# Response to Anonymous Referee #1

## General response

We sincerely thank the referee for the careful evaluation of our manuscript and the constructive suggestions. We have revised the manuscript to improve readability, clarify the scope and limitations of the experimental design, and explain the interpretation of the humidity ground-check measurements. Our point-by-point responses and the corresponding changes are detailed below.

### 01 General 1 — Excessive acronyms

We agree that excessive acronyms can reduce readability. We have reduced the use of unnecessary abbreviations, particularly “RS” and “GC”, while retaining established terms such as GRUAN, SHC, MGC, ARL, and GDP.

Manuscript revision (throughout): Unnecessary “RS” and “GC” abbreviations have been replaced by the corresponding terms where appropriate.

### 02 General 2 — Climate representativeness

We agree that geographical diversity does not guarantee representative storage conditions. We have clarified the effects of launcher environmental control and the limited climatic coverage, and restricted the interpretation to the tested site–launcher combinations (Sects. 2 and 4.1).

Manuscript revision (Sect. 4.1): “Although this diversity provides valuable insights into operational variability, the six sites do not cover the full range of climatic environments encountered across the global observing network (Table 1). In particular, the response of radiosondes stored under more extreme climatic conditions, such as polar or persistently humid tropical environments, remains to be evaluated. The findings should therefore not be extrapolated to untested site–launcher combinations without additional validation.”

### 03 Line 46 — Role of GRUAN

We agree. The Introduction now describes GRUAN as a framework for traceable reference observations and quantified measurement uncertainties, rather than as a general mechanism for overseeing automation.

Manuscript revision (Sect. 1): “GRUAN provides a framework for traceable reference observations with quantified measurement uncertainties (GCOS, 2007), enabling the consistency of observations from manual and automated radiosonde operations to be assessed.”

### 04 Line 57 — Site naming consistency

We have revised the list in Sect. 1 to provide the institutions, stations, and countries consistently.

Manuscript revision (Sect. 1): The list now identifies Hong Kong Observatory (Hong Kong), MeteoSwiss (Payerne), CNR-IMIOT (Potenza), Japan Meteorological Agency (Tateno), AEMET (Tenerife), and MeteoModem (Ury), with the corresponding station codes.

### 05 Lines 80–84 — Full site names

We have replaced code-only geographical references with full station names followed by their codes in Sect. 2.

Manuscript revision (Sect. 2): The geographical description now uses Tenerife (TEN), Tateno (TAT), Ury (URY), and Hong Kong (HKO).

## 06 Lines 80–84 — Longitude and climate classification

We have added Köppen–Geiger climatic categories in Table 1 and revised Sect. 2 to distinguish geographical location from the actual storage conditions inside climate-controlled launchers.

## 07 Lines 80–84 — Extreme environments

We agree that the results cannot be assumed to apply to more extreme or untested environments. This limitation is now explicitly addressed in Sect. 4.1, including the role of launcher climate control.

Manuscript revision (Sect. 4.1): The revised limitations paragraph states that the findings should not be extrapolated to untested site–launcher combinations without additional validation.

## 08 Table 1 — Split and expand headings

We have separated the former combined table into Table 1 (site coordinates and climatic categories) and Table 2 (radiosonde, launcher, climate control, SHC and loading configurations, and sample sizes).

Manuscript revision (Table 1): Separate site name, site code, latitude, longitude, and Köppen–Geiger climate category columns are now provided.

Manuscript revision (Table 2): The radiosonde–launcher configurations, climate-control facilities, SHC type, loading procedure, and 7-/14-day sample sizes are reported. Some abbreviations and table notes still require final editorial clarification (see verification report).

## 09 Line 98 — GPS heading

We have replaced the former “GPS” heading with separate latitude and longitude headings in Table 1.

Manuscript revision (Table 1): The headings are “latitude” and “longitude”.

## 10 Line 116 — Forecasting vs NWP

We agree and have clarified the distinct uses of radiosonde observations for operational forecasting, numerical weather prediction, and climate monitoring without asserting a single accuracy requirement.

Manuscript revision (Sect. 3): “Radiosonde observations support operational forecasters directly, are assimilated into numerical weather prediction systems, and provide long-term information for climate monitoring. The required accuracy depends on the application.”

## 11 Lines 154–157 — Campaign duration

We agree. Sect. 4 now distinguishes the approximately two-month campaigns at most sites from the extended Tateno dataset and explicitly acknowledges that the shorter campaigns were not designed to resolve seasonal effects.

Manuscript revision (Sect. 4): “The approximately two-month campaigns at the other sites were sufficient to evaluate the prescribed residence-time comparisons under the conditions encountered during those campaigns, but they were not designed to resolve seasonal effects. Longer, seasonally distributed measurements would strengthen the assessment of generalizability.”

## 12 Line 180 — Table phrasing

We have revised the phrasing and updated the table reference after separating the original table.

Manuscript revision (Sect. 4.1): The text now reads “As shown in Table 2” when referring to the launcher configurations.

## 13 Lines 191–192 — Unbalanced contribution

We have clarified the unbalanced representation of radiosonde–launcher systems and the possibility of confounding by site-specific conditions.

Manuscript revision (Sect. 4.1): “The dataset is unbalanced across radiosonde–launcher configurations: four sites contributed RS41–AS15 measurements, whereas the IMS-100–ARS and M10–Robotsonde configurations were each represented by one site. Consequently, same-systems comparisons may also reflect site-specific conditions.”

## 14 Line 197 — Quality Controlled

We agree and will use “quality-control (QC) criteria” consistently.

Manuscript revision (Sect. 5 and acronym list): Replace “Quality Controlled” with “Quality Control”.

## 15 Figure 2 left — Influence of first blue point

We agree that the first RS2 point affects the apparent slope. We have retained the observation, since there is no justified exclusion criterion, and replaced the claim of an approximately linear decrease with a more cautious description.

Manuscript revision (Sect. 5.4): “both RS41 radiosondes, RS1 and RS2, show an overall decrease in correction values over successive cycles.”

## 16 Figure 2 — Offset between RS1 and RS2

We have clarified that the offset concerns manufacturer ground-check correction values from different radiosondes and that its origin was not determined in this experiment.

Manuscript revision (Sect. 5.4): “The offset between RS1 and RS2 represents a difference in their manufacturer ground-check correction values. Because these are distinct sensors, the offset cannot be interpreted as a storage effect, and its specific origin was not investigated here.”

## 17 Lines 346–348 — SHC orientation effect

We agree that SHC sensor orientation relative to airflow is relevant. We have introduced this issue in Sect. 3 and clarified that paired differences cancel stable orientation-dependent offsets only when the measurement configuration remains unchanged. Time-varying effects are not eliminated by this approach.

Manuscript revision (Sect. 3): “SHC measurements may depend on the orientation of the radiosonde humidity sensor relative to the chamber airflow (M. Sommer, personal communication, 2024). Such configuration-dependent effects can contribute to the observed RH offset and should be considered when comparing measurements between sites or test sessions. However, as described in 4, the analysis is based on differences relative to the initial SHC measurement at t0, thereby canceling out systematic offsets associated with sensor orientation, provided that the SHC configuration remains unchanged between measurements.”

## 18 Technical — Line 6 apostrophe

Thank you. The apostrophe has been removed.

Manuscript revision: “humidity sensor performance”.

## 19 Technical — Line 137 Vaisala repeated

Thank you. We have removed the repeated manufacturer name and use the designation “Vaisala Autosonde® (AS15)” in the manuscript.

Manuscript revision (Sects. 1–2): “Vaisala Autosonde® (AS15)”.