Climate Change Research: Evaluation and Policy Implications
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Determination of the NE. Atlantic current field with ARGOS drifters.

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The patterns of near-surface currents in the ocean as we know them today only give a very general picture, because they are based upon data that and calculations that are not adequate in every respect. Regional and temporal variability cannot be resolved in sufficient detail and this is for instance reflected in uncertainties in the estimates of the transport of mass and heat in the ocean. Yet these estimates are important for the assessment of the role of the oceans in the climate system.
For example, in the northern part of the North Atlantic, north of latitude 53°, the near-surface circulation follows an anticyclonic pattern (the Sub-Arctic Gyre), with northward flow in the eastern part, and southward flow in the west. But how much of the water flows into the Norwegian Sea beyond the Scotland-Iceland Ridges, and along what routes, and how much of it turns westward south of Iceland, is still a matter of dispute. As the Sub-Arctic Gyre is an important link in the thermohaline ocean circulation (the "Conveyor Belt") better information is required for a realistic modelling of the oceanic part of the climate system.

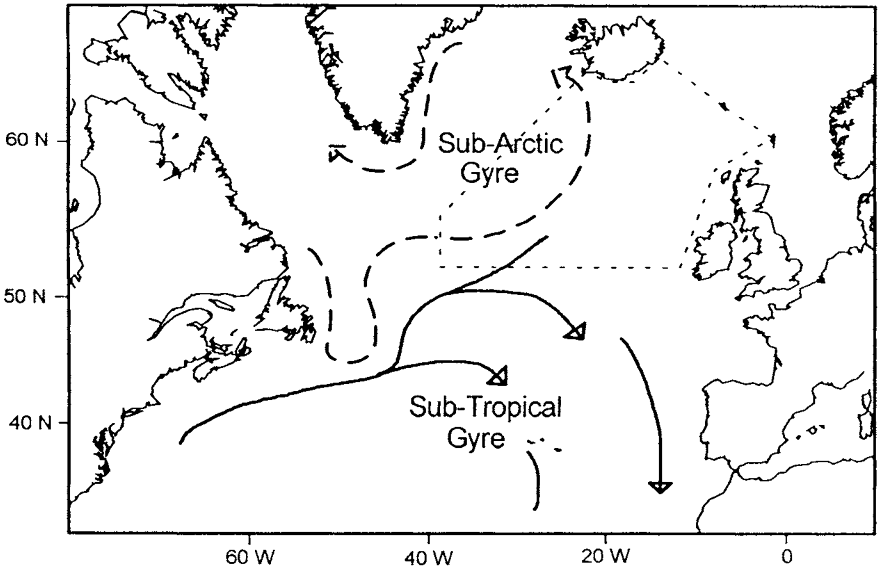

Fig.1. General pattern of the surface circulation of the NE. Atlantic and the "DUTCH-WARP" study area.

Since about a decade the use of satellite-followed drifters offers a new possibility for observing ocean currents. The principle is that drifters that are released in the ocean can be followed regularly from satellites, and the analysis of the tracks thus obtained gives information on the mean current pattern, and the variability in time, the occurrence of eddies, etc. In the framework of the "DUTCH-WARP" programme ("Deep and Upper Transport, Circulation and Hydography, WOCE Atlantic Research Programme"), aiming at a better description of the circulation of that part of the Atlantic, a series of drifter observations was initiated, that has been supported by the VvA-3 programme. In the years 1990-1993 in total 19 drifters were released from the RV "Tyro" and the weathership "Cumulus" in the NE Atlantic. The drifters were drogued at 15 m, and were followed over periods between 43 and 365 days. In total the data cover some 10 drifter-years. The mean drift velocity for the area is typically of the order of 2 cm/s, to the northeast. However, the tracks reveal an important effect of the submarine topography and the main thermohaline structure on the regional current pattern. During the summer mean westward flow is observed over the western part of the Iceland Basin, and northeastward flow over most of the eastern parts. Over the Rockall Plateau the currents are variable and smaller. It is also interesting to compare the drift observed across the WOCE AR-7E section (Ireland-Greenland) with the hydrographic structure observed during "DUTCH-WARP" 1991.
As for many ocean areas the eddy kinetic energy in the area is much higher than the mean kinetic energy. This means that the role of eddies in the transport of heat and salt cannot be neglected. An interesting result is that there is a marked difference between the high levels of eddy kinetic energy over a deep (> 2000 m) region as the Iceland Basin, and the much lower levels over the shallower (< 1000 m) parts of the Rockall Plateau.
The results found here show that transport and exchange of water over parts of this area can be quite different. As there are indications that the convection over the Rockall Plateau is an important mechanism in the formation of the so-called "Mode Water", the transport and exchange between this area and the surrounding waters is an important point in the air-sea exchange of the NE Atlantic region.
In the coming years drifter data will be used to obtain improved maps of surface currents. The programme reported here is a contribution to this international effort.

