FREEWAT

Free and Open Source Software Tools for Water Resource Management

EU HORIZON 2020 Project

FREEWAT newsletter,
issue 2/ May 2016

1 Year of FREEWAT

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Content

One year of FREEWAT

One year is passed from the starting date of the FREEWAT project and yet several activities are going on and the first project results are seen.

On February 1st 2016, the beta version of the H2020 FREEWAT platform was released for the project Consortium partners. The present version consists in a plugin integrated within the QGIS GIS desktop using Spatialite as spatial database. Within the plugin, several tools and modelling components for the analysis of water quality and quantity are incorporated.

The modelling environment is based on the well-known codes of the MODFLOW family (USGS)- basically used for analysis of groundwater systems. The version integrated in FREEWAT is the MODFLOW One Water Hydrologic Model (MODFLOW-OWHM; Hanson et al., 2014), aiming at performing simulations of systems where conjunctive use of surface- and ground-water is of concern. It also includes a specific module to run management decisions and evaluate different irrigation scenarios, which is coupled to a crop growth module for simulating crop yield.

Along to this, simulation of solute transport in aquifers may be performed by means of the MT3DMS code (Zheng, 2010), including density dependent capabilities using the SEAWAT code (Langevin et al., 2007; USGS).

The modelling framework is completed by including GUIs to run automated codes

▲ Upward groundwater flow in Italy
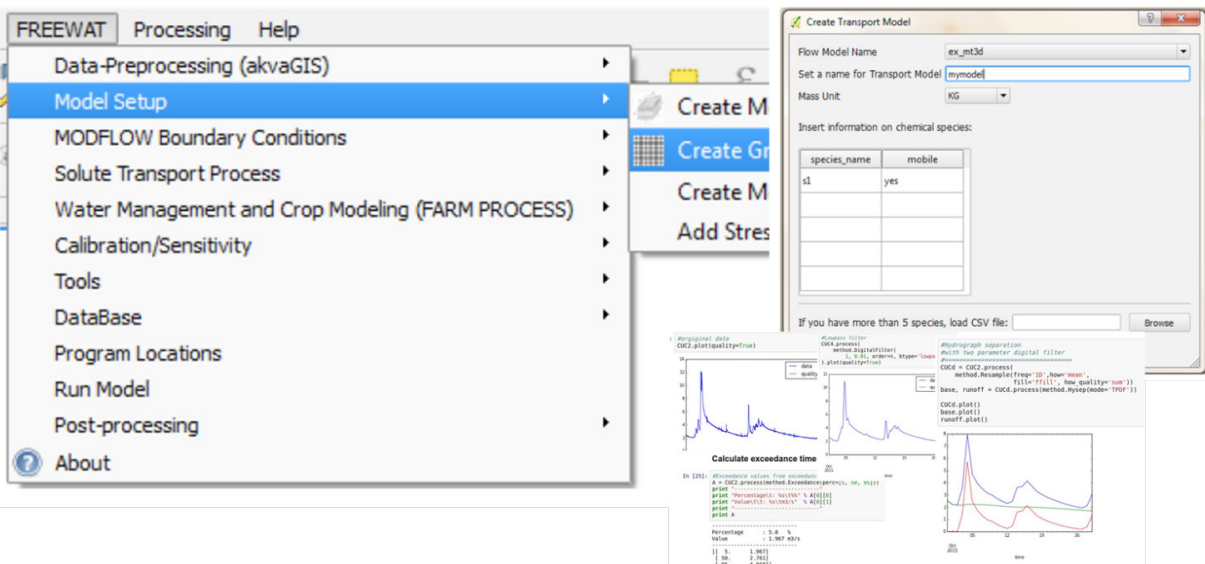
▲ Example of the FREEWAT main menu with some graphs produced using the OAT module

(UCODE_2014; Poeter et al., 2014) for assessing sensitivity analysis, calibration and uncertainty evaluation of hydrological models.

A set of tools to facilitate the management of a large number of physical and chemical parameters, to ensure compliance with standard regulatory guidelines (with a special focus on requirement deriving from the Groundwater Directive), is included via the akvaGIS module (developed by the IDAEA-CSIC partner).

Finally, the FREEWAT platform is improved by adding the following modules:

1. aquifer-lake interaction (integration of the MODFLOW - LAK7 package, USGS);

2. a tool for time-series analysis in data processing for model calibration (Observations Analysis Tool – OAT).

