Low frequency ambient noise measurements and trends in offshore BC waters

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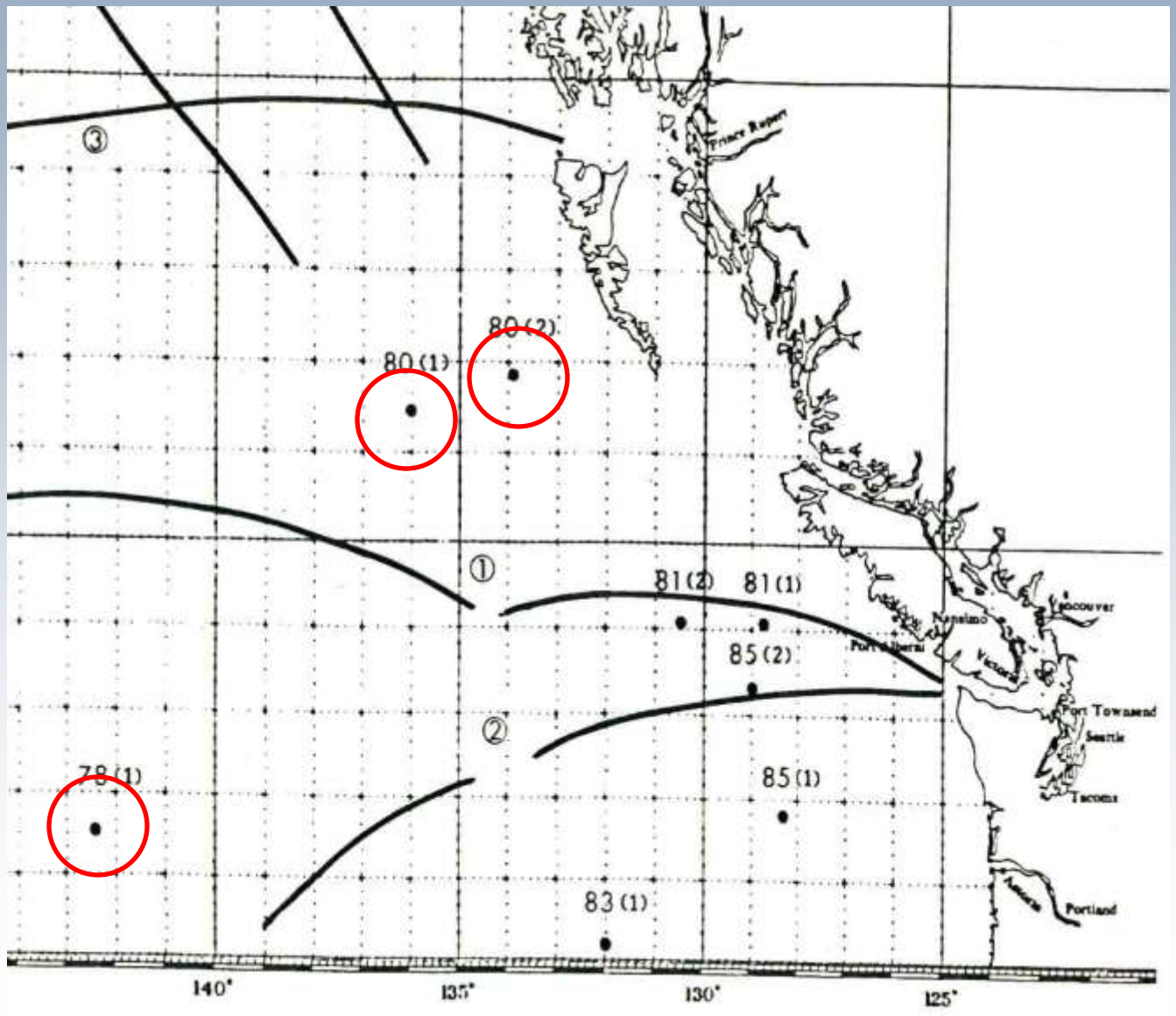
Outline

- DREP measurements of ambient noise
  - 1978-1986 sites in NE Pacific
- Measurement system
  - MEVA: volume hydrophone array
- Single hydrophone noise spectra
  - noise levels: 10-400 Hz
- Horizontal and vertical directionality
- Deep Ocean Noise trends:
  - 1960s to present

