3D CRS imaging for recovering high subsurface resolution from sparse 3D seismic surveys

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Seismic aquisition in frontier areas represents a high risk when dealing with remote areas with difficult access, limited operation times due to seasonal influences and governmental restrictions, and a large uncertainty in the design of optimum aquisition parameters. Under such circumstances, high-fold 3D seismic surveying is not feasable, but 2D surveying may also not be appropriate to describe the areal extent of potential targets.

Sparse 3D surveys are frequently used as a compromise. A land data example from North Africa is presented here where large bin sizes (50x50m), and low data fold kept the aquisition costs below given limits. Seismic investigations focussed on flat target horizons, and low-throw faulting in the target regions. As expected, the results of standard time processing could not compete with results from nearby high-fold surveys. A much lower signal-to-noise ratio provided a very restricted resolution of the subsurface.

As an alternative, a CRS time processing was applied to these data. This method is well suited to tackle noise problems in low-fold data, since it uses a much higher stacking fold than conventional time domain imaging. CRS obtains the high fold by assuming subsurface reflector elements with dip and curvature.

CRS imaging of the sparse 3D data provided a strong increase in subsurface resolution, and signal-to-noise ratio. It also resolved the faulting which was almost completely buried in noise in conventional images. The combination of sparse 3D aquisition with CRS processing thus proved to be a suitable strategy for achieving good subsurface resolution with a limited acquisition effort.