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Multiscale Image of a Seep Structure - Takahe, Offshore New Zealand

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We present a multi-scale geophysical study of a methane seep site "Takahe" on the southern Hikurangi Margin offshore New Zealand's North Island. Seismic, Parasound, sidescan sonar and subbottom profiler data were combined to image the spatial structure of the seep and its expression at the seafloor.
The data were acquired in March of 2011 during the cruise $SO_2$14 with the German research vessel R/V Sonne. The aim of the project was to investigate cold seep structures within the gas hydrate stability zone (GHSZ). 2.5D seismic reflection data reveal the sub-seafloor structure of gas migration pathways beneath Takahe, which can be traced to a source that is at least as deep as the base of the GHSZ. The structure can be divided into three parts: i) a broad feeding base that narrows into an inverted bathtub-shaped funnel, ii) a narrow, vertical conduit extending upwards from the funnel to approximately 50 m beneath the seafloor and iii) a second bathtub-shaped expression fanning out from the top of the narrow conduit to the seafloor.
Multiple Parasound transects acquired over Takahe reveal the shallow structure of the upper 50 m of the gas conduit in very high detail. The conduit penetrates a strong reflection representing an unconformity between less-consolidated sediments above and well-indurated "hard" sediments below. Shallow amplitude anomalies within the conduit are interpreted as free gas close to the seafloor. The high-frequency component of the Parasound system was used to image numerous flares in the water column, revealing that gas is actively venting from the seafloor at this site.
Active venting is also suggested by several flares imaged in the water-column of the unprocessed sidescan sonar data. Takahe site is marked by slightly elevated backscatter over a 0.059 km^2 large, oval-shaped area. Authigenic carbonates are not present on the seafloor, which distinguishes Takahe from the majority of seeps on Opouawe Bank. Takahe possibly is a relatively young seep that has not been active long enough to precipitate carbonates onto the seafloor. The elevated backscatter may result from shallow gas accumulations, which is supported by acoustic turbidity in subbottom profiler data indicating the presence of gas only a few metres beneath the seafloor.