Geophysical Research Abstracts
Vol. 19, EGU2017-1043, 2017
EGU General Assembly 2017

Influence of natural and anthropogenic factors on the dynamics of CO_2 emissions from chernozems soil

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Twentieth century marked a significant expansion of agricultural production. Soil erosion caused by human activity, conversion of forests and grasslands to cropland, desertification, burning nutrient residues, drainage, excessive cultivation led to intense oxidation of soil carbon to the atmosphere and allocation of additional amounts of CO_2. According to the UN Intergovernmental Panel on Climate Change, agriculture is one of the main sources of greenhouse gases emissions to the atmosphere. The thesis reveals main patterns of the impact of natural and anthropogenic factors on CO_2 emissions in the chernozems typical and podzolized in a Left-bank Forest-Steppe of Ukraine, seasonal and annual dynamics. New provisions for conducting monitoring CO_2 emissions from soil were developed by combining observations in natural and controlled conditions, which allows isolating the impact of hydrological, thermal and trophic factors. During the research, the methods for operational monitoring of emission of carbon losses were improved, using a portable infrared gas analyzer, which allows receiving information directly in the field.
It was determined that the volumes of emission losses of carbon chernozems typical and podzolized Left-bank Forest-Steppe of Ukraine during the growing season are 480–910 kg/ha and can vary depending on the soil treatment ±(4,0 – 6,0) % and fertilizer systems ± (3,8 – 7,1) %. The significant impact of long application of various fertilizer systems and soil treatment on the intensity of carbon dioxide emissions was investigated. It was found that most emission occurs in organic- mineral fertilizers systems with direct seeding. The seasonal dynamics of the potential capacity of the soil to produce CO_2 were researched. Under identical conditions of humidity and temperature it has maximum in June and July and the gradual extinction of the autumn. It was determined that the intensity of the CO_2 emission from the surface of chernozem fluctuates daily from 5 to 15 % of the average level.
The influence of the crop on the allocation dynamics of CO_2 was also investigates during the research. Due to root respiration, total CO_2 flux from soil increases by an average of 12–32 % when growing grain crops.
The mathematical models of dependency between the 2 emissions intensity and hydrothermal conditions were developed. These models will allow to predict the volume of CO_2 emissions from automorphic chernozems under different scenarios of weather conditions during warm period, based on generalizing models with the corrections depending on the method of cultivation, fertilization system and agricultural culture.
As a result of the research, it was proved that there is a necessity to conduct periodic direct measurements of CO_2 emission losses from the soil surface and to summarize the results in an annual cycle, which allows estimating the probable emission losses of carbon already in the first years of the introduction of new agricultural technologies.