EPA'S NINTH CONFERENCE ON AIR QUALITY MODELING

Comments on behalf of the American Petroleum Institute

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Introduction

- Promulgation of more stringent ambient air standards has resulted in more non-attainment areas and the need for more complex and more regional modeling.
- These comments cover many issues relating to aspects of the EPA's Guideline on Air Quality Models.
- Highlights are listed here and our written comments will contain details and references.

Need for Complete Documentation and Guidance

- All codes should be in public domain.
- All documentation (especially CALPUFF) needs to be brought up-to-date and made publicly available.
- There is a general need for more EPA guidance, workshops and training for the modeling community.

Distance limits on model applications

- Better guidance on distance limits for models is needed (esp. AERMOD and CALPUFF).
- What is the minimum domain size and grid size where grid models such as CMAQ or CAMx can be used, and what is the recommendation for Plume in Grid (PinG) modeling?
- Distance limits should not be arbitrary, but should depend upon scientific issues, including topography, wind persistence data and land use variations.

Meteorological inputs to models

- There has been an increase in the use of meteorological drivers (e.g., diagnostic models such as CALMET and prognostic full-physics models such as MM5) for both steady state and time varying dispersion models (e.g., AERMOD, CALPUFF, CMAQ).
- Prognostic meteorological models such as MM5 and WRF (often called 'Met models') have been improving with advances in science and resolution.
- Other agencies (DTRA and NOAA) now have linked Met model (MM5 or WRF) to Puff AQ models or grid AQ model systems that are operational.

Meteorological inputs to models (continued)

- Research effort needed to optimize use of Met model and CALMET model predictions with observations.
- Specific issues:
  - Clarify differences between full-physics Met model (e.g., MM5) and CALMET
  - Assess effects of grid size and vertical grid spacing on bias and accuracy
  - Develop recommendations for optimal grid sizes for different topographic and meteorological settings; minimum grid size (Penn State MM5 developers recommend 4 km as safe general rule, although 1 km can be used in special cases; this is due to physics assumptions in model)

Meteorological inputs to models (Specific issues continued)

- Determine overall model performance of Met models coupled with dispersion models vs. field study data sets; possible new field experiments
- Determine how met observations can best be used and assimilated in Met models? (note differences between NCAR and Penn State MM5 Met model data assimilation methods)
- Assess if CALMET (or any diagnostic model) is truly needed as an intermediate step between the Met model and the AQM.
- Work with other agencies (DTRA, NOAA) who have operational Met model-AQM systems operating and make use of their technology where appropriate.

Regional Models (CMAQ, CAMx, and others)

- New mechanisms in CMAQ (and CAMx and other models) need to be comprehensively tested and subjected to review by external expert panels.
- We recommend that EPA devote more resources to subgrid scale modeling in CMAQ, including consideration of the use of the SCICHEM PinG model, and set up a decision process for which point sources should be modeled with PinG.
- EPA should have comprehensive scientifically based model evaluations/comparisons performed for CMAQ vs. CAMx (and any other credible regional grid model).
- Databases are being developed in Wyoming and the Four Corners region that will provide monitoring data and emission inventories.
- EPA needs to set a de minimis significance level for project ozone concentration impacts for regional modeling efforts.

CALMET/CALPUFF

- Need overall model evaluations of CALPUFF using full chemistry as very limited evaluations of the model in the mode that it is being used have been conducted.
- Evaluation should include other models such as SCIPUFF.
- Ability to handle complex terrain, short term puff dispersion, chemical reactions, and other incorporated capabilities (e.g., FOG) needs to be evaluated.
- Modify chemistry based on API/AER recommended revisions.

CALMET/CALPUFF (Continued)

- Documentation is incomplete, and lack of detail causes many users to rely heavily on default values.
- Need to resolve met input questions (CALMET or Met model such as MM5 – see previous slides on Met inputs)
- Need to test the use of CALPUFF for regional AQRV analyses (NEPA studies are currently using this approach in the West).
- Operational use should be based on peer and stake holder review using best science approach as opposed to IWAQM mandates.

