South China Sea Shelfbreak TL and Horizontal Coherence Statistics

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NPS Accomplishments

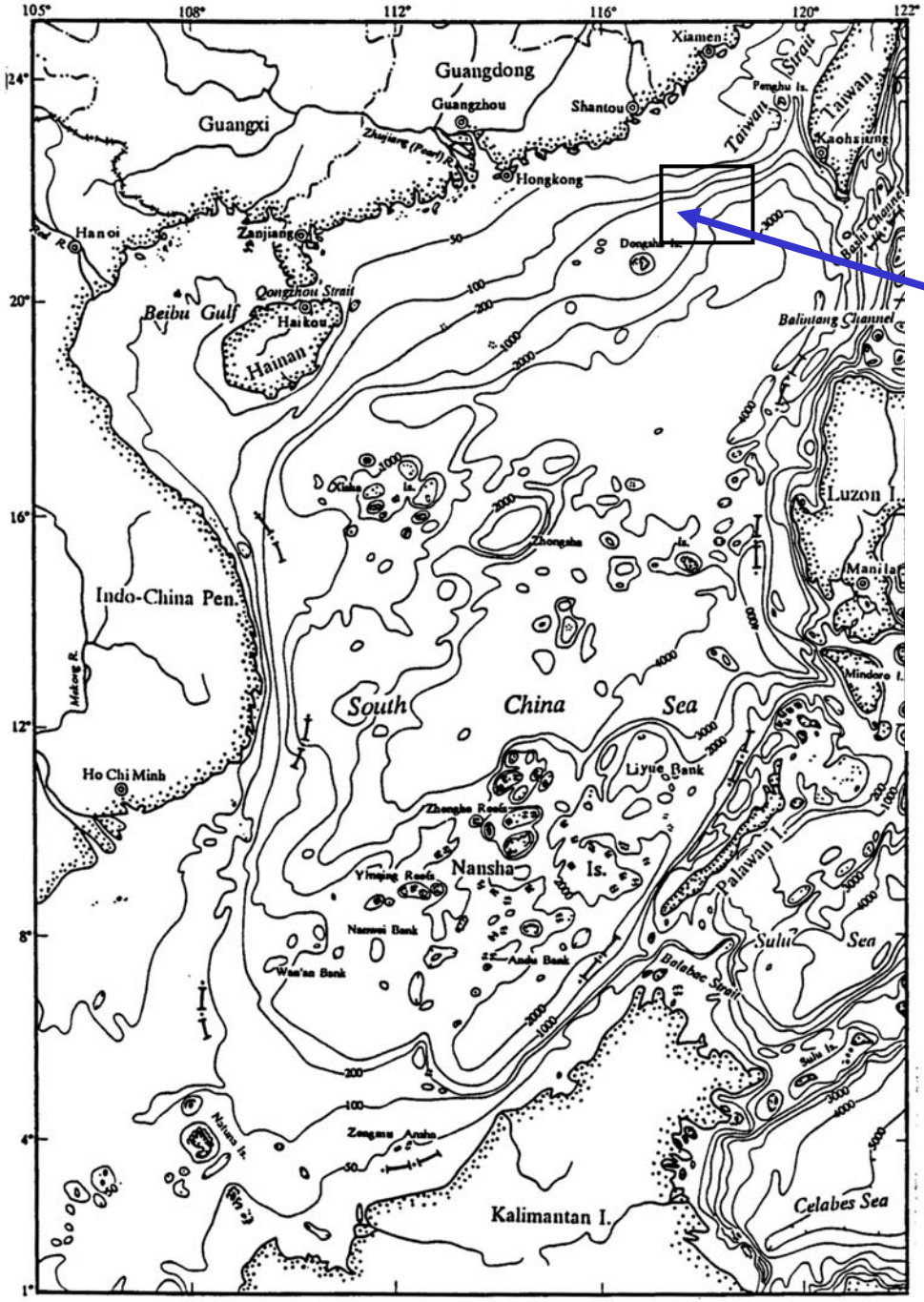
(1) TL and Coherence Uncertainty Characterization (short scales)

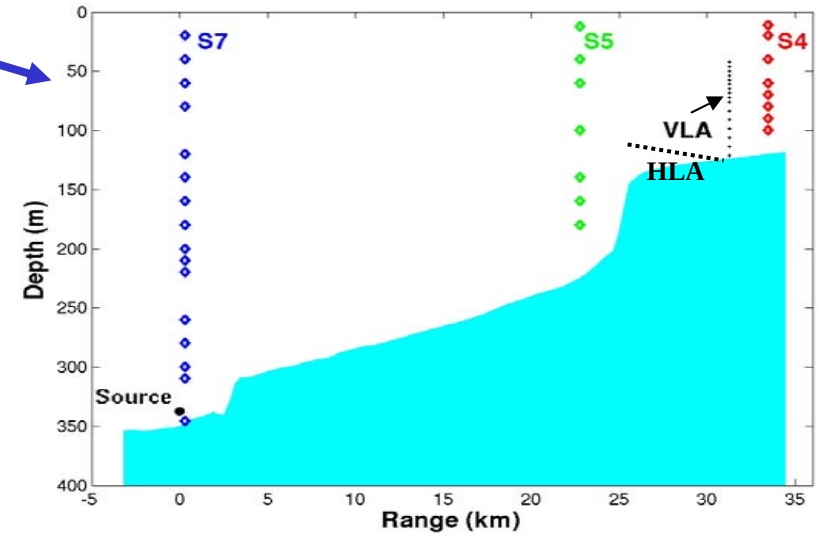
- Analyzed Shelfbreak PRIMER TL statistics. (IEEE JOE paper in preparation with OASIS.)
- Analyzing intra and inter-daily variability of the SCS shelfbreak (ASIAEX) TL, temporal and horizontal coherence statistics.
- Analyzing the dependence of the SCS shelfbreak TL fluctuation statistics on signal bandwidth.
- Performing model simulation of the SCS shelfbreak TL fluctuation statistics, and comparing modeled statistics to measured statistics to quantify NIW, LIW and bottom contributions.

