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Long-term analysis of the Energy Balance Closure and flux partitioning over agricultural systems in Southwestern France

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In the micrometeorology community, it is already well known that the energy balance measured with the Eddy Covariance (EC) system is usually not closed over many surfaces. However, the nature of this imbalance remains unknown and it raises questions about the use of EC data for model development, calibration, and validation. The objective of this study is to get a better understanding of the energy partitioning over fast changing surfaces of lands and crops, to investigate how meteorological factors, land usage, soil hydric conditions, and different tillage practices affect the flux partitioning and the energy balance closure. To this end, this study relies on a unique database of 14 years of turbulent fluxes; sensible (H) and latent heat (LE) measured by an EC system along with measurements of net radiation (Rn) and ground heat flux (G) at two crop sites (Fr-Lam, FR-Aur) in Southwestern France belonging to the ICOS network. Meterological variables, soil and vegetation parameters were continuously monitored with the agricultural practices gathered through regular surveys. The sampled crops are wheat and maize.

The main findings of the study can be summarized as follows:
• LE dominated the energy partitioning for fully developed maize; By contrast, LE dominated the energy balance around emergence and during the first development stages of wheat. Likewise, it was observed that G took prominence over H in low wheat while H had a stronger influence for grown wheat.
• High seasonal variability of the energy balance closure was found in all the different surface types with the exception of low and mature maize plants which exhibited similar level of consistencies across all the years. Bad closure is found for bare soils with large clods while the best closure is for mature crops, mainly maize and wheat.
• An analysis of the inter-annual flux partitioning was carried out for each surface type. This partitioning allowed us to detect doubtful measurements and occasional events like management changes and climatic anomalies.