

Ocean oxygen depletion due to decomposition of submarine methane hydrate

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Global warming could decompose submarine methane hydrate and cause methane release into the ocean. The released methane causes oxygen depletion via oxidation; however, its global impact is yet to be quantitatively investigated. We have projected the potential impact of oxygen depletion due to methane hydrate decomposition via numerical modeling. We find that the global methane hydrate inventory decreases by approximately 70% (35%) under four times (twice) the atmospheric CO₂ concentration and is accompanied by significant global oxygen depletion on a timescale of thousands of years. In particular, we demonstrate the great expansion of suboxic and hypoxic regions, having adverse impact on marine organisms and ocean biogeochemical cycles. This is because hydrate decomposition primarily occurs in the Pacific Ocean, where present-day seawater has low oxygen concentration. Besides the decrease in oxygen solubility and reduced ventilation associated with global warming, the process described in this study is also important in oxygen depletion.

Keywords: methane hydrate, global warming, ocean oxygen depletion