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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling natural emissions in the Community Multiscale Air Quality (CMAQ) model – Part 2: Modifications for simulating natural emissions" *by* S. F. Mueller et al.

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General Comments

The authors describe the chemical mechanism modifications in order to simulate the natural background levels of pollutants in the absence of anthropogenic emissions using the natural emissions database they have developed in their companion paper. Although, the new release of CMAQ, version 4.7, includes most of the chlorine mechanisms that the authors modify in their version, the sulfur mechanisms from natural

sources are still lacking. Thus, I find this study useful in terms of introducing the updated sulfur mechanisms in the CMAQ system. However, I would expect a more detailed discussion on how the existence of the anthropogenic emissions could have changed these results since mixing of natural and anthropogenic species lead to a more complex chemistry.

CMAQ 4.6 does not include a dynamic fine-coarse aerosol interaction as it treats the coarse fraction inert. This particularly affects the secondary aerosol formation in the system. As the natural sulfur emissions may have an important impact on SOA formation, I believe the authors should discuss how this drawback may have affected their results.

In Section 4.1, the authors discuss their temporal ozone profile with regards to other literature. Although these literatures present a clear spring maximum in ozone concentrations, I cannot see the same variation in their results. There is a clear decrease in ozone concentrations in May, opposite to the literature they present. The maximum levels appear to be calculated in the winter period. Besides, the authors say that the boundary conditions from the GEOS-CHEM model appear to be the source of a background ozone level that lead to these almost constant ozone concentrations in the first four months. However, I was not able find this conclusion in the available literature. The authors should present a reference backing this hypothesis. Jacob et al. (2005) does not include this information.

Finally, the GEOS-CHEM global simulations for the year 2002 include anthropogenic emissions, as explained in Jacob et al. (2005). So the boundary conditions provided to the CMAQ model includes anthropogenic-originated mass that can elevate the background concentrations, whereas the actual CMAQ simulation does not include anthropogenic emissions. Although the initial concentrations come into equilibrium in the given spin-up period, the elevated boundary levels may introduce continuously elevated air pollutant levels. Thus, the authors should provide a more detailed model configuration on how frequent (daily, weekly, monthly, etc. . .) the boundary conditions

are provided to the CMAQ model and discuss the possible effects of these boundary conditions.

Specific Comments

Section 2.1/Page 4: SMOKE/CMAQ system does not include wind-blown dust emission treatment. Dust emissions can be provided offline to the model and processed through coarse PM and fine other PM emissions, for example.

Section 3.1.5/Page 11: Lucas and Prinn (2005) should be added to the Reference list.

Section 3.1.5/Page 12: The year is missing for the Kukui et al reference.

Section 4.1/Page 22: The year is missing for Morris et al. (2006) in the sentence that starts with "The changes introduced by . . .".

References/Page 34: The year is missing for the Morris et al. (2006) reference

References/Page 32: The year 1975 should be corrected as 1965.

Table 2: The rate constant of the last reaction is reported as 3.0x10-13 at NASA, 1997, please check.

Table 3: The last four reactions are not available in Atkinson et al. (2004), please check.

Figure 1: Please correct the format of the y-axis title.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 15811, 2010.