Testing survey resolution using Spectral Analysis

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Theoretical Models: One and Two Layers

One Layer; 50x50m, 100x100m and 500x500m grid spacing

Two Layers; 100x100m, 200x200m and 500x500m grid spacing
One layer model: Basement
Profile view of one layer model
Simple one layer model: Basement at 1km and 5km
Manual Multi-Window Test

Grid Resolution 50x50m; Source Depth 1km
MWT plot for 50x50m grid, source depth 5km
Simple one layer model: Basement at 1km and 5km
MWT plots for 500x500m grid, source depth 1km

1000m
MWT plot for 500x500m grid, source depth 5km
Two layer model: Sedimentary layer
Profile view of 2 layer model
Two layer model: 100x100m grid, source depths 1 & 2km
Two layer model: 100x100m grid, source depths 4 & 5km
Two layer model: 200x200m grid, source depths 1 & 2km
Two layer model: 200x200m grid, source depths 4 & 5km

Manual Multi-Window Test
Grid Resolution 200x200m, Sedimentary Section at 4km, Basement at 5km

Interpretation Depth (m)

Window Size (Grid Cells)

4000m

5000m
Two layer model: 500x500m grid, source depths 1 & 2km
Two layer model: 500x500m grid, source depths 1 & 2km
Two layer model: 500x500m grid, source depths 4 & 5km
Case study using survey acquired on behalf of USGS in Central San Luis Basin, Colorado, U.S.A.
Central San Luis Basin survey (USGS)

Examples using the 200m line spacing dataset (40x40m grid)

Traverse lines removed to simulate;
400m line spacing (80x80m grid)
800m line spacing (160x160m grid)
2000m line spacing (400x400m grid)
Location of MWT profile and manual stations

Central San Luis: Colorado: 'RTP'
40x40m gc; test area
San Luis Multi-Window Test 40x40m Grid Auto-ESA CUSPS Interpretation
MWT: Depth vs. Window Size at 4 points along profile (40x40m)
MWT: Example of spectrum at 417000mE (2)
San Luis Multi-Window Test 80x80m Grid Auto-ESA CUSPS Interpretation
MWT: Depth vs. Window Size at 4 points along profile (80x80m)
MWT: Auto-ESA (160x160m)
MWT: Depth vs. Window Size at 4 points along profile (160x160m)
MWT: Depth vs. Window Size at 4 points along profile (400x400m)
Examples of manual MWT at well locations in Middle East
MWT example at well location 1
Spectrum example at well location 1
MWT example at well location 2
Spectrum example at well location 2
The resolution of the survey data has significant impact on ability to accurately define depths using spectral analysis.

High resolution surveys with line spacings of 200 and 400m are needed to image subtle intersedimentary horizons.

Widely spaced surveys of 1600 and 2000m are unlikely to resolve shallow features.


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