Simulation of disaster research with UAV on Kumamoto earthquake

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KEY WORD: 3D model, GIS, IR filter, NDVI

ABSTRACT: On APRIL 14, 2016, Kumamoto earthquake occurred with magnitude 6.5 and followed on April 16 with magnitude 7.3 and in total 49 victims. UAV is available for air photographs and their analysis assisted reconstruction for damaged areas. The authors investigated most damaged areas by using UAV, Phantom 4 on May 28 and 29, June 11 and 12, especially Aso-Ohhashi Bridge and Ohkirihata Dam. These data were analyzed by Photoscan and ArcGIS. The authors verified and that UAV gets a satisfactory data in limit time.

1. INTRODUCTION

UAV is widely used as a low-cost and user-friendly research tool. A researcher can research with UAV solely [0]. Low altitude aerial photos by UAV have detail date compared to satellite image. These superiority of UAV hides the possibility of speeding up rescue work and restoration. Construction of a 3D model by aerial photos with UAV make it easy to grasp the disaster situation.

The authors researched Kumamoto earthquake that occurred on April 14, with UAV. This paper discussed current status and future development of disaster research with UAV. This research was held on the assumption in emergencies. The authors verify that UAV can take satisfactory data with in a limited time.

2, METHODS

2.1 Equipment

The authors utilized Phantom 4.0 (DJI) performed manually. The camera is standard installation of Phantom 4.0. The authors used IR filter, IR72 to calculate NDVI. The authors made orthogonal photo and 3D model with Photoscan professional (Agisoft).

2.2 Survey contents

The authors investigated two times on 28 and 29 May, 2016, on 11and 12 June, 2016.

The rain made it impossible for us to survey enough on May. A shooting conditions in this survey in June is shown in Table

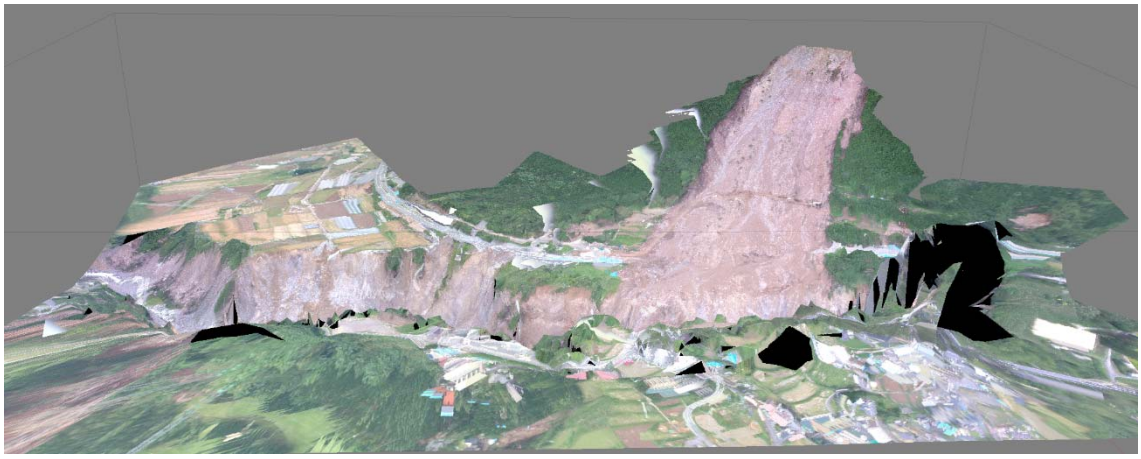

Fig.1 Developed 3D model at Aso-Ohhashi Bridge by SfM

Table1 shooting conditions

place	Time limit	Number of shots
Aso-Ohhashi(RGB)	20m	1
Aso-Ohhashi(IR72)	10m	4
Ohkirihata	5m	335

2.3 Construction 3D models

Fig.1 shows a 3D model of Aso-Ohhashi Bridge. Moreover, the authors utilized 96 aerial photos with UAV from 500m of height above land. Fig. 2 shows camera positions. Fig. 3 shows a 3D model of Ohkiritaha Dam. Moreover, the authors utilized 5 aerial photos with UAV between 380m and 430m of height above land. Fig.4 shows camera positions.

