OPEN SOURCE for WATER MANAGEMENT: INCLUDING CAPABILITIES of MODFLOW-OWHM in the FREEWAT GIS MODELLING ENVIRONMENT

I. Borsi¹, R. Rossetto², Massimiliano Cannata³, G. De Filippis², M. Ghetta²
¹TEA SISTEMI S.p.A., Pisa (Italy)
²Scuola Superiore Sant’Anna, Pisa (Italy)
³Scuola Universitaria Professionale della Svizzera Italiana, Lugano (Switzerland)

THE FREEWAT PROJECT

FREEWAT is an ongoing GIS environment to serve as pre- and post-processor for running simulations of surface-groundwater interaction, with the possibility to activate several features accounting for the different water stresses. Here the capability related to address water resource management problems is reported, by activating management tools available in the MODFLOW-OWHM code. The latter is integrated in FREEWAT, which appears as composite plugin of the well-known QGIS software (QGIS, 2016). Therefore, all the necessary pre- and post-process procedures can be run effectively within QGIS, also in conjunction with the several tools for GIS analysis already included in QGIS. It turns out a simple and intuitive user interface to manage the simulation of complex problem in which the mutual interaction among surface waters, groundwaters and anthropic water demand/supply terms can be handled. The development phase of such tools is already at an advanced stage, while next work will be focused on producing real-world applications to serve as tutorial for interested Users.

HOW FREEWAT ACTS AS WATER MANAGEMENT TOOL

Defining WATER DEMAND UNITS

- Any “entity” consuming water (urban zone, industrial zone, farms, rural areas, natural vegetation areas, etc.)

Defining WATER DEMAND and WATER SUPPLY

- Water Demand: rural, urban or industrial
- Water Supply: from external sources, surface- and/or groundwater

Water Supply Optimization

- If DEMAND > SUPPLY, optimization of the supply procedures may be applied

WATER MANAGEMENT IN FREEWAT

FREEWAT includes capabilities to address water resource management. The specific goal is to exploit the output of a numerical simulation to solve problems of water delivery control and optimization.

Conjunctive use of water is the joint usage and management of surface- and groundwater resources to meet required water demand and minimize potential damage to the quantity or quality of the resource. To get an effective representation of conjunctive use of surface and subsurface water, it is necessary to integrate simulation methods for subsurface, surface, and urban and agricultural water-demand computations. Furthermore, these models have to take into account the cases where there is not enough water supply to meet the total water demand, and propose possible management strategies.

To simulate water management, FREEWAT applies the MODFLOW-OWHM (Hanson et al., 2014), which can be used also to include the specific computation of water demand coming from rural environments and crops acreage. This approach has been tested in several water management applications, as documented in Faunt (2009) and Hansons et al. (2010), for instance. It allows an effective planning of long-term water resources uses and management of short-term water resources allocation.

DATA FLOW IN FREEWAT

References

Hanson R.T., Schmid W., Faunt C.C., and Lockwood B. (2010), Simulation and Analysis of Conjunctive Use with MODFLOW’s Farm Process, Ground Water 48(5):674-89

Acknowledgements

This paper is presented within the framework of the project FREEWAT, which has received funding from the European Union’s Horizon 2020 research and innovation programme under Grant Agreement n. 642224. This poster content reflects only the authors’ views and the European Union is not liable for any use that may be made of the information contained therein.