

Dear Editor in Chief

We are pleased to submit a revised manuscript entitled *Efficacy of using Radar Induced Factors in Landslide Susceptibility Analysis: case study of Koslanda, Sri Lanka* for publication in the Journal of Natural Hazards and Earth System Sciences. A revised copy of the manuscript is provided with changes to the manuscript requested by the reviewers indicated in the attached document, together with detailed responses to the reviewers' comments.

Yours Sincerely

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## **Responses to reviewer comments on the paper " Efficacy of using Radar Induced Factors in Landslide Susceptibility Analysis: case study of Koslanda, Sri Lanka"**

We wish to thank all reviewers for their constructive comments. All reviewers felt that the paper has to be well organized and the introduction part should be reduced by moving some parts to the methodology. Specifically, all reviewers felt that the description of the study area should make as little larger with comprising additional information about the geology and the typology of the landslides. Further they have commented on the rewriting of the abstract and the conclusions according to the conducted research work. All reviewers stated on the inclusion of colour figures as they are more appeal. Consequently, the paper is rearranged with the rewritten abstract, reduced introduction, properly arranged methodology, and study area. Results and Discussion were separated and Conclusions changed accordingly. All the figures were inserted with the colour by preserving the colour blindness using colour scales. The details of these changes are provided below, along with responses to the other more minor comments.

In the following, the comments of the reviewers are shown in italics and our responses indented in normal text. References to the edited lines are according to those found in the revised manuscript, unless specifically referred to in the original manuscript.

### **Response to Short Comment #1.**

*The manuscript shows the comparison among different approaches (bivariate/multivariate analyses) using different sets of data (classic/classic + radar data) to produce a landslide susceptibility map of an area located in Sri Lanka. The work in general seems appropriate for the journal but it is not very well organized. In the paper a reader would expect to read: 1) a comprehensive introduction with proper literature, 2) a detailed description of the study area and its problematic in terms natural hazard; 3) a description of the adopted methodology; 4) the presentation of the results, 5) a discussion of the obtained results; 6) final remarks. I think the manuscript contains some of these issues but not well organized.*

- \* *The introduction session is very long with respect to the rest of the paper.*

The introduction part made improved by reducing the extra information where unnecessary. Deleted the Lines, page 2 lines 3-5, lines 10-12, line 22, and lines 28-29.

Further, as commented, part of the statistical methods for landslide susceptibility analysis moved to the methodology part. (page 3 lines 17-33 and page 4 lines 1-2 to page 9 lines 22-30, page 10 lines 14-24).

- \* *The authors should add some background knowledge about the use of remote sensing data and inparticular of radar data to infer topographical, soil and land cover information.*

Use of radar remote sensing for topographical information is added in page 6 lines 19-23, for soil information in page 8 lines 3-4, and for land cover information in page 8 line 30 -page 9 line1.

- \* *The literature review part in the first part of the Introduction needs to be improved. The second part (Statistical methods for landslide susceptibility analysis) should be reduced and part of it should be moved in to the methodology description.*

The introduction part made improved by reducing the extra information where unnecessary. Deleted the Lines, page 2 lines 3-5, lines 10-12, line 22, and lines 28-29.

Further, as commented, part of the statistical methods for landslide susceptibility analysis moved to the methodology part. (page 3 lines 17-33 and page 4 lines 1-2 to page 9 lines 22-30, page 10 lines 14-24).

- \* *The description of the study area is very short. Please add some information about the geology of the study area and about the typology of the landslides which affect the study area.*

Geological information about the study area is inserted. (page 4 line 31 -page 5 line 4)

Typology of the landslides of the particular area is inserted. (page 4 lines 22 – 24)

\* *The section “Data and methodology” is actually a list of the data available. There is nothing about the bivariate or multivariate methods. I suggest to show a map for each considered predisposing factor.*

Data and Methodology section is separated, while improving the methodology part. (page 9 line 20 – page 11 line 3).

Statistical analysis of bivariate and multivariate methods are inserted in to the manuscript. (page 9 line 22 – page 11 line 3).

When considering the guide lines of the preparation of manuscript, even though the individual figures from fifteen predisposing factors are really significant, it is difficult to add them to the manuscript. Hence, all the fifteen predisposing factors in colour figures were added as supplementary materials (Sup 1-3).

\* *Some factors need for a more accurate description, for example you need to describe the geology of the study area (Geological factors), in this paragraph information about the geology of the study area and the used classes totally lack.*

The geological information of the study area is inserted in to the manuscript. (page 4 line 31 – page 5 line 4). Further, some more geological information and used classes are included under the Geological factors. (page 9 lines 14 – 15)

\* *How do you decide the weight of influence of all predisposing factors?*

The details of the relative weight calculation in bivariate, information value method (page 10 lines 4 – 12) and multivariate, MCDA based on AHP is inserted in to the manuscript (page 10 line 17 – page 11 line 3).

\* *I suggest to split the results from the discussion. In the results section you need to present the landslide susceptibility maps and to explain their significance in terms of predisposing factors. In the discussion you can compare all the obtained maps highlighting advantages, drawbacks and limitation.*

Splitted the Discussion part from the Results and described accordingly (page 11 line 18).

In the results section, four colour landslide susceptibility maps are inserted in to the manuscript by preserving the colour blindness. (Figure 4)

- \* *Figure 1: I think that a colour figure can have more appeal, the same for figure 3.*

All the figures were inserted in to the manuscript with the colour by preserving the colour blindness using colour scales. (Figure 1, 2, & 4)

### **Minor issues**

- \* *Page 1 Line 23: I think that you mean 90% and not 09%*

According to the literature by Chalkias et al., 2014, Landslides from all natural hazards are 9% not 90%.

- \* *Page 2 Line 11: Earth and not earth*

When reducing the Introduction part by removing the unnecessary information, particular line has been deleted.

- \* *Page 2 Line 33: delete “employed”*

Corrected. (page 2 line 33)

- \* *Page 4 Line 24: “act as a sponge” does not sound really scientific*

Inserted the word “act as a highly absorbing entity” instead of “act as a sponge” (page 4 lines 29-30)

- \* *Page 5 line 5: how much is the DEM resolution?*

DEM resolution is added in to the manuscript. (page 5 line 15)

- \* *Page 7 line 6: what does “Thermal-NDVI space” mean?*

There is a unique relationship between Soil moisture, NDVI, and Land Surface Temperature for a given region. This relationship is described as the “Universal Triangle” and results were confirmed by the theoretical studies using soil-vegetation-atmosphere-transfer (SVAT) model (Wang and Qu, 2009, Zenga et al., 2004).

\* *Page 9 Line 2: How do you extracted the lineaments from Landsat and Sentinel 2 images? Are you sure that joints and fractures can be observed with the resolution of Landsat and Sentinel?*

This study only used 10m resolution Sentinel-2A image (not Landsat) for the Lineament extraction of the study area. Most recent studies as Kati et al., 2018 and Adiri et al., 2017 confirmed the use of 10m resolution Sentinel 1 and 2A images for lineament extractions.

\* *Several references are not reported in the reference list: (van Vesten 1997; Somaratne, 2016; Rahman et al., 2008; Septiadi and Nasution 2009; Zhan et al., 2002)*

Missed references are added to the reference list.