Geophysical Research Abstracts
Vol. 18, EGU2016-12837, 2016
EGU General Assembly 2016

High-resolution Pleiades DEMs and improved mapping methods for the E-Corinth marine terraces

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The newest generation of satellite imagery provides exciting new possibilities for highly detailed mapping, with ground resolution of sub-metric pixels and absolute accuracy within a few meters. This opens new venues for the analysis of geologic and geomorphic landscape features, especially since photogrammetric methods allow the extraction of detailed topographic information from these satellite images. We used tri-stereo imagery from the Pleiades platform of the CNES in combination with Euclidium software for image orientation, and Micmac software for dense matching, to develop state-of-the-art, 2m-resolution digital elevation models (DEMs) for eight areas in Greece. Here, we present our mapping results for an area in the eastern Gulf of Corinth, which contains one of the most extensive and well-preserved flights of marine terraces world-wide. The spatial extent of the terraces has been determined by an iterative combination of an automated surface classification model for terrain slope and roughness, and qualitative assessment of satellite imagery, DEM hillshade maps, slope maps, as well as detailed topographic analyses of profiles and contours. We determined marine terrace shoreline angles by means of swath profiles that run perpendicularly to the paleo-seacliffs, using the graphical interface TerraceM. Our analysis provided us with a minimum and maximum estimate of the paleoshoreline location on ∼750 swath profiles, by using the present-day cliff slope as an approximation for its paleo-cliff counterpart. After correlating the marine terraces laterally we obtained 16 different terrace-levels, recording Quaternary sea-level highstands of both major interglacial and several interstadial periods. Our high-resolution Pleiades-DEMs and improved method for paleoshoreline determination allowed us to produce a marine terrace map of unprecedented detail, containing more terrace sub-levels than hitherto. Our mapping demonstrates that we are no longer limited by the resolution or accuracy of topographic information to understand the tectonic and climatic processes that shape marine terraces, but rather by our knowledge of these processes themselves.