

GIS open source framework for an interactive surface and groundwater modelling

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Unione europea
Fondo sociale europeo



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Fondo Sociale Europeo
Programma Operativo
Regione Toscana



**MINISTERO DEL LAVORO,
DELLA SALUTE E DELLE POLITICHE SOCIALI**

Direzione Generale per le Politiche
per l'Orientamento e la Formazione





Project SID&GRID

Simulazione e sistemi IDroinformatici per la Gestione delle Risorse IDriche

Funded under POR FSE 2007-2013 by Regione Toscana
From April 2010 to March 2013

Scientific partnership:

Dep. of Mathematics, University of Firenze
Land Lab, Scuola Superiore S.Anna, Pisa
CNR--ISTI, Pisa



End-users partnership:

Ingegnerie Toscane S.r.l., Pisa
Autorità di Bacino Pilota del Fiume Serchio, Lucca
H2O Ingegneria S.r.l., Pisa



Final goal of the project

To develop a DSS (*Decision Support System*) for **water management and planning** based on results derived from a 3D physically based hydrological (surface+subsurface) model to be used as helpful tool by public bodies (possible applications for private companies as well) in order to simulate the **whole hydrological cycle and perform spatial-temporal analysis**.

Request open source and public domain codes

SID&GRID architecture is based on:

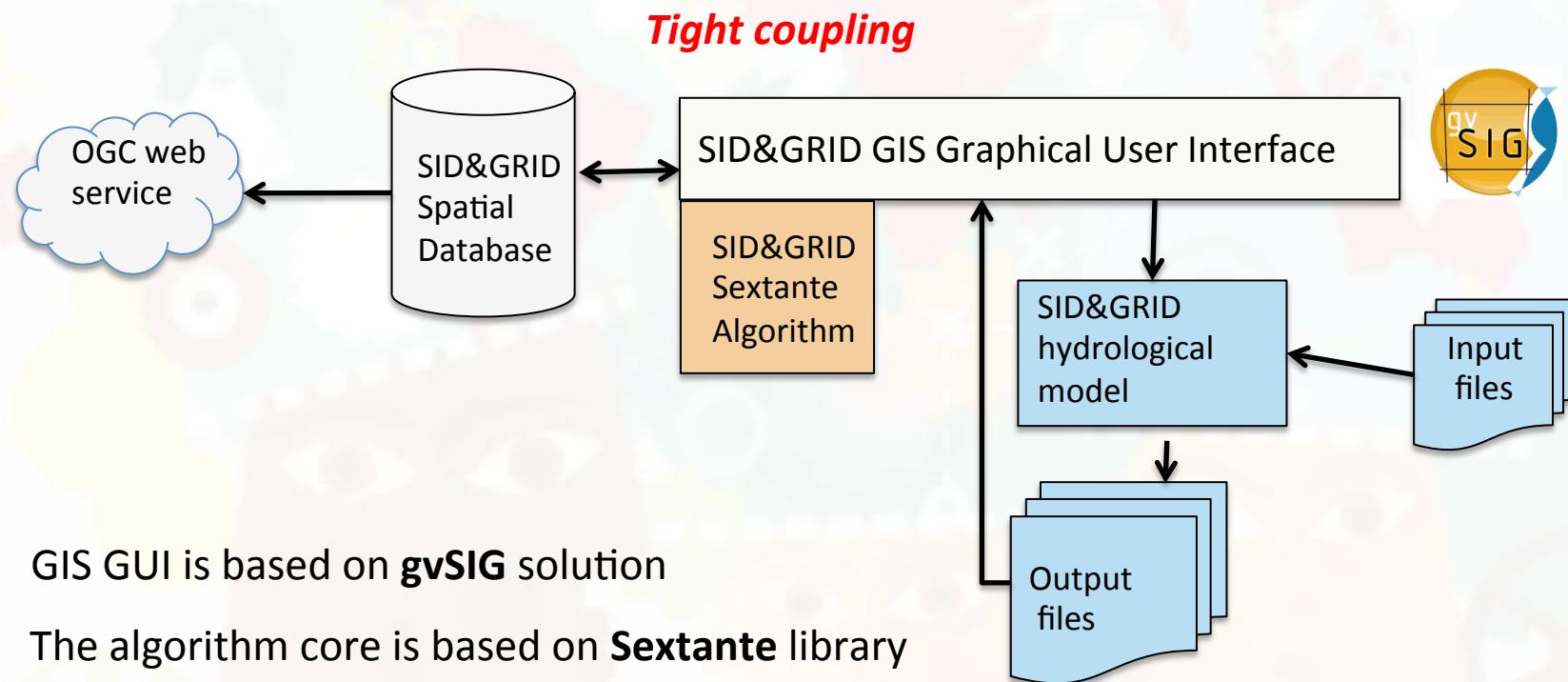
- integration of DBMS (Data Base Management System);
- development of tools/toolbar into a GIS framework;
- integration and development of groundwater (saturated/unsaturated zone) and surface water hydrological modeling codes.



