



## **Coupling of above and below-canopy flows for three towers in a spruce ecosystem site located on a hill**

**M. Zeri** (1) and C. Rebmann (1) and W. Kutsch (1) and O. Kolle (1) and T. Foken (2) and C. Feigenwinter (3)

(1) Max Planck Institute for Biogeochemistry, Jena, Germany, (2) Department of Micrometeorology, University of Bayreuth, Bayreuth, Germany, (3) Institute of Meteorology, Climatology and Remote Sensing, University of Basel, Basel, Switzerland  
(mzeri@bgc-jena.mpg.de / Fax: +49 3641 577863 / Phone: +49 3641 576163)

The coupling of the wind direction below and above the canopy was compared for three towers installed at the Wetzstein site, in Thuringia, Germany. The site is a spruce ecosystem located on a hill and was chosen to be part of the CARBO-EUROPE-IP advection experiment, ADVEX, carried out between April and June, 2006. Additional towers (equipped with 3D sonic anemometers in several levels) were set-up around the main tower, as well as an additional one at approximately 900 m distance, at a slope, at the main wind direction. Data measured at the main and slope towers as well as at one of the four ADVEX towers were used in this work.

The analysis consisted on the comparison between the wind directions measured below and above the canopy at all 3 towers. The lowest level was located around  $1/10$  of the canopy height  $h$  for all the three towers; the highest level was located at approximately  $1.4h$  for the towers at the hill top and at  $1.3h$  for the slope tower.

The coupling between the wind direction above and below the canopy was compared for several classes of friction velocity  $u_*$  and atmospheric stratifications. The results show that for the towers located at the top of the hill, on a plateau with a small slope, the coupling between the levels is best for a range of moderate values of  $u_*$  ( $0.3 - 0.5 \text{ ms}^{-1}$ ); the slope tower is still highly affected by decoupling for the same range of  $u_*$ , due to the drainage of cold air during stable conditions. Decoupling was also observed

in all towers for high values of  $u^*$ , with different patterns for the towers at the plateau. These results suggest that extremely turbulent situations at this site should be removed and gap filled if annual sums of  $\text{CO}_2$  are calculated, given that the coupling between levels is important for the validity of both  $\text{CO}_2$  eddy fluxes and storage correction.