

Wavefield imaging/inversion/tomography/MVA: what is the difference?

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Abstract: Waveform inversion and wave-equation migration velocity analysis share one common feature: both techniques exploit information available in the same source and receiver wavefields reconstructed at all times and at all locations in space. These two wavefields are reconstructed from the same source function and observed data as solutions to the same wave-equation. Both techniques invert for the same model parameters and are formulated in the same inverse problem framework coupled with gradient calculations using the adjoint state method.

The main distinction between these techniques is in the way in which they handle the many seismic experiments representing a seismic survey. For the techniques in the waveform inversion family, an objective function is formulated by comparing wavefields for individual experiments; then, a compound objective function is formed by summing the objective functions of all the experiments. Many wavefield comparison measures are possible, including differencing and simple or oriented cross-correlations. For the techniques in the wave-equation migration velocity analysis family, an objective function is formulated after we accumulate for all experiments, e.g. through stacking, different wavefield comparison measures. Here, too, we can compare the wavefields using different measures, including simple and oriented cross-correlations. This summation over experiments produces images that simply function as proxies for the underlying seismic wavefields.

References

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