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# Comment on nhess-2022-76

Anonymous Referee #1

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Referee comment on "Landslide susceptibility assessment in the rocky coast subsystem of Essaouira, Morocco" by Abdellah Khouz et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2022-76-RC1, 2022

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Dear Editor,

The paper entitled "Landslide susceptibility assessment in rocky coast subsystem of Essaouira coastal area – Morocco" by Abdellah Khouz and co-authors is a timely study that quantitatively assesses landslide susceptibility on a coastal area, through a bivariate statistical method - Information Value. The landslide susceptibility was evaluated in Essaouira coastal area, considering both a pixel based-, and an elementary terrain units' approach. The authors used a set of 22 conditioning factors and a landslide inventory record with 588 events, of which 70% were used for training and 30% for validation purposes. The accuracy and prediction capacity of the models were assessed by ROC curves and the Area Under the Curve.

General comments:
The paper presents a good database, based on diverse sources, and a considerable amount of work has been done, including field work, which is valuable. Although the method used in this work (Information Value) is not novel, the work is innovative in the area, combining a wide range of data.
The strength of the paper is the analysis of the landslide susceptibility on a coastal area, integrating an interesting number of conditioning factors and a large landslides database, allowing to perform a comparative analysis based on elementary terrain units and pixel-based approaches. The work is original and valuable. The approach consists of a good statistical analysis, which may be of interest for the scientific community.
However, some aspects deserve to be more/better discussed in the text. Additionally, the paper needs a revision of the English. You should be more careful with phrase construction. Sometimes sentences start with lowercase. Sometimes, the sentences end with a comma and starts a new sentence after the comma. A deep revision by the senior co-authors certainly could help to improve. Some figures are not of good quality, i.e., are not readable and this has to be considered.

Thus, the paper deserves publication in Natural Hazards and Earth System Sciences, after

considering the following issues.

**Specific comments:**

a) Minor comment: in line 43 you refer to "pressure". What kind of pressure? Urban pressure?

b) Regarding the landslide inventory and the training and validation groups. How were selected the two groups? Randomly? Selected according to any specific criteria? Please state in the methods.

c) Why did you use 70% of the inventory and 30% for the validation? Why not 50% for each? You should state in the methods section why did you use these percentages?

d) The most frequent phenomena are rockfall (149 events). However, translational and rotational slides occupy 85% of the unstable area, mainly occurring in the southern section, where they have higher weight on landslide susceptibility. Is there a higher landslide susceptibility in the southern section because of a higher number of these landslide events or is it because of the area of each landslide, thus performing higher susceptibility?

e) L. 284-286: You state that slope angle does not have the same importance for all types of landslides in your study area. (This would be better stated and discussed in results and discussion section).
Can you state why? Is it only because different types of landslides require different factors and different weight of each factor? Or is it because in your study area, are there other important factors also contributing for slope instability?

f) You also mention that slope angle is one of the most influent factors (lines 481-482). However, table S1 shows that some types of landslides do not fit in this assumption. What does contribute for the low IV score for the highest slope classes (> 35º) for models 10-13, and 15? In the case of rock topple, slopes >15º have negative scores. This should be discussed.

g) In table 5 you have the same percentage of landslide susceptibility for translational and shallow translational landslides. What is the explanation? Is it an error or are you assuming all translational landslides as shallow translational?

h) You state that the precipitation is not a “decisive conditioning factor” (L. 588). From a pure statistical point of view, it is true. The reason why you don’t see great differences may be because you are using annual average values of precipitation. However, in drier areas, rainfall intensity may be more important than the annual average amount. Since precipitation is an important triggering factor, it would be expected an increase of landslide events during the rainy season. Didn’t you find any variation? Considering precipitation is not a permanent factor as the others, is it proper to treat it as a conditioning factor based on its (low) annual average?

i) In L. 549-550, you found that eliminating precipitation and TWI of your analysis you get better results (Fig. 11). This is statistically valid. However, considering that this is a dry climate, the effect of humidity and precipitation, when they occur, may be very important for slope instability, but your analysis cannot identify it. It would be important to discuss the limitations of this statistical analysis.

j) Given your results and considering the two approaches (Pixel-based and ETU) used in this work, which is the most suitable one for representing the landslide susceptibility in the area?
Since ETU are defined based on the morphometry of the area, there is a more “guided” analysis in this approach, comparing with pixel-based that is more “random”, some differences between both modelling should be expected.
However, in L. 594, you conclude that both ETU and pixel analyses have similar behaviour. What is causing or contributing to this similarity? The reasons for these similarities and the differences between both approaches should be better discussed in the text.

k) One limitation of this bivariate statistical method is that it does not consider possible correlations between variables. This limitation and its impact on possible high scores should be discussed.

l) Another, and very important, drawback of this method is that it uses a part of the landslide inventory to model the susceptibility. Considering this, the validation is not done with the whole inventory, and the landslide dimensions may bias the IV scores. It would be important to discuss this in the text. How do these drawbacks may influence the final results?

**FIGURES:**
Figure 3: You jumped from C to E and forgot D.

Figure 6: This figure is very low. Please make the fond size readable. The legend and the vertical scale are not readable.

**Technical issues:**
Some issues were found, especially in phrase construction, and the connection between sentences is not always clear. Sometimes it is difficult for the reader to understand your ideas. Please revise your writing.
A brief list of issues below:

L. 125-129: Big paragraph, with several sentences separated by semi-colon. Consider rephrasing in shorter and clear sentences.

L. 130-135: you have two sentences starting after a comma, instead a full stop:
- L. 131: "(…) Dufaud et al. 1966, Its existence…"
- L. 132: "(…) Weisrock 1980), It consists (...)" - substitute "," by "."

L. 148: you could delete "of the replay"

L. 195-199: "According to the rainfall data, which were made available…". You stopped this sentence without finishing your idea. Then in L. 196 you end a sentence with a comma and then start a new sentence.
Be very careful with this. You have many examples like this.
This becomes confusing.

L. 202-203: Please, show the maximum and minimum values (mm) of precipitation

L. 223: In the end of the line "… (Mennani, 2001), It…" – again you end a sentence with a comma.

L. 225-231: A big sentence that could be divided in two, starting in line 228 "For this reason…".

L. 284: You start again a sentence after a comma. "… (Epifânio, et al. 2013), Slope angle…".

L. 292: "… nouthern part…". Do you mean "northern section", "northern area"?
You often use in the text the terms northern and southern part. Consider using "section"

or “area”…instead of “part”. It is more correct from a geographical point of view.

L. 342: Consider substituting "than" by "then".

L. 412-413: Like it is written, it does not make much sense.
Do you mean "... Calcareous crusting and Essaouira sandstone-calcarenite are the two lithological formations most found in the majority of ETU...”?

L. 435: that’s – please, avoid word contractions.

L. 452-453: Please revise the sentence. As it is does not make much sense.
Do you mean this? - "These considerably affect the mechanical processes that lead to slope failure and to the subsequent post-failure movements, especially where there are marls or clays."

L. 496-497: Or "as they usually happened next..." or "as they are usually next..."

L. 540-545: There is a huge number of commas.
"Tab. 6 shows..." should start as a new sentence.
"...AUC values. Model 1..." Model 1 should also start as a new sentence.

L. 575-578: Please revise the text.

L. 579: Substitute “it’s” by “its”.