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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Atmospheric mercury concentration and chemical speciation at a rural site in Beijing, China: implication of mercury emission sources" *by* L. Zhang et al.

Anonymous Referee #2

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This study measured the speciated mercury concentrations in the atmosphere for an entire year at a rural site in Beijing, China. The authors found that this site was highly affected by anthropogenic emissions. The authors also evaluated the seasonal cycle and diurnal cycles of different mercury species at this site. They compared the mercury concentrations with CO, O3, and PM2.5, which further releases source information of mercury. Meanwhile, the authors also employed back-trajectory analysis to explore the source region of mercury over this site.

The paper was clearly written and the results were well discussed with proper details and depth. Clearly, this paper deserves to be published on this journal. However,

the authors still need to address the following points before it's accepted for formal publication. One general comment regarding this paper is that the authors need a better discussion and explanation for the seasonal variation of Hg concentrations. At this site, the highest seasonal average GEM concentration occurs in summer, while the lowest value occurs in winter. This is actually the opposite of those of the observations over other sites in the North Hemisphere. A summer minimum is often reported at these sites because of the stronger oxidation and subsequently deposition loss during summertime (e.g. Holmes et al., 2010; Lan et al., 2012; Song and Selin, 2013). Why did Miyun site show a totally different seasonal cycle? Meanwhile, the discussion for the diurnal cycle of speciated mercury concentrations in section 3.3 is also a little bit too superficial and lack of quantitative information.

Line 104-108: I suggest show the boundaries for your definition of "regional" and "inter-regional" source regions in Fig. 1. This is helpful for people not familiar with the names of the mentioned provinces.

Line 161-164: The weighting function defined in equation (2) actually punishes grid points with small nij values. Can you provide more explanation and/or reason to do this? Probably a couple of references would be helpful. It was not clearly stated in the current manuscript.

Line 167: Does it really make sense to divide your domain into 0.5 degree x 0.5 degree grids even if you are using 1 x 1 degree meteorological data?

Line 182-183: Only existing literatures for observations conducted in China are tabulated in Table 2. This point was clear in the table but not here.

Line 197: To my knowledge, the API is decided by the concentration of pollutant which has the severe pollution compared with their own thresholds. I guess PM could be the dominant pollutants in these events. Can you clarify it about this point?

Line 212: Can you explain why the RGM concentration in summer is lower than in fall?

Isn't the summer season has the strongest photochemical productions?

Line 226: Can you observe inverse correlation relationship between GEM and RGM in these hours, as suggested by Timonen et al., 2012? The peak of RGM occurs in the afternoon; however, the GEM is the lowest in the morning, e.g. 8:00-10:00 AM in fall. Is this against your conclusion that GEM is oxidized to RGM?

Line 227-228: I don't get this point. How is pollution episode associated with higher RGM concentrations? Is there any casual effect between them?

Line 293-299: The discussion regarding the intercept of the trend line is very interesting, because previous studies were more focused on the slopes.

Section 4.3: Have you investigated the relationship between PBM/PM2.5 ratio and temperature and RGM concentrations? Do they comply with the relationship observed by Rutter and Schauer 2007?

Fig. 3: I suggest draw monthly values, instead of "seasonal" ones. So you don't bother to define the different seasons. The reader can also get more information from your plots.

References:

Holmes, C. D., D. J. Jacob, E. S. Corbitt, J. Mao, X. Yang, R. Talbot, and F. Slemr (2010), Global atmospheric model for mercury including oxidation by bromine atoms, Atmospheric Chemistry and Physics, 10(24), 12037-12057.

Lan, X., R. Talbot, M. Castro, K. Perry, and W. Luke (2012), Seasonal and diurnal variations of atmospheric mercury across the US determined from AMNet monitoring data, Atmospheric Chemistry and Physics, 12(21), 10569-10582.

Song, S., and N. E. Selin (2013), Quantifying uncertainties of the global mercury cycle using the GEOS-Chem model and observations, The 6th International GEOS-Chem Meeting, May 2013, Cambridge MA,

http://www.fas.harvard.edu/∼geoschem/Tuesday/TueB_HgPOP_song_shaojie_1_pc.pptx

Timonen, H., J. L. Ambrose, and D. A. Jaffe (2012), Two new sources of reactive gaseous mercury in the free troposphere, Atmospheric Chemistry and Physics Discussions, 12(11), 29203-29233.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 12177, 2013.