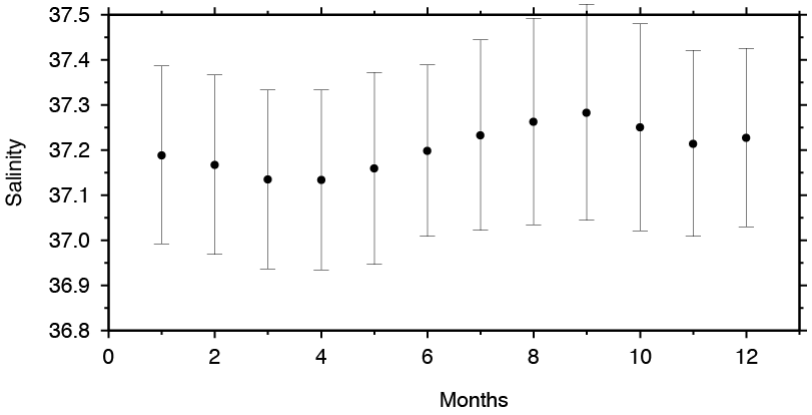
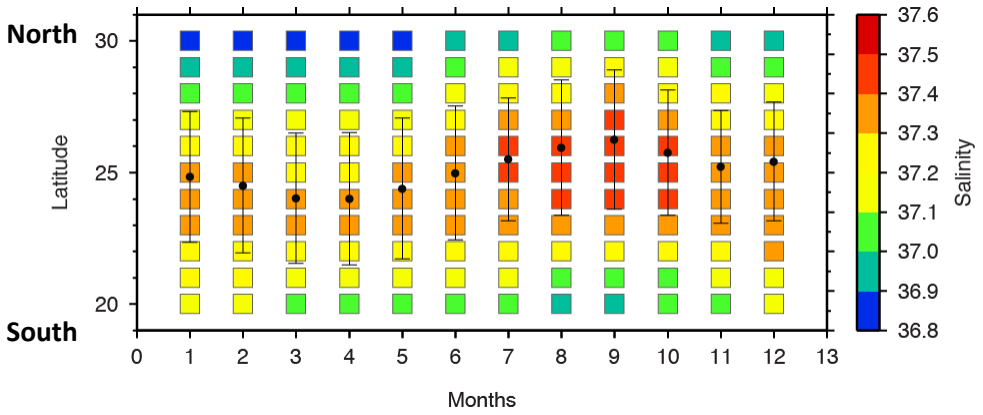
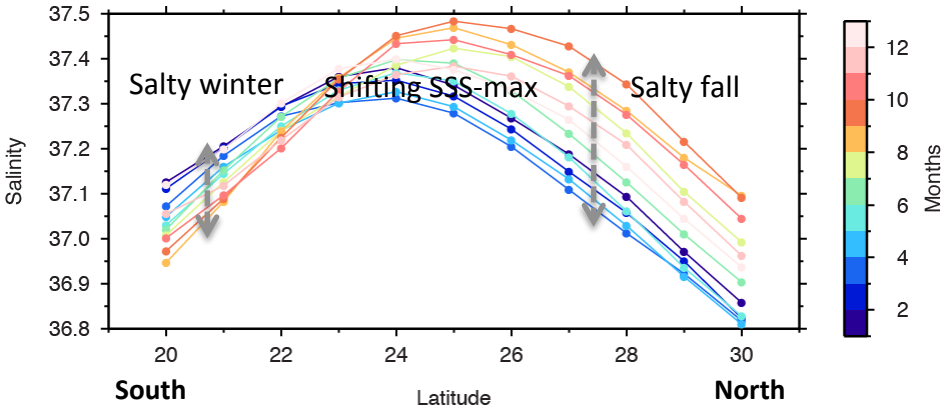
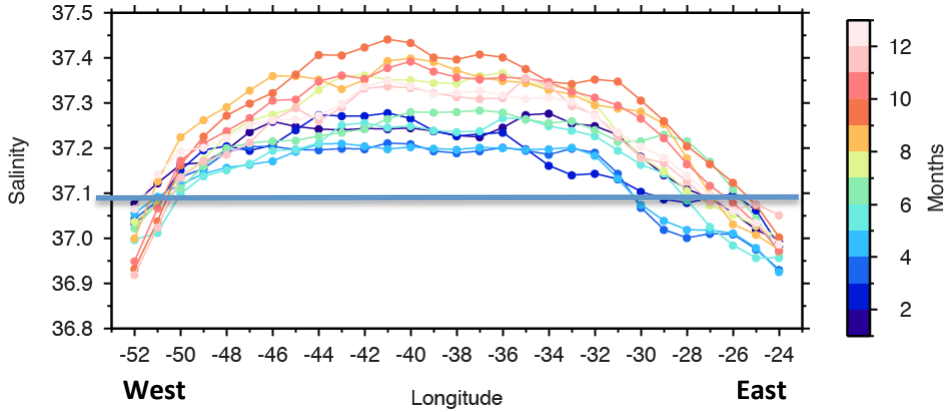
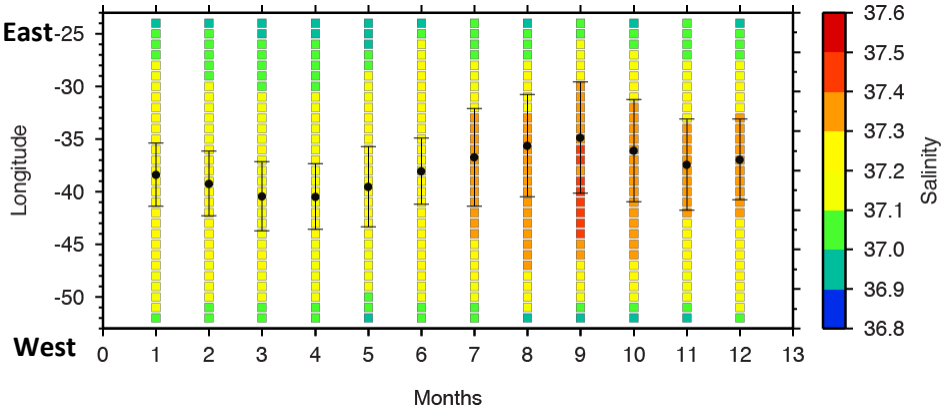
Average of SSS within 20-30N;52-24W (using SSS after objective analysis)

