

AERMOD Modeling System: Status and Updates

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Outline

- Recent AERMOD developments
 - AERMOD dispersion model
 - AERMET meteorological preprocessor
 - AERMAP terrain preprocessor
- AERSCREEN status and plans
- AERSURFACE issues and plans
- Pending “Clarification Memos”
- Questions

Recent AERMOD Developments

- AERMOD model updated Oct. 19, 2009, version dated 09292:
 - Numerous Bug Fixes, Enhancements and Miscellaneous changes relative to version dated 07026, documented in Model Change Bulletin (MCB) #3
 - Significantly expanded standard test cases provided with updated model, including detailed summary of differences between version 09292 vs. 07026
 - Updated and expanded AERMOD User's Guide Addendum to provide more complete documentation of current model options

AERMOD 09292 – Bug Fixes

- Corrected significant bug with use of OLMGROUP keyword for OLM option; more details in Addendum to MCB#3
- Corrected problem with PVMRM for cases with multiple level wind measurements
- Corrected problems with processing of surface file header for screening meteorology, for interface with AERSCREEN
- Initialization of unallocated arrays; created problem for some platforms/compiler

AERMOD 09292 – Bug Fixes

- Corrected potential problems related to options that assume full years of meteorological data
- Corrected potential problems with MAXIFILE and POSTFILE outputs for re-started model runs using the SAVEFILE/INITFILE option

AERMOD 09292 – Enhancements

- New options to vary emissions by hour-of-day and day-of-week (HRDOW and HRDOW7)
- Enhanced HOUREMIS option to allow specifying hourly-varying release heights and initial sigmas for VOLUME and AREA sources (more flexibility for mobile sources)
- Improved memory allocation, especially for AREAPOLY sources
- Non-DFAULT option to specify FLAT terrain for specific sources (Section 4.1 of *AERMOD Implementation Guide*)
- Non-DFAULT 'FASTALL' option for “optimized” meander implementation for POINT and VOLUME sources; effective σ_y used to replicate peak centerline χ from DFAULT option, without upwind dispersion

AERMOD 09292 – Enhancements

- Allow OPENPIT source with gaseous emissions; may be applicable for depressed roadway segments
- Use of DOUBLE PRECISION for nearly all non-integer variables
 - addresses long-standing and recent issues with precision
 - improves consistency of results across different compilers, compiler options, and computing platforms

AERMOD 09292 - Miscellaneous

- Treat urban roughness length values other than 1m as non-DFAULT (Section 5.3 of *AERMOD Implementation Guide*)
- Elimination of TOXICS option
 - Inherited from ISCST3 model; linked with range of disparate model options; role is no longer well defined
 - New non-DFAULT option (FASTAREA) for area source optimizations formerly under TOXICS option
- Clarification of deposition options
 - Distinction between CONCentration calculations with deposition effects (settling and removal) vs. calculation of dry and/or wet deposition fluxes (DDEP, WDEP and/or DEPOS)
 - Particle dry deposition algorithms, with user-specified particle size distribution, has never been considered as a non-DFAULT option in ISCST(1), ISCST3 or AERMOD
 - Dry and wet deposition of gases, and METHOD_2 option for particle deposition (ANL) treated as non-DFAULT options

Pending AERMOD Changes

- Additional updates to AERMOD are nearly complete – expect release on SCRAM by end of May 2010
- Allow user-specified rank on RECTABLE keyword for processing PM_{2.5} 24-hour averages to accommodate recent Page memo recommendations for PM_{2.5} modeling
- Incorporate design value calculations for new hourly NO₂ standard and pending hourly SO₂ standard
- New MAXDAILY option on the OU pathway to output the summary of daily maximum 1-hour values for each day. These files can provide an interim output product that may be used to analyze new NAAQS based on a specified percentile rank of daily maximum 1-hour values.
- Modified debug option (DEBUGOPT keyword) to allow user to specify debug output only for PVMRM or deposition options – avoids potentially large MODEL debug files if user only needs PVMRM or DEPOS files

MAXDAILY Output File

* AERMOD (10090): AERMOD Test Case - MAXDAILY Output File Example

04/06/10

* MODELING OPTIONS USED:

02:00:08

* CONC

ELEV

* MAXDAILY FILE OF DAILY MAXIMUM 1-HR VALUES FOR SOURCE GROUP: ALL

* FOR A TOTAL OF 11 RECEPTORS.

