Range-dependent seabed effects on shear resonances and long-range propagation

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Propagation measurements in some high latitude areas have shown large losses at specific frequencies. These nulls, many tens of dB higher loss than adjacent frequencies, have been shown to arise from trapped shear wave resonances in an unconsolidated sediment layer above a consolidated basement, e.g., see [1,2,3] which was predicted theoretically by Paul Vidmar [4]. The theory and modeling to date has focused on a plane-layered media, i.e., a range-independent seabed. This has been useful in explaining some, but not all, the characteristics of the high loss.

Here, we examine the role of range-dependence in the sediment layer. Since the received level at a shear quarter-wave resonance is very low and otherwise high, it may seem that a mixture of resonant and non-resonant conditions along track would result in low levels being 'filled in' or smoothed out. However, we show theoretically using a simple energy flux model [5] that the smoothing effect, while operative, may often leave observable low amplitudes (high losses) in real-world sediment environments. The characteristic width of the nulls provides some information about the sediment layer range-dependence. [Research supported by the ONR Ocean Acoustics Program]

Keywords: shear speed; shear attenuation; shear resonance; energy flux model.

References

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