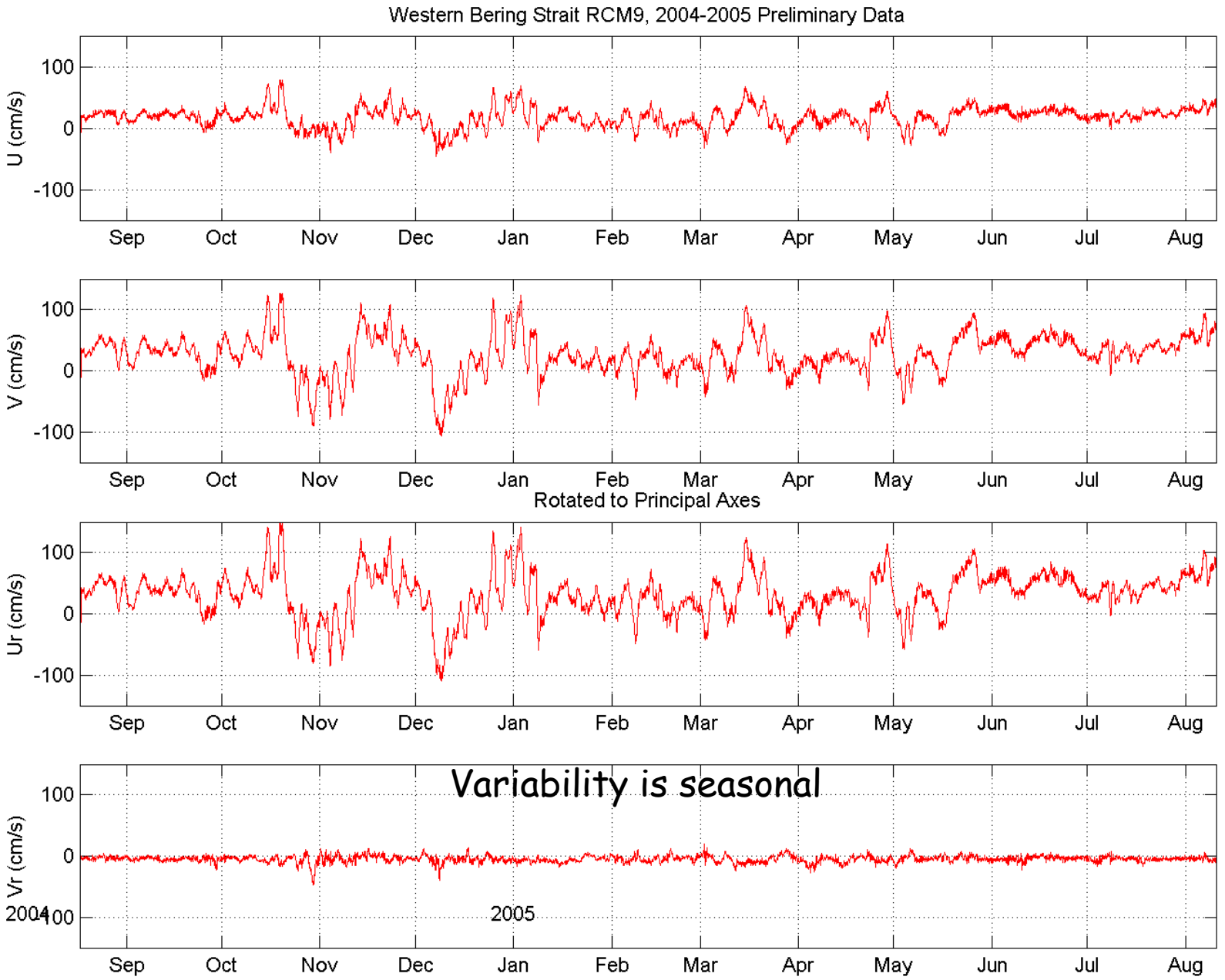
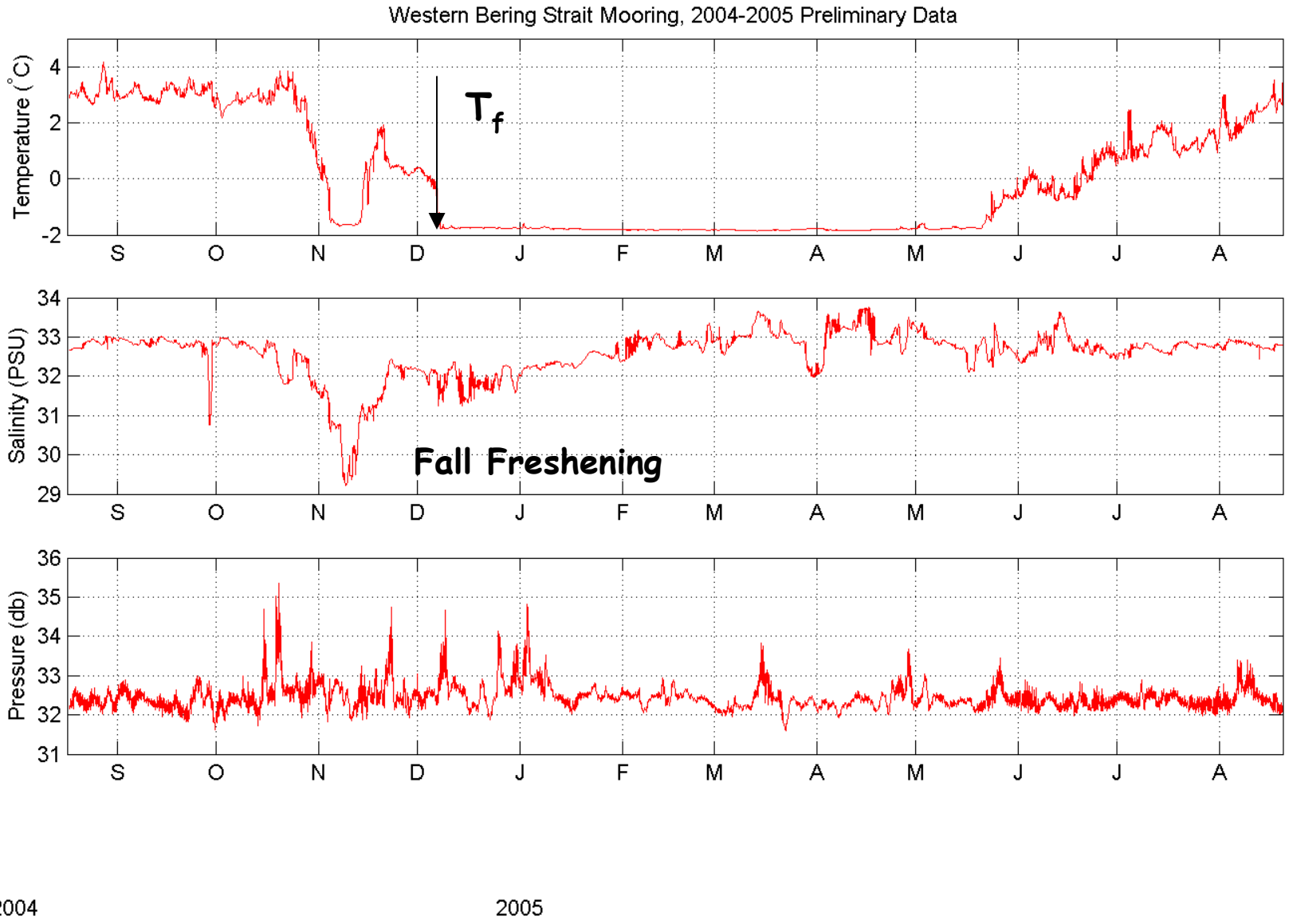
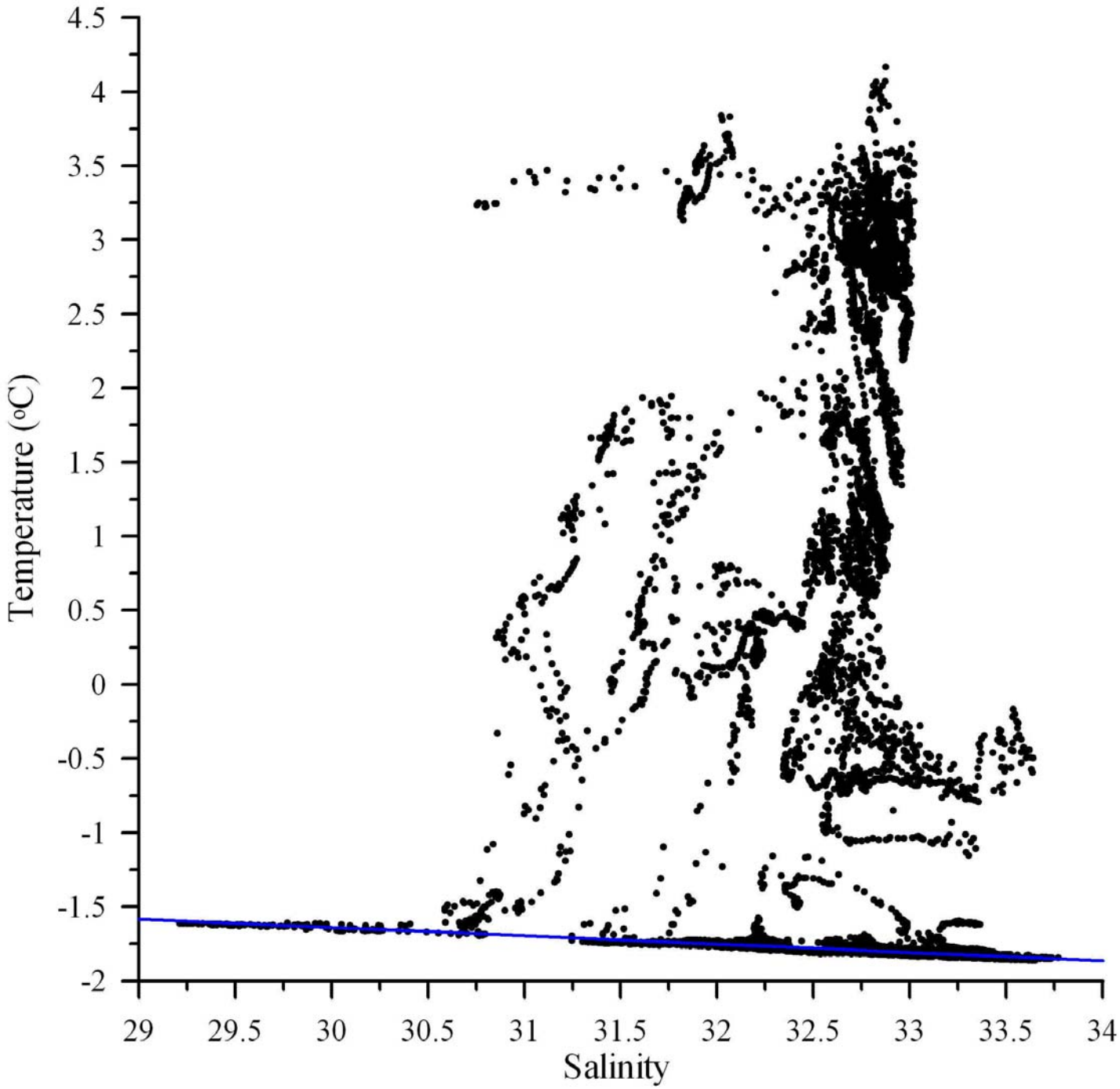
