High-definition topography applied to landslide hazard assessment around Aso Volcano

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In the last few years, small unmanned aerial vehicles (UAVs), and structure from motion and multi view stereo (SfM-MVS) photogrammetry have attracted a tremendous amount of interest for the creation of high-definition topographic data. This study was conducted to detect temporal changes of topography around shallow landslides using small UAVs and SfM-MVS photogrammetry. Study areas are the Sensuikyo area (1.2 km^2) and the Saishigahana area (0.06 km^2) around Aso Volcano, where many shallow landslides occurred because of heavy rainfall in July, 2012. During 2014–2016, field surveys were conducted using small UAVs. After acquiring high-definition DSMs and ortho-rectified photographs, we analyzed the topographic changes of shallow landslides in comparison to LiDAR-based DSMs in 2004.
We obtained ortho-rectified photographs and DSMs with spatial resolutions of 4 cm and 10 cm, respectively. In the Saishigahana area, 20 landslides (20–4,600 m^2) occurred. The ratio of the total landslide area reached 30% of the area. These landslides tended to occur specifically on 40-degree slopes. The landslide depth was ca. 1.0 m. The estimated total landslide volume was $1.5–2.8×10^5$ m^3/km^2. In the Sensuikyo area, 300 landslides (10–10,000 m^2) occurred. The estimated total landslide volume was $1.1–1.4×10^5$ m^3/km^2. In the Sensuikyo area, the landslide distribution was not uniform. Our results indicate that topography and past landslide history affected these landslide occurrences. Additional studies must be conducted to detect temporal changes of topography and vegetation around shallow landslides based on multi-temporal ortho-photographs and DSMs.

Keywords: shallow landslide, UAV, SfM-MVS photogrammetry

