INTEREST OF THE INTERACTING PARTICLE FILTER FOR UPDATING DYNAMIC CROP MODEL PREDICTION

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Dynamic crop models are often used by agronomists for optimizing farmers′ practices in function of soil, climate, and crop characteristics, but the errors of prediction of such models are often large. The objective of this study is to evaluate the interest of the interacting particle filter for updating crop model predictions from real-time measurements. The interacting particle filter is a Bayesian method that consists in estimating the posterior distribution of a vector of state variables conditionally to one or several real-time measurements. This distribution is estimated using a sample of state vector values randomly drawn from a Gaussian process. Here, the interacting particle filter is implemented with a dynamic model developed for wheat crop. Different values of random process variance, number of simulations, and types of real-time measurements are considered. The results show that the errors of prediction of the state variables are strongly decreased (up to 45%) when the filter is applied to the model with one or several measurements. The performance of the method highly depends on the variances of the Gaussian process. The best results are obtained with the highest variance values. We also show that only 10,000 random state vector values are required to obtain an accurate estimation of the posterior distribution.