

## ***Interactive comment on “Radiative feedbacks of dust-in-snow over East Asia in CAM4-BAM” by Xiaoning Xie et al.***

**Anonymous Referee #2**

Received and published: 18 June 2018

General Comments: The authors present a modeling study using the Community Atmosphere Model (CAM) with the bulk aerosol model (BAM) to investigate the positive radiative feedback of dust deposition on snow over East Asia. Due to the large scale climate impacts induced by Tibetan Plateau thermal forcing, this is a particularly important region to investigate. The study includes three 21-year simulations to isolate the radiative forcing associated with decreased snow cover and reflectivity due to dust deposition. There are some minor comments and questions that should be addressed along with deficiencies in overall grammar and sentence structure which are distracting to the content.

Specific Comments:

page 1, line 2: Please correct this sentence to, “. . .and removing snow cover through  
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increased snowmelt”

page 1, line 6-7: Please correct this sentence to, “Our results show that SRF increases the East Asian dust emissions by 13.7% in the spring, countering a 7.6% decrease in emissions by the . . .”

page 1, line 8: Please correct this to, “. . .dust cycle, including transport and deposition of dust aerosols over East Asia.”

page 1, line 8-10: I suggest rephrasing this and removing “overall dust cycle over this region” as this has been stated in the previous sentence. “The simulations indicate an increase in dust emissions of 5.1% due to the combined effect of DRF and SRF.”

page 1, line 12: Please correct this to, “. . .latent heat flux, which in turn increases the aridity and westerly winds over Northwest China and enhances the regional dust cycle.”

page 2, line 3: is this eastern China or the east China Sea?

page 2, line 8: Please change “by” to “as”

page 2, line 13: Please rephrase this. The DRF with particle size distribution for dust from Kok, 2011, is less cooling (smaller forcing). The new size distribution results in DRF range of  $\sim -0.5$  to  $+0.2$  W/m<sup>2</sup> compared to AeroCom results of  $\sim -0.8$  to  $-0.01$  W/m<sup>2</sup> accounting for the possibility that the atmospheric dust burden could be a warming influence on net RF.

page 2, line 18: Please change “with” to “by”

page 2, line 23: Please change “depending” to “dependent”

page 2, line 31: Please remove “also” (last word on this line)

page 3, line 1-2: This is a run-on sentence. Please add a full stop after Qu et al., 2014 and start a new sentence with “These studies further claim. . .”

page 3, line 5: Please change to “. . .aerosol in snow can cause a  $\sim 1$  degree warming

of the TP, which...”

page 3, line 7: Replace “through” with “by”

page 3, line 9: Please remove “by” before “to explain”

page 3, line 13: Replace “affecting” with “impacts on”

page 3, line 19: Insert “been” between “not” and “studied”

page 3, line 19: Remove “here” and change “extended” to “extend”

page 3, line 20: Add a comma after SRF and remove “and” after SRF

page 3, lines 18-21: Run-on sentence, please break up this sentence either by adding a semicolon or making this two sentences.

page 3, line 23: Change “experiment design,” to “experimental design.” Remove “and furthermore” and begin new sentence “The model...”

page 3, line 24: Change “observations about the snow cover and the surface temperature” to “observations of snow cover and surface temperature.” Change “The model results about” to “The model results for”

page 3, line 29: Remove “detailedly” and insert “in detail” between “described” and “by”

page 3, line 31: The improvements to CAM4-BAM are for the dust cycle only.

page 3, line 33-34 and p4, line 1: Can the authors be more specific about the impacts from the improved parameterizations? (e.g., dust in CAM4 release version was too absorbing and the size distribution was weighted too heavily on finest mode (bin1))

page 4, line 2: Insert “the” between “investigate” and “East”, change “Asia” to “Asian” and replace “display its” with “the”

page 4, line 8-9: Can the authors add the sources of the input datasets used to drive the model? Please also describe the CAM4 and SNICAR setup. Please explain if these

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are nudged simulations and if so, which meteorology data was used.

page 4: This study considers the dust-in-snow impact on RF but can the authors add some discussion on the combined deposition of all aerosols on snow? It would have been interesting to consider an additional case with deposition to snow from all radiatively active aerosols to shed light on the impact of dust-in-snow relative to, for example, BC+dust in snow.

page 4, line 16-17: Please rephrase the second part of this sentence to something like, “compared with changes induced solely by DRF”

Figure 2 (c) and (d): The color of the contour showing terrain > 2500m is difficult to see as it blends with the color scale in the figure.

page 4, line 24: Please rephrase, “. . .dust AOD has larger values over dust source regions (Gobi and Taklamakan deserts), where dust AOD is greater than 0.2 particularly over the Taklamakan desert.”

