

Climatic and management drivers of CO₂ exchanges by a production crop: analysis over three successive 4-year cycles.

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Carbon dioxide (CO_2) exchanges between crops and the atmosphere are influenced by both climatic and crop management drivers. The investigated crop, situated at the Lonzée Terrestrial Observatory (candidate ICOS site) in the Hesbaye region in Belgium and managed for more than 70 years using conventional farming practices, was monitored over three complete sugar beet/winter wheat/potato/winter wheat rotation cycles from 2004 to 2016. Eddy covariance, automatic and manual soil chambers, leaf diffusion and biomass measurements were performed continuously in order to obtain the daily and seasonal Net Ecosystem Exchange (NEE), Gross Primary Productivity (GPP), total Ecosystem Respiration (TER), Net Primary Productivity (NPP), autotrophic respiration, heterotrophic respiration and Net Biome Production (NBP). Meteorological data and crop management practices were also recorded.

Climatic and seasonal evolutions of the carbon balance components were studied and crop carbon budgets were computed both at the yearly and crop rotation cycle scales.

On average over the 12 years, NEE was negative but NBP was positive, i.e. as far as carbon exportation by harvest are included in the budget, the site behaved as a carbon source.

Impacts of both meteorological drivers and crop management operations on CO_2 exchanges were analyzed and compared between crop types, years, and rotation cycles. The uncertainties associated to the carbon fluxes were also evaluated and discussed.