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A ∼3200-year high-resolution reconstruction of relative sea level from Rhode Island, USA

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Studies on the US Atlantic and Gulf coasts have utilized continuous cores and/or basal salt-marsh peats and the macro- and microfossils preserved within them to reconstruct high-resolution records of relative sea level (RSL). Following this approach, we reconstructed RSL change in Rhode Island to expand our knowledge on high-resolution RSL trends beyond the Common Era in southern New England. After preliminary coring throughout Narragansett Bay, the thickest continuous salt-marsh peat sequence was found at Fox Hill Marsh, Conanicut Island, where a ∼3.4 m core was recovered. Foraminiferal assemblages were enumerated throughout the core at 3 cm intervals and trends in δ13C were assessed at 5 cm resolution. We obtained 30 AMS 14C dates and historical chronological markers of known age to develop the chronology, spanning ∼3,300 years with an average resolution of ±50 years per 1 cm slice. The effects of compaction (mechanical compression) were assessed by collecting 12 basal peat samples overlying the antecedent topography and using a published decompaction model.

We employed our fossil salt-marsh foraminifera and bulk sediment δ13C to estimate paleomarsh elevation using a published Bayesian transfer function for southern New England. We combined our RSL reconstruction with tide gauge measurements from Newport, Rhode Island and used an Errors-in-Variables Integrated Gaussian Process (EIV-IGP) model to estimate past rates of RSL change. Sea-level change was also evaluated after removing a Glacial Isostatic Adjustment (GIA) contribution of 0.9 mm/yr. RSL rose from -3.9 m at ∼1250 BCE reaching -0.4 m at 1850 CE (average of 1 mm/yr). The Newport tide gauge records RSL rising almost 3 times faster (2.74 ± 0.17 mm/yr). After removal of GIA, our RSL reconstruction shows multiple oscillations of accelerating and decelerating RSL superimposed on an overall rising trend. Both the basal peat approach and decompaction model suggest that there is little evidence for compaction within the continuous core. Our reconstruction is in agreement with prior reconstructions from the US Atlantic coast showing evidence for sea-level changes that may be related to the Medieval Climate Anomaly and Little Ice Age.