Characteristics and generation mechanisms of black aurora obtained from simultaneous REIMEI image and particle observations

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In order to investigate the characteristics of fine-scale black aurora, observations with the multi-spectral auroral camera (MAC) on board the REIMEI satellite, which is in a polar orbit in the noon-midnight meridian at an altitude of ˜640 km, are being carried out. The characteristics of auroral particles are simultaneously observed by the electron spectral analyzer (ESA) and the ion spectral analyzer (ISA) instruments also on board the REIMEI satellite. In the nightside auroral region, MAC can take monochromatic images at three wavelengths of N2+ 1N band (427.8 nm), OI (557.7 nm), and N2 1P band (670 nm) with high temporal (max. 120 msec) and spatial (max. 2 km) resolutions. Since the REIMEI satellite is 3-axis stabilized, the FOV of MAC can be directed to a footprint of magnetic field line threading the satellite to realize simultaneous auroral particle and emission observations. In this study, several fine-scale black aurora events have been examined. In these black auroras, their spatial thickness was less than 10km, and they were embedded within rather uniform diffuse aurora connecting to the inner plasma sheet region. For example, an event on 13 Nov. 2005, it is found that the appearance of black aurora clearly corresponded to a region where the electron pitch angle distribution showed the double loss cone, while in the pulsating aurora lying in the lower latitude, the electron energy distribution showed apparent energy dispersion. Thus, it is suggested that the black aurora is produced by a lack of precipitating electrons caused by the double loss cone type pitch angle distribution. Further, it is also suggested that the black aurora is the stable spatial structure corresponding to the lack of the pitch angle diffusion. On the other hand, pulsating aurora is caused by the time variation of pitch-angle diffusion. In order to study the generation mechanisms of these black auroras, the following works should be needed; the conjugate observation between REIMEI and high altitude satellites, the modeling of wave-particle interaction causing pitch angle diffusion in the magnetosphere. In addition, we have been trying to find the auroral structure produced by the divergent electrical field. In the presentation, we report recent results of data analysis of black aurora in detail.