

Effect of tropospheric models on derived precipitable water vapor over Southeast Asia

ABSTRACT

An interesting subject in the field of GPS technology is estimating variation of precipitable water vapor (PWV). This estimation can be used as a data source to assess and monitor rapid changes in meteorological conditions. So far, numerous GPS stations are distributed across the world and the number of GPS networks is increasing. Despite these developments, a challenging aspect of estimating PWV through GPS networks is the need of tropospheric parameters such as temperature, pressure, and relative humidity (Liu et al., 2015). To estimate the tropospheric parameters, global pressure temperature (GPT) model developed by Boehm et al. (2007) is widely used in geodetic analysis for GPS observations. To improve the accuracy, Lagler et al. (2013) introduced GPT2 model by adding annual and semi-annual variation effects to GPT model. Furthermore, Boehm et al. (2015) proposed the GPT2 wet (GPT2w) model which uses water vapor pressure to improve the calculations. The global accuracy of GPT2 and GPT2w models has been evaluated by previous researches (Fund et al., 2011; Munekane and Boehm, 2010); however, investigations to assess the accuracy of global tropospheric models in tropical regions such as Southeast Asia is not sufficient. This study tests and examines the accuracy of GPT2w as one of the most recent versions of tropospheric models (Boehm et al., 2015). We developed a new regional model called Malaysian Pressure Temperature (MPT) model, and compared this model with GPT2w model. The compared results at one international GNSS service (IGS) station located in the south of Peninsula Malaysia shows that MPT model has a better performance than GPT2w model to produce PWV during monsoon season. According to the results, MPT has improved the accuracy of estimated pressure and temperature by 30% and 10%, respectively, in comparison with GPT2w model. These results indicate that MPT model can be a good alternative tool in the absence of meteorological sensors at GPS stations in Peninsula Malaysia. Therefore, for GPS-based studies, we recommend MPT model to be used as a complementary tool for the Malaysia Real-Time Kinematic Network to develop a real-time PWV monitoring system.

Keyword: Tropospheric model; Precipitable water vapour; Numerical weather model; Peninsula Malaysia