geoconvention
Virtual Event
September 21-23
2020
CSPG • CSEG • CWLS • GAC • MAC • IAH

A Fresnel zone based survey design approach

Michael S Hons
Imperial

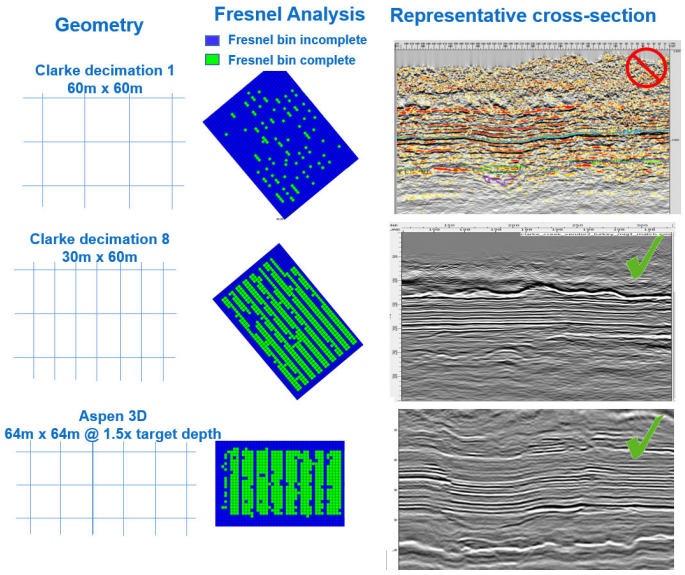
Summary

CDP fold does not provide an adequate representation of ultimate data quality because it is related to processing bin size (Lansley, 2004). A series of decimation tests and comparisons of existing datasets shows that trace density can also fail to correctly rank dataset integrity and quality in cases where target depth varies significantly and when dense stations intervals are on sparse line intervals. Analysis based on the Fresnel zone size of the target has been shown to be a reliable predictor of data quality (Krey, 1987). In, a method is proposed to gather traces that are within the same area of influence (scaled Fresnel zone) and evaluate each gather for completeness. A map of a completeness attribute is proposed instead of a single metric to represent an entire 3D dataset.

Theory / Method / Workflow

A first Fresnel zone describes a region where the wavefield for a given frequency will combine constructively (Sheriff, 2006), and reflections from different offsets & azimuths reflecting within a Fresnel zone width be said to be related to the same subsurface point. As noted in Sheriff (2006), outermost reflections contribute very little, so the Fresnel zone must be scaled to represent the radius in which gathered reflections are dominantly related to the same subsurface point. Once this scaled radius is determined, a set of data completeness tests in offset and azimuth are proposed to evaluate the completeness and integrity of the dataset by evaluating each Fresnel zone.

Results from three decimation test on a dense oilsands volume as well as comparisons to other oilsands surveys at different target depths show this strategy can predict image quality from given survey parameters and density.



References

"Attenuation of random noise by 2D and 3D CDP stacking and Kirchoff migration" by Krey (Geophysical Prospecting, 1987)
"CMP fold: a meaningless number" by Lansley (TLE, 2004)
Sheriff, R.E.; 2006; Encyclopedic Dictionary of Applied Geophysics (4th Edition)