

Interactive comment on “Contributions of Transported Prudhoe Bay Oilfield Emissions to the Aerosol Population in Utqiagvik, Alaska” by Matthew J. Gunsch et al.

Anonymous Referee #2

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General comments:

In this study, the authors present observations of particle composition and size distributions from the Barrow Environmental Observatory. The authors compare and contrast observations of aerosol from air masses that originated over the Arctic Ocean with aerosol from air masses that originated from the direction of the Prudhoe Bay oil fields.

I recommend the manuscript for publication, provided that my following points, and those of the first reviewer, are addressed. In order to reduce redundancy for the authors' response, I will restrict my points to those not covered by the first reviewer.

Specific comments:

C1

P3 Lines 14-16: Stohl et al. (2013) makes no attribution of PM or OC from Prudhoe Bay.

P9 Lines 18-25: I think perhaps that the authors intend to exclude regional-scale nucleation events here, but not nucleation within emissions plumes from the Prudhoe Bay oil fields. The authors even suggest that the emissions from such drilling operations can contribute to new-particle formation on page 3, lines 19-21. Observations of particle growth would be expected for a regional-scale nucleation event, but not for continuous nucleation within an emitted plume of condensable gases, such as those observed by Brock et al. (2002) and Brock et al. (2003). If there was continuous new-particle formation occurring within a plume from the Prudhoe Bay oil field, under steady-state conditions (including constant wind speed and direction), no change in the size of observed aerosol would be observed unless the distance from the source changed. The age of the aerosol between nucleation in the plume and detection at the observation site would be constant with time, and therefore so would the size of the aerosol.

Technical corrections:

P11 Line 16: “(Sierau et al. (2014))” should be “(Sierau et al., 2014)”

Citations:

Brock, C. A., Washenfelder, R. A., Trainer, M., Ryerson, T. B., Wilson, J. C., Reeves, J. M., Huey, L. G., Holloway, J. S., Parrish, D. D., Hübler, G. and Fehsenfeld, F. C.: Particle growth in the plumes of coal-fired power plants, *J. Geophys. Res.*, 107(D12), doi:10.1029/2001JD001062, 2002.

Brock, C. a., Trainer, M., Ryerson, T. B., Neuman, J. A., Parrish, D. D., Holloway, J. S., Nicks, D. K., Frost, G. J., Hübler, G., Fehsenfeld, F. C., Wilson, J. C., Reeves, J. M., Lafleur, B. G., Hilbert, H., Atlas, E. L., Donnelly, S. G., Schauffler, S. M., Stroud, V. R. and Wiedinmyer, C.: Particle growth in urban and industrial plumes in Texas, *J. Geophys. Res. Atmos.*, 108(D3), doi:10.1029/2002JD002746, 2003.

C2

Stohl, A., Klimont, Z., Eckhardt, S., Kupiainen, K., Shevchenko, V., Kopeikin, V., and Novigatsky, A.: Black carbon in the Arctic: the underestimated role of gas flaring and residential combustion emissions, *Atmos. Chem. Phys.*, 13, 8833-8855, 2013.

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