Atmos. Chem. Phys. Discuss., 13, C8778–C8780, 2013
www.atmos-chem-phys-discuss.net/13/C8778/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "An AeroCom assessment of black carbon in Arctic snow and sea ice" *by* C. Jiao et al.

A. Stohl (Referee)

ast@nilu.no

Received and published: 9 December 2013

This paper is a useful compilation of snow BC concentrations as derived from BC deposition fields simulated by AEROCOM models and two models of BC behavior in land-based and sea-based snow pack. It is well written and serves the purpose of getting a quick overview of model results with respect to BC snow concentrations. On the other hand, I have not learned much from reading the paper with respect to process-level understanding. The fact that the same snow pack models are used for converting BC deposition values from all AEROCOM models into BC snow concentrations is a limitation, which likely leads to strong underestimation of the true uncertainties inherent to the modeling of BC snow concentrations. Even though, modeled snow concentra-

tions are very different between the various models. However, the paper fails to identify the critical processes which need to be considered and/or improved in order to facilitate more accurate BC-in-snow concentration simulations (e.g., why are some models better than others?). On balance, however, considering the useful data compilation, I recommend that the paper can be published in ACP after minor revisions, considering my further comments.

The models seem to systematically underestimate the BC concentrations in snow in the Eastern Arctic (Russia) but overestimate BC concentrations in the Western Arctic (Alaska, Canada, Greenland). Does this indicate a shortcoming of the emission data underlying the emissions? Stohl et al. (2013) have recently suggested that gas flaring in Russia is an important source of BC in the Arctic, which would probably help to explain the underestimates seen in Russia.

Pg 26225, line 25: Is it realistic to assign all BC wet deposition to the hydrophilic species? Wouldn't some scavenging (e.g., below-cloud scavenging) also occur for hydrophobic BC?

Pg 26226: Is there no transfer between hydrophobic and hydrophilic BC, once BC is deposited in the snow pack? I would assume that BC also ages in the snowpack, especially in summer when the snowpack is strongly illuminated.

Pg 26223, lines 20-24: The statement: "the emission inventory. . .has very weak seasonal variation. . ., contributing to the lack of seasonality in BC deposition" is wrong. BC emissions from most sources are likely highest in winter and this would further flatten the seasonal cycle.

The scatter plots (e.g., Fig. 1-3) need improvement. In Fig. 1, the same type of symbols is used for all models, making it impossible to distinguish between different models (colors are often too similar). In Fig. 2, there is so much overlap between symbols that they cannot be distinguished. Especially most of the few observation symbols are entirely hidden. Maybe changing the plotting sequence (plotting observations on top of

models) and enlarging the symbols would help.

Fig. 4: Models should be named, as in Fig. 1-3, instead of just numbering them.

Minor:

Pg 26224, line 3: reports -> report or reported

Pg 26224, line 8: organic carbons -> organic carbon

Pg 26226, lines 4-5: this sentence is somehow incomplete. “ratio of BC concentration”: Ratio to what?

Reference: Stohl, A., Klimont, Z., Eckhardt, S., Kupiainen, K., Shevchenko, V. P., Kopeikin, V. M., and Novigatsky, A. N.: Black carbon in the Arctic: the underestimated role of gas flaring and residential combustion emissions, Atmos. Chem. Phys., 13, 8833-8855, doi:10.5194/acp-13-8833-2013, 2013.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 26217, 2013.