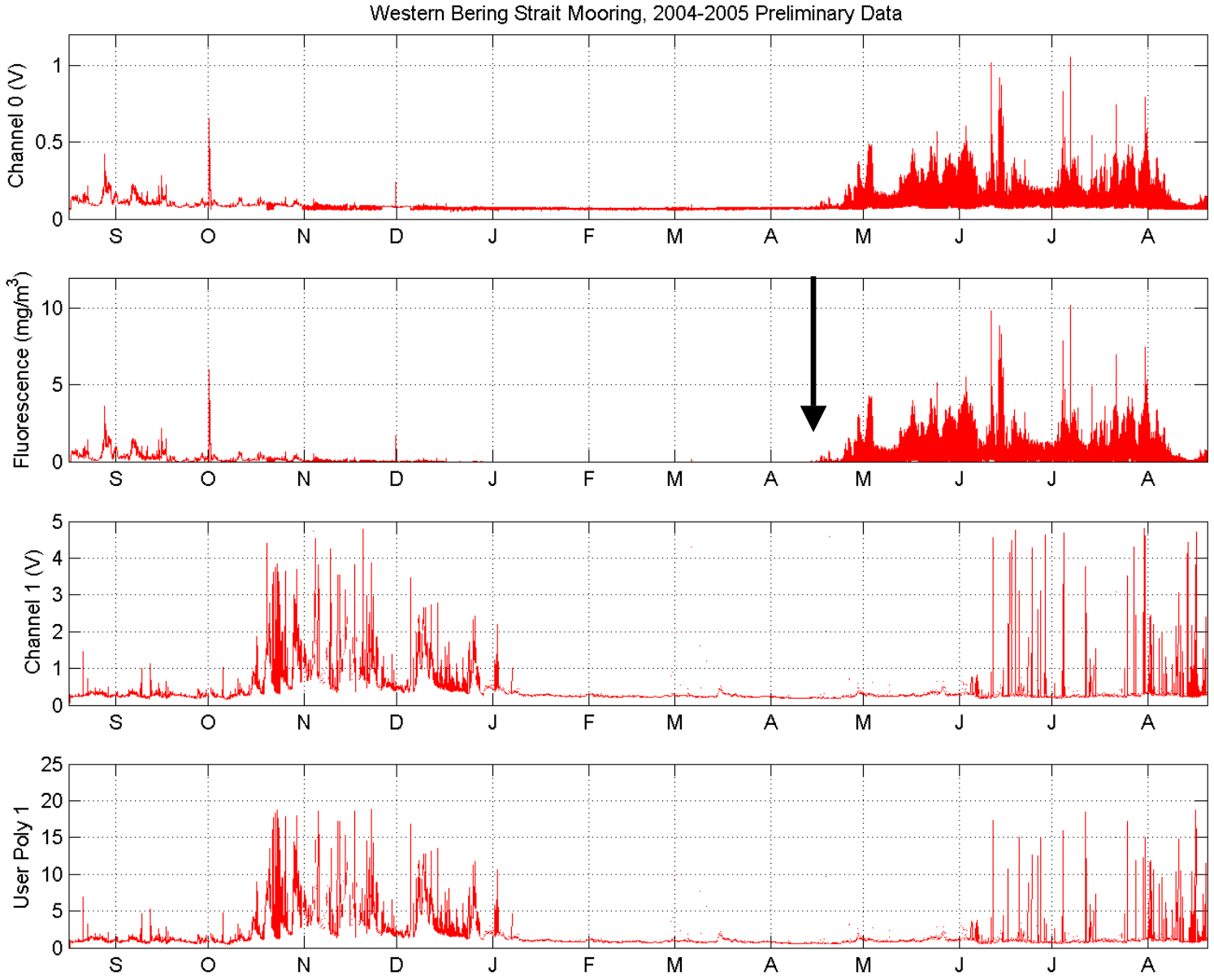
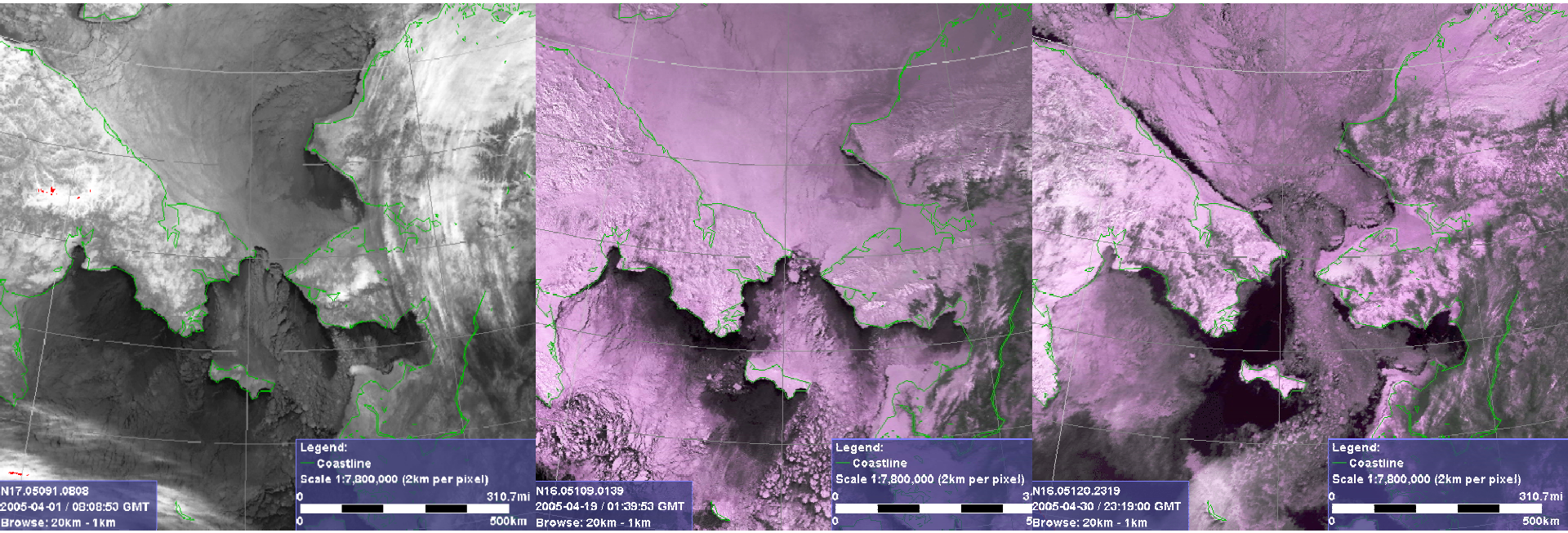

