The Air-Water CH\(_4\) Gradient in the Siberian Arctic Seas

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A remarkable coherence seen between measurements of late Quaternary atmospheric methane (CH\(_4\)) changes and temperature variations recorded in ice cores suggests that CH\(_4\) played a significant role in climate change [IPCC, 2001]. Polar ice cores and marine sediments document interglacial and interstadial episodes marked by dramatic warmings that occurred in just a few decades [IPCC, 2001]. Each of these rapid warmings was closely linked to a rapid increase in atmospheric CH\(_4\). However, the cause of these rapid warmings have largely remained a mystery. The largest potential sources of CH\(_4\) emission to the atmosphere is natural gas hydrates [Makagon, 1982; MacDonald, 1990]; the shelf and continental slope reservoir is estimated to be roughly 6×10\(^{18}\) g (or 6,000,000 Tg), and the on-shore permafrost reservoir is about 16×10\(^{18}\) to 32×10\(^{18}\) g. Doubling of the atmospheric methane from present conditions requires release of less than 0.03% of the permafrost hydrate reservoir. Therefore conversion of a small part of the carbon buried in permafrost might cause a large change in the growth of atmospheric CH\(_4\). Estimates of the potential gas fluxes to the atmosphere and the timing of these gas fluxes require detailed information on the dynamics of thawing subsea permafrost and gas hydrate decomposition [Semiletov et al, 2004]. Here we present new CH\(_4\) data obtained over the shallowest and broadest Arctic East Siberian shelf which may indicate that processes of permafrost warming and release of CH\(_4\) from destabilized methane hydrates may already be in progress. Russian literature data are reviewed also to make a full picture for the air-sea CH\(_4\) gradient in the Siberian Arctic seas.

REFERENCES.