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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Investigation of effects of varying model inputs on mercury deposition estimates in the Southwest US" *by* T. Myers et al.

Anonymous Referee #1

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This study focuses on the impact of boundary conditions and meteorology on mercury deposition in the SW US within the CMAQ regional model. Several papers have been published on the issue of boundary/initial conditions for regional Hg models (Bullock et al., 2008, 2009; Pongprueska et al., 2008) and this study appears to provide only incremental new information on the topic. In particular the authors focus on the use of different vertical resolution in the regional model and on the impact of high altitude boundary. The most interesting aspect of this study is the large influence of the top boundary condition on surface deposition.

Major comments

- The authors discuss how different assumptions affect the calculated deposition, however they do not discuss how the resulting simulations compare to observations. In

particular they show MDN wet deposition observations in several figures, but fail to discuss them.

- I am not quite sure what is the value of adjusting the GEOS-Chem boundary conditions (section 3.2). The authors (and previous studies) have already established that the speciation of Hg at the boundaries influences wet/dry deposition. It seems obvious that changing the partitioning of Hg speciation in GEOS-Chem would affect deposition. I suggest eliminating section 3.2.

- Now that CMAQ exists on a hemispheric scale it seems that the exercise of using different global models for boundary/initial conditions for the regional CMAQ model is not very useful. Using the hemispheric CMAQ model directly would yield more self-consistent results in terms of having the same meteorology, chemistry, deposition schemes for both domains. The authors need to justify the value of using GEOS-Chem and GRAHM instead of CMAQ-hemispheric for boundary conditions.

- Section 4 (page 10281). It is not surprising that different meteorology would yield different results. The authors simply note interannual variability. What would be more valuable is an analysis of why dry deposition is significantly larger with July 2005 meteorology compared to July 2001. Does it have to do with temperature? Vertical transport? Horizontal transport? etc...

Minor comments

-Page 10275. The authors discuss removing the Hg-NO3 pathway at length, but they don't really mention what are the main Hg oxidation/reduction reactions in the CMAQ model version that they use. Please correct that omission.

-Table 1. It would be useful to include the approximate altitude or pressure-altitude in this table.

Bullock Jr., O., Atkinson, D., Braverman, T., Civerolo, K., Dastoor, A., Davignon, D., Ku, J., Lohman, K., Myers, T., Park, R., Seigneur, C., Selin, N., Sistla, G., and Vija-

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Bullock, O.R., Jr., D. Atkinson, T. Braverman, K. Civerolo, A. Dastoor, D. Davignon, J-.Y. Ku, K. Lohman, T.C. Myers, R.J. Park, C. Seigneur, N.E. Selin, G. Sistla, K. Vijayaraghavan, 2009: An Analysis of Simulated Wet Deposition of Mercury from the North American Mercury Model Intercomparison Study (NAMMIS). J. of Geophys. Res., 114, D08301, doi:10.1029/2008JD011224.

Pongprueksa, P., Lin, C. J., Lindberg, S. E., Jang, C., Braverman, T., Bullock, O. R., Ho, T. C., and Chu, H. W.: Scientific uncertainties in atmospheric mercury models III: Boundary and initial conditions, model grid resolution, and Hg(II) reduction mechanism, Atmos. Environ., 42, 1828–1845, 2008.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 10273, 2012.