

Diurnal, seasonal and geographic location effects on TEC variation over Malaysia

Siti Aminah Bahari¹, Mardina Abdullah², Alina Marie Hasbi² and Baharudin Yatim³

¹Institute of Space Science, Level 2 Faculty of Engineering and Built Environment Building, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia, sitiaminahbahari@ukm.my

²Department of Electrical, Electronic and System Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia. mardina@eng.ukm.my,alina@eng.ukm.my

³Center for Applied Physics, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia, baha@ukm.my

Abstract

The ionosphere is a layer in the Earth's atmosphere where free electrons exist in sufficient numbers to affect the propagation of electromagnetic waves especially the Global Positioning System (GPS) signals. The study of the Total Electron Content (TEC) variation in the ionosphere and structures is important to ensure the reliability of radio communication systems and accuracy of space weather forecasting. This paper presents the diurnal, seasonal and geographic location effects on TEC variation over Malaysia using Precise Point Positioning (PPP) technique. Since the GPS signals are broadcasted in two widely spread L-band frequency channels namely L1 and L2 consisting of code and phase, it is possible to determine the TEC by employing differencing techniques. This study is conducted using GPS data obtained from 50 stations all over Malaysia. The results of the diurnal analysis show that the mean TEC reaches its maximum during post local noon and its minimum during early morning. The results of the seasonal analysis show that the mean TEC during the equinox months is 35 TECU higher than during the solstice which is only 25 TECU. The seasonal effects on TEC variation is due to the location of the Sun, the movement of plasma around the magnetic equator, and the location of Malaysia. The latitudinal profile of TEC during equinox shows that the location of TEC maximum during the daytime is at southern Malaysia, but changes to the north during nighttime. During solstice, the location of TEC maximum during both day and nighttime is at northern Malaysia, while TEC maximum during early morning is located at southern Malaysia. These results can be used as a reference for ionospheric characterization over Malaysia.