Geophysical Research Abstracts
Vol. 12, EGU2010-4379-2, 2010
EGU General Assembly 2010

Spatial variability of heterotrophic and autotrophic soil respiration in a winter wheat stand

N. Prolingheuer, B. Scharnagl, A. Graf, H. Vereecken, and M. Herbst
Agrosphere Institute (ICG-4), Forschungszentrum Jülich, Germany (n.prolingheuer@fz-juelich.de)

Soil respiration - the exchange of carbon dioxide from the soil to the adjacent atmospherical layer - is known to be highly variable in both, space and time. The sources of these carbon losses are of heterotrophic and autotrophic nature caused by microbial decomposition of organic matter and respiration from plant roots, respectively. Focus of this study was to quantify the contribution of each component to the total spatial variability of soil respiration.
From April to August 2009 closed chamber systems were used to measure soil respiration weekly at 61 locations in a 50×50 m plot in a winter wheat stand in Jülich, Germany. Each sampling location consisted of a short soil collar (10 cm length) to measure total soil respiration R and a long soil collar (50 cm length) to exclude roots and to measure only heterotrophic respiration R_h. Additionally, soil temperature T and water content θ in 6 cm depth were measured simultaneously.
Heterotrophic respiration was almost constant during the study ($\overline{R_h} = 2.12$ g C m^{-2} d^{-1}) whereas autotrophic respiration was highest in April and decreased down to zero in the mid of July ($\overline{R_a} = 1.54$ g C m^{-2} d^{-1}). During the study the autotrophic part contributes up to a maximum of 60 % to the total soil CO_2 efflux. Measurements showed that spatial variations of total soil respiration originate mainly from spatial variations of the heterotrophic part. When the heterotrophic and the autotrophic efflux was nearly similar during the study spatial variations of the autotrophic part were two to three times higher than spatial variations of the heterotrophic part. However, the autotrophic contribution to the total variations of soil respiration was only 20 %. The dominance of the heterotrophic component was also found concerning the spatial dependence of total soil respiration. Variogram analysis revealed only moderate spatial dependence for total soil respiration as well as for its heterotrophic and autotrophic components. However, the average correlation length of the heterotrophic part ($a = 29$ m) was similar to the range of total soil respiration whereas the corelation length of the autotrophic part was slightly shorter ($a = 22$ m).