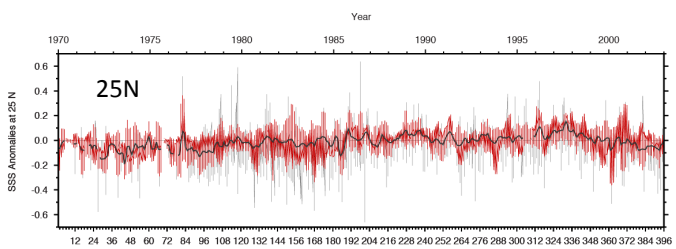




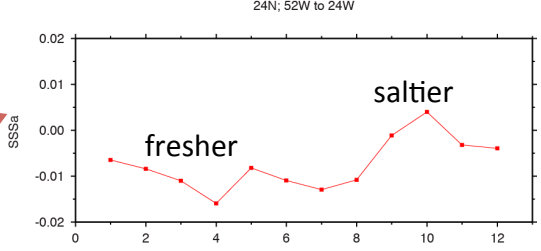


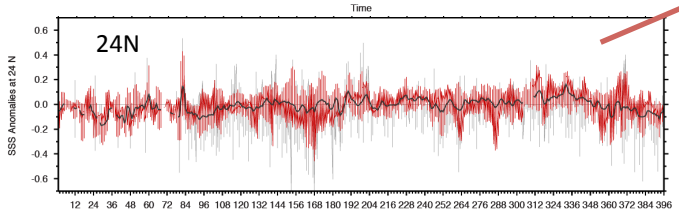


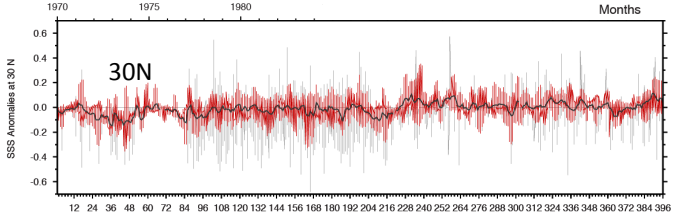


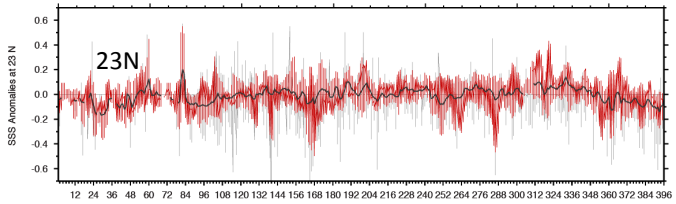


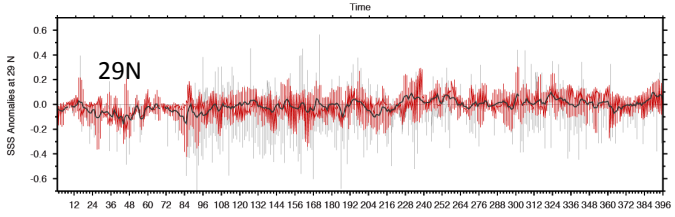
SSS anomalies at different latitudes within 52W-24W



