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Energy partitioning and GPP values in a rotating crop in the Spanish Plateau

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In order to assess crop ability to act as a CO_2 sink and to describe GPP dynamic evolution, in 2008 we installed an eddy correlation station located in an agricultural plot of the Spanish plateau. Continuous measurements of 30-min NEE fluxes and other common variables have been measured over four years. Agricultural practices at the selected plot consisted of annual rotation of non-irrigated rapeseed, wheat, peas, rye. The maximum canopy height of rapeseed, wheat and rye was 1.3, 0.6 and 1.6 m respectively, the values being reached at the end of May. Although no measurements were performed in the pea crop, according to the farmer's information the maximum height was approximately 0.45-0.5 m. The quality of long–term eddy covariance data was evaluated by calculating the energy balance closure. This paper presents and compares the seasonal variation of major components involved in the energy balance as well as GPP for each type of crop.

An energy balance closure of 92% was found when using the global dataset. On a four-year basis, the sensible heat flux, H, played the main role in the energy balance with a ratio of 52%. Latent heat flux, LE, accounted for 40% of the energy, with soil heat flux contributing around 8% to the energy balance. These values changed during the period of maximum interest. For this period LE played the main role, using over half of the available energy, 51%, related to evapotranspiration processes. Over the four years of study annual accumulated GPP exhibited a great variability, 1680, 710, 730 and 1410 g C m-2 for rapeseed, wheat, peas and rye, respectively.

The influence of crop architecture, phenology and climatic conditions dominated crop-to-crop seasonal evolution. The highest LE contributions to the energy balance were found for rapeseed and rye. Higher GPP were also obtained for denser and higher canopy height crops, rapeseed and rye, yielding annuals almost comparable to C4 plants. Both crops exhibited a marked seasonal variation of evaporative fraction, EF, driven by evapotranspiration and longer GPP seasonal cycles.

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