DREP Noise Measurement Sites: 1978-1986

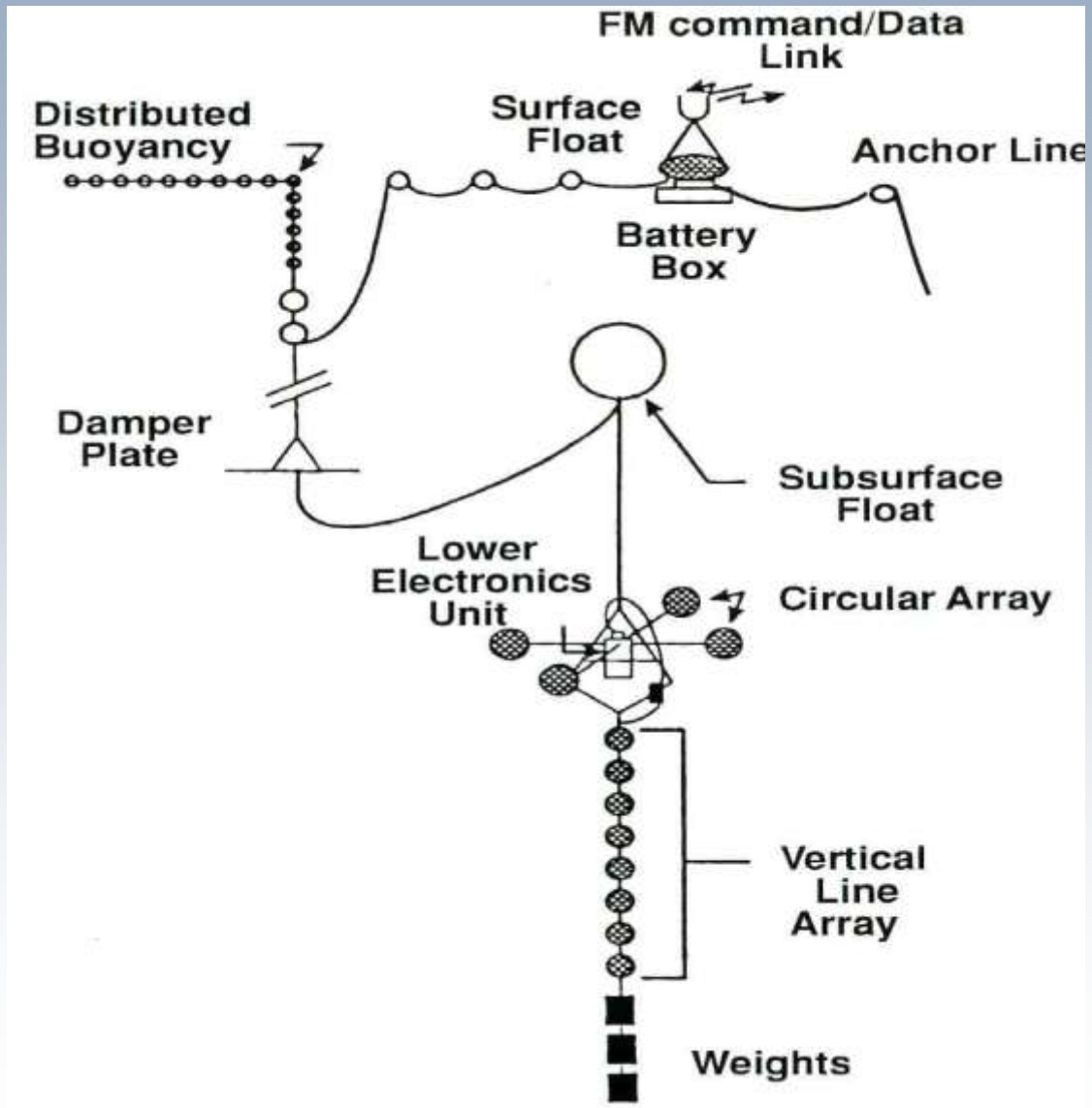


Low Frequency Noise Measurement System: MEVA

- 16 channels
- VLA: 10 – 16 phones
- HPA: 4 – 6 phones

- Deployed at sound channel axis: 400 m

- 2-stage mechanical decoupling from sea surface motion



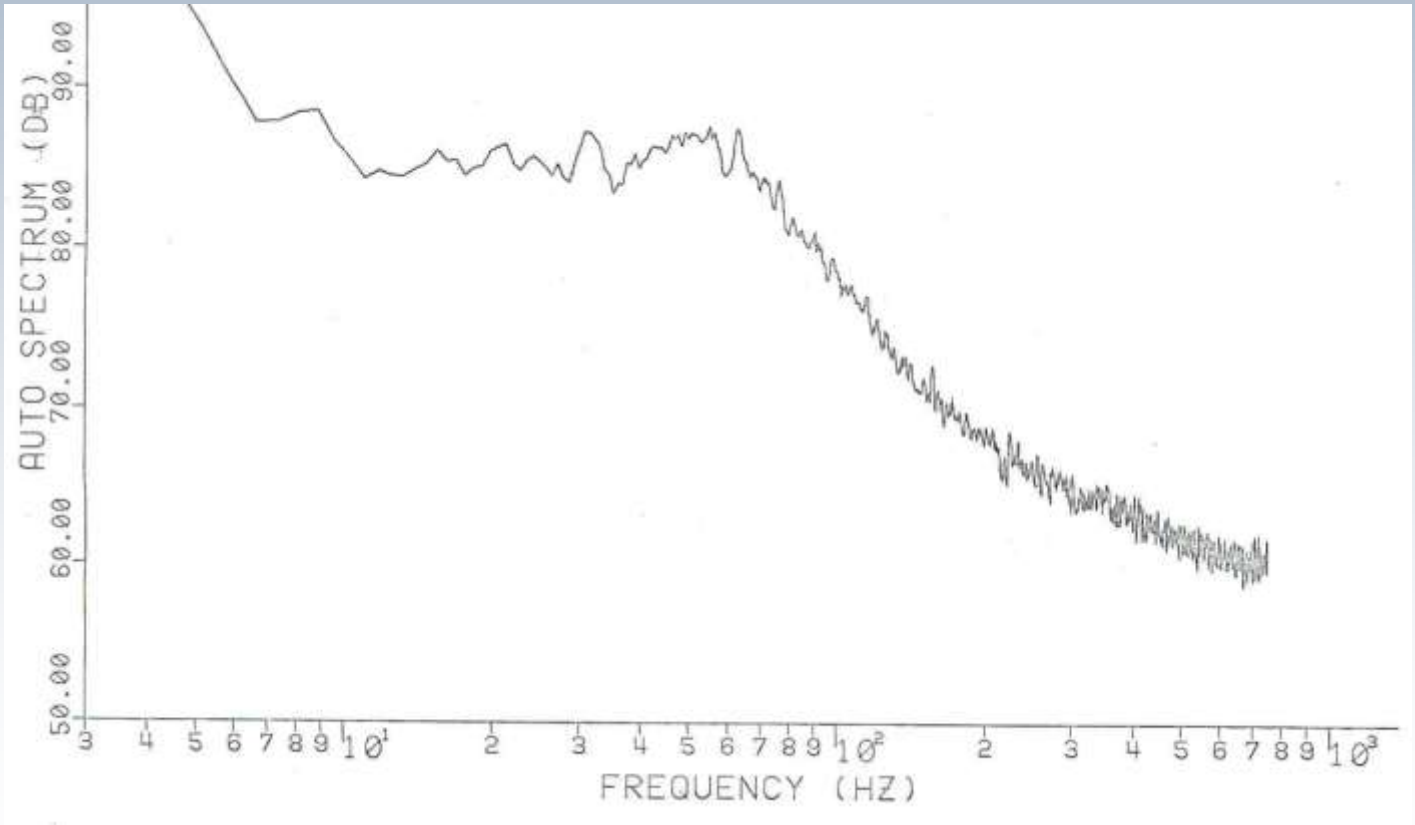
MEVA Calibration

