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Record-Breaking Avalanches in Nonlinear Threshold Systems
ROBERT SHCHERBAKOV, Department of Earth Sciences and Department of Physics and Astronomy, Western University, London, Ontario, Canada — Record-breaking avalanches generated by the dynamics of several driven non-linear threshold models are studied. Such systems are characterized by intermittent behaviour, where slow build-up of energy is punctuated by an abrupt release of energy through avalanche events which usually follow scale invariant statistics. From the simulations of these systems it is possible to extract sequences of record-breaking avalanches, where each subsequent record-breaking event is larger in magnitude than all previous events. In the present work, several cellular automata are analyzed among them the sandpile model, Manna model, Olami-Feder-Christensen (OFC) model, and the forest-fire model to investigate the record-breaking statistics of model avalanches which exhibit temporal and spatial correlations (Shcherbakov et al., PRE 87, 2013, 052811). Several statistical measures of record-breaking events are derived analytically and confirmed through numerical simulations. It is found that the statistics of record-breaking avalanches for the above cellular automata exhibit behaviour different from that observed for i.i.d. random variables which in turn can be used to characterize complex their spatio-temporal dynamics. The most pronounced deviations are observed in the case of the OFC model.

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