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A Prototypical Substorm with Conjugate Ground and Space Data

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The substorm at about 5 UT on February 26, 2008 (Angelopoulos et al., Science, 2008) has been taken as prototypical of reconnection in the Near-Earth Neutral Line model. Further examination by Pu et al. (JGR, 2010) showed that the event was preceded an hour earlier by one with very similar signatures. Traditional use of AE-related indices suggests that the first event was smaller in terms of electric currents than the second. More detailed examination of ground magnetic data shows that it was in fact comparable: in addition, the second event was considerably further to the west. The ensemble of data suggests more similarity than differences for the two sub-events. We investigate the potential of inclusion of SCW currents themselves to improve mapping of THEMIS footpoints to Earth poleward of where quasi-static models map, to better match ground and CHAMP observations. Automated Meridian Modeling shows that a simple electrojet model with only three parameters (electrojet borders and current) matches data well with approximately 0.2 MA cross-meridian current in both subevents. GOES spacecraft approximately conjugate to eastern North America show dipolarization signatures consistent with this magnitude of current. There was good conjugacy between hemispheres, as indicated by Antarctic magnetometers and inversion based on them. SuperMag data gives dense enough magnetometer coverage that the layout of the substorm current wedge, with auroral zone westward electrojet and subauroral perturbations mainly due to field-aligned current, can be determined. The quantitative data from the ground provides a context in which flows, magnetic fields, and other parameters at the THEMIS constellation and other conjugate spacecraft may be interpreted.

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