

Study of the relationship between whistler-mode chorus emissions and Pc5 ULF waves based on the ERG satellite observation

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Whistler-mode chorus emissions are electromagnetic plasma waves generated in the equatorial region of the terrestrial magnetosphere. Previous studies suggested that chorus emissions play an important role in the precipitation of energetic electrons through wave-particle interaction. The amplitude modulation of chorus emissions is thought to be related to the phenomena occurring in the ionosphere such as the variation of the electron number density and auroral emissions. Thus, in order to understand these phenomena, it is important to investigate the generation mechanism of chorus emissions. One of the important factors of the modulation of chorus wave intensity is ULF (Ultra Low Frequency) wave, which is a low frequency plasma wave occurring in the terrestrial magnetosphere. Previous studies especially focus on the Pc4, Pc5 ULF waves, whose range of the periodicity is about 1-10 minutes. Li et al. (2011) reported that the periodic intensity variations of chorus emissions correspond to the compressional Pc4, Pc5 ULF waves, and the Pc4, Pc5 ULF waves oscillate southward when chorus emissions are enhanced. On the other hand, Jaynes et al. (2015) reported that the periodic variations of chorus waves intensity correspond to the toroidal and poloidal mode Pc4, Pc5 ULF waves, and the periodicity of the ULF waves is twice as long as that of chorus wave intensity.

In the present study, we investigate the relationship between the amplitude modulation of chorus emissions and ULF waves using observation results of the ERG satellite. We use the data measured by the Onboard Frequency Analyzer (OFA), one of the instruments of the Plasma Wave Experiment (PWE), and the Magnetic Field Experiment (MGF). We focus on the event observed from 0430UT to 0530UT on March 30, 2017, when the ERG satellite located in the region where the magnetic local time was about 03:00, the magnetic latitude was about below 5 degrees, and the L-value was about 6.0, near the equatorial region of the dawn sector of the magnetosphere. In the results of the analysis, we find the enhancement of the compressional Pc5 ULF waves, whose periodicity is about 5-10 minutes, and the ULF waves correspond to the generation of chorus emissions. We find that the compressional Pc5 ULF wave oscillates southward when the chorus wave grows, which is consistent with Li et al. (2011).

Keywords: ULF waves, chorus emissions