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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Detection of collapsed buildings due to the 2016 Kumamoto, Japan, earthquake from Lidar data" *by* Luis Moya et al.

Luis Moya et al.

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We acknowledge Referee #2 for his insightful comments. Please kindly find our response below and the updated version of the manuscript as an attached file. Besides, within the updated file, all the changes are in green color.

GENERAL WORDS:

The paper examines the usage of LiDAR scans in detecting and characterizing collapsed building. General detection of buildings is based on geocoded database coupled with pre-event laser scanned data. Each building is then characterized by three parameters based on pre- and post-event scans: height differences (ΔH), standard deviation (σ) and correlation (r). Based on these parameters the authors test three

different methods to classify collapsed and non-collapsed building. They make further use of the parameters in order to characterize the collapse pattern. The paper is well written, and provides an approach to damaged building detection. However, some points should be considered:

(1) SPECIFIC COMMENT:

The detection of collapsed buildings is essentially change detection via laser scanning in urban areas. Nevertheless, the authors did not refer to such (or other) change-detection related works, where height difference is used as the most reliable and efficient way to detect changes. It is unclear why this case should be different, yet it the authors consider it as an innovation.

AUTHOR'S RESPONSE:

The referee is right to point out the lack of previous works related to change detection via laser scanning. It is because there are no publications related to change detection using laser scanning, as we mentioned in the introduction (Page 2 Line 12 of the updated manuscript). The main reason relies on the absence of a pre-event LiDAR data. However, from the references mentioned in the Introduction section. Maruyama et al. (2014) used different of height between DSMs obtained from aerial images. Furthermore, the lack of previous research on this subject highlights our desire to contribute in the use of a pair of Lidar data to extract collapsed building. Our results are supported by surveyed data, which was used as ground truth database.

CHANGE IN MANUSCRIPT:

In the reference of the paper of Maruyama et al. (2014) we modified to highlight that they used differences of elevation to detect collapsed buildings. See Page 2 Line20: "Instead of LiDAR data, Maruyama et al. (2014) constructed two digital surface models (DSMs) from two sets of aerial images: before and after the earthquake. Then, the collapsed buildings after the 2007 Niigata-Chuetsu-Oki, Japan, earthquake were

extracted using the difference of elevation between the DSMs."

(2) SPECIFIC COMMENT:

Although a major part of the paper deals with the classification of the collapsed buildings, this objective is not spelled out, and no reference to it – or to its importance – is made before page 4, where it is somewhat hidden within the general methodology of detecting collapsed buildings in general.

AUTHOR'S RESPONSE:

Indeed the referee is right. The main target is not clear in the firsts sections. We acknowledge the referee for highlighting this issue. Perhaps the current version highlights the time-line of our research on this topic. Where, at the early stage we intended to extract several levels of damage. However, at the end, only collapsed buildings were extracted with high accuracy. In the new version of the manuscript, we clarify that the major part of this manuscript deals with the extraction of collapsed buildings.

CHANGE IN MANUSCRIPT:

Page 2, Line 34: "Therefore, this study explores the potential use of Lidar data to extract collapsed buildings over the affected area. The difference of elevation, the standard deviation and the correlation coefficient were tested for this purpose."

(3) SPECIFIC COMMENT:

The standard deviation and the correlation coefficient parameters hardly affected the detection, but were vital to identifying the pattern of the collapse. Though this is an interesting and new usage in these parameters, it is missing throughout the paper, especially in the discussion

AUTHOR'S RESPONSE:

The collapsed patterns are correlated to the failure mechanism of the buildings, which is important for forensic engineering, investigation of failures, etc. We have included

these comments in the discussion.

CHANGE IN MANUSCRIPT:

Page 7 Line 32: "The collapsed patterns are correlated to the failure mechanism in buildings, which might highlight some deficiencies of the design codes that was used during the construction process. A detailed understanding of failure mechanism is important to the practice of forensic engineering, the investigation of failures and other performance problems. Moreover, with further evaluation, the collapsed pattern can contribute to future improvements of the construction design codes. Unfortunately, it was not possible to calibrate a threshold that can properly classify different collapsed patterns. The main reason is because there was not information related to collapse patterns in the surveyed data. Perhaps this task can be done in further research after new surveyed data are released."

(4)SPECIFIC COMMENT:

As the discussion is quite short I would consider merging it with the conclusion to one "Discussion and conclusions" section.

AUTHOR'S RESPONSE:

The discussion section has been enlarged after (1) including a discussion related to collapsed pattern, which was the previous comment and (2) including some word related to future studies, which was a suggestion from the Interactive Discussion Forum (Page 8 Line 22).

CHANGE IN MANUSCRIPT:

No changes

FOCUSED COMMENTS

(4) SPECIFIC COMMENT:

Throughout the paper: please change “Lidar” to “LiDAR”.

AUTHOR’S RESPONSE:

As suggested by the reviewer, Lidar has been changed to LiDAR throughout the paper.

CHANGE IN MANUSCRIPT:

Throughout the paper (please see attached file)

(5) SPECIFIC COMMENT:

Page 3, line 24: “geocoded building footprint dataset” – is that a vector map of the area?

AUTHOR’S RESPONSE:

The referee is right to point out the technical word is vector data. However, we decide not to use it because NHESS gathers readers from different disciplines that might not be familiar with GIS technical words.

CHANGE IN MANUSCRIPT:

No changes

(6) SPECIFIC COMMENT:

Line 27: “reduced by 1 m” – what does this mean? Is that an offset from the building boundaries?

AUTHOR’S RESPONSE:

That is right, to make it clear and following the comment of referee #1, the reduced building boundary is now included in Figure 4 as dashed lines.

CHANGE IN MANUSCRIPT:

The updated figure 4 is located in Page 14 and referred in Page 4 Line 4 (See attached

file).

(7) SPECIFIC COMMENT:

Page 6, Eq. 4-9: the order is reversed to the comments below. It should start with the elements that build the final coefficient, and not the other way around.

AUTHOR’S RESPONSE:

As suggested by the referee, the order of the equations has been modified.

CHANGE IN MANUSCRIPT:

Page 6, Eq. 4-9 (See attached file).

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2017-186/nhess-2017-186-AC3-supplement.pdf

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