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Two new studies substantially advance understanding of currents that help regulate climate

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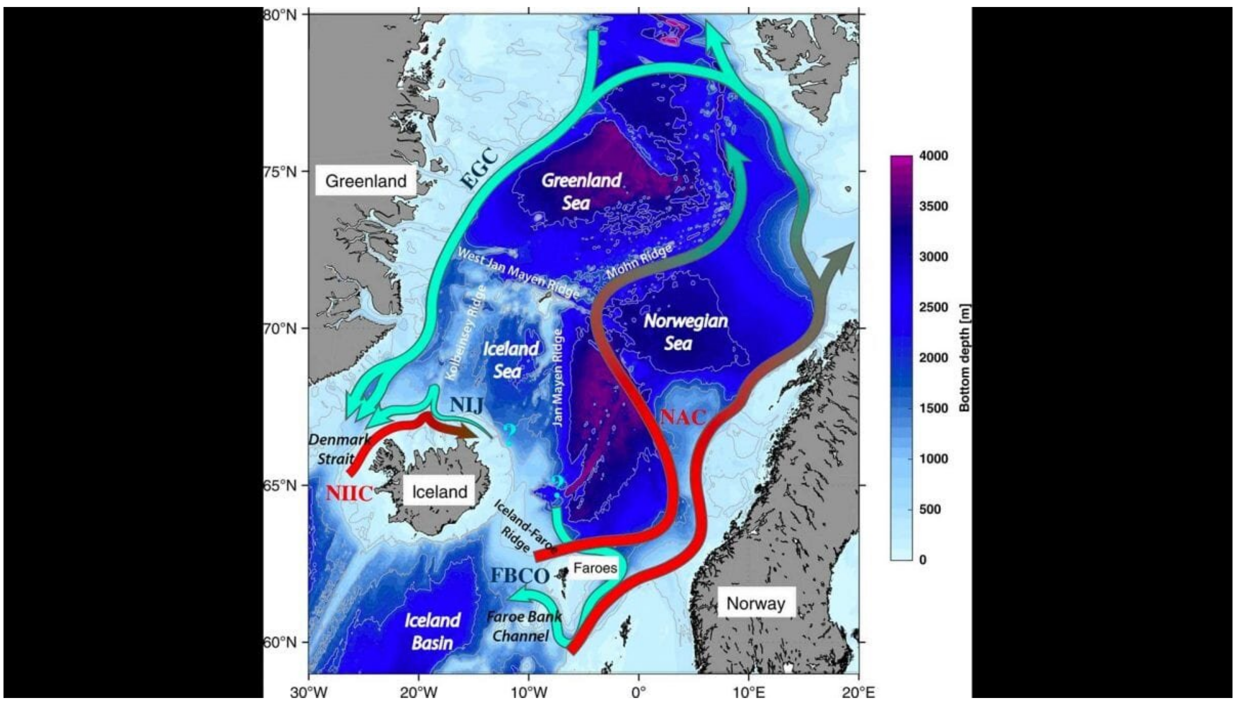

Schematic of circulation in the Nordic Seas shows the pathways of warm, saline inflow (red arrows) and cold, dense outflow (green arrows). Abbreviations include: East Greenland Current (EGC); Iceland-Faroe Slope Jet (IFSJ); Norwegian Atlantic Current (NAC); North Icelandic Irminger Current (NIIC), and North Icelandic Jet (NIJ). Credit: Huang et al (2020)

As the planet warms, significant questions have arisen regarding the impacts of rising temperatures on the ocean circulation that helps regulate global climate.

Two studies available online in *Nature Communications* shed new light on a critical driver of the Atlantic Meridional Overturning Circulation (AMOC), sometimes known as the "ocean conveyor belt." Together, these give greater insight into the northern origins of the AMOC and potential impacts of warming on regions of the North Atlantic that are critical to this system of currents.

One study, led by Jie Huang, a former guest student at WHOI and currently a researcher at Tsinghua University in China, found that a common source supplies the pathways of the coldest and densest water in the AMOC. Huang arrived at this conclusion by using a new method known as "sigma-pi distance" to analyze a historical set of oceanographic data that includes the temperature and salinity of water samples collected in the region since the 1980s. In doing so, Huang was able to trace the water spilling over the Greenland-Scotland Ridge on the seafloor and into the North Atlantic via the Denmark Strait and the Faroe Bank Channel back to the same location in the Greenland Sea.

This flow of deep water is formed as surface waters in the region cool, releasing heat to the atmosphere, becoming colder and denser. Scientists have long suspected that warming in in the Arctic and North Atlantic could disrupt the formation of this deep water formation, causing the AMOC to change or weaken and cause significant changes to regional and global climate patterns.

Huang also found in his analysis that the location of deep water formation in the Greenland Sea has shifted since the 1980s from the periphery of the slowly turning counter-clockwise circulation—known as the Greenland Sea Gyre—to the center, where it is today.

"Where and how dense water is formed in the Nordic Seas is likely to change in a warming climate," said Huang. "This could affect the composition and the pathways of the dense water supplying the overflows."

The other paper, led by University of Bergen physical oceanographer and former WHOI guest student Stefanie Semper used four independent sets of observations to provide clear evidence of a previously unknown current following the seafloor slope between Iceland and the Faroe Islands. This so-called Iceland-Faroe Slope Jet supplies as much as half of the water overflowing the Greenland-Scotland Ridge into the North Atlantic via the Faroe Bank Channel, making it a major component of the overturning circulation in the region.

"These two studies fundamentally advance our understanding of the origin and pathways of the densest overflow water supplying the deep limb of the AMOC," said WHOI physical oceanographer Robert Pickart, who is second author on both papers. "This is imperative if we hope to accurately predict how the AMOC will evolve in the future."

More information: Jie Huang et al. Sources and upstream pathways of the densest overflow water in the Nordic Seas, *Nature Communications* (2020). DOI: 10.1038/s41467-020-19050-y

Stefanie Semper et al. The Iceland-Faroe Slope Jet: a conduit for dense water toward the Faroe Bank Channel overflow, *Nature Communications* (2020). DOI: 10.1038/s41467-020-19049-5

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