



Needs and priorities for software capability in water resource management



Key Policy Messages

- ✓ A questionnaire for defining needs and priorities in ICT related to water resource management issues
- ✓ Results of this survey show seven groups of needs of tools
- ✓ Expected capabilities of software tools (and modules) included in FREEWAT platform reflect the ranking of priorities highlighted by the survey

WHAT H2020 FREEWAT is

FREEWAT is an HORIZON 2020 project financed by the EU Commission, aiming at promoting water resource management through innovative ICT tools and participatory approach.

Main result of the project is the free and open-source FREEWAT software: a QGIS integrated environment, where several simulation codes, based on the hydrological cycle, hydrochemical or economic-social processes, are integrated in a unique GIS project for conjunctive use of surface- & ground-water.

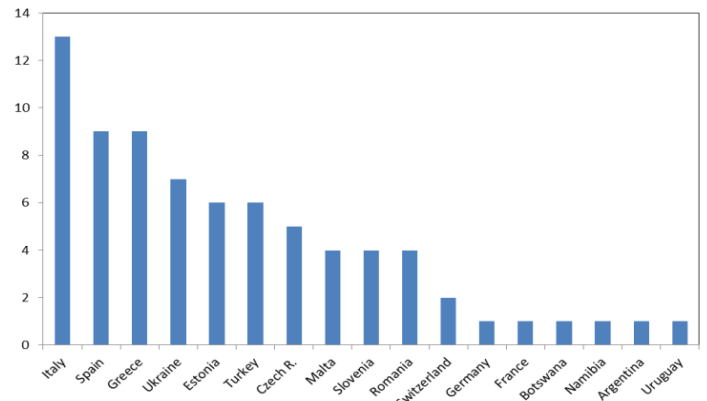
This Policy Brief is part of series of seven whose goal is to illustrate the FREEWAT approach and achievements.



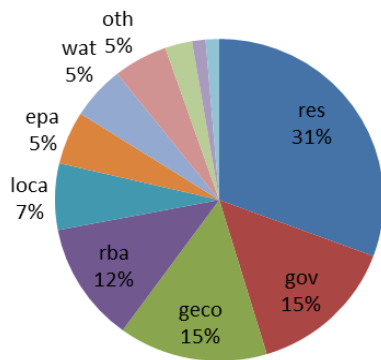


Needs/priorities concerning ICT tools for water resource management

A questionnaire was distributed to about 250 stakeholders, receiving a complete response from 70 of them. On this basis, a set of relevant information was collected from various people dealing with Water Resource Management (WRM).



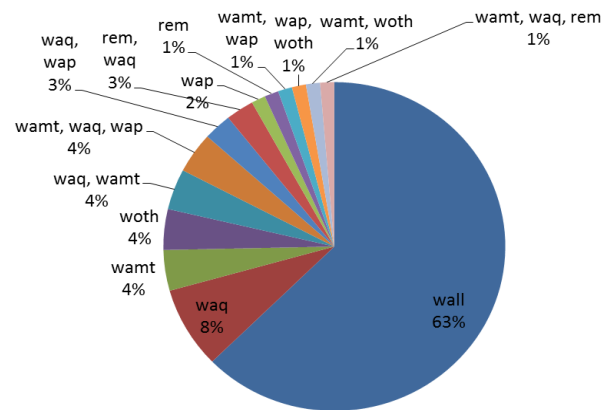
Number of replying entities by Country



% of replying entities by type of Institutions

Legend:

res: research; rba: river basin authority; epa: environmental protection agency; wat: water utility; gov: ministry or similar; loca: local authorities involved in water management; geco: geoenvironmental company; oth: other.



% of replying stakeholder by main area of interest

7 groups of needs for ICT tools in WRM

Needs identified during the survey were classified in 7 groups. They represent the most important needs raising from the analysis of survey results. Some groups focus on water quality, others on water availability, others on the impact of human infrastructures on the quality and quantity of groundwater and surface water:

1. Tools for assessing the impact of agricultural activities on surface- and ground-water
2. Sustainable management of groundwater
3. Analysis of impact of groundwater withdrawals
4. Understanding impact of human infrastructures on sustainable water management
5. Tools for preventing pollution of water wells, including heavy metals (mine waste sites) and old military, industrial activities
6. Tools for simulation of flows and water balances and for the analysis of river/aquifer interactions
7. Tools for Managed Aquifer Recharge (MAR) design and operational management
8. Societal impact of sustainable water management



● Priorities and EU Regulations

The survey allowed to identify the following priorities, namely the most relevant needs to be addressed in term of ICT tools availability for WRM.

