General Comments

The authors of CRUX-1.0 performed data analyses of CO_2 and O_3 measurements from Antarctica. I read the manuscript with great interest, as this type of work is beneficial for advancing our understanding of atmospheric gas abundances and their trends. I recognize that this manuscript should primarily demonstrate the technical and operational capabilities of the measurement system, highlight the challenges of continuous measurements in harsh environments, and provide practical solutions to address those challenges.

The authors are encouraged to reduce extraneous information and focus on the core of their work. Furthermore, they should discuss in more detail how the calibration protocols can be improved and how the power supply can be enhanced to enable long-term observations.

Major Comments

1. **Lengthy background information:** In several instances, additional information is provided that is not directly required or used in the manuscript. For example, the Introduction and Section 2.2 (descriptions of other stations) are excessively lengthy and detract from the main technical focus.

2. **CO_2 calibration protocol:** CO_2 calibration was performed using a single standard gas. Is this approach sufficient for maintaining WMO-compliant accuracy? How could this protocol be improved (e.g., by incorporating a second standard or zero-air calibration)?

3. **O_3 calibration protocol:** Is it sufficient to perform O_3 calibration only before and after the measurement period? Specifically, for deployment periods longer than one month, what is the expected drift, and how should it be addressed? Please elaborate on this in the manuscript.

4. **Deployment duration and environmental challenges:** While this study provides a good demonstration of system capability, a one-month measurement period is insufficient to validate long-term reliability in such a challenging environment. How can power supply improvements enable longer deployments? Would it be feasible to extend future deployments to at least three months or longer? Please discuss these challenges and propose concrete solutions.

5. **Power supply management:** Can the authors provide a technical solution for managing the station's power supply more effectively? Are there any practical strategies to further reduce power consumption without compromising data quality?

Detailed Comments

- **Line 158:** Is the reported temperature variability (austral winter vs. summer) statistically or operationally significant for system performance? If so, please clarify.
- **Lines 167–171:** Why is this wind pattern information included? Was it used in data analysis (e.g., to flag periods of potential contamination or blowing snow)? If not, consider removing or moving it to supplementary material.
- **Lines 179–180:** Did you observe any measurable impact from the generator cabin on your CO_2 or O_3 measurements? If so, how were affected data identified and treated?
- **Section 2.2 (Lines 183–223):** The descriptions of other stations (South Pole, Barrow, Mauna Loa, Jungfraujoch) are lengthy. It is unclear whether all of this information is necessary for the manuscript. This section could be heavily shortened, and any essential comparisons could be moved to the Introduction or Discussion.
- **Lines 269–272 and Table 2:** Is the current CO_2 calibration protocol (single standard gas, twice daily, 5 minutes each) sufficient? Would it be preferable to use a broader span (e.g., a low and a high standard)? What was the mixing ratio of the calibration gas used?
- **Lines 328–331:** Please discuss the O_3 calibration protocol in greater detail, specifically addressing its adequacy for longer observation periods (e.g., multiple months). How was drift assessed and corrected?

Figures

- **Figure 2:** The numbers (axis labels and legends) are very small and difficult to read. Please increase font size for better legibility.
- **Figure 6:** What specific insight does the comparison of continuous measurements from all five stations provide? The purpose of this figure should be more clearly stated in the caption and main text.

Tables

- **Table 1:** I could not locate Table 1 in the manuscript. Please check the numbering or provide the missing table.
- **Table 2:** Comparing power usage across stations shows that CRUX-1.0 consumes substantially more power (350 W) than the BAS Ozone Network (11–13 W) or the Kunlun Station Ozone Monitor (5 W). Is this increase solely due to the addition of CO_2 measurements and active temperature control? Are there practical ways to lower power usage without degrading data quality? Please discuss.