

Interactive comment on “Chemical characteristics of submicron particles at the central Tibet Plateau: influence of long-range transport” by Jianzhong Xu et al.

Anonymous Referee #2

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In this study, the authors report inorganic salts, BC, and carbonaceous components in submicron aerosol particles at a remote elevated site in the Tibet Plateau in a period including pre-monsoon and monsoon weather conditions. The data in the manuscript are original and in good quality. In particular, the long-term trend and the diurnal variation of the components are very meaningful for understanding the origins and the effects of aerosol particles due to the long-range transport from the outside of the plateau and the local or regional emissions. I suggest the accept of the publication in the journal after a number of minor revisions.

Major comments:

C1

Most of the species measured in this study had a clear diurnal variation, which was closely dependent on the meteorological conditions, i.e. wind direction, wind speed and likely solar radiation. Regarding the distinctive terrain around the observation site, the variation of wind direction and wind speed on clear days is naturally expected and is a local and terrain-dependent phenomenon. As the authors attributed the diurnal variation of the chemical composition of aerosol particles to the diurnal variation of meteorological conditions, they also emphasized the predominance of the long-range transport. This makes me confused that which part of the variations of aerosol particles were caused by long-range transport and which part were directly or indirectly due to the diurnal variation of meteorological factors or local emissions. According to the description of the observation site, there were some anthropogenic sources near the site which might have constant or episodic influence.

Sub section 3.6 has little contribution to the major conclusions. Simplifying largely the descriptions into a few sentences and moving Figure 13 into supplementary materials are likely a good choice.

In addition, adding a brief discussion on the implication of the present results in understanding the air pollution in the Tibetan atmosphere will increase largely the significance of this paper.

Minor comments

1. Both “O/C” and “O:C” are used to describe the ratios of O to C. Unify them please, unless they have different meaning.

2. Lines 24-27: Remove “The average ambient . . . worldwide”. The results are dependent on the length of the pre-monsoon period and the monsoon period used for the average. In addition, the results in the abstract, i.e. the relative contribution of each species, were different from those shown in Figure 2 and described in the text in Line 213. The authors are requested to carefully check all figures in the whole manuscript with authors’ records.

C2

3. Line 34: the ratio of O/C 0.48 was not found in the manuscript. From Fig.8, the ratio was between 0.7-0.8. Could this value mean a significant difference of the oxidation state of OA in comparison to the OA with the ratio 0.88?
4. Line 62-64: After this description, a brief introduction of the difference of large-scale circulation between pre-monsoon periods and monsoon periods helps readers to easily understand the results of the present study.
5. Line 133: Shown in Figure 1 are different from the description here.
6. Line 212-224 "The average mass concentration ...high sulfate": These descriptions and comparisons are unnecessary. As mentioned above, the average results of per-monsoon and monsoon periods here are not referentially meaningful due to the dependence on the length of the periods.
7. Line 229: The description of "suggesting high efficiency of wet scavenging for ..." lacks evidence. The authors did not give any data on the wet scavenging. If all pollutants were consistently from same sources and experienced similar history, this statement might be acceptable.
8. Line 230. "The contribution of OA was thus ...": Do the authors mean wet removal of salts such as sulfate was more efficient than the removal of OA, and this difference resulted in the present result? Is the result the matter of origins, transport and in-air variations?
9. Line 251-253 "This high ... for ammonium": (1) explain RIE; (2) evidence for this explanation is necessary.
10. Line 257-273: Observational data, including meteorological data, from activities of this study are necessary to support the discussion in this paragraph. My feeling is that the long-range transport provided the background level of pollutants, and the diurnal variation was driven by the meteorological conditions on the basis of the long-range transported and locally-originating background level of pollutants. Please notice that

C3

soot particles in the Tibetan atmosphere could be aged rapidly (Zhang et al. 2001. Atmos. Environ. 35, 5883-5894). In addition, please check carefully the grammar and words.

11. Line 277-284: The discussion lacks evidence. The authors used several "suggesting", but did not show evidence. In addition, the sentence is too long, tedious, and includes "suggesting" repeatedly.
12. Line 291-306: As mentioned in the major comments, the discussion is too qualitative.
13. Line 316-317 "...O:C ratio (0.90 vs 0.98) and ...": Is this correct?
14. Line 337-340: "deep convection over the Tibet Plateau" usually causes upward mixing. Evidence from the present study for the conclusion of "Thus the ... layer." (Line 339-340) is necessary.
15. Line 365-366: The ratios separately in pre-monsoon and monsoon periods are more referentially meaningful. Average over the whole period should be avoided.
16. Line 396: I cannot find results on PM1 from REAM in the manuscript.
17. Line 398-424: The linkage between the simulated results and the observational facts is weak. The point in the last sentence (Line 423-424) is important, but there is no discussion on its confidence.
18. Line 416: What does "this difference" mean here?
19. Line 694 Figure 2: wind direction is hard understood.

Syntax corrections:

I found inaccurate words and sentences, and syntax errors. I list some of them here. I am not a native speaker, but feeling the authors need to carefully check words and grammar in the whole manuscript, including figure captions, in the revision.

C4

1. Line 20: replace “mechanism” with “processes”. This study discusses processes, does not mechanism.
2. Line 20: remove “pristine”: The area was polluted according to the content of the paper.
3. Line 20: replace “performed” with a suitable word, such as “did” or “carried out”.
4. Line 28: replace “while” with a suitable word. Similarly, in Line 38.
5. Line 86-88: remove “Therefore”, and rephrase this sentence properly.
6. Line 104-105: remove “However, . . . so far”.
7. Line 107: remove “comprehensive”.
8. Line 119: “This” is vague.
9. Line 133: replace “is” with “was”; replace “conditions” with “conditioners”.
10. Line 134: “total inlet”?
11. Line 139: “this inlet”?
12. Line 139-140: Check the grammar.
13. Line 181: replace “decomposition” with “apportionment”. Similar in Line 344.
14. Line 245: remove “chemical”; replace “from” with “in”; and replace “between” with “of”.
15. Line 249: remove “concentration of”.
16. Line 250: replace “, however, the” with “. The”.
17. Line 250: rephrase “The ratios of . . . and . . . were . . .” into “The ratios of . . . and . . . to . . . were . . .”.
18. Line 279: replace “to” with “on”.

C5

19. Line 296: rephrase “all periods during the . . . period of this study”.
20. Line 298: remove “were”.
21. Line 301: remove “While”.
22. Line 319-320: rephrase the sentence.
23. Line 325: replace “check” with “examined” or a proper word.
24. Line 325-326: “at the function”?
25. Line 342: “The” is likely a typo.
26. Line 355: remove “was”.
27. There are too many “in this study” or “during this study” in the text.

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C6