

High-resolucional topographic survey using small UAV and SfM-MVS technologies in hardly accessible area

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Abstract. Aerial photogrammetry and/or airborne laser scanning with manned light plane are normally used for geomorphological measurement especially in hardly accessible areas. Those methods are, however, relatively expensive and therefore frequent measurement is practically difficult. Additionally, as the manned plane cannot fly at low altitude, it would not measure a correct topography of subvertical features and concave geometries like caves. To solve such problem, the authors have experimented an aerial photography based SfM-MVS (Structure from Motion and Multi-view Stereo) technique on a 'peninsular-rock' surrounded on three sides by the sea at a Pacific coast in Chiba Prefecture and on a waterfalls surrounded by mortar-shaped cliffs in a mountain in Tochigi Prefecture. The survey was carried out using UAS (Unmanned Aerial System) combined with a commercial small UAV (Unmanned Aerial Vehicle) carrying a compact digital camera. The three-dimensional model has been constructed by digital photogrammetry using a commercial SfM-MVS software which can generate sparse and dense point-clouds and orthophotographs. Using the 'flight-log' and/or GCPs (Ground Control Points), the software can generate digital surface model with absolute coordinates. As a result, high-resolucional aerial orthophotographs and a three-dimensional model were obtained. The results have shown that it was possible to survey the inaccessible area like free face and deep gorge in detail. This system has several merits: firstly lower cost than the existing measuring methods such as manned-flight survey and aerial laser scanning. Secondly, compared to these other methods, the one the authors have presented also enables frequent measurements. Thirdly lightweight and compact system realizes higher applicability to various fields.

Keywords. UAV, SfM-MVS, Photogrammetry, Cliff, Topographical survey