- Calibrated hydrophones
  - -187 db re 1V/μPa
- Calibrated Receiving system
  - 5 Hz – 400 Hz

Deep Ocean ambient noise in the sound channel

- ‘Quiet Periods’: no local ship noise

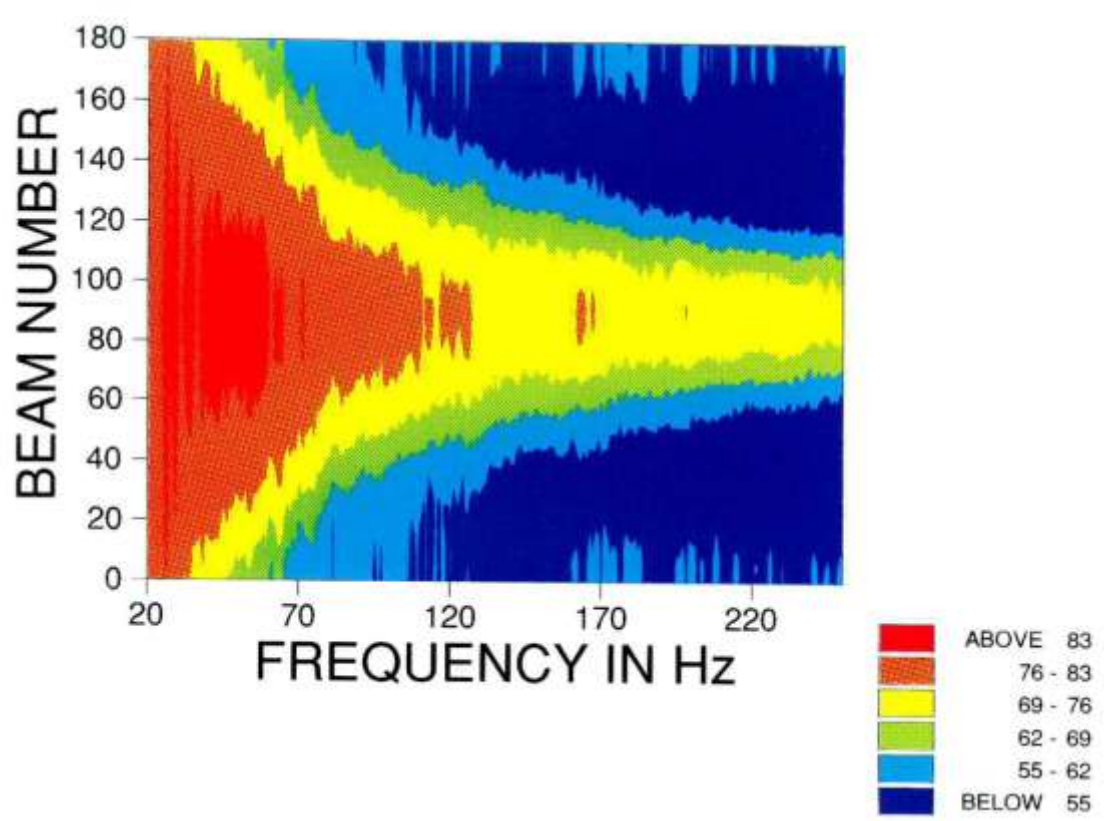
- Single hydrophone spectra: Omni-directional
  - spectral levels; statistical properties; stationarity of noise



