

## ***Interactive comment on “On the Limit to the Accuracy of Regional-Scale Air Quality Models” by S. Trivikrama Rao et al.***

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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. Atmospheric stochastic variability extends to scales that are well below current Eulerian model resolution. Eulerian models calculate gas-phase

C1

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).

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C2