

A multiple approach to support geo-hydrological risk mitigation pursued by the land reclamation authority (Gargano, Apulia)

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The main scope was to provide technological and methodological innovation to the Consorzio di Bonifica Montana del Gargano (CBMG), the land reclamation authority of the Gargano Promontory, to support their responsibilities that ranges from mitigation of hydrogeological risk to water supply, mainly for agricultural purposes. It was pursued by a group of private enterprises, with the CNR-IRPI's Hydrology laboratory support, through the GarganoLab project "Integrated information system for land management, environmental monitoring and emergency alert", funded by the Apulia Region as part of "Living Labs" measures.

The attention was paid to the natural hazards mitigation, due to landslides and floods, particularly catastrophic, as in the most recent flood event, which occurred from 1 to 09/09/2014, and the drought effects.

The Gargano Promontory is widely steep karstic. Due to the high proximity to the sea, it is hit by particularly sudden and extreme meteorological phenomena; with these characteristics the river flow even if infrequent and of short duration, is very often lightning catastrophic.

The idea behind the initiative was to create an integrated system of all useful knowledge to the CMBG mission and integrated into a system, which includes a WEB GIS interface, useful for interrogation, the continuous updating and real time dissemination of news and warnings concerning risky situations. The system integrates the climate networks with gauges installed in critical areas, located on the basis of studies realized by the project landslide risk.

The use of the GIS tool has created the most comprehensive geo-database for the study's area, collecting all the useful information (climate, geology, hydrogeology, monitoring networks, transport infrastructure, vulnerable areas, etc.), and integrating this knowledge with layers arising from previous activities.

A specific layer was proposed and realized concerning all type of works, hydraulic works, aqueducts, embankments, erosion protection, reforestation, dewatering, reclamation, implemented by the CMBG, including at least the geographical location and extent (linear or areal) in order to offer a digital basic tool to manage the works life from the idea, to the realization and maintenance, in which work all relevant data can be contained and updated, including geometric, temporal (relating, for example, to the design, implementation, testing, maintenance and functional recovery) and economic data.

A module provides the collection and statistical analysis of climatic series, available since 1918. Based on these data, constantly updated by gauge data, other modules characterize the drought and assess the exceptionality of the extreme rainfall events that occurred or are expected.

Using the most appropriate statistical indexes, as the Standardized Precipitation Index (SPI), the drought module was equipped with a useful tool to identify dynamically the statistical trends of drought for different time durations, useful to characterize the drought from meteorological, hydrological and agricultural point of view. Estimate the probability distribution functions of extremes on the basis of a dual component approach (TCEV) at all levels of regionalization. Using time series of maximum rainfall from 1 hour to 5 days, it is now possible to assess the rain exceptionality or return period for each Gargano location on the basis of its elevation or to convert real-time short-term rainfall forecasts, drawn up by the national civil protection system, in return period for each location. These information can be very useful to support emergency management, whether due to rain triggering landslides and/or floods.

Another module was based on a geodatabase of catastrophic geo-hydrological events. Historical research of technical documentation through local and national newspapers, national and scientific publications database, was at the core of unpublished database of Gargano catastrophic geo-hydrological events, focusing on landslides and floods, which occurred since 1876. On this basis, the most critical areas were bounded and then thoroughly studied. In this way the location in which new gauges should be installed were selected.