

Interactive comment on “The regional distribution characteristics of aerosol optical depth over the Tibetan Plateau” by C. Xu et al.

Anonymous Referee #1

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The article contains some interesting results regarding aerosol optical depth (AOD), aerosol type, and aerosol vertical distribution analysis over the Tibetan Plateau. It is an observational study using long term MISR AOD retrievals and CALIPSO aerosol type characterization over the TP. The paper is primarily descriptive, offering some limited insights into possible causes of aerosol distribution over the region. The authors use the ERA-Interim reanalysis to show seasonal meteorology (winds) in the area and to link the atmospheric circulation with AOD distribution over the TP. Generally, the study presents some useful, although rather limited science results.

General comments.

The authors do not elaborate on limitations of the satellite datasets, neither use ground-

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based observations to justify the representativeness of satellite retrievals in the region. In particular, the uncertainties in characterization of aerosol type from CALIPSO are not discussed in sufficient detail. The pure dust samples over the northern India appear excessive (Figure 3). One would expect higher concentration of anthropogenic pollution in this area. Furthermore, some analyses of smoke samples over the TP seem dubious, as they are not directly linked to the sources south from the TP.

Specific comments.

1. It would be beneficial to have the geographic regions mentioned in the text labeled on the topographic map in Fig. 7. A reader might not be very familiar with names such as Quaidam Basin, Tarim Basin, Hexi Corridor, the mentioned mountain ranges on the TP and the corridors in the Himalayas. As the impact of topography is extensively discussed in the study, proper labeling will improve readability.
2. In the abstract, I find it confusing that the authors talk about a natural boundary that extends to an altitude of 6-8 km. The boundary discussed in the text is between the more polluted northern TP and the less polluted southern TP. I don't understand the need to mention the height of the boundary, which is a horizontal (latitudinal) phenomenon. The aerosol layer, according to the CALIPSO data, extends to about 6-8 km.
3. (in abstract) "... it is possibly associated with the high altitude terrain in the same geographic location." How high is this mountain range in comparison to the surrounding terrain?
4. (in abstract) "The whole TP blocks the atmospheric aerosols ... on the TP also cause an obstruction to the transport of aerosols". This sentence is unclear and appears redundant.
5. (page 4, line 5-6) How is the special pattern consistent with the vertical distribution?
6. (p6, line 18) It should be ~15 instead of ~10 years.

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7. (p6, line 25-26) What is the elevation difference of these mountain ranges with respect to their surrounding area?
8. (p7, line 10) Mentioning "high precipitation" is not justified. Precipitation does not obstruct AOD retrievals; clouds do.
9. (p7, 12-13) Repetition. This sentence repeats what was already said before.
10. (p7, 16-17) Tarim Basin and northern India do not have "extremely high" AOD values in each month. For example, Tarim Basin has small and medium AODs in fall and winter.
11. (p7, 17-18) Repetition.
12. (p7, 22) It should be fifteen years.
13. (p7, 22) Repetition.
14. (p7, 24-28, and p8, 1-4) This section could be shortened and better organized. Some sentences could be combined to offer a better flow.
15. (p9, 14-18) Confusing analysis of the height of the boundary. See point 2 above.
16. (p9, 18-19) "Dust occurs much less frequently above the TP in autumn and winter,..." Repetition.
17. (p9, 22-23) Could you offer an explanation for that?
18. (p10, 12-13) The scale is saturated, therefore it is impossible to see any differences in vertical distribution even if they existed.
19. (p10, 17) Redundant.
20. (p10, 22-23) This is too obvious.
21. (p11, 1-12) In the smoke analysis, smoke appears to be disconnected from sources to the south and north of the TP. This is especially visible in summer. There is slightly

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higher sampling in the central TP, whereas you would expect higher smoke samplings closer to potential sources in the northern India. It suggests that local sources might be at play?

22. (p11, 13-24) Could you elaborate a bit about CALIPSO uncertainties in determining aerosol type? Maybe some of the features you analyze are merely instrument or algorithm artifacts? See the general comment.
23. (p11, 21) Unclear and redundant.
24. (p11, 26-27) "... aerosols hardly come from local contributions." Any proof? Citations?
25. (p12, 19) "This phenomenon may be related to the terrain of the TP." A plot of AOD vs. elevation would be highly in place here to support this statement and the analysis.
26. (p12, 22-25) Repetition.
27. (p12, 27-28) "Aerosols are rarely transported onto the TP across other parts of the Himalayas Mountains." The data does not support this statement. It's speculation.
28. (p13, 1-3) Not very scientific statement. Speculation.
29. (p13, 4-5) Repetition.
30. (p13, 5-8) A confusing analysis of the vertical extend of the horizontal boundary. See point 2.
31. (p13, 12) "... and the extremely high mountains ..." Again, how much higher are these mountains than the surrounding terrain? Could you be specific?
32. (p13, 28) Figure 8 does not support this statement. Airflow at 33-34 N is slightly northerly, with a substantial vertical component. Judging by the streamlines, the flows meet closer to ~30 N.
33. (p13, 29) Repetition.

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34. (p14, 3) Strong updrafts are also clearly shown over the TP.
35. (p15, 9-10) "Aerosols are found to be more easily transported onto the TP across the northeastern edge..." I have an issue with the word "northeastern". The data shows that AODs are higher over the northern TP, suggesting advection from the north. Why then the northeastern direction is singled out as dominant? I don't think the data supports that.
36. (p15, 11-12) Confusing. The aerosol layer extends to 6-8 km, not the boundary.
37. (p15, 20) "... and aerosols can even spread to the region north of 33-34N" Redundant.
38. (p15, 27-29) This was not explored in the text.

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