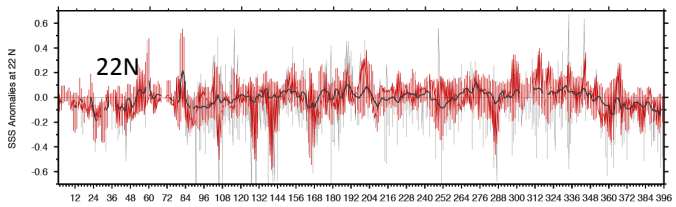


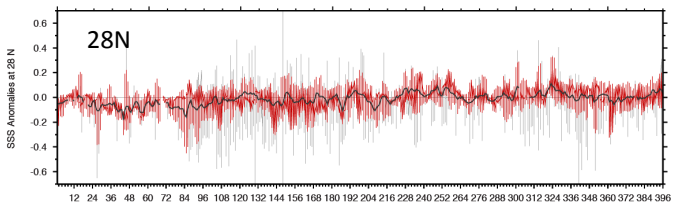


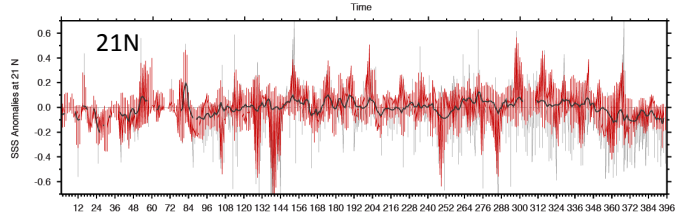


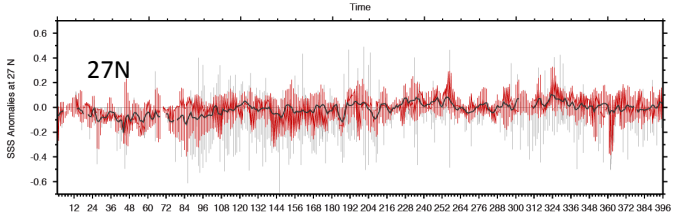


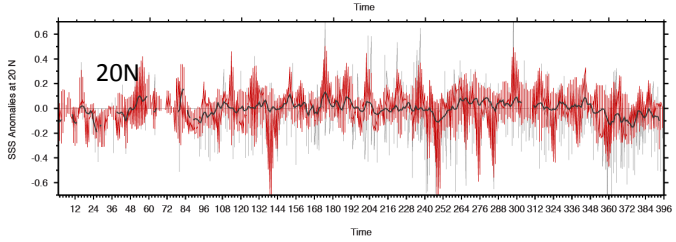
Larger eddy SSS events south of SSS-max

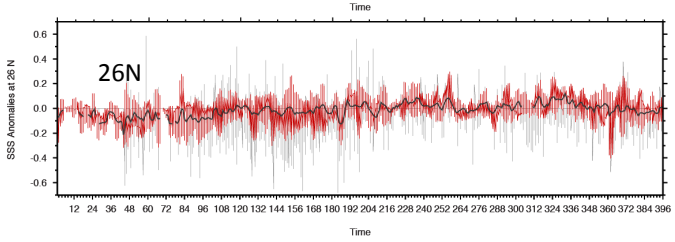




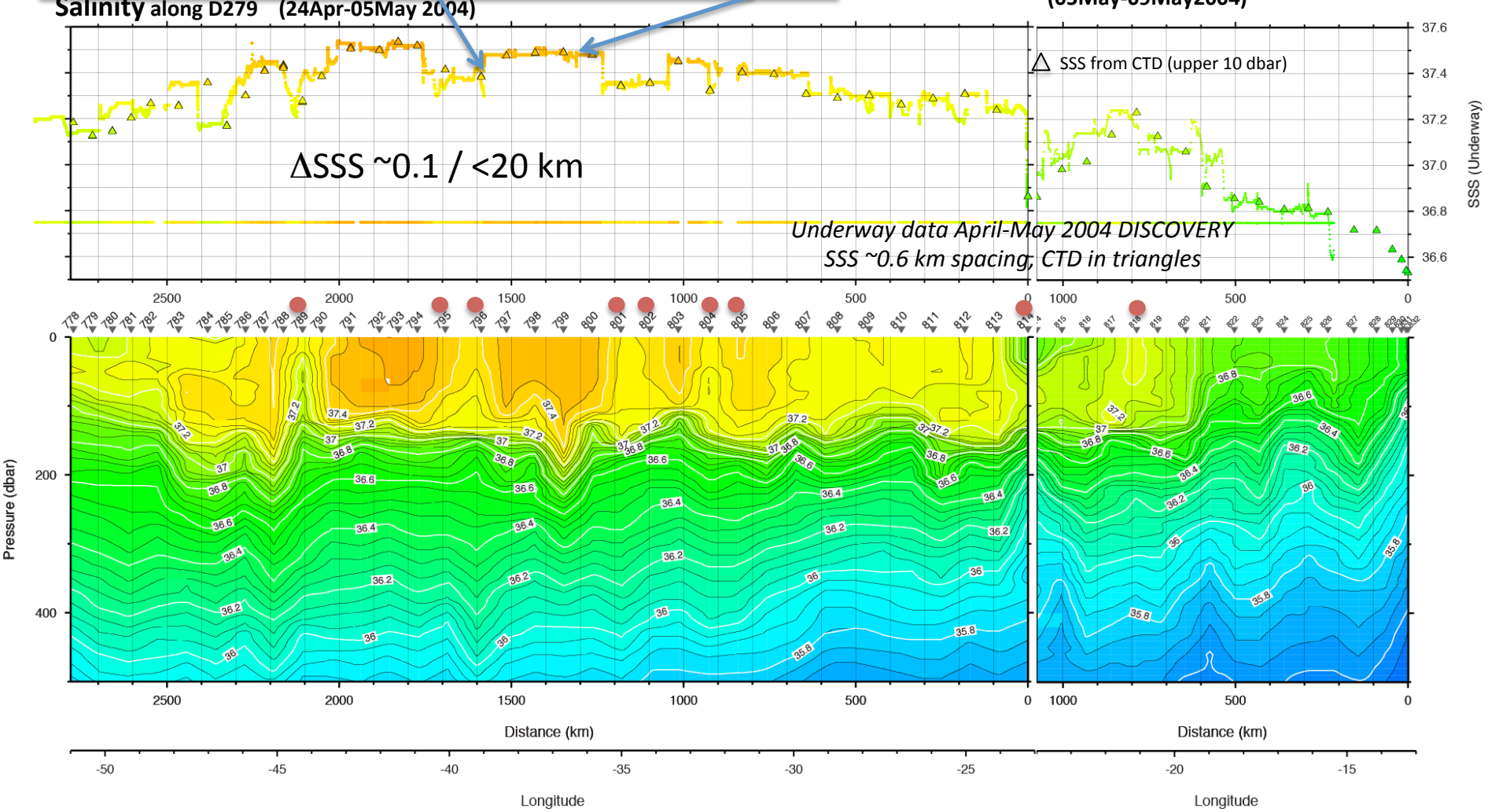


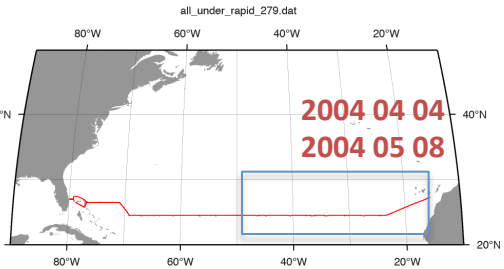






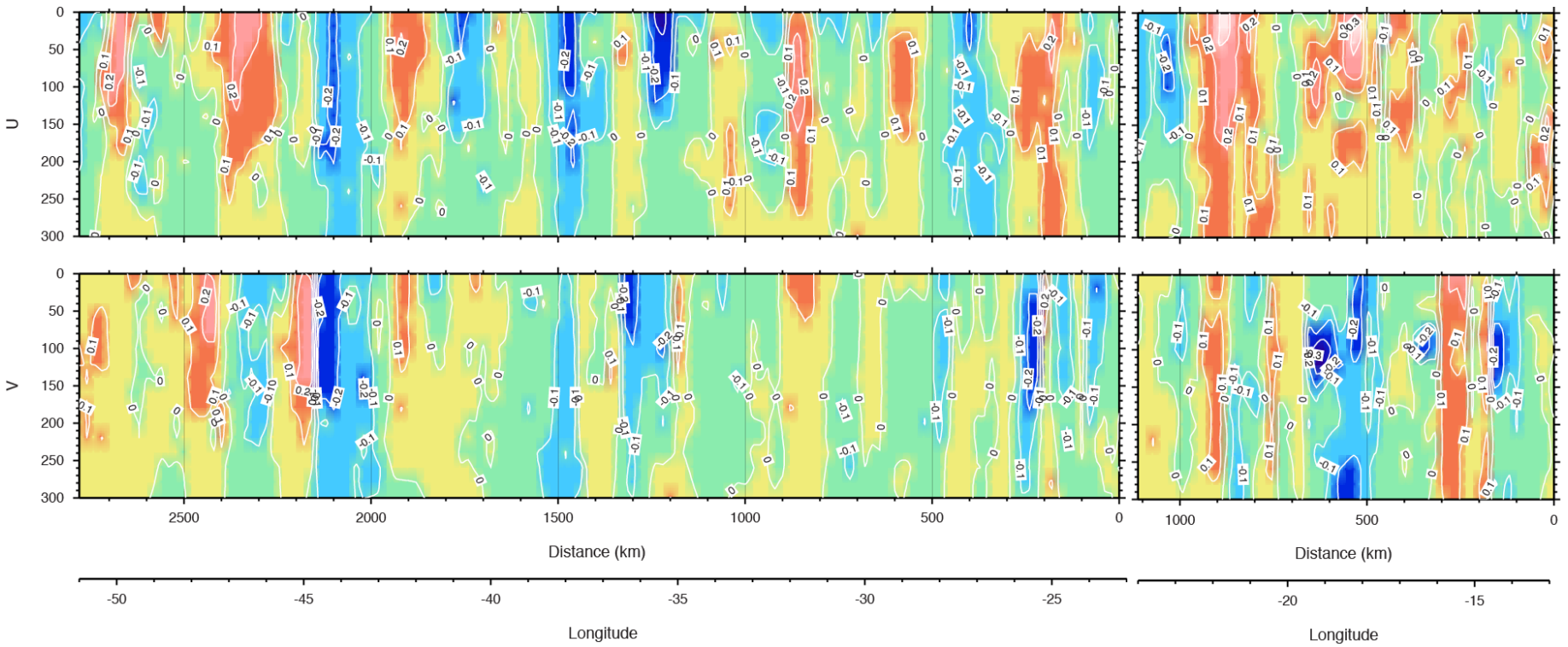
Box structure? Sharp fronts separate SSS plateaus



