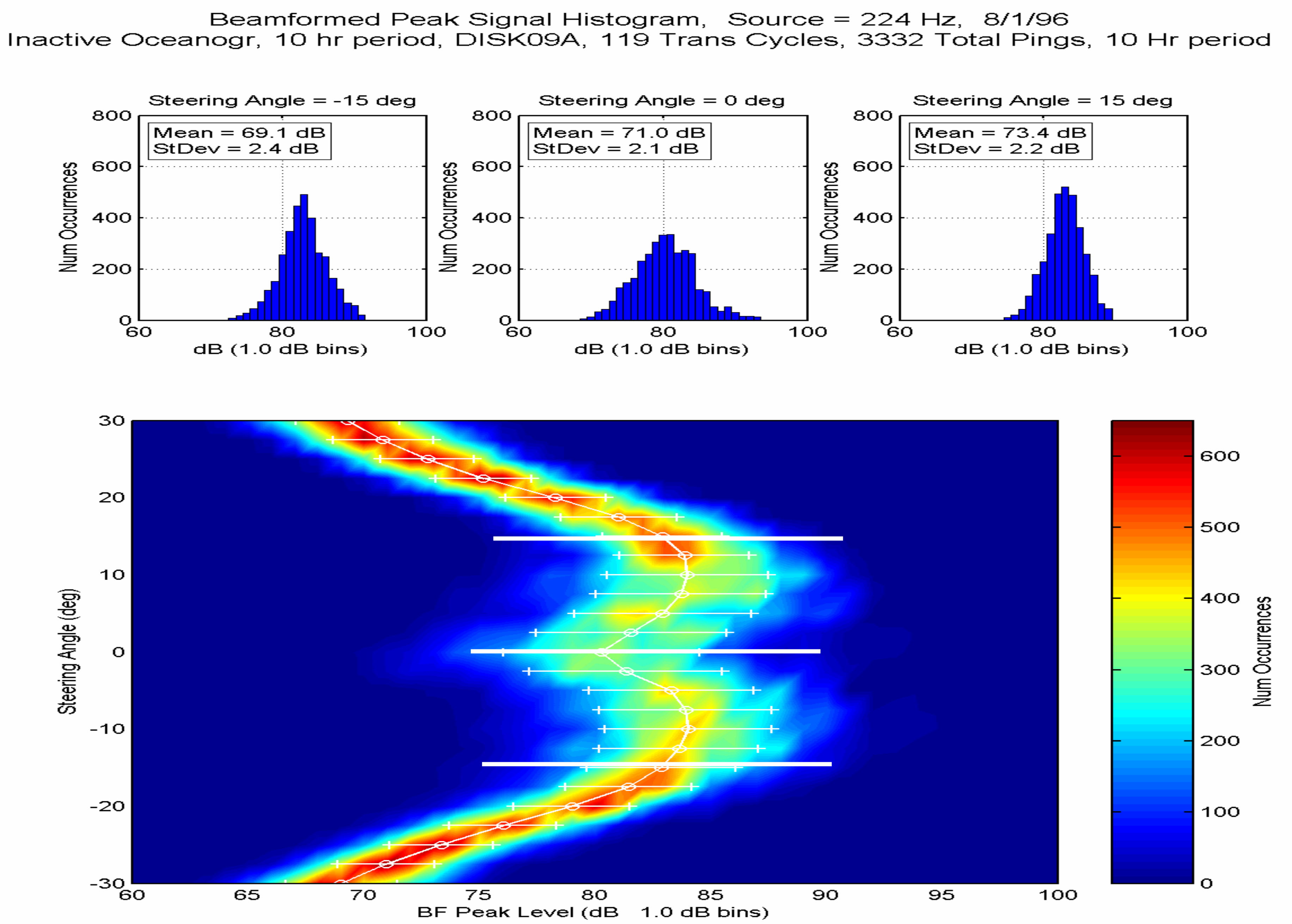
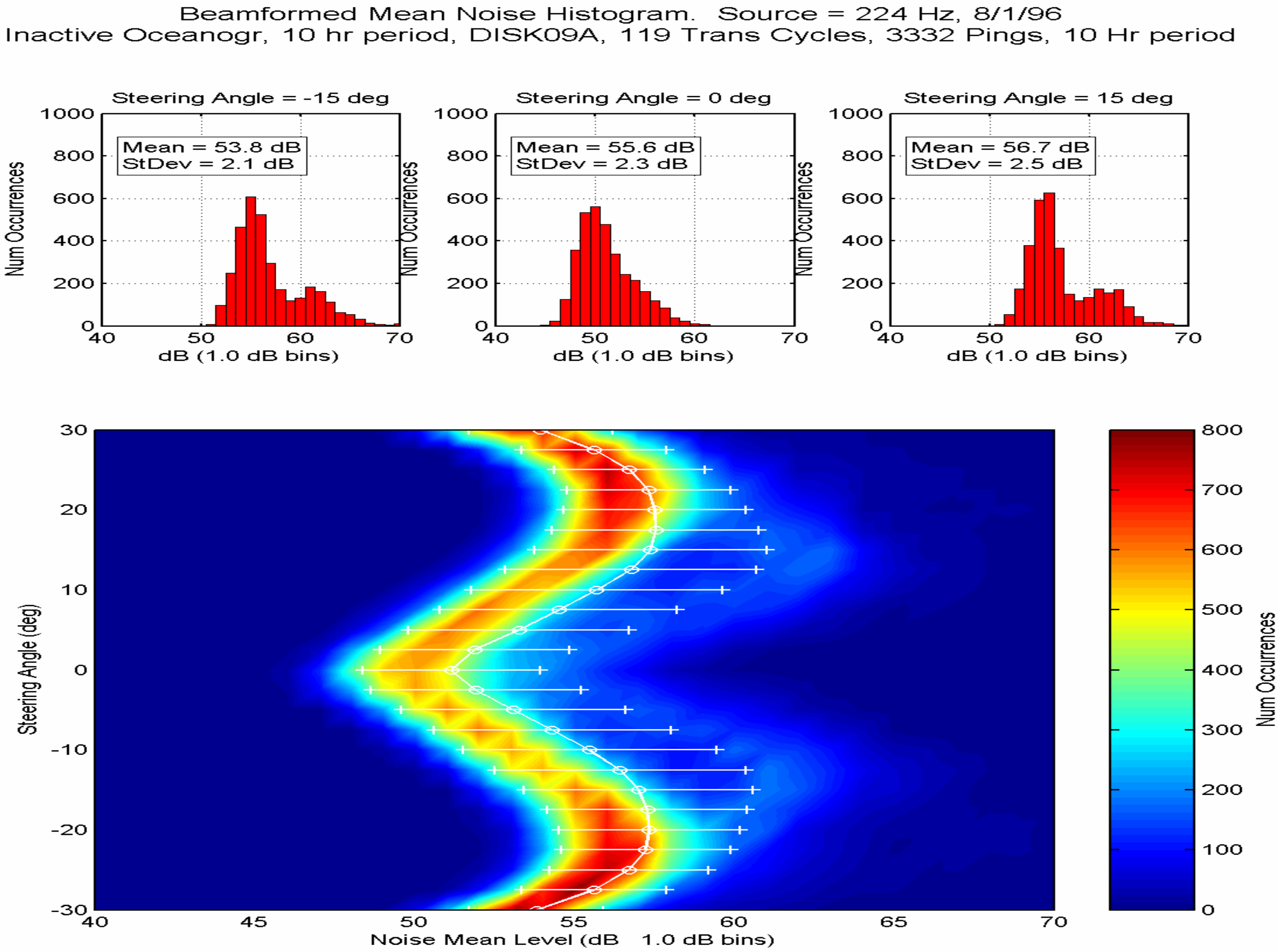
