

ASSESSING EARTHQUAKE DISASTER USING ALOS PALSAR AND AERIAL PHOTOGRAPHS: A CASE STUDY OF THE IWATE-MIYAGI NAIRIKU EARTHQUAKE IN 2008

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ABSTRACT:

In this study we estimated the distribution of topographic horizontal displacement using ALOS/PALSAR image correlation in Aratozawa, where a massive landslide was triggered by the Iwate-Miyagi Nairiku Earthquake in 2008. The range and azimuth offset fields of a pair of SAR Single Look Complex (SLC) data (pre- and post- earthquake) were measured. Offset fields were converted into topographic horizontal displacement on a local plane coordinate system. Since differential interferometric SAR can not retrieve surface deformation due to low coherency, our approach shows that the estimated horizontal displacement has reasonable consistency with aerial photogrammetric analysis and ground truth.

1. INTRODUCTION

A large earthquake (MJMA=7.2) occurred on 14 June, 2008 in Iwate prefecture located in the north-east of mainland Japan (Tohoku region). According to aerial photo interpretation over disaster area, this earthquake resulted in 2,975 slope failures and 37 landslides (Fig. 1).

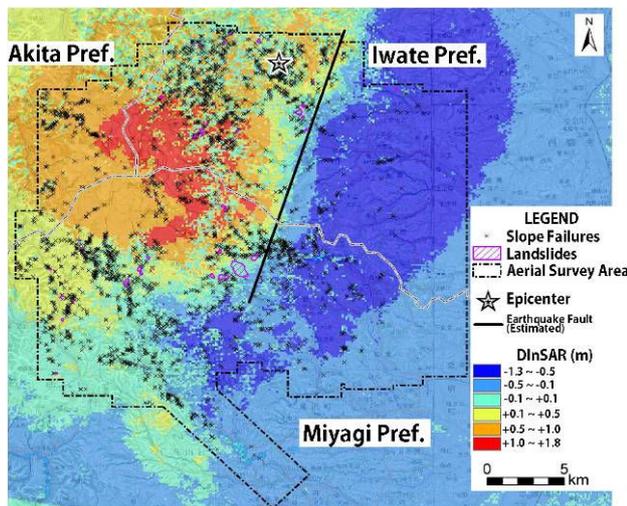


Fig. 1 Aerial photo interpretation and DInSAR

2. MASSIVE LANDSLIDE AT ARATOZAWA

Aratozawa Dam is located 14 km south-southwest of the epicentre, where one of the huge landslide was triggered by this earthquake. Figure 2 shows the ortho-rectified aerial photo of this area and road map before the earthquake strike. The horizontal displacement of this landslide extends to more than 300 m. The road path on the sliding soil mass still remains.

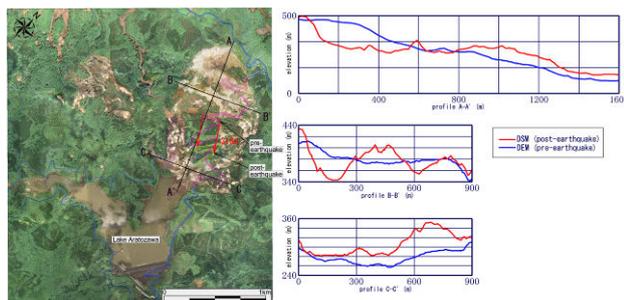


Fig. 2 Massive landslide at ARATOZAWA

3. SURFACE DISPLACEMENT ESTIMATED BY SAR IMAGE CORRELATION

Figure 3 shows the estimated displacement using SAR image correlation over the Aratozawa area. Direction and magnitude of displacements are represented as vectors in the Fig.3. In northwest part of the study area, the distance is approximately 3 – 4 m in the southeast direction. In contrast, displacement is almost smaller than 1 m in the south-eastern part of the study area. The reason for the empty space in Fig.3 is the low correlation inside the landslide. Our result has reasonable consistency with ground survey performed by AFERC, AIST [1]. The yellow line in Fig. 3 shows one of the fault scarps found by their field research. In addition, we superimposed the results from Kamiya et al. [2], who also investigated the displacement using aerial photogrammetry. His results which are shown as blue arrow in Fig. 3 are consistent with our results in the same direction. However, magnitude is about 1.5 – 2 times larger than ours.

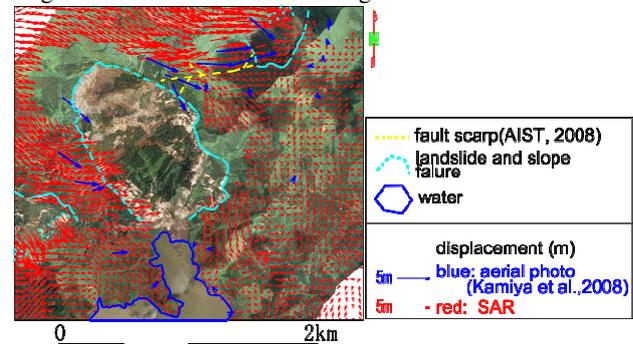


Fig. 3 Surface displacement by SAR image correlation

4. CONCLUSION

The estimated displacement has good consistency with other results at Aratozawa in direction and position. In particular, our method successfully detected the location of fault scarp found by the ground survey. However, the distances are smaller than other methods possibly due to the difference in the window size of the estimation analysis.

REFERENCES

- 1) http://unit.aist.go.jp/actfault/katsudo/jishin/iwate_miyagi/080709_1m.ap.pdf (in Japanese)
- 2) Izumi KAMIYA, Mamoru KOARAI, Tatsuo SEKIGUCHI, Junko IWAHASHI, Takayuki NAKANO, "Horizontal displacement in the north of the Aratozawa dam caused by the Iwate-Miyagi Nairiku Earthquake in 2008," Journal of the Japan Society of Photogrammetry and Remote Sensing, Vol. 47, No. 6, 2008. (in Japanese)