Atmos. Chem. Phys. Discuss., 13, C4035–C4037, 2013
www.atmos-chem-phys-discuss.net/13/C4035/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Method development estimating ambient mercury concentration from monitored mercury wet deposition" *by* S. M. Chen et al.

Anonymous Referee #2

Received and published: 21 June 2013

The manuscript describes a statistical treatment of mercury wet deposition data in an attempt to estimate ambient mercury concentration, and to certain degree, the concentration of gaseous oxidized mercury and particulate bound mercury. This is a very ambitious research goal and I do agree with the authors that a method capable of relating existing mercury wet deposition measurement to ambient mercury concentration will be very useful in locations where only wet deposition is measured. However, the attempt falls far short of being capable of reliably predicting the ambient concentration from wet deposition data and the manuscript is not in a form that meets the publication standards of Atmospheric Chemistry and Physics because of the following reasons:

(1) The primary deficiency of the statistical model is that it lacks an appropriate ability to achieve the stated objective. This is clearly demonstrated in both Figure 5 and Figure 8. I am concerned that such a substantial deviation of model estimates from the measurements, if applied broadly in the community, may lead to serious misinterpretation of mercury concentration in air.

(2) The data used for statistical model building is limited in geographical coverage and site characteristics. The data applied for this study are from MDN and AMNet, which represent mainly the northeastern region of North America. In addition, most of these sites have been selected such that the site locations are somewhat distant from direct anthropogenic influences. Given the specific emission contributions from different anthropogenic sources, environmental settings and transport characteristics in this region, I am not sure if the model developed from this data set alone is broadly applicable.

(3) The sample size of the data used in the study, although not specifically mentioned in the manuscript, is quite small judging from the data points shown in the figures. The processes involved in the speciation, partitioning and chemistry that lead to the measured wet deposition is complex. I do not see how using a small sample size can decouple the processes such that the presented statistical coefficients are significant and meaningful. This is a fundamental weakness of the study.

(4) Another major deficiency in this model development work is the lack of model validation/verification using data elsewhere. Without this important step, it is not conceivable that the model is capable and useful.

(5) By developing a pure statistical model without incorporating any process factors that relate the response (mercury wet deposition) to the predictor (ambient concentration), the model bears no science advance in understanding the relation between mercury deposition and ambient concentration.

(6) I fundamentally disagree with the approach for estimating dry ambient concentra-

ACPD
13, C4035–C4037, 2013

tion presented in Section 3. The authors treated ambient mercury concentration as a normalized random variable that follows beta distribution function. The assignment of the probability density function seems arbitrary, not to mention that such a treatment disregards the contribution of mercury emission sources and atmospheric transport scenarios. Given that the relatively smaller number of days having precipitation events compared to the dry days, such an arbitrary statistical treatment potentially causes systematic bias in the estimated concentrations.

(7) Presentation issues. The manuscript is somewhat difficult to follow because (a) the data entering the model building was not clearly described (for example, how many datasets, the time periods of the datasets, sample size, and most importantly, the data characteristics and selection of model data for statistical modeling), (b) the unclear labeling of many figure axes, and (c) the lack of discussion regarding how the model can be applied elsewhere.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 12771, 2013.