(2) TL Uncertainty Reduction (long scales)

- Combined PRIMER SeaSoar and moored data (data integration) to upgrade daily SSP and TL estimates, and examined the sensitivity of the TL estimate to the resolution of the sound speed estimate. (JOE paper in preparation with WHOI.)
- Continuing to work with HU on coupled ocean and acoustics data assimilation. PRIMER data assimilation to be completed by end of FY04.

Transmission Configuration





Source on slope

f_o = 400 Hz, BW = 100 Hz

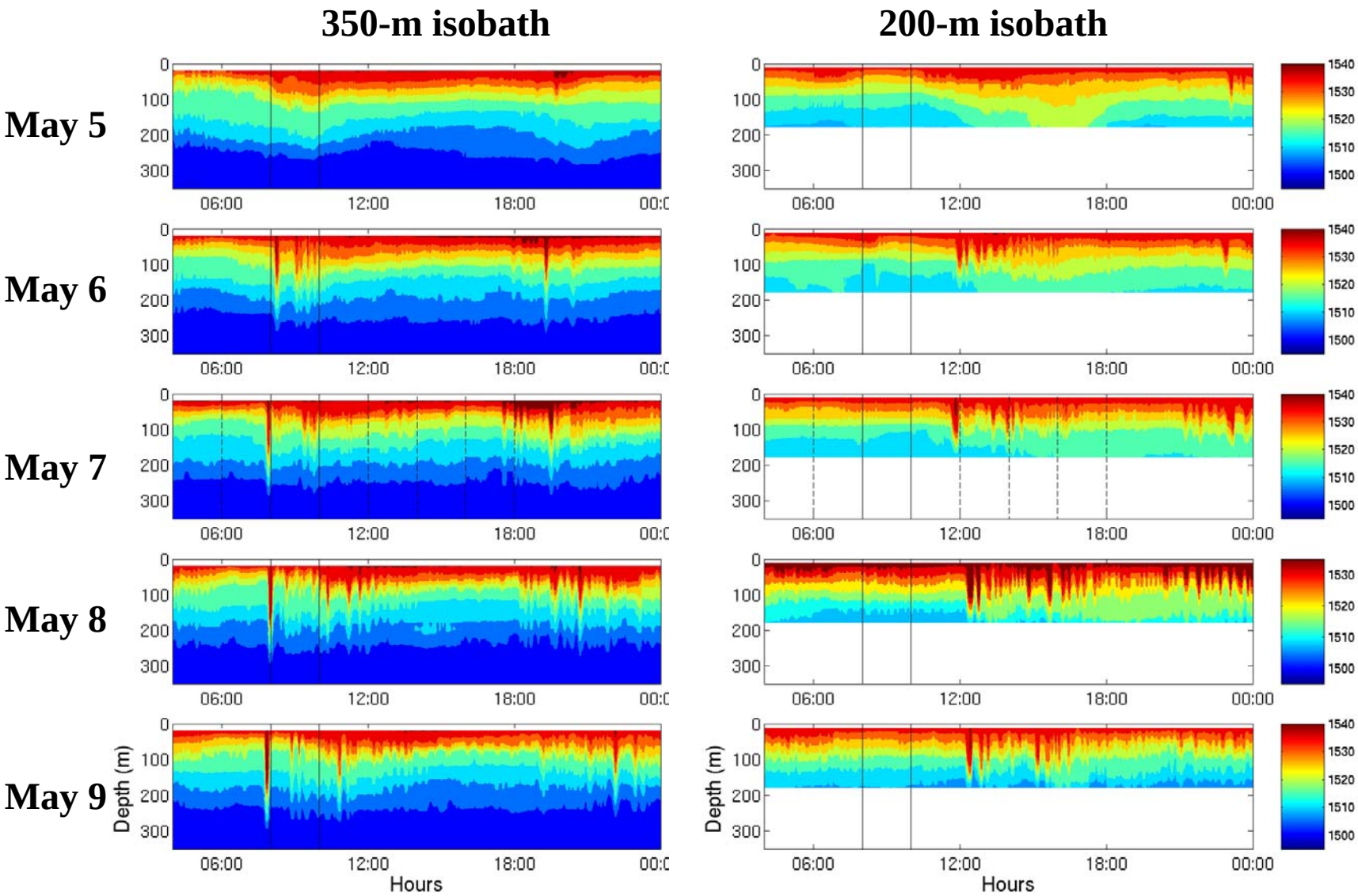
Receiver arrays (VLA & HLA) on shelf

Source bearing ~62°

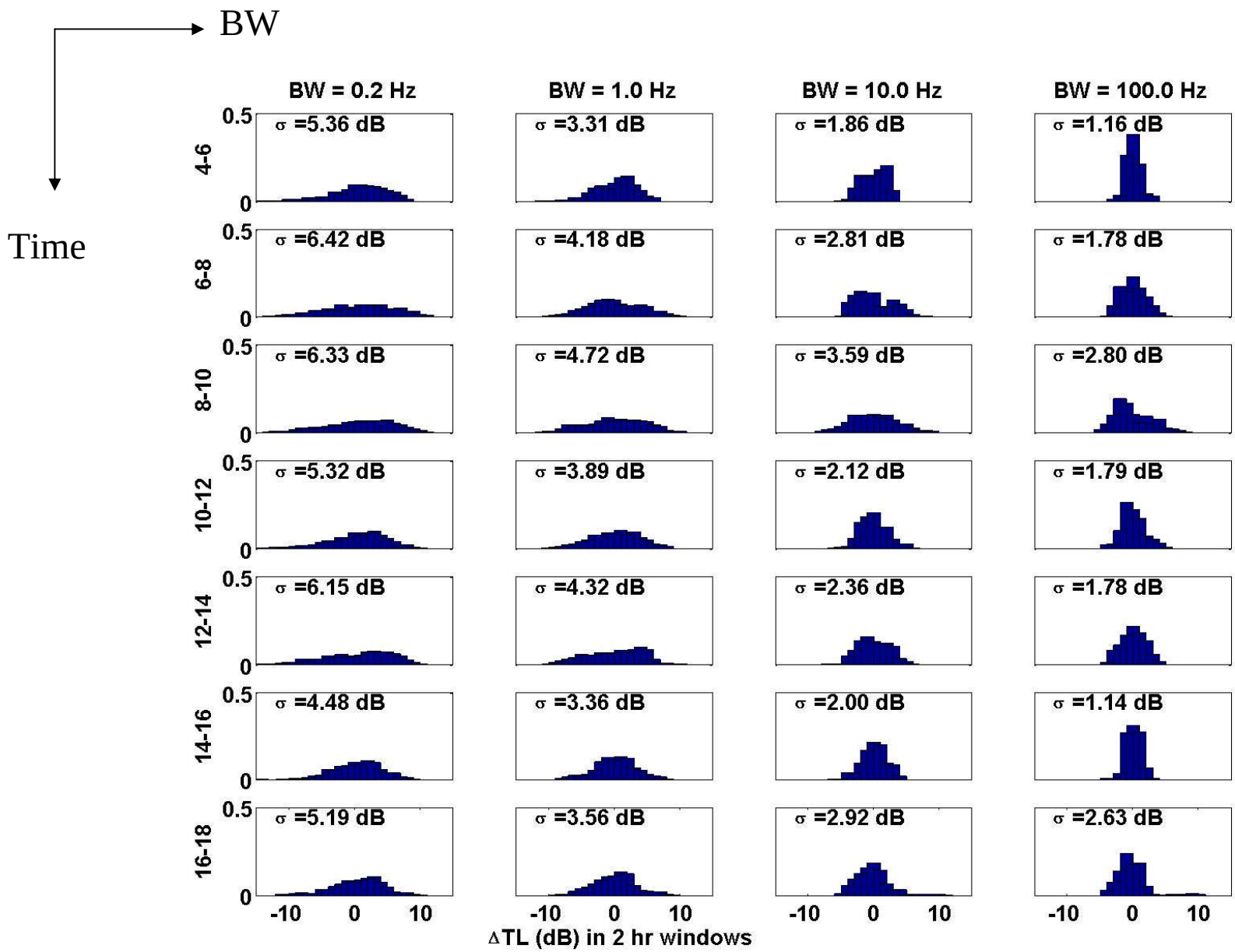
7.5-min (88 signals) transmission every1/2 hr

