

Washington, DC sinking fast, adding to threat of sea-level rise

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New research led by University of Vermont scientists Paul Bierman (left), and by his former graduate student, Ben DeJong (right), confirms that the land under the Chesapeake Bay is sinking rapidly and projects that Washington, DC, could drop by six or more inches in the next century -- adding to the problems of sea-level rise. The study also shows that this sinking land will continue, unabated, for tens of thousands of years. Credit: Joshua Brown, UVM

New research confirms that the land under the Chesapeake Bay is sinking rapidly and projects that Washington, D.C., could drop by six or more inches in the next century—adding to the problems of sea-level rise.

This falling land will exacerbate the flooding that the nation's capital faces from rising ocean waters due to a warming climate and melting ice sheets—accelerating the threat to the region's monuments, roads, wildlife refuges, and military installations.

For sixty years, tide gauges have shown that sea level in the Chesapeake is rising at twice the global average rate and faster than elsewhere on the East Coast. And geologists have hypothesized for

several decades that land in this area, pushed up by the weight of a pre-historic ice sheet to the north, has been settling back down since the ice melted.

The new study—based on extensive drilling in the coastal plain of Maryland—confirms this hypothesis, and provides a firm estimate of how quickly this drop is happening. Additionally, the researchers' detailed field data make clear that the land sinking around Washington is not primarily driven by human influence, such as groundwater withdrawals, but instead is a long-term geological process that will continue unabated for tens of thousands of years, independent from human land use or climate change.

The new research was conducted by a team of geologists from the University of Vermont, the U.S. Geological Survey, and other institutions. The results were presented online July 27 in the journal *GSA Today*.

Geological Waterbed

Washington's woes come from what geologists call "forebulge collapse." During the last ice age, a mile-high North American ice sheet, that stretched as far south as Long Island, N.Y., piled so much weight on the Earth that underlying mantle rock flowed slowly outward, away from the ice. In response, the land surface to the south, under the Chesapeake Bay region, bulged up. Then, about 20,000 years ago, the [ice sheet](#) began melting away, allowing the forebulge to sink again.

"It's a bit like sitting on one side of a water bed filled with very thick honey," explains Ben DeJong, the lead author on the new study, who conducted the research as a doctoral student at UVM's Rubenstein School of Environment and Natural Resources with support from the U.S. Geological Survey, "then the other side goes up. But when you stand, the bulge comes down again."

The new research provides the first high-resolution data from the same latitude as Washington, D.C., DeJong said, of how this forebulge has subsided—and will continue to. "Until recently, the age of the thing was really poorly constrained," he said.

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Provided by University of Vermont

To design the study, DeJong and others drilled seventy boreholes, many up to a hundred feet deep, in and around the Blackwater National Wildlife Refuge, near Washington, on the Chesapeake's eastern shore. Then he examined layers of sediment in these deep cores, using a suite of techniques to calculate the age of the sand, other rocks, and organic matter in each layer.

Combining this data with high-resolution LiDAR and GPS map data allowed the team—that included scientists from UVM, the US Geological Survey, Utah State University, Berkeley Geochronology Center, and Imperial College, London—to create a detailed 3D portrait of both the current and previous post-glacial geological periods in the Chesapeake, stretching back several million years. This longer view gives the geologists confidence that they have a "bullet-proof" model, DeJong says, showing that the region today is early in a period of land subsidence that will last for millennia.

Wet Feet

"Right now is the time to start making preparations," said DeJong. "Six extra inches of water really matters in this part of the world," he says—adding urgency to the models of the Intergovernmental Panel on Climate Change that project roughly one to three or more feet of global [sea-level rise](#) by 2100 from global warming.

"It's ironic that the nation's capital—the place least responsive to the dangers of [climate change](#)—is sitting in one of the worst spots it could be in terms of this land subsidence," said Paul Bierman, a UVM geologist and the senior author on the new paper. "Will the Congress just sit there with their feet getting ever wetter? What's next, forebulge denial?"

More information: *GSA Today*,
[www.geosociety.org/gsatoday/ar ...](http://www.geosociety.org/gsatoday/ar...)

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