Vertical directionality

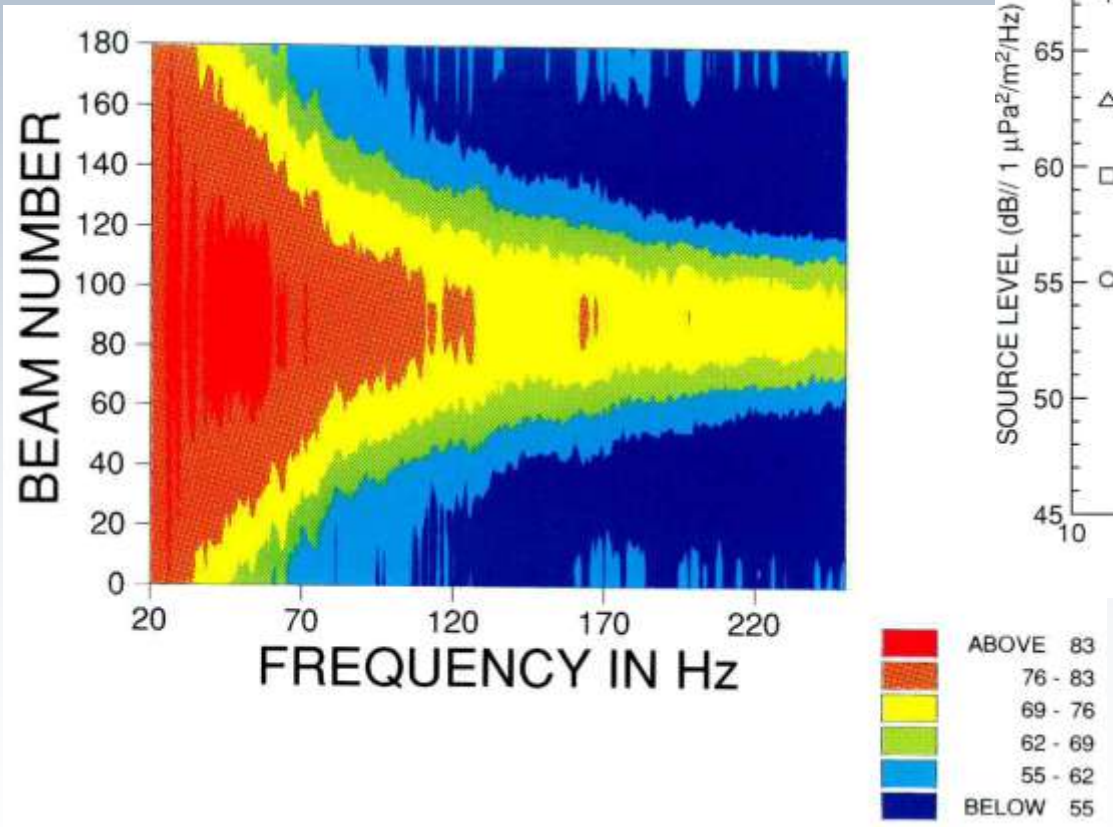
- Distant shipping noise characterized by ‘pedestal’
  - High levels at low propagation angles in deep sound channel

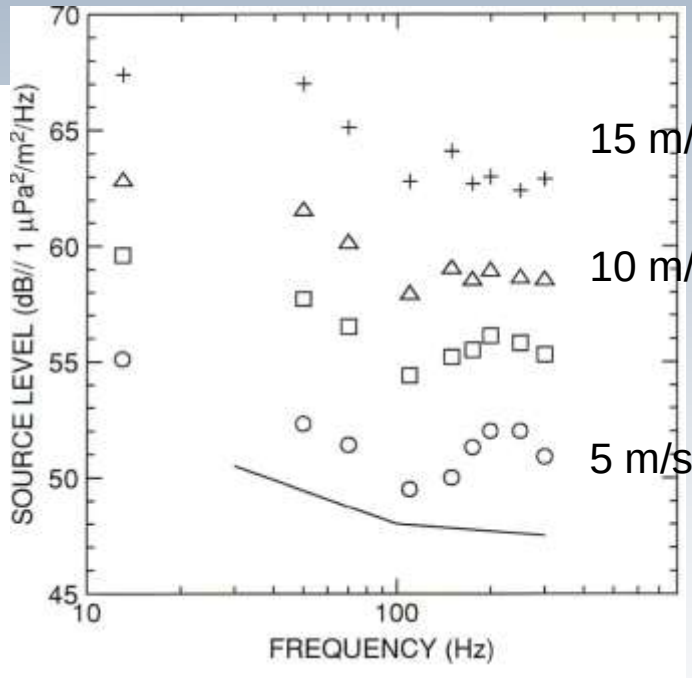
- Downslope conversion at continental shelf
- Other?
- High latitude wind?
- High latitude surf?