Sound speed measured by 3 moorings

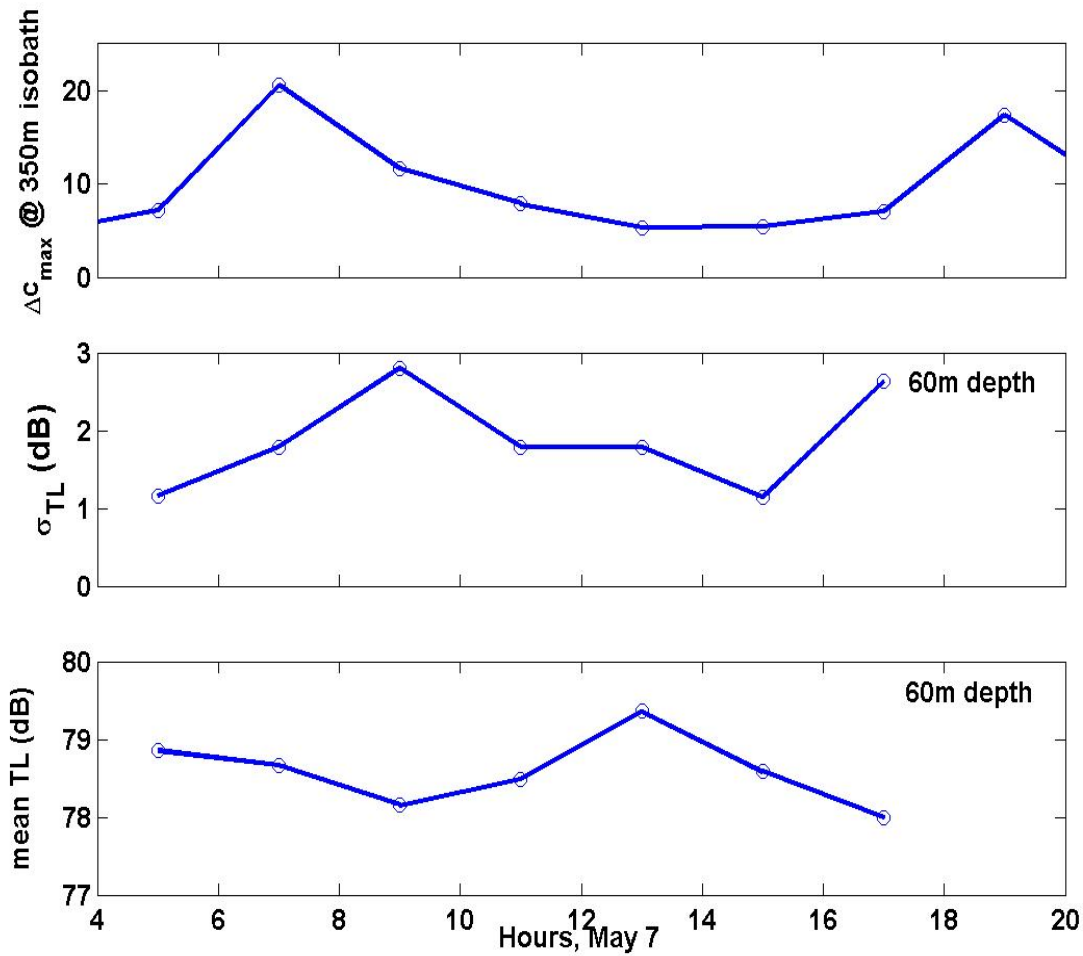
Measured Sound Speed in ASIAEX SCS



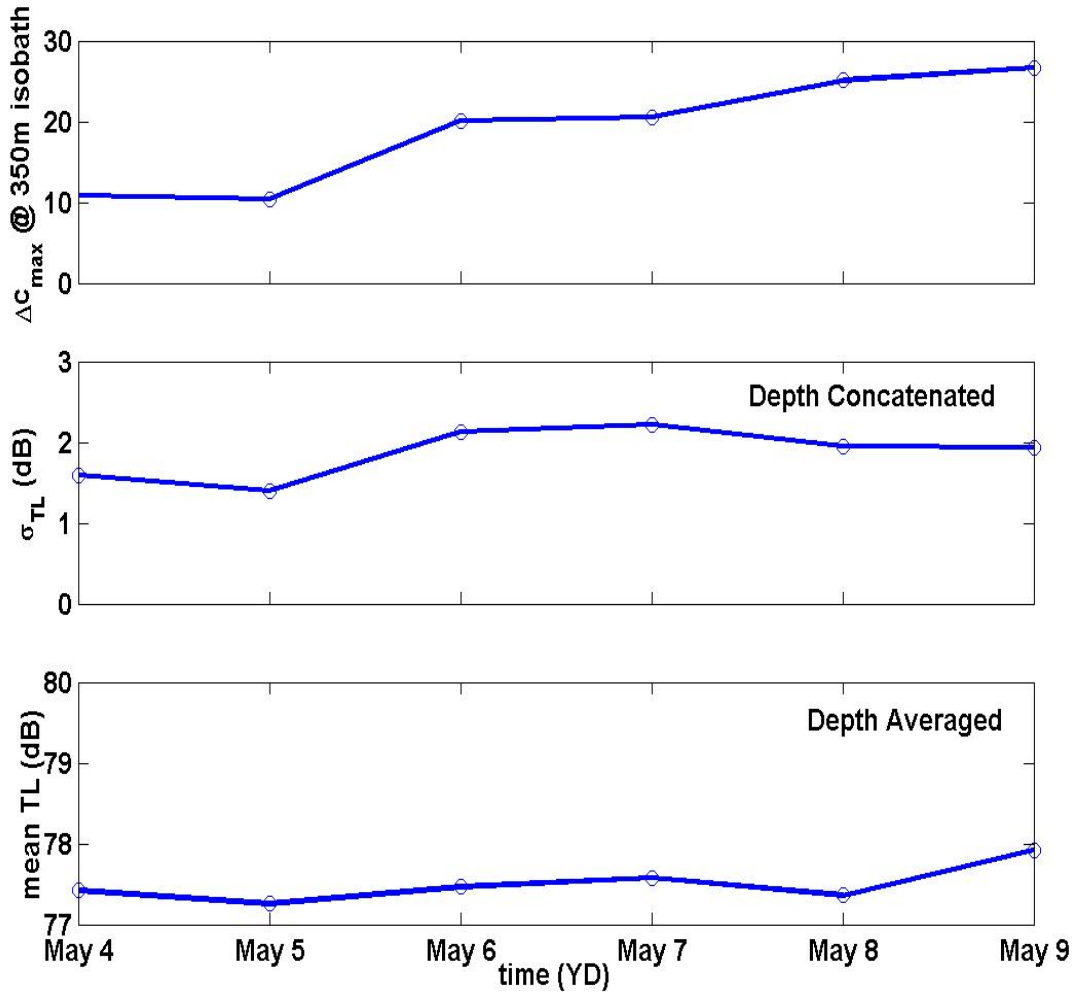
