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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling study on the transport of summer dust and anthropogenic aerosols over the Tibetan Plateau" *by* Y. Liu et al.

Y. Liu et al.

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We are very appreciative for the referee's careful review and constructive suggestions with regard to our manuscript. His/her suggestions and comments are helpful in improving the paper. We hope that the revised version of the paper has addressed much of the referee's concerns and is now acceptable for publication. The following are our point-by-point responses to the referee's comments:

Comments: The paper addressed the evaluation of SPRINTARS using satellite observations. Sprintars must have been evaluated previously by several investigators. Also, there is no novel idea was addressed which merits the publication of this version in ACP. However, it may be considered if the authors address the following issues: Response:

Thank you for your comments. As you mentioned, SPRINTARS has been evaluated by many previous studies, and its performance was well confirmed for "Global Scale Simulation", whose grid resolution is usually a hundred to several hundreds km. However it has not been implemented into "regional scale model" until now. In this study, SPRINTARS is firstly implemented "regional scale model" called NHM (Saito et al. 2006). The weakness of Global Climate Models is low resolution and neglecting the complex geomorphic types, different natural conditions and human activities. Regional climate models have higher resolutions and they can characterize the terrain and the surface condition better. Generally speaking, there are a large amount of tunings and parameterizations in aerosol modules, and it is not always clear whether these tunings and parameterization work well or not in regional scale model. In this point, SPRINTARS is no exception. In this sense, it is very important to confirm the validity of the SPRINTARS coupled with regional scale model with 20 km grid resolution, and we think that this study is very important for showing the performance of SPRINTARS in regional model for the first time. The validity of the SPRINTARS coupled with regional scale model will ameliorate the regional simulations from global climate model and increase the simulating accuracy of regional climate change.

Comments: The dust simulations and its spatial extent around 40N shown in Figure 3 does not very well compared with OMI observations. Response: Thank you for your comments. There really exists some underestimation in the simulations with the dust emission parameter used in GCM model. We have re-run the model with the tuned the parameter of dust emission and the corresponding results (figures 3-9 in the manuscript) have been given in the document 'figures'.

Comments: Also, model overestimates the carbonaceous and sulfate aerosol distribution around 100E. The reasons why it is not matching with observations are not explained clearly. Response: First of all, we think that the aerosol distribution around 100o E is not bad, and there are many missing value in observation data around this area. We can add some word for this reason. From the available satellite data, we

think the agreement with simulation is not bad. Does the reviewer indicate aerosol distribution east to 105oE? If so, we think that one of the reasons of the overestimation is the effect of lateral boundary. In generally, results of the regional scale model, into which SPRINTARS firstly implemented by this study, are affected by artificial wave and artificial noise around lateral boundary. These noises also affect the advection of aerosol, and therefore spatial distribution of aerosol. All of the regional scale models have the problem of lateral boundary, and we omitted the discussion on the results around lateral boundary.

Some minor suggestions Comments: Page # 15013 Line 19: Rainclouds may be corrected as "warm clouds" Response: Sorry for our mistake. The word "rainclouds" should be "raindrops" or "cloud droplets". We modified this word in revised manuscript (15013 Line 19).

Comments: Page # 15016 Line 14: "Considering the missing satellite observations over 21-23 August". You have used MISR, OMI and which data was missing? Response: We are very sorry for our ambiguous descriptions. The MISR orbit can only cover 360 km wide and there exist plenty of missing observations in daily products (as shown in Fig. B1). In order to evaluate SPRINTARS combined with NHM, we compared the simulated monthly aerosol optical properties with the MISR observations. To express more accurately, we rewrite this sentence and 'Considering the missing satellite observations over 21–23 August, we compared the simulated monthly aerosol optical properties with the MISR observations on August 2007 over the TP' is changed to 'Considering the missing observations of MISR, we compared the simulated monthly aerosol optical properties with the satellite observations on August 2007 over the TP' (15016 Line 14-16).

Comments: In some places it is spelled as "Taklimakan" instead of "Taklamakan" Response: Sorry for our negligence. These two words both mean the largest desert in China, filling the Tarim Basin. In order to unify the writing, all of these words "Taklamakan" are changed to "Taklimakan". We modify the spells in revised manuscript

(15017 Line 11, 14). We have checked the manuscript and revised it according to the comments. We submit here the revised manuscript as well as a list of changes. If you have any question about this paper, please don't hesitate to contact me at the address below. Thank you and best regards. Sincerely yours, Yuzhi Liu

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Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/15/C6907/2015/acpd-15-C6907-2015-supplement.zip

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Interactive comment on Atmos. Chem. Phys. Discuss., 15, 15005, 2015.

