れいめい画像-粒子同時観測による微細オーロラダイナミクス

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Dynamics of fine-scale aurora obtained from simultaneous image and particle observation data by Reimei

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To clarify the fine-scale auroral structure, we examined simultaneous image and particle observation data obtained by a multi-spectral aurora camera (MAC) and particle sensors (ESA and ISA) on board the REIMEI satellite. Since the successful launch in August 2005 into sun-synchronous polar orbit at an altitude of 640 km, Reimei have carried out continuous observations of auroral image and particles for about one year. Three emissions of N2+ first negative band (427.8 nm), OI (557.7 nm) and N2 first positive band (670 nm) are independently obtained by the MAC with typical spatial and time resolutions of 2 km and 120 ms, respectively. Energy range and time (spatial) resolution of particle sensors are 10 – 12 keV/q, 40 ms (300 m), respectively. During the period from September 2005 to March 2006, Reimei was mainly operated in the northern hemisphere, while during the period from April to August 2006 Reimei was mainly operated in southern hemisphere, since Reimei was usually operated in the winter hemisphere. In addition, the direction of MAC was precisely determined by star and ground images.

This talk focuses on recent results of discrete and pulsating aurora events summarized as follows.

1) On the spatial structure more than 3 km, it is found that there is good correspondence between auroral emission and electron total energy flux.

2) From cases of 09 UT on Dec. 26 and 00 UT on Dec. 29, 2005, occurrence of fine-auroral structure (less than 10 km) with fast shear motions and/or auroral streaming clearly corresponded to the appearance of fine-scale energy-dispersed supra-thermal electron bursts. It is strongly suggested that the supra-thermal electron burst was caused by dispersive/inertial Alfven waves. The supra-thermal electron bursts appeared in the energy range lower than that of the quasi-electrostatic inverted-V type accelerated electrons. Therefore, the auroral emissions were not produced by electrons accelerated by Alfven waves, but caused by inverted-V electrons. Actually, fine-scale variations of peak energies of inverted-V electrons occurred in association with Alfven waves. It is found that the source altitudes estimated from electron energy-dispersion with the ToF method were 1600 - 2600 km, suggesting that Alvenic acceleration region corresponds to the bottom of acceleration region.

3) From cases of 23 UT on Jan 25, 2006 and 01 UT on Nov. 12, 2005, pulsating aurora appeared corresponding to the energy-dispersed periodic precipitation of inner plasma sheet electrons. It is found that the existence and absence of electron precipitations correspond to single loss cone type electron pitch angle distribution and double loss cone type, respectively. Using the ToF analysis method, the source regions were estimated to be 34000 – 52000 km above the satellite. In this presentation, we discuss the relationship between electron and ion precipitations associated with pulsating aurora.