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Seismic characterisation of shallow gas distribution beneath marine seep sites on New Zealand's Hikurangi Margin

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During recent years, increased attention has been paid to cold seep research within the large gas hydrate province of New Zealand's Hikurangi Margin. We present seismic data that characterise a shallow gas hydrate province beneath an uplifted ridge where three separate areas of sea floor seepage have been recognized. One of these sites was known prior to 2006, but the other two have been discovered since then.

The seismic data provide good evidence for gas migration pathways beneath the seep sites. We observe various seismic manifestations of gas, including amplitude enhancement, signal "wipeout", and warped reflections. Beneath each of the seeps sites there is an apparent association with gas hydrate-bearing sediments, suggesting that gas hydrates play an important role in deflecting fluid flow pathways. Beneath some seeps, fluids appear to be partially trapped beneath the base of gas hydrate stability, where anomalous fluid pressure may accumulate and facilitate gas injection into and through the gas hydrate stability zone. At other sites, the base of hydrate stability converges with the sea floor, meaning that gas can reach the sea floor directly, without having to penetrate hydrate-bearing sediments. Aside from gas hydrate influences on fluid flow, gas migration seems to exploit relatively-high-permeability conduits, owed to fault zones or particular sedimentary horizons.