

BOTTOM REVERBERATION DATA ANALYSIS AND PROPAGATION MODELING OF COMPLEX MULTIPATHS

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LONG-TERM GOAL

The overall goal of this project is to improve our understanding of long-range, low-frequency reverberation. Of particular interest to me were the effects of multipaths on our ability to identify specific scatterers or scattering locations.

SCIENTIFIC OBJECTIVES

The objective of this work is to quantify the significance of multipaths on monostatic reverberation from distant scattering patches.

APPROACH

Data taken from the area of B' in the ARSRP Natural Lab will be examined in the context of multipath influences. A version of the University of Miami Parabolic Equation (UMPE) model (Smith and Tappert, 1993) will be used in conjunction with Tappert's PE Reverberation (PEREV) model (Tappert, 1993). Bathymetric data for this region and sound speed profiles from CTD casts were also available for modeling purposes.

WORK COMPLETED

This was the final phase of a multi-year effort to employ numerical modeling to aid in our understanding of the generation of long-range reverberation. For this work, a set of fully coherent, broadband calculations were made to provide the most accurate predictions of the influence of multipaths on reverberation.

RESULTS

The data displayed in Figure 1 show the comparison between this new, coherent broadband prediction and the previous, more typical, CW type prediction. Two points are of considerable interest. First, the broadband calculation shows how multipaths can increase predicted reverberation levels in "CW shadow zones" by as much as 20 dB. This

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broadband calculation was also found to be more consistent with the measured data. Secondly, it is worth noting that for much of the predicted reverberation signal, the CW method works quite well. Therefore, some intermediate approach may be most useful which takes advantage of the efficiency of the CW method but is able to fill in such shadow zones in a manner consistent with multipath propagation.

IMPACT/APPLICATION

The significance of multipath influences on reverberation should not be ignored. However, careful treatment of quicker, CW results may provide adequate predictions of reverberation in most tactical situations.

TRANSITIONS

None at this time.

RELATED PROJECTS

1 - Fred Tappert (NPS) has performed similar comparisons of reverberation predictions with measured data.

REFERENCES

Smith, K.B. and Tappert, F.D., "UMPE: The University of Miami Parabolic Equation Model, Version 1.0," Marine Physical Laboratory Technical Memo 432, 1993.

Tappert, F.D., "Physics of the PE Reverb Model," ONR-ARSRP Symposium, La Jolla, CA, March 23- 25, 1993.

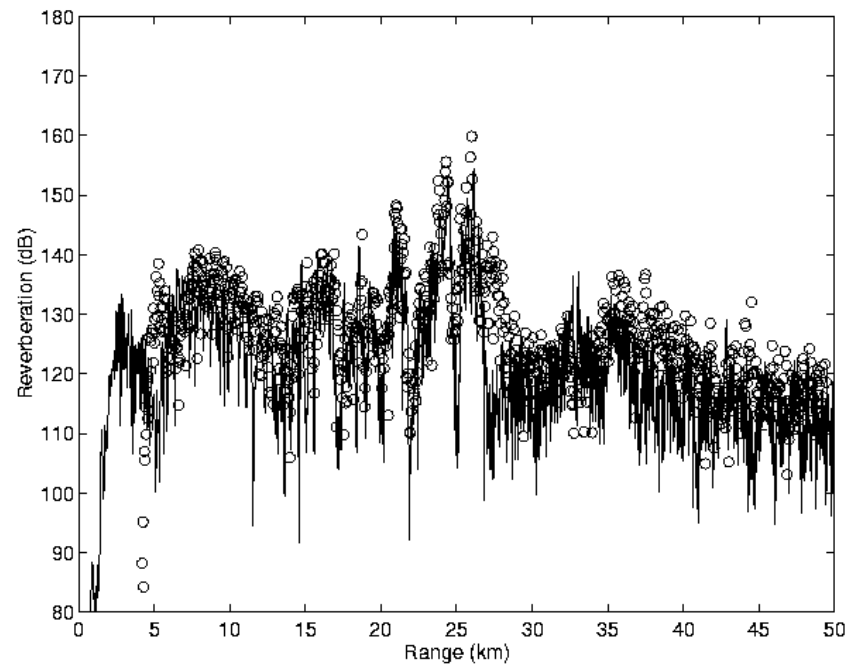


Figure 1: Comparison of reverberation prediction techniques:
CW approach (solid line) and two-way travel time technique (circles).