

Distribution of soil organic carbon along the bioclimatic and permafrost transect from the south taiga to the south tundra of West Siberia

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Understanding the heterogeneity in carbon exchange in terrestrial ecosystems in different permafrost zones is a significant step towards understanding the global carbon cycle. The aim of our study was to assess variability in the soil organic carbon pool and CO₂ efflux from the soils in south taiga, north taiga, forest tundra and south tundra zones of West Siberia (Russia). The special grids (100 m*100 m, 121 points of measurements) have been used on all sites. The south tundra research site (Urengoy) is located in continuous permafrost zone (N 67°48'; E 76°69'). Soils of this research site are characterized by low active layer thickness, CO₂ efflux and content of microbial carbon (August 2016). The spatial distribution of CO₂ efflux and content of water-extractable organic carbon are strongly correlated with hypsometric levels ($r = -0,33$, and $r=-0,42$ respectively, p -level $<0,05$) in tundra ecosystems. The forest-tundra research site (Urengoy Gas Field) is located in continuous permafrost zone (N66°18', E76°54'). The average active layer thickness was 85 ± 10 cm (August 2015). CO₂ efflux from peatland soil was low and characterized by high variability. The average content of total organic carbon was high (29.58 ± 5.02 mg carbon dioxide /m²hr) and characterized by high spatial and temporal variability. The upper horizons of the peatland soils statistically differed from those of the bog in the contents of the total (31.88 ± 3.02 and 37.96 ± 2.00 mg carbon dioxide /m²hr) and characterized by high spatial variability. The north taiga research site (Nadym) is located in discontinuous permafrost zone (N65°18', E72°52'). The average active layer thickness was 163 ± 8 cm (August 2015). The CO₂ efflux from the peatlands was low (202 ± 37 mg carbon dioxide /m²hr) and characterized by high spatial and temporal variability. The south taiga research site (Tumen) is located in seasonal permafrost zone (N57°19', E64°58'). The CO₂ efflux from the forest soils was low (170 ± 37 mg carbon dioxide /m²hr) and characterized by high spatial variability (June 2018). All other investigated parameters (environmental parameters, as well as contents of the total, labile and microbial carbon) are characterized by high spatial variability. Despite the wide array of changes in both physical (soil temperature, soil moisture) and biological conditions (vegetation composition, content of labile and microbial soil carbon), our results showed that soil CO₂ flux did not vary significantly throughout transect (south taiga – north taiga - forest tundra - south tundra). But depth of permafrost table differed significantly. It explains the necessity of adequate assessment of the spatial variability on the active layer thickness as a significant factor influencing regional CO₂ emission. This research has been financially supported by the project № -1181.2018.5 (grant of the President of Russian Federation).