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Predictability of Fat-tailed Extremes

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We conjecture for a linear stochastic differential equation that the predictability of threshold exceedances (I) improves with the event magnitude when the noise is a so-called correlated additive-multiplicative (CAM) noise, no matter the nature of the stochastic innovations, and also improves when (II) the noise is purely additive obeying a distribution that decays fast, i.e. not by a power-law, and (III) deteriorates only when the additive noise distribution follows a power-law. The predictability is measured by a summary index of the receiver operating characteristic (ROC) curve. We provide support to our conjecture, to compliment reports in the existing literature on (II), by a set of case studies. Calculations for the prediction skill are conducted in some cases by a direct numerical time-series-data-driven approach, and in other cases by an analytical or semianalytical approach that we have developed. Our results might be relevant to atmospheric dynamics where CAM noise arises as a result of stochastic parametrization.