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Statistical analysis of chorus emissions in the dayside outer magnetosphere

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We analyze chorus emissions observed by Geotail spacecraft in the dayside outer magnetosphere (L from 9 to 10). On the basis of the nonlinear growth theory [1], a rising-tone element is initially generated continuously in the frequency range from 0.1 to 0.7 fce, where fce is the gyrofrequency in the generation region. Because of the nonlinear damping mechanism the rising-tone element is separated into upper and lower bands at half the local gyrofrequency (1/2 fce) during propagation [2]. As the rising-tone emissions are generated in the minimum-B region and propagate toward the larger-B regions along the geomagnetic field line, the upper cutoff of the lower-band chorus indicates 1/2 fce in the generation region, whereas the lower cutoff of the upper-band chorus becomes equal to 1/2 local fce at the observation point. In the previous study, we evaluated these characteristics of dual-band chorus emissions observed by the wave form capture (WFC) and the sweep frequency analyzer (SFA) onboard Geotail [3].

In this study, we statistically analyze the characteristics of the dual-band chorus observed in the dayside outer magnetosphere by Geotail. Because the highly distorted geomagnetic field there due to the solar wind dynamic pressure, we analyze the dependence of the dual-band chorus occurrence on the geomagnetic indices. It is found that the dual-band chorus is observed mainly in the morning side when the Dst index becomes lower than -40, with larger wave intensities in the off-equatorial regions. We will present statistical analysis of the dependence of the chorus frequency and intensity on the solar wind and geomagnetic activity.

[1] Omura Y., Y. Katoh and D. Summers (2008), Theory and simulation of the generation of whistler-mode chorus, J. Geophys. Res., 113, A04223, doi:10.1029/2007JA012622.

[2] Omura Y., M. Hikishima, Y. Katoh, D. Summers, and S. Yagitani (2009), Nonlinear mechanisms of lower-band and upper-band VLF chorus emissions in the magnetosphere, J. Geophys. Res., 114, A07217, doi:10.1029/2009JA014206.

[3] S. Yagitani, T. Habagishi, S. Mori, Y. Omura, and H. Kojima, Generation and propagation characteristics of dual-band chorus emissions observed by Geotail, American Geophysical Union Fall Meeting 2012, December 2012, San Francisco, USA.

Keywords: Chorus emission, Geotail spacecraft, Statistical analysis, Upper-band chorus, Lower-band chorus, half-gyrofrequency