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2D–Gas hydrate inventories offshore Costa Rica

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Marine gas hydrate inventories have been estimated along 2 seismic lines across the Pacific continental margin offshore Costa Rica. A complementary approach has been developed using geochemical reactive-transport models and geophysical rock physics modelling to quantify regional GH inventories. In detail, a geochemical transport-reaction model has been applied to predict sub-seafloor gas hydrate distributions under varying environmental conditions and constrained by field data derived from various DSDP and ODP drill sites. Based on these results, a simplified transfer-function has been derived that enables the calculation of gas hydrate by 3 easily accessible parameters: the gas hydrate stability field, the sedimentation rate, and the sub-seafloor penetration of seawater sulphate. Independently, in situ gas hydrate concentrations have been determined by inversion of P-wave velocities from multichannel seismic data. The geophysical approach uses the Migration Velocity Analysis (MVA) for determination of in-situ P-wave velocities. The gas hydrate concentrations are then derived from these seismic velocities using a petrophysical model based on an effective medium theory (EMT) and e.g. lithological parameters from local drill sites. In addition, the interpretation of the post-stack seismic sections has been used to derive regional variations of the thermal gradient (using the depth of the BSR) and the overall sediment thickness. Applying the transfer function results in GH concentrations ranging from 0 to 100 g CH4 per cm2 seafloor. The highest amounts of GH are expected at mid-slope depths, where optimal conditions with respect to organic matter input, sediment thickness and stability conditions are met. Integration of the GH bearing sediments along the profile and subsequent extrapolation to 1 km of continental margin length yield a GH potential of 18.7 Tg CH4 per km.