**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Bimodal variation in mercury wet deposition to the coastal zone of the southern Baltic" *by* P. Siudek et al.

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Thank you for valuable comments.

1. Introduction is too long and not focused enough on wet deposition. The introduction has been shortened.

2. 22781 L3. It's not clear how the labile form was determined, physically what it means, or why this approach is useful. Assuming equilibrium with Hg0 what percent of the Hg in the rain was due to Hg0 (likely very little). If most of the Hg is from scavenging HgP or RGM, is the labile form from RGM and the remainder from HgP? Is there evidence of this? Once in the environment is the fate of the labile and non-labile forms different?

We are aware of the fact that Hg washed out of the air by precipitation can be either from RGM or from TPM, but unfortunately we can say nothing about the contribution of each form.

3. 22780 L5. What were the results of duplicate/triplicate analyses?

The average standard deviation on precision for results of duplicate sample analyses of Hg(II) was <10.0% and for THg – 8.0%.

4. 22780 L11. How was it determined that the filtration process did not contaminant the samples? Since some samples were filtered and some were not how was it determined that this difference did not impact the results? In the unfiltered samples some or most of the Hg sorbed to particles was likely included in HgT while in the filtered samples sorbed Hg was not included.

The filtration process was carried out in a laboratory, in a laminar air flow chamber covered by a Teflon tape from the inside in order to minimize sample contamination. Contamination of environmental samples was excluded by carrying out the tests for filtration. The series of filtrated blanks (milliQ water) was tested for Hg and we obtained the results similar to non-filtrated blanks. The results did not show statistically significant differences.

5. 22782 L 17. Most of the Hg in the air is Hg0 which is not effectively scavenged therefore rain does not "purify" the air of mercury

Yes, we meant the process of washing out the air of TPM and RGM ("scavenging"). The word "purify" has been replaced by the word "scavenge".

6. 22782 L 30. Correlated normally infers a statistical test. How was it determined that they were strongly correlated?

The term "strongly correlated" has been used incorrectly. Instead of "strongly correlated" there should be "dependent of". It has been corrected.

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Discussion Paper

7. 22783 L15. Hg is also dry deposited - do you mean annual input from wet deposition?

THg deposition (in Discussion) mainly refers to wet deposition, but in some parts also to dry deposition of Hg, because the samples were collected in bulk collectors. The exposure of the collector to dry precipitation was too short and it preceded rain events, after which samples were taken straight to the laboratory.

8. 22783 L25. See comment above about "purifying" The appropriate changes has been made.

9. 22784 L 2 Were these values statistically different?

The significance of measurement seasons influence on the Hg concentrations in precipitation over the southern Baltic was verified by U Mann-Whitney test. THg concentrations in the following heating seasons were not statistically different.

10. 22784 L15. Were the yearly values statistically different? As noted above - how are TPM and labile forms related? What role does RGM play in this analysis?

Hg(II) concentrations in precipitation in the measurement seasons were proved to be statistically different in terms of Hg(II) concentration values for each season (significance level: $p < 0.05$, U Mann-Whitney test). In the whole period of Hg measurements in precipitation, quantitative analysis of RGM in the air was not carried out. We only have data on TPM and TGM concentrations in the selected measurement periods (data published until 2008 and data not yet published), so we are not able to determine RGM/TGM rate in the individual measurement seasons. On the basis of data, which we gathered on Hg particulate forms contribution in the atmospheric Hg pool, we can say that Hg(p) contribution is up to 5% of TGM in the air. Lower contribution was observed in summer and higher – in winter. In future we plan to broaden our research interests and include RGM.

11. 22784 L25. Are pH and concentration correlated? What is the r2 value?

For the heating season of 2008 we got statistically significant negative correlation between pH value and Hg(II) concentration (significance level: $p<0.05$), the r2 value (coefficient of determination) was 0.055 and, in contrast, for the non-heating season r2 value was 0.002 ($p<0.05$).

12. Section 3.3. This comparison should be made statistically. One way to do this is using a conditional probably function (CPF) approach.

Hg is emitted from different types of sources at the same time and levels of its concentration in the air are dependent on the distribution of air parameters. Because of that, it is difficult to precisely indicate sources having an impact on the concentrations measured in precipitation. These concentrations are rather the resultant of many processes. One of the approaches to estimate source-receptor interactions is the suggested approach called conditional probably function (CPF) which eliminates from the wind speed distribution values lower than 1 ms-1. The problem of the influence of mercury emission sources on Hg concentrations in precipitation has been presented as a simple dependence of the three variables (THg concentration, wind direction, wind velocity). In Figure 6 we presented conditions of the occurrence of elevated Hg concentrations in precipitation taking into account the prevailing wind speed (the formula presented below) and the average wind speed in the given sector including calm wind events.

Prevailing wind speed has been calculated using the formula by Rubinstejn (Kostin and Porkowska, 1957).

13. Figure 1. This figure needs to be improved. All of that area of Europe should be included with an insert of the specific sampling area. A scale should be included.

Figure 1 has been improved.

14. Figure 6. Back trajectories of all of the samples should be included.

In Figure 6 (in the first version of the manuscript, after correction it refers to Figure 5)

four examples of back trajectories has been chosen to illustrate much lower impact of distant emission sources in comparison with local or regional sources on concentrations of Hg in precipitation over the southern Baltic. Part 3.3 of the Discussion refers to four examples of back trajectories. In Table 2 we presented statistics calculated for the database of THg and Hg(II) concentrations in precipitations for all the trajectories in 2006 and 2008. However, due to limited possibilities, presenting and discussing all the 100 maps (for 2006 and 2008) is inconvenient. Because of that, part 3.3 of the Discussion is based on Hg concentrations in main marine and continental air masses taking into account the whole database (maps from 2006 and 2008).

Additional reference: Kostin S. and Porkowska T.: Klimatologia, PWN, Warszawa, 469, 1957.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/9/C10093/2010/acpd-9-C10093-2010-supplement.pdf

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