

Old whaling logbooks offer new insights into modern-day climate conditions

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Captains and first mates of whaling ships kept daily logs of weather information during each voyage, including wind speed and direction, sea conditions, air temperature, and other variables. Researchers can use these weather records to gain a better understanding of climate conditions we face today. Credit: Justin Buchli

In September 1871, a fleet of 33 American whaling ships navigating through Arctic waters came upon a disastrous impasse. Mountains of ice

pack, some clumped nearly mast high, formed a natural blockade around the convoy. Crews anxiously waited for winds to bail their ships out from the pulverizing grip of the ice, but it never blew their way. Ice tore into hulls and as the shredded vessels surrendered to the sea, more than a thousand men, women, and children fled for nearby rescue boats.

Today—nearly 150 years later—whalers in the same stretch of the Arctic would likely not have been trapped. Climate has changed considerably since then, and while seasonal ice still forms during the winter, much of the thicker, multi-year ice sea ice in the region has been diminished.

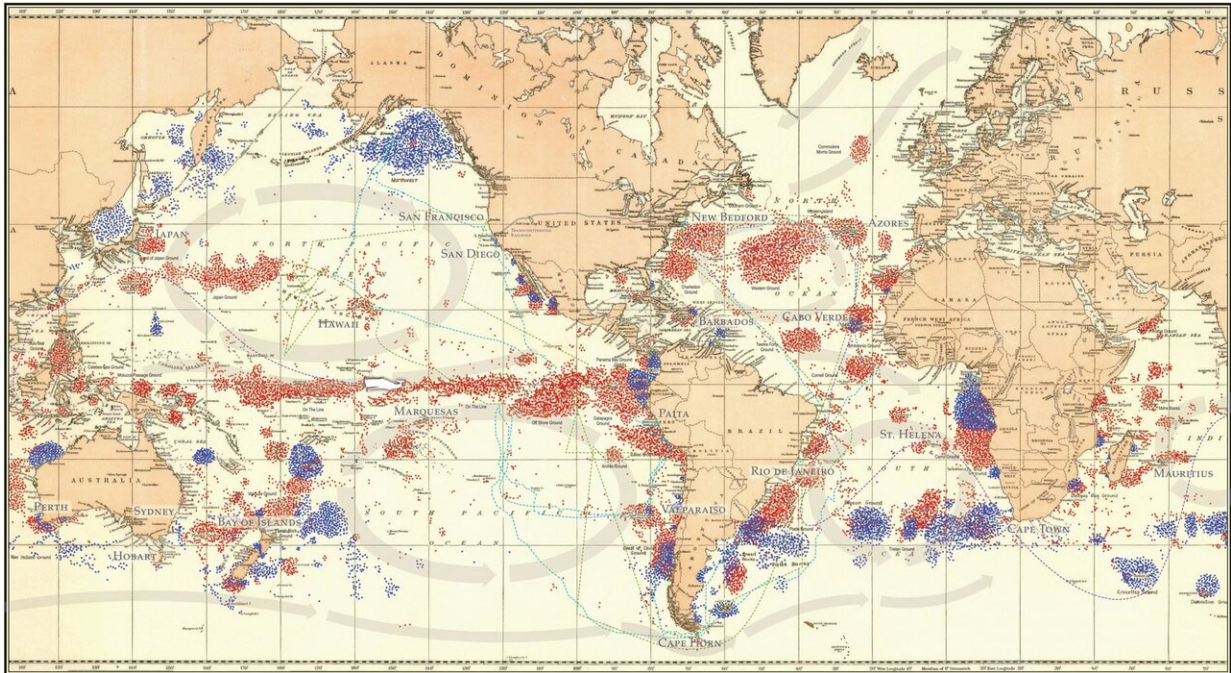
"We've observed a lot of changes over recent decades, including warming oceans, melting ice sheets on Greenland, shifts in [weather patterns](#), and more frequent, intense droughts and floods," said Caroline Ummenhofer, a [climate scientist](#) at Woods Hole Oceanographic Institution. "However, in many [remote areas](#), such as the Arctic, we lack long datasets that can put recent observations into a long-term context. This has limited our ability to understand how shifting [weather](#) and [climate](#) patterns may affect human society and ecosystems."

