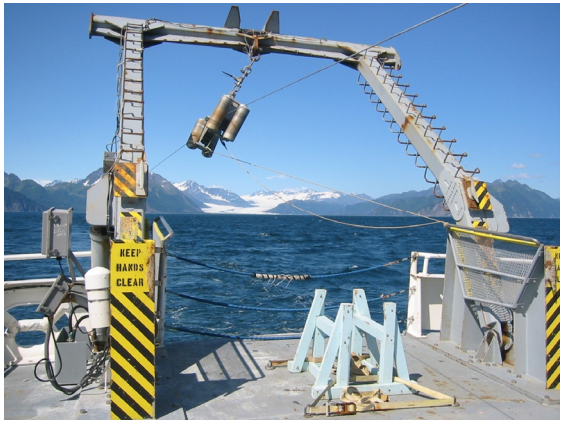
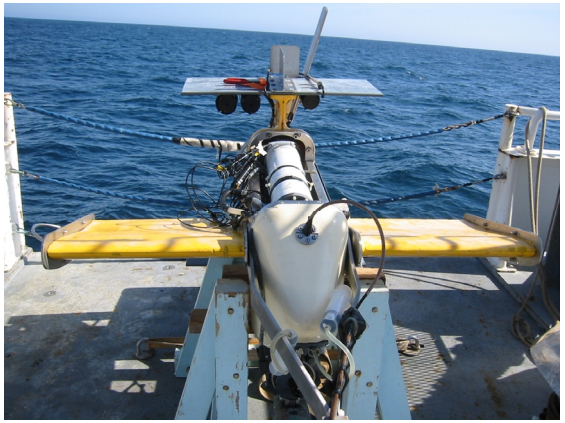
Variability in the Circulation Outside of Resurrection Bay: *Results fresh from the cruise to your table*



PI: Dave Musgrave

Scott Pegau: OSU, Kachemak Bay Research Reserve

Rachel Potter, Hank Statscewich, Melanie Rohr, Sookmi Moon: UAF IMS

Matthew Watts: U.S Naval Academy

Britta Hinrichsen: OSU

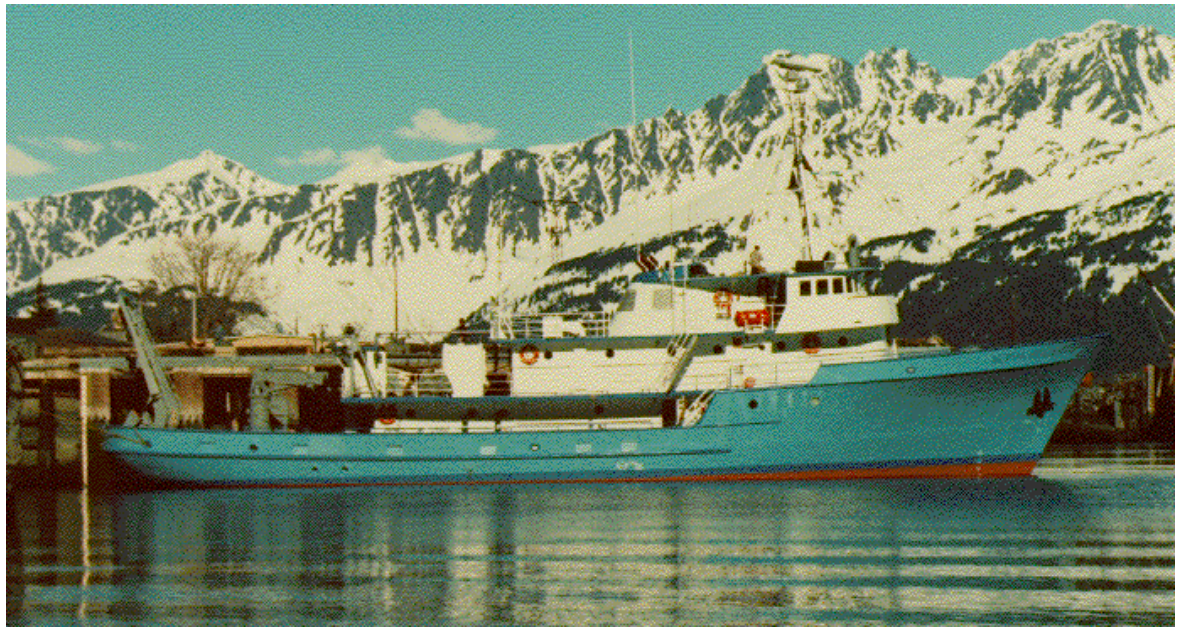
GLOBEC

- NorthEast Pacific Program (NEP)
  - California Current
  - Coastal Gulf of Alaska
    - Important fisheries
    - Climate variability impacts productivity

GOAL: *study the physical and biological oceanographic distributions and processes influencing marine organisms, specifically juvenile salmon*

LTOP

- Long-Term Observation Program
- Seven 10-day cruises between March and December
- 1998-2004

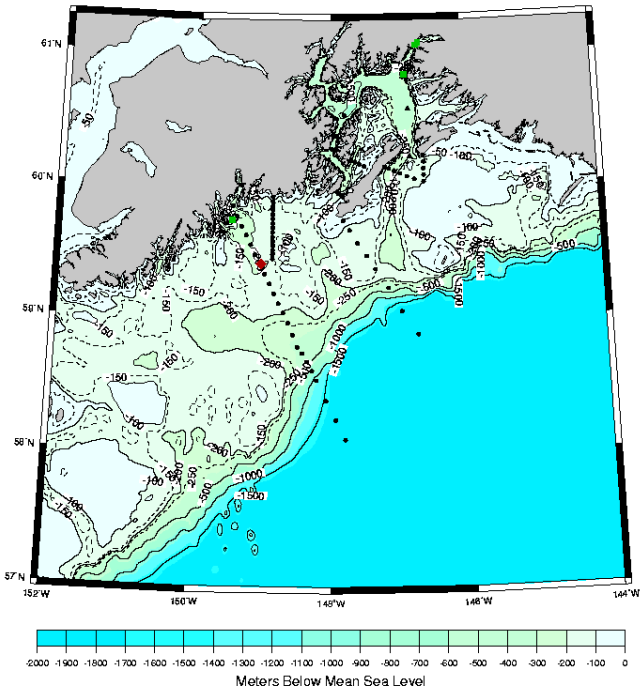


R/V Alpha Helix

LTOP

- Nutrient concentration, primary production, zooplankton species composition, abundance, and biomass
- Abundance of juvenile salmon

