Statistical analysis of the traveling directions of vortex in the magnetopause

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The plasma mixing and transportation are recognized as one of important processes in astroplasma as well as in space plasma physics. It is well known that the Kelvin-Helmholtz instability develops by being the velocity shear flows between the flow of the magnetosphere and the flow of the magnetosheath region, and it is believed that the plasma mixing has been initiated in this boundary region. However, how plasma is transported while passing such a mixing process is not yet clarified.

In this presentation, we study statistical traveling directions of vortex by the in-situ observation of the GEOTAIL satellite, and we pay attention to the velocity angle hodogram of vortex motion. The angle of the flow vector is defined to be zero toward the sun-direction of +X in the GSM-XY plane, and the counterclockwise direction is assumed to be positive. Suppose that the KH vortex is being gradually transported from the magnetosheath side into the magnetosphere. In this transition phase, the rotation hodogram shows a unique behavior such that a saw-toothed oscillation with the gradual increase from -180 deg to +180 deg and then the sudden change to -180 deg in the early phase. In the next phase, we can expect a rectangular oscillation and the inverse-saw-toothed oscillation in the late phase.

According to past simulation research (Matsumoto and Hoshino, 2004), the difference in density across the magnetopause is known to be an important controlling parameter of the plasma mixing and the invasion of the vortex motion toward the magnetosphere. In this presentation, we discuss the transport of KH vortex into the magnetosphere as a function of the solar wind density by analyzing the traveling directions of the KH vortex.