

Abstract: We discuss the problem of modeling the joint distribution of duration ( $N$ ), maximum ( $Y$ ) and magnitude ( $X$ ) of stochastic episodes (events). We present models for the exact distribution of the vector  $(N, X, Y)$  for data coming from light and heavy tailed populations. We also discuss a new, easy to implement test for exponential versus Pareto distribution that came about as a "by-product" of parameters' estimation procedures. Modeling potential of these distributions will be illustrated using problems and data from climate, hydrology and finance.