



Influence of climate variability and urban areas on the flood events in Bari (Apulia, southern Italy)

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The Damaging Hydrogeological Events (DHEs) can be defined as the occurrence of one or more simultaneous phenomena, 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), causing damages. They represent a serious problem, especially in DHE-prone areas with growing urbanization, where the infiltration capability is limited by buildings and where the vulnerability is higher than other areas.

The paper proposes a methodology, based on both historical and time series approaches, used for describing the influence of climatic variability and urban development on the number of phenomena observed.

The historical approach is finalised to collect phenomenon historical data, very important for the comprehension of the evolution of a study area. Phenomenon historical data is useful for expanding the historical period of investigation in order to assess the occurrence trend of DHEs. The historical analysis of DHEs can support decision making and land-use planning, ultimately reducing natural risks.

The time series approach includes the collection and the statistical analysis of climatic data (monthly rainfall, wet days, rainfall intensity, and temperature), 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 study of land use variations, with a special emphasis on the urban areas, is important to understand how the modifications occurred in the territory, especially in terms of vulnerability, could influence the occurrence of DHEs. The methodology can be applied simultaneously to floods and landslides and was tested considering the municipality of Bari (southern Italy), particularly affected by flood events.

Since the climate trend (decreasing trend of rainfall and rainfall intensity and an increasing trend of wet days and temperatures) does not show favourable conditions for the increase of the annual number of damaging floods, its trend is increasing. The role of anthropogenic modifications and the mismanagement of risk-prone areas should be considered to justify the increasing occurrences of floods.

A validation of this hypothesis comes from the study of land use modifications, carried out comparing different temporal levels of land use (from 1959 to 2006). The analysis shows, starting from 1959 to 2006, a significant increase in urban areas (of about 50%) on the entire regional territory.

The municipality of Bari, the regional main town, has undergone a remarkable development of its urban areas, from 12.45 Km² in 1959 to 58.82 Km² in 2006. The consequent increased vulnerability of this area has been highlighted during the recent flood event occurred in 2005, which caused six casualties, numerous injuries and damages to roads, buildings, industries, agriculture, livestock and services.

More details on previous results of this research activity were recently published (Polemio, 2010; Polemio and Lonigro, 2012).

References

Polemio M. (2010): Historical floods and a recent extreme rainfall event in the Murgia karstic environment (Southern Italy). *Zeitschrift für Geomorphologie*, 54(2): 195-219.
Polemio M., Lonigro T. (2012): Variabilità climatica e ricorrenza delle calamità idrogeologiche in Puglia. *Geologia dell'Ambiente*, 2/2012: 262-266.