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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Overview of receptor-based source apportionment studies for speciated atmospheric mercury" *by* I. Cheng et al.

**Anonymous Referee #1**

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Receptor models have been used to trace sources, long-range transport and atmospheric processes of atmospheric speciated Hg in many previous studies. This review present a comprehensive synthesis of the previous studies. In this review, the principles, mathematical model, advantages, disadvantages and achievements were introduced. I think this review could help to better use the receptor models in future studies. It is recommend that this paper should be published in ACP in a final version. I have no major questions on the manuscript. There are several minor points should be considered before final publication.

1. Line 266-267: I am not very clear about the conclusion on the effect of larger nij on the lower PSCF values near the receptor. I think this should be depending on the threshold, source regions and trailing effect. PSCF values generally indicate the rel-



ative contributions of source regions, and larger threshold would likely generate lower PSCF values at most of the potential source regions. If the areas close to receptor were located downwind the major source regions, I think larger nij may overestimate the PSCF values for nearby areas. 2. Line 419-426: I think the authors may discuss the uncertainties related to contribution of the Hg-O3 photochemistry to receptor measurements. It is currently unclear whether O3 is the major oxidant in the transformation of Hg in continental boundary layer. I doubt that many of the good correlations between O3 and GEM and GOM may be partially attributed to the co-occurrence of photochemistry processes of O3 and GOM. It is also possible that other oxidants or processes may contribute to the transformation of GEM to GOM. 3. Section 3.1.2: the authors should also discuss other photochemical processes involved in the atmospheric Hg transformation. For example, Timonen et al. (2013) and other previous literatures identified a new sources of GOM in the free troposphere and boundary layer over ocean. This type of GOM events showed a anti-correlation between GOM and O3, indicating halogens chemistry plays an important role. Also, Fain et al. (2009) did not observed clear correlation between GOM and O3 during high GOM events in the free troposphere. These findings may suggest many oxidants may play a combined effect. I think the Hg-O3 chemistry may not well explain the speciated Hg at high-altitude sites. 4. Section 3.1.2: I suggest the author may provide the TGM/CO ratio, and it may be an important components associated with forest fire smoke. The TGM/CO ratios of forest fire were found to be significantly different from air flows from anthropogenic air plume and could be used in PCA anlysis. Also, for ratios of TGM/CO, TGM/CO, TGM/CH4, etc were also different from different regions. Can these components be used in PCA models? 5. Section 3.3; I suggest that the authors may discuss the what kind of receptors are suitable for using of PSCF and CWT models. In my opinion, the PSCF model is aimed to study the long-range transport. Therefore, the models may not work well at receptors with strong local impact. In addition, clear spatial distributions of anthropogenic emissions is also important for accurate simulations.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 5493, 2015.