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Carbon Dioxide Fluxes from a Winter Wheat Stand Related to its Phenology

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For an improved prediction of the effects of climate change on structure and functions of agricultural regions, the understanding of local exchange processes is evident and has been investigated in the integrated DFG-project on "Regional Climate Change" (PAK 346). The aim of this part of the project was to quantify the carbon dioxide fluxes over the vegetation period of the winter wheat stand and relate the results to the observed phonological states. Eddy-Covariance measurements were conducted on a winter wheat field in the Kraichgau, an intensively used agricultural area north-west of Stuttgart, Germany. The rawdata measured with a frequency of 10 Hz were aggregated to 30 min-fluxes. Beside the micrometeorological data-collection, the phenological data as well as the canopy heights of the wheat were recorded.
A footprint analysis was performed, showing that on average more than 95 % of the carbon dioxide fluxes detected at the turbulence tower originated from the surrounding winter wheat field. The highest CO2 -uptake rates were reached in the mid of June, when the plants were in the phenological state of flowering. After flowering, the CO2 -fluxes increased rapidly and the CO2 -uptake decreased, respectively, until the fluxes became positive at the end, due to a net respiration of CO2. The winter wheat field showed a pronounced ripening and maturing phase. We found a distinct negative correlation between the trends of CO2 -flux and evaporation. Although a net respiration was detected at the end of the measuring period, the typical diurnal cycle of plants, taking up CO2 during day and releasing CO2 during night, was observed. These previous results will be completed with analysis of net ecosystem exchange, characteristic CO2 -fluxes for the different phenological phases and later on be compared with the seasonal behaviour of the next vegetation periods.