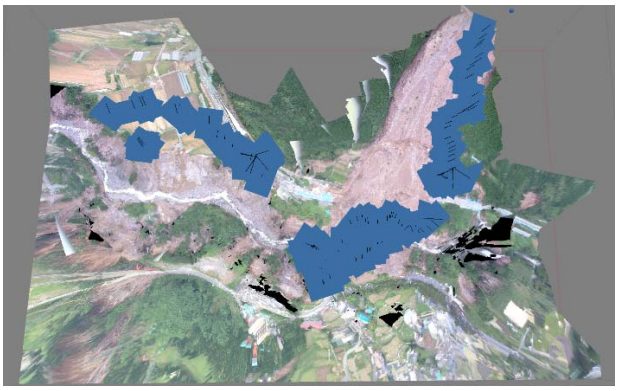

Fig. 2 Estimated camera position at Aso-Ohhashi

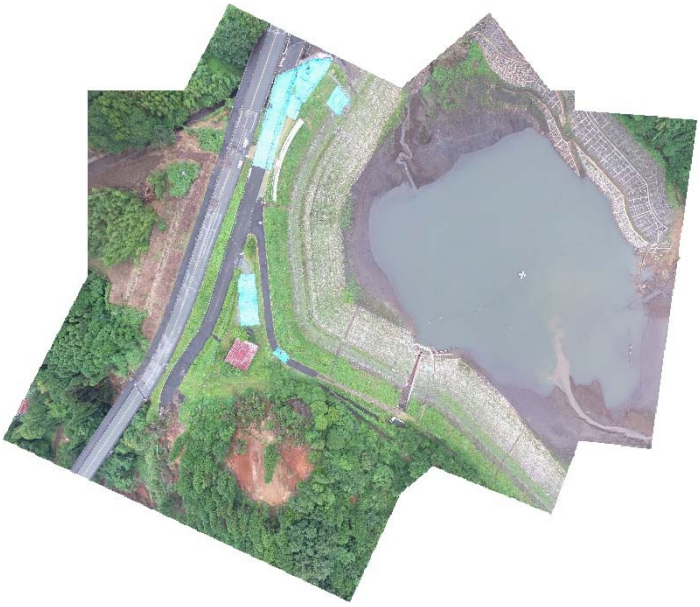

Fig. 3 Developed 3D model at Ohkirihata Dam bySfM

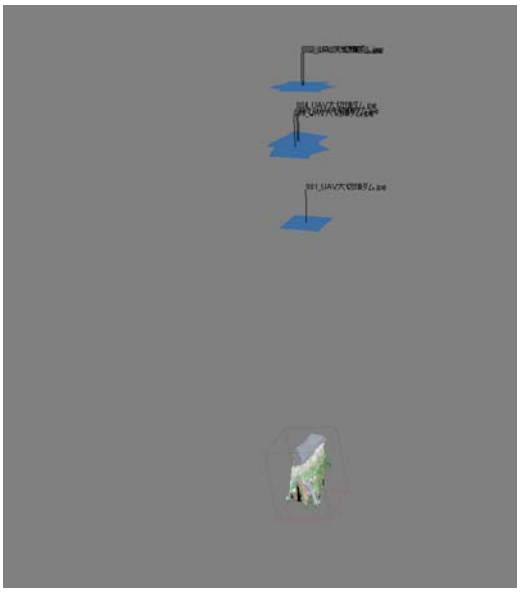

Fig. 4 Estimated camera position at Ohkirihata Dam

3. RESULTS AND DISSCUTION

3.1 DEM

Constructing a 3D model makes DEM. Fig. 5 (a) shows a orthogonal photo of Aso-Ohhashi Bridge. Fig.

5 (b) shows a DEM image of Aso-Ohhashi Bridge. DEM on shooting route leads to correct result. However, DEM strayed off shooting route incorrect result. Fig. 6 (a) shows orthogonal photo of Ohkirihata Dam. Fig. 6 (b) shows a DEM image of Ohkirihata Dam. It represents that the DEM value of the reservoir is larger than the DEM value of land. It is obvious that this result is mistaken. This is why aerial photos make a 3D model have nothing but vertical image[2)] (Fig. 7).

