Dear editor

The paper by Abdellah Khouz and co-authors, “Landslide susceptibility assessment in rocky coast subsystem of Essaouira - Morocco” focuses on the quantitative assessment and mapping of landslide susceptibility in a coastal area, using the bivariate Information Value statistical method. Were used pixel based and elementary terrain unit approaches, a 588 landslides inventory, a set of 22 landslide conditioning factors. The inventory was partitioned in a 70% training set and a 30% validation set, and modeling results were validated with ROC curves and the corresponding AUCs.

In spite of several issues, the paper contains a certain degree of innovation and deserves to be published after a major revision process.

General comments:

The theme of sea cliff and coastal areas landslide susceptibility and hazard assessment has received very little attention by the research community, despite its relevance in terms of hazard prevention and sustainable land use planning and management. In consequence, the submission of the paper is very welcomed and contains some innovation and interesting results.

The study made included a considerable amount of work to gather the required information, namely for landslide inventory and acquisition of field-based data, on the large number of landslide conditioning factors considered, and also on the extensive modeling made.
However, the paper suffers from various issues which, without detracting its interest and merits, will require substantial revision by the authors.

The manuscript needs a careful English revision for spelling and phrase construction.

The manuscript references suffer from a heavy bias toward in land landslide studies (more than 40 references) while those on sea cliffs are only 13. This problem must be solved because many very important sea cliff studies are missing and are relevant for the topic of the paper. Some suggestions are made along the comments.

There is a lack of clarity on the study area: it is referred in several parts of the paper that study focus on the coastal area, but in Line 107 is stated that the focus is on landslides at the sea cliffs. Later, in lines 113 and 114 and Fig. 1, the coastal subsystems include sandy coast, rocky coast, and anthropic coast. The rocky coast corresponds to sea cliffs or includes sections of low height rocky coast, with no well-defined cliff. It is important to clarify and to use uniform designations along the paper.

The rainfall data would be better expressed with the inclusion of graphs instead of descriptive and incomplete data.

The aerial photographs and satellite images area coverage for the landslides inventory construction should be included in table 1. This is important because any inventory is incomplete by its own nature and depends heavily on the database available. It is also important to clarify that the inventory is of the historical type, with no past date of occurrence limits, and it is also useful to point out its limitations.

In the modeling, 70% of the inventory were used as training set and the other 30% as validation set – explain why those values were used. The validation process is also a matter of debate in the discussion part of the paper.

In the various model results classification why were used the IV values instead of a classification based on the ROC curve results, with limits of unstable areas of, for example 50%, 65%, 80%, 95% of the correctly predicted unstable terrain units.

Although involves some additional work, it would be useful to have the AUC of the ROC curve of each individual factor, at least for all types of movements, to enable the assessment of the more important susceptibility predisposing factors, which could be improved in further studies, in order to obtain better models.
In the paper is missing a discussion of the results obtained and a comparison with other studies of the same type carried out in other coastal cliffs.

One other aspect to address is the validation method: using one part of the inventory to build the model and the other part for validation is a statistically sound method of validation, but it only indicates that the landslide inventory is robust enough and that the inventory partitions are representative samples of the total inventory and have similar relations with the landslides predisposing factors. However, as showed in Queiroz and Marques (2019) a temporal partition of a cliff failure inventory (1947-1980 and 1980-2012) led to very high success ROC AUC values, but to poor prediction rates, which raises fundamental doubts for the true prediction of future evolution behavior of sea cliffs based on its past evolution (as in Guilham et al., 2018). It is the reviewer opinion that this matter should also be subject of discussion and a subject for future work.

Detail comments:


L 44 – In the reference it is suggested to ad “e.g. Marques, 2009” but also other relevant references as Teixeira (2006, 2014), Moore and Davis (2015), Gilham et al., (2018) among others.

L 60-62 – The landslide predisposing factors which have been used in published studies are listed along specific cliff factors as the cliff toe protections. This requires some separation, due to the specific context of sea cliffs and also because it was found that the factor is relevant in these studies (Marques et al., 2011, 2013; Marques, 2018, Guilham et al., 2018, Letortu et al., 2019, Queiroz and Marques, 2019).

L 71 – For sea cliff susceptibility, the terrain unit discussion and one solution were presented in Marques et al. (2011, 2013), which were published before Epifâneo et al. (2014).

L 95 – The phrase seems out of context.

L 121-129 – Rewrite and clarify the setting of the study area and be more specific on the
geological structure et relations with geomorphology.

L 130-166 – The text chaotic and requires clarification, a deep reformulation, and the use of shorter periods.

L 143 – extensional instead of distensional; NNE-SW ??? correct.

L 144 – What is the second direction – only one was indicated above.

L 216 – 231 – The hydrogeological information is relevant for the sea cliffs evolution?

L 246 - 247 – What was the threshold percentage of unstable area in each terrain unit to be considered unstable.

L 295 – 296 – phrase seems incomplete.


Table 2 – Replace “limstone” by limestone.

Figure 5 – Replace the pie plots by bar or column plots.

L 417 – What is “limestone barre”? Clarify.

L 528 – Clarify “the respective average of the unstable area, are located more to the souths of study area.”
Suggested References:


