Global climate variability is extreme at the rim of the Arctic. Ocean water masses are modified here, transports of liquid freshwater, ice and heat are strong, atmosphere-ocean interaction is strong, and yet direct observations are sparse.

Here we combine satellite altimetry with deep-diving autonomous Seagliders to observe key elements of the ocean circulation and water-mass production. ONR, NOAA, NSF and NASA components have given this observing program unprecedented coverage.

Results:

1. Seagliders have shown that offshore flow from Greenland controls deep convection and Labrador Sea Water production, as well as controlling the principal spring phytoplankton bloom of the western subpolar Atlantic. Low-salinity source waters from Greenland and the Arctic are likely to accelerate with global warming. Identification through glider action, altimetry, ocean color and SST imagery.

2. Altimetry combined with deep Seaglider sections reveals the 3-dimensional structure of the mesoscale anticyclonic eddies that dominate the Labrador Sea and the altimetric map of eddy kinetic energy.

3. Current deployments of Seagliders between Iceland and Norway are providing intensive hydrographic surveys and velocity information revealing sites of deep, dense overflows southward into the Atlantic. Together with altimetric maps of SSH and anomalous velocities we have identified intense jet-like northward flow of warm, saline Atlantic water feeding the Faroes Current.

4. Continuing study of the downward trend in subpolar gyre surface circulation identified by Pickart & Rhines (2004), Hatun et al. (2005), includes the warming and increase in salinity of the Atlantic inflow to the Nordic Seas, and begins to connect this striking 15-year trend with other datasets and detailed altimetrically observed behavior of the North Atlantic Current.

Satellite Altimetry and Seagliders: observing high-latitude ocean climate

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