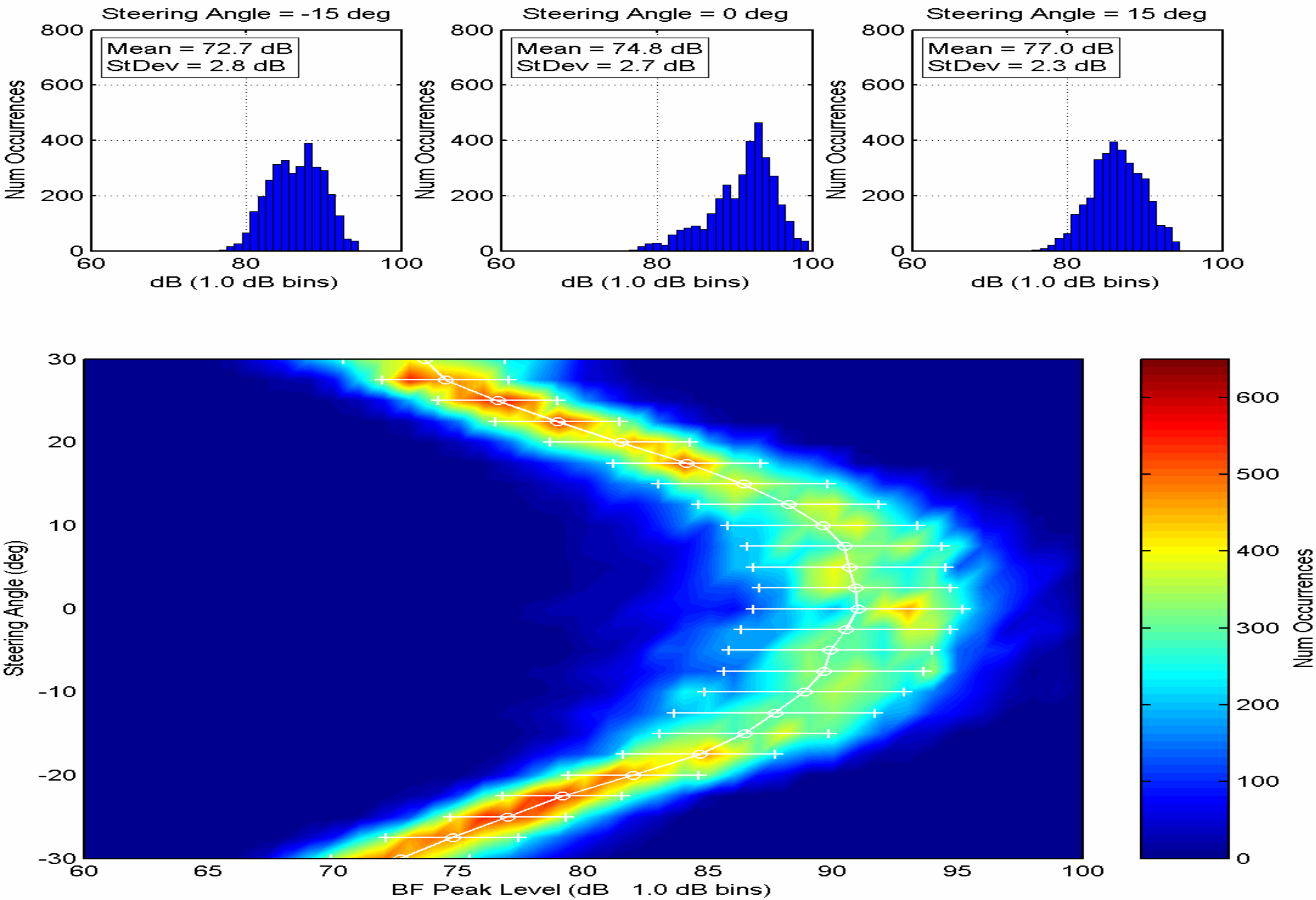
Possible Correlations in PRIMER Signals Due to Oceanographic Scattering

