Capturing Variability and Uncertainty at the Shelfbreak Front: Examples from the Summer Shelfbreak PRIMER Experiment

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Outline

1. Provide background on shelfbreak water masses and frontal structure

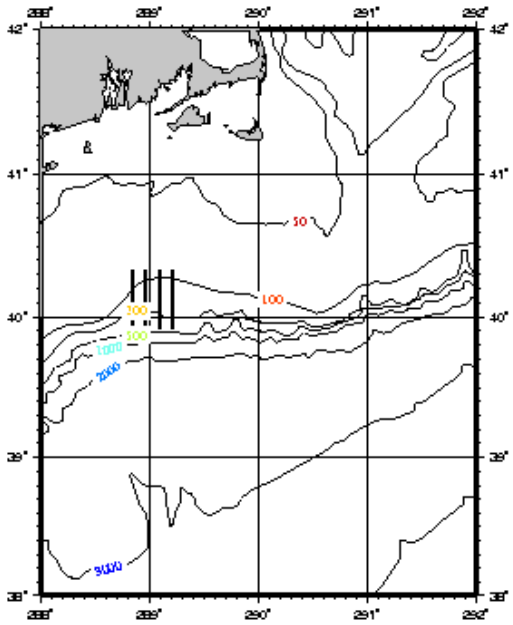
2. Illustrate typical sections and maps highlighting the day to day variability of the front

