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Role of diffusion in transport of cold-dense plasma in the Earth's magnetosphere

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In order to understand mechanisms of plasma transport we investigated cold-dense plasma, which is of solar wind origin, in the Earth's magnetosphere using particle and wave data obtained from THEMIS satellite. In this presentation, we will show a case study of THEMIS observations in which three of the THEMIS spacecraft observed earthward transport of the cold dense plasma in the dayside-dawn plasma sheet. Analysis of phase space density indicates that the observed transport is not simply due to magnetospheric convection. In order to clarify role of diffusion in the transport, we calculate diffusion coefficients of Landau damping (parallel electric field) and transit -time damping (parallel magnetic field) in the kinetic Alfven waves (KAWs) and lower hybrid drift instability (LHDI) using wave data and formulae of quasi-linear theory. We found that in some intervals the diffusion coefficient of KAWs can exceed the value needed to account for the observed transport. This result suggests that diffusion induced by KAWs contributes to transport of cold-dense plasma in the magnetosphere as well as at the magnetopause. We will investigate whether and how KAWs cause diffusion using test particle simulation.

Keywords: diffusion, kinetic Alfven wave, THEMIS, cold dense