

*Code and data availability.* The current version of the ZHD\_crct model and its corresponding documents are available at the DOI <https://doi.org/10.5281/zenodo.6948148> (Fan et al., 2022). ERA5 data can be obtained from the Copernicus Climate Data Store (<https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-pressure-levels?tab=form> [TS16](#)).

The US Standard Atmosphere 1976 model can be referred to at <https://www.pdas.com/atmosTable1SI.html> [TS17](#).

The ETOPO elevation dataset can be downloaded at <https://ngdc.noaa.gov/mgg/global/global.html> [TS18](#).

*Author contributions.* HF designed the research framework, wrote the paper, and conducted most of the code implementation and data analysis. SL was involved in data collation and revision of the paper. ZS was responsible for supervision. The work in this paper was funded by the programs of GX and XiaL. XinL revised the paper. [TS19](#)

*Competing interests.* The contact author has declared that none of the authors has any competing interests. [TS20](#)

*Disclaimer.* Publisher's note: Copernicus Publications remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

*Acknowledgements.* [TS21](#)

*Financial support.* This research has been supported by the NAME OF FUNDER (grant no. GRANT AGREEMENT NO.) [TS22](#)

*Review statement.* This paper was edited by Thomas Poulet and reviewed by two anonymous referees.

## References

- [TS23](#)  
 Abdelfatah, M. A., Mousa, A. E., and El-Fiky, G. S.: Precise troposphere delay model for Egypt, as derived from radiosonde data, NRIAG J. Astron. Geophys., 4, 16–24, <https://doi.org/10.1016/j.nrjag.2015.01.002>, 2015.
- Alizadeh, M., Wijaya, D., Hobiger, T., Weber, R., and Schuh, H.: Atmospheric Effects in Space Geodesy, 35–71, [https://doi.org/10.1007/978-3-642-36932-2\\_2](https://doi.org/10.1007/978-3-642-36932-2_2), 2013. [TS24](#)
- [TS25](#)  
 Amante, C. and Eakins, B. W.: ETOPO1 1 Arc-Minute Global Relief Model: Procedures, Data Sources and Analysis, National Geophysical Data Center, NOAA [data set], <https://doi.org/10.7289/V5C8276M>, 2009.
- [TS26](#)  
 Beck, H. E., Zimmermann, N. E., McVicar, T. R., Vergopolan, N., Berg, A., and Wood, E. F.: Present and future Köppen-Geiger climate classification maps at 1-km resolution, Sci. Data, 5, 180214, <https://doi.org/10.1038/sdata.2018.214>, 2018.
- Bekaert, D. P. S., Hooper, A., and Wright, T. J.: A spatially variable power law tropospheric correction technique for InSAR data, J. Geophys. Res.-Sol. Ea., 120, 1345–1356, <https://doi.org/10.1002/2014JB011558>, 2015.
- Bevis, M., Businger, S., Chiswell, S., Herring, T. A., Anthes, R. A., Rocken, C., and Ware, R. H.: GPS Meteorology: Mapping Zenith Wet Delays onto Precipitable Water, J. Appl. Meteorol. Climatol., 33, 379–386, [https://doi.org/10.1175/1520-0450\(1994\)033<0379:Gmmzwd>2.0.Co;2](https://doi.org/10.1175/1520-0450(1994)033<0379:Gmmzwd>2.0.Co;2), 1994.
- Boehm, J., Werl, B., and Schuh, H.: Troposphere mapping functions for GPS and very long baseline interferometry from European Centre for Medium-Range Weather Forecasts operational analysis data, J. Geophys. Res.-Sol. Ea., 111, <https://doi.org/10.1029/2005JB003629>, 2006.
- Boehm, J., Heinkelmann, R., and Schuh, H.: Short Note: A global model of pressure and temperature for geodetic applications, J. Geod., 81, 679–683, 2007.
- Böhm, J., Möller, G., Schindelegger, M., Pain, G., and Weber, R.: Development of an improved empirical model for slant delays in the troposphere (GPT2w), GPS Solutions, 19, 433–441, <https://doi.org/10.1007/s10291-014-0403-7>, 2015.
- Chen, G. and Herring, T. A.: Effects of atmospheric azimuthal asymmetry on the analysis of space geodetic data, J. Geophys. Res.-Sol. Ea., 102, 20489–20502, <https://doi.org/10.1029/97JB01739>, 1997.
- Chen, Z., Zhang, S., and Feng, H.: Research on the correction of troposphere dry delay in GPS positioning and inverting the water vapor in atmosphere, Sci. Meteorol. Sin., 29, 4527–4530, 2009.
- Dai, W. and Zhao, Y.: Modeling The Dry And Wet Component Of Regional Tropospheric Delay, J. Geod. Geodyn., 33, 72–76+81 [TS26](#), <https://doi.org/10.14075/j.jgg.2013.02.010>, 2013.
- Davis, J. L., Herring, T. A., Shapiro, I. I., Rogers, A. E. E., and Elgered, G.: Geodesy by radio interferometry: Effects of atmospheric modeling errors on estimates of baseline length, Radio Sci., 20, 1593–1607, <https://doi.org/10.1029/RS020i006p01593>, 1985.
- Dogan, A. H. and Erdogan, B.: A new empirical troposphere model using ERA5's monthly averaged hourly dataset, J. Atmos. Sol.-Terr. Phys., [TS27](#), 105865, <https://doi.org/10.1016/j.jastp.2022.105865>, 2022.
- Drożdżewski, M. and Sośnica, K.: Tropospheric and range biases in Satellite Laser Ranging, J. Geod., 95, [TS28](#), 2021.
- Eriksson, D., MacMillan, D. S., and Gipson, J. M.: Tropospheric delay ray tracing applied in VLBI analysis, J. Geophys. Res.-Sol. Ea., 119, 9156–9170, <https://doi.org/10.1002/2014JB011552>, 2014.
- Fan, H., Sun, Z., Zhang, L., and Liu, X.: A two-step estimation method of troposphere delay with consideration of mapping function errors, Acta Geod. Cartog. Sin., 48, 286–294, 2019.
- Fan, H., Li, S., Sun, Z., Xiao, G., Li, X., and Liu, X.: Data and documents used in ZHD\_crct model (Analysis of Systematic Biases in Tropospheric Hydrostatic Delay Models and Construction of Correction Model), Zenodo [code], <https://doi.org/10.5281/zenodo.6948148>, 2022. [TS29](#)
- Feng, P., Li, F., Yan, J., Zhang, F., and Barriot, J.-P.: Assessment of the Accuracy of the Saastamoinen Model and VMF1/VMF3 Mapping Functions with Respect to Ray-Tracing from Radiosonde Data in the Framework of GNSS Meteorology, Remote Sens., 12, 3337, [TS30](#), 2020.