

Self-organized criticality in the substorm phenomenon and its relation to localized reconnection in the magnetospheric plasma sheet

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Evidence is presented that suggests that there is a significant self-organized criticality (SOC) component in the dynamics of substorms in the magnetosphere. We assume that observations of bursty bulk flows, fast flows, localized dipolarizations, plasma turbulence, etc. show that multiple localized reconnection sites provide the basic avalanche phenomenon in the establishment of SOC in the plasma sheet. First results are presented from a study of this avalanche process based on this working assumption. A magnetic field reversal model is discussed. Resistivity, in this model, is self-consistently generated in response to the excitation of an idealized current-driven instability. When forced by convection of magnetic flux into the field reversal region, the model yields rapid magnetic field annihilation through a dynamic behavior that is shown to exhibit many of the characteristics of SOC. Over a large range of forcing strengths, the annihilation rate is shown to self-adjust to balance t