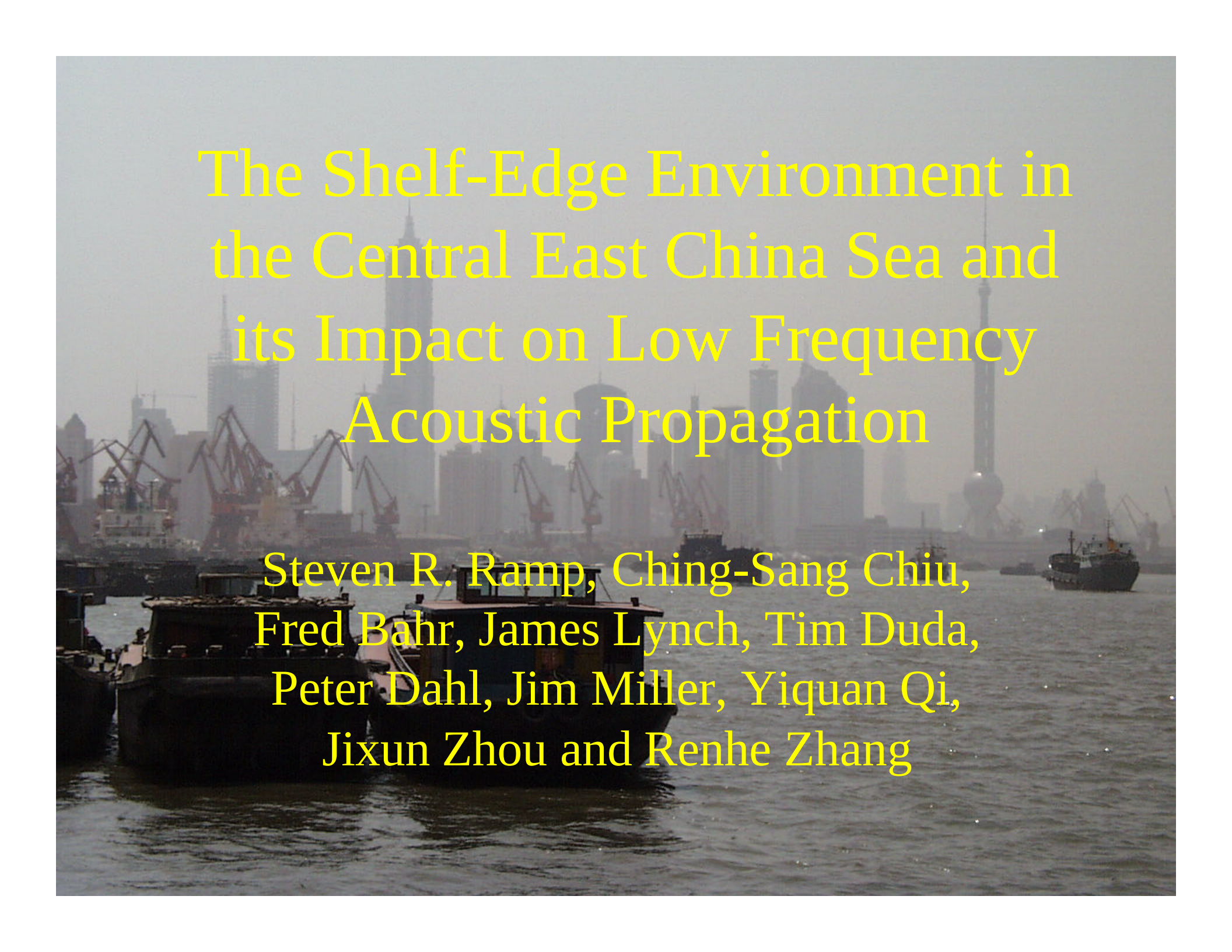




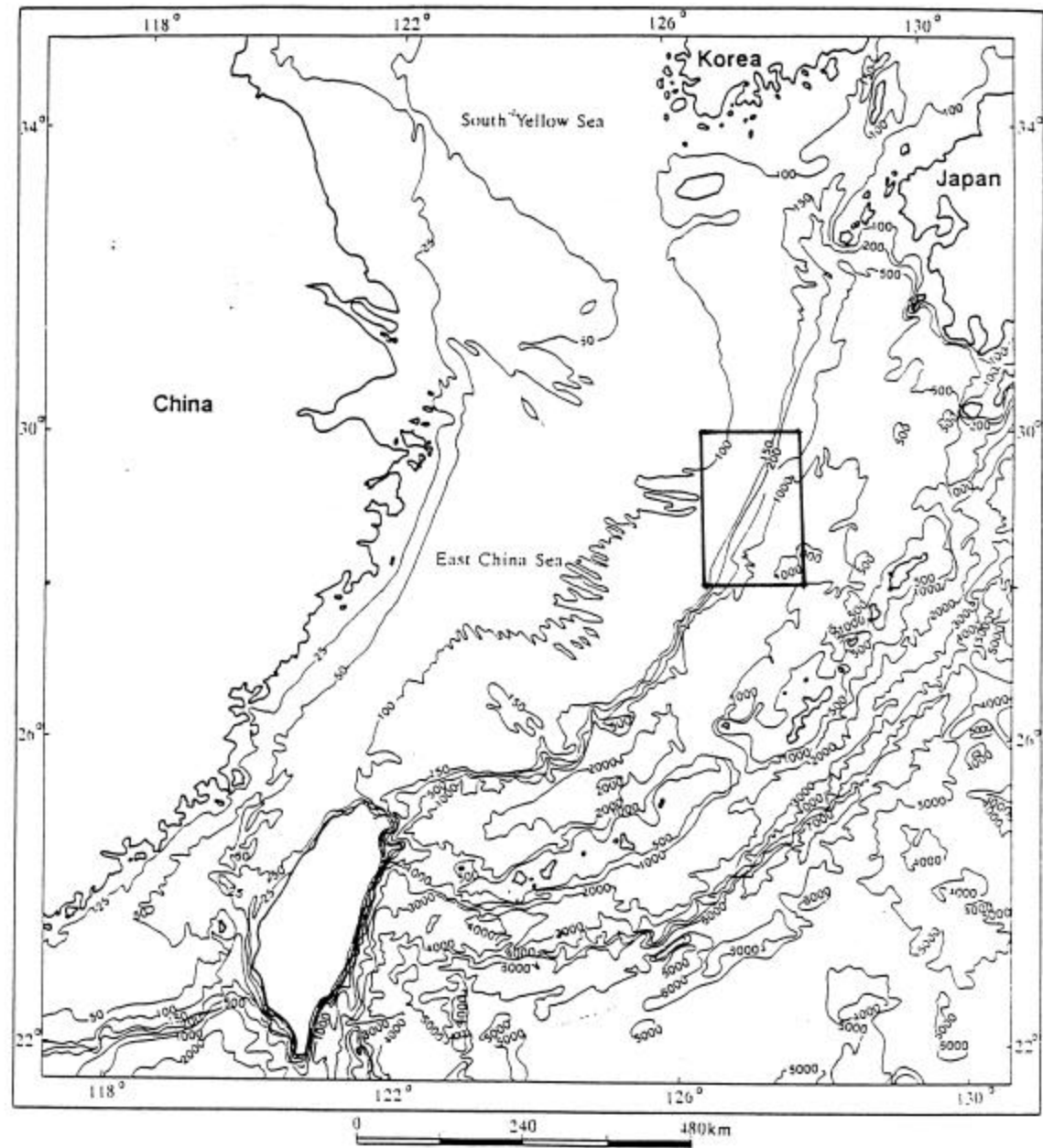
# The Shelf-Edge Environment in the Central East China Sea and its Impact on Low Frequency Acoustic Propagation

Steven R. Ramp, Ching-Sang Chiu,  
Fred Bahr, James Lynch, Tim Duda,  
Peter Dahl, Jim Miller, Yiquan Qi,  
Jixun Zhou and Renhe Zhang

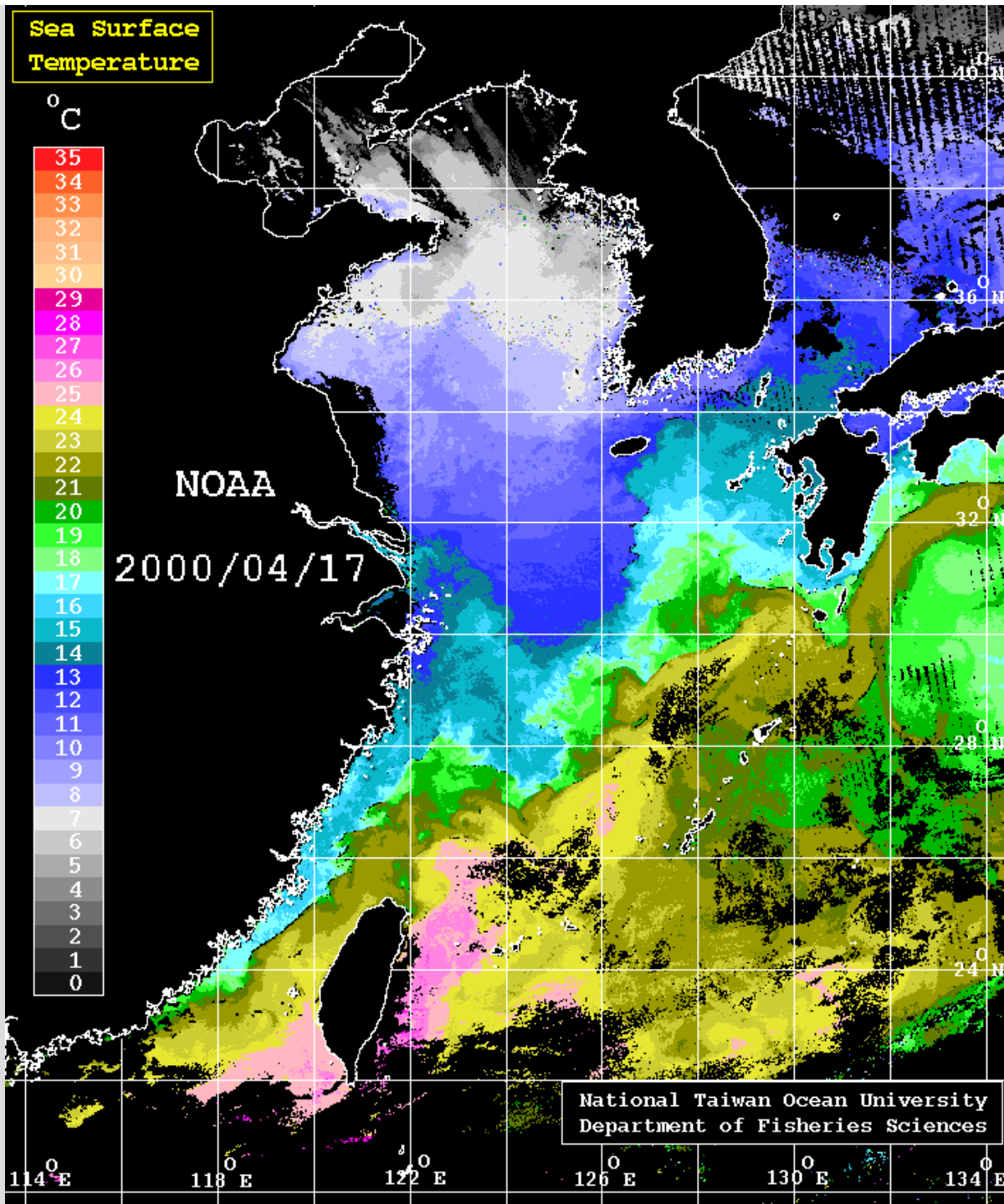
| Report Documentation Page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    |                                     | Form Approved<br>OMB No. 0704-0188         |                                             |                                    |
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## Bottom Topography of the East China Sea.

