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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.

Anonymous Referee #2

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This paper presents a second part of a study to be able to simulate ambient air quality concentrations under natural conditions (i.e., in the absence of man-made anthropogenic emissions). The first part of this study addressed the model inputs, whereas this paper presents updates to the CMAQ Version 4.6 (V4.6) chemical mechanisms to simulate natural conditions. The paper is well written and mostly free of typos etc., which have been pointed out previously. Although some of the CMAQ chemistry updates have been implemented in the latest version of CMAQ (V4.7 and V4.71) this does not detract from the work these authors did and there are still other chemistry updates

they implemented not yet implemented in the current version of CMAQ.

The issue of natural ambient concentration conditions is of utmost regulatory importance given USEPA's tightening of ozone and PM2.5 standards so that they are much closer to "background conditions." There are currently discrepancies between the measured and modeled estimates of natural conditions, with the modeled values being much lower than data analysis of measurements. This paper represents scientific advancements in simulation natural conditions using clear and concise scientific methods.

One concern I have is the choice of concentration variables for displaying the results of the different CMAQ simulation scenarios. The average surface concentration across the entire continental U.S. (CONUS) domain is used in many of the displays. This modeled parameter will have a tendency to smooth things out and potentially hide potentially important local changes across scenarios through the averaging process. The spatial maps are a good addition and they display there is a lot of spatial variability across the scenarios. However, in one of their replies the authors allude to a Part 3 paper on the study that focuses on the results for which more sub-regional analysis would be useful and enlightening.

One technical issue that should be addressed is the authors' explanation about the source of the higher spring time ozone concentrations on page 29 (Section 4.1). The authors explain the higher spring time ozone is due to more transport across the Pacific of ozone of Asia origin. Although it is true that the transport systems conducive for transporting pollutants across the Pacific Ocean from Asia to North America are fairly optimal in the spring, that may be only part of the issue. Version 4.6 of CMAQ used by the authors has a known excessive vertical velocity problem that has been known to bring down high ozone concentrations in the top layers of the model to the ground over the very highest terrain features. During the spring, the tropopause lowers resulting in the GEOS-Chem model bringing high ozone of stratospheric origin into the ozone boundary conditions (BCs) in the top layer of CMAQ that in turn can be advected into the domain and then brought down to the ground over high terrain due to the excessive

vertical velocity issue. This issue has been fixed in CMAQ V4.71 released in June 2010. (http://www.cmascenter.org/conference/2009/slides/young_mass_consistency_2009.pdf)

In summary, the paper is policy relevant and advances the science toward simulating natural conditions and is worthy of publication.

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