

Long-term measurements in the Bering Strait - results from RUSALCA, AON, IPY ...



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Thanks to Jim Johnson, David Leech, Seth Danielson, Kay Runciman, Wendy Ermold, Mike Schmidt and the crews of the Alpha Helix, Laurier, Sever, Lavrentiev and Khromov

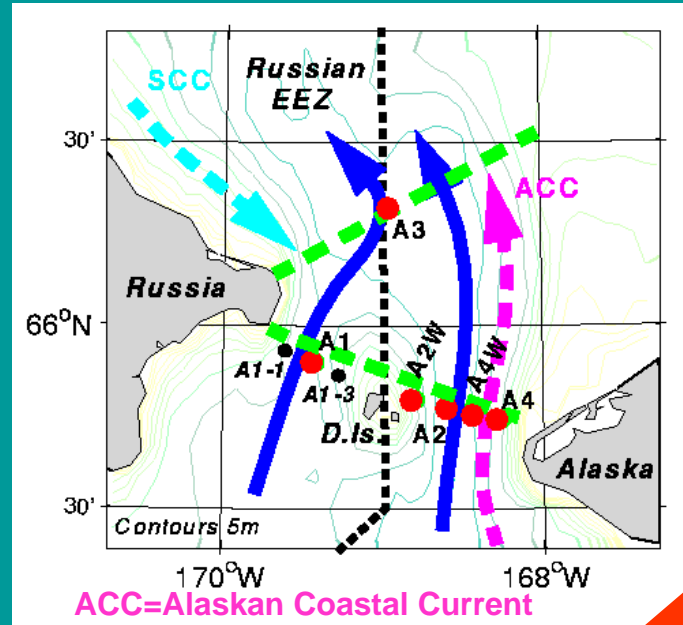
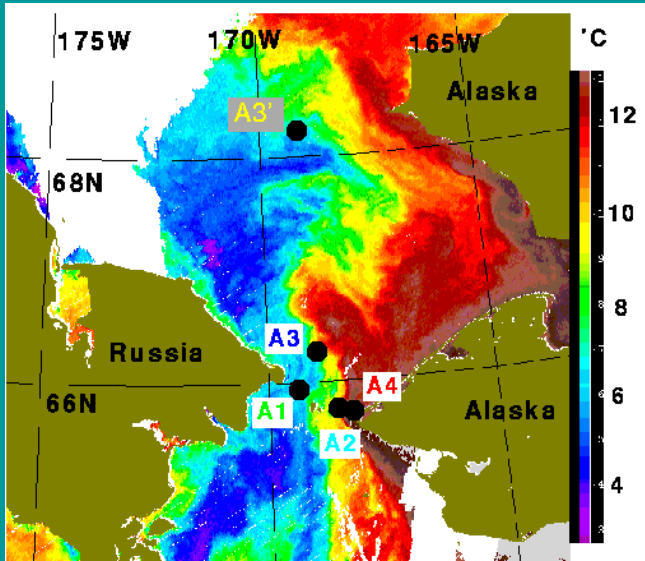
Long-term measurements in the Bering Strait - results from RUSALCA, AON, IPY ...

Long-term mooring (and CTD) scheme
- some results

Things we need to consider for the DBO

Collaborations and comparisons

Bering Strait Moorings



ACC=Alaskan Coastal Current

Since 1990
1-4 near-bottom moorings

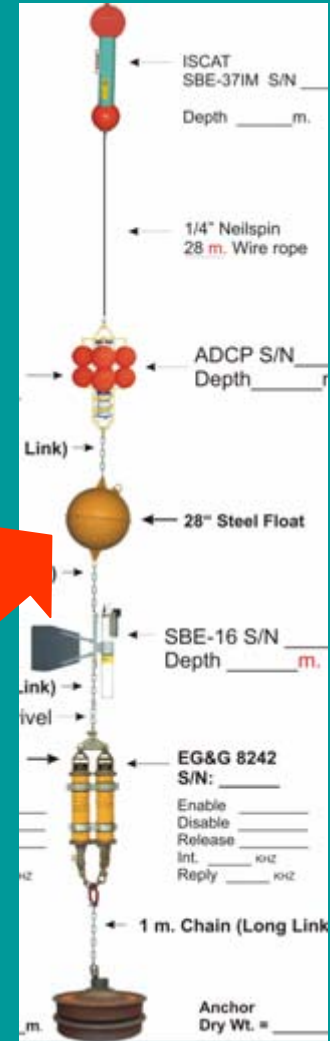
Since 2007
(*International Polar Year*)
8 moorings with upper and lower sensors

Now also with

- Whale Recorders – Kate Stafford and Carter Esch
- pH and pCO₂ sensors – Fred Prahl, OSU

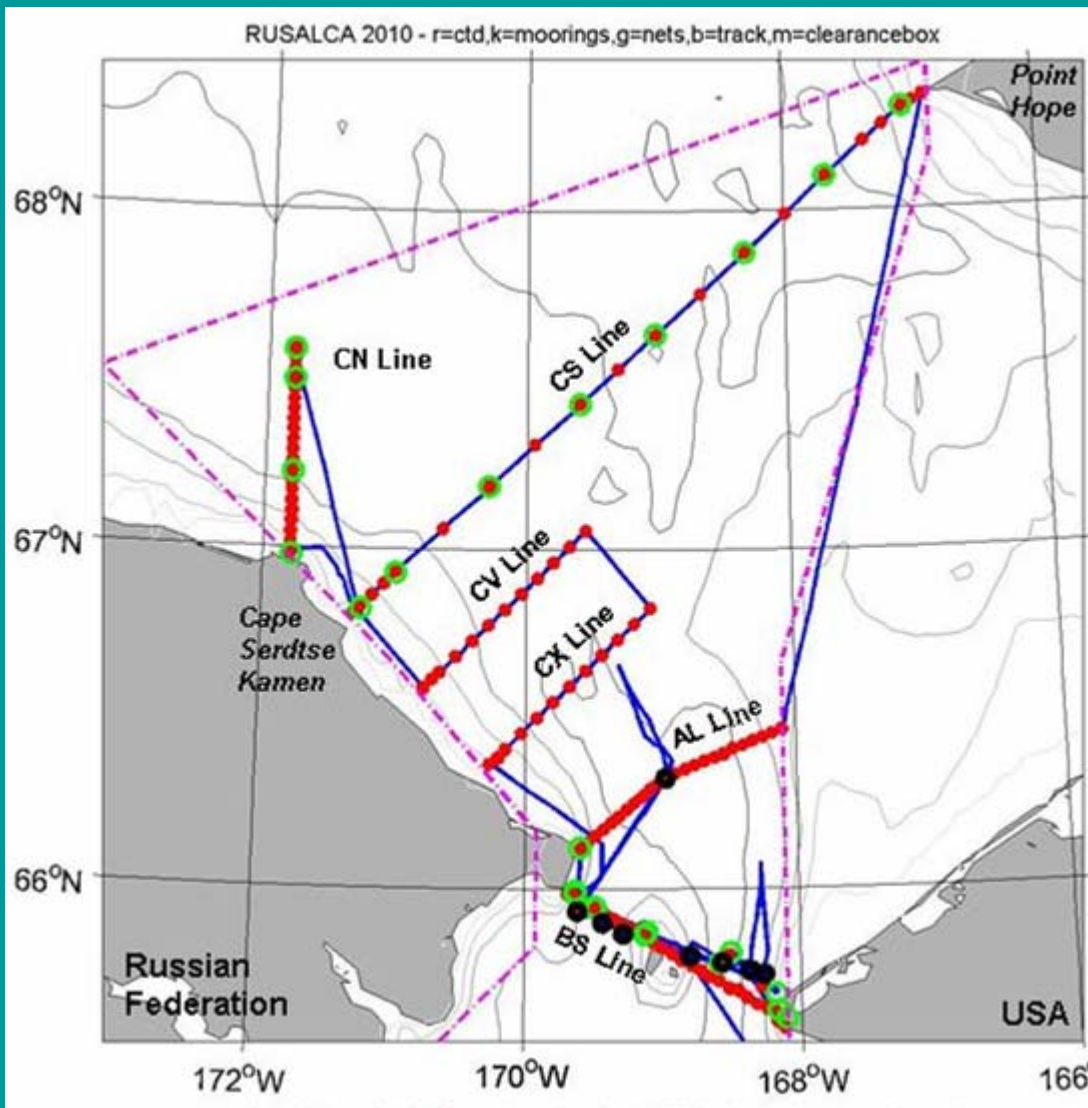
Annual CTD sections

Your instrument here!!!!

