

Statistical characteristics of quasi-periodic Pc1/EMIC waves in the magnetosphere and the ionosphere

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Pc1 pearl structure is a quasi-periodic amplitude modulation of Pc1 pulsations with repetition periods of several tens of seconds. In previous studies, Pc1 pearl structures have been frequently observed on the ground, but only sparsely in space. In order to understand the generation and propagation mechanisms of the pearl Pc1 waves, we investigated the statistical characteristics of quasi-periodic (QP) and randomly structured (RS) EMIC/Pc1 waves in the magnetosphere and in the ionosphere, using ground induction magnetometers located at Athabasca (ATH, L = 4.3) in Canada and Magadan (MGD, L = 2.7) in Russia and the Van Allen Probes (RBSP-A and B) satellites located in the inner magnetosphere. From data covering a one-year period from August 2012 to August 2013, we found a total of 590 hours of Pc1 events at ATH, 295.4 hours at MGD, and 73 hours at RBSP-A, 75.8 hours at RBSP-B. By comparing the observations at ATH and MGD, we found that the occurrence of RS Pc1 waves is independent of UT and that QP Pc1 waves occur concurrently with typical Pc1 waves detected at subauroral latitudes. We also found that on the ground QP Pc1 waves are observed more often than RS Pc1 waves (69 % at ATH, and 68 % at MGD). At RBSP-A and B, EMIC waves exhibit a peak occurrence at L~6 and in the morning sector. In space, the QP and RS EMIC waves occurred at similar rates. QP EMIC waves are observed most often in the He⁺ band, at L~4.5, and in the morning and dusk sectors. RS EMIC are frequently observed at L~5 from the midnight to morning sector. From these observations we conclude that the L and local time occurrence pattern of QP/RS EMIC differs between space and ground. To understand the source of the difference, we examined the propagation and polarization characteristics of pearl Pc1 waves that were simultaneously detected at magnetically conjugate locations on the ground and in space.

Keywords: Pc1 pearl structures, ground and space observations, conjugate events