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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Shallow landslides stochastic risk modelling based on the precipitation event of August 2005 in Switzerland: results and implications" *by* P. Nicolet et al.

Anonymous Referee #2

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The manuscript represents an original and to some extent promising approach for landslide risk modeling at large scale. In particular, the use of radar data to model the spatial distribution of rainfall in order to simulate potential future events is novel and of broad interest. Methods and techniques are valid. Interpretations and conclusions are supported by data analysis and discussed in an appropriate way. The manuscript is properly organized and written clearly using correct grammar and syntax. The approach, results and conclusions are intelligible from the abstract alone. The title is a reflection of the content. Figures and tables are, in general, useful and of good quality. Referencing is relevant and up to date.

Some scientific comments: Page 5, line 16: "Soils (regolith) and loose materials cover most of the time the bedrock. Most of these shallow and superficial formations have not been mapped, except for the cases where. . .. . ." You may want to comment this in connection with the working scale. In the same way, it implies an additional limitation of the lithological units used (to be mentioned in the discussion section). Page 6, line 17: "It is worth mentioning that the uncertainty of this estimation is quite important as an event of such intensity was never observed in the past at the considered weather stations." You should mention and discuss this issue within the discussion section.

Page 10, line 9: "The highest accumulations are observed on the northern slope of the Alps, in particular along a line from the Berner Oberland to the mountain range of Saentis." If it is possible and easy, I suggest you to indicate those locations in figure 1. "The spatial distribution of landslides closely follows the regions with the highest rainfall totals with some spatial heterogeneity due to the different geological settings." Could you provide a clearer and more extended explanation?

Page 10, line 18: Can you provide any reference on the geotechnical map of Switzerland you have used?

Page 11, line 3: "Cells that contain water (lake or glacier) or that are located on the Swiss border have a cumulative value below 1 (Fig. 4e). The model is run several times and assigns at each iteration a unique lithological unit following the probabilities given in the maps shown in Fig. 4." It is not clear to me how you obtained unique lithological units. I ask you to explain the procedure in a more detailed way." I think Fig. 4e should be 4E. Next paragraph: "Landslides are transformed from point features to a raster displaying the landslide number in each cell (Fig. 1). This raster is then MULTIPLIED by the cumulative geological raster (Fig. 4e) to take into account the smaller land surface inside the cell. Indeed, cells with a total value below one for the geology (borders of Switzerland, lakeshores, etc.) are taken into account only at some iterations. Therefore, by DIVIDING them with the geology allows to maintain a. . .." Again, I can't understand well the procedure.

Page 12, line 22: “Since, for a given surface, an elongated shape is more likely to intersect a building than a round one, the circle diameter is set to 200m in order to completely include 90% of the landslides (Fig. 2). This diameter results in an overestimation of the landslide surface, but takes indirectly into account the landslide geometry and provide a slightly pessimistic risk estimation in terms of number of affected buildings. Thus a 100m . . ..”. 200 m is the distance traveled by the 90% of the landslides but this is a very maximum diameter, since shallow landslides are normally very elongated features (rather than circular). Why have you applied a 100 m buffer and not 120/90 m for instance? Will you please explain and justify it? Also I ask you to explain better figure 9 (I do not understand: “Thus, if the center of a circular landslide (in brown), . . .”).

Page 13, line 12: “. . ...The lack of knowledge on the precise landslide characteristics and location as well as the inherent variability of the elements at risk complicates even more the assessment of the vulnerability (Galli and Guzzetti, 2007).” This is true and particularly in the case of deep seated landslides. Shallow landslides are simpler. Additionally, the vulnerability of buildings to shallow landslides is normally very low (They rarely affect building foundations).

Page 13, line 18 and following paragraph. Again, it is not clear to me the procedure you used.

Page 14, line 20: “The probability to observe a given number of landslides in a given lithological group is a monotonically increasing function of the precipitation amount.” This is an interesting result. Nevertheless, I think (theoretically speaking) that the function shouldn’t be so monotonically increasing. For example, I am thinking in low precipitations (a rainfall threshold depending on the lithology would determine a nick-point in the function).

Page 17, line 2: “However, other variables such as terrain slope, soil thickness and permeability contrast,. . .” At least you should add “etc” since some important conditioning factors are missing in the text. For instance, vegetation could play a relevant

role in shallow landslide generation. I think that vegetation is simpler to model at your working scale than lithology. Similar comment can be done for other important factors. Therefore I suggest reinforcing this part of your discussion. I think one of the limitations of your contribution is the working resolution. Working in higher resolution (e.g. 100 m x 100 m) would probably reveal that rainfall is not so significant and other missing variables become critical.

Table 1. I am not familiar with this type of data. Will you please comment on it ?

Figure 5. It is not clear to me. “A lithology is assigned at each model iteration by choosing a random number u.” This sentence is quite ambiguous to me.

Figures 7 and 8 don’t provide any additional clarification to what is indicated in the text. Perhaps, you could improve the figure/caption/text to make the methodology more comprehensible. Please use cell instead of “celle” in those figures. Figure 11. Colors in the legend are not clear (lowest value in red; highest values also in red tones)

Technical corrections: In several parts of the manuscript appears 1 km2 x 1 km2. Please, use 1 km x 1 km resolution instead (or 1 km2 cell).

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 747, 2013.