

Performance evaluation of plasma bubble monitoring by VHF radars for GNSS augmentation systems

SAITO, Susumu^{1*} ; YAMAMOTO, Mamoru² ; OTSUKA, Yuichi³ ; YOSHIHARA, Takayuki¹

¹Electronic Navigation Research Institute, ²RISH, Kyoto University, ³STEL, Nagoya University

For global navigation satellite systems (GNSS), ionospheric plasma is one of the most serious error sources. Especially in air navigation where safety is extremely important, augmentation systems corresponding to flight phases are used. Even with augmentation systems of current design, such as ground-based augmentation system (GBAS) or satellite-based augmentation system (SBAS), probability of miss-detection of ionospheric anomalies prevent them from more advance operations. In the low latitude region, ionospheric anomaly detection is a challenge because of frequent occurrence of plasma bubbles.

In this study, plasma bubble detection by a VHF backscatter radar is proposed as an external ionospheric monitor. Multi-beam observation of plasma bubbles can detect two dimensional shapes of plasma bubbles in a plane perpendicular to the magnetic field. When satellite-receiver path of GNSS signals pass crosses the magnetic field line, the signals shall be discarded because it may be affected by plasma bubble.

To evaluate the performance of this system, a VHF radar-GNSS receivers combined experiment has been conducted. The Equatorial Atmosphere Radar (EAR) is used to detect plasma bubbles. Sets of GNSS receivers around the EAR and in Bangkok are used as the pseudo-user and reference station. The observation started from

October 2012, and continues with some technical interruptions.

At the meeting, first results of the experiment will be presented.

Keywords: Equatorial Atmosphere Radar, GNSS augmentation system, plasma bubble, ionospheric monitoring