Tom Weingartner
Terry Whitledge
Ken Coyle
Russ Hopcroft
Lew Haldorsen



Process

- Grazing and production rates of phytoplankton, microplankton, and zooplankton

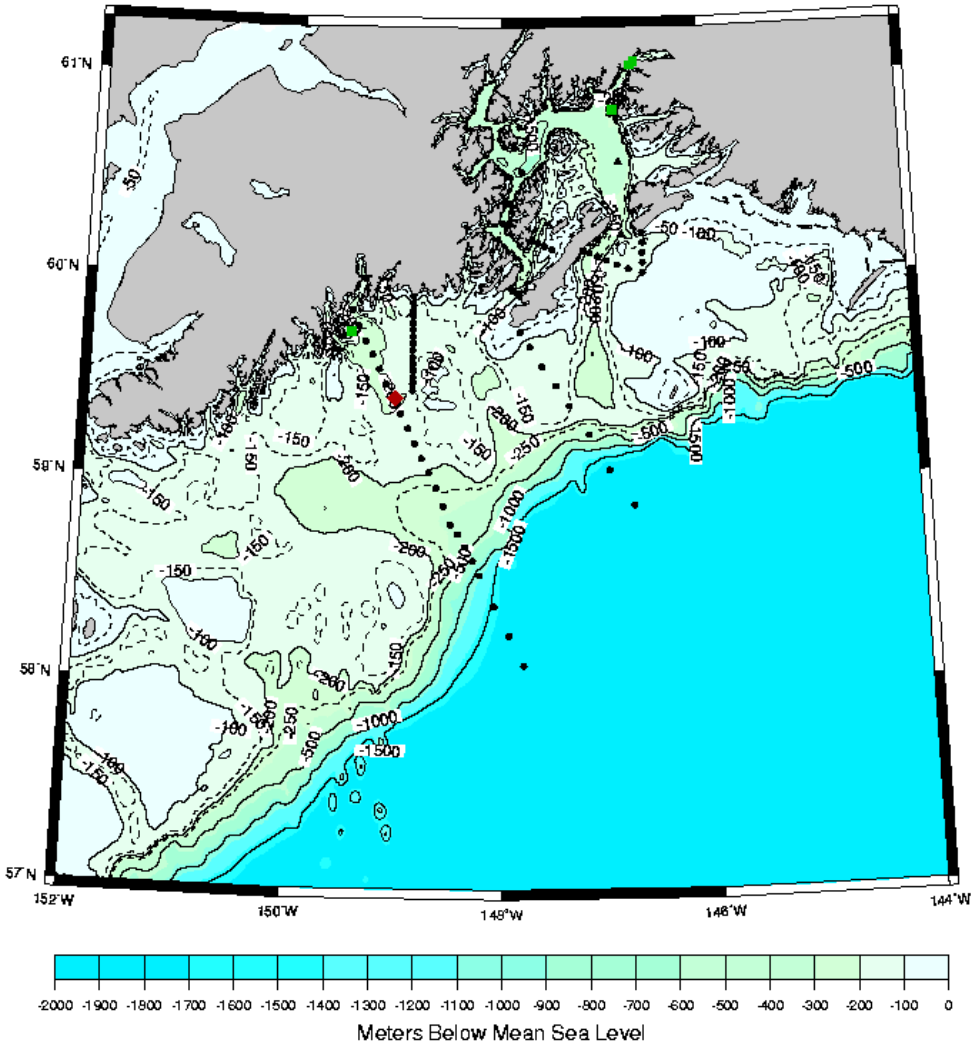
Russ Hopcroft

Evelyn Lessard

Suzanne Strom

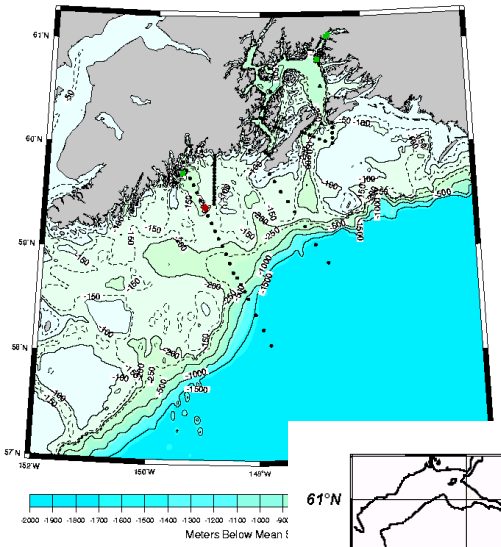
Jeff Napp

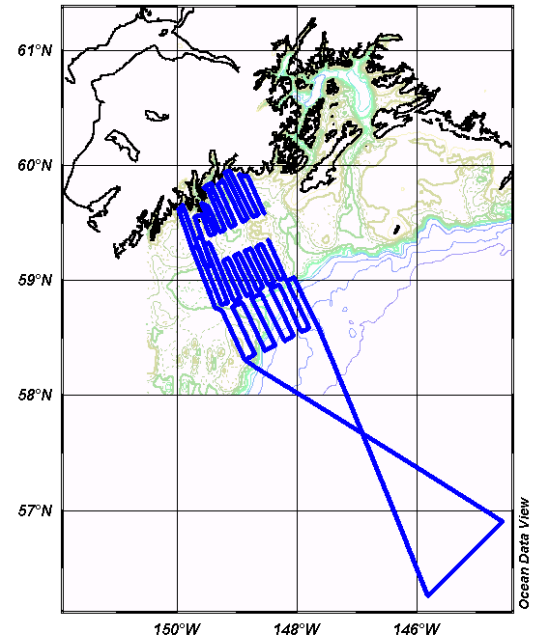
Ned Cokelet



Mesoscale

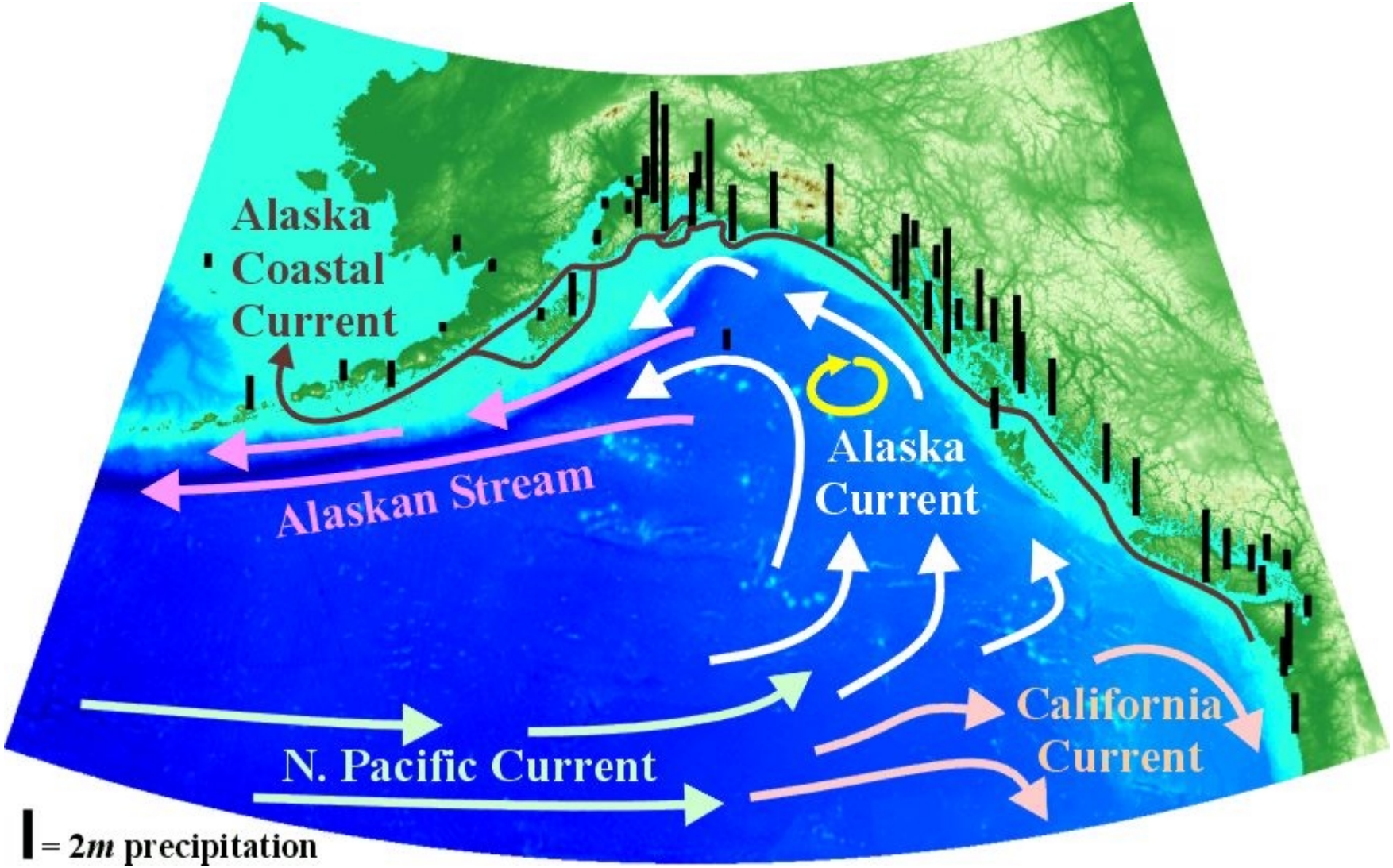
- Cruises in May and in July/August
- Physical/biological oceanographic data
- Provide spatial context for process studies





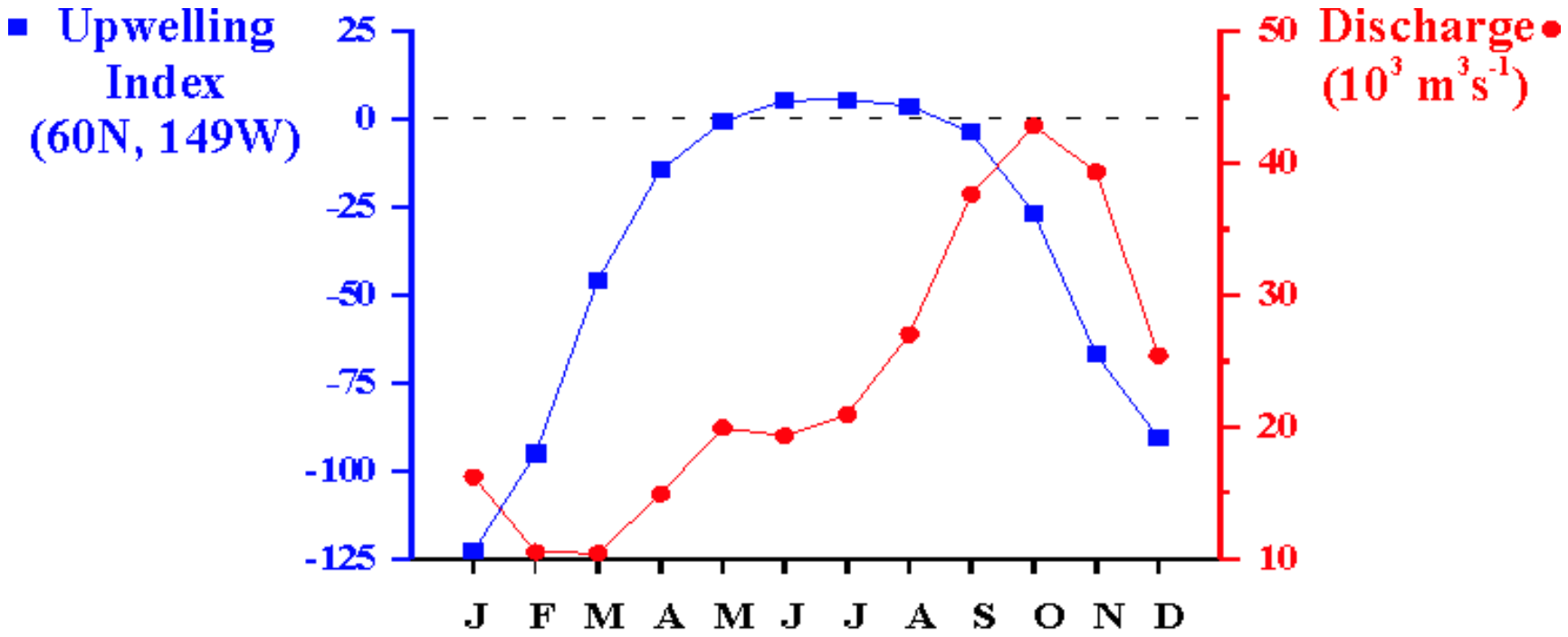
RV/Wecoma

Gulf of Alaska Circulation



• The **Alaska Coastal Current** is a wind and buoyancy driven coastal current directly influencing the distribution of freshwater marine organisms around the Gulf of Alaska

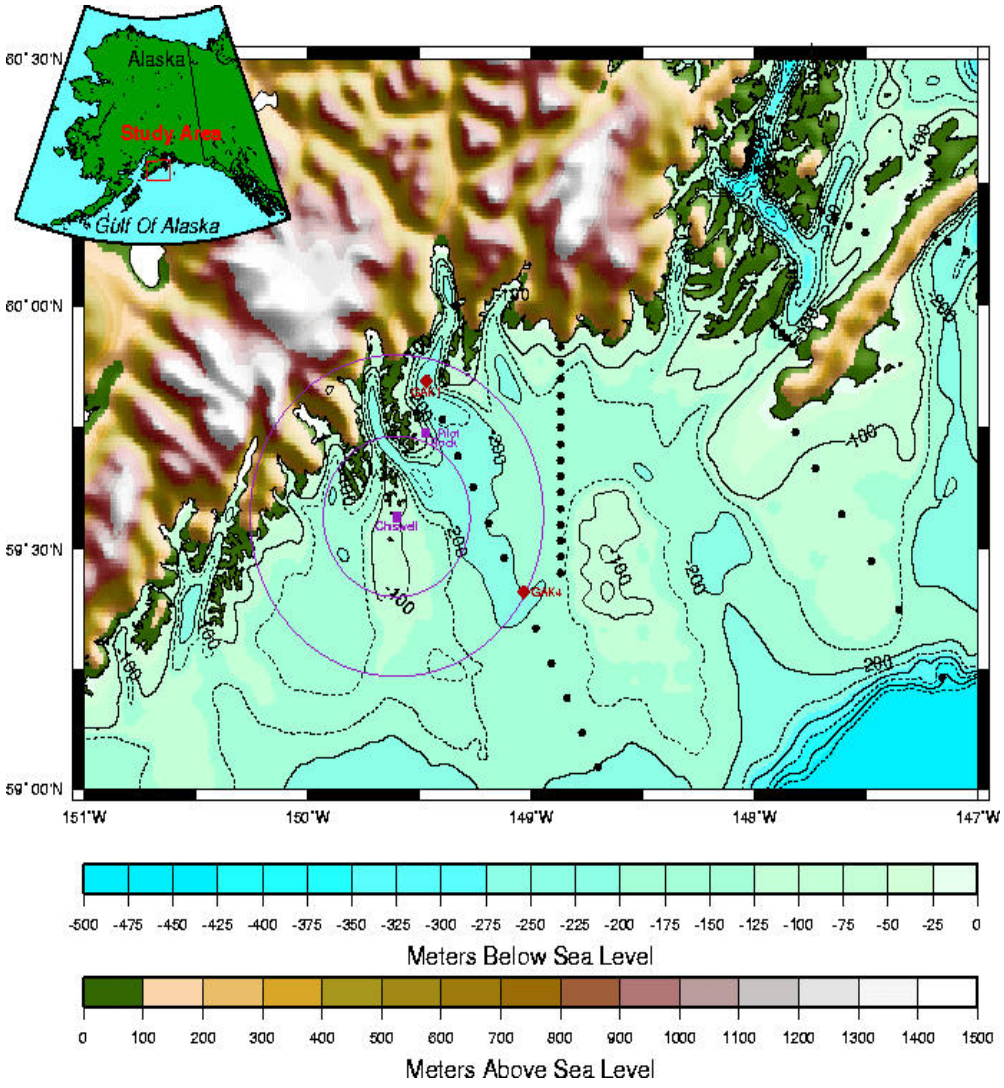
Gulf of Alaska Forcing Mechanism



- Seasonal variation of wind and buoyancy (freshwater) forcing is large
- Timing is out of phase:
  - Maximum discharge in fall leads maximum winds by 3 months
- Mean Annual Freshwater Discharge
  - Entering the Gulf of Alaska = 24,000 $m^3 s^{-1}$
  - Mississippi River = 19,000 $m^3 s^{-1}$
  - Columbia River = 7,000 $m^3 s^{-1}$

