SITE SPECIFIC CALIBRATION OF A CROP MODEL BY ASSIMILATION OF OBSERVATIONS DERIVED FROM REMOTE SENSING

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Crop models are key tools for helping in decision making in the frame of precision agriculture. However they need a site-specific calibration in order to give coherent spatial representation of crop and soil state variables that can be used to make diagnosis and allow recommendations. This paper shows how to perform such a calibration on the STICS model, using the assimilation of external data on crop status obtained at several times during the season from remote sensing images. LAI and chlorophyll content derived from hyper-spectral reflectance obtained by a CASI sensor, and LAI derived from SPOT data were used to constraint the model simulation by re-estimating some soil and plant input variables. A Bayesian method was used that allowed taking account of prior information on the distribution of these variables. According to the great number of simulations which are involved, an equivalent of the STICS crop model has been designed with a neural network.

This approach is developed in the frame of a precision agriculture project dedicated to site specific recommendation of nitrogen application. It is applied to 2 field\textsuperscript{\ast}year, using 5 and 8 remote sensing dates according to the field\textsuperscript{\ast}year, working on the estimation of 12 soil and plant input variables, with a spatial resolution of 20 m. The posterior distribution estimates of soil input variables were compared with a precise pedologic characterization: the method could hardly reproduce the actual spatial distribution and values of these variables, due to the compensations occurring among the different input variables. But the assimilation process improved the estimation of a number of output variables (yield, protein content and soil mineral nitrogen) which are important variables in decision making for nitrogen fertilization recommendation. This aspect could be evaluated...
by comparing the estimates to maps obtained from automatic measurement from yield monitoring, and krigged values derived from punctual measurements: the representation of within field variability was greatly improved even if some bias was still remaining.