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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Atmospheric mercury in the southern hemisphere – Part 1: Trend and inter-annual variations of atmospheric mercury at Cape Point, South Africa, in 2007–2017, and on Amsterdam Island in 2012–2017" *by* Franz Slemr et al.

Anonymous Referee #2

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This study presents the long-term trend of atmospheric Hg at two monitoring sites in the Southern Hemisphere and explains the factors related to the trends. To my knowledge, this is an unique study monitoring the long-term trend of atmospheric Hg in the Southern Hemisphere. The finding of this study that the continuous increasing trend of atmospheric Hg concentrations in the Southern Hemisphere has been reversed (or weakened) since 2012-2014 is exciting to me. This is in contrast with some recent global bottom-up emission inventories that showed increasing anthropogenic Hg emis-

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sions during 2010-2015, suggesting that the measures taken during implementation of Minamata Convention may have reduce the anthropogenic emissions in recent years. Therefore, this study is valuable to atmospheric research communities and government. This paper is well organized and easily to be read. I have several comments that I wish could be addressed by the authors before the final publication of this paper. 1. line 34-37: this seems to be confusing. I would suggest the authors to separate these two periods throughout the manuscript because the trends during these two period is quite different. As mentioned by the authors, the increasing trend was only observed between 2007 and 2014, and a declaration of an upward trend to 2017, to me, is at least not precise. If we look at the median (or mean) between 2007-2008 and 2016-2017, there is no clear increase of Hg concentrations. 2. line 57-59: the study by Zhang et al., 2016 simulated the trend between 1990 and 2010 and compared them with field observations, that is not study related to the trend in last ten years. Also, I did not see any remarks from this study that anthropogenic Hg emissions is decreasing. 3. line 77-82: I would suggest to add Figure 1 to show the locations of the sampling sites. In some of following sections, the authors discussed the effect of atmospheric transport patterns on seasonal Hg trend. It will be excellent that the authors could provide the major air mass origins in wet and dry seasons. 4. Line 133-144: From Figure 1, I see the seasonal variation in Hg at CPT (although not statistical significant) is opposite to that at AMS, with Hg peak in austral summer at CPT and in austral winter at AMS. I think the authors have not provide clear explanations for this. The contrast seasonal pattern indicate that the atmospheric transformation, foliar uptake, or oceanic emissions might play an unimportant role here. The authors suggest that the frequent biomass burning in southern African and prevailing transport in austral winter may explain the seasonal trend at AMS. My question is why the enhanced biomass burning activities in southern African did not cause an increase of Hg in austral winter at CPT? which is located more close to southern African continent. Is the air mass transport from southern African to CPT less in austral winter than summer? 5. line 182-183: here the authors should indicate the sources of GEM. Are the sources related to oceanic emissions or

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long range transport from other countries or continents. This should be clarified here. 6. line 200-201: here the author declare no clear GEM trend in 2012-2017. But in many other sections the authors also say a slightly downward trend. I think the authors should provide a consistent conclusion for the trend during this period. 7. line 277-279: it is very interesting that the authors explore the relationship between GEM trend and climate change (e.g., ENSO). But I am wondering that how would the climate would effect the long-term trend of Hg. Will the occurrence of ENSO decrease or increase the natural Hg emissions from continents or oceans? I think it is better to provide a further discussion for this. Table 1-3: I think it is better to add the trend in percentile (the authors only provide absolute concentration trend) to these tables. This is because we can not read whether the trend is strong or not based on concentrations. For example, does the annual increase of 0.05 mBq m-3 yr-1 of median Rn concentrations indicate a strong increase for Rn concentrations? Figure 2: I would suggest the authors add a figure to show the means of Hg. the authors used the means many time throughout the paper.

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