

## Timing of substorm signatures in auroral ionosphere and magnetosphere during March 12, 1991

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We present the ionospheric and magnetospheric signatures of dynamic features of the substorm during March 12, 1991. This event is a sequence of optical pseudo-breakups and breakup followed by the large substorm expansion. After pseudo-breakups, the growth phase continues and the CRRES (located on  $L \sim 6$  near the Earthward edge of plasma sheet in the evening sector) encounters the Alfvén layers of low-energy electrons. Before  $T_0$  (breakup onset on the latitude  $63^\circ$ ) the precursors of the substorm onset are: (a) nearly simultaneous growth of westward ionospheric electrojet both near and westward of Harang discontinuity and (b) the increase of the amplitude of the Pi2 type oscillations both on the ground and in the magnetosphere. After  $T_0$  the westward substorm electrojet suppresses the global current system on the CRRES meridian located westward of the optical breakup. Only after the substorm activation, which occurred on the latitude  $\sim 71^\circ$ , the typical current picture associated with the leading edge of the substorm current wedge was observed over the CRRES meridian and the westward electrojet region was established here. Simultaneously the pulsating auroras appear near the poleward boundary of the diffuse auroral band. Just at this time the CRRES encountered the region 2 of field-aligned currents flowing from the ionosphere. We discuss different substorm models and suppose that the formation of periodic auroral vortices seen during the substorm growth phase one be important feature to “trigger” the substorm expansion phase.