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Detection of the pre-356AD coastal line on the suouthwestern coast of Crete using a combination of mobile LiDAR and mobile SfM mounted on a boat

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The south western shoreline of Crete as southern part of the Lefka Ori (white mountains) is mainly dominated by steep hard rock cliffs and is considered as a classic example for well-preserved coastal notches as a result of a rapid tectonic uplift due to an seismic event in the year 356AD. This historic coastline is highly visible and lies up to 9m over the actual coastline in the outermost western part (rising from 0m in the central southern part of Crete) and is described in many studies, which used the measured vertical distance between the notches and the actual mean sea level as indicator for the coastal uplift. Due to the proximity to the Lefka Ori with its highest peak Pachnes (2454 m a.s.l.) and the very short distance between the highest parts of the mountains and the coast, most parts of the shoreline are difficult to access or only visible from the sea. Thus previous studies determined the coastal uplift only on selective points by using different methods like terrestrial LiDAR or GPS in order to produce a detailed insight in the topography of parts of the coast or to produce interpolated contour lines of the amount of uplift.
During a field trip in March 2017 a mobile LiDAR device (Riegl VP1-POD) was used in combination with two digital cameras (Sony Alpha 6000) and a differential GNSS system mounted on a boat in order to produce a high resolution point cloud and nearly 40 000 pictures of a 65 km shoreline between Chora Sfakion and Paleochora. The recorded LiDAR data were processed, showing a high mean point density for the lower parts of the coast (up to 30m above the actual sea level). Parts of the pictures were used to derive orthoimages in order to produce a panorama view of the coastline. After the time-consuming processing steps, the notches could manually be mapped for the investigated shoreline using both, the point cloud data and the derived orthoimages. These data afterwards formed the base for the development of an automatic notch detection approach using a combination of different geomorphometric tools in the GIS software SAGA LIS.