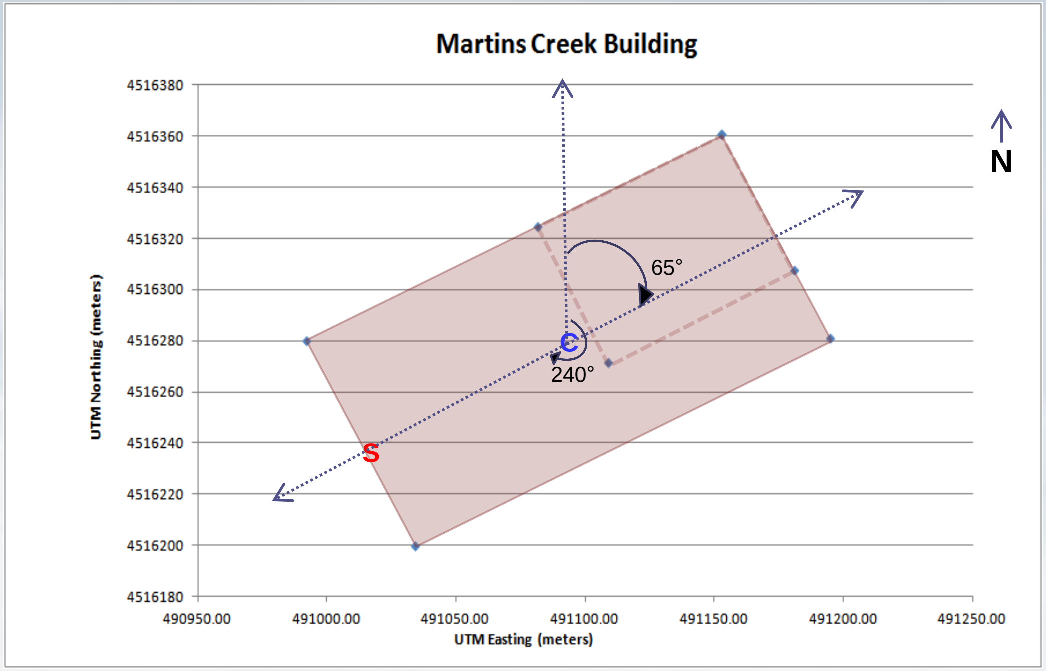
RUNNING AERSCREEN



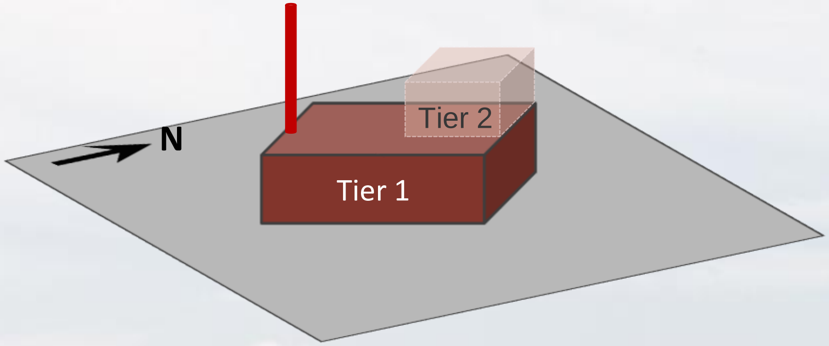
Running AERSCREEN—Buildings

- The screen will clear, and you are prompted on whether to include building downwash—enter “Y” or “y” to include downwash
- You are given the option to use a pre-existing BPIPPRM input file; for this hands-on activity, we will not use a pre-existing file
- The screen will clear, and you will be prompted for several parameters for one single-tiered building
  - Building height: **60 meters**
  - Maximum actual (not projected) horizontal building dimension: **180 meters**
  - Minimum actual horizontal building dimension: **90 meters**

STRUCTURE DIAGRAM—BOTTOM TIER



S = Stack C = Building Center



RUNNING AERSCREEN—BUILDINGS

- Maximum building dimension angle to true north: **65 degrees**
- Direction of the stack from the building center: **240 degrees**
- Distance between stack and building center: **90 meters**

Running AERSCREEN—Terrain/Receptors/Source

- The next prompt is whether to include terrain—respond with **Y** (Yes)
- The next set of prompts define receptors and source location
  - Maximum distance (in meters) to probe: the default value will depend on the application—we will use **5000 meters**
  - Include up to 10 optional discrete receptors: **N** (No)
  - Flagpole receptors: **N** (No)
  - Source elevation: press the **"Enter"** key to let AERMAP derive the elevation

