Geophysical Research Abstracts
Vol. 21, EGU2019-6769, 2019
EGU General Assembly 2019

Assessing decoupling of above and below canopy air masses at a Norway spruce stand in mountainous terrain

Georg Jocher, Milan Fischer, Marian Pavelka, Ladislav Šigut, and Pavel Sedlák
Global Change Research Institute, Department of Matter and Energy Fluxes, Brno, Czech Republic (jocher.g@czechglobe.cz)

Above canopy eddy covariance (EC) derived forest carbon fluxes might be biased due to decoupling and insufficient mixing between above and below canopy air masses and consequently missing soil respiration components in the above canopy derived data. The most common way to address insufficient mixing across the canopy is to filter the above canopy derived fluxes at a certain u_*-threshold. However, at some sites like e.g. at the current study site Bílý Kříž (49˚30′N, 18˚32′E; 800–900 m a.s.l.) located in the Moravian-Silesian Beskydy Mountains, the Czech Republic, it is not possible to identify a u_*-threshold due to the complexity of the surrounding terrain. The Bílý Kříž experimental forest is a $\sim$ 40 years old Norway spruce (*Picea abies* /L./, Karst) monoculture with a leaf area index of $\sim$ 9 m^2 m^{-2} in 2016. Eddy covariance measurements of energy and trace gas fluxes have a more than decade long tradition at this site. The EC tower is situated close to a ridge on a steep roughly south oriented planar slope with a regular inclination of 13˚. North of the site, there is a W-E-oriented mountain crest with a shallow saddle. The ridge and slope force the flow above the canopy in two main regimes, namely upslope and downslope.

Recently, an additional below-canopy EC system was installed at the study site to support the interpretation of the above canopy derived EC data. Amongst others, such a below-canopy system provides readings of the standard deviation of vertical wind (σ_w). The correlation of σ_w between above and below canopy EC measurements remarkably differs for the cases of decoupling and the cases of full coupling between below and above canopy air masses. Thus, once an objective site-specific threshold in this σ_w correlation is experimentally determined, it can be used as an EC flux filtering approach to improve the representativeness of the above canopy derived fluxes.

With this study we aim to assess decoupling with a set of two-level filtering approaches based on 1 year (August 2017 – July 2018) of vertical wind measurements above and below the canopy: i) σ_w (described above), ii) telegraphic approximation (w) which identifies periods where the vertical wind above and below the canopy is directed in the same direction and considers these periods as coupled, iii) cross correlation maximum (w) which is used as measure for maximum of below-above canopy coupling. The value ranges and characteristics of these 3 measures throughout the seasons will be given and ways to identify filtering thresholds will be discussed. We further evaluate the effect of these filtering approaches on the above canopy derived carbon fluxes. Finally, recommendations shall be derived how to treat carbon exchange EC data at forested sites in complex terrain in the most proper way to minimize potential biasing effects by decoupling on the above canopy derived carbon fluxes.