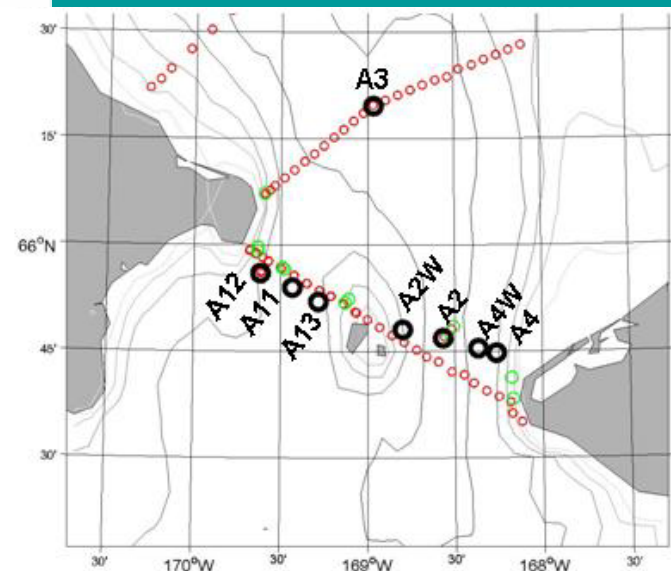


RUSALCA 2010 Khromov Cruise

31st July
– 11th Aug 2010
Nome to Nome

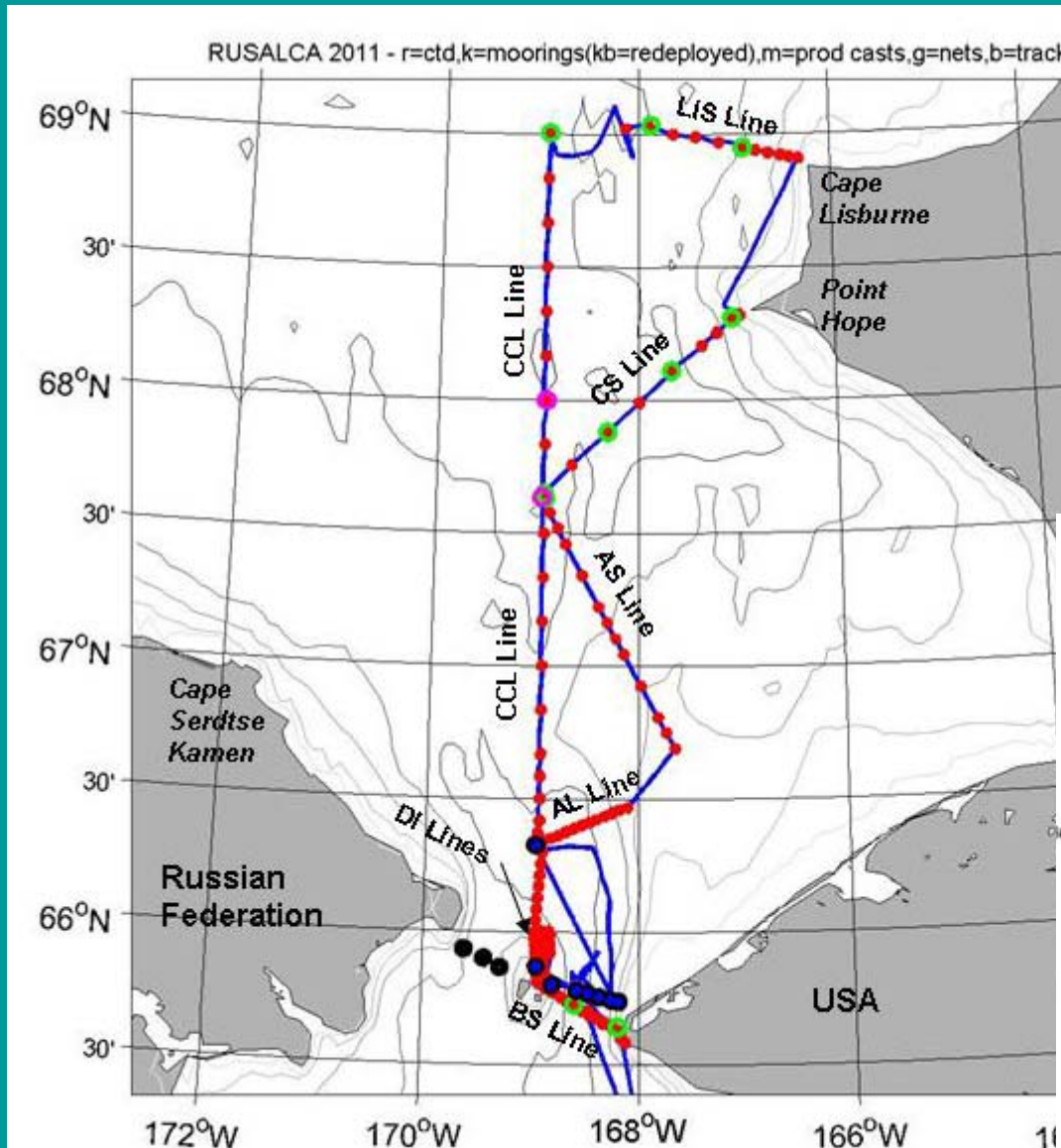


Mauve = clearance box
Blue = ship track
Black dots = moorings
Red dots = CTDS
Green dots = nets
+ 4 Primary productivity stations

