

Interactive comment on “New insights into aerosol and climate in the Arctic” by Jonathan P. D. Abbatt et al.

Anonymous Referee #2

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This manuscript provides a detailed overview of the science highlights that have arisen from the Canadian NETCARE programme. It serves as an access portal to the extensive collection of literature now available from analysis of NETCARE data and modelling activities, including several special issue journal collections. The paper aims to synthesise the NETCARE results, bringing them together into three broad themes, and does a nice job in illustrating where NETCARE has brought about new understanding in Arctic aerosol research, as well as identifying remaining open questions. The paper is very well written and presented, is very accessible to the general atmospheric and climate science communities, and its content is well within the remit of ACP. I recommend that the paper be published, subject to addressing the following minor comments.

There is a lot of dense information presented. It may be a challenge for the reader to

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efficiently find a specific aspect that may be of particular interest. One idea to help this would be something like a contents table up front, perhaps at the end of the Introduction section, listing the topics presented in each sub-section of Sections 3-5. However, I am not sure how this would sit with ACP editorial policy.

Line 5: The link between long-range transport and Arctic environment / climate is perhaps not so obvious without explicit mention of the role of long-range transport in controlling aerosol and trace gas sources.

Line 7: "Arctic amplification of radiative forcing" Do Arctic feedbacks strictly amplify a forcing, or the temperature / climate response to a forcing?

Page 6, Line 3/4: Do changes in transport patterns also affect the winter / summer differences in aerosol loading?

Page 6, line 6: "dome keeps the summertime Arctic nearly free of anthropogenic aerosol" Is this the case generally, or just at the surface? Data from the POLARCAT studies in 2008 demonstrates some influence from remote sources aloft in summer (e.g. Schmale et al., 2011).

Page 7, line 28: A reference to Table 1 / Figure 1 would be useful when referring to the NETCARE summer campaigns.

Page 9, line 22-25: Potential source of highly water soluble oVOCs. Is there any information that can help elucidate the more likely mechanism? What specifically are the compounds that could lead to SOA? Is there evidence for these having a common source with those measured in the Mungall study?

Page 10, Line 19 - Mention of Lana climatology. Perhaps some context needed here? I felt that this statement came out of the blue. Perhaps a reiteration / statement that this is standard dataset used in models, with appropriate references is needed. Or perhaps this statement could be made more explicitly earlier in Section 3.

Page 14, line 1: "Natural emissions of ammonia are also important in this context." As

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this is a new paragraph, "this context" is unclear. Please clarify.

Section 4.2 - discussion of ammonia sources. Fires, tundra and seabirds are all mentioned. It would be useful for the reader to know the relative magnitudes of these sources in terms of their Arctic influences. Is information available e.g. from the GEOS-CHEM modelling study?

Page 16, line 24 - In what sense is the GEOS-CHEM adjoint source contribution study different from previous studies? Simply in terms of improved spatial information on sources? Different conclusions on importance of source regions? Or something else?

Page 18, line 25: Please provide a reference for the assertion regarding expected future increases in Arctic shipping.

Page 25, line 6: ".. transport of long-range pollutants.." Not sure what would be defined as a "long-range pollutant". Should this be "long-range transport of pollutants..".?

Page 25, line 24: Since the IMPAACT project is not yet funded, it might be helpful to explicitly mention that IMPAACT is part of a broader activity aimed at reducing uncertainties in pollution processing during LRT to the Arctic under the PACES umbrella (<https://pacesproject.org/about>).

References Schmale, J., J. et al., (2011), Source Identification and Airborne Chemical Characterisation of Aerosol Pollution from Long-range Transport over Greenland during POLARCAT Summer campaign 2008, *Atmos. Chem. Phys.*, 11, 10097-10123.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, <https://doi.org/10.5194/acp-2018-995>, 2018.