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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Summertime elemental mercury exchange of temperate grasslands on an ecosystem-scale" *by* J. Fritsche et al.

J. Fritsche et al.

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Response to interactive comment of anonymous Referee #3

The referee has provided a review of the manuscript in which he values our work as an interesting contribution to the subject. Besides some controversial technical definitions and conclusions, the author is mainly concerned about the validity of the flux-data with respect to the sensitivity of the applied method. These issues are important and have been considered by the authors, but seem not correctly interpreted by the referee. The author's response to the issues addressed by the referee and, where applicable, the proposed corrections to the manuscript are as follows:

1) The referee suggests to exchange the term GEM (gaseous elemental mercury) to Hg, as he believes that the analytical instrument measures total gaseous mercury and

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not GEM.

The question whether the analytical instrument (Tekran) detects TGM (total gaseous mercury) or GEM is not resolved yet. For example, Bash and Miller (Journal of Atmospheric and Oceanic Technology, 25, 244-257, 2008) and Radke et al. (Journal of Geophysical Research - Atmospheres, 112, D19305, 2007) also used the Tekran in their studies, but reported their results as TGM and GEM, respectively. TGM represents the sum of GEM and RGM (reactive gaseous mercury, e.g. HgCl2); normally RGM would be amalgamated and detected by the Tekran, but as RGM is easily adsorbed to sampling lines and fittings it will not be detected quantitatively (details see e.g. Temme et al. 2003, Environmental Science and Technology, 37, 22-31). Therefore, neither TGM nor GEM represent the correct quantity that is measured by the Tekran. The involved error however, is acceptable as RGM is typically in the range of a few pg/m3 and GEM ng/m3. We thus argue, that a change of the expression GEM will not enhance terminological accuracy.

2) The referee is concerned about the sensitivity of the applied method, as the Tekran has a detection limit of 0.1 ng/m3. He also questions the stated minimum resolvable GEM gradients and fluxes and regards only fluxes $>$4 ng/m2h as believable.

It is correct, that the Tekran has a detection limit of $<$0.1 ng/m3. However, the measured gradients represent a difference of concentrations of about 1.2 ng/m3, which is well above the detection limit of the Tekran. Additionally, we determined the minimum resolvable gradient by placing all sampling lines on the same height (see section 3.1) and thereby considering any bias of the Tekran. The gradients of 0.02 and 0.06 ng/m3m1 (scaled to a height of one meter) reported in section 4.3 are average values, which are indeed extremely small, but above the minimum resolvable gradient.

Regarding the comment of the referee that only fluxes $>$4 ng/m2h are believable we refer to section 3.1 where we state that the minimum GEM fluxes of 2.8 and 4.6 ng/m2h that were determined with the applied method, refer to typical turbulence regimes and

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are not absolute values. Air surface fluxes of trace gases are driven by atmospheric turbulence, which can be lower than the typical conditions assumed for computation of the above values. Hence, no corrections are deemed necessary in this respect.

3) The referee suggests to reduce the discussion of the observed correlations of GEM and environmental parameters/ozone as it appears too speculative.

This issue is similar to the one raised by referee #2 and the authors propose - as in the response to the interactive comment of referee #2 - to reduce this section since it is not absolutely necessary for the scope of this paper.

4) Finally, the referee has noted that data of the Fruebuel site (reference on line 1, page 1954) had been presented in an earlier paper and that this should be clarified in the text.

In the paper of Fritsche et al. (2008) a long-term study of GEM exchange is reported that focuses on seasonal GEM exchange patterns and the application of micrometeorological methods for the quantification of this exchange. The authors suggest to state this with the reference on line 1, page 1954.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 1951, 2008.