James Lynch

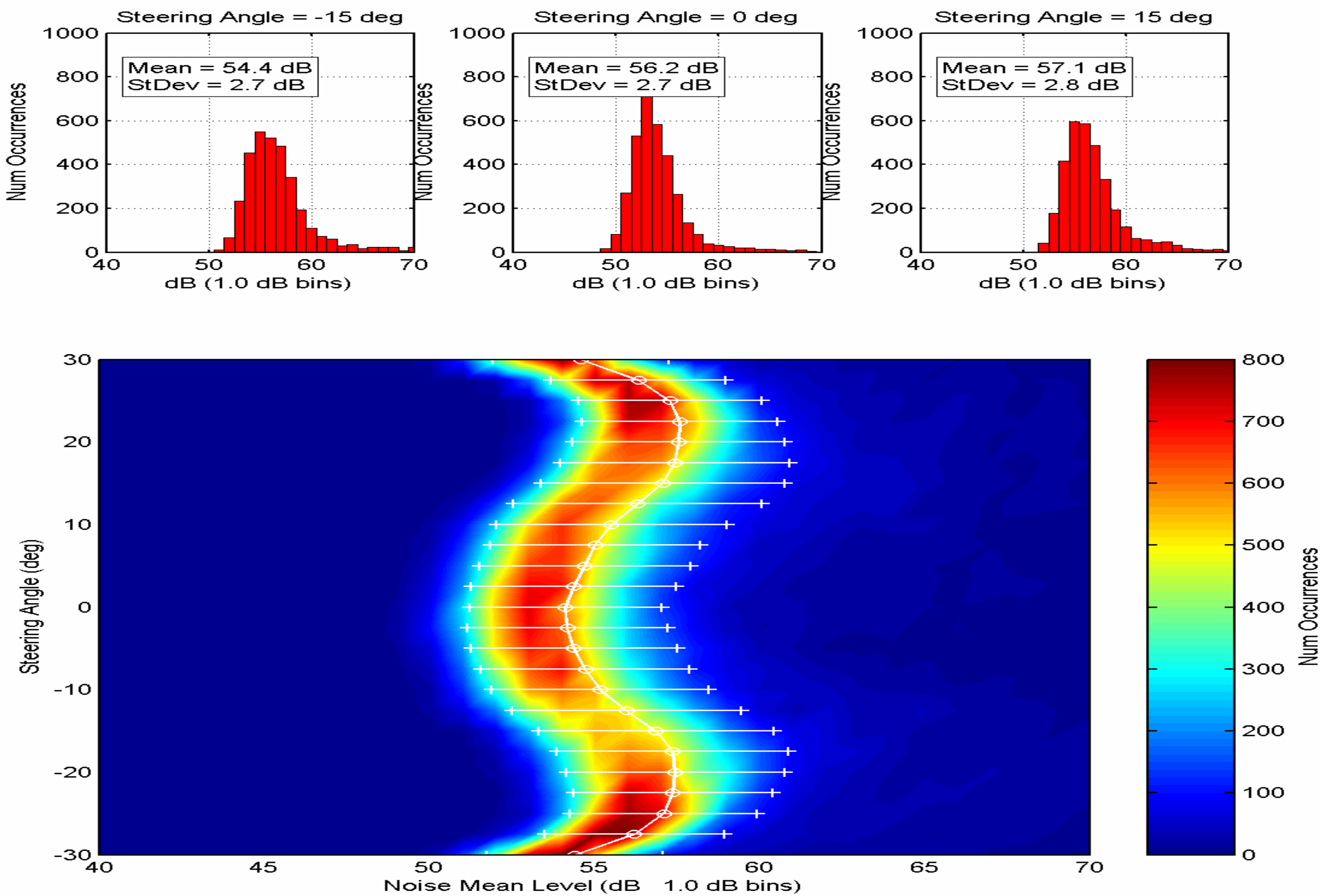

Beamformed Peak Signal Histogram, Source = 224 Hz, 8/1/96
Inactive Oceanogr, 10 hr period, DISK09A, 119 Trans Cycles, 3332 Total Pings, 10 Hr period
Steering Angle = -15 deg
Mean = 69.1 dB
StDev = 2.4 dB
Steering Angle = 0 deg
Mean = 71.0 dB
StDev = 2.1 dB
Steering Angle = 15 deg
Mean = 73.4 dB
StDev = 2.2 dB
Num Occurrences
dB (1.0 dB bins)
Steering Angle (deg)
BF Peak Level (dB 1.0 dB bins)
Num Occurrences


Beamformed Mean Noise Histogram. Source = 224 Hz, 8/1/96
Inactive Oceanogr, 10 hr period, DISK09A, 119 Trans Cycles, 3332 Pings, 10 Hr period
Steering Angle = -15 deg
Mean = 53.8 dB
StDev = 2.1 dB
Steering Angle = 0 deg
Mean = 55.6 dB
StDev = 2.3 dB
Steering Angle = 15 deg
Mean = 56.7 dB
StDev = 2.5 dB
Num Occurrences
dB (1.0 dB bins)
Steering Angle (deg)
Noise Mean Level (dB 1.0 dB bins)
Num Occurences

