



Parameterization and long term simulation using the SVAT-model STICS

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According to their particular conception, SVAT-models are used to simulate matter cycling and water fluxes in a complex system of soil, plant and atmosphere continuum.

STICS (Simulateur Multidisciplinaire pour les Cultures Standards) is a SVAT-model developed by INRA (Institut National de la Recherche Agronomique), France. STICS simulates the behaviour of the soil-crop system over one or several crops as well as soil water and nitrogen balances, driven by daily climatic data. Thus, it calculates both, agricultural and environmental variables. One of its key elements is the adaptability to a broad number of crops and even crop varieties. This makes it possible to apply the model to a large number of given situations. In reality, the high applicability also implies a limitation of the model: the specific and detailed data for all kinds of crop varieties are often rather restricted. In this contribution the main focus of interest lies on two subjects:

(A) Complexity by parameterizing STICS

Specific problems are discussed more closely.

1. Plant module: difficulties can occur by simulating perennial plants because of the required specification of initial values for parameters such as initial LAI, initial biomass, initial biomass of grains, initial quantity of nitrogen in the plant or depth of initial root zone. These parameters do not only depend on plant specification, but also on factors like climatic and soil conditions as well as

management, which makes an estimation quite unstable.

2. Soil module: to use the parameter „stone fraction“ correctly, two correlating parameters have to be indicated: the volume quantity of stones in each horizon (vol. %), but not less important the type of stone, represented through its apparent specific volume mass (g/cm³) and humidity at the field capacity (weight %). These parameters have to be adjusted carefully, as they have an important impact on the model results.

(B) Long-term simulations with the model STICS

As a result of the modelling of the nitrogen load in the Upper Rhine Valley (project MONIT) there is a broad dataset, containing data about soil, plant, management and climate. The dataset was used as input for further thorough investigation and processing with STICS.

Based on the mentioned dataset long-time scale simulations have been carried out, for German as well as for French locations, all in the Upper Rhine Valley. For a period of 20 years (1982-2002) different crop rotations, e.g. wheat-maize, were stringed together and simulated with STICS. Periods of uncovered land were also considered in the simulation.

For these long-time scale simulations various scenarios were framed. They base on altering soil conditions, crop rotations, management procedures and climatic change options. The first three years of the output are considered as a start-up phase and are therefore ignored in the interpretation and evaluation of the results. Interpretation and evaluation of the results means the validation of the parameters dry matter of grains and total above-ground dry matter, which are crucial parameters indicating a good or a poor crop. Assuming that a realistic crop output stands for the correct parameterization of the model.

A summary of the results and attendant problems concerning the long-time scale simulation is given. The main attention concentrates on crop yield, nitrogen leaching, soil moisture and percolation respectively.