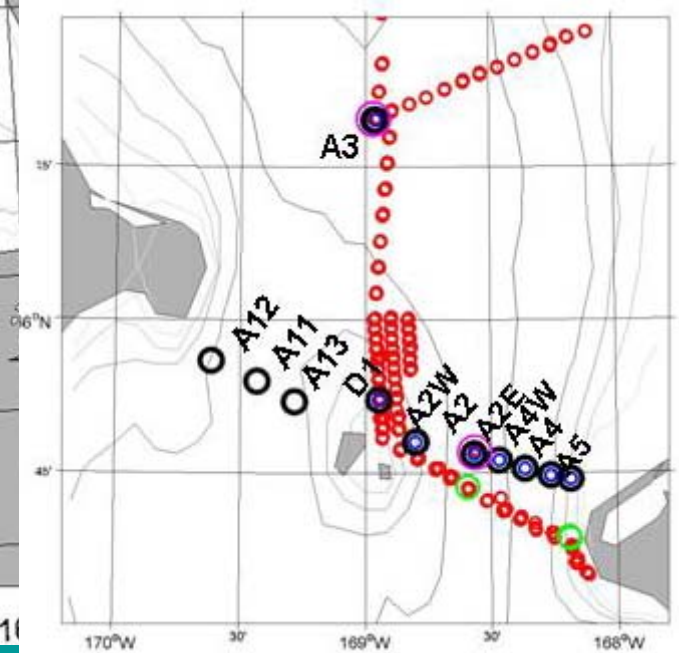


RUSALCA 2011 - Khromov

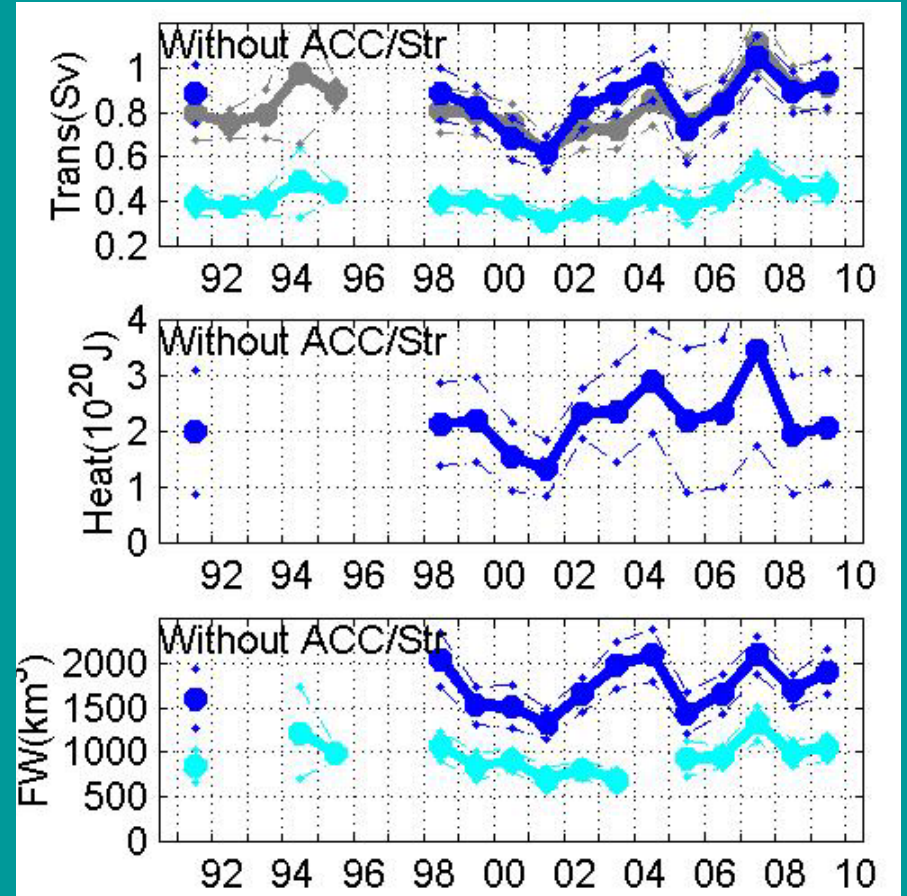
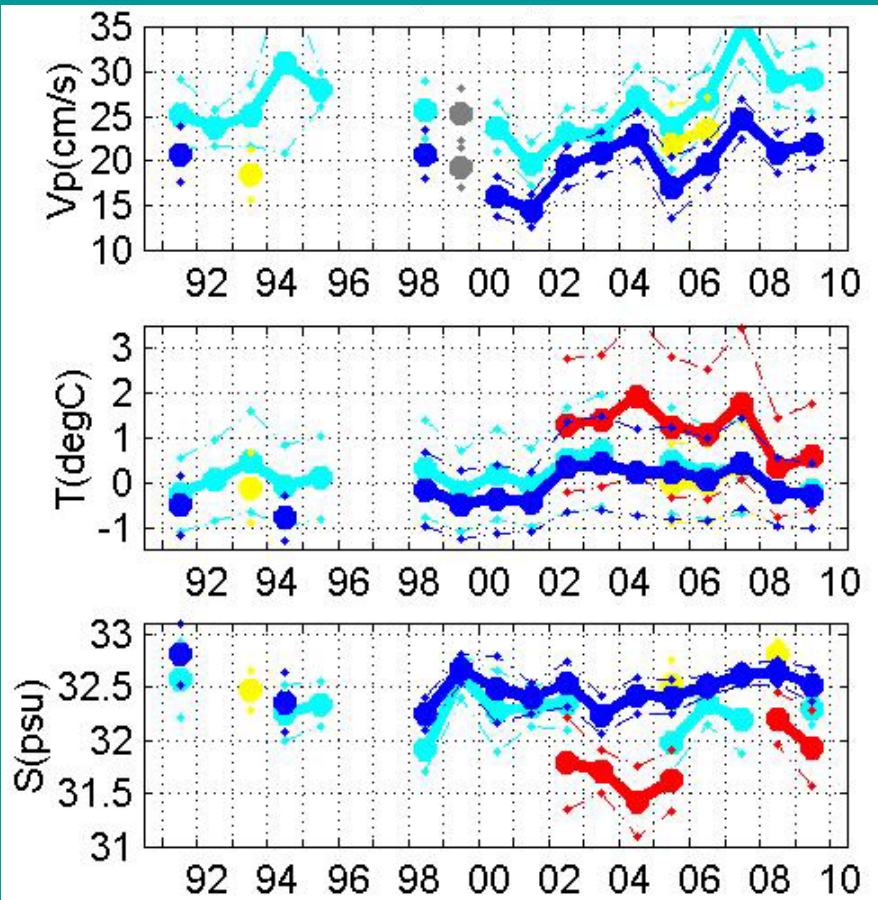
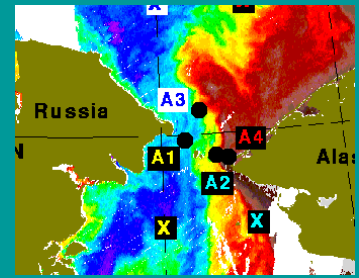
12th – 23rd
July 2011
Nome to Nome



Blue = ship track
Black dots = moorings
Red dots = CTDS
Green dots = nets
Primary productivity stations



Bering Strait Annual Mean Fluxes



Colours give mooring location (red=ACC)

Seasonal cycle in water properties (Woodgate et al, 2005)

SALINITY

31.9 to 33 psu

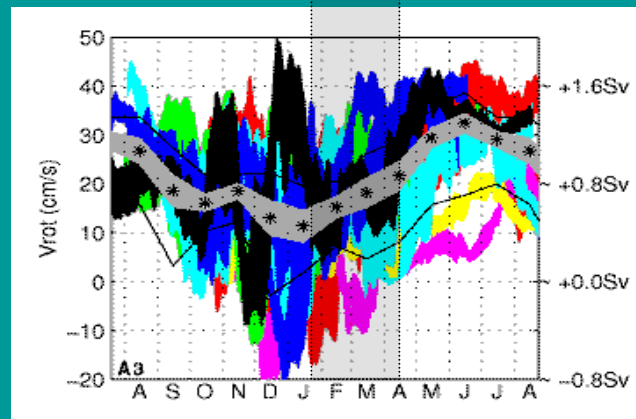
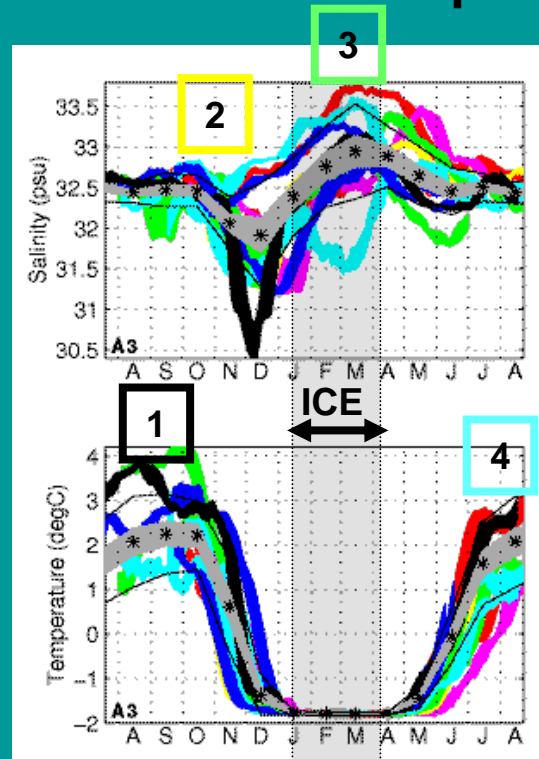
TEMPERATURE

-1.8 to 2.3 deg C

TRANSPORT

0.4 to 1.2 Sv

(30 day means)

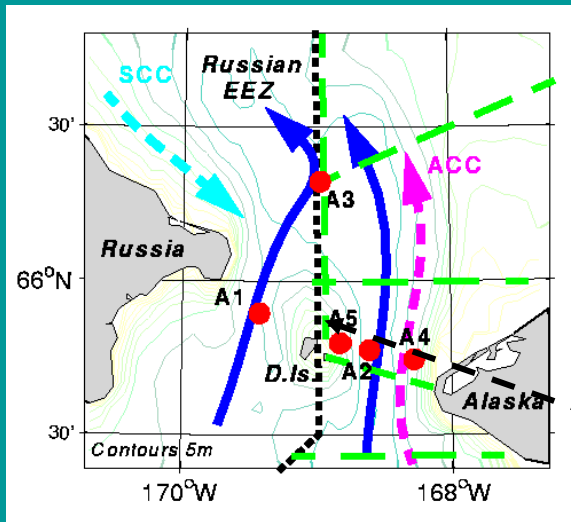


WHY CARE?

