Multi-event analysis of isolated auroral arcs and Pc 1 geomagnetic pulsations at subauroral latitudes

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We have been conducting observations of aurora and geomagnetic pulsations using a highly sensitive monochromatic all-sky imager and an induction magnetometer at the Athabasca station, Canada, located at a subauroral latitude (magnetic latitude: 62^o, L˜4.6). At latitudes separated equatorward from the main auroral oval, we often observed isolated auroral arcs at wavelengths of 557.7 nm, 630.0 nm, and 486.1 nm (Hbeta emission from protons). Simultaneous ground and satellite observations of the isolated arc event of September 5, 2005 showed close relationship among isolated auroral arc, a localized precipitation of energetic ions, and Pc 1 geomagnetic pulsations, which was reported at the SGEPSS fall meeting, 2006. In this presentation, we report multi-event analysis of isolated auroral arcs and related Pc 1 geomagnetic pulsations. From one-year observation of September 4, 2005 - September 3, 2006, we found 13 events of isolated arcs. All of these isolated arcs occurred coincident with Pc 1 geomagnetic pulsations observed simultaneously at Athabasca, though there were 9 other events of Pc 1 pulsations without isolated arcs. The isolated arcs were observed in both pre- and post-midnight sectors and tend to appear during late recovery phase of geomagnetic storms. The isolated arcs had narrow latitudinal widths (less than 170 km) and limited longitudinal lengths (˜250-800 km), and did not change their structure and intensity according to higher-latitude substorm activities. When isolated arcs moved equatorward (poleward), frequencies of the simultaneous Pc 1 pulsations increased (decreased). Using the Tsyganenko 96 magnetic field model, we found that observed Pc 1 frequencies were almost same as the frequencies of He^+-band electromagnetic ion cyclotron (EMIC) waves at the equatorial plane of the magnetic field line that is connected to the observed isolated arcs. These results imply that the instabilities and dynamics in the inner magnetosphere are mapped to the upper atmosphere and can be monitored as auroral emissions equatorward of the ordinary auroral oval. We add Prof. Martin Connors as coauthors of this paper.