EGU2020-11360
https://doi.org/10.5194/egusphere-egu2020-11360
EGU General Assembly 2020

One tower - two heights: A study of mixed hemiboreal forest carbon balance estimated from two eddy covariance systems

Alisa Krasnova[1,2], Dmitrii Krasnov[1], and Steffen Noe[1]
[1]Estonian University of Life Sciences, Tartu, Estonia (alisa.krasnova@emu.ee)
[2]University of Tartu, Estonia

Eddy-covariance (EC) method is widely used to calculate fluxes of different gases from different ecosystems. One of the assumptions is that the footprint of eddy tower is homogeneous in terms of plant species composition, height, age, soil properties, etc. In reality that is usually not the case: European forests are mostly managed and thus have compartments of tree species. This is even more so in the hemiboreal zone that is characterized by higher heterogeneity and tree species diversity. This results in the possibility for the individual features to have stronger influence on the eddy measurements.

Two identical EC systems (LI-7200 gas analyser + Metek uStar Class A anemometer) were placed at 30m (EC30) and 70m (EC70) height on an atmospheric tower of SMEAR Estonia (Station for Measurements of Ecosystem Atmosphere Relations) above a 20m high forest to measure CO_2 fluxes. The footprints are represented by compartments of Scots pine (*Pinus sylvestris*), Norway spruce (*Picea abies*) and Birch trees (*Betula pendula* and *Betula pubescens*) and clear-cut areas.

According to the EC30 flux data, the mixed hemiboreal forest ecosystem was a source of CO_2 (505 gC m^{-2} in 2015; 333 gC m^{-2} in 2016; 276 gC m^{-2} in 2017; 603 gC m^{-2} in 2018), while according to EC70 data it was a minor sink in some of the years (-47 gC m^{-2} in 2015; 10 gC m^{-2} in 2016; -142 gC m^{-2} in 2017; 151 gC m^{-2} in 2018).

Both the ecosystem respiration (ER) and the gross primary production (GPP) were bigger when estimated from EC30 than in EC70 for all the years:
GPP EC30: 1738 gC m^{-2} in 2015; 1669 gC m^{-2} in 2016; 1892 gC m^{-2} in 2017; 1654 gC m^{-2} in 2018;
GPP EC70: 1242 gC m^{-2} in 2015; 1192 gC m^{-2} in 2016; 1215 gC m^{-2} in 2017; 988 gC m^{-2} in 2018;
ER EC30: 2057 gC m^{-2} in 2015; 1999 gC m^{-2} in 2016; 1992 gC m^{-2} in 2017; 2070 gC m^{-2} in 2018;
ER EC70: 1088 gC m^{-2} in 2015; 1120 gC m^{-2} in 2016; 1019 gC m^{-2} in 2017; 1021 gC m^{-2} in 2018;

All the 4 study years (2015-2018) showed similar difference patterns between the two heights: higher EC30 nighttime NEE values and similar daytime NEE values throughout the season. The peak difference between the two systems was in the end of August - middle of September for all the years.