

## Energetic electron precipitation and auroral morphology at the substorm recovery phase

\*Shin-ichiro Oyama<sup>1</sup>, Antti Kero<sup>2</sup>, Craig J Rodger<sup>3</sup>, Mark A Clilverd<sup>4</sup>, Yoshizumi Miyoshi<sup>1</sup>, Noora Partamies<sup>5,6</sup>, Esa Turunen<sup>2</sup>, Tero Raita<sup>2</sup>, Pekka T Verronen<sup>7</sup>, Shinji Saito<sup>1</sup>

1. Institute for Space-Earth Environmental Research, Nagoya University, 2. University of Oulu, 3. University of Otago, 4. British Antarctic Survey, 5. The University Centre in Svalbard, 6. Birkeland Centre for Space Science, 7. Finnish Meteorological Institute

It is well known that auroral patterns at the substorm recovery phase are characterized by diffuse or patch structures with intensity pulsation. According to satellite measurements and simulation studies, the precipitating electrons associated with these aurorae can reach or exceed energies of a few hundred keV through resonant wave-particle interactions in the magnetosphere. However, because of difficulty of simultaneous measurements, the dependency of energetic electron precipitation (EEP) on auroral morphological changes in the mesoscale has not been investigated to date. In order to study this dependency, we have analyzed data from the European Incoherent Scatter (EISCAT) radar, the Kilpisjärvi Atmospheric Imaging Receiver Array (KAIRA) riometer, collocated cameras, ground-based magnetometers, the Van Allen Probe satellites, Polar Operational Environmental Satellites (POES), and the Antarctic-Arctic Radiation-belt (Dynamic) Deposition-VLF Atmospheric Research Konsortium (AARDDVARK). Here we undertake a detailed examination of two case studies. The selected two events suggest that the highest energy of EEP on those days occurred with auroral patch formation from post-midnight to dawn, coinciding with the substorm onset at local midnight. Measurements of the EISCAT radar showed ionization as low as 65 km altitude, corresponding to EEP with energies of about 500 keV.

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