Measured Intra-daily ΔTL Histograms - May 7, 60-m depth



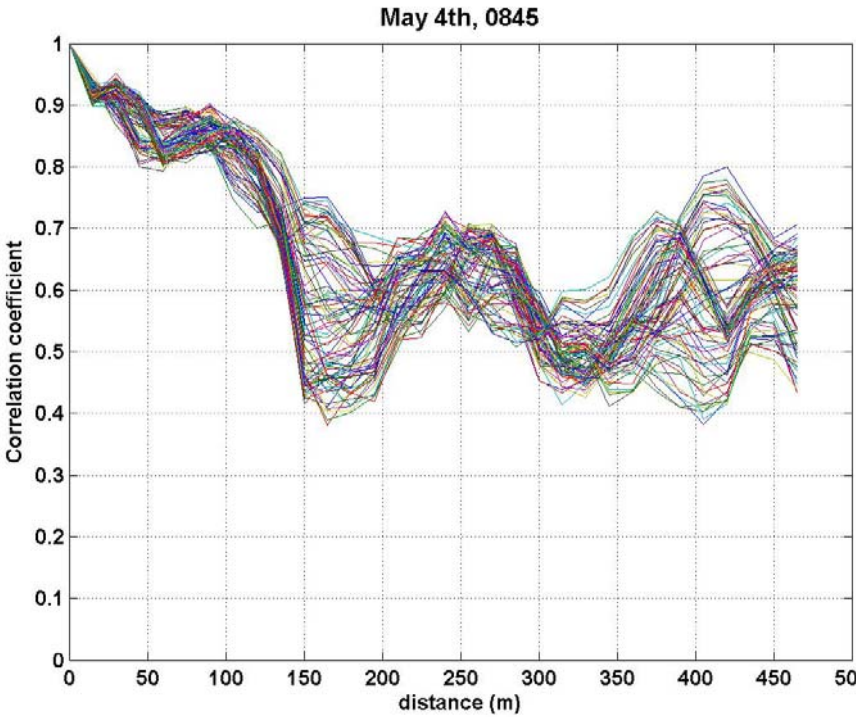
Summary of Measured Intra-daily TL Statistics - May 7

