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Open Source GIS tools for Water Resources Management

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The water resource is facing a growing pressure due to anthropogenic impact and varying climate conditions. Recommendations have then been issued also by the European Environment Agency focusing on the need for the implementation of new tools and technologies to manage such a resource.

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) defined by a framework based on open source and public domain solutions for the planning and management of the water resource. It will consist in watershed-scale model able to simulate surface and subsurface flow in a three-dimensional domain. The SID&GRID solution will be able to connect the DataBase Management System (DBMS), catchment models and GIS interface by Open Source applications and library, choosing the most effective and efficient integration approach. The outcomes of the project will be available to the final users of the project partnership (e.g. river authorities and water service companies).

A graphical user interface to manage, analyze and run the SID&GRID hydrological model will be developed; it is thought as a "master control panel" able to guide the user from pre-processing spatial and temporal data to run and analyze the hydrological model outputs. This master control panel will be based on an open source GIS framework and a Spatial Data Infrastructure to share and interoperate with distributed geographical data. To achieve the goal, the following architecture was designed:

1. a Postgresql/PostGIS for the Geo Data base Management System;
2. gvSIG with Sextante and Grass tools for the desktop GIS;
3. Geoserver and Geonetwork to share and discover spatial data on the web according to Open Geospatial Consortium (Open Geospatial Consortium, 2008);
4. new tools based on the Sextante GeoAlgorithm framework.

This approach is based on the Sextante geo-algorithm library capabilities to interface with gvSIG GIS and GRASS tools. According to this framework, two primary components of the master control panel were identified:

1. a SID&GRID toolbar integrated into gvSIG map context;
2. a new Sextante set of geo-algorithm to pre and post process of spatial data for the hydrological model.

In order to develop the SID&GRID master control panel, the research group started a first "test step". The test step is based on some pre-process algorithms that were developed in beta version into gvSIG and Sextante Java spatial framework:

1. a tool to calculate stress periods from time series and to refer them to the spatial domain;
2. a geo-algorithm to create the 2D grid for the numerical model from a spatial region like a watershed;
3. a geo-algorithm to implement the 3D layers for the groundwater analysis;
4. an algorithm to wrapper the spatial wells data to the input file for the model;

5. a number of wrapper for the discretization and basic configuration model input parameters

After this development phase, which will end in the coming months, the project will focus on other hydrological process spatial wrapper and on the SID&GRID graphical user interface (like a toolbar) able to call every pre and post process SID&GRID tools.

References

Open Geospatial Consortium Inc., 2008, OGC Reference Model [WWW] <URL: http://www.opengeospatial.org/standards/orm > [Accessed 2009]