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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Source-receptor relationships for speciated atmospheric mercury at the remote experimental lakes area, Northwestern Ontario, Canada" *by* I. Cheng et al.

Anonymous Referee #3

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General comments

This study used three different receptor models to identify Hg related sources/processes and the HYSPLIT was also applied to help locating these sources. All three models agreed well with their corresponding back trajectories. However, some factors from those analyses were still combined together. My specific comments are listed below:

Page 31435 Line 8 – 20, the author should add some discussions on advantages and disadvantages of source-based and receptor-based models.

Page 31436 Line 5-11, please read and cite relevant references Kabashnikov et al.,

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2011 Atom env. 5425-5430; Line 27, suggest to add “processes” before the sources

Page 31437 site description, suggest to add a map of the site with Hg related emission sources, this would help the readers to understand the location of the site.

Page 31439, Line 1, what is the external calibration frequency? Line 9-12, it will be good to include the uncertainties of GEM, RGM, and PHg are 10-20, ∼30, and up to 70%, respectively. See Gustin and Jaffe, 2010, EST.

Page 31440, Principal components analysis, does the authors normalize the data before the analysis? Previous studies usually used normalized data for PCA. This is not clear in the text. If select eigenvalue as 1, some factors cannot be separated, as discussed later.

Page 31441, HYSPLIT, the uncertainty of HYSPLIT should be discussed, please see Weiss-Penzias et al., 2009 JGR.

Page 31442, Line 12, suggest to add “concentrations” after RGM

Page 31443, higher PHg in winter has the change from wood combustion; please see Choi et al., 2008 ES&T; Huang et al., 2010 ES&T; Huang et al., 2011 Chemosphere.

Page 31444, Line 9-12, how was the statistical analysis for diel pattern done? Please be clear.

Page 31445, Line 1, nighttime dry deposition might be not a good explanation for GEM. Could the authors explain the reason Ca2+ (sea-salt and soil), K+ (wood combustion), and Mg2+ sea-salt and soil) grouped together by wind direction (they should be from different processes or sources)?

Page 31446, Correlation analysis, why did the authors choose PHg as the most important species?

Page 31448, Line 22, PCA-1, is this possible from wood combustion? K+ is an important indicator for wood combustion, and the other species are also related to this

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source. Based on PCA, could the authors look at the time as the PCA-1 factor loadings were high? This might help to identify the source.

Page 31449, Line 1, PCA-2, this looks like two or more factors combined in PCA-2, could the authors separate them? Line 10-13, halogens can be emitted from coal-fired power plants, so the reactions in the inland sites are still possible. Line 22, PCA-4 is still correlated to SO2, could the authors explain this? Two factors (PCA-2 and 4) seem to contain two or more factors together, the authors should discuss this.

Page 31450, Line 10-12, this is not clear. Line 12, KCA-3, the wood combustion should be considered as discussed above (same for HCA).

Page 31452, Line 5-7, What is the percentage of trajectories coming from fossil fuel power plants? Line 11, KCA-2 is associated with PHg and RGM, the authors should mention the uncertainty of precipitation during transport using HYSPLIT. Line 26, please read and cite Holmes et al., 2009; 2010. Line 26, what is the percentage corresponding to "mainly"?

Page 31454, Line 1-3, wood combustion will show the similar result.

Overall, this study compared Hg sources/processes using three different receptor models and came out a very good agreement. However, some factors were still mixed together and confused the readers.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 31433, 2011.