静止軌道上に現れる高密度プラズマの磁気圏侵入プロセスについて

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Possible entry process of dense plasma observed at geosynchronous orbit

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An appearance of dense (>2cc) plasma at geosynchronous orbit is one of the characteristic natures after a prolonged northward IMF duration. This dense material can contribute to the enhancement of the ring current density, which results a further declination of Dst [Lavraud et al., 2006a]. Therefore investigating the origin, path and fate of the dense plasma is important to understand how it preconditions the magnetosphere during calm before storm [Borovsky and Steinberg, 2006]. Observational evidences have shown that the cold dense material builds up during the northward IMF intervals in the flanks of the magnetosphere [e.g., Wing and Newell, 2002] which is referred to as the low latitude boundary layer (LLBL). The entry process of those populations into the magnetosphere during the northward IMF conditions has been a controversial issue in contrast to the Dungey's reconnection model for the southward IMF cases. The major candidate processes are the double lobe reconnection (DLR) model [Song et al., 1999], in which newly closed magnetic field lines on the dayside magnetopause capture the solar wind plasma, and the diffusive transport mechanisms such as diffusion driven by the kinetic Alfven waves (KAWs) [Johnson and Cheng, 1997] and a turbulent transport by the Kelvin-Helmholtz instability (KHI) driven by the fast solar wind flow [e.g., Matsumoto and Hoshino, 2006].

We have studied a statistical study of dense plasma sheet observed at geosynchronous orbit and its relation to the solar wind conditions. We selected a start time when the LANL spacecraft at geosynchronous orbit continuously observed dense plasma (>2cc) for more than 30 minutes. Based on the list of the collected events, we performed superposed epoch analysis of the solar wind parameters using the OMNI2 data. As a result, the appearance of dense plasma at geosynchronous orbit was preceded by the solar wind characterized by large density (>15cc) and dynamic pressure (>8 nPa) followed by high speed solar wind. No characteristic signature was found in the interplanetary magnetic fields (IMF). To discuss an entry process of the dense plasma into the magnetosphere, we then analyzed the ULF Pc-5 index [Kozyreva et al., 2007]. The superposed time profile of the index showed a peak around the zero epoch time, suggesting that the activity of compressional waves at the magnetopause gradually increased as the high pressure solar wind approached. The fact that the ULF Pc-5 index followed the solar wind density (dynamic pressure) profile rather than the speed indicated that KAWs and/or KHI were also responsible for the solar wind plasma transport before the zero epoch time. In this presentation, we show statistical properties of the dense plasma observed at geosynchronous orbit and the corresponding solar wind conditions and the ULF activities. Possible entry processes of the solar wind plasma during those intervals are also addressed.