Beamformed Peak Signal Histogram, Source = 224 Hz, 7/26/96
Active Oceanogr, 10 hr period, DISK02A, 119 Trans Cycles, 3332 Total Pings, 10 Hr period



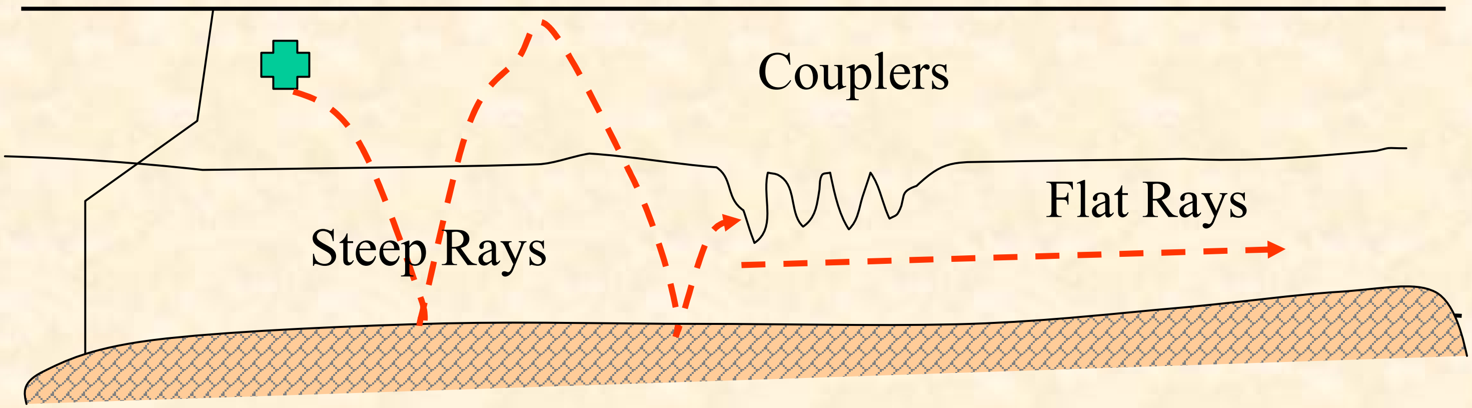
Beamformed Mean Noise Histogram.   Source = 224 Hz, 7/26/96
Active Oceanogr, 10 hr period, DISK02A, 119 Trans Cycles, 3332 Pings, 10 Hr period



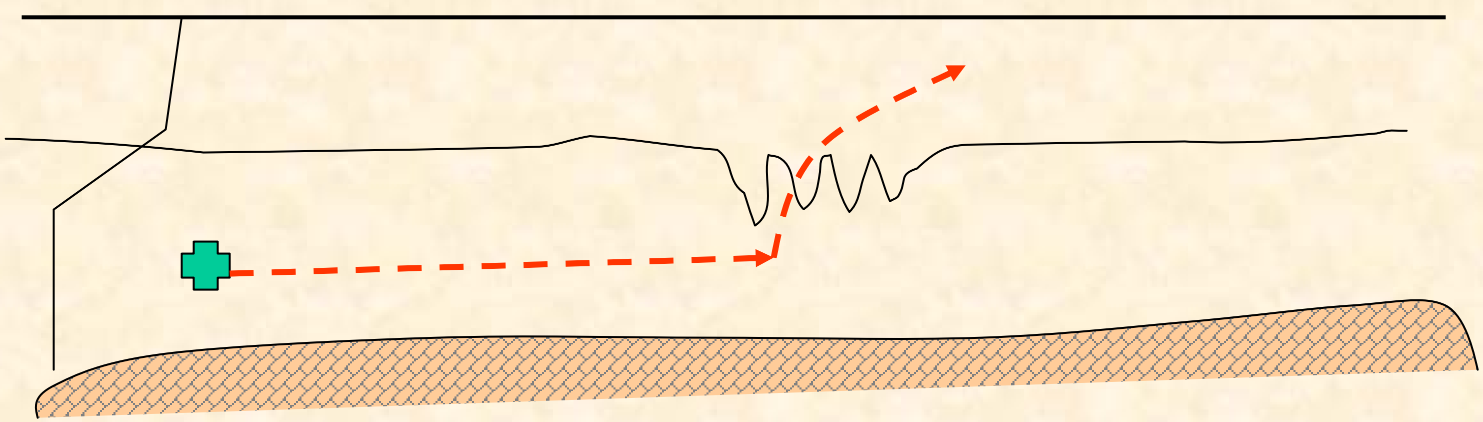
Surprising? Not really.

