Different CH_4 emission from different Arctic surface soils under warming incubation

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Global climate change models have predicted the highest increase in temperature in the polar region. As Arctic soil contains a huge amount of organic carbon that is vulnerable to warmer conditions, many studies have addressed effects of warming on decomposition of organic matter which may accelerate warming by positive feedback. Although the global warming potential of CH_4 is 30 times greater than CO_2, dynamics of CH_4 emission from arctic soil under warming conditions is still elusive. This study aimed to address this issue by monitoring CH_4 releases from different arctic soils (peat/organic, wetland/upland) that were exposed to various temperatures from -20 to 20 °C.

CH_4 emission from wetland (peat/organic) soil cores significantly increased at thawing temperature (0.2-0.3 nmol g^{-1} hr^{-1}), but upland soils did not exhibit such changes. Furthermore, CH_4 emission from the wetland peat cores drastically increased at 20 °C (8.5 nmol g^{-1} hr^{-1}), while still small CH_4 flux was observed in upland soil surfaces. When sieved vs. intact soils from the same upland site were compared, much higher CH_4 emission was observed for sieved soil (0.7 nmol g^{-1} hr^{-1}) when the temperatures remained below freezing. Unlike CH_4 emission, CO_2 emission from all arctic soils increased linearly along the temperature rise (0.01-0.1 μmol g^{-1} hr^{-1}). Our results suggest that locally inundated condition in very warm season may cause explosive CH_4 emission, and physical lockup and releases of CH_4 could contribute much to the total dynamics of CH_4.