EMS Annual Meeting Abstracts Vol. 11, EMS2014-332, 2014 14th EMS / 10th ECAC © Author(s) 2014



Nonstationary return levels for rainfall in Spain

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Trends can already be detected in daily rainfall amount in Spain, and it is thus necessary to take nonstationarity into account when estimating extreme events through return levels. This study aims at introducing, comparing and discussing different approaches used for such computations. All estimations are based on the application of the statistical extreme value theory, and more specifically of the peak over threshold model. The first approach used to deal with nonstationarity is the use of a time-varying threshold defined using quantile regression, as suggested in Roth et al. (2012). Then, a method is proposed to retrieve the return level for all days using only the rainfall information on rainy days. Using this approach, a link is identified in the trends in mean and variance of all rainy days and trends in extremes of these rainy days. This link and the previously defined relation between return levels obtained with rainy days and for all days are used to estimate future return levels based on the stationary return levels of a standardized rainy days time-series and the trends in mean, variance and proportion of rainy days. The comparison is done for spring, fall and winter and shows some significant evolutions for the 20-year return levels expected in 20 years: winter and spring show a decrease while autumn shows a different pattern over Spain with both positive and negative evolutions.

M. Roth, T.A. Buishand, G. Jongbloed, A.M.G. Klein Tank and J.H. van Zanten: A regional peaks over threshold model in a nonstationary climate; Water Resources Research, vol 48, W11533, 2012