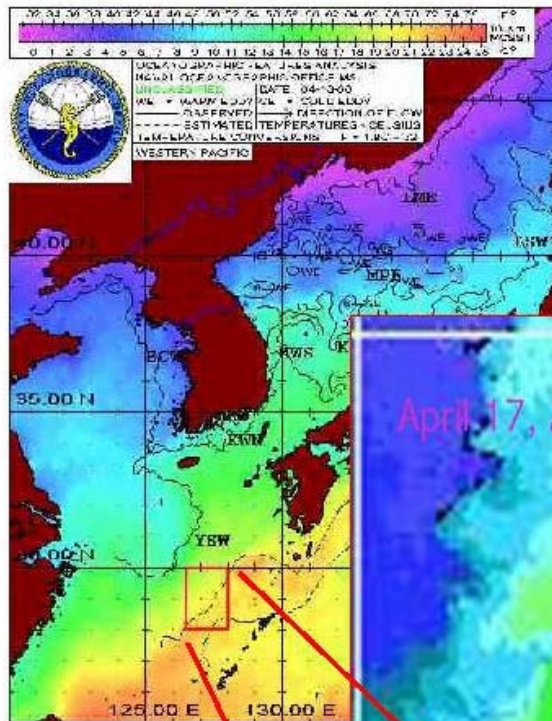
The ASIAEX study  
region is indicated



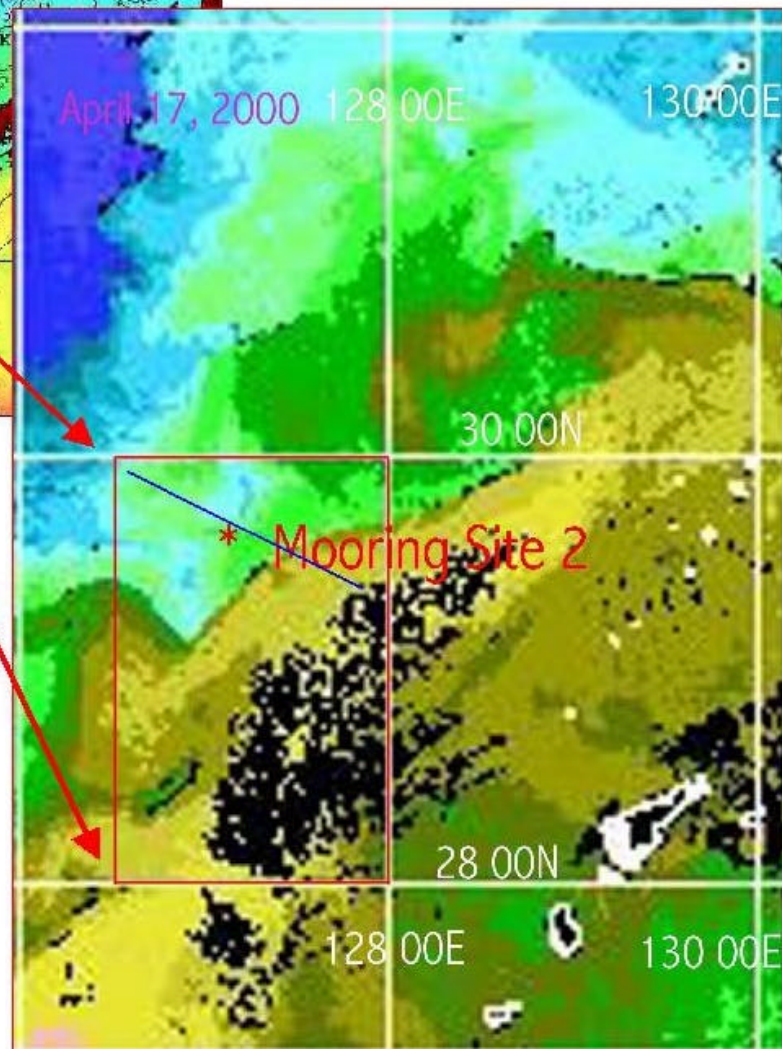




April 17, 2000



# East China Sea ASIAEX Site Locator Map

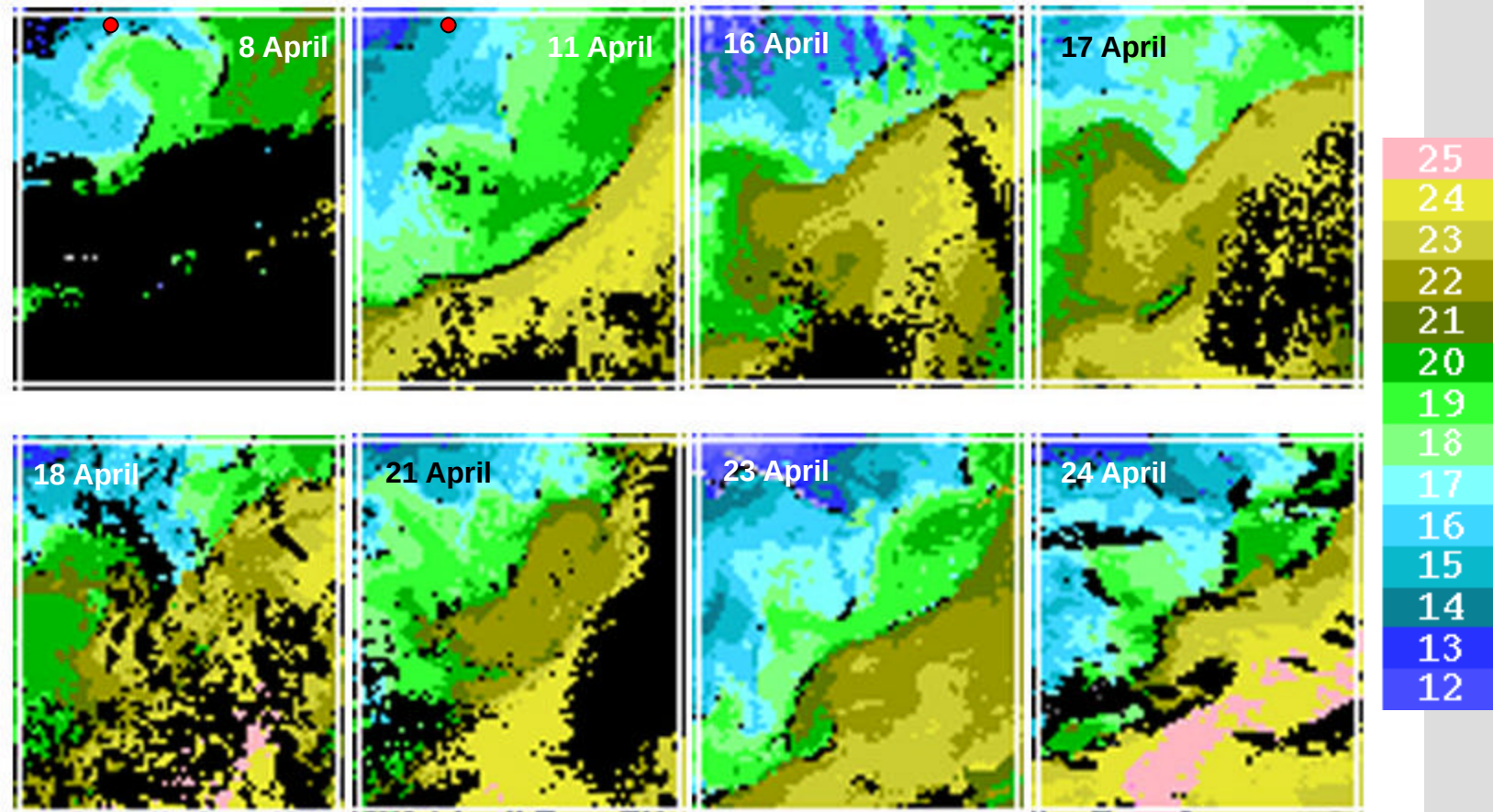


## \* Mooring Site

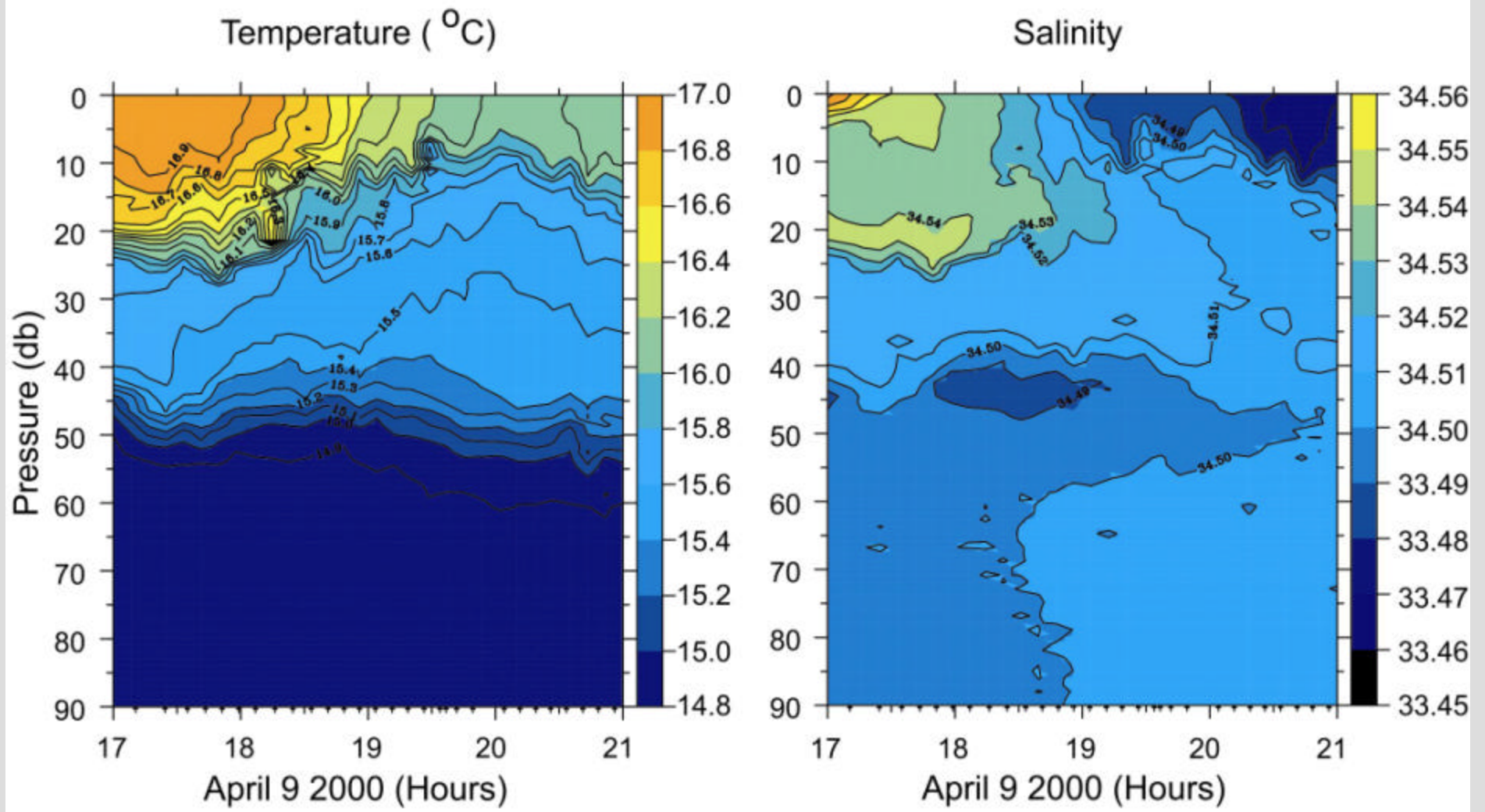
# CTD Transect



# Frontal Movements During April 2000

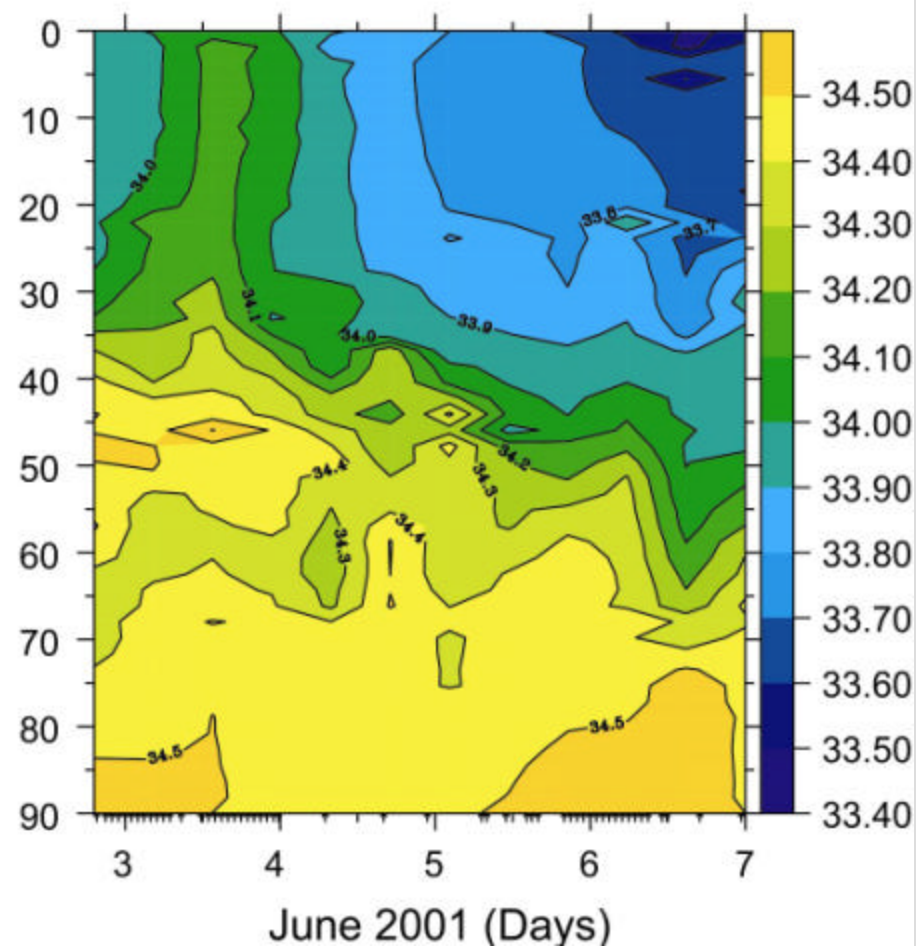
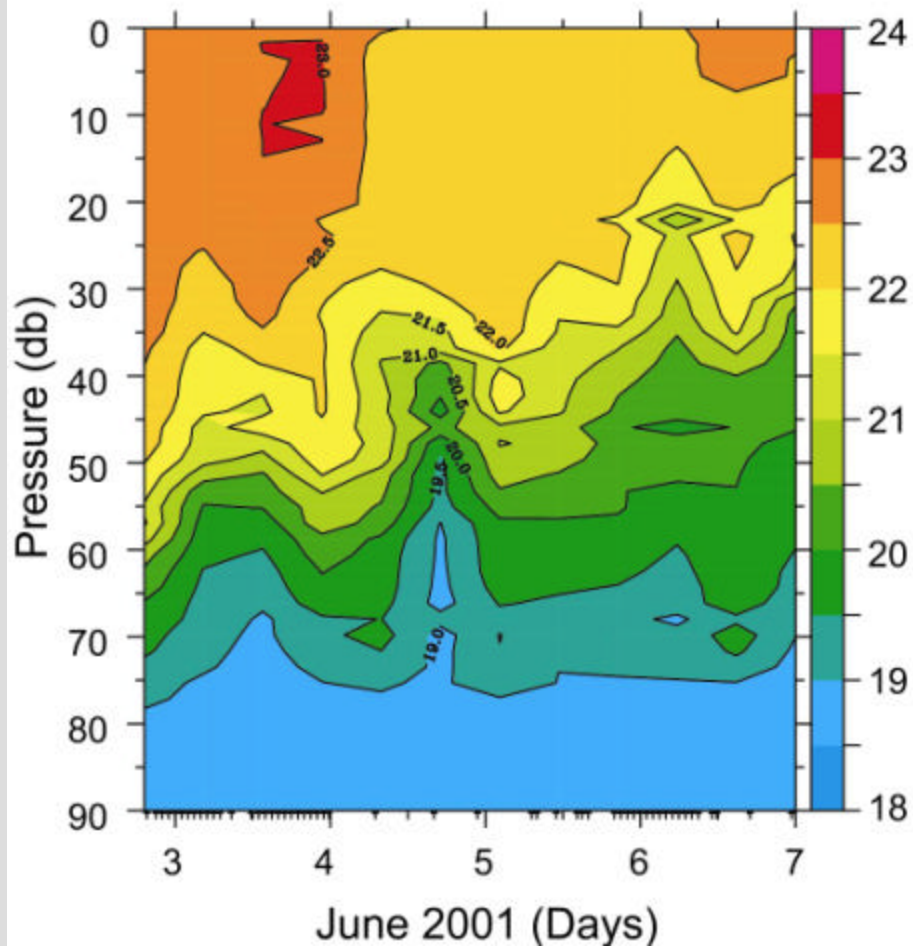