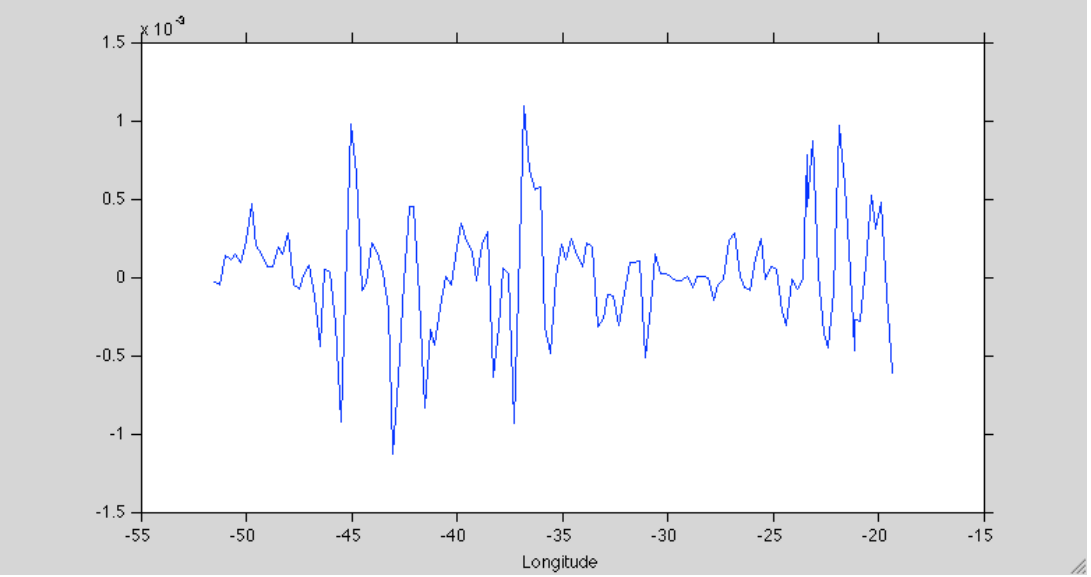


● Stations where we have vertical profiles and T/S plots (in the plots, later on, we have identified those stations and the neighboring stations as well).

SADCP D279 (24Apr-05May 2004)



Grid 20x20



The freshwater flux is the integral over area A of the correlation between the velocity component normal to the section and salinity anomaly relative to a reference value S_0, here chosen to be 34.8 so as to be comparable to previous estimates of freshwater fluxes at Arctic gateways (Melling 2000):

$$F = \int_A f_A(x, z)\, dA, \qquad (9)$$

where

$$f_A(x, z) = V(x, z)\{1 - [S(x, z) + s_t]/S_0\}.$$

The salinity $S(x, z) + s_t$ and along-channel speed $V(x, z)$ are shown in Fig. 6c and Fig. 11, respectively, where the velocity, but not the salinity field has the tidal variability removed. The variable s_t indicates the unknown tidal component of the salinity field. Recall from our

From Munchow et al, 2006

Mass, salt and freshwater transports through a vertical section are given by

$$M = \rho v\, dA$$
$$S = \rho s v\, dA \qquad (2a, b, c)$$
$$F = M - S = \rho v(1 - s)\, dA$$

Here ρ, v and s are density (kg m^{-3}), velocity normal to the vertical area (m/s) and salinity as reported in full mks units (kg/kg), that is, the usual salinity multiplied by 0.001 kg/g. There is no net salt transport ($S = 0$) when (2) is integrated over a vertical section, for which $dA = da\, dz$ where a is the along-section coordinate and z is depth, and where the section (or section plus a strait flow) is closed so that mass must be nearly conserved. Mass and freshwater transport are balanced by precipitation/evaporation/runoff ($P - E + R$) in the area enclosed by the section(s). Following Wijffels et al. (1992), this is expressed as

$$\delta = E - P - R = \oint \rho v\, dA$$
$$0 = \oint \rho v s\, dA \qquad (3a, b, c)$$
$$\delta = E - P - R = \oint \rho v \left(1 - \frac{s}{s_o}\right) dA$$

where v is velocity, positive relative to the inward normal to the closed contour. (That is, if there is net transport of freshwater into the closed region, then there must be net evaporation in the region.) The arbitrary constant s_o is chosen to be 34.9, which is close to the mean salinity of 34.83 for all sections used (see below). The integral on the RHS of (3c) is called the *freshwater transport*, and is in units of kg/s. Transports are listed here throughout as Sverdrups (Sv) since this is a more convenient unit of transport. Instead of volume transport though, the definition used here is mass transport: 1 Sv = 1×10^9 kg/s. Mass must be balanced for (3c) to be unique; otherwise it depends on the reference salinity. More exactly, mass is nearly balanced, as the small deviation from exact balance is the actual freshwater gain or loss, e.g. (3a).

From Talley, 2008

Data:
SADCP and SSS (from underway) along 24N from D279 (approx. between 19W to 55W).

Grid both datasets onto: 0.25degx0.25deg.

