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Natural Hazards and Earth System Sciences
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Discussions

NHESSD

1, C2985–C2991, 2014

Interactive Comment

Interactive comment on "An assessment of landslide distribution in the Faifa area, Saudi Arabia, using remote sensing and GIS techniques" *by* T. Alharbi et al.

T. Alharbi et al.

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I would like to thank Dr. Lanorte for his thorough review and for his comments, suggestions, and inquiries. The issues raised by Dr. Lanorte are straightforward, minor, and were all addressed in accordance with his suggestion.

Reviewer's Comment: 1) Modify debris flow (debris flow within ephemeral valleys, overland debris flows) Hazard maps to reflect danger levels for each pixel instead of classifying the pixels as being prone or not prone to debris flow.

Authors' Response: We did. In response to the suggestion/request made by Dr.

Lanorte, figure 5 and 6 were modified to reflect differences in hazard levels as a function of the distance from the regression line within areas previously identified on figure 5 as being prone to debris flow. Inspection of figure 5 shows that as slope values increase and/or NDVI values decrease, points become progressively separated from the regression line. Thus, the larger the separation of a point from the regression line, the greater the hazard level. A similar procedure was adopted to classify hazard levels associated with overland debris flows; figures 8 and 9 were refined accordingly.

Reviewer's Comment: 2) Provide comparisons between predicted and observed landslides for areas that are classified as being non-prone to landslide development.

Authors' Response: We did. Comparisons between the distribution of a subset of random areas identified as being non-prone to debris flow within ephemeral valleys and the observed debris flows in the field and from Google Earth yielded a success rate of 99.2%. Similar analysis for areas identified as being non-prone to overland debris flow yielded a success rate of 99.3%.

Reviewer's Comment: 3) Clarify why the upslope contributing area is not considered for optimal prediction of debris flows as is the case with other studies for elsewhere.

Authors' Response: We did. Upslope contributing area was considered in the prediction of the debris flows within ephemeral valleys. Areas susceptible to the development of debris flow had to meet a number of conditions: low NDVI, high slope angle, and located along mapped stream lines and off areas mapped as terraces. In defining the stream lines a threshold contributing area of 25 pixels (area 2500 m2) was required. In the revised text, we further clarified the notion that upslope contributing area was considered in our analysis.

Reviewer's Comment: 4) Assign a title more appropriate to the manuscript because it is more about landslide hazard rather than landslide distribution.

Authors' Response: We did. The title was modified in accordance with suggestions

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made by the reviewer: “An assessment of landslide hazards in the Faifa area, Saudi Arabia, using remote sensing and GIS techniques”

Reviewer’s Comment: Provide the date(s) for the acquisition of the satellite imagery.

Authors’ Response: We did. The Google Earth images were acquired on April 2010.

The final revised version of manuscript will be submitted to the editorial office as soon as the remaining comments are received.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 6685, 2013.

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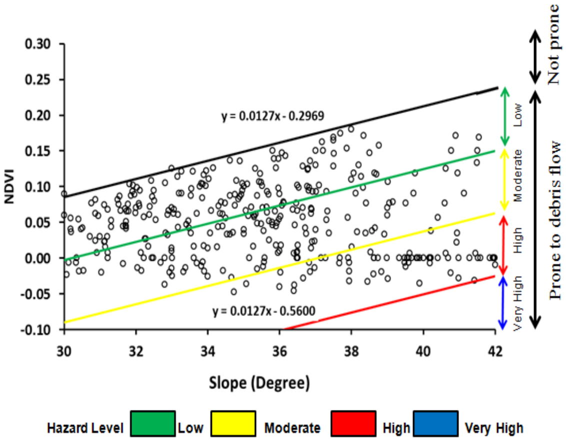

Revised Fig. 5 in text. Extraction of a relationship between the NDVI and the slope values for the debris flows within ephemeral streams that were verified in the field and/or by examination of Google Earth images. A linear regression was used to identify the equation of a straight line that separates points prone to landslide (below line) from others that are not prone to debris flows (above line). Figure also shows hazard levels as a function of the distance from the regression line; in areas prone to debris flows, the larger the separation of a point from the regression line, the greater the hazard level.

Fig. 1.

