Atmos. Chem. Phys. Discuss., 11, C10008–C10011, 2011
www.atmos-chem-phys-discuss.net/11/C10008/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol simulation applying high resolution anthropogenic emissions with the EMAC chemistry-climate model" *by* A. Pozzer et al.

Anonymous Referee #1

Received and published: 10 October 2011

This paper discusses the implementation of a high-resolution emission inventory into a lower resolution model to evaluate the model. This paper is clearly written and has some interesting insight. Although I looked hard, though, I could not find where the authors pointed out new scientific findings or modeling techniques, particularly as other studies have done similar analyses with modest variation. As such, my first suggestion is for the authors to motivate their study better, particularly in light of what has been published to date in the literature with respect to other model studies and other emission inventories by explaining more completely what new information is being presented beyond what is in the literature. My second suggestion is to use the model to show a benefit of using a high-resolution-in time inventory versus an annual-average

inventory in comparison with data, since otherwise, I don't see what the point of stating that a high-resolution emission inventory is used in the title of the paper unless the authors show some benefit from it or actually use the inventory at its resolution. Third, the statistical measures uses are not rigorous, as they are not paired in time and space, so some work would help the paper in that respect.

First, previous papers have evaluated either a global model at relatively high resolution or a global-through-urban nested model at much higher resolution than here, or regional models at higher resolution than here. For example, Lin et al. (2008) ran and evaluated a global model at similar resolution as run here with an emission inventory at the same resolution as their grid. Jacobson (2001) and Jacobson et al. (2007) ran and evaluated a global-through-local nested model at multiple resolutions, including a global domain and several higher-resolution domains where meteorological and chemical variables were nested. They used emission data at the same horizontal resolution as their domains and hourly time resolution. On the regional scale alone, several studies (e.g., Jang et al., 1995; Weisman et al., 1997) have examined the effects of grid resolution on model results.

The authors should discuss their own study in light of these other studies. What are the advantages and disadvantages of each type of model set up? Under what conditions is a 1 degree coarse resolution study more useful than a nested study at higher resolution? The authors should also mention that other regional emission inventories are highly resolved in space and time (e.g., the U.S. EPA National Emission Inventory for one), since otherwise, it appears that the authors believe the emission inventory they use is the most resolved available when, in fact, higher-resolution inventories exist in space and time, but on smaller scales.

A potential advantage here compared with Lin et al. (2008) is that the present study has a higher-resolution emission inventory in space and is monthly in time; however, the inventory here is not taken advantage of, except for the resolution in time, since the model's horizontal resolution here is still over 1 degree in the horizontal. The other

papers cited used higher temporal emissions (hourly) than used here (monthly).

One way the authors can obtain new information from their study is to show that the use of the monthly inventory gives a better result, when compared with data, than the same inventory with the emissions annually-averaged. Otherwise, again, it is difficult to find novelty in the study or to understand what advantage there is to making a major point about using a high-resolution emission inventory in a coarse-resolution model.

Additional comments:

Section 3.1 “In general, the AOD simulated by the model corresponds very well. . .with a difference below 0.07.” I’m not sure how a difference of 0.07 can be categorized as a good comparison when the mean AOD over the globe is on the order of 0.16. The authors need to explain the errors as a percent error not an absolute error and be more cautious about their interpretation.

Section 4. The ratio of wet to dry deposition of BC (79%) is lower than but not too far from that calculated with the physical model of Jacobson (2010) of 92%. Please discuss in more detail how wet and dry deposition are calculated.

Table 2. What emission factors were used in deriving BC from biomass burning, and what was the fuel burn? Also, state what the acronyms DU and SS mean in the footnote. The number of significant digits for both should be limited to 3.

Table 3. The arithmetic mean of the model versus the arithmetic mean of the data, unpaired in time or space, is not so useful. Please provide either the normalized gross error or the root mean square error resulting from the comparisons when they are paired in time and space. In other words, what is the absolute value difference at a given time and location, relative to the measurement, summed and averaged over all times and locations?

Table 6. Please provide either the normalized gross error or the root mean square error of the comparisons among all stations, when the model and data are paired in time.

Figure 1. It would be useful to see the actual model AOD; otherwise, there is no context for the differences.

Figures 5,7,9,11. Scatter plots are not so useful. Please show at least some plots that are paired in space and time as in Jacobson (2001).

References

Jacobson, J. Geophys. Res., 106, 5403-5420, 2001. Jacobson et al., J. Geophys. Res., 112, D24205, doi:10.1029/2007JD008922, 2007. Jacobson, J. Geophys. Res., 115, D14209, doi:10.1029/2009JD013795, 2010. Jang et al., Atmos. Environ, 29, 3101-3114, 1995 Lin et al., Atmos. Environ, 42, 8470-8483, 2008. Weisman et al., Mon. Weather Rev., 125, 527-547, 1997.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 25205, 2011.