RUNNING AERSCREEN—TERRAIN/RECEPTORS/SOURCE

- Coordinate type: Universal Transverse Mercator (**UTM)** coordinates
- Easting: **491020** meters
- Northing: **4516237** meters
- Zone: **18**
- UTM datum: **4**

RUNNING AERSCREEN—METEOROLOGY

- The next set of prompts is for meteorological input
  - Minimum and maximum ambient temperature: accept the **default** values (250–310 kelvin) by pressing ENTER
  - Minimum wind speed: accept the **default** value of 0.5 m/s
  - Anemometer height: accept the **default** value of 10 meters
  - There are three options for the surface characteristics—select **option 1** to enter a single set of values that apply to all hours and wind directions
    - Albedo: **0.18**
    - Bowen ratio: **0.55**
    - Roughness Length: **0.1** (meter)

RUNNING AERSCREEN—ADDITIONAL OPTIONS

- Adjust U* to address potential overpredictions under stable low wind conditions: **N**
- Estimate concentrations if the condition of “inversion break-up fumigation” occur: **N**
- Estimate concentration under conditions of shoreline fumigation: **N**
- Turn on the debug option? If yes enter **Y**, if no press <enter>: **ENTER**

RUNNING AERSCREEN—OUTPUT FILENAME

- AERSCREEN prompts for the output filename
  - Use any name or use the default aerscreen.out—for this exercise, use the **default** name

RUNNING AERSCREEN—VALIDATION

- After entering the filename or accepting the default name, a menu appears providing the categories of input data that can be examined and, if necessary, you can edit AERSCREEN's input before it runs
- The menu contains eight categories of input information from which to choose
- Once you are satisfied with the input press enter to run AERSCREEN

Running AERSCREEN—Executable Files

- Next, we will need to tell AERSCREEN the locations and names of the program executables when prompted
  - **AERMOD:** ..\AERMOD\aermod.exe
  - **MAKEMET:** ..\MAKEMET\makemet.exe
  - **BPIPPRM:** ..\BPIPPRM\bpipprm.exe..\
  - **AERMAP:** ..\AERMAP\aermap.exe

AERSCREEN—OUTPUT

- Based on the responses to the prompts, AERSCREEN generated 195 receptors along 36 radials for a total of 7,020 receptors
- The screening meteorology generated by the MAKEMET program consisted of 678 “hours”
- AERSCREEN writes information to the computer monitor and then displays the progress such as wind flow sectors and receptors

AERSCREEN.LOG

```
 Start date and time  10/10/19 15:51:46
                            AERSCREEN 16216

Hands On

            Hands On


        -----------------  DATA ENTRY VALIDATION  -----------------
                         METRIC                ENGLISH
 ** STACKDATA **  ---------------     ----------------

 Emission Rate:       1.0000 g/s              7.937 lb/hr
 Stack Height:        182.90 meters          600.07 feet
 Stack Diameter:       5.300 meters          208.66 inches
 Stack Temperature:    400.0 K                260.3 Deg F
 Exit Velocity:       11.000 m/s              36.09 ft/s
 Stack Flow Rate:     514212 ACFM
 Model Mode:           RURAL
 Dist to Ambient Air:         170.0 meters           558. feet
.
.
.
REFINE       ended 10/10/19 16:06:03

 **********************************************
 AERSCREEN Finished Successfully
 But with Warnings
        0 receptors skipped for FLOWSECTOR
        0 receptors skipped for REFINE
 Check log file for details
 ***********************************************

 Ending date and time  10/10/19 16:06:04
```

AERSCREEN.OUT

```
AERSCREEN 16216 / AERMOD 18081                                     10/10/19
                                                                   16:06:03

TITLE: Hands On


-----------------------------------------------------------------------------
*****************************  STACK PARAMETERS  ****************************
-----------------------------------------------------------------------------

SOURCE EMISSION RATE:            1.0000 g/s                  7.937 lb/hr
STACK HEIGHT:                    182.90 meters              600.07 feet
STACK INNER DIAMETER:             5.300 meters              208.66 inches
PLUME EXIT TEMPERATURE:           400.0 K                    260.3 Deg F
PLUME EXIT VELOCITY:             11.000 m/s                  36.09 ft/s
STACK AIR FLOW RATE:             514212 ACFM
STACK BASE LONGITUDE:          -75.1065 deg                491020. Easting
STACK BASE LATITUDE:            40.7971 deg               4516237. Northing
STACK BASE UTM ZONE:                                            18
REFERENCE DATUM (NADA):                                          4
STACK BASE ELEVATION:             71.53 meters              234.68 feet
RURAL OR URBAN:                   RURAL

DIGITAL ELEVATION MAP(S)          ..\..\AERMAP\Seamless_Dem\MC_NED_76.tiff
                                  ..\..\AERMAP\Seamless_Dem\MC_NED_75.tiff

INITIAL PROBE DISTANCE =          5000. meters              16404. feet
```