* FORMAT: (2(1X,F13.5),1(1X,E13.6),3(1X,F8.2),2X,A6,2X,A8,2X,I4,2X,I3,2X,I8.8,2X,A8)

* X Y AVERAGE CONC ZELEV ZHILL ZFLAG AVE GRP JDAY HR DATE NET ID

*

X	Y	AVERAGE CONC	ZELEV	ZHILL	ZFLAG	AVE	GRP	JDAY	HR	DATE	NET ID
3500.00000	67750.00000	0.744519E+01	237.48	239.26	0.00	1-HR	ALL	1	13	88010124	
3600.00000	69700.00000	0.969755E+02	319.31	330.67	0.00	1-HR	ALL	1	15	88010124	
4520.00000	69780.00000	0.841511E+02	296.71	296.71	0.00	1-HR	ALL	1	3	88010124	
5500.00000	70450.00000	0.852949E+02	234.88	329.78	0.00	1-HR	ALL	1	11	88010124	
4780.00000	70700.00000	0.830831E+02	324.80	329.02	0.00	1-HR	ALL	1	2	88010124	
5110.00000	70850.00000	0.117521E+03	319.80	322.66	0.00	1-HR	ALL	1	11	88010124	
5810.00000	70900.00000	0.784420E+02	253.17	323.10	0.00	1-HR	ALL	1	11	88010124	
5860.00000	71340.00000	0.618998E+02	160.97	340.96	0.00	1-HR	ALL	1	11	88010124	
6250.00000	71070.00000	0.478960E+02	276.63	276.63	0.00	1-HR	ALL	1	11	88010124	
6930.00000	71300.00000	0.281358E+02	156.75	276.71	0.00	1-HR	ALL	1	12	88010124	
7870.00000	69130.00000	0.169679E+01	26.09	26.09	0.00	1-HR	ALL	1	16	88010124	
3500.00000	67750.00000	0.401384E+00	237.48	239.26	0.00	1-HR	ALL	2	21	88010224	
3600.00000	69700.00000	0.128584E+01	319.31	330.67	0.00	1-HR	ALL	2	21	88010224	
4520.00000	69780.00000	0.964383E+00	296.71	296.71	0.00	1-HR	ALL	2	21	88010224	
5500.00000	70450.00000	0.309438E+00	234.88	329.78	0.00	1-HR	ALL	2	21	88010224	
4780.00000	70700.00000	0.124218E+01	324.80	329.02	0.00	1-HR	ALL	2	21	88010224	

Pending AERMET Changes

- Updates to AERMET are nearly complete – expect draft Beta version to AIWG by end of May
- Corrected problems with averaging of sub-hourly inputs for site-specific data
- Make broader use of station elevations from data files (ISHD & SAMSON) and/or user-specified elevations for SURFACE data
- Corrected problems with time zone adjustments for cases with surface and onsite stations in different zones
- Incorporated changes to handle ISHD files with “problem” addressed on interim basis by *FIXISHD* utility

