Geophysical Research Abstracts
Vol. 16, EGU2014-5063, 2014
EGU General Assembly 2014

3D Modelling of Inaccessible Areas using UAV-based Aerial Photography and Structure from Motion

Hiroyuki Obanawa (1), Yuichi Hayakawa (2), and Christopher Gomez (3)

(1) Chiba University, Centre for Environmental Remote Sensing, Japan (obanawa@faculty.chiba-u.jp), (2) University of Tokyo, Centre for Spatial Information Sciences, Japan (hayakawa@csis.u-tokyo.ac.jp), (3) University of Canterbury, College of Sciences, Dept. of Geography, New Zealand (christopher2501@gmail.com)

In hardly accessible areas, the collection of 3D point-clouds using TLS (Terrestrial Laser Scanner) can be very challenging, while airborne equivalent would not give a correct account of subvertical features and concave geometries like caves. To solve such problem, the authors have experimented an aerial photography based SfM (Structure from Motion) technique on a 'peninsular-rock' surrounded on three sides by the sea at a Pacific coast in eastern Japan. The research was carried out using UAS (Unmanned Aerial System) combined with a commercial small UAV (Unmanned Aerial Vehicle) carrying a compact camera. The UAV is a DJI PHANTOM: the UAV has four rotors (quadcopter), it has a weight of 1000 g, a payload of 400 g and a maximum flight time of 15 minutes. The camera is a GoPro 'HERO$_3$ Black Edition': resolution 12 million pixels; weight 74 g; and 0.5 sec. interval-shot. The 3D model has been constructed by digital photogrammetry using a commercial SfM software, Agisoft PhotoScan Professional®, which can generate sparse and dense point-clouds, from which polygonal models and orthophotographs can be calculated. Using the 'flight-log' and/or GCPs (Ground Control Points), the software can generate digital surface model. As a result, high-resolution aerial orthophotographs and a 3D model were obtained. The results have shown that it was possible to survey the sea cliff and the wave cut-bench, which are unobservable from land side. In details, we could observe the complexity of the sea cliff that is nearly vertical as a whole while slightly overhanging over the thinner base. The wave cut bench is nearly flat and develops extensively at the base of the cliff. Although there are some evidences of small rockfalls at the upper part of the cliff, there is no evidence of very recent activity, because no fallen rock exists on the wave cut bench. 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. However, the method is still in need of development, as the measurable range is narrower than the other airborne methods, normally up to several hectares, and data accuracy of coordinate and elevation is unknown from SfM alone.