

## Comment on **essd-2022-211**

Anonymous Referee #2

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Referee comment on "High-resolution physicochemical dataset of atmospheric aerosols over the Tibetan Plateau and its surroundings" by Xinghua Zhang et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2022-211-RC2>, 2022

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This manuscript reports an hourly-resolution dataset from the online aerosol observations at seven different sites over the Tibetan Plateau and its surroundings. The data are measured synchronously from multiple online instruments including the core instrument of HR-ToF-AMS and other optional instruments. It is well known that the measurements and researches of atmospheric aerosols over the high-altitude TP regions starts relatively late. Meanwhile, due to the extremely harsh natural conditions, aerosol observations in this region are relatively scattered and mostly based on these off-line filter samplings. Real-time online measurements using those high-time-resolution instruments at multiple TP sites are very hard and rarely reported previously. Therefore, although the sampling periods are generally monthly-scales, the reported hourly dataset that focusing on diverse aerosol physicochemical and optical properties are remarkably valuable for the researches of atmospheric, environmental, and cryospheric sciences in this remote region. Overall, the manuscript is well prepared and the database meets the requirements for furthering reuse in Earth system sciences. I suggest it be a good study after addressing the following comments.

Main concern:

- The aim and frame of the observation project in this study should be further clarified clearly and discussed in detail in a separated paragraph, such as the specific statements and explanations for the selections of the observational sites, periods, and instruments in this project. Although some relevant introductions have already been mentioned in the Sections 1-3 in your current manuscript, they are relatively scattered and not conducive for the readers to understand easily and accurately.
- It is suggested to summarize the existing off-line or on-line observations of atmospheric aerosols over the Tibetan Plateau in previous publications, including the observational periods and sites, sampling methods and resolutions, etc., so as to further highlight the observation advantages in your study through these direct

comparisons.

- Although this journal is for the publication of original research datasets, some necessary figures, discussions, and evidences for these important results and conclusions should also be included in the manuscript, at least in the supplement file, rather than a simple description or pointing to references.

Specific comments:

- Line 30-32: Does the author mean that the scarcely available dataset is an important factor on disturbing the climate and environment in this region? Please state it clearly.
- Line 72-75: Actually, atmospheric aerosols have various significant impacts on regional climate, air qualities and visibilities, human health, and so on. Why only the two roles in the climatic and cryospheric changes are emphasized here?
- Line 79: More convincing results about the impacts on radiative forcing and albedos of snow/ice from those light-absorbing carbonaceous substances in the TP in previous literatures are suggested to be presented here rather than a brief statement.
- As the site descriptions in Section 2, those remote observation sites generally situated around the mountains in the TP, such as the Mt. Everest, Himalayas and Gangrigab Mountains, Waliguan, Qilian Mountains, and Tianshan Mountains that mentioned in the manuscript, therefore the specific locations of these mountains are suggested to be added in Figure 1 to give a visual knowledge about the sampling regions. Meanwhile, the altitude of each site is also suggested to be marked in Figure 1.
- Line 165-169: The division of the pre-monsoon season and monsoon season in the TP in this study need to be clarified clearly with the supported references. Meanwhile, I also doubt whether the current statements of the dominant air masses in the different seasons in the TP is accurate (e.g., westerly and southerly winds in pre-monsoon season vs. southwesterly winds in monsoon season), please check it carefully.
- Line 456-458: The main purpose of the displayed Figure 2 needs to be further emphasized in the manuscript, otherwise it seems unnecessary to shown. In addition, showing the mass concentration of  $PM_{10}$  in this figure would be better.
- Why obviously weak  $R^2$  value or scattered data point is found in Lhasa compared with those in the other sites in Figure 4 ?
- Line 528-530: The calculated ratios or regression slopes in the acidity analysis is markedly different between the two northernmost sites (LHG and Bayanbulak) and the two relatively southerly sites of Waliguan and Motuo. Therefore, it is best to discuss them separately and give the reasons for their difference.
- Line 544-546: Actually, the secondary inorganic species even contributed more dominantly than organics in those northern sites as shown in figure 3, hence the size distributions of those secondary inorganic species also need to be further discussed.
- Figure 5: Why different size ranges are reported in the different sites? Please clarify clearly in the manuscript. Meanwhile, the inset plot in figure 5 seems too small and too fuzzy in the current version.
- Line 598-599: Are there more direct evidences to prove that this bimodal pattern of diurnal variation at the urban site in Lhasa is related to those primary sources from vehicle exhausts, cooking, and biomass burning emissions?
- Figure 6: A clear description is suggested to be added in the figure caption to clarify what these symbols represented in the box plot. Similar description is also needed in Figure 9. Besides, what do these different colored boxes represent in Figure 6(b)? It would be best to clarify it clearly in the figure because of the usage of multiple colors within it.
- Line 634: Why the Waliguan is used as example for the comparison of HRMSs between

the remote and urban site? It is better to firstly do the correlation analysis of HRMSs among those remote sites to confirm that they are indeed highly similar before using the Waliguan HRMS as example or using the average HRMS.

- As introduced in Section 3.3.3 and Section 4.6, source apportionments of OA were conducted separately using the PMF analysis on each OA HRMS data in the different field campaigns. The mass spectrum of the same component will be more or less different in different campaigns, e.g., MO-OOA in NamCo vs. MO-OOA in LHG. Therefore, the specific mass spectrum of each OA factors in the different campaigns are suggested to be shown and analyzed, at least in the supplement file, before carrying out the comparisons among different campaigns.
- Line 701-702: As discussed in Section 4.6, distinct types of OA components with different O/C ratios were identified at different sites. However, it seems still insufficient to explain the OA source differences in the different TP regions, especially between those remote sites and urban site, only from the comparisons of mass concentrations or O/C values. Some commonly used tools in previous AMS studies such as the Van Krevelen diagram and triangle plots (e.g.,  $f_{44}$  vs.  $f_{43}$  and  $f_{44}$  vs  $f_{60}$ ) are suggested to display to clearly illustrate the differences in these OA components.
- Line 723-728: A clearer explanation for reason of the discrepancy between mass concentrations and number concentration at different sites is indispensable here.
- Line 740-743: It is better to show a specific NPF event with the typical banana-shaped variation pattern of PNSD as example. Meanwhile, the important parameters of NPF event such as the new particle formation rate and growth rate are also suggested to be reported, which may be useful for the comparison of NPF frequencies and properties with other studies. Moreover, as shown in Figure 8, the NPF events are also observed at the other three sites although the frequencies are obviously lower than that at Lhasa. The reason for this difference needs to be stated clearly.
- As shown in Figure 9, obviously higher average values than median values of Bscat and Babs are found at QOMS compared with other sites. The reason and impacts of this discrepancy need be discussed. In addition, these Bscat and Babs values at those TP sites should be further compared with those in other regions, especially those relatively polluted urban areas.