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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Anthropogenic and forest fire pollution aerosol transported to the Arctic: observations from the POLARCAT-France spring campaign" *by* B. Quennehen et al.

Anonymous Referee #3

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GENERAL REMARKS

The manuscript presents data from airborne observations of pollution plumes transported from Asia and Europe to the Arctic. The observations were part of the POLARCAT-France spring campaign using the French ATR-42 research aircraft.

The reported observations of aerosol size distributions, trace gases, aerosol light absorption coefficient combined with FLEXPART plume analyses and aerosol modelling make a significant contribution to the research on climate change impacts on the Artic region. The manuscript fits well into the scope of ACP and deserves publication.

Major weaknesses of the manuscript are an incomplete description of the applied data

analyses steps and - more important – a large portion of speculation in the data interpretation; see specific comments for details. Concluding, the manuscript is acceptable for publication in ACP after major revisions.

SPECIFIC COMMENTS

1. The authors state that the evolution of the particle size distributions could not be explained by coagulation only. However, earlier studies on the ageing of biomass burning aerosol from an event in 1998 (Fiebig et al., 2002) and 2004 (Petzold et al., 2007) showed in combination with results from source studies as cited in (Dentener et al., 2006) that the evolution of biomass burning aerosol in the accumulation mode can be explained by coagulation. Another good reference for the study of aged boreal fire aerosols is (Müller et al., 2007). The above-mentioned references should be included into the introduction.

2. It is recommended that the authors plot their size distributions in Figs. 5a and 10 in the same way as in Dentener et al. (2006) and Petzold et al. (2007) to check whether their observations fit into the presented scheme. Although Fig 5a refers to the Aitken mode, there should be a link between modal diameter and distribution width. In addition, at least a brief description of the coagulation model is needed. Does it, e.g., include particle nucleation which would enhance Aitken mode growth by coagulation, etc.?

3. The attribution of the missing size shift to condensation is valid only if all data refer to a Lagrangian case. This however is not shown in the manuscript. If the measurements were not performed in a Lagrangian way then the authors have to evaluate very carefully if it is justified to connect size distributions from different plume ages by a single model run. Methven et al. (2006) have shown a very powerful approach for testing Lagrangian cases in airborne studies.

4. The authors do not explain how they determined the excess CO and the aerosol absorption coefficient from PSAP data. A careful discussion of the determination of

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the background CO for subtraction from the signal in order to determine excess CO is required. Furthermore, the authors should describe how they performed the light scattering correction of the PSAP data.

5. The abstract needs to be rewritten and substantially shortened to highlight the key outcomes of the presented work.

6. A discussion section is missing which compares the reported observations to results from earlier studies. It could be an option to shorten the conclusions and replace this section partially by a more extensive discussion of the observations and the resulting consequences in relation to earlier studies.

MINOR COMMENTS

1. Please use either log-normal, or lognormal.

2. Page 4548, line 24: delete “trace gas” at the end of the line.

3. Page 4552, line 10: Check the numbering of Figs. 7 which you are referring to.

4. Page 4552, line 13: I suggest “First” instead of “Firstly”.

5. Page 4554, line 23/24: I suggest “the Aitken mode” and “the accumulation mode”.

6. Page 4560, line 17: please check the wording of this sentence.

7. Page 4561, line 6: correct “transported”.

REFERENCES

Dentener, F., et al.: Emissions of primary aerosol and precursor gases in the years 2000 and 1750 prescribed data-sets for AeroCom, Atmos. Chem. Phys., 6, 4321-4344, 2006.

Fiebig, M., et al.: Optical closure for an aerosol column: Method, accuracy, and inferable properties applied to a biomass-burning aerosol and its radiative forcing, J. Geophys. Res., 107, 8130, doi:10.1029/2000JD000192, 2002.

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Methven, J., et al.: Establishing Lagrangian connections between observations within air masses crossing the Atlantic during the International Consortium for Atmospheric Research on Transport and Transformation experiment, J. Geophys. Res., 111, D23S62, doi:10.1029/2006JD007540, 2006.

Müller, D., et al.: Multiwavelength Raman lidar observations of particle growth during long-range transport of forest-fire smoke in the free troposphere, Geophys. Res. Lett., 34, L05803, doi:10.1029/2006GL027936, 2007.

Petzold, A., et al.: Perturbation of the European free troposphere aerosol by North American forest fire plumes during the ICARTT-ITOP Experiment in summer 2004, Atmos. Chem. Phys., 7, 5105-5127, SRef-ID: 1680-7375/acpd/2007-7-4925, 2007.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 4541, 2012.