Geophysical Research Abstracts
Vol. 21, EGU2019-7843, 2019
EGU General Assembly 2019
© Author(s) 2019. CC Attribution 4.0 license.

Hot spots and leading factors of the spatial distribution of organic and inorganic carbon fluxes on a wetland complex: three days in the palsa life (West Siberia, Russia)

Olga Goncharova, Georgy Matyshak, Anna Bobrik, Tarkhov Matvey, Timofeeva Maria, Sefilian Anna, Petrov Dmitry, and Ryzhova Irina

Lomonosov Moscow State University , Soil Science , Moscow, Russian Federation (goncholgaj@gmail.com)

Northern ecosystems are crucial to the global carbon cycle because they are rich in organic carbon, which has built up in frozen soils, litter, and peat (Schuur et al., 2008). Although climate change is expected to lead to permafrost thawing and an increase in greenhouse gas fluxes between soils and the atmosphere (Koven et al., 2011), the regulating factors of organic matter decomposition and translocation in the seasonally thawed active layer, however, are insufficiently understood to confidently predict the feedback of thawing permafrost to global warming.

The aim of this study was to identify hot spots and leading factors of the spatial distribution of organic and inorganic carbon fluxes on a wetland complex of North West Siberia. The study included a simultaneous measurement of some labile indicators of soils and natural waters, as well as environmental factors for a single small area of palsa and surrounding wetlands (august 2016, 2017, and 2018).

The research area is located in the discontinuous permafrost zone in the northern taiga of West Siberia, Russia. Palsa, the object of this study, is 1 m high above the surrounding wetlands and is about 30 m in diameter. It is flat with a slight slope and abrupt edge to the bogs. Typical vegetation is various lichens and mosses, dwarf birch, sedge. The average thickness of peat is 30 cm. The test points were arranged in circles: central, middle, edge of the palsa and wetland (without permafrost) near the palsa.

The interannual variability of weather conditions determined the difference in soil temperature, the active layer thickness, and the CO_2 efflux. However, all the patterns of spatial distribution of these indicators were identical. The minimum active layer thickness was at the middle part of the peatland, and the maximum was in the center and on the edge. The minimum soil temperatures were observed in the middle part of palsa, in areas with shallow permafrost. In the same part, the minimum values of CO_2 efflux from the soil surface and CO_2 concentrations in the suprapermafrost layer were also noted. Directly near the edge of the palsa, high values of dissolved organic carbon (DOC) (up to 90 mg/l) and CO_2 concentration (headspace equilibration method, up to 17000 ppm) in bog water were recorded. With increasing distance from the palsa CO_2 and DOC concentration decreased.

We assume that such variations in CO_2 flux and DOC concentrations are due to its lateral transport in the soil, especially in the suprapermafrost layer. Thus, the peatland edge is a hot spot of carbon exchange between soil, natural waters and the atmosphere. And the redistribution of carbon flux depends largely on the topography of the permafrost table.

This research was supported by the Russian Foundation for Basic Research (Grant 18-04-00952).

References

Koven, C.D., Ringeval, B., Friedlingstein, P., et al., 2011. Permafrost carbon-climate feedbacks accelerate global warming. Proceedings of the National Academy of Sciences 108: 14769-14774.

Schuur, E.A.G., Bockheim, J., Canadell, J.G. et al., 2008. Vulnerability of permafrost carbon to climate change: implications for the global carbon cycle. BioScience 58(8): 701-714.