

## Earthward and tailward propagation of high plasma pressure region as pre-cursor and post-cursor of substorm onset

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Cause of substorm expansion onset is one of the major problems in the magnetospheric study. On the basis of a global magnetohydrodynamic (MHD) simulation, Tanaka et al. [2010] suggested that substantial accumulation of the plasma pressure caused by the state transition in the plasma sheet could cause sudden intensification of the Region 1 and 2 field aligned currents and the westward auroral electrojet. In this sense, the accumulation of the plasma pressure is a key in understanding the substorm onset in the magnetosphere. On 5 April 2009, three probes of the Time History of Events and Macroscale Interactions during Substorms (THEMIS) were located at  $X_{GSM} \sim -11$  Re around the equator, which provide unique opportunity to investigate the spatial-temporal evolution of the high-pressure region (HPR) near the substorm expansion onset. Just before the onset, a positive excursion of the plasma pressure appeared at the outermost probe first, followed by the innermost one. Just after the onset, the opposite sequence took place. These features are consistent with the simulation result that the HPR implodes earthward before the onset associated with the plasma sheet collapse, and expands tailward after the onset. A positive excursion of the Y-component of the current density was observed, which is also consistent with the simulation. These results may provide evidence for the accumulation of the plasma pressure predicted by the MHD simulation, and suggested that the earthward implosion of the HPR may be regarded as a pre-cursor of the substorm expansion onset and the tailward expansion as a post-cursor.

Keywords: High plasma pressure region, Substorm expansion onset, THEMIS satellite, Global MHD simulation