Western Bering Strait RCM9, 2004-2005 Preliminary Data
U (cm/s)
V (cm/s)
Rotated to Principal Axes
Ur (cm/s)
Vr (cm/s)
100
0
-100
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Variability is seasonal
2004
2005


Western Bering Strait Mooring, 2004-2005 Preliminary Data
Temperature (°C)
4
2
0
-2
T_f
S O N D J F M A M J J A
Salinity (PSU)
34
33
32
31
30
29
Fall Freshening
S O N D J F M A M J J A
Pressure (db)
36
35
34
33
32
31
S O N D J F M A M J J A
2004
2005


Temperature (°C)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
29
29.5
30
30.5
31
31.5
32
32.5
33
33.5
34
Salinity


Western Bering Strait Mooring, 2004-2005 Preliminary Data
Channel 0 (V)
0
0.5
1
Fluorescence (mg/m3)
0
5
10
Channel 1 (V)
0
1
2
3
4
5
User Poly 1
0
5
10
15
20
25
S
O
N
D
J
F
M
A
M
J
J
A

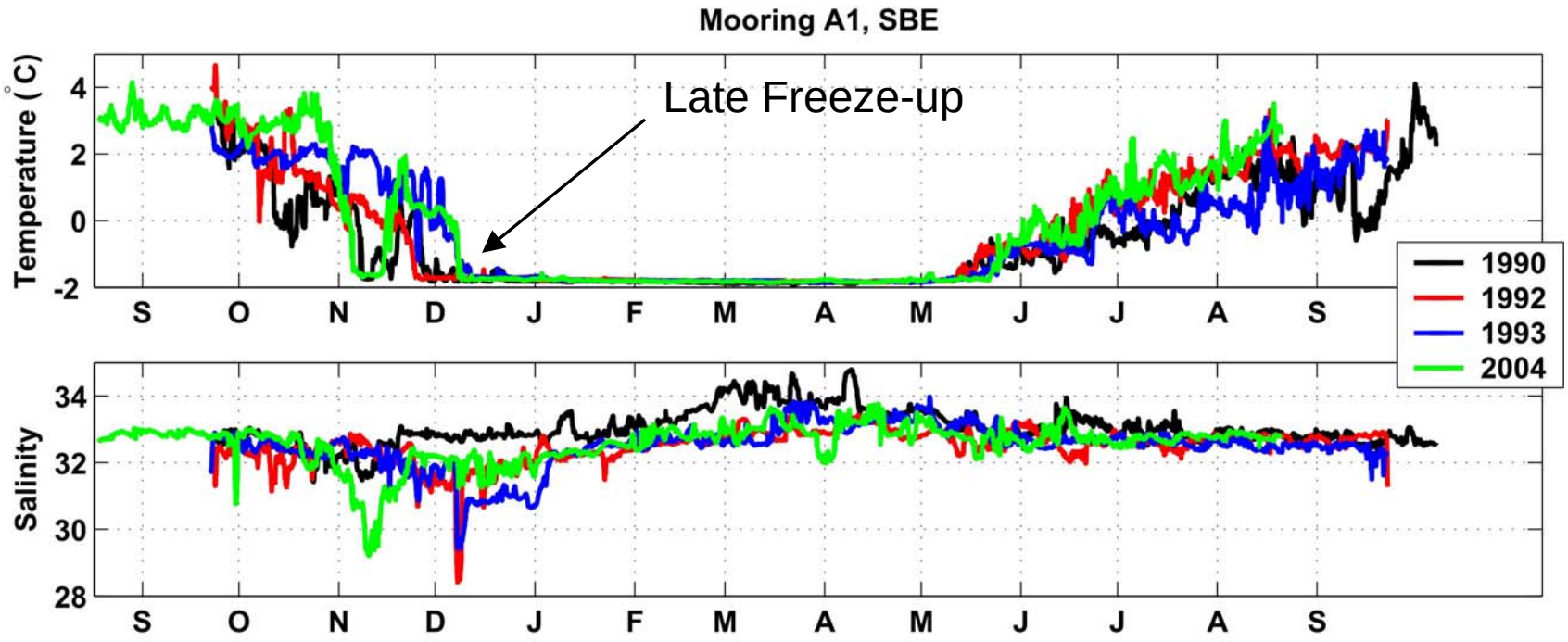


April 1

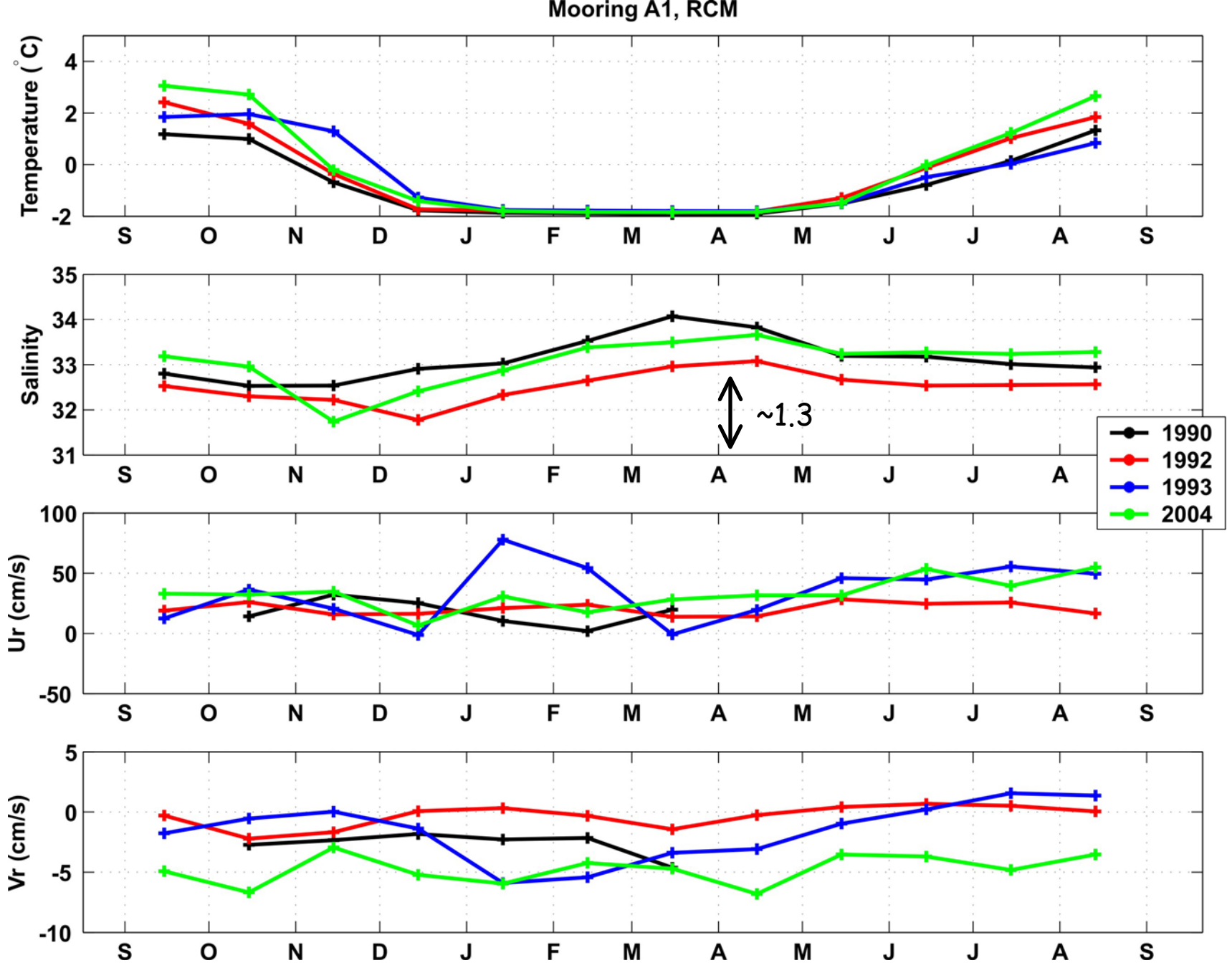
April 19

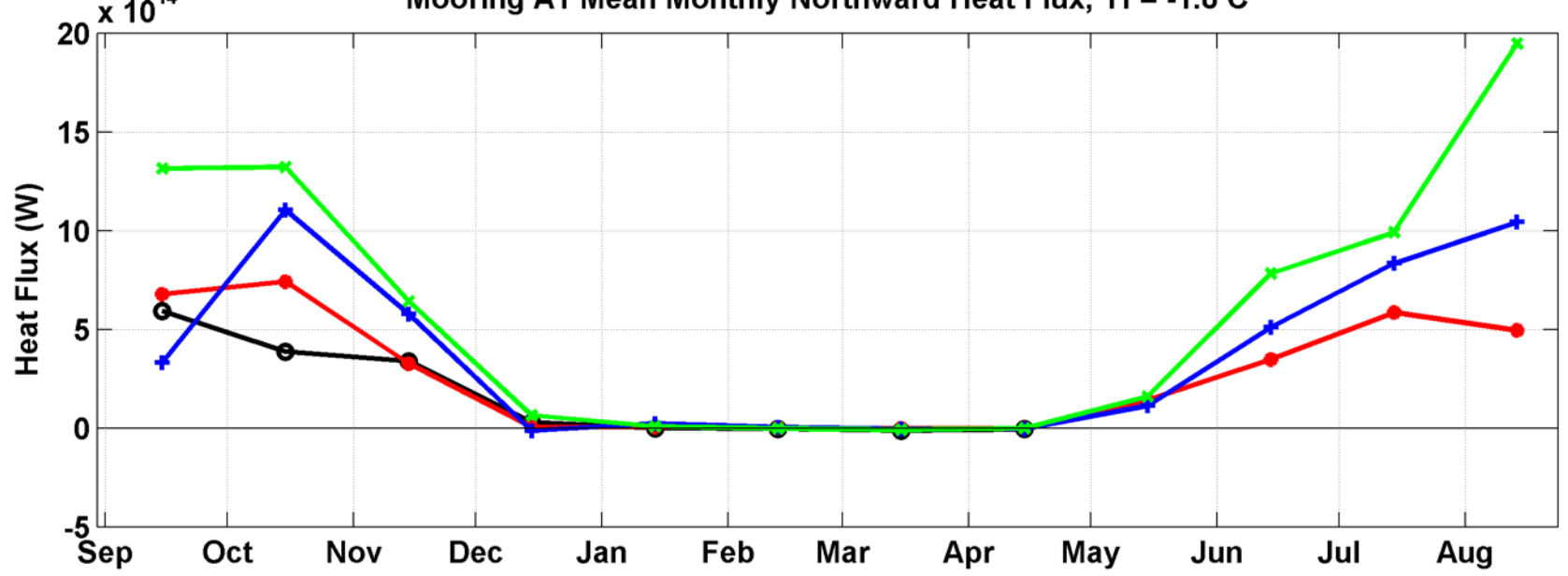
April 30

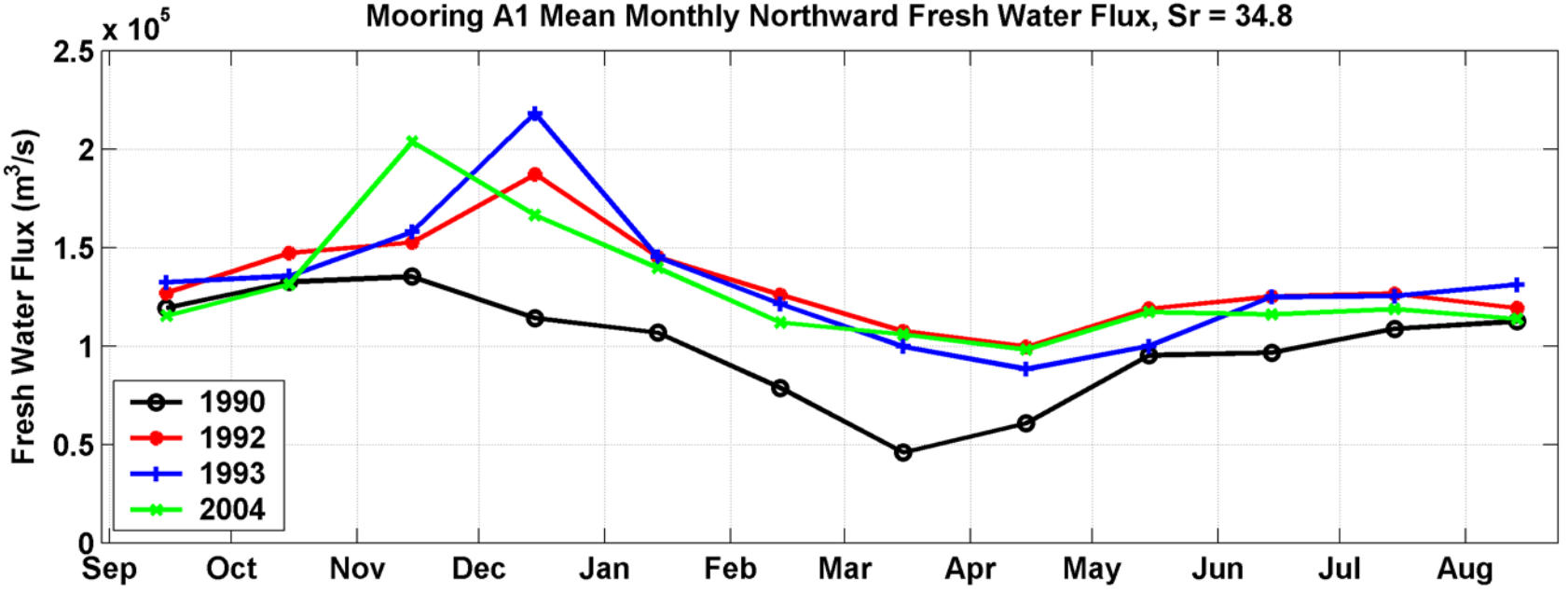
2005



Fall Freshening events Except 1990

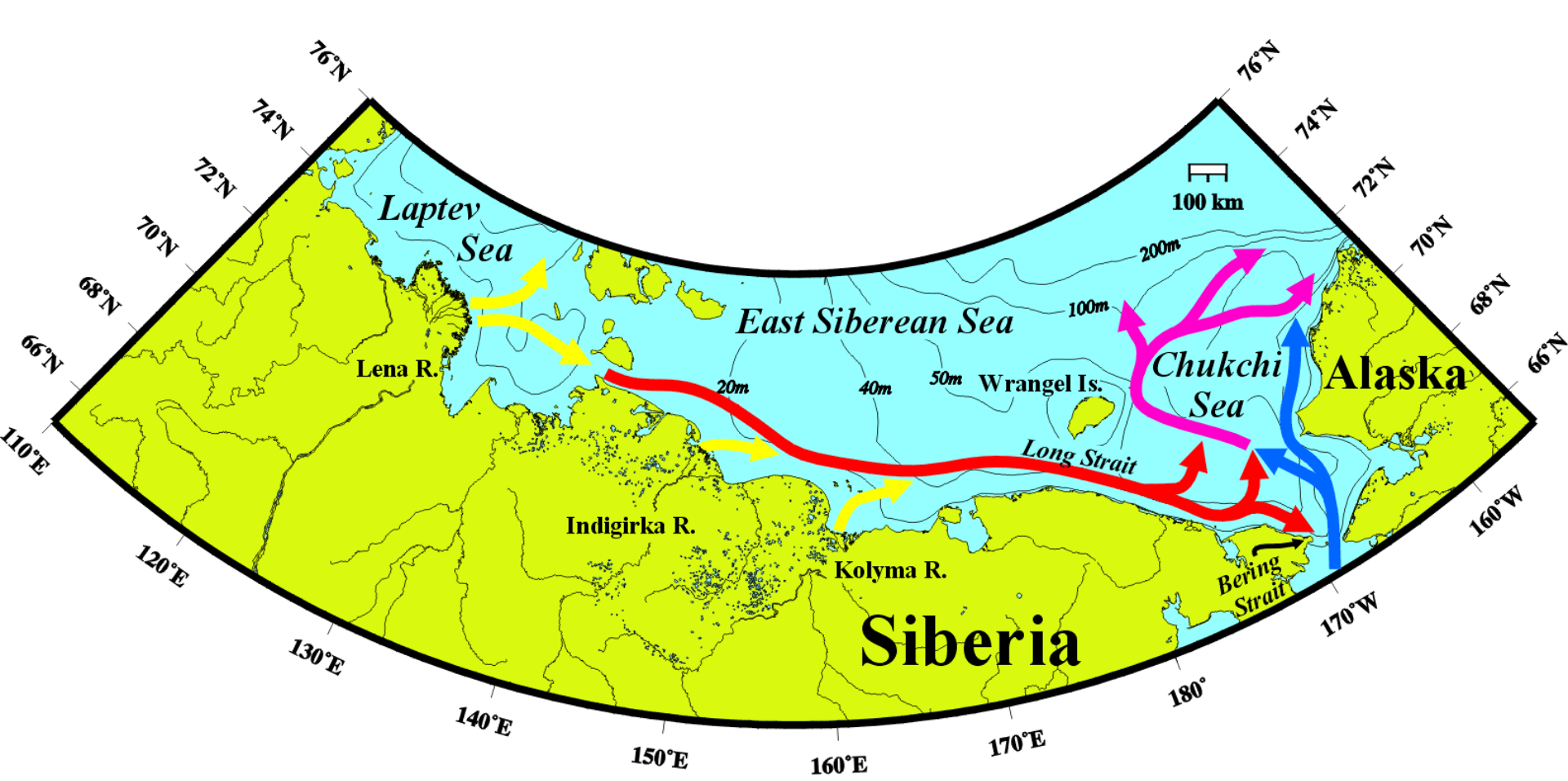

Mooring A1, RCM
Temperature (°C)
4
2
0
-2
S O N D J F M A M J J A S
Salinity
35
34
33
32
31
