'Short-circuit' discovered in ocean circulation

May 10 2007

Scientists have discovered how ocean circulation is working in the current that flows around Antarctica by tracing the path of helium from underwater volcanoes. The details are published in *Nature* this week.

The team, led by Alberto Naveira Garabato of the National Oceanography Centre, Southampton (formerly based at the University of East Anglia), has found a 'short-circuit' in the circulation of the world's oceans that could aid predictions about future climate change.

This process in the Southern Ocean allows cold waters that sink to the abyss to return to the surface more rapidly than previously thought.

This affects the Southern Ocean circulation, which links all the other oceans, and is also relevant to uptake and release of carbon dioxide by

the sea – transport between the deep and surface waters in the Southern Ocean is particularly important for this process.

Understanding oceanic circulation is important because it distributes heat, carbon and nutrients around the globe and therefore plays a central role in regulating Earth's climate.

The findings show that much of the overturning circulation - how water moves and mixes vertically - around Antarctica takes place just around the tip of South America and in the small region in the Atlantic south of the Falklands, called the Scotia Sea.

Co-author Prof Andrew Watson, from the University of East Anglia's School of Environmental Sciences, said they were fundamental findings.

"The Southern Ocean is the least well understood part of the world ocean, but one of the most important parts. We are going to have to understand its circulation before we can make really confident predictions about how the climate is going to change over the next 100 years.

"This is a piece of knowledge that will help us do that. This tells us how an important part of it works"

The research shows that a combination of rapid mixing across and rapid movement along density surfaces creates a 'short-circuit' in the overturning circulation, meaning it is more concentrated in this part of the Southern Ocean.

The researchers made use of a unique signal - the spread of helium released naturally from the Earth's interior at deep vents in the Pacific. The helium dissolves in the deep sea and a plume of this marked water travels down the coast of Chile. It is injected at depth into the Antarctic

current on the Pacific side of Cape Horn.

It then streams through into the Atlantic with the current, but in the process is spread, shifted and diffused by the circulation. Measurements of this spreading of the helium were used to deduce the ‘short-circuit’.

Dr David Stevens, from UEA’s School of Mathematics, and Wolfgang Roether, from the University of Bremen, Germany, are also co-authors.

Source: National Oceanography Centre, Southampton