Occurrence characteristics of Saturn's short-term radio burst

D. Maruno[1], Y. Kasaba[1], T. Kimura[2], A. Morioka[1], B. Cecconi[3]

[1] Department of Geophysics, Tohoku University, [2] ISAS, JAXA, [3] LESIA, Observatorire de Paris

Saturn kilometric radiation (SKR) is emitted from auroral electrons and suggested to be correlated with Saturn's auroral processes. Thus SKR can be regarded as a proxy for Saturn's auroral activity. Since SKR from northern and southern hemispheres are circularly polarized to opposite senses, respectively, one can separately monitor auroral processes in each hemisphere based on its polarization state. Previous observations reported that SKR showed transient variations (SKR bursts), which are characterized by the enhancement of the power and the lower-frequency extension, corresponding to magnetotail reconnections. Regarding the timing of SKR bursts, there are two kinds of SKR bursts: one depends on the SKR periodic modulations and the other do not depend on the modulation phase. The investigation of SKR phase dependence of SKR bursts is helpful for understanding the trigger of the SKR burst. Recent observations suggested the north-south asymmetry of the SKR modulation period and intensity. However, SKR bursts have not yet been examined from the aspect of the relationship between northern and southern radio emissions. The purpose of this study is to investigate characteristics of the SKR burst such as the occurrence frequency, intensity, onset timing, relationship to the N- and S-SKR modulations, in particular, with focusing on the north-south comparison.

We extracted northern SKR (N-SKR) and southern SKR (S-SKR) burst events, by newly defined selection criteria, with radio data observed by the Cassini Radio and Plasma Wave Science (RPWS) instrument in the period from day 250 of 2005 to day 200 of 2006. The data was separated into northern and southern components according to its circular polarization degree. As a result, 16 N-SKR burst events and 36 S-SKR burst events were identified in this period. Based on statistical studies of these events, we obtained the following results: (1) We derived typical frequency profiles of N- and S-SKR during SKR bursts to compare the intensity of N- and S-SKR bursts. The profiles show that the S-SKR burst was more intense than the N-SKR by 7 dB in the main frequency range. From the recent studies, the north-south asymmetry could be explained by the difference in solar illumination due to the tilted the magnetic and rotational axis. (2) By comparing onset timings of N- and S-SKR bursts, we found that 67 % of S-SKR burst events were accompanied by N-SKR bursts or burst-like enhancements. (3) To elucidate what determines the timing of SKR burst onsets, we compared the onset timing of N- and S-SKR bursts with each SKR phase of the periodic modulations. The result showed that the timing of SKR burst onsets generally depends on both the N- and S-SKR modulation phases. This suggests the existence of the internal control of SKR burst onsets. It is, however, noted that some SKR bursts occurred out of phases with SKR modulation phases. That indicates the timing of SKR bursts can also be determined by the external process, i.e., solar wind compressions.

In conclusion, our study demonstrated the north-south asymmetry, the conjugacy and the dependence on the SKR periodic modulations of SKR bursts. These results would be helpful for understanding the auroral process at Saturn's magnetotail reconnections by elucidating the relationship between SKR bursts and reconnections.