Atmos. Chem. Phys. Discuss., 14, C7385–C7389, 2014
www.atmos-chem-phys-discuss.net/14/C7385/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Size-dependent wet removal of black carbon in Canadian biomass burning plumes" *by* J. W. Taylor et al.

Anonymous Referee #2

Received and published: 25 September 2014

This work presents a detailed case study on the wet removal of black carbon containing aerosol in one Canadian biomass burning plume by comparing it to two similar plumes that did not experience precipitation. It focuses on aerosol chemical characteristics, BC core and coating size distributions and optical properties. The paper is concisely written, well researched and provides new insights into the atmospheric lifetime of coated BC aerosol in biomass burning plumes. I recommend publication with minor revisions as specified in the following.

General Comments:

It seems that only one back trajectory was calculated for each of the three plumes. Given the uncertainties of the model and the fact that all further analysis and argu-

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

mentation is based on these results a sensitivity study is necessary. It should at least include multiple releases of back trajectories from slightly varied locations around the plume centers to test the robustness the results.

The ratios presented in Section 3.2 are not emission ratios but ratios that are affected by chemical and microphysical processes in the atmosphere. Rename the section to "chemical characteristics", "tracer ratios" or something similar and change the terminology for the chemical ratios that are not emission ratios in the text.

For better comparability with existing and future studies of biomass burning aerosol, more information on the organic aerosol should be included to elucidate the chemical age of the plumes you describe. Given the AMS data set you can include the fraction of the mass to charge ratio 44 of the whole OC mass (f44, e.g. Ng et al. 2010) or convert this into the O:C ratio. Either parameter will give further ideas regarding the solubility of OA due to its degree of oxygenation which might play a role for the wet removal, and can further describe chemical similarities or differences between the plumes which again is crucial for your analysis. In addition, including more information on the OA concentrations in plume 3 in the text would be helpful, because values cannot be read from the graph due to the coarse resolution of the axis.

Include information on how many data points you have from the SP2, AMS and SMPS measurements during plume interception.

Specific comments:

Be more specific about the different types of diameters throughout the manuscript (e.g. mobility diameter on p. 19477, l. 24.)

Section 2.1: There is no information about the flight track and altitude. Insert the flight track in figure 1 and include a more detailed description in this section.

Section 2.3: Elaborate how you identified the regional background and why Rˆ2 >= 0.55 is considered as threshold for a good correlation between CO and CH3CN.

ACPD

14, C7385–C7389, 2014

Section 3.1, until p. 19480, l. 5: These are not results, move these paragraphs to a new subsection in section 2.

p. 19480, l. 12: give numbers for the altitudes

p. 19480, l. 16: How many hours before sampling?

p. 19481, l. 14: give a reference that describes the decrease of the OA/CO ratio due to evaporation

p. 19485, l. 2: Is this only because of the coating or also because of the size? Include a brief discussion on this.

p. 19488, l. 11: Elaborate, from the given information it's not clear why the result would be 0.1.

p. 19488, l. 13f: Has this been shown before? If yes, give references.

Table 2: The nomenclature for plumes of the ARCTAS campaigns is confusing, because it's not clear that "ARCTAS Asia" means BB plumes from Asia measured during ARCTAS. Change the nomenclature so that this becomes clear. If there is information on the age of plumes that are compared in this table and the type of fire (smoldering, crown fire etc.) include it, because it is important information regarding their comparability. Figure 2: Include the back trajectories in this plot for better readability.

Technical comments:

p. 19471, l. 13: single-scattering albedo

p. 19471, ll. 15-17: "..., possibly due to the thick coatings..." does this refer to the particles you measured or to the Asian outflow aerosol?

p. 19471, l. 17: "... provides important constraints..." give examples

p. 19471, l. 26: insert "...as well as its chemical processing and lifetime in the atmosphere and optical properties. "

ACPD

14, C7385–C7389, 2014

p. 19473, first sentence: BC aerosol that is coated with hydrophilic material wouldn't be considered fresh anymore. The sentence needs to be rewritten accordingly.

p. 19474, l. 4: insert "BC" after "diesel-dominated"

p. 19474, l. 8: insert "a" before "precipitating cloud"

p. 19474, l. 8: delete the sentence "Franklin et al. . ." There is no gain in information.

p. 19475, l. 9: split sentences here: ". . . temperature. During BORTAS. . ."

p. 19477, l. 4-5: organic aerosol, no capital letters

p. 19478, l. 23: delete "in the Supplement" before "in Table S1"

p. 19479, l. 9: What do you mean by "contrasting"?

p. 19479, l. 11: use the newest reference for the HYSPLIT model

p. 19480, l. 22: the correct time period is: 12:45 – 13:00 UTC

p. 19480, l.29: give a reference

p.19482, l. 26: specify which ARCTAS campaign/s

p. 19490, l. 14: BC removes environments? I think it's "remote".

p. 19490, l. 18: ". . . because the original size distribution was smaller than Moteki et al. . .". I hope that the particles are smaller than Moteki et al. . .. Please change to: ". . .was smaller than the one described by. . ."

Figure 5, 6, 7: Include a note regarding which instrument generated the data.

Reference: Ng, N. L., Canagaratna, M. R., Zhang, Q., Jimenez, J. L., Tian, J., Ulbrich, I. M., Kroll, J. H., Docherty, K. S., Chhabra, P. S., Bahreini, R., Murphy, S. M., Seinfeld, J. H., Hildebrandt, L., Donahue, N. M., DeCarlo, P. F., Lanz, V. A., Pr′evËĘot, A. S. H., Dinar, E., Rudich, Y., and Worsnop, D. R.: Organic aerosol components observed in Northern Hemispheric datasets from Aerosol Mass Spectrometry, Atmos. Chem.

ACPD

14, C7385–C7389, 2014

Phys., 10, 4625–4641, doi:10.5194/acp-10-4625-2010, 2010.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 19469, 2014.