Reasons for the project

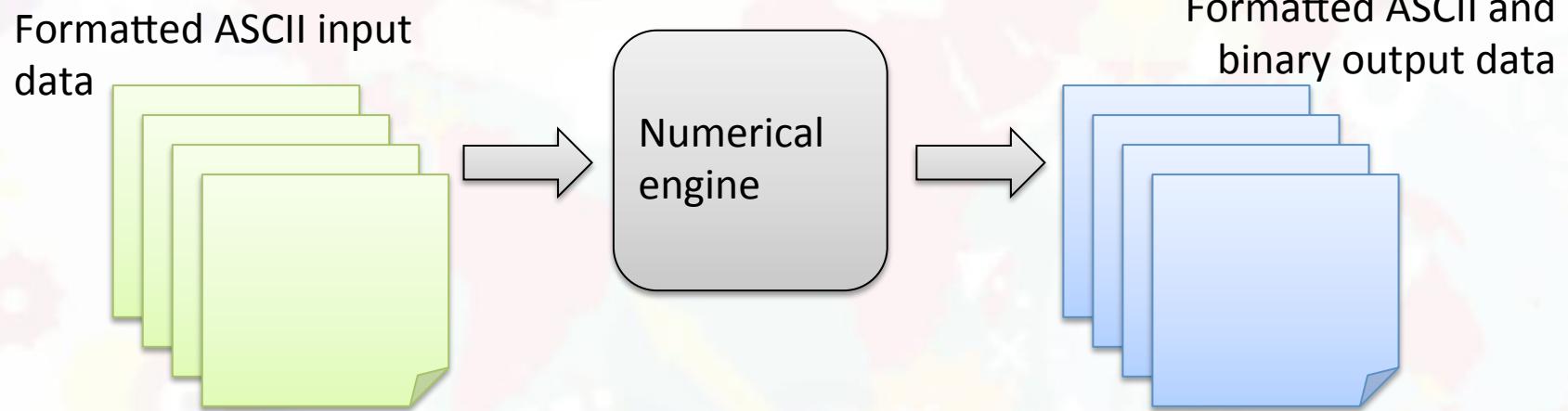
- to improve public authorities knowledge in the field of hydrology (surface and subsurface);
- to improve water management and planning at public authorities by providing state of the art data management, analysis and visualization tools;
- to spread the use of new technologies to the general public;
- to develop a GUI within GIS in order to apply codes (such as those for the unsaturated zone) that at present do not benefit of tools for spatial data implementation;
- to spread the use of free and open source technologies ... it's also a matter of:
 - saving money while performing the same activities of commercial ones

SID&GRID strategy about GIS and hydrological modeling linking



- GIS GUI is based on **gvSIG** solution
- The algorithm core is based on **Sextante** library
- The key code for hydrological modelling is **Modflow-2005**
- **PostGIS** and **Geoserver** to store, manage and publish data

How Model engine works



SID&GRID framework is able to **manage** spatial data and **wrap** them to Model engine input format. It is possible for each hydro process wants to simulate

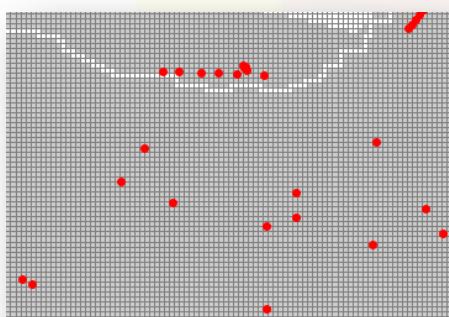
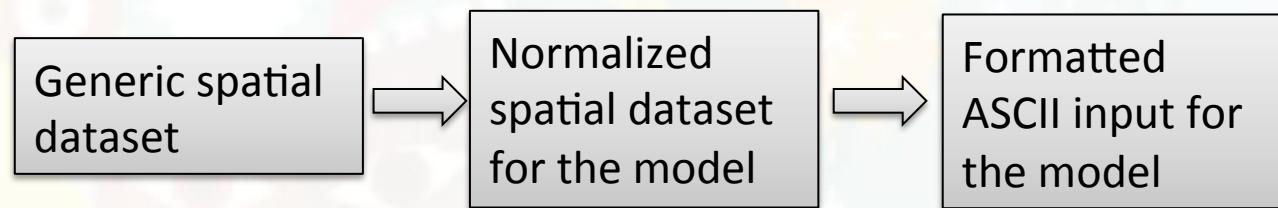
SID&GRID framework is also able to **map** the model output such as groundwater flow

