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AgroC - Development and evaluation of a model for carbon fluxes in agroecosystems

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Agroecosystems are highly sensitive to climate change. To predict and describe the processes, interactions and feedbacks in the plant-soil-system a model accounting for both compartments at an appropriate level of complexity is required.

To describe the processes of crop development, crop growth, water flux, heat transport, and carbon cycling three process models were coupled: the one-dimensional soil water, heat and CO_2 transport model SOILCO_2, the carbon turnover model RothC, and the plant growth model SUCROS. Thereby, the main focus was on the full description of the CO_2 flux into the atmosphere via plant and soil processes and finally on simulating the net ecosystem exchange. Additionally, the model was modified to work at the temporal resolution between 1 and 24 hours.

For model evaluation a winter wheat and a grassland data set obtained within the TERENO Rur catchment (North Rhine-Westphalia, Germany) was used. For model initialisation soil carbon fractions were available. Plant specific parameters and soil thermal properties were taken from literature. Measured soil water contents, soil temperatures, crop measurements, autotrophic, and heterotrophic chamber-based respiration measurements were used for validation and calibration.

The coupled agroecosystem model AgroC described the crop development and heat transport reasonably well. Minor adjustments had to be made for carbon cycling, and to adapt the model to site specific conditions. Therefore, the soil hydraulic properties for soil water transport had to be determined by inverse modelling.