

Response to Reviewer 1

Dear Reviewer,

We thank you for reviewing our manuscript. We have clarified the purpose of this Measurement Report, strengthened the atmospheric context, and stated the limits of the observations. Below we respond to each comment and identify the corresponding changes in the current manuscript.

General Response

We have revised the manuscript to distinguish the contribution of the measurement dataset from interpretation of atmospheric processes. The revisions add comparisons with published observations and explain which questions this monitoring network can address.

The manuscript was submitted as a Measurement Report, with the four-year hourly observations from ten sites as its central contribution. The revised Introduction now makes this aim clearer and places the dataset alongside regional monitoring and satellite observations.

We compare three machine learning models for gap filling, evaluate both a random train/test split and leave-one-site-out validation, and use SHAP to examine associations between predictors and measured NH_3 . The fitted responses near 1.02 kPa vapor pressure, 13.78 °C air temperature, and 1.11 m s^{-1} wind speed are interpreted as approximate model responses (Sections 2.3, 2.4, 3.1, and 3.4).

The ten-site design allows us to examine spatial contrasts and temporal variability within one county. The revised Introduction explains how these observations complement broader ground networks and satellite products. The Conclusions now state that the monitoring framework can be extended to other agricultural counties, while transferring observed patterns requires independent local observations and validation.

Detailed Point-by-Point Response

Comment 1: "The study relies almost entirely on pure statistics and machine learning, lacking substantive investigation into atmospheric chemical and physical processes"

[Response]: We agree that the original manuscript needed a clearer distinction between statistical associations and direct evidence of atmospheric processes. Sections 3.2–3.4 now discuss the observations in relation to published emission inventories, isotope measurements, and field studies. The dataset remains the main contribution of this Measurement Report.

Section 3.4 explains that the XGBoost model was trained on measured NH_3 and that the SHAP analysis used test samples with measured NH_3 . The meteorological responses are discussed in relation to volatilization and dispersion, with their fitted transitions described as approximate model responses rather than fixed physical thresholds.

Section 3.2 compares the concentration gradient with the Quzhou emission inventory of [Kang et al. \(2023a\)](#), which estimated 6559.7 t of NH_3 emissions in 2019 and higher emissions in the south.

Section 3.3 compares the seasonal pattern with [Shen et al. \(2011\)](#) and [Meng et al. \(2018\)](#), and cites winter isotope observations in Quzhou ([Feng et al., 2022](#)). These comparisons provide context for the measured patterns. They do not constitute a new source-apportionment analysis of our network.

Section 3.2 also states that the four-year record cannot separate management effects from interannual meteorological variability. Temperature, precipitation, humidity, wind, regional transport, and gas–particle partitioning may contribute to the observed trend.

These revisions connect the measured patterns with existing atmospheric evidence while retaining the limitations of the monitoring design.

Revised location: Manuscript, Section 3.4, first paragraph (pp. 15–16, lines 362–373). The revised text states: “*They are therefore interpreted as approximate model responses rather than fixed physical thresholds.*”

Comment 2: "Completely omitting regional scale transport dynamics"

[Response]: We agree that regional transport is relevant to the interpretation of ambient NH₃. We have expanded the discussion in Section 3.4, while stating that our network does not quantify transport or source–receptor relationships.

The revised discussion cites nitrogen isotope observations suggesting NH₃ transport from agricultural regions to urban Beijing ([Gu et al., 2022a](#)), observations and modeling of transport from the NCP to a mountain site in Shanxi ([Pu et al., 2026](#)), and satellite and ground observations identifying the NCP as an NH₃ hotspot ([Sun et al., 2025](#)).

These studies provide regional context. They do not directly quantify transport at the Quzhou sites. The revised text therefore interprets the wind-direction response as an association rather than transport attribution.

Sections 3.2 and 4 also acknowledge transport as one contributor to ambient concentrations and their temporal variation.

Revised location: Manuscript, Section 3.4, last paragraph (p. 17, lines 399–412). The revised text states: “*These studies provide regional context, but our network does not quantify source–receptor relationships. The wind-direction response is therefore interpreted as an association rather than transport attribution.*”

Comment 3: "There are already many studies on constructing high spatiotemporal resolution atmospheric composition datasets... this study only focuses on a small region"

[Response]: We agree that the contribution needs to be defined relative to existing datasets. The revised Introduction explains how four years of hourly records at 10 sites add information on spatial contrasts and temporal variability within one agricultural county.

The Introduction discusses the six-site NCP network of [Shen et al. \(2011\)](#), the 43-site Nationwide Nitrogen Deposition Monitoring Network, the 53-site AMoN-China campaign, and high-frequency

observations at Gucheng and in Beijing. It notes that [Shen et al. \(2011\)](#) included one site in Quzhou and that monthly integrated observations cannot resolve diurnal variability.

Complementarity with satellite products: The revised Introduction also summarizes representative validation characteristics of IASI and CrIS NH₃ retrievals and explains why independent ground observations remain necessary for assessing local spatial representativeness and temporal sampling.

The four-year site means range from 20.89 to 53.05 ppb (Sections 3.2 and 4). The ten-site record resolves differences among nearby agricultural environments alongside the temporal variations described in Section 3.3.

The four annual hourly files contain station coordinates, meteorological predictors, retained NH₃ observations, and complete NH₃ series after gap filling. NH₃_Source distinguishes observed values from model-filled values (Data availability).

Revised location: Manuscript, Introduction, last paragraph (p. 3, lines 77–87). The revised text states: *“It provides a ground observation reference at the county scale to complement regional monitoring, satellite retrievals, and atmospheric models.”*

Comment 4: "It would be more valuable if the data are expanded to the entire North China region or even China"

[Response]: We agree that broader coverage would provide additional regional information. This study presents the four-year hourly record from 10 sites in Quzhou. The Conclusions explain how the monitoring framework can be extended and why transferring the observed patterns requires independent local observations and validation.

Section 2.1 and **Table S1** describe the analyzer specifications and scheduled calibration and maintenance. **Table S1** distinguishes the engineer-supplied maintenance schedule from a complete record of work performed at each station.

The Conclusions state that other NCP counties may differ in cropping systems, fertilization schedules, livestock systems, soils, irrigation, background pollution, and transport conditions. These differences limit direct transfer of the observed concentration patterns and fitted meteorological responses.

The dataset provides a county-scale reference that can be used alongside regional monitoring networks, satellite retrievals, and atmospheric models.

Revised location: Manuscript, Section 4, last paragraph (p. 19, lines 445–454). The revised text states: *“Therefore, transferring the observed patterns or fitted responses requires independent local observations and validation.”*

Summary of Revisions

Section	Revision
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Section	Revision
Introduction (Section 1)	Compared the county network with existing ground-monitoring networks and satellite products, and clarified its spatial and temporal contribution.
Sections 3.2-3.3	Compared the measured patterns with a local emission inventory and published isotope and field observations, and moderated causal statements about interannual changes.
Section 3.4	Clarified SHAP response interpretation and added published regional-transport evidence, with explicit limits on transport attribution.
Conclusions (Section 4)	Explained the requirements for transferring observed patterns and fitted responses to other counties.
Data availability	Described the observed and complete NH ₃ series and the field identifying observed and model-filled values.

Concluding Remarks

We thank the reviewer for the comments. The revised manuscript defines the contribution of the dataset, connects the observations with published atmospheric evidence, and makes the limits of process interpretation and county-scale inference explicit.

The point-by-point responses above identify the relevant sections and quote the current manuscript text for verification.

Thank you again for your time and constructive feedback.