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# Effect of drying-rewetting events on the decomposition of labile and recalcitrant soil organic matter in long-term incubation experiments

Alla Larioinova (1), Anna Kvitkina (1), Sergey Bykhovets (1), Evgenia Blagodatskaya (1,2)

(1) Institute of Physico-Chemical and Biological Problems in Soil Science, Pushchino, Russia, (2) Dept. of Soil Science of Temperate Ecosystems, University of Göttingen, Germany

Short-term pulses of $CO_2$ emission coupled with soil organic matter (SOM) decomposition are usually observed after rewetting of extremely dry soil. The magnitude of these pulses strongly exceeds the $CO_2$ emission from the soil under optimal soil moisture. The contribution of such $CO_2$ pulses to an annual $CO_2$ efflux from soil to the atmosphere is still disputable. If drying-rewetting cycles intensify the decomposition of both labile and recalcitrant SOM pool, they may strongly contribute to the greenhouse effect. This study was aimed to compare the decomposition rate of recalcitrant SOM under drying-rewetting and optimal soil moisture.

A long-term (365 d) laboratory incubation experiment was conducted to estimate the SOM decomposition rates of labile and recalcitrant carbon pools in two arable soils: Phaeozem (Moscow Region, 54o50'N, 37o35'E) and Chernozem (Voronezh Region, 51o41'N, 39o15'E) in European Russia. Two series of 10 g top soil samples: 1) air dried and rewetted to 70% water holding capacity (WHC) and 2) field-moist 55% WHC and adjusted to 70% WHC were incubated in 120 ml vessels at 22oC. $CO_2$ emissions were measured periodically in the course of the incubation by gas chromatography.

The parameters of double exponential SOM decay under drying-rewetting and optimal moisture regimes were substantially different. The decomposition rate constants of labile pool increased after extreme drought, while those of recalcitrant pool were decreased by the factors of 1.2 and 2 in Phaeozem and Chernozem, respectively. This decrease explained a relatively short duration of soil respiration pulses after rewetting. Our results indicate that drying-rewetting decreases recalcitrant SOM decomposition at the annual scale. Thus, drying -rewetting events are likely to mitigate the greenhouse effect.