SID&GRID Algorithm module

The SEXTANTE project aims to create a platform for the development of geoalgorithms, wrote by V.Olaya, that makes it easy both to implement and to use those algorithms.

A set of base classes which constitute a robust analysis platform and a set of 220+ algorithms built on top of them.

New set of geoalgorithm was developed in Sextante framework to manage, wrap and create hydro model dataset



ID	from_lay	to_lay	sp_1	sp_2	sp_3	sp_4
1	2	2	0.0	-4000.0	-4050.0	-4100.0
2	2	2	0.0	-4000.0	-4050.0	-4100.0
3	2	2	0.0	-4000.0	-4050.0	-4100.0
4	2	2	0.0	-4000.0	-4050.0	-4100.0
5	2	2	0.0	-4000.0	-4050.0	-4100.0
6	2	2	0.0	-4000.0	-4050.0	-4100.0
7	2	2	0.0	-4000.0	-4050.0	-4100.0
8	2	2	0.0	-4000.0	-4050.0	-4100.0

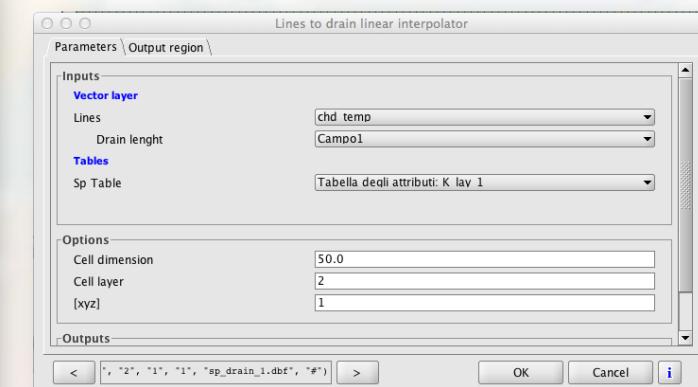
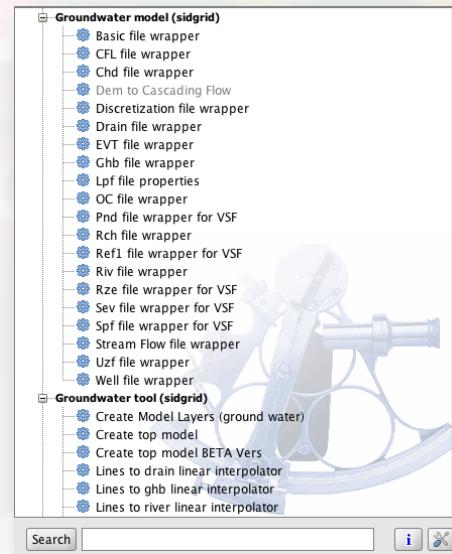
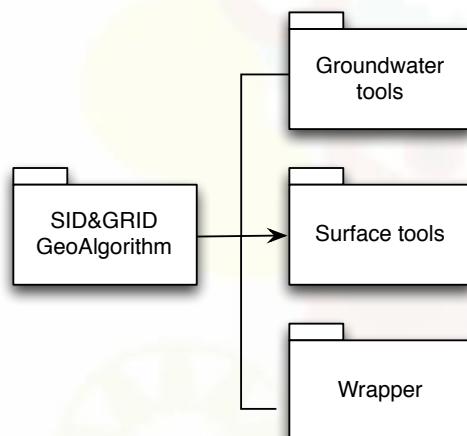
Well Package

245	0			
245				
2	121	138	-565.0	
2	122	137	-565.0	
2	123	137	-565.0	
2	124	136	-565.0	
2	125	135	-565.0	
2	126	134	-565.0	
2	127	134	-565.0	



