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A novel approach for automated shoreline extraction from remote sensing images using low level programming

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Tracking coastline changes is a crucial task in the context of coastal management and synoptic remotely sensed data has become an essential tool for this purpose. In this work, and within the framework of BeachTour project, we introduce a new method for shoreline extraction from high resolution satellite images. It was applied on two images taken by the WorldView-2 satellite (7 channels, 2m resolution) during July 2011 and August 2014. The location is the well-known tourist destination of Laganas beach spanning 5 km along the southern part of Zakynthos Island, Greece. The atmospheric correction was performed with the ENVI FLAASH procedure and the final images were validated against hyperspectral field measurements. Using three channels (*CH2*=blue, *CH3*=green and *CH7*=near infrared) the Modified Redness Index image was calculated according to: $MRI=(CH7)^2/[CH2\text{x}(CH3)^3]$. *MRI* has the property that its value keeps increasing as the water becomes shallower. This is followed by an abrupt reduction trend at the location of the wet sand up to the point where the dry shore face begins. After that it remains low-valued throughout the beach zone. Images based on this index were used for the shoreline extraction process that included the following steps:

a) On the MRI based image, only an area near the shoreline was kept (this process is known as image masking).

b) On the masked image the Canny edge detector operator was applied.

c) Of all edges discovered on step (b) only the biggest was kept.

d) If the line revealed on step (c) was unacceptable, i.e. not defining the shoreline or defining only part of it, then either more than one areas on step (c) were kept or on the *MRI* image the pixel values were bound in a particular interval $[B_{low}, B_{high}]$ and only the ones belonging in this interval were kept. Then, steps (a)-(d) were repeated.

Using this method, which is still under development, we were able to extract the shoreline position and reveal its changes during the 3-year period. Although simple, with minimal human interaction and low level programming, this method can provide precise coastlines with just one pixel resolution. Images covering more locations are currently under consideration.