# Anchor Station Temperature and Salinity, April 2000





## Anchor Station Temperature and Salinity, June 2001



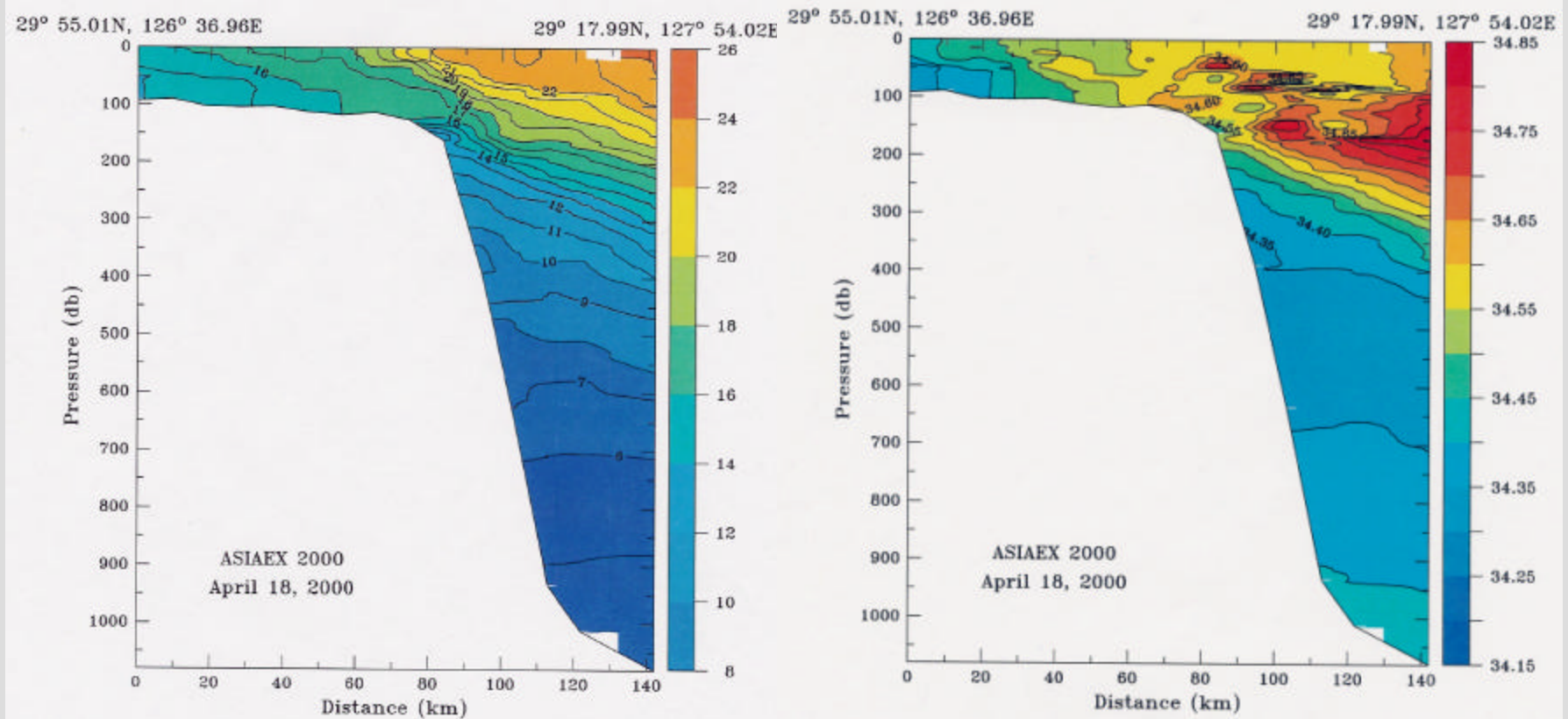


# Across-Shelf Temperature and Salinity Sections

## From the ASIAEX Pilot Study Cruise, April 2000

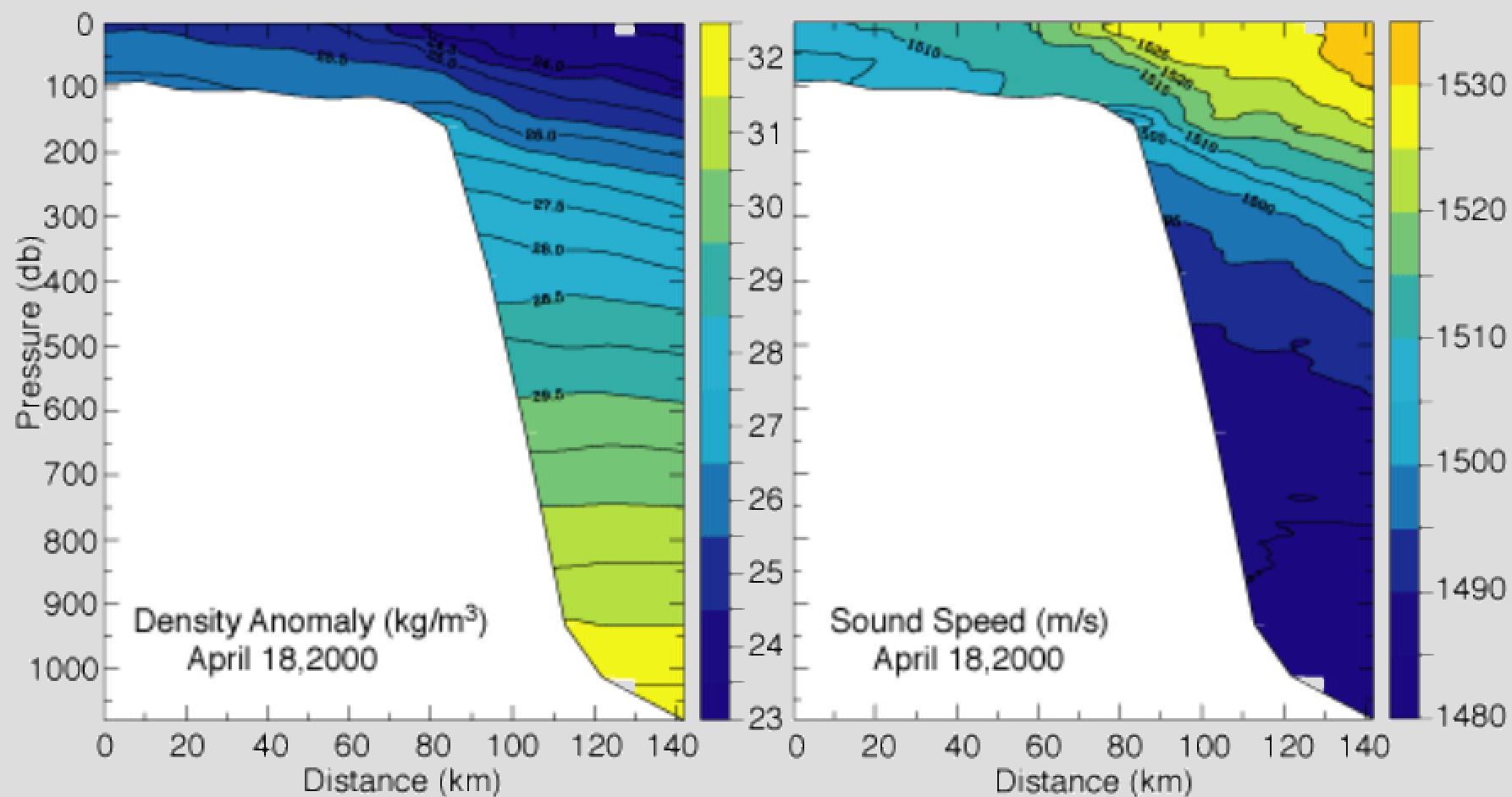
Temperature

Salinity



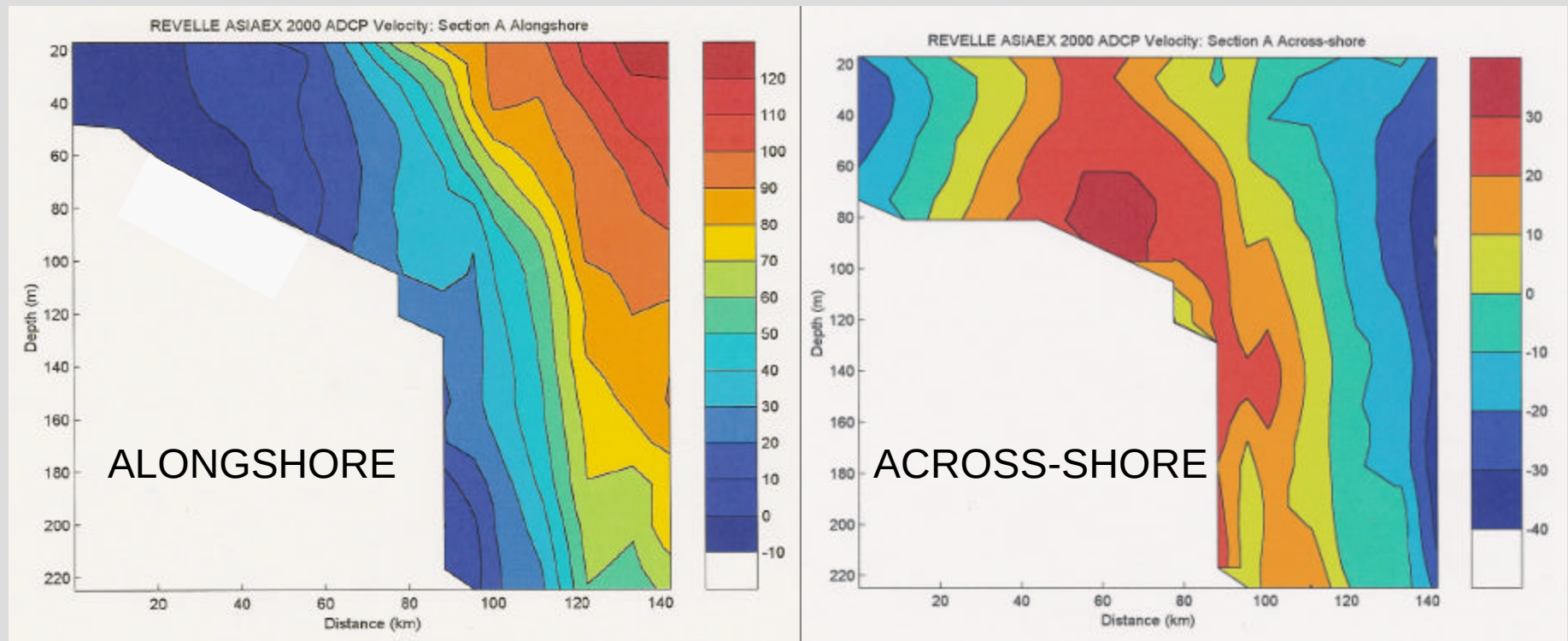
