

***Interactive comment on “Four years of atmospheric mercury records in Northwestern Patagonia (Argentina): potential sources, concentration patterns and influence of environmental variables observed at the GMOS EMMA station” by Maria C. Diéguez et al.***

**Anonymous Referee #1**

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Manuscript: Four years of atmospheric mercury records in Northwestern Patagonia (Argentina): potential sources, concentration patterns and influence of environmental variables observed at the GMOS EMMA station. From: María C. Diéguez , Patricia E. Garcia , Mariantonia Bencardino , Francesco D'Amore, Jessica Castagna , Sergio Ribeiro Guevara and Francesca Sprovieri.

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This manuscript deals with a relevant issue, with proper instrumentation and linked to good analytical protocols from the GMOS project. The manuscript reports gaseous elemental Hg (GEM) concentrations observed from October 2012 to May 2016 in North-western Patagonia (Argentina) at the GMOS EMMA monitoring station. It is a pity that the other Hg components of the mercury cycle (GOM and PBM) were not measured. I think the introduction needs to discuss that in more detail.

Also, in this study, only GEM and met variables were measured. The experimental design should have done to include other variables that could help to identify processes that influences GEM concentrations, other than only wind direction and air mass trajectory. Trace gases and simple aerosol measurements taking together with Hg are valuable enhancements. With only GEM and Met variables, it is hard to do a good scientific job. The cluster and PCA analysis had too small number of variables to deal with (only 4-5 variables), do not allowing a clear separation of the various components that influences GEM concentrations. Do you have precipitation amounts at the station? Or upwind of the station? This could help in the association between GEM and met variables.

With the study limitation, the conclusions are quite obvious: low GEM concentrations are observed when air masses comes from the ocean. High GEM concentrations come from volcanoes in the cordillera. This is the conclusion of the study, and is well known already from previous studies. What this study innovates in science? What is exactly the new issue brought to the knowledgebase? Only GEM concentrations of  $0.865 \pm 0.149 \text{ ng m}^{-3}$ ? No new Hg removal or production processes? No parallel measurements with other variables that could trace processes?

I think the manuscript needs a deep revision to make it to the published at the level of the others ACP papers.

Specific issues: Page 3 line 10: Instead of 'biomass burn', please use "biomass burning".

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Page 3 Line 15: You report that “Until recently, atmospheric Hg levels in the region were derived from point measurements performed in Northwestern Patagonia, reporting a mean GEM concentration of  $7.5 \pm 1.4 \text{ ng m}^{-3}$  (Higuera et al., 2014)”. I think you must comment on this very high level reported. Why? Instrumental problems? Specific issues?.

Page 5 line 10: Your statement on STP is that “all concentrations refer to STP conditions.”. Which STP conditions? There are several. Temperature of 0 or 25 degrees? Pressure? 1000 mb? Please specify.

Page 5 line 26 – for Backward Trajectories (BWT), the manuscript uses HYSPLIT plus Global Data Assimilation (GDAS). This could be the best possible approach, but the lack of meteorological stations in this part of the globe increases significantly the uncertainties of the modeled backward trajectories. I think you must recognize that and comment on the possible implications for the study. As you can see in Figure 6, air mass trajectories comes from Southern Pacific, with no met stations to validate the modeled air mass trajectories.

Page 8 line 10: You stated that: “Finally, the direct relationship between GEM concentration and temperature computed for the whole data set resulted weak, although it was positive and significant ( $r=0.132$ ,  $p<0.001$ )”. There is no “Weak” or “Strong” correlation, but instead, statistically significant or not. In this case, the GEM and temperature are statistically significant within 95% confidence interval. The question is why? Which mechanism could make sense for this association?

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