3. Describe decorrelation scales and provide rules of thumb

4. Problem areas- Non-stationarity and Regional differences

5. Future Directions- Methodology and Prioritization

Seasoar Track July 1996

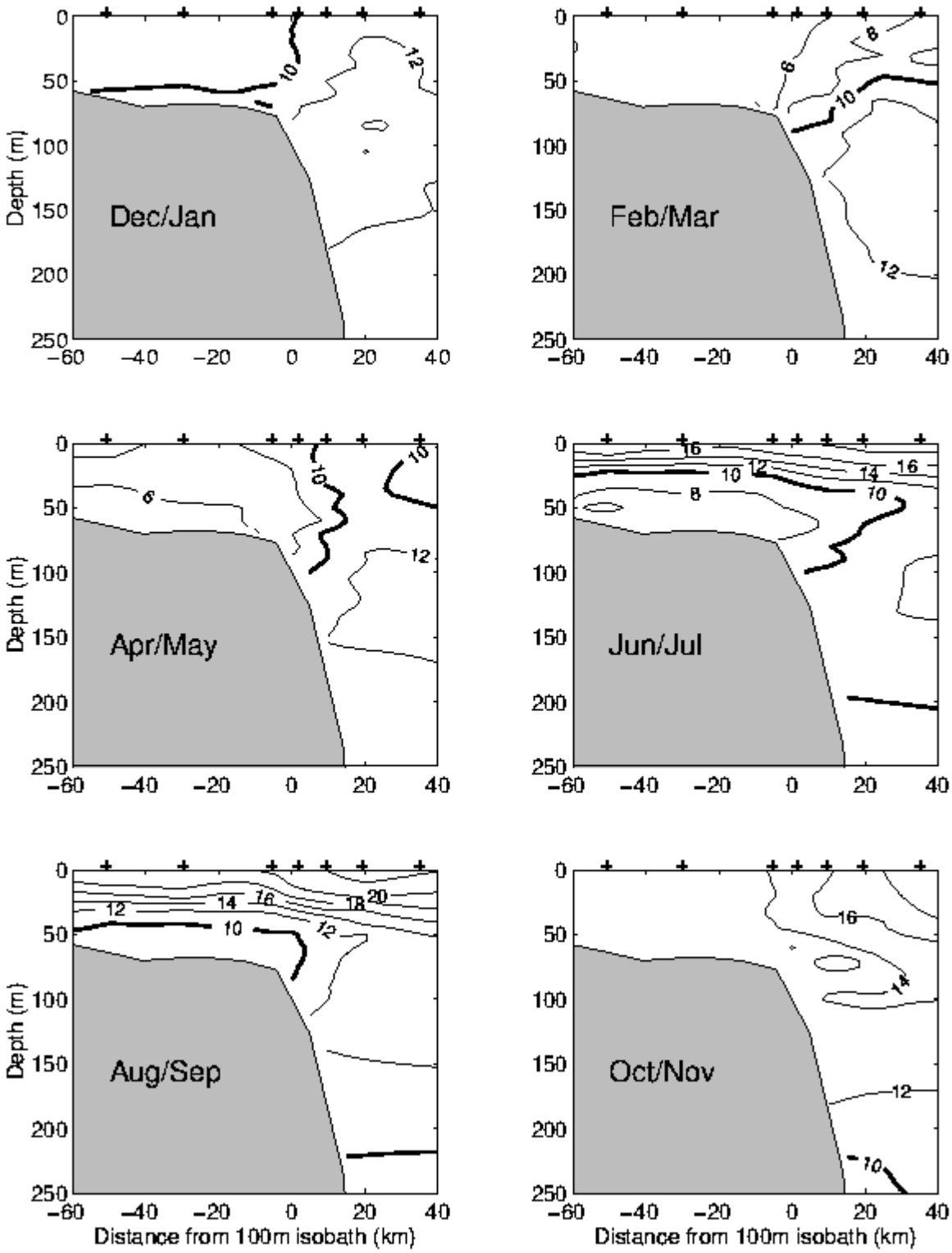


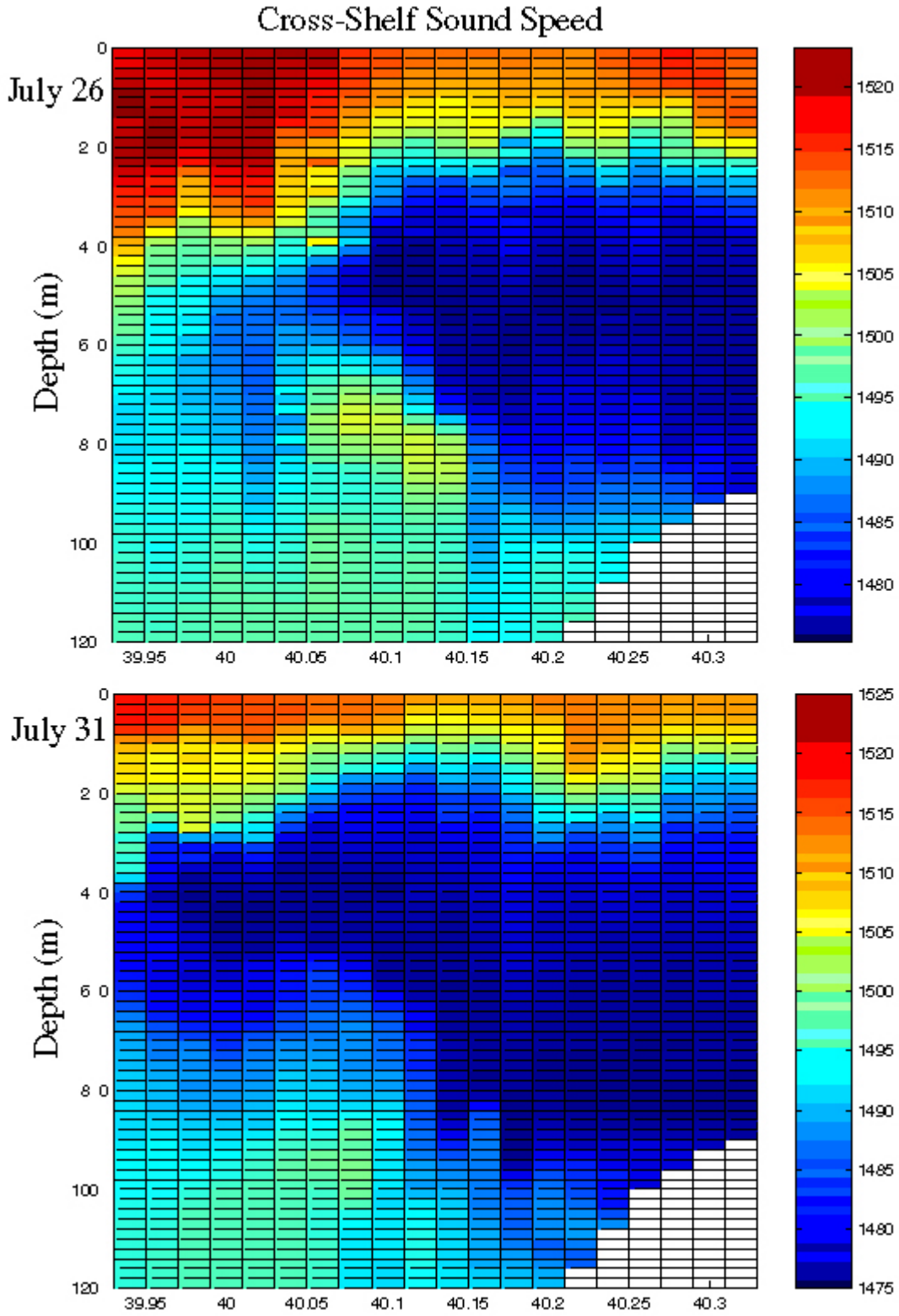
Shelfbreak PRIMER

1. Concurrent high-resolution hydrographic measurements with shelf-slope acoustic mooring array

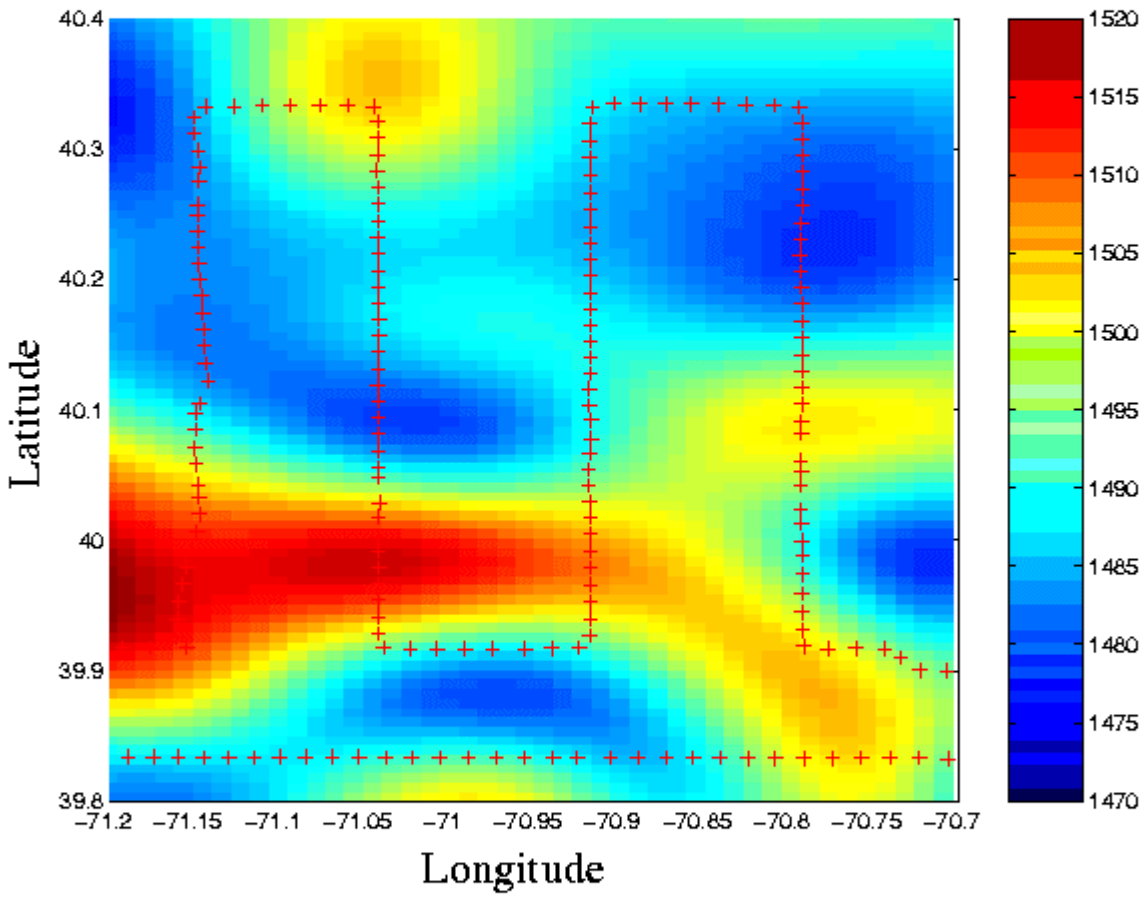
2. Sampling strategy set by a priori knowledge of temporal and spatial decorrelation scales

