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# The influence of strong ground motion intensity measures on earthquake induced landslide susceptibility estimates

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Strong ground motion intensity measures, for example Peak Ground Acceleration (PGA) or Peak Ground Velocity (PGV), are important dynamic features, or predictive variables, in most regional earthquake induced landslide susceptibility models. Despite global reliance on these ground motion intensity measures, little work has been done to evaluate how dynamic feature selection, and underlying ground motion models, influence the predictive performance of landslide susceptibility models. Here, we conduct a feature sensitivity analysis, training a suite of 131 comparative logistic regression models on the distribution of landslides from the 2016 Mw 7.8 Kaikōura earthquake on the South Island of New Zealand. This analysis uses a combination of common susceptibility features (e.g., slope, curvature), distance to a surface fault rupture (both a susceptibility and dynamic feature), and 9 ground motion intensity measures (PGA, PGV, Arias Intensity, PSA - Peak Spectral Acceleration at 0.3, 1.0, 3.0, and 10.0 seconds, MMI - Modified Mercalli Intensity, and Duration of Shaking) derived from 4 published ground motion models for the Kaikōura earthquake. Ground motion is highly correlated with distance to a surface fault rupture (a Pearson $R^2$ as high as 0.86). Models trained using both distance to surface fault rupture and a ground motion intensity measure produce high model performance but are overfit to the Kaikōura landslide distribution with negative model coefficients for most ground motion intensity measures. Excluding distance to a surface fault rupture still produces high model performance (less than a 0.04 drop in Model AUC) when including the most predictive ground motion intensity estimates (typically MMI, PSA at a period of 0.3 seconds, PGA, or PGV from the USGS ShakeMap) and results in more explainable, and likely more applicable, model coefficients. Although MMI and PSA at a period of 0.3 seconds (3.3 Hz) appear to be good predictors of the landslide distribution from the Kaikōura earthquake, MMI can be influenced by the availability of felt reports and the frequency of shaking can vary in different earthquakes. PGA and PGV provide acceptable model performance for the Kaikōura landslide distribution and are likely more applicable to other events. Highly variable performance is observed when applying the same ground motion intensity measures from different published ground motion models. The choice of ground motion model may, therefore, introduce a high degree of uncertainty into the landslide susceptibility analysis that remains relatively underappreciated in most studies. Additional recorded strong motion data will likely be required to further improve ground motion models, and thereby landslide susceptibility models, for future events.