AERSCREEN.OUT

```
----------------------------------------------------------------------------
**********************  BUILDING DOWNWASH PARAMETERS  **********************
----------------------------------------------------------------------------

BUILDING HEIGHT:                    60.0 meters              196.9 feet
MAX BUILDING DIMENSION:            180.0 meters              590.6 feet
MIN BUILDING DIMENSION:             90.0 meters              295.3 feet
BUILDING ORIENTATION TO NORTH:       65. degrees
STACK DIRECTION FROM CENTER:        240. degrees
STACK DISTANCE FROM CENTER:         90.0 meters              295.3 feet
```

AERSCREEN.OUT

```
----------------------------------------------------------------------------
*************************  FLOW SECTOR ANALYSIS  **************************
               25 meter receptor spacing: 170. meters - 5000. meters
----------------------------------------------------------------------------
```

FLOW SECTOR	BUILD WIDTH	BUILD LENGTH	XBADJ	YBADJ	MAXIMUM 1-HR CONC (ug/m3)	IMPACT DIST (m)	RECEPTOR HEIGHT (m)	TEMPORAL PERIOD
10	199.07	176.97	-30.63	-68.95	0.8548	1625.0	25.66	ANN
20	190.92	190.92	-26.52	-57.85	0.8533	1625.0	15.59	ANN
30	176.97	199.07	-21.59	-45.00	0.8527	1600.0	9.44	ANN
40	157.64	201.17	-16.02	-30.78	0.8566	1575.0	34.31	ANN
50	133.52	197.16	-9.95	-15.63	0.8568	1525.0	43.90	ANN
60	105.35	187.16	-3.58	0.00	0.8567	1550.0	39.64	ANN
70	105.35	187.16	-4.94	15.63	0.8566	1575.0	34.85	ANN
80	133.52	197.16	-14.00	30.78	0.8562	1575.0	32.68	ANN
90	157.64	201.17	-22.64	45.00	2.450	4350.0	228.91	ANN
100	176.97	199.07	-30.59	57.85	3.052	4200.0	281.08	ANN
110	190.92	190.92	-37.61	68.94	2.304	4750.0	268.01	ANN
120	199.07	176.97	-43.48	77.94	2.840	3475.0	258.06	ANN
130	201.17	157.64	-48.04	84.57	3.265	3125.0	262.37	ANN
140*	197.16	133.52	-51.13	88.63	4.034	3000.0	290.93	ANN
150	187.16	105.35	-52.67	90.00	3.818	3050.0	258.05	ANN
160	187.16	105.35	-68.30	88.64	3.092	3500.0	250.77	ANN
170	197.16	133.52	-97.54	84.57	2.195	3975.0	225.50	ANN
180	201.17	157.64	-123.82	77.94	1.046	4600.0	185.98	ANN
190	199.07	176.97	-146.33	68.95	0.8546	1600.0	24.23	ANN
200	190.92	190.92	-164.40	57.85	0.8556	1600.0	28.93	ANN
210	176.97	199.07	-177.48	45.00	0.8544	1600.0	22.83	ANN
220	157.64	201.17	-185.16	30.78	0.8524	1625.0	3.95	ANN
230	133.52	197.16	-187.21	15.63	0.8278	1625.0	-10.82	ANN
240	105.35	187.16	-183.58	0.00	0.8531	1625.0	13.56	ANN
250	105.35	187.16	-182.21	-15.63	0.8531	1625.0	13.63	ANN
260	133.52	197.16	-183.15	-30.78	0.8539	1625.0	19.84	ANN
270	157.64	201.17	-178.53	-45.00	0.8536	1625.0	18.30	ANN
280	176.97	199.07	-168.48	-57.85	0.8525	1625.0	6.35	ANN
290	190.92	190.92	-153.31	-68.94	0.8529	1625.0	11.70	ANN
300	199.07	176.97	-133.49	-77.94	0.8545	1600.0	23.33	ANN
310	201.17	157.64	-109.60	-84.57	0.8551	1625.0	26.82	ANN
320	197.16	133.52	-82.39	-88.63	0.8555	1600.0	28.56	ANN
330	187.16	105.35	-52.68	-90.00	0.8557	1600.0	29.36	ANN
340	187.16	105.35	-37.04	-88.64	0.8560	1600.0	31.34	ANN
350	197.16	133.52	-35.98	-84.57	0.8565	1575.0	33.85	ANN
360	201.17	157.64	-33.82	-77.94	0.8565	1575.0	35.22	ANN

