

CELLULAR-AUTOMATA MODELS, SOC AND NATURAL HAZARDS

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The concept of self-organized criticality evolved from studies of three simple cellular-automata models: the sand-pile, slider-block, and forest-fire models. In each case, there is a steady input and the loss is associated with a power-law distribution of “avalanches.” Each of the three models can be associated with an important natural hazard: the sand-pile model with landslides, the slider-block model with earthquakes, and the forest-fire model with forest fires. We show that each of the three natural hazards have frequency-size statistics that are well approximated by power-law distributions. The power-law behavior of the natural hazards has important implications for probabilistic hazard assessments. The recurrence interval for a severe event can be estimated by extrapolating the observed frequency-size distribution of small and medium events. We also discuss, besides the universal power-law behavior, whether the cellular automata models are appropriate analogues for each of the natural hazards that they “model.”