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Solar activity dependence of latitudinal variation of ionospheric fluctuations associated with equatorial plasma bubbles

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It is well known that equatorial plasma bubbles (EPBs) are frequently observed in the magnetic equatorial region since EPBs generate in the magnetic equator. Rate of TEC change index, which is the standard deviation of temporal variations of total electron content (TEC), is used to detect EPBs because the enhancement of ROTI is dependent on the development of kilometer-scale disturbances. In the previous study, the authors studied the latitudinal dependence of ROTI associated with EPBs using GPS receivers of Southeast Asia Low-latitude Ionospheric Network (SEALION) installed by National Institute of Information and Communications Technology (NICT). Since EPBs extend along the magnetic field lines, the altitudes of an EPB is the highest in the magnetic equator. Then, it is expected that the the mean values of ROTI increase with latitude because the electron density in lower ionosphere is larger. As a result, however, the mean value of ROTI associated with EPBs is independent on latitude. One of the reasons for this independence is that the EPB occurred in the solar minimum period and the apex height is rather lower.

Recently, the solar activity becomes higher and EPBs are observed around Japan. In the present study, therefore, the latitudinal dependence of ROTI is studied using GPS data during the solar maximum period. It is shown that the mean value of ROTI increase with the latitude. In studying EPBs during the solar maximum period, GPS-TEC data determined by Japanese GPS Network, GEONET is also available. In addition, RINEX data in Shanghai, Manila, and Taipei are supplied by International GNSS Service (IGS) as for GPS station in the lower side of GEONET. The latitude dependence of ROTI determined by GEONET and IGS stations overlap each other at the geographic latitude of 20-30. This dependence is almost the same as that determined by SEALION stations. Therefore, the structures of EPBs are very similar in these longitudes.

Keywords: ionosphere, plasma bubble, GPS, TEC, ROTI