



EGUsphere, referee comment RC1
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Comment on egusphere-2022-776

Anonymous Referee #2

Referee comment on "The role of dust sources in the Tibetan Plateau may be Underestimated: A high-resolution simulation study of regional differences in dust characteristics in the Tibetan Plateau" by Yunshu Zhang et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-776-RC1>, 2022

This manuscript reports results of WRF model simulation to quantify the spatial and temporal variability of dust emissions, dust loading, and their characteristics within the Tibetan Plateau during 2004-2006. The authors divide the main body of the Tibetan Plateau into three regions, and argue that the results of the simulations about dust activity were consistent with the reanalysis data and ground observations.

Overall, simulation of winter dust on the Tibetan Plateau is with great importance. However, this manuscript has some shortages, and some of the implications and discussions in the manuscript are not appropriate. I have a number of comments and concerns listed below, and the authors should make Major revisions of this manuscript before it can be potential published on ACPD.

Main comments

- The current definition of the Tibetan Plateau is confusing and not appropriate. In common sense, the Tibetan Plateau is the region higher than 2500 or 3000m above sea level. The western of the Sichuan Basin, the western of the Loess Plateau, the eastern of the Tarim Basin and other regions shown in Fig. 1 cannot be incorporate into the Tibetan Plateau. Please read the definition by Yao et al., 2012, Nature Climate Change (DOI: 10.1038/NCLIMATE1580) and Liu et al., 2022, Global and Planetary Change (<https://doi.org/10.1016/j.gloplacha.2022.103893>).
- The division of the three regions on the Tibetan Plateau is crude. The authors mentioned that the resolution of WRF model was 6 km, it can be more precise for division of those three regions. The dust sources of the plateau are located in the northern part of the Qiangtang Plateau, the Yarlung Tsangpo River basin, the Namucuo and Lhasa regions, the Qaidam Basin, the source areas of the Yellow and Yangtze Rivers, and the Qinghai Lake and its surrounding areas. Therefore, I strongly suggest

the authors use Qiangtang Plateau (between the Kunlun Mountains and Gangdisi Mountains) as the western Tibetan Plateau, north of the Tanggula Mountains (roughly around 32-33°N) as the Northern Tibetan Plateau, and south of the Gangdisi Mountains-Tanggula Mountains as the Southern Tibetan Plateau, on the basis of the definition of the Tibetan Plateau (higher than 3000m or 2500 m).

- The authors only provide results of three years during 2004-2006. However, a climate pattern (30 years, such as 1991-2020) can provide more confident results and reliable conclusions.
- The dust emission rate data on the Tibetan Plateau throughout the manuscript should be checked carefully. Previous studies reported that dust emission rate in the Taklimakan desert was about 0.38 ton/ha yr (equals to 38 g/m²), in the Central gobi-desert is about 0.24 ton/ha yr (equals to 24 g/m²) (see Xuan et al., 2002, Atmospheric Environment, [https://doi.org/10.1016/S1352-2310\(02\)00585-X](https://doi.org/10.1016/S1352-2310(02)00585-X)). In comparison, the authors report dust emission rates of about $11.00 \times 10^7 \mu\text{g}\cdot\text{m}^{-2}$ (equals to 110 g/m²) in the west, $3.30 \times 10^7 \mu\text{g}\cdot\text{m}^{-2}$ (equals to 33 g/m²) in the south and 4.5×10^7 (equals to 45 g/m²) in the north during winter on the Tibetan Plateau, in this work. I am not sure whether dust emission rate on the Tibetan Plateau can be much higher than the Taklimakan desert and Go-bi desert?
- In the abstract, "few studies have been conducted on dust aerosols within the plateau", and Line 80-83, "there are few studies on dust within the plateau, and conclusions regarding the distribution of dust sources within the plateau, the spatial and temporal variability of dust initiation, and the contribution of dust to the air column above the TP are not clear". As far as I know, there are many studies on dust aerosols in the TP. The sentences are too absolute. For example, Liu et al., ACP 2008; Kang et al., AE 2016; Mao et al., SCIENCE CHINA Earth Sciences 2013; Mao et al., AE 2019; Yuan et al., JC 2019, etc. Mao et al., did a lot of work on dust using WRF-Chem in the TP. What are the differences between your manuscript and Mao's work? The authors should highlight your characteristics and differences relative to previous studies. In addition, please add the dynamic mechanism related to your results in the abstract.
- If the authors add the model evaluation of AOD between the results of WRF and MODIS or MISR, cross sections of dust extinction coefficient between the results of WRF and CALIPSO, the results will be more reliable.
- The language of this manuscript needs editing by a native speaker.

Other comments

- Line 36, the definition of the Tibetan Plateau
- Line 45, Batangilin Desert? Is it Badanjilin Desert/ Badain Jaran Desert?
- Line 53, the unit of 6.6G is "g" or "ton"?
- Lines 79-82, the inner dust sources on the Tibetan Plateau are clear, please read Wu et al., 2013, Quaternary Science Reviews (<http://dx.doi.org/10.1016/j.quascirev.2012.10.003>).
- Line 93, similar to former major concern, why only choose 2004-2006?
- Lines 101-102, I strongly suggest the authors provide a map of sand dunes and deserted land on the Tibetan Plateau in the manuscript or in the supporting information.
- Lines 102-115, the climate patterns are the basis for the division of the three regions on the Tibetan Plateau. The authors should read some most recent papers about the climate modes on the Tibetan Plateau, redefine the three regions and rewrite this paragraph.
- Fig 1. The north and south are wrongly labeled, the authors should better add the

variation of meteorological parameters such as temperature and precipitation of these three regions.

- Line 206, Gondola Mountains?
- Lines 236-236, are you sure that the modern East Asian summer monsoon can reach the Qaidam Basin and cause heavy rainfall? If yes, please cite the suitable references. To our knowledge, the maximum of the East Asian summer monsoon is around Lenglongling in the eastern Qilian Mountains.
- Lines 271, "the dust in the north stayed in the atmosphere for a long period of time", does this mean the potential effects of dust from the Tarim basin?
- Lines 289-291, the western Tibetan Plateau is mainly the Qiangtang Basin, the landscape consists planation surface.
- Lines 304-305, the height 8 km above sea level reaches the middle-upper troposphere, does this meant the height of the boundary layer over the Tibetan Plateau was about 3-4 km above the ground level?
- Please add the linkages of the meteorological and other dataset used in this paper in the Acknowledgement section.
- References should be updated. For instance, line 489 "*Journal of geophysical research. Atmospheres: JGR, 124, 8043-8064*" is not correct.
- Please check all the reference format. Like in line 55, 61, "the results of Wang(Wang et al., 2021)" , "Hu(Hu et al., 2020)", not correct.