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Atmospheric Measurement Techniques Discussions

Interactive comment on "Is it feasible to estimate radiosonde biases from interlaced measurements?" *by* Stefanie Kremser et al.

Anonymous Referee #2

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This paper investigates potential usefulness of "interlaced" comparison measurements from two different radiosonde types, rather than "dual" measurements with single balloons, being motivated to reduce the cost that the sites need to cover for dual measurements when changing from one instrument type to another. The authors prepare several different sets of simulated dual/interlaced measurement data with specified instrument biases, different autocorrelation coefficients (a measure of high frequency weather disturbances), and different numbers of flights, and calculate the standard deviation (a measure of uncertainty) of estimated instrument biases. The authors find that the standard deviation reduces as the number of flights increases or as the autocorrelation coefficient increases (i.e., weather variability decreases), but virtually never reaches the level that dual measurements would provide. Thus, they conclude that the

method on interlaced comparison measurements is "unlikely to provide a robust estimate of the difference in biases for a reasonable length of the measurement period" (e.g., 2 years).

This is an important contribution to the climate science community by providing a statistics-based evaluation of usefulness of the method of interlaced measurements that some operational sites or researchers may consider as an option. The methodology of the paper is sound and basically explained well. The manuscript is appropriate for AMT, and should be published once the following minor comments and suggestions are considered.

Specific comments.

Page 2, line 21: Kobayashi et al. (2012) also give a very good example of dual sounding program (a total of 115 dual soundings for four different seasons) at a GRUAN site, Tateno when they changed from Meisei RS2-91 to Vaisala RS92.

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

Page 2, around line 21: WMO conducted several radiosonde intercomparison campaigns in the past (e.g., Nash et al., 2011; Jeannet et al., 2008 and the references therein). It would be fair to mention these and discuss its usefulness and/or limitations.

Nash, J., T. Oakley, H. Vömel, and L. Wei, 2011: WMO intercomparison of high quality radiosonde systems, Yangjiang, China, 12 July-3 August 2010. WMO/TD No.1580. IOM Report, No.107, World Meteorological Organization, Geneva, 248pp., available at https://library.wmo.int/opac/index.php?lvl=notice_display&id=15531#.WrBryGrFJ0w

Jeannet, P., C. Bower, B. Calpini, 2008: Global criteria for tracing the improvements of radiosondes over the last decades, WMO/TD No. 1433, IOM Re-

port No. 95, World Meteorological Organization, Geneva, 32 pp., available at https://library.wmo.int/opac/index.php?lvl=notice_display&id=15522#.WrBt_WrFJ0w

Figure 1, caption. Please add the explanation on the dotted and blue lines in the upper two panels.

Page 4, Equation 4: Why the delta-hat is not E[delta]? A sentence explaining the reason for this at line 28 may be useful for readers.

Page 5, Equation 5: Why there is a phase component "-pi/2"? Also, in general, there should be cosine components as well for both diurnal and semi-diurnal variations? If, for this simulation study, it is enough to consider sine components only, mention that perhaps at line 23.

Page 5, lines 20-21: The key word "weather" has already appeared at line 10, but it would be useful to mention it again when "a" first appears here, so that the readers are reminded that "a" is the one related to the magnitude of high frequency weather variability which is "noise" in this study. Something like: "(or the magnitude of weather-related variability, larger for smaller a)"

Page 6, line 13-14: "larger persistence lead to larger uncertainties" – isn't it possible to show an equation for this using "a"?

Page 7, lines 10-13: It would be nice to have some more explanation on the GAMs. (Are the GAMs a class of statistical distributions that Tt,AB would follow? What factors/components determine the degrees of freedom here?) This is in part because the authors mention the GAMs again at the second line of the Conclusions, as a key component for this study.

Page 7, line 30: I assume that 300 hPa at Lindenberg (a midlatitude site) would give near-largest weather-related variability, i.e., minimum "a", compared to other height regions and other latitude regions. But, I think it would be useful to actually show this by showing the values of "a" for other height regions at Lindenberg (and perhaps at a

tropical site as well).

Page 8, lines 9-10: Please also add explanation on M here.

Page 10, line 25, and lines 28-29: Showing a figure on this might be useful? Also, stratospheric water vapor measurements may be an example for this?

Page 12, Competing interests: The period is missing at the end of the sentence.

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