GIS embedded hydrological modeling: the SID&GRID project

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The SID&GRID research project, started April 2010 and funded by Regione Toscana (Italy) under the POR FSE 2007-2013, aims to develop a Decision Support System (DSS) for water resource management and planning based on open source and public domain solutions.

In order to quantitatively assess water availability in space and time and to support the planning decision processes, the SID&GRID solution consists of hydrological models (coupling 3D existing and newly developed surface- and ground-water and unsaturated zone modeling codes) embedded in a GIS interface, applications and library, where all the input and output data are managed by means of DataBase Management System (DBMS).

A graphical user interface (GUI) to manage, analyze and run the SID&GRID hydrological models based on open source gvSIG GIS framework (Asociación gvSIG, 2011) and a Spatial Data Infrastructure to share and interoperate with distributed geographical data is being developed. Such a GUI is thought as a "master control panel" able to guide the user from pre-processing spatial and temporal data, running the hydrological models, and analyzing the outputs.

To achieve the above-mentioned goals, the following codes have been selected and are being integrated:
1. Postgresql/PostGIS (PostGIS, 2011) for the Geo Data base Management System;
2. gvSIG with Sextante (Olaya, 2011) geo-algorithm library capabilities and Grass tools (GRASS Development Team, 2011) for the desktop GIS;
3. Geoserver and Geonetwork to share and discover spatial data on the web according to Open Geospatial Consortium;
4. new tools based on the Sextante GeoAlgorithm framework;
5. MODFLOW-2005 (Harbaugh, 2005) groundwater modeling code;
6. MODFLOW-LGR (Mehl and Hill 2005) for local grid refinement;
7. VSF (Thoms et al., 2006) for the variable saturated flow component;
8. new developed routines for overland flow;
9. new algorithms in Jython integrated in gvSIG to compute the net rainfall rate reaching the soil surface, as input for the unsaturated/saturated flow model.

At this stage of the research (which will end April 2013), two primary components of the master control panel are being developed:
i. a SID&GRID toolbar integrated into gvSIG map context;
ii. a new Sextante set of geo-algorithm to pre- and post-process the spatial data to run the hydrological models.

The groundwater part of the code has been fully integrated and tested and 3D visualization tools are being developed. The LGR capability has been extended to the 3D solution of the Richards' equation in order to solve in detail the unsaturated zone where required.

To be updated about the project, please follow us at the website: http://ut11.isti.cnr.it/SIDGRID/

References

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