

FREEWAT

Free and Open Source Software Tools for Water Resource Management
EU HORIZON 2020 Project

**FREEWAT newsletter,
issue 1/ November 2015**

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Boosting the use free and open source software tools in water resource management

FREEWAT is a HORIZON 2020 project financed by the EU Commission under the call WATER INNOVATION: BOOSTING ITS VALUE FOR EUROPE. FREEWAT aims at promoting water resource management by simplifying the application of the Water Framework Directive and other EU water related Directives through the use of state-of-art simulation tools.

The main result of FREEWAT will be an open source and public domain GIS integrated modelling environment for the simulation of water quantity and quality in surface water and groundwater with an integrated water management and planning module. Specific objectives of the FREEWAT project are:

- to coordinate previous EU and national funded research to integrate existing software modules for water management in a single environment into the GIS based FREEWAT;
- to support the FREEWAT application in an innovative participatory approach gathering technical staff and relevant stakeholders (in primis policy and decision makers) in designing scenarios for the proper application of water policies.

The open source characteristics of the platform allow consideration of this initiative “ad includendum”, as further research institutions, private developers etc. may contribute to the platform development.

The core of the FREEWAT platform will be the SID&GRID framework (GIS integrated physically-based distributed numerical hydrological model based on a modified version of MODFLOW 2005; Rossetto et al. 2013) in its version exported to the QGIS desktop. Capabilities to be integrated in FREEWAT are:

- a dedicated module for water management and planning;
- a whole module for calibration, uncertainty



- and sensitivity analysis of models;
- a module for solute transport in the unsaturated zone;
- a module for crop growth and yield and water requirements in agriculture;
- tools for dealing with groundwater quality issues;
- tools for the analysis, interpretation and visualization of hydrogeological data.

Through creating a common environment among water research/professionals, policy makers and implementers, FREEWAT's main impact will be on enhancing participatory approach and evidence-based decision making in water resource management, hence producing relevant and appropriate outcomes for policy implementation. The Consortium is constituted by partners from various water sectors from 11 EU countries, plus Switzerland, Turkey and Ukraine. Synergies with the UNESCO HOPE initiative on free and open source software in water management greatly boost the value of the project. Large stakeholder involvement is thought to guarantee results through dissemination and exploitation.

For more information refer to

www.freewat.eu

and to the publication

“FREEWAT: FREE and open source software tools for WATER resource management Rendiconti Online Società Geologica Italiana Volume 35, 1 April 2015, Pages 252- 255”

The project Consortium is made up of 19 partners representing various water sectors from 11 EU countries, Switzerland, Turkey and Ukraine and UNESCO international organization.



Scuola Superiore Sant'Anna (SSSA)



TEA Sistemi SpA (TEA SISTEMI SPA)



Technische Universität Darmstadt (TUDA)



Agencia Estatal Consejo Superior de Investigaciones Científicas (CSIC)



Oslandia (OSLANDIA)



United Nations Educational, Scientific and Cultural Organization (UNESCO)



Regione Toscana (RT)



METCENAS o.p.s. - Methodology Centre for Environment Assessment (METCENAS)



Zeta Amaltea s.l. (ZETA AMALTEA)



Institut za Ekološki Inženiring (IEI)



Erciyes Üniversitesi (ERU)



National Technical University of Athens Asset Management and Development Corporation, Greece (NTUA-AMDC) - Lavrion Technological and Cultural Park (NTUA / AMDC)



National Institute of Hydrology and water management Bucarest (INHGA)



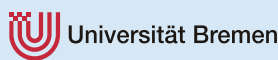
University of Tartu (UTARTU)



Taras Shevchenko National University of Kyiv (TSNUK)



Paragon Europe (PRN)



Universität Bremen (BUGS)



International Groundwater Resources Assessment Centre (IGRAC)



University of Applied Sciences and Arts of Southern Switzerland (SUPSI)

Kick-Off Meeting

20-21 April 2015

The kick-off meeting for the FREEWAT project was held in Pisa, Italy, on 20th- 21st April 2015. The Consortium partners met for the first time at this meeting which was organised by the project Coordinator Scuola Superiore di Studi Universitari e di Perfezionamento Sant'Anna. This was an opportunity for all partners to meet and discuss the plans and future of this project.

The partners meeting was followed by the international Workshop **Advantages of using Numerical Modeling in Water Resources Management and Managed Aquifer Recharge schemes**. This workshop was a joint event including members of the EU MARSOL FP7 project (www.marsol.eu) and within the framework of the European Innovation Partnership MAR Solutions - Managed Aquifer Recharge Strategies and Actions (AG128).