3. Cruises covered seasonal extremes in stratification


Dec/Jan
Feb/Mar
Apr/May
Jun/Jul
Aug/Sep
Oct/Nov
Depth (m)
Distance from 100m isobath (km)
0
50
100
150
200
250
−60
−40
−20
0
20
40
6
8
10
12
14
16
18
20

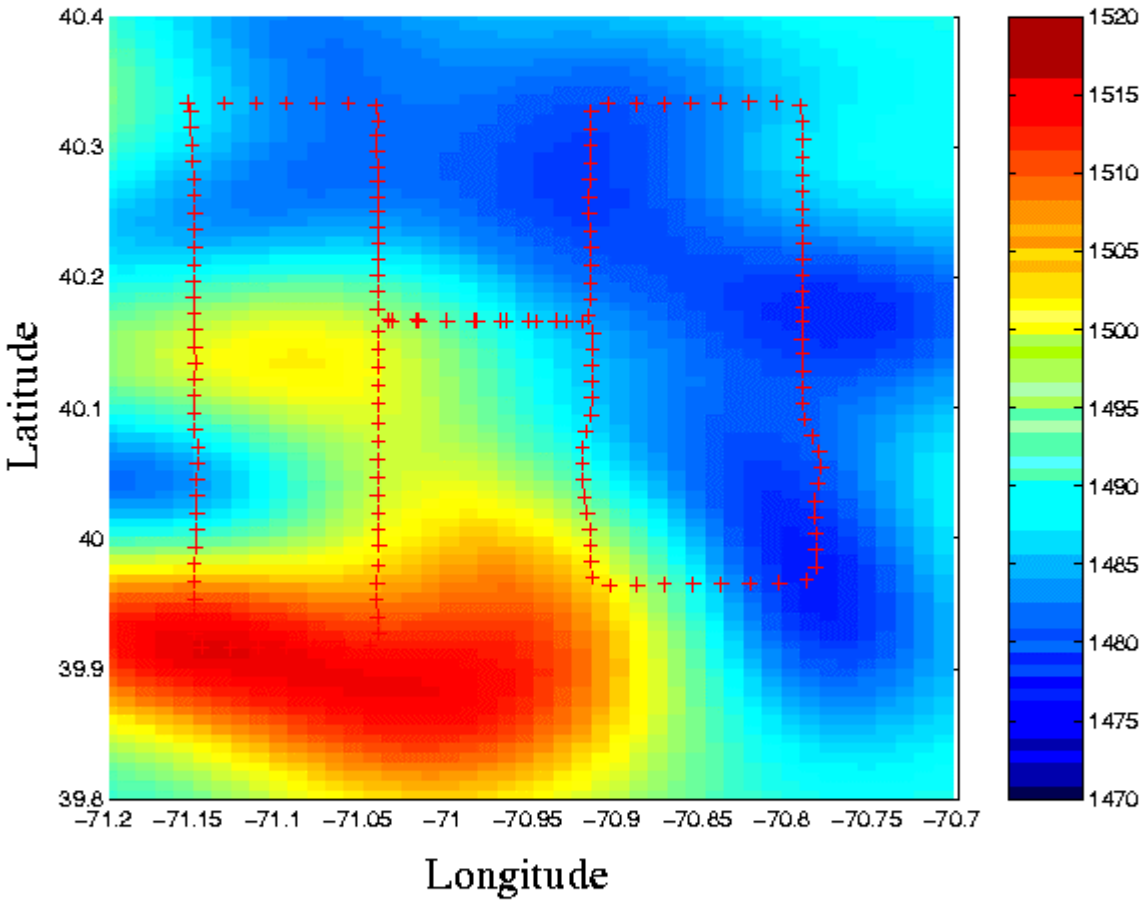

Cross-Shelf Sound Speed
July 26
Depth (m)
0
20
40
60
80
100
120
39.95
40
40.05
40.1
40.15
40.2
40.25
40.3
1520
1515
1510
1505
1500
1495
1490
1485
1480
July 31
Depth (m)
0
20
40
60
80
100
120
39.95
40
40.05
40.1
40.15
40.2
40.25
40.3
1525
1520
1515
1510
1505
1500
1495
1490
1485
1480
1475

