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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Hazard Assessment Comparison of Tazhiping Landslide Before and After Treatment" *by* Dong Huang et al.

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Response to Reviewer Comments

Manuscript title: (the original title: Hazard Assessment Comparison of Tazhiping Landslide Before and After Treatment) Manuscript number: 2016-391 Thanks very much for reviewer's comments, which helped us to improve the quality of manuscript. We have made major revisions to address the comments raised by the reviewer. The following responses have been prepared to address reviewer' s comments in a point-by-point fashion. All changes have been marked with RED in the revised manuscript. We would be happy to make further modifications if required. We hope the changes listed have made the manuscript suitable for publication, and we look forward to your response.

General comments

Q1: The paper by Huang et al. addresses relevant scientific and technical questions. It presents a concept and adoption of a well-known method to simulate mass movement processes. The used methods are in principle up to international standards but there is some doubt whether they used the appropriate method for this study.

A1: We acknowledge the remark of the reviewer. This paper addresses an interesting and relevant scientific topic. We adopted a well-known method to simulate mass movement processes. The methods are up to international standards. We are expanding the method in this contribution.

Q2: The scientific methods and assumptions used are valid and outlined clearly. There is some confusion about the mass movement process that is discussed and approached by the presented and adopted rheological model. In principle, the numerical approach in RAMMS can also be used for the simulation of landslides. But it is actually not intended for it and does not take into account specific properties of this kind of mass movement (landslides).

A2: We totally agree with the reviewer. The geomorphic heterogeneity of rapid shallow flow-type landslides such as hillslope debris flows is larger than those observed in channelized debris flows; however, many of these flows can be successfully modeled using the Voellmy-fluid friction relation with a block release initiating the flow (Christen et al., 2012). Therefore, the numerical approach in RAMMS can be used for simulation of flow-type landslides. We have added new interpretation in the new version of the manuscript. Please see Page 2, line 63-64 and the discussion section in the new version of the manuscript.

Q3: The results of the study are not really surprising. Interpretation of the simulation results is derived poorly. Some important questions remain still unanswered, namely the sensitivity of the friction parameters and more important the derivation of the best-fit parameters presented in Table 2. This aspect should be at least considered in the

discussion and ideally in the methods section. While the methods section is very detailed (and also well written in good English) regarding the numeric, no information is given about the modeling procedure and interpretation of the simulation results.

A3: The result of the study is in agreement with field survey results. The derivation of the best-fit parameters is an important issue, which we have elaborated on in the discussion and methodology sections. The present estimation of model parameters can be acquired by laboratory or small-scale experiments in some instances, however calculation of the Voellmy rheological model friction coefficient is difficult. Therefore, we tested different coulomb friction coefficient values ranging between and viscous friction coefficient values ranging between . Finally, we selected the coulomb friction coefficient and viscous friction coefficient in accordance with back-analyses of well-documented landslides (Cepeda, J., et al. 2010; Du et al., 2015). The methods and discussion sections have been revised in the new version of the manuscript. Thank for your compliment on the writing of methods section in the new version of the manuscript. Please see p.12-13, line 271-278 and p.22-23, line 384-411.

Q4: The title does not promise detailed information about the numeric but rather a specification about the hazard assessment comparison. Therefore or the title or the content of the paper should be changed. The same is true for the abstract. More information should be given for the methods section or the method section should be adjusted. The mathematical formulae, symbols, abbreviations and units are correctly defined and used.

A4: Thank you for the insightful comments. We totally agree that the title should be revised. The title of this paper has been revised to "Hazard Assessment Comparison of Tazhiping Landslide Before and After Treatment Using the Finite Volume Method". The corresponding abstract has been revised as well. The methods section has been revised. Please see the response to comment A3. Please see p.1, line 2 and line 12-13; p.12-13, line 271-278.

Q5: There is some confusion in terminology for figures 6 and 7, that have to be changed. Figures should be improved. Figure 1 seems to be taken from an existing paper without citation. Figure 2 needs more information about the location of the study site in a global perspective and better visualization of the exact location in the Baisha river basin. figures 6 and 7 do not contain more details on the landslide area, location of the objects at risk, etc. This information is only given in figure 8 but visualized rather small. Readability of the outlines of buildings is very hard and not mentioned in the legend. The authors give in principle proper credit to previous and related work. Own contributions are not well indicated (besides the adoption of the model and the interpretation of the simulation results).

