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Respiratory activity of permafrost peatland and north taiga soils of West Siberia (Russia)

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Ecosystem respiration is one of the largest terrestrial carbon fluxes. The response of soil respiration and its components to climate warming is one of the uncertainties in ecosystem carbon models. Soil carbon dioxide fluxes are driven by both autotrophic and heterotrophic respiration, which may respond differently to environmental change. Knowledge on soil microbial respiration rates and thus soil-related carbon losses from Arctic soils is vital because of the crucial importance of this ecosystem within the global carbon cycle and climate system.
The major components of soil respiration are root or autotrophic respiration (root respiration and respiration from root-derived, recent components) and soil organic matter decomposition by heterotrophs (soil microbial respiration).
In order to clarify the role of root and microorganisms in the carbon cycle of the boreal forest and permafrost peatland ecosystems, the vertical distribution of respiratory activity was studied.
The study area was located in the northern taiga with discontinuous permafrost near the town Nadym, north of West Siberia (Russia).The research was conducted on two sites. The forest site was in a suffruticose-pine forest without permafrost. The permafrost peatland site was on flat and slightly inclined surfaces with cloudberry-Sphagnum cover. The active layer is a peaty horizon. Permafrost occurs below 40 cm. We tasted method “The component integration”. We measured separately cleaned roots of vascular plants and basal soil respiration. Input of each component was estimated as part of total respiration. The roots collected from each horizons were washed to remove adhered humus and were divided into fine, medium and thick fractions.
The average soil respiration rates measured using a portable infrared gas analyzer at the surface was 425mgcarbon dioxide/(m2hr) for forest soil and 100mgcarbon dioxide/(m2*hr)for peatlands. In the forest soil, about 55% of carbon dioxide was evolved from organic horizon. Low but significant carbon dioxide emission(30%)was detected even in deeper soil horizon (BHF horizon).The upper horizon of peatland soil emits 90% of carbon dioxide of the total emission. In the forest soil about 80% of the root biomass was in the upper organic horizon. Root biomass in the AE horizon comprised 5% of the total root biomass. In the peatland soil 100% of root biomass was in the upper horizon.
We also examined the contribution of root respiration to total soil respiration, calculated from root biomass and respiration rate of cut roots. It was estimated that root respiration varied from 50 to 70% of the total respiration in the uppermost organic horizon in the forest soil. In the permafrost peatland soil the root respiration in the upper horizon is about 30%. The upper 10 cm organic horizon is the major contributor to soil respiration both in forest and permafrost peatland soils.