Sea-level rise in New Jersey fact sheet

All shorelines (including the New Jersey shore) are dynamic environments that are constantly being reshaped by sea level rise, storms, and currents.

Figure 1. 27th St., Ship Bottom, NJ after Superstorm Sandy. Credit: AP Clem Murray.

Sea level is not fixed. Globally, sea level rose approximately 400 ft (120 m) over the last 20,000 years, as the great northern ice sheets that once extended down to northern New Jersey melted. This has caused the position of the shoreline to move landward over 75 miles. By about three thousand years ago, average global sea level stabilized near its present level. During the 20th century, sea level rose globally by 0.7 inches/decade due to warming oceans (thermal expansion) and the melting of land ice. Over the last twenty years, it has risen by about 1.3 inches/decade and appears to be accelerating.

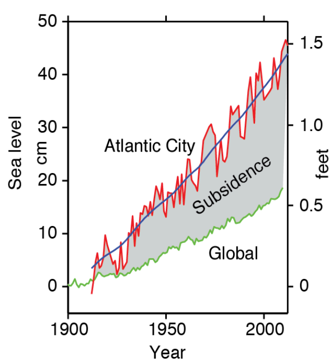

Figure 2. Atlantic City tide gauge data (red = data, blue = model) and global average sea level (green). Miller et al. (2013).

Sea level is rising faster at the New Jersey shore than the global average because of land subsidence (sinking). Between 1 and 1800 AD when global sea level was stable, sea level on the Jersey shore rose at an average rate of about 0.6 inches per decade. This rise was largely due to "glacial isostatic adjustment" (GIA), the ongoing response of the Earth to the melting of the great ice sheets, a seesaw effect causing the land to sink in the mid-Atlantic region while rising in formerly ice-covered areas.

In the 20th century, sea level rose by 12 inches at bedrock locations (Bayonne, Trenton, and Camden). Along the Jersey shore from Sandy Hook to Cape May, it rose an additional four inches due to compaction of sediments caused by natural effects and groundwater withdrawal. There is a 95% probability that the 20th century rate of sea-level rise along the New Jersey shore was faster than it was in any century in the last 4,000 years.

Combining observations, model projections, and expert assessment, we project sea-level rise during the 21st century, with low, central, high, and higher scenarios. At bedrock locations (Bayonne, Trenton, and Camden), our projections are 0.7 ft by 2030, (range 0.5-1.2 ft), 1.3 ft by 2050 (range 1.1-2.3 ft), and 3.1 ft (range 2.5-5.9 ft) by 2100 (Table 1). Projections for New Jersey shore locations are higher than bedrock locations by 0.1, 0.2, and 0.4 ft by 2030, 2050, and 2100, respectively (Table 1). We do not assign probability estimates to these four scenarios. For a discussion of the likelihood of different levels of sea-level rise, see climateprospectus.org.

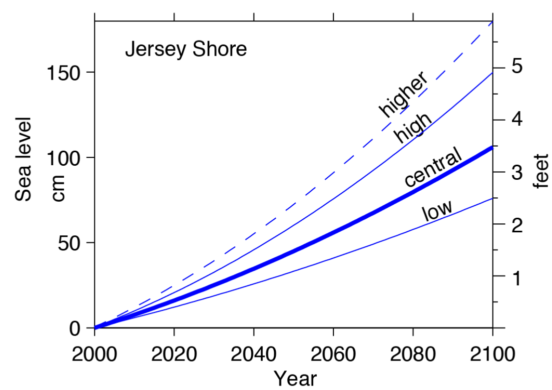

Figure 3. Projections of relative sea level rise on the Jersey shore relative to sea level in the year 2000. (Miller et al., 2013).

Damage from storms will increase as sea level rises. Sandy had a storm tide (sum of surge and tide) of 13.9 ft in NYC and 8.9 ft at Atlantic City. Sandy was added onto the 12-16 inch 20th century sea level rise, causing it to flood an area 27 square miles greater than it would have in 1880, increasing the number of people living on land lower than the storm tide by about 38,000 in New Jersey. A sea-level rise of 1.5 ft (our central estimate) would cause the 1-in-10 year flood at Atlantic City (the flood level that has a 1-in-10 chance of happening in any given year) to exceed the highest flood level experienced over the last century.

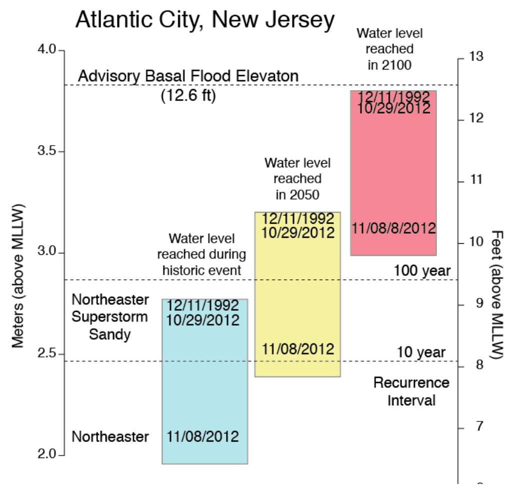

Figure 4. Effects of sea-level rise on storm surge for Atlantic City assuming relative rises of 1.5 ft (2050) and 3.5 ft (2100) (central scenario of Figure 3).

Table 1. Range of sea-level estimates for bedrock locations (Bayonne, Trenton, & Camden) and New Jersey shore locations (Sandy Hook-Cape May) for 2030, 2050, and 2100. After Miller et al. (2013).

	Sea-level rise (feet)		
	Global	Bedrock	Shore
2030 central	**0.5**	**0.7**	**0.8**
2030 low	0.3	0.5	0.6
2030 high	0.7	1.0	1.1
2030 higher	0.9	1.2	1.4
2050 central	**0.8**	**1.3**	**1.5**
2050 low	0.5	0.9	1.1
2050 high	1.3	1.8	1.9
2050 higher	1.6	2.1	2.3
2100 central	**2.5**	**3.1**	**3.5**
2100 low	1.4	2.2	2.5
2100 high	4.0	4.6	4.9
2100 higher	4.6	5.5	5.9
2100 collapse	8.7	9.7	10.1

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For further reading:

K.G. Miller, R.E. Kopp, B.P. Horton, J.V. Browning, and A.C. Kemp, 2013, A geological perspective on sea-level rise and its impacts along the U.S. mid-Atlantic coast. *Earth's Future* 1: 3-18, doi:10.1002/2013EF000135.

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R.E. Kopp, R.M. Horton, C.M. Little, J.X. Mitrovica, M. Oppenheimer, D.J. Rasmussen, B.H. Strauss, and C. Tebaldi, 2014, Probabilistic 21st and 22nd century sea-level projections at a global network of tide gauge sites. *Earth's Future*, doi: 10.1002/2014EF000239.