The European Commission
Community Research
Energy, Environment and Sustainable Development

Fifth Framework Programme

MAIA

Monitoring the Atlantic Inflow toward the Arctic

What is MAIA?

Monitoring the Atlantic Inflow toward the Arctic (MAIA) is a research project within the Fifth Framework Programme of The European Commission (Contract EVK2-CT-1999-00008). The project is part of the Energy, Environment and Sustainable development Programme: to better exploit existing data sets and observing systems. The project started January 2000 and will last until December 2002. It is a European extension of a Nordic collaboration within the *Nordic Arctic Research Programme*.

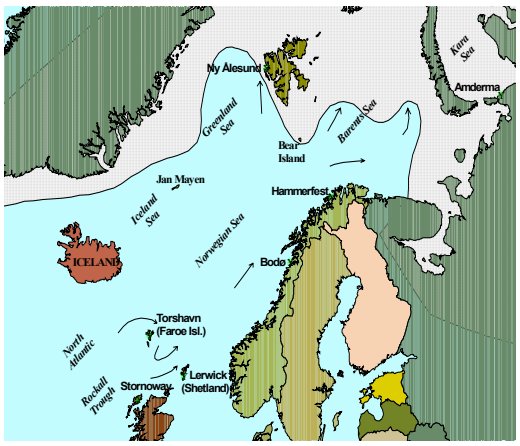
The objective of MAIA

The overall *objective* of MAIA is to develop an inexpensive, reliable system based on coastal sea-level data for monitoring the inflows of Atlantic Water to the northern seas.

Available observation systems, including standard tidal stations, will be used to obtain transport estimates with a time resolution of less than a week and show that the method is generic and can be applied to a similar monitoring of other regions.

Why MAIA?

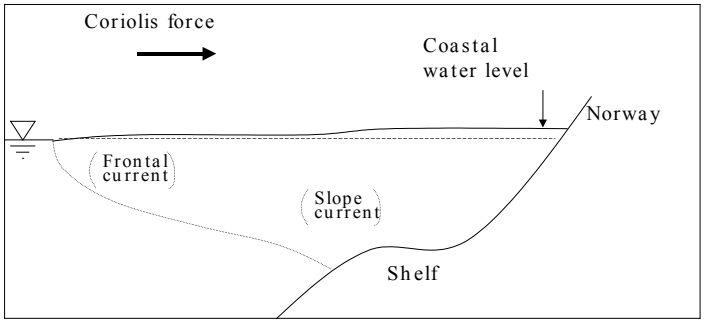
The flux of Atlantic Water to the Nordic and Barents seas is vital for the existence of life in northern Europe. There have been several attempts to estimate and monitor these fluxes, using expensive arrays of current meters, and to see how the ice extent in the north is correlated to them. The ice cover is an important link in the arctic climate system. More than half of the Atlantic Water appears to enter the Norwegian Sea to the west of the Faroe Islands, the warmer part enters along the continental margin past Scotland.



MAIA region with tidal stations noted

Coupled circulation models have indicated a possible weakening of the global thermohaline overturning and have therefore caused concern about the stability of the inflow and its sensitivity and coupling to global and regional changes. Variations in the ice front, or marginal ice zone, in the Barents Sea are a measure of climate variability. Observations show that the Arctic sea-ice cover has decreased over the past decades.

The MAIA project was motivated by these facts and that most of the monitoring of the ocean currents has been performed using expensive arrays of current meters. A potentially inexpensive monitoring can be achieved by using the coastal surface rise induced by the ocean transports on the rotating earth- the so-called geostrophic balance between the Coriolis force and the surface tilt.



Cross section of the Norwegian Atlantic Current showing the balance between the Coriolis force and the surface tilt.

Description of MAIA

The project is divided into 3 phases:

Phase I of the project is to analyze historical observations of sea-level fluctuations during the past decade and compare them with available bottom pressure measurements and *in-situ* current velocity measurements in the region of interest. Hourly sea-level measurements from the standard tidal stations in the figure are used to obtain a true measure of the surface height throughout the normal variability of tides and weather patterns. These data are averaged over 5 days to eliminate this type of variability. The region of interest extends from Rockall Trough in the southwest to the Kara Sea in the northeast. In the north, MAIA is aimed at monitoring the flows through the Barents Sea.

Phase II of the project is a dedicated validation study in the Shetland-Iceland region and in the Barents Sea to verify that the system can give the required results to the desired accuracy and resolution. The validation period is from summer 2000 to summer 2001.

Phase III of the project includes evaluation of the effects of external influences, ice studies and the validations, and recommendations for future monitoring.

Use of MAIA results

The user-oriented Steering Committee of MAIA includes representatives from the offshore petroleum industry, fisheries, environment, weather forecasting, ocean monitoring and climate studies.

The potential results of MAIA for predicting sea surface temperature and ice-front position over weeks, based on transports of warm Atlantic Water to the region of interest, could enhance long-term weather forecasting.

Foinaven FPSO working West of Shetland

For the petroleum industry MAIA can provide a means to calculate the long-term variability of the Atlantic inflow to put short-term measurements into perspective. This will lead to more reliable estimates of extreme current speeds in areas where it is an important design parameter. MAIA can also provide more reliable boundary conditions for numerical models of the shelf seas from the North Sea to the Kara Sea, north of Siberia, and improve their value as a forecasting tool for operational purposes, as well as a tool for establishing long-term data series of ocean currents. The results can also provide a correlation between easily observable oceanic parameters and the ice extent in the Barents Sea, which can be used for ice cover forecasts on a time scale of months to seasons.

Commercial fisheries are pursued in sea areas influenced by the Atlantic inflow to the Arctic by the European Community, Nordic and Russian Federation nations. These fisheries are of great socio-economic importance and have in the past been managed by international agreements based upon annual scientific stock assessments and population predictions. There is a growing impetus towards introducing multi-species interactions and environmental influences to fisheries management.

Fishing the Nordic Seas

As to the environment, the transport routes for Atlantic water toward the Arctic will provide valuable information for assessing the fate of pollutants in northern European shelf seas.

The results of MAIA are directly relevant to the World Climate Research Programme's climate studies: Arctic Climate System Study (ACSYS) / Climate and Cryosphere Programme (CliC) and Climate Variability (CLIVAR).

Changing arctic climate?

The European component of the Global Ocean Observation System (EuroGOOS) is concerned with identifying the potential synergy from a range of measurements. It has a strong and continuing interest in measuring the strength of the thermohaline circulation, monitoring deep-water formation, convection, and northward transport. MAIA represents first and foremost added value to existing measurement/monitoring programmes.

MAIA partners

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