

Interactive comment on “Comparison of Vaisala radiosondes RS41 and RS92 at the ARM Southern Great Plains Site” by M. P. Jensen et al.

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Questions for "Comparison of Vaisala radiosondes RS41 and RS92 at the ARM Southern Great Plains Site" by Jensen et al.

This paper discusses the results from 20 comparison flights of Vaisala RS41 and RS92 radiosondes at Oklahoma, USA during June 2014. The authors conclude in Section 5, "... but under most observational conditions, the RS41 and RS92 measurements agree to within the manufacturer specified limits and so a switch to RS41 radiosondes will have little impact on long-term observational records." However, Figure 8 (and other figures) shows characteristic profiles of temperature and relative humidity (RH) differences: RS92 temperature is ~ 0.05 C warmer than RS41 temperature around 3

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km and is ~ 0.1 C colder around 9 km; and RS92 RH is always smaller than RS41 RH in the troposphere, with its peak of $\sim 2\%$ RH around 10 km. I am not sure whether 20 comparisons give statistically significant (and robust) results, but it seems to me that these results are rather robust at least at this site during June 2014 (and for the production batches for these radiosondes). If these results are robust for all RS92 and RS41 data regardless of location, time/season, and batches, the climate community needs to take these into account when analyzing long-term variability (or when homogenizing the time series).

Furthermore, the pressure differences are very important, if they exist, because the climate community usually uses pressure as the vertical coordinate; even if there is no difference in temperature/RH measurements, the difference in pressure measurements would create temperature/RH differences where temperature/RH has vertical gradients. Therefore, it would be very useful to provide a summary table for the "profile" differences, not only for "individual sensor" differences. See, for example, p. 928 of Kobayashi et al. (2012), who discussed "simultaneous sensor comparison" versus "comparison on pressure levels."

My questions are related to the reasons for the above mentioned temperature/RH differences. The authors discuss (p.11332, lines 13-16), "The relative peaks in the temperature and relative humidity differences near a height of 10 km are likely related to a combination of increased radiative heating of sensors due to contributions from cloud albedo, "wet-bulbing" effects and sensor response time in regions of strong gradients as the sondes traverse cloud layers." Is there also a possibility that the factory calibration procedure could play a role? The choice of calibration temperature/humidity points and the choice of fitting curve function might play a role. If this is not the case (i.e., these factors would not create the above mentioned magnitudes of differences), then how about the possibility that the sensor supporting structure might cause heat contamination to the temperature and RH sensors differently for RS92 and RS41? Also, RS92 has two RH sensors heated alternatively to reduce the sensor icing and thus to

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reduce wet-bulbing effects, while RS41 only has one RH sensor. Why does the RS41 is less prone to wet-bulbing effects (p. 11331, lines 27-28)? But, Anonymous Referee #2 pointed out that RS41 also has a heating mechanism. Please give more detailed descriptions about both RS92 and RS41 RH sensors and their heating mechanisms.

Also, let me point out that for RS41 which uses GPS to measure pressure, temperature and RH errors, if they exist, would propagate to the pressure data. Does this explain (at least part of) the RS92-RS41 pressure differences? But, it looks from Anonymous Referee #2's review that the authors should check the pressure ground check procedure (or the treatment of surface pressure data in the data processing) first.

Finally, I agree with Anonymous Referee #2 that the authors should also analyze GRUAN RS92 data product so that we can clarify whether the differences they found come from the correction algorithms for RS92 or not.

Reference: Kobayashi, E., Noto, Y., Wakino, S., Yoshii, H., Ohyoshi, T., Saito, S., and Baba, Y.: Comparison of Meisei RS2-91 rawinsondes and Vaisala RS92-SGP radiosondes at Tateno for the data continuity for climatic data analysis, J. Meteorol. Soc. Japan, Vol. 90, 923-945, doi: 10.2151/jmsj.2012-605, 2012. <http://doi.org/10.2151/jmsj.2012-605>

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