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Return Levels of Extreme Rainfall over Extremadura (Spain)

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The study of extreme rainfall is of major interest worldwide as it has important implications for life insurance, civil protection, town and regional planning, civil infrastructure design, and many other human activities. The statistical Extreme Value Theory (EVT) is commonly used by engineers to evaluate the intensity of meteorological extreme events for water resource design and management. These events are evaluated as long return levels (RLs) which correspond to very rare events. EVT has been used to evaluate RLs for Extremadura, in the Southwest of the Iberian Peninsula using both observational (73 stations from Spanish Meteorological Agency, AEMET) and gridded (SPAIN02 database) data at a daily timescale during the period 1961-2010. Extreme events have been considered as exceedances over a defined high threshold (POT methodology) that follows a generalized Pareto Distribution (GPD), whereas their dates of occurrence follow the trajectory of a Poisson process. The calculation of the trends in the occurrence of extreme rainfall events leads to the fitting of a non-stationary Poisson process to the dates of exceedances. Also, this trend is taken into account for the calculation of the return levels together with the trend in the scale parameter of the GPD. The identification of trends can be made either in the parameters of the extreme value distribution or in the mean and variance of the whole series. Then, an analysis has been made to test if the trends in extremes can be explained by the trends in mean and variance of the whole dataset. The results show both, decreases and increases of the RLs, depending on the season. Also, the comparison of the observational data with the gridded ones leads to a good accordance although this get worse for the areas with scarce number of observatories.