Geo-MHYDAS: A discretization procedure of cultivated landscapes for distributed hydrological modelling

P. Lagacherie and M. Rabotin

INRA, UMR LISAH, 2 place Pierre Viala, 34060 Montpellier France (rabotin@supagro.inra.fr)

Distributed hydrological models provide effective simulation tools for exploring basin hydrological processes and predicting the effects of changes on catchment response. Each model has its own method to represent landscape variabilities which strongly influences its performances and often limits its use. It is thus important to provide adequate spatial discretizations of landscapes that could be coupled with physically-based representation of hydrological processes. Grid-based segmentation of landscape are the most commonly used by hydrological distributed models because grid-based Digital Elevation Models (DEM) are the most commonly available, the methods of analysis are computationally efficient and simple and this structure is compatible with remotely sensing techniques and Geographic Information Systems (GIS).

A more adapted landscape representations is considered in MHYDAS (Distributed hydrological modelling for agrosystems), a physically-based catchment model specifically designed for agricultural catchments. MHYDAS considers a discretization of catchments into irregularly sized and shaped areal and linear topographically-connected hydrological units which allows to take into account a great number of natural and man-made hydrological discontinuities that can be encountered in farmed catchments. This communication presents Geo-MHYDAS, the GIS procedure that help users of MHYDAS - and possible similar models - to perform this complex landscape discretization prior to running the model. This landscape discretization has the following characteristics:

* take into account both natural and man-made landscape features of various sizes e.g. subcatchments, soil units, land use units but also ditches network, field boundaries.
* provide both linear and polygonal hydrological units by an overlay procedure and selective cleaning operations that perform an user-controlled filtering of the small and/or badly-shaped units
* build a topology that connects all the areal and linear hydrological units along an oriented tree to enable the routing of the simulated flows
* enable multiple discretizations for sensitivity analysis of geographical input data thanks to a full automatization of the discretization process

The peculiarity of Geo-MHYDAS is to implement a more complex discretization by handling a great variety of landscape features that are not all ordered along the slope. Beside, the parametrization step, i.e. the estimation of hydrological model parameters for each hydrological units from current landscape database remains local-specific in this presented version of Geo-MHYDAS. Geo-MHYDAS has been developed under GRASS because this software have large amount of functionalities, both in the raster and in vector mode and because of its ability to be largely diffused as an open source software.

In this communication, the spatial segmentation of Geo-MHYDAS is presented with its different steps, namely creating/importing geographical objects, building hydrological units, and creating oriented topologies. The use of Geo-MHYDAS is then illustrated by a MHYDAS modelling of discharge at the outlet of an intensively cultivated vineyard catchment located in the south of France (the Roujan catchment).