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# Elevating salinity and temperature with hydrate formation at deepwater Gulf of Mexico vents

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We study the Ursa vent in ∼1070 meters water depth at lease blocks MC852/853 in the northern Gulf of Mexico. Elevated salinities and temperatures at the vent shift the base of the hydrate stability zone (HSZ) to the seafloor (Paull et al., 2005; Ruppel et al., 2005). We model the coexistence of high salinities, high temperatures, and an uplifted hydrate phase boundary with a one-dimensional, multicomponent, multiphase, fluid- and heat-flow model of hydrate formation. In this model, free gas supplied from depth migrates vertically through a high-permeability conduit to the regional hydrate stability zone (RHSZ). Once reaching the base of the RHSZ, gas combines with water to form hydrate, salt is excluded, and heat is released. Hydrate formation continues until water is too warm and saline for further hydrate formation. This process self generates three-phase (gas, liquid, hydrate) equilibrium through the RHSZ and allows gas to vent from the base of the RHSZ to the seafloor. Once the reaction front breaches the seafloor, a pseudo steady state is reached in which a continuous salt flux diffuses from the seafloor, and further hydrate formation occurs at a rate necessary to replace the diffuse salt loss. This continued hydrate formation has the potential to produce large, steady fluxes of salt and heat from the seafloor. Such gas-hydrate and fluid-flow systems are important because they are especially sensitive to global ocean warming due to the large concentrations of hydrate that exist at three-phase equilibrium near the seafloor.

References:

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