“Multi-year record of atmospheric mercury at Dumont d’Urville, East Antarctic coast: continental outflow and oceanic influences” by H. Angot et al.

Response to referee comments by Referee #1.

We provide below a point-by-point reply to the comments (points raised by the referee in bold, changes made in the manuscript in red).

This paper presents the first multi-year dataset on atmospheric gaseous mercury from Antarctica, and places the results into context by describing the meteorological and other atmospheric processes responsible for the patterns observed. Although some periods of time do not have data owing to technical failures, data are presented for at least a good part of each year for over three years. I rate this MS very highly. The paper itself is well laid out and clearly written, and is comprehensive in its discussion of the processes and implications of the results; the quality assurance is clearly described and appropriate. More than anything else, the paper is the culmination of several years of careful measurements on Hg in air and snow, conducted under logistically challenging and very remote conditions. All in all, the team is to be congratulated on this achievement.

My comments below are minor and editorial in nature.

- L. 30. Abstract should end with summary of the implications.

The following sentence has been added at the end of the abstract:

“This paper also discusses implications for coastal Antarctic ecosystems and for the cycle of atmospheric mercury in high southern latitudes”.

- L. 43. The sentence beginning “Mercury can be…” is too brief, and misses out mention of the photo-reduction step in re-emission.

This sentence has been corrected:

“Upon deposition, Hg(II) can be reduced and reemitted back to the atmosphere as Hg(0).”

-L. 304-305. These lines present BrO and NO2 “mixing ratios”, but are not the data presented actually concentrations?

Measurements such as ppmv, ppbv, or pptv are usually called mixing ratios.

-L. 328. The p value is incorrectly expressed as it is – the exact value looks to be the p value, not less than this value. The format is wrong as well. I would suggest simply “p<0.0001”; more precise than this is pointless.

We agree. This has been corrected throughout the revised manuscript.

- L. 330. Seems to be a missing word or phrase after the Angot et al. (2016) reference.

This sentence has been reworded in the revised manuscript:

"Brooks et al. (2008) reported elevated concentrations of oxidized mercury species at SP in summer (0.10 – 1.00 ng m^{-3}). Similarly, Angot et al. (2016) observed low Hg(0) concentrations at the same period of the year at DC (0.69 ± 0.35 ng m^{-3}, i.e., ~ 25% lower than at NM, TNB and MM)."

- L. 337. Insert a new heading for this following text on snow Hg results.

The following heading has been added in the revised manuscript:
"Transect from central to coastal Antarctica"

- L. 391. Paragraph ends abruptly. Needs more explanation of what the other processes could be to explain the daily Hg(0) cycle.

This paragraph was a bit out of context here. It has been removed in the revised manuscript.

- L. 399. By "snow accumulation" I think you mean "snowfall" or "wet precipitation"; are you saying here that scavenging of Hg(II) by higher rates of snowfall on the coast is responsible ?

Yes indeed, we meant "wet deposition". This has been corrected in the revised manuscript.

- L. 411. How likely is it really that Asia – which is separated from Antarctica by tropical and sub-tropical regions with extremely high rates of photo-oxidation and rainfall (scavenging of Hg (II)) – will contaminate Antarctica?

According to modeling studies (UNEP, 2015), mercury deposition to Antarctica is determined by long-range atmospheric transport from major source regions (East Asia and Africa).

- L. 419. When you write "turn left", I think you mean "turn west" (?).

In order to avoid any misunderstanding, this sentence has been reworded in the revised manuscript:

"the katabatic flow draining from the Antarctic plateau ~~turns left under the action of the Coriolis force and~~ merges with the coastal polar easterlies under the action of the Coriolis force".

- Figure 11. I recommend deleting this figure. Its only purpose is to show seasonal changes in sea-ice around the DDU site. But one could simply refer to the sea-ice dataset on the website to support your statement about this. In any case, the scale is insufficient for a reader to clearly see anything changing around DDU.

We agree. This figure has been deleted in the revised manuscript.

References

Angot, H., Magand, O., Helmig, D., Ricaud, P., Quennehen, B., Gallée, H., Del Guasta, M., Sprovieri, F., Pirrone, N., Savarino, J., and Dommergue, A.: New insights into the atmospheric mercury cycling in Central Antarctica and implications at a continental scale, Atmospheric Chemistry and Physics Discussions, 10.5194/acp-2016-144, in review, 2016.

Brooks, S. B., Arimoto, R., Lindberg, S. E., and Southworth, G.: Antarctic polar plateau snow surface conversion of deposited oxidized mercury to gaseous elemental mercury with fractional long-term burial, Atmospheric Environment, 42, 2877-2884, 2008.

UNEP: Global mercury modelling: update of modelling results in the global mercury assessment 2013, 2015.