**IPPC 2007 assessment references with respect to risk**

 **from Arctic summer sea ice loss and methane carbon feedback**

The 2007 IPCC technical summaries specifically identify Arctic methane hydrate as a catastrophic risk

<http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch1s1-4-5.html>

As permafrost thaws due to a warmer climate, CO2 and CH4 trapped in permafrost are released to the atmosphere. Since CO2 and CH4 are greenhouse gases, atmospheric temperature is likely to increase in turn, resulting in a feedback loop with more permafrost thawing. The permafrost and seasonally thawed soil layers at high latitudes contain a significant amount (about one-quarter) of the global total amount of soil carbon. Because global warming signals are amplified in high-latitude regions, the potential for permafrost thawing and consequent greenhouse gas releases is thus large.

<http://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch2s2-2-4.html>

IPCC AR 4 WG 3 2.2.4 Risk of Catastrophic or Abrupt Change

The possibility of abrupt climate change and/or abrupt changes in the earth system triggered by climate change, with potentially catastrophic consequences, cannot be ruled out. Positive feedback from warming may cause the release of carbon or methane from the terrestrial biosphere and oceans which would add to the mitigation required.

<http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter15.pdf>

In both polar regions, components of the terrestrial cryosphere and hydrology are increasingly being affected by climate change (very high confidence). These changes will have cascading effects on key regional bio-physical systems and cause global climatic feedbacks

<http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch8s8-7-2-4.html>

8.7.2.4 Methane Hydrate Instability/ Permafrost Methane

Methane hydrates are stored on the seabed along continental margins where they are stabilised by high pressures and low temperatures, implying that ocean warming may cause hydrate instability and release of methane into the atmosphere. Methane is also stored in the soils in areas of permafrost and warming increases the likelihood of a positive feedback in the climate system via permafrost melting and the release of trapped methane into the atmosphere.

Both forms of methane release represent a potential threshold in the climate system. As the climate warms, the likelihood of the system crossing a threshold for a sudden release increases. Since these changes produce changes in the radiative forcing through changes in the greenhouse gas concentrations, the climatic impacts of such a release are the same as an increase in the rate of change in the radiative forcing.

**Third Assessment 2001**

<http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=431>

IPCC 2001 11.2.1.5. Cryosphere and Permafrost

Because large quantities of carbon are sequestered in the permafrost of boreal peatlands and tundra regions (Botch et al., 1995; Ping, 1996), changes in distribution of frozen ground and systematic increase in the thickness of seasonally thawed layer are likely to result in the release of large amounts of CO2 and possibly methane (CH4) into the atmosphere.

<http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter15.pdf>

*15.4.1. page 662*

*Methane hydrates: significant amounts of methane hydrates are contained in sediments, especially on Arctic continental shelves. As these areas warm, this methane may be released, adding to the greenhouse gas concentration in the atmosphere.*

<http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch4s4-7-2-4.html>

*4.7.2. Subsea Permafrost*

*Subsea (or offshore) permafrost refers to permafrost occurring beneath the seabed. It exists in continental shelves of the polar regions. Subsea permafrost formed either in response to the negative mean annual sea-bottom temperature or as the result of sea level rise so that terrestrial permafrost was covered by seawater. Although the potential release of methane trapped within subsea permafrost may provide a positive feedback to climate warming, available observations do not permit an assessment of changes that might have occurred.*

[*http://www.ipcc.ch/publications\_and\_data/ar4/wg1/en/ch7s7-4-1-2.html*](http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch7s7-4-1-2.html)

*Climate also affects the stability of CH4 hydrates beneath the ocean, where large amounts of CH4 are stored (~4 ×106 Tg; Buffett and Archer, 2004). The δ13C values of ancient seafloor carbonates reveal several hydrate dissociation events that appear to have occurred in connection with rapid warming episodes in the Earth’s history (Dickens et al., 1997; Dickens, 2001)*