

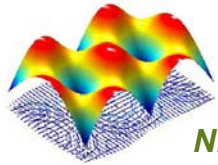
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Northwest Electromagnetics &
Acoustics Research

Overview

- **Use ambient noise in ocean to determine environmental parameters**
 - Seabed depth
 - Sub-bottom sediment layering & properties
- **Sponsor: ONR (Office of Naval Research)**
- **People**
 - Dr Martin Siderius (Associate Professor)
 - Lanfranco Muzi (PhD research assistant)
 - John Gebbie (PhD research assistant)
 - Joel Paddock (B.S. student)





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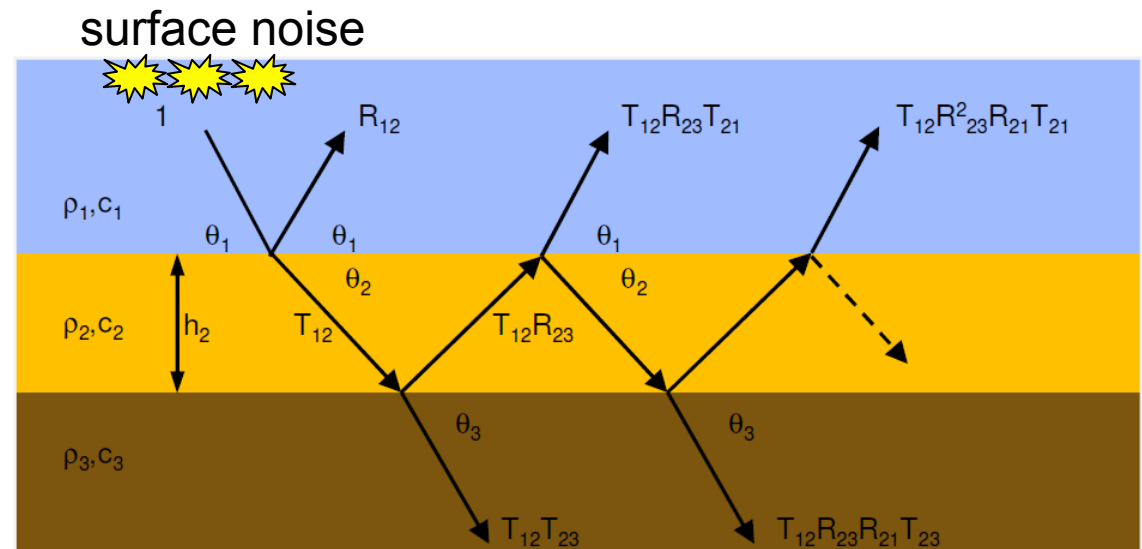
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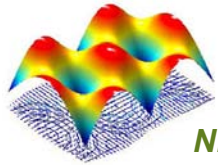
Reflection Loss

- Snell's Law governs reflection coefficient (R)
- Reverberation
 - Multiple interfering reflections
- Can compute reflection loss (RL) from R

$$R_{12} = \frac{\rho_2 c_2 / \sin \theta_2 - \rho_1 c_1 / \sin \theta_1}{\rho_2 c_2 / \sin \theta_2 + \rho_1 c_1 / \sin \theta_1}$$

$$RL = -10 \log |R|^2$$



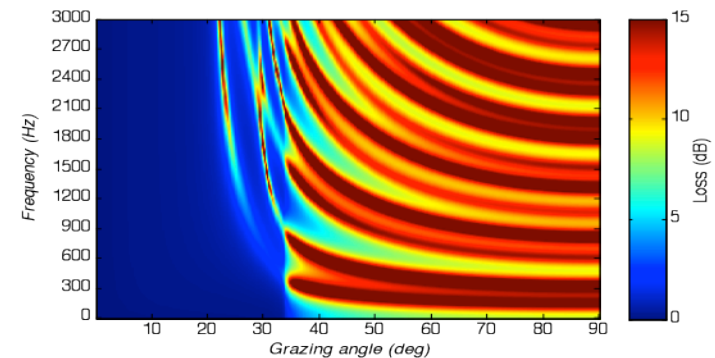
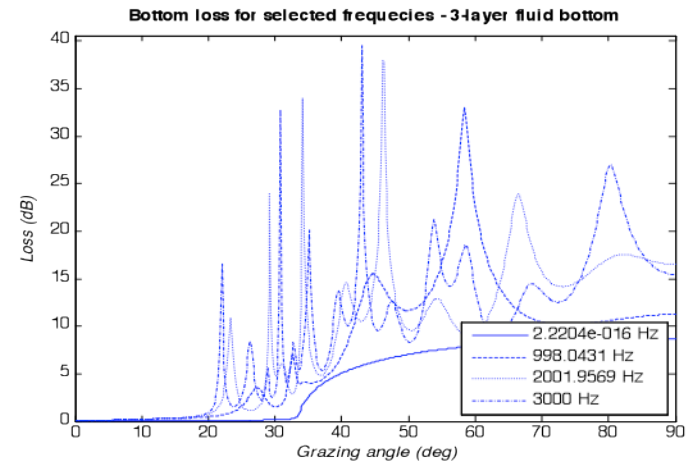


