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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Transport of anthropogenic emissions during ARCTAS-A: a climatology and regional case studies" *by* D. L. Harrigan et al.

Anonymous Referee #1

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This is a relatively ambitious paper presenting results from the IPY-related campaign ARCTAS-A. The study presents evidences further supporting processes involved in atmospheric transport into the Arctic troposphere from anthropogenic sources at different latitudes and continents. There will always be a great need for thorough case studies like this one, complementing previous studies and allowing us to gain a better understanding of the complex structure of the Arctic atmosphere. I believe this paper is good enough and deserves to be published in ACP. However, before doing so I hope that the authors take the comments stated below under consideration in order to make some parts of the paper less confusing and hopefully increase its scientific impact.

In section 2.2 (P.5441 L.4-5) It is explained that trajectories represent the paths taken by air parcels over a period of time. However, in numerous places in the text this relationship between air parcels and trajectories is very confusing. In its current form the paper almost treat trajectories as a synonym for air parcels which is misleading. Please take this comment under consideration and rewrite these parts of the text. P.5436 L.13, P.5441 L.20, P.5441 L.26, P.5444 L.1, P.5448 L.2, P. 5451 L.5, P.5453 L.23, P.5454 L.16, P.5455 L.26, 5458 L.25, P.5461 L.18, and P.5462 L.19

P.5438 L.19: Consider mentioning of the cooling effect of snow as well as of ice.

P.5439 L.21: biomass emissions -> should it state: biomass burning emissions?

P.5441 L.8-10: Why were trajectories more appropriate than calculation by a Lagrangian particle dispersion model (LPDM)? Transport statistics have been calculated using LPDM's in several studies in the past e.g.:

Hirdman, D., et al.: Source identification of short-lived air pollutants in the Arctic using statistical analysis of measurement data and particle dispersion model output, Atmos. Chem. Phys., 10, 669-693, 2010

Hirdman, D., et al.: Long-term trends of black carbon and sulphate aerosol in the Arctic: changes in atmospheric transport and source region emissions, Atmos. Chem. Phys., 10, 9351-9368, 2010

Paris, J.D., et al.: Wildfire smoke in the Siberian Arctic in summer: source characterization and plume evolution from airborne measurements, Atmos. Chem. Phys., 9, 9315-9327, 2009

Paris, J.-D., et al.: Source-receptor relationships for airborne measurements of CO2, CO and O3 above Siberia: a cluster-based approach, Atmos. Chem. Phys., 10, 1671-1687, 2010

Warneke, C., et al.: Biomass burning in Siberia and Kazakhstan as an important source for haze over the Alaskan Arctic in April 2008, Geophys. Res. Lett., 36, L02813,

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11, C1102–C1104, 2011

doi:10.1029/2008GL036194, 2009

Warneke, C., et al.: An important contribution to springtime Arctic aerosol from biomass burning in Russia, Geophys. Res. Lett, 37, L001801, doi:10.1029/2009GL041816, 2010

P.5455 L.26-27: Consider to reformulate this sentence. It is at the moment unclear if it should state that 54% of all trajectories calculated from releases between 40 and 50 degrees North reach the Arctic, or if it instead should express that 54% of the trajectories reaching the Arctic originate from releases between 40 and 50 degrees North.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 5435, 2011.