“Relaxed Eddy Accumulation based Flux measurement of Atmospheric Inorganic Acidic Species over Cropland under the Long-Term Exposure to Chemical Industry Emissions in a Chinese Megacity”

General Comments

This manuscript presents the development of a Relaxed Eddy Accumulation (REA) system for assessing the fluxes of inorganic acidic species over cropland located in the vicinity of an industrial zone within the Chinese megacity of Wuhan. The study was conducted during late autumn and early winter 2025, with particular focus on a subset of selected 11 days period spanning November-December 2025.

The authors clearly demonstrate the development of the instrument and provide a thorough description of the uncertainty calculations used to characterise the system, including both the REA sampling setup and the offline analytical procedures. The reported measurement precision ranged from 3–30%, with LOD between 6.1×10^{-4} and 2.4×10^{-1} μg m^{-2} s^{-1} across the eight monitored species.

A key finding of the study is that the observed HONO and HNO_3 fluxes were one to two orders of magnitude higher than values previously reported in the literature for similar landscapes.

The authors conclude that the strong positive nitric acid fluxes were enhanced under conditions of elevated turbulence, whereas the enhancement of nitrous acid fluxes appeared to be associated with lower ambient temperatures.

Specific comments

Although the authors predominantly present the fluxes in units of μg m^{-2} s^{-1}, there are instances where inconsistent units appear to have been used, for example in Figure 3(a) (page 18) and line 326 (page 17). It is recommended that the authors review and correct all such instances to ensure consistency throughout the manuscript.

The results are primarily presented as “diurnal” plots, despite the fact that most of the 12-hour sampling period (08:00–21:00 local time) falls largely within daytime hours (typically 06:00–17:00, even during winter months). I would therefore advise against the use of the term “diurnal” to describe the results presented in this manuscript, as it does not accurately reflect the temporal coverage of the study.

An operational flow rate of 10 L min^{-1} resulting in a 3.1 s exchange time (page 7, lines 108-109) implies an internal denuder volume of approximately 0.5 L. However, the authors state on page 8, line 159 that the volume per denuder is 0.6 m^3 ((i.e. 600 L), which is inconsistent with the previous inference. The authors should clarify this discrepancy.

While the reviewer agrees with the authors that the positive morning HONO fluxes are associated with lower temperatures, the same relationship also appears to apply to HNO_3 (as shown in Figure S5). However, the authors attribute the HNO_3 behaviour exclusively to enhanced morning turbulence in Figure 6. This point requires further clarification, and the conclusions and abstract may need to be revised accordingly to reflect the broader interpretation.

Technical corrections

- Page 4, line 73: Typographical error: ".. an REA" should read ".. a REA".
- Page 7, Figure 1: The locations and information for T_{up} and T_{down} are not shown in either the figure or the corresponding caption.
- Page 15, line 303: The concentrations presented here are mean values, the authors should explicitly state this in the text.
- Page 16, Figure 2: Panels (a) and (b) are not labelled in the figure.
- Page 16, line 314: In Figure 3(a), "proportion" of flux should be replaced with "percentage" of flux. The authors should correct all similar instances throughout the manuscript (see also page 17, line 337).
- Page 16, line 315: The authors should also refer to Figure 3(b) in the text as part of the description of the mean ± SD values.
- Page 17, lines 337-338: Figure 2(b) does not present information on flux percentage, but rather the flux magnitude. Please clarify this in the text.
- Page 18, lines 344-346: This statement is not clearly described and should be rewritten for clarity.
- Page 19, Figure 3: The caption does not include descriptions for panels (a) and (b).
- Page 19, Figure 4: The downward fluxes are shown as negative values in the figure. This should be clarified either in the main text or in the figure caption.
- Page 20, Figure 5: A legend distinguishing upward and downward fluxes, similar to that used in Figure 4, should be added. I would also suggest changing the colours of R^+ and R^- to match the corresponding flux directions.
- Page 20, lines 387-388: The word "reaction" is duplicated.
- Figure S1 could be improved by adding annotations indicating the industrial area, as well as a distance scale on the map shown on the right-hand side.