

Interactive comment on “Mercury and trace metal wet deposition across five stations in Alaska: controlling factors, spatial patterns, and source regions” by Christopher Pearson et al.

Anonymous Referee #1

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Review of Pearson et al.

This manuscript provides a detailed analysis of long term atmospheric chemical measurements at sites in Alaska. The authors provide a wealth of statistical and back trajectory analyses and the wealth of information is well presented. This manuscript will be of interest to a variety of readers and is well suited for ACPD. There are a lot of small grammatical and typographical errors and it is frustrating to see this and have to address it all. In the future I recommend all authors read and edit and fix these issues as I do not feel it is a Reviewer's job to fix grammar and punctuation. That said I recommend minor editing and a few suggestions but overall I strongly recommend this for

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publication.

General comments keyed to the text:

12: no comma after Service 13: after “years.” I recommend a sentence identifying the locations of the stations. I also recommend mentioning here that there are data from a variety of other metals otherwise at line 31 we see mention of the other metals. 16: were statistically significantly? 30: here and elsewhere (line 38) it is “in between” with no hyphen 66: to Alaska 76: study of 78: Perhaps a sentence here providing context for Hg deposition attribution from other locations? Perhaps the Lower 48 since that is brought in later for the other metals. Is 57% high, low, or likely about average for global sources and deposition? 86: Program’s 98-101: I like that a little description of the terrain and vegetation is given for the Gates of the Arctic site but what about the others? Add some more info please. Maybe a sentence for each site? 128-9: “due to the low sample volume collected for each deposition sample”? 220: The highest 231: also occur 232: and decrease 249: Gates 259-264: what about the typical and long term different fractions of wet and dry precipitation at each site? Is this changing over time? How were snow samples collected? And is there any sense that the dry precipitation is shifting towards wet? Particularly at the more northern sites? This could feed into some comments I have later about the future deposition.

Were there any major storm events that stood out in the analysis? I realize long precip event samples were broken up but can they be pieced back together to identify how/where large precip events may affect the overall yearly deposition at a site? I realize this may be a giant analysis that I do not want to send the authors out on but I am curious. This is sort of addressed in the next few lines.

280: the MDN 328-9: This is an extremely important finding. Figure 4a: why do Gates of the Arctic and Nome have seemingly anomalously higher values (ie the small circles of higher color keyed values) only where the stations are located? I assume some sort of kriging of data analysis artefact?

394: Since Denali National Park is mentioned. Isn't there some data or results from Denali? Again I do not want the authors to spend a lot of time on this but I wonder if there are similar results or analyses from any other locations. Or other studies with similar approach applied to Alaska that could be referenced? What about the long term DOE air monitoring sites- do they measure metals or Hg?

395: amounts 401: maps of estimated 418: remove "deposition" after "lowest" 419-420: "individual used twice. Can this be cleaned up to one mention of "individual"?"

435-445: This is an interesting result of the study.

523: elements 525: suggests. Here and elsewhere I recommend active and not passive tense. 526: the results also support the possibility 530: crustal sources while (no comma) 533: in between and thereby do not indicate (if you agree to shift to active tense)

General comment: There are an increasing number of studies showing that the Arctic is getting wetter, particularly that the winter is shortening and the snow to rain fraction is decreasing. Could the authors break their data into snow versus rain as the seasonal sources and then use potential projections to address who/where a wetter Arctic may affect deposition? At the least there should be some mention of how a warmer future Arctic and its' changing precipitation dynamic may affect loadings.

Figure 2: how were the different season parsed? And were snow versus rain events separated? I realize the coastal sites may see lots of winter rain but I am curious again at the snow versus rain breakdowns.

Figure 5: The areas projected by the true color images (ie the map area) are slightly different. I recommend providing one consistent background and maps at the same scale to show the different source regions and distances of back trajectories.

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