

Ocean robots help to trace ocean warming to late 19th century

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A new study contrasting ocean temperature readings of the 1870s with temperatures of the modern seas reveals an upward trend of global ocean warming spanning at least 100 years.

The research led by Scripps Institution of Oceanography at UC San Diego physical oceanographer Dean Roemmich shows a .33-degree Celsius (.59-degree Fahrenheit) average increase in the upper portions of the ocean to 700 meters (2,300 feet) depth. The increase was largest at the ocean surface, .59-degree Celsius (1.1-degree Fahrenheit), decreasing to .12-degree Celsius (.22-degree Fahrenheit) at 900 meters (2,950 feet) depth.

The report is the first global comparison of temperature between the

historic voyage of HMS Challenger (1872-1876) and modern data obtained by ocean-probing robots now continuously reporting temperatures via the global Argo program. Scientists have previously determined that nearly 90 percent of the excess heat added to Earth's climate system since the 1960s has been stored in the oceans. The new study, published in the April 1 advance online edition of *Nature Climate Change* and coauthored by John Gould of the United Kingdom-based National Oceanography Centre and John Gilson of Scripps Oceanography, pushes the ocean [warming trend](#) back much earlier.

"The significance of the study is not only that we see a temperature difference that indicates warming on a global scale, but that the magnitude of the temperature change since the 1870s is twice that observed over the past 50 years," said Roemmich, co-chairman of the International Argo Steering Team. "This implies that the time scale for the warming of the ocean is not just the last 50 years but at least the last 100 years."

Although the Challenger data set covers only some 300 temperature soundings (measurements from the sea surface down to the deep ocean) around the world, the information sets a baseline for temperature change in the world's oceans, which are now sampled continuously through Argo's unprecedented global coverage. Nearly 3,500 free-drifting profiling Argo floats each collect a temperature profile every 10 days.

Roemmich believes the new findings, a piece of a larger puzzle of understanding the earth's climate, help scientists to understand the longer record of sea-level rise, because the expansion of seawater due to warming is a significant contributor to rising sea level. Moreover, the 100-year timescale of ocean warming implies that the Earth's [climate system](#) as a whole has been gaining heat for at least that long.

Provided by University of California - San Diego

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