

Authors' Response (in red) to Dr. William Stockwell's Comments

Rao et al. examine how the stochastic variability of the atmosphere affects the accuracy of regional air quality model predictions. Stochastic variability would be expected to introduce error in predictions even if the model is "perfect". This paper provides an analysis of the expected error. The question of the limits of "predictability" of models is well known in meteorology but it has not been explored very extensively for air quality models. Therefore, this paper provides a valuable contribution to the literature. The paper provides an excellent basis for future research and improvements to air quality models as well.

We thank Dr. Stockwell for his positive feedback on our paper.

Atmospheric stochastic variability extends to scales that are well below current Eulerian model resolution. Eulerian models calculate gas-phase chemical transformations across the modeling domain within grid-boxes and instantaneous uniform mixing of chemical species is assumed for each grid-box. However, the stochastic variability of wind fields suggests that chemical concentrations should be represented by mean and varying components. This difference between reality and model representation may be most important for rapid, diffusion-limited reactions that affect ozone and particulate formation (Stockwell, J. of Meteor. and Atmos. Phys., 57, 159-172, 1995).

Agreed. We hope that the next generation of operational Eulerian models would be able to handle the physical and chemical processes as suggested by Dr. Stockwell. Also, it is important to resolve emissions inventories to the time and space scales of the model.