Title:	Earthquake induced landslide susceptibilities: increasing model accuracy with machine learning techniques
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Abstract:	Major earthquakes trigger a range of surface and sub-surface processes including devastating landslides, which can range in size from small surface failures to huge, destructive rock avalanches. However, near real time assessment of the coseismic landslide hazards in seismically active regions is limited. In this context, this work devised an integrated techniques combining machine learning and satellite remote sensing that aimed at preparing landslide susceptibility maps (LSM) for any given seismic event. Previous studies have mainly focused on regional assessments of Earthquake Induced Landslides (EQIL) vulnerability, while global analyses are lacking. We therefore constructed a global model for rapid assessment of EQIL using publicly available coseismic inventory. In total, 290,367 landslides from 17 EQIL studies were utilized to develop the global landslide model. Following this, 17 factors (topographic, hydrologic, seismic etc.) relevant to the landslide conditioning in the region were prepared as predictors and dependent variables. From these 17 factors, 10 factors were selected based on the correlation attribute evaluation for further analysis. Among the conditioning factors, positive openness, terrain ruggedness index, slope factors and stream power index are the most important conditioning factors. This work further explores the predictive performance power of different machine learning models in LSM, such as logistic regression (LR), decision trees (DT), random forest (RF) and Artificial Neural Network (ANN). Results of the comparative evaluation of the different models demonstrated that the random forest (RF) outperforms other models, and we chose this for the landslide susceptibility modelling. For training purposes, we utilized the data from 16 locations outside the present study region, while testing was conducted using the datasets from the current study locations. In this way, we performed the landslide susceptibility modelling for each 17 study regions. The RF 9 | Pagemodel showcased robust spatial generalizability, achieving an AUC greater than 86.6% for training data across all landslide inventories. It also demonstrated commendable performance in the test events. The resultant maps depicting landslide susceptibility also align quite well with the real locations of landslides, with most of the landslide areas in each location being in zones of moderate to very high susceptibility, suggesting satisfactory performance of the modelled output. The established RF model could prove valuable in researching susceptibility to earthquake-induced landslides and facilitating emergency response efforts following an earthquake.
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