From the weather to marine life

AIR-SEA INTERACTIONS IN THE NORDIC SEAS

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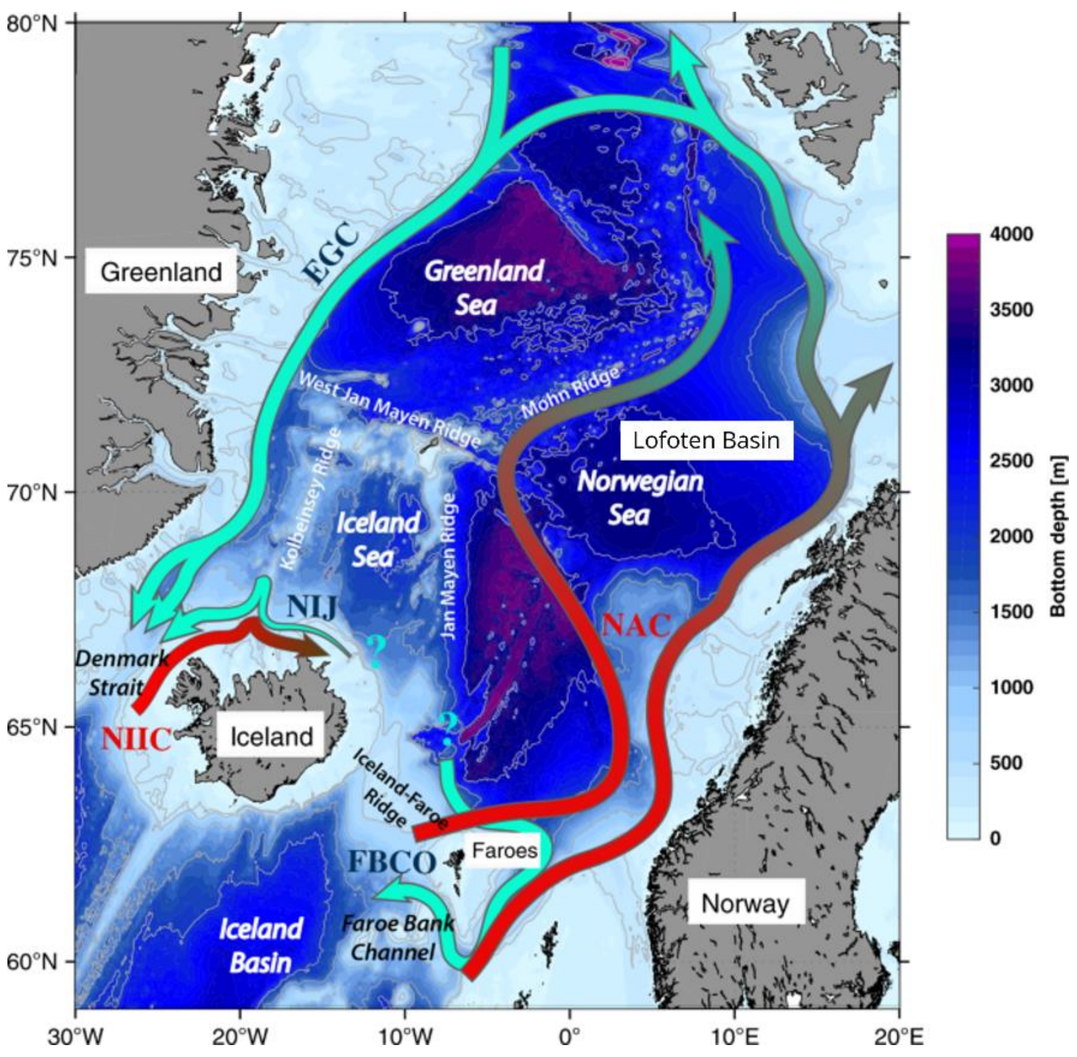
Background and motivation

I am a researcher in physical oceanography with a focus on dynamical processes in polar regions, but have always wanted to expand into considering the impact of atmospheric and oceanic processes on marine biogeochemistry. The flux of nutrients into the near-surface ocean is the basis of most marine life, and that flux is significantly affected by oceanic physical processes such as vertical mixing. The SEAS programme is allowing me to pursue this interest while maintaining my work in dynamical oceanographic processes.

Project description

Submesoscale processes in the ocean (eddies and flows with horizontal scales around 1-10 km and lifespans around 1-10 days) have a significant impact on upper ocean structure, dynamics, and biogeochemistry, in particular, the flow of nutrients upward into the surface layer of the ocean from greater depths, vital for the growth of marine phytoplankton. However, submesoscale processes are difficult to observe because of their small scale, rapid evolution and short lifespans. Ocean gliders have recently proven relatively successful at this task due to their ability to take continuous observations at small spatial scales and with high vertical resolution for many months. This project will use ocean glider observations in the Nordic Seas, a dynamically active region which experiences intense heat loss from the ocean to the atmosphere, to study the effect of atmospheric forcing on the development of submesoscale processes, and the subsequent effect of submesoscale processes on nutrient fluxes into the near-surface ocean.

