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木星デカメータ電波 S バーストの繰り返し周期の統計解析
Statistical analysis of the repetition frequency of S-bursts of Jovian decametric radiation

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Repetition frequency of S-bursts of Jovian decametric radiation has been statistically analyzed based on the datasets of ground-based observations performed at the observatories of Tohoku University since 1985. In the Jovian magnetosphere, the radio waves are generated in decametric wavelength range due to the interactions between the rotating magnetic field and the satellite Io. Among them, the S-busts are intense emissions which show quasi-periodic frequency drift on a time scale of msec. The typical repetition frequencies are within 2-400 Hz [Carr and Reyes, 1999]. Based on the studies of the Earth's ionospheric Alfven resonator (IAR), Ergun et al. [2006] proposed that the periodicity of the S-bursts was caused by the Jovian IAR. According to the hypothesis, it is expected that the repetition frequency of S-bursts and IAR increase as the solar zenith angle at the Io footprint increases and plasma density in the Jovian ionosphere decreases. In order to verify the Jovian IAR hypothesis, we have analyzed repetition frequency of S-bursts.

We have analyzed datasets obtained by ground-based observations performed at the observatories of Tohoku University since 1985. The datasets obtained by new HF receiver system installed at Yoneyama observatory (141.2E, 38.6N) in 2012 are also utilized in the analyses. The frequency range, frequency and time resolutions of the new HF receiver system were 21.5 - 37 MHz, 1.2 kHz, and 0.8 msec, respectively. As a result of the statistical analysis of the datasets since 1985, it was found that the repetition frequency of S-bursts decreases as the increase of solar zenith angle at the Io footprint on the Jovian ionosphere. The result was opposite to the expectation. Some previous studies reported that the activity of the Earth's aurora depends on the solar zenith angle in the ionosphere [Newell et al., 1997]. They explained that it was because the growth of the feedback instability in IAR depended on the conductivity of the ionosphere. If the auroral electron precipitations increase in Jovian IAR when the solar zenith angle increase just as in the Earth's IAR, we can expect that the repetition frequency of S-burst decreases due to the increase of the plasma density and the temperature in the ionosphere.

Keywords: Jovian decametric radiation, S-bursts, Ionosphheric Alfven resonator, Solar zenith angle dependence, Jovian ionosphere, Feedback instability