Seasonally varying input to the Arctic Ocean

- temperature
- salinity
- volume
- equilibrium depth (~50m in summer ~120m in winter)
- nutrient loading

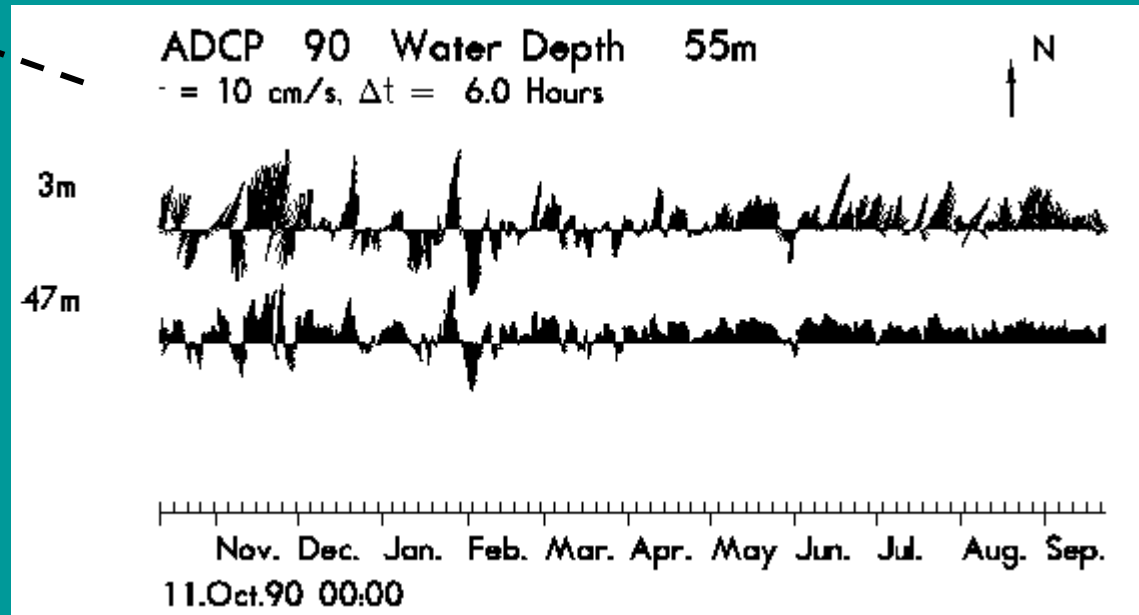
Bering Strait Basics



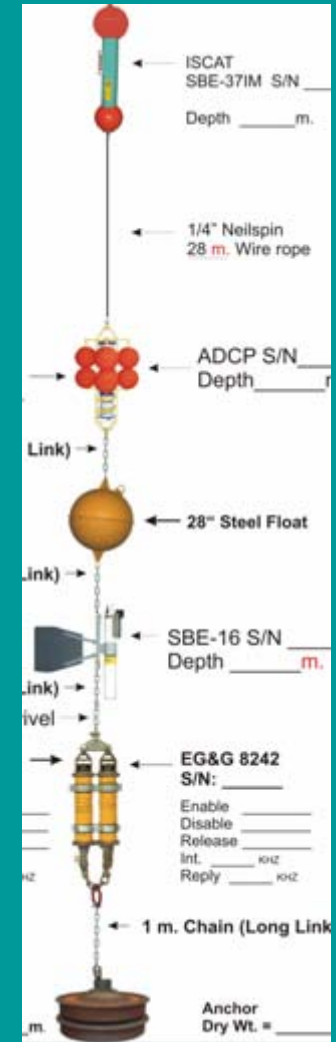
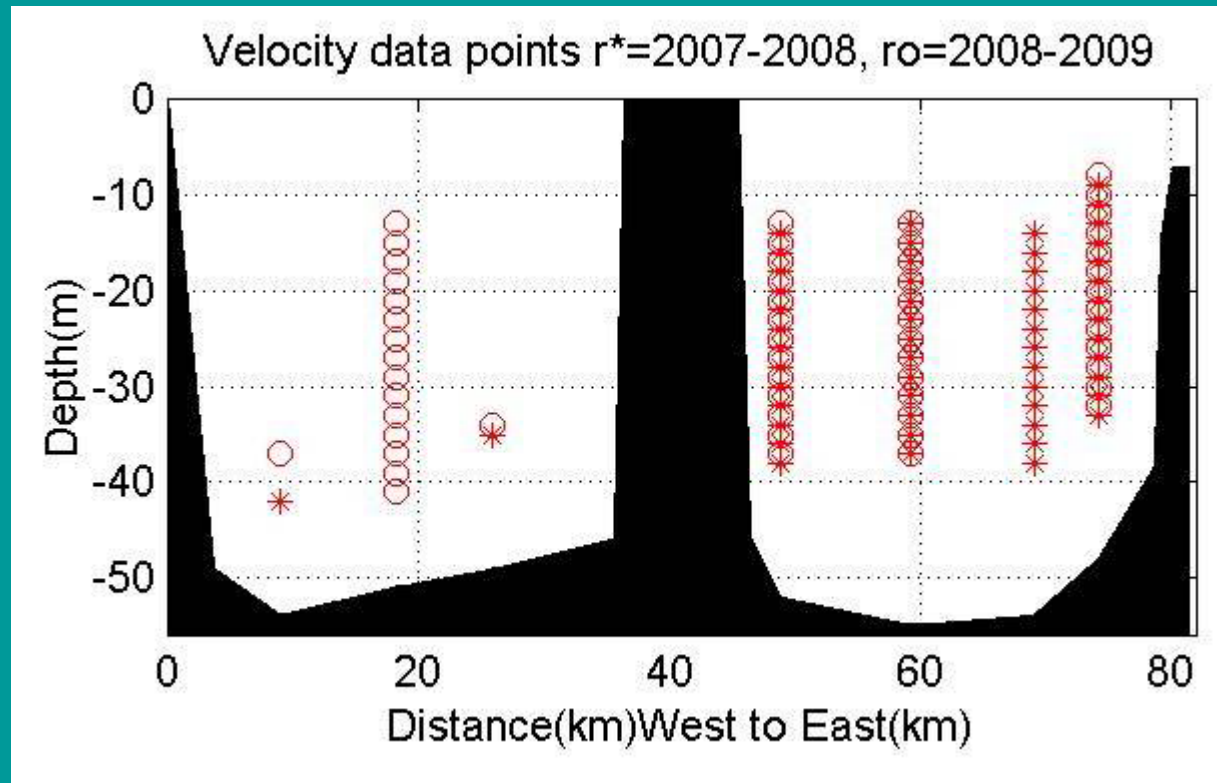
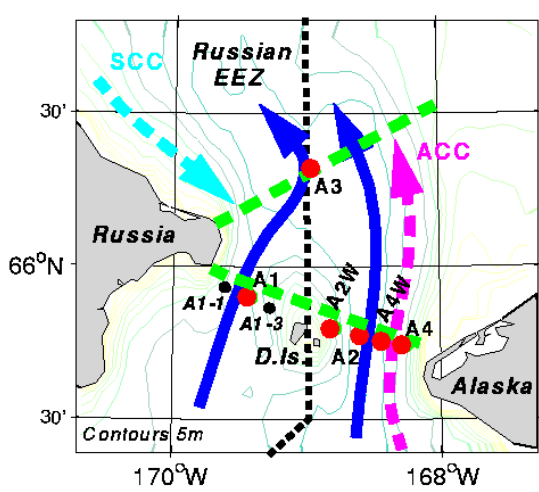
- annual mean ~ 0.8 Sv northwards
 - monthly means ~ 0.3 to 1.3 Sv
 - weekly means: -2 Sv to $+3$ Sv
 - hourly flow up to 100 cm/s
 - Alaskan Coastal Current 50 - 100 cm/s stronger
 - rectilinear flow; weak tides
- (Roach et al, 1995; Woodgate et al, 2005)

- away from boundaries, flow dominantly **barotropic**
(Roach et al, 1995)

