Title: Geomorphological contribution to flash flood hazard evaluation

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Research program

Flash floods are a frequent natural hazard in many parts of Europe, including Italy. Due to the particular orography and climate of the country, they occur in many different settings, from mountain valleys to coastal and inland plains, in volcanic areas, and in semiarid and/or karst environments.

Such floods are of limited areal extent and may occur in small catchments drained by torrential streams feeding alluvial fans (basin/fan systems). They may display highly variable magnitudes due to the size of the basins, the concentration times and extent of possible channel filling. These phenomena induce highly erosive flows and impact forces due to the mix of water, soil, boulders, trees and debris, but they also have a very high rate of aggradation due to the deposition of large particles.

In many areas of Italy and Europe, a wide urbanization occurred in this type of geomorphological settings since the 1960s, which has produced a considerable increase in exposure to such hazards. Moreover, the return period of these events is very high (larger than twenty years) and there is limited awareness of the actual hazard conditions by the local community. In the light of the projected climate change scenarios, in these settings an increased probability of major economic and social impacts is also expected as the century progresses.

Geomorphological analysis may provide significant contribution in flash flood hazard studies.

Proposal for a PhD position

This PhD project will focus on the magnitude evaluation of flash flood events in the stream basins of Southern Apennines by means of a multidisciplinary approach.

The proposed methodology involves the integration of field data, deriving from detailed geological-geomorphological surveys, remote-detected data by the use of laser scanners and drones, and hydrological and hydraulic data. The project will be developed and tested on a case study, selected from a relevant database (more than 500 flash flood events recorded between 1500 and today), which allows the identification of the areas more prone to flash floods in Campania region in the last centuries.

LiDAR and high-resolution aerial photogrammetric surveys from drones, will acquire data to obtain detailed topographic models (DSM and DTM models) of the investigated catchment and its outlet area. They will also be used to define cross sections of the valley floor and the longitudinal profile of the main stream.

The PhD project will benefit of FRA 2020 fundings (P.I. prof. Santangelo in collaboration with Prof. Ascione and Prof. Chirico, Agraria Department). The project title is “Magnitude evaluation of Flash Floods events in torrential basins of the Southern Apennines”. The acquisition and processing of the remote sensing data will be handled in collaboration with Dr. Ermanno Marino at the RESILAB laboratory of the DICEA.