U.S. NAVAL RESEARCH LABORATORY

Modeling High Latitude Ocean Dynamics

AT A GLANCE

What is it?

Understanding the ocean dynamics causing the source of deep-water formation in the North Atlantic and Arctic Oceans to shift southward.

How does it work?

This will be accomplished by performing very high-resolution modeling and examining observations, atmospheric conditions, and sea ice coverage.

What will it accomplish?

The results of this project will provide us with the understanding of how deep-water formation events is correlated and caused by other dynamic mechanisms such as frontogenesis, ice-coverage, wind events, and melting shelf ice.

R&D Sponsor(s)

ONR

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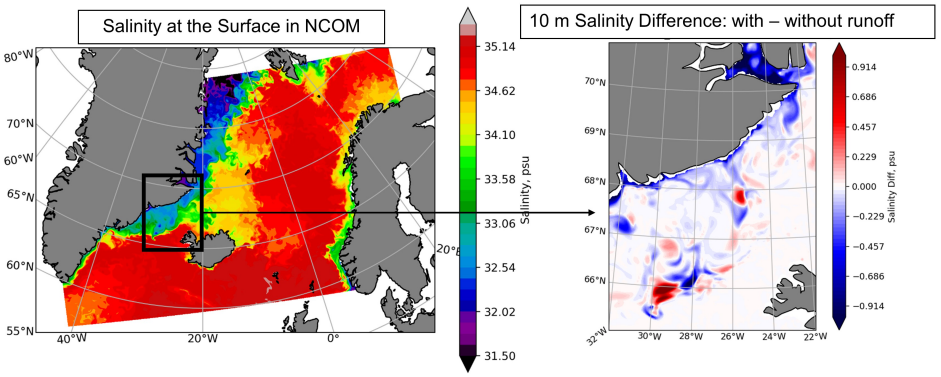
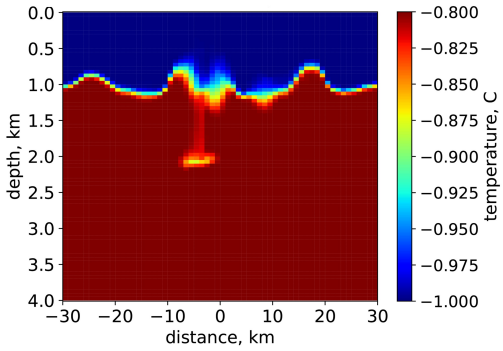


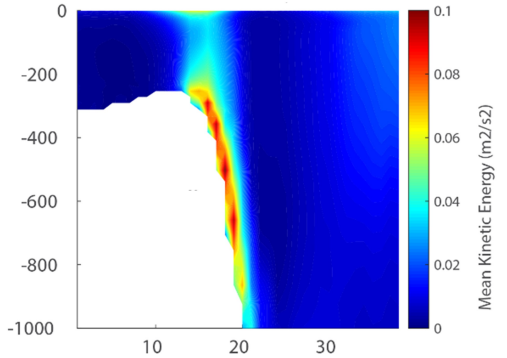
Simulations with and without freshwater runoff from the melting Greenland Ice Sheet show the pathway for freshwater that may alter where and how deep-water formation occurs.



An Idealized Arctic experiment showing that convection can be resolved with a thermobaric resolving model.

The Greenland, Iceland and Norwegian Seas (the Nordic Seas) are a critical area for deep water mass formation, where, cold, dense water sinks forming a modified water mass at depth, which is a key step in the global thermohaline circulation. The process by which deep water is formed often involves deep convection, where cooling surface waters become denser than the water below resulting in convection plumes. In recent decades, the source of deep-water mass formation has changed in the Nordic Seas and now also includes the Irminger Basin.

This project aims to determine the cause of deep-water mass formation by using observations and very high-resolution modeling. The modeling effort will include both hydrostatic and non-hydrostatic models, a new 2-way nesting technique, ocean and ice coupled dynamics, and air-sea interactions. This long-term work will increase our knowledge of high latitude ocean dynamics and the mechanisms that cause deep water mass formation.



Modeled mean kinetic energy shows a possible deep-water mass formation mechanism across the Greenland shelfbreak.