

## ***Interactive comment on “Observations of precipitable water vapour over complex topography of Ethiopia from ground-based GPS, FTIR, radiosonde and ERA-Interim reanalysis” by G. Mengistu Tsidu et al.***

### **Anonymous Referee #1**

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The paper studies observations of integrated precipitable water vapor from two ground based remote sensing instruments, ERA interim, and radiosonde profiles.

The study is interesting, since it presents data from an often data poor region. The results are largely consistent with our understanding of the observing system, but I would still recommend publication after some major revisions.

Major comments:

C3293

The paper could benefit from making the presentation more concise and avoiding excessive redundancies in the discussions. It could be shortened significantly without any loss in content.

Since several radiosonde correction algorithms have been published to account for the dry bias, it would have been good to see these applied and verified here. In fact, there are very few validations of these correction algorithms at high altitude, low latitude sites and this would be a valuable contribution the paper could easily provide.

Some biases of the different instruments are known and documented. Throughout the paper it was difficult to follow, which instrument is biased against which and in which direction. This concern could be addressed by rigorously trying to include estimated uncertainties with the observations and to evaluate the biases with the estimated uncertainties. The conclusion section could summarize, which is the optimal method of estimating PWV given this mix of data sources.

Minor comments:

Page 9876, lines 18-19: GPS PWV can be determined either from a network solution or from precise point positioning. It appears that the network solution is used in this study. This could be made clearer. Can you say something about the uncertainty of a single point observation in the network solution?

Section 2.3: The Vaisala RS92 radiosonde and its known dry bias should be introduced in this section. The entire section 3.1.3 should be included in section 2.3.

The integration of PWV in radiosondes should start at  $P=0$ , although for practical purposes the tropopause pressure can be used reliably without any significant error. Later in the paper  $P=500$  hPa is mentioned, which would be incorrect.  $g_0$  should be given in m/s not cm/s.

Section 3.2: You frequently talk about dry bias. You should clarify, whether the bias you find should be considered as offset of scaling factor.

C3294

Page 9884, line 28: What do you mean by 'dry biased at the upper end of PWV time series'. I guess you just mean 'dry biased'.

Page 9886, line 1: Why are there more FTIR / ERA interim comparisons than FTIR / GPS comparisons? GPS should run on a much higher temporal resolution and should produce more data than ERA interim.

Page 9887, lines 1-8: Can you make a statement about the sensitivity of PWV to surface pressure. It would be interesting to know which error in surface pressure causes which error in PWV. In this context it would be good to know what the difference between observed pressures at some stations is to the modeled pressure at these stations.

Page 9892, lines 11-12: This sentence mentions the 500 hPa integration. It is not clear where this sentence comes from and what its purpose is.

Technical comments:

Page 9872, line 25: Change 'due to slow balloon ascent' to 'due to the fact that radiosondes are launched only once per day'

Page 9874, line 12: Change 'GPS sites are installed since 2007' to 'GPS sites have been installed since 2007'

Page 9874, line 13: Change to 'as permanent stations'

Page 9874, line 15: Change 'albeit some interruption at some stations' to 'despite some interruptions'

Page 9875, line 17: Change 'latitude' to 'altitude'

Page 9881, line 16: Delete 'considerably', delete 'remains'

Page 9886, line 29: Change 'observations that provide PWV from ground' to 'source of PWV data.'

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Page 9888, lines 11-14: Please rephrase this sentence.

Page 9892, lines 17ff.: What is the difference between surface pressure and synoptic pressure that you refer to here. Do you mean measured and modeled pressure?

Page 9892, line 26: What is the meaning of 'gain' in this context?

At several locations change 'Fig.' to 'Figure'

Figure 1, legend: Change 'locatopns' to 'locations'

Figure 1: The lakes cannot be seen in the map and could be highlighted.

Figure 4: This figure is too small to read.

Figure 6: It would be good to switch the axes, i.e. move the radiosonde data to the vertical axis corresponding to Figure 5.

Figure 7: It would be good to switch the axes, i.e. move the GPS data to the horizontal axis corresponding to Figure 5.

Figure 8: This figure is too small to read.

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Interactive comment on Atmos. Meas. Tech. Discuss., 7, 9869, 2014.

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