

GEOTAIL observations of the dayside low-latitude boundary layer: IMF control and dawn-dusk asymmetry

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The formation mechanism of the low-latitude boundary layer (LLBL) on the dayside as well as on the tail-flanks still remains an open question. We investigate both ion and electron behaviors in the dayside low-latitude magnetosphere just inside the magnetopause with GEOTAIL data, in order to obtain clues for understanding the entry/transport processes of the solar wind plasma. The dayside region was classified into several categories according to ion velocity distribution characteristics, electron pitch-angle anisotropy, the north-south polarity of the IMF, and the observed locations. An important category is the ion mixing region. A data sample falls into this class if both the number density and the ion flux at 5 keV exceed certain threshold values. We found that the ion mixing region thus defined contains cool, dense ions of the solar wind origin and hot magnetospheric ions simultaneously, and this occurs far more often when the IMF having a northward component lasts for about 4 hours or more. The ion mixing region under extended northward IMF is almost always accompanied by field-aligned, bi-directional electrons of a few hundreds eV, which energy is higher than that of typical magnetosheath electrons. These facts suggest that the plasma transport process operating for extended northward IMF periods plays an important role for heating electrons in the direction parallel to the magnetic field. The mixing region exhibits a clear dawn-dusk asymmetry in the ion energy spectrum, supporting the idea that the transport/heating process of the entrant solar wind ions is different for different sides of the magnetosphere. Based on similarities/differences between these observed signatures and those having been found in the tail-flanks, relationships between the dayside and tail LLBLs under extended northward IMF are also discussed.