Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2020-274-RC1, 2020


Atmospheric Measurement Techniques Discussions

# *Interactive comment on* "A new global grid-based weighted mean temperature model considering vertical nonlinear variation" *by* Peng Sun et al.

**Maohua Ding (Referee)**

jiaotongdmh@sina.com

Received and published: 31 October 2020

General comments

The authors developed a weighted mean temperature (Tm) model called GGNTm. Similar to other recent published Tm models, GGNTm is a blind global Tm model and suitable for sites from the earth's surface to a height of 10 km. After reading this article for several times, my suggestion is that this article can be suitable for a possible publishing in Atmospheric Measurement Techniques (AMT). The following reasons prompted me to make a decision.

(1) A three-order polynomial function to model the vertical variation of weighted mean temperature (Tm) which is more advanced than a linear function. The coefficients in



the three-order polynomial function (i.e. a, b, c and d) were provided with global grids with a resolution of $1^\circ \times 1^\circ$ and annual and semi-annual variations. This modeling idea is relatively new.

(2)The state of the art meteorological reanalysis data (ECMWF ERA5 monthly mean reanalysis data) were used as modeling data of GGNTm.

(3) GGNTm has been compared with state of the art blind Tm models (i.e. GTrop and GWMT_D) and this new model show some improvements in accuracy.

Specific comments

Overall, this paper is well prepared. However, the authors should pay attention to the following problems.

(1)Although many latest studies [2][3][4] used the a linear function to describe the vertical variation of Tm, a nonlinear function has already been used by Yao et al. 2018[1]. Thus, it is not the first attempt using a nonlinear function. Although this reference is included in the reference list, I can not see any further discussions with their study. Their work has a very significant correlation with your study.

(2)It is good to compare GGNTm with GTrop and GWMT_D, since GTrop and GWMT_D stand for the state of the art blind Tm models. However, results of GPT3 are redundant and even meaningless. In fact, GPT3-Tm is GPT2w-Tm and many studies [1][2][3][4] have clearly pointed out the defect of GPT2w-Tm and the accuracy of GPT2w-Tm has been discussed for several times. I think just a few sentences can describe the defect of GPT3-Tm (GPT2w-Tm) and citing results of GPT2w-Tm in other references (e.g. reference [4]) is enough.

(3) I'm very curious that if the height of the GNSS user site is lower than the height of the grid points, will unpredictable results be produced?

Technical corrections

(1)Line 32: ‘needing’ can be replaced by ‘requiring’.

(2)Line 40: ‘a standard empirical model together with some surface meteorological data’ can be replaced by ‘the Saastamoinen-ZHD model together with measured site meteorological data’

(3)Lines119-120: The geopotential heights can not be convert directly to the ellipsoidal heights.

(4)Line 208: The statement ‘there may exist systematic differences between the re-analysis data from ECMWF and NCEP’ should be supported by some references.

(5)Line 281: ‘surface Tm’ can be replaced by ‘site Tm’.

References

[1]Yao Y, Sun Z, Xu C, Xu X, Kong J (2018) Extending a model for water vapor sounding by ground-based GNSS in the vertical direction. J Atmos Sol Terr Phys 179:358-366

[2]Li, Q., Yuan, L., Chen, P. and Jiang, Z.: Global grid-based Tm model with vertical adjustment for GNSS precipitable water retrieval, GPS Solut., 24(3), 73.

[3]Yang F, Guo J, Meng X, Shi J, Zhang D, Zhao Y (2020) An improved weighted mean temperature (Tm) model based on GPT2w with Tm lapse rate. GPS Solut 24:46

[4]Sun Z, Zhang B, Yao Y. (2019) A Global Model for Estimating Tropospheric Delay and Weighted Mean Temperature Developed with Atmospheric Reanalysis Data from 1979 to 2017. Remote Sens 11(16):1893.

---

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2020-274, 2020.