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Seismic Modeling of Near Vertical Heat and Fluid Flux Conduits in the Methane Hydrate Stability Zone

The distribution of natural methane hydrate in marine sediments is very likely controlled by near vertical fluid flux which concentrates biogenic or thermogenic methane in shallow (<500m) sediments. When great enough, this flux perturbs the base of the methane hydrate stability field allowing gas to exist at shallower depths in the sediments than would be possible with no flux. The presence of gas, combined with offset in reflectors if the conduit is a fault, allows the detection of these conduits with the reflection seismic technique. However, the detection is problematic for conventional surface-towed systems due to the small size of many of these features (10's of meters wide), and their near vertical orientation. Numerical and physical modeling of the acoustic impedance contrasts associated with the conduits shows the significant sensitivity of the seismic response over these features to not only the frequency content, but also the proximity of the seismic source and receivers to the conduit.