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Please fill in your abstract title.	2D Sparse Radon Data Reconstruction

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Abstract

Objective/Scope

High-resolution Radon transform algorithms became the alternative to standard algorithms. Forcing sparseness on the Radon transform leads to a high-resolution transform, which might be used in multiple attenuation, interpolating and reconstructing missing data. In this paper, a new time domain implementation of a sparse apex-shifted hyperbolic Radon transform is presented and demonstrated on synthetic and field data. Time domain implementations enforce time and Radon parameter sparseness simultaneously. They can deal with time variant problems and aliasing.

Methods, Procedures, Process

The new sparse Radon transform parameters are not saved and displayed in the conventional way. But, they consists of matching filters which are saved as short seismic traces with the appropriate information written into headers, i.e., vertical travel time, velocity and apex-shift. Each matching filter contains its relevant reconstruction parameters which are needed to reconstruct a hyperbola in the space-time domain. Adding all of those reconstructed hyperbolae together, reproduces the original data. One may think of these matching filters as extracted wavelets from every reflection event in the input data. The new approach is similar to matching pursuit algorithms.

Results, Observations, Conclusions

The new 2D sparse Radon data reconstruction algorithm will be demonstrated on a synthetic data example with different spatial sampling intervals. It will be demonstrated on field data example. During data reconstruction, one can reconstruct the data at its original geometry, which could be sparse and irregular, or to a new well-sampled and regular geometry. The field data example shows that the new 2D sparse Radon data reconstruction algorithm is capable of properly reconstructing the data to its original geometry or to any desired fine spatial sampling. Generally, seismic data has some degree of amplitude variation with offset. A single matching filter, for each hyperbolic event in data, will not be able to fit and reconstruct such variation perfectly. Yet, the performance of the sparse Radon transform can be improved by using short laterally varying space-time filters (2D filters) instead of single time filters (1D filters). These short 2D filters are fixed in time but variable in space. During the reconstruction process, one can choose to use all of the filters (wavelets) or just part of them. This gives us the opportunity to work with each single wavelet separately.

Novel/Additive Information

The new 2D sparse apex-shifted hyperbolic Radon transform is unlike the conventional transforms. It does not consider inverting the whole Radon trace in each iteration. Instead, it only selects the strongest event in that particular Radon trace for that iteration and works with it in a least-squares manner. The new algorithm decomposes any seismic gather into a linear expansion of waveforms that are extracted from the seismic reflections available in the data.