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Dear Editors and Reviewers:

Thank you for your letter and for the reviewers' comments concerning our manuscript entitled "In-situ observation of warm atmospheric layer and the heat contribution of suspended dust over the Tarim Basin (acp-2021-892)". These comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our researches. We have studied comments carefully and have made correction which we hope meet with approval. Revised portion are marked in the document named "manuscript\_revised". The point-to-point responses to reviewer #1's comments are as follows.

## **Reviewer #1:**

Comment to "In-situ observation of warm atmospheric layer and the contribution of suspended dusts over the Tarim Basin"

The large amount of dust aerosols from Taklimakan Desert could introduce serious impacts on the atmospheric thermal structure by absorbing solar radiation and then change regional weather and circulation. Using in-situ radiosonde observations along with the CALIPSO satellite observations, this study provides a comprehensive analysis about the warm atmospheric layer observed and examines the contribution form suspended dusts. This is particularly valuable for the aerosol science community and I would like recommend its acceptance for publication after some necessary minor revisions.

**Response:** Thank you so much for your kindness and your encouragement.

1. Line 32, adding "and" would be helpful before "large amounts of"

**Response**: Thanks for your comments. We have modified the sentence as "The Taklimakan Desert (TD), i.e., the world's second largest moving desert, is contained in the TB, emits large amounts of dust particles, which remain suspended over the TB." (Lines 27-29).

**2.** Line 52, I would suggest changing "which neighbors the Tibetan Plateau (TP) located to the south" to "with the Tibetan Plateau (TP) located to the south".

**Response**: Thanks for your comments. According to your comments, we have modified the sentence as "The Tarim Basin (TB), is situated north of the Tibetan Plateau (TP), covers an area of  $5.3 \times 105$  km2, and contains the Taklimakan Desert (TD), which occupies the main part of the TB and is a major dust source in Asia." (**Lines 48-50**).

**3.** Line 62-65, A recent study also investigates the dust radiative impacts on vertical distribution of temperature and water vapor over Atlantic region, which is worthy to mention, Sun and Zhao (2020, Doi: 10.1029/2020JD033454).

**Response**: We have carefully read this paper. Sun and Zhao (2020) investigated the dust radiative impacts on vertical distribution of temperature and water vapor over Atlantic region. We have referenced it in our manuscript (**Lines 58-59**).

4. Line 72, I would suggest changing "present" to "presented"

**Response:** Thanks for your comments. We have modified the sentence as "Gu et al. (2006, 2016) and Law et al. (2006), based on numerical results, elucidated the impact of dust on air temperature in the upper layers" in the revised version (Lines 67-68).

5. Line 103, "reanalyzes" should be "reanalysis"?

**Response:** Thanks for your comments. We have changed "reanalyzes" to "reanalysis" (Line 97).

6. Line 129, As we know, it is more suitable to assume linear relationship between T and geometric altitude. When we use the altitude in hPa, I am not sure if the linear assumption between T and H is still robust or not. It might be okay when H (in hPa) varies within a small range.

**Response:** Thanks for your comments. In this study, the H (in hPa) varied within a small range (25 hPa), therefore, the linear assumption between T and H is still robust (Lines 123-125).

7. Line 130, "Where" should be "where".

**Response:** Thanks for your comments. We have corrected "Where" to "where" (Line 127).

8. Line 147-149, since the description here is similar as that at Lines 137-139, the authors might simply indicate that "The OMR value signal and magnitude have the same meanings as  $\Delta T$ ".

**Response:** Thanks for pointing out it. We have modified the sentence as "The signs and magnitudes of the OMR values have the same meanings as those of  $\Delta T$ " (Lines 148-149).

**9.** Line 157-158, the acronyms of the stations have already defined earlier, and no need to repeat.

**Response:** According to your comments, we have deleted full names of the stations here (Lines 156).

10. Line 158-159, this sentence might be also not necessary.Response: Thanks for pointing out it. We have deleted this sentence (Lines 157).

11. Line 177-178, I would suggest "radiative forcing"
Response: Thanks for pointing out it. We have changed "radiation" to "radiative" (Line 174).

12. Line 200, "were" is suggested as "are".

**Response:** Thanks for pointing out it. We have modified the sentence as "CALIPSO data revealed that vertically extended dust layers were widespread throughout the TB with peak lidar returns between 2.5 and 5.5 km above mean sea level due to strong convective activity during dusty as well as clear days (Cheng et al., 2020); this is consistent with other studies" (Lines 192-195).

13. Line 243, "present" should be "presents"

**Response:** Thanks for pointing out it. We have changed "present" to "presents" (Line 236).

**14.** Line 245-247, potential errors in ERA-5 reanalysis data are worthy to mention, while it is widely used and believed to be reliable.

**Response:** According to your comments, we have mentioned it in our manuscript in Lines 233-234.

15. Line 289, "suspend" should be "suspended"

**Response:** Thanks for your comments. We have corrected "suspend" to "suspended" (Line 279).

**16.** Line 295-299, the discussions here are great.

**Response:** Thanks so much for your kindness and your encouragement.

**17.** Line 341, "are" should be "is"

**Response:** Thanks for your comments. We have modified the sentence as "the average OMR values of the heating layer were 0.28 and 0.12 K in spring and summer, respectively" (Lines 333-335).