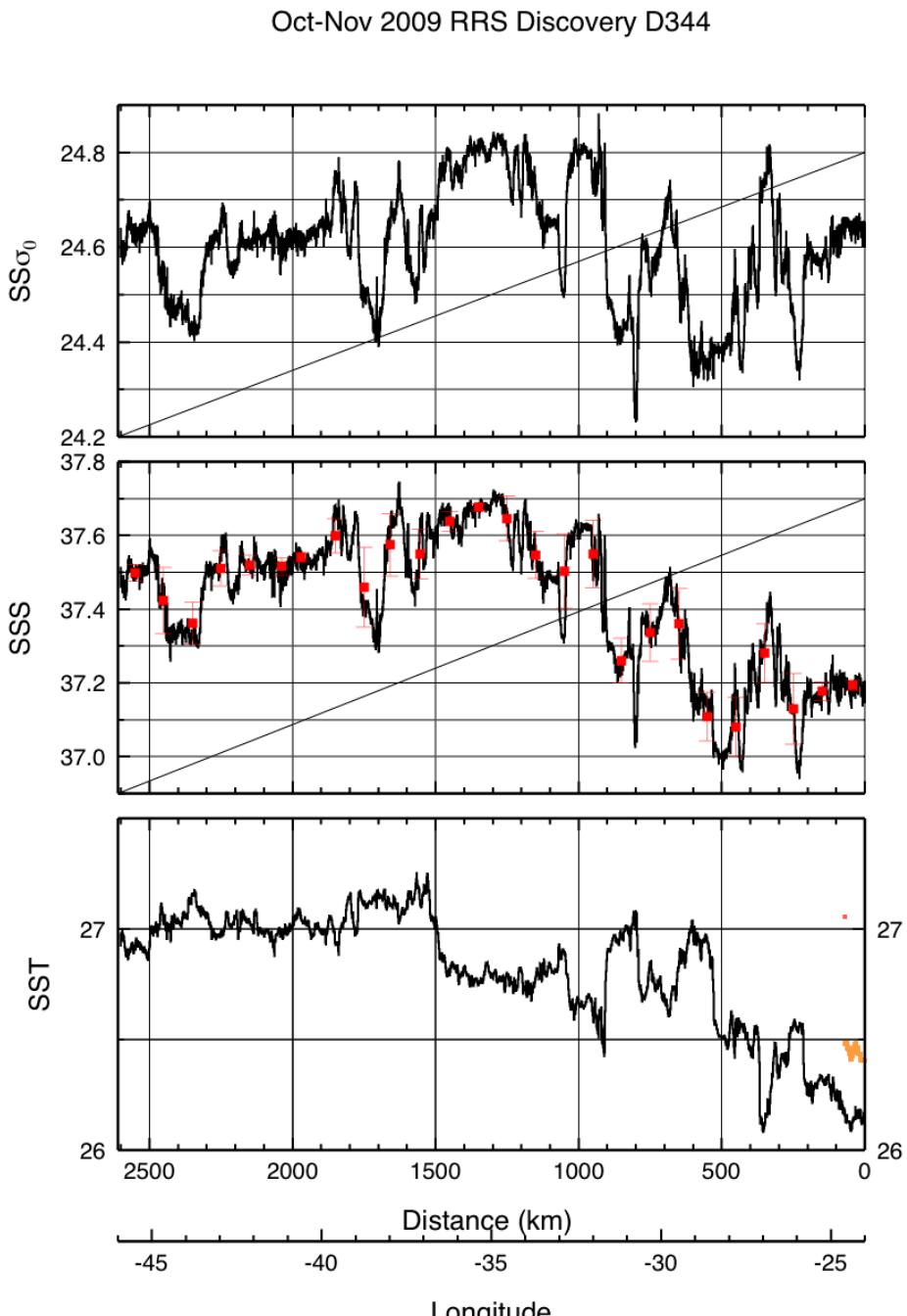
Average SSS for that section = 37.2.

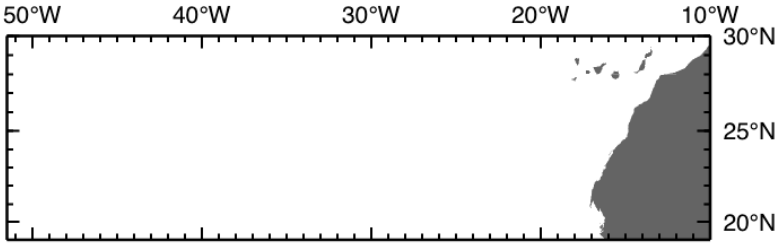
F = Sum(v*[1-(sssi/sss)])=0.0031m/s
Area = 3200km (*1000)*10m=320000000m2

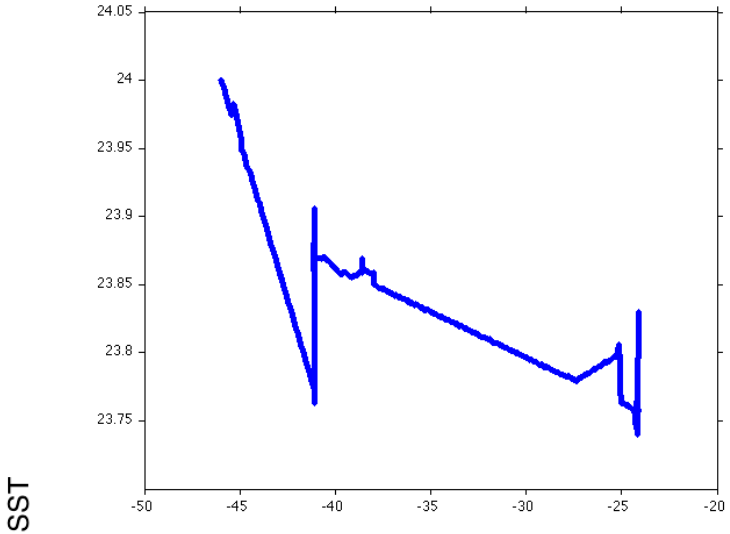
sum(f)*3200*1000*10=9.7936e+04 m3/s=0.0979 Sv

