Analysis of extreme rainfall events using attributes control charts in temporal rainfall processes

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The impacts of most intense rainfall events on agriculture and insurance industry can be very severe. This research focuses in the analysis of extreme rainfall events throughout the use of attributes control charts, which constitutes a usual tool in Statistical Process Control (SPC) but unusual in climate studios. Here, series of daily precipitations for the years 1931-2009 within a Spanish region are analyzed, based on a new type of attributes control chart that takes into account the autocorrelation between the extreme rainfall events. The aim is to conclude if there exist or not evidence of a change in the extreme rainfall model of the considered series.

After adjusting seasonally the precipitation series and considering the data of the first 30 years, a frequency-based criterion allowed fixing specification limits in order to discriminate between extreme observed rainfall days and normal observed rainfall days. The autocorrelation amongst maximum precipitation is taken into account by a New Binomial Markov Extended Process obtained for each rainfall series. These modelling of the extreme rainfall processes provide a way to generate the attributes control charts for the annual fraction of rainfall extreme days. The extreme rainfall processes along the rest of the years under study can then be monitored by such attributes control charts.

The results of the application of this methodology show evidence of change in the model of extreme rainfall events in some of the analyzed precipitation series. This suggests that the attributes control charts proposed for the analysis of the most intense precipitation events will be of practical interest to agriculture and insurance sectors in next future.