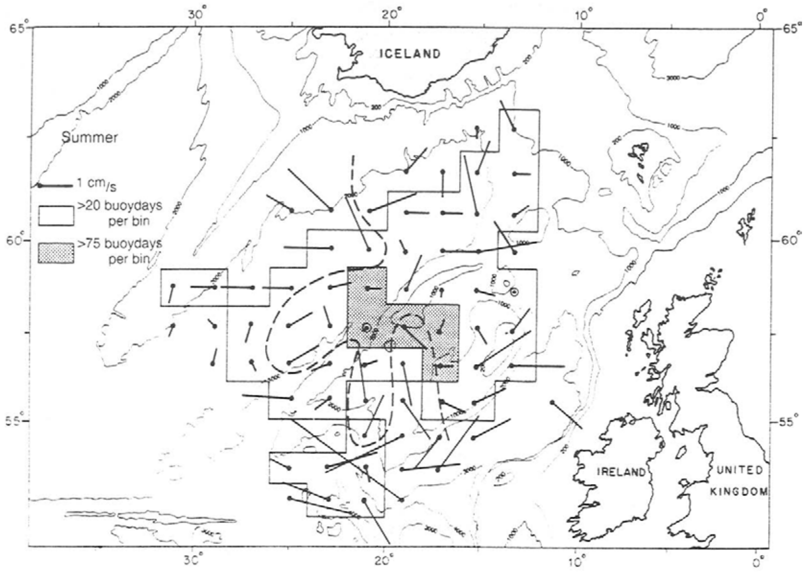

Fig.2 Mean surface current derived from summer data 1990-1993 per bin (1°latitude x 2°longitude).

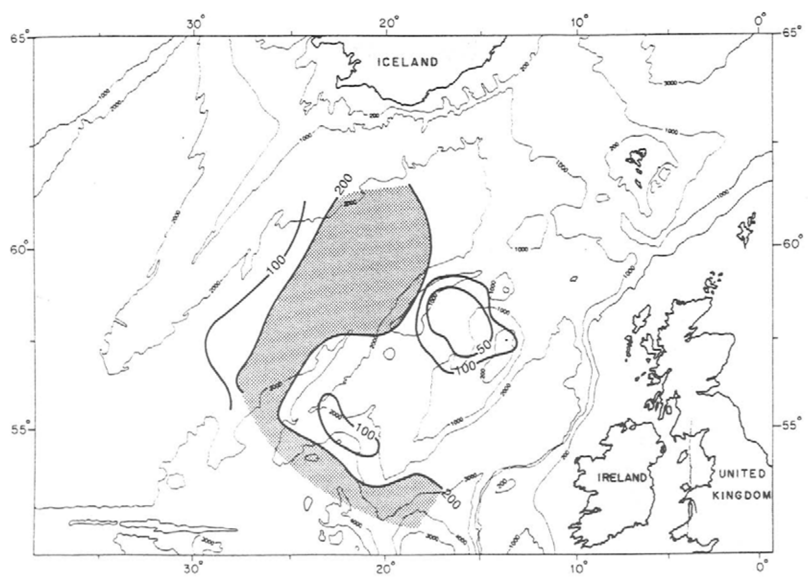

Fig.3. Distribution of surface eddy kinetic energy per unit mass (cm/s)2 in summer.