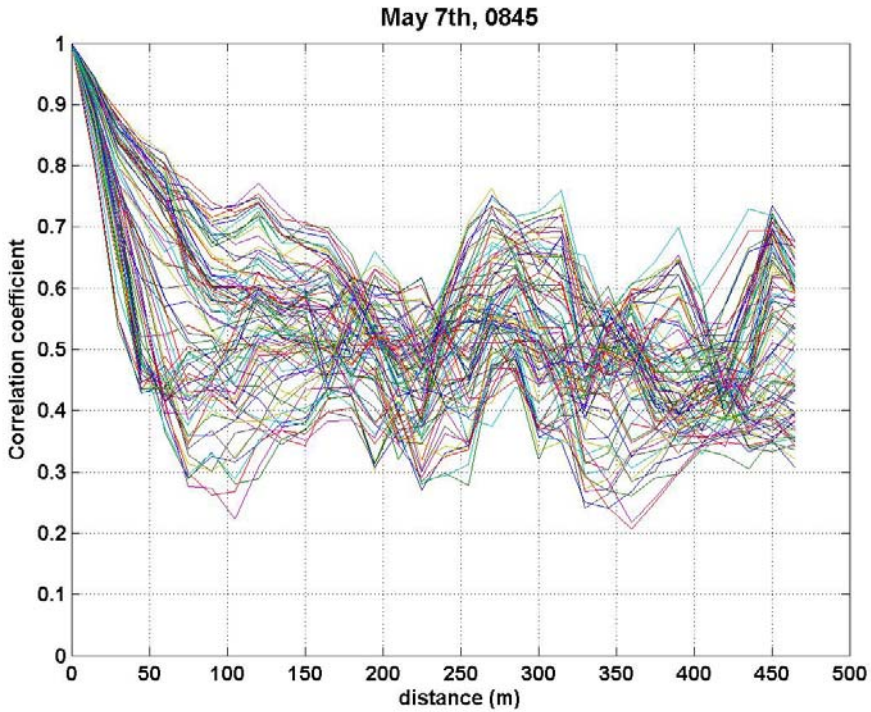


Measured Inter-daily TL Statistics in the 8:00-10:00 window

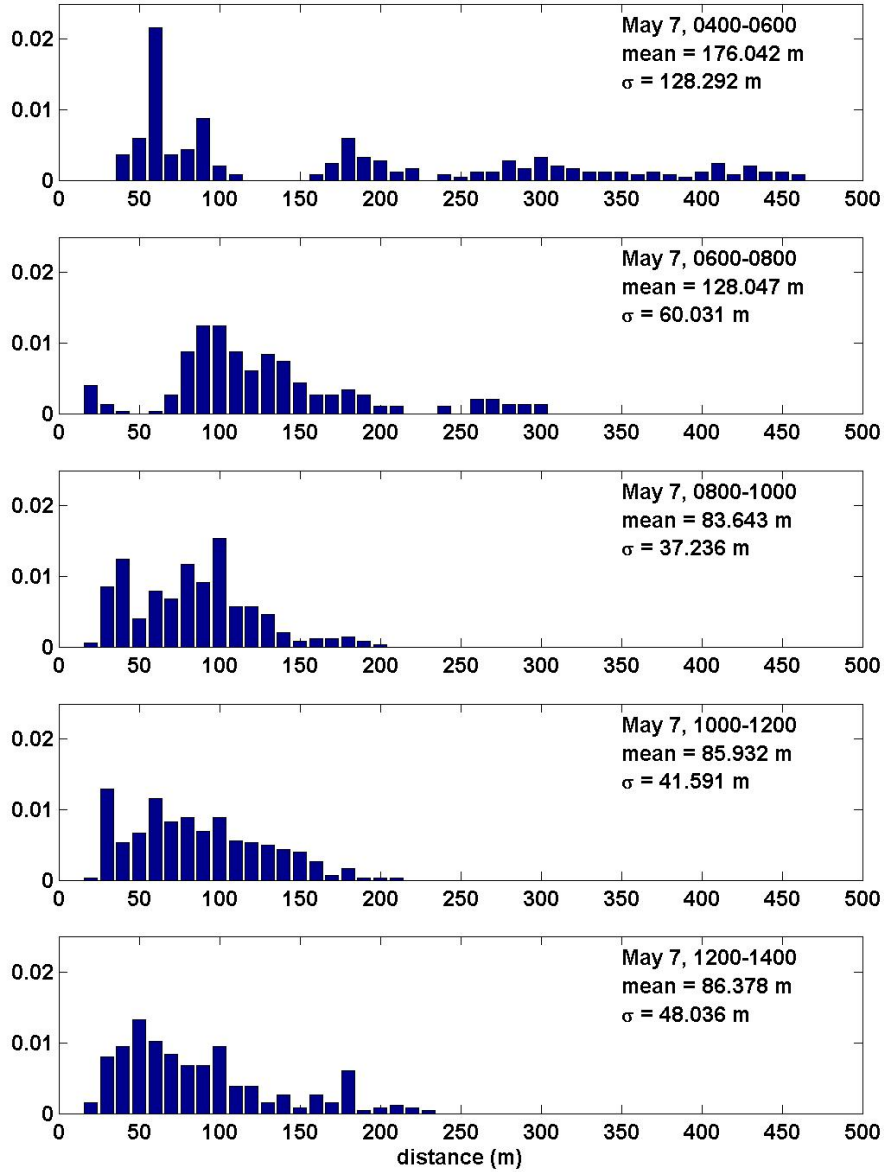


Measured Horizontal Coherence Snapshots

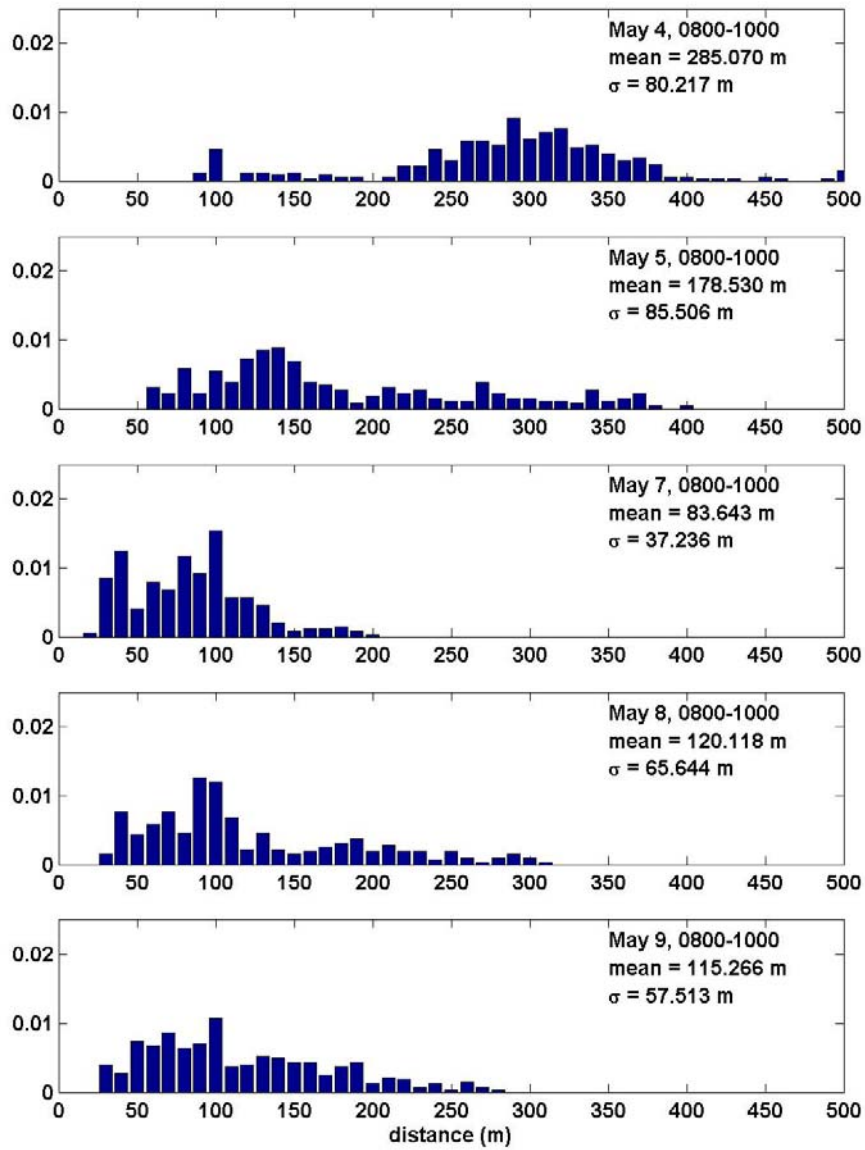