~1.3
1990
1992
1993
2004
Ur (cm/s)
100
50
0
-50
Vr (cm/s)
5
0
-5
-10


x 10^14
Heat Flux (W)
20
15
10
5
0
-5
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug

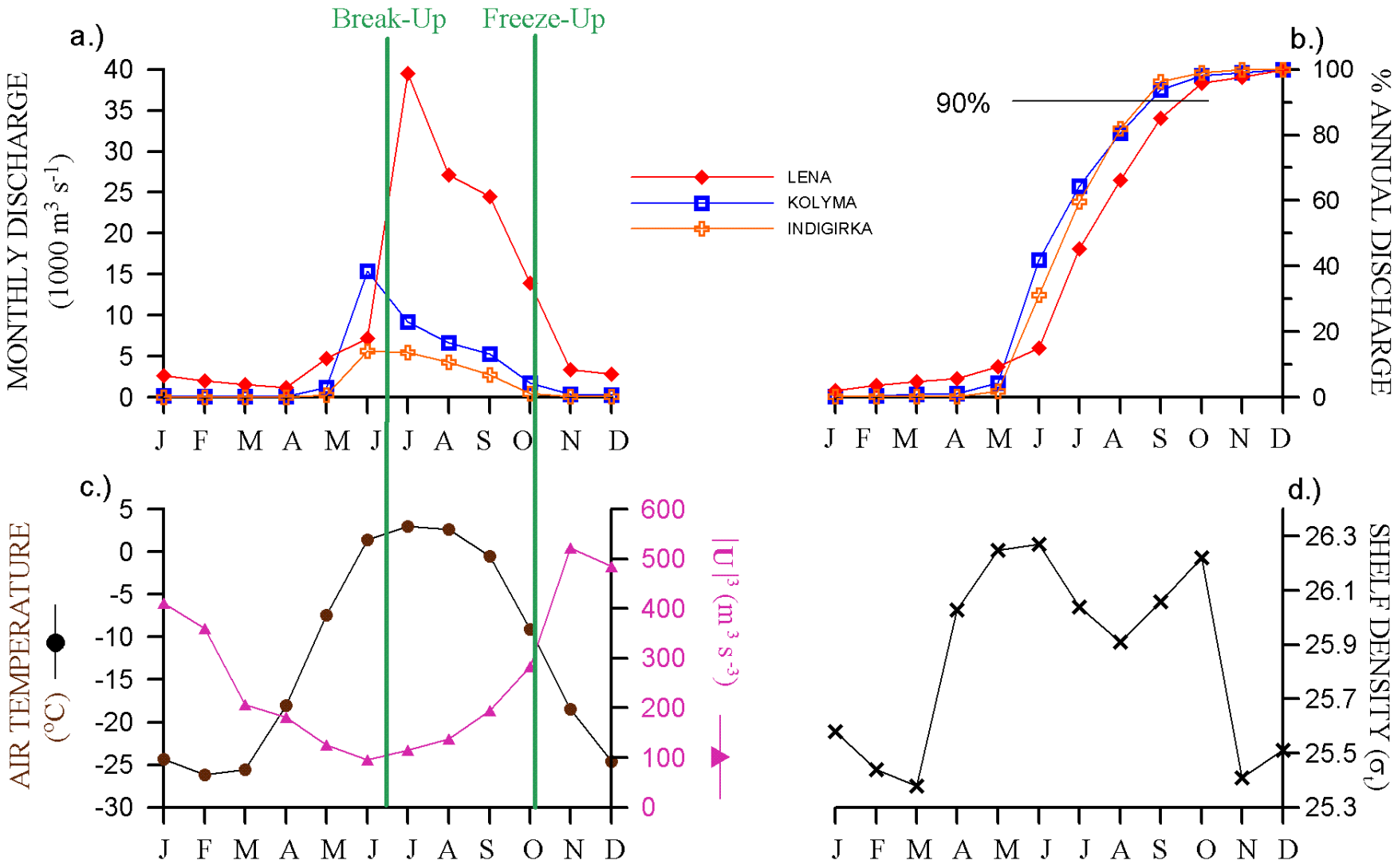

Mooring A1 Mean Monthly Northward Fresh Water Flux, Sr = 34.8
x 10^5
Fresh Water Flux (m^3/s)
2.5
2
1.5
1
0.5
0
1990
1992
1993
2004
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug

Comments:

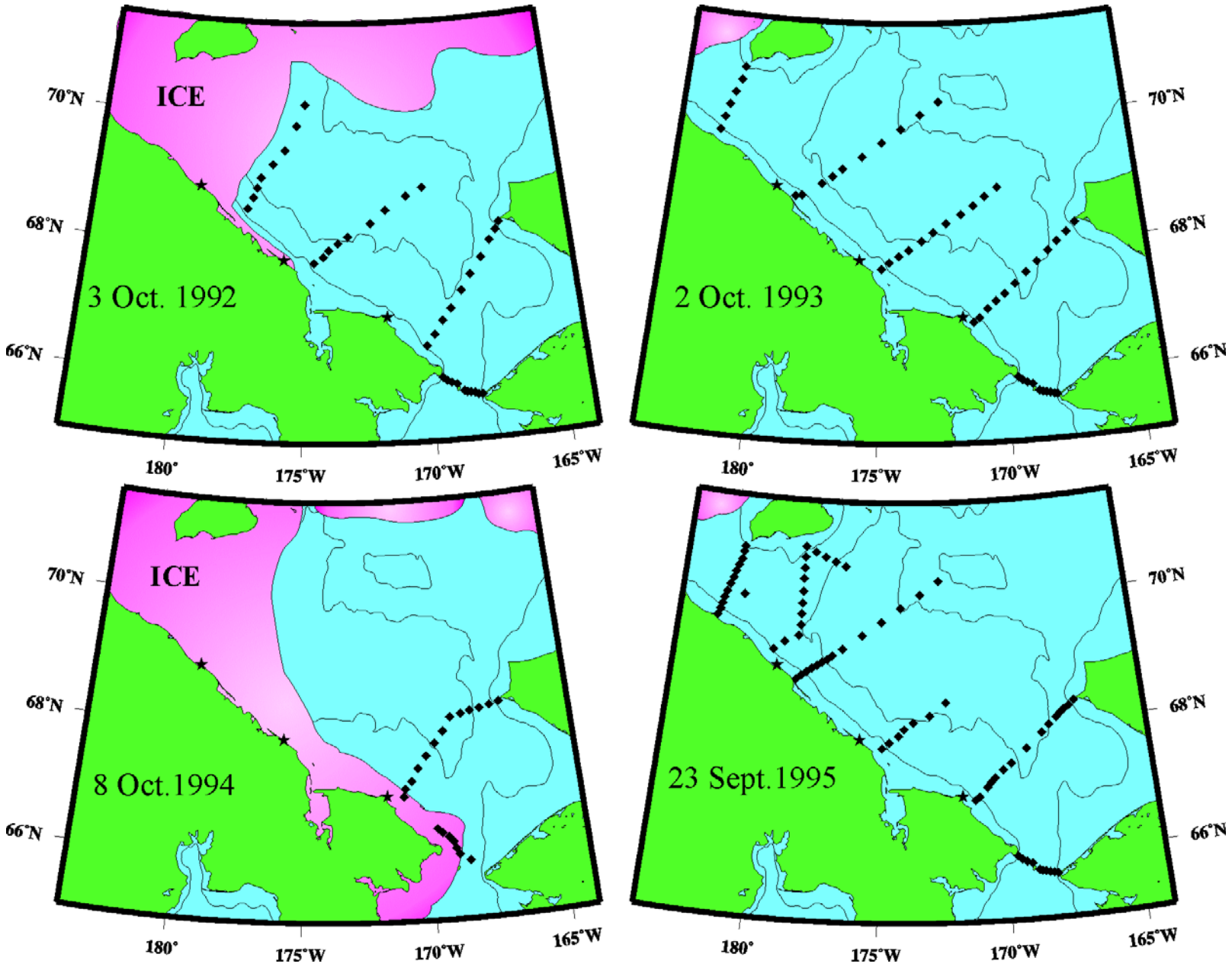
1. Data looks good
2. Temperatures in late summer-fall 2004 were ~1C warmer than previous years. Salinity not anomalous
3. Northward heat fluxes 2-3 times greater – affects onset of fall freeze-up and heat export into the Arctic Ocean.
4. Fall freshening events appear to affect the winter salinity increase (and thus halocline ventilation). Freshening is a 3-D process and not limited to the strait.
5. Fall northward flux of marine snow? Carbon transport (type and quantity) varies seasonally.
6. Fluorescence begins in mid-April – is it tied to leads?
7. Why is the duration of the waters with $T = T_f$ in the strait constant (Dec-May) although the Bering Sea ice edge extent has varied tremendously?

