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Topic : Integration of remote sensing data within the models

Coupling of satellite observations and crop production models. Application to the estimations of CO₂ fluxes over agricultural areas

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Satellite systems allow a continuous monitoring of agricultural areas, and provide information which can be correlated with crops activity. Such radiative observations, however, do not give access to all biological or ecophysiological processes which determine productivity. Deterministic crop production models simulate growth and development depending on biotic (plant characteristic) and abiotic factors (agrometeorological conditions). Depending on the current knowledge and the complexity of the model, process-based or empirical relationships are used for the simulation of the various mechanisms (photosynthesis, respiration, transpiration, allocation, phenological development...) and their interactions. Simulation of CO₂ fluxes during the growing season is therefore a part of the modelling process, which allows for net primary production and yield estimation. The correct description of the temporal features of the CO₂ exchanges depends mainly on the accuracy of the simulation of the temporal behaviour of the canopy leaf area index.

At short wavelengths, satellite data have proved to be useful tools in monitoring the temporal behaviour of crop canopies. Therefore the coupling of satellite observations with crop models gives some constraints on the modelling of the leaf area index, and consequently on the description of all soil-vegetation-atmosphere exchanges. High resolution as well as coarse resolution satellite data can be used, providing radiometric corrections which are as complete as is possible.

We will shortly mention these virtually complete radiometric corrections, and we will present the various strategies for the coupling of satellite data with crop models. The specific problem of heterogeneous pixels when observing agricultural areas with coarse resolution satellite will be discussed. Examples of estimation of spatial and temporal features of CO₂ over the Beauce region (France) will be shown.