How quickly can topographic data are acquired after earthquake? A case study for the landslide in Minami-Aso, Kumamoto, Japa

*Yuichi S. Hayakawa[1]

1.Center for Spatial Information Science, The University of Tokyo

A large earthquake can drastically deform the land surface including buildings, roads and slopes, therefore prompt topographic mapping of damaged areas is crucial for identification of those changes just after the earthquake. Photographs or videos taken either on ground or from air often provide great amount of information, but more can be obtained, including three dimensional data, from those datasets. Structure-from-Motion Multi-View Stereo (SfM-MVS) photogrammetry enables to generate three-dimensional topographic data from multiple photographs or video images. Here the author demonstrates prompt 3D mapping of the earthquake-triggered landslide occurred in Minami-Aso, Kumamoto. Several data sources are utilized for the photogrammetric processing, including oblique aerial photographs taken from a manned aircraft, and video images taken by either a manned or unmanned aircraft. The data processing can be carried out remotely, without the necessity to visit the field site if the data sources are provided online. Topographic data, with accuracies on the order of meters, were obtained within tens of minutes after these data sources became available. An example is shown in the figure attached, which was generated from oblique aerial photographs provided by Geospatial Authority of Japan (GSI). During the data processing, setting ground control points (GCPs) was the most time consuming because it requires manual reading of the images. The images of the mapped data (topographic contour lines, hillshade image, and orthorectified photographs) were promptly shared over online social networks including twitter and facebook, as visible jpg or animation gif files, and the data itself including point cloud, digital elevation model and orthorectified image were published in an online data storage system (Hayakawa, 2016). Three-dimensional models (point cloud or TIN) were also shared online to enhance the visibility of the data. These data helped some people particularly in remote places (e.g., university students and overseas researchers) to understand the situation of the landslide area, although limitations exist for the on-site use. For the purpose of enhancing the use of prompt and accurate 3D mapping, the speed of such data processing should be further improved. The exported products should also be in other formats, not only digital ones but also printed paper maps, if they are to be used for on-site rescue purposes. This study is supported by JSPS KAKENHI Grants (25702014).
Hayakawa, Yuichi (2016),"Topographic data generated from oblique aerial photos in Minami-Aso, Kumamoto, Japan just after the April 2016 earthquake", Mendeley Data, v1. doi:10.17632/sbxkzhy7h6.1

Keywords: structure-from-motion multi-view stereo photogrammetry, point cloud, digital elevation model, data sharing, landslides, topographic mapping