- We feel we understand these results, based on earlier internal wave scattering work. (But we still need to describe the correlations *quantitatively* and also consider *all* possible coupling mechanisms).
- Duda, Preisig *et al.* work in "across IW wavefront" coupled mode scattering (extending Zhou's early work.)
- Sperry, Lynch, Gawarkiewicz, Chiu work on mode coupling by bathymetry, fronts, IW's.

Two “Duda-Preisig” Cases

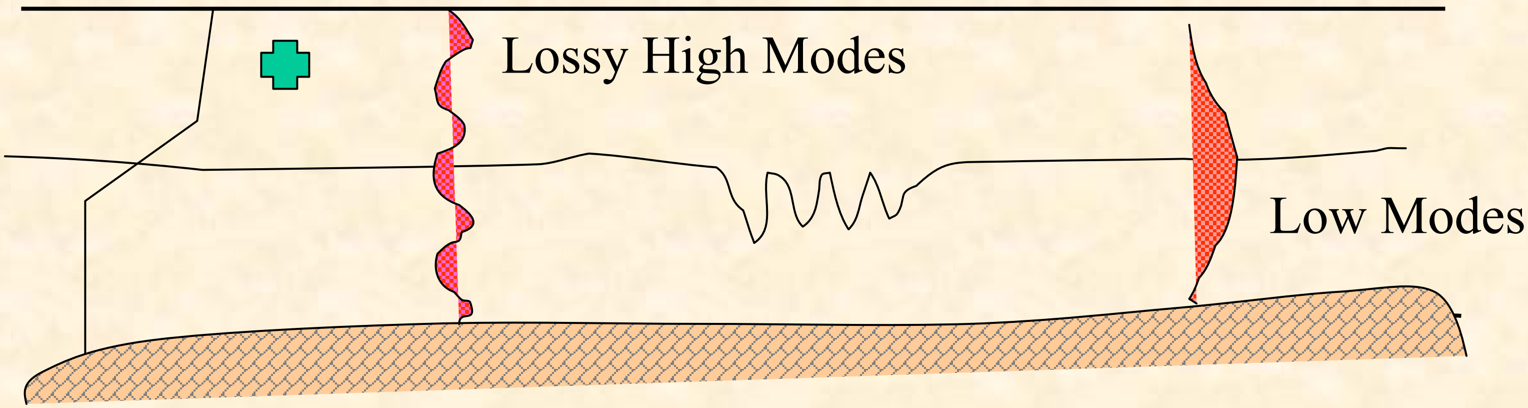


PRIMER Noise Case

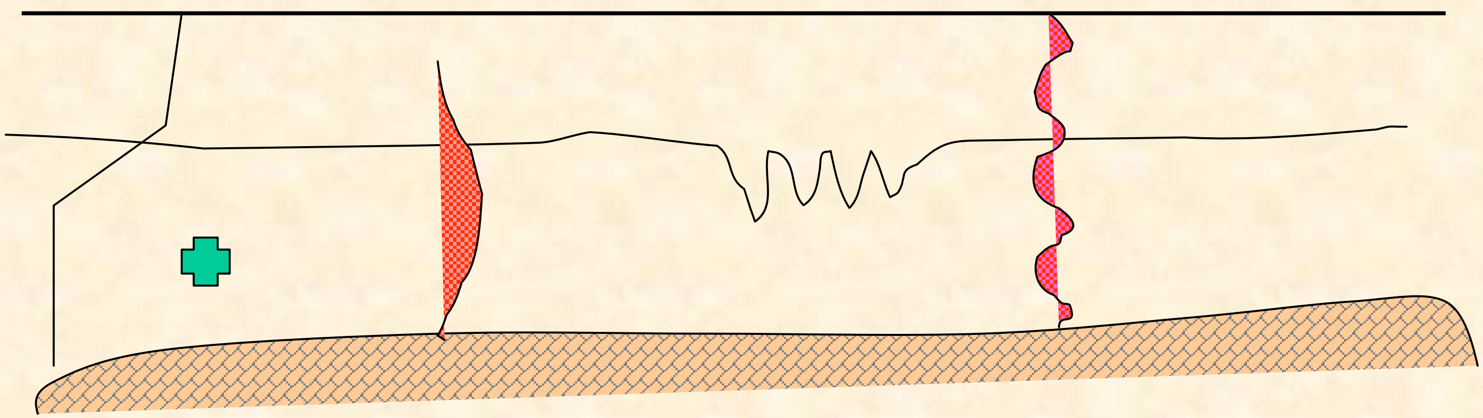


Zhou Yellow Sea Case

Two “Duda-Preisig” Cases

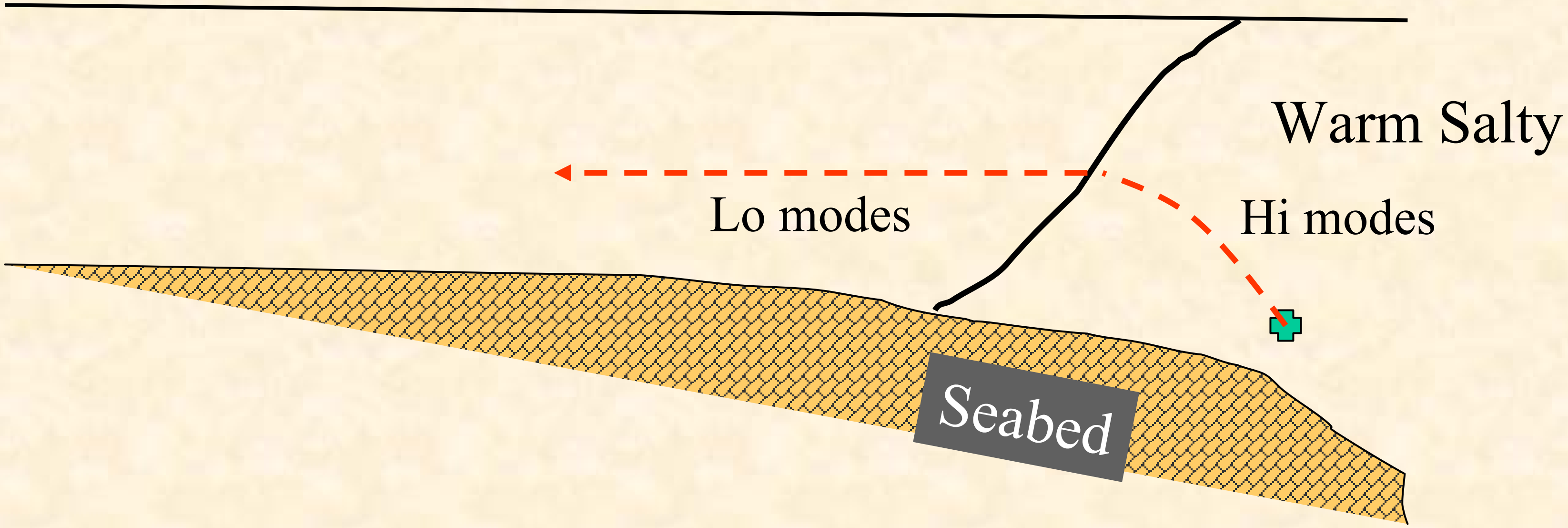


PRIMER Noise Case

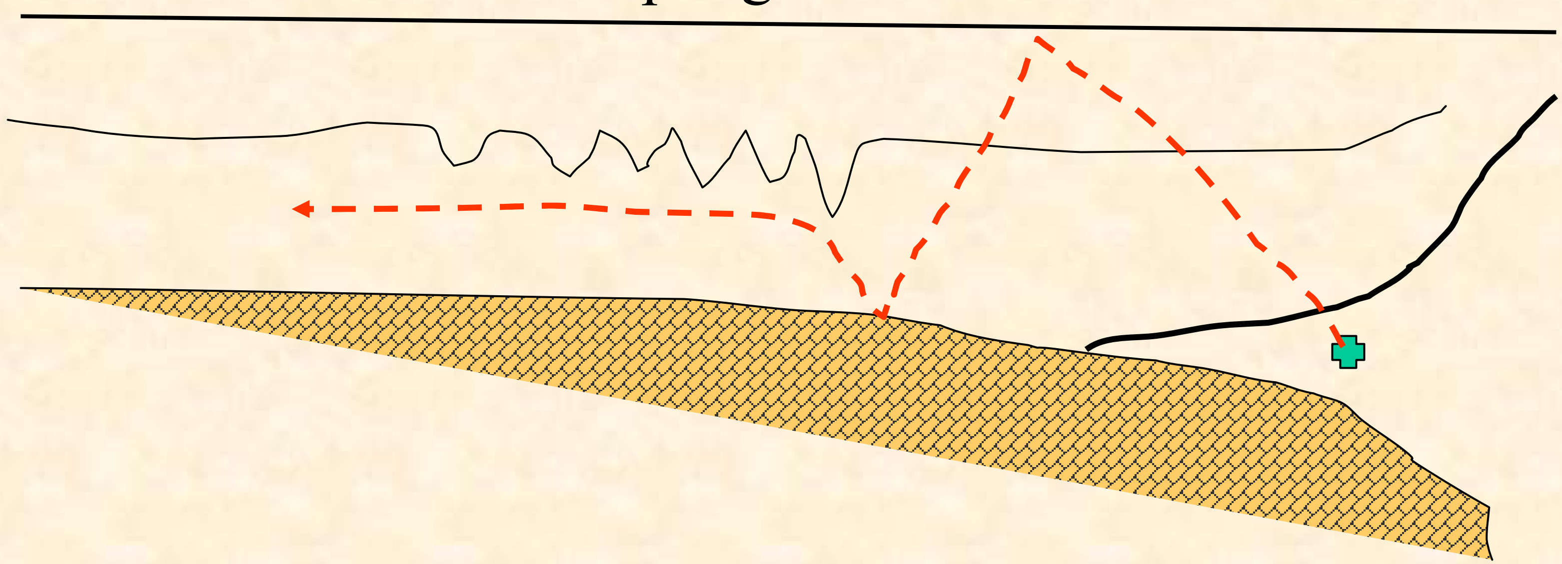


Zhou Yellow Sea Case

Strong Front Coupling



Weak Front Coupling + NIW’s



Conclusions

- We have shown that the physical mechanisms discussed are plausible ones to explain the variability of the PRIMER signal and noise seen.
