# Research ship Polarstern returns from Antartica

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Bremerhaven, 19 May 2011. The research vessel Polarstern of the Alfred Wegener Institute for Polar and Marine Research in the Helmholtz Association will arrive back at its homeport of Bremerhaven after a seven-month expedition on Friday, 20 May. Nearly 200 researchers from institutes in 15 countries took part in the expedition. The oceanographers on board conducted measurements showing that warming of the water in the deep Weddell Sea continues further. The observations of biologists indicated that organisms in the Antarctic adapt very slowly to changes in the environment.

The Weddell Sea in the Atlantic sector of Antarctica is a favourite place for German polar research. Oceanographers, for instance, operate a network of moorings and floats with sensitive sensors that determine temperature, salt concentration and thickness of sea ice. To read out the data and maintain the equipment, the moorings have to be replaced. The floats transmit their data by means of satellites. Expansion of this measurement network was one of the focal points of the cruise leg headed by oceanographer Dr. Eberhard Fahrbach. "An initial evaluation of the measurement data shows that the temperature down to great depths of the Weddell Sea continues to rise," states Fahrbach, who was in Antarctica on the Polarstern from the end of November to the beginning of February.

Data from the moorings as well as measurements conducted directly on the ship were collected within the framework of international observation programmes. In this way they make a major contribution to

gaining a better understanding of the significance of the Atlantic sector of the Southern Ocean for large-scale events of relevance to the climate. Among other things, the researchers analyse the temperature and salt concentration distribution in this context. In the Weddell Sea the worldwide conditions in the deep sea are influenced in such a way that cold, saline water sinks (thermohaline circulation). It can therefore be expected that changes in the properties of these cold water masses in the Antarctic will have worldwide impacts. As a matter of fact, the temperature increase of bottom water can be detected over large sections of the ocean north of the Atlantic. According to Fahrbach, the temperature in the Weddell Sea has risen by six hundreds of a degree on average across the entire water column in the last 26 years.

"This temperature rise seems small," says Fahrbach, "but because it extends down to great depths, it entails a considerable heat volume that is stored in the ocean. This contributes to the fact that the atmosphere heats up less than expected as a result of the increase in the greenhouse effect. According to the World Climate Report (IPCC), more than 80 percent of the heat that the Earth has additionally absorbed thus far due to the altered greenhouse effect is stored in the upper ocean layers down to a depth of 1,500 metres. Now we have been able to show that the deep ocean with its enormous volume is also involved in this process."

Plants and animals have adapted to the extreme Antarctic conditions. In the following section of the expedition, which was entitled "CAMBIO" (Change in Antarctic Marine Biota), biologists studied what species can adjust how quickly to climate change.

The researchers led by expedition head Dr. Rainer Knust from the Alfred Wegener Institute set course for sites near the coast in the western and eastern Weddell Sea. They went to stations they were familiar with from earlier expeditions in order to determine whether the species composition on the seafloor had changed. The former Larsen

A/B ice shelf areas on the western Antarctic Peninsula, which were covered by a thick layer of ice for millennia, were of particular interest. Because large ice shelf areas broke up in 1995 and 2002, an exchange with the sea surface is possible again, which has dramatically altered the conditions for organisms on the seafloor. Large areas of water and rapidly descending meltwater from the remaining ice shelf indicate that the decline continues even now. However, the biotic communities on the seafloor settle the now vacant areas only at a very, very slow pace.

The scientists found another reaction of the organisms to a different disturbance of their habitat in the eastern Weddell Sea, where they had artificially churned up the seafloor eight years before. Because of the currents, icebergs often scrape across the bottom of the ocean here so that the researchers would actually have expected more rapid recolonisation of these areas. "The slow recolonisation shows that the ecosystems in the eastern and western section of the Weddell Sea react sensitively to disturbances," explains Knust.

The reason why some animal species cope better with altered conditions than others is because of their physiological features. They have adapted to their environmental conditions in the course of evolution and species from the high Antarctic have adjusted optimally to very low, but also very constant water temperatures. The biologists caught fish, crustaceans and squid to find out in experiments on board what possible adaptation mechanisms the animals have to be able to react to changes. Some animals have commenced the long voyage across the equator so these studies can be continued under controlled conditions in the laboratories of the Alfred Wegener Institute.

The arrival in and departure from Antarctica were taken advantage of to conduct continuous measurements of atmospheric and oceanographic parameters used in research on the interactions between ocean and atmosphere. Moreover, further developed and/or new equipment was

tested in operation at sea. A training programme for junior scientists on use of the measuring devices also took place on board. After routine shipyard and repair work the Polarstern will leave Bremerhaven again heading for the Arctic on 15 June.

**More information:** You can find more information on the now completed Antarctic expedition of the research vessel Polarstern in the weekly on-board reports at www.awi.de/de/infrastruktur/sc … tern/wochenberichte/

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