

ID: W2107785479

TITLE: Gas hydrates: past and future geohazard?

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ABSTRACT:

Gas hydrates are ice-like deposits containing a mixture of water and gas; the most common gas is methane. Gas hydrates are stable under high pressures and relatively low temperatures and are found underneath the oceans and in permafrost regions. Estimates range from 500 to 10,000 giga tonnes of carbon (best current estimate 1600-2000 GtC) stored in ocean sediments and 400 GtC in Arctic permafrost. Gas hydrates may pose a serious geohazard in the near future owing to the adverse effects of global warming on the stability of gas hydrate deposits both in ocean sediments and in permafrost. It is still unknown whether future ocean warming could lead to significant methane release, as thermal penetration of marine sediments to the clathrate-gas interface could be slow enough to allow a new equilibrium to occur without any gas escaping. Even if methane gas does escape, it is still unclear how much of this could be oxidized in the overlying ocean. Models of the global inventory of hydrates and trapped methane bubbles suggest that a global 3(degrees)C warming could release between 35 and 940 GtC, which could add up to an additional 0.5(degrees)C to global warming. The destabilization of gas hydrate reserves in permafrost areas is more certain as climate models predict that high-latitude regions will be disproportionately affected by global warming with temperature increases of over 12(degrees)C predicted for much of North America and Northern Asia. Our current estimates of gas hydrate storage in the Arctic region are, however, extremely poor and non-existent for Antarctica. The shrinking of both the Greenland and Antarctic ice sheets in response to regional warming may also lead to destabilization of gas hydrates. As ice sheets shrink, the weight removed allows the coastal region and adjacent continental slope to rise through isostasy. This removal of hydrostatic pressure could destabilize gas hydrates, leading to massive slope failure, and may increase the risk of tsunamis.

SOURCE: Philosophical transactions - Royal Society. Mathematical, Physical and engineering sciences/Philosophical transactions - Royal Society. Mathematical, physical and engineering sciences

PDF URL: None

CITED BY COUNT: 235

PUBLICATION YEAR: 2010

TYPE: article

CONCEPTS: ['Permafrost', 'Clathrate hydrate', 'Methane', 'Global warming', 'Arctic', 'Geohazard', 'Geology', 'Environmental science', 'Earth science', 'Oceanography', 'Climate change', 'Atmospheric sciences', 'Hydrate', 'Geomorphology', 'Chemistry', 'Landslide', 'Organic chemistry']