Pending AERMET Changes

- Include option to process 1-minute ASOS wind data to supplement standard ISHD archive
 - Separate 1-minute ASOS pre-processor generates hourly averaged WS/WD, input to AERMET in Stage 2
 - Used in preference to standard ASOS observations which are based on single 2-minute averages
 - Increases data completeness by filling in calm and missing periods, including variable winds, and eliminates need for “randomizing” WD
- Incorporate adjustment to ASOS wind speeds to account for truncation of archive winds
 - Archived ASOS winds are truncated to whole knots, including 1-min data
 - All non-calm ASOS wind speeds increased by $\frac{1}{2}$ knot in Stage 3
 - Includes option for user to disable the truncation adjustment
- Option to “include” AERSURFACE output in Stage 3
- Option to include separate set of surface roughness values for use with substituted NWS wind data

Pending AERMET Changes

- Enhanced default upper air sounding window to select 12Z or 00Z sounding from “current day” or 12Z sounding from “previous day” (± 1 hour) depending on latitude of upper air station; 12Z from “previous day” used for Eastern Hemisphere time zones
- Added optional user-specified upper air sounding window to expand default range relative to three primary soundings
- Additional option to allow AERMET to select “optimal” sounding based on local sunrise for station location
 - Enhances portability of AERMET for non-US applications
 - Accommodates potential use of more frequent pseudo-soundings derived from NARR or gridded met models in the future beyond standard twice-daily observations
 - May result in no acceptable sounding at high latitudes in summer with standard twice-daily soundings

AERSCREEN

AERSURFACE

- See separate presentation

Pending/Potential Issues for Clarification Memos

- Use of ASOS vs. observer-based National Weather Service (NWS) data and treatment of missing NWS data in AERMOD
- Implementation of EPA formula for Good Engineering Practice (GEP) stack height in AERMOD (with PRIME downwash)

Pending Clarification Memo – NWS Met Data Issues in AERMOD

- AERMOD requirements for data completeness differ from ISCST3, which required 100% completeness under regulatory default option
- AERMOD sensitivity to ASOS vs. observer-based data has been assessed; generally less of an issue with AERMOD than ISCST3 (AERMOD ASOS study documentation to be provided)
- Missing NWS data more extensive with advent of ASOS and METAR, with data gaps biased toward low wind speeds, raising concerns regarding representativeness for some applications
- Potential use of 1-minute ASOS data to supplement standard NCDC archived data with hourly averaged winds; could significantly reduce number of calm and missing hours

Pending Clarification Memo – GEP Formula Height in AERMOD

- AERMOD currently turns off building downwash effects if stack height is greater than or equal to EPA formula for GEP stack height, H_{gep} :
 - $H_{\text{gep}} = H_b + 1.5L$, where
 - H_b = building height above stack base
 - L = lesser of building height and projected width
- AERMOD implementation is consistent with all previous versions of AERMOD and ISC
- Significant discontinuities in AERMOD impacts have been noted for stacks that straddle the GEP formula height; orders of magnitude in some cases

Pending Clarification Memo – GEP Formula Height in AERMOD

- Comments at 7th Modeling Conference in 2000 recommended that EPA consider changing ISC-PRIME to eliminate discontinuity at GEP height
- EPA response was that current implementation is a requirement imposed by GEP Stack Height Regulations in Section 123 of CAA
- Magnitude of discontinuities found in some cases has prompted reexamination of this position
- Current assessment is that AERMOD should be modified to remove this criterion for turning off downwash influences

Pending Clarification Memo – GEP Formula Height in AERMOD

- GEP Stack Height regulations define GEP stack height as the greater of:
 - 65 meters (de minimis GEP height);
 - EPA formula height; or
 - height determined by field study or fluid modeling demonstration
- Based on the definition, EPA formula height does not apply below 65 meters
- Discontinuities are primarily a concern for shorter stacks, usually with squat buildings

Pending Clarification Memo – GEP Formula Height in AERMOD

- Pre-PRIME downwash algorithms defined vertical extent of wake influence generally consistent with EPA formula height, resulting in little, if any, discontinuity
- Vertical extent of wake influence in PRIME formulation can extend well above the EPA formula height
- Wind tunnel studies clearly support wake influences above EPA formula height for some stack/building geometries

Questions?

