

Review for article " Modulation of surface sensible heating over the Tibetan Plateau on the interannual variability of East Asian dust cycle" by Xiaoning Xie and co-authors

Synopsis & General remarks:

The authors present a research on the interannual variability of East Asia dust cycles by using the model CAM4-BAM, the surface meteorological data in TP and the global reanalysis from MERRA-2 as observations. They have found the interesting relations between the dust cycle variability in East Asia and the MAM surface sensible heating from Tibetan Plateau (TPSH) which has triggered two anticyclonic anomalies in the dust source area and in the downwind North Pacific Ocean. This kind of anomalous circulations finally enhances the surface wind at 10-m which is absolutely determined to enhance the dust emissions as the 10-m wind is the key input for dust emission in the dust product scheme MB95 used in CAM4-BAM. The manuscript is written in a well structure way and in fluent and concise English. The results are reasonable and interest. This work also gives us a clue to pin down the relations between the dust cycling and the regional climate in East Asia from the long time scale point of view, especially the importance role of the TP.

Taklimakan and the Gobi desert are the two major dust sources in East Asia. The dust is emitted mostly as the cold wind with the Siberian High comes through these two areas. As the cold air mass in East Asia is mostly dominated by the position of polar vortex in north Hemisphere and absolutely also influenced by the huge complex terrain of TP. So the authors should be careful to draw the conclusion the TP is the dominating factor for all the variabilities of the dust cycling in East Asia.

Verdict

Some major and some minor revisions have to be done. In particular, the authors need to be on alert about the conclusions they get.

Major Comments:

1. Page 4 Line 9: As the TPSH index is very important in this manuscript, please add how you get it by the bulk aerodynamics method in detail to make it more readable.
2. Page5 Line10: How do you set you simulation time period? Is it the same time period as 1980-2008 of MERRA-2 except the spin up time? Please clarify.
3. Section 3.2: Researches have shown that the dust emission trend in East Asia is decreasing since 1970 but with a small increase trend from 1995 to 2003. The results in Figure 3f is consistently showed this small increase trend while the model results in Figure 3c didn't. This is also reasonable that the correlation coefficient in Figure3F is much smaller than that in Figure 3c. In this case, the authors should investigate and try to explain the difference with the information of other factors such as the activity of the

polar vortex, an important factor that influence the cold air mass activities then hence the dust emission activities in the targeting region.

4. Section 3.3: In figure 6d-6f, there are remarkable dust emissions in west and central TP, this not consistent with the normal dust sources distributions in East Asia in other researches. Maybe there are some errors in the source data, please clarify.
5. Section 4: All the meteorological results related to the TPSH's potential mechanisms of the effects on dust cycle are deduced from the model result. Have you ever evaluated the basic parameters of temperature and wind with the routine meteorological measurements or the reanalysis in the targeting region? As the differences in temperature and in wind from Figure7-10 are quite small which may be in the same range of or be noised by the bias of the modelling.
6. Page9 Line28-29: As there is no detail evidence from the manuscript for the dust deposition on **SNOW** and so for the feedbacks, please be careful to draw the conclusion.

Minor Comments:

1. Page3 Line 34: Is the 'CAM-BAM' right? Should it be 'CAM4-BAM'? Please check.
2. Page5 Line 27-28: For the sentence ' It presents ..., 30 model years, respectively', it is repeated described, please delete it.
3. Page8 Line18-20: For the sentence 'According to ... with the significant increase in TPSH', it is not logically right. Please find another way to describe it and make it more readable.
4. Page 19: The 'C' is missing in the figure caption.
5. Page 21: Please use the same dust concentration scale for Figure 3b and Figure 3e, for Figure 3c and figure 3f, to make it more readable.

Do you mean the dots in the black box? They are not very clear in Figure 3a and Figure 3d as the dots look like some lines. Please clarify.