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Prediction of Extreme Threshold Crossings

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We investigate the predictability of extreme events in time series. The focus of this work is to understand, in which circumstances large events are better predictable than smaller events. Therefore we use a simple prediction algorithm based on precursory structures which are identified via the maximum likelihood principle. Using theses precursory structures we predict threshold crossings in autocorrelated processes of order one, which are either Gaussian, exponentially or Pareto distributed. Using the receiver operating characteristic as a measure for the quality of predictions we find that the dependence on the event size is closely linked to the probability distribution function of the underlying stochastic process. We evaluate this dependence on the probability distribution function numerically and in the Gaussian case also analytically. Furthermore we study predictions of threshold crossings in correlated data, i. e. , velocity increments of a free jet flow. The velocity increments in the free jet flow are in dependence on the time scale either asymptotically Gaussian or asymptotically exponential distributed. If we assume that the optimal precursory structures are used to make the predictions, we find that large threshold crossings are for all different types of distributions better predictable. These results [1] are in contrast to previous results, obtained for the prediction of large increments [2], which showed a strong dependence on the probability distribution function of the underlying process.

[1] S. H. and H. Kantz, *How Does the Quality of a Prediction Depend on the Magnitude of the Events under Study?*, submitted to Nonlin. Processes Geophys.

[2] S. H. and H. Kantz, *Influence of the Event Magnitude on the Predictability of Extreme Events*, Phys. Rev. E 77, 011108 (2008)