* = worst case flow sector

AERSCREEN.OUT

```
----------------------------------------------------------------------------
**********************  MAKEMET METEOROLOGY PARAMETERS  *********************
----------------------------------------------------------------------------

MIN/MAX TEMPERATURE:    250.0 / 310.0 (K)

MINIMUM WIND SPEED:       0.5 m/s

ANEMOMETER HEIGHT:     10.000 meters

SURFACE CHARACTERISTICS INPUT: USER ENTERED

ALBEDO:                  0.18
BOWEN RATIO:             0.55
ROUGHNESS LENGTH:       0.100 (meters)

SURFACE FRICTION VELOCITY (U*) NOT ADUSTED


       METEOROLOGY CONDITIONS USED TO PREDICT OVERALL MAXIMUM IMPACT
       -------------------------------------------------------------

 YR MO DY JDY HR
 -- -- -- --- --
 10 03 13  13 01

    H0     U*     W*  DT/DZ ZICNV ZIMCH  M-O LEN    Z0  BOWEN ALBEDO  REF WS
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 -3.71  0.065 -9.000  0.020 -999.  191.      5.7 0.100   0.55   0.18    1.50

    HT  REF TA     HT
- - - - - - - - - - -
  10.0   250.0    2.0

WIND SPEED AT STACK HEIGHT (non-downwash):        4.0 m/s
STACK-TIP DOWNWASH ADJUSTED STACK HEIGHT:       182.9 meters
ESTIMATED FINAL PLUME RISE (non-downwash):       94.4 meters
ESTIMATED FINAL PLUME HEIGHT (non-downwash):    277.3 meters
```

Continued on next slide

AERSCREEN.OUT

```
METEOROLOGY CONDITIONS USED TO PREDICT AMBIENT BOUNDARY IMPACT
        -------------------------------------------------------------

  YR MO DY JDY HR
  -- -- -- --- --
  10 03 04  13 12

     H0      U*      W*  DT/DZ ZICNV ZIMCH  M-O LEN    Z0  BOWEN ALBEDO  REF WS
  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 211.15  0.101  1.800  0.020 2249.   74.     -1.0 0.100   0.55   0.18    0.50

     HT  REF TA     HT
 - - - - - - - - - - -
   10.0   310.0    2.0

 WIND SPEED AT STACK HEIGHT (non-downwash):        0.7 m/s
 STACK-TIP DOWNWASH ADJUSTED STACK HEIGHT:       182.9 meters
 ESTIMATED FINAL PLUME RISE (non-downwash):      237.2 meters
 ESTIMATED FINAL PLUME HEIGHT (non-downwash):    420.1 meters
```

AERSCREEN.OUT

```
------------------------------------------------------------------------------
*********************** AERSCREEN AUTOMATED DISTANCES *********************
                  OVERALL MAXIMUM CONCENTRATIONS BY DISTANCE
------------------------------------------------------------------------------


            MAXIMUM    RECEPTOR                       MAXIMUM    RECEPTOR
     DIST   1-HR CONC   HEIGHT               DIST    1-HR CONC    HEIGHT
      (m)    (ug/m3)     (m)                  (m)     (ug/m3)      (m)
    ----------------------------         -----------------------------
      170.00  0.2584        0.64             2600.00    2.255        195.34
      175.00  0.2590        0.55             2625.00    2.471        200.38
      200.00  0.2591        0.64             2650.00    2.710        206.47
      225.00  0.2732        0.01             2675.00    2.907        212.52
      250.00  0.2795        0.72             2700.00    3.050        218.46
      275.00  0.2797        0.69             2725.00    3.138        224.72
      300.00  0.2791        7.55             2750.00    3.156        231.04
      325.00  0.2745       13.82             2775.00    3.204        237.67
      350.00  0.2657       15.69             2800.00    3.382        245.29
      375.00  0.2568       21.21             2825.00    3.514        251.50
      400.00  0.2559       24.27             2850.00    3.666        258.24
      425.00  0.3080       24.08             2875.00    3.762        265.12
      450.00  0.3588       23.76             2900.00    3.836        270.90
      475.00  0.4079       24.89             2925.00    3.796        275.75
      500.00  0.4538       26.43             2950.00    3.837        281.02
      525.00  0.4962       27.91             2975.00    3.989        286.35
      550.00  0.5341       28.69             3000.00    4.034        290.93
      575.00  0.5675       28.64             3025.00    4.007        294.50
      600.00  0.5970       28.56             3050.00    3.970        295.24
      625.00  0.6230       28.64             3075.00    3.944        294.07
      650.00  0.6457       29.21             3100.00    3.913        292.91
      675.00  0.6652       29.66             3125.00    3.877        291.70
      700.00  0.6816       30.00             3150.00    3.844        291.27
      725.00  0.6954       30.69             3175.00    3.811        290.96
      750.00  0.7070       32.05             3200.00    3.773        290.10
```

