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Model estimation of carbon flux from the soil: Russia case study

Leonid L. Golubyatnikov

A.M.Obukhov Institute of Atmospheric Physics, Russian Academy of Sciences, Laboratory of Mathematical Ecology, Moscow, Russian Federation (golub@ifaran.ru / +7-495-9531652)

Soil carbon is one of the major component of the terrestrial carbon cycle. The carbon flux from the soil exerts an essential effect on carbon balance in terrestrial ecosystems. We suggest a terrestrial carbon cycle model based on a scheme of the phytomass change which is continuous in time [1]. We consider phytomass B(t, τ) for "age" τ at time moment t in carbon units along the axis τ : B(t, τ) is the living phytomass in the time [0, τ^1]; B(t, τ) is the dead phytomass (mortmass) in the time [τ^1, τ^2] and B(t, τ) is organic matter in soil (humus) in the time [τ^2, ∞]. The mortmass are decaying under biological and non-biological processes. The humus is slowly decaying organic substances and its life time is very large. Parameter τ serves as a 'demographic' marker for phytomass. The suggested mathematical model permits us to evaluate intensity of carbon flux from the soil for the terrestrial ecosystems under concern. The model is applied for the territory of Russia as a case study. The role of Russian soils in the global carbon cycle is very considerable, therefore more accurate estimates of the carbon fluxes from the terrestrial ecosystems of Russia should be obtained. Using the experimental data over the second half of the 20th century, we have calculated the annual carbon flux from the soil for territory under study. According to our calculations, the carbon emission from the soil is highest for forest and steppe soils, intermediate for tundra soils, and lowest for semi-desert soils. The estimates obtained are in agreement with those of other authors [2, 3].

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