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THE REPEATED DRYING–WETTING AND FREEZING–THAWING CYCLES AFFECT ONLY THE ACTIVE POOL OF SOIL ORGANIC MATTER
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The decrease in the content of soil organic carbon, particularly in active form, is one of the major problems of the 21st century, which is closely related to the disturbance of the biogeochemical carbon cycle and to the increase in the emission of carbon dioxide into the atmosphere. The main reasons for the SOM losses are the surplus of the SOM active pool losses due to mineralization, erosion, and infiltration over the input of fresh organic matter to the soil, as well as the changes in the soil conditions and processes due to natural and anthropogenic disturbing impacts.
Experiments were carried out with mixed samples from the upper layers of soddy-podzolic soil, gray forest soil, and typical chernozems. Soil samples as controls were incubated after wetting for 150 days. The dynamics and cumulative production of C–CO_2 under stable temperature (22°) and moisture conditions were determined; the initial content of potentially mineralizable organic matter (C0) in the soil at the beginning of the incubation was then calculated to use these data as the control. Other soil samples were exposed in flasks to the following successive treatments: wetting →incubation → freezing → thawing → incubation →drying. Six repeated cycles of disturbing impacts were performed for 140 days of the experiment. After six cycles, the soil samples were incubated under stable temperature and moisture conditions for 150 days.
The wetting of dried soils and the thawing of frozen soils are accompanied by the pulsed dynamics of the C–CO_2 production with an abrupt increase in the rate of the C–CO_2 emission within several days by 2.7–12.4 and 1.6–2.7 times, respectively, compared to the stable incubation conditions. The rate of the C–CO_2 production pulses under each subsequent impact decreased compared to the preceding one similarly for all studied soils, which could be due to the depletion in potentially mineralizable soil organic matter (C0). The cumulative extra C–CO_2 production by soils of the natural lands during six cycles of disturbing impacts composed 21–40% of that by soils incubated under stable conditions; the corresponding values for the cultivated soils, including soil under the continuous bare fallow, were in the range of 45–82%. The structure of the active organic matter pool in uncultivated soils after six incubation cycles became similar to those for soils under the continuous bare fallow, as well as under farming agrocenoses. Following from the obtained results that the organic matter mobilized by disturbing impacts was predominantly mineralized in arable soils with an initially low C0 content, while a part of the mobilized organic matter was stabilized in untreated soils with the high initial C0 content.

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