STATISTICAL STUDY OF SUBSTORM TIMING SEQUENCE

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Observations of timing sequences of substorms expected in various onset mechanisms are examined by using a space-time diagram, which correlates observed space signatures and auroral signatures on the ground during substorm onset. Results from a statistical study of eleven substorms show that signatures in the mid-tail (x ~ 15-25 R_E) typically occur before the ground signatures and those in the near tail (x ~ 10 R_E), and the signatures in both regions observed prior to the substorm onset often occur in an advanced time range which was shorter than those expected from propagation between different regions. It suggests that the disturbance onsets in different active regions do not seem to have a simple causal chain relationship between them as described by reconnection or current disruption models of substorms. The activation of perturbed fields and plasma flows in space including the signatures of reconnection and current disruption may occur in multiple localized regions throughout the stressed tail current sheet. The activation seems to be continuously observed well after the substorm onset. These results to some extent are consistent with suggested Global Alfvénic Interaction considerations, in which the substorm onset is the result of Alfvénic Interaction in the global current systems.

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