Geophysical Research Abstracts
Vol. 18, EGU2016-7844, 2016
EGU General Assembly 2016

Impact of surrounding environment evolution on long-term gas flux measurements in a temperate mixed forest

Quentin Hurdebise (1), Toma Rixen (1), Anne De Ligne (1), Caroline Vincke (2), Bernard Heinesch (1), and Marc Aubinet (1)

(1) Gembloux Agro-Bio Tech, University of Liege, Gembloux, Belgium (quentin.hurdebise@ulg.ac.be), (2) Earth and Life institute, Université catholique de Louvain, Louvain-la-neuve, Belgium

With the development of eddy covariance networks like Fluxnet, ICOS or NEON, long-term data series of carbon dioxide, water vapor and other gas exchanges between terrestrial ecosystems and atmosphere will become more and more numerous. However, long-term analyses of such exchanges require a good understanding of measurement conditions during the investigated period. Independently of climate drivers, measurements may indeed be influenced by measurement conditions themselves subjected to long-term variability due to vegetation growth or set-up changes.

The present research refers to the Vielsalm Terrestrial Observatory (VTO) where fluxes of momentum, carbon dioxide, latent and sensible heat have been continuously measured by eddy covariance during twenty years. VTO is an ICOS site installed in a mixed forest (beech, silver fir, Douglas fir, Norway spruce) in the Belgian Ardennes.

A multidisciplinary approach was developed in order to investigate the spatial and temporal evolution of several site characteristics:

-displacement height (d) and relative measurement height (z-d) were determined using a spectral approach that compared observed and theoretical cospectra;
-turbulence statistics were analyzed in the context of Monin-Obukhov similarity theory;
-tree height during the measurement period was obtained by combining tree height inventories, a LIDAR survey and tree growth models;
-measurement footprint was determined by using a footprint model.

A good agreement was found between the three first approaches. Results show notably that z-d was subjected to both temporal and spatial evolution. Temporal evolution resulted from continuous tree growth as well as from a tower raise, achieved in 2009. Spatial evolution, due to canopy heterogeneity, was also observed.

The impacts of these changes on measurements are investigated. In particular, it was shown that they affect measurement footprint, flux spectral corrections and flux quality. All these effects must be taken into consideration in order to disentangle long-term flux evolutions due to climate or phenology from changes resulting from measurement set-up changes.