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Agroecosystem GHG balances monitoring and management in case of climate-change-modified conditions of RF agriculture in XXI century

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Introduction. Complex interactions between Global climate changes, agroecosystem GHG balances and agriculture efficiency are becoming more and more important before XXI century challenges in climate-change opportunities and constrains for the RF and global agriculture. While globally projected climate changes will result in most crop yields general decline (up to 20%, IPCC 2014), Russia will benefit from temperature warming due to an increasing of growing season length and generally more mild climate conditions, including predicted enhancement of precipitation (Valentini, Vasenev, 2015).

Objects and methods. Principal experimental investigations have been done in the zonal set of representative field agroecosystems with winter wheat, barley, potatoes and grasses on the Albeluvisols and Chernozems under different agrotechnologies. They included the traditional methods of soil science plus agroecological monitoring automated stations with year-round analysis of PAR, air and soil temperature and moisture, energy, water and CO_2 fluxes. Additionally LCA has been done for C-print of meat production in case of the representative for Moscow region poultry and pig farms actively developed in Russia with governmental support.

Results and discussion. Characteristic for the RF southern taiga zone in XXI first decades accelerated annual temperature growth is almost in 3 times higher than mean planetary one – up to 0.54 ^{o}C per last 10 years (Vilfand, 2017). Together with essentially increased precipitation values this resulted in 2 record years for grain crops total harvest with 130.4 million t in 2017. Our investigation has shown the possibilities of CO_2 sink in case of landscape adaptive intensive land-use technology application with positive input of crop higher yield. The current trend of agroclimate changes in the southern taiga zone of the Central region of Russia allow predict the following increasing of grain yield in 15-20 % in 5-7 years there based on the comparative analysis of our Moscow site agroecological monitoring plots in the Central Chernozemic region of Russia. However, despite these favorable circumstances further sustainable development of RF agriculture requires land current and predicted state agroecological assessment, climate-smart agricultural land-use design using new crop varieties and agrotechnologies – best adapted to local agrolandscape and agroclimate conditions. Increased temperature and precipitation are favorable not only for crops but their pests, weeds and pathogens too that already resulted in the fusariose fast expanding in 2016.

Conclusions. Global climate changes, connected with them more favorable agroclimate conditions and grain export growth gradually improve RF farming profitability and sustainability including its meat production sector. Growing RF agricultural potential will be strengthened due to arable land area increasing in case of previously abandoned farms and profitable farming development in new intensive agricultural regions with favorable agroecological conditions – especially in the boreal parts of Russia. To be able to solve the new agroecological problems and to use the new land agroecological potentials we need the adapted to concreate regions of Russia smart agroecological monitoring and decision support systems (Vasenev e.a., 2017) as combination of climate, soil, crop and land-use models to help land-users in implementation of agriculture best practices.