The new jar algorithm library was developed within Sextante GIS framework with three main group tools:

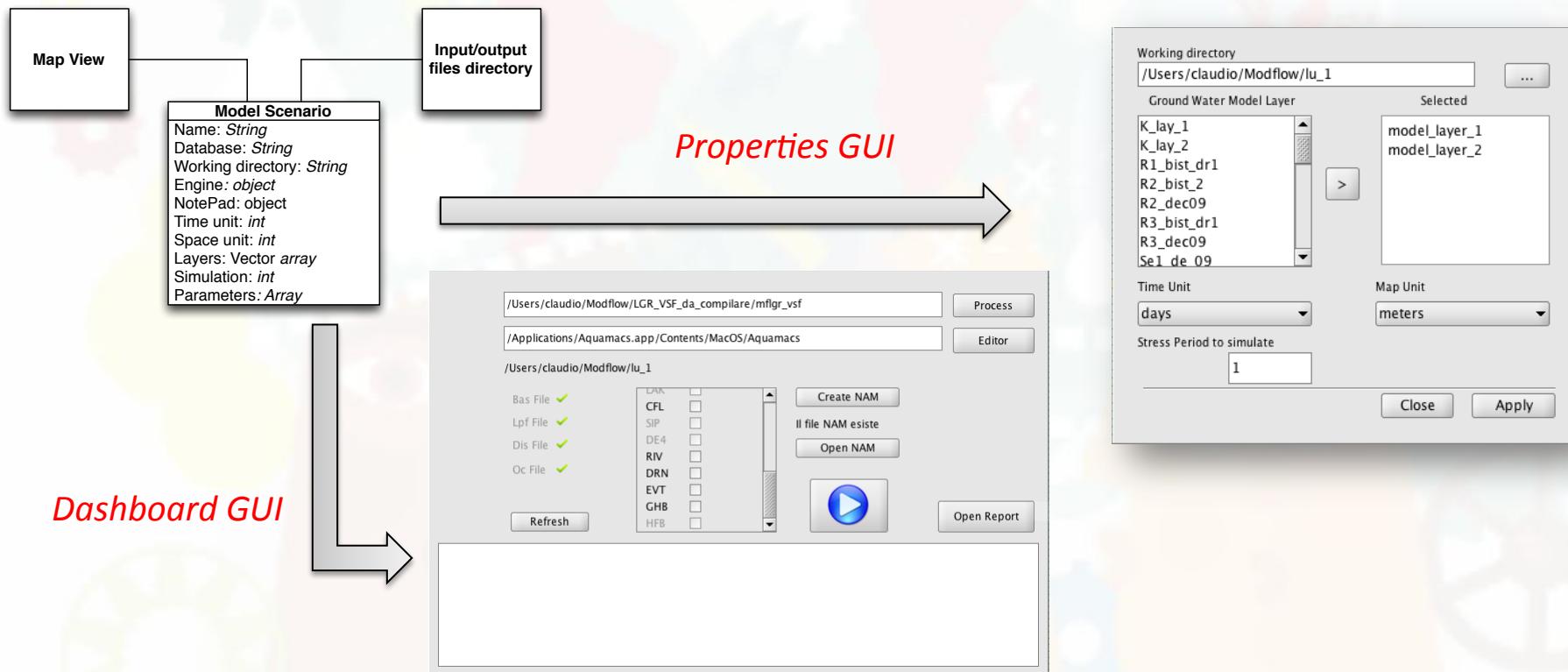
- **Groundwater tools** to create and manage subsurface layers for the hydro model and normalize them according to time and spatial model discretization;
- **Surface tools** to create and manage surface model layer like soil type or net rain for example;
- **Wrapper** tools to translate spatial dataset to numerical model input dataset



The gvSIG role

SID&GRID GIS module links together previous modules within a common graphical user interface based on gvSIG desktop GIS

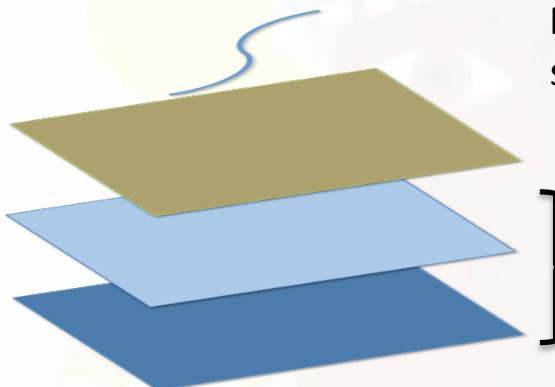
The core of this module is a new gvSIG project object: **Model Scenario**



