Geophysical Research Abstracts
Vol. 17, EGU2015-13469, 2015
EGU General Assembly 2015

Analysis of seasonal and diurnal dynamics of green house gases emission urban ecosystems of forest-steppe zone of Russia

Dmitrii Sarzhanov, Viacheslav Vasenev, Iuliia Sotnikova, Ivan Vasenev, and Riccardo Valentini
Russian Federation (sarzhanovd@bk.ru)

Global climate change, mainly determined by increased anthropic emissions of green house gases (GHG) (CO_2, CH4, N2O), is among the key contemporary environmental problems. Land use is a principal parameter, distinguishing GHG fluxed in terrestrial ecosystems. Urbanization increase is an important feature of recent land-use change. Formation of urban soils, which are significantly different form natural ones, is one of urbanization results.
Urban soils provide a key element of urban ecosystems. Urban ecosystems located in forest-steppe zone in Central-Chernozemic region of Russia are of especial interest, since zonal soil in the region are represented by chernozems and dark grey soils, having the largest carbon stocks and the highest rate of soil respiration.
Spatial and temporal variability of urban soil's respiration was carried out over vegetation seasons of 2013-2014 in different functional zone of the Kursk city: residential, recreational and industrial. GHG fluxes were measured once in 10 days before 12 am by chamber approach. CO_2 flux was measured in situ using Li-820 close-path analyzer. Diurnal dynamic of CO_2 efflux from soil was measured twice a year: in cold and warm season. Soil air samples were collected by syringe into glass vials and further analyzed on GC to estimate CH4 and N2O fluxes. Soil temperature and moisture was measured in parallel to soil respiration.
CO_2emission estimated for urban soils in 2013-2014 was 20-25% higher than in reference zonal soils. Obtained seasonal dynamics showed the highest 2 emissions in August of 2013 (39-83 g 2/m2 day) with further decrease by the end of October for major part of the plots. Significant diurnal dynamics was found for the case of the industrial zone. Maximal CO_2 emission was obtained between maximal 40 g 2/m2 day at 5 AM and 1 PM and minimal 28 g 2/m2 day at 23 PM in June. Soil CO_2 efflux was positively correlated with soil temperature (r = 0.65) and negatively correlated with soil moisture (r = - 0,40), although range of the parameters was not high (22,1-26,6 0 and 22,0-28,4 % correspondingly). Diurnal dynamic in October was significantly lower than in June: soil respiration varied between 13,3 g 2/m2 day between 10 AM and 14 PM and 11,6 g 2/m2 day at 2 AM. CO_2 flux was negatively correlate to soil moisture (r = - 0.61).
Seasonal measurement of CH4 fluxes showed that the methane stocks were 2-6 times lower in urban soils compared to natural ones. Maximal CH4 stock was obtained in June –July (- 1 mg CH4 /m2 day) for majority of the measuring points, whereas minimal values were obtained in October for the industrial plot (- 0.2 mg CH4 /m2 day). Maximal emission of N2O was also found in June (0.7-0.11 mg N2O/ m2 day), although in July N2O flux was close to zero.
Comparative analysis between two years of measurement showed decrease of CO_2 emissions for all the plots in more dry summer period of 2014. Interestingly, minimal decrease between the years was found for the least disturbed recreational zone and natural references whereas CO_2 emission from residential and recreational areas was twice lower in 2014 compared to 2013. Even more evident decrease of soil respiration was obtained for all urban plots, which was also likely caused by drier conditions (average soil moisture was 11% lower). Total emissions in winter and spring period were comparable to summer time, which was an unexpected result.