Proposed Collaborative Field Experiment for Linked Met Model - AQM Evaluation

- Purpose: to test and improve the linkage of Met models and air quality models in mountainous terrain, such as Wyoming where there is much current mesoscale and regional modeling underway.
- EPA should lead effort with invited participation of API and other industries and stakeholders.
- Include meteorological observations, tracer releases, and PM and visibility observations over an area of about 200 km by 200 km, sufficient to test the use of Met model (e.g., MM5) direct input vs CALMET diagnostic model.

Model Evaluation and Uncertainty

- Recent improvements in regional dispersion model performance measures have been made; EPA efforts (in collaboration with members of an international workgroup) are described in a recently submitted paper by Dennis et al.
- Rather than having different evaluation approaches and performance measures for the different model scales, a comprehensive set of performance measures should be devised for use at all model scales.

Model Evaluation and Uncertainty (Cont)

- The bootstrap method used in the ASTM and BOOT software should be recommended to evaluate significant differences in model performance results for all model scales.
- Model acceptance criteria should be set and used in modeling protocols and decision making.
- Uncertainty in model predictions (also called "probabilistic forecasts") should become available to and used by regulatory decision makers. EPA should investigate and possibly make use of the probabilistic AQM system (Met model –SCIPUFF) in use at DTRA.

Modeling Protocols and Screening Models

- Modeling Protocols should be determined up front and dependent upon science and regulatory needs.
- When will the screening model AERSCREEN be released to the public?

AERMOD

- Establish a peer–review panel from all segments of the community to review planned improvements and draft documents produced.
- Incorporate algorithms for near calm winds and test with appropriate field data sets.
- Improve algorithms for use in urban areas, especially for near-ground sources in built-up downtown areas.
- Determine science-based criteria for deciding distance limits and whether “complex terrain” is significant.

ASOS and AERSURFACE

- EPA guidance limits the influence of nearby land use in parameterizing surface roughness to a 1 km radius of ASOS anemometers generally located on airport property.
- For many pollutant sources this means that the dispersion modeling domain is dominated by surface roughness of airport property.
- Better guidance is needed for translating the airport wind observations to the land characteristics of the pollutant source domain.

Meteorological data processing with AERMET for input to AERMOD

- AERMET Stage 3 output should summarize the processed met data so the user knows during the AERMET processing steps if that year of data is suitable for regulatory modeling purposes (>90% available).
- Currently this summary information is not provided until AERMOD is run.

Plume Molar Volume Ratio Model (PMVRM)

- EPA should further test this model and, if acceptable, recommend the use of this model for predicting NO2 concentrations in the presence of ambient air ozone concentrations.
- This should be performed for both AERMOD and CALPUFF.

Encourage development and use of science-based models

- Some non-regulatory driven studies concerned, for example, with health risk assessments use AQ monitoring data combined with statistical correlations as a substitute for the use of detailed dispersion models (AERMOD, CALPUFF, or CMAQ) for estimating air quality concentrations.
- EPA should promote consistent and general use of dispersion models that are based on physical understanding of meteorological principles (e.g., AERMOD, CALPUFF, CMAQ, CAMx etc.) as opposed to statistical fits to site specific concentration data sets.
- The use of statistical models in place of more rigorous dispersion models should be reviewed by an expert panel that includes all scientific and stakeholder communities.

Encourage development and use of science-based models (continued)

- Avoid arbitrary non-scientific criteria for model selection (such as eliminating models with a bias for over-prediction)
- Encourage scientific peer review of all models (i.e., both internal EPA and outside models) and of proposed modifications to model algorithms.
- Model acceptance criteria should be developed through discussions with the entire community of model developers and stakeholders.

Summary of Key Recommendations

- Need to update and improve model guidance and documentation.
- Encourage development and use of science–based models through model evaluation efforts and enhanced public involvement.
- Test, validate, and recommend procedures for using meteorological models to drive dispersion models.
- Conduct a Mesoscale/Regional collaborative model evaluation using the existing databases and/or conduct a field experiment that could be used to evaluate regional models in rural regions in the intermountain west or similar location.