Near-field effects in VSP-based Q-estimation for an inhomogeneous model

Arnim B. Haase and Robert R. Stewart

ABSTRACT

As a continuation of earlier near-field investigations into homogeneous situations we expand our analysis to an inhomogeneous example. We show that depth locations of so-called wrap-around points, where spectral ratio method Q-estimates change from large negative values to large positive values are controlled by P-wave velocities and intrinsic Q-factors. A velocity-step model and Q-factors derived from these velocities by empirical equation are used to demonstrate near-field Q-factor recovery by inversion. Because VSP model data and forward models are computed with the same multi-interface Sommerfeld integral it is found that, in this noise-free situation where velocities and densities are assumed to be known exactly for the forward modelling step, Q-factors can be recovered exactly also. Even though this VSP model approach is a simplification in many respects it does include near-fields, far-fields and geometrical spreading in the analysis.

MOTIVATION

- Find a velocity model that causes multiple SRM Q wrap-arounds.
- What is the sensitivity of VSP model data to forward model difference with respect to intrinsic Q-factors?
- Can intrinsic near-field Q be recovered in an ideal model situation?

CONCLUSIONS

- Multiple SRM Q wrap-arounds can be generated by a simple velocity-step model.
- The sum of squared differences between forward model and VSP model data shows a minimum at the correct intrinsic Q-value.
- The sum of (un-squared) differences helps to find the parabolic range for a faster minimum search.