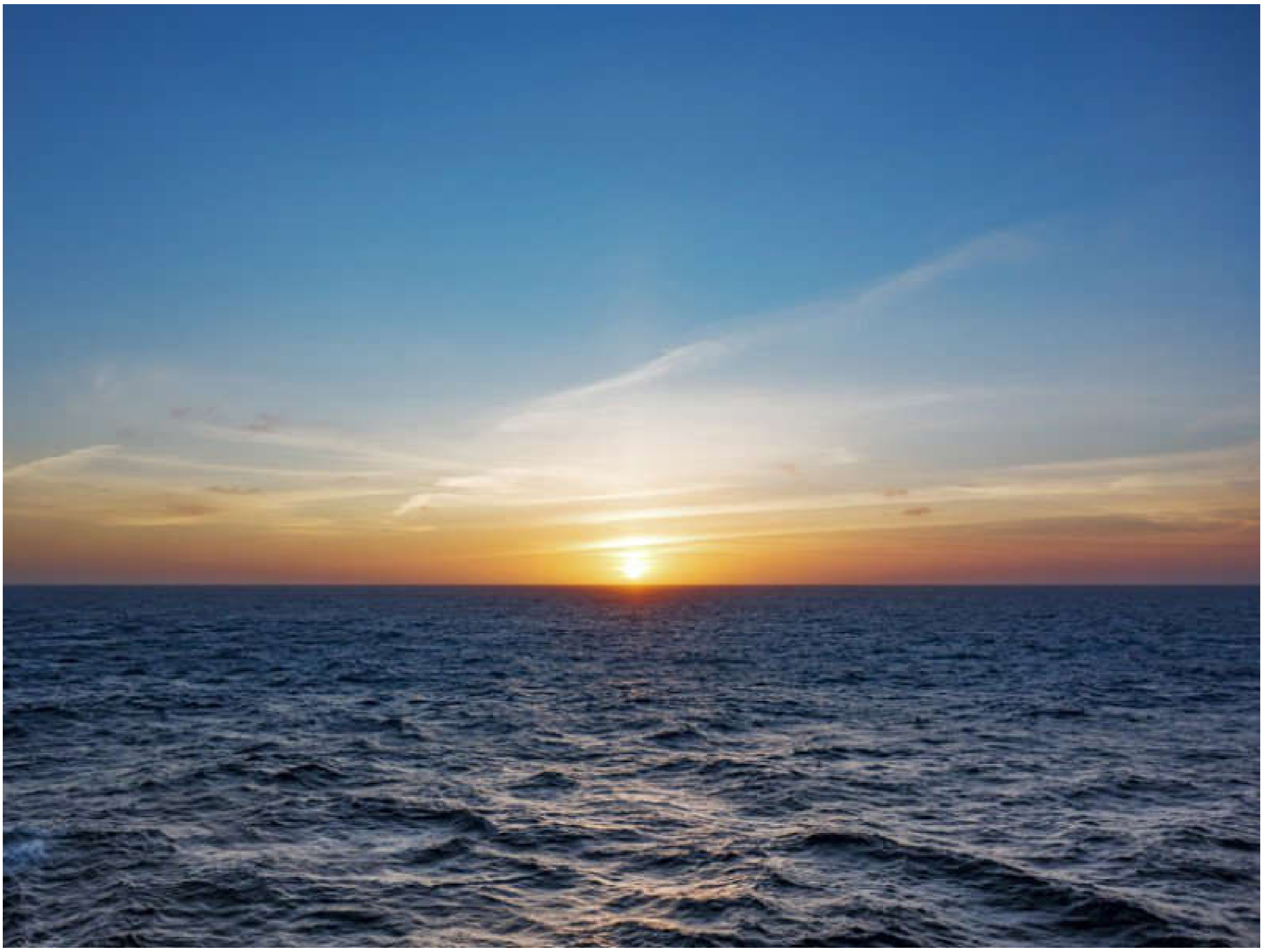
The North Atlantic Ocean's Missing Heat Is Found in Its Depths

In the 2000s, the North Atlantic stopped absorbing as much atmospheric warmth. However, the ocean lost only a little heat—the rest was held deeper below the surface by altered circulation patterns.

Source: Geophysical Research Letters



The Atlantic Ocean once absorbed the most atmospheric heat of any ocean as greenhouse gases continued to trap the Sun's warmth, but a shift in oceanic patterns hid most of that heat deep below the surface. Credit: magann/Adobe Stock

By Cody Sullivan 3 March 2016

Earth's oceans quietly and effectively moderate the globe's temperature. As greenhouse gases blanket Earth in an insulating haze, the oceans sequester much of the atmosphere's heat in their depths. Ocean temperatures rise as warm air is sucked out of the atmosphere, but some oceanic regions absorb more heat than others, and these thermodynamics are in constant flux.

Since the mid-2000s, the North Atlantic Basin's upper layers have stopped storing as much atmospheric-derived warmth—to the point where it lost its crown as the greatest-warming basin, in the mid-2000s, to the tropical waters of the Indian and Pacific Oceans. In the Atlantic, heat moved down from the upper layers of the ocean into the deeper sea, hiding much of the water's warming.

The first part of the North Atlantic's transformation occurred when the waters of the eastern North Atlantic mixed in the winter of 2005, *Somavilla et al.* (http://onlinelibrary.wiley.com/doi/10.1002/2015GL067254/full) explain in a new paper: Swirling ocean waters changed the overall characteristics toward a saltier, warmer, and denser environment. This newly dense water sinks down from the surface, carrying along the warmth it absorbed during its stint at the top. This transfer of heat down to the depths wasn't a one-time occurrence during the winter of 2005 either; it continued on by altering the flow of the ocean itself.

Mixing the waters and increasing densities have altered the ocean circulation patterns, the authors suggest. The local (http://oceanservice.noaa.gov/education/tutorial_currents/05conveyor1.html) currents actually flipped around from a southward flow to a northward flow in the eastern North Atlantic. This reversal in direction brings warmer salty water up from the tropics only to sink down to the North Atlantic's deeper waters because of the salt's higher density. The North Atlantic Subpolar Gyre (http://education.nationalgeographic.org/encyclopedia/ocean-gyre/) also contracted, which allows even more warm and salty water from the tropics to make its way north.

This continuous supply of salty southern waters continues the process of oceanic convection in which the warmer water on the surface cycles down to deeper layers of the ocean. However, the oceans can't store or hide away the heat forever; eventually, they will reach capacity and be unable to buffer the globe's warming as effectively. (*Geophysical Research Letters*, doi:10.1002/2015GL067254 (http://onlinelibrary.wiley.com/doi/10.1002/2015GL067254/full), 2016)

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