Employing Tropospheric Numerical Weather Prediction Model for High-Precision GNSS Positioning

Daniele Alves, Tayna Gouveia, Pedro Abreu, and Jackes Magário
UNESP University, São Paulo State, Brazil

In the past few years is increasing the necessity of realizing high accuracy positioning. In this sense, the spatial technologies have being widely used. The GNSS (Global Navigation Satellite System) has revolutionized the geodetic positioning activities. Among the existent methods one can emphasize the Precise Point Positioning (PPP) and network-based positioning. But, to get high accuracy employing these methods, mainly in real time, is indispensable to realize the atmospheric modeling (ionosphere and troposphere) accordingly. Related to troposphere, there are the empirical models (for example Saastamoinen and Hopfield). But when highly accuracy results (error of few centimeters) are desired, maybe these models are not appropriated to the Brazilian reality. In order to minimize this limitation arises the NWP (Numerical Weather Prediction) models. In Brazil the CPTEC/INPE (Center for Weather Prediction and Climate Studies / Brazilian Institute for Spatial Researches) provides a regional NWP model, currently used to produce Zenithal Tropospheric Delay (ZTD) predictions (http://satelite.cptec.inpe.br/zenital/). The actual version, called eta15km model, has a spatial resolution of 15 km and temporal resolution of 3 hours. In this paper the main goal is to accomplish experiments and analysis concerning the use of troposphere NWP model (eta15km model) in PPP and network-based positioning. Concerning PPP it was used data from dozens of stations over the Brazilian territory, including Amazon forest. The results obtained with NWP model were compared with Hopfield one. NWP model presented the best results in all experiments. Related to network-based positioning it was used data from GNSS/SP Network in São Paulo State, Brazil. This network presents the best configuration in the country to realize this kind of positioning. Actually the network is composed by twenty stations (http://www.fct.unesp.br/#!/pesquisa/grupos-de-estudo-e-pesquisa/gege//gnss-sp-network2789/). The results obtained employing NWP model also were compared to Hopfield one, and the results were very interesting. The theoretical concepts, experiments, results and analysis will be presented in this paper.