

NEWS RELEASE

From School of Ocean and Earth Science

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Climate change clues in the rough seas of the Southern Ocean

On 30 November 2010 scientists aboard the RRS *James Cook* will be leaving Punta Arenas, Chile to study the movement of water in the Southern Ocean – from the surface to the deep abyss. Dr Alberto Naveira Garabato of the National Oceanography Centre, Southampton, University of Southampton and Dr Mike Meredith of the British Antarctic Survey, will be leading an international team to study how different water masses mix in this remote ocean.



During the six-week expedition the scientists will be looking for signs of a man-made tracer that was released two years ago at a depth of 1500 metres. The team will be measuring how far and deep it has travelled, indicating the rate of horizontal and vertical mixing between different water layers.

Alberto Naveira Garabato said: 'The Southern Ocean is the main place in the global ocean where water masses get exchanged between the surface and the deep ocean floor, carrying with them heat, carbon and nutrients. The eddies and currents in the Southern Ocean play a crucial role in the global circulation and even have an effect as far away as the North Atlantic.'

The tracer was released into the Antarctic Circumpolar Current – the strongest of the world's ocean currents – two years ago by an American team that included Dr James Ledwell and colleagues from the Woods Hole Oceanographic Institution. James Ledwell joins this team to record its progress. The man-made tracer, trifluoromethyl sulphur pentafluoride (CF₃SF₅) is detectable in minute concentrations. It will remain in the ocean for decades until it escapes through the sea surface.

Mike Meredith said: "The Antarctic Circumpolar Current circles Antarctica with no interruption by land masses, linking the Pacific, Atlantic, Indian and Southern Oceans. We will be measuring how eddies mix water masses across the ACC with a swarm of 150 subsurface floats, and how the underlying seabed affects the turbulence of this current as it flows over the underwater topography with turbulence-measuring profilers. This will be the first time that some of these measurements are made in the Southern Ocean."

There are several reasons why mixing in the Southern Ocean is of interest to the scientists. As well as heat exchange between the oceans, this mixing brings nutrients from the deep ocean to the surface – nutrients needed by phytoplankton. In addition to being the base of the ocean food chain, phytoplankton plays a key role in the carbon cycle – it removes the carbon dioxide generated by burning fossil fuel carbons from the atmosphere to the deep ocean. Ocean mixing

also affects the global concentration of atmospheric CO₂ as it is sensitive to the rate at which this exchange happens. Measuring all these factors will help quantify the rate of climate change.

Joining the NOC and BAS oceanographers are scientists from a number of British and American institutions, including the Universities of East Anglia, Florida State, Southampton and Washington; Lamont-Doherty Earth Observatory and Woods Hole Oceanographic Institution. The expedition is funded by the UK's Natural Environment Research Council (NERC) and the American National Science Foundation (NSF) and is part of the DIMES project consortium. (DIMES, the Diapycnal and Isopycnal Mixing Experiment in the Southern Ocean) Isopycnal means approximately horizontal mixing – along surfaces of constant seawater density, diapycnal means approximately vertical mixing – across surfaces of constant seawater density. The experiment aims to determine how much of each is involved in returning the deep water that sinks in the North Atlantic to the ocean surface.

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