# Following the ocean's flow

by **Julia Horton**

The dramatic sight of Atlantic waves crashing onto UK shores from the vast, surging ocean illustrates perfectly the joke behind its nickname of 'The Pond'.

Such an impressive natural strength demonstrates the physical threat which these mighty waters can pose to coastal communities in the UK and the USA.

What it doesn't show is the hidden power of oceans to cause the kinds of climate and weather changes that help to create such stormy seas in the first place. Ocean currents act like a global conveyor belt, continually carrying heat from the sun between the equator and the frozen poles. Water sinks from the surface to the deep as it cools down, before rising again as it warms up in an ongoing cycle.

This movement through the seas, dubbed overturning, combines with heat moved through the air by the weather to influence atmospheric temperature, rainfall and wind.

Water takes much longer to heat up and cool down than the air, so knowing the condition of the ocean now can help to forecast the climate in years to come.

## Causing a stir

The exact nature of the water's movement in the Atlantic Ocean is unknown, however. Until now it has been impossible to test the various theories put forward by scientists, as that would involve setting up a major experiment in the middle of an ocean.

Now climate scientists have been able to do just that thanks to NERC research ships. Vessels including the RRS Discovery have allowed experts to voyage across the North Atlantic to moor specialist instruments from the seabed recording crucial data on factors including temperature and current speeds.

The project, known as the Overturning in the Subpolar North Atlantic Programme, or OSNAP, is a global collaboration aimed at providing evidence to guide action to combat the impact of climate change on future generations.

The pioneering study began six years ago and is the first to continuously measure how the ocean circulates between Canada, Greenland and Scotland in the subpolar region. The North Atlantic was chosen for the research because it influences the climate worldwide, reaching the Arctic Ocean in the north and the equator in the south.

Penny Holliday, principal investigator for the UK arm of the study at NERC's National Oceanography Centre, explains: "Climate change is the biggest scientific challenge of our time and predicting what the climate is going to do in the next ten, 50 or 100 years will provide incredibly important information so we can change our behaviour if we want to slow down climate change, and decide what to do in terms of mitigating climate change.

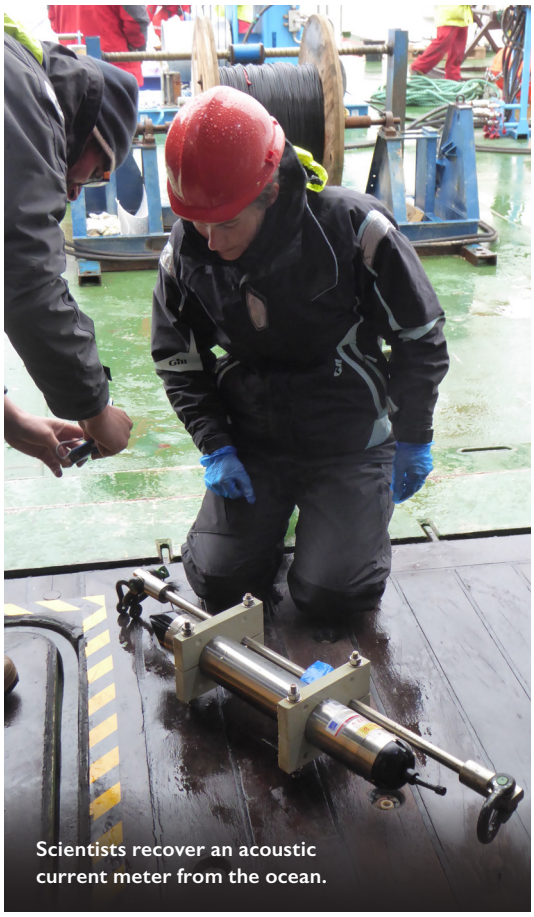
"We could not do this without working with colleagues in other countries including Canada, the Netherlands, Germany, China and the US."

## Tricky conditions

The team also relies on research ships to gather the data, taking the instruments back out of the ocean every two years to collect the vital information they hold, before suspending them again from the seabed using cables attached to glass floats.

But even with the ships extreme challenges remain.

Penny explains: "The subpolar North Atlantic is an inhospitable place and even in the summer you can get some mad storms. In a three week cruise we plan three days of down time due to bad weather, because when a North Atlantic storm is in full swing you can't even get onto the deck."



Scientists recover an acoustic current meter from the ocean.

## The sea's circulation

NERC investment since 2001 is revolutionising understanding of an important system in the Atlantic called the Atlantic Meridional Overturning Circulation (AMOC). This is a critical element of the global climate system with substantial impact on UK climate. The NERC funded Rapid Climate Change programme (RAPID) provides advice to policymakers by reducing uncertainty in regional climate predictions. Scientists have installed ground-breaking equipment across the Atlantic and, for the first time, are able to monitor the circulation of Atlantic currents in real time. This is important because if this circulation changes there could be significant temperature changes across Europe. Together these two programmes give a more complete picture of what's happening to the Atlantic's circulation.

### Pushing the boundaries of knowledge

The unique evidence which experts have gathered so far has already proved one theory wrong, which was that the Labrador Sea would be a key location for overturning as the North Atlantic nears the Arctic.

Penny says: "We have taken one concept that we have had in our minds [about what was happening in the Labrador Sea] and shown that it isn't right. What we think now is that this process of overturning is happening between Greenland and Scotland, and north of Iceland in the Nordic seas.

"The only way to improve climate models is to go out into the ocean and make observations to see if what you think is happening is actually happening."

The findings will be among the evidence upon which the UN Intergovernmental Panel on Climate Change will base its global warming reports, influencing politicians and people across the planet.

### More questions, more research

Ongoing investigations have also suggested that UK waters are far more important than previously thought, and the relationship between the ocean and the climate can be unexpected.

Penny adds: "We have been able to show that very cold ocean temperatures to the west of the UK can lead to heatwaves in Europe (including the UK), which is counterintuitive."

With extreme and unusual weather patterns reported globally and growing warnings over climate change, the need for answers is rising too.

Given the findings so far, 'The Pond' looks certain to prove even more significant in the world.