

Sporadic E detection with GPS TEC and estimation of its horizontal and vertical structure

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Sporadic E

Ionosphere is often divided into three parts (layers) depending on its electron density. F-layer is the most ionized layer at the highest altitude of 130~500 km, followed by E-layer at 90~130 km and D-layer at 70~90 km. During the summertime in mid-latitude region in where Japan is located, sudden increase of electron density in E-region of ionosphere which is called sporadic E often occurs.

Observations of sporadic E

Ionosonde has long been taking the main role of ionospheric and sporadic E observation for a long time, now we have another method to monitor ionosphere, that is, GPS (Global Positioning System) satellites. We used TEC (Total Electron Content) which is derived from L1/L2 phase data to detect the sudden increase of electron density caused by Sporadic E. With the expansion of GNSS (Global Navigation Satellite System) and the dense network of GEONET GPS receivers in Japan, it is possible to watch ionosphere more spatially than ever before.

Results of sporadic E observation with GPS TEC

We observed sporadic E with GPS TEC method which has mainly been used for ionospheric disturbances in F-region of ionosphere. This study provides first results of sporadic E observation with GPS TEC.

With the data from the dense array of GEONET GPS receivers, firstly, GPS TEC has revealed the horizontal structures of sporadic E. One of the characteristics of the horizontal structure of sporadic E is the East-West belt-like shape with the length of ~100 km and the width of ~20 km. Secondly, the results comes about sporadic E motion. The speed and the direction of sporadic E motion do not look uniform. Some sporadic E moves southwestward at the speed of ~50 m/s and some moves eastward at ~150 m/s.

We are also reporting the first results of thickness estimation of sporadic E with GPS TEC in combination with Ionosonde.

Keywords: Sporadic E, Ionosphere, GPS TEC, ionosonde, GEONET

