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MAPPING COASTAL DYNAMISM FROM SPACE: A SMALL SATELLITE APPLICATION FOR THE ONBOARD AUTOMATIC EXTRACTION OF COASTAL BOUNDARIES

Abstract

The coast is a highly dynamic environment with complex interacting processes that are being impacted significantly by climate change. An estimated two fifths of the world's population live on or near the coast, putting key transport infrastructure, businesses and communities at risk of increased erosion and flooding as sea levels continue to rise. To redirect assistance and focus planning and adaptation strategies to those most at risk, standardised and regular observations of how coasts are changing needs to be available to coastal managers and policymakers.

Due to inherent dynamism, the coast is logistically difficult and costly to survey on the ground. Earth Observation has opened new opportunities for gathering repeated measurements of shoreline positions and coastal vegetation boundaries to infer morphological changes and damages to coastal assets from flooding and erosion. Many methodologies now exist to extract these coastal boundaries from freely available satellite-based optical and synthetic aperture radar sensors, but there is no dedicated coastal monitor which means current lead-times on obtaining useful data are long and data must be extracted manually with each new image.

We present the overall system architecture of a 3U CubeSat platform and full data product for a coastal observation mission. Novel onboard processing routines regularly image the coast from a low-Earth orbit, pre-process images, use spectral band indices to extract shoreline positions and coastal vegetation edges and downlink this vector information to be used rapidly by stakeholders. By shortening the lead-time significantly, a faster response to storm event risk and damage assessment can be obtained and a more holistic approach to analysing coastal change can be taken. The data products OirthirSAT will provide on a weekly basis can be easily visualised for a comprehensible understanding of coastal change, and fed into modelled predictions of future coastal change.