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Response of the global hydrate stability zone volume and hydrate inventory to IPCC AR5 RCP future scenarios.

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We present results from a multi-model study investigating how the global Hydrate Stability Zone (HSZ) volume and methane hydrate inventory will respond to the four Representative Concentration Pathways (RCPs) modelled within CMIP5. We begin by evaluating GCM model performance against WOA05 bottom water conditions and generate model weights to guide our multi-model mean. From initial pre-industrial conditions we model the propagation through the sediment column of bottom water temperatures through the historical and RCP scenarios to 10 kyr into the future (with conditions held fixed from the end of the RCP). Incorporating models of potential sea-level change we then model the temporal evolution of the extent of the HSZ on a global scale. Preliminary results suggest that for the RCP85 scenario (business as usual) the fractional change in global HSZ volume will exceed the envelope of modelled global change felt during the last glacial cycle (120 kyr) within as little as 2-3 kyrs depending upon the sea-level scenario. Modelling global hydrate evolution is more speculative. Starting from a mean equilibrium state derived from pre-industrial conditions we will model the first-order transient behaviour of the hydrate inventory using a 1-D model adapted from Davie and Buffett (2003). We will present results of a sensitivity analysis and describe the caveats associated with this work.
M. K. Davie, B. A. Buffett, (2003) Sources of methane for marine gas hydrate: inferences from a comparison of observations and numerical models, EPSL v. 206, p. 51-63