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Space-time landslide size modelling in Taiwan

Luigi Lombardo[1], Zhice Fang[2], Yi Wang[2], and Cees van Westen[1]
[1]University of Twente, Faculty of Geo-Information Science and Earth Observation, Applied Earth Sciences, Enschede, Netherlands (l.lombardo@utwente.nl)
[2]Institute of Geophysics and Geomatics, China University of Geosciences, Wuhan 430074, China

Landslide susceptibility assessment using data-driven models has predominantly focused on predicting where landslides may occur and not on how large they might be. The spatio-temporal evaluation of landslide susceptibility has only recently been addressed, as a basis for predicting where and when landslides might occur.

The present study combines these new developments by proposing a data-driven model capable of estimating how large landslides may be, for the Taiwanese territory in a fourteen year time window. To solve this task, our model assumes that landslide sizes follow a Log-Gaussian probability distribution in space and time. Spatially the area is subdivided into 46074 slope units, with 14 annual timesteps from 2004 to 2018. Based on this subdivision, the model we implemented regressed landslide sizes against a covariate set that includes temporally static and dynamic properties. In the validation of our model, we nested a wide range of cross-validation (CV) procedures, such as a randomized 10fold-CV, a spatially constrained CV, a temporal leave-one-year-out CV, and a spatio-temporal CV. The final performance was described both numerically as well as in map form.

Overall, our space-time model achieves interpretable and satisfying results. With the availability of more complete landslide inventories, both temporally and spatially, we envision that spatio-temporal landslide size prediction will become the next challenge for geomorphologists to finally address a fundamental component of the landslide hazard definition. And, because of it's spatio-temporal nature, we also envision that it may lead to landslide simulation studies for varying climate scenarios.