A statistical study of longitudinal extent of Pc1 pulsations using seven PWING ground stations at subauroral latitudes

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Ultra-low-frequency (ULF) Pc1 geomagnetic pulsations correspond to the electromagnetic ion cyclotron (EMIC) waves in the magnetosphere, and are excited sporadically in the magnetospheric equatorial plane with a frequency range of 0.2-5 Hz. Pc1/EMIC waves occur as a result of the ion-cyclotron instability. These waves may contribute to loss of the radiation belt electrons in the inner magnetosphere through wave-particle interactions. Previous researches on the spatial extent of EMIC waves mainly used only a specific ground station or a few ground stations. There are also some researches on the global distribution of EMIC waves using statistical study of data obtained by single satellite rather than through ground stations. However, the instantaneous longitudinal extent of Pc1 waves has not been fully understood yet. In order to investigate this instantaneous longitudinal extent of Pc1 waves, in this study, we analyze the magnetic field data obtained at the seven ground stations at Athabasca (54.6N, 246.36E), Kapuskasing (49.39N, 277.81E), Gakona (62.39N, 214.78E), Husafell (64.67N, 338.97E), Zhigansk (66.78N, 123.37E), Istok (70.03N, 88.01E), and Oulu (65.08N, 25.90E) for one year from July 2018 to June 2019. The magnetometers at the 6 stations have been deployed and operated by “study of dynamical variation of Particles and Waves in the INner magnetosphere using Ground-based network observations (PWING)” project, while the magnetometer at Oulu has been operated by Sodankylä Geophysical Observatory. We will report local time variations of the occurrence rates and average frequencies of the Pc1/EMIC waves at these stations and discuss the characteristics of the wave appearance including their instantaneous longitudinal extent. We also make some model calculation about the possible longitudinal extent to explain the observed instantaneous occurrence rate distributions. The above analysis reveals that the average instantaneous longitudinal extent of the Pc1 waves is about 80 degrees in longitudes at subauroral latitudes. There was no clear difference in the longitudinal extent of Pc1 waves between two different geomagnetic activity levels defined by the Dst index less/more than -15 nT.

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