

Development of SDR-based scintillation detector system integrated with MAGDAS project

*Akiko Fujimoto¹, Shuji Abe², Akimasa Yoshikawa²

1. Kyushu Institute of Technology, 2. Kyushu University

Radio communications and radio navigation (GPS: global positioning system, GNSS: Global Navigation Satellite System) are used in worldwide and widely deployed in a variety of fields, for example, tracking, automated vehicle, clock synchronization or sport analysis. The ionosphere, where is a part of Earth's upper atmosphere between 80 and about 600 km in altitude, plays an important role in the radio/telecommunication and navigation. The ionosphere is characterized by the high density of free electrons produced by the energetic photo-ionization of ultraviolet (UV) and X-rays from the Sun. The structure of ionosphere is not stable and variable in the time of day, season, latitude and solar activity, because of the differences of the energetic photo-ionization process. The irregularities and disturbances in the ionosphere cause various severe problems, for example, lower accuracy of the radio navigation due to GPS/GNSS scintillation, disruption in High Frequency (HF) radio wave bands or interference due to anomalous propagation, etc. Especially, more robust correction models for ionospheric GPS/GNSS delay errors are required to enhance the utility value of GPS/GNSS clock synchronization for the fifth generation (5G) wireless technology. Also, the real-time alert for interference on HF radio waves is necessary for the safety navigation.

We have developed the SDR (Software-Defined Radio) -based scintillation detector system integrated with MAGDAS (<http://data.icswse.kyushu-u.ac.jp>) project. This system will be installed at the observatory where operates the FMCW radar to measure ionograms. Thus, our new system allows to investigate and monitor simultaneously the magnetic field variation recorded by MAGDAS magnetometer, the ionosphere plasma density profile in altitude with high time resolution and GPS scintillation level. We will present our initial development status.