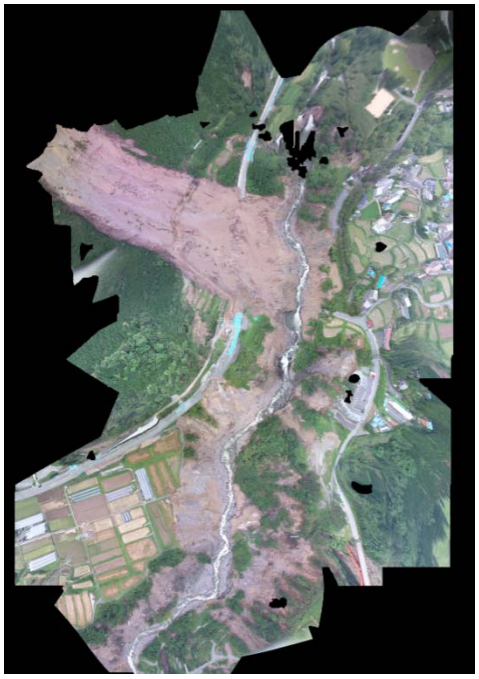

Fig. 5(a) Orthogonal photo of Aso-Ohhashi

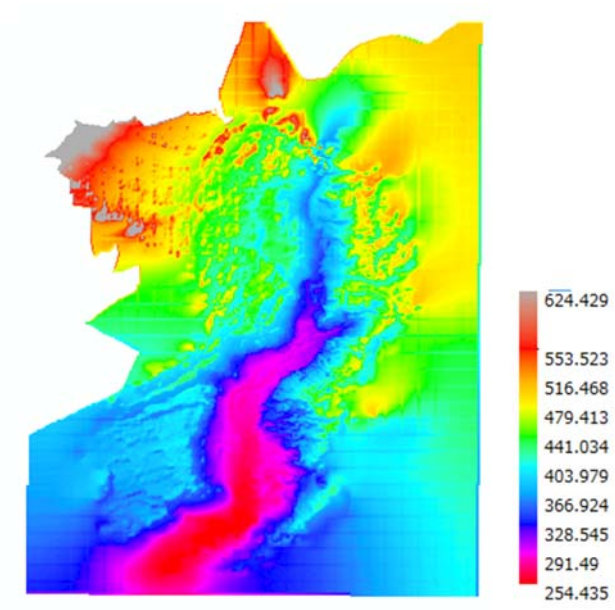

Fig .5(b) DEM image of Aso-Ohhashi

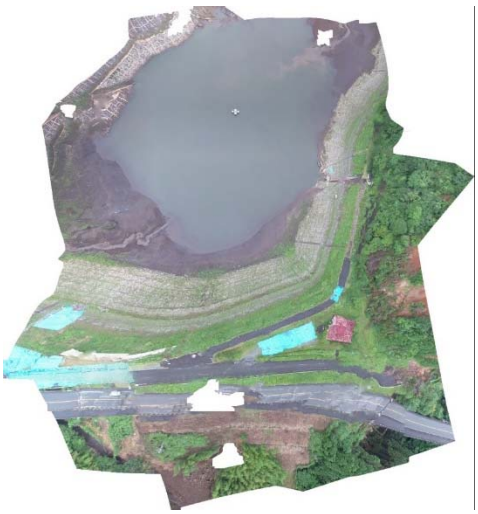

Fig. 6(a) Orthogonal photo of Ohkirihata Dam

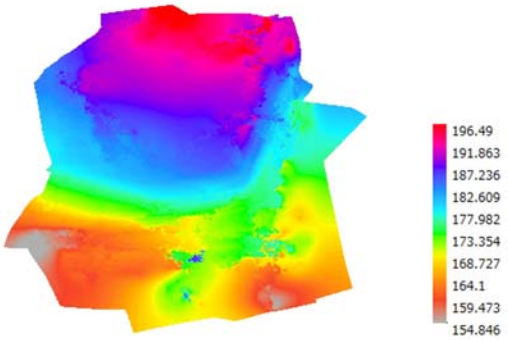

Fig. 6 (b) DEM image of Ohkirihata Dam

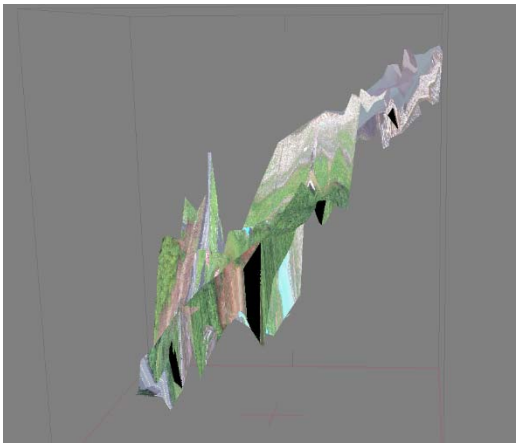

Fig. 7 3D model from a lateral view

3.2 NDVI

The redo flame of Fig.80 shows the coverage of the survey of NDVI. The number of aerial photo by IR72 is low (Fig. 9). But, it is enough to measure surface as NDVI. （Fig. 10）

