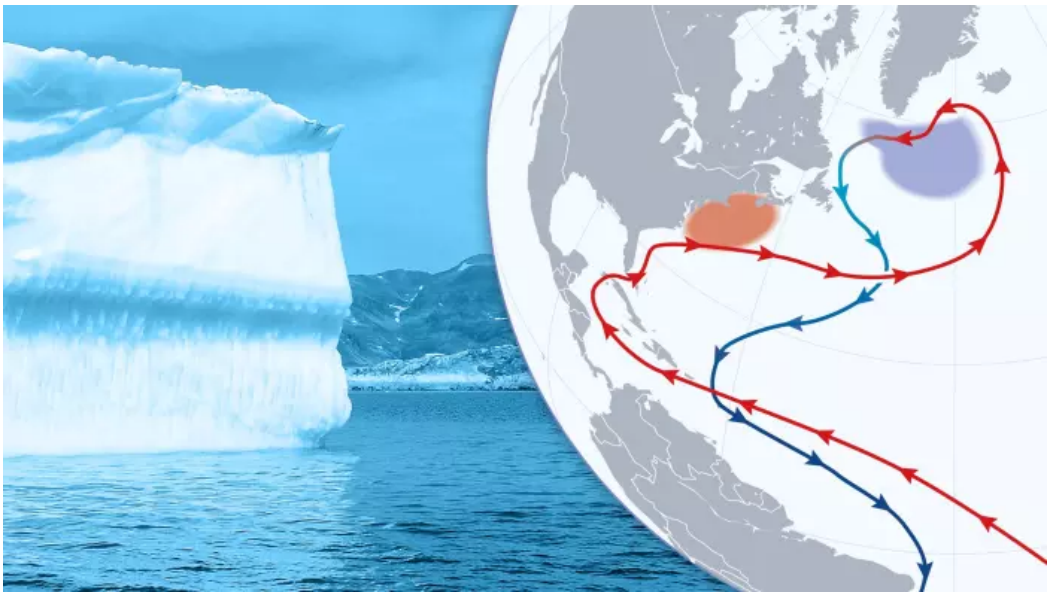
Climate change

Global warming to give colder winters and hotter summers

Studies say system of ocean currents that plays vital climate role is losing strength



Amoc's strength has declined by 15% since the mid-19th century and is now at its weakest for at least 1,500 years © FT montage; Dreamstime

Clive Cookson in London APRIL 11, 2018

Global warming is weakening the circulation of the North Atlantic ocean, which plays a crucial role in the world's climate, including keeping winters in western Europe relatively mild.

Two international research teams have published separate studies in the journal Nature, which together add powerful evidence to fears that the system of ocean currents known as the Atlantic Meridional Overturning Circulation or Amoc is losing strength.