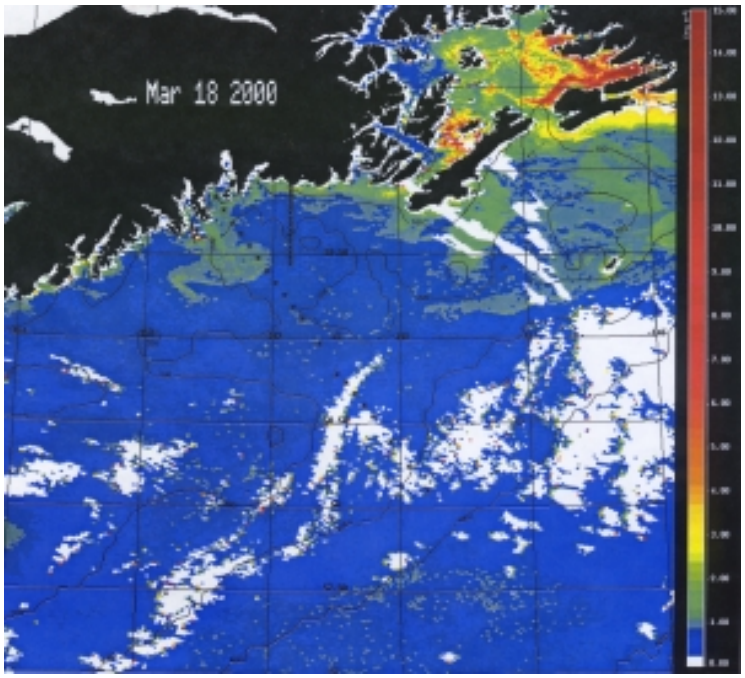
Bathymetry

- shallow banks (75-100 m) and deep troughs (200-250 m) cutting across the shelf
- Junken Bank is ~100m, while Resurrection Canyon is >200m
- Coastline directs the flow offshore at Chiswell Ridge



SeaWiFS

(Sea-viewing Wide Field-of-view Sensor)



Chlorophyll Concentration

Blue = low

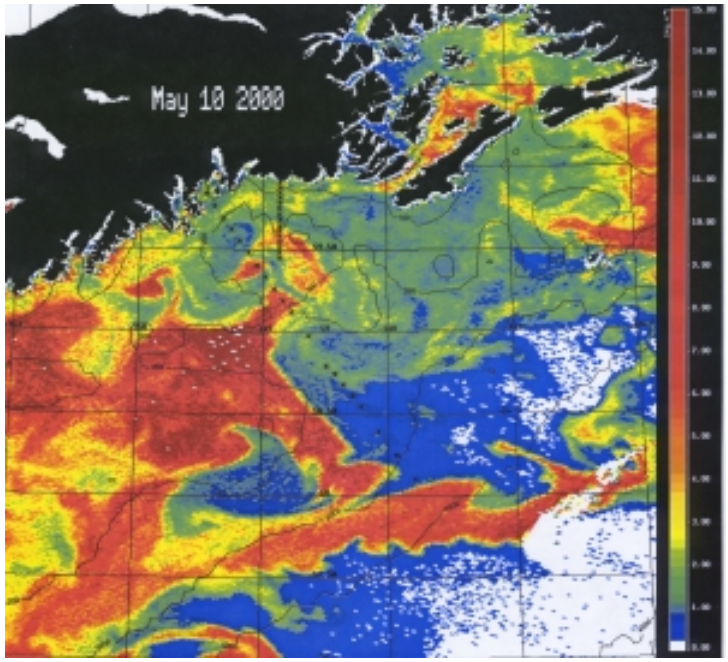
Green = intermediate

Yellow = intermediate

Red = high

Seward Eddy?

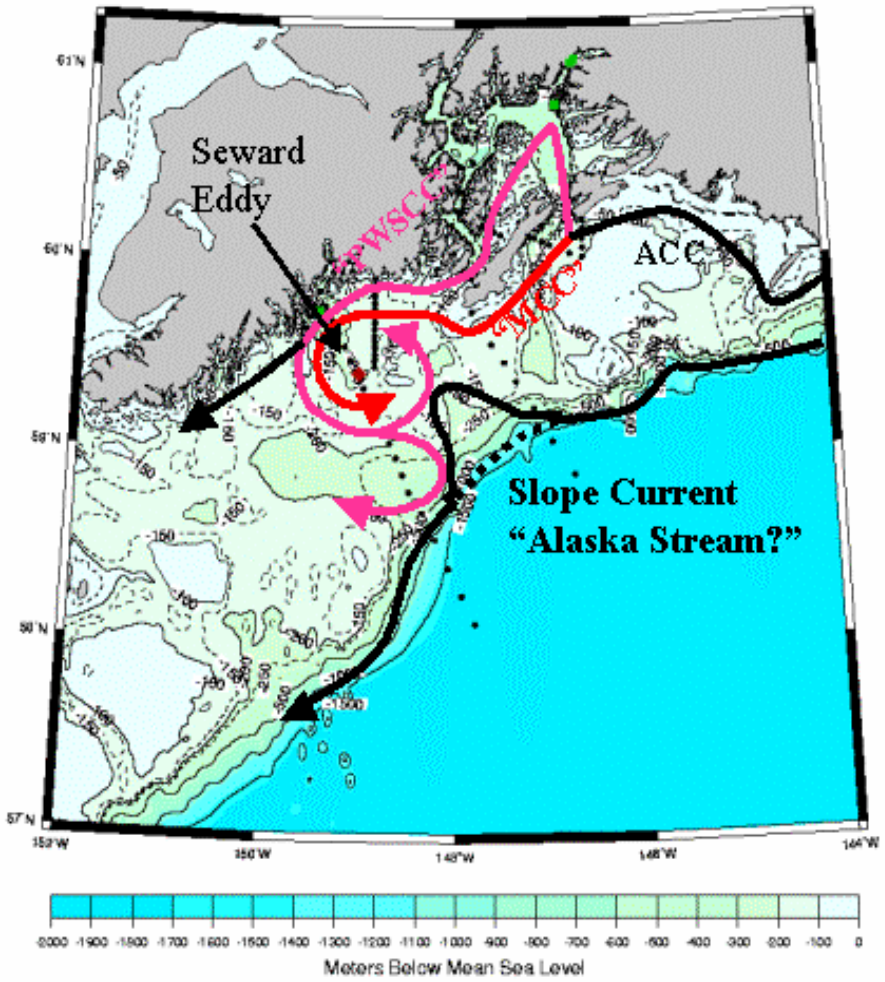
(ACC and Chiswell Ridge)



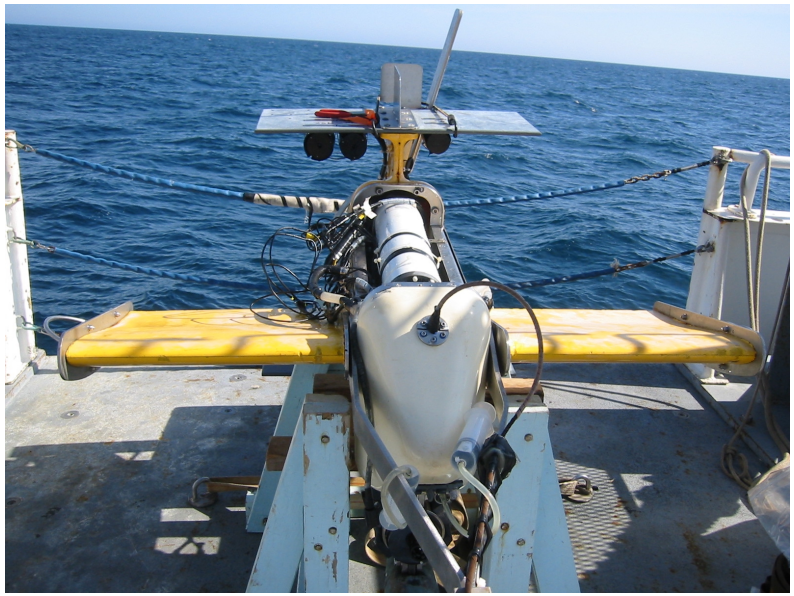
Mesoscale Study

- Quantify cross-shelf and along-shelf variations for three physical regimes
  - **Inner shelf** = low salinity
  - **Middle shelf** = intermediate salinity
  - **Outer shelf** = shelf break and inner slope is saltier and nutrient rich

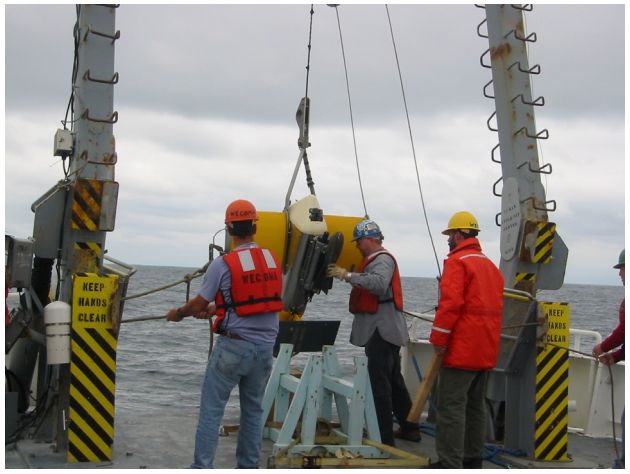
Variations in currents

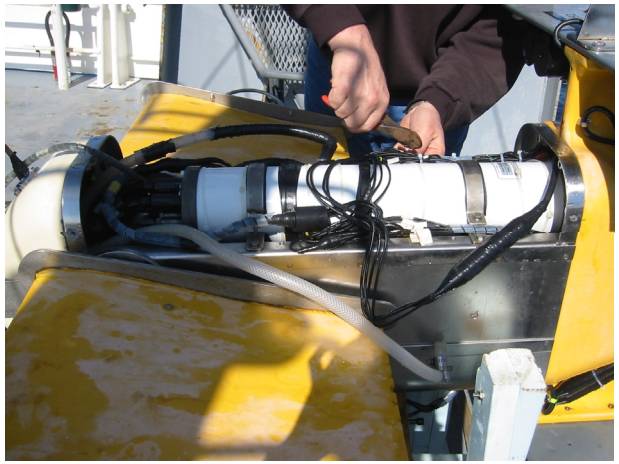


SeaSoar



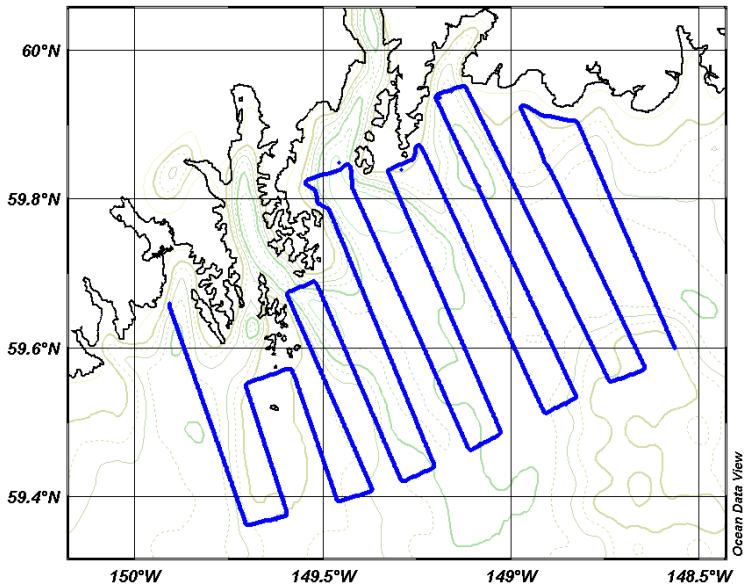
- Nitrate
- Fluorescence
- Chlorophyll
- Conductivity
- Temperature
- Pressure





