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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Emissions databases for polycyclic aromatic compounds in the Canadian Athabasca Oil Sands Region – development using current knowledge and evaluation with passive sampling and air dispersion modelling data" *by* Xin Qiu et al.

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Response to Referee #2

We appreciate the comments by the reviewer to help us improve the paper. Our responses to the specific comments are shown below.

Within the article, two speciated and spatially-resolved emissions databases for PACs

in AOSR were developed. Further, the PAC concentrations in AOSR were simulated using the CALPUFF atmospheric dispersion model for both scenarios (both databases) and compared with passive monitoring data to assess which emissions input can achieve better agreement with measurements. According to my opinion, the manuscript represent a significant scientific contribution in studying PACs (PAHs, alkylated PAHS and DBTs) in oil sends regions where uncertainties in the PACs emissions are still significant. I recommend the manuscript for publication with minor revision:

1. Although if deposition had been considered in the CALPUFF model, the modeled values would be even lower then the measured, I would ask the authors to explain why they have excluded the loss by wet and dry deposition in the modeling process. Were there any other reasons?

Response: We made this decision after running a few model scenarios and decided to present the model results without deposition processes. This is because modeled concentrations from simulating emissions, transport and dispersion processes, but without deposition processes, are already lower than measurements, demonstrating that emission inputs are conservative or underestimated. By including deposition processes, modeled concentrations would be even lower than measurements; however, in this model scenario it would be hard to say if this was caused by too low emissions input or too high deposition rates, knowing that large uncertainties exist in treating dry and wet deposition processes. For example, there are large uncertainties in the PAC dry deposition velocities (Zhang et al., 2015a), PAC scavenging ratios for snow and rain scavenging of gas-phase and particulate-phase PACs (Zhang et al., 2015b), and scavenging coefficients of aerosols in general by snow and rain scavenging processes (Zhang et al., 2013; Wang et al., 2014). Our next study related to this project is to compare the deposition output using various approaches.

2. The authors should also take into consideration the fact that values of PAC concentrations obtained using the passive samplers refer only to the gaseous phase of pollutant and reflect a more accurate concentration for the low molecular weight PACs

comparing to high molecular weight compounds.

Response: Although certain types of passive air samplers show a bias for gas-phase compounds, the PUF disk samplers used in the oil sands network have been shown to capture both gas-phase and particle-phase PAHs with the same efficiency as conventional high volume air samplers (Harner et al., 2013; Markovic et al., 2015).

References:

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