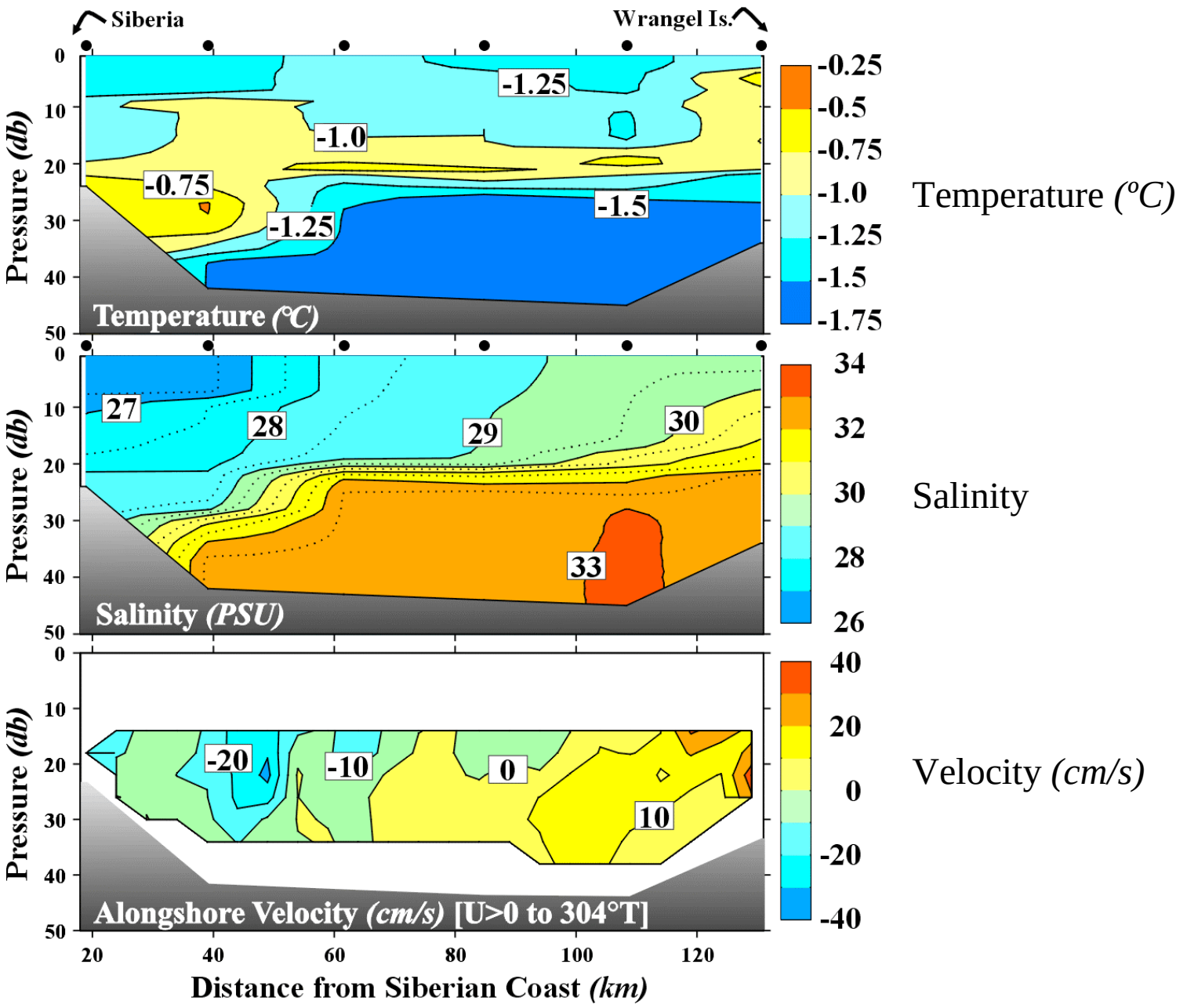

76°N
74°N
72°N
70°N
68°N
66°N
110°E
120°E
130°E
140°E
150°E
160°E
170°E
180°
170°W
160°W
Laptev Sea
East Siberean Sea
Chukchi Sea
Lena R.
Indigirka R.
Kolyma R.
Wrangel Is.
Long Strait
Bering Strait
Siberia
Alaska
100 km
200m
100m
50m
40m
20m

