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Changing pattern of natural hazards due to extreme hydro-meteorological conditions (Apulia, southern Italy)

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Recent international researches have underlined the evidences of climate changes throughout the world. Among the consequences of climate change, there is the increase in the frequency and magnitude of natural disasters, such as droughts, windstorms, heat waves, landslides, floods and secondary floods (i.e. rapid accumulation or pounding of surface water with very low flow velocity). The Damaging Hydrogeological Events (DHEs) can be defined as the occurrence of one or more simultaneous aforementioned phenomena causing damages.
They represent a serious problem, especially in DHE-prone areas with growing urbanisation. In these areas the increasing frequency of extreme hydrological events could be related to climate variations and/or urban development. The historical analysis of DHEs can support decision making and land-use planning, ultimately reducing natural risks.
The paper proposes a methodology, based on both historical and time series approaches, used for describing the influence of climatic variability on the number of phenomena observed.
The historical approach is finalised to collect phenomenon historical data. The historical flood and landslide data are important for the comprehension of the evolution of a study area and for the estimation of risk scenarios as a basis for civil protection purposes. Phenomenon historical data is useful for expanding the historical period of investigation in order to assess the occurrence trend of DHEs.
The time series approach includes the collection and the statistical analysis of climatic and rainfall data (monthly rainfall, wet days, rainfall intensity, and temperature data together with the annual maximum of short-duration rainfall data, from 1 hour to 5 days), which are also used as a proxy for floods and landslides. The climatic and rainfall data are useful to characterise the climate variations and trends and to roughly assess the effects of these trends on river discharge and on the triggering of landslides. The time series approach is completed by tools to analyse simultaneously all data types.
The methodology was tested considering a selected Italian region (Apulia, southern Italy).
The data were collected in two databases: a damaging hydrogeological event database (1186 landslides and floods since 1918) and a climate database (from 1877; short-duration rainfall from 1921).
A statistically significant decreasing trend of rainfall intensity and an increasing trend of temperature, landslides, and DHEs were observed. A generalised decreasing trend of short-duration rainfall was observed. If there is not an evident relationship between climate variability and the variability of DHE occurrences, the role of anthropogenic modifications (increasing use or misuse of flood- and landslide-prone areas) could be hypothesized to justify the increasing occurrences of floods and landslides..
This study identifies the advantages of a simplifying approach to reduce the intrinsic complexities of the spatial-temporal analysis of climate variability, permitting the simultaneous analysis of the modification of flood and landslide occurrences.