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Comment on amt-2021-337

Anonymous Referee #2

Referee comment on "Intercomparison of Vaisala RS92 and RS41 radiosonde temperature sensors under controlled laboratory conditions" by Marco Rosoldi et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-337-RC2, 2022

In the manuscript, Intercomparison of Vaisala RS92 and RS41 radiosonde temperature sensors under controlled laboratory conditions, the authors describe a laboratory setup to characterise the temperature sensors of the Vaisala RS92 and RS41 radiosondes. The concept to characterize radiosonde's sensors in a dedicated setup under well-controlled laboratory conditions is employed to achieve measurement traceability for reference observations. This could answer the long-standing need in the research-community for independent and traceable assessment of measurement- and calibration errors of radiosondes.

However the experiment and the methodology described in this manuscript have several severe shortcomings that make it hard to draw reliable conclusions from the measurement data. In its current shape manuscript does not meet the quality standards for publication in AMT, and I don't think this can be remedied by a major revision, since the shortcomings in the experimental setup are of a more fundamental nature, which would require a modification of the setup and a complete repeat of the experimental work. On this basis, I would recommend to reject the manuscript for publication in AMT.

The main issue concerns the lack of ventilation in the experiment:
The authors do not provide an exact number for the ventilation speed in the chamber at the location of the radiosondes' temperature sensors, it is stated in line 499 that "the ventilation is weak". This is an important difference with the way radiosondes are normally operated, namely with a ventilation of 3-7 m/s (WMO-CIMO recommendation) provided by the lift of the balloon. This ascent-driven ventilation makes sure that the sensors, that are located near the tip of the sensor boom, do not sample air that is contaminated by the casing of the radiosonde. This lack of ventilation is the likely cause for the periodic peaks in for the RS92 in Figure 3 (that are not addressed by the authors). The RS92 is equipped with two humidity sensors that are alternately heated to remove contamination. It appears that during the experiment, this heating of the RH sensors leaks through to the temperature sensor by conduction. In case of proper ventilation, these periodic peaks in

the temperature signal would have been suppressed.

For future reference: this heating can be switched off by subjecting the RS92 to T < -60C or to pressures lower than 100 hPa. The heating function is reactivated by initialisation in the GC25 unit.

The lack of ventilation also affects the results of the temperature-change experiment, an example of which is presented in Figure 6. Due to the thermal mass of the table on which the radiosondes is mounted, it takes several minutes for the setup to stabilize. During this stabilisation phase, the temperature recordings appear noisy. However, this is not to be interpreted as as noise from the sensor (an instrument property) but rather the result from thermal gradients and other inhomogeneities in the setup which cause for example small-scale turbulences. Proper ventilation in the setup would reduce this transient noise.

Furthermore, I don't think there is much added value in investigating the behavior of the radiosonde when subjected to a temperature change associated with e.g. leaving a building. This pre-flight situation (with very limited ventilation) does not represent the actual operational mode of the radiosonde during an ascent for which it is devised.