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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Role of sea surface temperature responses in simulation of the climatic effect of mineral dust aerosol" *by* X. Yue et al.

Anonymous Referee #1

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Comments on "Role of sea surface temperature responses in simulation of the climatic effect of mineral dust aerosol"

General: The paper tries to understand the role of dust-induced sea surface temperature (SST) responses in simulation of the climatic effect of dust using a GCM with/without the two-way dust-climate coupling, focusing on the differences in simulated dust-induced changes in temperature and precipitation in the presence and absence of SST responses. This paper found that the SST responses are much more important when dust-climate interactions are included in climate simulations. The radiative effect of dust leads to a strong annual and global mean cooling of 0.09 K at the surface. Be-

sides, the dust-induced reductions in SST lead to reductions in precipitation and hence increase the global burden of small dust particles.

The subject of this paper is important and appropriate for the ACP. However, some suggested minor modifications are listed in the following:

Major comments

1. Author should include some newly published paper which is related Asia dust transportation and dust-cloud interaction. For example: 1): Huang, J. et al., 2008: Long-range transport and vertical structure of Asian dust from CALIPSO and surface measurements during PACDEX, J. Geophys. Res., 113, D23212, doi:10.1029/2008JD010620. 2) Wang W., et al., 2010: Dusty cloud properties and radiative forcing over dust source and downwind regions derived from AâĂŘTrain data during the Pacific Dust Experiment, J. Geophys. Res., 115, doi:10.1029/2010JD014109.

2. On Page 8, 'A maximum warming of 0.3-0.7K is found over northern Africa(10°W-30°EïijŇ15°N-30°N) in both cases, which can be explained by the SW absorption of dust over high-albedo surface, LW absorption by large dust particles, as well as the dust-induced decreases in middle cloud amount(MCA,Fig.6) over this area. ' But how to explain the large area in the middle latitude of cloud amount reduction in Fig.6(b) colored by purple, which is not consisted with the max distribution of âŰşSAT in Fig.4e. The authors have to be more careful when trying to establish a causal link.

3. This paper doesn't include the semi-direct effort of aerosol dust, which is one of the uncertain elements of the simulation. Besides direct radiative effects, dust also has important microphysical effects on clouds and precipitation through the influence on cloud drop nucleation, which affects cloud life time, cloud albedo, precipitation loading and abnormal cloud properties (Refer: 1) Huang, J., et al., 2006: Satellite-based assessment of possible dust aerosols semi-direct effect on cloud water path over East Asia, Geophys. Res. Lett., 33, doi: 10.1029/2006GL026561. 2) Huang, J., et al.,

2006: Possible influences of Asian dust aerosols on cloud properties and radiative forcing observed from MODIS and CERES, Geophys. Res. Lett., 33, L06824, doi: 10.1029/2005GL024724.)

4. If you choose spring as the simulation period for this study, The results will be different?

Minor Comments:

5. The 21st line on Page 3: The full name of SSTs should be provided at the place where SSTs appear first.

6. The 17th line on Page 6: The full name of SAT has been explained at the place which appear first and it doesn't need to repeat.

7. The 13th line on Page 13: The word 'net' has been explained at the place which appear first and it doesn't need to repeat.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 1121, 2011.