Measured Intra-daily Horizontal Coherence Length Statistics - May 7



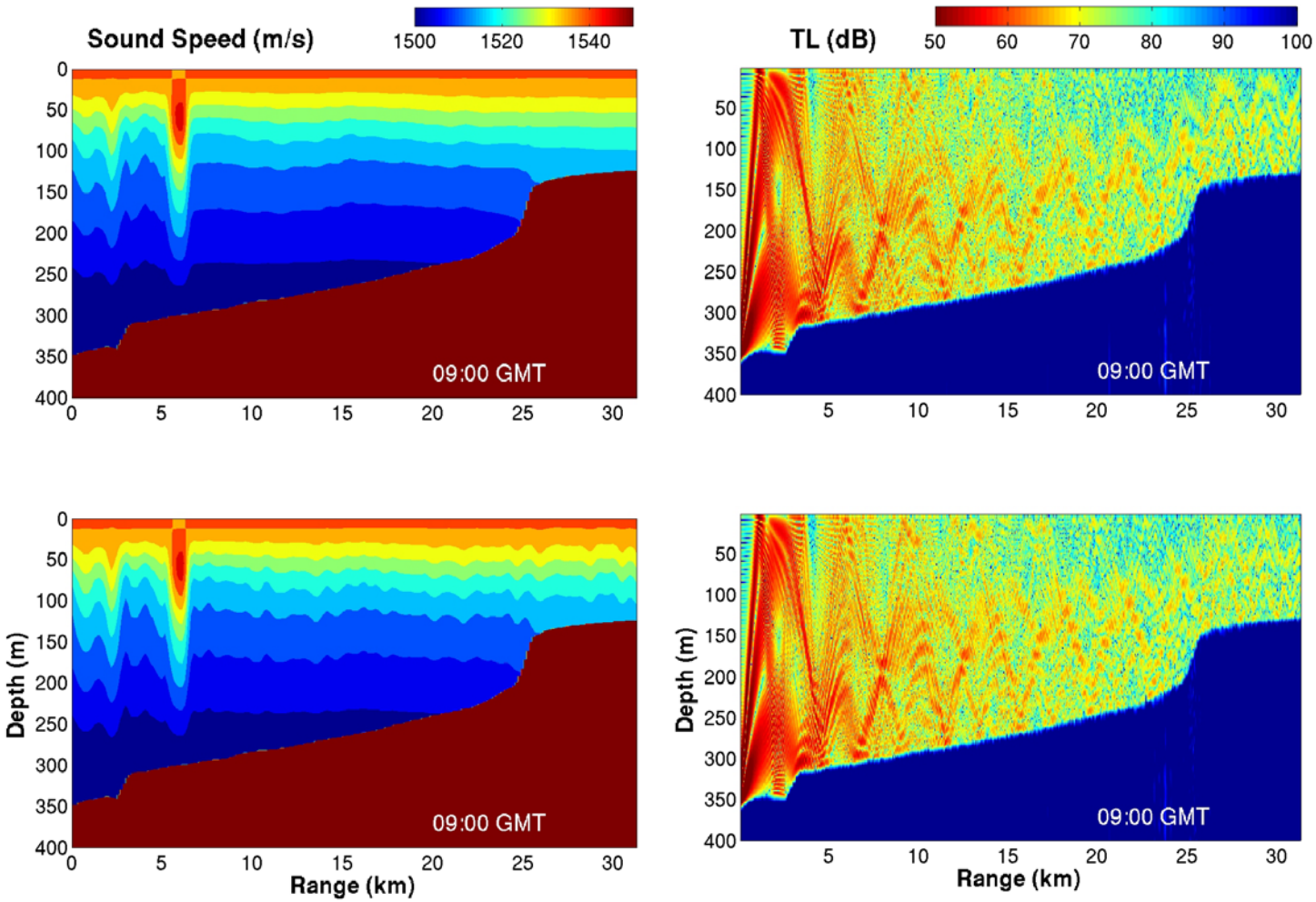
Measured Inter-daily Horizontal Coherence Length Statistics in the 8:00-10:00 window



