Diffraction Imaging Using Multiplication Imaging Condition

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Abstract

OBJECTIVES
This abstract presents a new algorithm to generate diffraction image on prestack seismic data or migrated stack image. Both synthetic and real data are tested to demonstrate the validity of diffraction imaging using the multiplication imaging condition.
METHODS
The key idea is that discontinuity responses are comprised of all dip angle ranges and thus they can exist in both negative- and positive-dip structure images. However, reflection responses can only exist in either negative- or positive-dip structure images. Applying multiplication imaging condition to two opposite-dip structure images can generate a diffraction image. This method can be applied to both prestack seismic data and migrated stack image. For the prestack seismic data, wavefield separation is used to generate negative- and positive-dip structure images. The wavefield calculation can be based on one-way or two-way wave-equation. For the migrated stack image, F-K filtering is a straightforward method to split the negative- and positive-dip structure.
RESULTS
In the synthetic and real data set tests, the subsurface model has faults, pinch-out and reflectors with different structure dips. After wavefield separation or F-K filtering, we generate one negative-dip structure image that contains the negative-dip reflectors and diffractors and another positive-dip structure image that has positive-dip reflectors and diffractors. Performing the multiplication imaging condition sample-by-sample between two opposite images, the diffraction image is generated. The faults and major discontinuities along the reflectors are clearly imaged and the reflection response is mainly suppressed. The testing examples prove that our proposed diffraction imaging methodology can remove reflected events from the prestack seismic data or migrated stack image and allow mainly diffracted based images for further interpretation.
CONCLUSIONS
Multiplication imaging condition on different dip structure images provide a novel and efficient method to image the discontinuity from prestack seismic data or migrated stack image.