# Across-Shelf Density and Sound Speed

From the ASIAEX Pilot Study Cruise, April 2000



# Along and Across-Shore ADCP Velocity Sections

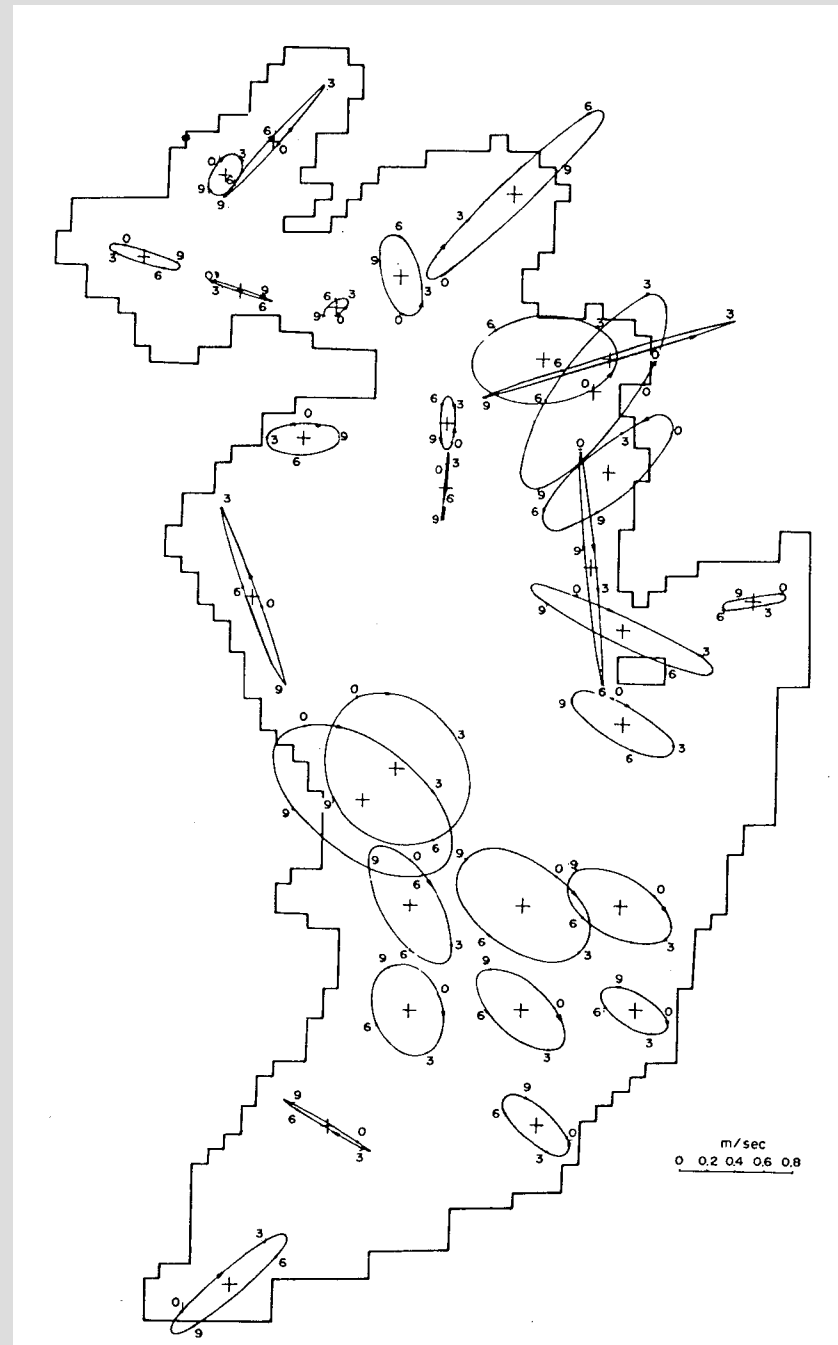
ASIAEX Pilot Study Cruise, April 2000





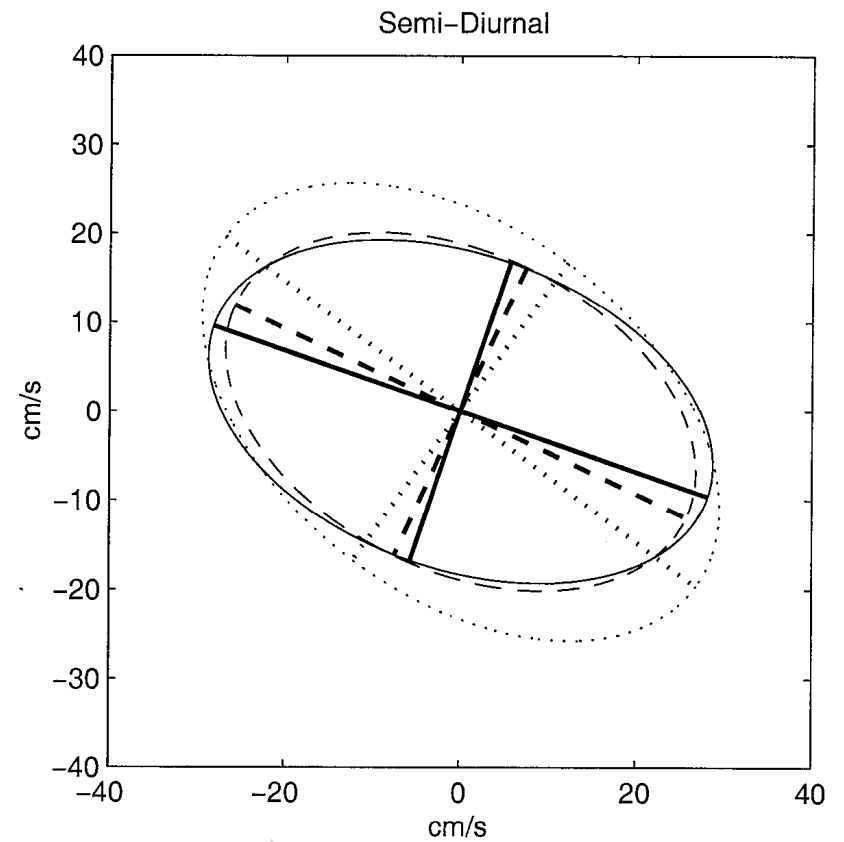
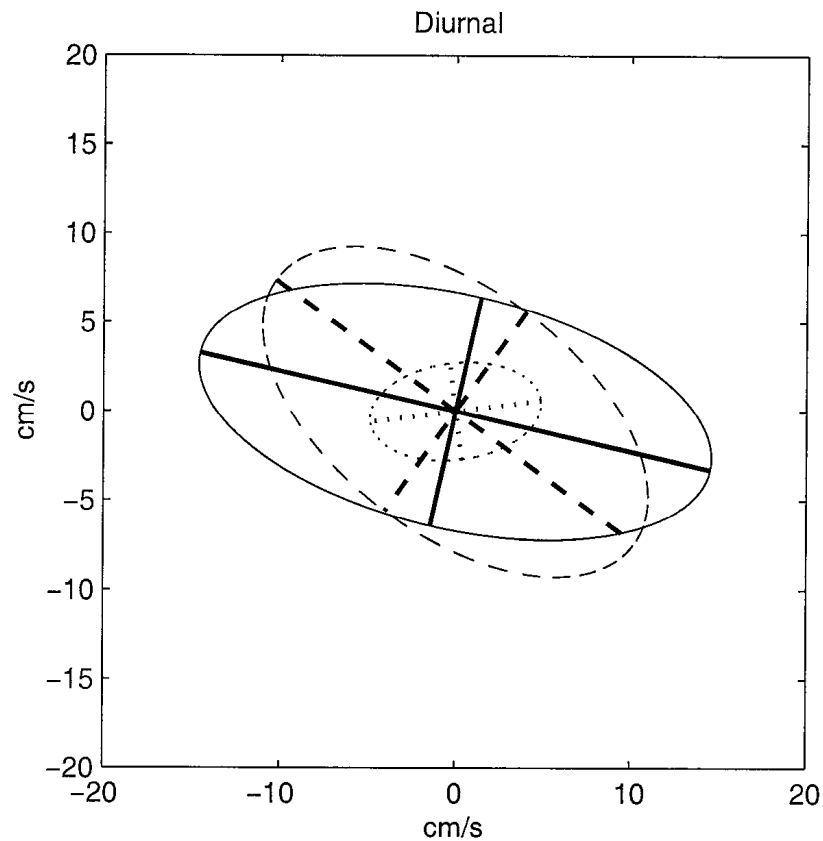
# M2 (semidiurnal) Tidal Ellipses in the Yellow and East China Sea

[from Larsen et al., 1985]

