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# Magnetosphere-Ionosphere Coupling at Substorm Expansion Phase Onset

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With the explosive release of energy within a substorm, stored magnetic energy is quickly converted to plasma kinetic energy, resulting in dramatic changes in the large-scale magnetic topology of the Earth's night-side magnetic field and in increases in the flux of energetic particles in near-Earth space, and generates an apparently repeatable time series of events in the dynamic aurora spanning many degrees of latitude and hours of local time. Whilst the processes leading to energy storage in the magnetotail are well-understood, the same cannot be said for the conditions which lead to rapid energy release rather than a more gradual dissipation of stored energy. Without an improved understanding of the conditions leading to the triggering of rapid destabilisation of the tail, the forecast of the timing and geographical region affected by large GICs remains largely impossible. Here we examine the potential role of magnetosphere-ionosphere coupling (MIC) in triggering large scale morphological changes in the magnetotail across many hours of local time. We present ground-based magnetometer and all-sky imager observations combined with conjugate in-situ observations of the magnetic fields and temperature anisotropies of electrons and ions from GOES as well as the NASA Van Allen Probes and THEMIS satellites. By utilising the extensive ground coverage available from the Geospace Observatory (GO) Canada array we resolve longitudinal and relative timing uncertainties between the measurement platforms at onset. We seek to establish a causal sequence of events and thereby examine especially the potential role of near-Earth MIC processes in the substorm sequence, particularly that of the Akasofu auroral evolution at onset –independent of whether this precedes or follows the onset of magnetic reconnection at the near-Earth neutral line.

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