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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Air–surface exchange of Hg^0 measured by collocated micrometeorological and enclosure methods – Part 1: Data comparability and method characteristics" *by* W. Zhu et al.

Anonymous Referee #1

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Review comments for Atmos. Chem. Phys. Discuss. 14, 22273-22319, 2014 Doi: 10.5194/acpd-14-22273-2014 Title: Air-Surface Exchange of Hg0 Measured by Collocated Micrometeorological and Enclosure Methods – Part I: Data Comparability and Method Characteristics

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Comments:

The authors present the results from co-location measurements of Hg surface emissions using multiple methods, including dynamic flux chambers and micrometeorological methods. These methods have been widely applied to understand Hg emission from surfaces; however, there are some disagreements to inter-compare the data measured using these methods. This information is useful and will help Hg scientists to understand Hg emissions from surfaces based on previous measurements. I suggest to publish this paper on Atmos. Chem. Phys. after a major revision.

Overall comments:

The solar radiation was measured at 3-m height; we all know solar radiation (here I am referring to UV light, especially for UV-B) is a critical factor for Hg emission from soil, and penetration of solar radiation under flux chamber is not 100%. For thick poly-carbonate chamber, the UV penetration could be down to 30%. Do you think the solar radiation measured at 3-m height can represent the UV light intensity in the chamber? Different DFCs were made by different materials, quartz (I guess this should the thick one) and poly-carbonate film. I understand it might be complicated, is it possible for the authors to include discussions related to this question, and to report the penetration of UV-B under DFCs cover?

Specific comments: The authors used many abbreviations in the manuscript, could the authors add an overall table to make this clear?

Page 22275, line 4, "Mercury(Hg)……" a reference is needed

Page 22276, line 3, suggest to use other word instead of "realized".

Page 22277, line 4, correct "per se"

Page 22278, line 20, friction velocity, does this mean the atmospheric boundary layer u* or the u* in the NDFC?

Page 22279, line 3, "whole-air type" what does this mean?

Page 22282, line 3, “DOY” spell out, is this day of year?

Line 2-11, can the authors make a clear table to include all the information?

Line 21, why is the flow rate 0.75 Lpm? The 2537 cycle here is 5-mins, why not use 2.5 mins to obtain higher resolution data than 5 mins?

Page 22283, line 6-10, could the authors add some details for the operation of synchronized DFCs? If I understand this correctly, one 2537 was used to measure Hg concentration in following processes: 1. inlet of TDFC for 5 mins (2.5-min cycle) 2. outlet of TDFC for 5 mins. 3. inlet of NDFC for 5 mins. 4. inlet of NDFC for 5 mins.

Line 26-27, did the authors measure Hg concentrations at same location to determine system blank for MM methods?

Page 22284, line 15-17, what parameters were used in this study?

Line 20, “°C” for temperature?

Page 22285, line 26, I understand this might need additional work; however, conditional probability function (CPF) can better present the data than Hg concentration wind rose. This is just a suggestion.

Page 22286, line10-11 and 14-15, these two sentences are similar please rephrase.

Line 16, the temporal variation of what?

Line 16-17, please re-write, it is difficult to follow.

Line 24, what the IQR is? Please spell out.

Page 22288 line 1, was, however, 3.5 times higher than that “measured” by TDFC.

Here, I have some questions in series. What are the penetration of UV-B through thick quartz chamber and thin polycarbonate film? If the numbers are different, how did the authors compare the data measured by these two different chambers? Is there any way to correct this influence? Can this help to explain that NDFC measured higher flux

than the number measured by TDFC?

Line 10, how did the authors normalize the data?

Line 13, what does “marker’s color” mean? I understand the authors present the data in another paper; however, could the authors briefly discuss the uncertainties in this paper?

Line 21, is this real “observed flux” or estimated flux?

Page 22289, line 5-7, based on the figures, the Hg emission wasn’t enhanced when the precipitation occurred? This is different from previous Hg emission measurements; most studies have reported Hg emission was enhanced when water was applied, any thoughts?

Line 18, what does the sampling mean here? Sampling method? Sampler?

Line 20-27, just a comment, sources and sinks of Hg from surfaces are related to surface types, surface conditions, Hg soil content, and the environmental conditions.

Page 22290, line 23-26, could the authors please explain this in more detail?

Page 22291, line 25, areal?

Page 22294, line 25-27, the reason of a good correlation for integrated flux over time is the way the integrated flux was calculated. The integrated flux at time t was calculated as the flux from t-1 to t adding to the integrated flux at t-1, therefore, both integrated fluxes (MBR and NDFC) are showing increasing trend. This might not be a good way to present the data, the better way to explain the data is to use longer time average (eg. daily, or every three hours)

Page 22295 line 1-2, I am wondering is this possible due to the UV-B influence. Look at Hg0 concentrations in detail, we can find this surface was functioned as a sink rather than source from 20:00-8:00. I am wondering is that possible the daytime emission was from night deposited? And At 10:00 am, the natural soil surface received enough

solar radiation, and showed a peak at 11:00 am then Hg emission started to decrease after that due to lack of available Hg. However, because the penetration of UV-B under chambers was not high enough till 2:00 pm, it peaked at 2:00 pm. I know it is complicated, just some ideas.

Line 15-18, the authors should read Choi and Holsen, 2009 Environ Pollution, page 1673-1678.

Page 22296, there is a problem from their PCA results, in Table 3, some factors are only explained by one variable. For example, factor 4 IC#2, this factor is only correlated to REA flux, this cannot help explain the data. People usually selected the factor number once the eigenvalue reaches to 0.9-1, and there is no factor explained by a single variable. It depends on the situation, to reduce the number of factor might not influence the meaning of factors; however, in some cases, in-properly using PCA might mislead the results. I suggest to redo the PCA or move all PCA to SI not emphases in this section.

Table 3, how many data points were used to run PCA?

Figure 1, this figure is busy, and the resolution is low, could the authors provide a high resolution one. It is a very good figure, but cannot be read very well.

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