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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Analysing the relationship between rainfalls and landslides to define a mosaic of triggering thresholds for regional scale warning systems" *by* S. Segoni et al.

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This short comment is with regards to the discussion paper by Segoni et al. (2014a) recently submitted to NHESS Discussion Journal. The paper proposes the application of a standardized and automated procedure (described in a different paper by Segoni et al., 2014b) to define statistical rainfall thresholds. The potential innovation of the discussion paper is the application of the procedure at a more detailed spatial scale, allowing for the definition of an ensemble of rainfall thresholds that could perform better

than a single threshold when employed in a warning system. Use of a larger (more detailed) geographical scale allows the authors to analyse how the geo-hydrological properties in their study area influence the rainfall thresholds.

In this comment, I would like to bring forward (1) a couple of medium level issues that I believe should be addressed, (2) some technical/editorial issues. This is not meant to be a complete review (rather a comment). I believe the overall research themes addressed by the authors (one that I am currently exploring in a slightly different way myself, thus my interest in the general themes) is an important one in the natural hazard community, but also believe that the two medium/major level issues (robustness of given thresholds/uncertainty; correlations) both needing addressing by the authors so that the methodology and results can be better put into a working and academic context. I hope that the authors will be able to address these issues, thus improving the overall strength of these ideas in the longer term.

1.0 Medium/Major Level Issues

1.1 ROBUSTNESS OF GIVEN THRESHOLDS AND BETTER DESCRIPTION OF UNCERTAINTY. I am somewhat concerned with the robustness of the given thresholds with respect to the number of rainfall events used to calculate them. In several parts of the text, the authors state that the proposed method provides "satisfactory results" independently of the number of events in the data set (e.g., on page 2195, lines 18-20, and on page 2220, lines 14-19). The data sets used to define the thresholds vary from eight rainfall events to a maximum of 79 rainfall events that have triggered known landslides. The statements would be much stronger if they were supported by a sensitivity analysis, or an analysis of the uncertainty associated with the definition of the thresholds (that is, the uncertainties associate to the parameters α and β of the thresholds). The equations listed in Table 1 do not show an uncertainty associated with α and β. If the method (and the thresholds) is (are) really independent on the size of the data set (which I believe would be somewhat surprising), the uncertainty should not vary too much.

To demonstrate that their results are “satisfactory”, the authors refer to Table 2 (page 2195, line 19), that shows (page 2206) the results of the validation process (TP, TN, FP, FN) for each threshold. It is not clear how these values can, by themselves, demonstrate that “the dimension of the dataset does not influence the quality of the results”. I believe that a much stronger exposition of how robust the results and the broader context of exploring uncertainty, are important to address to strengthen the final impact of this paper.

1.2 BETTER DESCRIPTION OF HOW CORRELATIONS ARE BEING DONE. A second issue that I believe it is important to address in this paper is that of correlations, as described in the Discussion (pages 2198-2199, lines 17-3), and repeated in the Conclusions (pages 2199-2200, lines 26-8). The authors write that they have identified a “correlation” between the “no rain gap” (defined as “lapse of time without rainfall needed to consider two rainfall events as separate”), and the prevailing lithology in each of their subdivisions (the so called “alert zones”. A correlation defines a mutual or reciprocal relationship between two or more variables. The degree of correlation is defined quantitatively by a correlation coefficient. If a correlation exists, a functional relationship of the type e.g., y = f(x), should exist. This is not demonstrated by the authors, and it is therefore not clear what this “correlation” is, exactly

For each threshold, a value for the “no rain gap” is obtained through a calibration process (described in Segoni et al., 2014b), and dedicated software “MaCumBA” uses this value to identify rainfall events that have triggered landslides, or not. Rainfall events that have not caused failures are used for calibration and validation to determine false positives (PF) and true negatives (TN). Based on the procedure proposed by the authors to define the rainfall events, larger values for the “no rain gap” parameter will result in longer rainfall events. Hence, the proposed “correlation” between the “no rain gap” and lithology would imply a functional relationship between lithology and the duration of the rainfall events. This “correlation” is difficult to understand.

If the “no rain gap” was used only for the identification of rainfall events that have

resulted in landslides, the (possible) relationship with lithology might have been acceptable (i.e., considering soil permeability, as mentioned by the Authors in page 2198 , lines 18-24). But, since the “no rain gap” was used to reconstruct all the rainfall events, the found “correlation” implies that the duration of all rainfall events occurred in their study area depends on the prevailing lithology. This result is difficult to accept, conceptually.

It might be appropriate to consider different values for the “no rain gap” for areas characterized by a different “lithology”, but not arguing about a “correlation” between “lithology” and “no rain gaps”.

2.0 [A couple minor issues I spotted] Technical / Editorial issues

2.1 Table 1. In the equations for the thresholds, the β parameter is shown with a variable number of decimal digits (from 1 to 3). The authors should use the same number of significant digits for all the thresholds, or they should specify why some of the thresholds have the β parameter with more significant digits than other thresholds. The authors should be aware that three decimal digits for the β parameter are most probably unnecessary given associated uncertainties. Any variation in the third decimal digit will result in a variation of the rainfall mean intensity lower than the instrumental sensitivity of the standard rain gauges (e.g., 0.2 mm). This goes back to a better understanding of uncertainties associated with the different variables and results.

2.2. Figure 1. Please re-examine the numerical precision given for the elevation and the mean annual precipitation.

2.3 Figure captions in general. Can the figure captions be more ‘self standing’ so the reader does not need to read in detail the text to figure out what the figure is of.

Reference Cited

Segoni S., Rosi A., Rossi G., Catani F., Casagli N. (2014a) Analysing the relationship between rainfalls and landslides to define a mosaic of triggering thresholds for

regional scale warning systems. Nat. Hazards Earth Syst. Sci. Discuss., 2, 2185–2213. Segoni S., Rossi G., Rosi A., Catani F. (2014b) Landslides triggered by rainfall: a semi-automated procedure to define consistent intensity-duration thresholds. Computers & Geosciences 63, 123-131.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 2185, 2014.