19. Dynamics of CO₂ Evolution of Arctic soils from northern Siberia and Scandinavia

Manfred Bölter and Wiebke Müller-Lupp

Institute for Polar Ecology, University Kiel, Wischhofstr. 1-3, Bldg. 12, 24148 Kiel, Germany

Abstract

Arctic soils are generally regarded as environments posing extreme conditions to life processes. This holds true for all life forms, but with special respect to microorganisms, which have to survive strong gradients in temperature, moisture, and nutrients in both time and space. Soil respiration can be regarded as an overall indicator for mineralization processes in soils. Different soils from northern Siberia (Lena Delta) and north Finland were investigated for their CO₂-evolution in relation to environmental parameters. The Siberian sites were at different spots of a low center polygon filed and represent soil habitats with different contents of moisture and organic matter. The sites in Finland show different vegetation cover due to different land use. The studies put main emphasis on the reactions of respiratory activity to temperature and potential temperature shifts. The data showed a strong correlation between temperature and water availability, even greater effects than total soil carbon content. Q₁₀-values for respiratory activity were in similar ranges as in soils of temperate regions, but there are significant shifts with respect to individual temperature steps. Thus, a controlling factor of the actual CO₂-evolution is the water availability at freezing temperature. These ecologically important stressors set the frame of overall microbial activity. Seasonal time shifts in thawing and freezing thus have central roles also for landscape ecology and long-term analyses of soil microbial effects on global scales.