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Observations of fine structure and variation of auroral emissions and particles with high-time and spatial resolutions: Initial results of the Reimei satellite and simultaneous ground-based observations

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A micro-satellite of the Japanese INDEX mission was successfully launched from Baikonur Cosmodrome in Kazakhstan on August 23, 2005, as a piggyback satellite by a Dnepr rocket and the satellite on orbit has been given a Japanese name meaning dawn, Reimei. The satellite attitude is three-axially stabilized and sun-oriented. The scientific target of Reimei is the exploration of fine structure and variations of aurora phenomena on a sun-synchronous orbit in the meridian of 0050-1250 LT at about 630-km altitude. For achieving the scientific purpose, the Reimei satellite carries some few but optimized instruments: three-channel monochromatic auroral imaging CCD camera (MAC), top-hat-type auroral electron and ion energy spectrum analyzers (ESA/ISA), and three sets of Langmuir-type anodes as plasma current monitors (CRM). The auroral phenomena are characterized by photon emissions over a wide wavelength range, associated with distinctive energy and pitch-angle distributions of electrons and ions. MAC takes two-dimensional images of visible auroral emissions of 428, 558, and 670-nm wavelengths with a field-of-view of 7.6 deg x 7.6 deg with spatial and time resolutions of 2 km and 120 msec, respectively. ESA and ISA measure wide pitch angle-energy distributions of electron and ions by covering an energy range of 10 eV - 12 keV in 40 msec of 32 steps with a field-of-view of 4 deg x 300 deg divided by 30 sectors. The geomagnetic field can be monitored by three-axial

fluxgate magnetometer in the satellite body. By controlling the satellite attitude, we can simultaneously observe spatial distribution and time variation of fine aurora emissions associated with auroral electron precipitation and ionospheric ion outflows with a full pitch-angle coverage and a high-time resolution. On one hand, our Reimei team has started some collaborative observations with EISCAT, all-sky cameras, and SuperDARN. Almost every new moon interval, we have been achieving simultaneous observations with Reimei and the ground-based instruments. In this talk, we discuss some comparisons of interesting data obtained by these multilateral observations as well as the initial results of the instruments themselves on Reimei.