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Optimization of a coupled hydrology/crop growth model through the assimilation of observed soil moisture and LAI values using an Ensemble Kalman Filter

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It is well known that the presence and development stage of vegetation largely influences the soil moisture content. In its turn, soil moisture availability is of major importance factor for the development of vegetation. The objective of this paper is to assess to what extent the results of a fully coupled hydrology/crop growth model can be optimized through the assimilation of observed Leaf Area Index (LAI) and soil moisture values. For this purpose, the crop growth module of the WOFOST model has been coupled to a fully process-based water and energy balance model (TOPLATS). LAI and soil moisture observations from 18 fields in the Loamy region in the central part of Belgium have been used to thoroughly validate the coupled model. An Observing System Simulation Experiment (OSSE) has been performed, in order to assess whether soil moisture and LAI observations under realistic error conditions are useful for data assimilation purposes. The results show that the modeled LAI values improve through the assimilation of soil moisture values before the initiation of crop growth. Further, even under realistic conditions (bi-weekly observations with a noise level of 10 volumetric percent for soil moisture and 1 for LAI), an improvement in the model results can be expected.