

Response on Interactive comment on “Landslide susceptibility mapping by using GIS along the China–Pakistan economic corridor (Karakoram Highway), Pakistan” by Sajid Ali et al.

Sajid Ali

First, we would like to thank you for evaluation and highlighting the deficiencies in the manuscript. It is indeed valuable addition and help us to improve our manuscript. Please find below our response to Referee’s comments.

Comment: Generally, the issue considered in the manuscript is very important to Earth sciences community and could be publish in Earth System Sciences. However, the manuscript does not have the high scientific level presented by the journal.

The issue considered in the manuscript has been deeply discussed for decades, with many papers, methodologies and case studies. New works are more than welcome as long as they contribute something new to Earth science community, which may be new approaches, new case studies, and of course an improvement over the methods already published. Unfortunately this paper, even if engaging, doesn't offer anything new.

Here goes the list of critical shortcomings:

Generally, WOL method presented in this study was firstly presented in 1994 in work:

Bonham-Carter, G.F., 1994. Geographic information systems for geoscientists: modelling with GIS. Pegamon Press, Oxford.

Since this time a lot of improvements, strategies, combination, comparison with other techniques have been presented in scientific community, the method is not new. Please check this papers with novelties in similar methodologies:

- Yalcin, A. (2008). GIS-based landslide susceptibility mapping using analytical hierarchy process and bivariate statistics in Ardesen (Turkey): comparisons of results and confirmations. *Catena*, 72(1), 1-12
- Althuwaynee, O. F., Pradhan, B., Park, H. J., & Lee, J. H. (2014). A novel ensemble bivariate statistical evidential belief function with knowledge based analytical hierarchy process and multivariate statistical logistic regression for landslide susceptibility mapping. *Catena*, 114, 21-36.
- Pawluszek, K. & Borkowski, A. *Nat Hazards* (2017) 86: 919. doi:10.1007/s11069-016-2725-y
- Ahmed, B., & Dewan, A. (2017). Application of Bivariate and Multivariate Statistical Techniques in Landslide Susceptibility Modeling in Chittagong City Corporation, Bangladesh. *Remote Sensing*, 9(4), 304.

Response: The Karakoram Highway is an important physical connection between Pakistan and China and is the talk of the town these days due to its inclusion in China Pakistan Economic Corridor.

This contribution on above subject along this particular highway is first of its kind. In addition to it, diverse geology, seismology, tectonics, climate and geomorphology along the highway makes it unique.

We used landslide data of different periods (1982-82, 1996-2000, 2014-16) and then considered almost all aspects (Geomorphology, Geology, Seismology, Weather), which can contribute to slope failures.

Lastly, as recommended by first Referee, we will include a case study in our discussion chapter.

According to us, it will be an important contribution to this special issue “Landslide–transport network interactions”.

Additional drawbacks:

Introduction

Comment: nothing was said about machine learning methods to assess landslide susceptibility

Response: We are not using any machine learning techniques.

Comment: generally introduction section should be rewritten in order to give more flow. - author started the introduction with describing the study area, the importance of the landslide hazard over there and the overview of the landslide susceptibility method without clear paragraph where the objective of the study is described (usually in the end of the introduction section).

Response: We will include objectives and more references.

General situation of the study area

Comment: Based on the information provided in this section (“Weather condition along KKH are not uniform and are characterized by a wide range of annual mean temperatures and precipitation”) it seems that study area cover a lot of square kilometers, this information is not provided in the manuscript.

Response: We already mentioned its 840 km long highway, but we can also mention area of the susceptibility map.

Comment: I will encourage you to combine section 3 and 4 with the section 2 Study area and then create subsection general setting, geological setting, seismological setting etc.

Response: We have made these sections to facilitate the reader.

Comment: **Subsection D- hydrology.** Where is the image of this factor? What exactly has been used as hydrological factor? Proximity to the river? Precipitation? It is not clearly specified and it is not showed as a figure.

Response: We have used rainfall intensity. Figure 4 is showing different weather conditions along the highway.

Comment: I encourage you to create a table with all controlling parameter/ layers, which was used for the analysis with one column where the source of the data will be presented, number of classes, weights etc.

Response: We will include this.

Comment: Evaluation. It is written “According to the obtained results, most of the landslide events were found in high and very high susceptibility zone.....” You didn’t provide the number in the text and in table 4 there is no 4 susceptibility classes but 10 stability zones and landslide density over this zones. It is difficult to evaluate this map because of the heterogeneity.

Response: We will indicate absolute values of area and observed landslides as proposed by first Referee.

Comment: There is no information how many landslide was used to create the model, how many landslide to validate the model ? How man percentage?

Response: We used 72 random landslides from whole inventory to validate the map. The addition of a separate inventory map indicating all slope failures (rock-fall, debris slide) will resolve the problem.

Comment: Line 9 “However, in our area these parameters seem to have a reduced influence on landslide occurrence” Based on what you are able to say this?

Response: Based on statistical analysis, we were able to say.

Comment: English should be increased. For instance word geomorphologic or geomorphological is used interchangeably

Response: We will request our colleague who is native English speaker for proof reading.

Comment: Weighted Overlay Method. Even when it is simple “*Weighted Sum*” tool in ArcGIS, some equations to this method are needed. Moreover, the references to this method are missing

Response: We will add references.

Comment: The rule how author classify the final weighed sum into 4 susceptibility zones is missing.

Response: We will explain it.

Figures:

Comment: Figure 6 Why spatial analysis of controlling factors have been made only for 6 layers not for all controlling parameters which were used? For instance, it will be good to see the how many landslide fall into the specific seismicity zone, land cover zone, hydrology etc. This part is missing.

Response: We will add it.

Comment: Figure 4 - no scale

Response: We will insert it.

Comment: Figure 5 - it will be nice to see on this detailed geology overlaid with the KKH road

Response: We will overlay the highway.

Comment: Figure 7 and 8 legend for KKH road.

Response: We will add legend for KKH.