

DEVELOPMENT OF SUBSTORMS IN THE NEAR-EARTH TAIL

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Magnetic reconnection usually takes place in the premidnight sector of the magnetotail at radial distances of 20-30 Re at substorm onsets. Substorm signatures inside 10 Re are examined with a substorm on July 22, 1998. GOES 10 (at 6.6 Re) and Geotail (at 9.2 Re) were almost aligned in the midnight meridian. The first signature of the onset is earthward plasma flows at 9.2 Re, and the second signature is a rapid dipolarization in the magnetic field at 9.2 Re. Then, a change in the field configuration takes place at 6.6 Re. These observations provide evidence that a dipolarization in the near-Earth magnetic field is produced with outflows from magnetic reconnection.

Development of substorm onset signatures in the near-Earth magnetotail is studied with a substorm on July 22, 1998. Magnetic field variations in the CANOPUS magnetometer chains are examined. A westward electrojet with Pi2 pulsations started just after 0655:00 UT at Rabbit Lake (66.6 MLAT, 23.0 MLT). A development of the westward electrojet at Gillam (65.8 MLAT, 23.9 MLT) was slightly delayed. The westward electrojet developed only with an amplitude of 200 nT and its center was located south of Rabbit Lake and Gillam. A positive bay was recorded after 0655 UT at midlatitude stations Frederickburg (48.8 MLAT), Boulder (48.7 MLAT) and Tucson (40.2 MLAT). The D deflection was westward at Frederickburg (01.6 MLT), whereas the D deflection was eastward at Boulder (23.4 MLT) and Tucson (23.1 MLT). Hence, this event was a well-isolated small substorm, with its central meridian just west of the midnight meridian.

In association with the onset, GOES 8 (75W, 01.8 MLT) observed only westward D deflection, whereas GOES 9 (135W, 21.8 MLT) observed only eastward D deflection. These D variations are caused by substorm-associated field-aligned currents. Since no significant changes in the field configuration were observed, the substorm effect was well localized in the tail. GOES 9 (104W, 23.8 MLT) observed a westward D deflection after 0655.3 UT and a dipolarization after 0656.5 UT.

Geotail was located near the equatorial plane at a radial distance of 9 Re near the 23.8 MLT meridian. Geotail observed earthward flows after 0654:30 UT and a sharp increase in Bz resulting in a rapid dipolarization in the field after 0655:00 UT. Hence, the earthward flows near 10 Re are the initial signature for the onset. The change in the field configuration takes place first near 10 Re, and then at 6.6 Re. These observations are typical in the development of substorm onset signatures in the near-Earth magnetotail.