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## Improved Model Performance Evaluation (MPE) Tools (Cross-cutting Issue)

### Background

Model performance evaluation (MPE) is a task that is cross cutting through many of the other issue papers presented here, including modelling of nitrogen deposition, background ozone, regional haze, winter ozone & PM2.5, fire impacts, and evaluation of global modelling. MPE is a critical task that must be completed before models are used for regulatory application. The MPE should include an operational evaluation (the comparison of meteorological and photochemical model simulations to ambient measurement data for historical conditions) as well as diagnostic evaluation of key processes in the model, and sensitivity simulations and uncertainty analysis. Dynamic model evaluation assesses the ability of the model to reproduce observed historical changes in air quality caused by changes in source emissions or meteorological conditions.

### Problem Statement

Appropriate model evaluation based on current guidance (EPA, 2014[1]; Gaber et al., 2009[2]) requires very in-depth activity, which currently occurs at the end of what is typically already a very long and resource intensive process of developing model input data and completing model simulations. It commonly requires weeks to months of clock time to complete a simulation, and when model input errors are discovered at the end of the modeling activity, time may be limited for correcting and redoing model simulations, so there is a need to detect model errors while the model is running. Additionally, ambient monitoring data are often not readily available in a format that can be easily compared to model results, so there is also a need to streamline the integration of monitoring data for model evaluation.

### Research and Development Topics

- Develop automated tools for inline production of model evaluation products so that model performance can be assessed quickly while the model simulation is still running.
- Preprocess all available ambient monitoring data so that it is readily available in the same format and temporal resolution needed for the MPE.
- Perform dynamic model evaluations to assess how well models reproduce observed historical trends in ozone and regional haze in the western U.S.

[1] EPA, 2014, Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze, Draft Guidance, December, 2014. Available at: https://www3.epa.gov/scram001/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf

[2] Gaber et al. "Guidance on the development, evaluation, and application of environmental models." Report, Council for Regulatory Environmental Modeling (2009): 81.

- Perform more rigorous diagnostic evaluations for specific episodes and individual monitors that are most relevant to air quality planning.

**Desired Outcomes**

- Develop automated tools that facilitate real time evaluation and quality assurance of model simulations that are in progress.
- Reduce the time and cost needed to complete the MPE.
- Develop MPE products that are more relevant to specific air quality planning goals.
- Develop greater confidence in the reliability of models for use in air quality planning.