The gvSIG role

is an User Control Panel for the entire modeling workflow

The user is able to **define** a new *model scenario*, to **create** and to **manage database**, to **use** specific *geoalgorithm* to create and manage *Model Data Object*, to **write** input files for the *model engine*, to **run** the *simulation* and (finally) to **analyze** and to **map** model output



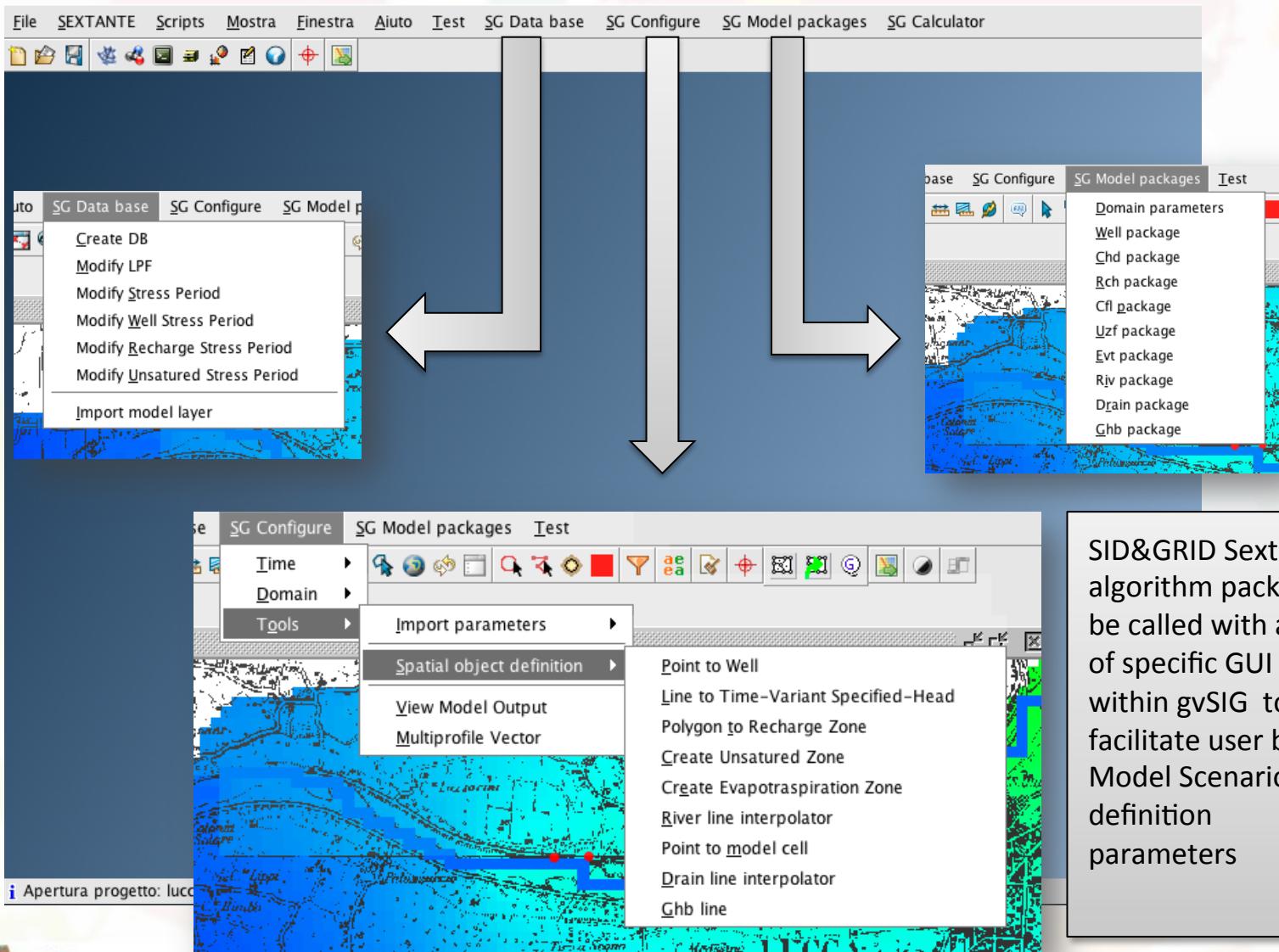
Model data object: spatial normalized dataset for each hydro process to simulate

