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Island evolutionary stage a stronger short-term driver of island instability than sea-level on Maldivian reef rim islands

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Coral reef islands are considered highly vulnerable landforms to global environmental change because they are inherently low-lying (<3 m elevation) and comprised of unconsolidated bioclastic sediment generated from adjacent reef communities. Future scenarios of sea-level rise often portray islands as passive geomorphic entities that will drown on their platforms following inundation. However, this is overly-simplistic given the diversity of islands globally, regional variability in sea-level rise and a lack of quantitative case studies, particularly those on atoll reef rims which support the majority of the population in the Maldives. Here, we use a short-term time-series (2005-2014) of high-resolution multi-spectral satellite imagery to measure changes in shoreline position, island area and planform morphology (shape) of 9 uninhabited reef rim islands within Lhaviyani atoll, Maldives. We show that under very low rates of sea-level rise (<1 mm y^{-1}), rapid shoreline change and island mobility has occurred with maximum net shoreline erosion calculated at 89 m (∼12 m y^{-1}). However, shoreline erosion on the windward island margin was typically matched by similar rates of island progradation on the leeward reef resulting in only a small net change in island area (3-8%). Our findings therefore suggest that island mobility occurs independent of sea-level, even on reef platforms associated with healthy coral communities (∼40% cover) and high rates of sediment production (∼5 kg m^{-2} y^{-1}). Indeed, island evolutionary stage (the ratio of island size to reef area) is a far better indicator of island stability, where mobile incipient sandbanks become more stable as they are vegetated, grow in size and are constrained by the either living reef or consolidated conglomerate ("beachrock"). Understanding the physical controls on island dynamism are central to informing predictions of island morphological responses to future environmental change and allow for mitigation and adaptation strategies to be established.