



## **Using Monte Carlo simulation to isolate specific parameter ranges: exemplified by the crop model STICS**

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Modelling requires first of all to parameterize a model; this mostly is a crucial part. Diverse parameterizations of the crop model STICS (Simulateur multidisciplinaire des cultures standard, INRA, France) collected in the region of Bitburger Gutland (Rhineland-Palatinate, Germany) did not lead to satisfactory simulation results with regard to the real amount of yield quantified in the study site. This was caused mainly by an enduring period of water stress associated with moderate precipitation and lightly elevated temperatures. Though artificial irrigation as well as the increase of the daily amount of precipitation led to a quantitative improvement of simulated yield, the modelled results could not reach the real level of yield measured in the field.

An additional study of the model's soil water balance showed that the method of the computation of actual evaporation mainly bases on two parameters:  $q_0$  (= evaporation value at the end of the maximum evaporation stage) and  $a_{clim}$  (= climatic component that essentially depends on average wind speed). As  $q_0$  is a parameter difficult to determine it has been necessary to base the parameterization on values suggested in very few references. Unfortunately the recommended values vary extremely. Furthermore the parameter  $a_{clim}$  is not measurable but has to be derived from wind speed (as annual average).

These uncertainties, related to the model's input parameters, have been the motivation to implement a Monte Carlo simulation tool for STICS. The Monte Carlo simulation aims to isolate the optimal range of values for the parameters  $q_0$  and  $a_{clim}$ , to map the

efficiency of these two parameters and finally to improve the parameterization scheme. The target variables amount of yield, biomass above ground and root growth have been defined. The number of simulation runs has been fixed to 10.000 simulations, which allows 100 samples for each parameter.

After the presentation of the Monte Carlo simulation a summary of the results is given and an evaluation of the Monte Carlo simulation itself is carried out.