page 4, line 25: Please insert “mean” between “monthly” and “dust”

page 4, line 26: Please combine “The result also indicates...” with the previous sentence, “. . .dry, wet and total (dry+wet) deposition, with the highest values in MAM.”

page 4, line 27-28: I would rephrase “probably because of less rain over Northwest China.” Consider adding citations for the trends in seasonal precipitation over this region (Xu et al., 2008; Kang et al., 2010; Fig. 8, Lau et al., 2006) Kang, S., Xu, Y., You, Q., Flügel, W.A., Pepin, N. and Yao, T., 2010. Review of climate and cryospheric change in the Tibetan Plateau. *Environmental Research Letters*, 5(1), p.015101. Xu, Z.X., Gong, T.L. and Li, J.Y., 2008. Decadal trend of climate in the Tibetan Plateau—regional temperature and precipitation. *Hydrological Processes*, 22(16), pp.3056-3065.

page 4, line 29-31: Please change this sentence to, “Additionally, deserts in the western and northeastern regions of TP exhibit peaks in dust deposition, which we expect

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to further increase the SRF signal.”

page 5, Figure 3 (a) and (b): Can the authors provide further discussion on the low bias in the model for SCF during (MAM) and how this will impact their results? What are the implications of the low bias in surface temperature over the Gobi desert?

page 5, line 18: Replace “in the” before “MAM” with “during”

page 5, line 21: Typo “colume”

page 5, line 25: Change “remarkedly” to “markedly”

page 5, line 28: Are these statistically significant?

page 5, line 29: Please change “is” after “dust emissions” to “are”

page 5, line 30-31: Please insert “by 5.1%” between “East Asia” and “with”

page 6: The second paragraph in section 3.2 is good but can the authors comment on how well the simulated albedo in Figure 6 (a) matches satellite observations of albedo over this region?

page 6, line 17: Please change “That” after “Figure 7a).” to “This” and remove “that” between “because” and “the”

page 6: The negative RF from DRF over the Taklamakan and Gobi deserts from the scattering efficiency explained by simulated AOD would be more conclusive if the model AOD is compared to obs in the dust dominated regions.

page 6, line 20: Please change “decrease” after “surface” to “decreasing”

page 6, line 25: Please remove “reach” in “(reach above 20 W/m2)”

page 6, line 29: Please change “whereas” to “compared to”

page 6, line 30: Please change “determines” to “dominates”

page 6, line 33: Please change “followings.” to “following sections.”

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page 7, line 8: Typo “(LHF+LHF)” (LHF+SHF)

page 7, line 9: Please change “resulting in” to “thereby”

page 7, line 12: Please add “referred to” between “TP” and “as” and change “monsoonal” to “monsoon”

page 7, line 19 and 20: I don’t think “anonymous” is the right word. Do you mean anomalous?

page 7, line 21: Please change “That” between “regions.” and “is” to “This” and remove “that” between “because” and “the”

page 7, line 28: Please remove “remarkedly” and add “the” between “affects” and “dust”

page 7, line 29: Please change to “which in turn increases the magnitude of the whole dust cycle”

page 7, line 34 and page 8, line 1: Please rephrase this sentence, in particular “decreased (increased)” and “over the north of the TP (over the TP)” is confusing.

page 8, line 3: Please change “generally” to “general” and “enhances” to “enhancing”

page 8, line 11: please change “that” to “the” between “because” and “largest”

page 8, line 14: Please rephrase to something like, “The above results indicate the predominate causes for SRF enhancement of the dust cycle over East Asia and is illustrated in Figure 13.”

page 8, line 15: Please rephrase to something like, “Dust aerosols emitted from East Asian source regions where precipitation is limited and deposited . . .”

page 8, line 18: Please change to “enhancing the south-north temperature gradient and the aridity over. . .”

page 8, line 19: Please change “These” to “The”

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page 8, line 23: Please change “we compares” to “we compare”

page 9, line 2-4: This sentence is grammatically incorrect, please try breaking it into two sentences or adding a semicolon.

page 9, line 7-9: Please change to “The CAM4-BAM simulations show that SRF increases dust emissions in the spring by 14.78Tg/season (13.7%), thus enhancing dust transport and deposition over East Asia.”

page 9, line 12-14: Please change to something like, “Dust-in-snow reduces the albedo over the TP which warms the TP and enhances TP thermal effects and the regional dust cycle; increased sensible and latent heat fluxes from the surface result in increased aridity and westerly winds over North China.”

page 9, line 14: Please change “In generally” to “In general”

page 9, line 15: Remove “overall”

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-350>, 2018.