

High-Resolution Broadband Processing and Quantitative Seismic Interpretation

A Paradigm Geoscience Data Service

Geophysicists are enjoying the benefits of a new generation of seismic data aimed at recovering missing low frequencies in such data. This is a necessary driver for other procedures, such as full waveform and seismic impedance inversion, where geoscientists require high-resolution, shallow velocity models or high-resolution stratigraphic images from the seismic method. Broadband seismic data is an impetus for new quantitative seismic interpretation (QSI) solutions that drive a more unified and concurrent approach to transforming seismic amplitude data to elastic and rock properties.

Broadband seismic acquisitions are now routinely employed for offshore acquisitions and include slanted and variable depth streamers, over-under streamers, dual sensor streamers and others to remove source and receiver ghosts that adversely impact the resolution of seismic data. These acquisitions can be adapted for specific exploration targets and objectives. Algorithmic processing approaches have also emerged for application to conventional towed streamers, to correct the notches in the amplitude spectrum and improve seismic resolution. By correcting the ghost effect and preferentially dealing with the low frequencies, the efficacy of other processing techniques like Q (absorption) filtering, spectral extension, and seismic inversion are greatly enhanced, leading to even higher-resolution seismic images.

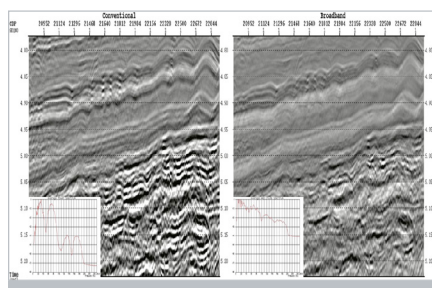
Paradigm offers an innovative broadband deghosting solution to correct the source and receiver notches produced from their respective and undesirable reflections from the sea surface. These reflection delays (ghosts) are estimated using a recursive filter with least squares energy minimization criteria. The resultant data is suitable for processes like seismic inversion, that require the low frequencies needed to form the broad spectrum used in stratigraphic imaging and property recovery, and a powerful QSI outcome.

Paradigm Broadband Processing and QSI Solutions

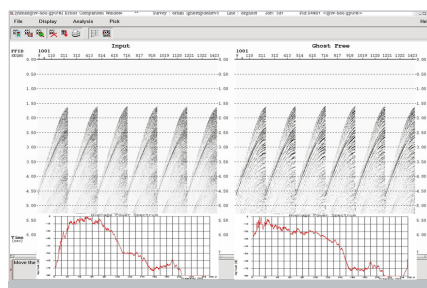
- Highly adaptable broadband deghosting procedure (recursive filter) to recover low frequencies and correct source and receiver ghost notches
- Options to apply deghosting operator on recorded offset traces or constant “p” traces obtained from a linear Radon transformation
- Recursive filter operator with user-selected least squares criteria to search a range of possible source/receiver depths for precise locations
- Time-frequency spectral extension and noise suppression methods to enhance the deghosting inputs and outputs
- Model-constrained simultaneous angle inversions and full prestack gather inversions for high-quality Quantitative Seismic Interpretation outcomes
- Well data calibration and advanced synthetics for thin bed and property validation

Paradigm Broadband Processing and QSI Advantages

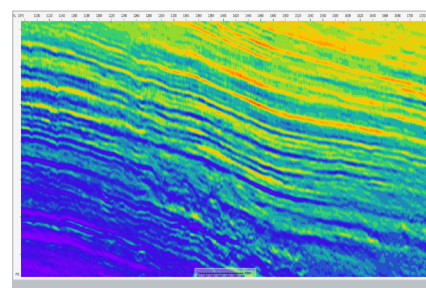
The Paradigm Geoscience Data Services team is able combine a powerful deghosting procedure with other data conditioning operations to create the broadband data needed to carry out seismic inversion operations. By working with a broadband amplitude spectrum, uncertainties in the seismic inversion process are minimized. The results are highly suitable for Quantitative Seismic Interpretation objectives, including stratigraphic imaging and elastic property recovery.



▲ Before and after broadband deghosting correction



▲ Before and after source and receiver deghosting



▲ Deghosting as a natural prerequisite for seismic inversion