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Equatorial late-afternoon periodic TEC fluctuations observed by multiple GPS receivers

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We report the equatorial periodic total electron content (TEC) fluctuations observed in the late afternoon by multiple GPS receivers. As a part of Southeast Asia low-latitude ionospheric network (SEALION), GPS receivers at Chiang Mai and Chumphon, Thailand, have been operated since 2005. We found that periodic TEC fluctuations (PTF) with the periods of 15-30 minutes are often observed at these two sites in the spring (Apr-May) late afternoon. Further investigations using multiple GPS receivers in Southeast Asia revealed that the PTFs propagate at 150-200 m/s away from the equator and their amplitudes depend on the satellite azimuth angle. Statistical study of the PTF activity at different latitudes and longitudes clarified that the PTFs are not observed at mid-latitudes, and their seasonal variations are different at different longitudes and at geomagnetically conjugate regions. These observational results indicate that the PTFs are caused by the atmospheric gravity waves (AGW) which are generated in the equatorial lower atmosphere and propagate away from the equator. The seasonal variations in the PTF activity in Asian, African, and Atlantic regions are similar to those in the occurrence rate of plasma bubbles. Simultaneous GPS-TEC and ionosonde observations at Chumphon revealed that the day-to-day variations of PTF activities are well correlated with those of the rate of TEC change index (ROTI) and the occurrence of equatorial spread F (ESF) after the sunset. These results indicate that the late-afternoon PTFs may be related with the onset of the ESF and plasma bubbles.

Keywords: ionosphere, equatorial region, GPS, total electron content, traveling ionospheric disturbance, plasma bubble