Geophysical Research Abstracts
Vol. 17, EGU2015-2008, 2015
EGU General Assembly 2015

Spatial and temporal features of heavy rainstorm events in Calabria, Southern Italy

Oreste Giuseppe Terranova (1), Stefano Luigi Gariano (2,3), and Raffaele Greco (1)

(1) Italian National Research Council, Research Institute for Geo-hydrological Protection, Rende (CS), Italy (terranova@irpi.cnr.it), (2) Italian National Research Council, Research Institute for Geo-hydrological Protection, Perugia, (3) Department of Physics and Geology, University of Perugia, Perugia, Italy

Heavy rainstorms often induce flash floods, shallow landslides and debris flows, which cause several damage to manmade infrastructures and loss of lives. The analysis of spatial distribution and temporal features of intense rainfall events is a fundamental step for a better understanding of the phenomena and for its possible prediction.
The present study is an attempt to improve, from a statistical point of view, the understanding at sub-hourly scale of the temporal and spatial structure of intense rainfall events, by examining those that have hit Calabria (Southern Italy) in the years 1998-2008. More in detail, a considerable amount of series with high temporal detail (5 min) related to 155 sites (one rain gauge per less than 100 sq km), were analysed. First, more than 152 thousands rainfall events, separated by at least 6 hours of dry weather, were recognized. Then, less than a third (45,533) were selected, since denoted as erosive. Finally, several heavy rainstorm events (HREs) were chosen by considering the rainfall events recorded simultaneously at different rain gauges, even non-contiguous, within the region. In particular, this further selection was conducted, based on heuristic threshold values of cumulated rainfall ($\geq$ 100 mm), maximum intensity ($\geq$ 50 mm/h), and kinetic energy ($\geq$ 29 MJ/ha). Therefore, 25 distinct HREs, including all the well-known catastrophic geo-hydrological events, were subjected to thorough investigation.
The obtained HREs, automatically classified according to their structure in time, were analysed as regards both spatial and temporal evolution. At this end, the 25 HREs were distinguished as widespread (17) or localized (8), if the affected area is $\geq$ 500 sq km or < 500 sq km, respectively. In particular, the temporal storm structure was described by means of the standardized rainfall profile (rainfall amount vs. duration, in terms on cumulative percentages). Then, a 4-digit binary shape code was adopted to automatically identify the shape of the profile (Terranova and Iaquinta, 2011; Terranova and Gariano, 2014).
HREs have different spatial extents and temporal patterns. A wide spatial extent of the events does not imply damage proportionally high. Generally, a peak at the beginning of the event (thunderstorm-type) characterizes localized events. On the contrary, widespread events present mixed temporal structures with peaks localized in the last half of their duration.
The proposed method improves the knowledge regarding the input of rainfall-runoff watershed models. These models can benefit from design storms, based on the synthesis of recorded rainstorms, having a time structure integrated with the results of the spatial analysis. The notable size of the employed sample, including data with a very detailed time resolution that relate to several rain gauges well distributed throughout the region, gives robustness to the obtained results.

References

O.G. Terranova, and P. Iaquinta.: Temporal properties of rainfall events in Calabria (southern Italy). Nat. Hazards Earth Syst. Sci., 11, 751-757, 2011.
O.G. Terranova, and S.L. Gariano.: Rainstorms able to induce flash floods in a Mediterranean-climate region (Calabria, southern Italy). Nat. Hazards Earth Syst. Sci., 14, 2423-2434, 2014.