Progress of the SDR-based dual-band scintillation detector development and its application for space weather study

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11:30〜11:45

Progress of the SDR-based dual-band scintillation detector development and its application for space weather study

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The upper part of Earth's atmosphere located from about 60km to 1000km altitude is ionized by solar ultraviolet and X-ray radiation, called the ionosphere. There are many disturbances in the ionosphere, and these fluctuations changes ionospheric condition temporally and spatially. As a result, waves passing through the ionosphere are affected by these disturbances. One of the phenomena caused by these disturbances is the ionospheric scintillation, which is a rapid intensity and phase changes of radio waves passing through the ionosphere. Therefore, the observation of ionospheric scintillation is equivalent to observing the state of the ionosphere, which is very important for space weather research.

We manage a worldwide magnetometer and FM-CW network, called MAGDAS, and produced many results related to space weather research by using these data. For further growth of our science, we are developing the SDR (Software-Defined Radio) -based scintillation detector system. The system is based on the USRP N210 with WBX daughter board from Ettus research as the front end. It uses two GPS antennas; one is large multiband antenna with multipath mitigation for observation and the other is small antenna for GPS Disciplined Oscillator. The signal processing software is based on some open-source products. For the initial observation, we installed the system at Ito, Fukuoka Japan (33.60N, 130.22E, in Geographic Coordinate), and the data quality observed by our system have confirmed by comparing it to nearby GEONET reference stations. In the second place, we installed the system at Sasaguri, Fukuoka, Japan (33.64N, 130.51E) where is one of the magnetometers and FM-CW radar station of MAGDAS. This composition enables us to observe GPS scintillation simultaneously with magnetic field variation and ionosphere plasma density profile, which helps our understanding about magnetosphere and ionosphere coupling during the upcoming solar maximum. In this paper, we will present the initial results of these observations.