ASIAEX 2001: May 8 400-Hz Acoustic Modeling Snapshots/Realizations

Nonlinear IW only

Nonlinear IW + Linear IW

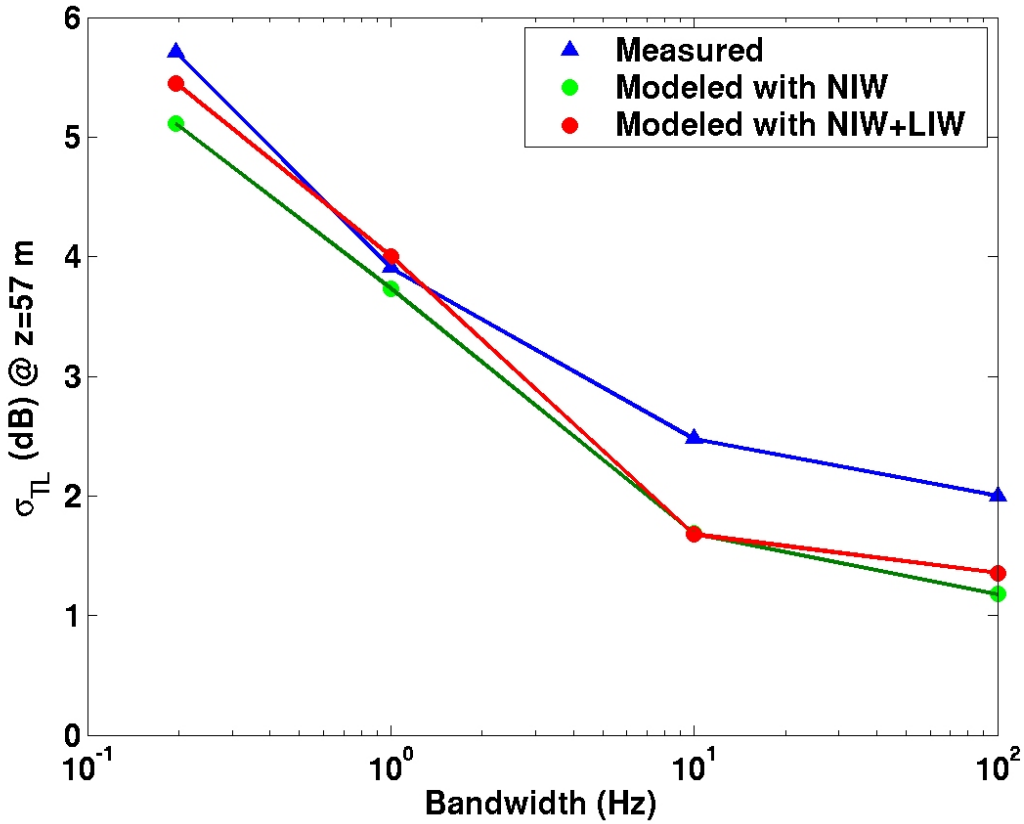


Sound Speed

[Data-based empirical model]

