Difference between amount and isotopic ratio of emitted methane from defferenrent vegatation and soil types in arctic area

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Methane, an important global warming gas is approximately 20 times more effective in retaining heat atmosphere than carbon dioxide. The concentration of methane is now about 1.7ppm and it is increasing.

Methane is an end product of organic matter decomposition under reductive conditions in soil. Methanogenesis archaea produce methane from carbon dioxide or small organic matter, which has methyl group, such as acetic acid. On the other hand, methane is oxidized to carbon dioxide with oxygen molecule by methanotroph bacteria in oxic soil. Generally, isotope ratio of product is depleted compared with its substrate by microorganisms. Therefore, stable isotopic ratio of efflux methane has information not only about the place it was produces but also the pathway of production and consumption.

It is important to document how methane dynamics is in arctic soils because the amounts of methane emission from arctic soil possibly change dramatically. Arctic wetland accounts not negligible percentage on whole global methane source. Addition to that, it is thought that arctic wetland has high potential of methane emission. On the other hand, methane dynamics in soil are very different between different vegetation. Some studies say that methane consumption in oxic arctic soil is underestimated and that the underestimation causes overestimation methane emission from arctic soil. IPCC makes it noticed that arctic area is sensitive to the effect of global warming but how it will change is not clear so far.

The purpose of my study is to identify how methane emission and stable isotopic ratio of emitted methane are different between different vegetation and soil types in arctic area.

Field studies were conducted in Arctic Long Time Ecological Research site, based at University of Alaska Toolik Field Station, which is located in the northern foothills of the Brooks Range. Arctic LTER project documents changes as they occur and compares the changes in environment, species composition, and ecosystem processes over time.

Sampling campaigns were carried out from June to July in 2004. Sampling plots were two distinct terrestrial ecosystem types that differ greatly in both vegetation growth form and soil type: tussock tundra and wet sedge tundra. Methane fluxes, d13C of emitted methane were measured. Methane flux was estimated using a static flux chamber method as same as previous study. To omit the spatial variation, three chambers were placed in each plot. Methane concentrations were measured by gas chromatography. d13C of samples were measured with a gas chromatography/ combustion/ isotope ratio mass spectrometry technique. With this result, the isotopic ratio of methane emitted from soil was estimated using Keeling plot.

Methane was emitted from wet sedge tundra but neither emission nor consumption were observed in tussock tundra. The spatial variation in wet sedge plot were very large. Two reasons were conceivable for the difference of methane emission between wet sedge tundra and tussock tundra. One case is that methane dynamics were same between both vegetation site but the activity is different. Second case is methane dynamics itself were deferent. The isotopic ratio of emitted methane, or the air in chamber headspace can help considering this point.