Interactive comment on “Assessing water vapor tomography in Hong Kong with improved vertical and horizontal constraints” by Pengfei Xia et al.

Dear Reviewer,

First of all, we would like to thank the anonymous two reviewers very much. All the comments helped us improve the manuscript a lot. We are very appreciative of that. For each comment, we have carefully examined and answered with our best efforts. Thank you! Please kindly find enclosed our updated manuscript and our responses to each comment below.

Best regards

Pengfei Xia

Anonymous Referee #1

Received and published: 4 June 2018

This paper focus on the optimizing of tomography technique in three aspects, 1) establishing a new $T_m$ model; 2) determining the scale height of water vapor, which used to construct the vertical constraint; 3) Obtaining the smoothing factor in the horizontal constraint. This paper has plenty of merit and is fairly well written. Therefore, I would recommend it for publication after the following corrections. Thank you very much for your comments.

General comments:
P254 Figure 3 only give three kinds of result while five kinds of result presented in the caption. Please correct.

Response: Thank you very much for your comment!
- In order to evaluate the new $T_m$ model, using the radiosonde-derived $T_m$ and COSMIC-derived $T_m$ as references, the new model was compared with two traditional models. As shown in the Figure 3, TmC is the Tm derived from COSMIC products; TmR is the Tm derived from radiosonde products; TmN is the Tm derived from the new model; TmB is the Tm derived from the Bevis model; TmW is the Tm derived from the Wang model.

If possible, please added some comments about the reasons why the improved result is not evident, as it can be seen from the comparison of tomographic result with radiosonde data, the improved performance of the optimized tomographic result (Figure 5) seems not so good.

Response: Thank you very much!
It can be observed in Fig. 5, the optimized result is closer to the “Rad”. The spatial distribution of water vapor density presents an exponential function of discontinuity. However, GNSS tomography techniques cannot inverse the spatial characteristics of water vapor density.

Minor revision:
P38, please revise “Flores et al., 2001” to “Flores et al., 2000” and cite the reference “Bevis et al., 1992”.
Response: Thank you very much! Revision has been made.

P113 please revise “Flores et al., 2001” to “Flores et al., 2000”.
Response: Thank you very much! Revision has been made.

Anonymous Referee #2
Received and published: 17 June 2018
General comments
The paper investigates the improvement in the estimation of atmospheric water vapor by 1) constructing a new Tm model, 2) determining the scale height of water vapor, which used to calculate the vertical constraint and 3) Deriving the smoothing factor in the horizontal constraint. This study is interesting and worth to be published. It is well written and well-organized.
Thank you very much for your comments.

Specific comments
In page 20, section 4.2, lines 386-387. The authors set up a set of criteria to evaluate the tomography profile PPC>0.9 and RMS <2.0 g/m3. Can you please explain why you choose these criteria? Are there any references for choosing these specific numbers?
Response: Thank you very much for your comment!

• We have set the criteria for evaluating the success of tomographic profiles (Jiang et al., 2014). These specific numbers of criteria was quoted from Jiang et al. (2014). However, duo to the water vapor is relatively rich and there is a serious “inversion layer” in the vertical direction in August in Hong Kong, the thresholds of PCC and RMS (PPC>0.9 and RMS <2.0 g/m3) were redefined in this paper.

Jiang, P., Ye, S.R., Liu, Y.Y., Zhang, J.J., Xia, P.F., 2014. Near real-time water vapor tomography using ground-based GPS and meteorological data: long-term experiment in Hong Kong. Ann. Geophys. 32, 911-923.