

New Long-term Observatory for Arctic Ocean Observations



Scientists and engineers of the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI, Germany) are starting work on a long-term observatory with observation stations from the Norwegian Sea to the Arctic Ocean. In the coming years, the AWI researchers intend to upgrade their existing long-term observatories along this key climatological interface into a comprehensive research infrastructure and deploy a wide range of modern marine technologies.

The overriding objective is to be able to observe the changes in the ocean and its ecosystems from the surface to the deep sea with the aid of the new FRAM observatory. The Helmholtz Association has approved this strategic expansion investment and the German government and the state of Bremen are financing the establishment of this new

platform for the first five years with EUR25 million.

The present AWI long-term observatories “Verankerungskette” (“Mooring Chain”) and “Hausgarten” (“House Garden”), which have been located in the Fram Strait for over 15 years, form the basis for the new FRAM (Frontiers in Arctic Marine Monitoring) research platform. The current stationary measuring units will be supplemented with a number of mobile components, such as deep-sea robots, ice buoys, gliders and autonomously operating underwater robots. These will enable the researchers to extend their vision beyond “Verankerungskette” and “Hausgarten” from the Norwegian Sea to the Arctic.

FRAM will be expanded over a period of five years. Following this phase, the Alfred Wegener Institute will assume operation and maintenance of this infrastructure. Scientists from ten sections at AWI are involved in the expansion and operation of FRAM. However, research cooperation with MARUM at the University of Bremen and GEOMAR in Kiel is planned as well. AWI is also working internationally with Norwegian, French, Polish, Canadian, American and Japanese oceanographic institutes, which are all very interested in contributing their know-how to the FRAM infrastructure.

One special feature of this research infrastructure is that it will be able to conduct concurrent physical, chemical and biological measurements on the basis of a multi-sensor approach throughout the entire year – even in the Arctic winter – using autonomous platforms. The FRAM objective represents a special challenge of having to carry out constant measurements of the light-suffused, ice-covered ocean surface, which is so important for the coupling of physical and biological processes. The research vessel *Polarstern* also plays a key role here: she will travel to the study regions annually in order to replace sensor platforms and conduct additional measurements.

First, however, the FRAM team has a lot of development work to do. The harsh local weather conditions and the great distance from the mainland pose special challenges for both the technology and the scientists. The measurement area at the transition from the Norwegian Sea to the Arctic Ocean is largely covered by sea ice in winter, which among other things poses the risk that instruments which have to surface to transmit data will be destroyed by ice. Technical solutions have to be found that enable these devices to recognise whether the surface above them is covered with ice or clear. A second important issue is the robot power supply. They all need to operate so efficiently that their battery reserves are sufficient for at least a year.

Initial device prototypes that meet these requirements are currently being developed at AWI. They include autonomously operating deep-sea robots, which are being developed in cooperation with the Helmholtz alliance ROBEX, underwater winches with attached sensor profilers to enable study of the ice-covered ocean surface even during the Arctic winter – as well as sampling devices that photograph microscopic organisms in water and fix their DNA.

The FRAM project also includes the development of a data portal and a regional environment model so that the data can subsequently be used in as many different ways as possible. Scientists specialising in remote satellite sensing will also benefit: with its numerous measuring stations, the new long-term observatory will provide them with valuable validation data.