

Application of Seismic Visualization to Carbon Sequestration Planning in the Illinois Basin

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Planning for carbon sequestration must incorporate results from analyses of seismic reflection data integrated with available geological data. For an area like the Illinois Basin (USA), deep structural discontinuities (e.g., due to possible faults and asymmetric folds) can have a subtle expression. It is thus essential that data processing and visualization techniques be applied that can expose structural anomalies that are at or just below the seismic detection limit when using conventional data displays. In this study, several techniques are examined that enhance the interpretation of the deep structure of oil fields and possible target sequestration sites in the Illinois Basin. The techniques used include 3-D spectral decomposition and semblance, combined with other seismic attributes that reduce noise and preferentially display discontinuities. We show that the coincident application of enhancement techniques to both 2-D and 3-D seismic data from the same geological feature emphasizes the value of tracing discontinuities within 3-D seismic attribute volumes as opposed to using single profiles. The results show that 3-D seismic analysis can identify discontinuities at or near the sealing horizon, whereas on conventional 2-D seismic profiles, these discontinuities are at best subtle and difficult or impossible to interpret. This type of analysis can focus the attention on potential problem areas for sequestration; however, the seismic data analysis alone cannot determine if reflector discontinuities necessarily imply potential leakage but can decrease the uncertainty in evaluation.