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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #1

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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. Furthermore, 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) "Reflcting and absoring 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.

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:InïňĆuence on Tibetan Plateau climate, Geophys. Res. Lett., 32, L06501, doi:10.1029/2004GL022076, 2005.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 5537, 2015.