Transmission Loss

ASIAEX SCS: Modeled σ_{TL} vs. BW and Comparison to Data

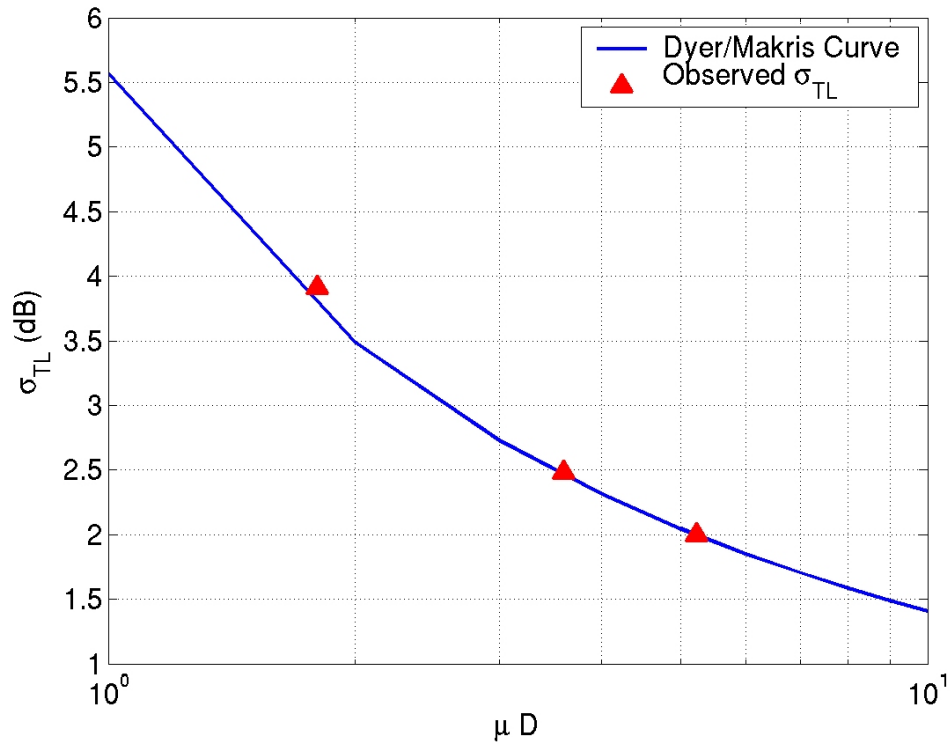


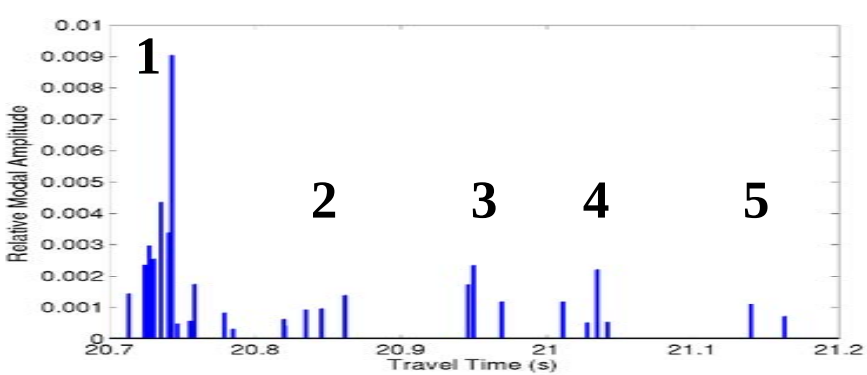
BW Dependence of the ASIAEX SCS σ_{TL}: an explanation

$$\mu = \begin{cases} 1 & \text{for } T \le T_c \\ T/T_c & \text{for } T > T_c \end{cases}$$

T = integration time
T_c = channel coherence time

D = # of temporally disjoint arrivals





Mode arrival structure showing approximately 5 groups of arrival.

Summary of SCS Shelfbreak Findings

•Both TL and horizontal coherence statistics exhibit intra and inter-daily variability.

•σ's and means appear to correlate well with Δc_{max}.

•Knowing whether the nonlinear internal waves are "present" or "absent" is key to assigning the proper uncertainty statistics.

•Linear internal waves add little to the σ_{TL}^2.

•Nonlinear and linear internal waves do not resolve all the observed σ_{TL}^2. Is the unresolved σ_{TL}^2 attributable to the bottom?

•The bandwidth dependence of σ_{TL} appears to be related to the number of temporally disjoint arrivals.

Supplemental Slice

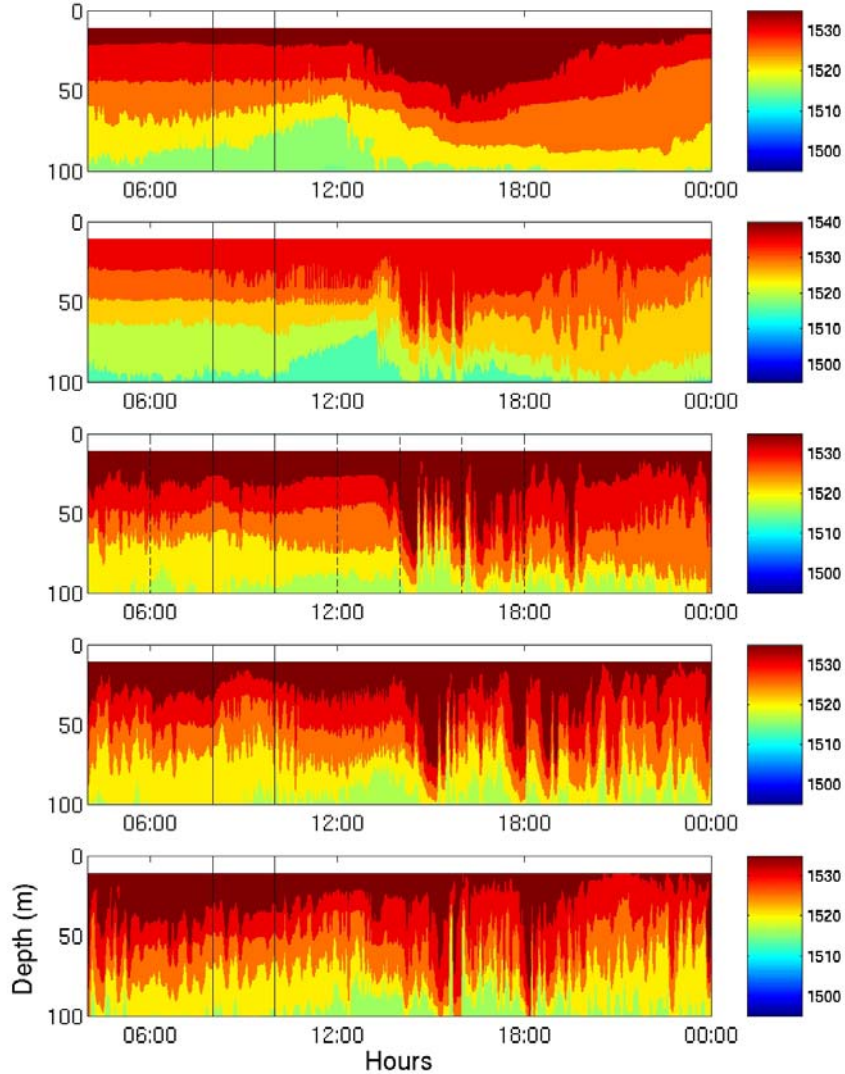
Measured "Shelf" Sound Speed in ASIAEX SCS

120-m isobath

May 5

May 6

May 7

May 8

May 9