SeaSoar Data

- Vertical resolution of 24 data points per second
- Horizontal resolution of 2 km per cycle

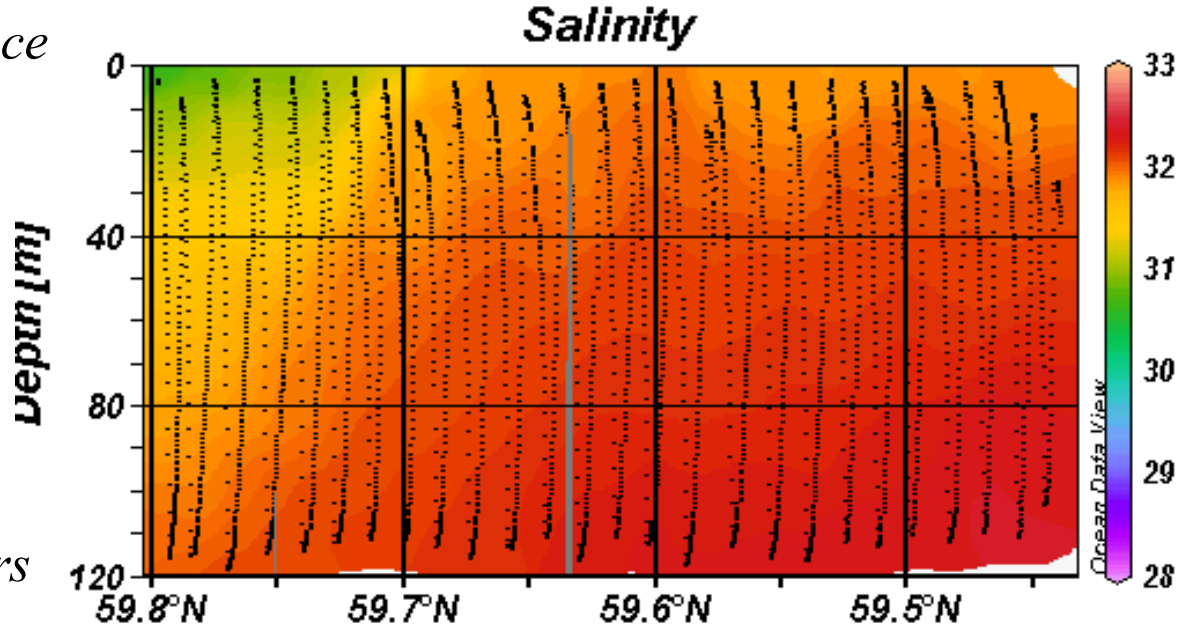


surface

onshore

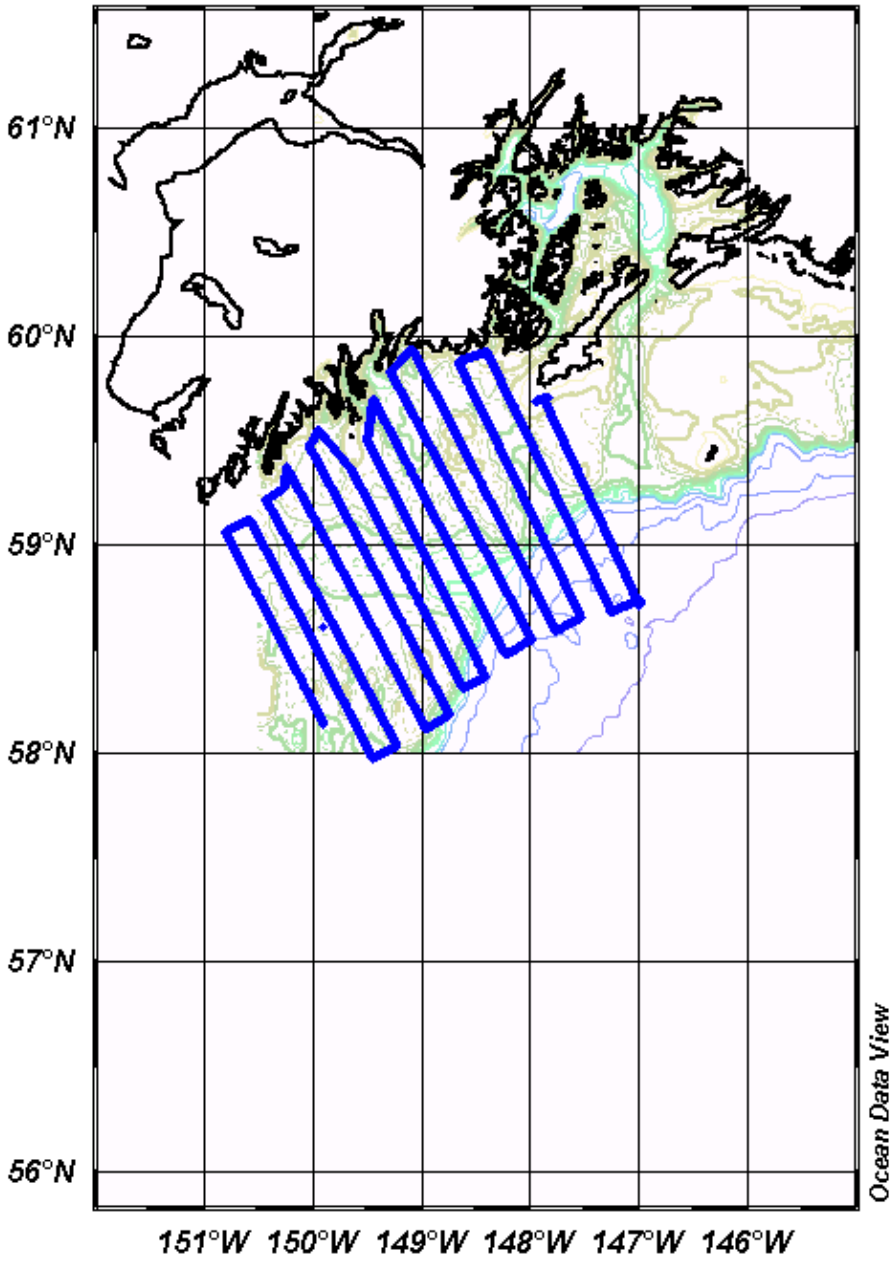
offshore

120 meters

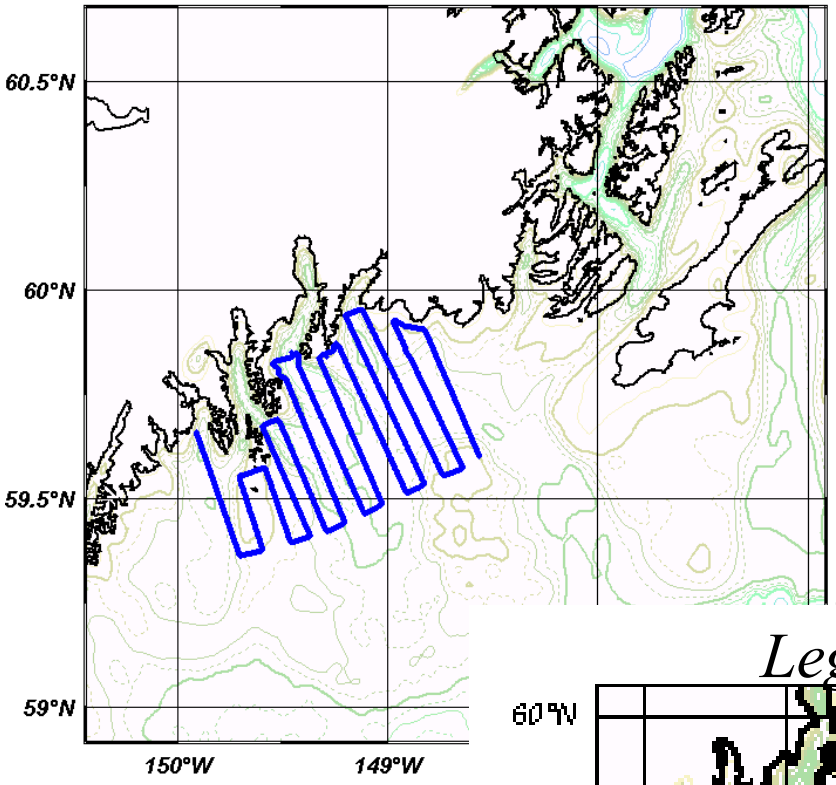


Survey Grids

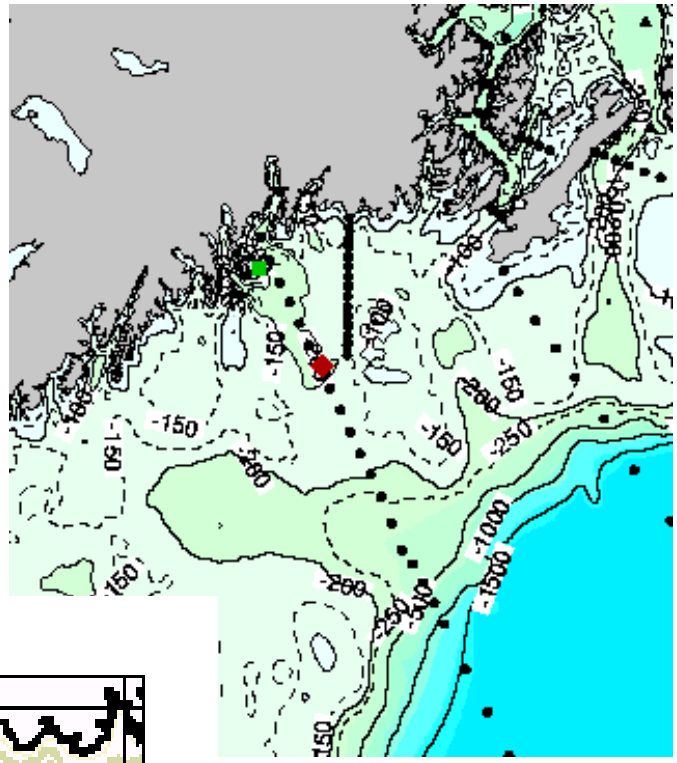
- **Finescale A**
  July 22-23
- **Mesoscale**
  July 24-31
- **Finescale B**
  August 2-3
- **Finescale C**
  August 4-5
- **Eddy**
  August 6-8
- **Finescale AII**
  August 9-11



