UAV sensing of coastal cliff topography for rock fall hazard applications

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Abstract

Cliff topography measurements, in the last decade, have been performed with Terrestrial Laser Scanners (TLS), yielding dense measurements of 3D cliff surface points, of the order of 400 pts/m^2. Equipment cost and survey durations have begged for faster and cheaper techniques to achieve comparable results. In this paper, we present preliminary results of an Unmanned Aerial Vehicle (UAV) photogrammetric survey of the Mesnil Val coastal chalk cliff, in Normandy that was performed to challenge the speed and price of TLS surveys. We discuss the merits and pitfalls of UAV topographic sensing of coastal cliffs and their implication for deriving probabilistic rock fall hazard applications. Time-wise, UAV perform much faster to acquire stereo-photographs of a larger surface (about 30min flight in total for 60 ha coverage). Cost-wise, hardware come at around 10-15k€ compared to 50-100k€ for a TLS. Differences arise at the stage of data processing: UAV acquire hundreds of mighty redundant photographs, which hinders processing time. 3D topography from photogrammetric processing requires decimation. Shooting strategy, adding oblique photographs in addition to strictly normal shots, is also important to control the distortion of 3D models. Finally, the quality of the 3D dense reconstruction is very dependent upon software processing and its settings. In the case of Mesnil Val, UAV-sensed rock fall scars inventories censor the smallest events compared to TLS-sensed data but nevertheless proves valuable in terms of coverage completeness, extent and acquisition speed.