Update on FLAG

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Revisions to Guideline on Air Quality Models and FLAG 2010

• In summer of 2015, EPA proposed removal of CALPUFF as preferred model for refined LRT assessments
  – FLAG 2010 recommends using EPA approved version of CALPUFF for AQRV assessments for PSD, thus FLAG guidance affected by rulemaking.
• Revisions to GAQM provide unique opportunity for FLM’s to advance state-of-science and examine AQRV issues that cannot effectively be analyzed with current recommendations.
FLAG Update Process

• Representatives of the FLAG agencies have met to discuss issues on how to approach a FLAG update process

• Compiling a list of important issues to consider for future FLAG revision. Some ideas discussed include:
  – Consider new model platforms
    • Testing new models and procedures
  – Incorporate critical loads into FLAG framework
  – Consider impacts of ozone and air toxics
  – Enhance near-field modeling guidance where needed
  – Update guidance of existing model applications until FLAG is revised.
    • Use of MMIF and documentation of meteorological model performance evaluations.
The Primary Objectives of FLAG Revision Process

- Identify appropriate air quality models or modeling technique(s), which may include reduced form models for primary and secondarily formed air pollutants under various transport conditions for AQRV analyses;
- Identify the process and methods for model/technique evaluation, the criteria by which the performance of those modeling techniques should be evaluated, and optionally provide example performance evaluations;
- Identify evaluation databases and existing evaluations and how these results will be used to support model performance evaluation and as appropriate model improvement;
- Ensure that all air quality models or modeling techniques and computer codes deemed acceptable by the FLAG agencies are peer reviewed, publicly available, and fully documented including user guides and other necessary guidance;
- Develop and update guidance documents and revisions to Appendix W where appropriate
Deposition Issues

• FLM’s have interest in incorporating critical loads concept into FLAG framework
  – Current FLAG recommended procedures do not facilitate examination of cumulative deposition.

• Increase in number of near-field deposition evaluations for NEPA projects in western US
  – Current FLAG guidance is silent to this need
Near Field Deposition Issues

• AERMOD design has limitations which affect how any potential guidance is structured.
  – AERMOD is designed for prediction of air concentrations of chemically inert pollutants.
  – AERMOD is a “steady-state” model, meaning it only uses a single station of meteorology and transport is uniform across entire modeling domain.
  – Best for “line of sight” impacts (usually 0 – 10-km), not complex meteorological environments where many Class I areas are situated.
• Draft released in January 2014.
• Recommends a 3-tier screening approach for modeling deposition in the near-field.
  • Tier I (AERMOD) – conservative deposition velocities defined for SO₂ and NOₓ.
  • Tier II (AERMOD) – slightly more refined approach, allowing for pollutant specific properties to be considered in deposition analysis.
  • Tier III (CALPUFF) – two approaches, based upon source-receptor distances, making use of CALPUFF first-order chemical mechanism.
Tier III (CALPUFF)

• Tier III approach uses CALPUFF with first-order chemical mechanism to treat conversion
  – Within 0-20-km, if applicant can adequately demonstrate that steady-state meteorological conditions dominate source-receptor relationships, FLM will consider use of CALPUFF with AERMOD surface and upper air data.
  – All other applications will develop 3-D wind fields consistent with the unique nature of near-field application of model.
    • August 31, 2009 EPA memorandum regarding CALMET settings for LRT applications is not considered universally appropriate. Protocol necessary to discuss CALMET settings appropriate for near-field application of model.
MMIF Guidance

- FLM’s transitioning away from recommending CALMET to MMIF for supplying meteorology for AQRV modeling analysis.
- Forest Service developed guidance on the application of MMIF. Draft 1.0 dated August 2016
  - Covers meteorological performance evaluation recommendations
    - Metrics and thresholds
    - Software
    - Documentation recommendations
  - Preferred “switch” settings for MMIF
  - Geographic domain preferences
Ongoing FLM Efforts

• FWS/USFS testing of PGM’s for AQRV assessments
  – Building upon EPA study “Comparison of Single Source Air Quality Assessment Techniques for Ozone, PM$_{2.5}$, other Criteria Pollutants and AQRV’s”
  – Examining source apportionment techniques for single source applications
  – Development of standardized procedures and databases to streamline process

• Evaluation of FLAG procedures for PGM assessments
Model Consequence Testing

- Extension of USEPA single source photochemical demonstration project presented at 10th Conference on Air Quality Modeling

- Multiple Model Being Tested
  - CALPUFF (v5.8, v6.42) (completed)
  - SCICHEM 3.0 (current)
  - CAMx 6.x (current)

- Examining extinction budgets of same source type and emissions level at each Class I area across modeling platforms being tested.

- Revisiting Q/D concepts
# Summary of CALPUFF Sensitivities

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Summary of CALPUFF Simulation Results – Mesa Verde (MEVE1)

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Simulated Extinction Budget (MEVE1) - CALPUFF v5.8 - MESOPUFF-II, Ammonia Limiting (1.0 ppb NH3), 4-KM CALMET
Simulated Extinction Budget (MEVE1) - CALPUFF v6.42 - RIVAD/ISOROPPIA, RADM Aqueous, No Ammonia Limiting, 4-KM MMIF
Simulated Extinction Budget (MEVE1) - CALPUFF v6.42 - RIVAD/ISOROPPIA, RADM Aqueous, No Ammonia Limiting, 4-KM MMIF (MM5 CLWC)
Simulated Extinction Budget (MEVE1) - CALPUFF v6.42 -
RIVAD/ISOROPPIA, RADM Aqueous, No Ammonia Limiting,
4-KM CALMET (Default CLWC)
Simulated Extinction Budget (MEVE1) - CALPUFF v6.42 - RIVAD/ISORROPIA, RADM Aqueous, Ammonia Limiting (1.0 ppb NH3), 4-KM CALMET (Default CLWC)
Model to Model Comparisons – SO4
Model to Model Comparisons – NO3
Q/D Reexamined

• Q/D has been a useful first tier screening approach to reduce the overall burden of modeling for sources

• In the context of FLAG revisions and potential shift in modeling platforms, several questions arise:
  – Is the Q/D concept translatable between different source types
  – Can Q/D be applied in same manner to different modeling systems without modification
Q/D Reexamined

• Testing for all model platforms
  – Elevated and low level pseudo-source placed in center of modeling domain
  – Consistent emissions
    • 40 TPY SO2/40 TPY NOx to 4000 TPY SO2/4000 TPY NOx
  – Gridded results are extracted to examine peak visibility response as a function of downwind distance
Examining Q/D Closer
Exploring Alternatives to Q/d

- Forest Service developed an AERMOD post-processor called AerVisPost, designed to compute visibility impacts while using AERMOD as a first-level screen.
  - Advantage: Quick to run. Respects source-receptor relationships governed by meteorology.
  - Disadvantage: Must assume full conversion and neutralization from SO2 to SO4 and NOx to NO3.
Conclusions

- We want to make sure we are moving forward in modeling to keep pace with science and EPA efforts.
- Needs to be an orderly process where things are evaluated – not ad hoc “improvements”
- Not ultimately wedded to any particular modeling platform.
- As modeling technique change, FLAG will be revised.