

Interactive  
Comment

# ***Interactive comment on “Ten-year trends of atmospheric mercury in the high Arctic compared to Canadian sub-Arctic and mid-latitude sites” by A. S. Cole et al.***

**Anonymous Referee #1**

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This manuscript presents a long-term trend of atmospheric Hg at several sites in polar region and North America. The observations and discussion are an important contribution to the global atmospheric mercury studies. This result together with previous published papers in Europe and South Africa may help us to understand the global trends of anthropogenic and natural sources, and relative contributions of these sources to the distributions of atmospheric mercury in different areas over the world. Moreover, the long-term trend of speciated Hg presented in this study may elucidate the potential mechanism of the Hg transformation in polar region. All these possible mechanisms related to the long-term trend of atmospheric Hg in this study have been addressed in the discussion paper, and the manuscript is overall well organized and well written. I

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suggested that this paper could be published after minor revisions.

Here are some specific comments: 1. It seems that the authors are apt to suggest that anthropogenic and natural emissions in the North America as well as atmospheric transformations played a more important role here. In my opinion, the authors should differentiate the regional effect of locations of the six sites. As we can see from the map, several sites in mainland areas exhibited more pronounced decreasing trend compared to the site in coastal areas. This may indicate the levels of Hg at coastal sites might be mainly regulated by natural sources, which should maintain at the consistent levels during the years. For the Zeppelin site, additional effect may be also originated from emissions of Asian developing countries, the anthropogenic inventory of Hg was not well understood and may have increased significantly recently, which could compensate the effect of decreasing anthropogenic Hg emissions in North America. 2. It is better to show the annual mean Hg concentrations at all the sites in a new table. 3. In line 10 on page 2, the time period of the study should be introduced before. 4. In the section of method description. Firstly, I have no doubt of the data quality in this study. However, for this ten-year continuous monitoring, do you have some protocols to make the observation data be comparable throughout the 10 years? 5. line 14-30 on page 11, are there some studies with respect to the long-term trend of Ozone or bromine at the polar site? There may be relationship between the oxidants and RGM and PBM productions. 6. line 15 on page 15, the 'Svalboard' should be changed to Zeppelin station.

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