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Holocene relative sea-level changes from North America and the Caribbean

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Reconstructions of Holocene relative sea level (RSL) are important for identifying the ice equivalent meltwater contribution to sea-level change during deglaciation. Holocene RSL reconstructions from near, intermediate and far field regions enable the assessment of earth and ice parameters of Glacial Isostatic Adjustment (GIA) models. RSL reconstructions provide data for estimating rates of spatially variable and ongoing vertical land motion; a requirement for understanding the variation in modern and late Holocene sea level as recorded by instrumental and proxy records.
Here we explain the methodology employed to reconstruct former sea levels, which follows the practice of the International Geoscience Programme (IGCP). We produce sea level index points from the Pacific and Atlantic coasts of North America and the Caribbean. Index points are defined as the most reliable observations of former sea levels. They consist of an estimate of X (age) and Y (the position of former RSL). Where a suite of index points are developed for a locality or region, they describe changes in RSL through time and estimate rates of change. A valid index point must meet the following four criteria; (1) location of the sample is known; (2) the altitude of the sample (and the error associated with measuring that altitude) is known; (3) the indicative meaning (the relationship between the sample and a tide level) is estimated; and (4) the age of the sample, which is commonly radiocarbon dated is calibrated to sidereal years using the latest calibration curves.
In total databases have over 2000 sea-level index points from formerly ice covered, uplifting regions of Canada, to the region of forebulge collapse along the subsiding mid-Atlantic and mid-Pacific coastlines of the United States, to the tropical regions of the Caribbean. Recent analyses of these new published databases have led to a further refinement of the most recent of the ICE-NG (VMX) series of global models of GIA. The records from the region of forebulge collapse turn out to be especially sensitive to the mantle viscosity profile in the upper mantle, transition zone and uppermost lower mantle. Relatively minor adjustments to the depth dependence of viscosity characteristic of the VM5a profile employed to construct the newest ICE-6G model of deglaciation history lead to the definition of the refined viscosity structure VM6. This new viscosity model suffices to eliminate the majority of the misfits to the new U.S. Atlantic coast database. The west coast data were held back in the iterative procedure employed to define VM6; but this model is nevertheless found to be equally successful in fitting data from the U.S. Pacific coast. The ICE-6G (VM6) global model continues to provide good fits to all of the North American data from the ice-covered portion of the continent.