AERSCREEN.OUT

```
----------------------------------------------------------------------------
*********************  AERSCREEN MAXIMUM IMPACT SUMMARY  *********************
----------------------------------------------------------------------------

                      MAXIMUM       SCALED       SCALED       SCALED       SCALED
                       1-HOUR       3-HOUR       8-HOUR      24-HOUR       ANNUAL
  CALCULATION           CONC         CONC         CONC         CONC         CONC
   PROCEDURE          (ug/m3)      (ug/m3)      (ug/m3)      (ug/m3)      (ug/m3)
---------------     ----------   ----------   ----------   ----------   ----------
ELEVATED TERRAIN      4.034        4.034        3.631        2.421       0.4034

DISTANCE FROM SOURCE       3000.00 meters directed toward 140 degrees
RECEPTOR HEIGHT     290.93 meters



IMPACT AT THE
AMBIENT BOUNDARY    0.2584       0.2584       0.2325       0.1550       0.2584E-01

DISTANCE FROM SOURCE        170.00 meters directed toward  80 degrees
RECEPTOR HEIGHT       0.64 meters
```

AERSCREEN TO AERMOD COMPARISON

Averaging Time	AERSCREEN ($\mu g/m^3$)	AERMOD ($\mu g/m^3$)	AERSCREEN/ AERMOD
1-hour	4.03	2.18	1.85
3-hour	4.03	1.03	3.91
8-hour	3.63	0.68	5.34
24-hour	2.42	0.27	8.96
Annual	0.40	0.018	22.2

AERSCREEN—RESTART

- AERSCREEN looks for the file aerscreen.inp
- If you accepted the default AERSCREEN output filename (aerscreen.out), AERSCREEN created the file aerscreen.inp for you
- This file is used as a "restart" file
- If the file exists in the working folder, AERSCREEN asks if you want to use the restart file
- Enter "Y" or "y" if you want to use the file (otherwise press ENTER to start a new set of prompts)
- You are given the option of changing the input parameters

AERSCREEN.INP—RESTART

```
** STACK DATA          Rate     Height      Temp.  Velocity     Diam.      Flow
**              0.1000E+01  182.9000  400.0000   11.0000    5.3000   514212.

** BUILDING DATA    BPIP     Height  Max dim.  Min dim.   Orient.   Direct.    Offset
**                   Y      60.0000  180.0000   90.0000   65.0000  240.0000   90.0000

** MAKEMET DATA     MinT     MaxT  Speed    AnemHt  Surf  Clim   Albedo    Bowen   Length   SC  FILE
**               250.00   310.00    0.5    10.000     0     0   0.1800   0.5500   0.1000  "NA"

** ADJUST u*      N

** TERRAIN DATA    Terrain     UTM East    UTM North   Zone   Nada      Probe      PROFBASE   Use AERMAP elev
**                   Y        491020.0   4516237.0    18      4        5000.0          71.53           Y

** DISCRETE RECEPTORS  Discflag   Receptor file
**                        N         "NA"

** UNITS/POPULATION   Units    R/U  Population      Amb. dist.   Flagpole    Flagpole height
**                     M      R            0.        170.000       N          0.00

** FUMIGATION        Inversion Break-up  Shoreline  Distance    Direct  Run AERSCREEN
**                        N                  N          0.00       0.0      Y

** DEBUG OPTION      Debug
**                    N

** OUTPUT FILE "AERSCREEN.OUT"

** Temporal sector: Annual, flow vector: 140 degrees, spatial sector:  1

CO STARTING
   TITLEONE AERSCREEN Hands-on
**            REFINE STAGE 3
   MODELOPT CONC SCREEN
   AVERTIME 1
   POLLUTID OTHER
   RUNORNOT RUN
CO FINISHED

SO STARTING
   LOCATION SOURCE POINT        0.0      0.0      71.53
   SRCPARAM SOURCE   0.1000E+01  182.900  400.000   11.000    5.300
```