This beta version of the FREEWAT platform, along with six manuals aiming at highlighting capabilities ad functions, is now undergoing intensive testing thanks to the involvement of all the partners of the Consortium and associated stakeholders.

In the meanwhile, the FREEWAT community is growing, with about 380 participants in the LinkedIn EU H2020 FREEWAT group and some national LinkedIn groups started. Also TWITTER followers are increasing day by day with 280 followers.

All this thanks to the intense and passionate work done by all the people taking part in the FREEWAT Consortium.

Stay tuned for free software release on www.freewat.eu

Rudy Rossetto

Project Coordinator

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)

Technische Universitaet Darmstadt (TUDa)

Agencia Estatal Consejo Superior de Investigaciones Científicas (IDAEA-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. (AMALTEA)

Institut za Ekološki Inženiring (IEI)

Erciyes Universitesi (ERU)

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

National Institute of Hydrology and water management Bucarest (NIHWM)

University of Tartu (UTARTU)

Taras Shevchenko National University of Kyiv (TSNUK)

Paragon Europe (PRN)

Universitaet Bremen (BUGS)

International Groundwater Resources Assessment Centre (IGRAC)

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

Towards the second FREEWAT open workshop

ICT tools for ensuring availability and sustainable management of water (SDG6)

The workshop "ICT tools for ensuring availability and sustainable management of water (SDG6)" is an international event co-organized by the EU HORIZON 2020 FREEWAT project (www.freewat.eu) and UNESCO (partner of the project) in occasion of the FREEWAT project mid-term meeting. It is run in cooperation with the EU ICT4WATER cluster, with the support of H2020 KINDRA, and within the framework of the European Innovation Partnership MAR Solutions – Managed Aquifer Recharge Strategies and Actions (AG128).

In September 2015, countries adopted the 2030 Agenda for Sustainable Development to end poverty and promote prosperity while protecting the environment and addressing climate change.

The new 2030 Agenda has water and sanitation at its core, with a dedicated Sustainable Development Goal (SDG) 6 on water and sanitation and clear linkages to health, food security, climate change, resiliency to disasters and ecosystems, among many others. Reaching the ambitious objectives of the 2030 Agenda demands that we address universal access to drinking water and sanitation along with issues of quality and supply, along with improved water management to protect ecosystems and to build resiliency.

Objective of the workshop is then to discuss how Information and Communication Technology Tools (ICT) in the water sector may help in reaching the SDG6 related targets. A particular focus will be dedicated on how synergies between SDGs and the EU HORIZON 2020 Research and Innovation Programme may be created.

As the H2020 water projects aim also at boosting the job sector, potentialities of the water related ICT sector in targeting SDG#8 (Fostering Innovative Job Creation and Young Water Professionals Role) in the global change adaptation will be presented.

Speakers will point out which are the main and more relevant areas of water management that may benefit by applying ICT tools, and which ICT tools are available to particular sectors of water management. The needs of new ICT tools will also be devised. Through presentations of ongoing project activities and results, it will be possible to examine the state of the art of ICT with particular attention to open source and public domain software.

Speakers will also aim at raising awareness and interest on the role that ICT may play in promoting water resource management, through a deeper understanding of natural and manmade hydrological systems, especially when conjunctive use of surface- and groundwater within the water-energy and food nexus is of concern.

