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Geostatistical modeling to capture seismic-shaking patterns from earthquake-induced landslides

Luigi Lombardo (1), Haakon Bakka (2), Hakan Tanyas (1), Cees van Westen (1), P. Martin Mai (3), and Raphaël Huser (2)

(1) International Institute for Geo-Information Science and Earth Observation, ESA Department, Enschede, the Netherlands (luigi.lombardo83@gmail.com), (2) King Abdullah University of Science & Technology, CEMSE Division, Thuwal, Saudi Arabia, (3) King Abdullah University of Science & Technology, PSE Division, Thuwal, Saudi Arabia

In this contribution, we investigate earthquake induced landslides using a model that considers the latent spatial effect (LSE), i.e. the spatially-structured residuals in the data, taking aside the information carried through the covariates. Under the assumption that the LSE can retrieve the residual signal belonging to the trigger, we use seismically-induced landslides because for such disasters, data regarding the spatial pattern of the earthquake motion are generally available. We assess the landslide intensity - i.e., the expected number of landslide activations per mapping unit - for a study area in which landslides triggered by the Wenchuan (M 7.9 - May 12, 2008) and Lushan (M 6.6 - April 20, 2013) earthquakes overlap. The choice of an overlapping area aims at testing our method in case of landslide inventories located in the near and far field of the earthquake. Specifically, we generated three different models for each earthquake-induced landslide scenario where we kept constant the morphometric covariate set and varied the configuration by using: *i*) seismic parameters only, *ii*) latent spatial effect only, and *iii*) both seismic and latent spatial effects. This allowed us to compare the pattern in the latent spatial field and assess if it approximates the effects of seismic wave propagation, and to check if the latent spatial field is still capturing some effects that are not explained via the shaking levels, such as topographic amplification. Results show that the LSE is capable of reproducing the shaking patterns in space for both earthquakes with a level of spatial detail even greater than the seismic parameters we compare the LSE against. In addition, LSE was shown to increase the performance compared to conventional models featuring seismic parameters.