A5: Thank you for pointing out the accurate terminology. The confusion in terminology for Figures 6 and 7 has been revised. Please see p.14, line 282 and 284; p.16, line 323 and p.17, line 325. We have re-organized and added more information about the location of the study area. The Baisha river basin is visible in Figure 2. Please see p.9, line 214-215. In Figures 6 and 7 we added more detail on the landslide area shown in Figures 7a and 9a. Please see p.13, line 281; and p.16, 322. Figure 10 has been extensively revised. Building outline were added to the legend. Please see p.21, line 376 and p.22, line 379. Various minor modifications and revisions were made to all Figures. Please see p.10, line 216-217 and 218-219.

Q6: Number and quality of the references are appropriate. There are some publications in Chinese that are not accessible by all fellow scientist. There is some confusion for the article by Zhang,Z.Y., Wang,S.T., Wang,L.S.,et al., about the year of publication. In the text 1994 is mentioned while in the references there is written 1993. The reference of Toro, 1992 is missing.

A6: We have deleted some parts of unimportant Chinese's literature and revised all references according to the NHESSD journal style. We have cited the reference of Toro, 1992. Please see references section in the new version of the manuscript. Please see p.2, line 46, 51 and 52.

Q7: Structure and length of the paper is adequate. Methods section with the numeric is too long compared to the results section.

A7: We appreciate the comments. The methods section is very detailed; no more information is given on the simulation results. Thus, we have added more interpretation into the results section. Please see the results section in the new version of the manuscript.

Q8: Technical language and the English is more or less of good quality and understandable. Several sentences need to be reformulated, mostly because of wrong word order. There is no supplementary material available.

A8: We have carefully proofread the whole manuscript to exclude language issues as much as possible. All changes have been marked with BULE in the revised manuscript.

Other specific comments are given below.

Q9: p.2, line 61: what do the authors exactly mean with "landslide-debris flows?" Please rely on some definitions in the literature.

A9: Landslides move downslope in many different ways (Varnes, 1978). Flow-type landslides can evolve into rapidly travelling flows, which exhibit characteristics of debris flows on unchannelized or only weakly channelized hillslopes. The geomorphic heterogeneity of rapid shallow flow-type landslides such as hillslope debris flows is larger than those observed in channelized debris flows, however, many of these flows can be successfully modelled using the Voellmy-fluid friction relation and with an initial block release (Christen et al., 2012). It is true that there is some confusion about the term “landslide-debris flows” used here. We have revised it to “flow-type landslides” and add some definitions from the literature. Please see p2, line 63-64 and discussion section p22 and 23.

Q10: p.2, line 71: what to the authors exactly mean with 3D mapping of the division of hazard zones? Usually, hazards zonation is given on a map, e.g. in 2D

A10: Thank you for the correction. It has been revised to 2D. Please see p.2, line 74.

Q11: p.3, line 98: this figure is taken from Christen et al., 2010. Please cite source.

A11:It has been added. Please see p.3, line 101.

Q12: p.3, line 107: missing space.

A12: It has been revised. Please see p.4, line 109.

Q13: p.7, line 178: this reference is missing in the reference section.

A13: It has been cited. Please see reference p.26, line 539-540 and p.7, line 178 -179. " Toro, E.F.: Riemann problems and the waf method for solving the two dimensional shallow water equations, Philos. Trans. R. Soc. London, Ser., A 338, 43–68. 1992".

Q14: p.11, line 255: see comment for p.2, line 71

A14: It has been revised to 2D. Please see p.12, line 263.

Q15: p.11, line 266: figure is subtitled with "Thickness". Thickness of deposition is not equal to flow height (if a landslide really "flows"...). Please adapt wording.

A15: Thank you for pointing out the inaccurate terminology. It has been revised to flow height. Please see p.1, line 15; see p.14, line 282; p15, line 292 and 294; p.16, line 323; p17, line 332 and 334; p18, line341; p23, line 416.

Q16: p.12, line 268: subtitle of figure is "Speed", legend says "Velocity". If the blue to green marked zone shows the deposited mass of the landslide, there should be no velocity value (because it’s deposited). In chapter 3 is no indication or estimation about the speed of the landslide mass, therefore figure 6b does not really make sense.

A16: Thank you for pointing out the inaccurate terminology. It has been revised to Velocity. Please see p.1, line 15; p.14, line 284; p15, line 295 and p.17, line 325 and 334. In any case, velocity plays a more important role regarding kinetic energy acting on an obstacle. However, the Miaoba residential area of Red Village is located at the frontal part of Tazhiping landslide. Therefore, the maximum flow height of the landslide

is one of the direct factors influencing the building's deformation failure status. Please see p.18, line 346-353.

Q17: p.12, line 270: not clear, if the colored area shows the maximum pressure or an instantaneous for a given time step. Much more of interest would be a local value (over time) at the position of a building. And why the legend goes up to more than 1000kPa but no reddih or yellowish areas are marked?

