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Time-lapse (4D) seismic application in reservoir management programs provides valuable information on monitoring pore-fluid changes and mapping areas of bypassed hydrocarbons. Improved seismic resolution, higher signal-to-noise ratio, reduced turnaround time, and timely integration of time-lapse seismic results will be critical to successful, dynamic reservoir management.

Having subtle pore-fluid seismic effects in carbonates reservoirs, by virtue of the carbonates' high incompressibility, mandates optimized signal-to-noise ratio and resolution. When great care is taken in designing processing flows related to pore fluid, seismic resolution and signal-to-noise ratio can be boosted to allow recognition of seismic changes as small as 8-10%.

A processing flow has improved the seismic resolution by about 15% on time-lapse data used to monitor the pilot tertiary EOR-project at the Hall Gurney Field of Kansas, where the target is Lansing-Kansas City Group Carbonates. This improvement came as a result of raising the seismic dominant frequency from around 55 Hz after conventional processing to 90 Hz after a high-resolution tuned processing flow. The improved dominant-frequency-dependent resolution results in less reflection interference, and therefore better seismic attribute sensitivity to pore-fluid effects that otherwise would be subdued.

Signal-to-noise ratio improvements of about 8% compared to a conventional processing flow, lead to enhanced, more consistent CO_2-related seismic signature for the 4D seismic monitoring. Successful monitoring of CO_2-related changes relied on seismic amplitude attributes of high-resolution 4D seismic data with an improved signal-to-noise ratio over conventionally processed data. Integrating the 4D-seismic-imaged extension of the CO_2-bank with reservoir simulation models resulted in increased confidence supporting necessary modifications to pre-exiting simulators.