Geophysical Research Abstracts
Vol. 19, EGU2017-9319-3, 2017
EGU General Assembly 2017

CO_2 and heat fluxes in a recently clear-cut spruce forest in European Russia: experimental and modeling studies

Vadim Mamkin (1), Julia Kurbatova (1), Vitaly Avilov (1), Yulia Mukhartova (2), Alexander Krupenko (2), Dmitry Ivanov (1), Natalia Levashova (2), and Alexander Olchev (3)

(1) A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Science, Moscow, Russian Federation (vadimmamkin@gmail.com), (2) Faculty of Physics, Lomonosov Moscow State University, Moscow, Russian Federation, (3) Faculty of Geography, Lomonosov Moscow State University, Moscow, Russian Federation

Ecosystem carbon dioxide, energy, and water fluxes were measured using eddy covariance and portable chambers in a fresh clear-cut surrounded by a mixed spruce-birch-aspen forest in the boreal zone of European Russia. Measurements were initiated in spring 2016 following timber harvest and continued for seven months until the end of October. The influence of surrounding forest on air flow and turbulent fluxes within the clear-cut were examined using a process-based two-dimensional (2D) hydrodynamic turbulent exchange model.
Clear-cut was a permanent source of CO_2 to the atmosphere. During the period the mean daily latent (LE) and sensible (H) heat fluxes were very similar and the Bowen ratio (β=H/LE) averaged about 1.0. During the late spring and summer months the net ecosystem exchange of CO_2 (NEE) remained slightly positive following onset of vegetation growth, while β was changing in the range from 0.6 to 4.0. There was strong diurnal variability in NEE, LE and H over the measurement period that was governed by solar radiation and temperature as well as the leaf area index (LAI) of regrown vegetation. Modeled vertical CO_2 and H_2O fluxes along a transect that crossed the clear-cut and coincided with the dominate wind direction showed that the clear-cut strongly influenced turbulent fluxes within the atmospheric surface layer. Furthermore, modeled atmospheric dynamics suggested that the clear-cut had a large influence on turbulent fluxes in the downwind forest, but little impact on the upwind side. An aggregated approach including field measurements and process-based models can be used to estimate energy, water and carbon dioxide fluxes in non-uniform forest landscapes.
This study was supported by a grant from the Russian Science Foundation (14-14-00956).