

Interactive
Comment

Interactive comment on “Ocean mediation of tropospheric response to reflecting and absorbing aerosols” by Y. Xu and S.-P. Xie

Anonymous Referee #1

Received and published: 28 February 2015

In this paper, you proved the changes in the SST gradient and mid-latitude eddies are instrumental in creating a similar deep vertical temperature in response to BC and SO₄. It shows the importance of ocean-atmosphere interactions. This is the pioneering study about climate effects of aerosols at present. In this regard, this paper is interesting and important. The results are convincing and the simulations used are appropriate. I thereby believe this manuscript is appropriate for publication in ACP and would recommend publication subject to primarily minor revisions outlined below. Hope the comments below are of help for the authors.

(1) I am confused about how to conduct the model configuration in this paper. Parameterization schemes, spatial resolution, ... should be shown in this study. And more information about the emission inventory of BC and SO₄ should be mentioned. Fur-

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thermore, the introduction of the modeling performance about simulating BC and SO₄ is inadequate in this paper. BTW, BC in snow could increase the surface temperature and reduce snow pack. These impacts may result in the change of soil moisture, surface fluxes, and East Asian monsoon (Huang et al., 2011, Wang et al., 2013 and Flanner et al., 2005). Is BC in snow considered in the paper?

(2) “Reflecting and absorbing aerosols” are always mentioned in this paper. However, only SO₄ and BC₄ were considered in the simulations. As we known, dust is one of the absorbing aerosols in the atmosphere, which can influence the climate directly by modulating the radiation budget, affect the microphysical properties of clouds, and alter the surface albedo of the ground covered by snow or glacier. Therefore, I think more aerosols species should be discussed in detail.

(3) In this paper, you just showed the vertical profile of simulated results. I think the spatial distributions of the most relevant results are needed. It can help us decide whether the patterns of simulations are reasonable at global scales.

(4) Some parts of supplement materials including a detailed explanation should be put in the main body.

Minor comments:

(1) Table S1: How to get these results in Table S1? Please give more details about background information.

(2) Section 2.1: Introduce the model configuration including the modeling domain, the BC and SO₄ emission inventory.

(3) Figure 1 and Figure 3: The figures did not show the SST perturbation induced by BC. Why?

(4) Figure 4 and Figure S4: These figures need to be more clearly. Please improve them.

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Reference: 1. Huang, J., Fu, Q., Zhang, W., Wang, X., Zhang, R., Ye, H., and Warren, S.: Dust and black carbon in seasonal snow across northern China, *Bull. Amer. Meteor. Soc.*, 92, 175–181, doi:10.1175/2010BAMS3064.1, 2011. 2. Wang, X., S. Doherty, J. Huang, 2013: Black carbon and other light-absorbing impurities in snow across Northern China, *Journal of Geophysical Research: Atmospheres*, 118, doi:10.1029/2012JD018291. 3. Flanner, M. G. and Zender, C. S.: Snowpack radiative heating: Influence on Tibetan Plateau climate, *Geophys. Res. Lett.*, 32, L06501, doi:10.1029/2004GL022076, 2005.

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