Vertical directionality

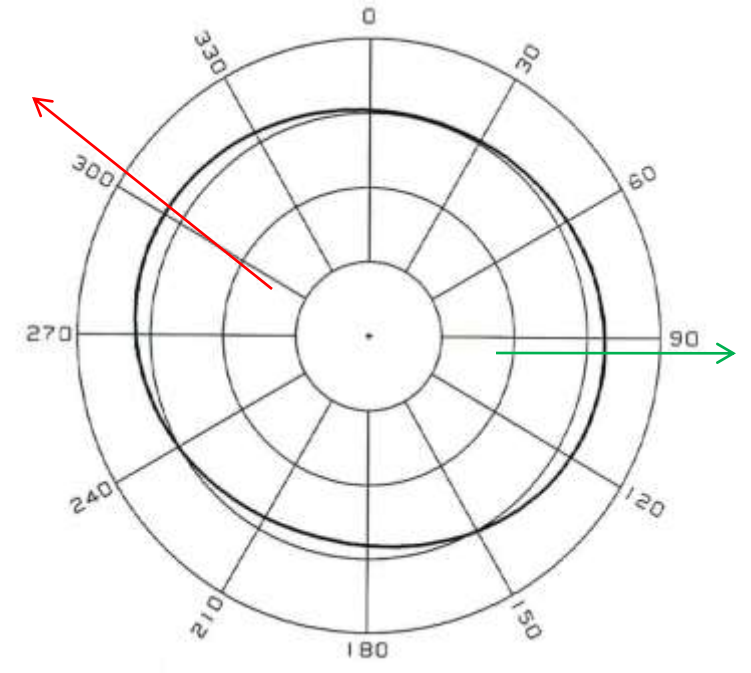
- Upward-looking endfire beam
- Source level of sea surface noise vs. wind speed at low frequency

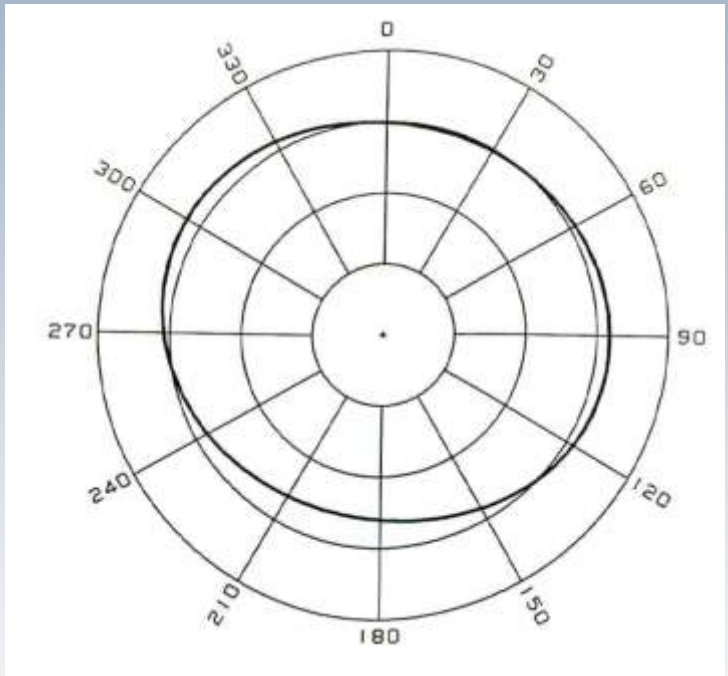




Horizontal Directionality

- Pressure gradient beamforming of planar array
- 1/3 octave band averages





- 31 Hz
- 75 dB at centre

- 250 Hz
- 55 dB at centre

- High latitude shipping lanes
- West coast N. America

Deep Ocean Ambient Noise level : 1960 - present

- Pacific Ocean data:
- Wenz: 1960s
  - Noise levels at Point Sur, San Nicholas
- APLUW: 1994 – present
  - Off shore California sites
- Frisk, McDonald, Andrew et al, Reeder
  - comparisons of Wenz vs. present day
- Ross: predicted trend of noise level increase
  - 0.55 dB/yr
  - Based on noise data from 1950-1975

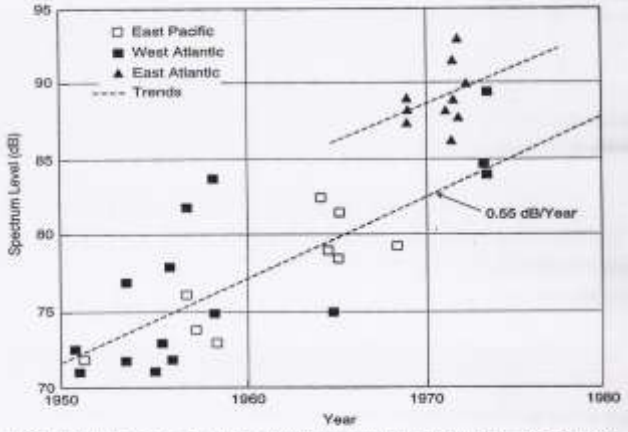


FIGURE 2-7 Long-term trend for low-frequency ambient levels for period 1958–1975. SOURCE: Ross, 1993, courtesy of Acoustics Bulletin.

