Can defensible estimates of canopy proximity be obtained based on single point eddy covariance measurements?

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

(1) Terra, University of Liege, Gembloux, Belgium (quentin.hurdebise@ulg.ac.be), (2) Earth and Life Institute, Université catholique de Louvain, Louvain-la-Neuve, Belgium

Understanding if and how the spatial and temporal variability of the surrounding environment affects turbulence is essential for long-term eddy covariance measurements above growing and heterogeneous ecosystems. It requires characterizing the surrounding environment. One way to achieve this is to analyse the canopy aerodynamic distance, which is the difference between measurement height (z) and displacement height (d).

In this study, twenty years of eddy covariance measurements from the Vielsalm Terrestrial Observatory, a site located in a mixed temperate forest, were used. Canopy aerodynamic distance (z-d) estimates were obtained using two micrometeorological methods: the first one, which is original so far as we know, was based on analysing sensible heat cospectra; the second one was derived from the wind speed profile equation. Canopy height estimates based on inventories were used to validate both methods.

The micrometeorological methods allowed the z-d variations due to changes in canopy or measurement height to be detected. In addition, the results obtained using the two methods were well correlated, spatially and temporally, with the z-d derived from canopy height measurements. The micrometeorological approaches used could therefore be a promising tool for investigating z-d variability at a high directional and temporal resolution. Questions remain, however, particularly with regard to the variability observed that cannot be explained by canopy or measurement height variation. Forest management practices and the non-fulfilment of similarity relationships were suspected to be the main explanatory factors.