July 26- Horizontal map of Sound Speed at 30 m Depth



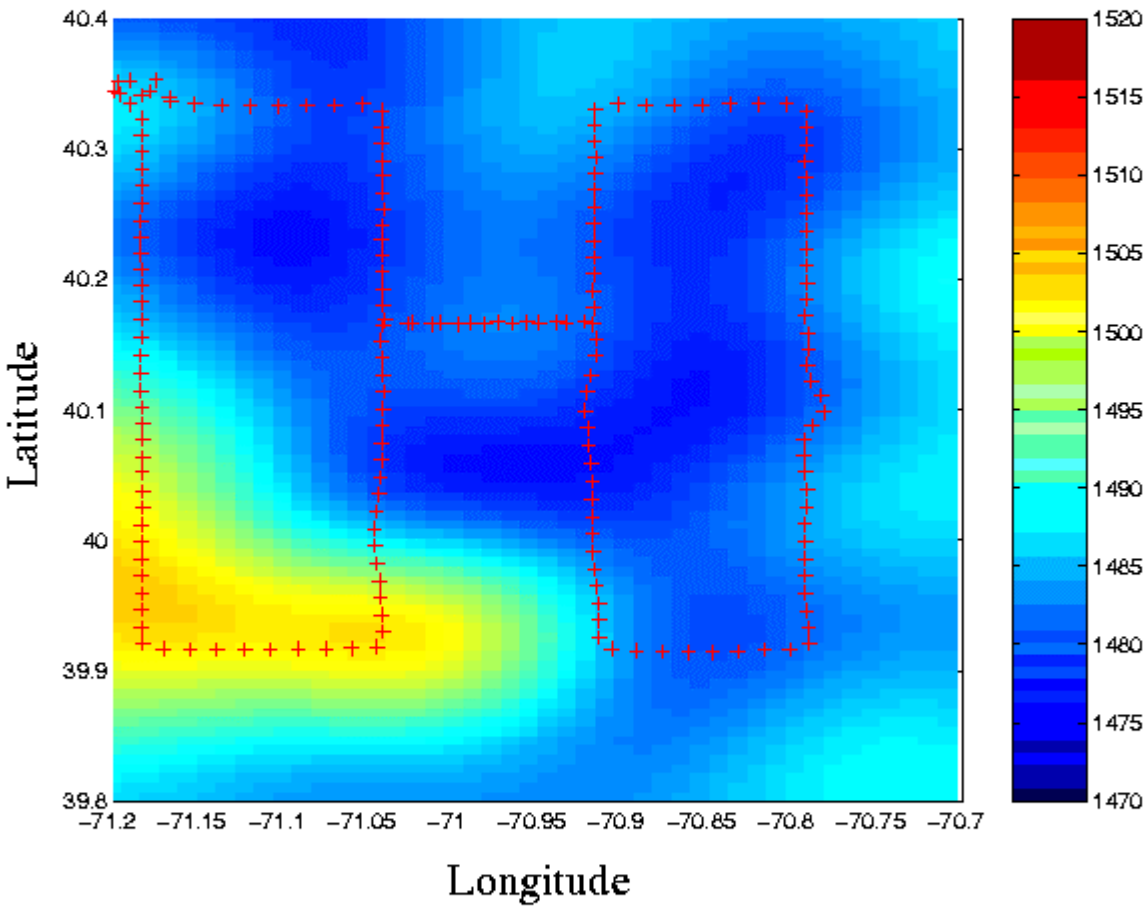
Note shelf water (blue) present at offshore edge of section, and slope water (red) present near onshore edge of section.

