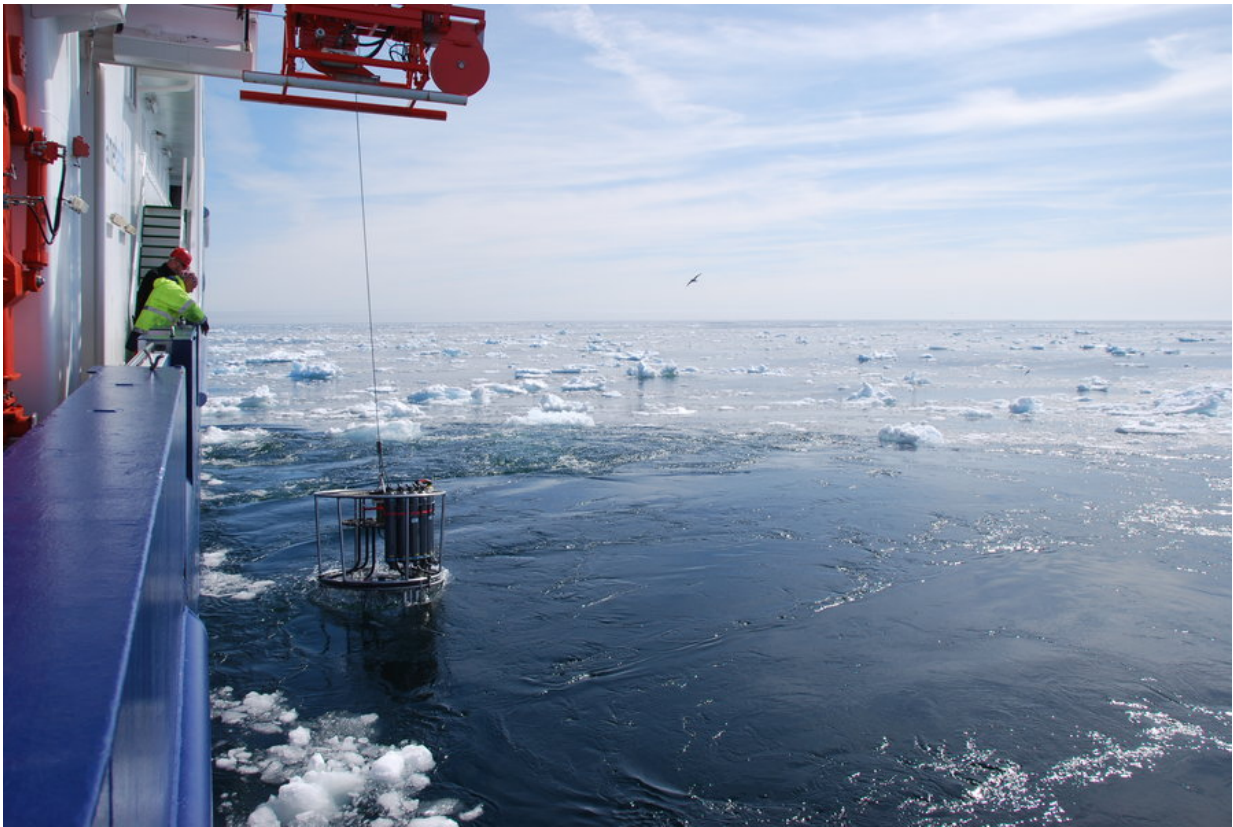


# Close connection between deep currents and climate

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Water samples are being obtained in the Labrador Sea. Credit: Rafael Abel, GEOMAR

Mild winters in northern Europe, rainfall in western Africa, hurricanes in North America -the energy transported around the world by the global

ocean circulation affects the climate as well as regional weather phenomena. One of the key regions for the ocean circulation is the Labrador Sea between North America and Greenland. There warm, saline waters coming from the south near the sea surface cool down and sink to the depth. There the water masses flow back to the south along the continental margin. Thereby the area is one of the regions of crucial importance for the global ocean circulation.

At the southern exit of the Labrador Sea, the GEOMAR Helmholtz Center for Ocean Research Kiel has been operating oceanographic observatories since 1997 that cover all levels of this current system. A team of four oceanographers now published the most complete analysis of these data in the *Journal of Geophysical Research Oceans*. "We were able to detect connections between the southward deep currents and the wind systems over the North Atlantic which were previously unknown," says lead author Rainer Zantopp of GEOMAR.

GEOMAR's oceanographic observatories are located at 53° North on the western boundary of the Labrador Sea. They consist of a series of current meters and sensors for temperature and salinity attached to chains and steel cables. Anchor weights at the lower end hold these so-called moorings in place while buoyant floatation pull the other end towards the surface. "This allows us to measure the currents from just below the surface to just above the ground," explains Rainer Zantopp. In addition, the study is based on data collected by the researchers during a total of 13 scientific cruises in the area between 1996 and 2014, mainly with the German research vessels METEOR and MARIA S. MERIAN, as well as with the French research vessel THALASSA.

The analysis showed that the southward deep currents along the western boundary of the Atlantic have fluctuations on different time scales. The authors were especially surprised by the deepest current near the ocean floor. "Although it is more steady than those at the upper levels, it varies

with an almost ten-year rperiod," Rainer Zantopp says.

Further analysis showed that the fluctuations of the deepest flow are synchronous with those of wind systems over the North Atlantic which are influenced by the pressure difference between the Azores high and the Iceland low. The indicator is called the North Atlantic Oscillation (NAO). "The intensity of the deepest southward current from the Labrador Sea shows similar fluctuations as the NAO", explains Rainer Zantopp. "We were somewhat surprised to find the signal so clearly in our measurement data."

These results from oceanographic long-term observations are of great importance for general climate research. "The better we understand the interactions between the [ocean](#) and the atmosphere, the more reliably we can distinguish natural variabilities and man-made changes and thus make better predictions about future developments," emphasizes Rainer Zantopp .

**More information:** R. Zantopp et al, From interannual to decadal: 17 years of boundary current transports at the exit of the Labrador Sea, *Journal of Geophysical Research: Oceans* (2017). [DOI: 10.1002/2016JC012271](#)

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