

Ionospheric effect on the trans-ionospheric radio waves at midlatitudes

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The ionospheric effect on the radio waves that propagates through the ionosphere was studied with total electron content (TEC) data measured by a GPS receiver array, GEONET, in Japan. Equatorial ionization anomalies, plasma bubbles and traveling ionospheric disturbances (TIDs) are structures of the ionospheric plasma at midlatitudes, and affect on the trans-ionosphere radio waves. TEC values over Japan at 20:45 JST on January 24, 2002 was 123.3 TEC unit (10^{16} el/m²) at 30 degrees of the geographic latitude, 23.4 TEC unit at 40 degrees, and 162. TEC unit at 45 degrees. This intense latitudinal gradient at lower latitude than 40 degrees indicates that the equatorial ionization anomaly was significantly enhanced during this period. TEC value at the same local time on the previous day, January 23, was 55.9 TEC unit at 30 degree of latitude. The difference of TEC between these two days shows that the day-to-day variation of the equatorial anomaly is large. The ionospheric delay of the GPS L1 band was 19.7m at 20:45 on January 24, 2002 at 30 degrees of latitude. The latitudinal gradient of the delay was 3.2m/degree and almost 10 times larger than the value calculated with the IRI model. The error of the estimation of the ionospheric delay with ionospheric models during the period of the enhanced equatorial ionization anomaly, plasma bubbles and TIDs were discussed.