GIC drivers - the Characteristics of Storm-time Rapid Geomagnetic Variations

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Rapid storm-time geomagnetic disturbances, typically at sub-auroral latitudes, have been recognized as one of the most detrimental space weather phenomena, potentially leading to damage to and outage of critical power infrastructure. We can show that sub-auroral magnetic spikes in storms (of the order of 1000 nT/min) do resemble in their appearance and spatio-temporal behavior small but intense and very short-lived substorms, including three-dimensional current wedge and electrojet-enhancement formation. Statistically these spikes do occur at all local times, but preferably pre-midnight and around 0600 MLT in the morning sector, which is only partially in agreement with the substorm analogy, and indicate that there may indeed be several mechanisms at work. We will present results from event and statistical studies to clarify the physical characteristics and potential drivers for these potentially most damaging geomagnetic disturbances in the SWx realm.