- Water management in rural areas (with special attention on nutrient management and related surface water and groundwater contamination).
- Prevention of seawater intrusion (including the Identification of the salinization front due to seawater intrusion and countermeasures for seawater intrusion through optimization of pumping and artificial recharge).
- Identification of areas for artificial recharge (including recharge of treated wastewater).
- Tools and methods for sustainable groundwater management and the implementation of European policies related to groundwater.
- Tools for the analysis of contaminants fate and transport in order to prevent and/or remediate groundwater.
- Tools for performing smart water balance calculations distributed in space and time, with special attention to climate extremes (floods and droughts).

A useful information about these priorities is their link with EU Directives and Regulations dealing with WRM, that represent the objective of such priorities. To this extent, the most ranked regulations are the following:

- ✓ Water Framework Directive 2000/60/EC (and in particular Article 16 – Strategies against pollution of water and Annex II – 2. Groundwater – 2.1 Initial characterization).
- ✓ Groundwater Directive 2006/118/EC.
- ✓ Nitrates Directive 91/676/EEC - Code(s) of good agricultural practice, designation of vulnerable zones, Action Plans.

● Status of Skills in GIS and Modelling

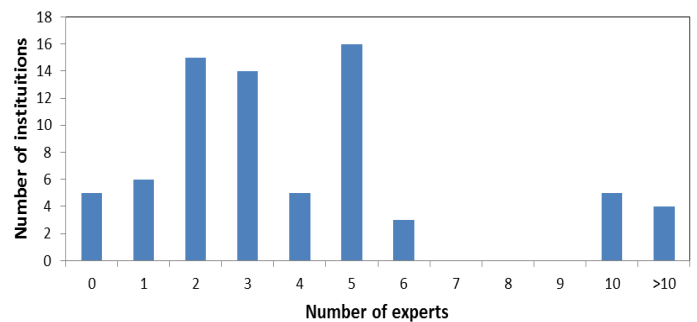
Which is the number of experts at your institution dealing with GIS and modelling tools for WRM?

This was the question posed to reflect the status of skill and expertise related to hydrological modelling software and its effective application in WRM.

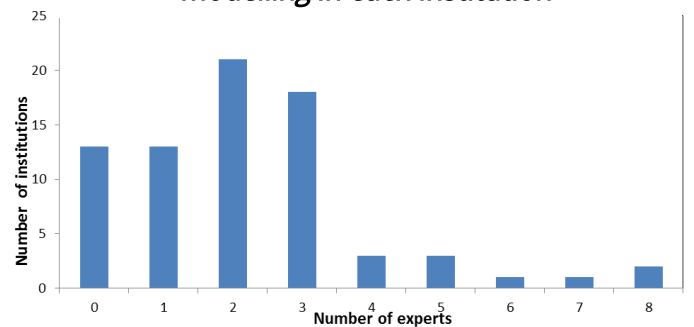
The typical number of people dealing with GIS in a technical unit is less than 6, while this is usually lower the one concerning hydrological modelling (less than 3).

This information lead to the objective of boosting actions devoted to capacity building (especially within public bodies), so that the challenge of an ICT- and data-driven decision making in WRM could be effectively addressed in next years.

Number of experts on GIS in each institution



Number of experts on hydrological modelling in each institution





What should ICT-tools for WRM be able to achieve?

Stakeholders would appreciate multi-functional ICT-tools able to manage spatial data incorporating modelling capabilities. The FREEWAT philosophy would provide an effective tool to address the above mentioned water management issues.

