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## Past, Present and Future Sea Levels in Singapore

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Singapore is a small (728 km<sup>2</sup>) island nation that is vulnerable to rising sea levels with 30% of its land surface area less than 5 m above present sea level. Rising relative sea level (RSL), however, is not uniform with regional RSL changes differing from the global mean due to processes associated with vertical land motion (e.g., glacial-isostatic adjustment) and atmospheric and ocean dynamics. Understanding magnitudes, rates, and driving processes on past and present-day sea level are therefore important to provide greater confidence in accurately quantifying future sea-level rise projections and their uncertainty. Here, we present a synopsis of Singapore's past and present RSL history using newly developed proxy RSL reconstructions from mangrove peats, coral microatolls and tide gauge data and conclude with probabilistic projections of future RSL change.

Past RSL is characterized by rapid rise during the early Holocene driven primarily by deglaciation of northern hemisphere ice sheets. Sea-level index points (SLIPs) from mangrove peats show sea levels rose rapidly from -20.7 m at 9.5 ka BP to -0.6 m at 7 ka BP at rates of 6-12 mm/yr. This is substantially greater than predicted magnitudes of RSL change from the ICE-6G\_C GIA model which shows RSL increasing from -6.4 m at 9.5 ka BP to a ~2.8 m highstand at ~7 ka BP. SLIPs show the mid-Holocene highstand of  $\sim 4 \pm 3.6$  m at 5.2 ka BP before falling towards present at rates up to -2 mm/yr driven by hydro-isostatic processes. The nature of RSL changes during the mid- to late-Holocene transition remains poorly resolved with evidence of sea levels falling below present level to  $-2.2 \pm 2.0$  m at 1.2 ka BP. Present RSL reconstructions from coral microatolls coupled with tide-gauge data extend the limited instrumental period in this region beyond ~50 years. They show RSL rose  $\sim 0.03$  m from 1915 to 1990 at  $0.7 \pm 1.4$  mm/yr before increasing to  $1.5 \pm 2.1$  mm/yr after 1990 to 2019. Future RSL change from probabilistic projections to 2100 under low (RCP 2.6) and high (RCP 8.5) emission scenarios show sea levels rising 0.43 m (50<sup>th</sup> percentile) (0.06 – 0.96 m; 95% credible interval) and 0.74 m (0.28 – 1.4 m), respectively. However, projected magnitudes of sea-level rise driven by rapid ice sheet dynamics and the unknown contribution of atmospheric and ocean dynamics in Southeast Asia have the potential to exacerbate projection magnitudes.