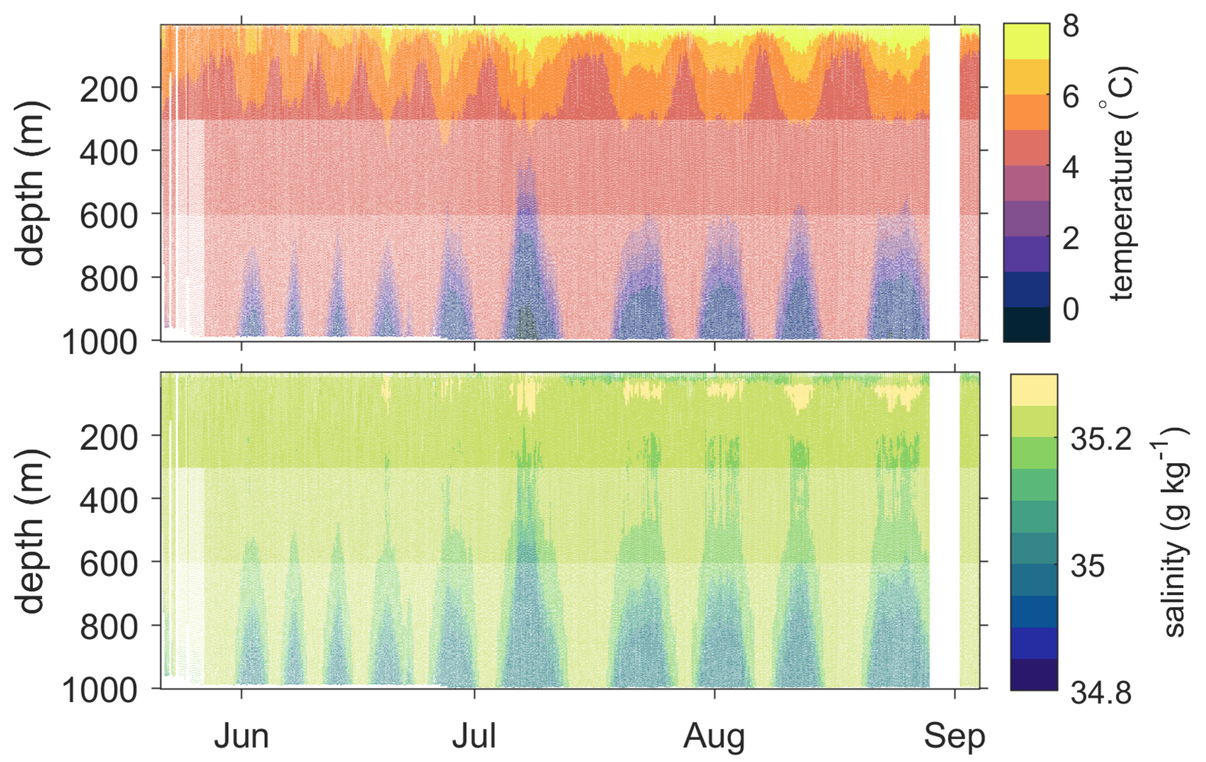


1. Data collection

Glider observations in the Lofoten Basin, the largest reservoir of oceanic heat in the Nordic Seas and the site of an intense permanent eddy known as the Lofoten Basin Eddy (LBE), are currently underway. These new observations will be compared to observations from previous years collected along the Mohn Ridge, where the Norwegian Atlantic Front Current (NwAFC) carries warm Atlantic Water to the north.

2. Analysis

I will compare and contrast the frontal dynamics of the circular LBE with those of the linear NwAFC, with a particular focus on the impact of atmospheric forcing on the development of submesoscale instabilities and the transfer of energy downscale to turbulent dissipation.



Ongoing data collection in the Lofoten Basin. Within the LBE, the temperature (top) and salinity (bottom) are well mixed to 1000 m, whereas on the outskirts of the eddy there is greater vertical structure. This creates intense lateral gradients at depth.

3. Nutrient Fluxes

By combining the estimates of turbulent dissipation with existing nutrient datasets in the region (from previous cruises and ongoing biogeochemical Argo float deployments), I will estimate vertical nutrient fluxes and assess how they are altered in the presence of submesoscale instabilities.

Marine sustainability

Atmospheric forcing in this region is likely to become more intense as climate change increases. We need to understand the links between atmospheric forcing and nutrient fluxes in order to estimate the possible future impact on marine productivity.

Supervisory team

Prof. I. Fer & Prof. T. Spengler, Geophysical Institute, UiB
Mentor: Dr Jenny Ullgren, Runde Miljøsenter