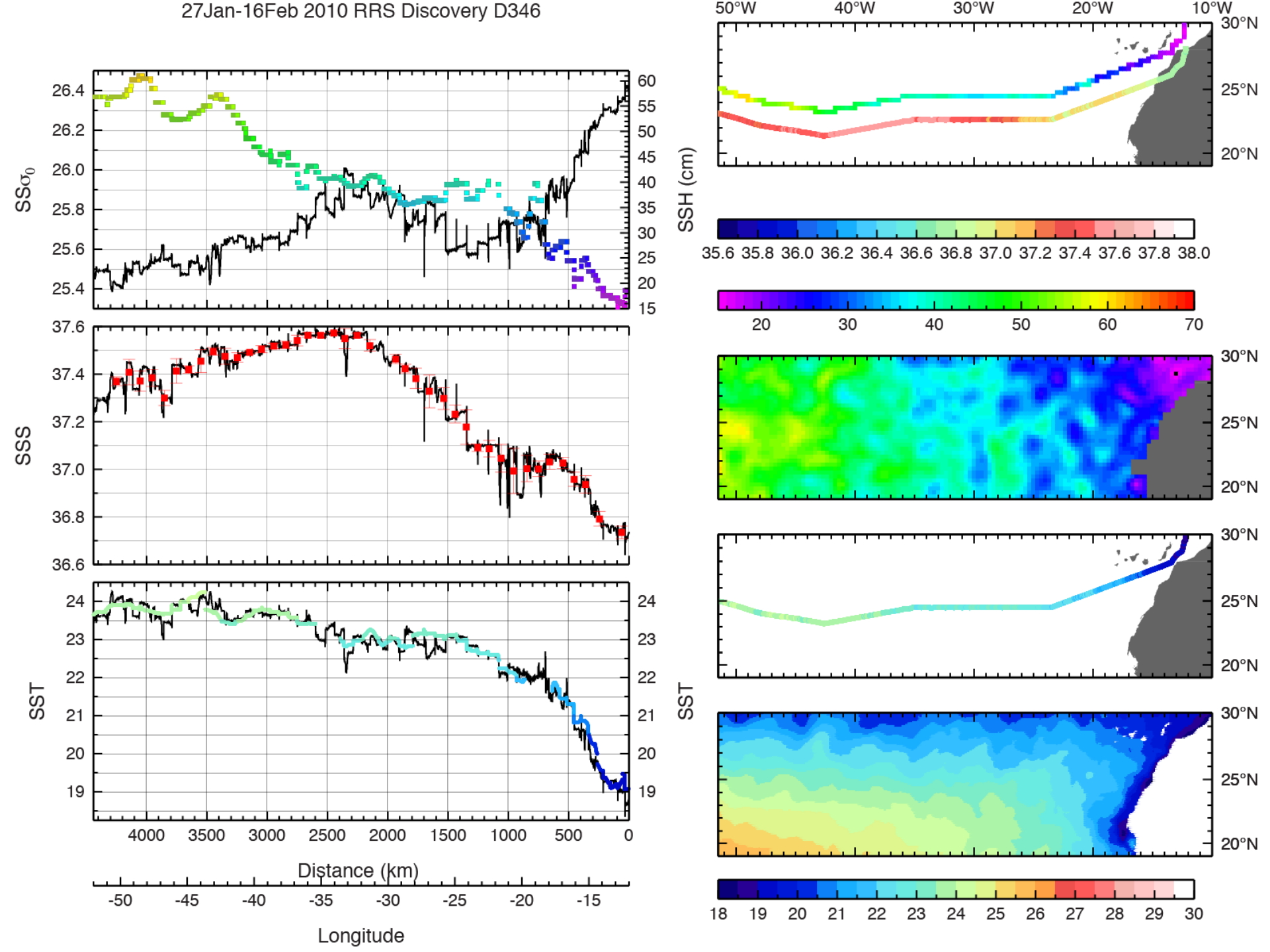
E-P = 1m/yr , for the SPURS area = 3200km*1000*1100*1000, divided by 31536000 = 1.014e+05m3/s=0.1014Sv!

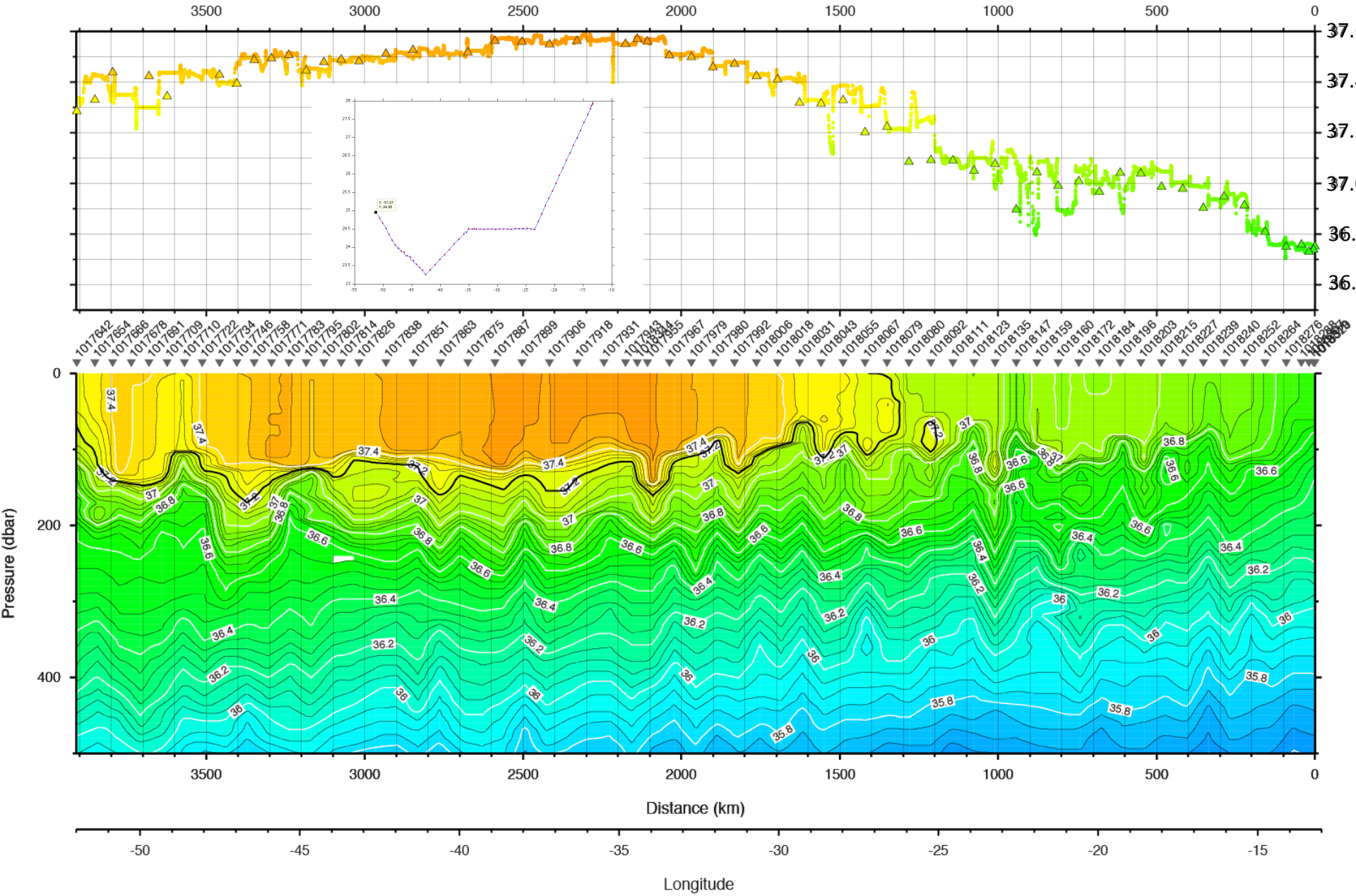
Eddy stirring can provide the FW to balance E-P


