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Interactive comment on "ECHMERIT V1.0 – a new global fully coupled mercury-chemistry and transport model" *by* G. Jung et al.

Anonymous Referee #2

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General comments:

This paper presents a newly developed chemical transport model for simulation of the mercury atmospheric transport on a global scale. A particular feature of the model is a full on-line coupling of the general atmospheric circulation, the photo-oxidation chemistry and the mercury atmospheric chemistry within the single modeling system. The advantage of this approach is complete consistency between different physical and chemical processes governing mercury fate in the atmosphere which should reduce uncertainties of the modeling results. First results of the model testing are presented in the paper along with some evaluation of the model performance against observations. The paper is completely relevant for publication in the journal. It is well structured and contains novel ideas for the mercury atmospheric modeling. Therefore, I recommend

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it for publication after some minor revisions discussed below.

Specific comments:

(1)In the paper an extensive discussion is focused not only on the mercury simulation itself but also on simulation of ozone as one of the major reactants responsible for the mercury oxidation in the atmosphere. However, there is almost nothing about other reactants, first of all, about OH which is also included in the model chemical scheme and could be as important for mercury oxidation as ozone. Some characterizing of OH levels and distribution is also required, in particular, for the interpretation of the modeling results.

(2)The simulated air concentrations of total gaseous Hg (TGM) are evaluated against observations. However, it is not enough evaluation of the model performance. In particular, the evaluation of deposition fluxes are also required. It is important since the same levels of TGM can be obtained with different combinations of emissions and the removal parameters. The balance between emission and deposition could be partly evaluated in comparison with measured wet deposition fluxes. The extensive databases of the wet deposition observations are available for North America (NADP/MDN network) and Europe (EMEP network). However, the complete evaluation of the balance requires measurements of dry deposition which are not available so far.

(3)In the Conclusions it is stated that "... modelling uncertainties due to interpolation of meteorological input variables on the CTM model grid and also uncertainties due to the lack of representation of high-frequency meteorology features are reduced." (p. 412, lines 5-7). Since there is no any qualitative or quantitative evaluation of this uncertainty reduction, this conclusion does not follow from the paper. I would suggest to reformulate it in a way that the model is aimed at the reduction of these uncertainties. Nevertheless, this aspect is very interesting for the research and could be addressed by the authors in future.

(4)At p. 389, lines 3-5, it is mentioned that the strong increase of mercury concen-

GMDD

2, C110–C112, 2009

trations can be observed in Europe from 2003 to 2005 which could be caused by the emission growth in Asia. I think that the 3-years period is not a statistically significant period for conclusions on the increasing trend. In particular, the changes could result from the inter-annual variability of meteorological parameters.

(5)At p. 409 lines 20-21, it is noted that "... before wet deposition of mercury species can be evaluated it is reasonable to evaluate model performance with respect to precipitation. " There is no any evaluation of the simulated precipitation in the paper, except for the Figure 13 which is not accompanied by any discussion.

(6)At p. 403, line 11, it is stated that "ECHAM5 is a spectral transform model". Should it be "ECHAM5 is a spectral transport model"?

Interactive comment on Geosci. Model Dev. Discuss., 2, 385, 2009.