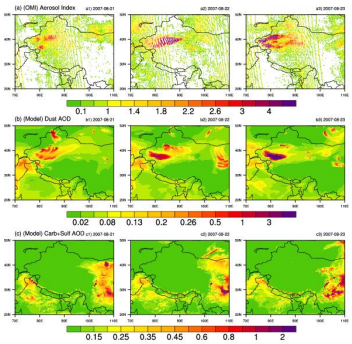
(a) (OMI) Aerosol Index
0.1 1 1.4 1.8 2.2 2.6 3 4
(b) (Model) Dust AOD
0.02 0.08 0.13 0.2 0.26 0.5 1 3
(c) (Model) Carb+Sulf AOD
0.15 0.25 0.35 0.45 0.6 0.8 1 2

Fig. 1.

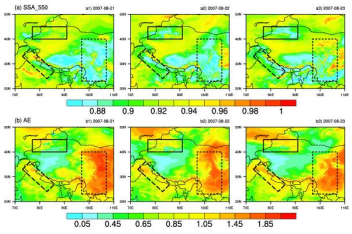
(a) SSA_550
0.88 0.9 0.92 0.94 0.96 0.98 1
(b) AE
0.05 0.45 0.65 0.85 1.05 1.45 1.85

Fig. 2.

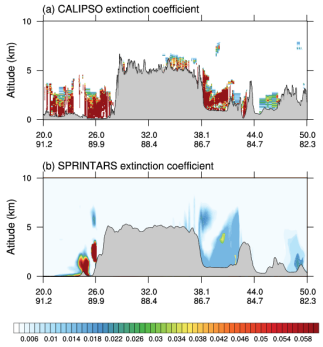
(a) CALIPSO extinction coefficient
Altitude (km)
10
5
0
20.0 26.0 32.0 38.1 44.0 50.0
91.2 89.9 88.4 86.7 84.7 82.3
(b) SPRINTARS extinction coefficient
Altitude (km)
10
5
0
20.0 26.0 32.0 38.1 44.0 50.0
91.2 89.9 88.4 86.7 84.7 82.3
0.006 0.01 0.014 0.018 0.022 0.026 0.03 0.034 0.038 0.042 0.046 0.05 0.054 0.058

Fig. 3.

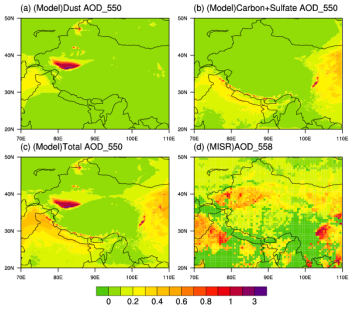
(a) (Model)Dust AOD_550
(b) (Model)Carbon+Sulfate AOD_550
(c) (Model)Total AOD_550
(d) (MISR)AOD_558
50N
40N
30N
20N
70E 80E 90E 100E 110E
0 0.2 0.4 0.6 0.8 1 3

Fig. 4.

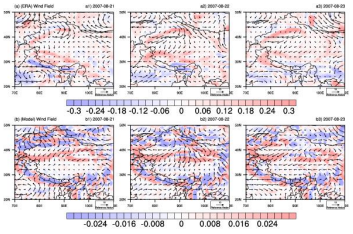
-0.3 -0.24 -0.18 -0.12 -0.06 0 0.06 0.12 0.18 0.24 0.3
-0.024 -0.016 -0.008 0 0.008 0.016 0.024

Fig. 5.

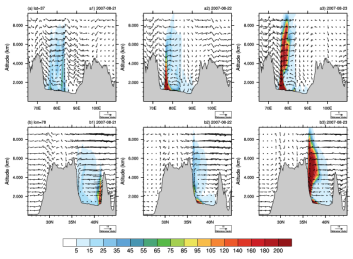
0 15 25 35 45 55 65 75 85 95 105 120 140 160 180 200

Fig. 6.

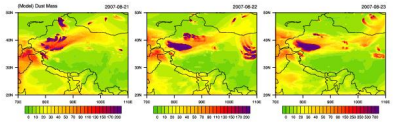

Fig. 7.

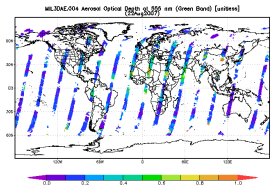

Fig. A1 Aerosol optical depths at 555nm on 22 August 2007 from the MISR.

Fig. 8.