An Observational Array for High Resolution, Year-Round Measurements of Volume, Freshwater and Ice Flux Variability in Davis Strait

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Motivation

- *Understand the processes governing freshwater exchange between the Arctic and Subarctic.*
- *Freshwater exchange between the Arctic and North Atlantic across Davis Strait exerts a strong influence over Labrador Sea deep water formation and the associated meridional overturning circulation.*

Challenges

- Small-scale circulations (tens of km) within the strait.
- Quantify critical near-surface regime in the presence of seasonal ice cover.
- Measurements over shallow, ice-threatened shelves.
- Quantify ice component of freshwater flux.
- Conduct sustained, year-round measurements.
- Develop cost-effective system for conducting economical long-term (decades) measurements.

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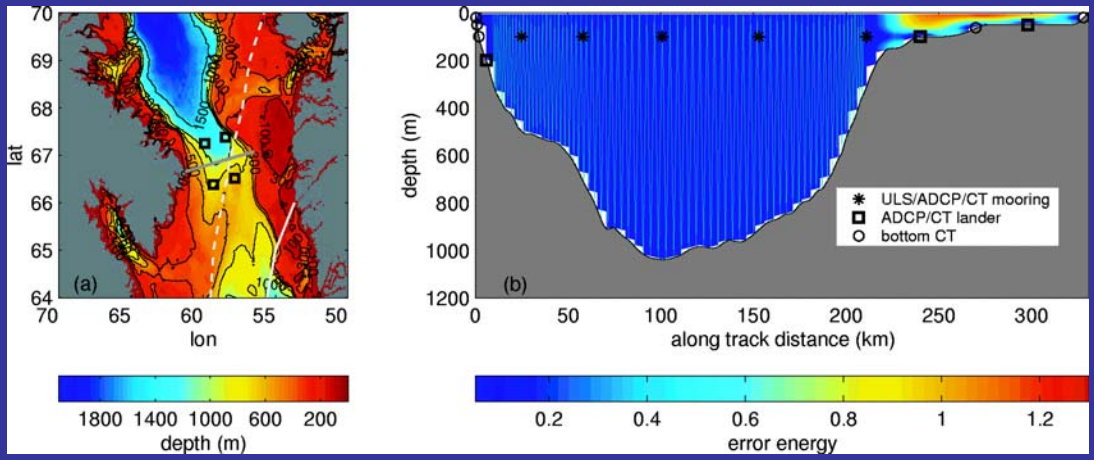
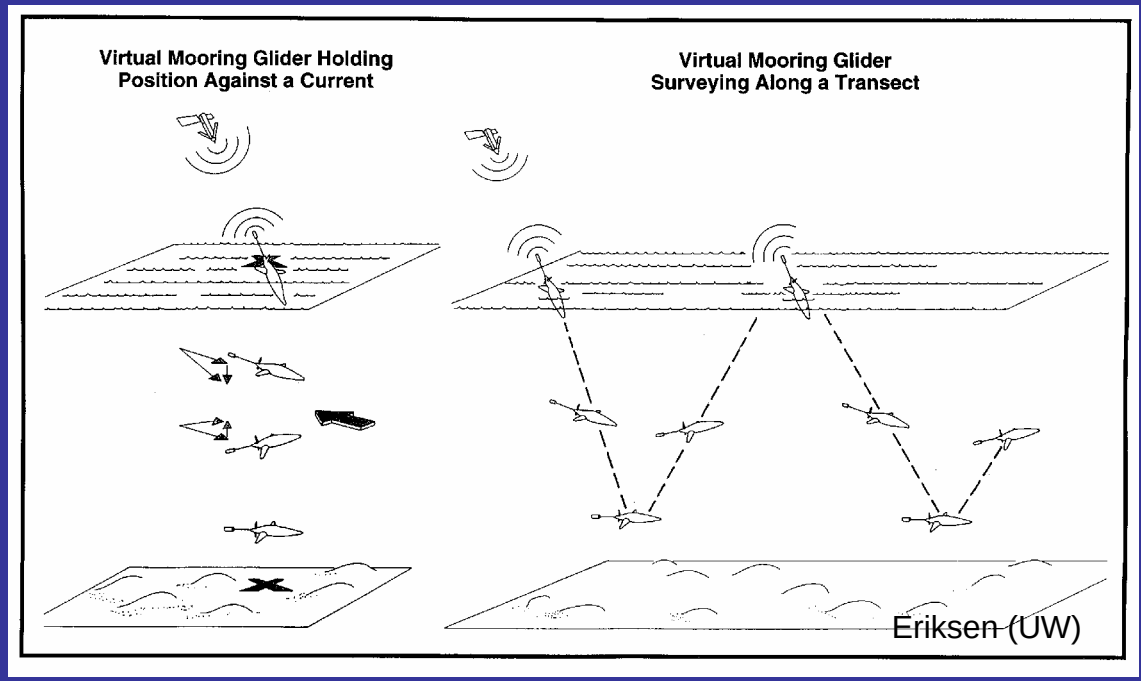


