20 percent more water in Antarctic circumpolar current than previous estimates

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The Antarctic Circumpolar Current transports water around Antarctica and into the Atlantic, Pacific and Indian Oceans, transferring heat and energy around the globe. Quantifying how much water it carries is an important step in understanding climate change and validating the accuracy of climate and oceanographic models.

By analyzing four years of continuous measurements of the current at Drake Passage, the narrowest point in the Southern Ocean, three University of Rhode Island oceanographers have concluded that the current carries 20 percent more water than previous estimates. They also found that the current remains strong all the way to the seafloor.

"It's important to understand the dynamics of the current so we can understand the impacts of our changing climate," said Kathleen Donohue, associate professor at the URI Graduate School of Oceanography. "We want to know how the current will respond to changing conditions, so quantifying the transport gives important guidance to the climate models that are trying to predict the future."

Donohue, along with URI Professor Randolph Watts and Marine Research Specialist Karen Tracey, will present the results of this research this week at the biennial Ocean Sciences Meeting in Honolulu. The meeting is sponsored by the American Geophysical Union, The Oceanographic Society, and the Association for the Sciences of Limnology and Oceanography.

The Southern Ocean is warming faster than other oceans, and the easterly winds that drive the current have increased significantly in the last 30 years. How the current will respond to these changes is not fully understood. Eddies, or ocean storms, are essential for transferring momentum from the circumpolar winds that drive the current to the sea floor.

To study the dynamics of the current, Donohue, Watts and Teresa Chereskin of the Scripps Institution of Oceanography deployed 35 current and pressure recording inverted echo sounders, which measure oceanic fronts and currents, across Drake Passage in 2007. They retrieved them in 2011. Another more closely spaced array of instruments was also deployed to map circulation and eddy patterns. The instruments collected higher resolution data over a longer period of time than the only other similar study of the Antarctic Circumpolar Current, which was conducted in the 1970s.

Drake Passage is an important site for oceanographic measurements because it is one of the few places around the globe where ocean currents travel through a somewhat narrow passage. Drake Passage is 800 kilometers wide and runs from the southern tip of South America to the northernmost point of Antarctica.

"We're never going to be able to measure the whole ocean," said Watts. "So if we're going to make accurate predictions of future climate, we're going to have to accurately measure processes like water transport and heat flux at key locations like the Drake Passage to guide our understanding."

The next step for the scientists is to develop a method of monitoring the Antarctic Circumpolar Current using a smaller array of instruments so the measurements can continue well into the future. They also hope to travel to the South Pacific and South Atlantic to make additional

measurements of how ocean storms transport heat toward the pole.

Provided by University of Rhode Island