

***Interactive comment on* “Characterizations and source analysis of atmospheric inorganic ions at a national background site in the northeastern Qinghai-Tibet Plateau: insights into the influence of anthropogenic emissions on a high-altitude area of China” by Bin Han et al.**

Anonymous Referee #1

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In this work, the authors did a field observation in the northeast of Tibetan Plateau, including the particulate matters as well as trace gases. Although such study is meaningful for the better understanding the atmospheric chemistry over this region, the current version of the manuscript suffer major problems.

Specific comments: 1. In the introduction parts, the authors should state the motivates of this study more clearly. Several papers have been published for this site (Menyuan)

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in this special issue. Based on the previous studies, line 80-88, what the knowledge gaps or questions still exist for this region? 2. In the section of Methods (sampling site), the Qinghai lake (major source of sulfate found later of this study) and major traffic roads (major source of NO_x in this study) should also be introduced. 3. In the section 2.2, why Cl⁻ data was missing? What's the data quality of this online monitoring? Did you compare it with the traditional method (filter sampling + IC)? What's the detection limits of the trace gases? 4. For the ion balance, without the Cl⁻ data, it is somewhat strange to see that anion is only composed of sulfate and nitrate. 5. Line 158-173, there is no need to describe the the basic theory of PMF in such detailed way 6. Regarding the contents in table 2, some locations may be unnecessary to include. Line 221, are you sure the study site of Kumar and Sarin (2010) is urban area? 7. I understand the NO₃⁻/SO₄²⁻ is frequently used to indicate the relative importance of vehicle and coal combustion. Such works were mostly based in urban or populated area like North China Plains or South Asia. However, such ratio seems not applicable for this study (Menyuan) for several reasons. First, as stated in Line 257 and later (by PMF results), biomass burning is also important source of nitrogen species. For sulfate, besides the coal combustion, salt lakes (like Qinghai Lake) were also proposed at important source of sulfate (see more details in PMF parts). 8. Line 267-269, actually, this is no data of concentration abundance of organic matters yet. So it is not so conniving to say the particle growth is caused by organics. 9. Some time, the authors say "particle growth" sometime, "PM2.5 increase" were used. So is there any difference between such two expression? particle growth means hygroscopic growth in terms of mass or size?? 10. Section 3.2, regarding the diurnal variations, what's the role of meteorologic factors like PBL? 11. Line 298, what's the meaning of remote transportation? 12. Line 308-311, maybe crustal materials is responsible for the increase of PM2.5 13. Line 332-334, it is strange to see such description here. You know such points actually were established after the discussion for Figure 6. 14. In the previous studies, the aerosols and rain over Tibetan Plateau were found to be alkaline. However, in this study, the aerosols were found to be acid. SO more discussion (more references for Tibetan

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Plateau) is also expected, to make this point more convincing. 15. For the source apportionment by PMF, the ions were only ascribed to two factors. I.e., factor 1, salt lake and factor 2, mixed. It seems PMF failed to identify the sources of those inorganic ions adequately. 16. Currently, the writing of the conclusion part is very weak. What's the values and implications of this work for the international scientific communities? Compared with the statements in the Introduction parts, what's questions have been addressed after the study? 17. Line 487-488, the authors stated that "Our analysis suggests that photochemical reactions played a critical role in the formation of SO₄²⁻ and NO₃⁻ during our observation period." However, salt lake emission was identified as the first factor (for SO₄²⁻) by PMF. Such expressions seem contradict.

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