

GLOBAL INVENTORY OF BEACHES BACKED BY ARTIFICIAL STRUCTURES

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INTRODUCTION

Sandy beaches, which account for about 31% of the world's coastline (Luijendijk et al., 2018), have a high socioeconomic value (Cooley et al., 2022). Vousdoukas et al., (2020) projected that on a global scale, 50% of the sandy beaches are under serious threat of erosion under the high emission RCP8.5 scenario by 2100. The projected shoreline retreat does not automatically translate into complete beach area loss since sandy beaches can translate landward as long as there is enough accommodation space. Only when sandy beaches have been "hardened", by having artificial structures such as sea walls, or revetments on the back beach, they lose their natural adaptability to future sea level rise. This situation may lead to the complete loss of the sandy beach in front of the structure (Nordstrom 2014, Schoonees et al., 2019). To date, the global quantity of "hardened" sandy beaches is still unknown. The global amount of hardened sandy beaches is an important knowledge gap to further disclose the information of sandy beaches that could face severe loss in the presence of chronic shoreline retreat.

METHOD

We used an updated and manually improved version of Luijendijk et al.'s (2018) Satellite-Derived Shorelines (SDS) dataset which is based on supervised pixel classification of Sentinel-2 imagery to detect the presence of sandy beaches. We integrated the high-resolution global impervious surface area (GISA-10m, Huang et al., 2022) dataset to search for the impervious surfaces in the vicinity of the sandy location. We limited our analysis only to those locations where the beach type is certain to be sandy, which left us with approximately 1.3 million locations along the global ice-free coastline.

RESULTS

Our analysis shows that about 70% of the global ice-free sandy coastline is backed by artificial structures, with a global median distance of about 60m from the shoreline to the hard structure. Approximately 75% of the hardened sandy locations are located in upper-middle-income and high-income countries, according to the World Bank classification. If we subdivide the globe using the IPCC WGI regions, more than 90% of sandy beaches have been hardened in the Bay of Bengal, West North America, Central Africa, West and Central Europe, the Mediterranean, and East North America regions as shown in Figure 1.

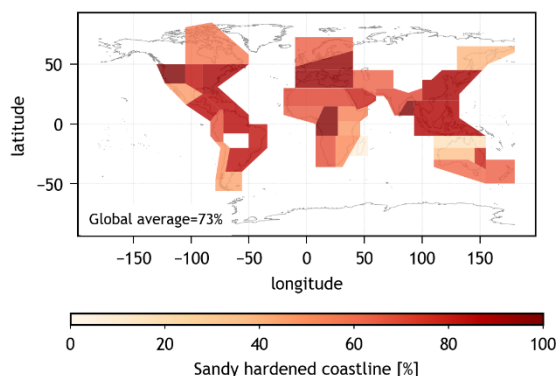


Figure 1 - Percentage of sandy beaches that are hardened per IPCC WGI reference region

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