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Isolated proton auroras and Pc1/EMIC waves at subauroral latitudes

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Isolated proton aurora (IPA) in the subauroral ionosphere is created by energetic proton precipitation through wave-particle interactions with electromagnetic ion cyclotron (EMIC) waves in the conjugate inner magnetosphere. In this study, spatial distribution and occurrence probability of IPAs were statistically investigated as a proxy for regions of EMIC wave occurrence using ground-based imaging data in 2006-2012 at Athabasca, Canada. The seven-year average of the IPA occurrence probability over the total observation interval was estimated to be 0.83% and a factor of five change was found between maximum and minimum years. Local time (between 16 and 06 MLT) distribution shows double peaks at pre-midnight and at dusk. The occurrence probability increases with Kp and the MLT location tends to shift duskward. The statistical distribution of IPA size shows a clear peak at a spatial size of 10,000 km^2, and latitudinal and longitudinal lengths have peaks at 56 and 340 km, respectively, at the ionospheric altitude. The equatorial projections of IPA source locations and two-dimensional structures are estimated by magnetic field tracing. These spatial structures are essential to quantitatively estimate the loss rate of energetic particles, contributing to space weather studies.

キーワード: proton aurora, EMIC wave, Pc1 pulsation, subauroral latitude, ring current proton, wave-particle interaction
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