
Joint Analysis of PP and PS Data from a 3D-4C OBC Seismic Survey over a Clastic Reservoir in the Arabian Gulf

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In 2002 Saudi Aramco conducted its first ever 3D, 4-Component ocean bottom cable (OBC) seismic survey in the Arabian Gulf. The main objective was the delineation of the Cretaceous fluvial stringer sands of the target reservoir overlying the massive main sands of the Zuluf field. A pre-survey modeling study based on Vp and Vs logs indicated that the use of converted waves holds promise of improved structural and stratigraphic imaging of the target reservoir which is typically characterized by weak acoustic impedance contrasts.

Commensurate with the objectives of the experiment, the 100 Km² survey was acquired with an in-line swath shooting geometry employing two seabed receiver cables, with a symmetric split spread deployment of the 4-C sensors. There were six sail lines per swath with a single boat dual source flip-flop configuration.

The data was processed through dual source summation, horizontal component rotation and PP/PS pre-stack time migration. Post-stack enhancement in the form of non-stationary Gabor deconvolution proved particularly beneficial in view of the low frequency content of the acquired converted wave data.

Well-to-seismic calibration for both PP and PS data at five wells greatly aided in the interpretation of the data. In the end, five key horizons were interpreted and correlated between the PP and PS sections. Joint analysis of the interpreted horizons, using both amplitude and interval time information, enabled us to map the lateral variations of Vp/Vs ratio within the survey area. Although it was not possible to resolve individual sand stringers, these maps of the Vp/Vs ratio allowed us to estimate the overall net pay zones of the sand-shale sequences of the target reservoir.