Finescale A Survey

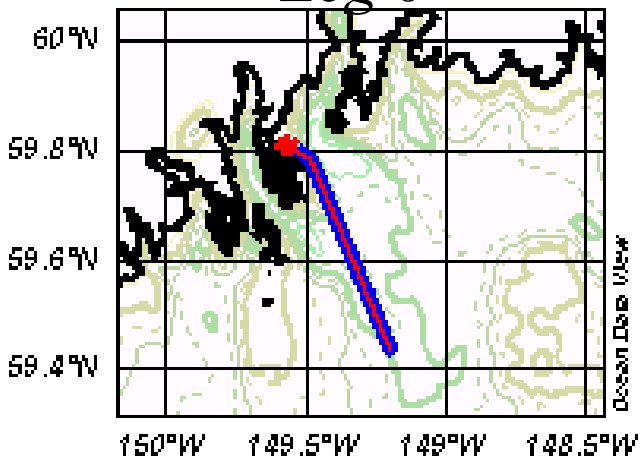


Finescale A: inner shelf



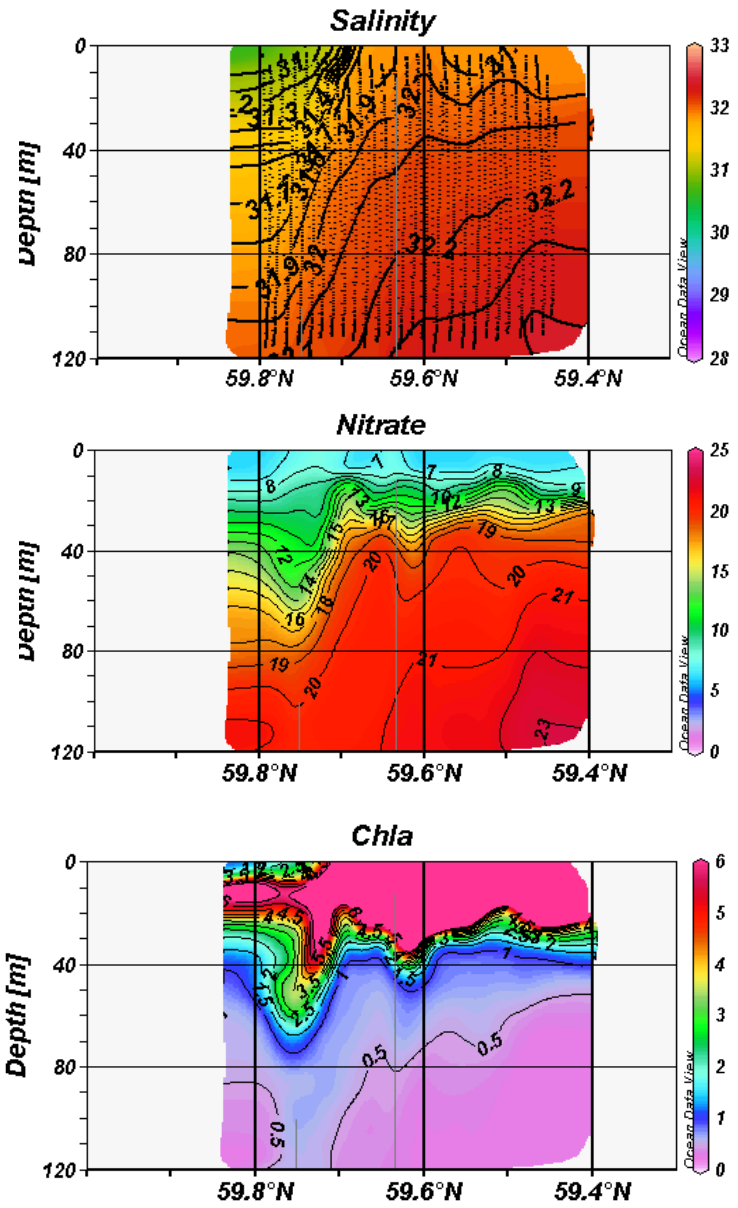
Seward Line: LTOP

Leg 6

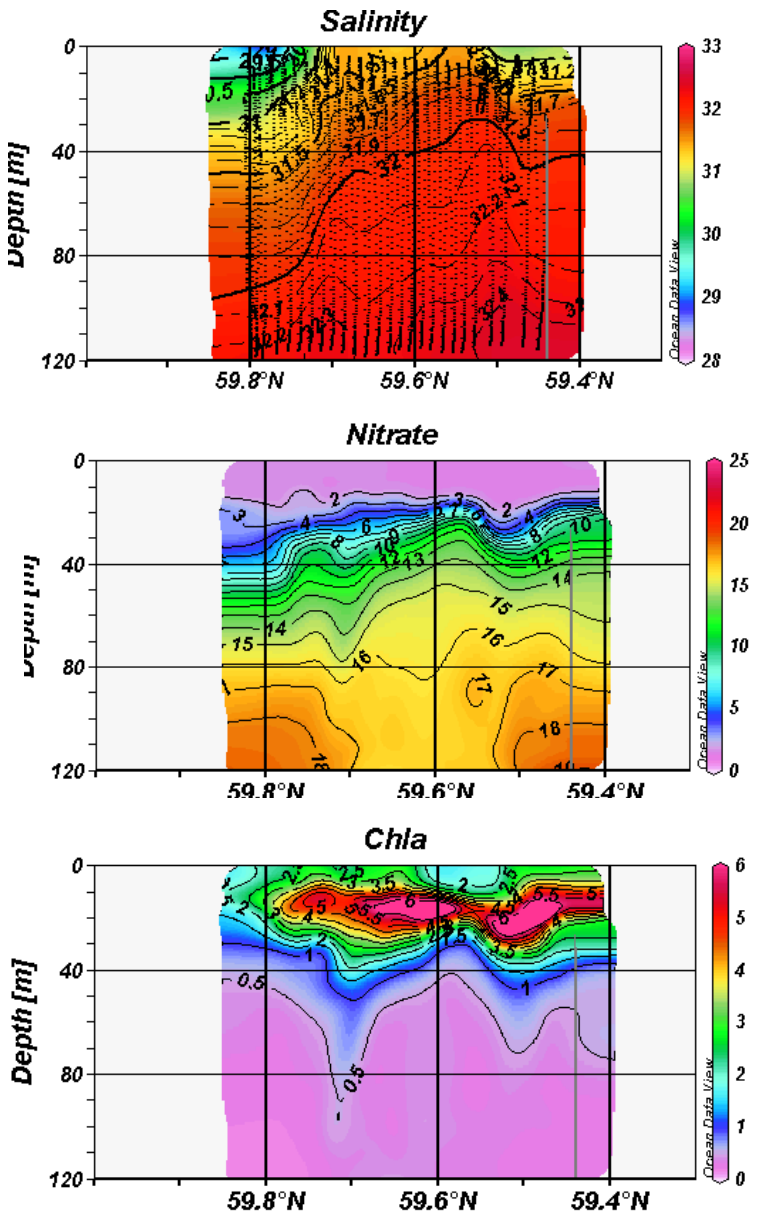


Finescale A

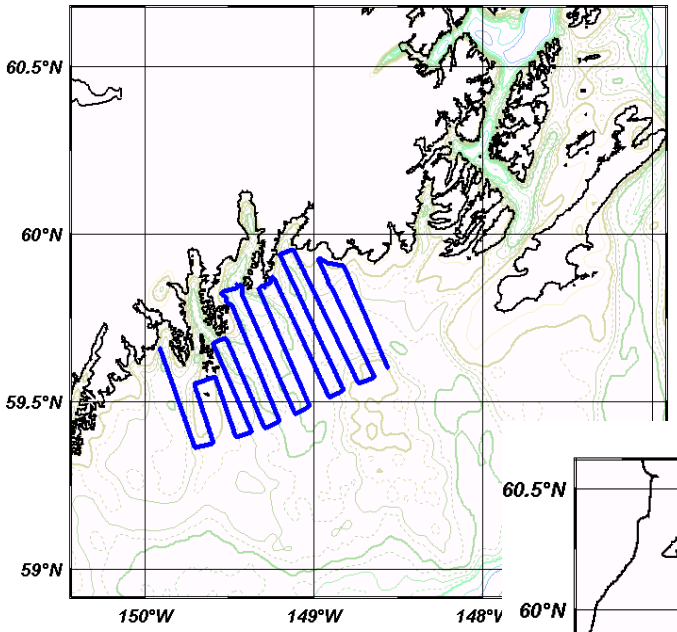
May 3, 2003



July 22, 2003

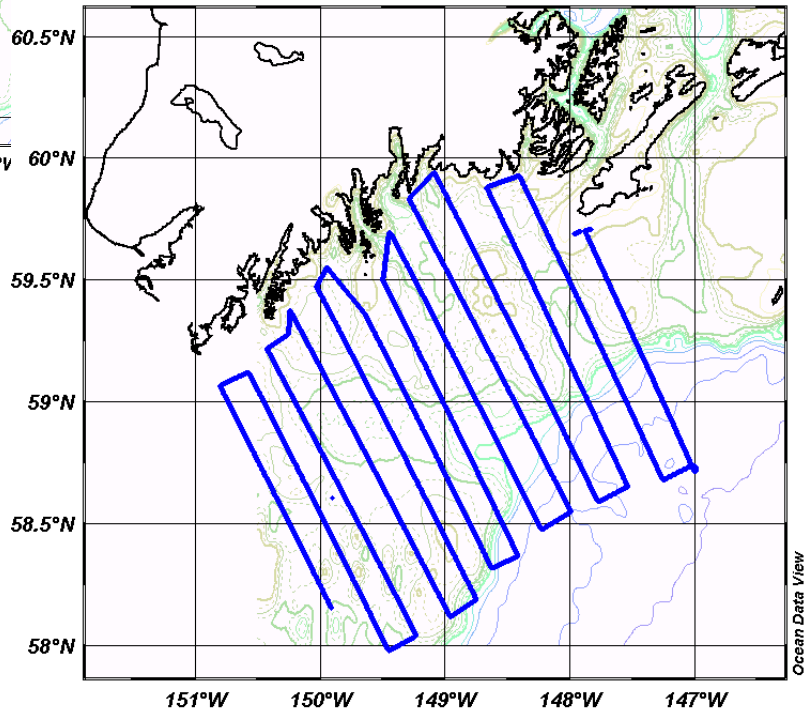


Mesoscale Survey

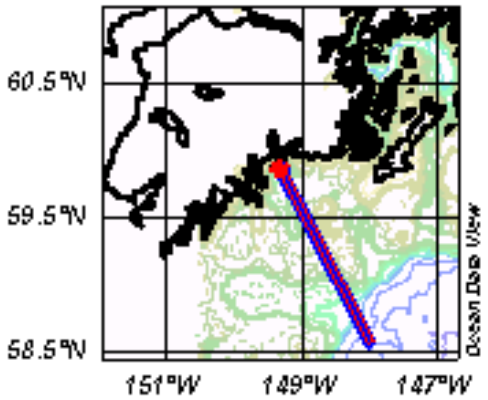


Finescale A

Mesoscale: onshore out to shelf

