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Probabilistic identification of rockfall source areas: an example from El Hierro island (Canary Island, Spain)

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Rockfalls are the most frequent and dangerous instability phenomena in mountainous areas, causing high economic and social damages. Rockfalls are triggered by complex instability mechanisms and the source areas are controlled by environmental factors like geology, the presence of discontinuities and slope angle. Modeling rockfall phenomena is complex and requires diversified input including parameters controlling the boulders trajectories and the source areas identification.

In the Canary Islands, the steep topography and the geological complexity influence the activation of slope dynamics and the occurrence of slope failures. In particular, rockfalls are very common and they represent a major threat to society, costing lives, disrupting infrastructures and destroying livelihoods. In 2011 the volcanic crisis in El Hierro Island triggered numerous rockfalls that affected the road network causing a great social alarm.

After the recent event, we have attempted to identify rockfall source areas using different approaches including probabilistic modeling. The probabilistic approach applies a combination of multiple statistical models and requires a map of the observed source areas as dependent variable and a set of thematic information as independent variables (e.g., morphometric parameters derived from DTM, lithological information that considers the mechanical behavior of the rocks). For the purpose, we have identified various scenarios selecting different training and validation zones and evaluating for each scenario the associated errors. The maps resulting from the models, provide for the whole El Hierro Island, the probability of a pixel being a source area and can be used as input for the rockfall modeling.

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