World Academy of Science, Engineering and Technology
International Journal of Electronics and Communication Engineering
Vol:13, No:09, 2019

Measurement of Ionospheric Plasma Distribution over Myanmar Using Single Frequency Global Positioning System Receiver

Authors : Win Zaw Hein, Khin Sandar Linn, Su Su Yi Mon, Yoshitaka Goto

Abstract : The Earth ionosphere is located at the altitude of about 70 km to several 100 km from the ground, and it is composed of ions and electrons called plasma. In the ionosphere, these plasma makes delay in GPS (Global Positioning System) signals and reflect in radio waves. The delay along the signal path from the satellite to the receiver is directly proportional to the total electron content (TEC) of plasma, and this delay is the largest error factor in satellite positioning and navigation. Sounding observation from the top and bottom of the ionosphere was popular to investigate such ionospheric plasma for a long time. Recently, continuous monitoring of the TEC using networks of GNSS (Global Navigation Satellite System) observation stations, which are basically built for land survey, has been conducted in several countries. However, in these stations, multi-frequency support receivers are installed to estimate the effect of plasma delay using their frequency dependence and the cost of multi-frequency support receivers are much higher than single frequency support GPS receiver. In this research, single frequency GPS receiver was used instead of expensive multi-frequency GNSS receivers to measure the ionospheric plasma variation such as vertical TEC distribution. In this measurement, single-frequency support ublox GPS receiver was used to probe ionospheric TEC. The location of observation was assigned at Mandalay Technological University in Myanmar. In the method, the ionospheric TEC distribution is represented by polynomial functions for latitude and longitude, and parameters of the functions are determined by least-squares fitting on pseudorange data obtained at a known location under an assumption of thin layer ionosphere. The validity of the method was evaluated by measurements obtained by the Japanese GNSS observation network called GEONET. The performance of measurement results using single-frequency of GPS receiver was compared with the results by dual-frequency measurement.

Keywords : ionosphere, global positioning system, GPS, ionospheric delay, total electron content, TEC
Conference Title : ICE 2019 : International Conference on Electronics
Conference Location : Singapore, Singapore
Conference Dates : September 10-11, 2019