Intense dB/dt variations driven by near-Earth Bursty Bulk Flows (BBFs): A case study

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During geomagnetically disturbed times, geomagnetically induced currents (GICs) flow in power systems potentially causing damage to the system. The largest GICs are often produced when the surface geomagnetic field abruptly changes (for example, an induced rate of change of the horizontal magnetic field component, dH/dt). It is well established that intense dB/dt variations take place in the main phase of a geomagnetic storm, particularly while magnetic substorms occur during the active period. However, there are currently few studies that report intense dB/dt variations which are directly driven by bursty bulk flows (BBFs) at geosynchronous orbit. In this study, we investigate the characteristics and response in the magnetosphere-ionosphere system during the recovery phase of a geomagnetic storm that occurred on 7 January 2015 by using a multi-point approach combining space-borne Cluster and SWARM measurements, and a group of ground-based magnetometer observations. The locations of Cluster and SWARM map to the same conjugate region as the magnetometer ground stations at the time of the BBF. The measurements show that corresponding signals in all measurements occur simultaneously in this region. Our results suggest that the most intense dB/dt (dH/dt) variations are associated with R1-type FACs that are driven by BBFs at geosynchronous orbit around substorm onset.