



Applications of UAV Photogrammetric Surveys to Natural Hazard Detection and Cultural Heritage Documentation

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Unmanned Aerial Vehicle (UAV) systems are increasingly seen as an attractive low-cost alternative or supplement to aerial and terrestrial photogrammetry due to their low cost, flexibility, availability and readiness for duty. In addition, UAVs can be operated in hazardous or temporarily inaccessible locations. The combination of photogrammetric aerial and terrestrial recording methods using a mini UAV (also known as "drone") opens a broad range of applications, such as surveillance and monitoring of the environment and infrastructural assets. In particular, these methods and techniques are of paramount interest for the documentation of cultural heritage sites and areas of natural importance, facing threats from natural deterioration and hazards. In order to verify the reliability of these technologies an UAV survey and a LIDAR survey have been carried out along about 1 km of coast in the Salento peninsula, near the towns of San Foca, Torre dell' Orso and Sant'Andrea (Lecce, Southern Italy). This area is affected by serious environmental hazards due to the presence of dangerous rocky cliffs named "falesie". The UAV platform was equipped with a photogrammetric measurement system that allowed us to obtain a mobile mapping of the fractured fronts of dangerous rocky cliffs. UAV-images data have been processed using dedicated software (Agisoft Photoscan). The point clouds obtained from both the UAV and LIDAR surveys have been processed using Cloud Compare software, with the aim of testing the UAV results with respect to the LIDAR ones. The analysis were done using the C2C algorithm which provides good results in terms of Euclidian distances, highlighting differences between the 3D models obtained from both the survey techniques. The total error obtained was of centimeter-order that is a very satisfactory result.

In the the 2nd study area, the opportunities of obtaining more detailed documentation of cultural goods throughout UAV survey have been investigated. The study area is an ancient Aragonese watchtower of the seventeenth century, located near the Abbey of San Vito in the countryside of Polignano a Mare (in the province of Bari, Southern Italy). The survey has been carried out with an "esacopter" equipped with a CANON EOS 550D. The image processing was carried out with Photogrammetric and Structure from Motion software (Agisoft PhotoScan) and, as a result, a cloud of 524.607 points with a 0.010096 m/pix resolution was obtained starting from 330 nadiral and inclined images. In order to verify the suitability of this technique we carried out also a terrestrial photogrammetric survey using three different photographic media, a reflex camera with integrated GPS, a compact digital camera and a camera of a smartphone. Three data set of image have been obtained and then compared. In conclusion, it is possible to say that the peculiarity of the RPAS photogrammetric survey allowed highlighting some peculiar features of the tower, such as the presence of a trapdoor and of a chimney at the roof level, not detectable with a terrestrial survey, that could provide essential elements in order to execute restoration works aimed at the recovery of the cultural heritage.