Geomagnetic Storm Avalanche Model

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Abstract:

Earth's magnetosphere is a complex system that exhibits stochastic properties both spatially and temporaly.This behaviour has been reported on ground and in-situ observations (Uritsky et al., 2003).[1]

The physical mechanisms that could explain this complexity are not fully understood. Nevertheless, some of the magnetopsheric most studied phenomena, such as auroral emissions, exhibit power law statistical relations, contribute to the idea that the magnetophere is in a self-organized critical (SOC) state.

In particular we turn our aim to the study one of the regions of the magnetosphere: the central plasma sheet (CPS). We asssume that the CPC is a collection of discrete straight flux tubes and we study the evolution of the magnetic field in a weakly perturbed magnetosphere using a simple 1D cellular automaton. This numerical model produced spatially and temporally intermittent, avalanche-like release of magnetic energy, with frequency distributions of avalanche size parameters in the form of power laws.

Recently substorm occurrence rates and substorm recurrence-time distributions have been examined for observational data from 1979 to 2015 (Borovsky & Yakymenko, 2017)[2]. In this work we revisit the our CA model to compare three different definitions of waiting time (Sanchez, 2002)[3] and analyse the predicting capabilities of our numerical model.

References:

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Session: Space Plasma Physics and Nonlinear processes in Space Geophysics

Oral or Poster: Poster