

A Perspective on the Evolution of Processing Seismic Primaries and Multiples for a Complex Multidimensional Earth

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In exploration seismology seismic events are typically catalogued as primary or multiple, depending on the number of times they have experienced an upward reflection in the subsurface. One upward reflection is a primary and more than one is a multiply reflected event or multiple. Primaries are typically treated as signal and multiples as coherent noise requiring removal before useful information can be extracted from primaries. In this talk we will provide a view of the past, present and future of processing primaries and multiples. Fifteen years ago primaries were more advanced in terms of concept and efficacy in relationship to the removal of multiples. Now that situation is reversed. Back then, primaries were from a multi-D earth with a known multi-D velocity, and multiples were from a 1D earth with a known 1D velocity. Due to new concepts and algorithms derived from the inverse scattering series multiples can be removed today from a heterogeneous, anisotropic anelastic earth with no subsurface information, whatsoever.

Primaries remain today in concept basically where they were 15 years ago. A view of the future would bring the same inverse series to be applied to imaging and inverting primaries, providing an accurate spatial location of reflectors without a known or ever determined accurate velocity model. This would directly address our currently most intractable outstanding E&P obstacle to effectiveness, imaging and inverting beneath complex media, e.g., salt, basalt and karsted sediments. Synthetic and field data examples of this evolution will be presented, and open issues and plans discussed.
