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Propagation of landslide inventory errors on data driven landslide susceptibility models

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Research on landslide susceptibility assessment developed recently worldwide has shown that quality and reliability of modelling results are more sensitive to the quality and consistence of the cartographic database than to statistical tools used in the modelling process. Particularly, the quality of the landslide inventory is of crucial importance, because data-driven models used for landside susceptibility evaluation are based on the spatial correlation between past landslide occurrences and a data set of thematic layers representing independent landslide predisposing factors.
Uncertainty within landslide inventorying may be very high and is usually related to: (i) the geological and geomorphological complexity of the study area; (ii) the dominant land use and the rhythm and magnitude of land use change; (iii) the conservation level of landslide evidences (e.g., topography, vegetation, drainage) both in the field and aerial photographs; and (iv) the experience of the geomorphologist(s) that build the landslide inventory.
Traditionally, landslide inventory has been made through aerial-photo interpretation and field work surveying by using standard geomorphological techniques. More recently, the interpretation of detailed geo-referenced digital ortophotomaps (pixel = 0.5 m), combined with the accurate topography, as become an additional analytical tool for landslide identification at the regional scale.
The present study was performed in a test site (256 km2) within Caldas da Rainha County, located in the central part of Portugal. Detailed geo-referenced digital ortophotomaps obtained in 2004 were used to build three different landslide inventories. The landslide inventory #1 was constructed by a single regular trained geomorphologist using photo-interpretation. 408 probable slope movements were identified and geo-referenced by a point marked in the central part of the probable landslide rupture zone.
The landslide inventory #2 was obtained through the examination of landslide inventory #1 by a senior geomorphologist. This second phase of photo and morphologic interpretation (pre-validation) allows the selection of 204 probable slope movements from the first landslide inventory.
The landslide inventory #3 was obtained by the field verification of the total set of probable landslide zones (408 points), and was performed by 6 geomorphologists. This inventory has 193 validated slope movements, and includes 101 “new landslides” that have not been recognized by the ortophotomaps interpretation. Additionally, the field work enabled the cartographic delimitation of the slope movement depletion and accumulation zones, and the definition of landslide type.
Landslide susceptibility was assessed using the three landslide inventories by using a single predictive model (logistic regression) and the same set of landslide predisposing factors to allow comparison of results. Uncertainty associated to landslide inventory errors and their propagation on landslide susceptibility results are evaluated and compared by the computation of success-rate and prediction-rate curves. The error derived from landslide inventorying is quantified by assessing the overlapping degree of susceptible areas obtained from the different prediction models.