

## Comment on acp-2022-590

Anonymous Referee #1

---

Referee comment on "The shifting of secondary inorganic aerosol formation mechanisms during haze aggravation: the decisive role of aerosol liquid water" by Fei Xie et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-590-RC2>, 2022

---

### **Comment on "The shifting of secondary inorganic aerosols formation mechanism during haze aggravation: The decisive role of aerosol liquid water"**

General comments<sup>1/4</sup> □

Aerosol liquid water is an important constituent in PM<sub>2.5</sub>, which has a significant impact on the secondary aerosols. This manuscript reported a long-term observation of PM<sub>2.5</sub> and estimated ALWC and pH. And a detailed analysis on their relationships in different pollution conditions was performed. It is fully within the journal scope, but the authors should resolve the following questions before it can be published on ACP.

Major comments:

- The English should be improved. Some of the sentences are too long to follow. Also the format of units should be revised. L52 in the abstract " $\mu\text{g}/\text{m}^3$ ". L105, the format of  $\mu\text{g}/\text{m}^3$ ... Please unify the units in the manuscript.
- Throughout the whole text, you are saying the aqueous phase reactions and secondary formation in the local area. I am doubting whether there is long-range transport or primary emission resulting in the accumulation of secondary inorganic aerosols? And also the boundary layer change can also affect the concentration. Did you consider these factors other than secondary formation?
- Section 2.2 I doubt in the estimation of Rp and Sp. You cited the previous studies which conducted in different locations? Is it representative for your site?

- L189-191. I don't know how to get the conclusion about the homogenous gas-phase reaction from Fig. 2. Please explain it.
- L194-195. You said the ammonia has an important role in the atmospheric oxidative modification. Please listed the supporting information here.
- L209-213. Is there any possibility that the homogenously formed  $\text{NH}_4\text{NO}_3$ ,  $(\text{NH}_4)_2\text{SO}_4$  partitioned into the aqueous phase?
- L250-254. I'm confused by this sentence. Are you sure the oxidation was taken place in the aqueous phase initiated by the protons or it is just a thermal equilibrium from the gas phase to the aqueous phase?
- L265-270. Did you try to find any data from China? Since your data was from a Chinese site, I think it would be better to compare the other sites from China. Additionally, it is better to cite some foreign sites, like USA.
- Why did you choose the wavelength at 380 nm? Is it efficient for photochemistry?
- Section 3.2.4. A major concern here is that how can I distinguish the secondary formation and transport of  $\text{NO}_3^-$  just from  $\Delta\text{NO}_3^-$ ? It seems that you use  $\Delta\text{NO}_3^-$  to represent the secondary formation of  $\text{NO}_3^-$ . I can't agree with you about this.

Minor comments:

Main text:

- Some of the abbreviations in the main text are confused to me. Please list their full names when they appeared for the first time. And the figures in the manuscript and SI should be reorganized since some of them are too small to see them clearly, like Fig. 5b and Figs. S3, S8 and S9.
- Did you measure the transition metal ions during your campaign? If yes, it is better to show the heavy metal data than just cite the literatures. Or I don't think it is necessary to talk about heavy metals.
- Please show the exact pH value in summer.
- This figure is quite difficult for me to follow. It is better to simplify it and become easier to understand.
- The Z axis is repetitive with the color bar.

Supplementary:

- Most of the abbreviations are defined in SI. I think you should move them into the main

text.

- Fig. S8b didn't show the NO<sub>3</sub> concentration. It is SIA.
- As a main part of your manuscript, Table S1 should contain ALWC in different stages.