For further information write to: r.rossetto@sssup.it
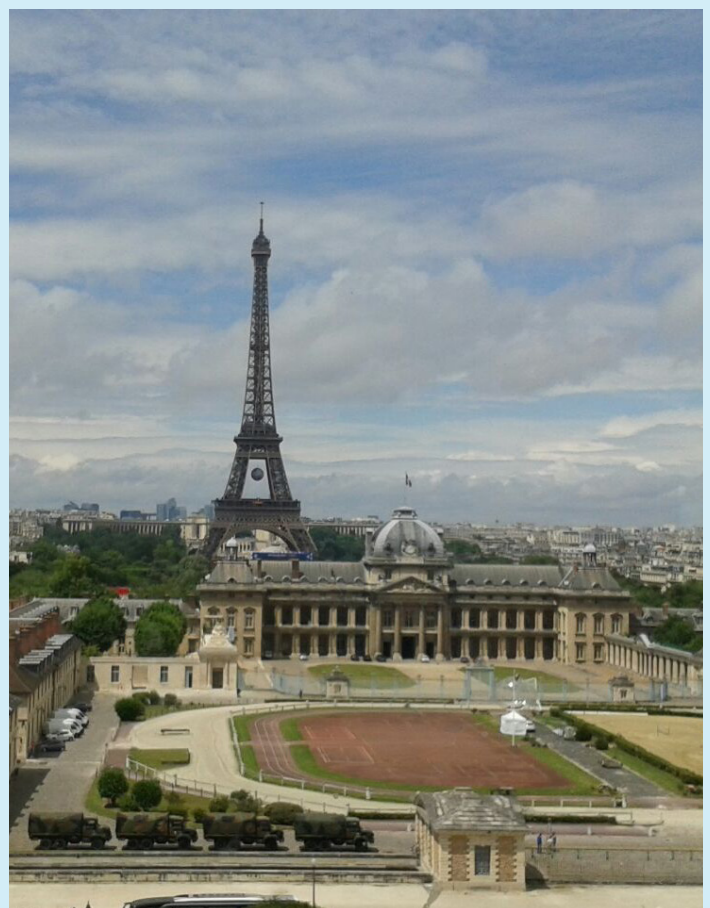
▲ View of Tour Eiffel from UNESCO main building

Training on the FREEWAT platform started

FREEWAT partners and associated stakeholders started training on the FREEWAT platform since November 2015.

First training activities were run within Task 3.1 – Preliminary training (Task leader: SSSA, all the partners involved). This preliminary activity was devoted to test the installation of a preliminary (unstable) version of the platform, which is the core of the customised version developed during the project. Afterwards, trainees were asked to perfom self-training (remotely driven) activities on using QGIS, on groundwater numerical modelling and to perform tutorials for testing the hydrological part of the platform. IGRAC also prepared and shared with the other partners contents related to the Global Groundwater Information System (GGIS) to be presented during the training. By this means, confidence on the software instrument was taken. Feedback was collected and relevant ideas and feedback came from all the Consortium participants.

Task 3.2 – Training of trainers (Task leader: IDAEA-CSIC, all the partners involved) activities started and one week training delivered at the premises of each case study partner (SSSA, UNESCO, METCENAS, ZETA, RT, IEI, ERU, NTUA/AMD, INHGA, PRN, UTARTU, TSNUK, BUGS, IST-SUPSI) by the FREEWAT Steering Group (SSSA, TEA, TUDA, IDAEA-CSIC) and IST-SUPSI to demonstrate all the platform capabilities. Training material was prepared (lecture notes, tutorials, etc.). The final version of the training material will be distributed through the web as soon as it will reach a stable form. Courses served as testing phase and feedbacks were collected to improve the platform. More than 100 people will form these courses.

▲ Trainers and trainees at the training week in Bucharest (INHGA partner)

Work in Progress

Sensitivity analysis and calibration in FREEWAT

The latest version of UCODE (UCODE_2014, Poeter et al., 2005; 2014), one of the inverse modeling codes supported by the U.S. Geological Survey, was integrated in FREEWAT. UCODE can be used with existing process models (such as MODFLOW) to perform sensitivity analysis, data needs assessment, calibration, prediction, and uncertainty analysis.

Sensitivity analysis, calibration, and uncertainty evaluation methods are recognized as critical to develop useful models of complex hydrologic systems, for which important characteristics cannot be measured accurately and(or) completely enough to define model input parameters (Saltelli et all, 2008; Hill and Tiedeman, 2007). These methods allow modelers to explore the relations between different types of data and the processes represented in the model, including the testing of hypotheses about system structure (alternative models). Models of natural systems are usually complex, include many different uncertain parameters to represent the different processes, and require significant computational effort; therefore the opportunity to gain insights on the model performance with fewer model runs is appealing. UCODE uses local perturbation methods for sensitivity analysis and nonlinear least squared regression using a modified Gauss-Newton method for model calibration. Compared to global methods, this approach is characterized by relatively frugal computational requirements and is well suited for complex models of natural systems (Foglia et al., 2007).

Why did we decide to integrate UCODE_2014 in FREEWAT? Why can these tools be important and useful for the stakeholders? We believe that the inclusion of inverse modeling capabilities is essential to ensure real-world applicability of FREEWAT. It is well known that calibration and uncertainty evaluation is crucial in practical applications of numerical hydrological models, and is necessary to increase model reliability and transparency. These are critical for comparing different models and model results when used by stakeholders and policy makers as decision support systems for water-resources management. Formal inversion methods have many advantages compared to trial-and-error calibration, which is often time consuming, subject to user bias, and provides little insight beyond the modelers' own intuition. Information provided by inverse modeling tools such as UCODE can be used to identify data and model shortcomings and properly guide the collection of new data and model improvements, minimizing time and economical effort in these critical tasks. It also provides a common framework for analyzing models and uncertainties, making comparisons more transparent, which is helpful when communicating results to stakeholders and policy makers.

