

# ***Interactive comment on “A spatial multicriteria prioritizing approach for geohydrological risk mitigation planning in small and densely urbanized Mediterranean basins” by Guido Paliaga et al.***

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We wish to thank the reviewer for comments and for the proposed changes for improving the paper, but we would like to detail some aspects that maybe do not arise clearly from the manuscript. The manuscript is aiming to give a possible answer to risk mitigation planning in a high-risk area that in the past, recent and not, has been hit by flood events and numerous rains induced shallow landslides, causing casualties and high damage. The more recent one (2014) caused 1 fatality and about 200 mln. € cost. Heavy rain events, characterized by a strong localization, have hit some of the

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small catchments but not others that, in the future, could be affected. Then we faced the problem of comparing the features of several small catchments in order to address risk mitigation strategies and planning in terms of priority between the catchments in a densely populated area. In our experience the risk mitigation works that have been done in the area in the last 30 years have substantially failed or do not completely fulfill the target for two main reasons: the lack in a holistic approach, that is ignoring the catchment scale processes and interactions, and a wide strategy and planning of works. In other words, no adequate planning according to priorities at catchment scale, no adequate approach to the problem itself and high cost after every heavy rain event. Actually, some works are ongoing in some catchment approaching only the hydraulic factor and ignoring the concurrent contribution of debris flow and strong solid transport in streams that occurs in occasion of heavy rain events, saturating the capacity of final stretch culverted streams. Such kind of events happened in the past during the 2010 flood that hit Chiaravagna catchment (one of the studied ones and published by some of the authors), 2011 flood in 5 Terre and Vara valley, 2014 flood in the Veilino, Geirato and Cerusa catchment, both of them included in the performed analysis, and during the 1970 and 1953 again in the Geirato one. The combined effects of heavy rains, morphometric features that determine reduced time of concentration, rain induced shallow landslides and culverted streams in highly anthropogenic modified context, caused devastating effects. Then we focused our attention on natural factors that cause hazard and on the strong anthropogenic modifications that have magnified the hazard effects like the culverting of streams and soil consumption, which is related to the constriction and confining of streambed. (The natural factors parameters are the ones that describe the features of the territory in terms of possible floods and in terms of rains induced shallow landslides: time of concentration, mean slope etc., together with the ones that describe the availability of potentially destabilizing deposits on the slopes.) The identified parameters, in our opinion and experience and after the effects of the cited events, are the ones more suitable for the local conditions. Maybe some of them could be redundant or maybe others could be added, but the approach we propose

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does not change: a methodology to realize of a catchments priority scale to identify the more urgent to act on. In different environmental conditions, different criteria could be more appropriate. A more rigorous approach maybe should have started calibrating the parameters on the effects after heavy rain in different catchments but we would need almost identical events hitting different catchments at the same time that is quite difficult, due even to the strong morphological heterogeneity of the area. Besides the more recent events are strongly localized, then affecting a small catchment but not the neighboring one. Identifying the more critical catchments could allow to design the operative planning of works, after a detailed basin scale analysis. Relating in-homogeneous parameters like natural factors, anthropogenic modifications and social ones, related to the exposure to flood risk, has been done applying the spatial multi-criteria analysis techniques, which are widely used in planning, environmental impact assessment and strategic environmental assessment to compare several choices. The comparing technique is here proposed to realize a classification of the worst conditions.

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