

EROSION OF SANDY BEACHES WORLDWIDE

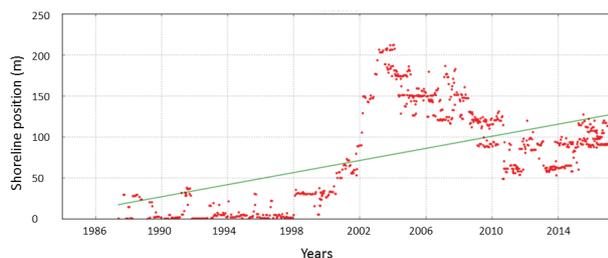
Recent technological developments have made it possible to conduct the first global assessment of changes in the world's coastlines over the last thirty-three years. We used freely available satellite data and Google Earth Engine, a platform for the planetary-scale scientific analysis of geospatial datasets that is open to the general public. The analysis of this unique dataset shows shoreline changes due to extreme events, man-made interventions, and natural variations on sandy coastlines with a resolution of thirty metres.



The world's sandy beaches (yellow dots)



Shoreline dynamics at Aveiro, Portugal showing accretion north of the port breakwaters between 1984 and 2017



Shoreline positions at Coolangatta Bay, Australia between 1986 and 2017

The spread of percentage values previously reported in literature for the global occurrence of sandy shorelines is very large (10-75%) and the methods used to arrive at these values remain unclear or qualitative. The global map shows all the sandy beaches in the world as derived from high-resolution satellite images. Image analysis showed that 31% of the ice-free world shoreline is sandy. The continent with most sandy beaches is Africa (66%), while only 22% of the shoreline in Europe is sandy. Sandy beaches are relatively sparse near the equator, where a lot of shorelines consist of muddy shores, mangroves, coral reefs, etc.

We then applied automatic detection methods to detect shorelines on every available cloud-free image for every coastal site in the world. The analysis of global shorelines revealed significantly lower percentages for shoreline erosion than reported in the literature (24% as opposed to 75%). Even so, a remarkably large proportion of sandy coasts (~14,000 km) are eroding at an alarming rate of more than 5 metres a year. Four of the seven largest erosive hot spots are located in the USA, while four of the seven largest accretive hot spots are human-induced. An example of a beach where erosion is strongest is the 29-km-long beach at High Island in Texas: it is eroding at a disruptive mean rate of at least 5 metres a year.

Beaches are not only eroding: there is also accretion at several locations. The accretion rate is highest on sandy beaches in Asia at 1.27 m a year on average, probably due to the development of the Chinese coast and large land reclamations in Singapore, Hong Kong, etc.

This unique high-resolution dataset can be used to reveal the impacts of storms or human interventions. An example is shown for a nourished beach in Australia. A sand bypass system was installed in 2002, after which the beach grew by ~100 m in just a few years. After the initial accretion, the beach started to lose sand again.

Rates of change of the shoreline position have now been made available for every 500 metres along the world's coastlines on an interactive website, which may be of interest to many national and local coastal authorities, coastal planners, home-owners etc.. [?](#)

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Further reading:

Luijendijk et al. (2018, in press) *The State of the World's Beaches*.
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