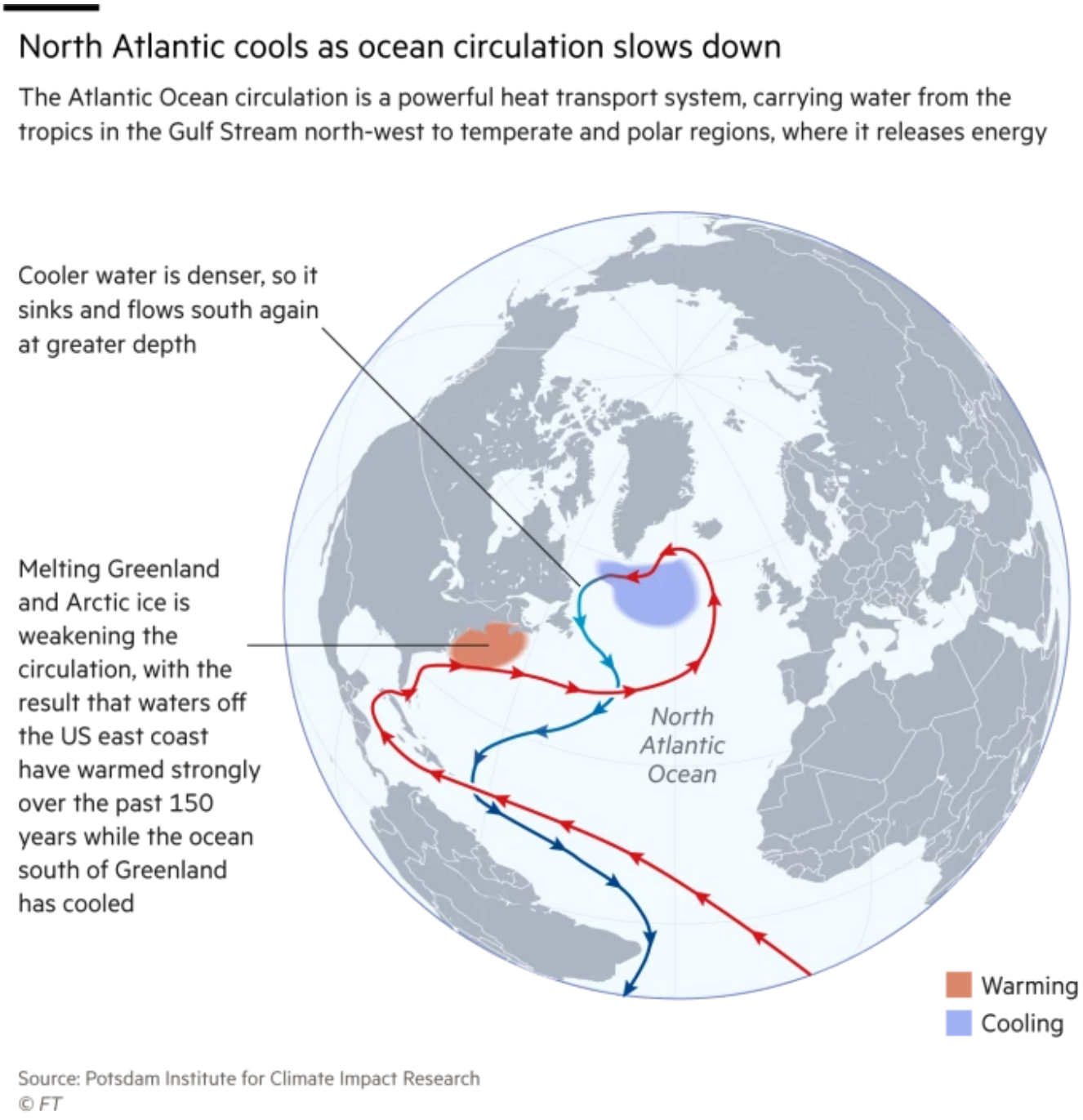
Amoc's strength has declined by 15 per cent since the mid-19th century and is now at its weakest for at least 1,500 years — and probably since the end of the last big Ice Age 11,500 years ago — said David Thornalley of University College London, lead author of one study by scientists at UCL and Woods Hole Oceanographic Institution.

If the weakening continues, the impact on Europe and the US east coast could be serious. Winter weather is likely to become less stable, with more outbursts of extremely cold air from the Arctic.

It could have the opposite effect in summer. For example, the 2015 European heatwave was paradoxically linked to record cold in northern Atlantic waters that year. That promoted an air pressure system that funnelled warm winds from the south into Europe. Further afield, a weakened Amoc tends to push African rainfall belts southward, increasing the risk of drought in the Sahel.

According to most climate models, there is only a small risk of the weakening leading to a complete shutdown of Amoc, which would be catastrophic. "But our work does suggest that they are

underestimating the chance of abrupt changes," said Dr Thornalley.



Amoc is a powerful heat transport system that carries water from the tropics north-west in the Gulf Stream to temperate and polar regions, where it releases energy. The cooled water is denser, so it descends to the ocean's lower depths and flows south again.

A warmer climate weakens Amoc by melting Arctic and Greenland ice (and increasing rainfall), which releases fresh water into the Atlantic at high latitudes. Reduced salinity makes the water less dense — and therefore less liable to sink and return south.

The UCL/Woods Hole collaboration used various techniques to estimate changes in Amoc. One measured the size of grains in cores drilled from sediments on the seabed; larger grains meant a stronger current. The other examined remains of microscopic sea creatures in the sediments, which indicate water temperature at the time. The analysis suggested that the weakening began at the end of the so-called Little Ice Age around 1850, when the world started to warm after two exceptionally cold centuries.

In the second study, scientists at the Potsdam Institute for Climate Impact Research in Germany used climate model data to confirm that sea surface temperature patterns are a good indicator of Amoc's strength. Then, analysing temperature data, they showed that Amoc weakened more rapidly since 1950 in response to recent global warming.

"We detected a specific pattern of ocean cooling south of Greenland and unusual warming off the US coast, which is . . . practically like a fingerprint of a weakening of these ocean currents," said lead author Levke Caesar. As Amoc slows down, it brings less heat to the northern Atlantic, the only ocean region that has cooled in the face of global warming. By contrast, sea temperatures off the US east coast have risen exceptionally fast.

Summer Praetorius of the US Geological Survey commented: "It is — at least scientifically — reassuring to see that the present two studies converge on the conclusion that the modern Amoc is in a relatively weak state. However, in the context of future climate change scenarios and a possible collapse in the Amoc in response to the continued melting of the Greenland ice sheet, it is perhaps less reassuring, because a weakened Amoc might lead to considerable changes in climate and precipitation patterns throughout the northern hemisphere."

Latest on Climate change