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Discussions

Interactive comment on "Capturing the signature of heavy rainfall events using the 2-d-/4-d water vapour information derived from GNSS measurement in Hong Kong" *by* Qingzhi Zhao et al.

Anonymous Referee #2

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The paper investigates the water vapour variations, as derived from GNSS, during heavy rainfall events in Hong Kong. Both the 2-d Precipitable Water Vapour (PWV), and 4-d variations (from tomography) are studied. I find the study of the 4-d variations especially interesting.

I have already reviewed this paper when it was recently submitted to a different Journal. Since I see that the Authors did not modify the paper before submitting it to ANGEO, I will include also some major comments arisen in the second round of that review. I will refer all the comments to the document angel-2018-76-AC1-supplement.pdf.

General comments: the research design is not appropriate to make most of assessments; the results are not clearly presented and commented. The conclusions are not fully supported by the shown figures. The paper needs to include more comparison/validation data in order to evaluate the results.

The topic of the application of GPS tomography to study the water vapour variations during rainfall is definitively worth to be deeply investigated. However, such a study needs to include validation using an alternative technique or at least a detailed discussion on what variations one could expect. If that would be done, the study would also serve as a further validation of the GNSS tomography technique. In this paper it is hard to say if the detected variations are real or simply some artifacts of the tomographic solution. As a matter of fact, the comparison with radiosondes made in the paper (Fig 6) is not convincing. It is reasonable not expecting a perfect agreement between radiosondes and tomography for a number of reasons. But, the tomographic profiles show too many abrupt variations respect to the radiosonde profiles. It should be pointed out that the resolution of the radiosondes may not be as bad as it looks like. Commonly, a radiosonde samples with a relatively high vertical resolution (10-50 m). However, reported are normally only the values at heights where there are significant variations in at least one of the meteorological parameters, as well as for a number of predefined standard pressure levels. Hence, a big gap in the radiosonde data does not necessarily mean that data is missing, but rather that the variations of the meteorological parameters in this interval were rather smooth.

Under these circumstances the tomographic solution should be further checked in order to demonstrate that the temporal variations seen in the tomographic profiles are real (what is important for the conclusions of the paper).

Furthermore, I think the authors should also look more on the horizontal motions. For example, can it be shown that the vertical motions seen from the time variations of the vertical profiles are really vertical motions and not actually horizontal motions of sliding clouds?

The paper contains too many figures; I think same of them are not necessary.

Line 56-59 Use NWP only

Line 180 The "post-processing mode" means that you are using corrections for GPS data not available in real time. What is the data latency of final products downloaded from the ftp site? This could limit very much the use of this technique for nowcasting and/or assimilation in NWP. If you agree this limitation should be included and discussed in Conclusion section.

Line 239-240 "The weather conditions are cloudy and sunny without rainfall happened for the period of 1 to 8, August 2015" —> It would be to describe better the atmospheric conditions and the type of occurred events.

Line 240-241 " Those two periods are selected in this paper to investigate the variation characteristics of atmospheric water vapor" —> It can be useful to introduce in the article a graph related to the total reference period

Line 254 See comment to 180

Line 261-261 "PWV does not show any continuous increasing trend when there is no rainfall" —> Is it a common behaviour within the whole database or does it happen only in the period you are reporting about (1 to 8, August 2015)?

Fig. 2 and 4. The chosen time resolution does not allow making some conclusive assessments. The reader cannot evaluate from the figures if the precipitation effectively reduce the available PWV or how much is related with precipitation. What is the situation the days before the selected events that was generating high PWV values? Some meteorological description of the selected periods would help very much to understand.

Line 317 Since the main focus is the tomographic 4-d, the amount of introductory figures on 2-d could be too many.

Figure 7 to 10 —> Why so many panels? It would be better to reduce and compact the

figures, i.e. by including in one single panel the temporal sequence of profiles. Also the description should be improved.