THE EFFECT OF INTERFACE CURVATURE ON AVO INVERSION OF LONG-OFFSET DATA

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It is important to find proper theoretical description of the reflection phenomena (AVO function) that closely relates the measured amplitude (AVO response). However, conventional AVO techniques based on linearized plane-wave reflection coefficients (PWRCs) in application to long-offset data will unlikely succeed, because it is limited to relatively plane interfaces, weak parameter contrasts and moderate incidence angles. Additionally, PWRC is not sensitive to the interface curvatures and breaks down at the near-critical offsets, where the head wave is generated, as well as at the post-critical offsets, where the reflected and head waves interfere. A curved reflector generates complex wavefronts of the reflected and head waves and their interference at the receivers has a strong effect on the theoretical description of the AVO function. We introduce an approach to long-offset AVO inversion based on the effective reflection coefficients (ERCs) and generalize it for curved interfaces. This approach has been tested with tip wave superposition method (TWSM) modelling for interfaces of Gaussian type with different curvatures in X- and Y directions. We found that the theoretical AVO function has a significantly more complicated appearance when the interface curvature is to be accounted for. It depends on the apparent curvature radius of the wavefront at the receiver, which has rough approximate form, and therefore gives less stable results compared with plane interfaces. However, the reasonably good match between AVO function and the AVO response suggests that AVO inversion is capable of producing stable results for near-critical and post-critical offsets.

References

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