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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simulation of atmospheric mercury depletion events (AMDEs) during polar springtime using the MECCA box model" *by* Z.-Q. Xie et al.

Anonymous Referee #2

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The discovery of so-called Atmospheric Mercury Depletion Events (AMDEs) with unexpectedly low concentrations of gaseous elemental mercury concentrations in the lower Arctic troposphere had significant influence on global mercury research and monitoring activities related to mercury cycling in Polar regions. This work describes a very interesting set of modelling results giving new insights in the chemistry that may lead to the fast oxidation of elemental mercury to less volatile species. A well-established box model (MECCA) has been applied to simulate mercury species both in the gas- and aqueous phase, including the bromine chemistry. This is a new and very interesting approach. The authors have examined model capabilities to reproduce experimentally observed concentrations during AMDEs. Although the overall quality of the work

is beyond doubt and it definitely deserves publication, a few major points should be considered by the authors when preparing a revised version.

I completely agree with the points made by anonymous referee #1 concerning the aspects related to reaction kinetics and support these questions and recommendations.

Furthermore, a few points should be considered: - it is well established that AMDEs are an annually recurring polar spring-time phenomenon that result in a deposition flux. However, whether the result is a net-deposition is still not clear: furthermore, recent research work shows that there is good scientific evidence that this may be doubted. This has been ignored by the authors and should be included in a revised version (see special issue /research front with a number of papers related to this question in Environmental Chemistry, Vol. 5, 2008, doi:10.1071/ENxxxx) - in the abstract and in the text body the authors use the term ?destruction of Hg?, which is not correct, since Hg is an element. Ozone can be destroyed, Hg(0) can be converted, oxidized or so - in the Introduction the authors cite work done in Antarctica. Sprovieri et al. (2002) and Temme et al. (2003) present speciation data from Terra Nova Bay and Neumayer in Antarctic summer, consequently outside the AMDE period. This should be stated more clearly. - the acronym MECCA should be spelled out when it occurs for the first time (3rd para of introduction) - reference to the work by Sander et al. (2006) ?to study the role of carbonate precipitation ?? occurs twice in the intro and in the model descripition with the same wording. - since dry deposition was ?switched off? in the model, possible implications of this assumption should be discussed more detailed (see Calvert and Lindberg and others) - Ebinghaus et al. (2002) present a cross-correlation of Ozone and GEM losses with a time lag of 15 min. This should be corrected in section 3.2, 5th para. - Fig. 1: The authors use the term ?RGM? and identify a number of Hg-species that could be summarized as such. However, RGM is only operationally defined and one should avoid the impression that we really know what RGM is, in terms of speciation. What the authors say is not wrong, but the implied accuracy of the statement is misleading.

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Interactive Comment

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 13197, 2008.

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