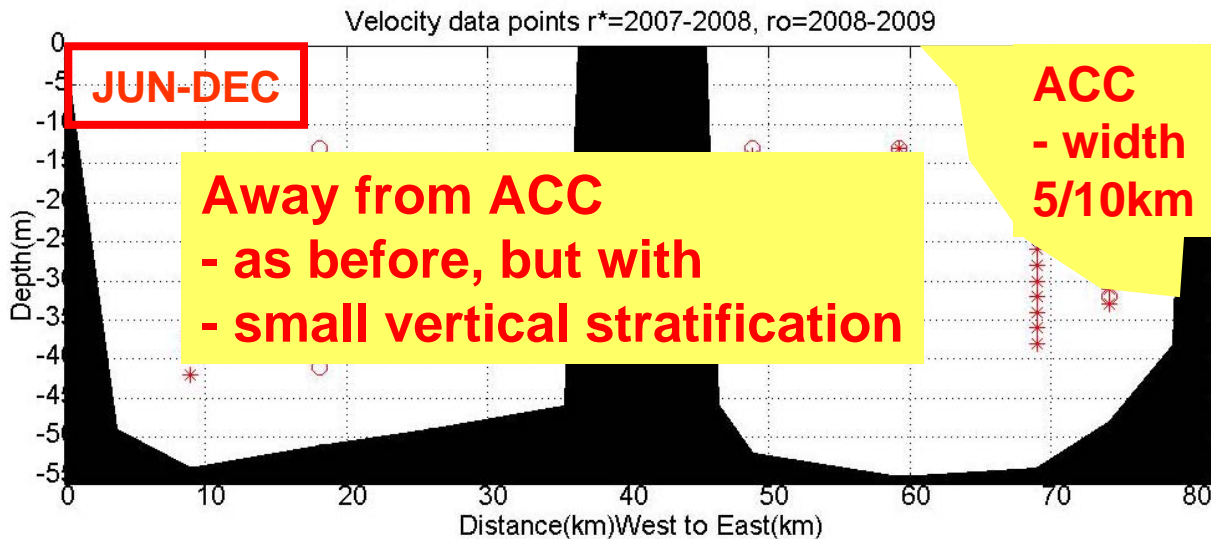
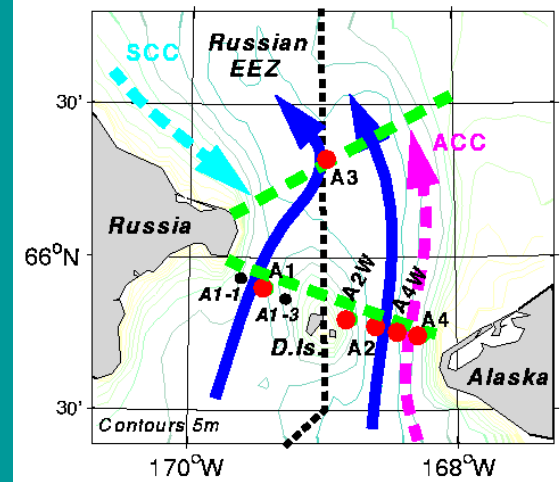
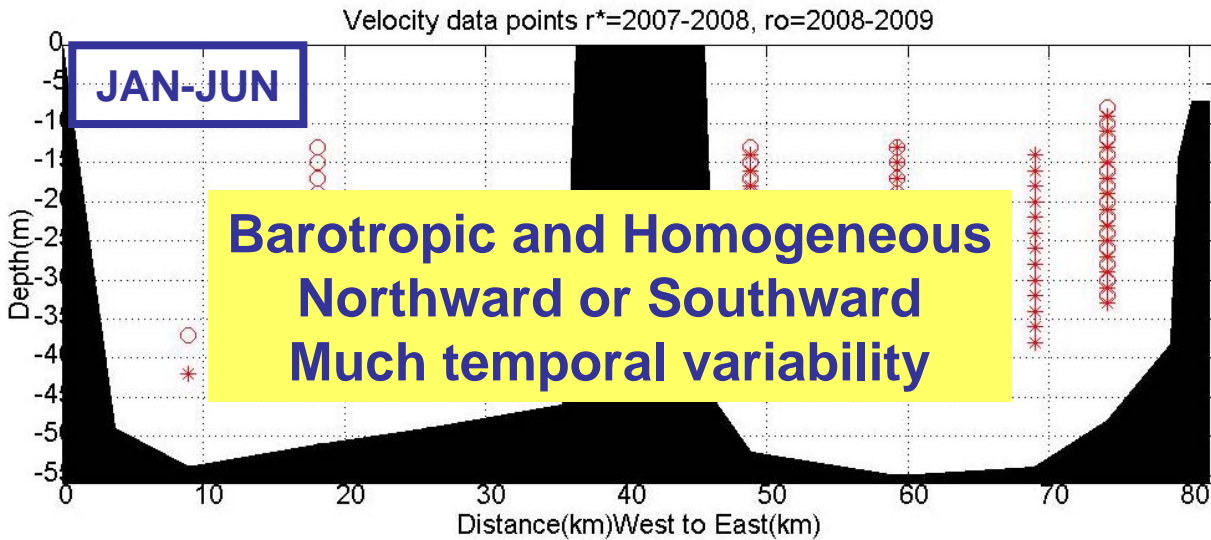
- flow in east and west channel **highly correlated**
(0.95 , Woodgate et al, 2005, DSR)



Mooring data: - Concurrent in time, but less spatial coverage

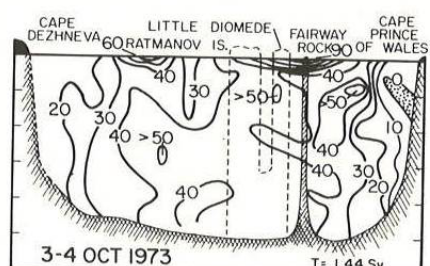
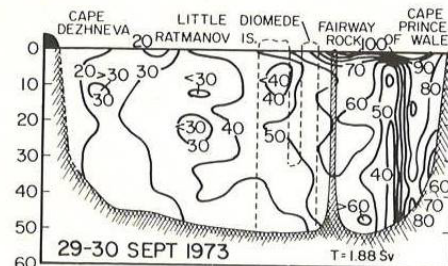
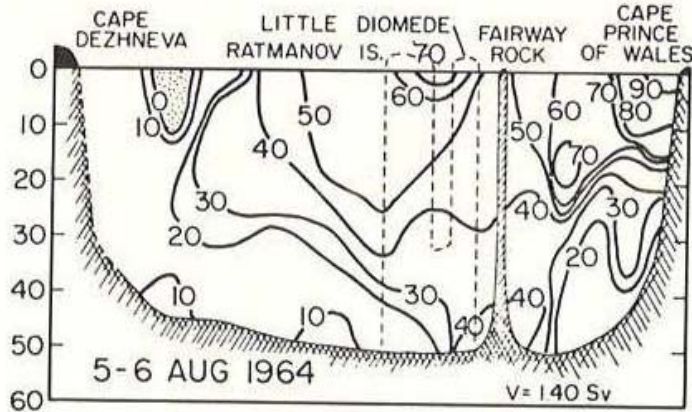
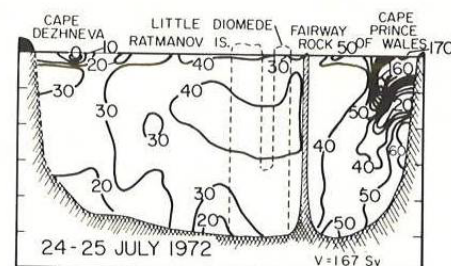
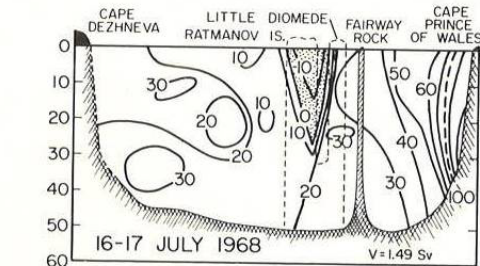
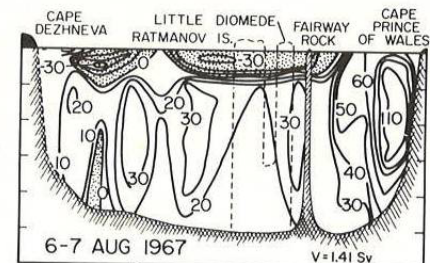
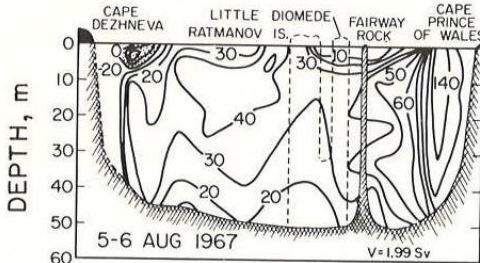
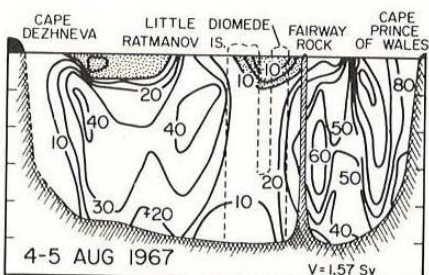
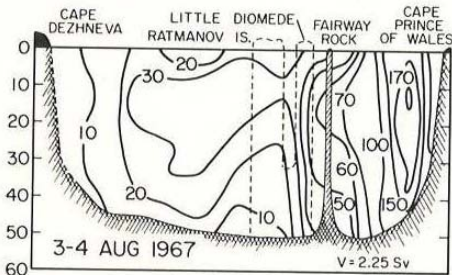
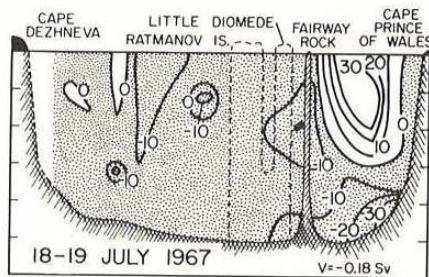
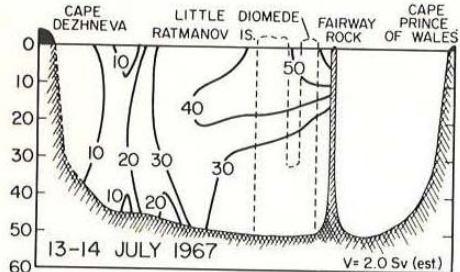
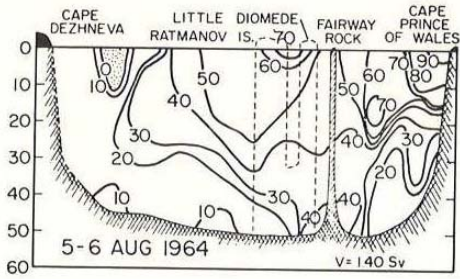


