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Atmospheric Measurement Techniques Discussions

Interactive comment on "A GPS network for tropospheric tomography in the framework of the Mediterranean hydrometeorological observatory Cévennes-Vivarais (South-Eastern France)" *by* H. Brenot et al.

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Review of "A GPS network for tropospheric tomography in the framework of the Mediterranean hydrometeorological observatory Cévennes-Vivarais (South-Eastern France)", by Brenot et al.

by David K. Adams

Recommendation: Accept with minor revisions

General Comments

Brenot and co-authors have analyzed GPS data for a short-term (2 months) dense network of GPS receivers over Southeastern France to derive 3D water vapor fields using a tomographic inversion technique. The work aims at quantifying the error associated with the GPS technique for deriving water vapor fields with a particular focus on the dense network geometry. The authors take advantage of a collocated radiosonde and nearby weather radar to compare evolving water vapor fields during disturbed weather as reconstructed through the tomographic inversion technique. The work is important and publishable. A few minor points within the manuscript need to be clarified as well as some improvement of a couple of the figures.

Surprisingly, 3D water vapor fields research with GPS has advanced very little since its first inception around the early 2000′s. Perhaps, the difficulty in constraining the water vapor fields from rather intermittent data will only lessen with the densification of GNSS satellite constellations. Hopefully, these authors and others will continue moving forward in this endeavor.

Major Comments

Equation 5 is not the typical meteorological definition of PWV. PWV is a measure (in mm or cm) of liquid water that could be condensed out of the atmospheric column. You have to divide through by the density of liquid water.

Pg 9523 "However, due to the exponential decrease of air density, most of the tropospheric variability is seen in the lower part of the troposphere, typically 2–3 km. " I think you mean here is that the water vapor scale height is about 2 to 3 km and this is what is important for the delay due to water vapor. The troposphere (the well-mixed dry components) has a scale height of 7 to 8 kilometers.

Pg 9534. Section 5.2 I am a little confused as to why you convert to sea-level pressure first and then back to station height. Isn't it just the relative difference in height/pressure

between sites that is important? Also, with your assumed lapse rate 6 C/km, you might what to mention the sensitivity of GPS PWV to surface temperature. I assume it's not very large.

Pg 9540 m0 (g m-3), what is this first guess? An exponential decrease with a scale height of about 2.5km? How sensitive is your final vapor fields to this initial guess? This is probably the most important point that needs to be clarified.

Technical comments.

Abstract Line 13. Change to: Also, the dense local network provided data which have been inverted using tomographic techniques to obtain the 3-D field of tropospheric water vapour content.

Line 16. This is unclear. What are "the optimal tropospheric GPS retrieval methods, "? Do you mean "using optimal tropospheric GPS retrieval methods"

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pg 9517 Line 1. Change to: "Within the OHM-CV framework, we completed the available measurements of humidity in a very significant way using GPS observations ..."

Line 5. Change to: " ...radiosonde measurements or water vapour radiometers (within1 to 2mm of precipitable water)"

Line 15-20. You should probably be a bit more consistent as to how you term the dense network (18 stations $\sim$30 km x 30km). When you say tomographic network, does it mean only these 18 stations or do it include the larger network with permanent stations?

Pg 9518 Line 4 Change to: "...field evolution and the rainfall estimation provided..."

Line 5. Change to: "...water vapour in the convective system's life cycle." I think this is what you want to say.

Line 6 Change to: " ...21st of October..."

Pg 9519 Line 3 "excluding any instrumental drifts." This is a bit unclear, what are you referring to?

Line 5 "However, the effect on the tropospheric parameter estimates is limited as an error in the vertical positioning is down-weighted by a factor of about 3 for the tropospheric parameter estimation" This sentence is unclear, please clarify what you mean by "down-weighted by a factor of about 3 for the tropospheric parameter estimation"

Line 8. I suspect readers will not know what "major ocean loading component M2" is.

Line 18. Change to: "ground-based" and throughout

I think after each of your points a), b), c), you should probably use a comma or semicolon, not a period, since it is all one idea.

Line 21 Change to: "and process-oriented studies"

Page 9520

Line 4. For clarity, I would write "This latter technique ..." or "This tomographic technique..."

Line 5 Change to: "horizontal resolution of several kilometers,..."

Line 6 Can you be more precise on the vertical resolution?

Line 19. Change to: ground pressure to surface pressure (here and throughout)

Pg 9523

Line 4. Change to: "For that study, the tomographic routine (LOFFTK) was employed for the GPS inversion."

Line 5. This is a little unclear "Based on this experience, a new software,called TSAAR (Tomography Software for wAter vApor Retrieval) has been developed by the authors."

Do you mean TSAAR is based on or a modified version LOFFTK developed by the present group of authors?

Line 7 Change to: “A full series of tests and validations are presented ...”

Line 9. Change to “TSAAR will be used ....”

Pg 9524

Line 3. Change to: “...completed by 5 meteorological data loggers ...”

Line 11 Change to: “Therefore, ...

Pg 9526

Line 4 Write “from the 20th to the 22cd of October 2002” Line 21 This is unclear. “The choice of the geometry of the network has also shown some results about the uncertainty of the two components (NS, EW) of horizontal gradients.”

Do you mean horizontal gradients are shown throughout the results of this study to be sensitive to the geometry of the network?

Pg 9528

Line 3 Change to; “We tried to identify a more appropriate reference frame...”

Pg 9530

Line 10. Change to: “For three days from the 20th to the 22cd October 2002,... ”

Pg 9531

Line 4 Change to: “In this section, ...”

Line 24. Define doy

Pg 9533

Line 9 Change to: “the signal due to the underlying topography prevails over ...”

Pg 9539

Line 9. Change to: “...widely used in the literature.”

Pg 9542

Line 16. Change to: “network for the 21st of October 2002” And throughout. Or October 21st, 2002

Tables and Figures

Figure 1 Change “temporal” to “temporary”

Figure 3 is very hard to see. I have it magnified to 300% and it′s still difficult. Can you maybe just do 4 stations?

Figure 15 is too small also. Is the last column d of the vertical profiles really revealing?

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 9513, 2013.