Dear Editor and Referees,

Thank you very much for your further evaluation and insightful comments on our manuscript "CRUX-1.0: An automatic GHG and Ozone observation system for inland Antarctica Plateau" [**Paper #EGUSPHERE-2026-1227**]. We sincerely appreciate the reviewers' guidance, which has helped us further refine and solidify the manuscript. We have thoroughly addressed each point raised and have revised the manuscript accordingly. **A point-by-point response to the suggestions is provided below, and the corresponding revisions have been highlighted in yellow in the revised manuscript for clarity.**

Anonymous Referee #1 (Remarks to the Author):

The authors have comprehensively and thoroughly addressed all comments raised by the reviewer during the interactive discussion phase. Relevant key technical parameters and quality indicators have been supplemented, supported by corresponding experimental data. The manuscript now complies with the formatting specifications and open data policy of Atmospheric Measurement Techniques (AMT). The scientific rigor and engineering completeness of the study have been significantly improved. I am satisfied with the current revisions and support the publication of this manuscript in the journal.

Response: We sincerely thank you for your positive evaluation and full recognition of our revisions.

1. Perform full-text proofreading and correct the listed grammatical, spelling and formatting issues.

Response: We have corrected all specified issues:

- Revised "This strategy could sufficient for the one-month experiment" to "This strategy is sufficient for the one-month experiment" in Section 3.2.2 Ozone Monitor;
- Corrected the spelling error "In addtion" to "In addition" in Section 4.2 Accuracy evaluation;
- Replaced the informal "in 2022/2023" with the standard en dash form

"in 2022–2023" in Section 1 Introduction.

Additional minor non-native expressions have also been polished throughout the manuscript.

Referee #2 (Remarks to the Author):

I thank the authors for their thorough revision of the manuscript and for carefully addressing the previous comments. This is a valuable study that demonstrates the feasibility of continuous atmospheric measurements under harsh environmental conditions. The work is highly relevant to advancing both the scientific understanding and the methodological framework of greenhouse gas (GHG) measurements in real-world conditions. I recommend publication of this study following minor revisions. Well done!

Response: We greatly appreciate your recognition of the value and relevance of this study. All minor revision suggestions have been fully addressed in the revised manuscript.

1. Replace all instances of "concentration" with either "mixing ratio" or "mole fraction" throughout the manuscript.

Response: We have replaced all instances of "concentration" with "mixing ratio" across the full text, covering Abstract, Section 1, Section 4, Section 5 and all other relevant parts.

Anonymous Referee #3 (Remarks to the Author):

1. The authors should further clarify and sharpen the main novelty of the manuscript. For example, is this the first unattended CO_2 observation system for the Antarctic inland, the first system capable of simultaneous CO_2 and O_3 observations, the first system with automatic calibration, or the first low-power design? The central innovation should be stated more clearly and consistently throughout the manuscript.

> **Response:** We have refined and unified the novelty statement in the Abstract, the last paragraph of Section 1 Introduction, and Section 6 Summary. We explicitly position CRUX-1.0 is the first unattended CO_2 and surface O_3 observation system for the Antarctic inland and low-power active temperature control tailored for the East Antarctic inland plateau, and ensured consistent wording throughout the text.

2. The manuscript appears to overstate the current capability of CRUX-1.0. In several places, the authors imply that the system can serve as a supplement to, or even partially replace, the global polar observation network by providing data quality comparable to that of manned stations. Such conclusions are not fully supported by the current dataset and should be moderated accordingly.

> **Response:** We have revised relevant descriptions in Section 5.1 and Section 6 Summary, removed overstated claims about supplementing or partially replacing the global polar observation network, and objectively presented the system's short-term verification results and future application potential.

3. The comparison with global observation stations still suffers from selection bias, as I pointed out in the previous review. The current study is based on only one month of observations, and the primary objective should be to demonstrate data quality, data processing procedures, and whether extreme low temperatures affect measurement accuracy. The selected stations differ substantially in latitude, elevation, environmental conditions, and observational objectives. Therefore, these comparisons cannot adequately demonstrate the performance of CRUX-1.0. Instead, based on the current one-month dataset and rigorous calibration and validation, the authors could emphasize the potential of Taishan Station as a future long-term

atmospheric observation site in Antarctica. Overall, I encourage the authors to refocus the manuscript on its primary objective.

Response: We have revised Section 5.2 to clarify that cross-station comparison is provided to place results in a global background context, not to directly validate system performance. We refocused the core narrative on data quality, data processing procedures and low-temperature adaptability, and strengthened the statement on the long-term observation potential of Taishan Station.

4.The authors should clarify the basis for the statement that the system can reduce routine logistical expenditure by more than 90%. It is unclear how this estimate was derived, and quantitative evidence or references should be provided.

Response: We have removed the quantitative statement of "more than 90% reduction in routine logistical expenditure" from the manuscript. Instead, we have revised the relevant descriptions in Section 5.1 and Section 6 to qualitatively state that the unattended operation mode of CRUX-1.0 can significantly reduce routine logistical costs by eliminating the need for resident personnel and frequent on-site maintenance, compared with conventional manned polar observation stations.

5.For Section 5.3, I suggest broadening the discussion to include the common and unique challenges faced by autonomous atmospheric observations in Antarctica, while reducing the descriptive discussion of CRUX-2.0. One issue that cannot be avoided is that the current validation period is only one month, which is insufficient to support the extensive discussion of long-term unattended operation. Instead, the authors could place their work in a broader context by discussing emerging technologies for Antarctic observations, such as the feasibility of renewable energy systems (e.g., wind power) for autonomous operation, or advanced calibration strategies for maintaining long-term measurement quality. A discussion of these general and Antarctic-specific challenges would increase the broader significance of the manuscript and provide valuable insights for the international research community engaged in Antarctic observations.

Response: We have restructured Section 5.3 accordingly: expanded discussion on three core challenges of Antarctic autonomous observations (polar-night energy supply, long-term calibration assurance, and extreme environmental adaptability); added discussion on emerging technologies including renewable energy systems and advanced calibration strategies for long-term operation; substantially reduced descriptive content on the CRUX-2.0 prototype to stay focused on the current study.