

# ScienceNews

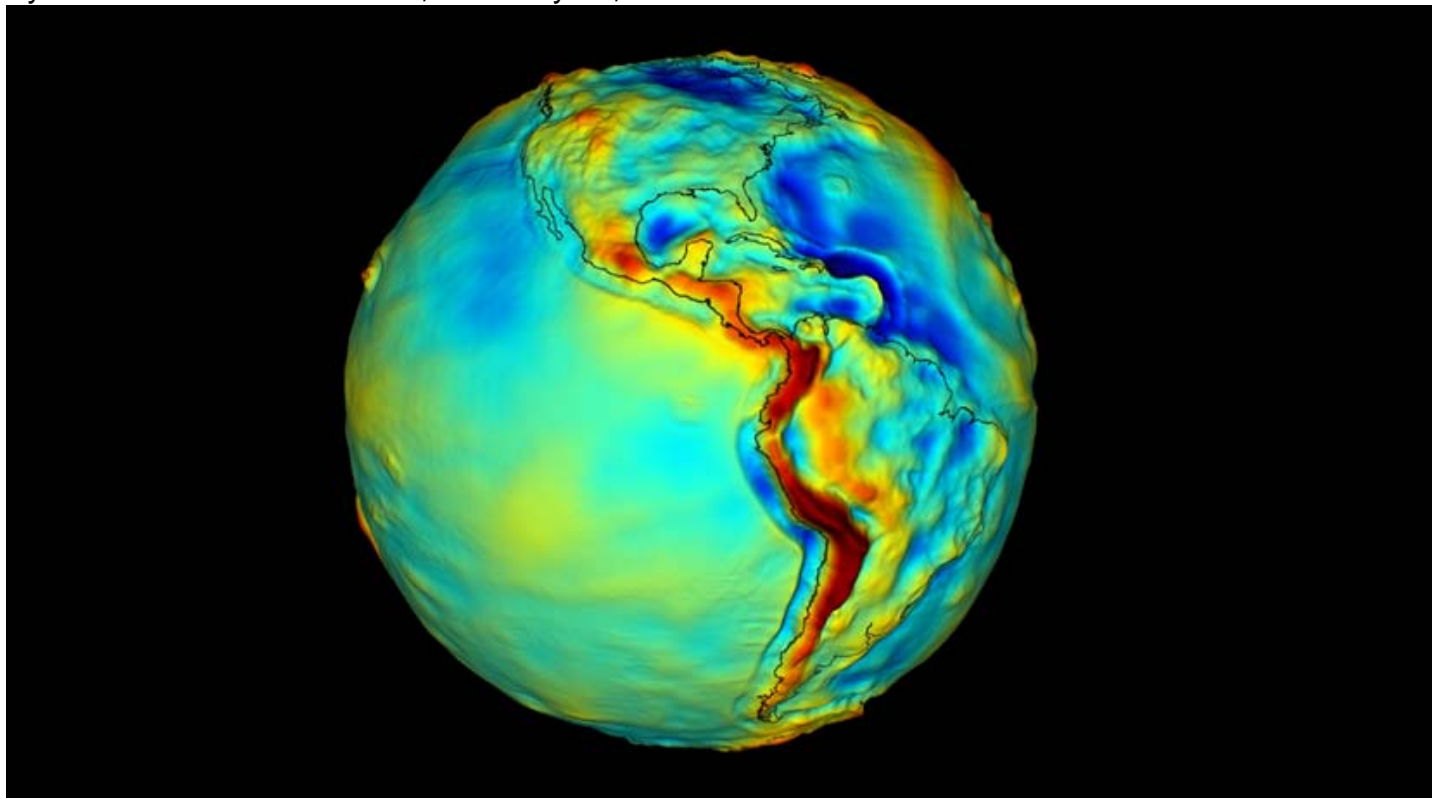
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News: Oceans, Climate

## On East Coast, sea levels lean southward

*Slope direction resolves decades-long dispute*

By Thomas Sumner 10:40am, February 13, 2015



**UNEVEN EARTH** Sea levels along the East Coast slope downward to the north. The finding is based on calculations of the rises and falls of Earth's oceans in the absence of tides, winds and currents. This natural shape of the ocean, known as the geoid, is shown here with exaggerated bumps.

Sea levels along North America's East Coast tilt downward as you travel north up the coastline, concludes new research to be published in *Geophysical Research Letters*.

The work resolves a dispute that has lingered since the 1920s between geological surveyors and oceanographers over the slope's direction, says study coauthor Philip Woodworth, an oceanographer at the National Oceanography Centre in Liverpool, England. The slope, which results in a roughly 30 to 40 centimeter sea level drop along the whole coast, will influence future predictions of sea level rise in the region, he says.

"This is quite conclusive, so it's really killed off the subject of debate," Woodworth says. "It's a

victory for the oceanographers, if you want to look at it that way.”

Winds, tides and ocean currents push seawater around, creating patches of high and low sea level. But even without these forces, the oceans wouldn't be flat like the water in a glass. The Earth's rotation and small-scale deviations in the planet's gravity cause ocean water to have a lumpy unperturbed state. Understanding this natural shape of Earth's oceans, called the geoid, is essential to sea level research. Whether an area has high or low sea level is relative to the geoid, rather than the seafloor or the center of the planet.

In 1927, geologist William Bowie compared tidal measurements with his own mathematical estimation of the geoid to argue that coastal sea levels along the East Coast tilt upward toward the north. The result was opposite that predicted by oceanographers, who calculated that the Gulf Stream pools extra seawater around Florida, resulting in a downward slope heading north.

After decades of disagreement, satellites offered a precise way to track sea levels and measure the minute gravity variations that contribute to the geoid's shape. Oceanographer Simon Higginson of the Bedford Institute of Oceanography in Dartmouth, Nova Scotia, Woodworth and colleagues used GPS to precisely measure sea surface heights along the East Coast relative to the center of the Earth. The measurements were then compared with a high-resolution geoid reconstruction created using gravity data collected by satellites to get the actual increase or decrease in sea level caused by forces such as currents and winds.

After comparing the geoid sea level measurements with those predicted by ocean circulation simulations, the researchers at last found agreement between the two approaches. Sea levels drop about 20 centimeters between the Florida Straits and northern Florida, eventually leveling out between North Carolina's Cape Hatteras and Canada.

“The fact that both techniques are agreeing now is very reassuring,” Woodworth says. “It means we must now have a good understanding of the oceans.”

This agreement may have importance beyond settling a nearly century-long disagreement, says physical oceanographer Tal Ezer of Old Dominion University in Norfolk, Va. Sea levels between Cape Hatteras and Boston are projected to rise faster than the global average ([SN: 7/28/12, p. 17](#)). The new sea level measurements will provide a better context for studying the interplay between offshore currents and coastal sea levels, he says.

“This work doesn't explain everything,” Ezer says, “but it provides a good base on which to continue studying the causes of sea level rise.”

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## Citations

S. Higginson et al. [The tilt of mean sea level along the east coast of North America](#). *Geophysical Research Letters*, in press, 2015. doi: 10.1002/2015GL063186.

## Further Reading

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D. Powell. [East Coast faces faster sea level rise](#). *Science News*. Vol. 182, July 28, 2012, p. 17.

J. Raloff. [Modern-day sea level rise rocketing](#). *Science News*. Vol. 180, July 16, 2011, p. 13.

C. Russell. First wave. *Science News*, Vol. 175, February 28, 2009, p. 24.

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