Geophysical Research Abstracts,
Vol. 11, EGU2009-3393, 2009
EGU General Assembly 2009

Turbulence parameter inside and above a tall spruce site

T. Biermann, K. Staudt, A. Serafimovich, and T. Foken

University of Bayreuth, BayCEER, Department of Micrometeorology, Bayreuth, Germany (tobias.biermann@uni-bayreuth.de)

In the EGER (ExchanGE processes in mountainous Regions) project, different physical, chemical and biological processes in the soil-vegetation-boundary-layer system were investigated. Field experiments were performed at the BayCEER research site Waldstein/Weidenbrunnen, a spruce site located in the Fichtelgebirge Mountains in North-Eastern Bavaria, which are challenging for their heterogeneity and orographically structured terrain. Turbulence structure, advection, flux gradients of meteorological and chemical quantities were observed within the first intensive observation period (IOP 1) in September and October 2007. Observations of turbulence structure were obtained by a vertical profile of sonic anemometers covering all parts of the forest up to the lower part of the roughness sub layer. Field observations are complemented by simulations of ACASA model (Advanced Canopy-Atmosphere-Soil Algorithm).

Integral turbulence characteristics, the normalized standard deviation of a turbulent quantity, can be used to describe the structure of turbulence. A comparison between measured and predicted values shows whether turbulence is fully developed or not and is therefore used in quality assessment. For this quality control and as an input for models, when measurements are not available, parameterizations for profiles are needed. Since there is no uniform theory for those parameterizations inside a forest available, different approaches were tested with data collected during the EGER IOP1. In order to parameterize the integral turbulence characteristics of the wind components inside the roughness sub layer a dimensionless height $\zeta = h_c\ L^{-1}$ should be used instead of $\zeta = z\ L^{-1}$, which is used above short vegetation. Profiles of integral turbulence characteristics from different ecosystems show that the decrease inside the roughness sub layer is similar but that parameterizations of profiles can not be generalized due to different stand structures. Selecting the profiles of the integral turbulence characteristics by coupling situations between the atmosphere above and inside the stand did not reveal a significant different behavior than a selection according to stratification above the canopy. A comparison between the measured values and model results from the ACASA model showed a good agreement for the normalized wind speed but the integral turbulence characteristics of the wind components were usually overestimated above the canopy and underestimated inside the trunk space.