Temporal dependence in extremes with dynamic models

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This paper is concerned with the analysis of time series data with temporal dependence through extreme events. This is achieved via a model formulation that considers separately the central part and the tail of the distributions, using a two component mixture model. Extremes beyond a threshold are assumed to follow a generalized Pareto distribution (GPD). Temporal dependence is induced by allowing to GPD parameters to vary with time. Temporal variation and dependence is introduced at a latent level via dynamic linear models (DLM). The implied temporal changes in the limiting regimes reflect better the data behaviour, with important gains in estimation and interpretation. The central part follows a nonparametric, mixture approach. The uncertainty about the threshold is explicitly considered. Posterior inference is performed through Markov Chain Monte Carlo (MCMC) methods. A variety of scenarios can be entertained and include the possibility of alternation of presence and absence of a finite upper limit of the parent distribution for different time periods. Simulations are carried out in order to analyze the performance of our proposed model. We also apply the proposed model to financial time series: returns of Petrobras stocks and Bovespa index. Results show advantage of our proposal over currently entertained models such as stochastic volatility, with improved estimation of high quantiles and extremes. Joint work with Fernando Ferraz do Nascimento and Hedibert Freitas Lopes.

Keywords: dynamic linear models; extremes; generalized Pareto distribution; time series.