Geophysical Research Abstracts,
Vol. 11, EGU2009-12686, 2009
EGU General Assembly 2009

Holocene sea-level changes along the North Carolina Coastline and their implications for glacial isostatic adjustment models

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We have synthesized new and existing relative sea-level (RSL) data to produce a quality-controlled, spatially comprehensive database of Holocene RSL changes from the North Carolina coastline. The RSL database consists of 54 sea-level index points that are quantitatively related to an appropriate tide level and assigned an error estimate, and a further 33 limiting dates that confine the maximum and minimum elevations of RSL. The temporal distribution of the index points is very uneven with only five index points older than 4000 cal a BP, but the form of the Holocene sea-level trend is constrained by both terrestrial and marine limiting dates. The data illustrate RSL rapidly rising during the early and middle Holocene from an observed elevation of -35.7 $\pm$ 1.1 m MSL at 11062 - 10576 cal a BP to -4.2 m $\pm$ 0.4 m MSL at 4240 - 3592 cal a BP.

We restricted our comparisons between observations with predictions from the ICE-5G(VM2) to the late Holocene RSL (last 4000 cal a BP) because of the wealth of sea-level data during this time interval. The ICE-5G(VM2) model with rotational feedback predicts significant spatial variations in RSL across the North Carolina, thus we subdivided the observations into two regions. Rotational feedback is predicted to increase the rate of sea-level rise in Region 1 (Albemarle, Currituck, Roanoke, Croatan, and northern Pamlico sounds) compared to Region 2 (southern Pamlico, Core and Bogue sounds, and farther south to Wilmington). The observations show late Holocene sea-level rising at 1.14 $\pm$ 0.03 mm yr-1 and 0.82 $\pm$ 0.02 mm yr-1 in Regions 1 and 2, respectively. The ICE-5G(VM2) predictions capture the general temporal trend of the observations, although there is an apparent misfit for index points older than 2000 cal a BP. It is presently unknown whether these misfits are caused by possible tectonic uplift associated with the mid-Carolina Platform High or a flaw in the GIA model. A comparison of local tide gauge data with the late-Holocene RSL trends from Regions 1 and 2 support the spatial variation in RSL across North Carolina, and imply an additional increase of mean sea-level of greater than 2 mm yr-1 during the latter half of the 20th century; this is in general agreement with historical tide gauge and satellite altimetry data.