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Atmospheric Measurement Techniques Discussions

Interactive comment on "Altitude misestimation caused by the Vaisala RS80 pressure bias and its impact on meteorological profiles" *by* Y. Inai et al.

Anonymous Referee #1

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The paper by Inai et al., reports on pressure errors, up to 0.4 hPa, for RS80 radiosondes. Pressure errors were determined using GPS data as a reference. Results come from SOWER radiosoundings over the 2003 to 2010 period in the tropical western Pacific. The pressure errors result in vertical shifts for temperature, water vapor and ozone profiles. The paper describes that the errors arising in these quantities from the vertical shifts can reach up to 1 K in temperature, one or two percent in water vapor and several percent in ozone. Errors are usually small to negligible in the troposphere, and become substantial in the stratosphere. Overall this is an important topic, relevant for atmospheric observations, and especially relevant for long-term trends from radiosonde data.

The paper does not present much new information over and above what has already

been published in the cited papers by Inai et al., 2009; Steinbrecht et al., 2008; and Stauffer et al., 2014. Still, the manuscript does provide another independent piece of information on the apparent pressure bias of Vaisala RS80 radiosondes. To me, this makes it acceptable for ACP.

1 Major comments

In order to put the Inai et al., results into better perspective, and to make it easier for readers to get the full picture, I request that the authors include the biases reported in Steinbrecht et al., 2008 and Stauffer et al., 2014 into their plots (Figs. 1,2,4,6).

In many places, the paper should be made shorter and more concise. Focus should be much more on the new / specific aspects.

- Abstract and Introduction could easily be shortened by 50%.
- Eqs. 1 and 2 are equivalent. One of them should be omitted, the discussion should be shortened substantially, since the cited references or a textbook give the information.

page 2194, lines 23, 24: To me, that statement is wrong, and should be deleted. I have looked at the Stauffer et al., 2014 paper. They correctly account for the effect of pressure on both mixing ratio calculation and vertical profile shifts. Note that this depends on the vertical coordinate system, and on the ozone quantity considered. There are three possible vertical coordinates:

1. Time: In that case, the ozone partial pressures are the same with or without pressure error. Ozone mixing ratios will be different, however, due to division by different pressures (at the same time).

2. Altitude: In that case, the ozone partial pressures with or without pressure error will differ, due to vertical profile shift. Ozone mixing ratios will differ further, due to additional division by different pressures (at the same altitude level).

3. Pressure: In that case, the ozone partial pressures with or without pressure error will differ, due to vertical profile shift. Ozone mixing ratios will not differ further, because division is by the same pressure (at the same pressure level).

I think the manuscript currently is not presenting these error sources correctly, e.g., in Figs. 5, 6 and 7. At least, I find the current presentation confusing or misleading. I think this needs to be corrected/ improved. As usual, shorter would probably be better.

2 Minor comments

Page 2196, lines 9, 10: Note that Stauffer et al., 2014 use a slightly different value for the specific gas constant for dry air (287.05 J kg-1 K-1 versus 287.10 = 8314.51 / 28.96 here).

Page 2197, last paragraph: As mentioned, the pressure biases from Steinbrecht et al., 2008; and Stauffer et al., 2014 should be included in Fig. 2, and could be compared briefly here.

Page 2199, lines 10 to 19: As I said before (last major comment), Stauffer et al., include both profile shift and conversion to mixing ratio correctly, as they plot things as a function of altitude. They do not plot things as a function of time, or pressure, and they give the overall effect for the altitude profile. See their Figs. 2 and 3, which show both the profile shift and the effect of conversion from partial pressure to mixing ratio. Please correct and shorten.

Page 2199, line 10 to page 2200 line 8: I find this lengthy and confusing. I would

shorten it and omit equations 4 to 6. See my last major comment. Since the authors are using altitude as vertical coordinate in their plots, there should be two curves in the right panel of Fig. 5, one for ozone partial pressure differences, and one for ozone mixing ratio differences. See also the different curves in the left and middle panel. The red line in the right panel cannot be the partial pressure difference. This difference would not be zero due to vertical profile shifts (see left panel).

Figure 6: Again, there should be two different curves, one for partial pressure difference, and one for mixing ratio difference. The corresponding result from Stauffer et al., should be plotted in here as well.

Page 2200 line 15 to page 2201 line 4: I think those paragraphs should be omitted. I find them more confusing than helpful.

Page 2201, line 12 to 21: Some comments as for ozone. Again, I think there should be two lines in the right panel of Fig. 7, one for the partial pressure difference in the right panel, and one for the mixing ratio difference in the middle panel.

Pages 2202, line 21 to page 2205 line 2: I find this discussion much too long, and quite far removed from the actual (new) findings of the paper. I do not see the need for reporting all these trend papers in lengthy detail. It would be enough/ better to compare the magnitude of the pressure error effects with the magnitude of observed/ reported trends. I suggest to shorten this discussion by about 50%.

Page 2205: I am missing a reference to Stauffer et al., 2014, and I am missing a statement, how your pressure difference and consequent results for temperature and ozone differences compare with the results reported in these studies. Please add, maybe also in the abstract. Since the present study does not report really new findings, it is key to put results into the perspective of existing literature.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 2191, 2015.