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EMS Annual Meeting Abstracts
Vol. 10, EMS2013-740, 2013
13th EMS / 11th ECAM


# Assessment of the phenology impact on SVAT modelling through a crop growth model under climate change conditions and consequences on the water balance

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In the coming years, water resources and vegetation production will be drastically affected by climate changes as well as intense and rapid changes in the land use. In particular, several databases gather observations on the impact of climate changes on the vegetation phenology (GDR coordinated by I.Chuine (CEFE-CNRS); international dadabase PEP 725; PHETEC and PERPHECLIM (AgroclimINRA)). But vegetation phenology is generally poorly taken into account in land surface models and may be a substantial source of uncertainties for global change scenario studies. The impact of climate and land-use changes on water balance and vegetation production can be analysed and predicted through land surface models, provided that the uncertainties associated to these models and to the data used to run them are evaluated.

In this paper, we discuss the improvement obtained in Soil Vegetation Atmosphere Transfer (SVAT) modelling by taking into account the phenology using a crop growth model, focusing on the water budget.

The STICS model (Brisson et al, 1998) is used to simulate crop processes (growth and development, taking into account water and nitrogen exchanges between the environment and the crop). STICS describes the vegetation phenology very accurately and was validated for many types of crop and various pedoclimatic conditions. The SVAT model being analyzed is the a-gs version (Calvet et al., 1998) of the ISBA model (Noilhan et al, 1989), which simulates the photosynthesis and calculates the plant biomass and the Leaf Area Index (LAI) using a simple growth model. In STICS, the phenology is driven by the sum of daily air temperatures, which is quite realistic, while in ISBA, the phenology is driven by the production estimation.
Long series of climatic data (past records and future simulations) are used as well as measurements (vegetation characteristics, soil properties, agricultural practises, energy and water balance) performed in the lower Rhone valley experimental area (Avignon, France).

In a first step, by running STICS and ISBA for a maize crop with long series of climatic data, including future scenarios of climate (CLIMATOR project, Brisson et al, 2010), we show that the range of phenology simulated by ISBA is much wider than the one simulated by STICS. The large variability obtained with ISBA is not realistic and does not match with the genetic characteristics of the studied crops. In a second step, STICS and ISBA-a-gs are run over the same
field cultivated during 10 years on a well instrumented site (Avignon, crop observatory site). Their simulations are compared, in terms of LAI (driven by phenology), biomass (crop production), and evapotranspiration (water balance).