Comments by referees are in blue.
Our replies are in black.
Changes to the manuscript are highlighted in red both here and in the revised manuscript.

Reply to referee #1

This manuscript provides a concise and informative comparison of aerosol aluminum (Al) solubility across seasons and sites (Xi'an and Qingdao), highlighting notable differences resulted from atmospheric aging. The use of < 1 μm and > 1 μm size fractions adds important size segregation to the analysis, and the interpretation grounded in source proximity and dust aging processes is scientifically sound and well-discussed.

Reply: We would like to thank ref #1 for reviewing our manuscript and recommending it for publication after minor revion. We have addressed these comments and updated the manuscript accordingly; when we do not quite agree with ref#1, we have provided proper explanation. Please find more details below.

Please see below for my detailed comments:

1. in the abstract, "Furthermore, seasonal variability of Al solubility, its correlation with relative abundance of sulfate and nitrate, and its dependence on relative humidity (RH), are all different at the two locations." it would be better if authors explain in detail how different these parameters are.

Reply: Indeed we would like to provide further details about aerosol Al slolubility in the abstract. However, the abstract cannot exceed 250 words, as required by the journal. As a result, we cannot provide these details in the abstract; instead, we present them in the conclusion.

2. authors used the phrase "significantly"/"significant" suggesting statistical analysis, but no mention is made of the statistical test used (e.g., t-test, ANOVA). Please clarify the method and significance level (e.g., $p < 0.05$) and indicate the results either in graphs in main text or in supplemental tables.

Reply: This is a good comment. Except correlation analysis, we did not use other statistical tests (e.g., t-tests); we use "significant/significantly" in our original manuscript mostly to express the extent, and do not indicate statistical significance. As a result, in the revised manuscript we have changed "significant" to "obvious", "great", or similar words, in order to avoid misunderstanding.

3. in line 468, authors said "Aerosol Al solubility at Xi'an showed no significant correlation with relative abundance of sulfate or nitrate", but in Table S8, the pearson r values were significant for > 1 μm particles at Xi'an in autumn and winter. please provide explanation.

Reply: The *r* values for coarse particles at Xi'an in autumn and winter were mainly dictated by three outliers for which aerosol Al solubility was very high. If we excluded these three outliers, *r* values decreased from 0.70 to 0.40 for autumn and from 0.93 to 0.44 for winter, and the correlations became insignificant (p <0.05). This further supports our original statement. In repsonce to this comment, we have modified Table S8 in the revised SI (page 9) to provide r values after excluding outliers, and please refer to our revised SI for further information.

4. in Figure 8, usually ascending order is used, such as "<2.5", "2.5-3.0"...

Reply: This is a good suggestion. In the revised manuscript (page 23) we have updated this figure, as suggested.

5. foggy weather might promote aluminum complexation reactions with organics. It's interesting that dissolved Al and Al solubility increased a lot in fog conditions in Table S7. Authors can consider adding a paragraph discussing this.

Reply: Indeed aerosol Al solubility was much higher during fog days, and in our original manuscript (page 15) we have used one paragrapgh to discuss this phenomenon. Acid and ligand processing can both enhance aerosol solubility, but at present it is difficult to disentangle their individual contributions. In the revised manuscript (page 16) we have added one sentence for further discussion: "Acid and ligand processing can both enhance aerosol Al solubility, although at present it is difficult to disentangle their individual contributions."