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Atmospheric Chemistry and Physics Discussions

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.

Bin Han et al.

baizp@craes.org.cn

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We appreciate the comments from Anonymous Referee #2. His or her comments helped us a lot in improving our manuscript. We have made corresponding revision according to his comments. We attached our revised manuscript in Supplement. All our responses are as follows:

The manuscript covers an important topic and key area relevant to the background

level air pollution in China. It gave an overall view of ion characterizations with PM2.5 at a remote site of the QTP. However, I have some concerns on this submission.

About PMF model, I think source apportionment of PM2.5 should be based on the full dataset of chemical compositions of particles, including ions, carbons and elements. However, in this study, only ions data was included, while carbons and elements were not analyzed. This might not be in line with the principle of source apportionment. Response to reviewer: I agree with the reviewer's opinion on the application of the PMF model. However, traditional application of the PMF model is based on the source apportionment of the mass of PM2.5, therefore, it requires the full dataset of PM2.5 compositions. However, in our study, we used the PMF model only for distinguish the potential sources of water-soluble inorganic ions, not the PM2.5 mass. So only the ions data is enough for the model. So previous studies also used only ions data for source apportionment according to their purpose (Han et al., 2016; Shi et al., 2017).

Another concern is that the authors included gases pollutants data in the model, but they are not chemical compositions of PM. Response to reviewer: We agree with the reviewer's point. So we excluded all gases pollutants in the PMF model and allowed only ion data in the model. Thus we got five factors including animal waste emission and biomass burning, crustal dust, salt lake emissions, secondary sulfate, secondary nitrate

The authors discussed a lot the secondary formation of sulfate and nitrate; however, part of sulfate was thought to be emitted directly by salt lake in PMF result. The secondary formation and direct emission of sulfate seem to exist simultaneously, but the authors failed to explicit them in their analysis. I suggested the author delete the section of PMF to avoid contradiction between different sections of manuscript, or give more detailed explanation on them. Response to reviewer: According to the comments from both reviewers, we ran the PMF model again by using only ions data, and excluded the ratio of sulfate emitted from the salt lake. Thus we used sulfate and nitrate concentrations after modeling calculation for SOR and NOR discussion. The method was

shown at line 198-204. Also in the conclusion, we added “After excluding the emission of sulfate from the salt lake” at line 482.

High relationship between SO42- and Na+ was found in this study, however, detailed discussion should be done in section 3.4. This is also important for the source analysis of sulfate. Response to reviewer: We added some analysis at line 290-292, which reads "Factor 3 has high Na+ loading and a moderate SO42- loading, which is also shown in previous correlation analysis with the correlation coefficient between SO42- and Na+ is 0.76."

Reference:

Han, B., Zhang, R., Yang, W., Bai, Z. P., Ma, Z. Q., and Zhang, W. J.: Heavy haze episodes in Beijing during January 2013: Inorganic ion chemistry and source analysis using highly time-resolved measurements from an urban site, Science of the Total Environment, 544, 319-329, 10.1016/j.scitotenv.2015.10.053, 2016. Shi, G. L., Xu, J., Peng, X., Xiao, Z. M., Chen, K., Tian, Y. Z., Guan, X. B., Feng, Y. C., Yu, H. F., Nenes, A., and Russell, A. G.: pH of Aerosols in a Polluted Atmosphere: Source Contributions to Highly Acidic Aerosol, Environmental Science & Technology, 51, 4289-4296, 10.1021/acs.est.6b05736, 2017.

Please also note the supplement to this comment:
https://www.atmos-chem-phys-discuss.net/acp-2018-1345/acp-2018-1345-AC3-supplement.pdf

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