Geophysical Research Abstracts
Vol. 21, EGU2019-17542, 2019
EGU General Assembly 2019

A methodology for characterization of debris flow deposits intended for early emergency response based on Earth-Observation data

Rosaria Ester Musumeci (1), Laura Maria Stancanelli (1), Stefano Lanzoni (2), and Enrico Foti (1)

(1) University of Catania, Department of Civil Engineering and Architecture, Catania, Italy (rmusume@dica.unict.it; lmstanca@dica.unict.it;efoti@dica.unict.it), (2) University of Padua, Department of Civil, Environmental and Architectural Engineering, Padua, Italy (stefano.lanzoni@dicea.unipd.it)

Debris flow events in gullies generate the formation of multiple deposits along the main riverstream, with a consequent increase in the hydraulic susceptibility of the surrounding areas. For the early emergency response a rapid assessment of the debris flow deposit stability and if possible of its resilience (function of the deposit interaction with the river water discharge) is needed. Moreover, considering the fact that debris flow deposits can form in many different locations along the river network, a speedy procedure for effective assessment of stability of debris dam, to be applied over large areas would be particularly useful.
Debris dam assessments are usually carried out adopting indexes, which have been developed considering morphometric or on the physically-based approaches. These indexes are difficult to be applied mainly because they are strongly dependent on the local environmental settings (i.e. channel width and slope) or on quantities that vary significantly during a given event (e.g., the main stream water discharge and the debris flow discharge).
The aim of the present research is to propose a deposit resilience stability index to forecast hazard scenarios at regional scale by using Earth-Observation data, such as aerial photos or satellite images. Considering that the deposit shape is the final result of the interplay between the physical forces that drive debris flow dynamics and deposition, we based this index on the shape characteristics of the debris deposits. In particular, elliptical Fourier descriptor analysis has been applied to study the morphometry of the deposit contours. More symmetrical shapes indicate more stable deposits. The standardizing procedure of the elliptical Fourier coefficients is adopted in order to have a scale-invariant index applicable to both large and small mountain basins. The index proposed has been calibrated on the basis of data provided by a systematic series of flume tests and then evaluated by using aerial pictures of debris flow deposits formed after extreme rainfall events in the Sichuan province, China (Tang et al. 2011, Landslide).
The proposed resilience index allows to take advantage of the possibility given by remote sensing for individuation of the limiting conditions and the deposit resilience status (low/high) as well as the blockage class (no blockage, partial blockage, full blockage).
The resilience index proposed seems to provide robust estimates of the resilience of sediment deposits to erosion by the water flow. In particular, the index appears to appropriately describe the state of different sediment deposits observed at the field scale, occurring under complex environmental conditions with varying channel slope, channel width, sediment size.