オーロラ電波から推測される土星のオーロラ加速域の日変動およびローカルタイム依存性

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Daily variations of local time dependence of Saturn’s auroral acceleration region deduced from auroral radio emissions

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Saturn emits an intense radio emission called Saturn kilometric radiation. SKR is emanated from energized electrons accelerated along auroral field lines via cyclotron maser instability. Cassini spacecraft has discovered a lot of characteristics of SKR since the Saturn orbit insertion in 2004. Compared with similar radiations from Earth and Jupiter, SKR shows several unique characteristics related to the modulation at or close to the planetary rotation period, i.e., periodic intensification every 10 hours, its long-term variation over several years and its North - South asymmetry. In addition, the similar periodicity of magnetic fields and magnetospheric plasma configurations has been reported. Associated with the enhancement of SKR during these modulations, it is commonly seen that SKR expands toward lower frequency. Because SKR is emitted at approximately local electron cyclotron frequency, the lower frequency extension (LFE) can be interpreted as an expansion of the auroral acceleration region to higher altitude. The LFE has been reported to have the general relationship between the lower- frequency extensions of SKR and substorm-like events seen as plasmoids in the magnetotail has been reported [e.g. Jackman et al, 2009].

In this study, we analyze the dependence of SKR spectra on SKR phase, North/South source and local time (SKR phase is defined to be 0 deg at its maximum intensity and have a range of 360 deg in one rotation period). This will help understanding of special and temporal variations of the M-I coupling region as well as the periodicity of SKR. The structure of field-aligned current in local time can be deduced from comparing our study with other in-situ and auroral observations. Furthermore, these comparisons will contribute to understanding for other interesting events such as, reconnection events at magnetotail, particle injections in the inner magnetosphere and substorm-like events. In addition, our potential motivation is to compare Earth and Saturn about the location and strength of accelerations using the auroral radio emission.

We checked dependence of SKR on local time and North - South asymmetry of SKR as a preliminary analysis by separating local sector in to two parts (LT 0200 -1400 h and LT 1400 - 2400 h). And we found the width of the auroral acceleration region shows rotational variation depending on the SKR phase especially on the dawn side. In contrast, this trend is not clear on the dusk side. This may support that an intense SKR source region locates on the dawn side. However, we have to take into account the effect of visibility which is an apparent variation in spectra due to beaming effect. It is also seen that SKR on the dawn side shows North - South dependence.

We will show more detailed dependence of SKR source region on local time and will discuss the daily variation less affected by the dependence on local time.