

Tailward flows in the near-Earth plasma sheet during substorms

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Tailward flows in the plasma sheet are sometimes observed even in the near-Earth region (where X_{gsm} [Re] is between -8 and -15), which have not been explained in conventional substorm models. In order to understand the cause and effect of these flows in the framework of substorms, perpendicular flows in the plasma sheet during the substorms, measured by GEOTAIL, have been investigated: We have performed a superposed epoch analysis of them. The timing of the auroral onset determined by Polar/UVI images has been used. Currently we have found that (1) the tailward flows are often observed at $X_{gsm} \sim -10$ Re near midnight sector at 3-5 minutes after the auroral breakup, (2) the tailward flows are often preceded by the earthward flow, thus it looks like a bipolar flow and (3) the electric field measurement suggests that these flows are electric field drift. In order to investigate whether the bipolar flows correspond to spatial variations or temporal variations, we have applied the minimum variance method to the flow and the magnetic field. The results suggest that these flows may correspond to the vortices in the plasma sheet for some event. We discuss whether/how these phenomena relate to the global ground magnetic field signatures by using the CPMN data.