Dynamic coupling of hydrogeological and agronomic models in the framework of the Eau-dyssée integrated model

O. Souhar*[1], F. Habets[1], N. Flipo[2], P. Goblet[2], E. Ledoux[2], P. Viennot[2], D. Ripoche[3], M. Launay[3], P. Bernard[3]

[1] UMR Sisyphe : CNRS – Université Pierre et Marie Curie - MINES ParisTech, France
[2] Centre de Géosciences, MINES ParisTech Fontainebleau, France
[3] Agroclim, INRA, Avignon, France
* otmane.souhar@mines-paristech.fr

Abstract

Efficient water management needs integrated modelling in order to estimate the evolution of the water quality and quantity. This multidisciplinary task can be achieved by the coupling of existing expert models. One difficulty is therefore to manage the different space and time scales, and to exchange the appropriate variables between models that can have quite different representations of the physical processes. Several integrated models have been built, most of them only take into account a one way coupling between the expert models. A fine interaction between the expert models requires a fine coupling system to exchange information between models. In the framework of the Eau-dyssée integrated model, the PALM dynamic coupler, from Cerfacs, is used to develop a two-way coupling between the MODCOU finite difference pseudo 3D hydrogeological model and the STICS agronomical model.

Such coupling is devoted to study the problem of transfer of diffuse pollutants though the hydrosystem such as nitrates or pesticides. One original aspect of the two-way coupling is to properly manage the crops irrigation: the estimation of the needed water volume for irrigation, computed by the agronomic model, is limited by the water effectively available in the river or in the aquifer. If such limitation is not taken into account, the climate change impact on the water resources and crop yield can be biased.

In the Eau-dyssée model, the surface water budget is calculated over two kinds of spatial units: agricultural plots are simulated by the agronomical model, while other land uses (forest, urban …) are simulated by the hydrological model. In each agricultural plot, the crop rotations as well as the agricultural practices are widely varying in time. This implies to manage a good connexion with the agricultural data base. At each hydrological time step, the surface water fluxes computed over the spatial units are transferred through the unsaturated zone to the aquifer, and the river-aquifer interactions are computed to simulate the river flows. In this communication, we will present the Eau-dyssée model, and its application to irrigated plots.