Study of daily and seasonal variation of the equatorial ionization anomaly in Asia based on satellite-ground beacon experiment

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Studies of ionospheric structures by the satellite-ground beacon experiment have been conducted in Southeast Asia. We have deployed a meridional chain of five beacon receivers from 0.2S to 18.2N along 100E meridian and investigated the meridional distribution of total electron content (TEC) of the ionosphere. Although there were preceding studies of time and spatial variabilities of the equatorial ionization anomaly (EIA), the data analysis was limited in the short period. It was because the estimation of bias values was not easy and time-consuming. In this study, we developed a method to automate the bias estimation. As a result, we obtained absolute TEC distribution from a large amount of data and created the TEC database. Using this database, we analyzed latitudinal TEC distribution in a wide area, from Thailand to Indonesia in 2012-2015.
EIA is characterized by two crests in latitudinal TEC distribution that are generated by the plasma fountain effect. We defined EIA by representing the TEC latitudinal structure by a fourth-order polynomial function. By investigating the occurrence ratio of EIA at each hour, we found that EIA grows in the period from 9 to 12 LT, showed its maximum at around 13 LT, and decays in the period after 13 until 23 LT. We further investigated the EIA hemispheric asymmetry at different local timings. In the period from 13 to 23 LT, while EIA is already generated and gradually decays in time, the northern crest tends to exceed the southern crest in summer. In winter, the hemispheric asymmetry is reversed. By comparing this result with the wind model, we found that the hemispheric asymmetry in the period is affected by the meridional winds. In the period from 9 to 12 LT, while EIA is growing, the trend of hemispheric asymmetry was opposite; the southern crest is larger in summer, and the northern crest is larger in winter. By comparing this result with O/N2 distribution model, we found the possibility that, during the growing phase of EIA, the hemispheric asymmetry is affected by the composition of atoms and molecules in the atmosphere.

Keywords: Ionospheric Total Electron Content, Equatorial Anomaly, Satellite-ground beacon experiment