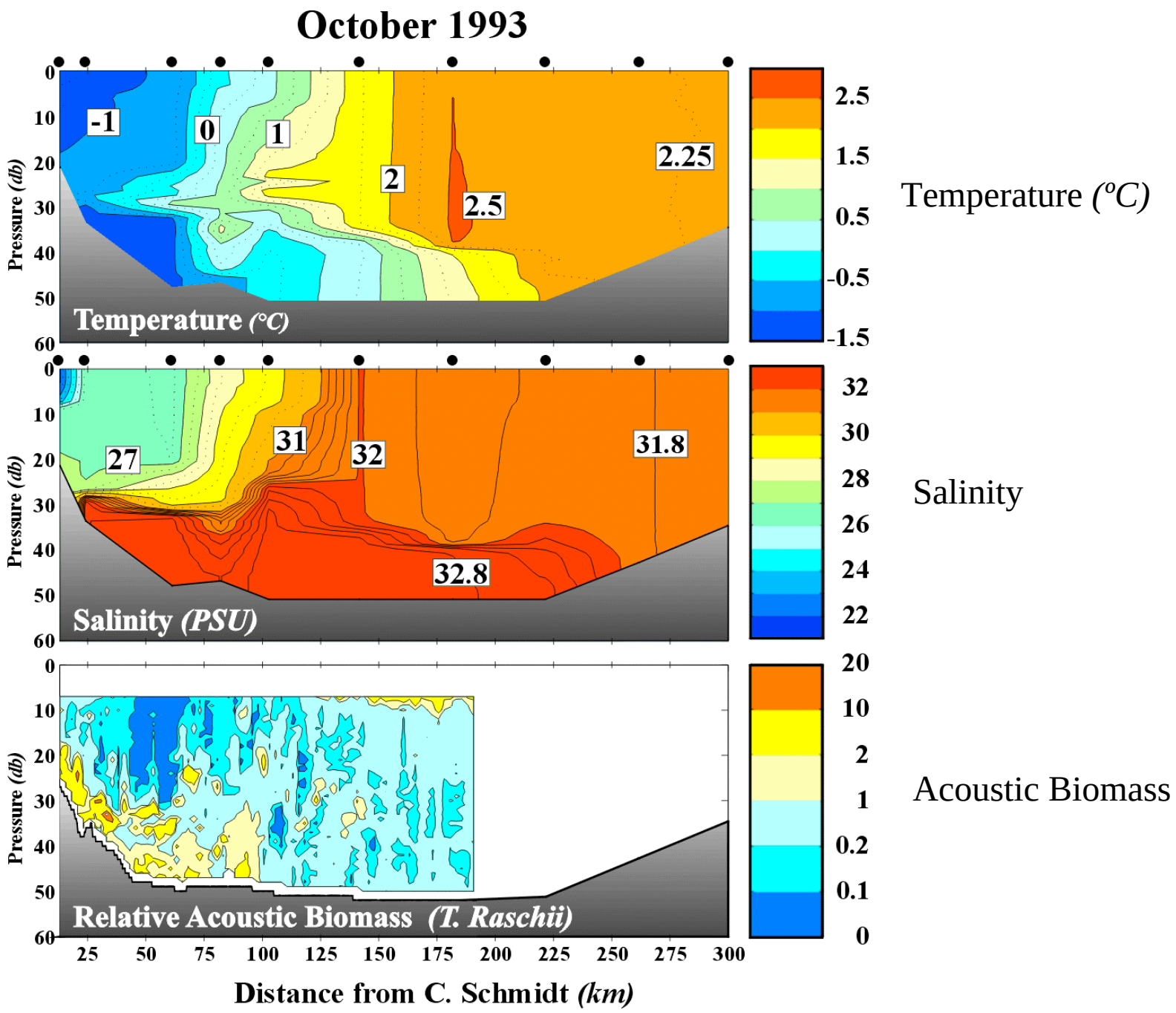
ANNUAL CYCLE OF CLIMATOLOGICAL FACTORS THAT AFFECT MIXING

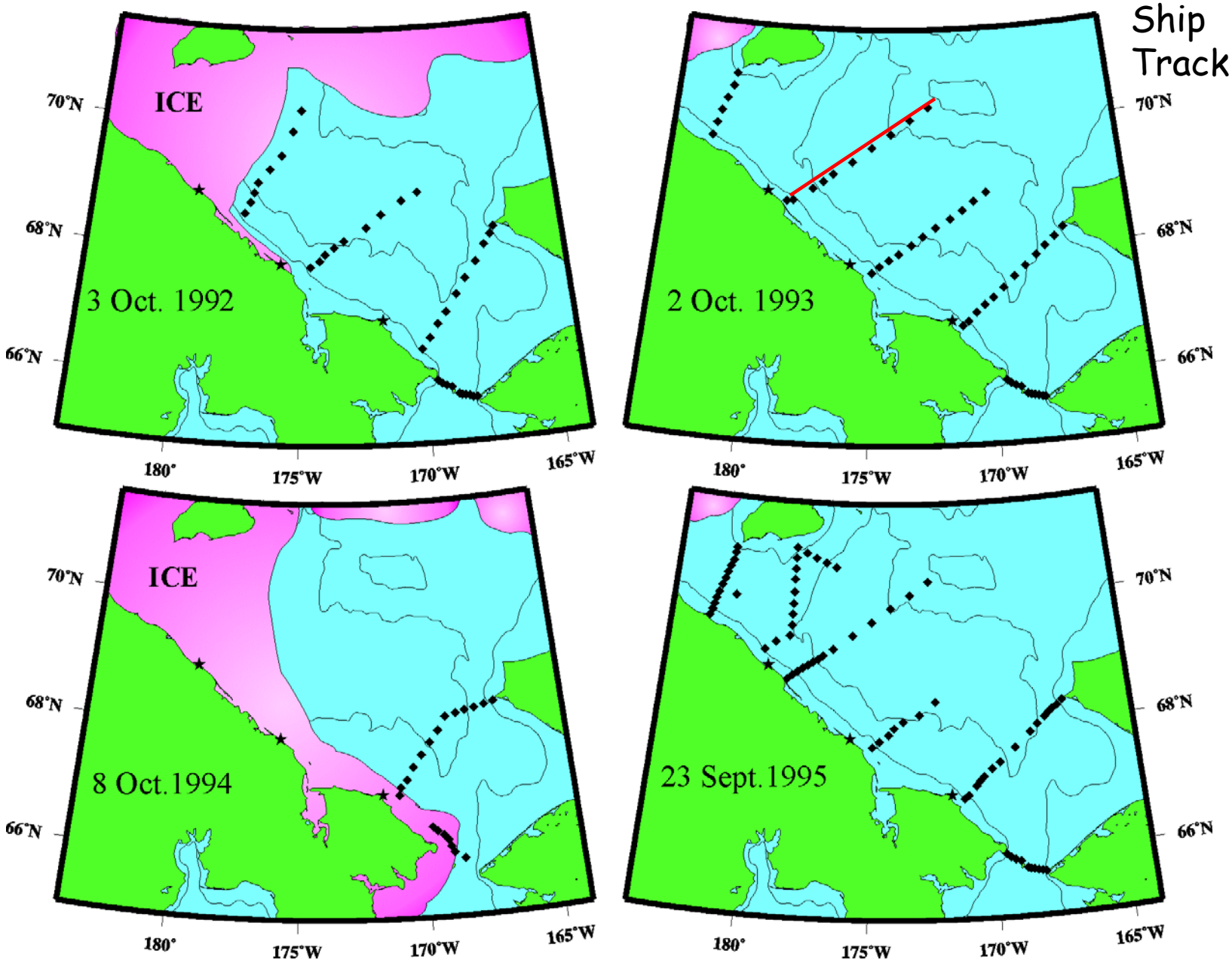


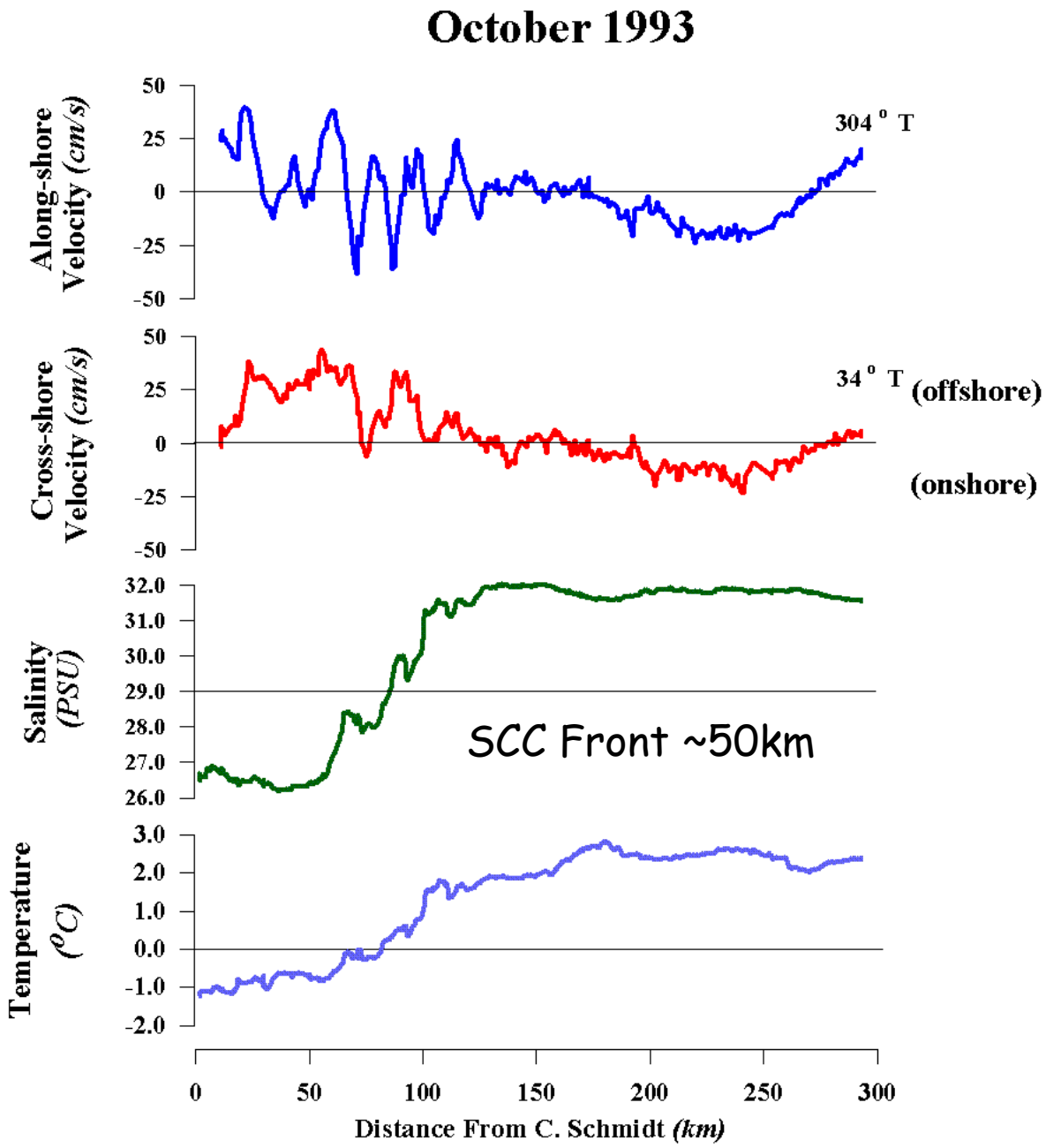
a) Mean monthly discharge, b) cumulative percentage discharge, c) air temperature and $|U|^3$ (proportional to the rate of working by the wind on the water), and d) the annual cycle of shelf water density (as measured at a site on the central Chukchi shelf).

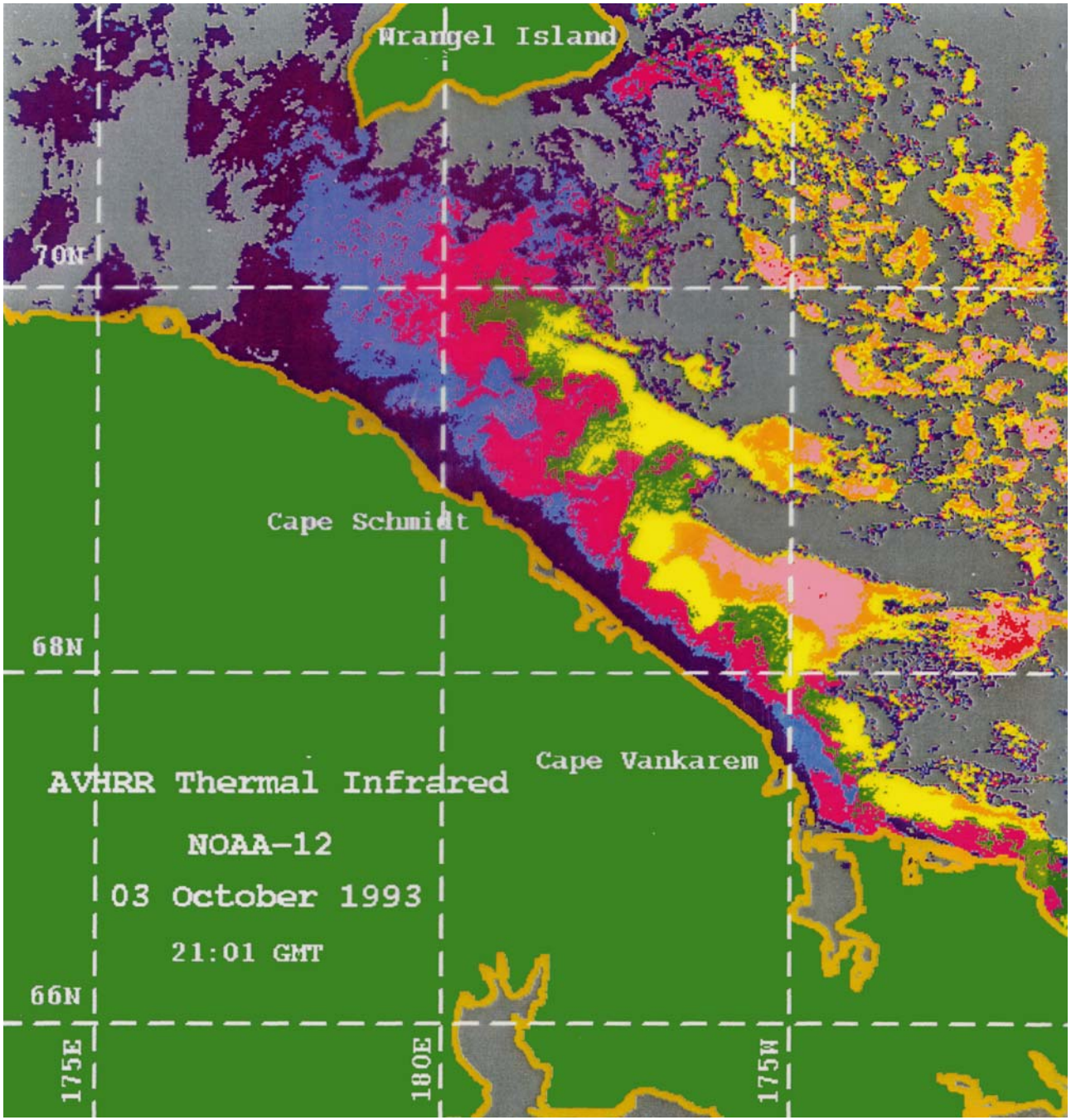

ICE
3 Oct. 1992
70°N
68°N
66°N
180°
175°W
170°W
165°W
ICE
8 Oct.1994
2 Oct. 1993
23 Sept.1995

