AAPG Search and Discovery Article #90051©2006 7th Middle East Geosciences Conference and Exhibition, Manama, Bahrain, March 27-29, 2006

Model-Driven Land Multiple Suppression - the Third Generation

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Land data, unlike marine data, are characterized with multiple arrivals that are neither continuous nor predictable due to near-surface and sub-surface anomalies. An even greater problem is caused by deeper non-surface related interbed reverberations where the multiple stacking velocity is close to that of the primary. This interbed multiple phenomenon is caused by the typical regional geology which is characterized by relatively shallow fast carbonates being interspersed with slower shales and clastics. In this paper we present an elegant and a powerful approach that suppresses multiple energy. This new technique is a macro model based approach which operates as a multi-step process. It is ideal for AVO analysis, imaging, and detailed structural and stratigraphic interpretation.

In this technique the seismic wavefield is separated into four main components; primary reflections, multiple reflections, random noise, and residuals of both the primaries and the multiples. The multiple energy is suppressed using a multi-step process beginning with the separation of the random noise using localized FK filtering. Then, far offset weighted median filtering is applied to separate the primary reflections from the multiples. These two components are then removed from the data and a localized path-summation methodology is used to model the remaining multiples at every time sample and along every trace. Finally, the modeled multiples are subtracted from the raw input data. The use of the residual components ensures a more realistic model and helps stabilize the final results. Both synthetic and real data examples are shown to illustrate this new technique better preserves both the amplitude and frequency of the primary reflections while effectively suppresses the multiple energy.