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Atmospheric Measurement Techniques Discussions

Interactive comment on "Improved Methods for Signal Processing in Measurements of Elemental Mercury Vapor by Tekran® 2537A and 2537B Instruments" *by* Jesse L. Ambrose

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The author reports a systematic bias in Hg measurements caused by default signal integration of Tekran instruments. This matters since these instruments are widespread and used not only for a measurement of elemental mercury, as mentioned in the title of the article, but they also serve as detectors for different mercury speciation methods. The bias has been reported before but its wide reaching consequences have mostly been neglected so far. The paper will hopefully help to make the mercury community aware of this problem and contribute to the improvement of accuracy and precision of worldwide measurements of mercury and its species.

The methods of signal processing are clearly described. The paper is well organised and written. It should be published with small changes suggested below.

Comments

Title: The implications of the improved processing of Tekran signal are even more important for measurements of gaseous oxidized mercury (GOM) and particulate bond mercury (PBM) than for measurements gaseous elemental mercury (GEM). A title without mentioning specifically "elemental mercury" would thus be more appropriate.

The author claims that the Tekran measurements even with loads $\geq$ 10 pg are biased low. This is probably not correct because it will depend on the calibration which uses the same default integration. If the calibration is made with 10 pg than then the measurement of 10 pg, both with the same default integration, will not be biased (the low bias of the calibration equals the low bias of the measurement and they cancel out). This should be mentioned and the text modified accordingly.

Page 2, line 23: A sentence describing the hardware change of the 2537B instrument would be helpful.

Page 5, lines 11-14: Three consecutive sentences start with "I estimate the uncertainty. . ."

Page 10, 1st paragraph: This paragraph concerning the GOM and PBM measurements with the Tekran speciation system is confusing and grossly underrates the problem. GOM and PBM measurements in AMNet could be mentioned as an example: With 2 h sampling at a rate of 10 l min-1 median GOM concentrations of 1.2 – 2.5 pg m-3 (Gay et al., ACP, 13, 11339-11349, 2013) will give loads of 1.4 – 3 pg. I.e. half of these measurements are made with loads below 3 pg (not to say anything about 8 pg mentioned in this paragraph as a minimum load to avoid large bias) and are thus substantially biased low with correspondingly poor precision. PBM measurements and other networks could be mentioned as well. As most of the existing GOM and PBM data

have been obtained by Tekran speciation system it can be said, without exaggeration, that most of them are biased low. The bias adds to the intensively discussed artefacts related to the GOM and PBM sampling.

Page 10, paragraph starting at line 14: Longer sampling times are another (hardware) way to increase the loads and thus reduce the biases and improve the precision especially of the GEM and TGM measurements. E.g. GEM measurements at stations in the southern hemisphere such as at Cape Point and Amsterdam Island are for these reasons already being made with 15 min sampling time which at a sampling rate of 1 l min-1 yields loads of $\sim$15 pg. For GOM and PBM measurements longer sampling times may not be feasible because of sampling artefacts and poor temporal resolution.

Fig. 2: There is hardly any contrast between the colours for methods VIm,a and VIa,a.

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