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 ocean 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 ice sheets that once extended down to northern New Jersey melted. This caused the position of the shoreline to move landward over 75 miles. By about 3,000 years ago, global sea level stabilized near its present level and New Jersey's barrier islands formed. During the 20th century, global sea level began to rise again (7 inches or 0.7 inches/decade) due to warming oceans (thermal expansion) and the melting of land ice. Over the last twenty years, sea level has risen by about 1.3 inches/decade and appears to be accelerating due to melting of ice sheets.

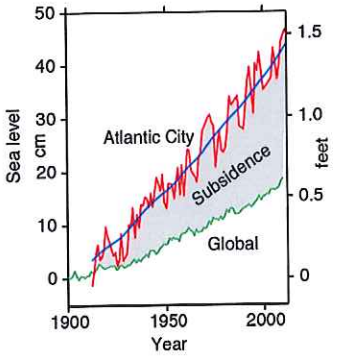

Figure 2. Atlantic City tide gauge data (red = data, blue = model) and global average sea level (green) (Miller et al., 2013).

Sea level is rising faster at the New Jersey shore than the global average, because of land subsidence (sinking; Fig. 1). Between 500 BC 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 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 processes and groundwater withdrawal. There is a 95% probability that the 20th century rate of sea-level rise caused by global, regional, and local processes 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 0.9-2.1 ft), and 3.1 ft (range 2.2-5.5 ft) by 2100 (Table 1). Projections for the New Jersey shore (Fig. 4) are higher than bedrock locations by 0.1, 0.2, and 0.4 ft by 2030, 2050 and 2100, respectively. For a discussion of the likelihood of different levels of sea-level rise, see climateprospectus.org.

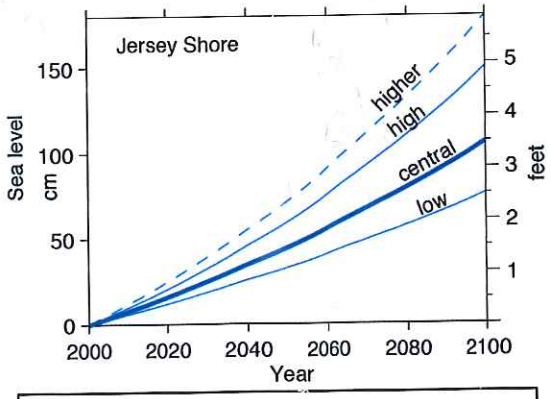

Figure 3. Projections of relative sea level rise on the Jersey shore relative to sea level in the year 2000 (Miller et al., 2013).

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. 20th century sea-level rise caused Sandy to flood an additional 27 square miles and exposed 38,000 more New Jersey citizens than it would have in the 19th century (Figs. 1, 4). A sea-level rise of 1.5 ft (our central estimate for the New Jersey shore at 2050) 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 (Fig. 4).

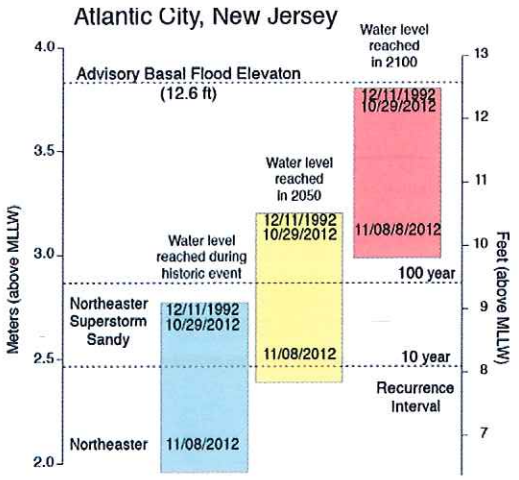

Figure 4. Effects of sea-level rise on storm surge for Atlantic City assuming relative rises of 1.5 ft (2050) and 3.5 ft (2100) (central scenario of Figure 3).

	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

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

About the authors

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For further reading:

Kemp, A.C., and Horton, B.P., 2013, Contribution of relative sea-level rise to historical hurricane flooding in New York City: Journal of Quaternary Science, v. 28, p. 537-541.

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

Houser, T., Kopp, R., Hsiang, S., Muir-Wood, R., Larsen, K., Delgado, M., Jina, A., Wilson, P., Mohan, S., Rasmussen, D.J., Mastrandrea, M., and Rising, J., 2014, American Climate Prospectus: Economic Risks in the United States: Oakland, Rhodium Group, http://www.climateprospectus.org/.

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