# Characteristics of ionospheric delay gradients over Japan by using long-term GEONET data

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Ground-Based Augmentation System (GBAS) using Global navigation satellite systems (GNSS) is planned to be implemented in Japan in the near future. It is important to understand the statistical characteristic of spatial scales of ionospheric gradient for low latitude region of Japan to mitigate the effect of the ionospheric threat for GNSS. This paper presents the result of characteristics of ionospheric gradients associated with plasma bubbles based on historical GEONET data for more than 10 years. The characteristics include gradient slope, spatial scale, orientation, velocity, and their dependence on the magnetic latitude. The techniques used are the single-frequency carrier-based and code-aided (SF-CBCA) developed by Fujita et al. [2010] for gradients and the techniques developed by Saito and Yoshihara [2017] for other parameters. This research helps implementing GNSS including GBAS not only in Japan but also in the region from low to mid-latitudes.

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