

# Characterization and estimation of the upcrossings index

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**Abstract:** Extreme Value Theory aims to predict occurrence of rare events, which in numerous situations have disastrous impacts, making an adequate estimation of the parameters related with such events of primordial importance in Statistics of Extremes. The extremal index  $\theta \in (0, 1]$  and the upcrossings index  $\eta \in (0, 1]$  play an important role when modelling extreme events. The knowledge of these parameters,  $\theta$  and  $\eta$ , entails in particular the understanding of the way in which exceedances and upcrossings of high levels, respectively, cluster in time. They provide different but complementary information concerning the grouping characteristics of rare events.

We review the most important results concerning the upcrossings index  $\eta$  and then focus on the estimation of this parameter. Several estimators for  $\eta$  will be presented and their properties, namely consistency and asymptotic normality, studied. The performance of these estimators is assessed through simulation studies for a range of different processes and case studies in the fields of environment and finance.

**Keywords:** Upcrossings index, blocks estimators, runs estimators, dependence conditions, consistency and asymptotic normality.

## References

- [1] Ferreira, H. (2006). The upcrossing index and the extremal index. *J. Appl. Prob.*, **43**, 927-937.
- [2] Ferreira, H. (2007). Runs of high values and the upcrossings index for a stationary sequence. In *Proceedings of the 56th Session of the ISI*.
- [3] Martins, A.P. and Sebastião, J. (2017). Methods for estimating the upcrossings index: improvements and comparison. *Statistical Papers*. doi: 10.1007/s00362-017-0876-x
- [4] Sebastião, J., Martins, A.P., Pereira, L. and Ferreira, H., (2010). Clustering of upcrossings of high values. *J. Statist. Plann. Inference*, **140**, 1003-1012.
- [5] Sebastião, J., Martins, A.P., Ferreira, H and Pereira, L., (2013). Estimating the upcrossings index. *Test*. **22**(4), 549-579.