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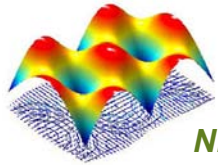
Reflection Loss

- Plot reflection loss as a function of:
 - Grazing angle
 - Frequency
- Frequency dependence contains information about separation and properties of layers



Critical angle



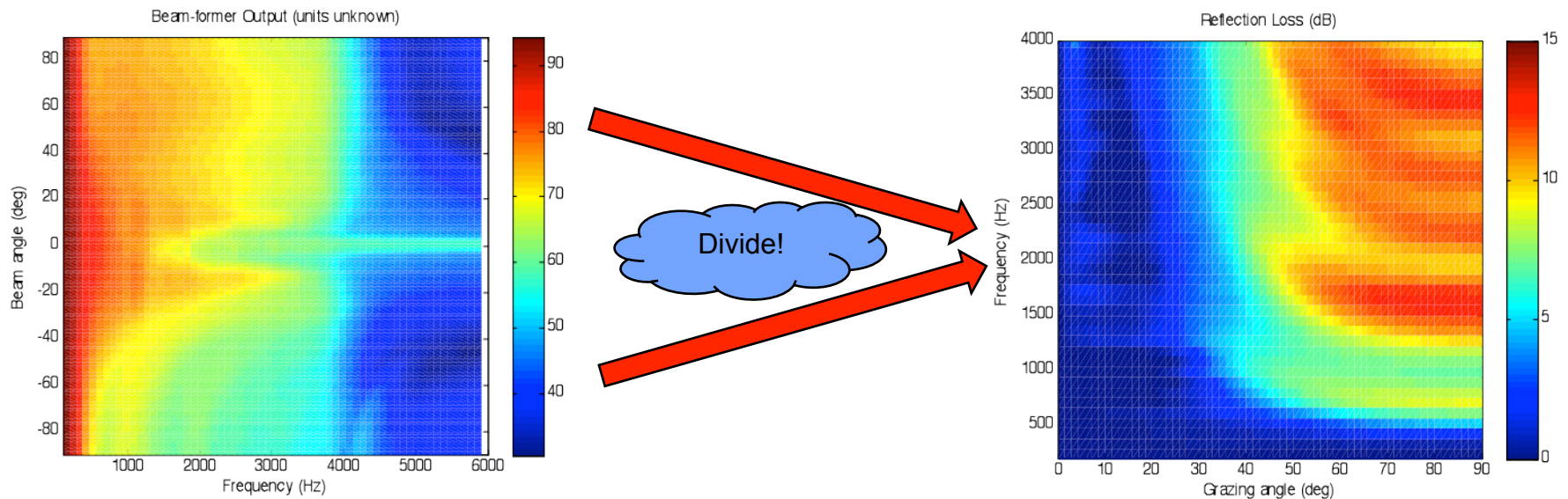


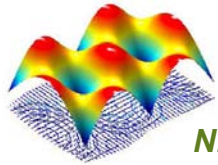
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Reflection Loss

- Can compute RL from real data
- Use adaptive beamformer to obtain noise power from positive and negative angles
- Divide to get ratio – this is also RL!





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Publications

- M. Siderius, H. Song, P. Gerstoft, W. S. Hodgkiss, P. Hursky, and C. Harrison, "Adaptive passive fathometer processing," *The Journal of the Acoustical Society of America*, vol. 127, no. 4, pp. 2193-2200, April 2010. [Online]. Available: <http://dx.doi.org/10.1121/1.3303985>
- M. Siderius, C. H. Harrison, and M. B. Porter, "A passive fathometer technique for imaging seabed layering using ambient noise," *The Journal of the Acoustical Society of America*, vol. 120, no. 3, pp. 1315-1323, September 2006. [Online]. Available: <http://dx.doi.org/10.1121/1.2227371>
- P. Gerstoft, W. S. Hodgkiss, M. Siderius, C.-F. Huang, and C. H. Harrison, "Passive fathometer processing," *The Journal of the Acoustical Society of America*, vol. 123, no. 3, pp. 1297-1305, March 2008. [Online]. Available: <http://dx.doi.org/10.1121/1.2831930>
- C. H. Harrison and M. Siderius, "Bottom profiling by correlating beam-steered noise sequences," *The Journal of the Acoustical Society of America*, vol. 123, no. 3, pp. 1282-1296, March 2008. [Online]. Available: <http://dx.doi.org/10.1121/1.2835416>
- M. Siderius, H. Song, P. Gerstoft, W. S. Hodgkiss, P. Hursky, and C. Harrison, "Adaptive passive fathometer processing," October 2009.

