High-resolution coherent noise removal

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In shallow hard water-bottom areas seismic data can be contaminated with linear refracted noise that may totally obscure signal amplitudes at medium and far offsets. Such noise is often highly aliased and resistant to removal via conventional approaches such as FK filtering or linear slant-stack. These can fail to remove the noise sufficiently for an accurate interpretation of amplitudes at far offsets, and have a tendency to smear signal amplitudes at all offsets.

In this paper we present results from an alternative approach, a high-resolution linear Radon technique, that uses data-derived constraints to improve the focusing and positioning of energy in the transform. This produces a more complete noise removal and better preservation of signal than is possible with conventional techniques.

We construct constraints from a simple iterative adaption of a standard slant stack, and uses these to drive a constrained least-squares inversion. This method has a stability in the presence of noise that can be absent in other, frequency bootstrapping, approaches to the high-resolution Radon transform.

We have found the technique to be particularly effective for noise removal in shallow water (about 100 msec two-way time) and over simple sedimentary sequences of layers. Data examples show that it can surgically remove steeply dipping coherent noise without altering less steeply dipping data. Although FK filtering may reduce the noise, after FK filtering the far offsets may still need muting because of the residual noise. With the high-resolution Radon transform, the noise can often be removed with little if any residual noise remaining. Primary amplitudes can then be viewed and interpreted out to the furthest offsets.