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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characteristics of atmospheric mercury in East China: implication on sources and formation of mercury species over a regional transport intersection zone" *by* Xiaofei Qin et al.

Anonymous Referee #1

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This manuscript presents a year of continuous measurements of atmospheric Hg species at a suburban site in eastern China, which is an important anthropogenic Hg source region in China. This study combines the analysis of speciated Hg concentrations, local meteorology, receptor-based modelling, PMF and specific event, showing the sources and transformations of atmospheric Hg.

Major comments:

The authors discussed the impact of local emissions and long-range transport of Hg

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Discussion paper

on observed atmospheric Hg. The analysis, however, do not generate a conclusion that which of these two processes were the dominant sources of the observations, and some of the conclusions from the analysis are contradictory to each other at times. The analysis of using PSCF model neglect the local meteorology. For example, when there is a shallow boundary layer formed at the sampling site, an analysis of long-range transport could be not suitable because local to regional are more important in this case.

This manuscript seems not have a clear motivating hypothesis. The authors made a brief introduction of Hg emissions in East Asia, but have not summarized the findings of many previous studies conducted in this region or in East Asia. They also have not addressed the scientific gaps existing after many previous studies in this region. Therefor, it is not clear to what extent that this study could contribute to the science.

The descriptions of the materials and methods section are not clear. The collection of GOM and PBM at 2-hour interval indicates a GOM or PBM concentration could be obtained every 3 hours (1 hour thermal desorption and detection is needed after collection). This does not match the backward trajectories simulated every two hours. The operations of the speciated Tekran system did not followed the standard method very well. For example, a replacement of filter at a monthly interval is too longer under heavily PM pollution conditions. The calculation of backward trajectory is not clear. What is the arrival height used for the calculation of backward trajectories? What is the threshold concentrations of speciated atmospheric Hg and the reasons of the selection of the thresholds.

Specific comments:

Line 26-27: a conclusion of impact of the long-range transport and local emissions on observations is meaningless. All observations could be impacted by local and long-range sources. Line 46 and 48: the citations of references are not correct. Please check the similar errors throughout the manuscript. Line 53: as for the anthropogenic

mercury? Line 71-72: are you sure that atmospheric transformations such as redox reactions could not impact atmospheric GEM. There are many evidence that transformations including oxidation of GEM and foliar uptake of GEM could significantly affect GEM observations. Line 75-85: a detailed introduction of previous studies in eastern China should be added here. You should also introduce the progress of atmospheric Hg observations and point out the remaining questions regarding sources and transformation in this region. Section 2.1: the authors declare that there is no large point sources within 20 km of the sampling site. This seems not correct. From the Chinese inventory and global inventory, I can calculate the total GEM emission reaches more than 10 tons with in $0.4^{\circ} \times 04^{\circ}$ grid of the site (corresponding to a 20 Km cycle around the site). For such a strong local emission, is it suitable to use PSCF modelling to study the long-range transport. How could you separate the local emissions from long-range transport signals? Section 2.4: you should show the arrival heights of the backward trajectories and the threshold concentrations. Line 193: standard errors o the means should be also presented here. You should also define the characteristic of the site. Is it a remote site or suburban site? I would prefer a suburban characteristic of the sampling site. Then, comparisons between previous observations in urban, suburban and remote areas are meaningful. Line 210: a description of elevated Hg concentrations in both cold and warm seasons is confusing. What is the statistical test for the seasonal variations? Line 214-216: here references are needed. Line 224-225: does a highest GOM concentration observed in winter support the effect of atmospheric oxidation at the sampling site. Generally, modeling studies argued that the oxidation rate of GEM should be highest in summer. Also, GOM observed peaked in morning (10:00), similar to GEM. This is in contrast with many previous studies that showed highest concentrations at noon, which could support a strong transformation between GEM and GOM. Line 241: are there any previous studies showed the diurnal patterns of anthropogenic emissions. The difference in Hg concentrations between daytime and night needs a statistical test. Line 257-258: PBM showed the highest in southwest, west and northwest winds, this is not consistent with the PSCF result. Please explain. Line 272: a

description of PBL should be presented before the abbreviation. What methods did you use to determine the PBL? It is also appropriate to separate the shallow PBL from the PSCF analysis. Line 300-301: I do not agree East China Sea is an important source region of the site given the PSCF values ranging from 0.2 to 0.4. There are also studies of atmospheric Hg in East China Sea, which highlighted that outflows of Hg from mainland China drive the increase of Hg concentrations. Line 314-315: what I see from Figure 7 is that GOM and GEM share the similar source regions, and what is different is that of PBM. Line 355-356: relative fraction of wind in south, southwest and west wind directions are similar in the four GOM/PBM groups, and why? Long-rang transport sources are also located in these directions. Line 359-382: low GEM concentrations were mostly related to high CO and SNA concentrations. Does this support that local-regional emissions are more important? This is contradictory to low GOM/PBM ratios, which indicates a progress of long-range transport. Section 3.3.3: why did not apportion the major sources of PBM and GOM? Line 401-406: factor 2 could be mostly related to oil combustion in motor vehicle in urban areas and shipping emissions over the Dianshan Lake. Section 3.4.1: I do not agree variations of GEM and GOM concentration can support a strong conversion of GEM to GOM. Did you observe a strong negative correlation between GEM and GOM concentrations? Line 452-469: Figure 12 is meaningless. Anyone could expect a similar trend between GOM concentrations and GOM/PBM ratios.

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