Bering Strait Moorings



All published Velocity Sections in the Strait

Coachman et al., 1975

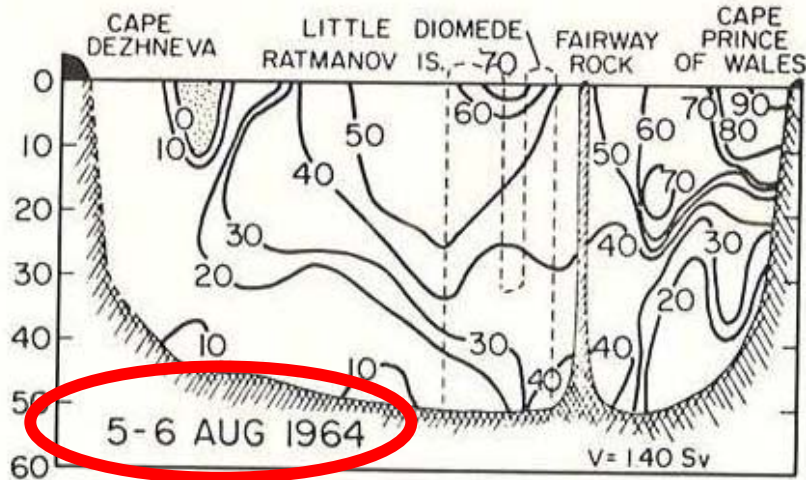


48. Isotachs of north-south flow for the eleven detailed Bering Strait sections

units presumably cm/s

Velocity Sections in the Strait

Coachman et al., 1975



units presumably cm/s

According to this, we have

- lots of variability across the strait
- lots of structure in the vertical
- flow reversals
- very strong currents at the US side

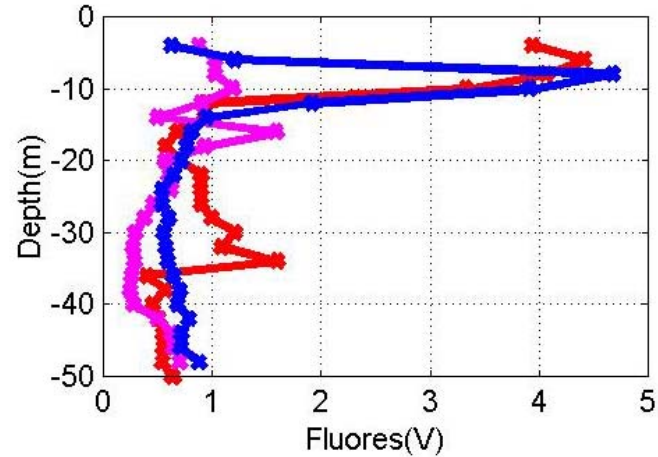
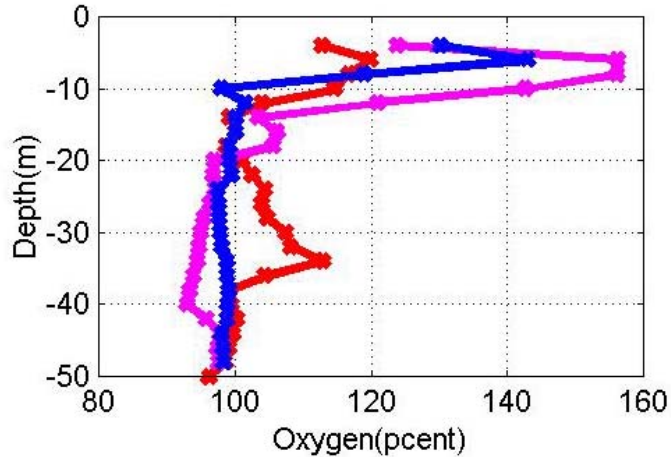
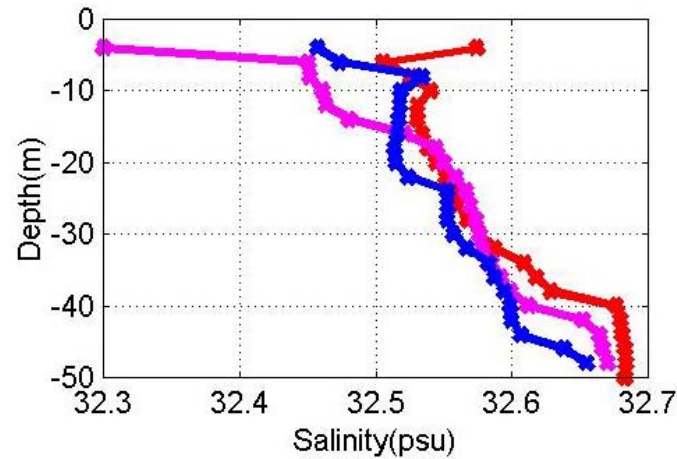
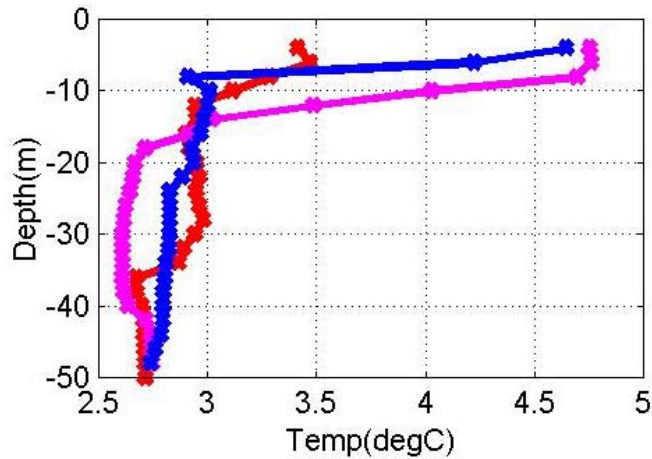
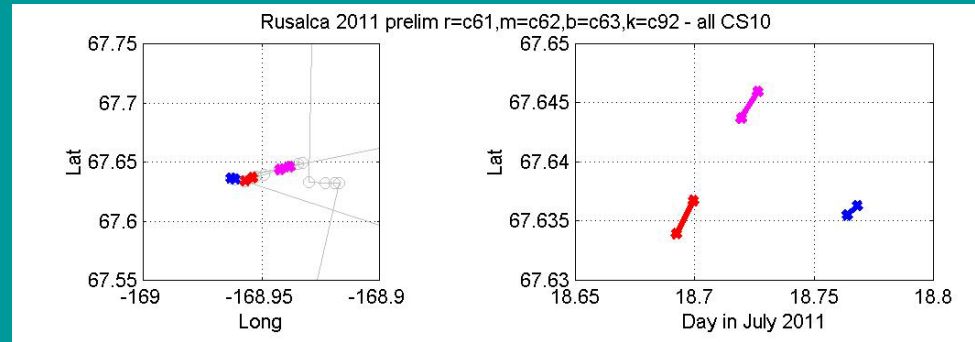
What happened to the “away from the boundary currents, predominantly barotropic, homogeneous flow”?

