The Coastal Northeastern US is a global warming hotspot

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New research, led by the University of Massachusetts Amherst reveals, for the first time, not only that the coastal Northeast—from Maine to Delaware—is heating faster than most regions of North America, but

that this heating is linked to drastic alterations in the ocean and atmospheric conditions over the North Atlantic.

"What does global warming mean for the Northeast?" asks Ambarish Karmalkar, professor of geosciences and researcher at the Northeast Climate Adaptation Science Center at UMass Amherst and lead author of the paper which recently appeared in *Nature Climate Change*. As Karmalkar started to pursue this question, he began noticing two disconcerting phenomena: the coastal Northeast is warming faster than most other regions in the U.S., and the northwestern Atlantic Ocean is also warming at a much faster rate than all the oceans as a whole. "I wanted to know if there was a link between these two trends, and if so, what that link is."

"The key findings here are that the observed warming in coastal Northeast is exceptional," says Karmalkar, "that some of the biggest populations centers in the U.S. are suffering the greatest degree of warming, and that this warming is being driven both by equally rapid trends in the Atlantic Ocean and by changes in atmospheric circulation patterns." Additionally, Karmalkar's research shows that, not only are Northeastern winters getting warmer, as expected, but significant and rapid summer warming is happening along the coast.

Several recent studies indicate that the Atlantic Meridional Overturning Circulation (AMOC) is slowing down due to climate change. Envision AMOC as a conveyor belt that transports warm, salty water from the tropics north toward Greenland, where it cools and sinks. This cooled water then flows back south in the form of deep-water currents. But as the climate warms, and glaciers in Greenland melt, the conveyor is slowing down. "One consequence of this conveyor belt slowdown is more heating of the ocean off the Northeastern coast, which helps to explain the spike in ocean temperatures in the Mid-Atlantic Bight and Gulf of Maine regions," explains Karmalkar.

One link between AMOC and rising temperatures in Boston, New York and Providence is the North Atlantic Oscillation (NAO), a weather phenomenon that governs the strength and position of the winds that blow from the US, over the Atlantic and on to Europe. There's a degree of natural variability to the NAO, which influences everything from storm tracks, the jet stream and seasonal temperatures in the Northeast. However, as Karmalkar and his co-author Radley Horton from Columbia University show, the NAO has, for the past few decades, tended to settle into a pattern which enhances the influence of ocean air on the climate of the eastern seaboard. Because the northwestern Atlantic is also warming due to the AMOC slowdown, this means that warmer ocean air is being blown over the coastal Northeast, accelerating land-based heating trends.

Karmalkar's research also highlighted the importance of using a new generation of high-resolution climate models that could more accurately capture changes in regional climate. "Our research," says Karmalkar, "implies that without improved high-resolution data, regional climate assessments, which inform our ability to plan for the future, may underemphasize warming in this populous region."

More information: Drivers of exceptional coastal warming in the northeastern United States, *Nature Climate Change* (2021). DOI: 10.1038/s41558-021-01159-7 , www.nature.com/articles/s41558-021-01159-7

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