

R006-21

A 会場 : 9/26 AM1 (9:00-10:30)

10:00~10:15

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Low-cost magnetometers using MI sensors: Estimation of magnetospheric plasma mass density from multi-point observation

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Magneto-impedance (MI) effect was discovered about 25 years ago and a micro-size magnetic sensor that utilizes this effect becomes commercially available. We made some modifications to the commercially available MI sensors as they can cover the range of the geomagnetic field. For the period of March 30 to April 27, 2018, we conducted experimental observations of geomagnetic field variations with the MI sensors at Mineyama observation site, which is located about 100 km north-west of Kyoto. Data obtained with the MI sensors were compared with those from the fluxgate magnetometer that has been working at the site. Results showed that the MI sensor recorded geomagnetic variations with amplitudes of ~1 nT that were also detected with the fluxgate magnetometer. This suggests that MI sensors are useful for research in geomagnetism or space physics, although they are much less expensive than fluxgate magnetometers.

Nomura [2021] developed a triaxial magnetometer which is composed of the MI sensors, Raspberry Pi, low-cost 24-bit A/D converters, and stable power supply circuits. This magnetometer is named MIM-Pi, and the cost of MIM-Pi is about one-tenth of that of fluxgate magnetometer. However, the result of the test at Inabu observation site in Japan showed that MIM-Pi had step noises with amplitudes of 2 – 3 nT which originated from an A/D converter. Therefore, we replaced the A/D converter with a new A/D conversion module (ADPi) and confirmed that modified MIM-Pi did not have such step noises. Long-term observation at Inabu with MIM-Pi has been performed since November 19, 2021 to January 14, 2022. The results show that MIM-Pi can record Sq variations and geomagnetic pulsations with amplitudes of 1 – 2 nT that were also detected with the fluxgate magnetometer. We also performed long-term observation at Kakioka Magnetic Observatory and found that MIM-Pi can identify Pc4 pulsations. To install MIM-Pi in a field, we made a jig for MI sensors and a case for the controller. The continuous observations with MIM-Pi's have been started at Kawatabi Observatory from September 9, 2022, at Shirakami observation site from November 15, 2022 and at Mutsu observation site from May 31, 2023. Comparing the acquired geomagnetic data with temperature data, we found that the data acquired by MIM-Pi was affected by temperature variations. We also found that Pc4 and Pi2 pulsations were recorded with MIM-Pi. From the frequencies of Pc4 pulsations, we estimate the plasma mass density in the inner magnetosphere. In presentation, we will show the MIM-Pi data and initial analysis results about the estimation of the plasma mass density. Future deployment of MIM-Pi in Tohoku-Hokkaido region will be also discussed.