Surface model layer: surface spatial grid of the hydro model

Groundwater model layer: groundwater spatial grid of the hydro model



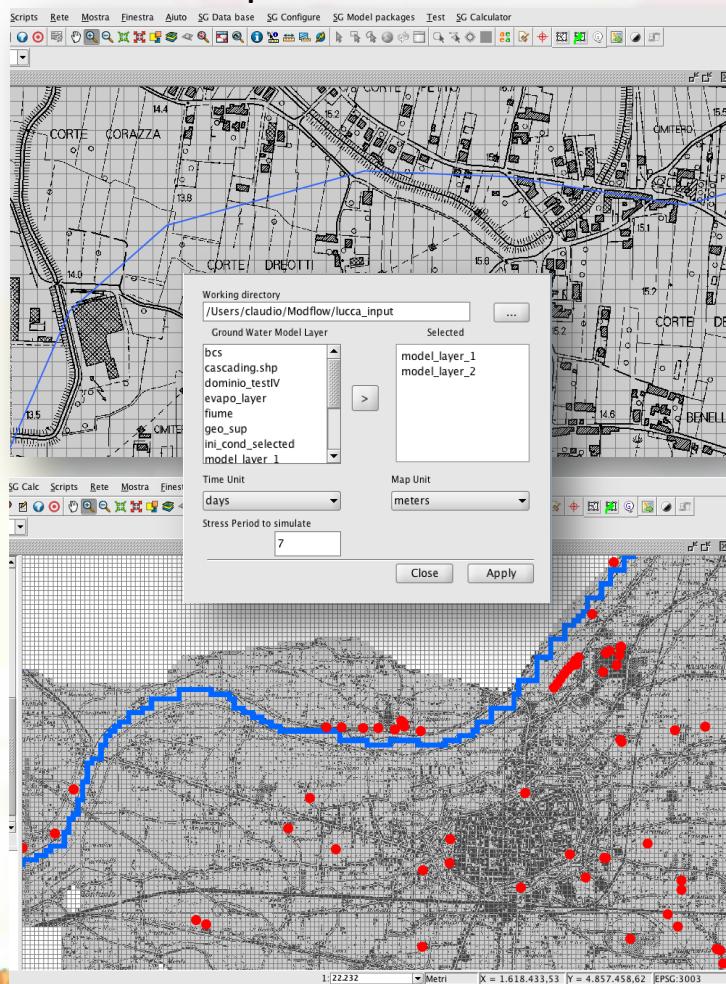
SID&GRID GIS and User Interface module



Test

Test phase started some months ago to evaluate and to improve SID&GRID workflow process

A first basic test was performed...



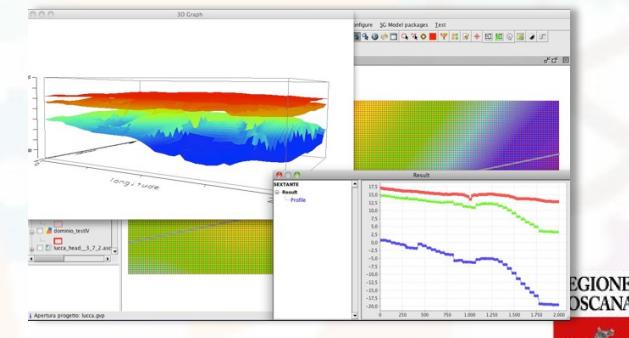
The scenario: simulate the water table trend during a hydrological year

