Anonymous Referee #2

Reviewer's comments:

The authors established a GZHD model using BP-ANN method trained by globally distributed radiosonde data and COSMIC-1 data. Then the GZHD model was evaluated. However, the evaluations have a problem: the period of test data repeated the period of training data. Therefore the performance of GZHD model at the time away from the training period is unknown. No information about the real-time availability of GZHD model is shown. According to my experience in training this type of data-driven model, the evaluations in the study may overestimated the accuracy of the new model. Therefore detailed evaluations in the period different from the training dataset, which should be more important than the evaluations presented by the authors, must be added.

Line 52: Add a reference of GPT.

Line 100: The color in figure 1(d) agrees very well with the terrain, e.g. the Tibet Plateau. Please explain it.

My response:

Thanks for the reviewer's suggestions and the modifications made accordingly in the new manuscript are as follows.

1) The GZHD model was evaluated using out-of-sample data: the radiosonde and ERA5 data during the one-year period of 2020 (in which no data were used to train the model). Results showed that the performance of GZHD was almost the same as that in the training period (please see Section 3.3 in the new manuscript).

2) The effect of the GZHD model was tested on real-time GNSS-PWV and results showed that GZHD outperformed GPT3 (please see Section 3.4 in the new manuscript). Note that the real-time ZTD used to retrieve GNSS-PWV was for 154 days in 2020, and it was processed by a modified BNC software package, more details can be found in the following paper:

Sun, P., Zhang, K., Wu, S., Wang, R., and Wan, M.: An investigation of real-time GPS/GLONASS single-frequency precise point positioning and its atmospheric mitigation strategies, Meas. Sci. Technol., https://doi.org/10.1088/1361-6501/ac0a0e, 2021b.

3) A reference of GPT has been added in line 52.

4) The color in Figure 1(d) agrees very well with the terrain, e.g. the Tibet Plateau. This is because the penetration depth of a profile has to be above the earth surface. In addition, there are over 3,000,000 profiles in this figure, thus some of the profiles are covered by others.

5) In addition to the above suggestions, we also found a new problem: when the integral method was used to calculate the ZHD, geoidal height or ellipsoidal height should be

used, so the geopotential height contained in what data?? at each pressure?? level needs to be converted to geoidal or ellipsoidal height. However, in the previous manuscript, the height was not converted. Although this fault might cause large biases in the ZHD, it is not necessarily to largely affect the RMSE of the ZHD. This is due to that the effect of this fault changes biases from positive to negative, but the values are about equal. In the new manuscript, all the problems have been corrected.