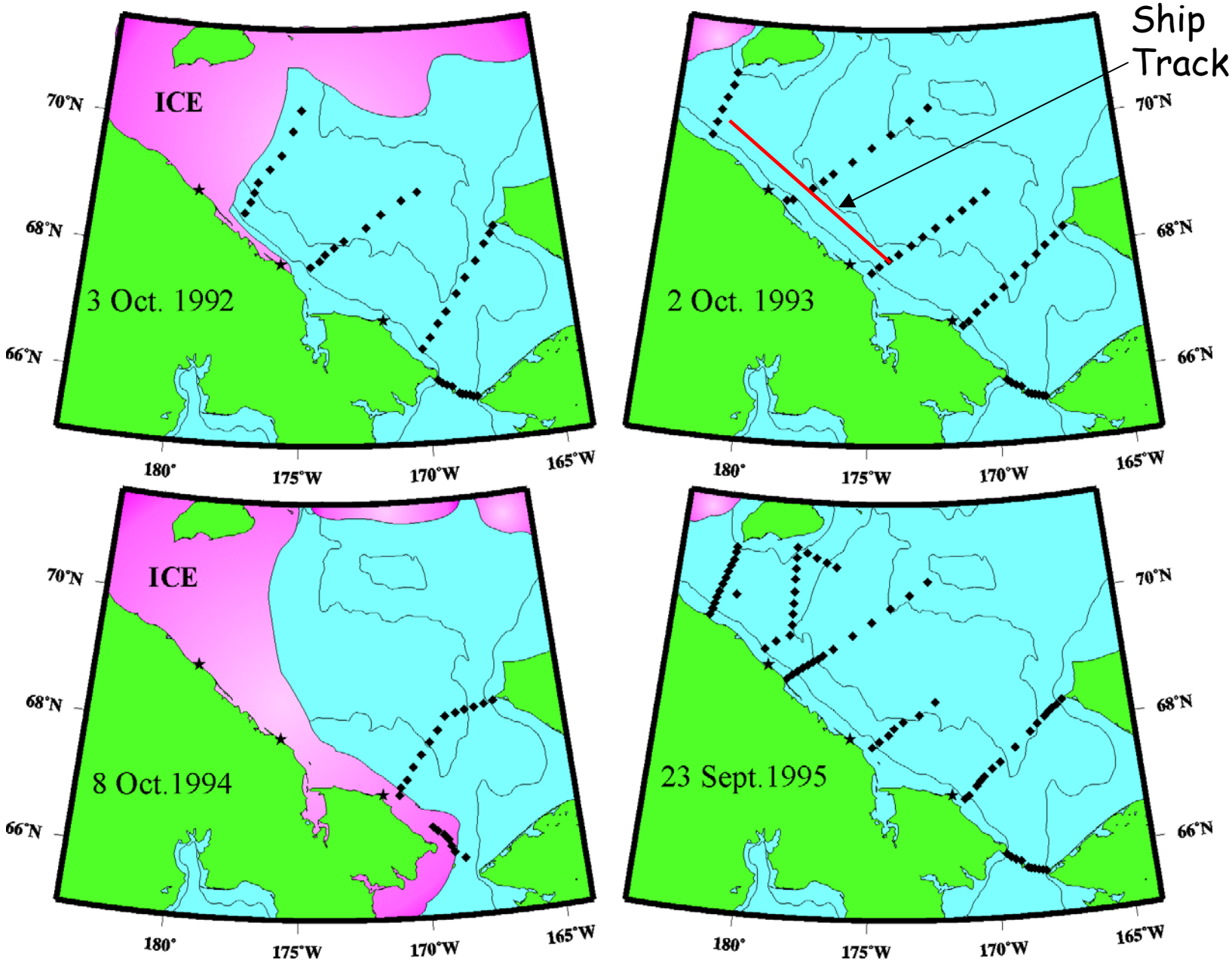

Long Strait: October 1993
Siberia
Wrangel Is.
Pressure (db)
Temperature (°C)
-1.25
-1.0
-0.75
-1.5
-1.25
-0.25
-0.5
-0.75
-1.0
-1.25
-1.5
-1.75
Temperature (°C)
Salinity (PSU)
27
28
29
30
33
34
32
30
28
26
Salinity
Alongshore Velocity (cm/s) [U>0 to 304°T]
-20
-10
0
10
40
20
0
-20
-40
Velocity (cm/s)
0
10
20
30
40
50
20
40
60
80
100
120
Distance from Siberian Coast (km)

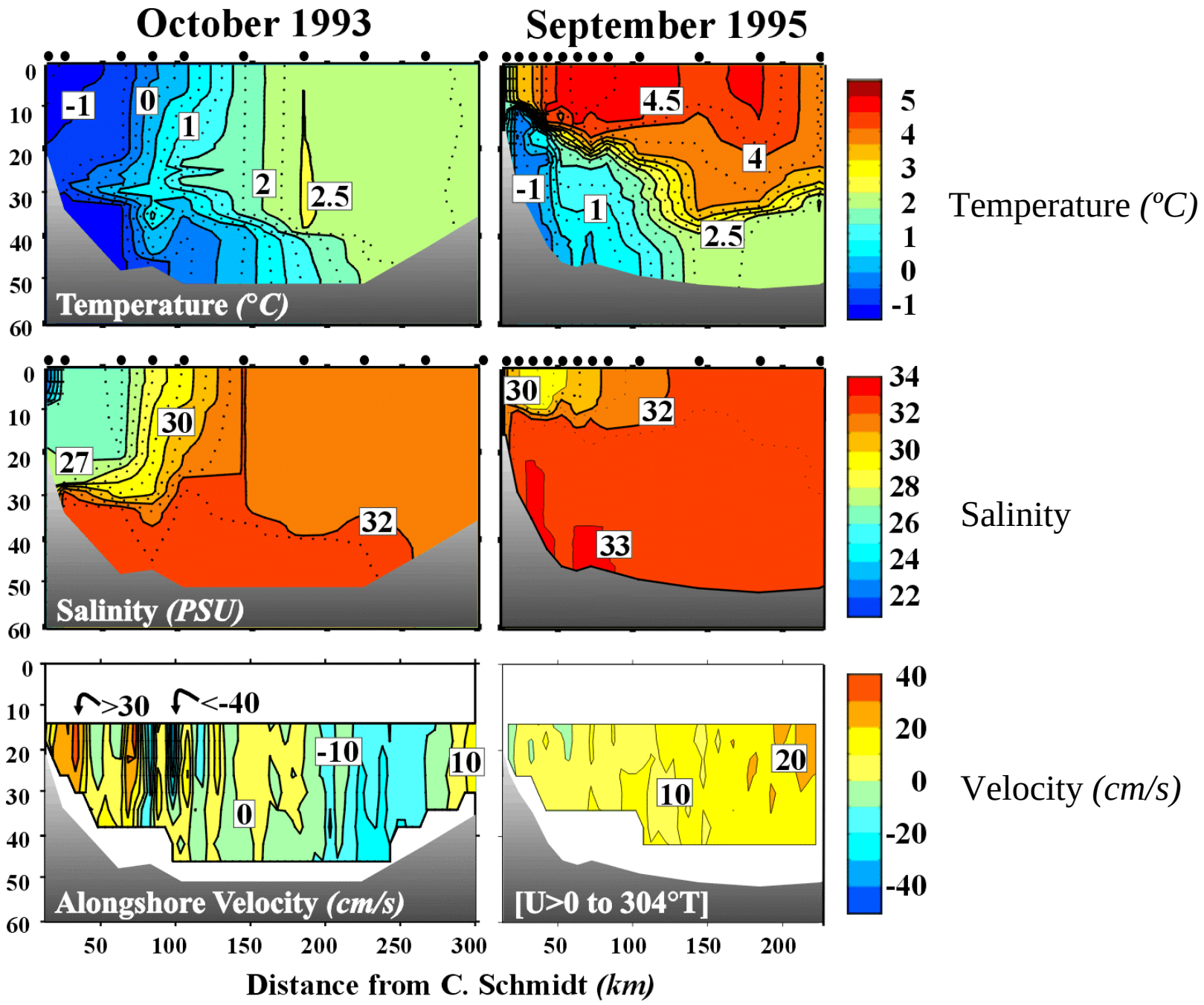

October 1993
Pressure (db)
0
10
20
30
40
50
60
-1
0
1
2
2.5
2.25
Temperature (°C)
2.5
1.5
0.5
-0.5
-1.5
Temperature (°C)
27
31
32
31.8
32.8
Salinity (PSU)
32
30
28
26
24
22
Salinity
Relative Acoustic Biomass (T. Raschii)
20
10
2
1
0.2
0.1
0
Acoustic Biomass
25
50
75
100
125
150
175
200
225
250
275
300
Distance from C. Schmidt (km)


ICE
3 Oct. 1992
70°N
68°N
66°N
180°
175°W
170°W
165°W
Ship
Track
2 Oct. 1993
ICE
8 Oct.1994
23 Sept.1995


October 1993
Along-shore Velocity (cm/s)
50
25
0
-25
-50
304 ° T
Cross-shore Velocity (cm/s)
50
25
0
-25
-50
34 ° T
(offshore)
(onshore)
Salinity (PSU)
32.0
31.0
30.0
29.0
28.0
27.0
26.0
SCC Front ~50km
Temperature (°C)
3.0
2.0
1.0
0.0
-1.0
-2.0
0
50
100
150
200
250
300
Distance From C. Schmidt (km)


Wrangel Island
70N
Cape Schmidt
68N
Cape Vankarem
AVHRR Thermal Infrared
NOAA-12
03 October 1993
21:01 GMT
66N
175E
180E
175W

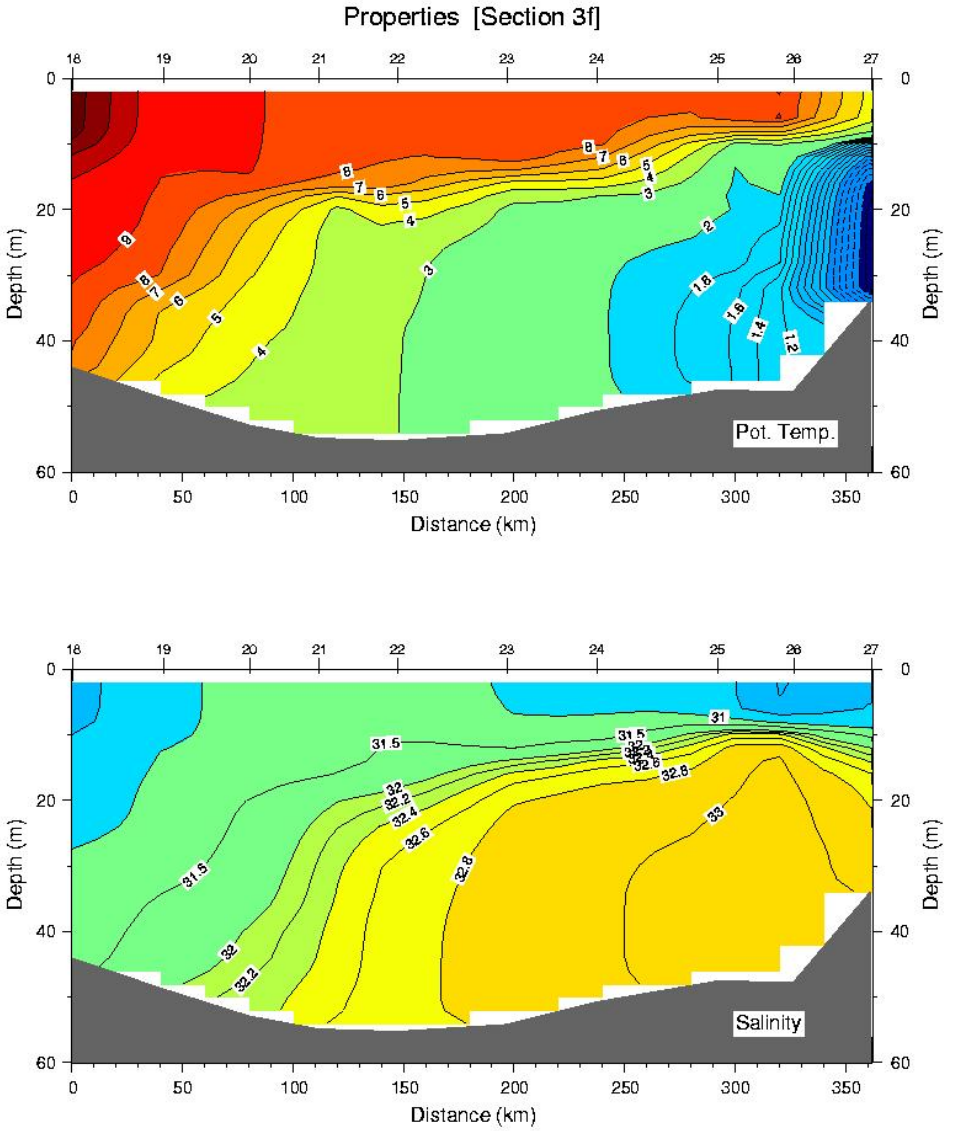

ICE
3 Oct. 1992
70°N
68°N
66°N
180°
175°W
170°W
165°W
Ship
Track
2 Oct. 1993
ICE
8 Oct.1994
23 Sept.1995


