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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Potential sources and processes affecting speciated atmospheric mercury at Kejimkujik National Park, Canada" *by* Xiaohong Xu et al.

Anonymous Referee #2

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This study used two-year Hg measurements (Tekran) with other air pollutants at Kejimkujik national park in Canada, and applied factor analysis (PMF) and principle component analysis to understand Hg sources and its related atmospheric processes. Overall, this is a well written article and easy to be followed paper. A very similar paper was published couple years ago; however, I understand the authors applied PMF as an additional analysis, and investigated how model setting impacts receptor modeling. There are couple things I would like suggest to the authors to look into detail: 1) Wang et al., 2013 Chemosphere and Huang et al., 2010 ES&T have compared results from PCA and PMF using Hg related concentrations at Rochester, NY using similar data set. PCA and PMF comparisons using aerosol data have been discussed in detail in

previous studies (Paatero and Tapper, 1994; Environmentrics, 1994). 2) This study and Cheng et al., 2013 are using similar data set with similar results. What is new that we can learn from this study? After reading the abstract, I think the one new thing to the global Hg research group is the difference between 2009 and 2010. I suggest the authors should focus on these important things instead of repeating what we already knew or has been published on journals. I suggest a minor revision before ACP can accept this article. The specific comments are listed below:

In abstract, the authors focus on comparison of result from different models; however, the title looks more like a straight source paper, suggest to modify either the title or abstract. After reading this paper, one selling point is both model can capture the significant reduction of Hg and SO2 from 2009 to 2010. However, it is not mentioned in the abstract. Line 46-64, the most important difference between PMF (as a factor analysis) and PCA is the different concepts of these two receptor models, PMF constrains factor loadings and factor scores to nonnegative values and thereby minimizes the ambiguity caused by rotating factors. I suggest the authors dig this into detail and include the information there. Line 60-62, Wang et al., 2013 Chemosphere and Huang et al., 2010 ES&T have done the comparison between PMF and PCA using Hg data. Line 62-64, PMF has been applied to aerosol and evaluated in plenty previous studies, Belis et al., 2013 is a good article to start. Line 120-123, many people using GOM and PBM to do advanced statistical analysis, the biggest problem is how to handle missing and BMDL data. I look into table 1, a large portion of GOM/PBM is missing or BMDL. I understand that is the limitation of using statistical modeling on Hg data, but it will skew data distribution significantly. Line 142-143, after reading the entire paper, I still don't fully understand these cases. Line 165, the authors used manufacture method detection limit. However, this can vary with locations and time, can the authors also talk about real MDL for Tekran system at this site? Line 166, why MDL for RM is 4 ng m-3? MDL is defined as 3 standard deviation of blanks, that could be the upper bound of MDL for RM, but if you look into distribution sum, that might be lower. Line 181, how did the authors select number of factor in PMF? In general, we look into Q

and the variation of Q and number of factor. Line 238, Is this possible only due to biomass burning + soil emissions? We will see high ozone with biomass combustion, and it matches to all these increase for GEM, GOM, PBM, ozone. Does this happen in summer or winter, if you look into detail time series factor profiles, the authors should be able to figure this out. Line 302, I don't suggest using these analyses to predict GOM and PBM concentrations, as discussed above, a large portion of GOM and PBM is missing and BMDL.

Table 7, in the column title they are Case 10, but I think they should be 9.

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