

Response to Editor and Reviewers

Dear editor and reviewers,

Thank you for offering us an opportunity to improve the quality of our submitted manuscript titled “**A hybrid-grid global model for the estimation of atmospheric weighted mean temperature considering time-varying lapse rate in GNSS precipitable water vapor retrieval**” (gmd-2024-21). We appreciated very much your constructive and insightful comments. In the following, we include a point-by-point response to the comments. We have had a native English speaker proofread this manuscript and carefully correct the grammar errors. Unclear sentences and phrases of this manuscript have been checked and corrected. In the revised manuscript, all the changes have been highlighted in red. We hope the revised manuscript has now met the publication standard of your journal.

Comment 1: The phrase of “surface grid T_m ” is very confusing. Please reword this phrase.

Response 1: Thank you for pointing this out. All the phrase of “surface grid T_m ” in the manuscript have been changed to “surface gridded T_m data” (see L19).

Comment 2: L21: higher? I think this is a typo. This should be lower?

Response 2: Yes, your point is correct. This should be lower (see L21).

Comment 3: L51: This sentence is confusing. Please revise it. What did the authors mean by "obtaining the ZTD information by integrating atmospheric reanalysis data"? Why is it related to high-precision observation data provided by the GNSS base station network?

Response 3: Thanks for your comment. We have corrected this sentence to “high-precision ZTD information can be obtained through data processing with high-precision GNSS data processing software”. What we want to express is ZTD can be obtained from GNSS rather than atmospheric reanalysis data (see L52).

Comment 4: L90: Please change significant performances to significant improvement.

Response 4: Thanks for your suggestion. “ significant performances” has been corrected to “significant improvement” (see L90).

Comment 5: L102: Please define the GPT-series models first.

Response 5: Thank you for pointing this out. We have defined the GPT-series models on L101.

Comment 6: Please revise the sentences from L102 to L106. Why did the authors mention the GPT2w model? What are the differences between GPT2w and GPT3 models?

Response 6: Thanks for the question you raised. To avoid misleading readers, we have revised the sentences by removing the introduction of GPT2w because what we want to emphasize is the GPT3 model. Global pressure and temperature (GPT) series models which include GPT, GPT2, GPT2w and GPT3 model. GPT3 is the latest generation model (see L101 to L104).

Comment 7: L105: elevation correction for what?

Response 7: Thanks for the question you raised. The purpose of elevation correction is to reduce interpolation errors. The detailed explanation can be referred from L162 to L165. In order to make it easier for readers to understand, We have revised “elevation correction” to “vertical correction” (see L104).

Comment 8: L115: Please revise this sentence. "Tm data from radiosonde stations with ERA5 reanalysis data"?

Response 8: Thank you for pointing this out. We have revised this sentence to “the NGGTm model was compared with the Bevis and GPT3 models using T_m data from radiosonde stations and ERA5 reanalysis data” (see L113).

Comment 9: L134: H in Eq. (1) is the integral range? It should be an integration variable. I would rewrite Eq. (1) in a clearer way.

Response 9: Thanks for your suggestion. We have rewritten Eq. (1) and explained the meaning of each variable in a clearer way (see L132 to L134).

Comment 10: Please revise L161. I believe the authors meant the disparities between the elevation of the analysis at the GNSS station and the actual elevation of the GNSS station.

Response 10: Thanks for your comment. We have revised “user point” to “target point” (see L161). The task of the Tm model is to calculate the Tm value at any spatial position. It should be noted that radiosonde stations can provide Tm instead of GNSS stations. The Tm derived from radiosonde stations is used as a reference value to validate the accuracy of the model. In practical applications, the Tm model can calculate Tm values including but not limited to radiosonde station locations.

Comment 11: Tm is a weighted mean temperature. Any phrases like "Tm elevation" or "vertical T_m information" are very confusing.

Response 11: Thank you for pointing this out. We have revised them to “Tm vertical correction” uniformly (see L89 and L104).

Comment 12: L164: elevation of what?

Response 12: Thanks for the question you raised. In this sentence, the object of variation is T_m rather than elevation, so we revised this sentence to “the vertical T_m variation is much larger than the variation in the horizontal direction” (see L161).

Comment 13: L165: what did the authors mean by "with elevation in depth"? with different elevations?

Response 13: Thanks for the question you raised. The meaning what we want to express is “to further analyze the variation in T_m with elevation”. The revised sentence can be seen L164.

Comment 14: L262: Did the authors mean " T_m from radio stations as the reference" and "the T_m calculated by the ERA5 surface-level data". Please revise this sentence.

Response 14: Thank you for pointing this out. We have revised this sentence to “the precision statistics obtained for the three resolutions of the NGGTm-H model tested using T_m data from global radiosonde stations in 2017” (see L256). We validate the accuracy of the NGGTm-H model using radiosonde station data instead of ERA5 data. ERA5 data is only the starting value for the NGGTm-H model.

Comment 15: L263-264: This sentence is very confusing. " what is comparing to the reference data"? Compared to the T_m from radiosonde stations, the correction made by the NGGTm-H model is too large in the land areas but too small in marine areas?

Response 15: Thanks for the question you raised. Reference data is the T_m from radiosonde stations. The T_m calculated using NGGTm-H model is compared to the reference data. ERA5 data is only the starting value for the NGGTm-H model. We have revised this sentence to “positive mean biases with relatively small absolute values were obtained for the NGGTm-H model at the three resolutions taking T_m data from radiosonde stations as reference values” (see L260 to L262).

In addition, we have also checked and revised other errors. Please refer to the manuscript for details. Thanks again for your constructive and insightful comments.