

Variability study of the amplitude and location of the ionospheric equatorial anomaly

M. L. Zhang (1), S. M. Radicella (2)

(1) Key Laboratory of Space Weather, Center for Space Science and Applied Research, Chinese Academy of Sciences, Beijing 100080, P. R. China. (E-mail: zhangml@cssar.ac.cn),

(2) Aeronomy and Radiopropagation Laboratory, The Abdus Salam International Center for Theoretical Physics, Trieste, Italy (E-mail: rsandro@ictp.it)

Abstract

The equatorial and low latitude ionosphere is one of the most important regions of the ionosphere which has a unique structure with two crests of ionization at about $\pm 17^{\circ}$ dip latitude on each side of the magnetic equator and a trough in between. This equatorial ionization anomaly (EIA) phenomenon is formed as a consequence of the so called "fountain" effect, which is produced by the upward ExB drift of the plasma followed by a downward diffusion along the magnetic field line to a higher latitude under the influence of the gravity and the pressure gradient forces. Two important parameters of the equatorial anomaly are the location of the crests and the strength of the equatorial anomaly. In this paper, the total electron content (TEC) data derived from GPS signals were used to study the variability of the equatorial anomaly. Some statistical results on the variation behavior of the equatorial anomaly with local time, season and the day-to-day variation are obtained. It is found that (1) The diurnal variation patterns of the north and south crest locations are well defined but different for different seasons. (2) The equatorial anomaly crests (both the locations and corresponding TEC values) are modulated by the 27-day solar rotation period and planetary wave type oscillations. (3) In general the locations of the crests are more dynamical in months around June-July than months around December. (4) The location of the south crest shows a clear annual variation. It shifts northward in months around June-July and southward in months around December. (5) The TEC values at the crests show a very evident semi-annual variation with maximum values occurring in equinoctial seasons and minimum values in June-July months.