October 1993
September 1995
Temperature (°C)
Salinity (PSU)
Alongshore Velocity (cm/s)
[U>0 to 304°T]
>30
<-40
Distance from C. Schmidt (km)
Temperature (°C)
Salinity
Velocity (cm/s)

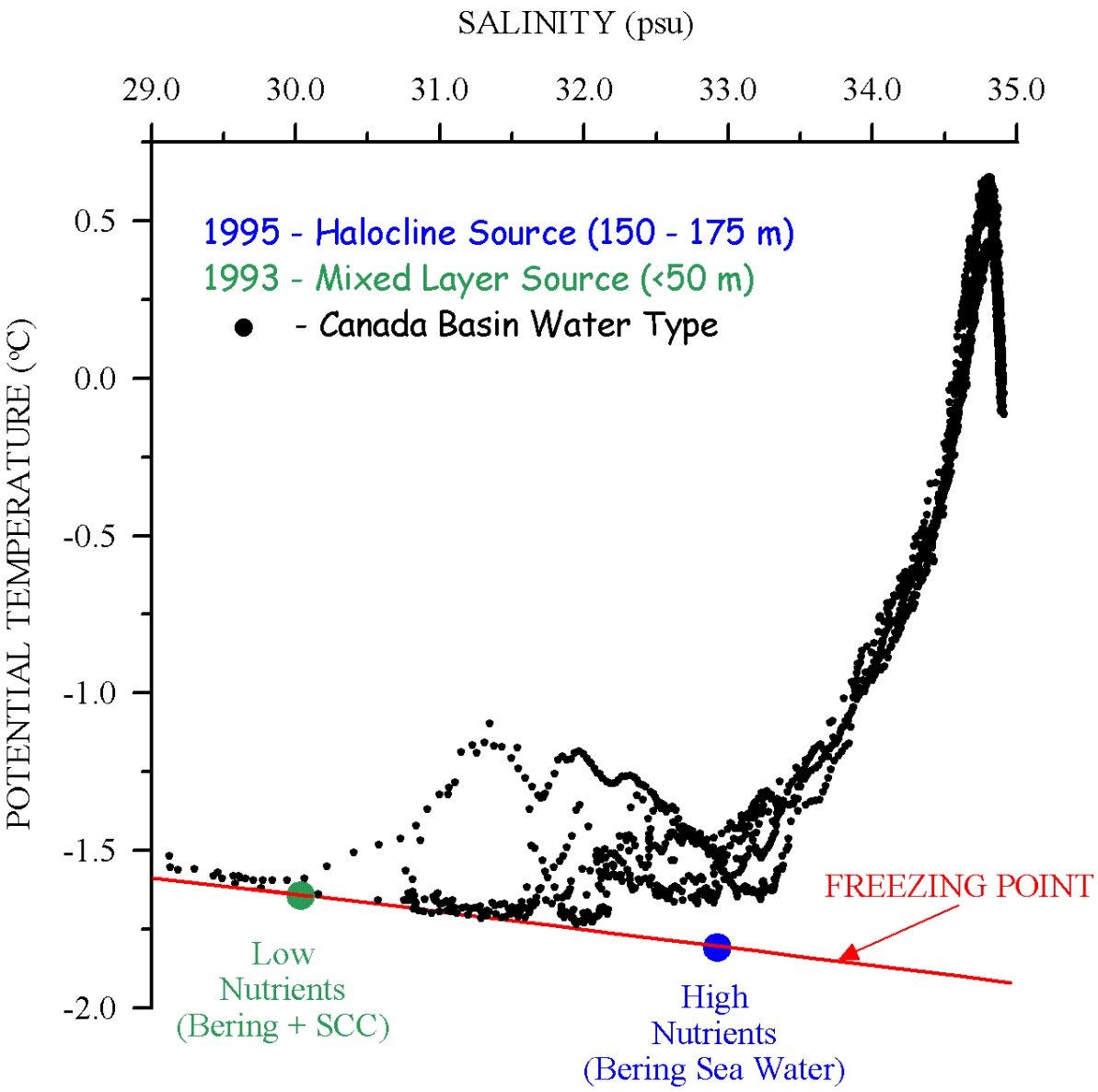
RUSALCA 2004

Alaska

Siberia



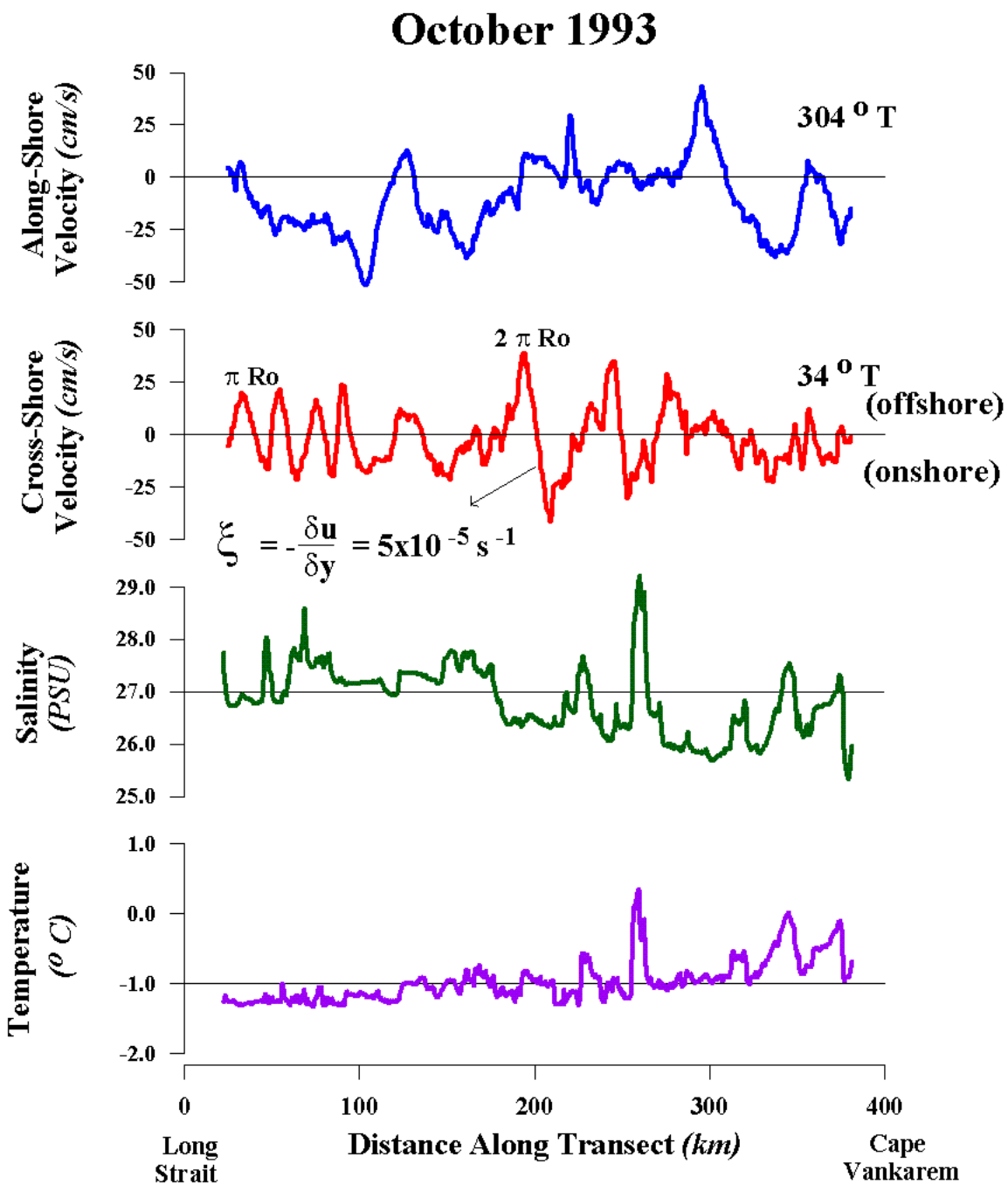
HYPOTHETICAL WINTER WATER MASSES
WESTERN CHUKCHI SEA 1993 VS. 1995



The SCC is a broad current carrying Siberian river water southwestward onto the Chukchi shelf. It has a well-developed front that is unstable (energetic eddies and meanders) . Habitats? Cross-shore transports?

It does not appear to have been well-developed during RUSLACA 2004 – the unusual situation. (Bering Sea Water instead of Siberian Coastal Water along Chukotka).

So how representative is RUSALCA 2004 with respect to the near-shore environment?


October 1993
Along-Shore Velocity (cm/s)
50
25
0
-25
-50
304 o T
Cross-Shore Velocity (cm/s)
π Ro
2 π Ro
34 o T
(offshore)
(onshore)
ξ = -δu/δy = 5x10 -5 s -1
Salinity (PSU)
29.0
28.0
27.0
26.0
25.0
Temperature (o C)
1.0
0.0
-1.0
-2.0
0
100
200
300
400
Long Strait
Distance Along Transect (km)
Cape Vankarem

EDDY BUOYANCY FLUXES

Long Strait - Cape VanKarem : $\overline{u'\rho'} = -2 \times 10^{-2}$ kg-m^{-2}

$\iint \overline{u'\rho'} dz dy = -1.5 \times 10^{5}$ kg-s^{-1} *out of SCC*

$dz = 20$ m; $dy = 400$ km

Jul - Sept. average discharge (Kolyma +Indigirka): $Q = 15000$ m^3-s^{-1}

$\rho' \sim -20$ kg-m^{-3}

$Q\rho' \sim 3 \times 10^{5}$ kg-s^{-1} *to SCC*

Moreover, from *Spall and Chapman* [1998] :

$\overline{u'\rho'} = c_e V_m \Delta\rho$; $c_e \sim 0.02 - 0.04$

Long Strait: V_m : 20 cm-s^{-1}; $\Delta\rho$: 4 kg-m^{-3}

Long Strait - Cape VanKarem : $\overline{u'\rho'} = -2 \times 10^{-2}$ kg-m^{-2}

$c_e \sim 0.02 - 0.03$

Suggesting:

1. The instabilities might be important for the offshore dispersal of freshwater, and
2. The Spall and Chapman parameterization might usefully be applied in Arctic GCMs.