Assessment of UNB3M neutral atmosphere model and EGNOS model for near-equatorial-tropospheric delay correction

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Abstract: Tropospheric delay is the second major source of error after the ionospheric delay for satellite navigation systems. The transmitted signal could face a delay caused by the troposphere of over 2m at zenith and 20m at lower satellite elevation angles of 10 degrees and below. Positioning errors of 10m or greater can result from the inaccurate mitigation of the tropospheric delay. Many techniques are available for tropospheric delay mitigation consisting of surface meteorological models and global empirical models. Surface meteorological models need surface meteorological data to give high accuracy mitigation while the global empirical models need not. Different satellite based augmentation systems use this type of model such as EGNOS model for the EGNOS augmentation system. Several hybrid neutral atmosphere delay models have been developed by (University of New Brunswick, Canada) UNB researchers over the past decade. The most widely applicable current version is UNB3M, which uses the Saastamoinen zenith delays, Niell mapping functions, and a look-up table with annual mean and amplitude for temperature, pressure, and water vapour pressure varying with respect to latitude and height. This paper presents an assessment of the behaviour of the UNB3M model and EGNOS model compared with highly accurate IGS-tropospheric estimation for IGS station (bhr1) sited in Bahrain kingdom. The study was performed over four non-consecutive weeks on different seasons over one year. It can be concluded that UNB3M model is recommended for seasons autumn, winter and spring while EGNOS model is recommended to be used in summer season.

Keywords: UNB3M model, EGNOS model, Troposphere