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

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Purpose
Landscape discretization is of major importance in distributed hydrological modelling. Geo-MHYDAS is a GIS tool that explicitly represents the landscape features, particularly the man-made ones. The landscape discretizations that are produced are used as input to the selected hydrological model.

Geo-MHYDAS includes three steps:
1. Processing, importation, creation and modifications of the geographical objects which are considered in the modelling.
2. Creation of the areal and linear units for hydrological modelling by a "selective cleaning" procedure after overlay.
3. Building of an oriented topology between irregularly-shaped areal units and linear units which allows the routing of the simulated water flows.

Geo-MHYDAS is a GIS tool that allows to explicitly represent the landscape features, particularly the man-made ones. Geo-MHYDAS can be handled by non-experienced GIS users.

Geo-MHYDAS allows a more precise representation of landscape features, particularly the man-made ones that are known to have a great impact on water and mass flows across the landscape.

Geo-MHYDAS can be handled by non-experienced GIS users. Although Geo-MHYDAS was initially developed to provide input files to a specific hydrologic model (MHYDAS), it can be potentially useful for a wide range of hydrologic models built on the same principle, i.e., having a water production function whose limits are considered as hydrological discontinuities in the model.

Geo-MHYDAS includes in its database, the input spatial data required by Geo-MHYDAS can be provided in a great variety of formats (GDAL shapefiles, grid raster, OGC standard...).

Geo-MHYDAS was developed using GRASS (Geographic Resources Analysis Support System), an open-source GIS (Geographical Information System) software package. It provides for the management of topological vector data as well as support for vector network analysis in an environment wide to create geometric algorithms.

The Geo-MHYDAS procedure is divided into independent GRASS scripts developed using Shell and Perl languages. Thanks to the GRASS libraries, the input spatial data required by Geo-MHYDAS can provide in a great variety of formats (GDAL shapefiles, grid raster, OGC standard...).

Webpage: http://grass.itc.it/geo-mhydas.html

software structure

Software structure

- Input datas: land use, soil map, Field boundaries, Reach segments
- Output datas: Hydrological network, Topological relations between hydrologic units are characterized by a set of parameters (downstream unit, process order, distance to the neighboring unit, ...)

Simulated discharges

The two simulations only differed in their landscape discretizations:

- Much runoff and Peak discharge three times higher on "DEM only" discretization.

Conclusion
Geo-MHYDAS allows a more precise representation of landscape features, particularly the man-made ones that are known to have a great impact on water and mass flows across the landscape.

Geo-MHYDAS can be handled by non-experienced GIS users. Although Geo-MHYDAS was initially developed to provide input files to a specific hydrologic model (MHYDAS), it can be potentially useful for a wide range of hydrologic models built on the same principle, i.e., having a water production function whose limits are considered as hydrological discontinuities in the model.

Additional versions of Geo-MHYDAS will be developed in the framework of the OpenFluid project to extend the functionalities of landscape representations on new landscape processes (e.g., erosion) will be integrated in the landscape modelling.

References


Legend

Input
Output
Objects

Landscape discretization

Input Output

Hydrologie network

Linear units topology parameters in attribute table

Areal units topology parameters in attribute table

Linear units topology parameters in attribute table

Areal units topology parameters in attribute table