Domain: 80 rows and 200 columns

Processes to simulate: pumping wells and recharge by rain

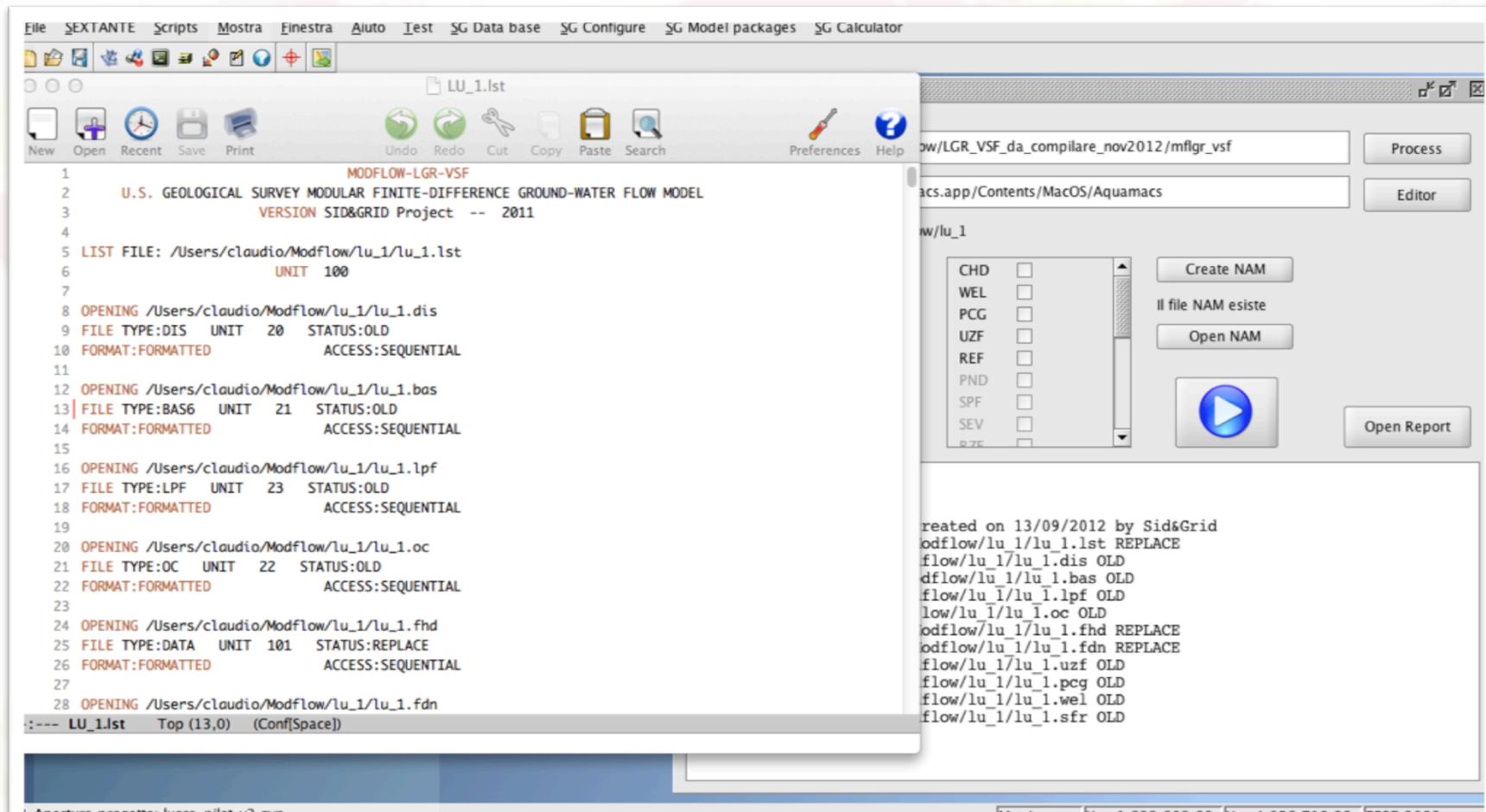
Time: 420 days

Model layers: 2 (Surface cover and aquifer)