Significant aliasing of temporal variability into spatial variability

(things change while you are running the line)

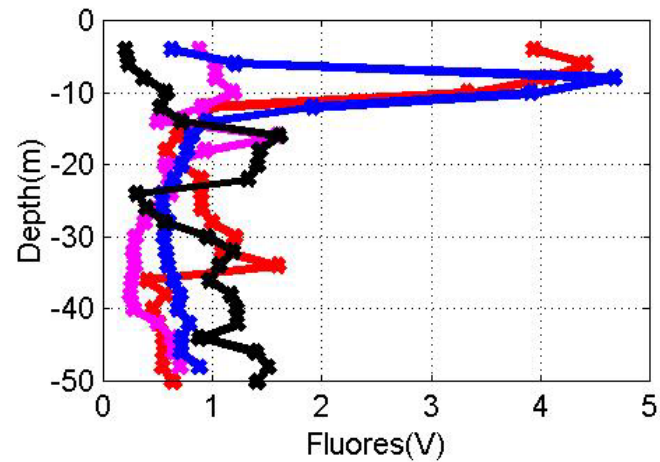
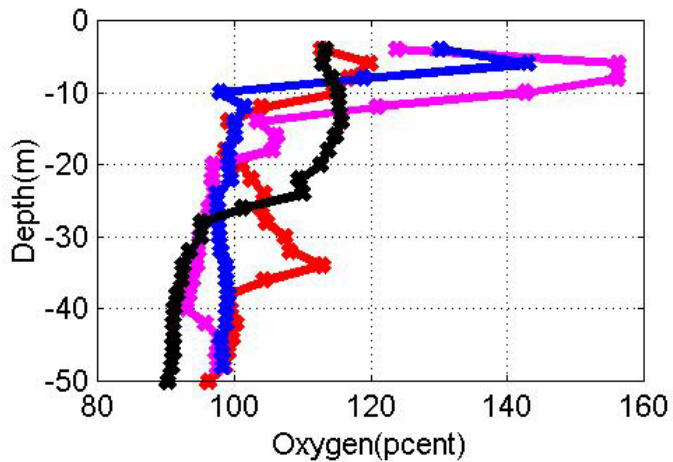
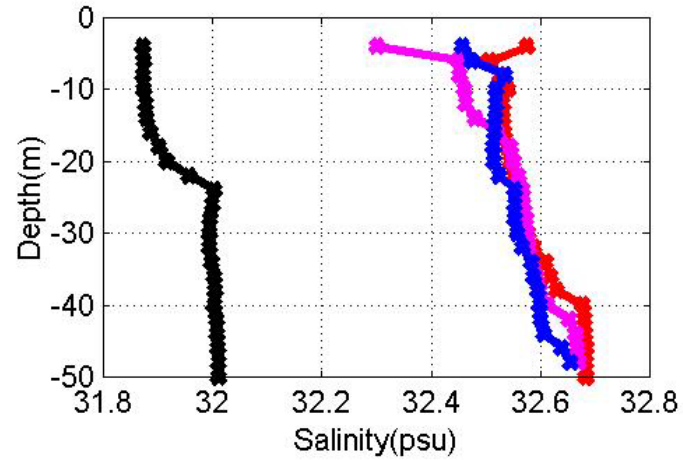
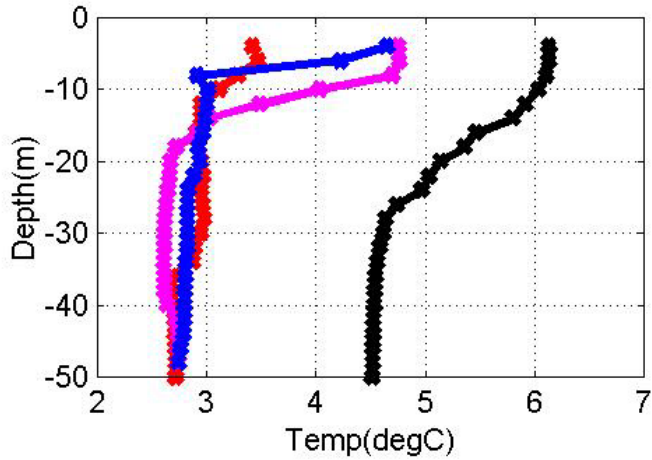
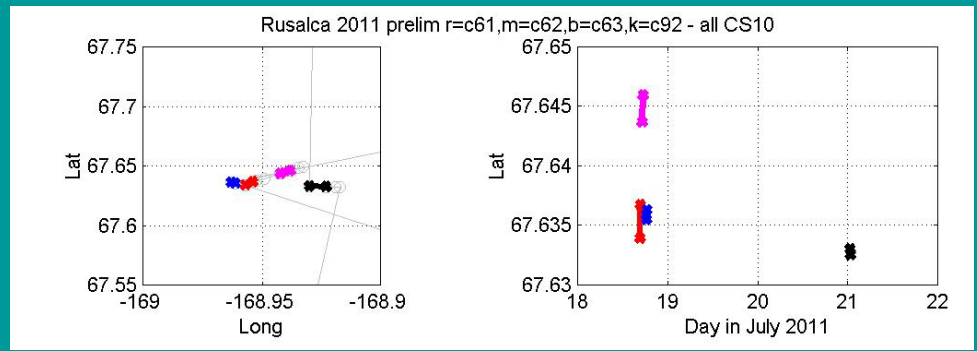
.....but how much?

2 hrs at CS10



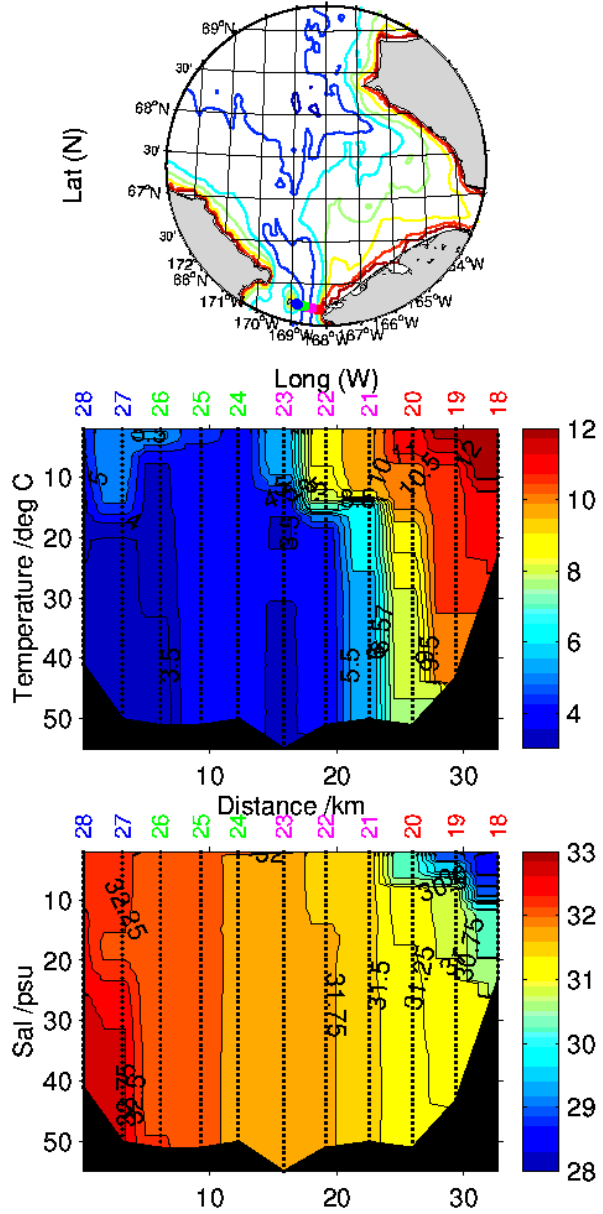
**Stations few
100m apart
apart, taken
within 2 hrs**

