

Study of scale-sizes of ionospheric TEC gradients associated with plasma bubbles

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Spatial inhomogeneity or gradient of ionospheric total electron contents (TECs) is an issue in differential GNSS systems. Spatial gradients in TECs are characterized by a slope (TEC change per unit length), depth (total change in TEC), scale-size (width of the gradient), and velocity (propagation speed and direction). The slope has rather been studied well in mid- and low latitude regions. However, other parameters have not been studied well. Especially, lower bound of the scale sizes is a key factor in differentially corrected GNSS systems, because small but steep TEC gradients could fall between users and reference stations and may cause undetected user position errors.

We have installed five GNSS receivers with mutual distances of 80-1600m in Ishigaki, Japan and continue observation since 2008. We used single-frequency carrier-based and code-aided technique to derive TEC gradients. From temporal TEC variations derived from dual-frequency measurements by three receivers are used to derive velocity and scale sizes. In the case of the steepest gradient ever observed (3.38 TECU/km) associated with a plasma bubble, the velocity was estimated to be 114 m/sec in NNE direction and the scale-size was estimated to be 10 km. Analysis with more data is being conducted and the statistical results will be presented at the meeting. Possibles means to validate the results by using independent observations will also be discussed.

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