AOGS 2006

Recovery of Streamlines in Kelvin-Helmholtz Vortices at the Magnetopause

HIROSHI HASEGAWA[1], BENGT SONNERUP[2], YOSHIFUMI SAITO[1], TOSHIFUMI MUKAI[1]

[1] *ISAS/JAXA*

[2] *Dartmouth College*

We present a new data analysis technique [Sonnerup et al., 2006] for producing a two-dimensional (2-D) map of the flow velocity field, that is, streamlines from single-spacecraft observations of the bulk plasma parameters and magnetic field. For dissipationless flow transverse to a unidirectional magnetic field, the MHD equation of motion can be reduced to a Grad-Shafranov-type (GS-type) equation for the streamline function, provided that the plasma structure is 2-D and time-independent in a proper frame. In this situation, three physical parameters, namely entropy, generalized enthalpy, and the frozen-flux function, remain constant along the streamlines. We show how this GS-type equation, along with the streamline invariants, can be used to recover the velocity field in regions surrounding a spacecraft trajectory, as in the GS reconstruction of the magnetic field [Sonnerup and Guo, GRL, 1996; Hau and Sonnerup, JGR, 1999]. The new method is benchmarked by use of a numerical solution of the GS-type equation and is further applied to an encounter of the Geotail spacecraft with a train of Kelvin-Helmholtz (K-H) waves in the flank low-latitude boundary layer. The reconstruction result demonstrates that a chain of vortices was present along the flank magnetopause, which is supported by other signatures showing the overturning of K-H waves. We also describe how the proper frame and the orientation of two-dimensionality could be determined.