

Response to comments on *Atmospheric NH₃ in urban Beijing: long-term variations and implications for secondary inorganic aerosol control*

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---We sincerely appreciate the time and effort invested by the referees and editor in evaluating our manuscript. We revised our manuscript according to the comments.

Response to comments by Anonymous referee #2

The revised manuscript has been significantly improved in scientific quality, although the presentation quality can still be improved. I only listed some grammar issues in Abstract and Introduction below, and I recommend the authors to carefully proofread the whole manuscript.

---- We greatly appreciate your time reviewing our manuscript, we have revised the original text and carefully proofread the entire manuscript according to your suggestions.

Line 12: change “their long-term behaviors” to “its long-term behaviors”

Lines 14-16: combine the two sentences together into this: “Annual average NH₃ mixing ratio increased from 2009 to 2017 by 50% and then decreased by 49% from 2017 to 2020.”

Line 19: by 60%: compared to which level?

---- The “60%” reduction is relative to the initial concentration. We have revised the sentence: Thermodynamic modeling revealed the nonlinear response of SIAs to NH₃, with increased sensitivity when its concentration is reduced to 40% of the initial level.

Line 22: change to this: “Nevertheless, the increased mass proportion of ammonium salts in SIAs...”

Line 32: change “Research on...” to “Existing studies on...”

Line 35: change "debate" to "a debate"

Line 47: change "countries have conducted studies" to "studies have been conducted"

Line 58: change "explore" to "explored"

List of all changes made in the manuscript:

- 1) Line 12: change "their" to "its".
- 2) Lines 14-16: change "NH₃ mixing ratios initially increased and peaked in 2017 but subsequently decreased. From 2009 to 2017, NH₃ mixing ratios increased by 50%, while there was a decrease of 49% in 2020 compared to 2017." to "Annual average NH₃ mixing ratio increased from 2009 to 2017 by 50% and then decreased by 49% from 2017 to 2020."
- 3) Line 19: change "to NH₃ when its concentration decreases by 60%." to "when its concentration is reduced to 40% of the initial level."
- 4) Line 22: change "in the proportion (mass proportion concentration)" to "mass proportion".
- 5) Line 32: change "Research" to "Existing studies".
- 6) Line 35: change "debate" to "a debate".
- 7) Line 47: change "countries have conducted studies" to "studies have been conducted".
- 8) Line 58: change "explore" to "explored".
- 9) Line 61: change "aims" to "aimed".
- 10) Line 65: change "Additionally" to "Furthermore".
- 11) Line 79: change "concentrations," to "concentrations;".
- 12) Line 85: change "Teflon line and," to "Teflon line, and".
- 13) Line 137: change "mode" to "model".
- 14) Line 140: change "(unit is k)" to "(in Kelvin)".
- 15) Line 141: change "(SO₄²⁻, Cl⁻ + HCl, NO₃⁻ + HNO₃, NH₄⁺ + NH₃, Na⁺, K⁺, Ca²⁺ and Mg²⁺)" to "(SO₄²⁻, Cl⁻ + HCl, NO₃⁻ + HNO₃, NH₄⁺ + NH₃, Na⁺, K⁺, Ca²⁺ and Mg²⁺)".
- 16) Line 203-205: change "The emission inventory data obtained (Figure 1) indicate that from 2009 to 2014, the total NH₃ emissions in Beijing remained stable, peaking in 2012. After 2014, NH₃ emissions in Beijing rapidly decreased, declining by 25% from 2012 to 2017." to "The emission

inventory data (Figure 1) indicate that NH₃ emissions in Beijing remained stable from 2009 to 2014, peaking in 2012. After 2014, NH₃ emissions in Beijing rapidly decreased, declining by 25% from 2014 to 2017.”

- 17) Line 282: change “Averaging minute-level data over one hour can smooth the effects the effect caused by variations in humidity” to “Averaging minute-level data over one hour can smooth the effects caused by variations in humidity”.
- 18) Line 291: change “infer” to “suggest”.
- 19) Line 322: change “investigates” to “investigated”.
- 20) Line 333: change “relationship ion NH₄⁺ in fine particulates and atmospheric NH₃” to “relationship of NH₄⁺ in fine particulates to atmospheric NH₃”.
- 21) Line 337: change “the highest” to “was the highest”.
- 22) Line 341: change “which in turn exacerbated” to “exacerbating”.
- 23) Line 356-357: change “As also suggested by Su et al. (2021), the acidic components” to “Su et al. (2021) also suggested that the acidic components”.