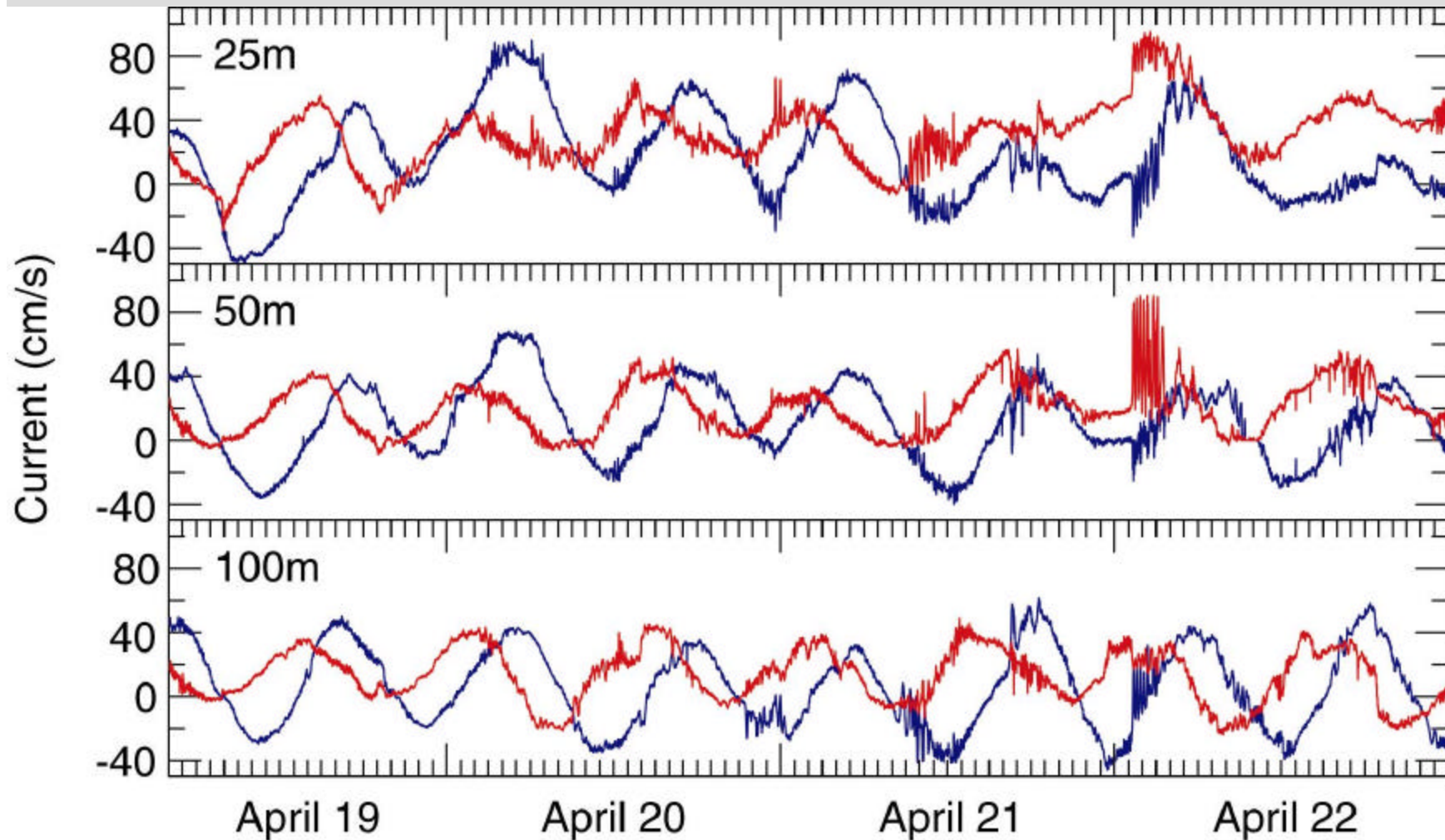


# Tidal Ellipses

## ASIAEX 2000 East China Sea Mooring

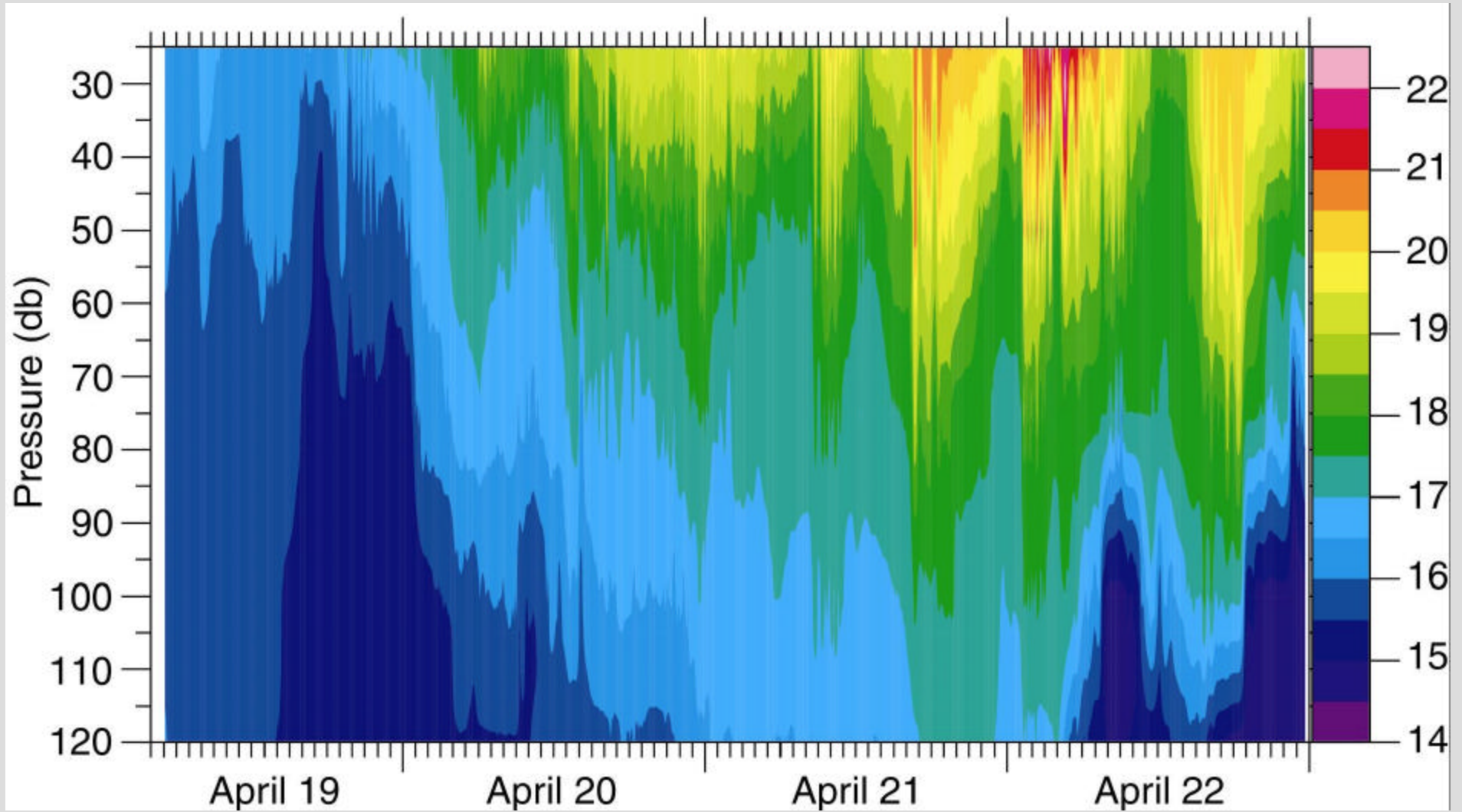


Alongshore (red) and Across-shore (blue) velocity components from the ASIAEX mooring, ECS Shelf

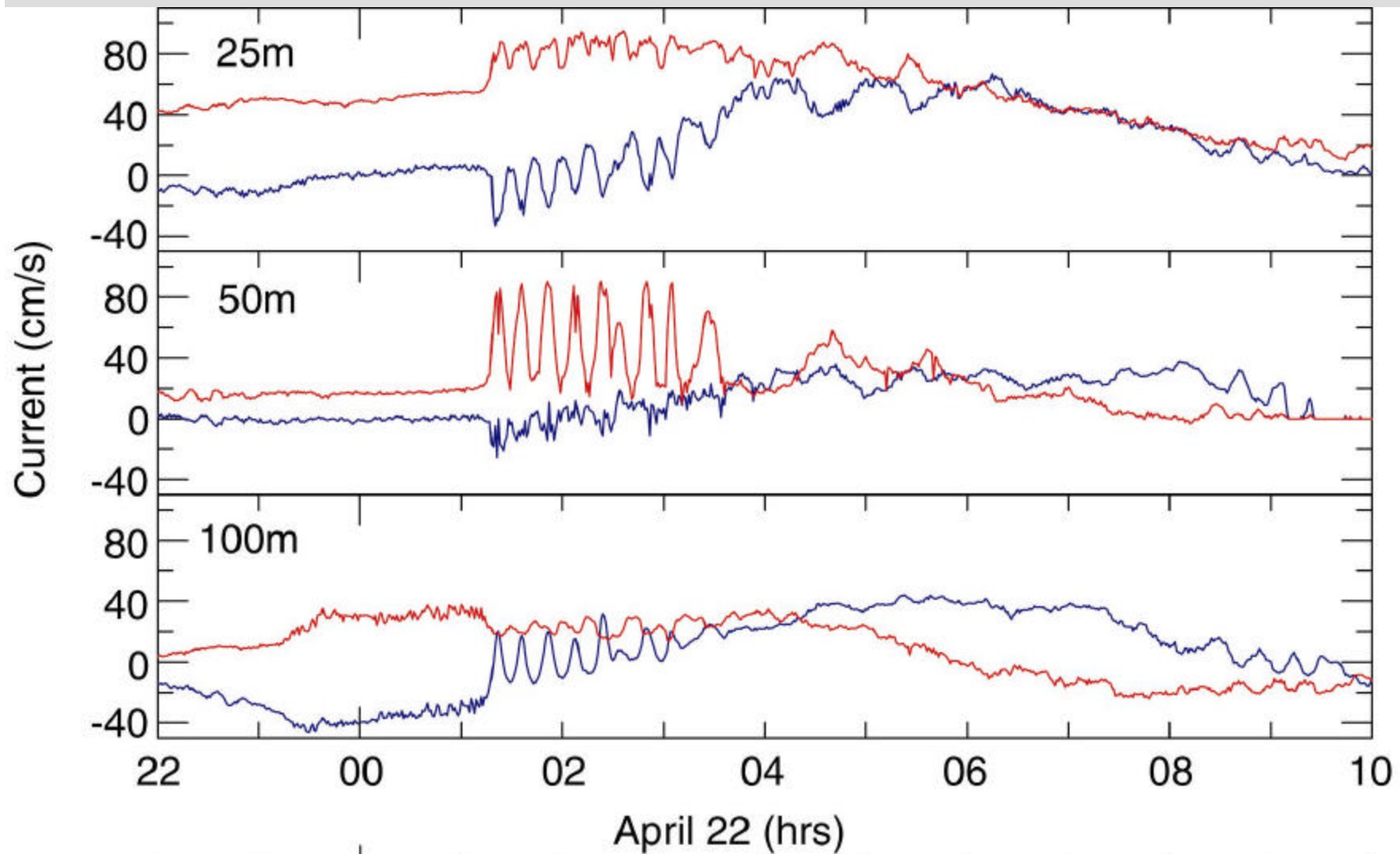




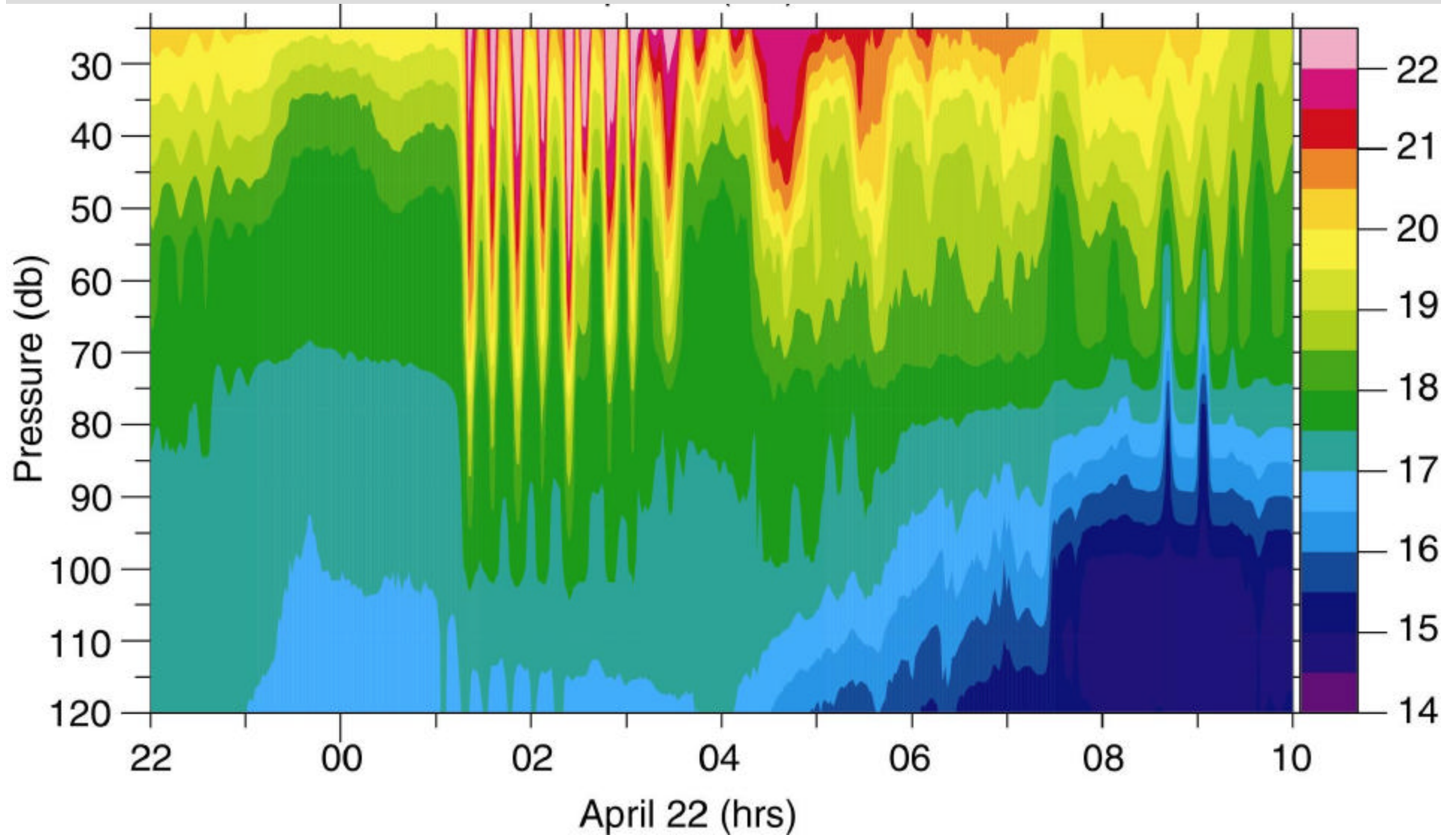
## Temperature Data from ECS Shelf Mooring, 125 m Isobath



