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Multi-scale analysis of reconnection and current disruption associated fluctuations during magnetospheric substorms

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Energy accumulation processes associated with subsequent explosive energy release phenomena are commonly observed in space and astrophysical plasmas. The most accessible space system in which explosive energy accumulation-release processes occur is represented by the Earth's magnetosphere during magnetospheric substorms. Since the explosive onset of substorms is localized in space and the subsequent energy redistribution affects large portions of the magnetosphere after the onset within 1-3 minutes, the identification of a triggering mechanism and its location is difficult. The time history of substorm signatures observed in-situ by the THEMIS satellites at multiple locations and available from ground-based measurements indicates that the source of the first substorm activation is magnetic reconnection in the mid-tail followed by cross-tail current reduction (current disruption) in the near-Earth plasma sheet. This opens up the possibility for the occurrence of triggering features associated with specific signatures during substorm initiation and expansion. We present multi-scale fluctuation signatures of some well-documented substorm events from the THEMIS mission when the observations over multiple locations indicated the occurrence of both mid-tail and near-Earth activations. Multi-scale methods allow to identify the scales of energization and in combination with the timing analysis lead to better description of energy redistribution during substorms.