

# **ON THE RELATIONSHIPS BETWEEN DOUBLE-ONSET SUBSTORMS, BURSTY BULK FLOWS, AND IMF VARIATIONS**

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The relationships between double-onset substorms, bursty bulk flows (BBFs), and the variations of the interplanetary magnetic field (IMF) are comparatively studied by using two events respectively observed by Geotail and THEMIS. Five (four) consecutive bursts of Pi2 pulsations for the Geotail (THEMIS) event occurred successively and simultaneously at the ground stations from high to low latitudes. Especially for both events, the last pair of Pi2 bursts are accompanied by magnetic bays at high latitudes and preceded by earthward BBFs in the plasma sheet. Polar UVI images show auroral activations at each Pi2 onset. The ground-based magnetometers and geosynchronous orbit sensed magnetic perturbations like the one affected by the formation of the substorm current wedge. The horizontal magnetic variation vectors, consisting of  $H$  and  $D$  components, had the vortex patterns like the ones induced by the upward and downward field-aligned currents during substorm times. These observations display two similar events of double-onset substorm. The mapping of ground Pi2 onset timing to the IMF observations at  $\sim 1$  AU just in front of Earth's magnetopause shows that they appear under the same variation cycles of north-to-south and then north. The comparison of both events suggests that double-onset substorms are externally triggered and driven by earthward BBFs as expected to result from magnetotail reconnection in association with the IMF variations.

Pi2 pulsations, bursty bulk flows, IMF variations

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