

Interactive comment on “Propagation of radiosonde pressure sensor errors to ozonesonde measurements” by R. M. Stauffer et al.

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Received and published: 18 October 2013

-*This is a preliminary response prior to final edits on this manuscript. Iterative comments are welcome*

-The authors would like to thank the reviewer for their time taken to make these comments. A revised paper will take these and other reviewers' comments into account.

The paper addresses an important issue that operators of ozone sondes need to be aware of. This issue is particularly important for long time series of ozone sonde observations since the pressure data impact the derivation of ozone observations in several different ways.

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I would recommend publishing this paper after my comments have been addressed.

This Vaisala RS92 radiosonde is equipped with both pressure sensor as well as GPS. The Digicora software can be configured such that the pressure is calculated from GPS already within the software. If the software has been configured to do that, then the agreement between the Vaisala pressure and the pressure derived by the authors using the GPS altitude would not show the quality of the pressure sensor, but rather show some minor inconsistencies in the math used to calculate the pressure. Although the most common setting is to use the pressure from the pressure sensor, the authors need to verify the source of the pressure observations from the Vaisala RS92 and state so explicitly.

-This will be verified and explicitly stated in the paper.

The data for the Internet radiosonde are grouped by letter of the serial number (see page 7777, line 8). Although suggestive, the letter of the serial number for Internet sondes has no relation to the pressure sensor or GPS unit contained in the sondes. The accuracy of the pressure measurements furthermore depend on the firm ware used by the sonde, which is not accessible to the user. Therefore, all Internet radiosonde data should be grouped together and not treated as distinct models.

- It will make it easier for a growing number of iMet users to apply these results to their data if we retain the labels of different models. We have been communicating with iMet throughout our analysis and during the field campaign in which the Porterville sondes were launched. Yes, there are firmware updates but the hardware is evidently the same on all the models.

The authors should discuss how the pressure measurements are being treated in the Vaisala System compared to the Internet System. Vaisala applies a ground check correction, which is not done for the Internet radiosonde. In the Vaisala RS80 the ground check correction depends on whether the radiosonde is received with the Vaisala receiving system or using any of the other interface telemetry systems. These details

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should be pointed out. The authors should also point out, that the meta data must have the information how the pressure measurement was treated, so that users can determine, whether a further correction is required or not.

-This discussion and verification of the Vaisala ground check process will be added to the paper.

Can the authors verify that all Vaisala RS80 and Internet soundings have been processed without pressure offset correction? Some sounding software has to option to correct for pressure offsets. The paper assumes that no pressure offset correction has been done, but this should be verified.

-All soundings were collected by and are the responsibility of one of the coauthors, so it is known that a pressure offset has not been applied.

The authors should indicate, which GPS data were used on the Vaisala RS80. Some models of the RS80 were equipped with their own GPS, but for some ozone sondes soundings the GPS unit provided with the ozone sonde was used.

-A separate Garmin GPS unit attached to the inside of the ozonesonde Styrofoam box was used. This will be added to the text.

The authors should briefly explain how the constant mixing ratio extrapolation is calculated. This will immediately illustrate the strong impact of any pressure error on the extrapolation.

-This will be added to the discussion. Certainly the constant mixing ratio extrapolation is over/underestimated in the case of a large pressure offset. Note, however, that in most of the cases presented in this paper, the ozone mixing ratio at burst is too high and leads to an exaggerated ozone partial column above balloon burst.

An important detail in equation 2 is the gravitational constant, which not only depends on geographic latitude, but also on altitude. The authors should elaborate how the gravitational constant is being calculated and should cite a reference. For example the

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paper by Inai et al. shows one method of calculation.

-An updated gravity formula is used that includes gravity's decrease with altitude. This only slightly changes any pressure offsets, but is included to be as accurate as possible. The gravity formula will be presented in the revised paper.

The authors should point out that for an accurate pressure profile based on GPS an accurate surface pressure is required if the radiosonde itself does not measure pressure at launch.

-While a precise surface pressure is necessary for an accurate calculation of pressure in the lower troposphere, there is less sensitivity near burst. Changing the surface pressure in the GPS calculation by even +3 hPa at the surface results in only a few hundredths of 1 hPa change in the stratosphere. A figure will be presented to the reviewer in the final response showing this.

The authors focus on the impact of the pressure measurement errors in the upper parts of the ozone sonde profile. However, at lower altitudes the GPS derived pressure is inferior to the measured pressure, leading to increased uncertainties in the lower troposphere. The authors should mention that GPS derived pressure improves only the upper parts of the profile, while decreasing the accuracy in the lower parts of the profile.

-In terms of absolute pressure offset (hPa difference), this is true in some cases. However, the percent difference at lower altitudes is negligible, and often +1 % in the troposphere. The revision will address this point.

Minor comments:

P7772, Line 20: Please rephrase this sentence. I believe the authors mean the difference in the total ozone column between pressure derived geopotential altitude and GPS derived geopotential altitude. The satellite climatology is used in both cases.

-That is true. This will be made clearer in the text.

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P7773, Line 8: Nash 2011 should be included as reference.

-We will read through this reference and add it to the list.

P7773, Line 16: There are only two manufacturers. One of them bought was bought by another company, but the sonde is basically the same.

-The Referee is technically correct that the ENSCI instrument is now manufactured by DMT. However, our authors represent an active set of users who have noted a definite change in ozonesonde instrument performance since 2012 apart from radiosonde variations. These changes include more frequent pump motor defects and long times (up to an hour or more) to reach acceptable background current levels in pre-conditioning and 'Day of Flight' tests. We have confirmed this with our NOAA colleagues (B. J. Johnson and P. Cullis) who are responsible for DMT sonde launches in Boulder, Hilo and several SHADOZ (tropical and subtropical) stations. This justifies our treating the DMT as a third instrument. When exactly the ENSCI and DMT instruments or, alternatively, earlier vs later DMT instruments began to diverge, it is not easy for us to say.

P7774, Line 2: Change 'fixed parameter' to 'free of biases'.

-This will be changed.

P7774, Line 5: Delete 'can'

-This will be deleted.

P7775, Line 7,8: Delete '(_10 m or less)'. Ozone sondes have a high vertical resolution, but due to their response time it is not that good.

-This will be changed to ~100m taking into account the 20-30s response time of the ozonesonde.

P7777, Line 7: Please make sure and specify that only RS92 SGP was launched. The RS92 K does not have a GPS.

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-This will be updated to state that.

P7784, Line 8: Change 'an' to 'of'

-We assume you mean P7785 line 8. This will be fixed.

P7785, Line 27: What do the authors mean by 'the agreement improved'?

-We mean that the differences in the ozone column calculated from the original pressure and the GPS pressure were reduced. This will be made clearer in the text.

P7786, Line 7: Add 'at the top of the profile'

-This will be added.

Figure A3 is very hard to read in a printout. Those sites that have only few soundings are particularly hard to see.

-The line colors will be darkened to make them easier to see.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 7771, 2013.

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