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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A physical approach on flood risk vulnerability of buildings" *by* B. Mazzorana et al.

B. Mazzorana et al.

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Dear Olga, many thanks for your insightful review and the constructive comments on our work. We are pleased that you found the presented method innovative, the paper well-structured and -explained. Your comments were very helpful for a further improvement of our manuscript. Please find below our reply to the specific remarks.

General comments:

Reviewer: The state of the art is missing some important works on the vulnerability of buildings to flood as for example the Australia guidelines for reducing vulnerability of buildings to flood damage (Guidance on building on flood prone areas).

Reply: In the revised version of the manuscript we included the works on vulnerability of buildings to floods indicated by the reviewer.

Reviewer: The information provided in Figure 1 is not schematically presented and it includes some points which are not discussed at all at this manuscript. Maybe it could be substituted by a simpler one which will facilitate the reader to understand easier the importance of the presented work in the general scheme of the vulnerability assessment procedure.

Reply: We acknowledge this comment; however, in order to present the entire concept we would like to keep this figure as it is. In the Figure caption it is indicated that steps D and E are not explicitly addressed in this paper, for details refer to Mazzorana et al. (2012c).

Reviewer: You provide information given by the Eurocode on the definition of the limit damage states, but then you do not use the serviceability limit. Please explain more on that. It is important to consistent terminology in the text about the hazard type. Is it debris flow or floods?

Reply: In the paper we use the serviceability concept in adherence to the EN 1990 norms for buildings. This concept refers to conditions under which a building is still considered useful. Should these limit states be exceeded, a structure that may still be structurally integer, while being unusable. Serviceability limit state design of structures includes factors such as durability, overall stability, fire resistance, deflection, cracking and excessive vibration. Moreover, at the current stage of research, we decided to accurately model the impacts on the building envelope and to infer "indirectly" consequences in the interior volumes of the building. For the pure water flood case we also simulated with a 3D model the flow behavior within a complex building. This degree of detail would allow for precise considerations regarding the loss of service of the facilities (electricity, water, power supply). Unfortunately for the debris flow case, to our knowledge, numerical models are not capable to reproduce the 3D flow field satisfac-

torily. Currently we are considering introducing, in addition to the damage susceptibility profile, the loss profile, where taking into consideration expert knowledge the consequences for the functional systems are assessed in detail (comparing scheme shown in Figure 1).

Figure 1: Damage susceptibility profile and loss profile

To conclude, we fully acknowledge the suggestions of the reviewer and we will approach with rigor these issues in the near future.

Specific comments:

Reviewer: P 1413, l 29: Maybe it is better to use back analyzing instead of recalculating.

Reply: We modified the text accordingly

Reviewer: P1416, l 29: Response spectrum usually refers to displacements, velocity or acceleration which is not the case in the methodology that you use, not presented in the results.

Reply: We modified the text string from "We will derive simplified computational schemes to be applied for specific impact (e.g. negligible geo-mechanical actions) and response spectrums (e.g. reliable structural integrity of and potential material intrusion into the element at risk)." to "We will derive simplified computational schemes to perform structural analyses for specific impact spectrums (e.g. negligible geo-mechanical actions) and check whether potential material intrusion into the element at risk might take place."

In this way we avoid to use the formulation response spectrum.

Reviewer: P 1417, l 11: I think it will be clearer to the reader if you complete the phrase with "expressing its intensity".

Reply: We modified the revised version of the manuscript accordingly

Reviewer: P 1417, l 10. Use capitals after a,b,c

Reply: We revised the manuscript accordingly.

Reviewer: P 1418, l 1: This sentence is too long and not very clear.

Reply: We decided to skip this sentence without losses in rigor and completeness

Reviewer: P 1418, l 9: Replace extend by extending

Reply: We revised the manuscript accordingly.

Reviewer: P 1419: l 29: Please specify which are the conserved and primitive variables

Reply:

In the revised version of the manuscript we only refer to the primitive variables. We do not mention anymore the conserved variables, since it is not necessary. Within the mathematical model Rosatti et al. (2013) use the conserved variables. is described in the text as transposed vector of primitive physical variables ( )

Reviewer: P 1420, l 5 and l 15: The symbols W and r are not very clearly defined in the text.

Reply: We clarified in the text: The vector is the vector of the primitive variables and the vector identifies of the cross section for geo-technical analysis.

Reviewer: P 1424, l 17: list the variables one below the other, or next to the other keeping together the symbol and its definition.

Reply: We do not see the confusion here and therefore we did not change the text.

Reviewer: P 1426, section 2.3.3: This must be explained together with what is written in section 2.2.2. Please check also the previous comment on the geomechanical analysis. Furthermore it is 2.2.2 and not 2.1.2.

Reply: We corrected the section references as indicated. However, for the reason of

completeness, we prefer to retain the same structure for process modeling and impact modeling.

Reviewer: P 1446, Fig 6: I think that this figure does not provide any additional information to what is explained inside the text. What does KO stand for? I doubt whether it is necessary here.

Reply: We extended the figure caption accordingly Reviewer: p. 1452 ,Fig 11: Figure B. It should be deposit and not deposito.

Reply: We corrected this mistake in the revised version of the manuscript.

Reviewer: Furthermore, the classification of deposits is different in A and in C. It would be nice to get them homogenously classifies in the calculated and the observed data. If in A there are not any areas of deposit greater that 1m, this class should be deleted from the legend.

Reply: We fully agree in principle with the reviewer's thoughts. The problem is, however, that the event documentation maps about the deposition depths are classified according to the very coarse scale reported in the figure. In our view it would not make much sense to classify the simulated deposition depths according to the rough classification of used for event documentation. We share the view of the reviewer that a more accurate documentation of the depths of the deposits at the residential buildings locations would be a true added value. For this reason we developed an ad hoc documentation form to be used by event documenters in their filed work.

Reviewer: Fig 3: Mark the number corresponding to each façade of the buildings. Although the results are presented for each side separately, we do not know which they are.

Reply: We modified Fig 3 according to the correct indication of the reviewer.

Reviewer: Fig 14: Why is there this step for 2000 N/m2?

Reply: We modified the figure caption accordingly: Figure 14. Pressure distribution on a selected vertical plane. The discontinuity in the pressure distribution in the upper part (layer approximately > 0,44 m) results from the boundary between debris flow material in motion and deposited volumes.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/11/C1961/2014/hessd-11-C1961-2014-supplement.pdf

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 1411, 2014.