Expanded x-axis to show internal solitary waves



## Corresponding Temperature Plot

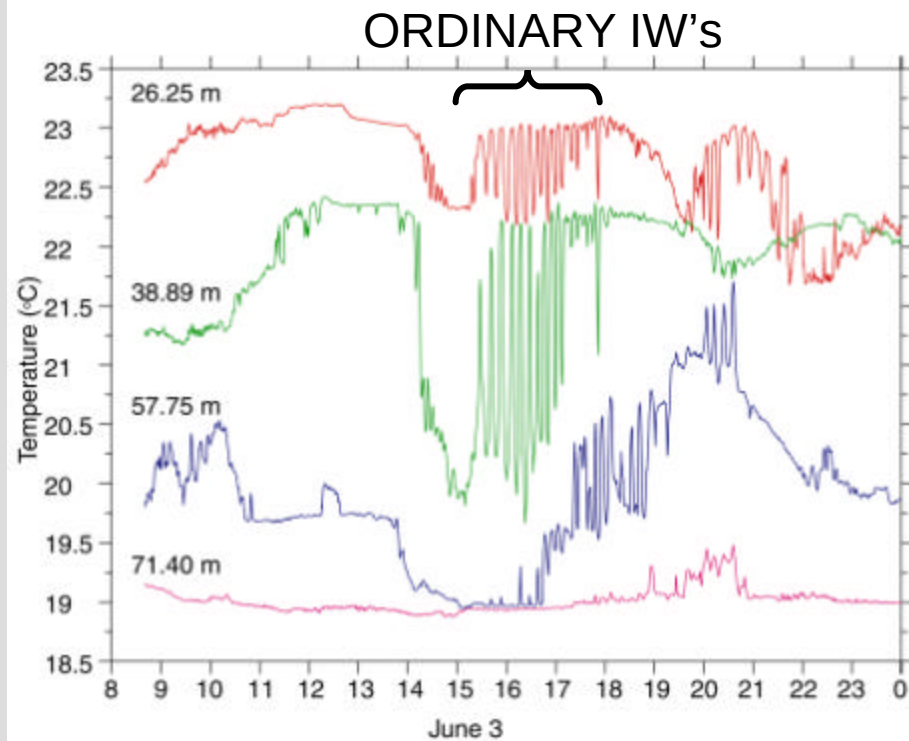
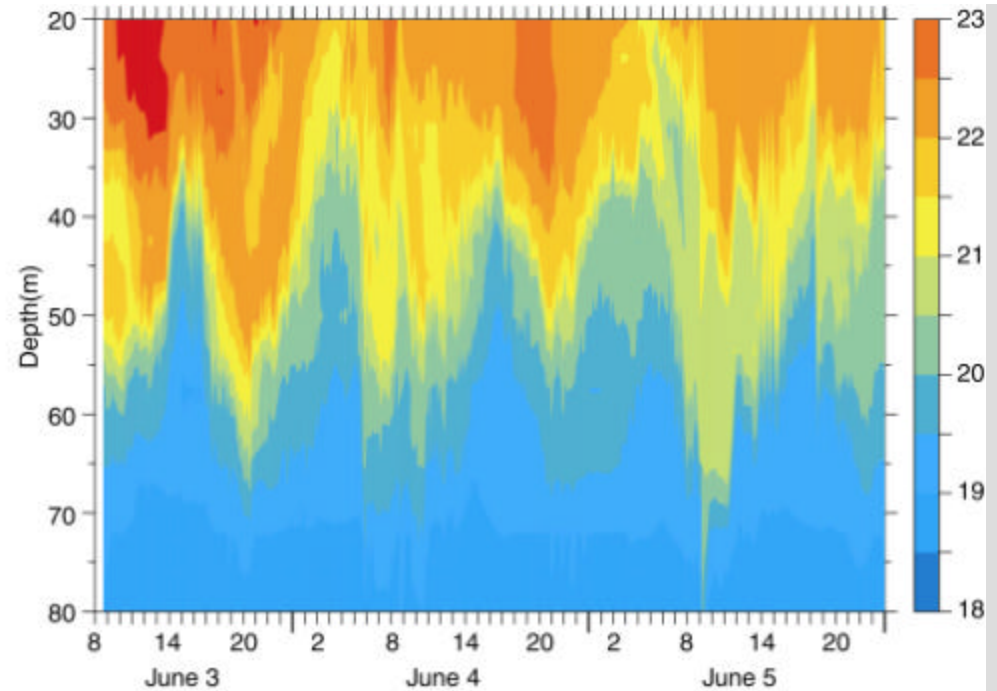


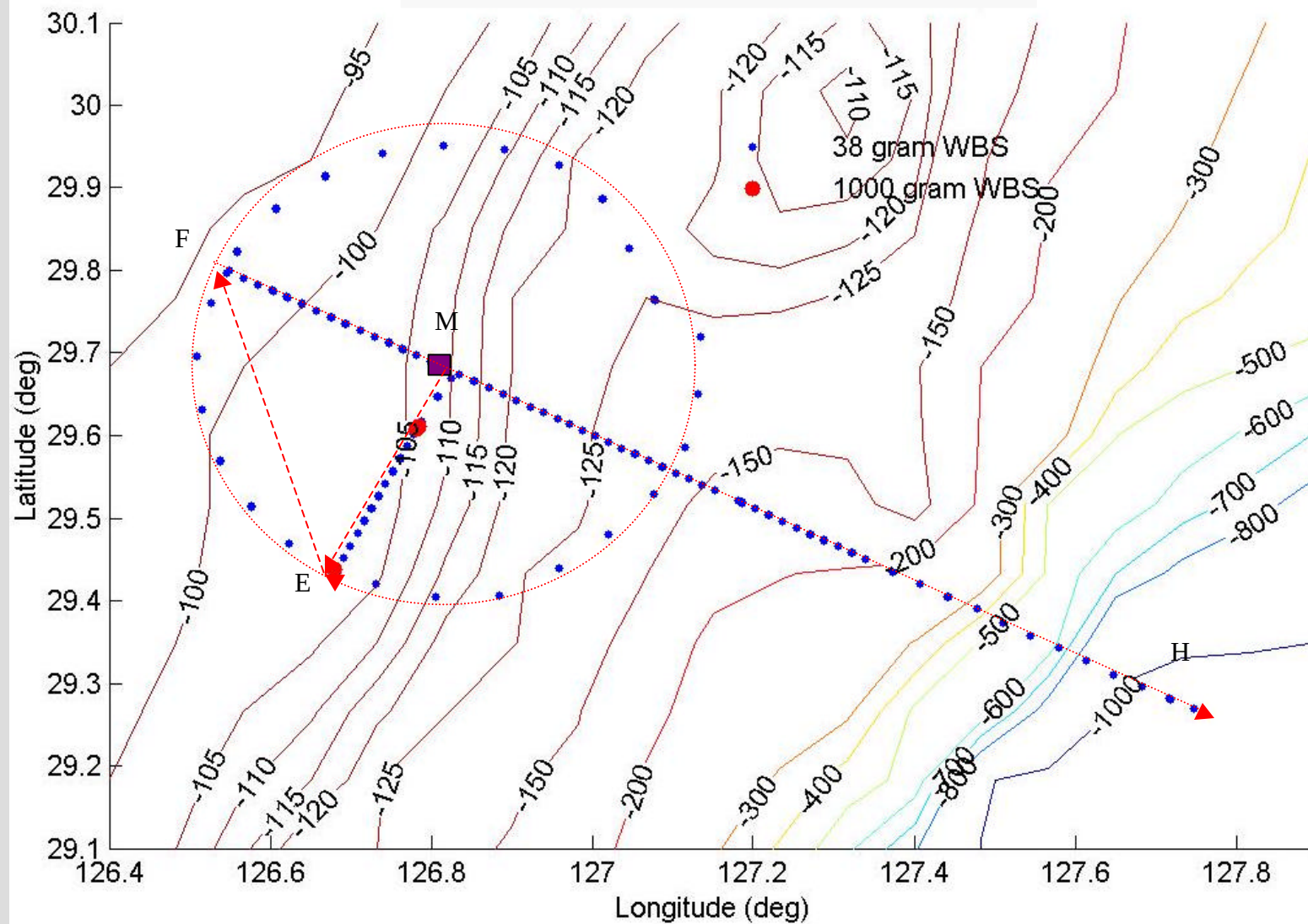
# Properties of the ECS Soliton Packet

|   |                          |                       |
|---|--------------------------|-----------------------|
| • | Amplitude ( $\eta_0$ )   | 40 m                  |
| • | Max Horizontal Current   | 70 cm s <sup>-1</sup> |
| • | Period (T)               | 15 min                |
| • | Phase Speed              | 83 cm s <sup>-1</sup> |
| • | Wavelength ( $\lambda$ ) | 500 – 800 m           |
| • | Half Width (L)           | ~300 m                |
| • | Number in Packet         | 8-9                   |
| • | Total Packet Length      | ~7 km                 |



