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Scale invariance of gravitational failures: A possible alternative to SOC?

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Most gravitational failures, as landslides, turbidites, or rockfalls, exhibit scale invariant size distributions. We recently showed that starting zones of snow avalanches are also power-law distributed.

In order to understand such a scaling for gravity-driven systems, we designed a twothreshold cellular automaton, taking snow avalanches as a model system. The automaton reproduces the scale invariant size distributions observed on such systems, provided some disorder is introduced in failure thresholds.

The exponents characteristic of snow avalanches and of other gravitational failures can be obtained varying a unique physical parameter that represents the anisotropy of failure thresholds.

As the observed and simulated size distributions deal with non-interacting events, the observed scale invariance is not relevant of the Self-Organised Criticality (SOC) concept. The present approach therefore appears as a possible generic model alternative to SOC for gravitational (stress driven) failures.