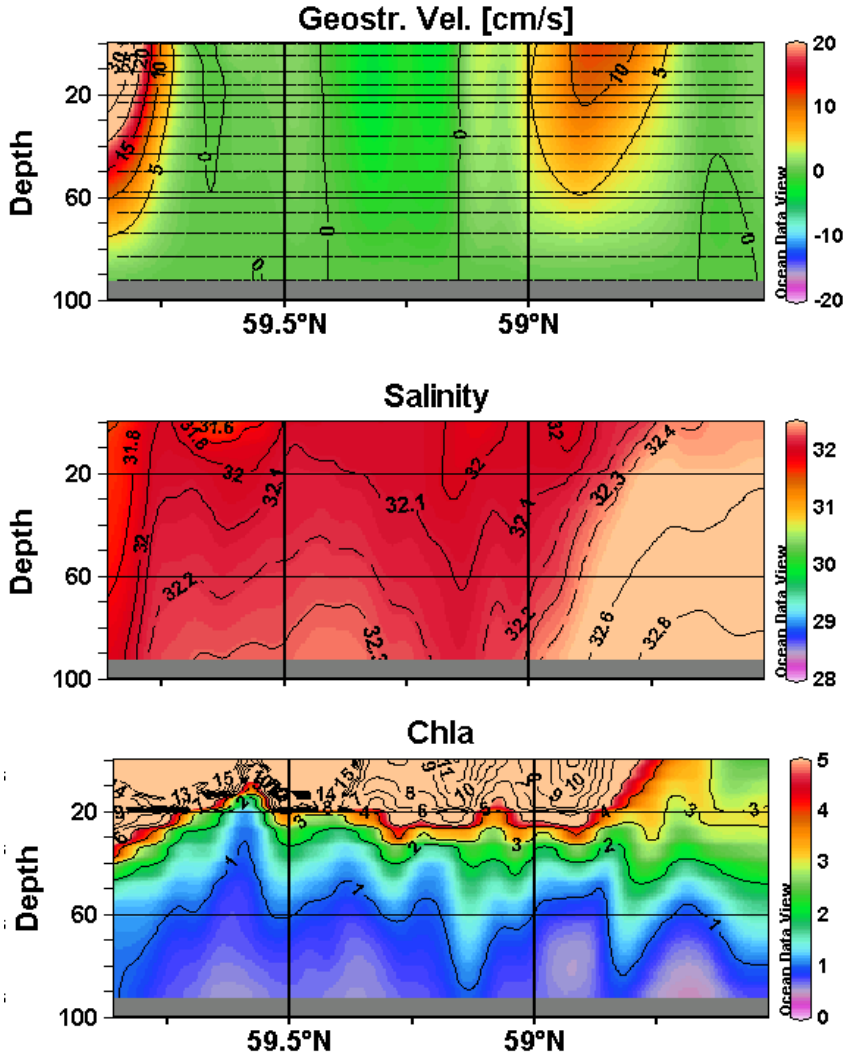


Leg 5

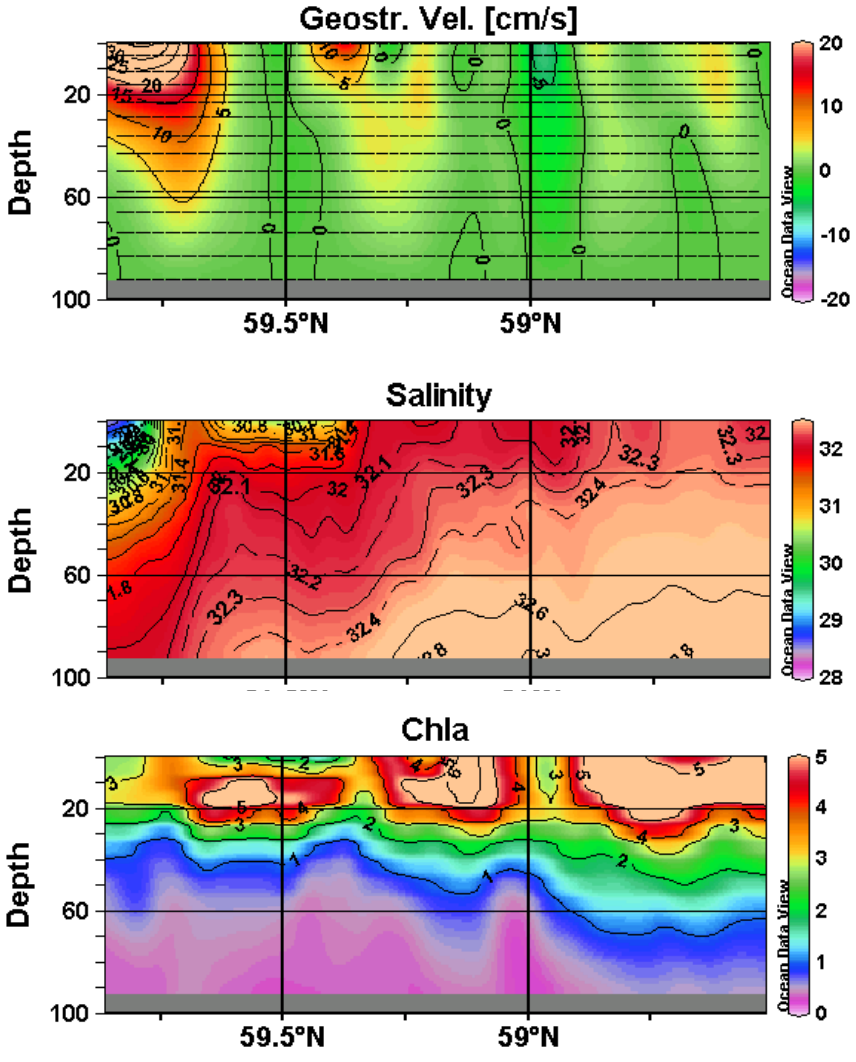


Mesoscale: Leg 5

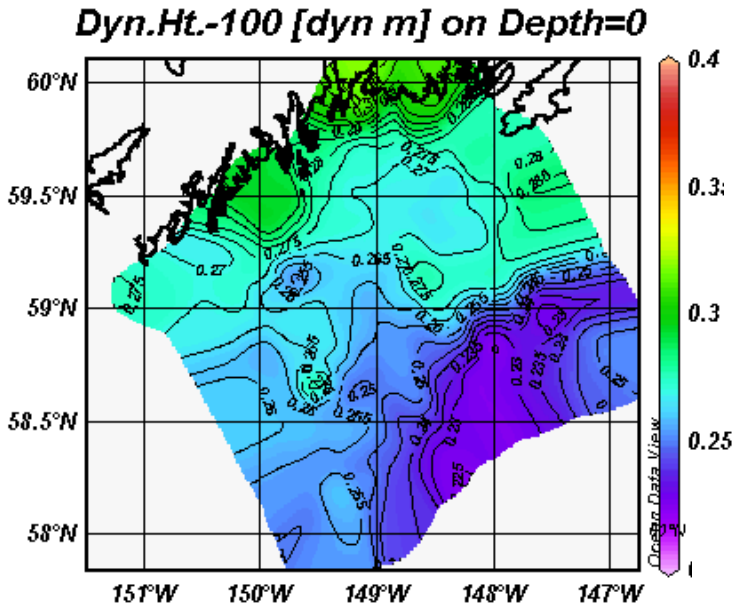
May 6, 2003

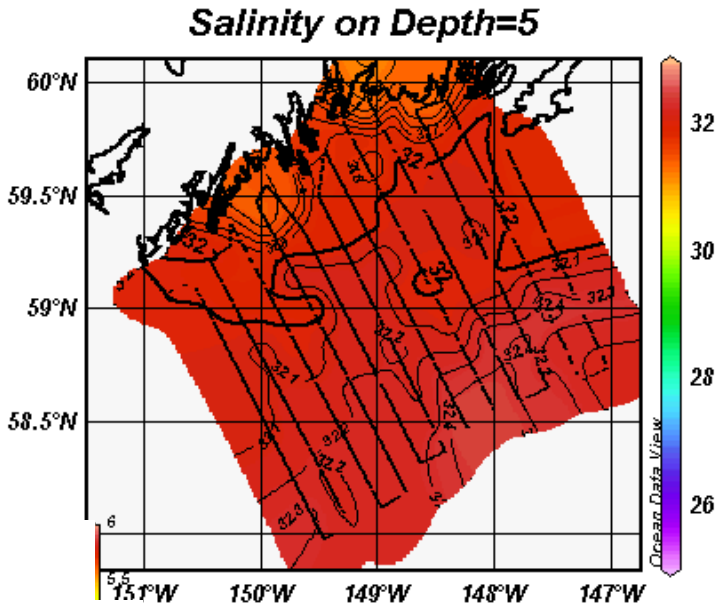


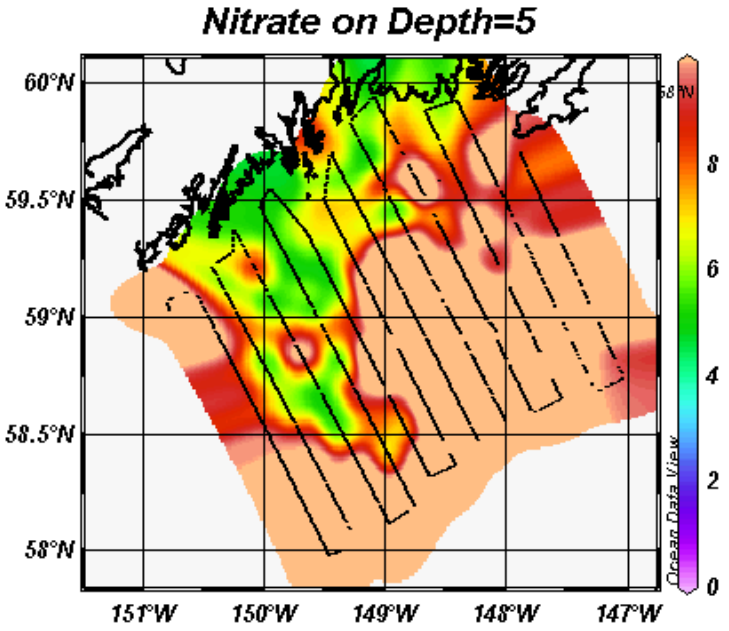
July 26, 2003



May Mesoscale

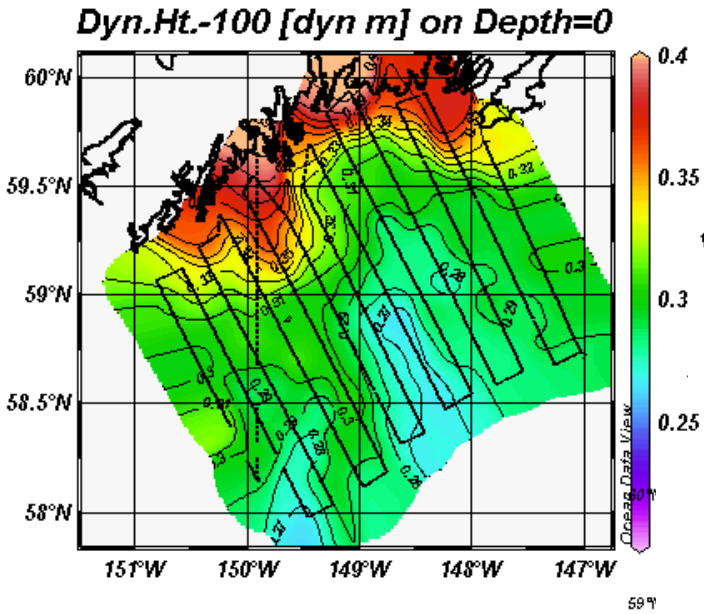


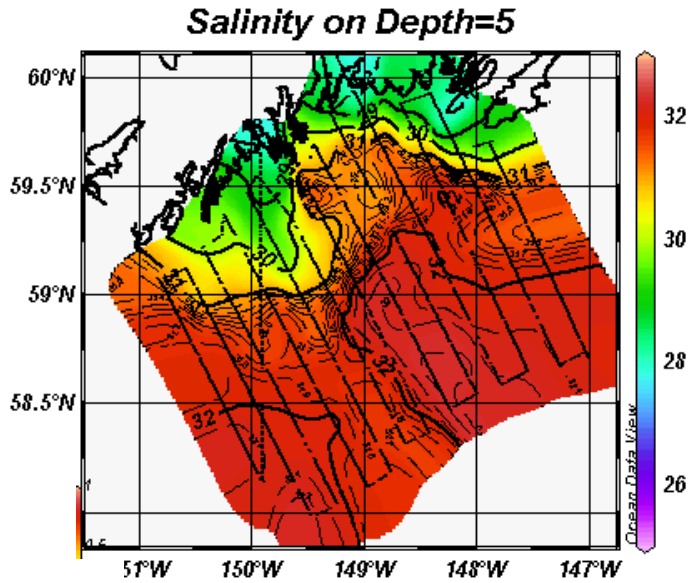


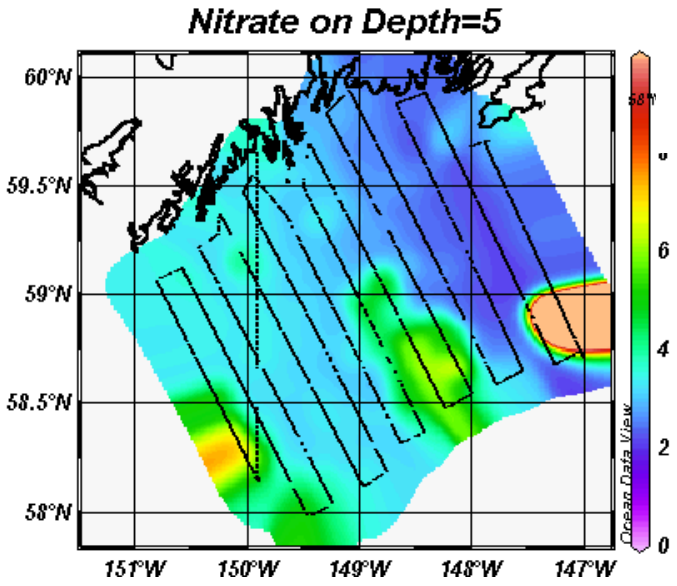