A17: The colored area shows the maximum values of moving process or an instantaneous pressure for a given time step. As the building of Red Village is located at the frontal part of landslide, the pressure of the middle and lower landslide deposits was about 200kPa. Thus, three-story and lower houses within the deposition range might be buried. The maximum pressure value in the surface gully can be found in the middle and upper slope. According to field surveys, we have found this gully is at an elevation of about 1,200 m. The maximum pressure value is easily found from the instantaneous for a given time step figure. Therefore, coupled with field observations and numerical simulation, they are especially helpful in understanding the landslide movement process in complex terrain. It has been introduced in p.17, line 329-330.

Q18: p.12, lines 274, 277 and p.13, line 278: not clear what numbers in the circle mean. Is this kind of a list or does it indicate a location in a figure?

A18: No, it does not indicate a location. It has been deleted. Please see p.14, line 291; p.15, line 294 and 295.

Q19: p.13, line 279: how is made this separation between houses of different numbers of stories? Please give more information and references to it.

A19: The building is 3m high on each floor. We have cited some literature (Hungr et al., 1984; Petrazzuoli et al., 2004; GB, 50010–2010; Hu et al., 2012; Zeng et al., 2015). Please see p18, line 362 and 364.

Q20: p.13, line 293: or indicate "about 1.2 m" or give exact value.

A20: The more exact value has been given. " with an elevation of 1,070-1,072m and a length of 182m." Please see p.15, line 317-318.

Q21: p.13, line 298: same remark as for figure 6a.

A21: It has been revised. Please see A.15.

Q22: p. 14, line 300: same remark as for figure 6b

A22: It has been revised. Please see A.16.

Q23: p.14, line 305: example of a sentence that has to be rewritten because of wrong word order.

A23: We have revised the sentence to read "Provided in Fig.9 are the kinematic characteristics of the landslide deposit." Please see p.17, line 329.

Q24: p.14, lines 305, 308, 309: not clear what numbers in the circle mean.

A24: It has been deleted. Please see p.17, line 331 and 334; p.18, line 335.

Q25: p.15, line 321/322: not sure, if this statement is really true. There may be examples where entire houses on a landslide mass are moved but not destroyed because of stable base plates. In any case, velocity plays a more important role regarding kinetic energy acting on an obstacle. You are right in the sense that the height of a moving landslide (e.g. the frontal part) plays an important role when it hits a building on a higher level, e.g. the second or third floor. Please clarify this point.

A25: We have clarified this point. "Landslides reflect landscape instability that evolves over meteorological and geological timescales, and they also pose threats to people, property, and the environment. The severity of these threats depends largely on landslide speed and travel distance. There may be examples where entire houses on a landslide mass are moved but not destroyed because of stable base plates. In any case, velocity plays a more important role regarding kinetic energy acting on an obstacle. However, the Miaoba residential area of Red Village is located at the frontal part

of Tazhiping landslide." Please see p.18, lines 346-353.

Q26: p.15, 16 and 17, table 3: the term "washed away" is not suitable for landslide process. It implies an major influence by a fluid.

A26: It has been revised. Please see p.18, line 366.

Q27: p.17, line 333: This should be 2D, because you show a map with the different zonations. These different zonations are not defined, by the way.

A27: It has been revised to 2D. Please see p.20, line 367 and p.22, line 381.

Q28: p.17, line 339: There seem to be marked buildings (in the red high-hazard zone). If so, adjust legend and make sure they are better visible. What zone is defined outside the colored area? No hazard or also low-hazard zone?

A28: In figure 10, the red high-hazard zone of buildings has been marded. We have adjusted the legend and defined outside the colored area as no-hazard. Please see p.20, line 371-374 and Figure.10 legend.

Q29: p.18, line 342: same as for figure 8a. And this should be 8b instead of 8c.

A29: It has been revised. Please see p.22, line 381.

Q30: p.18, line 350: what is a landslide-debris flow?

A30: It has been defined. Please see p.23, line 389-396 and answer A5.

Q31: p.18, line 358: this should be 2D.

A31: It has been revised. Please see p.23, line 423.

Q32: p.19, line 411: correct reference would be: Michael-Leiba, M., Baynes, F" Scott, G., Granger, K. 2003. Regional landslide risk to the Cairns community [J]. NatHazards, 2003,30 (2):233–249. Check reference style for all references according to the journal style!

A32: We have revised all references according to the NHESSD journal style. The reference list has been updated as well. Please see references section.

The text of the manuscript has been revised.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2016-391/nhess-2016-391-AC7-supplement.pdf

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