

Modeling the electron density distribution in the ionosphere over Japan

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In calculation of the amount of L1 wave propagation delay through the ionosphere in GPS observation, the electron density profiles over Japan have been approximated as a slab of constant density. However, actual electron density distributions are not so simple as this assumption and extend toward higher (the plasmasphere) and lower (the E region) altitudes. Furthermore, because Japan has long shape in the direction of latitude, the electron density increases in the low latitude region due to equatorial anomaly. Therefore, the assumption causes some errors in the estimation of a vertical TEC and detecting position.

Our study suggests a new electron density model localized in Japan in order to estimate and remove the influence of the ionosphere in the electric wave propagation with GPS. In this research, we divide the ionosphere into two parts at the height of F2 peak density (hmF2) : Topside and Bottomside. The model requires as parameters three types of measurements : ionosonde(foF2, foE, M3000F2, hmF2, etc), TEC(GPS-based), and O+-H+ ion transition level(UTL). In modeling the topside profile, we evaluate the applicability of the two UTL model (IRI and Truhlik model) on Japan. Furthermore, in modeling the bottomside one, we analyze the ionosonde data statistically during the period from 2002/1/1 to 2003/12/31 and produce empirical seasonal electron density profiles in magnetically quiet conditions. The bottomside empirical seasonal electron density profiles are compared with IRI. Last, we are plan to combine the topside and the bottomside model.

Reference

Truhlik .V, L. Triskova, and J.Smilauer, Improved electron temperature model and comparison with satellite data, Adv, Space, Res, 101-109, 2001.