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Monitoring plasma bubbles by a VHF radar for advanced use of GNSS

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Spatial gradient of the ionospheric total electron content (TEC) is one of the most important error source of differential GPS (DGPS) systems. It is especially important for augmentation systems where very high safety is required, such as a ground-based augmentation system (GBAS) or a space-based augmentation systems (SBAS).

The plasma bubble which frequently occurs in the low latitude ionosphere is one of the most important phenomena that accompany sharp ionospheric gradients. Its frequent occurrence makes it difficult to implement such augmentation systems with high availability in low latitude regions.

Among a number of techniques, the incoherent scatter radar which can directly measure electron density distribution is the most powerful but the most expensive one. Instead, we have propose a VHF coherent backscatter radar for the external ionosphere anomaly monitor.

In this study, the effects of the VHF radar monitoring for GBAS is studied by a simulation study with a 3-D ionosphere model including plasma bubbles.

The concept will be verified by using the EAR and GNSS measurements in the region.

Keywords: Equatorial Atmosphere Radar, plasma bubble, GNSS augmentation system, TEC gradient, ionosphere anomaly monitoring, field-aligned irregularities