Using available observations and the model outputs, the tools available in UCODE_2014 provide the connections between observations and model parameters (and further on, predictions) and allow users to answer critical questions related to their models. The basic question is "how does my model relate to the real world?". This question can be followed by more specific questions with the goals of understanding parameters-observations-predictions relationships.

Sensitivity analysis can help users answer the following questions:

1. Which parameters are supported by the observations?

2. Are any of the parameters dominated by a single observation?

3. Which parameters should be included in future calibration?

4. Which parameters are important for predictions of interest?

After performing sensitivity analysis, users can investigate estimation of parameters and consider questions such as:

1. Which parameter values produce the best fit to observations?
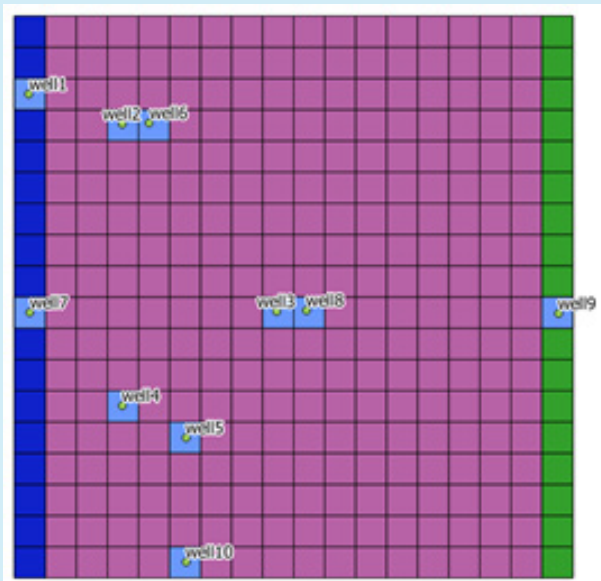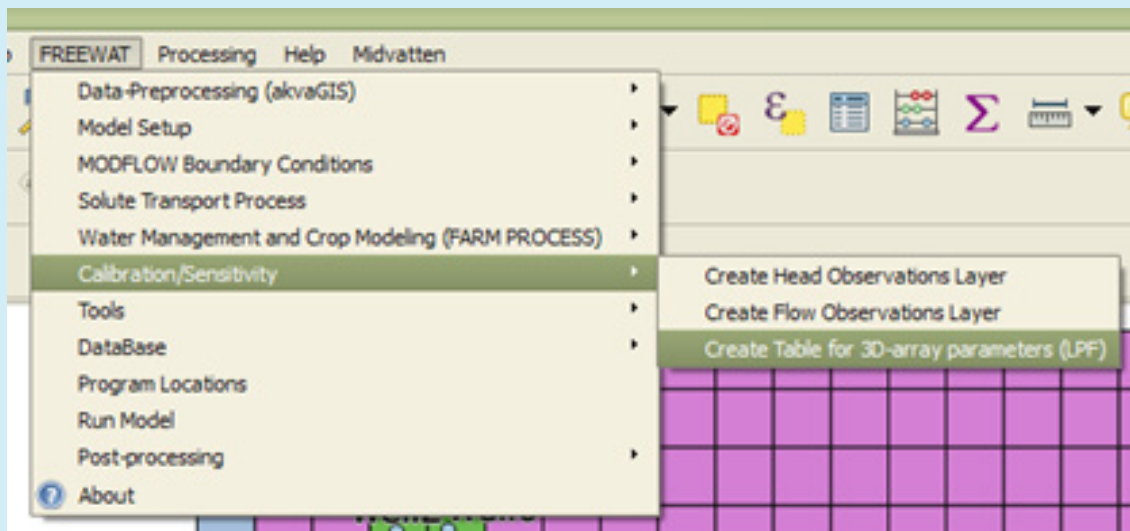
▲ **Example of the Model Data Object of observation heads**