2 hrs and 2 days at CS10



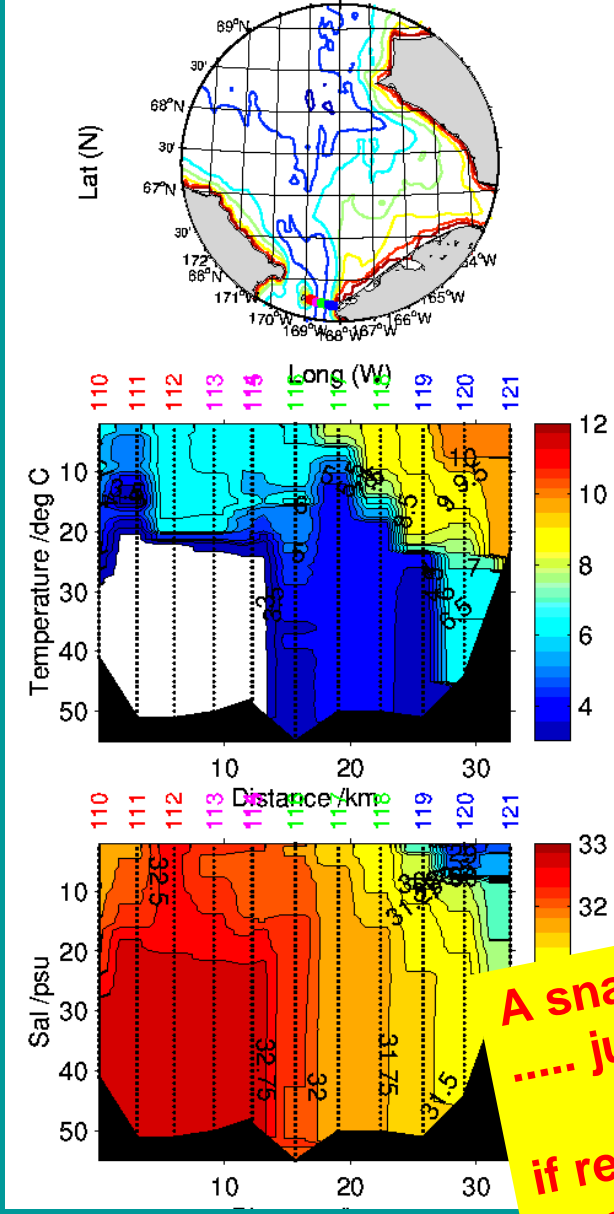
Bering Strait 2004

HX290 Aug/Sept 2004 – BSL(1) 028to018



1st Sept 2004

HX290 Aug/Sept 2004 – BSL(2) 110to121

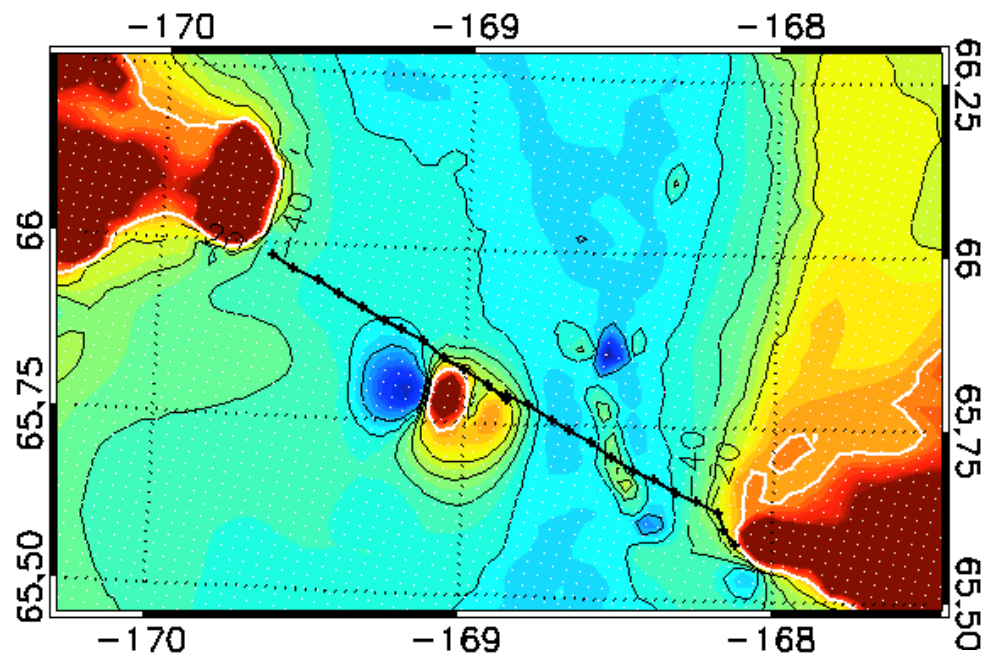


5th Sept 2004

Temperature, salinity and velocity change rapidly and on small space scales.

**A snapshot section is just a snapshot
if really you want a monthly or seasonal average, need something else**

IBCAO Bathymetry Issues



IBCAO Bathymetry with RUSALCA CTD line

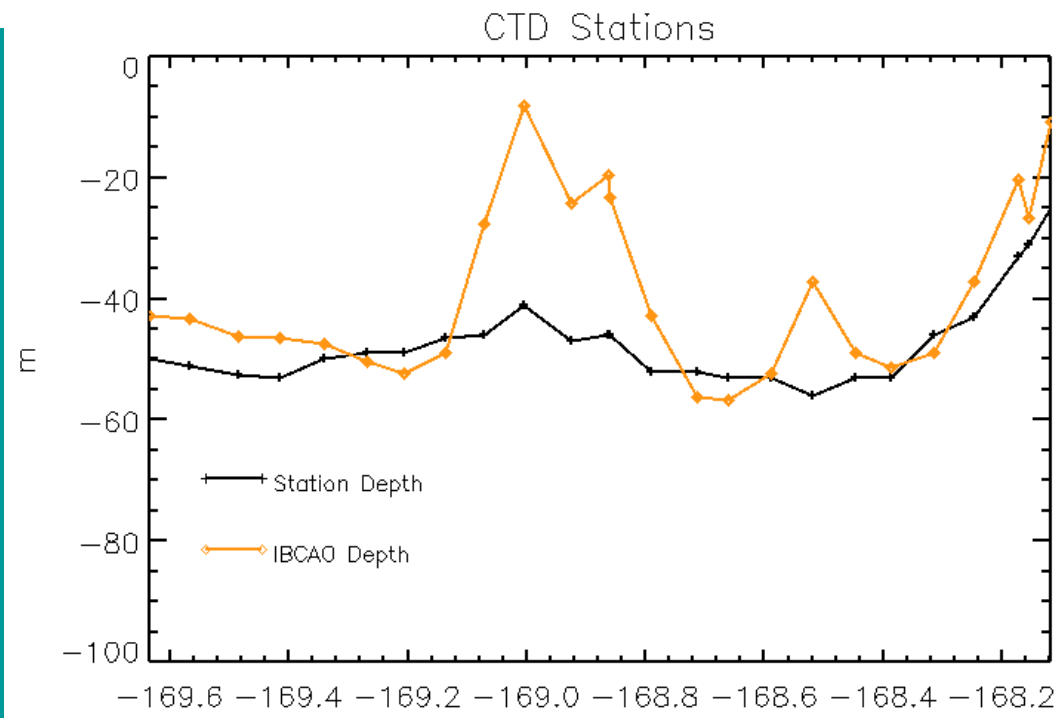
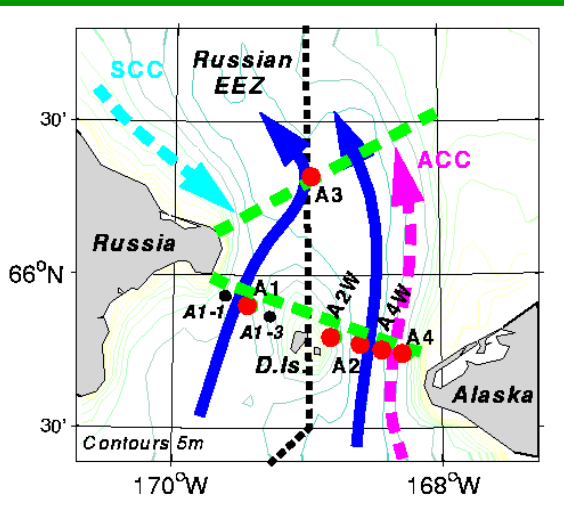
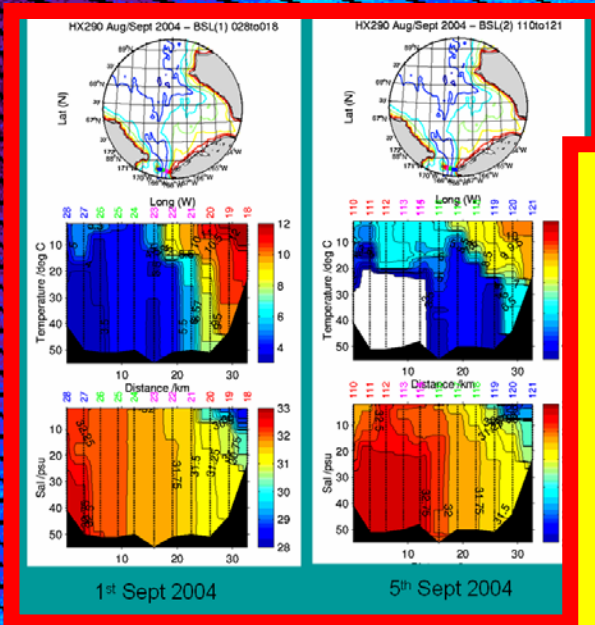


Figure from Ron Lindsay



High resolution mooring array in the strait + CTD until 2013
 – RUSALCA-NOAA & NSF



Time and space scales of change are FAST (hours) and SMALL (kms or less)

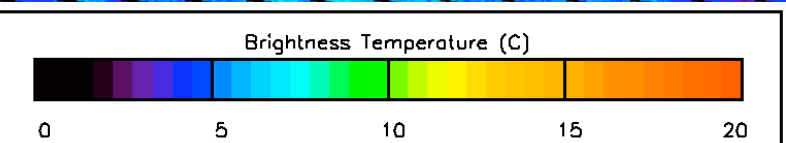
NEED TO WORRY ABOUT

- lack of synopticity of sections
- how representative a snap shot section is of what we really want to know
- what DO we really want to know?

WAYS FORWARD

- Comparing section data with Mooring data
- Comparing section data with satellite data

Land Sat = CH6H = Jul18th 2003, from R Lindsay



psc.apl.washington.edu/BeringStrait.html