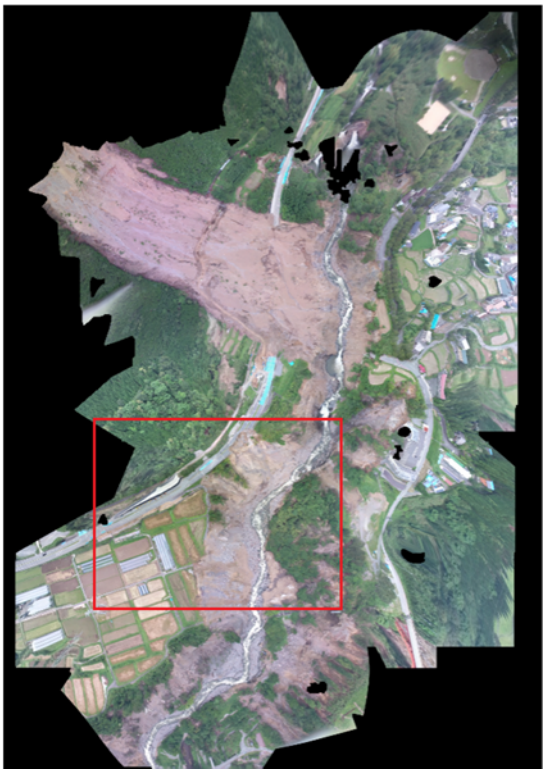

Fig. 8 Coverage of the NDVI survey in a red frame

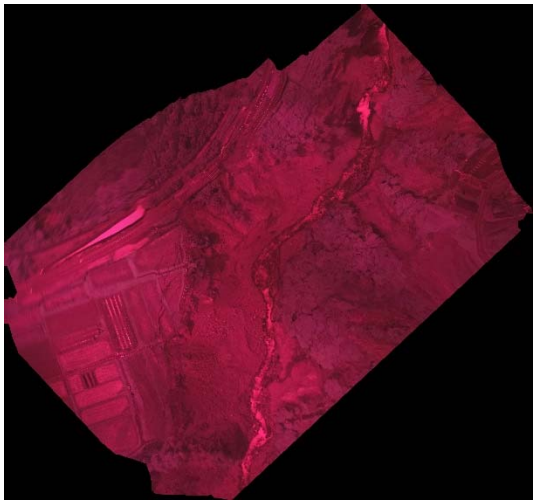

Fig. 9 Orthogonal photo with IR 72

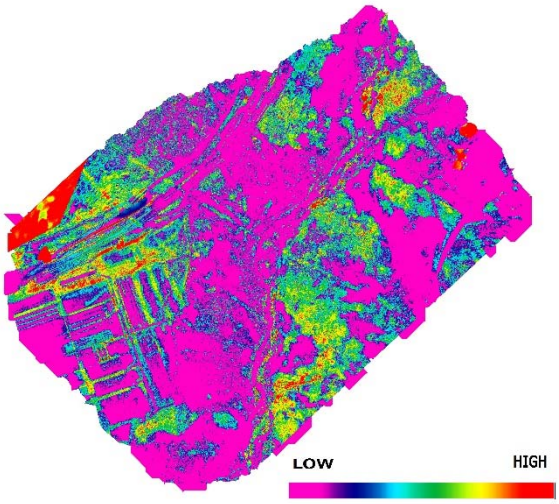

Fig. 10 NDVI at Aso-Ohhashi

4. CONCLUTIONS

Most UAV is not waterproof. Therefore, UAV does not work in rain. Treatment with UAV in emergencies depends on the weather. Development of waterproof UAV is required.

In researching disaster areas, we have to decide filming location on the spot and take photos within time limit. Therefore, it is necessary that developing a program to generate optimal routes to take photos with efficiency.

References

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