Horizontal map of Sound Speed- 30 m depth
July 28- Objectively mapped

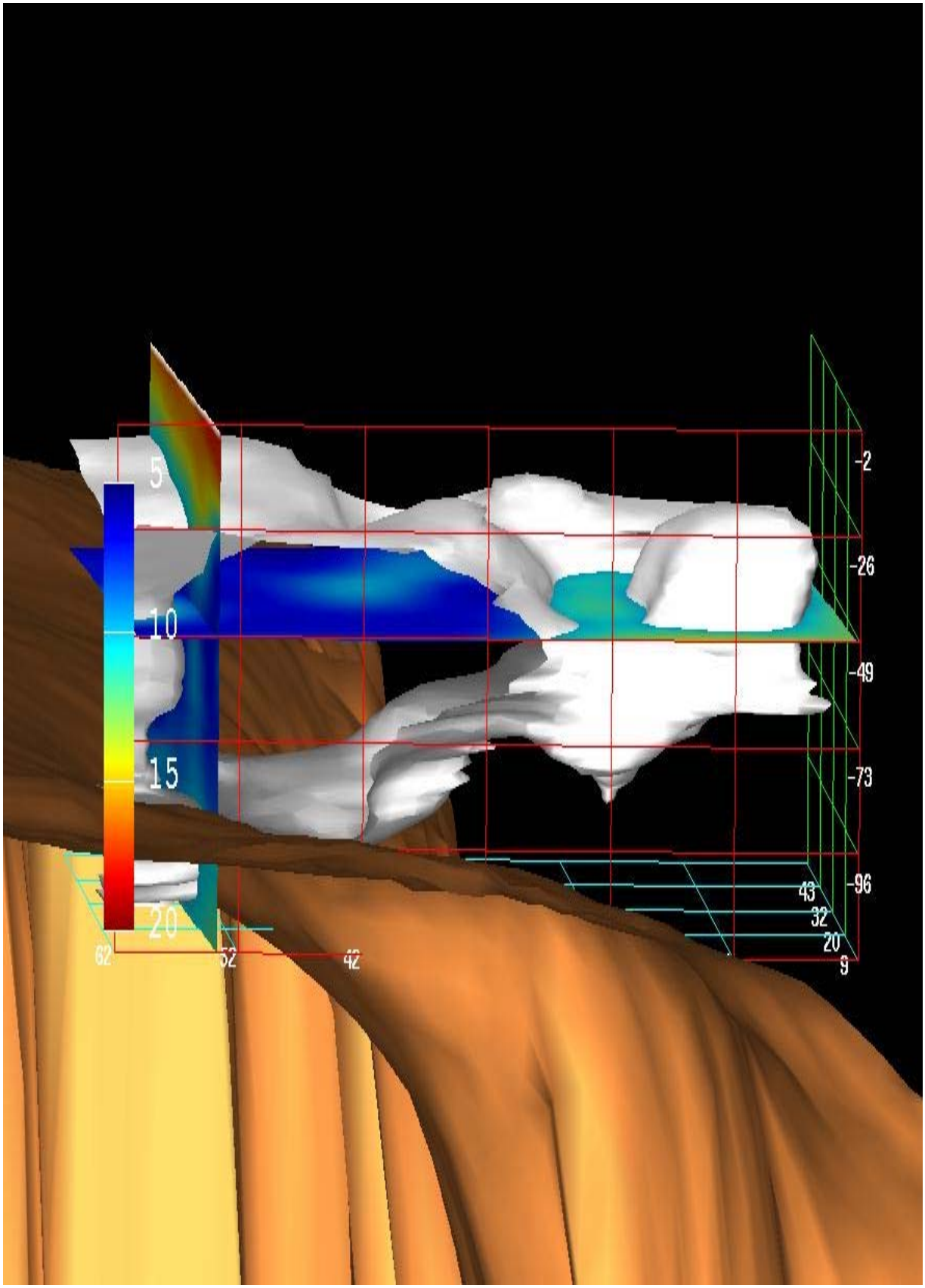


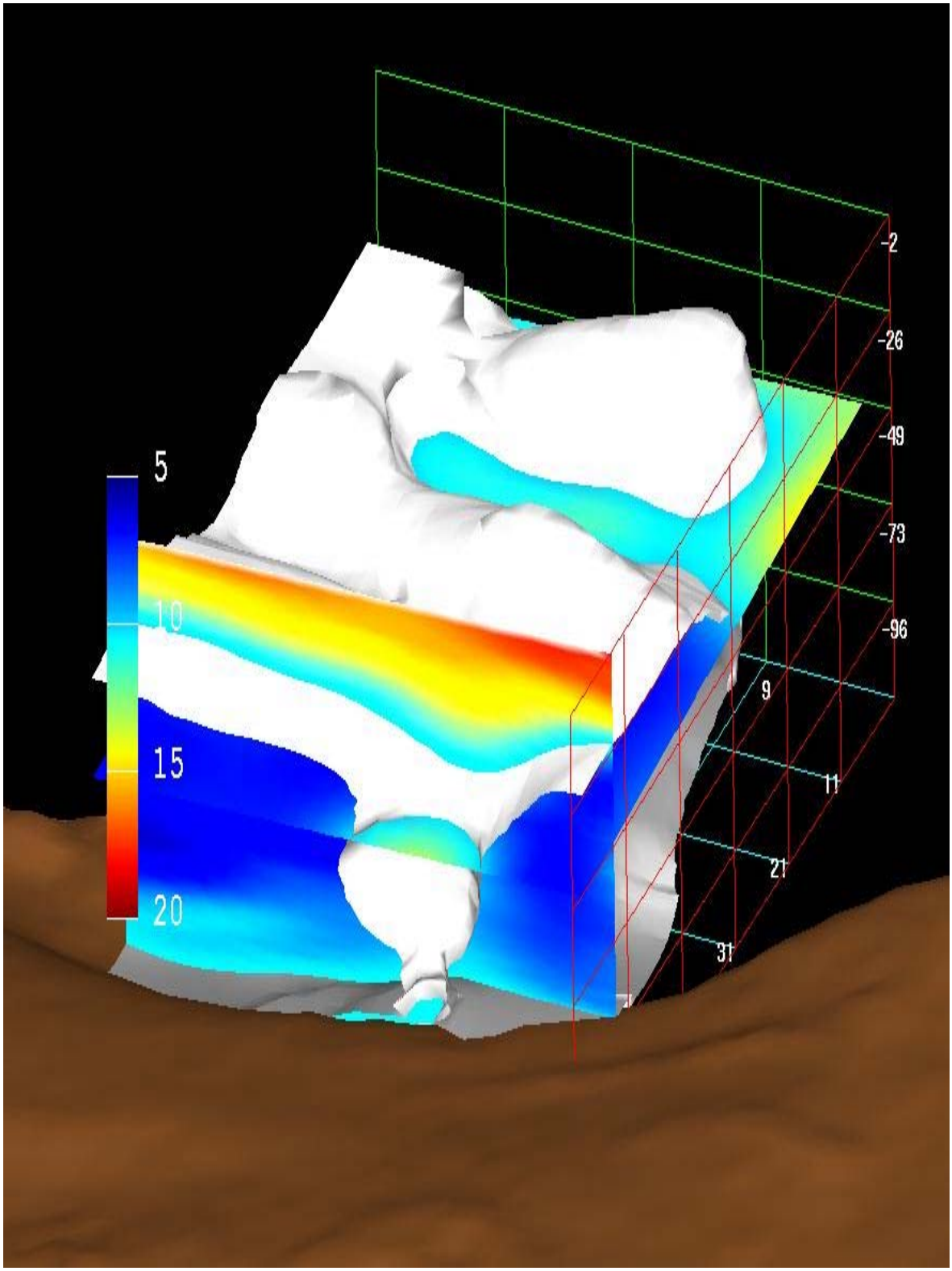
Note large band of shelf water (blue) passing into region from east- frontal meander propagating to west at 10 cm/s

