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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Transport of anthropogenic and biomass burning aerosols from Europe to the Arctic during spring 2008" *by* L. Marelle et al.

Anonymous Referee #1

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Review of "Transport of anthropogenic and biomass burning aerosols from Europe to the Arctic during spring 2008"

The present study elaborates on the characteristics and transport of aerosol pollution plumes in the European Arctic in spring 2008 and their anthropogenic and biomass burning related origins. This work combines data from airborne observations and monitoring stations with modelling results obtained with WRF-Chem and WRF-Flexpart. The model performance is evaluated and arguments for several assumptions or simplifications (e.g. aerosol chemical composition or comparison of PM2.5 with SMPS derived aerosol concentrations) are based on well elaborated arguments. Overall this

study sheds light on the details of pollution transport to the European Arctic including its effect on the radiative balance. I recommend publication of the manuscript after a minor revision.

General comments

None

Specific comments

p. 28334, last line: Is Finland not part of Scandinavia?

p. 28336, l. 1: "...chemical-transport models." This needs a reference, e.g., Shindell et al. (2008)

section 2.1.: please add information on the time resolution of the measurements

p. 28338, l. 1: please include information on the overall number of data points to show that the following analysis is statistically relevant.

p. 28338, ll. 2 – 7: Where does this information come from? Either provide a reference or give a concrete example based on the data you use.

p. 28339, l. 10: What type of data, mass concentration, chemical composition, etc.? Please specify.

p. 28340, l. 8: Please provide more specifics on what "aerosol/cloud interactions" includes.

p. 28340, l. 17 – 19: "... and SOA formation is likely to be low in Europe..." This needs a reference.

p. 28341, l. 8: Not clear to what these numbers refer. In-domain, global, other?

p. 28341, l. 27 – 29: How exactly do you make this estimation?

p. 28345, l. 16 – 18: What exactly do you mean by "compensated"? Does this refer to

the overall mass? Or to other characteristics such as hygroscopicity, optical properties, size, shape? Be more specific.

p. 28345 f, l. 25 – l. 3: How do Tuccella et al. (2012) explain the deficiencies in modeling OC?

p. 28346, l. 19: What is the number in brackets? Do you mean kappa 0.14? Specify.

p. 28346, l. 25: Do you mean all radiative effects or only the direct? Be more specific.

p. 28347, l. 26: Give a reason why you use 20 %.

p. 28349, l. 7: Include a reference for the underestimation by many global models.

p. 28349, ll. 9 – 13: How does this composition compare to other in-situ measurements of pollution plumes in the Arctic that were measured during the several POLARCAT (including ARCTAS and ARCPAC) campaigns? Is it special or similar to what we know already?

p. 28349, ll. 20 – 29: You elaborate on the deficiencies in representing nitrate, ammonium and OC with the model and then compare your results to Brock et al. (2011) for BC only. Include a discussion on the other chemical components as well.

p. 28350, l. 22: What is the diameter range of the accumulation mode you are referring to? Also specify the type of diameter.

p. 28355, l. 20: What do you mean by should? Do they contribute or do they not?

p. 28356, l. 19 and following: How comparable are the values? Have the plumes on average the same age, are the sources and characteristics comparable?

Figures S2: Describe what the letters mean in the plot.

Figure S3a: The column integrated PES is hardly visible. I suggest to zoom into the region.

Technical comments

p. 28334, l. 7: Split the sentence, it is too long.

p. 28336, l. 18: missing word “These studies pointed towards the needs. . .”

p. 28340, l. 7: there is a closing bracket too much after “version Z”.

p. 28344, l. 5: delete “by”

p. 28344, l. 20: Under these conditions the experience might have been like a “fight” but you probably mean “flight”.

p. 28346, l. 15: delete “of” in “. . . NH3 could cause of an enhanced. . .”

p. 28346, l. 22: The chemical formula for ammonium sulfate is incorrect.

p. 28351, l. 8: There is on “large” too much.

p. 28351, l. 15: Flanner (2013) would be another appropriate reference.

p. 28353, l. 4, a “,” is missing after “(Fig. 10c)”

p. 28353, l. 12: “ASPR” has not been introduced yet

p. 28354, l. 15: A “.” is missing between the sentences.

References:

Flanner, M. G.: Arctic climate sensitivity to local black carbon, Journal of Geophysical Research D: Atmospheres, 118, 1840-1851, 2013.

Shindell, D. T., Chin, M., Dentener, F., Doherty, R. M., Faluvegi, G., Fiore, A. M., Hess, P., Koch, D. M., MacKenzie, I. A., Sanderson, M. G., Schultz, M. G., Schulz, M., Stevenson, D. S., Teich, H., Textor, C., Wild, O., Bergmann, D. J., Bey, I., Bian, H., Cuvelier, C., Duncan, B. N., Folberth, G., Horowitz, L. W., Jonson, J., Kaminski, J. W., Marmer, E., Park, R., Pringle, K. J., Schroeder, S., Szopa, S., Takemura, T., Zeng, G., Keating, T. J., and Zuber, A.: A multi-model assessment of pollution transport to the Arctic, Atmos. Chem. Phys., 8, 5353-5372, 2008.