Ummenhofer, along with Timothy Walker, her research colleague from the University of Massachusetts Dartmouth (UMassD), are trying to fill these pre-nineteenth century weather data gaps with old climate records from whaling ship logbooks.

Treasure troves of climate data

Captains and first mates of whaling ships—like those caught in the [Whaling Disaster of 1871](#)—kept a daily log of events during each voyage; these invariably included a brief account of weather conditions. At various points throughout the day—in between chores like adjusting sails, pumping out water, and making ship repairs—they'd keep close

tabs on wind speed and direction, sea conditions, air temperature, and other weather variables, often documenting them in careful, handwritten cursive.



Whalers from New England covered a wide span of the globe, often traveling to remote locations that merchant and military vessels didn't venture to. This composite whaling map, collated from four original maps prepared under the direction of Charles Haskins Townsend, shows the historical distribution of various types of whales taken by New England/American whaling ships between 1785-1913. Each color represents the position of a ship on a day when one or more whales were taken. Credit: New Bedford Whaling Museum

What they didn't know at the time was how invaluable the records would become to scientists today.

"This logbook-derived data will not only help push the instrumental

climate record back to the late 1700s, but they can give us a much broader geographical distribution of weather data than is currently available," said Walker. "This can lead to a better understanding of modern climate records and help predict future changes."

Old weather records from merchant and military vessels have helped bridge gaps in the climatological record, but the data has typically been limited to areas near defined sea lanes. Whaling ships, on the other hand, were navigational outliers, often venturing to remote places that other vessels didn't go in order to follow prey.

The Indian Ocean is a case in point, and an area of particular interest to Ummenhofer. It's among the most remote and least-observed tropical ocean regions, yet its influence on the Asian monsoon—a lifeline for a billion people—is significant. "Even small changes in rainfall during the monsoon season can have a huge effect on crop production and economic wellbeing in the region," she said.

Hot spot for climate change

Mining old weather records, she feels, can be used to better understand climate variability in the "Roaring Forties"—a swath of the southern Indian Ocean at latitudes between 40 and 50 degrees known for its gale-force winds. In [recent decades](#), these strong westerlies have shifted south, becoming more aptly known as the "Furious Fifties."



The research team on a “field trip” to the New Bedford Whaling Museum, which holds several hundred whaling logbooks in its archives. From left to right: Justin Buchli, Caroline Ummenhofer, Cali Pflieger, Sujata Murty, Abigail Field, and Timothy Walker. Credit: New Bedford Whaling Museum

"The Indian Ocean is a hot spot for climate change, and an area where we've seen a significant amount of warming and wind changes," said Ummenhofer. She says that logbook records can help paint a picture of the past by telling us, for example, when the monsoon arrived each year based on entry dates and descriptive terms used. "We can then compare the legacy data with modern-day observations to gain insights into some of the unprecedented climate conditions we face today," she said.

Going digital

But it won't be easy. The researchers, with the help of volunteers, will need to sift through hundreds, and eventually thousands, of logbooks—many faded and/or damaged—from museums, archives, and libraries in New England to get the weather records into digital format. The process involves entering the handwritten weather descriptions into a web form containing fields for parameters such as wind speed, wind direction, cloud cover, and others. Once the data are entered and the form is submitted, the descriptions are automatically fed into a spreadsheet that assigns a numerical value to each description based on the Beaufort Wind Scale.

Walker notes that some of the handwriting in the logbooks is neat—some of it not so much—but all was penned in cursive. That could present a problem, at least for younger volunteers interested in helping out on the project, since cursive writing has become a lost art and may be unrecognizable to some. Scanning the logs with an optical character recognition system may not help much either since training the system to recognize handwritten characters from many different crew members across many different logbooks isn't feasible.

Despite these challenges, the researchers are committed to tapping these unexplored troves of climate data and are actively seeking funding sources to make it happen. There's a lot to get through, but Ummenhofer says the project can leverage already-established tools and methodologies that were developed as part of similar earlier projects, including [Old Weather](#) and the [Atmospheric Circulation Reconstructions over the Earth \(ACRE\)](#) project.

"By bringing together a team of oceanographers, climatologists, and historians, we're in a position to extract the climate data we need to make better sense of the past, while showcasing how this aspect of our

local history here in New England still has relevance today," said Ummenhofer.

Provided by Woods Hole Oceanographic Institution

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