

Antarctic large area network observation of auroral phenomena using unmanned system: Event studies of multi-point simultaneous observations

Akira Kadokura^{1,2,3}, Yasunobu Ogawa^{1,3}, Yoshimasa Tanaka^{1,2,3}, Hisao Yamagishi¹, Masaki Okada^{1,3}, Ryuho Kataoka^{1,3},
Yuichi Otsuka⁴, Henri Robert⁵, Ashwini K. Sinha⁶, and Gopi K. Seemala⁶

¹*National Institute of Polar Research*

²*Polar Environment Data Science Center, ROIS-DS*

³*The Graduate University for Advanced Studies, SOKENDAI*

⁴*Nagoya University*

⁵*International Polar Foundation*

⁶*Indian Institute of Geomagnetism*

Space and upper atmospheric sciences group in the National Institute of Polar Research (NIPR) is now constructing an observation network for auroral phenomena along the coast of the Dronning Maud Land in the Antarctica including Japanese Syowa Station (SYO), and has developed a Unmanned Auroral Observation system (UAO), which is equipped with a 3-axis fluxgate magnetometer, all-sky auroral imager, GNSS/TEC receiver, and a data communication system using the Inmarsat satellite data link with a low power consumption. The first UAO (UAO-1) had been installed at Amundsen Bay area (AMB), which is located about 500 km eastward from Syowa Station, in February, 2017 in the summer operation of the 58th Japanese Antarctic Research Expedition (JARE-58). The second UAO (UAO-2) had been installed at Belgium Princess Elisabeth Antarctica Station (PEA) in January, 2020. Electric power of the UAO-1 is supplied by a hybrid natural energy electric generation system which consists of three sets of 192W wind generators and 8 sets of 62W solar panels, while that of the UAO-2 is supplied from the AC power source of the PEA Station which is generated by a power generation system of the station using nine big wind generators and solar panels. For the UAO, observed magnetometer data (1 sec resolution), GNSS BINEX data (30 sec resolution), daily Keogram and sample image data of the auroral imager, and House Keeping data (temperatures and power voltages) (1 min resolution) are transmitted at every 1 hour via the satellite link system to a server in Japan by FTP, and auroral image data of 1 sec resolution are stored in a memory card of the video encoder in the system. Sample interval and pixel resolution of the transmitted auroral image data are 1 hour (5 minutes) and 640x480 (160x120) for the UAO-1 (UAO-2), respectively. UAO-2 has the other USB memory in the system which can store auroral still image of 1 sec resolution with 640x480 pixel resolution and GNSS BINEX data of 1 sec resolution. PEA Station is maintained during summer season, and becomes an unmanned station during winter season, while the electric power to all the instruments at the station is supplied continuously all through the season. In January, 2020, we had also installed an auroral imager system at Indian Maitri Station (MAI), which consists of four sets of all-sky imager using Watec cameras: 1) Panchromatic (color) ; 2) Panchromatic (black&white); 3) filtered at 560nm (FWHM:10nm); 4) filtered at 632nm (FWHM:10nm), respectively. Maitri is a year-round station. The auroral imager system is run autonomously. We ask expedition members at Maitri to send daily summary files via E-mail to us. We could obtain the simultaneous observation data at those four stations, MAI, PEA, SYO and AMB, on several nights in 2020. In our presentation, we will show some results of the event studies on those nights.