Geophysical Research Abstracts
Vol. 12, EGU2010-4264, 2010
EGU General Assembly 2010

Simulated fluxes of CO2 and H2O over heterogeneous terrain – coupling a photosynthesis model to a mesoscale atmospheric model

Mark Reyers (1), Andreas Krüger (1), Christiane Werner (2), Joaquim G. Pinto (1), Stefan Zacharias (1), and Michael Kerschgens (1)

(1) Institute for Geophysics and Meteorology, University of Cologne, Germany (mreyers@meteo.uni-koeln.de), (2) Experimental and Systems Ecology, University of Bielefeld, Germany

The mesoscale meteorological model FOOT3DK is coupled with a photosynthesis model to investigate the influence of surface heterogeneity on surface fluxes of CO2 and H2O under field conditions. The photosynthesis model consists of a C3 single leaf approach and an extended big-leaf (sun/shade) model which divides the canopy into a sunlit and a shaded fraction. Simulated CO2 fluxes of the stand-alone version of the photosynthesis model correspond well to measurements at eddy-covariance stations at a test site in a rural area of West of Germany.
The coupled FOOT3DK-photosynthesis model was validated for diurnal courses at singular grid points, where it delivers realistic fluxes with respect to the general day course and the order of magnitudes. Furthermore, the impact of surface heterogeneity on simulated surface fluxes is well represented. As expected, flux averages are strongly influenced by the underlying land cover. Sensitivity studies reveal a second order influence of additional parameters, e.g. soil moisture and atmospheric CO2 concentration. Photosynthetic CO2 uptake is associated with transpirational water loss via the stomata. The resulting opposing surface fluxes of CO2 and H2O are reproduced with the model approach and have an impact on the simulated concentrations in the lower planetary boundary layer. An anti-correlation of simulated low-level CO2 and H2O concentrations similar to the anti-correlation of the surface fluxes is observable. These results demonstrate that a mechanistic photosynthesis model can be effectively coupled with a mesoscale atmospheric model and enables the reliable reproduction of measured CO2 and H2O fluxes of different vegetation types.