

Interactive comment on “Geotechnical stability analysis, fragility of structures and velocity of movement to assess landslides vulnerability” by O. Cuanalo et al.

Anonymous Referee #1

Received and published: 7 October 2014

General Comment: Despite the importance of the subject (vulnerability analysis), its adequacy to the journal and the interest of the general idea the present manuscript has strong fragilities, but it may be published after major revisions. Strengths: obtain vulnerability values to areas where there is no landslide and consequent damage data available; local spatial management significance. Weaknesses: insufficient data and lack of validation. Pitfalls of methodology should be clearly presented. A little unbalanced both have good support literature (concepts, terms) as there is no reference to the framework of this kind of study in the world. Topics about general classification of landslides and meteorological evolution of “thunderstorm” episodes can be shortened

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or, sometimes, omitted.

Specific comments Scientific Significance/Originality: The manuscript could be classified as an interesting approach to vulnerability analysis trying to solve lack of data, namely landslide data and their damages. However, the presented methodology, namely the exposure level is supported in geotechnical stability analyses, which usually are missing data and are not easy to collect or cheapest. Additionally, the spatial interpolation of geotechnical parameters has, many times, the problem of high local variations, becoming tricky the spatial distribution of this type of data. The authors should make clear: a) if they already have a robust and significant data base of geotechnical properties (cohesion, friction angle, unit weight, etc.) in Puebla region, or at least a better data base than they have to landslides geometry (presented on table 2) and damages; b) is this methodology only applied on local scale?

In my opinion the application of the methodology overall it seems quite limited. However, I admit that can be of high importance in local terms, especially when planning the expansion of settlements, avoiding more exposed areas and choosing an adequate type of building material.

Scientific Quality: Concepts and terminology are, in general, well defined and used, bearing in credible and internationally recognized literature. Nevertheless, some problems are present in manuscript (see topic of landslide phenomena and file attached);

Page 5690 Line 20-23 The authors should explain and refer support literature, why tectonic slopes are more prone to landslides than others.

“A state of the art”, about Vulnerability is completely missing in the manuscript. Despite vulnerability to natural hazards, namely landslides, is a topic under development and with no “standard methodologies” there are many trial studies that should be considered in this work, even if they have different approaches (e.g., Nadim et al., 2006, Fuchs et al., 2007 Galli and Guzzetti 2007, Papathoma-Köhle et al., 2007, Uzielli et al., 2008, Kaynia et al., 2008, Petrucci and Gulla, 2009, among others).

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Topics 2.1 and 3 should be merged and shortened: a) Basic definitions of landslide classifications and illustrative figures (Fig 3 and 4), are trivial and not required at this level of publication (they should be removed). It is sufficient to indicate the basis of classification adopted (Varnes, 1978) outlining the types of phenomena that occur in the study area and their characteristics. Comment Table 2.

Is preferable to use the term “Fall”, that allows the use in lato sensu in rockfalls (“Fallen rocks” – page 5694) or earth/debris falls??? (“landfall” – page 5695)

Please, be careful with terminology, “Erosion” (page 5694) is not a type of landslide phenomena, probably the authors refer to landslides due to bank erosion or is soil erosion, like rill, gully? (please explain better this typology and if changes are made update table 2);

b) Despite the interest, the evolution of meteorological situation of Tropical depression and Hurricanes presented are not applied to the analyze performed in this manuscript;

c) Similar reflection could be done to Tables 3 and 4, which cost damages are not used in any analysis, even if the data are interesting. The presented damages are only due to landslides or “wind” damages are included? If table 3 remains in the manuscript please comment the different amounts expressed between Morales (2001) and Bitran and Reyes (2000)

Page 5694 – line 13 “Landslides phenomena occur frequently in Mexico, due to climate change (. . .)” – authors should make clear what are the real effects of climatic changes in Mexico – Are an increase of rainfall amount in Puebla region? Are intense rainfall events with capacity to trigger landslides more frequent? Please support this task in literature or data;

Figure 6 – The caption indicates to the reader that these are monthly data. It is not clear if the rainfall intensity (mm/day) is the maximum or the mean in the month. Please clarify; – A threshold of 100mm is assumed in the plots: a) How the authors reach

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this value? b) It is an empirical threshold? c) How are the frequency of false positives and false negatives? – Maximum values in Zacapoaxtla weather station should be referred (e.g. footnote) Please make clear how this data (b and c) are used or how they support the final results of this manuscript, to the reader understand why they are inserted. For example, how the rainfall amounts influence the typology of landslide and its velocity?

Topic 4 It seems from text and figure 10, that the authors assume that Exposure Level is affected by total slope height. The assumption that the landslide will take place in whole slope should be clear in the text and a comment to this assumption should be done.

Page 5697 - Please make clear in the text what is the “safety factor of project” and the spatial cover of both safety factors used on equation 3 (slope, region, etc.)

Page 5698 – “. . .all of them belonging to the determinants factors.” – it would be preferable “Conditioning factors”

Page 5698 - “In contrast, slow landslides occur in regions with low rainfall and where the triggering agent can be an earthquake . . .” – this sentence is not true worldwide. Earthquake can trigger extremely rapid rockfalls or in materials under the influence of liquefaction processes we can have rapid flows under certain slope conditions. Is it true in Puebla region?

Page 5699 – lines 5-14 One of the most important parameters that influence building damages is the deepness of slip surface or the thickness of displaced material. This quite big pitfall of the model should be referred in the text, because structure collapse did not depends only on velocity. What happens if an extremely rapid but shallow movement affects a nonstructural portion of a concrete building? Velocity is important but there are more influent factors on vulnerability assessment that, at least, should be mentioned.

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The reader as to assume that figure 9 and 11 are ok, because no example data, allowing the validation of the proposed method are present.

The obtained result must be validated and pitfalls of the presented methodology should be clearly mentioned, on discussion topic.

Presentation quality: The manuscript presents a general structure adequate to a scientific journal, with clear language. Title and abstract are clear as well titles and subtitles, but it seems that some captions need more information about the literature that support that figure (e.g., Figure 1 – It seems to lack in caption “(adopted or base on. . .sources))

In general the quality of figures and tables are ok (see typing errors, format in the attached file) but there are a few ones inadequate to the purpose of the manuscript and level of NHESS journal.

Technical comments

Additionally to the comments that were done before there some problems with references. Cited but not present in References topic: Bitran and Reyes (2000) Morales (2001) Varnes (1996) probably Cruden and Varnes

In References topic but not cited in the manuscript Cruden and Varnes (1996) Giani (1992) Glade and Crozier (2005) Guzzetti et al. (2005) Ragozin and Tikhvinsky (2000)

Some of the authors references are not easy accessible by fellow scientists and are in Spanish.

For additional comments or typos corrections see attached file

Please also note the supplement to this comment:

<http://www.nat-hazards-earth-syst-sci-discuss.net/2/C2206/2014/nhessd-2-C2206-2014-supplement.pdf>

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 5689, 2014.

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