

Measurement of Q and cumulative attenuation from VSP data

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Summary

The measurement of attenuation in seismic data is described and analyzed. The measurement problem is defined as the estimation of the attenuation parameter Q or the estimation of the related quantity CA (cumulative attenuation) or both. Two very different estimation techniques are described: the spectral-ratio method (SRM), which is well-known, and the dominant-frequency method, which is mostly new here. The strengths and weaknesses of both methods are discussed and the extension to CA is given. It is demonstrated that CA estimates are more stable than Q estimates when attenuation is weak. The application of these techniques is demonstrated on a zero-offset VSP with a vibroseis source. Using the shallowest receiver (2185ft) as a reference, attenuation estimates were obtained for all receivers at depths equal to or greater than 5000ft. Consistent estimates were obtained from both the SRM and the DFM but it is demonstrated that any residual upcoming waves in the downgoing wave cause considerable error. The possibility of extending these measurements to the earth's surface by assuming the reference wave there is the Klauder wavelet is examined. The results are plausible and seem appropriate to apply to surface recordings for bandwidth enhancement.