**Atmospheric
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Discussions**

Interactive
Comment

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

I. Cheng et al.

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We appreciate the reviewer's comments, which improved the clarity of the paper. We have addressed all the comments and revised the paper as detailed below.

RC- Review Comments; AC – Authors' Comments

RC: (1) In Table 3a and 3b, the criteria for statistical significance are different ($p=0.01$ for Table 3a and 0.05 for Table 3b). It would be more consistent to make the statistical criteria the same.

AC: The statistical significance criteria has been changed to $p < 0.05$ in Table 3a.

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RC: (2) In Section 3.2, the authors discuss the seasonal source characteristics of the potential sources. I wonder if it is a possibility to perform a seasonal trajectory analysis to verify the results obtained from the correlation analysis.

AC: The back trajectories for each season are included in the Supplementary Material and the following discussion has been added to section 3.2 of the revised paper: "In the Supplementary Material (Fig.S1), two-day HYSPLIT back trajectories were also plotted for each season to provide further insight into the correlation analysis results. From the correlations with PHg, potential sources of PHg may be from the absorption of gaseous Hg on re-suspended dust from crustal/soil (all seasons), road (winter), and agricultural activity (summer and fall), and point sources dust emission (all seasons). Back trajectories show that these are potential sources of PHg to the ELA site, since the trajectories passed over nearby sources of dust (see site description and Fig. 1). But there are uncertainties because of the potential deposition of particulate matter and the source of the absorbed mercury is unknown. The back trajectories might be more useful for confirming the influence of Hg point sources. Correlation results indicated RGM and SO_2 were correlated in every season except winter 2006, which is supported by the relatively fewer trajectories passing over Hg point sources southeast of the ELA site (Fig.S1c) compared to other seasons. Slower moving trajectories passing over urban and industrial areas could suggest that RGM was formed by photochemical processes involving O_3, since the precursors of O_3 are typically emitted from urban and industrial areas and stagnant air masses are conducive to O_3 formation (Logan, 1989). In the GEM-RGM correlations, none of the seasons were dominated by photochemical production of RGM and this was reflected in the shorter (i.e., slower) back trajectories found in all seasons. But this interpretation of the back trajectories might not be applicable if other atmospheric oxidants are involved in the photochemical production of RGM."

RC: (3) The trajectories shown for each cluster in Figures 2 and 3, although representing the same cluster, still look quite scattered. Can the authors explain the possible

reasons in the discussion?

AC: The following explanation was added (note the changes to figure numbers): "The trajectories shown for the hierarchical clusters in Fig. 4 were similar to some of the trajectories belonging to several k-means clusters in Fig. 3. This led to some differences in the trajectory plots for the two cluster methods even though they represented the same cluster based on the mean cluster centres in Tables 5 and 6. The clusters generated from both methods often represented several sources and processes (e.g., industrial/combustion emissions, photochemical production of RGM, and/or crustal/soil emissions). One possible reason for the discrepancy can be attributed to differences in the theoretical approaches of the two cluster analysis techniques (Viana et al., 2008), e.g. different clustering algorithm and distance/linkage measures. Another reason might be because these sources and processes are occurring simultaneously and could not be separated out in the data and hence, in the trajectory plots as well."

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

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