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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Temporal evolution of landslide hazard for a road infrastructure in the Municipality of Nocera Inferiore, Italy, under the effect of climate change" *by* Marco Uzielli et al.

Anonymous Referee #1

Received and published: 5 January 2018

General Comments This paper attempt to evaluate landslide hazard under the climate change. Because there is a possibility that the climate change will affect frequency of landslide hazard in the future, topic of this paper is very important. Statistical approaches, which are used in this study, is nice for evaluation of landslide hazard in the long-term future, because there are many uncertainties that physical models cannot overcome. However, there are some weakness in this paper.

1) Linkage between triggering probability and reach probability are expressed as equation (1) (p.4). However, the H (hazard probability?) are not calculated in this paper. Analyses of the triggering probability and the reach probability have been done sepa-

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Discussion paper

rately, and never been linked together. Therefore, I felt that this paper is composed of two different studies.

2) Although relationship between the climate change and the triggering probability are presented in chapter 5, there is no analysis on influence of the climate change on the reach probability. Because one of the most important aspect of this study is estimation of landslide risk under the climate change (as noted in 1. Introduction), effect of the climate change to the reaching probability is needed in this paper. This problem occurs because of the poor linkage between analysis of triggering probability and reach probability as I pointed out in the comment 1).

3) Statements in discussion parts (latter half in chapter 5, section 6.2) and the concluding section (chapter 7) are mostly about case example in the study site. General findings applicable to other areas are limited.

4) There are many assumptions in the analysis of this study. I agree that this kind of works need assumptions, because it is hard to obtain detailed data needed for the analysis. In addition, there are many uncertainties as authors discussed in the chapters 1 and 7. However, when the authors set important assumptions, explanations on reasonability of the assumption (or discussion on limitations in the assumption) are needed. See specific comments.

5) Locations (or characteristics) of source area and runout area of previous landslides are not shown in this paper. Such information is important when we consider if the assumption in this paper is realistic or not. The landslide histories can be used to verify result of the prediction.

Specific comments

pg.3, line 22 “(a) hyper-concentrated flows, which are. . .as debris avalanches”

Is there any difference in rainfall threshold and runout distance amongst these three landslide types? Many previous studies have reported that travel distance (and slope

angle) of landslides and debris flows are variable amongst different topography and different types of the mass movement. Gavan Hunter, Robin Fell (2003) Canadian Geotechnical Journal, 40, 1123-1141 R J Fannin, M P Wise (2001) Canadian Geotechnical Journal, 38, 982-994 C Scheidland, D Rickenmann (2010) Earth Surf. Process. Landforms, 2010, 35, 157–173 J Corominas (1996) Canadian Geotechnical Journal, 33, 260-271 In chapter 6, authors did not distinguish landslide types when they estimate the reach provability. Therefore, they assumed that the landslide type does not affect runout characteristics. Difference (and similarity) in the runout characteristics amongst landslide types is helpful for readers to consider reasonability of the assumption. Similar things can be said to the landslide triggering condition.

pg.4, line 4 “resolution of 15x15 m”

This resolution is larger than that recommended by Horton et al. (2013) NHESS. Why do you think this grid size is sufficient for estimation of the reach probability? It is hard to understand from the statements in chapter 6.

pg. 4 line 8 Equation (1)

H in the equation (1) can be given by the triggering probability multiplied by the reach probability. In my understanding, triggering probability indicates the probability of occurrence of one landslide in the entire analysis area (if only one landslide occurred during each rainfall event in table 2). However, if the reach probability was multiplied by the triggering probability, it means that landslides simultaneously occur at all of source areas during one rainfall event. Maybe I am misunderstanding the method, but detailed explanation is needed to prevent misunderstanding.

pg. 5, line 6 “The inventory of landslide events was. . .the Regional Civil Protection”

What kind of data do the reports include? Landslide timing? Locations of source area and runout area?

pg.6, line 1 “In the present study, climate simulations included in EURO-CORDEX

multi-model ensemble at 0.11' (approximately 12 km) are considered under the RCP4.5 and RCP8.5 scenarios as described in Table 3."

Difference in the triggering probability between RCP4.5 and RCP8.5 (Fig. 7) are based on the difference in the rainfall characteristics between the two scenarios. However, rainfall characteristics of the two scenarios are not explained in this paper. I suggest to explain difference in the rainfall characteristics between the two scenarios.

pg. 6, line 7 "Landslide triggering probability was estimated. . .and the 59-day rainfall ðİŻ¡59."

Why one-day rainfall and 59-day rainfall were used in the analysis? Rainfall intensity and duration are generally used in this kind of analysis (e.g., Berti et al., 2012). Berti et al., Journal of Geophysical Research, 117, F04006, 2012

pg. 7, line 10 "More specifically, Fig. 7a shows. . . variation for both scenarios"

This sentence is repetition of the Figure caption. I suggest to remove this sentence.

pg. 9, line 3-5 "In this work, source areas were identified. . ."

In this study, zero order basin and current failure areas are considered as source areas. Does this assumption agree with location of previous landslides in this area? Although this hypothesis are briefly explained in the next sentence, detailed explanations are needed, because setting of the source area is one of the most important factor controlling runout areas.

pg. 9, line 12 "An angle of reach of 4° was calibrated based on the geomorphological information (i.e., the extension of the slope fan deposition). . ."

"Extension of the slope fan deposition" is the maximum travel distance of the landslide. Do you mean all landslides possibly reach the end of fan deposition if there is no limitation by the flow velocity? As many papers have reported, landslide runout distance is variable depending on the landslide volume and landslide type (e.g., Corominas, 1996,

CGJ). I afraid that the “angle of reach” in this study overestimates the reach probability.

pg. 9, section 6.2

Results and discussion are mostly about spatial distribution of the runout area. However, the runout area is mainly controlled by “angle of reach” and “maximum velocity”, which are arbitrary set by authors. Therefore, results and discussion of probability is more important than the runout area. I suggest that authors add results and discussion on the probability.

Table 1

Coordinate of weather station at Castellammare di Stabia should be expressed by degree-minute-second.

Table 2

Please note the date of March 2005 event in Gragnano.

Table 2

How many landslides occurred during each event?

Fig. 1

A scale and a north arrow are needed.

Fig. 2

Does the area named M. Albino correspond to the area of Fig. 8? Please clarify.

Fig. 3

I think the area surrounded by the red line is the highway. Please note that in the figure caption.

Fig. 4

“Estimation of landslide triggering probability for RCP 4.5 and RCP8.5 scenarios” and “Estimation and mapping of reach probability” have been done in this study. However, three items at the bottom of the flow chart have not been done. Therefore, it is hard for me to image procedure in the last part of this flowchart.

Fig. 10

In the x-axis, the value “0” may indicate location of the point A. Please clarify.

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