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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Worldwide trend of atmospheric mercury since 1995" *by* F. Slemr et al.

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We thank both referees for thoughtful comments. Both of them propose additional hypotheses to explain the observed trend such as changes in the ocean-air exchange. We have revised the text accordingly and added a few paragraphs and a number of references to the final version of the paper.

Referee #1 encourages us to make the data available on which the paper is based. The data from Cape Point, Mace Head and most of the ship cruises will become available in the data bank of the European project "Global Mercury Observation System (GMOS)" (www.gmos.eu) which started on November 1, 2010.

Response to anonymous referee #1

The text has been revised according to the suggestions of the referee.

P 2357, line 17: Baseline data are frequently selected to calculate the trends, i.e. data not influenced by transport from nearby emissions. No such selection was made in the paper by Slemr et al. (2008).

P 2357, line 22-23: The text has been revised.

P 2360, section 2.2: The requested information has been added.

P 2363: The conclusions by Slemr et al. (2003) on the worldwide mercury trend between 1977 and 2002 have been criticized as inconclusive (Lindberg et al., 2003). Based on ship cruise measurements in 1977-1980 and 1990-2000 and on measurements at Cape Point and stations in Europe and North America we claimed in Slemr et al. (2003) that mercury concentration in air a) increased between 1977 and 1990, b) decreased from 1990 to 1996 and c) then remained afterwards approximately constant until 2002. The conclusion c) has to be revised as the data presented here show a further decrease since 1995 albeit with a smaller rate between 1995 and 2002. We believe that our conclusions a) and b) are correct on the basis of the data presented by Slemr et al. (2003). Lindberg et al. (2007) added a substantially smaller data set from southern Pacific Ocean measured between 1980 and 1990 to argue that there was no trend between 1980 and 1990. To our opinion the comparison of Atlantic and Pacific data in Lindberg et al. (2007) does not take into account the existence of longitudinal and latitudinal gradients as well as of seasonal variations. In addition, the techniques for measurements shown in Fig. 2a of Lindberg et al. (2003) have not been intercompared. Based on the homogeneity of our data we do not see any reason to revise our conclusions a) and b). In the light of the trends described in this paper it seems unlikely that the atmospheric mercury concentrations remained constant between 1977 and 1996. The text has been revised without mentioning the old and so far unresolved discussion in Lindberg et al. (2007).

P 2364: We refrained from the NH/SH box modeling because it needs emissions as a major input. With the largely unknown chemistry and current uncertainties in the

emission from oceans and soils not much clarification can be expected.

P 2365: We refrained from extending the discussion of the “unprecendented” trend and modified the text accordingly. In fact several trends of a similar or even larger magnitude have been reported for halocarbons whose emissions are controlled by Montreal Protocol.

P 2366-7: The text has been revised by adding a paragraph about ocean-air exchange and a few relevant references. As mentioned above we are skeptical about the revealing capabilities of NH/SH box model. An additional problem is the inhomogeneity of the northern hemisphere: which trend is representative – that of Mace Head or that of ship cruises?

Response to anonymous referee #2

As mentioned above, a paragraph and a few references have been added on the hypothesis of changing see-air exchange.

Undersampling by manual technique at Cape Point is now discussed in terms of 95% median confidence intervals. These are larger than the confidence intervals for automated measurements but much smaller than the observed trends.

Seasonal dependence of the downward trend: The seasonal dependence of the downward trend at Mace Head was investigated by Ebinghaus et al. (2011) in Fig. 4 and they found that the downward trend in winter was generally larger than in summer. This would suggest, in the first approximation, a decrease of emission e.g. from residential heating. But it is difficult to interpret this finding as long as the oxidation processes are not well known. E.g. the mercury depletion events at Cape Point (Brunke et al., 2010) occurred most frequently in austral winter. We refrained from the same analysis for Cape Point measurements because of the small number of manual measurements when disaggregated according to season.

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