Natural Hazards
and Earth System
Sciences

Open Access

EGU

Discussions

Interactive comment on "Dynamic path dependent landslide susceptibility modelling" *by* Jalal Samia et al.

Ben Mirus (Referee)

bbmirus@usgs.gov

Summary and Assessment:

The authors present an interesting study that builds on their prior work on the "path-dependency" phenomena in landslide occurrence. While the current and previous studies rely on the same multi-temporal landslide inventory from the Collazzone study area, Italy, the current study examines a finer spatial resolution (10x10m as opposed to individual watersheds) and also uses a new metric to quantify the spatio-temporal correlation component (Ripley's K coefficient). The study uses an appropriate split sampling approach to calibrate and validate the different susceptibility models as well as the widely used AUC metric from ROC analysis. This new approach using estab-

lished techniques provides a different result than the prior coarser application, which ultimately supports the importance of time-variable susceptibility models for this site and likely other landslide sites. The results further indicate that while the most complex "conventional plus path dependent" model exhibits the best performance, the "path dependent only" performs better than the "conventional' model despite having far fewer parameters.

Overall, the topic will be of considerable interest to readers of NHESS and the novel methods and contribution are suitable for publication. The manuscript is well written and logically organized. The figures are clear, and referencing is appropriate. I have only a few concrete suggestions for improvement and one general comment. Relatively trivial revisions should be sufficient to address these.

General Comment:

Given the superior performance of the "path dependent only" model over the "conventional" model, it is important to note that at least the spatial part of the path dependent model may not be entirely related to the occurrence of past landslides. Rather this might also be at least partially explained by the generally accepted phenomenon that landslides tend to happen where they have already occurred previously. That is, there could be factors that are not considered in the conventional model that explain the "where" of landslide occurrence better than the terrain attributes considered. For example, soil thickness or hydromechanical properties or climatic and environmental forcing factors that vary independently of topography.

Thus, it is unclear how much the timing of previous landslides is relevant compared to merely the occurrence of past landslides. Perhaps this would be beyond the scope of this study, but it would be very interesting if the authors could somehow separate the spatial and temporal element to see how much of the model improvement is related to "landslides occur here" vs. "a landslide just occurred here" phenomena. This is interesting because it offers the possibility that historic landsliding (without a multi-temporal

dataset) could be used as a variable to improve susceptibility modeling instead of trying to account for the difficult to measure subsurface variables.

These points are worth mentioning in the discussion section to provide further context for the significance of the contribution and possible future directions.

Specific Suggestions:

L214. Here and elsewhere I suggest using the Oxford comma to appropriately distinguish between items in a list. It is used sometimes in the manuscript but not consistently.

L225. Figure 6. What does the color red/green represent?

L270. Figure 7. In the Path dependent only case, there is clearly some red (0.8-1.0) on the map, but the pie chart indicates that 0% are in this class?

L375. There are three models considered, so perhaps edit to: "In both improved models. . ."

L381-387. It could be worth mentioning that precisely this phenomenon was observed at our site near Seattle (Mirus et al., 2017), namely for the same sequence of storm events a previous landslide remobilized multiple times whereas a neighboring hillslope with the same terrain attributes did not fail.