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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Atmospheric processes of persistent organic pollutants over a remote lake of the central Tibetan Plateau: Implications for regional cycling" *by* Jiao Ren et al.

Anonymous Referee #2

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Review of "Atmospheric processes or persistent organic pollutants over a remote lake of the central Tibetan Plateau: Implications for regional cycling"

This is a nice and impressive work addressing the atmosphere-lake water interactions for a number of organic pollutants in a Tibetan high altitude lake. The work is novel and of high quality. I suggest that this work can be accepted after the moderate modifications listed below.

- In the abstract and rest of the text, indicate how many PAHs. It is not the same to report the sum of concentrations of 16, 32 or 64 PAHs.

- PAHs are not strictly POPs, maybe refer to OPs instead of POPs.

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Discussion paper

- Lines 53-54. Rephrase and maybe cite Ma et al. Nature climate change 2011 and/or Cabrerizo et al. EST 2013 or Galbán-Malagon et al. Atm Environ. 2013.

- Note that low MW PAHs originate not only from fossil fuels and biomass burning, but could also be originating from biodegradation of some organic compounds, such as diterpenes. There are several works suggesting this for soils as well.

- The sampling times (deployment times) are long. This may be problematic for 2-4 ring PAHs, which could be degraded during sampling. This would indicate that the given PAH concentrations are a lower-end estimate, even though at low temperature this artifact is minimized.

- Lines 166.... I suggest to estimate the uncertainty due to propagation error for the fugacity ratios and air water exchange. This can be done as described in the supplementary material of Bigot et al. 2016, for example. The uncertainty for the fugacity ratio is significantly lower than the factor of three assumed by the authors.

- Equations 6-7. This works well for estimating precipitation of gas phase compounds by rain, but not by snow. Justify how snow deposition was estimated. There are several published snow washout ratios for PAHs and PCBs (Franz and Eisenreich EST 1998, or Zhang et al. ACP 2015).

- Lines 251-253. I like Figure 3 and the correlation between the Monsson index and POP concentrations. Is it possible to block the influence of monsoon and then test the influence of temperature?

- Lines 280-281. Maybe true, but I find difficult to believe. Is there any alternative source?

- I like the section related to the estimates of depositional fluxes. However, somewhere should say that only 15 PAHs were considered. There are other PAHs with higher abundances than phenanthrene (for example alkylated phenanthrenes), in addition to thousands of other anthropogenic organic compounds.

- Rewrite the section on the uncertainty of fluxes after a proper estimation of these uncertainties (see above).

- In section 3.5, maybe cite Gonzalez-Gaya et al. Nature Geoscience 2016, who were the first to discuss the inputs of aromatic hydrocarbons in a context of carbon inputs.

- I agree with the authors that atmospheric inputs of semivolatile organic compounds, but not only PAHs, may be supporting the microbial communities in the Plateau's lakes. I suggest that future work should follow this line of research.

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