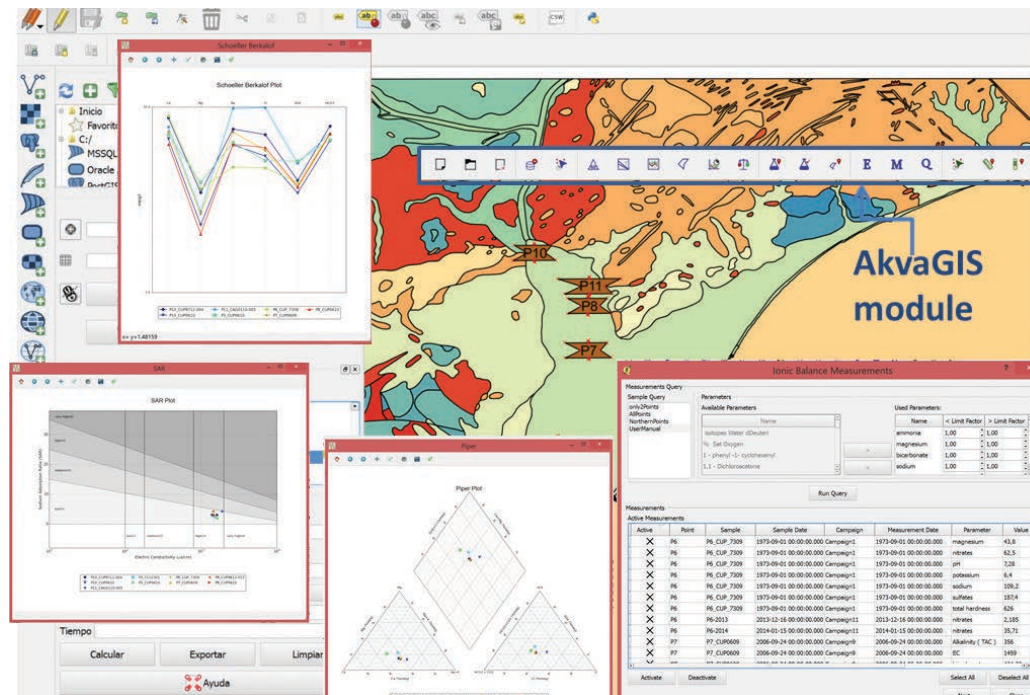
▲ The FREEWAT Consortium

The main objectives of this workshop were: 1) to gather a number of researchers, consultants, administrators and stakeholders interested in learning about how simulation models have been applied to address scientific and resources-management questions in Europe and in the US; 2) to present and discuss the importance of using numerical models for water resources management and for the implementation of the Water Framework Directive and related Directives in Europe; and 3) to promote the discussion about how to use models and how to present modeling results to different groups, such as stakeholders, decision makers. A number of about 130 participants attended the workshop from the research, water authorities, water utilities and professionals world.

Presentations from the event can be downloaded from:

<http://www.freewat.eu/node/573#presentations>

AkvaGIS Module in FREEWAT: Hydrogeological and Hydrochemical Analysis Tools



AkvaGIS Module in FREEWAT: Hydrogeological and Hydrochemical Analysis Tools

Comprehensive hydrogeological models could be only obtained by integrating properly detailed and accurate spatio-temporal dependent groundwater information. Furthermore, all data in modelling should be easily accessible to decision makers. To facilitate these tasks, a module for hydrogeological and hydrochemical data analysis is going to be integrated in Work Package 2 (**Software development and integration**) by IDAEA-CSIC (Spain, Task leader Violeta Velasco-Mansilla) into the GIS based FREEWAT platform. It is composed of a geospatial database and two families of tools that arrange all the available data into a coherent structure and provide support for their proper management, visualization, analysis and interpretation.

The geospatial database enables the user to integrate into a logical and consistent structure a wide range of hydrogeological information and its structure facilitates data harmonization and the creation and the execution of simple queries.

The first set of tools (**Hydrochemical Data Analysis Tools**) facilitates the management and interpretation of hydrochemical data. Its instruments cover a wide range of methodologies and calculations used

for querying, interpreting and comparing groundwater quality parameters. They include, among others, Charge Balance Error (CBE), chemical time-series analysis, chemical parameters plots, and calculation of various common in practice diagrams (e.g. Salinity Diagram, Schöeller-Berkaloff, Piper, Stiff) to which the spatial components are added. This enables us the generation of maps of the spatial distribution of several hydrochemical parameters and of the aforementioned specific hydrochemical diagrams.

The second set of tools (**Hydrogeological Analysis Tools**) is devoted to a better interpretation of the groundwater units, which in turn is crucial in modelling activities to define the conceptual model. Contour maps and further spatial operations of the depth of the hydrogeological units can be generated using customized queries. Likewise maps (e.g. piezometric map) can be created for the selected hydrogeological parameter, such as head level, depth to the water level or pumping rates, etc.