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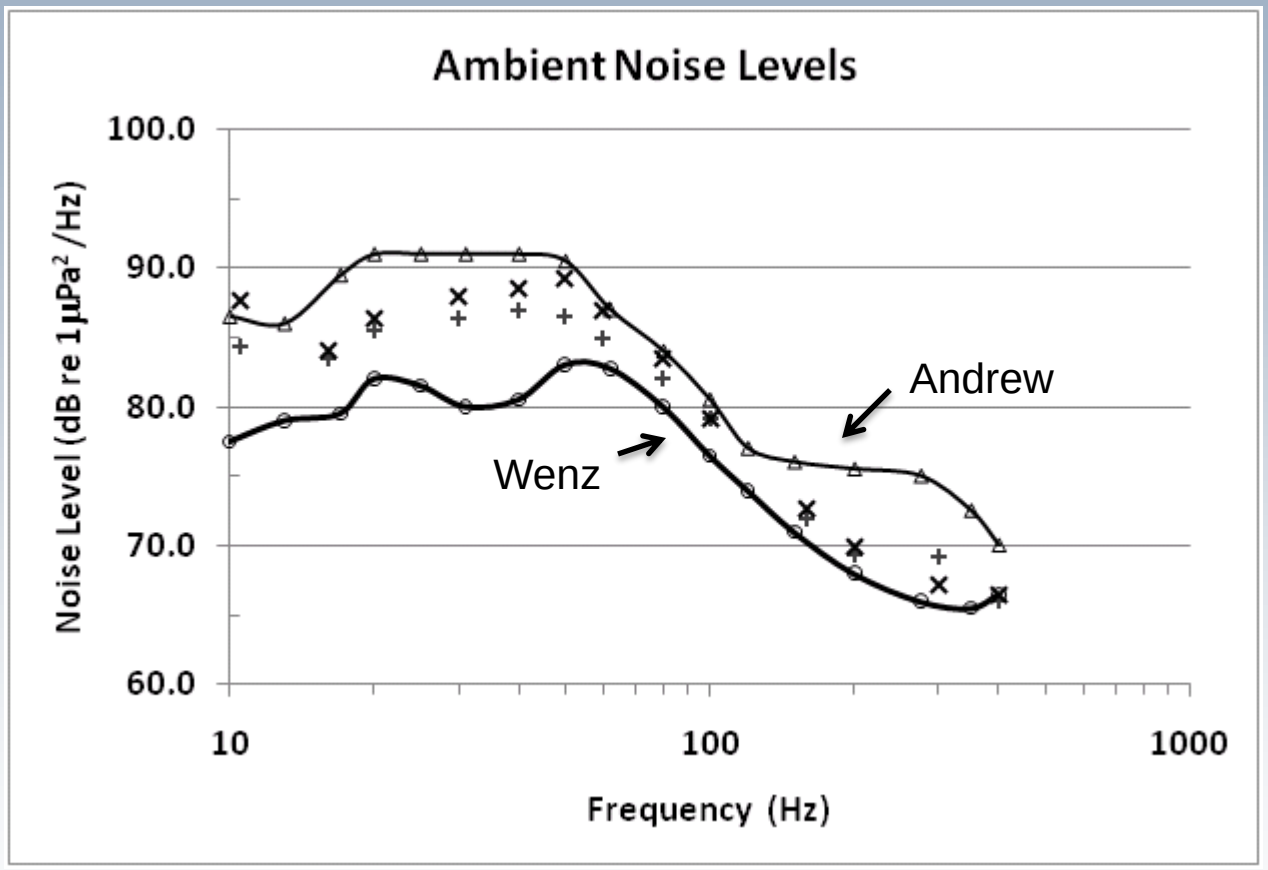
DREP Noise Measurements



