



## **Annual low-cost monitoring of a coastal site in Greece by an unmanned aerial vehicle**

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Coastal areas are under permanent change and are also the result of past processes. These processes are for example sediment transport, accumulation and erosion by normal and extreme waves (storms or tsunamis). As about 23% of the World's population lives within a 100 km distance of coasts, knowledge about coastal processes is important, in particular for possible changes in the nearby future. The past devastating tsunami events demonstrated profoundly the high vulnerability of coastal areas. In order to estimate the different effects, coastal monitoring approaches are of interest. Several different methods exist in order to determine changes in the sedimentary budget and coastline configuration.

In order to estimate constant annual changes, we have applied terrestrial laser scanning (TLS) in an annual monitoring approach (2009-2011). In 2014, we changed to an approach based on dense imaging and structure-from-motion, applying an unmanned aerial vehicle (UAV) in order to conduct an annual monitoring of a coastal site in western Greece. Therefore, a GoPro Hero 3+ and a Canon PowerShot S110 mounted on a DJI-Phantom 2 were used. All surveys were conducted in a manually structured image acquisition with a huge overlap. Ground control points (GCP) were measured by tachymetric surveying. This successful approach was repeated again in 2015 with the Canon camera.

The measurements of 2014 were controlled by an additional TLS survey, which revealed the high accuracy and more suitable coverage for the UAV-based data. Likewise, the large picture datasets were artificially reduced in order to estimate the most efficient number of images for dense point cloud processing. In addition, also the number of GCPs was decreased for one dataset. Overall, high-resolution digital elevation models with a ground resolution of 10 mm and an equal accuracy were achieved with this low-cost equipment. The data reveals the slight changes on this selected site.