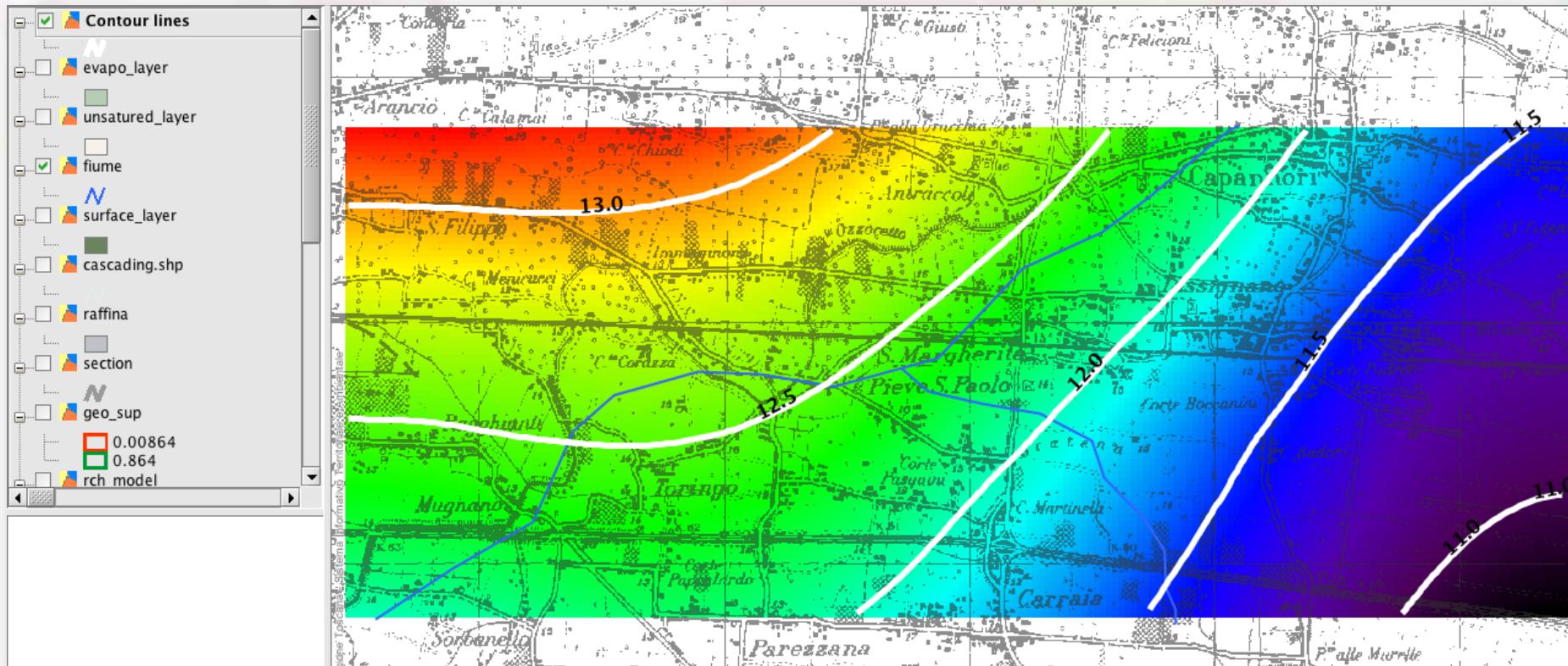
Test

After the model run, the user can read a **water budget report** within gvSIG GUI by the Model Dashboard



Test

...and map and analyze the aquifer flow at the end of summer, for example



Also evaluate the variability between rain and dry season using map algebra operators.

In conclusion...

The SID&GRID project provides a water management system spatial based to support:

- Water resource planning;
- Evaluate future scenario of soil change;
- Support agricultural water resource use;
- Evaluate urban and industrial impact on water resource availability
-

The system is composed by

- A **gvSIG** plugin to integrate Model Scenario object and toolbar;
- A new **Sextante** algorithm set;
- The **numerical engine** for the hydro model

...moreover

Postgresql/PostGIS installed on your machine





Menu Principale

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Sintesi e obiettivi del Progetto SID&GRID

Scritto da Administrator

Mercoledì 21 Aprile 2010 16:56

Simulazione e sistemi IDroinformatici per la Gestione delle Risorse IDriche



Ultime notizie

- Distribuzione delle versione beta del codice SID&GRID
- SID&GRID a EGU 2012
- Riunione di medio termine del progetto
- Presentazione dello strumento (test version)
- 3a fase del corso di formazione SID&GRID

Partner

- > Università degli Studi di Firenze
- > CNR ISTI
- > Scuola Superiore Sant'Anna
- > Acque S.r.l.
- > H2O Ingegneria S.r.l.

La gestione delle risorse idriche, attualmente soggette ad una crescente pressione antropica ed alle crisi ricorrenti legate ai cambiamenti climatici, costituisce una delle problematiche ambientali cui si deve porre maggiore attenzione. In questo senso numerose raccomandazioni relative alla necessità di un nuovo approccio verso le metodologie e procedure di gestione delle risorse idriche sono state emanate recentemente anche dall'Agenzia Europea dell'Ambiente.

Nel contesto italiano numerose autorità sono deputate al controllo e al governo della risorsa idrica, mentre enti e società sono deputati alla fornitura di acqua per gli usi agricoli, industriali e potabili.

Chi è online

1 visitatore online

Sondaggi

