DEBRIS EXTENT ASSESSMENT FROM LIDAR DATA

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1. STUDY AREA AND DATABASE

A Mw 6.5 earthquake hit Kumamoto prefecture on April 14, 2016. Then, 28 hours later, another earthquake of Mw 7.0 occurred. Both events were located in the suburban area of Kumamoto city and the most affected area was Mashiki town [1].

Two Airborne LiDAR missions were sent on April 15 and April 23, 2016 by the Asia Air Survey Co.. Thus, the effects of the main event were recorded. After post-processing, digital surface models (DSMs) of the most affected region were available. From the DSMs, the permanent ground deformation [2] and collapsed buildings [3] were extracted. In this paper, the collapsed buildings extracted from [3] are used to quantify their debris extent. A total of 851 wooden buildings were selected for this purpose.

2. DEBRIS EXTENT QUANTIFICATION

Figure 1 shows a closer look of the DSMs of a building. From a comparison between the DSM taken before and after the mainshock, it can be observed that the buildings collapsed toward the south-west direction. Furthermore, with this dataset, the length of the debris can be quantified accurately.

In order to quantify the debris, we calculated the difference of elevations between both DSM. Then we created a binary image where the differences of elevation greater than 50 cm were replaced to 1; otherwise, it is replaced to 0. Finally, the debris extent was measured with respect of the closest side of the building footprint.

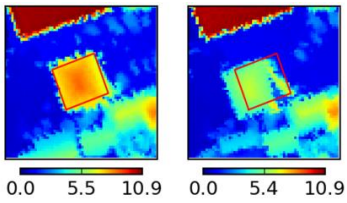

Figure 1. Closer look of a building. Left: pre-event DSM. Right: post-event DSM.

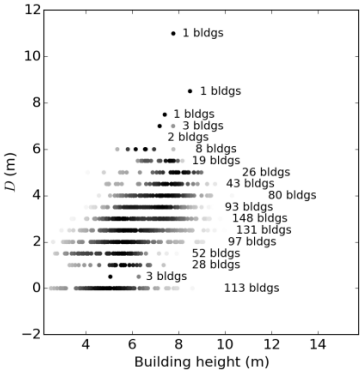

Figure 2. Scatter plot of debris extent (*D*) and building height.

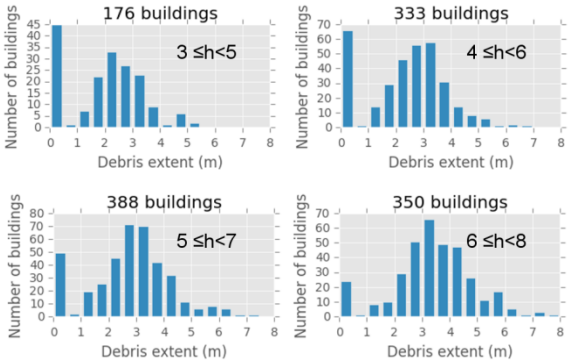

Figure 3. Histogram of debris extent of collapsed buildings grouped by ranges of height.

Figure 2 shows a scatter plot of the debris extent and the building height. The gray intensity depicts the density of points. It is observed a strong correlation between the building height and the debris extent. Based on that observation, the buildings were grouped by ranges of their height. Figure 3 shows the histogram of debris extent for different groups.

3. CONCLUSIONS

A total of 851 wooden collapsed buildings were used to quantify the debris extent. For that purpose a pair of LiDAR dataset was employed. The results showed the following: (1) a strong correlation of the building height with the debris extent. (2) The debris extent has a Gaussian distribution; however, there is a fraction of buildings with zero debris extent. (3) The fraction of buildings with zero debris extent reduces when the height increases. These findings will serve to the construction of probability functions, which well be addressed in a future study.

REFERENCES

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