Investigation on the impact of tropospheric models on baseline precision in a local GPS network: Case of the Malaysian RTKnet

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Abstract: Tropospheric bias is currently one of the major error sources in GPS Network, which limits the full functionality of GPS positioning. The delay in radio signals caused by troposphere can range from 2 m at zenith to 20 m at lower elevation angles (below 10 degrees). In order to reduce the tropospheric effects, global tropospheric models, derived experimentally using radiosonde data, are being employed today. These models are derived using data obtained from Europe and America. Considering the location of Malaysia in the equatorial and tropical region, it is susceptible to high tropospheric effect thereby having an adverse effect on the GPS signals which, in turn, affects positioning. With the establishment of the Malaysian RTK GPS Network (MyRTKnet), as one of the latest innovations in real-time precision positioning in meeting the nation's development, security and defence, the need to investigate impact of different global tropospheric models became imperative. This paper provides details on the network tests carried out by comparing GPS baseline results obtained from three different global tropospheric models, Saastamoinen model, Hopfield model and the Neil model, by applying standard and assumed local surface meteorological data. The results show that, there are no statistically significant differences in the performance of the three tropospheric models. Similarly, the results indicate a statistically significant correlation in the application of the standard and local surface meteorological data. On the whole, the Saastamoinen model produced more precise baseline results with 89% and 92% in the horizontal and height components, respectively; than the Hopfield and Neil models having 82% and 72% in the horizontal; and 85% and 64% in the height components, respectively.

Keywords: Hopfield model, Neil model, Baseline precision, Tropospheric effect, Saastamoinen model.