Horizontal map of Sound Speed- 30 m depth
July 30- Objectively Mapped

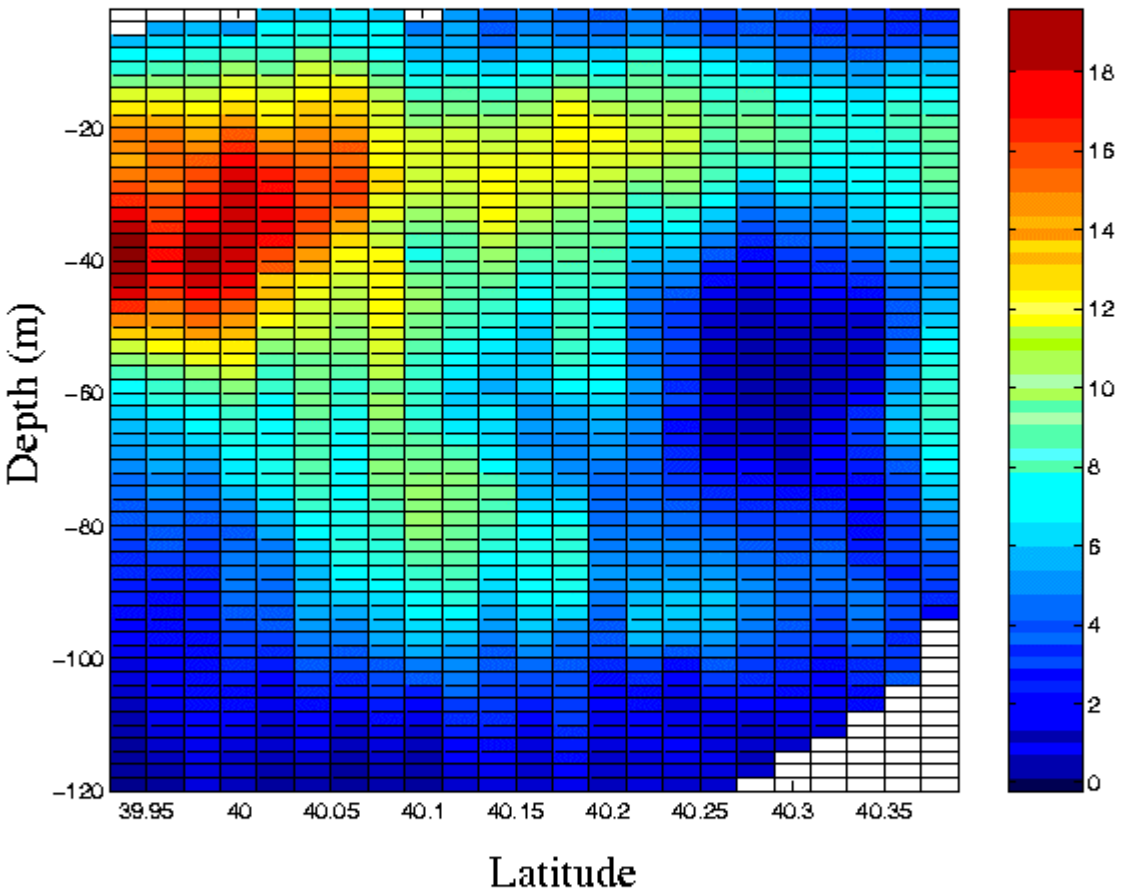


Note the dominance of the shelf water (blue) over most of the study area


5
10
15
20
62
52
42
-2
-26
-49
-73
-96
43
32
20
9


5
10
15
20
-2
-26
-49
-73
-96
9
11
21
31

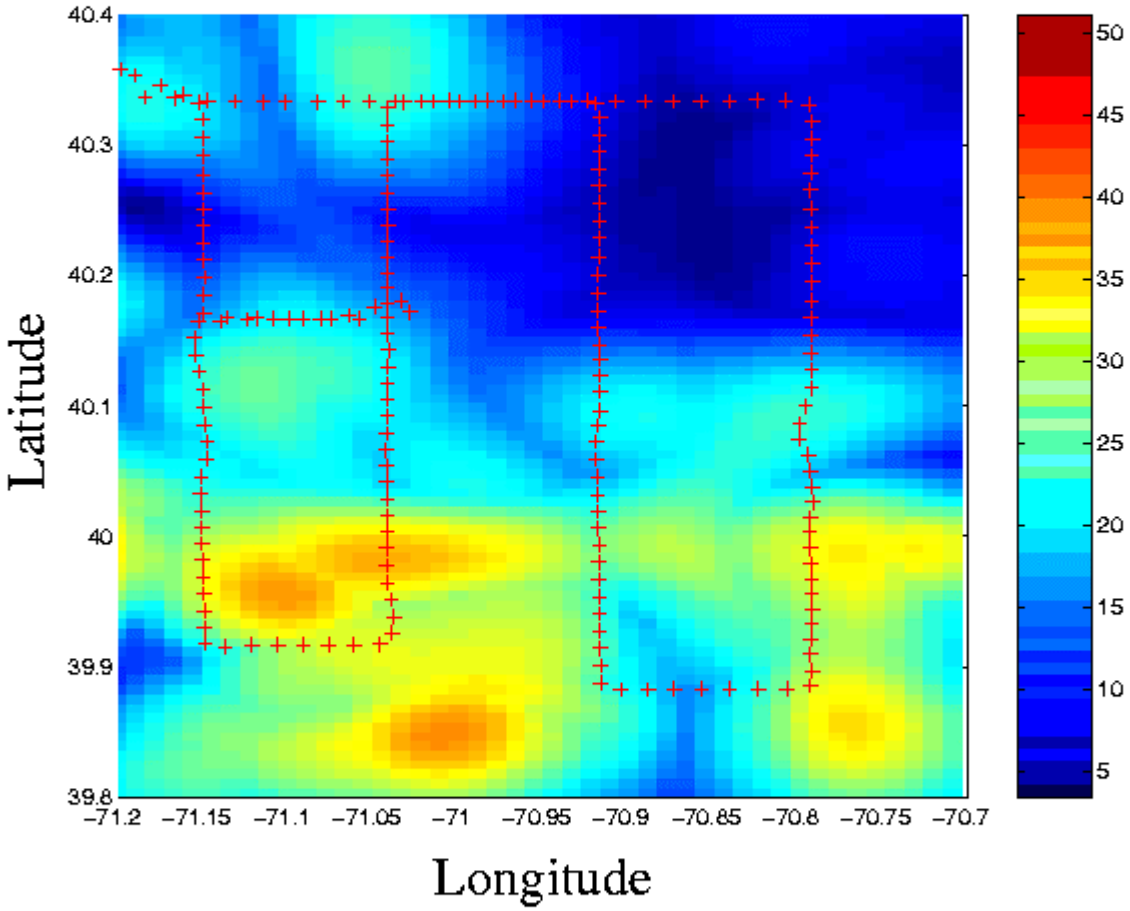
Cross-shelf Structure- Standard Deviation of Sound Speed over 6 days



Note- Maximum values ~ 20 m/s

Concentrated at offshore edge of section at 40 m depth

Maximum Difference in Sound Speed
over 6 days at 30 m Depth