Oct-Nov 2009 RRS Discovery D344
SSσ0
24.8
24.6
24.4
24.2
SSS
37.8
37.6
37.4
37.2
37.0
SST
27
26
2500
2000
1500
1000
500
0
Distance (km)
-45
-40
-35
-30
-25
Longitude

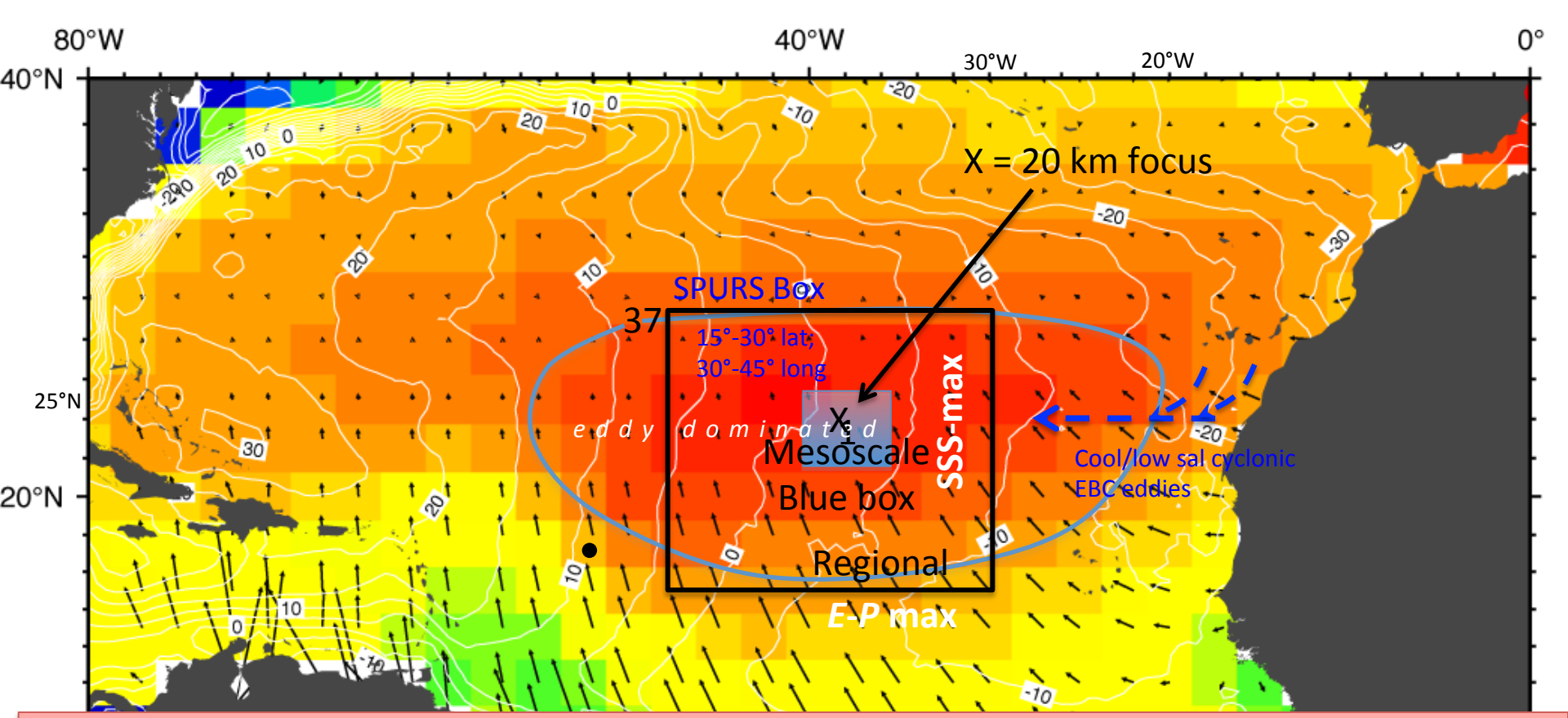

50°W
40°W
30°W
20°W
10°W
30°N
25°N
20°N


SST
24.05
24
23.95
23.9
23.85
23.8
23.75
-50
-45
-40
-35
-30
-25
-20


27Jan-16Feb 2010 RRS Discovery D346
SSσ0
SSS
SST
Distance (km)
Longitude
SSH (cm)
SST
50°W
40°W
30°W
20°W
10°W
30°N
25°N
20°N



27 Jan – 16 Feb 2010



NESTED Approach:

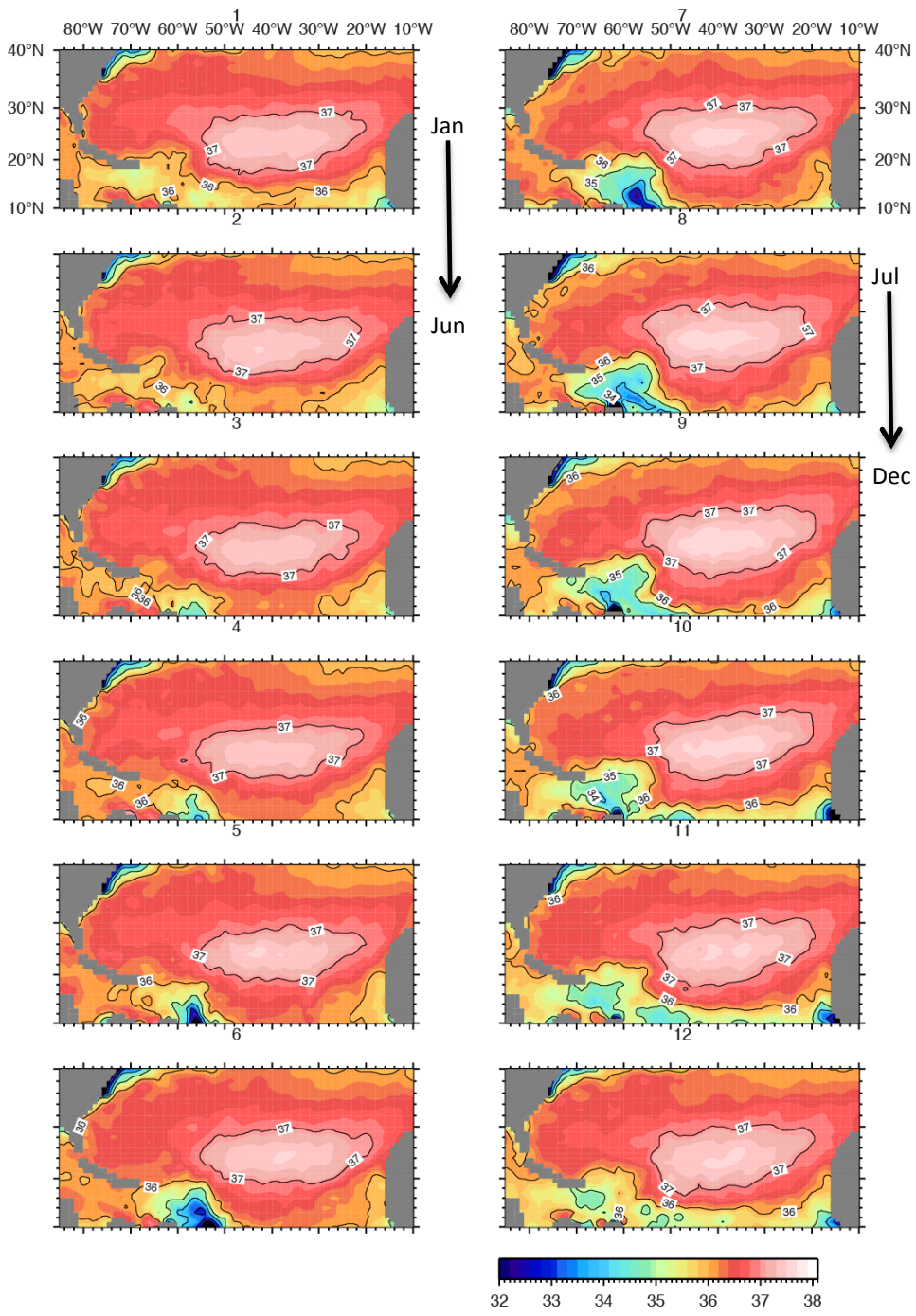
Regional covered by normal obs systems and sat assets;

