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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Two new sources of reactive gaseous mercury in the free troposphere" *by* H. Timonen et al.

Anonymous Referee #3

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This study identified the possible sources of the air masses during high RGM episodes at MBO. I agree with the other two reviewers that the authors should stick to this point and avoid sweeping, unfounded, sometimes false, statements. The title is misleading. Previous studies from these authors' group suggested that the upper troposphere, Asia and MBL could be the source regions of the air masses arriving at MBO. What this paper did was quantify Hg levels in two of those three air mass types, which were not looked into in their previous work. It can be a valid study if the authors come up with a more appropriate title and rewrite the paper focusing on the science. However, not in the least the findings from this study would change "our conceptual understanding of the formation and distribution of oxidized Hg in the global atmosphere".

Oxidation processes are known to take place in anthropogenic plumes and marine air

masses, and GEM oxidation has been observed to occur in marine air masses (e.g., Obrist et al., 2010, Nature Geosci.). Given the right oxidants, why should not GEM oxidation occur in anthropogenic plumes? I think the value of their study is to provide quantitative information of such oxidation processes in the two air mass types. An important question is whether and how the potential oxidation mechanisms would be different in the Asian plumes and marine air. Yet the authors' box model deployed the same Br-initiated reactions and the reaction of HgBr+OH. I suppose the different levels of Br, OH were used to represent different air masses. But can they really serve the purpose? In addition, what does their box model include? Only those four gas-phase reactions, no equilibrium and aqueous phase reactions? Didn't they speculate that surface and heterogeneous reactions might have played major roles in the observed high RGM levels? In my opinion, this kind of exercise cannot really add much at all.

One more problem is the reaction rate constants of Hg+Br –> HgBr and HgBr –> Hg + Br used in the box model, which were from Goodsite et al. (2004). The authors should have used the constants from Goodsite et al. (2012, ES&T). By using the updated constants, the lifetime of GEM against oxidation by Br forming HgBr2 would be increased from 35-60 h to 61-257 h.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 29203, 2012.