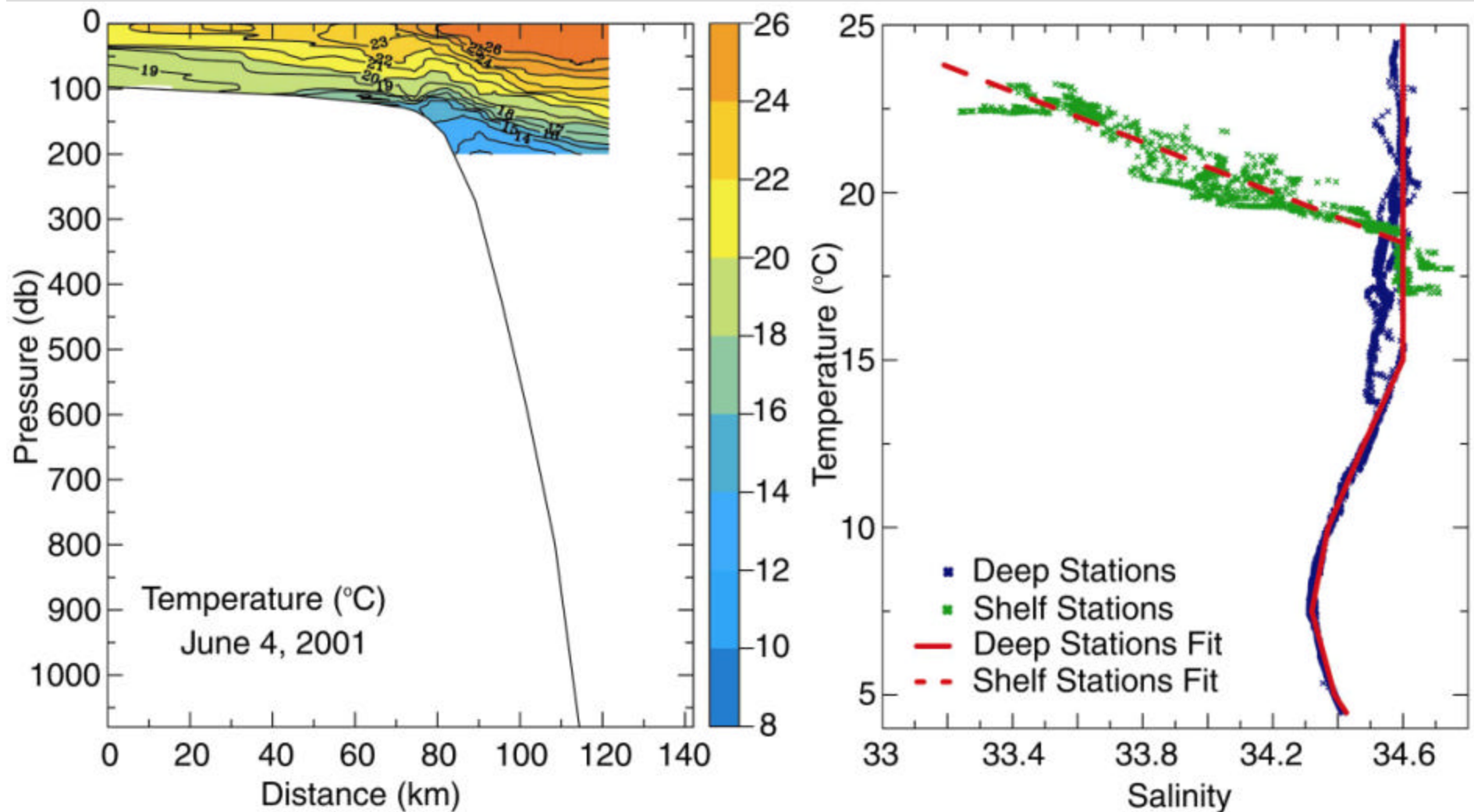
ASIAEX  
June 2001  
T-String  
Data



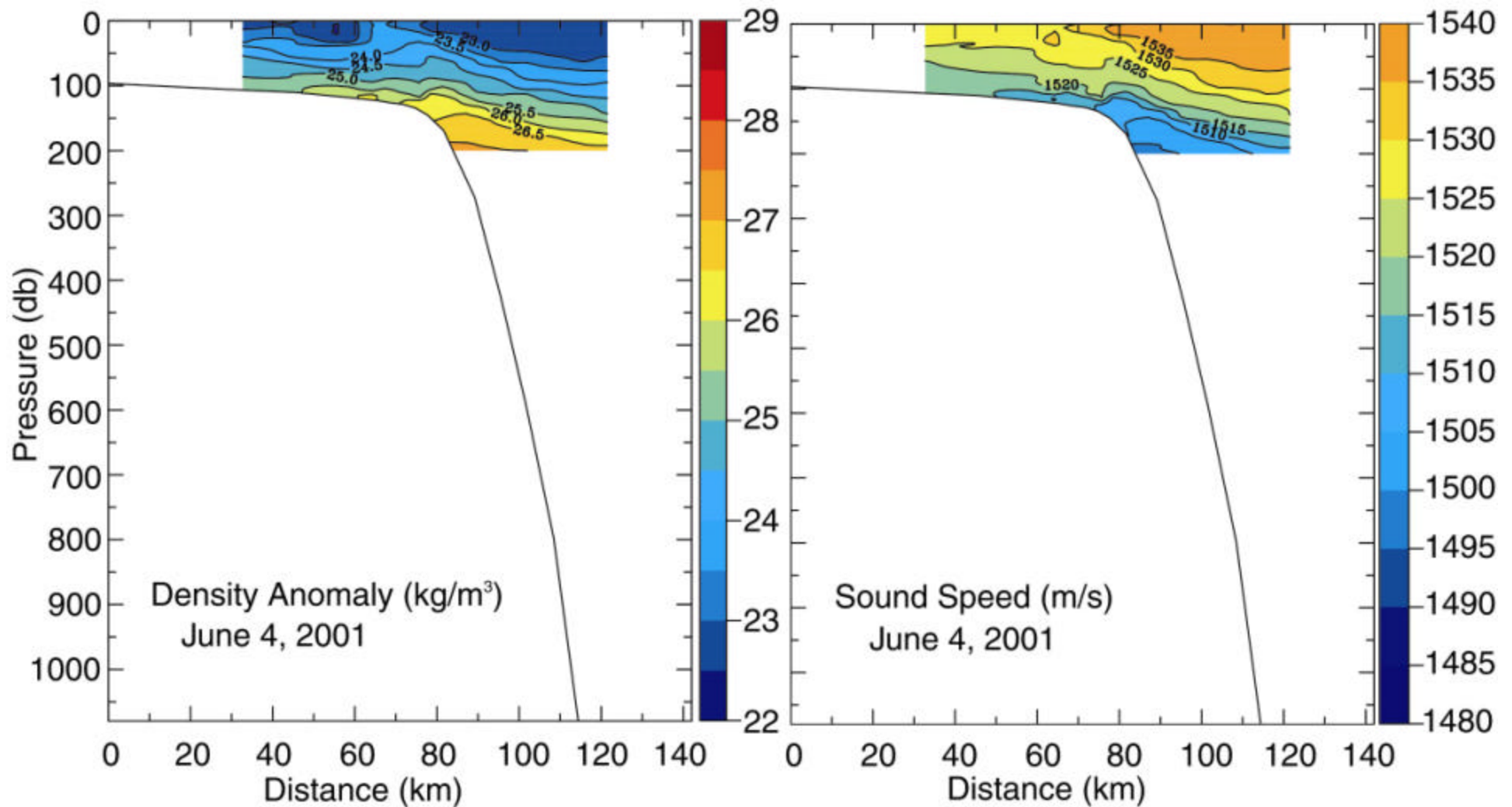


## SHI YAN 2 WBS AND XBT DROP LOCATIONS

# Synthesizing Sound Speed, June 2001



# The Results



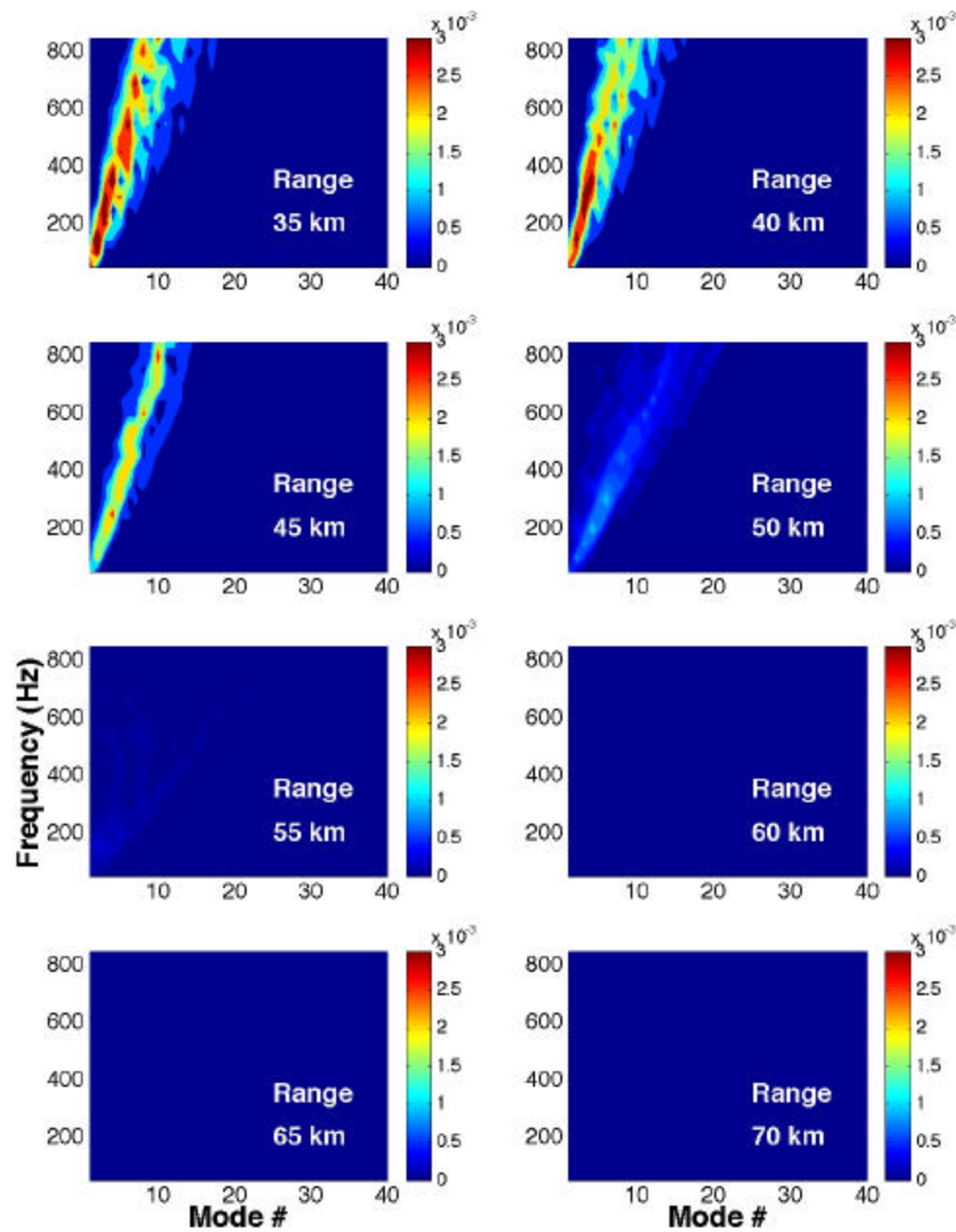




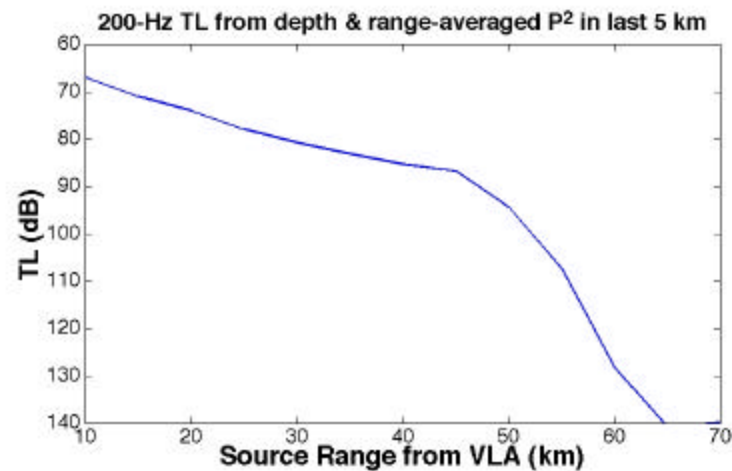
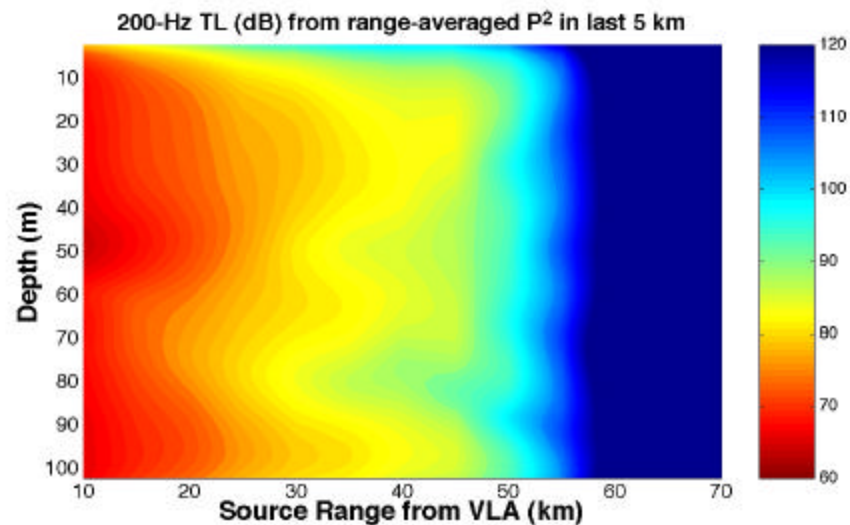
## ACOUSTIC IMPACTS:

