

Implications of small world sandpile model on seismicity

ABSTRACT

The study of self-organized criticality (SOC) has shown significant progress in deciphering the origin of complexity and scale invariance in various slowly driven, interaction-dominated threshold systems. Cellular automata sandpile models aimed to study SOC and their implications on the statistics of earthquakes, land slides and forest fires usually presume regular and nearest neighbor interactions. We incorporate small-world networks that have been shown to cause important collective dynamics into these models. We find that without disturbing the cliquishness of a typical neighborhood, a small amount of long-range connections modifies the collective behavior of the model systematically. For the sandpile model, higher degree of random long-range connections actually helps to relax the potential of catastrophic events and result in increased values of the exponent for the frequency-size power law and sandpiles with smaller quasi-static sizes. Implications on the reported accelerating seismicity of moderate size earthquakes preceding catastrophic ones are discussed.