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**COMPARISON OF FIVE OCEAN TIDE LOADING MODELS FOR GPS-BASED
ESTIMATION OF ZENITH TROPOSPHERIC DELAY OVER NIGERIA**

Adejumo, T. S., Opaluwa, Y. D., Folaranmi, J. A. and Danlami, D.

Department of Surveying and Geoinformatics, Federal University of Technology, Minna
Corresponding email: Temisadejumo3@gmail.com

ABSTRACT

Estimation of zenith path delay (ZPD) from Global Positioning System (GPS) data is crucial for improving GPS positioning accuracy and assimilation into Numerical Weather Prediction (NWP) models for improved weather outlook and climate studies. However, ocean loading effect has a periodic influence on station heights with amplitudes up to several centimeters. This loading of the lithosphere due to ocean tides could cause instability in station coordinate which will affect the accuracy of the ZPD estimates. This paper presents a comparative study of five selected ocean tide loading (OTL) models for GPS-derived tropospheric delay estimation. 30 days GPS data of January 2011 from the Nigerian GPS Network (Nignet) of Continuously Operating Reference Stations (CORS) and International GNSS Service (IGS) network were used and the GPS data were processed using Bernese 5.2 software to estimate hourly ZPD values. Five different ocean tide loading models (FES2004, FES2012, FES2014b, HAMTIDE and GOT002) were selected for the study, the data was processed in five campaigns by varying the OTL model. The statistics of the estimated ZPD was used to assess the performance of each model on ZPD estimation in the study area. The findings indicated that the mean ZPD values obtained using each of the five OTL models fall within the same range at each of the eight Nignet stations. FES2004 and GOT2002 models provided almost equal values of ZPD at all the stations with relatively high mean ZPD values compared to the other three models. They were followed by HAMTIDE and FES2014b respectively with FES2012 showing the least ZPD estimates in most of the stations. Almost equal standard deviation of the estimated ZPD were obtained at all the stations irrespective of the OTL model employed. The least standard deviation of about 0.650 was obtained at UNEC in Enugu and the maximum value of about 0.70 at BKFP in Birnin Kebbi and ULAG in Lagos. The analysis of variance (ANOVA) test revealed that there is no significant difference in performance level amongst the five ocean tide loading models at 95% significance level. It can be recommended from the findings that any of the five OTL models is suitable for ZPD estimation from GPS data in Nigeria.

Keywords: Zenith Path Delay (ZPD), GPS, Ocean Tide Loading models (OTLM), Troposphere, Numerical Weather Prediction (NWP) models.