

Review of:

YiBin Yao and YuFeng Hu, An empirical zenith wet delay correction model using piecewise height functions

The manuscript presents global model of the tropospheric delay part that is caused by wet component (water vapour). It combines the idea of global zenith wet delay model that requires non meteorological parameters with the focus on the behavior of the delay in height. The base data of temperature, geopotential height and specific humidity (source: ERA-Interim) for 37 pressure levels (monthly mean for years 2001-2010) are used to obtain a time series of Zenith Wet Delay that are further processed. The proposed model concerns 3 layers each of which is treated with separate global grid of ZWD for bottom of the layer and separate set of coefficients for change of ZWD in height. For each layer the proposed model assumes separate functions for change of ZWD in height (quadratic polynomial for layer <2km and exponential for both 2 to 5 km and 5 to 10 km), resulting in a set of 27 parameters for each grid point. Next the model is validated against ZWD profiles obtained from ERA-Interim data for year 2015 (6 hours resolution) and radiosonde data (318 stations, year 2015) and compared to GPT2w and UNB3m empiric models.

The concept is interesting and pushes the tropospheric modeling for space geodetic techniques a bit further. The final improvement reaches about 1-1.5 mm when comparing to other empiric models. The manuscript is well organized. The analysis vertical variations of ZWD and creation of the model takes about 35% of the contents while detailed validation and comparison with GPT2w and UNB3m of the model takes about 40%. However, the context and motivation could be improved. There are also some inconsistencies across the contents. Below are the remarks that could improve the clearness of the contents and substantiality of the conclusions.

General remarks:

1. In reviewers opinion, the reader does not get clear insight into current state of tropospheric modeling after reading the introduction. In addition, the context could contain the view of the empiric models and their quality in broader scope of model types that are commonly used in space geodetic techniques. The title suggests that the scope concerns empiric modeling, however, It could be clearly stated in the text (abstract or introduction).
2. The contents would benefit of clear statement, analysis, whether using meteorological parameters is not as efficient as using set of ZWD and coefficients for height correction.
3. The manuscript should contain the discussion on the data size that the model consist of with comparison to other models. (P11.220)
4. The ZWD as well as its typical modeling error decreases with height reaching small values for top layers. In addition, The variation there is small, which was also shown in the contents (truncating of semi-annual terms for middle and top layers, page 10). The contents would benefit of some reasoning if the improvement is significant facing the above against application in space geodetic techniques that are mentioned in the contents as possible applications (wide area augmentation systems, real-time aircraft navigation and positioning).

Detailed remarks:

P2.56 Citation needed here

P3.61 The reader gets confused if using meteo data or ZWD directly influences the precision of the resulting model.

P3.73-75 Does the quality of the models mentioned here brings any positioning deterioration when comparing to quality of the proposed model?

P4.90-93 Is the model proposed in the manuscript in fact comprises of the profiles of coefficients and ZWD. Is it more difficult to attach the profiles of meteo parameters and calculate the ZWD in the model procedure? The reasoning here is not convincing.

P5.125-127 and P6.152 If the conclusion is that the change is linear, why the model uses quadratic function below 2km?

P9.187 Figure 5 could be more informative if fitting curves with annual term were added in context of p10.198-203

P11.220 The statement here should be extended with comparison to other empiric models

Technical remarks:

P4. 107 It is not necessary to repeat the description of the symbols that are already described at the same page

P18.367 precusion -> precision

P14.296-298 The sentence here is not necessary as bias and RMS are already described at P12.237-238.

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10.07.2018, Jakub Z Kalita