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Magnetospheric response to a fast flow in the tail: A THEMIS approaching configuration study

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On 5 September 2005 between 0000 and 0200 UT the Cluster spacecraft were located in the Earth's magnetotail at $x_{\rm GSM} \sim 17R_{\rm E}$, Double Star TC1, TC2 and Polar were located closer to Earth $x_{\rm GSM} \sim 6R_{\rm E}$. These spacecraft made up a THEMIS-like configuration. Unlike THEMIS, not all spacecraft orbit in the equatorial plane and in this case TC2 is located at high $z_{\rm GSM}$.

Just after 0100 UT and at 0116 UT Cluster observes two dipolarizations with associated strong Earthward flow with $v \geq 1000$ km/s. At 0104 UT and 0116 UT WIC auroral images show poleward boundary intensifications (PBIs). The superDarn radars shows a 2 cell convection pattern with ionospheric flows. TC1 observes dipolarizations sligtly later than Cluster at 0104 UT and 0118 UT respectively, but no significant flows. Both TC2 and Polar show magnetic oscillations. Substorm onset is placed at ~ 0135 UT. The spacecraft footpoints map to the region between Scandinavia and Greenland. The image magnetometers show a negative bay in the $B_{\rm x}$ component, the lower latitude stations show minimum near 0130 UT, the higher latitude stations show decrease starting near ~ 0200 UT.

We will follow the fast flows and dipolarizations observed by Cluster and the related PBIs and possible magnetic field aligned currents through the magnetosphere using the various spacecraft available in this THEMIS-like constellation.