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Comment on nhess-2022-88

Anonymous Referee #1

Referee comment on "Multi-event assessment of typhoon-triggered landslide susceptibility in the Philippines" by Joshua N. Jones et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2022-88-RC1, 2022

General Comments

The authors present updated landslide susceptibility maps for in the Philippines Itogon and Abuan derived from typhoon-triggered landslide inventories. Binary Logistic Regression (BLR) and a Least Absolute Shrinkage and Selection Operator (LASSO) technique for the selection of variables were used to model the susceptibility of this region. Susceptibility models derived from independent and a combination of the 2009 and 2018 events were created in Itogon. A susceptibility model was also derived in Abuan based on a 2019 typhoon event.

Their results present information that emphasizes the importance of utilizing multi-temporal inventories in developing future susceptibility maps to inform land use and hazard zonation policies.

However, there are two significant points that should be considered to improve this manuscript:

First, the results of two different study areas considering 3 events across time that aim to assess a research objective that operates on the hypothesis that the time dependence of typhoon-triggered landslides in a region would be evident in the deterioration of model accuracy.

The results of the Itogon region with events from 2009 and 2018 sufficiently address this research question and provide quantified information on the temporal behavior of landslide susceptibility across time. The analysis of these results should already merit publication.

The inclusion of the results in the 2019 landslides from Abuan deviate from the direction of evaluating time-dependent susceptibility. The comparison of the model in Abuan to Itogon veers towards investigating regional and spatial differences between the sites in which these typhoon-triggered landslide occurred. I would recommend a separate study to focuses on the spatial and not temporal aspect of typhoon-triggered susceptibility be considered for the Abuan results.

Second, the authors could consider referencing an updated Landslide Hazard Atlas of susceptibility maps generated by the University of the Philippines Resilience Institute and the Nationwide Operational Assessment of Hazards (NOAH), available at https://noah.up.edu.ph, rather than the MGB susceptibility maps. The landslide hazard maps are available on a national level and are used in practice for hazard zonation and land use planning. A large section in their discussion could benefit from comparing their results to the NOAH hazard information.

The most important contribution of this study to the community is the quantified deterioration of susceptibility model performance accuracy in Itogon that typhoon-triggered landslides display a degree of dependency across time.

Overall, I recommend that the authors update their hazard information for better context in the discussion and to highlight the improvement of susceptibility information with multi-temporal landslide inventory. I also recommend that the authors contemplate on the exclusion of the 2019 Abuan landslides in this study. The results do not support the research objective's underlying hypothesis to consider the time-dependence of typhoon-triggered landslides.

Specific Comments

L45-50: Consider incorporating the landslide hazard information from the NOAH Landslide Hazard atlas. This information would be beneficial to further realizing the contribution made by this study in Itogon for typhoon-triggered landslides.

M.L. Rabonza, R.P. Felix, A.M.F Lagmay, R.N. Eco, I.J. Ortiz, ang D.K. Aquino (2015). Shallow landslide susceptibility mapping using high-resolution topography for areas devastated by super typhoon Haiyan. Landslides, Volume 13, Issue 1 pp 201-210

Alejandrino, A.M.F. Lagmay and R.N. Eco (2016) Shallow Landslide Hazard Mapping for Davao Oriental, Philippines Using a Deterministic GIS ,Model. In: Communicating Climate Change and Natural Hazard Risk and Cultivating Resilience: Case Studies for a Multidisciplinary Approach Eds. Yekaterina Y. Kontar. Springer, Berlin Germany

Paul Kenneth Luzon, Kristina Montalbo, Jam Galang, Jasmine May Sabado, Carmille Marie Escape, Raquel Felix, and Alfredo Mahar Francisco Lagmay (2016) Hazard mapping related to structurally controlled landslides in Southern Leyte, Philippines. Natural Hazards and Earth System Sciences, 16, 875-883, 2016

L61-63: The concept of spatial and temporal dependence introduced in this section could be strengthened by a connection to the path-dependence of landslides by Temme et al. (2020).

Temme, A., Guzzetti, F., Samia, J., & Mirus, B. B. (2020). The future of landslides' past—A framework for assessing consecutive landsliding systems. *Landslides*, *17*(7), 1519–1528. https://doi.org/10.1007/s10346-020-01405-7

L93: The use of the term time-dependence could pertain susceptibility during typhoon season, or within a sub-seasonal period. I recommend the authors to consider rephrasing this to a path-dependent perspective and connect to the concepts of Temme et al. (2020) and the results of the multi-temporal susceptibility analysis of Samia et al. (2020).

Samia, J., Temme, A., Bregt, A., Wallinga, J., Guzzetti, F., & Ardizzone, F. (2020). Dynamic path-dependent landslide susceptibility modelling. *Natural Hazards and Earth System Sciences*, *20*(1), 271–285. https://doi.org/10.5194/nhess-20-271-2020

L189: Why was the inventory slightly clipped? It also would be worth mentioning a brief qualitative comparison between this inventory 2018 Mangkhut and that of Emberson et al. (2022).

Emberson, R., Kirschbaum, D. B., Amatya, P., Tanyas, H., & Marc, O. (2022). Insights from the topographic characteristics of a large global catalog of rainfall-induced landslide event inventories. *Natural Hazards and Earth System Sciences*, *22*(3), 1129–1149. https://doi.org/10.5194/nhess-22-1129-2022

L371-400: These paragraphs are presented in a way that focuses on events across time, but gives the impression that the 2009, 2018 and 2019 landslides occurred on spatially similar settings or even same site. Splitting the presentation of results into two paragraphs (one for Abuan and one for Itogon) to discuss the separate geographic sites could make it clearer.

L455-473: Is there any insight on the hazard between 2009 and 2018 in Itogon that can be derived from the susceptibility models? Any insight on susceptibility or changes that could’ve caused landslides to occurred with smaller passing tropical cyclones within these

9 years? (Referring as well to insight from Figure 4)

L474-565: Please refer to the Landslide Hazard information from the susceptibility maps of NOAH to provide an updated hazard context for this section of the discussion.

L549-556: These are valid concerns and points of uncertainty raised for the Abuan susceptibility results. Though, the alignment of these results the objectives presented in L93-95 are not clear.

L529-538: While magnitude underestimation is a limitation in the use of satellite-derived rainfall products, another factor worth discussing is the limitation to capture spatial patterns and locate the storm centers when using such products. (See Ozturk et al., 2021)

Ozturk, U., Saito, H., Matsushi, Y., Crisologo, I., & Schwanghart, W. (2021). Can global rainfall estimates (satellite and reanalysis) aid landslide hindcasting? *Landslides*, *18*(9), 3119–3133. https://doi.org/10.1007/s10346-021-01689-3

L590-612: Table 1. Shows that land cover is significant for the 2009 and combined 2009+2018 model. It would worth mentioning the role of land cover change that could have an influence susceptibility over time. Itogon is estimated have had significant tree cover loss between 2010 and 2020 based on: Global Forest Watch, http://globalforestwatch.org.

C. Hansen, P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D.Thau,

S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, J. R. G. Townshend, High-resolution global maps of 21st-century forest cover change. Science 342, 850–853 (2013).

Technical Corrections

L32: ‘>30o’ to $>30^{o}$

Figure 6. Consider using ‘performance’ rather than ‘success’

Figure 7. Consider using ‘performance’ rather than ‘success’