

Dear authors, your paper about air-ocean exchange of PAHs and heavy metals is interesting. I believe the data can fill the gap of net input/output of these substances originating from both anthropogenic sources and natural sources. The clarification and structure of the paper is clear and generally good. I have some questions concerning to this paper.

Response: thank you for reading our manuscript. We have answered your questions item by item as follows:

1. How far the samples were collected between two sample sites?

Response: because the sampling for air and water (two portions, the same amount of water was directly extracted by SPE) were carried out simultaneously, we counted the time to next destination which was determined previously according to the potential coastal emission sources from the continent. According to geographic coordinate system, approximately 108 km for each sampling site on average.

2. How authors choose these sites?

Response: we separated the Russian Arctic Ocean by four seas which represent the close distance to anthropogenic activities and more natural Arctic systems.

3. Authors mentioned the atmospheric mercury depletion events (AMDEs) of Hg in the paper, so were there any sites collected during the sunrise in spring season?

Response: due to this special accumulation of Hg deposition during spring season, we have prevented sampling during the sunrise.

4. Do authors try to avoid this time?

Response: yes, we avoid this time for preventing abnormality data.

5. Were Dissolve Organic Carbon (DOC) and the concentration of surface chlorophyll same sample as the water?

Response: yes, we measured them from the same amount of water once we sampled during expedition.

6. How authors can make sure the corresponding the water sample to air samples?

Response: because the huge time gap and distance between two samples' site, we think the relatively error for this larger site is not very high.

7. Authors calculated the atmospheric oxidation of PAHs initiated by reaction with the OH radical in gas phase?

Response: yes, because previous studies have shown that in the gas phase naphthalene reacts with OH radicals and NO₃ radicals by initial addition of these radicals to the aromatic rings. he gas-phase OH radical and NO₃ radical reactions have been shown to proceed by initial addition to the aromatic rings to form hydroxycyclohexadienyl- and nitrooxycyclohexadienyl-type radicals, which can back-decompose to the reactants or react with NO₂ or O₂ to yield products. I listed some relevant references as shown below:

Jin Shi, Wenlong Bi, Shenmin Li, Wenbo Dong, and Jianmin Chen . Reaction Mechanism of 4-Chlorobiphenyl and the NO₃ Radical: An Experimental and Theoretical Study. *The Journal of Physical Chemistry A* 2017, 121 (18), 3461-3468. DOI: 10.1021/acs.jpca.6b08626.

Matthieu Riva, Robert M. Healy, Pierre-Marie Flaud, Emilie Perraudin, John C. Wenger, and Eric Villenave . Gas- and Particle-Phase Products from the Chlorine-Initiated Oxidation of Polycyclic Aromatic Hydrocarbons. *The Journal of Physical Chemistry A* 2015, 119 (45), 11170-11181. DOI: 10.1021/acs.jpca.5b04610.

Hyun Ji (Julie) Lee, Paige Kuuipo Aiona, Alexander Laskin, Julia Laskin, and Sergey A. Nizkorodov . Effect of Solar Radiation on the Optical Properties and Molecular Composition of Laboratory Proxies of Atmospheric Brown Carbon. *Environmental Science & Technology* 2014, 48 (17), 10217-10226. DOI: 10.1021/es502515r.

Abolfazl Shiroudi, Michael S. Deleuze, and Sébastien Canneaux . Theoretical Study of the Oxidation Mechanisms of Naphthalene Initiated by Hydroxyl Radicals: The OH-Addition Pathway. *The Journal of Physical Chemistry A* 2014, 118 (26), 4593-4610. DOI: 10.1021/jp411327e

8. Is it possible to be also degradable in the particle phase?

Response: it is also possible. However, we took account into only the degradation of gas phase PAHs, ignoring the potential degradation of aerosol-bound PAHs due to these sources of uncertainty, the figures given here for degradative fluxes have an error of factor of one to three depending on the individual PAH. We do not provide the atmospheric degradation fluxes since major uncertainties in their k_{OH} values.