The interpreted data and calculations can be easily consulted in the same platform and can be used to build an updatable model for further interpretations.

The EU cluster ICT4Water

The ICT4WATER (<http://ict4water.eu>*) is a cluster of Information and Communication Technology (ICT) and water management oriented projects, all co-funded by the European Commission, with the common goal to increase efficiency in water management and enable greater cooperation among water regulators, operators and users by deploying solutions provided by Information and Communication Technologies.

The vision of the cluster is to establish and support a thriving and interconnected ICT for the Water Community with the main objective of promoting the dissemination and exploitation of the results of European Union (EU) funded activities in this area. Once the project ends, the vision is twofold: in one hand, contribute to advance in the consolidation of an ICT for the Water Community that will be better informed, defined and integrated than today; on the other hand, ICT4WATER will help the results and outcomes from current research projects improving their exploitation plans and increasing their dissemination potential by delivering co-produced knowledge to a wide range of stakeholders and actors within the water community.

The target community will be mainly composed of different stakeholders including Water Authorities, Water Operators, System Integrators, ICT for Water technologies professionals, Policy Makers, and the relevant industry at large. The academic and research community will be also targeted and is strongly represented in the cluster. Considering the

above, the following groups shall benefit from the cluster initiatives:

- Participants of the EU funded activities: i) CIP-ICT-PSP thematic network @qua focused on ICT for water efficiency; ii) FP7-ICT-2013.6.3 projects: **WaterERP**, **iWIDGET**, **EFFINET**, **UrbanWater**, **ICeWATER**, **WISDOM**, **DAIAD**, **ISS-EWATUS**, **SmARTH2O**, **Waternomics** and iii) other relevant ICT for Water EU funded projects, such as the new H2020 Water-4a projects: **WIDEST**, **FREEWAT**, **KINDRA**, **WaterInnEU** and **BlueSCities** (new members of the cluster).
- Members of significant international associations like: i) International Water Association (IWA) with 10,000 individual and 500 corporate members in 130 different countries, including scientists from across many disciplines, economists, accountants, social scientists, and managers and leaders among those professions; and ii) **WssTP** with 98 members and a network of more than 700 individuals from industry, research, technology providers, policy makers and water users.
- The stakeholder network of ICT for the Water Community, including academic and research communities, industry, water technologies professionals, Small and Medium Enterprises (SMEs), start-ups and the public at large, end users and customer organizations.
- Decision makers trying to identify the most promising outcomes from research and innovation research areas.



This vision entails the following particular ten goals:

1. To aggregate and promote ICT for Water management projects by developing an updated portfolio of promising and disruptive innovations for effective technologies of varying readiness levels, contributing to the implementation of the “European Innovation Partnership on Water - Strategic Implementation Plan”;
2. Support discussion and collaboration among key academic and commercial stakeholders;
3. Encourage a sustainable collaboration infrastructure, including ICT communities, water stakeholders and policy makers;
4. Foster ICT for Water and ICT standardization efforts regarding to semantic interoperability and ontologies;
5. Contribute to identify gaps/barriers/bottlenecks on existing regulations blocking innovations and smart technologies;
6. Contribute to the achievement of EIP “Smart technologies” and “Decision Support System and Monitoring” priorities objectives;
7. Advise on needs for policy development for increasing efficiency of funding smart technologies;
8. Develop roadmap for effective implementation of a holistic approach of ICT tools through 2020;
9. Disseminate knowledge and strategic objectives to the water community at large;
10. To enhance implementation, interoperability and standardization, together with bringing economy of scale and business opportunities to the already existing solutions on the projects portfolios.



▲ Lake Svet, Trebon basin



▲ Trebon basin - the fishing out



▲ Flooding in Prague



These projects have received funding from European Union's Seventh and H2020 Framework Programmes from research, technological development and demonstration.

FREEWAT at the IAH Congress, Rome, 13 September 2015

On 13 September, a course on FREEWAT capabilities was organised by Rudy Rossetto (Scuola Superiore S.Anna), Laura Foglia (TU Darmstadt) and Iacopo Borsi (TEA SISTEMI), as a PRE-CONGRESS COURSE within the IAH 2015 International Conference in Rome.

Laura Foglia, Iacopo Borsi (on behalf of the FREEWAT Developers Group) presented the FREEWAT project and capabilities of the software platform which is going to be released. Mary Hill (University of Kansas) - who is chairing the FREEWAT Advisor Board - delivered an overall presentation on capabilities of the most important hydrological codes included in FREEWAT, namely MODFLOW and UCODE.

