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Drivers of Large GICs in Association with Strong Flank Magnetosphere-Ionosphere Dynamics During Two Major Geomagnetic Storms

An insidious effect of rapid magnetic field changes in the coupled magnetosphere-ionosphere-ground system is the generation of geomagnetically induced currents (GIC) on the ground. Previous analyses have focussed on the large scale geospace drivers associated with solar wind impulses and substorms and which affect primarily the magnetic noon or midnight local time sectors, respectively. During the geomagnetic storms of 17 March 2015 and 8 September 2017 we observed large dB/dt events on the flanks that are not consistent with solar wind compression and storm sudden commencement, ring current intensification, or auroral substorm expansion. The localization of this effect to local dawn or duck hinders auroral observations but additional magnetic and electric field measurements can be provided by overflights of the Swarm satellites. By analysing their spatio-temporal electrodynamic profiles in conjunction with the behaviour of the interplanetary magnetic field we explore the association of the drivers of these flank large geomagnetic disturbances (GMD) with enhanced convection and flank magnetopause dynamics. We present evidence that the drivers are also associated with large-scale auroral disturbances and field-aligned currents in flank local time sectors. Combining Swarm, global ground-based magnetometer, and additional ancillary satellite data we probe the likely causative drivers and examine the dynamics of the coupled MI system. Or goal is to understand the causes of the new and unexpectedly strong MI coupling processes.

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