Deployment Schedule

- Autumn 2004: Initial moored array deployment, acoustics experiment.
- Autumn 2005: Mooring turn-around, RAFOS deployment, initial glider deployments.
- Autumn 2006: Mooring turn-around, glider turn-around.
- Autumn 2007: Recover all gear. Extended deployments…?

- *Mid-Strait*
  - 6 subsurface moorings (400 – 1000 m depth)
    ULS, ADCP, Micorcat C-T (100 m), Aanderaa CM & C-T (300 m & 500 m)
  - 6 RAFOS sound sources (780 Hz, for Seaglider navigation)
- *Greenland Shelf*
  - 2 bottom landers: ADCP (300 kHz), Microcat C-T, C-T (@20 m)
  - 2 bottom-mounted Microcat C-T
- *Baffin Slope*
  - 1 bottom lander: ADCP (75 kHz), Microcat C-T, C-T (@20 m)
  - 3 bottom-mounted Microcat C-T
- *Seagliders*
  - 2 Seagliders: Year-round, high-resolution sections (T-C-DO) across Davis Strait. Full-water column, from surface/ice bottom to seabed.
- (tentative) acoustic receivers for marine mammal monitoring (S. Moore, NOAA).

Gliders for High-Latitude Sampling



- Nav fix plus dead reckoning using (model-actual) assimilation with Kalman filter.
- (ice-free) GPS navigation.
- (ice) Navigates using 780 Hz sound source array.
- (ice-free) Download data, upload new mission parameters. Irridium telemetry (100 bytes/s). Adaptive sampling in response to real-time access to observations.
- (ice) On-board storage and full autonomy.
- Bottom/ice avoidance using altimeter and on-board bathymetric chart.

- Hull length: 1.8 m
- Wing span: 1.0 m
- Mass: 52 kg
- Easy to deploy and recover- RIBs, fishing boats, research vessels, aircraft (?).
- ~$90k (w/ optics)

- Surface to 1000 m.
- Glide slopes from 1:4 to 3:2.
- Horizontal speed 0.25 m/s (22 km/day)
- Vertical speed 0.07 m/s (minimum).
- Up to 2,000 km (vertical) and 10,000 km (horizontal) per mission.

- Strain gauge pressure.
- Seabird temperature, conductivity and dissolved oxygen (free-flow).
- Depth-averaged flow (predicted-actual position).
- Vertical velocity (predicted-actual vertical speed).
- Vertical resolution 0.5–1.0 m.

- Sampling in open water and under ice.
- Profiles from surface/ice bottom to 1000 m (6000 m under development).
- Horizontal resolutions of kilometers.
- Extended operations (~1 year).
- Station keeping, surveys, free-drifting, mixed-mode operations (repositionable drifters).