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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Evaluation of Environmental Factors in Landslide Prone Areas of Central Taiwan using Spatial Analysis of Landslide Inventory Maps" *by* K.-L. Fu et al.

Anonymous Referee #1

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The paper analyses landslide inventories maps prepared for several events in Taiwan to evaluate which are the environmental factors and cumulated rainfall that influence the generation of new landslides, including the magnification effects produced by typhoons after the 2009 Chi-Chi earthquake. The Authors analyze a large set of spot images (17 scenes) to produce landslide inventory maps. They adopted a two-step mapping method, combining a semi-automatic method based on an object-oriented approach with interpretation made by a skilled photointerpreter to adjust the classification of the polygons. The landslide inventories are analyzed considering the environmental factors and the triggering (rainfall events) adopting the Uchiughi (1971) relation. The results obtained are used to build a so-called "logical reason-based" rule set to obtain

a landslide potential map. The contents of the manuscript fit the scope of the journal. The scientific approach is not innovative, but the use of a very wide dataset is interesting and probably worth being published. Unfortunately, in my opinion, the manuscript is poorly structured and the data are not presented clearly. This make the manuscript hard to read. I recommend the Authors to rewrite completely the work. 1. Number of figures: 23 figures are too many for a single paper. The number of figures could be reduced, for example, summarizing figures from 1 to 3 into a single figure; the same applies to other cases. 2. The Introduction section is rather general and not focused on the purpose of the work. Many introductive information are found in other paragraphs such as "Spatial data and methodology" or in the firsts parts of other subparagraphs (see specific comments). 3. Hazard history of the study area. This Section is too long and not useful to make the point of the manuscript (see specific comments). 4. The whole manuscript can be made clearer; for example the "Methods and spatial data" should present strictly the data and methods used for the analysis; the Results section should present strictly the results of this study(see specific comments). 5. In this Discussion section, the Authors should discuss ALL the obtained results point by point, which is not the case in the present version of the Manuscript. The discussion of the Earth amplification Effects is not clear to me and poorly described. Moreover the subsection 5.2 and 5.3 "Combination of Causative factors" and "Landslide potential maps" should be moved in the Method and Result section, respectively. Specific comments: Page 3, lines 6-11: what do you mean by "primary contributors" and "secondary contributors"? River undercutting is a borderline factor (trigger or causative). Page 5, line 6: the analysis consider the influence of Nanchuang and Heshe formations. Please describe the two formations in detail, highlighting the existing differences and providing information about the percentage content of each formation in the two watersheds, Aiyuzih and Chushui. Moreover, the two watersheds should be described in terms of factors considered for the analysis (elevation, slope, aspect, lithology, human activities ecc.), and other irrelevant information should be removed (for example, the historical information from page 5, line 14 to page 6, line 16) or substantially reduced. Page 6,

line 17-19: irrelevant here; please remove. From page 6, line 21 to page 9: there are many portions of text which belong to the Introduction. In this Section, only the spatial data used in the analysis should appear. Page 8, line 30: “If NDVI value is less than 0.05, there is a high probability that the detected land cover/objects are landslides (see Fig.5)”. This fact cannot be seen from figure 5. Moreover, the statement about the numerical value should be justified or a reference should be provided. From page 11, line 10 to page 12, line 10: please try to illustrate the artificial image identification in a clearer and synthetic way. Section 3.3: the whole section provides a lot of irrelevant information and, in my opinion, it should be substantially reduced. Page 13, line 21: “landslide area” should be “watershed area”, according to Eq. (2). Page 15, lines from 2 to 10: these introduction is irrelevant to the Section, and should be removed. In the following, the Authors use the Uchihugi formula to calculate the new landslide ratio from the magnitude of the rainfall events. They modify the original formula adding a parameter, C. How do they obtain the value of C parameter quoted in figure 17? What do they mean by “initial increment landslide ratio”? Which is the physical meaning of the constant they introduce? Page 15, line 15: “However, when the rainfall parameters of Uchihugi empirical model reach the critical rainfall, the new landslide in the watershed becomes zero.” This sentence is not clear to me! It seems that when the value of cumulated rainfall is larger than the value of critical rainfall the new landslide becomes zero. I checked in the article “S.-J. Chiou, et al.: Evaluating Landslides and Sediment Yields Induced by the Chi-Chi Earthquake and Heavy Rainfalls” (the suggested reference is actually only available in Japanese, which is not acceptable), in which the same formula is used and the value zero is obtained for cumulated rainfall smaller than critical rainfall, as it should be. From page 16, line 6 to page 17, line 3: the description of the temporal and spatial analysis could be used to introduce briefly paragraph 4.1 and 4.2. Please remove, or move this part to the suggested location. Page 20, lines from 2 to 8: this part fits better in the Discussion section than in the Results one; many sentences are very general ones and can be safely removed. In conclusion, I believe that, in general, the manuscript should be substantially reduced in length by

removing irrelevant information. The Discussion and Conclusions sections should be rewritten from scratch, using the results actually obtained in this work and avoiding generic comments and lengthy introductory text. Moreover, I suggest that the Authors analyze how the landslide potential map change using the combination of causative factor for the three temporal periods pre-1999 Chi-Chi earthquake, from 1999 Chi-Chi earthquake to pre- and post- typhoon Morakot. A validation of the map itself could be performed by discussing the landslide potential map obtained from each period against the observation of the next one.

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