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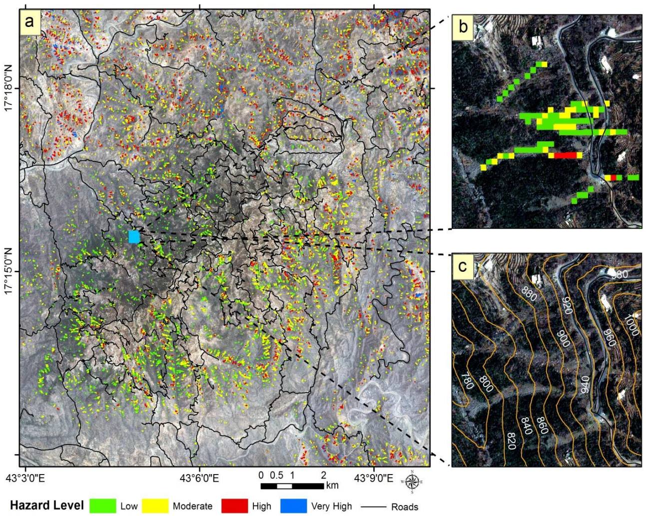

Revised Fig. 6 in text. Hazard map showing the hazard level for areas modeled as being prone to debris flow within ephemeral streams. (b) Enlargement of the boxed area in (a). (c) Same as (b), but with the modeled debris flow omitted. Note the correspondence between the modeled (b) and observed (c: bright areas) debris flows.

Fig. 2.

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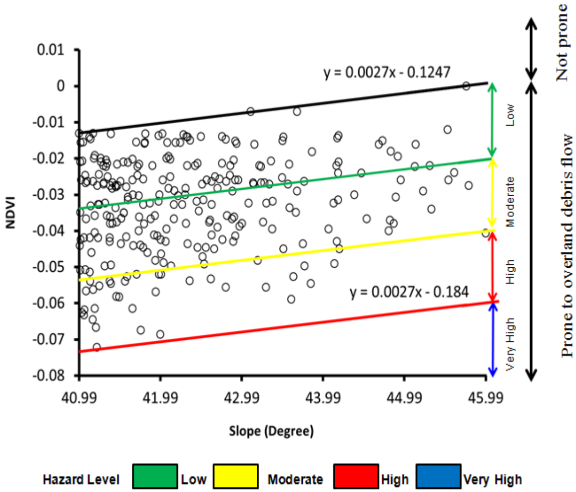

Revised Fig. 8 in text. Extraction of a relationship between the NDVI and the slope values for the overland debris flows on sparsely vegetated slopes that were verified in the field and/or by examination of Google Earth images. A linear regression was used to identify the equation of a straight line (black line) that separates points prone to overland debris flow (below line) from others that are not prone to overland debris flow (above line). Figure also shows hazard levels as a function of the distance from the regression line; in areas prone to overland debris flows, the larger the separation of a point from the regression line, the greater the hazard level.

Fig. 3.

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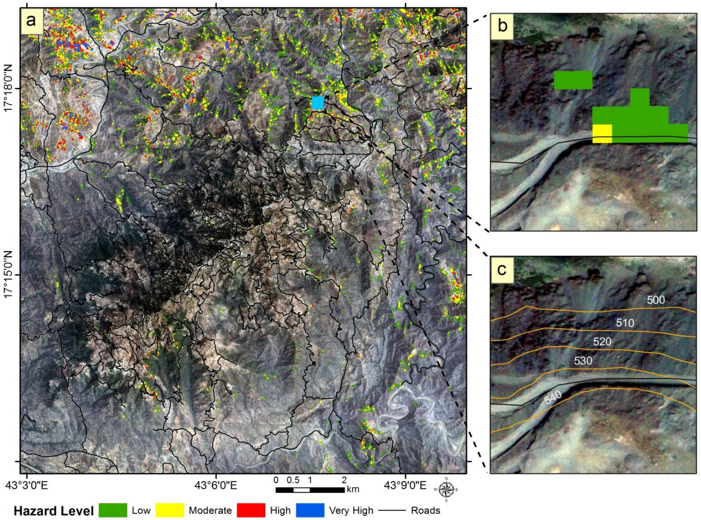

Revised Fig. 9 in text. Hazard map showing the hazard level of the areas modeled as being prone to overland debris flow related to the presence of sparsely vegetated steep slopes. (b) Enlargement of the boxed area in (a). (c) Same as (b), but with the modeled overland debris flow omitted. Note the correspondence between the modeled (b) and observed overland (c: bright areas) debris flows.

Fig. 4.