磁気雲に伴う太陽プラズマ塊と磁気圏ダイナミックス

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Enhanced plasma density variations accompanied with Interplanetary Magnetic Clouds and their role on the magnetosphere dynamics

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It is well known that Interplanetary Magnetic Clouds (IMCs) are frequently accompanied with ehnanced plasma density variations in their trailing part, where plasma property is of low temperature accompanied with a large content of alpha particle, suggesting to be originated from low altitude in the solar atmosphere. Large increases of plasma density are observed as 10/cc up to 50-60/cc, and continued from several minutes to several hours.

If solar wind speed in a trailing part of IMCs is assumed typically to be 450 km/s, their spatial scale is expected to be from about 300000 km to 5400000 km for each continuation, which appear to be large. However, as considering that a typical time scale of IMC is about a day or more, the time scale of the density variations is thought to be very short, and furthermore if we could consider an IMC as a large scale flux rope, the spatial scale of the density variations seems to be very narrow. Therefore, we can expect that there are a number of small loops including low-temperature plasmas within a large scale magnetic flux rope.

As was described above that the density variations are ranged from 10/cc to 50-60/cc, corresponding dynamic pressure changes are estimated to be a few nPa to several tens nPa, These dynamic pressure variations might also have severe effects on the magnetosphere dynamics. Therefore, it will be very interesting for us to think about how they do have effects on the magnetosphere dynamics in the solar wind- magnetosphere interaction.

Actually when rapid variations of solar wind plasma density were observed during the northward IMF Bz, plasma convection vortices in the polar ionosphere were frequently observed, and large amplitude ULF Pc 5 oscillations were observed on ground from high to low latitudes. They occurred intermittently and/or continued over several hours. Simultaneously, at synchronous orbit both the variations of magnetic field and high-energy particle fluxes were observed similar to the density variations of IMC in solar wind.

Several examples representing the relationship between plasma density enhancements appearing in a trailing part of an IMC observed in particular in the northward IMF Bz and corresponding magnetosphere signatures will be presented and discussed in relation to the magnetosphere dynamics.