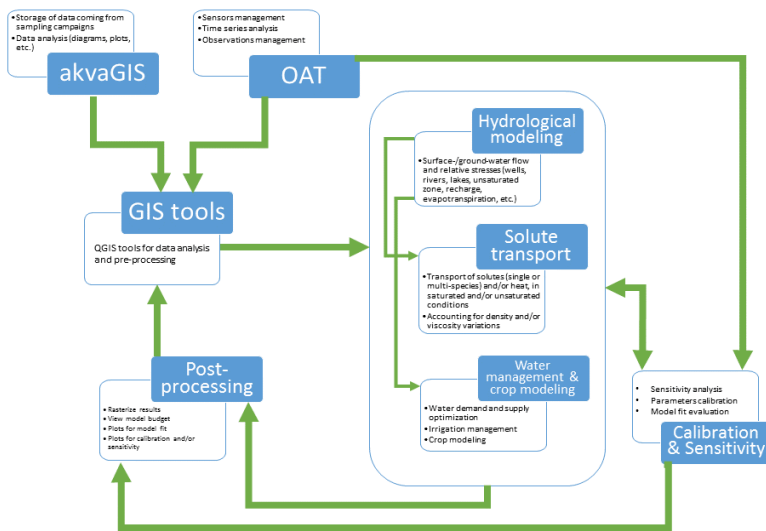
The following list summarizes the most ranked *desiderata* collected during the survey.

- Better estimation of actual water resources availability to improve water resources management, e.g. establishment of new location for supplementary wells, evaluation of the impact of alternative cropping systems, design of managed aquifer recharge scenarios, integrated GW/SW water management, irrigation planning.
- Simulate interactions between surface water and groundwater in terms of both water quantity and chemical quality.
- Simulation of seawater intrusion in coastal areas, including evaluation of the effects of managed aquifer recharge schemes.
- Estimate of wellhead protection areas.

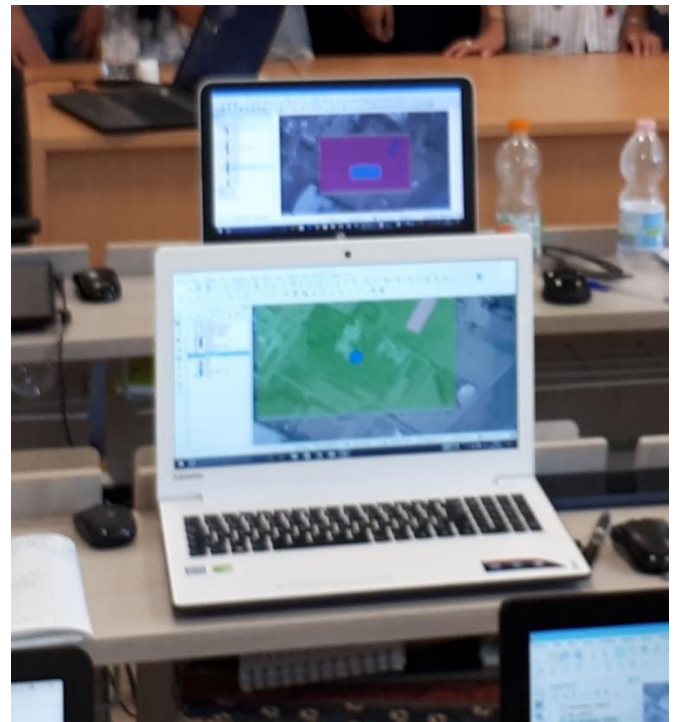
- Modelling-based methodology for evaluation of the efficiency of Action Programs related to Nitrates directive implementation and CAP cross-compliance fulfilment.
- New user-friendly (very intuitive) GIS-based modelling tools having capability to input and process geological, hydrogeological, hydrochemical, hydrological, climatic, land use and other related data for reliable modelling of land and water management.
- Tools for dealing with geothermal energy exploitation.

In this framework, stakeholders guess that FREEWAT application can provide a valuable contribution toward the application of the EU (and non-EU) policies, since it drives the following actions and achievements:

1. support local dialogue among stakeholders thanks to a tool able to early identify conflicts in terms of water uses (drinking, thermal exploitation, irrigation, etc.);
2. training in the use of combined modelling technology;
3. support the application of the related policies;
4. making existing data and models available to the public.



A sketch of tools included in FREEWAT



REFERENCES

QGIS Development Team (2017). QGIS Geographic Information System. Open Source Geospatial Foundation Project. <http://qgis.osgeo.org>

Rossetto, R., Borsi, I., & Foglia, L. (2015). FREEWAT: FREE and open source software tools for WATER resource management. *Rendiconti Online Della Società Geologica Italiana*, 35, 252–255. <http://doi.org/10.3301/ROL.2015.113>

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