Study confirms sea-level rise is accelerating along northeast U.S. coast

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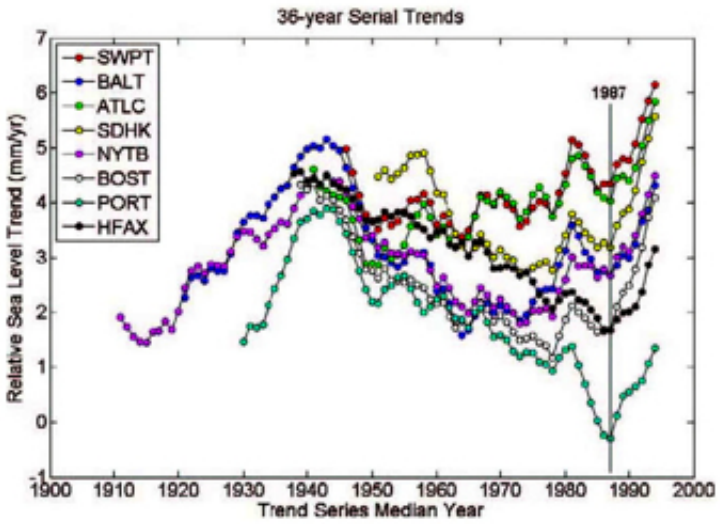

The rate at which sea level is rising increased abruptly beginning in 1987 at all 8 stations along the northeastern U.S. coast: SWPT = Norfolk; BALT = Baltimore; ATLC = Atlantic City; SDHK = Sandy Hook, NJ; NYTB = New York; BOST = Boston; PORT = Portland, ME; HFAX = Halifax, Nova Scotia. Credit: John Boon/VIMS

(Phys.org)—A new study by emeritus professor John Boon of the Virginia Institute of Marine Science shows that the rate of sea-level rise is increasing at tidal stations along the Atlantic coast of North America, including those in Norfolk, Baltimore, New York, and Boston.

Boon's findings, published online in the *Journal of Coastal Research*, confirm those of two other recent studies that find accelerating rates of sea-level rise along the Atlantic Coast of the U.S. and Canada. He'll discuss his research during the Oceans12 Conference at the Virginia Beach Convention Center this week, and at the annual meeting of the Geological Society of America in Charlotte in early November.

The question of whether sea level is rising at a steady or increasing rate is of critical important to those tasked with planning for and adapting to coastal flooding in their communities. "Localized projections of sea-level rise are needed to guide the regional planning and adaptation measures that are being pursued with increasing urgency in many coastal localities," says Boon.

"Acceleration in the rate of sea-level rise has the kind of compound effect you see in a savings account, or with credit-card debt," he adds. "It's not just that sea level is increasing, but that the rate at which it's increasing is increasing as well. That can cause future sea level to be significantly higher than if the rise rate were constant."

Boon's analysis—which looked at monthly records of mean sea level at 23 tide stations between Key West, Florida and St. John's, Newfoundland—shows that the rate of sea-level rise relative to land is increasing at all 8 of the tidal stations north of Cape Hatteras with records exceeding 75 years: Halifax, Nova Scotia; Portland, Maine; Boston, Massachusetts; New York's Battery; Sandy Hook and Atlantic City, New Jersey; Baltimore, Maryland; and Norfolk, Virginia.

"The trend in the rate of sea-level rise appears to have changed abruptly in 1987," says Boon, "followed by uniform and rapidly increasing rise rates at the 8 stations in the northeast. This feature is unprecedented in water-level records now spanning more than three-quarters of a century at tide stations along the Atlantic coast of the U.S. and Canada."

Location of tide stations on the Atlantic coast of North America. Sea-level data for U.S. tide stations are collected and distributed by NOAA's National Ocean Service.

Boone notes that the rate at which sea level is increasing in these locations is itself increasing by up 0.30 millimeters per year each year, an acceleration that he says "justifies concern over this region of the U.S. East Coast."

Boon says his examination of tidal stations with shorter records—using a 43-year base period from 1969 to 2011—"confirms that addition of a quadratic term representing acceleration is statistically significant at 8 additional tide stations from Virginia to Nova Scotia."

Results of Boon's analysis for 4 stations along the southeastern U.S. coast—in South Carolina, Georgia, and Florida—shows no discernible increase in their rate of sea-level rise. "Sea level is rising at these

stations," says Boon, "but there is no statistically significant acceleration in the rise rate during the period of record."

He suggests that the observed acceleration in the rate of sea-level rise for the northeastern stations may be due to changes in the strength and position of the Gulf Stream. Some climate models predict that the Gulf Stream and related ocean currents will slow down as greenhouse gases warm the planet and melting ice adds freshwater to the North Atlantic.

Cautions & Caveats

Boon's study comes with both cautions and caveats. He cautions that planners must recognize that future projections of sea-level rise—small or large—don't include the month-to-month variations in sea level that can cause elevated tides and coastal flooding even under today's conditions.

"Monthly mean sea level will vary in the future just as it does today," says Boon. "That's an essential concept regarding coastal inundation in response to sea-level rise. It's an inherent part of the flood-risk potential. When projecting the average sea level forward to some future year, there will always be uncertainty concerning the magnitude of the sea-level anomaly in any particular month, including one in which a tropical storm or nor'easter occurs. When a future storm does occur, its storm surge will add to the monthly mean sea level present at that time."

Boon says the magnitude of this short-term variability is "unlikely to decrease regardless of whether the rate of sea-level rise increases, decreases, or stays constant over the next few decades."

Boon's caveat relates to using his observed acceleration in the rate of sea-level rise as a basis for projecting future sea level. "My analysis is based solely on examination of past tide-gauge records," says Boon, "so

it—unlike climate models—provides no physical basis for predicting whether the acceleration will remain constant into the future."

Assuming that the acceleration does remain constant, Boon projects that by 2050, sea level will rise by 0.7 meters (±0.15 meters) in Boston, by 0.57 meters (±0.18 meters) in New York, by 0.49 meters (±0.27 meters) in Washington, D.C., by 0.62 meters (±0.22 meters) in Norfolk, and by 0.15 meters (±0.21 meters) in Charleston, South Carolina.

Boon notes that the similarity in projected sea-level rise between Boston (0.7 m) and Norfolk (0.62 m)—despite a much higher acceleration rate in the northern city—is explained by high rates of land subsidence in Norfolk and surrounding areas. "My analysis focuses on relative sea level," says Boon. "That value—the height of the sea surface in relation to the land, is what really matters to coastal communities."

More information: www.jcronline.org/doi/abs/10.2 … OASTRES-D-12-00102.1

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