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Atmospheric Chemistry and Physics Discussions

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Interactive Comment

Interactive comment on "Why models struggle to capture Arctic Haze: the underestimated role of gas flaring and domestic combustion emissions" *by* A. Stohl et al.

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The manuscript investigates the role of previously poorly resolved emissions (domestic combustion and gas flaring) on the modelled seasonal cycle of Arctic BC concentrations. It is an original contribution to the discussion of Arctic aerosol sources, transport and losses, and as such deserves to be published. Overall, the manuscript is well written and the methodological limitations are openly discussed. However, I agree with the anonymous referee that the conclusions regarding the role of gas flaring and domestic combustion should be tuned down unless a sensitivity analysis addressing some of the large uncertainties in the model set-up are addressed.

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Interactive Discussion
Discussion Paper

Specific comments:

1) There are large uncertainties related to the newly introduced emissions (e.g. gas flaring BC emission factor, intra-annual variability, emission height) as well as to the BC removal processes. I recommend a sensitivity analysis regarding these uncertainties so that the study could better constrain the role of different assumptions and processes in the modeled fields. The sensitivity simulations do not need to be run over the whole simulation period but can concentrate on e.g. 1 year period.

The large uncertainties should also be briefly mentioned in the abstract and the conclusions.

2) The cited study regarding the correlation between fuel use and HDD (Quayle and Diaz, 1980) is over 30 years old. How well does this study apply to the modern, better insulated housing with much more electrical gadgets that heat the indoor air? Is the base temperature of 15°C from the Quayle and Diaz study or from more recent research, and what is it based on?

3) What is the linear weighting of space heating and cooking between 15 and 55 N based on? How will this assumption affect the simulated Arctic BC concentrations?

4) What is the emission size of BC of 0.25 um based on? One would expect the emission size to differ between the different emission sources. How is this expected to affect the simulation results? How about the fact that BC wet deposition seems to be assumed independent of the hygroscopicity of the particles?

5) P. 9581, L. 19-24: Explain explicitly how the differences in the relative enhancement imply show that the enhancement is due to enhancement is mainly due to differences in transport pathways between seasons.

6) P. 9582, L. 3: '5%' should be '5 percentage points'

7) The implied very strong interannual variability of the measured and modeled monthly means should be somehow indicated ("broken" y axis in figure 8 or a table) to get a

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better idea of the model performance against the measurements. If one argues that HDD improves the match between observations and the model, this should be evident also in a year-to-year comparison.

8) Make sure that in the final figures the fonts for titles, colour bars, etc. are large enough! Currently many of them are impossible to read.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 9567, 2013.