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Catastrophic debris-flows: geological hazard and human influence

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Rainfall-induced landslides are widespread phenomena often affecting urbanized areas and causing intense damages and casualties. The management of the post-event phase requires a fast evaluation of the involved areas and triggering factors. The latter are fundamental to evaluate the stability of the area affected by landslides, in order to facilitate quick and safe activities of the Civil Protection Authorities during the emergency.
On October 1st 2009, a prolonged and intense rainstorm triggered hundreds of landslides (predominantly debris flows) in an area of about 50 km2 in the north-eastern sector of Sicily (Italy). Debris flows swept the highest parts of many villages and passed over the SS114 state highway and the Messina-Catania railway, causing more than 30 fatalities.
This work deals with the geological and hydro-geomorphological studies performed as a part of the post-disaster activities operated in collaboration with Civil Protection Authority, with the aim of examining landslides effects and mechanisms. The data were elaborated into a GIS platform, to evaluate the influence of urbanization on the drainage pattern and were correlated with the lithological and structural framework of the area.
The case study of Giampilieri focuses the attention on the necessity of sustainable land use and reasonable urban management in areas characterized by a high hydrogeological hazard and on the tremendous destructive power of these phenomena, which are capable of causing a large number of victims in such small villages.
Field surveys and stereo-photo geomorphological analysis revealed a significant human influence on determining landslide triggering causes, as well as the final amount of damage. In particular, destruction and injuries in the built-up area of Giampilieri were made even more severe by the main water flow lines made narrower due to building activity and enlargement of the urban area. The area maintains a high degree of hazard: deposits of poorly consolidated debris on steep slopes are still potentially subject to remobilization during rainy periods. Therefore, future management and localization of urban expansion areas should hopefully be based on a detailed geological and geomorphological characterization, pointing to establish the position of potential source areas and the possible evolution of the landslides.