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Non stationary extremes and trends of the whole dataset : examples for very hot and very cold temperatures

T.T.H. Hoang (1), M. Nogaj (2), S. Parey (2) and D. Dacunha-Castelle (1)

(1) Mathématiques, Modélisation Stochastique et Statistique, Université Paris-Sud, Orsay, France, (2) Electricité de France, Recherche & Développement, Chatou, France

sylvie.parey@edf.fr / Fax: 33 1 30 87 71 08 / Phone: 33 1 30 87 76 14

The analysis of extreme events evolution under climate change induces the question of its relationship with the evolution of the mean field : to what extend and in which way does the average field explain the non-stationarity of rare events? We studied the evolution of the mean and variance of the whole data set, and we present the equations directly relating these variations to the extreme parameters. Indeed, depending on different constraints on the whole data set distribution, we find relationships between the trends in the mean and variance, and the location and scale parameters of the Generalized Extreme Value (GEV) distribution of block extremes or the scale parameter of the Generalised Pareto Distribution and the intensity of the Poisson Process for Peacks Over Threshold. This has been applied to long observation series both for hot and cold temperature extremes. An important result is that the evolution of variance has a non negligible impact on the reconstruction of extreme evolution from mean and variance evolution, leading to higher difficulties for cold extremes. Thus, the variance evolution has to be carefully modelled, even under stationary conditions.