The course was attended by about 25 students of the Early Career Hydrogeologists Network, coming from different countries (Europe, South and North America). All of them showed great interest in future FREEWAT achievements and progress.



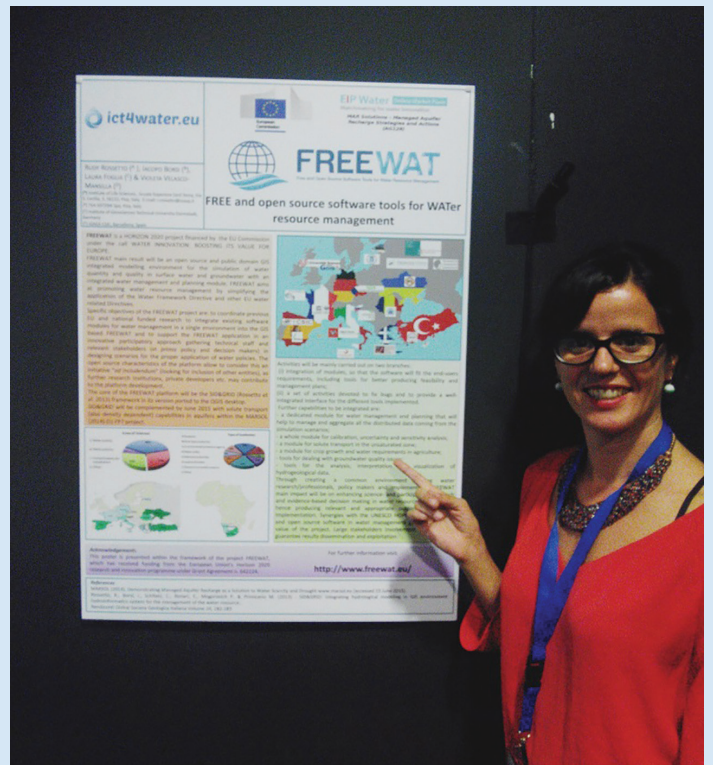
▲ From left: Mary Hill, Laura Foglia, Iacopo Borsi

On Thursday 17th the FREEWAT project was presented at the Workshop WATER PROJECTS IN HORIZON 2020. During the workshop, the “water” projects granted by the European Commission during 2014 under the European Horizon 2020 Research Programme were illustrated, by their Coordinators and partners. Knowing more about these projects represented an opportunity for the IAH community to create synergy at EU and international level on groundwater issues.

ICT4Water Open Day, Barcelona, 22 September 2015

The FREEWAT project was presented in the Poster Session of the ICT4Water Open Day by two of the partners of the project: Violeta Velasco (CSIC) and Youssef Filali-Meknassi (UNESCO).

The ICT4Water Open Day, which is one of reference event of Information and Communications Technologies (ICT) applied to water, was celebrated in Barcelona (Spain) on 22nd September 2015.



▲ From left: Violeta Velasco (CSIC), Youssef Filali-Meknassi (UNESCO)

Water, Megacities and Global Change,

1-4 December 2015 - UNESCO HQ, Paris

Organised by UNESCO and Arceau IDF.



WATER, MEGACITIES
AND GLOBAL CHANGE

<http://eaumega2015.sciencesconf.org/>

EIP Water Conference,

10 February 2016, Leeuwarden, The Netherlands

EIP Water

Boosting opportunities – Innovating water

<http://www.eip-water.eu/highly-interactive-eip-water-conference-2016-concluded-leeuwarden>

World Water Day

22 March 2016 - Worldwide



<http://www.unwater.org/campaigns/world-water-day/en/>

European Geosciences Union General Assembly,

17-22 April 2016, Vienna, Austria



<http://egu2016.eu/>

4th African Regional Conference on Irrigation and Drainage (ARCID)

26-28 April 2016 - Cairo, Egypt

Organised by The Egyptian National Committee for Irrigation and Drainage (ENCID).



http://www.icid.org/4th_afrc_call_papers.pdf

4th IAHR Europe Congress,

27-29 July 2016, Liege, Belgium



<http://www.iahr2016.ulg.ac.be/>

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FREEWAT · 11/2015

Project Coordinator
Dr. Rudy Rossetto



Institute of Life Sciences
Scuola Superiore Sant'Anna
Via S. Cecilia 3
56127 Pisa
Italy

Website:
www.freewat.eu

LinkedIn:
https://www.linkedin.com/grps?home=&gid=8393137&trk=groups_guest_about-h-logo



The FREEWAT project has received funding from the European Union's Horizon
2020 Research and Innovation Programme under Grant Agreement No 642224