Geophysical Research Abstracts
Vol. 20, EGU2018-5294, 2018
EGU General Assembly 2018


# Landslide susceptibility assessment at the basin scale for rainfall- and earthquake-triggered shallow slides: dissimilarities and the influence of the study area delineation

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The hydrographic basin is usually referred as the ideal study area to evaluate the landslide susceptibility using statistical methods. However, if the spatial distribution of landslides is strongly heterogeneous within the basin, this can affect the results of landslide susceptibility, generating too optimistic predictive results.
This work focuses over the hydrographic basin of Ribeira Grande (16.52 $km^2$), located in S. Miguel Island (Azores). The landslide inventorying was made through monoscopic analysis of orthophotomaps and systematic and detailed fieldwork performed in 2005 and 2016. A total of 616 shallow translational slides were inventoried in the hydrographic basin. These shallow slides were divided into two groups, depending on the associated triggering mechanism: Group 1, containing 442 slides triggered by rainfall, in different years (landslide historical inventory); and Group 2, containing 174 slides triggered by earthquakes in 2005 (landslide event inventory). Both landslide groups are not distributed uniformly in the study area and concentrate mostly in the upper sector of the hydrographic basin. The upper sector, corresponding roughly to half of the total area of the basin, contains around 90% of landslides belonging to Group 1 and the complete set of landslides belonging to Group 2.
Shallow slides from Group 1 and Group 2 were crossed separately with the same set of landslide predisposing factors (Elevation, Slope, Aspect, Slope Curvature, Topographic Position Index, Insolation, Slope over Area Ratio, Lithology and Land Use) to produce landslide susceptibility models using a simple bivariate statistical method (Information Value). In addition, the landslide susceptibility was also specifically assessed for the upper sector of the hydrographic basin, where most of the slides are concentrated. All susceptibility models were validated and compared using success rates, prediction rates, and Kappa statistics.
The results show that shallow slides triggered by rainfall and earthquakes in the study area have different morphometric characteristics. The former are typically larger in size, whereas the latter occur on steeper and higher slopes. Moreover, it was verified that models produced with Group 1 (rainfall-triggered landslides) are very effective in predicting the spatial location of Group 2 (earthquake-triggered landslides), but the same does not happen in the inverse situation.
Finally, landslide susceptibility models developed with Group 1 and Group 2 for the upper sector of the hydrographic basin, and latter applied to the complete watershed, present more modest predictive results in comparison with those obtain using the complete hydrographic basin to weigh predisposing factors. However, the first reflects more realistically the relationships between landslides and predisposition factors and therefore the real capacity to anticipate the spatial location of future landslides in the study area.