Atmos. Chem. Phys. Discuss., 14, C3800–C3802, 2014
www.atmos-chem-phys-discuss.net/14/C3800/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simulating black carbon and dust and their radiative forcing in seasonal snow: a case study over North China with field campaign measurements" *by* C. Zhao et al.

Anonymous Referee #2

Received and published: 18 June 2014

In this paper a regional model is used to simulate BC and dust, and their radiative forcing, in snowpack in North China over the period January to February 2010, when a field campaign was conducted in the area. The regional model used is WRF-Chem, and the modelled depositions of the atmospheric aerosols are coupled with the SNICAR model for the first time in this study. The paper describes well the WRF-Chem model and the regional simulations, and how it compares to the measurement campaign of BC in snow in 2010. The spatial pattern of the observations is captured by the model. They find that the radiative warming in the snowpack is of comparable magnitude to the surface radiative cooling due to BC and dust in the atmosphere. I recommend that the

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

paper can be published in ACP after minor revisions, considering my comments below.

General comments:

I find the conclusion section too long. In the introduction it is written: “The findings are summarized and discussed in Sect. 5” that does not match the title of the section. Some of the text in the conclusions is more or less a repetition of text in the result section. I would recommend to shorten the conclusion section and if needed include a discussion section.

Specific Comments:

Figure 6 show that dry deposition is of larger importance than wet deposition over parts of the region of interests, which is interesting. I would like a few more sentences in the model description (Page 13338, Line 4) regarding dry deposition of BC. Also, include in the model description what is not included, e.g. deposition of ice-borne aerosols which is mentioned on page 13356.

Section 2.4 Emissions: Which year is used for the China emissions from Lu et al. (2011)? For emissions in the model domain not given in Lu et al. (2011) (e.g. Russia, Mongolia, Korea), are the Zhang et al (2009) emissions used? Please specify. For the spin up period, is GFED 2009 emissions from October to December used?

Related to the emissions, the model results show large daily and diurnal variation of BCS (Page 13348, Line 17). Is there assumed any diurnal variability in the emissions?

The model uses chemical initial and boundary conditions from a quasi-global WRF-Chem simulation. I would recommend including a few sentences describing this simulation, including emissions used and deposition processes. A short discussion of weaknesses/advantages of the use of regional models could be of interest, especially regarding long range transport of BC. Is it possible to quantify how much of the deposited BC in the regional model domain comes from outside the domain?

The field campaign in North China provided BC concentration at several depths (Page

ACPD
14, C3800–C3802, 2014

13344, Line 20). Did you try to use this information when comparing model results and observations?

Figure 2 show the spatial distributions of snow depth and snow water equivalent from the WRF-Chem and the CMC reanalysis. Could you explain why there is no snow (white boxes) at the exact same sites in the reanalysis and the model data?

Page 13348, Line 11: Could you mention why there was no data available for sites 41-46?

In figure 7, is it a way to indicate if there are no observations? In figure b) I will suggest to align the dot in the circle with the station number. The explanation of the WRF-Chem box plot was hard to follow. "minimum and maximum simulated values at 24 h of January–February". What does at 24 h mean? (midnight, daily mean)

On page 13351, it could be useful to use the site numbers when discussion the observations in the different regions.

Technical corrections:

Page 13334, Line 3: "the sophisticated representation of snow metamorphism processes available for climate study.." -> "the most sophisticated" ?

Page 13334, Line 8: "In general, the model simulated spatial variability of BC and dust mass concentrations in the top snow layer (hereafter BCS and DSTS, respectively) are quantitatively or qualitatively consistent with observations." -> "that are quantitatively" (?)

Page 13347, Line 21: "BCS is determined by both snow coverage and BC deposition". Is snow coverage the right word?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 13331, 2014.