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Least-squares imaging with multiples

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Summary

We present an imaging tool derived from an Inversion Velocity Analysis (IVA) framework. Using a second-order Gauss-Newton update (Soubaras and Gratacos (2017)), we jointly invert for the source wavelet and for an extended reflectivity, by minimizing the data misfit between the measured raw shot records and the modeled shots. The second order update results in a reflectivity which is a least-squares migration. The modeling is based on one-way wave-equation propagation and includes the source wavelet, source and receiver ghost and multiples up to a given order. The presence of the multiples makes the wavelet estimation stable as the wavelet-reflectivity ambiguity is solved by fitting the first order modeled multiple to the data. As an unconstrained extended reflectivity is used, amplitude versus angle (AVA) effects are estimated. The input can be raw shots as source wavelet estimation and deconvolution, source and receiver deghosting and multiple attenuation are automatically performed by the joint inversion. An example on a real 2D real dataset is shown.

Abstract

We present an imaging tool derived from an Inversion Velocity Analysis (IVA) framework. Using a second-order Gauss-Newton update (Soubaras and Gratacos (2017)), we jointly invert for the source wavelet and for an extended reflectivity, by minimizing the data misfit between the measured raw shot records and the modeled shots. The second order update results in a reflectivity which is a least-squares migration. The modeling is based on one-way wave-equation propagation and includes the source wavelet, source and receiver ghost and multiples up to a given order. The presence of the multiples makes the wavelet estimation stable as the wavelet-reflectivity ambiguity is solved by fitting the first order modeled multiple to the data. As an unconstrained extended reflectivity is used, amplitude versus angle (AVA) effects are estimated. The input can be raw shots as source wavelet estimation and deconvolution, source and receiver deghosting and multiple attenuation are automatically performed by the joint inversion. An example on a real 2D real dataset is shown.

References

Soubaras, R. and Gratacos, B. (2017). Migration Velocity Analysis: mitigating the gradients artefacts by Gauss-Newton update. 79th EAGE Conference & Exhibition, Extended Abstracts, WS09-D01.