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オーロラ電波から推定する土星オーロラ加速域の季節変動
Seasonal variations of Saturn's auroral acceleration region deduced from spectra of auroral radio emissions

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Multi-instrumental surveys of Saturn's magnetosphere by Cassini have indicated that auroral radio emissions (Saturnian Kilometric Radiation, SKR), aurorae at UV and IR wavelengths and Energetic Neutral Atoms (ENA) from the inner magnetosphere exhibit periodic behavior at around Saturn's rotational period with the north-south asymmetry and seasonal variations [e.g., Gurnett et al., 2010; Mitchell et al., 2009; Nichols et al., 2010]. These rotationally periodic phenomena suggest that the magnetosphere-ionosphere coupling process and associated energy dissipation process (aurora & SKR) are dynamically dependent on both magnetospheric rotations and long-term conditions of the magnetosphere/ionosphere.

To reveal the global view of this M-I coupling process, this study investigated seasonal variations of Saturn's auroral acceleration region, which is the interface between the ionosphere and magnetosphere, based on a sufficient data volume of SKR observed by Cassini's Radio and Plasma Wave Science (RPWS) experiment. Morioka et al. [in press] investigated the spatial distribution of the auroral acceleration region along polar magnetic field lines based on spectra of the terrestrial auroral kilometric radiation (AKR). By application of this approach to Saturn, we deduced the height distribution of the auroral acceleration region in the northern and southern hemispheres from SKR spectra acquired during 2004 to 2010. It was found that the southern (summer) SKR spectral density was 10db greater at the peak altitude (~0.9Rs) on average, and harder than in the northern (winter) hemisphere. In addition, the southern and northern spectral densities became comparable with each other around equinox. These results suggest stronger field aligned acceleration and current in the southern hemisphere than north depending on season. The main infrared (H3+) auroral oval in IR was similarly more intense in the southern summer hemisphere than in the north [Badman et al. 2011]. Badman et al. [2011] suggested that greater conductivity in the southern polar ionosphere could result in greater precipitating electron flux and/or Joule heating, which are responsible for the stronger southern IR auroral emissions. The north-south asymmetric acceleration region deduced from SKR will be further compared with ionospheric and magnetospheric parameters (e.g., electron density, temperature, conductivity). Finally, comparative discussions of M-I coupling process between Saturn and Earth will also be presented.

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