Study of the correlation between nKOM and reconnection in the Jovian magnetosphere: Inward radial transport in the magnetosphere

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Jupiter has the largest magnetosphere in the planets of our solar system, which has been produced by its rapid rotation period (about 10 hours), strong intrinsic magnetic field and internal source of heavy plasma originated from Io plasma torus (IPT).

The observations by the Galileo orbiter revealed that there were quasi-periodic phenomena in the Jovian magnetotail, such as radial flow bursts of energetic particles [Krupp et al., 1998, Woch et al., 1998] and the variation of radial and north-south component of the magnetic fields [Krupp et al., 1998], which imply occurrences of magnetic reconnections and the periodic thinning and thickening of the plasma sheet. The signatures of these events were similar to the terrestrial substorm, so they are called ””substorm-like events (SLE)”” [Woch et al., 1998].

It is also known that there are radio emissions from the Jovian magnetosphere which correlate with SLE. In the preceding studies, Louarn et al. (2001, 2014) reported the narrow-band KilOMetric radiation (nKOM) and the HectOMetric radiation (HOM) correlated with inward flow burst and variation of the north-south component of the magnetic field during SLE. X-lines where the SLEs are thought to start were located at around 60-80 Jovian radii (R_J) region from Jupiter [Woch et al., 2002], while the source of nKOM is suggested to be located at the outer edge of the IPT (6-10 R_J) [Reiner et al., 1993]. The report implies that the generation process of nKOM relates to the reconnection at the magnetotail. However, it has not been revealed well yet how inner (6-10 R_J) and outer (60-80 R_J) magnetospheres couple each other during SLE.

The purpose of this study is to reveal coupling processes of the formation of nKOM at the inner magnetosphere (6-10 R_J) and the reconnection at the magnetotail (60-80 R_J). To study this process is important in order to understand the inward radial transport of energy and/or plasma in the Jovian magnetosphere and the proceeding processes of the global dynamics of the Jovian magnetosphere (as suggested by Kivelson et al. (2005)).

Louarn et al.(2015) suggested that the role of reconnection in the mechanism of radial inward transport was not clarified. Although reconnection thought to be trigger of inward radial transport, statistical analysis shows signatures of inward plasma flows reaching at inner magnetosphere (such as increase of southward magnetic field) were rare.

In this study, we have used nKOM which can be observed by remote sensing and have compared reconnection in the magnetotail region and characteristics of nKOM at the inner magnetosphere. We have obtained intensity of each nKOM event and have compared it with variation of B_r, radial component of magnetic field, as a parameter of SLE. As a result, there was correlation between the intensity of nKOM and the variation of B_r which corresponds each nKOM event.

This indicates there is relation between the energy stocked as stretching of magnetic field and the energy input towards the inner magnetosphere by the result of reconnection. We think this is one of evidences indicating inward radial transport of energy in the Jovian magnetosphere. We will discuss the energy balance and the time series of each phenomenon during SLE in order to explain this relation. We will also discuss the physical processes of this relation in order to consider the role of reconnection for inward radial transport of energy and the coupling processes of the formation of nKOM in the inner magnetosphere and the reconnection in the magnetotail region.