Sea-level change along the Atlantic coast of the United States

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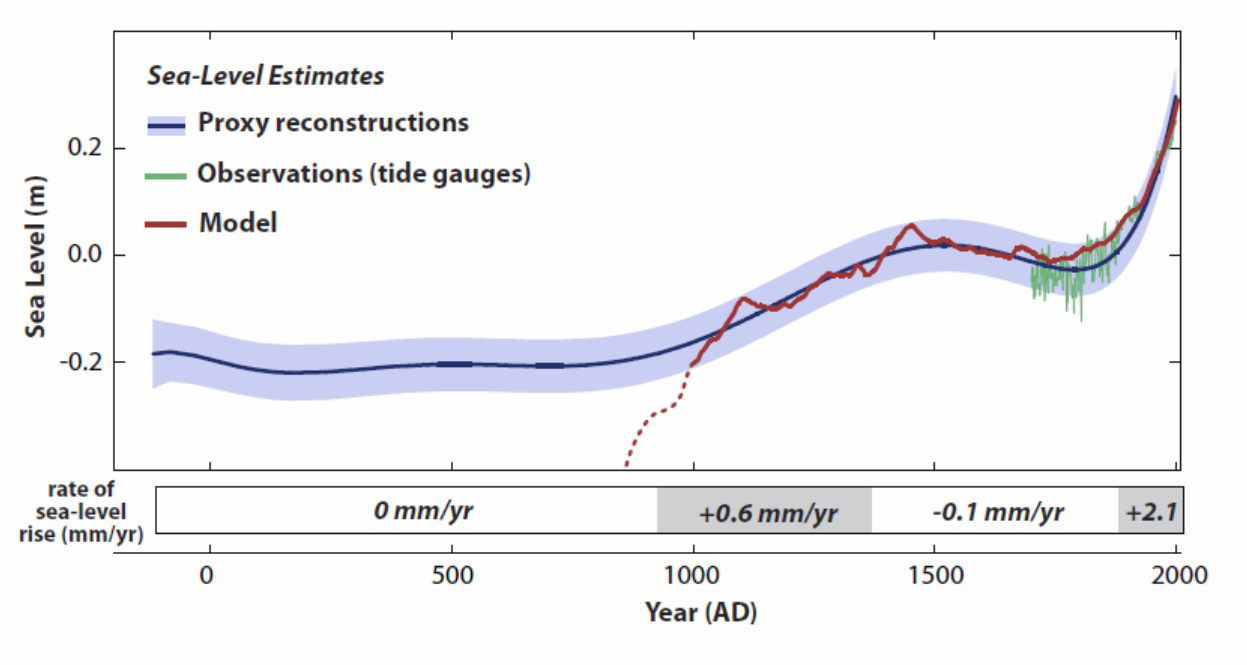
The rate of sea-level rise along the US Atlantic and Gulf coasts increased through the 20th century and will almost certainly continue to accelerate during the 21st century and beyond, although significant uncertainty surrounds the magnitude and geographic distribution. Key uncertainties include the role of the Greenland and West Antarctic ice sheets, mountain glaciers and ocean density (steric) changes. Insufficient understanding of these physical processes has precluded accurate predictions of sea-level rise. New approaches using semi-empirical models that relate instrumental records of climate and sea-level rise have projected up to 2 m of rise by AD 2100. But the duration of instrumental records is insufficient to adequately constrain the climate-sea-level relationship.

We have produced new high-resolution reconstructions of sea-level along the Atlantic Coast of the United Statesfor the last 2000 years, spanning the alternation between the warmer so-called "Medieval Climate Anomaly" and relatively colder "Little Ice Age". Innovative microfossil-based transfer functions from salt marsh sediments are used to generate sea-level records at a ±0.1-0.3m vertical resolution. Combining this approach with a suite of complementary dating methods facilitates the ability to precisely constrain the chronology (decadal to centennial age resolution) of subtle changes in sea level. We have used the proxy data of sea level and global temperature reconstructions to provide crucial additional constraints to the parameters in semi-empirical models of sea-level rise.

Before the models can provide appropriate data for coastal management and planning, they must be complemented with regional estimates of sea-level rise. The proxy sea-level data collected from four study areas (Massachusetts, Connecticut, New Jersey and North Carolina) exposes regional variability due to glacial isostatic adjustment (GIA) of the solid Earth. In Massachusetts, Connecticut and New Jersey GIA corrected sea level was stable from at least BC 200 until AD 500. Sea level then increased at a rate of less than 1 mm/yr likely correlated with the Medieval Climate Anomaly. In North Carolina, the rise in sea level began slightly later at AD 950. All records show stable or falling sea level between AD 1400 and the late 19th century at the time of the Little Ice Age. Since then, sea level has risen at rates greater than 2 mm/yr, representing the steepest century-scale increase of the past two millennia.


Sea-Level Estimates
Proxy reconstructions
Observations (tide gauges)
Model
Sea Level (m)
0.2
0.0
-0.2
rate of sea-level rise (mm/yr)
0 mm/yr
+0.6 mm/yr
-0.1 mm/yr
+2.1
0
500
1000
1500
2000
Year (AD)