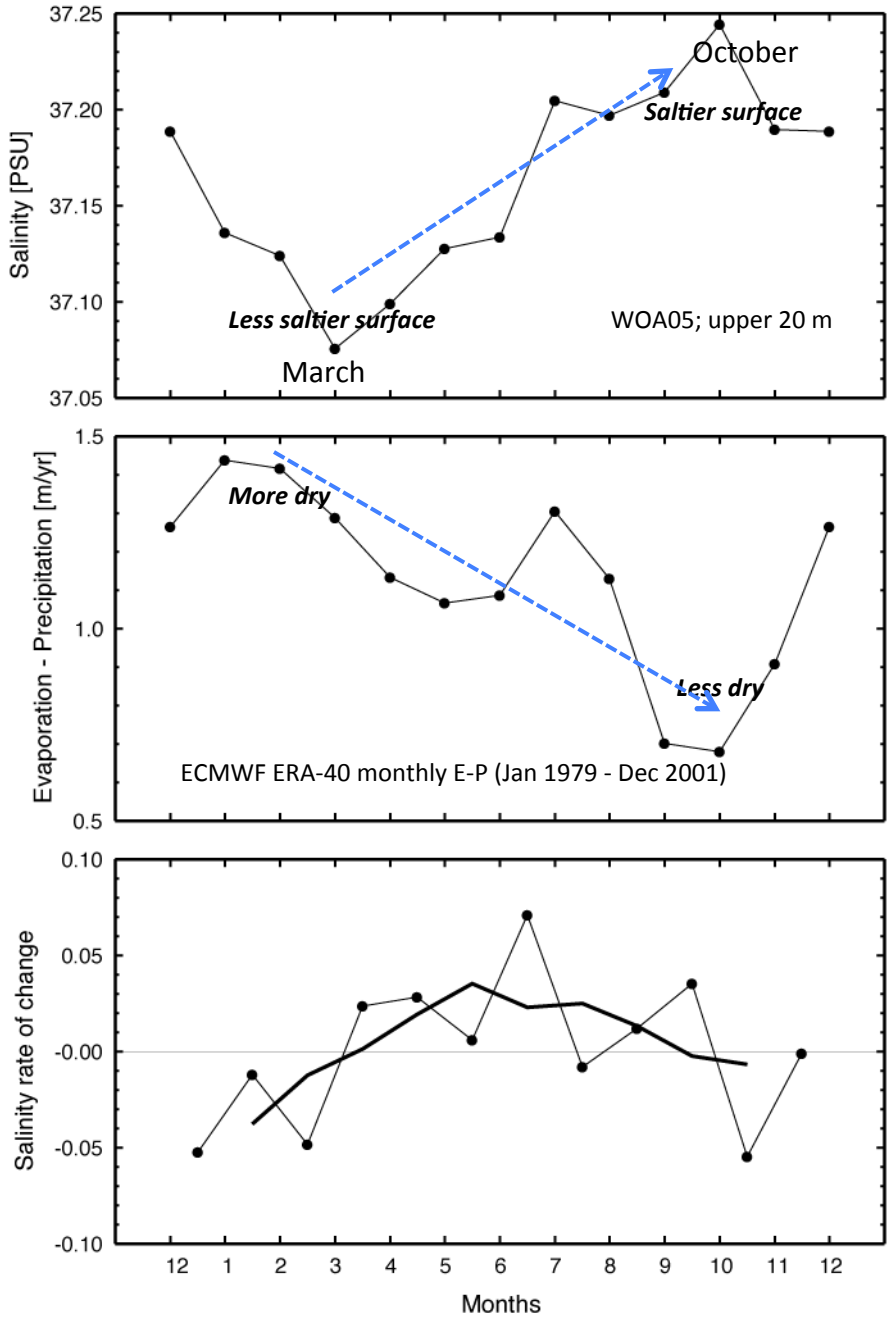
Mesoscale box ~100-200 km:

High res box X. moorings/gliders- to get at processes within the mesoscale [the fronts?]

Where? When? to best meet sci objectives

Arrows: Ekman transport
White lines: absol dy topo


1
80°W 70°W 60°W 50°W 40°W 30°W 20°W 10°W
40°N
30°N
20°N
10°N
Jan
2
7
8
Jul
3
Jun
9
4
Dec
10
5
11
6
12
32 33 34 35 36 37 38



SSS increases when the E-P is decreasing?

SSS/(E-P) trends suggest that ocean processes are of significance in establishing the annual SSS cycle. Candidates:

Might mesoscale eddies be central in understanding the annual cycle of SSS within the SSS-max region of the North Atlantic?

The eddy driven 'freshwater' flux into the surface mixed layer of the subtropical North Atlantic by lateral [and vertical] processes may very well be key in understanding the subtropical surface layer salinity-budget.