\+ 1978 data x 1980 data

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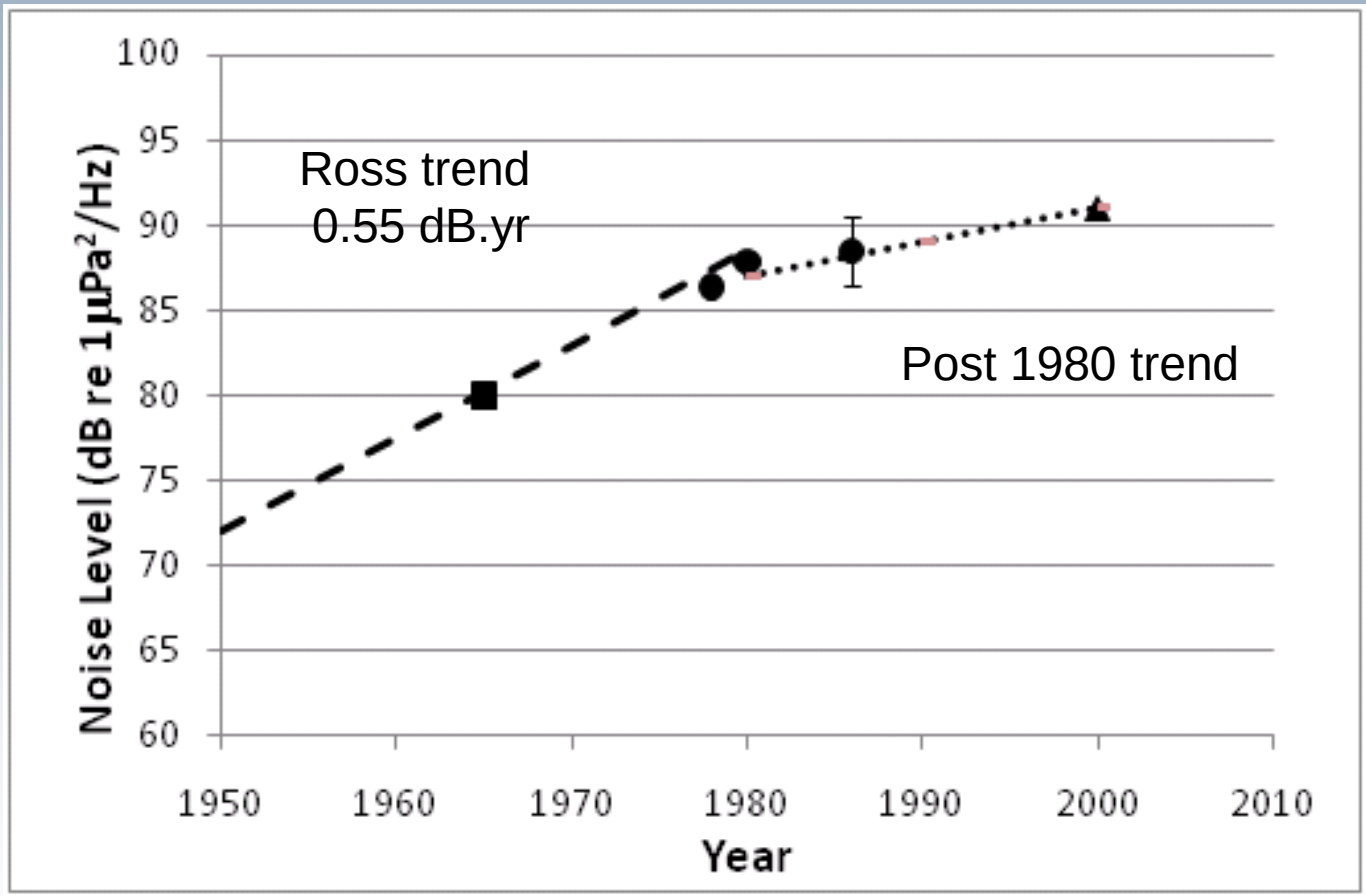
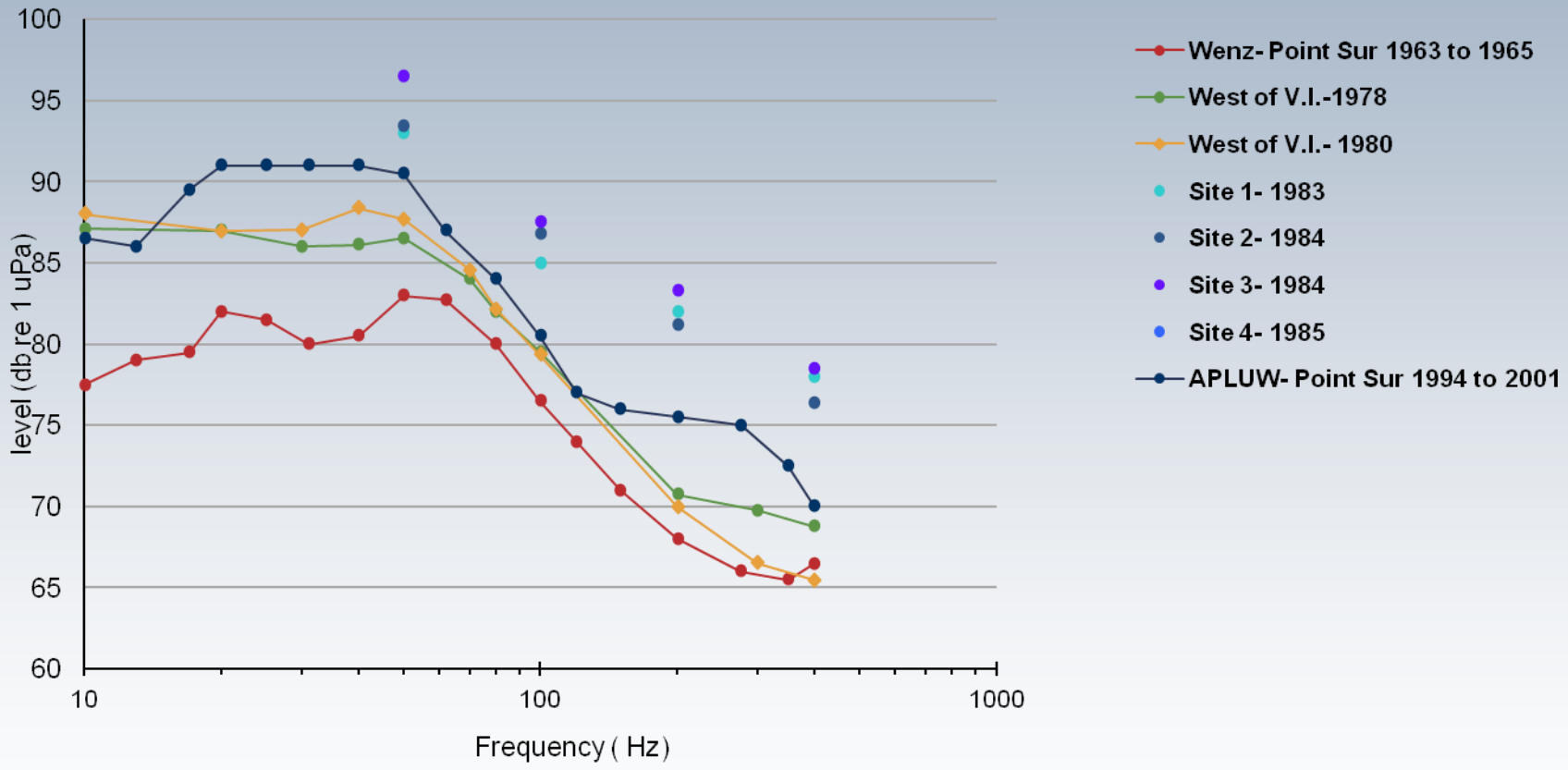
‘Keeling curve’ of deep ocean ambient noise



