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TITLE: A half-century of coastline change in Diego Garcia ? The largest atoll island in the Chagos

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ABSTRACT:

Being low and flat, atoll islands are often used as case studies against which to gauge the likely impacts of future sea-level rise on coastline stability. Furnished with lengthy temporal datasets, Pacific atolls form the majority of studies with scant information published for sites in the Indian Ocean. To address this imbalance, this study considers Diego Garcia, an atoll island situated in the remote equatorial Indian Ocean, which has undergone pronounced natural and anthropogenic change in the last fifty years. To explore the former, time separated remote sensing images spanning the years 1963?2013 are assembled to provide insight into the natural dynamics of the shoreline of this island and ocean climate data are compiled to investigate possible controls. Disregarding the precinct of the atoll on which a military complex has been constructed, overall land area of Diego Garcia decreased by a net value of only 0.92% between 1963 and 2013. While net island area is relatively unchanged, 12% of the shoreline that is not in the military precinct displayed discernible accretion and 15% has receded, with the lagoon-facing coastline having undergone the most pronounced changes and at rates higher than recorded for the island's exterior. Broad trends in the morphological adjustment of the island exist. The north-eastern limb of the atoll has generally receded while the south-eastern limb has extended. The south of the island has also extended, the south-western region has eroded and the north-western part has generally also eroded with the exception of notable shoreline extension at Simpson Point. The most common mechanism by which the lagoon-ward coastline has aggraded is through the in-filling of cusped embayments with sediment which is later stabilized by the expansion of terrestrial vegetation. This evolution is most active in the complex network of embayments in the south of the atoll lagoon. The ocean-facing coastline, by contrast, typically aggrades and erodes through the linear shift of the vegetated coast along the strike of the beach line. While the areal extent of Diego Garcia has been almost static for the last half century, the annualized rate of flux of the coastline is considerable at 0.30 m yr⁻¹; a rate comparable to other atoll islands. The literature consistently reports two factors as relevant to increasing the rate of shoreline migration ? human modification of it and sea-level rise. Both are foreseeably set to increase for Diego Garcia, the former due to its strategic importance, not least its use as a military base, and the latter due to global environmental change. The findings of this work serve to remind that the coastline of Diego Garcia, as for all atoll islands, is naturally dynamic and will likely become more so in the future.

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