First simultaneous observation of a SAR arc at subauroral latitudes using a ground all-sky camera and the Arase satellite in the inner magnetosphere

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Stable Auroral Red (SAR) arc is characterized by a 630.0 nm emission observed at subauroral latitudes. The energy of precipitating electrons that cause the SAR arc emission is several electron volts (eV). Precipitation of low-energy electrons is expected to occur due to spatial overlap between the plasmasphere and the ring current, where high-energy (more than 10 keV) ring current ions heat low-energy (less than 1 eV) electrons in the plasmasphere. Simultaneous observations of SAR arcs using the ionospheric satellite and ground all-sky cameras have been already done [e.g., Foster et al., 1994]. However, there has been no reports on in-situ measurements of plasma and electromagnetic fields in the inner magnetosphere, where the plasmaspheric plasma is heated by the ring current. In this study, we report simultaneous observations of a SAR arc at 22:04 UT on March 28, 2017, by using an all-sky camera at Nyrola (62.34 N, 25.51 E, MLAT 59.4 N) at subauroral latitudes and the Arase satellite. We analyze the all-sky camera data and the satellite data of this event to investigate the generation mechanism of the SAR arc. We find interesting features in the electric field data and the energy flux of electrons observed by the electric field detector of the plasma wave experiment (EFD/PWE) and the low-energy particle experiments–electron analyzer (LEP-e), respectively, onboard the Arase satellite at the crossing of the SAR arc. A negative excursion of the Ez component of the electric field (GSE coordinate system) with an amplitude of ~2.4 mV/m was observed at the crossing time. The Bx component of the magnetic field (GSE coordinate system) was negative. Thus the direction of the E ×B drift is westward, which is consistent with the westward auroral motion observed in the SAR arc by the ground all-sky camera. At the SAR arc crossing, the energy flux of electrons below 100-eV electrons is slightly intensified. We will discuss these observations in relation to the proposed SAR-arc generation mechanisms.

Keywords: ERG, SAR arc, All-sky imager, Simultaneous observation

