Geophysical Research Abstracts
Vol. 13, EGU2011-4293-3, 2011
EGU General Assembly 2011

Analysis of shallow landsliding triggered by extreme precipitation: the October 1, 2009 event in Giampilieri (Sicily)

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The work aims to document and analyze the geomorphic impact of the flash flood event which affected the area of Giampilieri (Sicily) on October 1, 2009. The event was caused by a deep cyclone developed in the Southern part of the Mediterranean basin producing an intense rainstorm over the Ionic sea coast of Sicily, Italy. The analysis of the event suggested that more than 220 mm of rain fell in less than 4 hours with a peak of about 110 mm/hr in 5-minutes. Its probability was estimated as the equivalent of a 1 in 100 year return period. The storm caused forty casualties and significant damage to property, buildings, roads and bridges estimated close to 200 million Euro. The shallow landslides triggered by the precipitation are analyzed by using a model for the prediction of both topographic and climatic control on shallow landslide initiation processes. The model uses a 'quasi-dynamic' wetness index to predict the spatial distribution of soil saturation in response to a rainfall of specified duration.
The model is coupled with a simple scaling GEV model for the assessment of the relationship between rainfall amount and corresponding exceedance probability. This allows to characterize the rainfall predicted to cause instability in each topographic element by duration and frequency of occurrence.
The application of the model to the study area provides a way to identify the relative potential for shallow landsliding as well as to evaluate the quality of the model description of the soil instability process. Modelling results are evaluated against all the surveyed landslides. These were mapped in the field and by using post-event high resolution aerial photographs.
The results indicated that the model reasonably reproduces the observed distribution of landslides, offering specific insight on landsliding susceptibility in hilly and mountainous areas characterized by short and intense storms, like those prevailing in the Alpine and Mediterranean climate.