

AERMOD Modeling System: Status and Updates

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Outline

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

Recent AERMOD Developments

- Updates to all three AERMOD components completed or nearly complete:
 - AERMAP (v.09040) released February 11, 2009
 - AERMOD and AERMET updates to be released on SCRAM ASAP
 - Miscellaneous bug fixes and enhancements for all three AERMOD components (more details on following slides)
 - Improvements in code portability across compilers and platforms (Windows/Linux) for all components
 - Update to Intel Fortran compiler for AERMOD executable (about 40% runtime improvement compared to Compaq Visual Fortran); G95 open source Fortran compiler used for AERMAP up to 4X faster than Intel
 - User's Guides being updated to incorporate Addenda & other corrections

AERMOD Update – 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 Update – 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 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 Update – Enhancements

- Allow OPENPIT source with gaseous emissions; may be applicable for depressed roadway segments
- Option to specify FLAT terrain for some sources
- 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
- Significantly expanded test cases for next AERMOD update; more robust test of model options

AERMOD Update - 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

Recent AERMAP Changes

- Version 09040 update released on SCRAM Feb. 11, 2009
- Fixed problems with processing Alaska DEM files (1-deg, 15-min and 7.5-min data; non-uniform longitude spacing of nodes)
- Support for National Elevation Dataset (NED), available from USGS Seamless Data Server in GeoTIFF format
- Allow “mixed” DEM files (1-deg, 7.5-min, and 15-min for AK); can be used to fill gaps in 7.5-min coverage, such as over water grids; however, no support for mixed DEM & NED data
- Domain keywords (DOMAINXY/DOMAINLL) are now optional; will use all available data if omitted
- Support for INCLUDED keyword on RE and SO pathways
- Improved handling and reporting of non-standard (non-USGS) terrain data, including identification of receptors located in “gaps” between terrain files or inside terrain files

Recent AERMAP Changes (cont.)

- Allocatable array storage at runtime
- Modified to use standard convention of negative for West longitude
 - Simplifies code structure and inputs
 - Consistency with other tools (e.g., AERSURFACE)
 - Improves applicability beyond the U. S.
 - Code included to convert DOMAINLL inputs to new convention for backward compatibility
- Update to *AERMOD Implementation Guide* with new sections to discuss issues regarding sources of terrain data (DEM, NED, SRTM, etc.), and use of AERMAP to estimate source elevations, posted on SCRAM March 19, 2009

Recent AERMET Changes

- 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
- Added optional user-specified upper air sounding window, currently hardwired to 11-13Z
- Incorporated changes to handle ISHD files with “problem” addressed on interim basis by *FIXISHD* utility
- Option to process 1-minute ASOS wind data to supplement standard ISHD archive
- Option to “include” AERSURFACE output in Stage 3 rather than copy & paste

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?

