STAHY2017-21
STAHY 2017 workshop,
21–22 September 2017, Warsaw, Poland

Space-time analysis of rainfall extremes in Italy: clues from a reconciled dataset

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Like other Mediterranean areas, Italy is prone to the development of events with explosive rainfall intensity, lasting for several hours. The main triggering mechanisms of these events is quite well known but this knowledge still has not helped much in building rainstorm hazard maps compatible with the actual probability of occurrence of these very severe events.
This work aims at assessing the existence of a meaningful population of records deviating from the ordinary definition of extreme rainfall and evaluating the stationarity and spatial distribution of the subset across Italy. To this aim, several sources of data are gathered, for assembling the first comprehensive and updated dataset of extreme rainfall of short duration in Italy. The resulting dataset, referred to as RED, includes the annual maximum rainfalls recorded in 1 to 24 consecutive hours from more than 4500 stations across the country, spanning the period between 1916 and 2014.
Exploratory statistical analyses for providing information on the climatology of extreme rainfall at the national scale are carried out and the stationarity in time of the highest quantiles is analysed by pooling up all the data for each duration together. The cumulative empirical distributions are explored looking for clues of the existence of a class of events with a peculiar statistical behaviour. The analysis of the spatial the distribution of the records exceeding the 1/1000 overall empirical probability shows an interesting spatial clustering. However, once removed the influence of the uneven density of the rain gauge network in time and space, the spatial susceptibility to extraordinary events seems quite uniformly distributed at the country scale. Additional clues derive from spatial statistical analyses undertaken considering sets of geo-morphological parameters, to identify the existence of areas of Italy more prone to the development of explosive rainfall systems.