Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2018-402-RC1, 2018


Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Urban source term estimation for mercury using a boundary-layer budget method" *by* Basil Denzler et al.

**Anonymous Referee #1**

Received and published: 2 August 2018

Denzler and coworkers present a top-down approach to estimate urban mercury emissions from ground-based measurements. Their approach is a nice and simple boundary-layer mass balance method applied during periods of temperature inversion and low wind speeds when the measured urban concentrations are most sensitive to local emissions. Using two years of measurements, they calculate gaseous elemental mercury emissions in Zurich and compare it to those reported in the Swiss national emissions inventory. The authors also provide a convenient tool based on their approach to calculate gaseous elemental mercury emissions in other cities.

It is important to quantify the anthropogenic emissions of mercury to understand its effects on the biogeochemical cycling of mercury and to build the knowledge needed for the success of regional and global efforts to lower the human health burden of mercury.



Bottom-up emissions inventories are uncertain and need to be checked against top-down estimates, as has been done in this study. The top-down method described here will certainly be of much interest to readers of ACP who study mercury and also to those who are working to quantify emissions of similar pollutants. The study is scientifically sound, well written, and presents the relevant data supporting their conclusions.

I have divided my further comments into two categories as follows: Major comments: (i) The authors seem to have completely overlooked gas and particle-bound oxidized mercury. There is ample evidence that a significant fraction of mercury emissions are in these forms (e.g. Zhang et al., 2016). It is important that the authors discuss the effect of neglecting oxidized mercury on their emissions estimate and its comparison with estimates of (total) mercury emissions.

(ii) In section 4, the authors provide a tool in the form of a nomogram that can supposedly be adapted by nonspecialists to calculate emissions elsewhere. This is indeed useful, but I am concerned that the conditions under which this tool is broadly applicable (or not applicable) are not clearly laid out. I recommend that a more objective description of this be presented in this section. It could include for example a threshold for the meteorological parameters for which their method works, the general characteristics of the site that measures the urban background, what if the stacks of point sources are taller than 150 m, etc.

Minor comments: Figure 2 shows the weekly and monthly variation of mercury concentrations and that of other species. The authors use this figure to demonstrate that mercury emissions are constant in time. However, the relatively high background concentration of mercury makes the variations in local concentrations seem small. It would be more insightful to subtract the background and then show how local mercury concentrations vary in time. It is not clear why the deposition, emissions from land and water, and oxidation of mercury can be neglected in the model. This needs to be better discussed with relevant citations. In Section 2.1, a second measurement site on the outskirts of Zurich is mentioned. But those measurements are not discussed in the pa-

per. I think they could provide valuable constraints on the spatial contrasts in mercury and help support their assumption that deposition and chemistry can be neglected. Page 4, line 14: ". . .were identified by visual inspection of the data." Which data? Page 3, line 30: "boundary-layer *top* is reached" There are several spelling errors that I assume will be corrected in the production process if the paper is accepted.

References: Zhang, L., Wang, S., Wu, Q., Wang, F., Lin, C.-J., Zhang, L., Hui, M., Yang, M., Su, H., and Hao, J.: Mercury transformation and speciation in flue gases from anthropogenic emission sources: a critical review, Atmos. Chem. Phys., 16, 2417-2433, https://doi.org/10.5194/acp-16-2417-2016, 2016.

---

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-402, 2018.