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The Caribbean conundrum of Holocene sea level.

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In the tropics, pre-historic sea-level curve reconstruction is often problematic because it relies upon sea-level indicators whose vertical relationship to the sea surface is poorly constrained. In the Caribbean, fossil corals, mangrove peats and shell material dominate the pre-historic indicator record. The common approach to reconstruction involves the use of modern analogues to these indicators to establish a fixed vertical habitable range. The aim of these reconstructions is to find spatial variability in the Holocene sea level in an area gradually subsiding (< 1.2 mm yr^{-1}) due the water loading following the deglaciation of the Laurentide ice sheet.

We construct two catalogues: one of published Holocene sea-level indicators and the other of published, modern growth rates, abundance and coverage of mangrove and coral species for different depths. We use the first catalogue to calibrate ^{14}C ages to give a probabilistic age range for each indicator. We use the second catalogue to define a depth probability distribution function (pdf) for mangroves and each coral species. The Holocene indicators are grouped into 12 sub-regions around the Caribbean. For each sub-region we apply our sea-level reconstruction, which involves stepping a fixed-length time window through time and calculating the position (and rate) of sea-level (change) using a thousand realisations of the time/depth pdfs to define an envelope of probable solutions.

We find that the sub-regional relative sea-level curves display spatio-temporal variability including a south-east to north-west 1500 year lag in the arrival of Holocene sea level to that of the present day. We demonstrate that these variations are primarily due to glacial-isostatic-adjustment induced sea-level change and that sub-regional variations (where sufficient data exists) are due to local uplift variability.