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Improved seismic scattering feature detection using seismic diffraction imaging techniques

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Seismic diffraction imaging provides a method for detecting scattering objects in the subsurface with greater resolution and precision than conventional imaging techniques. Applying a plane wave destruction filter to seismic data removes the majority of energy which comes from plane wave reflection and leaves only low-energy signal associated with diffraction scattering from inhomogonaities like vugs and voids in karstal topography, the edges of channels, and steeply dipping velocity interfaces. Migration of this data provides a more focused and precise image of subsurface scattering features.

This study examines the results of seismic diffraction imaging on a set of synthetic seismic volumes. Images created by seismic diffraction methods and those produced by conventional methods are compared to each other and the initial velocity model to determine their relative accuracy and resolution. Situations where diffraction imaging techniques are unable to detect velocity model inhomogenaities are explored and described. Results are used to illustrate situations where seismic diffraction imaging can be particularly useful for accurate feature detection and situations where the methods do not accurately image the subsurface.

Keywords: seismic imaging, diffraction, computational seismology, synthetic seismic imaging, Madagascar, plane wave destruction