Shallow water ambient noise



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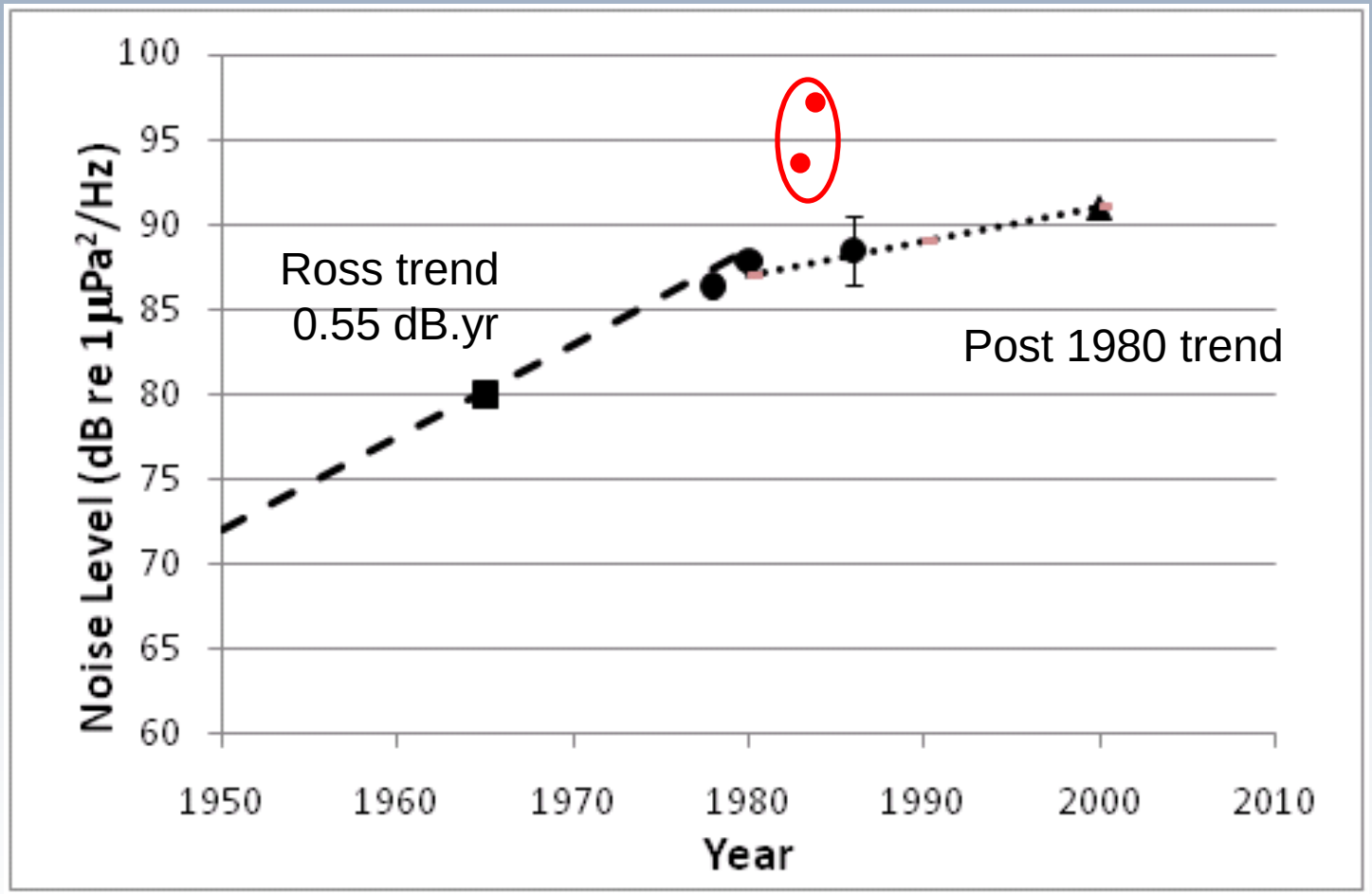
Deep and shallow water



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Conclusion

- DREP ambient noise data from Deep Water NE Pacific
  - Calibrated omni-directional noise levels
  - ‘Keeling curve’ of ambient noise 1950-2000
- Noise levels consistent with Ross’ prediction
  - 0.55 dB/yr increase to ~1980
- Change observed in trend from 1980 – present time
  - ~0.15 dB/yr
- Shallow water noise is significantly greater and variable over location and time