- ACC moves along coast, influenced from PWS
- Defined shelf-break front
- Salinity higher offshore
- Nitrate high offshore, lower as depleted inshore, flowing off Chiswell Ridge

July Mesoscale

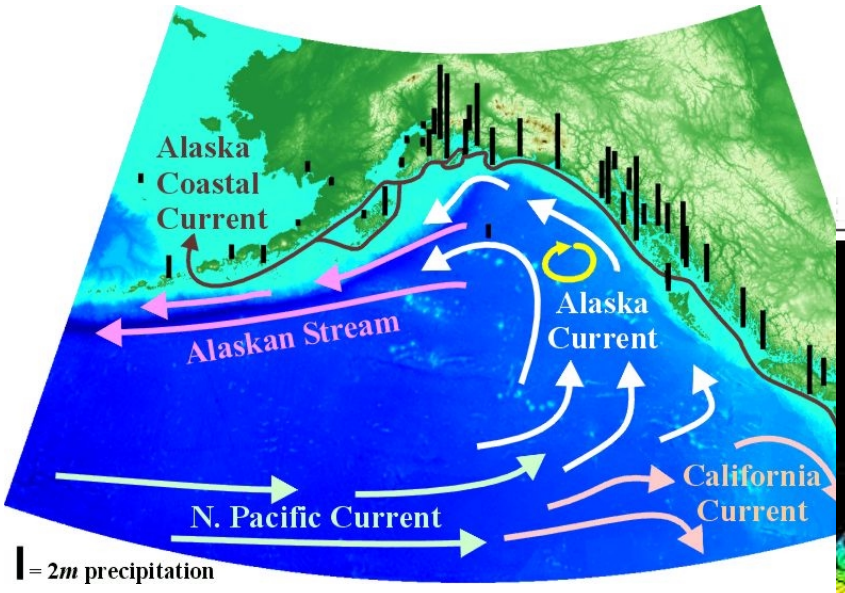


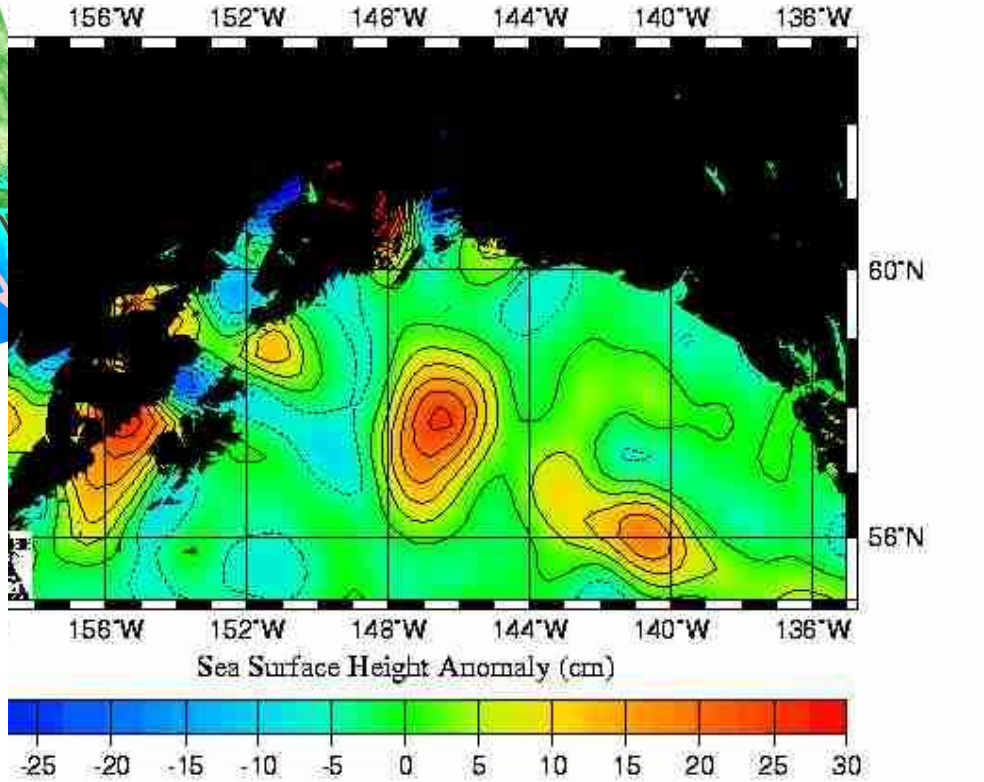




- ACC further off coast, influence from Montague Island
- No defined shelf front
- Lower salinity inshore
- Lower nitrate at surface

