

What does Fresnel Fold mean?

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Summary

Modeling Fresnel coverage during seismic acquisition designs is becoming more common, and Fresnel coverage is offered in several acquisition modeling software packages. Due to its recent development, a standard has not yet been adopted to relate Fresnel fold to standard CMP fold, or to propose a new measure of coverage for Fresnel purposes.

Fresnel fold requires a re-evaluation of fold assignment, which has traditionally been based on source-receiver midpoints. The mid-point hit is assigned to one particular bin, and increments the fold in that bin by 1. Fresnel fold, in comparison, represents the approximate area of reflection at the target that contributes to a reflection event at the receiver. This area becomes larger for lower frequencies and longer offsets, and spreads across many bins.

If the Fresnel fold is incremented by 1 for each bin that is included in the Fresnel zone, then each source-receiver pair can contribute different total Fresnel fold to the map depending on the offset and azimuth relative to the bin grid. Longer offsets will be counted with much greater fold coverage than nearer offsets. While this does represent how many traces contain partial information about a bin-sized zone on a reflector, it doesn't scale the fold to acknowledge that the trace in question contains partial information from many bins. Additionally, the reflection arrival on the trace is more closely related to the central portion of the Fresnel zone than the edges.

We suggest a convention based on the reflection intensity function for the first Fresnel zone on a flat reflector, which is then normalized by the number of bins contained in the Fresnel zone such that the total Fresnel fold added by one source-receiver pair is 1. This leads to decimal fold values in each bin, but relates directly back to familiar fold values from the traditional 'Mid-Point hit' case, where each trace counted as '1'. Adopting a convention that links Fresnel fold values back to conventional fold plots may be most helpful in promoting a common understanding of what Fresnel fold means.

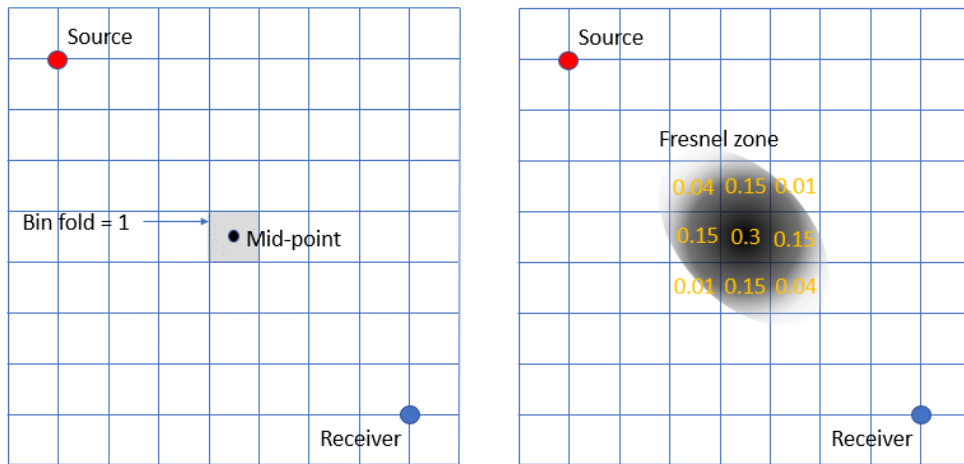


Figure 1. Left: Standard mid-point fold for a source-receiver pair. Right: Fresnel fold, scaled for reflection intensity and single total fold for each source-receiver pair