Maximum Difference is 50 m/s

Largest values are near shelfbreak

Coherent structures visible

Spatial and Temporal Decorrelation Scales

From Summer Shelfbreak PRIMER:

Temperature at 54 m depth- 8 km

Salinity at 54 m depth- 7 km

Velocity at 57 m- 8 km (east) and 10 km (north)

Temporal- 1 day

How does this compare with the baroclinic Rossby radius?

For a density difference of 0.3 kg/m , and
H=100 m, baroclinic Rossby radius is 5.8 km

If H=150 m, baroclinic Rossby radius is 7.1 km

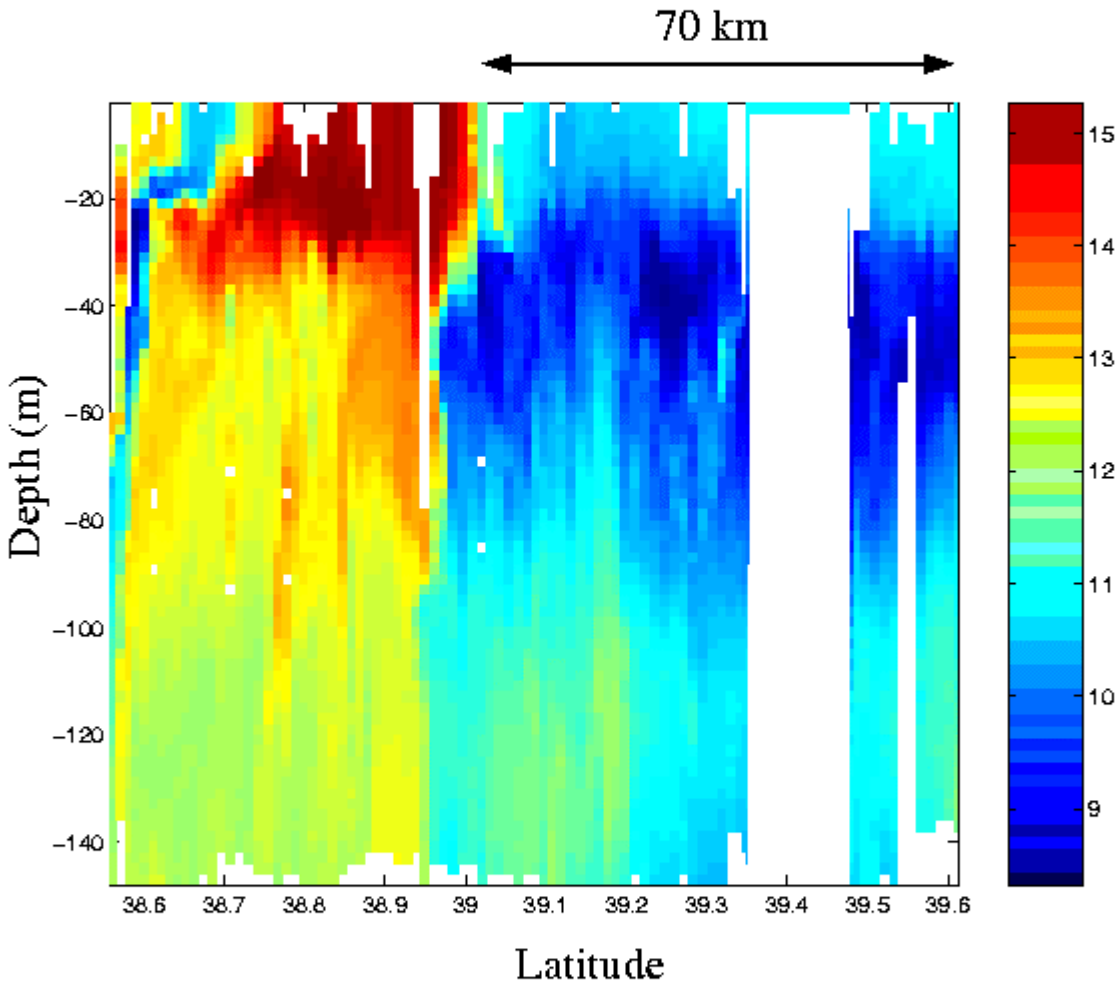
During Winter Shelfbreak PRIMER:

Temperature at 54 m- 10 km

Velocity at 57 m- 10 km

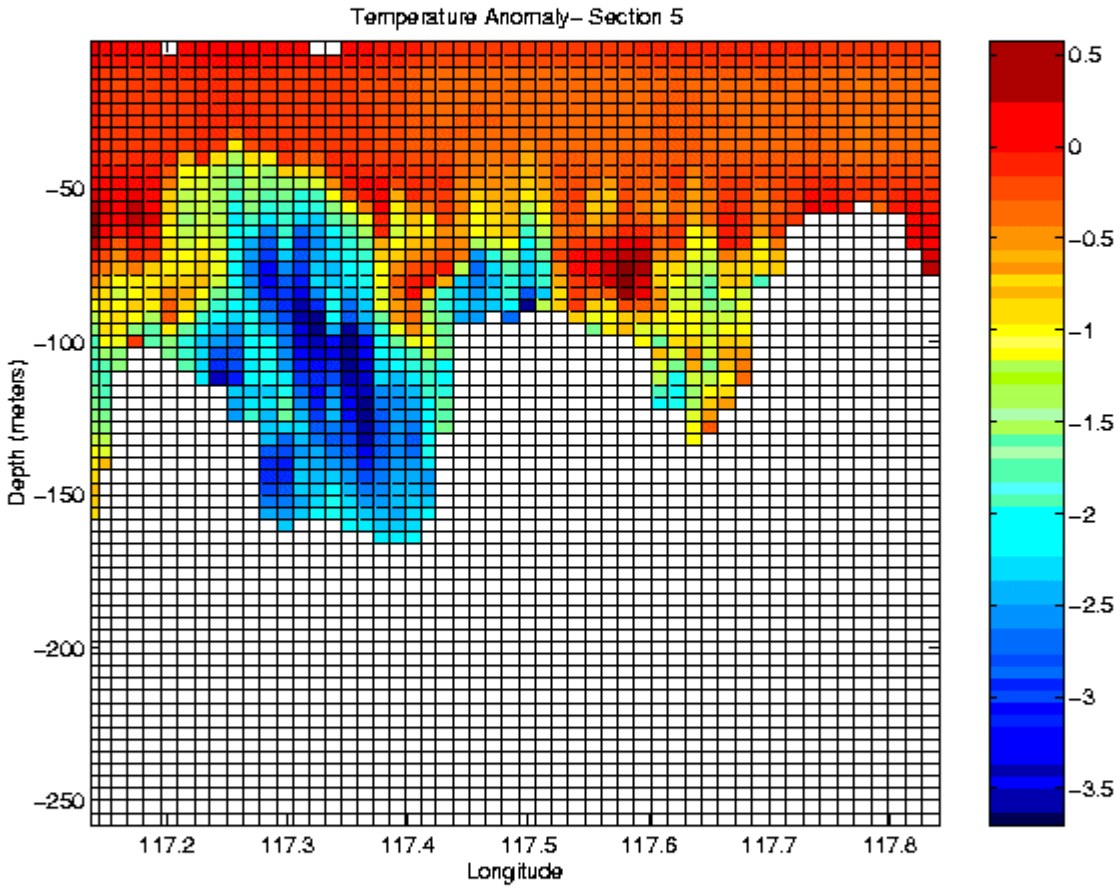
Example of Larger Scale Spatial Coherence over Slope- Spring PRIMER

Shelf water is present as far south as 39 Deg N (3000 m isobath)



Shelf water is 100 km south of the shelfbreak

From ASIAEX South China Sea Pilot Study: Temperature anomalies (relative to mean vertical profile) appear to be strongly related to topographic length scales



Spatial decorrelation scale- 10 km

Canyon scale- 10 km

Conclusions

1. Temporal and spatial decorrelations in PRIMER study are small (1 day and 10 km)

2. During summer, largest variability at 30 m depth with maximum of 20 m/s

3. Differences in sound speed at a fixed location may be as large as 50 m/s

Future Directions

1. What are the physical parameters which set the decorrelation scales in different regions (e.g. stratification, bottom slope)

2. Which physical processes are MOST CRITICAL in affecting uncertainty in different regions?

3. How can we deal with non-stationarity and exploit times with large correlations?