



## **Methane bubble escape from gas horizon in muddy aquatic sediment under periodic wave loading**

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Ebullition of greenhouse methane (CH<sub>4</sub>) is often observed at low tides and waves in marine and lacustrine settings, presenting an important ecological hazard. However, the dynamics of bubbles escape under the periodic wave loading and its controlling factors are still enigmatic. In this study CH<sub>4</sub> bubble escape from gas horizon in muddy sediment is modelled under various static water column heights and periodic wave characteristics. For the first time it is shown that a scaling between the wave amplitude, wave period and background static load of the water column defines a possibility of the bubble escape from gas horizon and its propagation pattern within muddy sediment. It is found that bubbles escape from gas horizon is more feasible under the shorter-period (surface) waves (e.g., wind waves and swells) travelling in the shallow water. Moreover, hydrostatic pressure drop due to waves is found to control a bubble release from gas horizon, while the role of solute exchange with ambient sediment is minor, in contrast to the bubble ascending from the place of its nucleation.