Extreme rainfall analysis based on precipitation events classification in Northern Italy

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Extreme rainfall statistical analysis is constituted by a consolidated family of techniques that allows to study the frequency and the statistical properties of the high-intensity meteorological events. This kind of techniques is well established and comprehends standards approaches like the GEV (Generalized Extreme Value) or TCEV (Two Components Extreme Value) probability distribution fit of the data recorded in a given raingauge on a given location. Regionalization techniques, that are aimed to spatialize the analysis on medium-large regions are also well established and operationally used. In this work a novel procedure is proposed in order to statistically characterize the rainfall extremes in a given region, basing on a "event-based" approach. Given a temporal sequence of continuous rain maps, an "event" is defined as an aggregate, continuous in time and space, of cells whose rainfall height value is above a certain threshold. Basing on this definition it is possible to classify, on a given region and for a given period, a population of events and characterize them with a number of statistics, such as their total volume, maximum spatial extension, duration, average intensity, etc. Thus, the population of events so obtained constitutes the input of a novel extreme values characteriztion technique: given a certain spatial scale, a mobile window analysis is performed and all the events that fall in the window are anlysed from an extreme value point of view. For each window, the extreme annual events are considered: maximum total volume, maximum spatial extension, maximum intensity, maximum duration are all considered for an extreme analysis and the corresponding probability distributions are fitted. The analysis allows in this way to statistically characterize the most intense events and, at the same time, to spatialize these rain characteristics exploring their variability in space. This methodology was employed on rainfall fields obtained by interpolation of the raingauges observation in northern Italy for the period 2006-2015.