Improving Images below Shallow Gas Clouds with Full Waveform Inversion, Q Tomography and Q Migration: A Case Study from Offshore Myanmar

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Abstract

Obtaining high-resolution seismic volumes remains a challenge for the seismic industry, especially when the overburden is complex. The presence of shallow absorbing anomalies has long been recognized as a significant problem in seismic data processing. The seismic image underneath such anomalies often suffers from serious wavefield distortion and amplitude loss.

Standard ray-based tomography generally fails to capture the detailed velocity variation within the shallow anomaly. However, with full waveform inversion (FWI), high-resolution velocity details can be revealed. Moreover, such a detailed model can be used to guide a Q tomography inversion. With correct velocity and Q models, pre-stack depth Q migration (Q-PSDM) is an effective tool for compensating the distortions caused by the absorbing heterogeneities.

In this paper, we present a case study from offshore Myanmar that combines FWI and FWI-guided Q tomography to invert velocity and absorption model of shallow anomalies to improve the seismic image. This dataset has a very shallow seafloor (~20 m) characterized by slow-velocity gas-charged channels in the near surface. The seismic data are therefore plagued with wavefield distortions and a degraded signal-to-noise ratio. The traditional ray-tracing based tomographic inversion is challenging due to the lack of offset coverage and overall poor data quality.