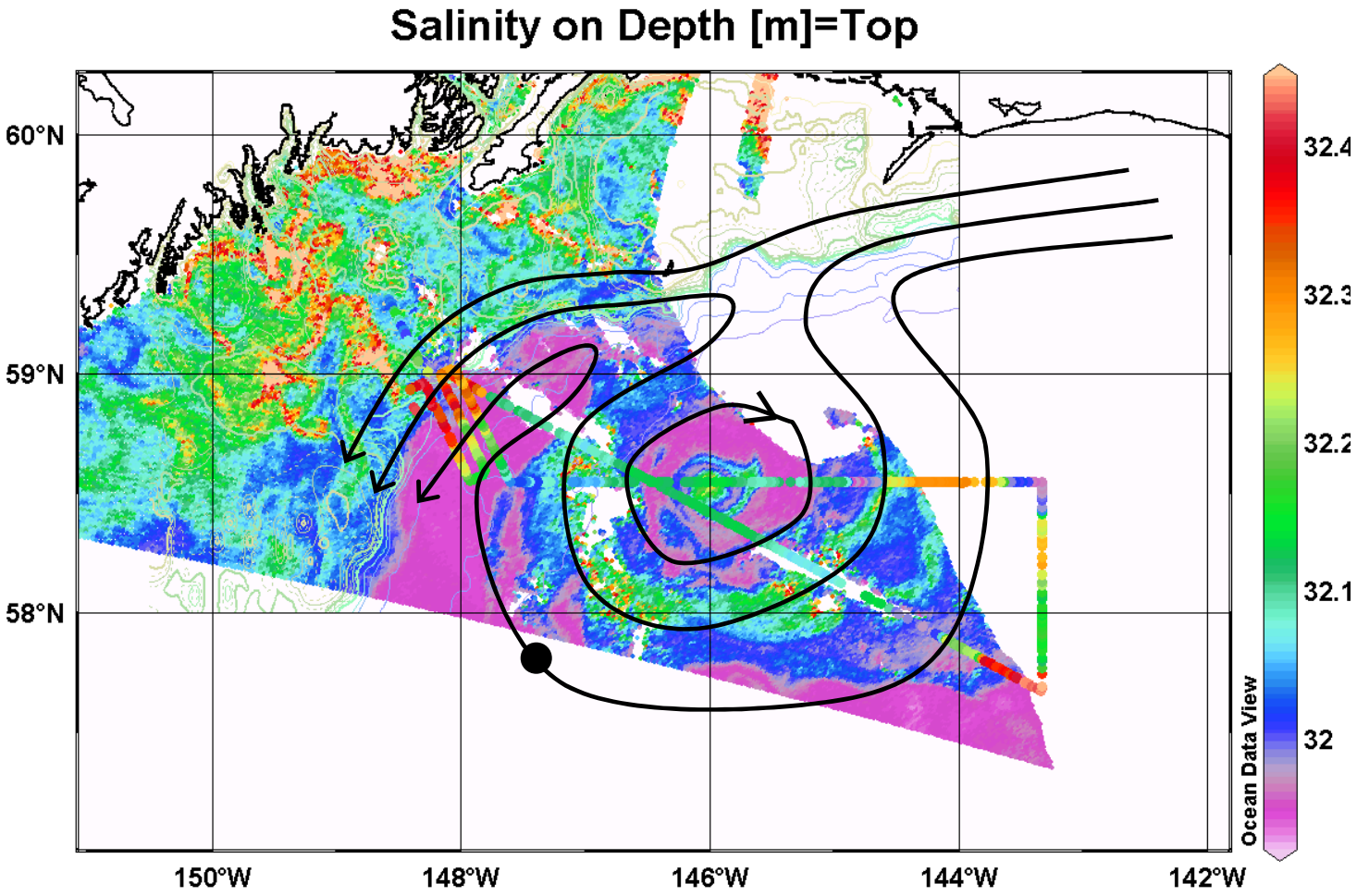
Deep-sea Eddy Formation





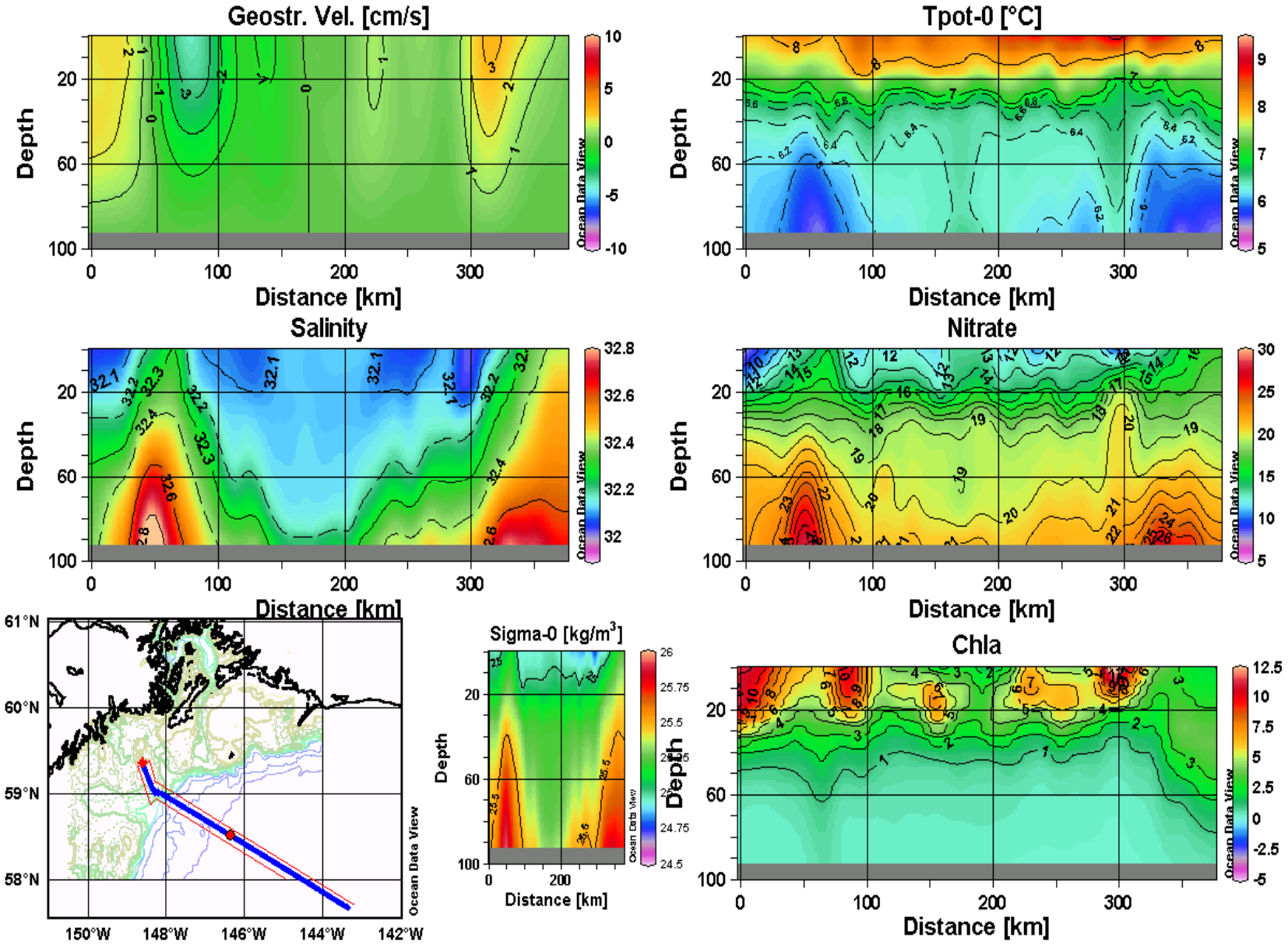
high height = red
low height = green
pressure gradient = clockwise flow

Deep-sea Eddy



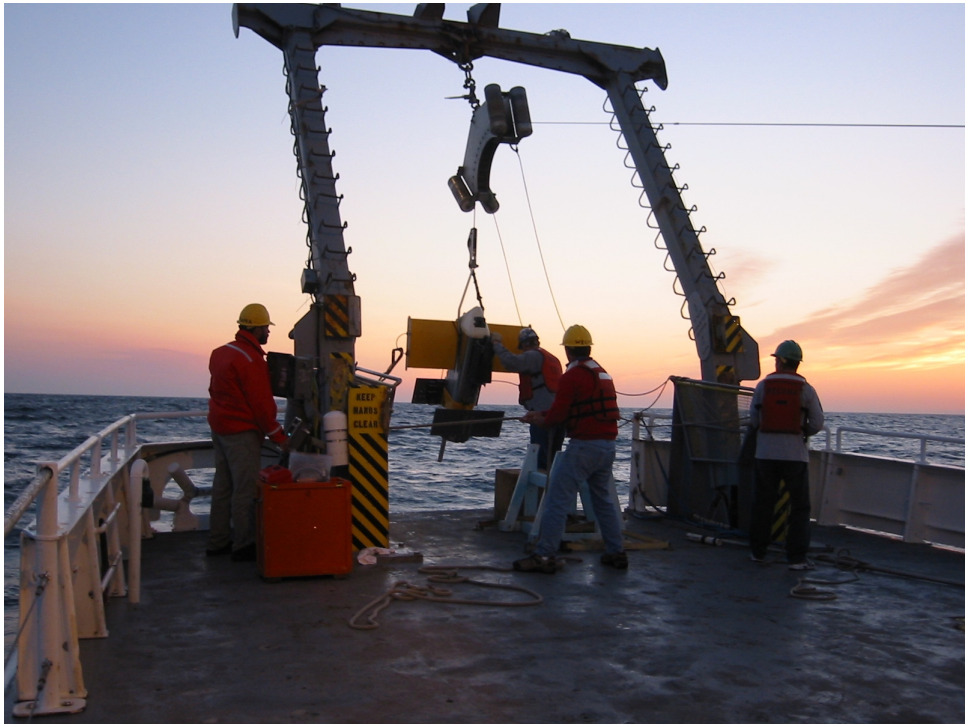
- High chlorophyll inshore, low chlorophyll offshore
- Eddy interacts with shelf-break front
- Survey transects show advection from inshore
- New location of the eddy

Eddy: May, 2003



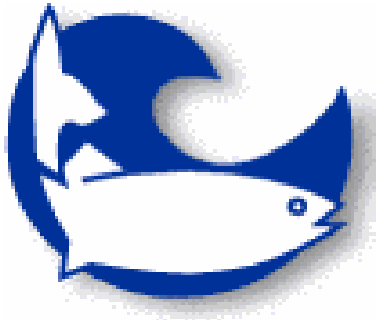
In Conclusion…

- Seasonal progression of Mesoscale field
  - ACC
  - Salinity
  - Nitrate
  - Chlorophyll
- Finescale shows higher resolution
- Deep-sea Eddy
  - Not in original plan
  - Not previously identified
- Seward Eddy?
  - Not always present
  - Topographical influence



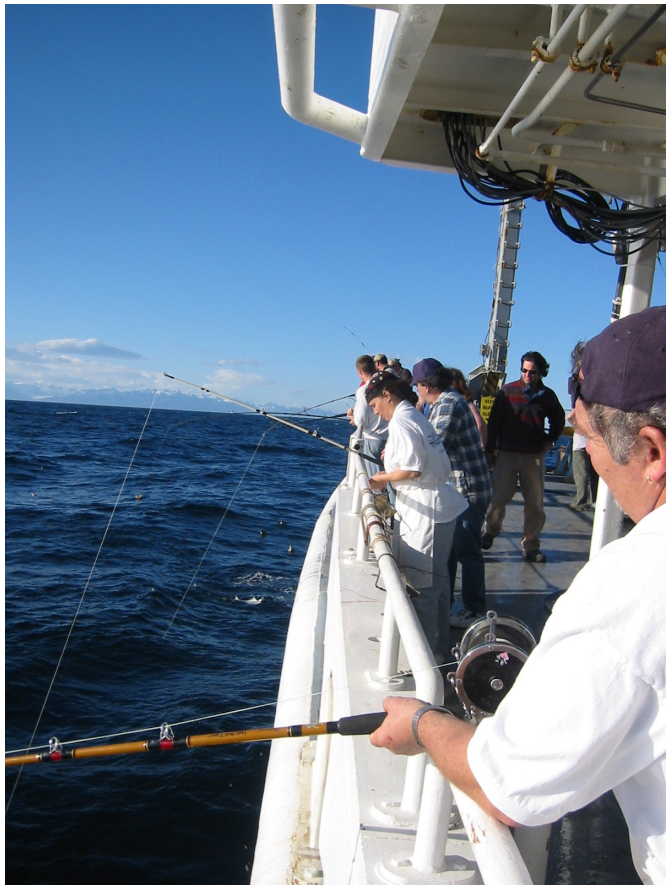
Thanks to…

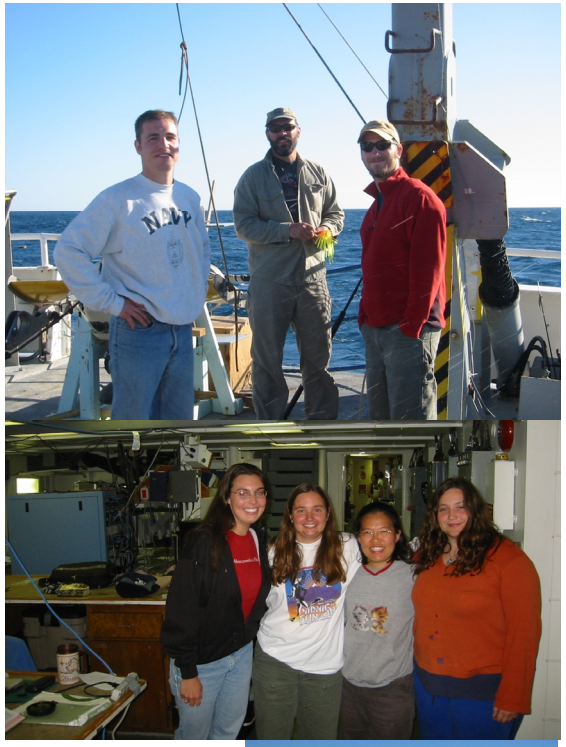
U.S. GLOBEC



And of course…

R/V Wecoma Crew





Science party