Geophysical Research Abstracts
Vol. 17, EGU2015-2676, 2015
EGU General Assembly 2015

UAV survey of a Thyrrenian micro-tidal beach for shoreline evolution update

Guido Benassai (1), Giovanni Pugliano (1), Gianluigi Di Paola (2), and Luigi Mucerino (3)

(1) Dept. of Engineering, University Parthenope, Naples, Italy (g.pugliano@uniparthenope.it), (2) Dept. of Science and Technology, University Parthenope, Naples, Italy (gianluigi.dipaola@unimol.it), (3) Dept. of Earth, Environment and Life Sciences , University of Genoa,Italy (luigi.mucerino@gmail.com)

Coastal geomorphology requires increasingly accurate topographic information of the beach systems to perform reliable simulation of coastal erosion, flooding phenomena, and coastal vulnerability assessment. Among the range of terrestrial and aerial methods available to produce such a dataset, this study tests the utility of low-altitude aerial imageries collected by Unmanned Aerial Vehicle (UAV). The image-based approach was selected whilst searching for a rapid, inexpensive, and highly automated method, able to produce 3D information from unstructured aerial images. In particular, it was used to generate a high-resolution Digital Surface Model (DSM) of the micro-tidal beach of Serapo – Gaeta (LT) in order to obtain recent update of erosional/accretional trends already established through historical shoreline evolution.

A UAV exacopter (fig. 1a) was used, weighing about 2500g, carrying on board a GPS and multi-directional accelerometer to ensure a recovery of the beach features (fig. 1b) through a sweep with constant speed, direction and altitude. The on-board camera was a Canon 16M pixels, with fixed and constant focal takeoff in order to perform the 3D cloud points. Six adjacent strips were performed for the survey realization with pictures taken every second in sequence, in order to allow a minimum 80% overlap. A direct on site survey was also carried out with a DGPS for the placement of GPS markers and the geo-referencing of the final product (fig. 1c).

Each flight with constant speed, direction and altitude recorded from 500 to 800 shots. The height of flight was dictated by the scale of the final report, an altitude of 100m was used for the beach survey. The topographic survey on the ground for the placement of the control points was performed with the Trimble R6 DGPS in RTK mode.

The long-term shoreline evolution was obtained by a sixty-year historical shoreline time-series, through the analysis of a number of aerial photographs dating from 1954 to 2013. The shoreline change analysis was performed using the ArcGis 9.3 extension Digital Shoreline Analysis System (DSAS), v. 3.2 (Thieler et al., 2005). Transects orthogonal to the shoreline were generated at 100m intervals along the 1,4 km stretch of beach studied. The DSAS allowed the calculation of the rates of erosion/accretion between points, on the basis of the distance between them and the elapsed time, assuming changes to be linear processes. The rate of change of shoreline positions was evaluated at 14 points.

The availability of shoreline data of the years 1954, 2000, 2006, 2008 and 2013 allowed to obtain the shoreline evolution trend in the last 60 years. Moreover, the UAV survey allowed to update the shoreline evolution and to obtain the volume of sediment lost by erosion, in order to suggest the locations and the amount of possible replenishments.