East China Sea Frontal Effect:

Signal degradation in slope-to-shelf  
transmission

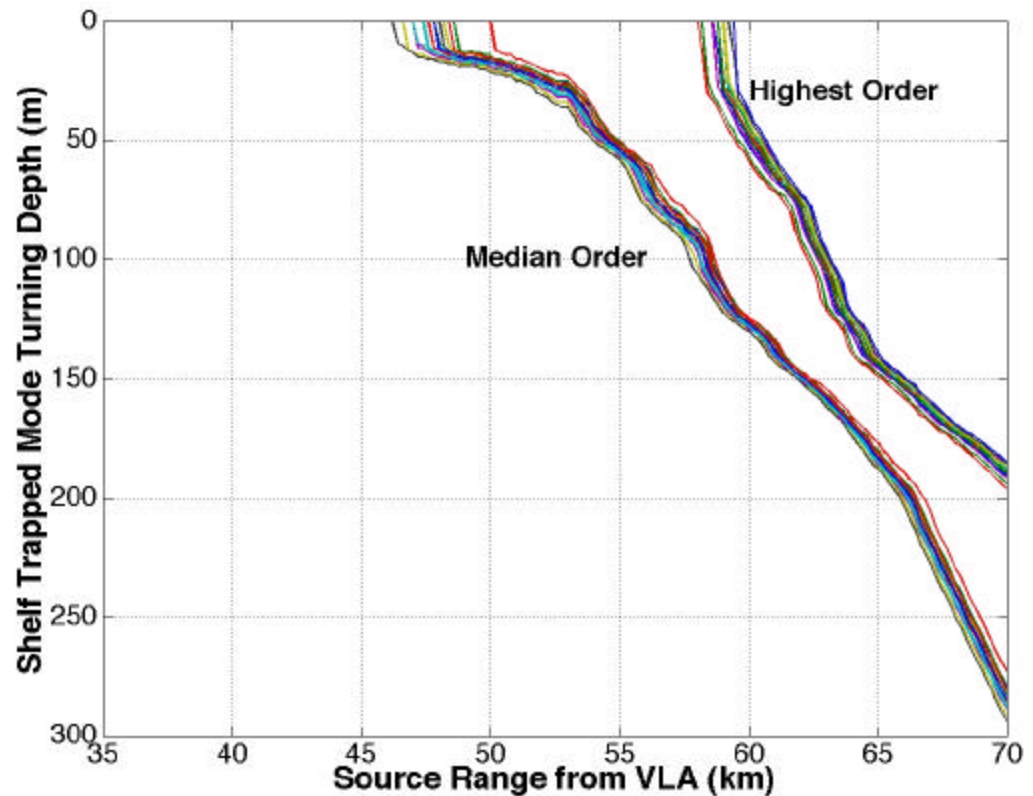
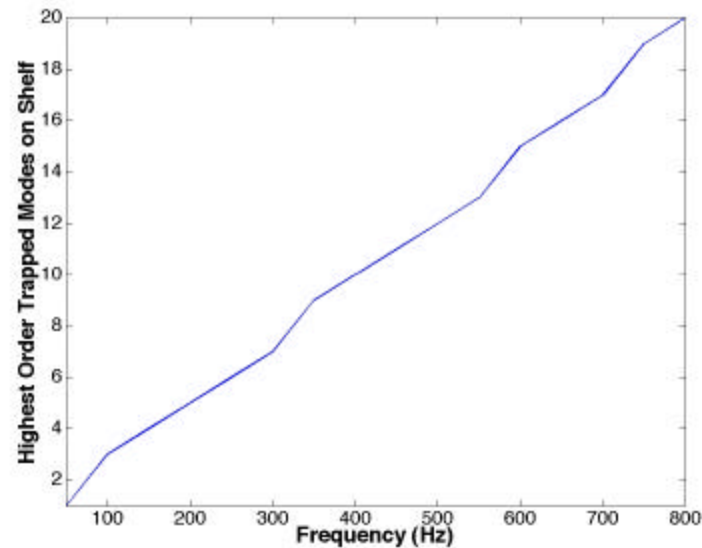


Modeled frequency-mode # distribution of signal magnitude at VLA location on the shelf (0 km) and its dependency on source range (positive seaward). Source depth was 50 m.



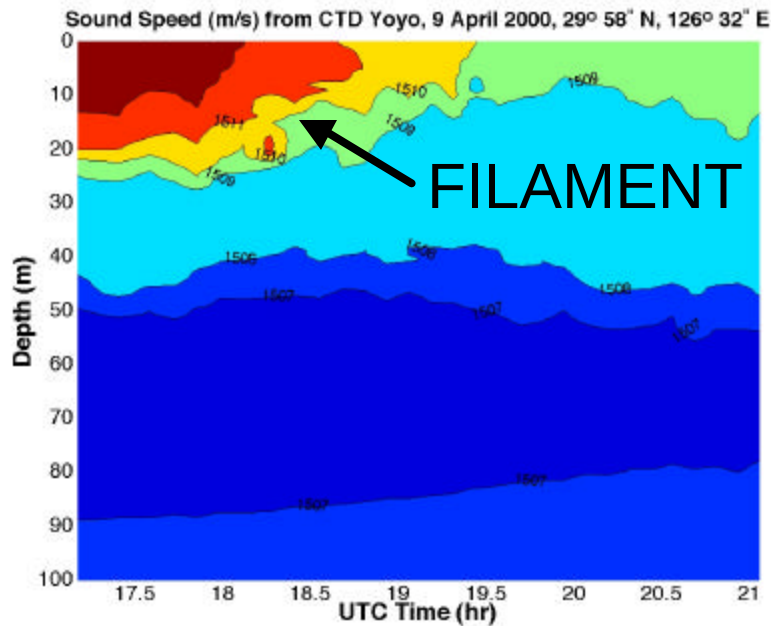
Modeled 200-Hz TL at VLA location (0 km) as a function of source range (positive seaward) for a source depth of 50 m.





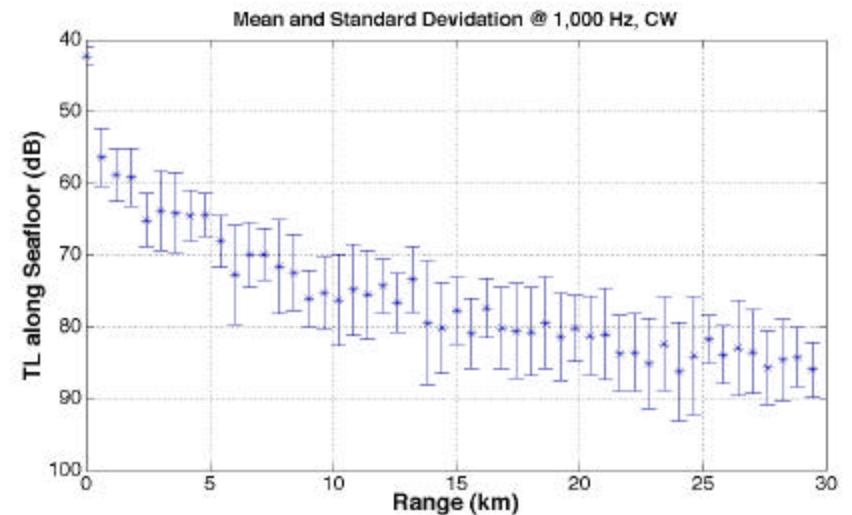
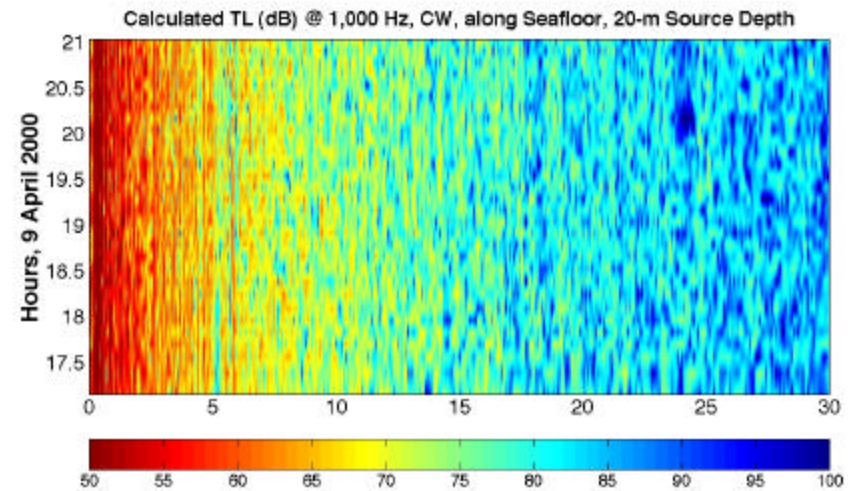
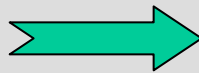
The maximum number of trapped modes on the shelf is shown on the left. These trapped modes begin to turn in the interior near the shelf edge (right) due to an increased down gradient. Note: No “shelf” trapped modes are excited if the source is placed above the turning depth of the highest-order trapped modes.

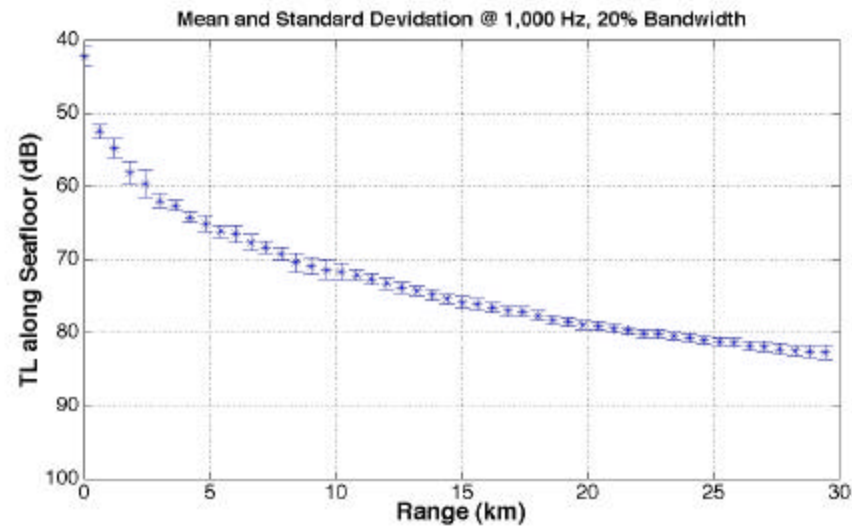
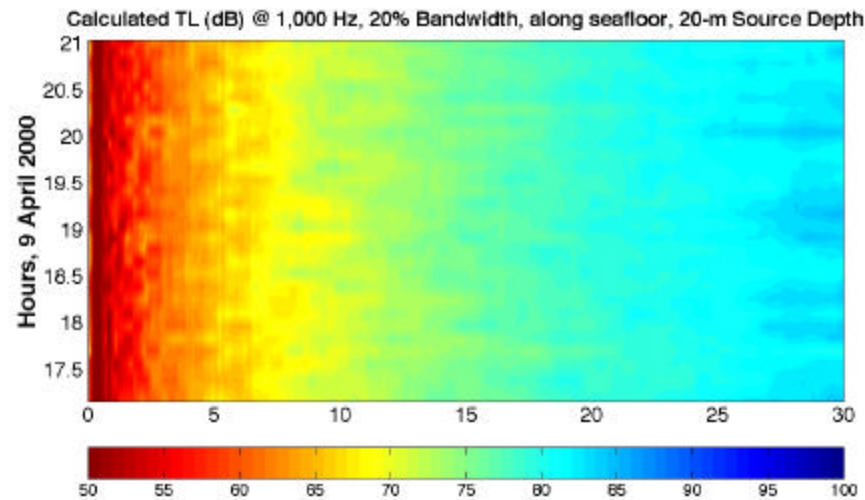




## Sound Speed versus Time

Corresponding temporal fluctuations in the modeled TL for a CW transmission, showing large variances.





Corresponding temporal fluctuations in the modeled TL for a bandpass signal transmission, showing much reduced variances.

# Summary

- The primary ocean feature of interest in the ASIAEX ECS region is the Kuroshio front
- Seasonal evolution of T/S structure to warmer/fresher in summer than spring
- Solitons not common, but may be generated under special conditions combining tidal and mesoscale motions
- Acoustic model across KS front can explain observed WBS propagation loss
- Small warm filament on shelf caused 5 db uncertainty in TL at 1 kHz along the bottom