Atmos. Chem. Phys. Discuss., 11, C8244–C8245, 2011
www.atmos-chem-phys-discuss.net/11/C8244/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effects of model spatial resolution on the interpretation of satellite NO_2 observations" *by* L. C. Valin et al.

Anonymous Referee #3

Received and published: 26 August 2011

This manuscript makes a valuable contribution to understanding the effects of model spatial resolution on the interpretation of satellite NO2 observations. It is an important question to address. I commend the authors for undertaking the investigation. A variety of models are used to examine how NO2 depends on resolution. The manuscript is concisely written which helps to highlight the main points but also leads to many questions. Several major issues need to be addressed prior to consideration for publication.

The title implies a general statement on the relation of resolution and NO2. But the studies are rather specific and idealized. The reader is left wondering whether the conclusions are general. Some of this confusion could be avoided by adding to the title phrases such as "in the southwest US" or "in idealized environments". Or even better, the study could be made more general.

For example, the 1-d and 2-d simulations place a single local source in the domain. The existence of bias is no surprise for this idealized scenario. While this condition might represent some power plants, it begs the question of what happens for other more typical source environments. What happens in the other extreme, when emissions are uniformly distributed over the domain? Or what about a scenario with a random distribution of source locations and magnitudes? What happens if an area source is added or used in place of local sources? What about increasing the layer height from 1km to 2km? Or increasing the initial and boundary concentrations? Investigation of these different scenarios are needed to support the existing statements about the relation of bias with the magnitude and spatial extent of the NO2 source.

How does diurnal variation affect the 1-d and 2-d simulations? For example, suppose the domain concentration was initialized at sunrise after nighttime chemistry and advection. How would the bias be affected?

The WRF-CHEM studies are more realistic, but it is not clear whether the conclusions about necessary resolution are robust. The simulations take place over only a week in July. Is this a typical week? Does time averaging over several weeks affect the result? Is summer the most extreme case, or is the same resolution required in other seasons? How does meteorology (clouds, wind speed, . . .) alter the resolution requirement? Are resolution requirements different for other regions of the world with different characteristics than the southwest US? Is the resolution requirement specific to OMI (afternoon), or would it differ for a morning observation by GOME-2?

Why is 12km accuracy sufficient for Los Angeles, but 4km accuracy needed for the San Joaquin Valley for prediction to 10% accuracy? Does this tell something about the spatial extent of the source? Or is it simply a function of the choice of sub-domain?

Abstract. The first sentence about ozone production should be removed or better supported in the manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 20245, 2011.