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Atmospheric Measurement Techniques Discussions

Interactive comment on "Comparison of the GRUAN data products for Meisei RS-11G and Vaisala RS92-SGP radiosondes at Tateno (36.06° N, 140.13° E), Japan" *by* E. Kobayashi et al.

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I wish to congratulate the authors for the clear paper and through analysis of differences between the two GRUAN products considered. In particular, the importance of measurement uncertainty produced by GRUAN approach is evident in the analysis based on Immler's formula.

Focusing on temperature, I consider two points in this discussion.

1) The paper considers the mean in each of the 13 pressure layers of Kobayashi et al. (2012) and compares the ensemble average of the two instruments for each layer. The

statistical approach is quite simple and clear. Nonetheless, state of the art literature is not considered.

In my opinion, it should be important to deepen the literature review and cite recent papers on alternative methods for radiosonde comparisons such as the approach based on functional data analysis of Fassò et al. (2014).

2) Figure 22 shows that the two instruments have differences with a probability much larger than stated, under zero mean Gaussian assumptions, in Tab. 4, leading to inconsistent measurements. This is especially true for daytime as noted by the authors in the abstract, in Section 5.3 and in the Summary.

Now, this may be due partly to random and correlated effects and partly to a non-Gaussian distribution of the differences. Using notation of Eq. (9), we may have that

$$d > 3u_c$$

for various (and combined) reasons:

a) The ensemble average difference, estimated in Eq.(6) and mentioned in point 1 of this discussion, is not zero. For example, the observed difference of $0.4K$ is enough to justify Tab. 4?

b) d is not Gaussian;

c) the number of samples is small.

I do not consider point c) in detail here because M is not very small and, moreover, the number of seconds per layer is relatively large.

Regarding point a), we have information given by Figure 8 where M (independent) launches are averaged and each layer gives an average of possibly correlated differences (d). So the following question arises:

Is the ensemble average difference (6) large enough to justify the inconsistency or other co-location issues are present, or measurements are not Gaussian, so the use of Immler's constants ($k = 1, 2, 3$) is not appropriate?

I think that addressing this point using e.g. the histogram of differences (d) in each layer and/or other techniques to analyse the distribution of the differences (d) may help.

Minor points & typos:

Fig. 22 legend misspelling

Eq. (8) is a square missing?

References

Fassò, A, Ignaccolo, R, Madonna, F, Demoz, B. and Franco-Villoria M. (2014) Statistical modelling of collocation uncertainty in atmospheric thermodynamic profiles, Atmos. Meas. Tech., 7, 1803–1816, doi:10.5194/amt-7-1803-2014. http://www.atmos-meas-tech.net/7/1803/2014/amt-7-1803-2014.pdf

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