- More work is necessary to quantify correlations and to examine other possible mechanisms for mode coupling).
- Impact for Uncertainty DRI is that the signal and noise fluctuation characteristics (level and low-angle notch) are correlated due to propagation through common scatterer(s).
- This is a big "Caveat Emptor" for using uncorrelated sonar equation terms.

References (PRIMER related only)

- Duda and Preisig (1999) “A modeling study of acoustic propagation through moving shallow-water solitary wave packets.” *IEEE J. Oceanic Eng’g* 24(1), 16-32.
- Preisig and Duda (1997) Coupled acoustic mode propagation through continental shelf internal solitary waves. *IEEE J. Oceanic Eng’g* 22(2) 256-269.

References (cont'd)

- Duda (2003) "Acoustic mode coupling by nonlinear internal wave packets in a shelfbreak front area", submitted to *IEEE J. Oceanic Eng'g*.
- Lynch et al (2003) "Spatial and temporal variations in acoustic propagation characteristics at the New England shelfbreak front." *IEEE J. Oceanic Eng'g.,* 28(1), 129-150.
- Sperry et al. (2003) "Characteristics of acoustic propagation to the eastern vertical line array receiver during the summer 1996 New England Shelfbreak PRIMER experiment." Submitted to *IEEE J. Oceanic Eng'g*.
- Fredericks, Colosi, and Lynch (2003). "Analysis of multipath scintillations observed during the summer 1996 New England shelfbreak PRIMER study." Submitted to *IEEE J. Oceanic En'g*.

References (ASIAEX)

- Duda, Lynch, Newhall, Wu, and Chiu (2003). “Fluctuation of 400 Hz sound intensity in the 2001 ASIAEX South China Sea Experiment.” Submitted to *IEEE JOE*.
- Chiu, Ramp, Miller, Lynch, Duda and Tang (2003). “Acoustic intensity fluctuations indueced by South China Sea internal tides and solitons.” Submitted to *IEEE JOE*.