

Dear Editors,

Thank you very much for your help with the peer review of our manuscript. We are also very grateful to all the reviewers for their help to improve the quality of our manuscript. We have made a thorough revision of this manuscript according to the reviewers' recommendations. All modified content, including added or deleted parts, are marked with color (green) in the revised manuscript. The following are our point-by-point responses. We hope the revised manuscript is now suitable for publication in *Earth System Science Data*.

Kind regards,

Jianping Huang

The manuscript focuses on establishing a robust dataset of tropospheric aerosol properties over the Tibetan Plateau (TP) using CALIOP data from 2007-2020. The study provides a new vertical aerosol index (AI) parameter, extracted observations, which is comprehensively validated. The research highlights the unique climate and geographical features of the TP and the challenges in data collection for this region. The findings offer insights into the aerosol climatology of this region. I believe this paper can be published in ESSD with a few minor changes:

Minor comments:

1. Line 42 contains a repetitive phrase regarding data validation. It would be clearer if rephrased to "...which was rigorously quality-checked and validated..."

Response: Thank you for your suggestion. We have corrected it.

2. Line 66 needs an article for readability: "...have a crucial role..."

Response: Thank you for your comments. We have corrected it.

3. Line 118: I suggest change it to "...mainly due to the lack of a long-term ..."

Response: Thank you for your suggestion. We have corrected it.

4. Line 121: I suggest change it to "...vertical dataset..."

Response: Thank you for your suggestion. We have corrected it.

5. Line 148: "...better lead..." to "...better leads..."

Response: Thank you for your comments. We have corrected it.

6. Additionally, a grammar check is recommended to refine the paper's language and clarity.

Response: Thank you for your comments. We have carefully reviewed all the recommendations and made corresponding revisions. In addition, we also invited experts who are native English speakers to proofread the entire text. We hope that the revised manuscript will address all your concerns.