

Interactive comment on “Combining METEOSAT-10 satellite image data with GPS tropospheric path delays to estimate regional Integrated Water Vapor (IWV) distribution” by Anton Leontiev and Yuval Reuveni

Anonymous Referee #1

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Use of GPS derived Water Vapour (WV) in Europe is a well established techniques but there exist a large difference on regional level. While west and central Europe the topic has reached maturity in south and particularly east Europe it is currently under development. This paper presents the first results of GPS derived water vapour for Israel. Covering this region is a much needed positive development however this paper has major weaknesses, which make the study incomplete and needs to be addressed in full before proceeding to publication. Below is the summary:

Abstract:

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The first sentence “can help us to understand the physical conditions in the upper atmosphere” is incorrect. To the best of my knowledge GPS Meteorology niche is the lower atmosphere. The term “upper atmosphere/troposphere” is incorrectly used in the entire paper and I can advice the authors to seek collaboration with atmospheric scientists to cover the obvious gaps of knowledge in their team.

Introduction:

The paper lack review of the-state-of-the-art in the GPS meteorology and Meteosat methods and water vapour products. The focus in the introduction is the WV derived with radiosonde (RS). Further problem is the use of misleading or general statements. For example:

- 1) line 59-60 “this problem manifests the most in the upper troposphere” - incorrect
- 2) line 78-79 “. . . , which conduct upper-air measurements to characterised the temporal behaviour of atmospheric boundary layer” - incorrect and misleading.
- 3) line 80-81 “This makes it almost impossible to precisely detect the horizontal boundaries between moist and dry air” - what do you mean here?
- 4) line 86 “vary constantly” - not clear does it “vary” or is “constant”.
- 5) The terms WV/IWV/PWV are mixed in the text and also figures, which makes poor impression and makes the paper difficult to read. Also different units are used “kg/m²” and “mm” through the paper which is not helpful.

In short the introduction is not focused and lacks: 1) review of the previous studies in the GPS Meteorology and products from satellites and 2) clearly defined aim and objectives of the study. Thus it is not acceptable in this form.

Technical Approach and Methodology:

The proposed in this section method to derive WV from Meteosat is not convincing.

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2.1 PW/IWV

- 1) It is not clear how ZWD is obtained and what is its accuracy.
- 2) The requested surface observation radius is 10 km. It is unclear why such narrow radius is selected and preferred. Published studies suggest that the appropriate radius of surface observations can be much larger. Unless sensitivity studies are done the selection of this radius seems arbitrary.
- 3) Missing is information of derivation of surface temperature from Meteosat. The accuracy of this products is also not clear.

2.2 WV

- 1) The proposed WV extraction from Meteosat is not convincing. Without proper treatment of the bottom part of the atmosphere this procedure is incomplete and thus the poor comparison reported in section 3. Methods to derive WV product from Meteosat WV channel have been published in the literature and it is advisable to review those methods or use the processed by Meteosat WV products.
- 2) In my opinion the proposed Least Squares procedure (equation 8) to link GPS-IWV and Meteosat pixel value is not very appropriate. It will likely smooth the high temporal and spatial variability of WV. Thus it needs to be demonstrated that this procedure is appropriate on day to day basis.

Results:

- 1) The advantage to use Meteosat temperature to surface observations is not clearly demonstrated. The large difference of “1.36 mm” is likely contributed by the accuracy of Meteosat product.
- 2) The good agreement between the GPS and RS IWV is poorly demonstrated. Statistic with 9 points is not really meaningful. A proper comparison will need to be done covering preferably one year of observations in all seasons.

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3) The reported large mean difference of 4.48 mm between GPS and Meteosat WV likely reflects the proposed method for derivation of Meteosat products in section 2.2.

Conclusions:

Incomplete statements needs to be carefully reviewed and corrected.

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