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Pc1 waves spectral characteristics associated with variations of their source location

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Electromagnetic ion cyclotron (EMIC) waves can interact with high-energy ions (several keV ~ tens of keV) near the magnetic equator. Then, precipitating protons into the ionosphere can be seen as pulsating proton aurora (PPA). The PPA and related Pc1 waves, which is equivalent to EMIC waves in the magnetosphere, were observed at Athabasca, Canada (L value=4.3), using an all-sky EMCCD camera (110 Hz sampling) and an induction magnetometer (64 Hz sampling) at 05:30-06:00 UT on 17 February, 2017. The spectral characteristics of the observed Pc1 waves changed to broadband waves from coherent discrete elements, when PPA was drifting from higher latitude to lower one. This auroral movement can be related with the variations of magnetospheric source region. In this study, we estimated the source region of PPA from the time difference between PPA and Pc1 waves observed on the ground and theoretical time difference between them at each magnetic latitude. The estimated results showed that the source region was localized at the magnetic equator within the magnetic latitudes from -8.4 to +8.6 degrees. We calculated the curvature of magnetic field line near the magnetic equator to investigate the curvature effects on the generation of the EMIC waves. The curvature variations were calculated by Tsyganenko 2002 model. The calculation result shows that the gradient of magnetic field line became 15% smaller during the equatorward auroral drifting. The observation results support the importance of curvature effects on the generation of EMIC waves, because the spectral characteristics of the observed Pc1 waves changed to broadband waves from coherent discrete elements when the gradient of magnetic field line decreased.

In this presentation, we will discuss the analysis results of the magnetospheric source region and related Pc1 waves spectral characteristics in detail.