Temperature-Dependence of Methane Oxidation Rates in Permafrost Soils of the Lena Delta, Siberia

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Wet tundra environments of the Siberian Artic are considerable natural sources of methane, a climate relevant trace gas. The Arctic is observed to warm more rapidly and to a greater extend than the rest of the earth surface (IPCC 2001). It is suggested, that the tundra in Alaska and Russia has changed from a net sink to a net source of atmospheric carbon.

The potential impact on the Arctic carbon reservoirs is highly influenced by changes in microbial processes like methanogenesis and methane oxidation. Methanogenesis describes the terminal step in the anaerobic degradation of organic matter and is undertaken by methanogenic *Archaea*. The emission rates of the biologically produced methane from arctic Permafrost soils are highly divergent. Seasonal methane emission from low-centred polygons, which are characteristic for the micro-relief of the Lena Delta, ranged between 53.2 ± 8.7 mg d^{-1} m^{-2} for the depressed polygon centre and 4.7 ± 2.5 mg d^{-1} m^{-2} for the polygon rim. The amount of methane released is mainly controlled by obligatorily aerobic or micro-aerophilic *α*- and *γ-Proteobacteria*, the methane oxidising bacteria (MOB).

In Arctic environments, biological processes are controlled by seasonal freezing and thawing, which leads to an extreme temperature regime in the upper active layer of the permafrost. First research on the temperature-dependence of the methanotrophic activities in samples of a polygon rim and of a floodplain soil of Samoylov Island (Lena Delta, Siberia) indicate a shift in the temperature optimum with depth. MOB in the upper soil layers appeared to have their highest activity at temperatures of 21 °C. Contrarily to that, in deeper horizons close to the permafrost table the maximum methane oxidation rates were determined at 4 °C. These results contradict the idea of a ‘community of survivors’ in permafrost soils. They rather indicate the existence of very specialised methanotrophic communities within their environment of Siberian permafrost soils.

Further research on the temperature-dependence of the methanotrophic activities will be undertaken for samples of a polygon centre. In addition, it is planned to study the structure and the dynamic of the methanotrophic communities in Siberian permafrost soils using culture independent techniques.