A plan of unmanned magnetometer network observation around Syowa Station during IPY period

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Upper Atmosphere Physics group of National Institute of Polar Research (NIPR) is planning to deploy unmanned magnetometer network in the surrounding area of Syowa Station during the International Polar Year period. The magnetometers will form a nested grid of ˜70km spacing and a few hundred km spacing. This magnetometer network will be useful for the study of the relationship between different scale-size magnetic pulsations, field line resonances (FLRs), and ionospheric current systems.

Magnetometer to be used for this network are low power magnetometer (LPM) developed by British Antarctic Survey (BAS), and similar one with satellite data communication function developed by NIPR. They are hereafter referred to as BAS-LPM and NIPR-LPM, respectively. BAS-LPM can be operated at very low temperatures below 70, and to be used in the inland area of the Antarctic continent. On the other hand, NIPR-LPM can be operated at temperatures below 40, and to be used near the coastal area of the Antarctic continent.

BAS-LPM is designed to reduce the power consumption by intermittent operation of a flux-gate magnetometer. Sensitivity of the system is 1 nT and sampling interval can be selected from 1, 10 and 60s. Power consumption for these sampling intervals is 420, 80 and 50mW, respectively. Sampling interval of 60s is selected in winter months in which solar panel cannot be used.

In 2003, we deployed 3 sets of BAS-LPM in the surrounding area of Syowa Station to form a grid with 100 km spacing. We found small scale ionospheric current vortex at the onset of aurora substorm, and also found small scale feature of FLRs. These BAS-LPMs were moved to inland in 2004 along the traverse route between Syowa Station and Dome Fuji with an interval of 250˜500 km, aiming at detecting larger scale phenomena.

NPR-LPM adopts intermittent operation of the flux-gate magnetometer as well, and is specially designed to detect magnetic pulsations with increased sensitivity (0.2nT) and suppressed power consumption at higher sampling rate (190 and 120mW for 1 and 10s sampling). NIPR-LPM can transfer observed data to Japan via Iridium satellite telephone line. Power consumption for sending 1s sampling data for one day amounts to 800mW in daily average. Our operation plan of NIPR-LPM is as follows. During winter months in which solar panel cannot be used, sampling rate of 10s is selected, and the data are stored in a Compact Flash memory. The power consumption is 120mW. During summer months in which solar panel can be used, sampling interval of 1s is selected, and the daily data are transferred to Japan via Iridium satellite phone, together with the data recorded in winter months. The power consumption is 1W.

Data logging system of NIPR-LPM was tested in Antarctica for one year in 2006, and a good performance was confirmed. Two sets of NIPR-LPM were deployed at inland and coastal area in January, 2007 to form a grid of 70km spacing with Syowa Station. High quality data, enough for pulsation study, are transferred to Japan every day. We will extend NIPR-LPM network in geomagnetic EW direction along the coast line with 200˜500km interval. They will form a large grid of a few hundred km spacing together with BAS-LPMs which were already deployed in inland in 2004.