2. Are these parameter values reasonable and unique?

3. Are all the processes properly represented in the model?

4. What is the uncertainty in the calibrated parameters and model predictions?

5. Which observations are important for making predictions?

The UCODE-FREEWAT linkage is ongoing, but the most important tools are already available. Many types of observations can already be included (such as groundwater heads, river flows, drain flows, general head boundary flows, and constant head boundary flows). Parameters that characterize aquifer properties as specified in the LPF (Layer Property Flow) package (hydraulic conductivities, vertical hydraulic conductivities, specific storage, and specific yield) can be estimated with sensitivity analysis and calibration provided within the UCODE-FREEWAT linkages. Parameters such as recharge, evapotranspiration, and conductances (for example for rivers or drains) will be supported in the near future. Tools for creating sensitivity and calibration plots and capabilities for evaluating the predictions of interest are under development.

Foglia, L., Mehl, S.W., Hill, M.C., Perona, P., Burlando, P. (2007): Testing alternative groundwater models using cross validation and other methods, Ground Water, Vol. 45:5, pp. 627-641, DOI: 10.1111/j.1745-6584.2007.00341.x.

Hill, M.C. and C.R. Tiedeman, 2007, Effective calibration of groundwater models, with analysis of data, sensitivities, predictions, and uncertainty, John Wiley and Sons, New York.

Poeter, Eileen P., Mary C. Hill, Dan Lu, Claire R. Tiedeman, and Steffen Mehl, 2014, UCODE_2014, with new capabilities to define parameters unique to predictions, calculate weights using simulated values, estimate parameters with SVD, evaluate uncertainty with MCMC, and More: Integrated Groundwater Modeling Center Report Number: GWMI 2014-02.

Poeter, E.P., Hill, M.C., Banta, E.R., Mehl, Steffen, and Christensen, Steen, 2005, UCODE_2005 and Six Other Computer Codes for Universal Sensitivity Analysis, Calibration, and Uncertainty Evaluation: U.S. Geological Survey Techniques and Methods 6-A11, 283p.

Saltelli, A., M. Ratto, T. Andres, F. Campolongo, J. Cariboni, D. Gatelli, M. Saisona, S. Tarantola, 2008, Global sensitivity analysis, The primer: Chichester, West Sussex, England, Wiley and Sons, 292p.

Laura Foglia (TU Darmstadt)
Steffen Mehl (Chico University - US)

NEW FEATURES IN QGIS 2.14

QGIS (http://qgis.org) is a user friendly open source Geographic Information System (GIS) that runs on Linux, Unix, Mac OSX, Windows and Android (QField).

QGIS has a strong community of enthusiastic people: around 300 developers, document writers, testers and ten of thousands of users.

In the last years, QGIS has become the worldwide Geographic Free and Open Source Softwares (GFOSS) used thanks to all the features implemented and the enhancement made.

Besides the ease of use of the interface, one of the biggest advantages of QGIS is that the user may use thirdly parts software (GRASS, SAGA, R, OTB, Lidar Tools) thanks to the Processing Framework (also known as Sextante plugin). In this way, the user has one single interface where to run several different algorithms. Moreover, the algorithm number is increasingly growing.

A new stable version of QGIS is released every 4 months and a Long Term Release (LTR) is released every year. LTR releases allow a stronger reliability of the algorithms and the whole software infrastructure without breaking the interface and the existing functions.

The last stable release is known as QGIS ESSEN 2.14 and it is a LTR release. This version will be maintained for 2 years because of the Python3/Qt5 migration of QGIS.

The migration to Python3/Qt5 will be made step by step and will be also supported by several tests. The first QGIS release with Python3/Qt5 support will be the first 3.x release and even though the user will not notice the changes, the whole software structure and code will be enhanced with new functions.

In the last version of QGIS several improvements were made. Each QGIS release is followed by a complete changelog, that is a detailed description of the changes:

(https://www.qgis.org/it/site/forusers/visualchangelog214/index.html)

One of these new functions is the support for virtual layers. Each loaded layer can be treated as a virtual layer, meaning a very easy performing of SQL-like queries on the layers and adding them on the map without breaking the original structure of the layer and without storing new data on the disk.

Another improvement is the extension of the 1:N (one to many relation) to the N:M relation (many to many). Even though QGIS is not a Database software, this functions are very useful for the user that has not experience with Database relational software.

Additional features have been added to the symbology functions. The most important is the new 2.5D symbology. This symbology type allows to simulate 3D effects on layers that are actually just plane polygons. The user can set the colors of both walls and shadows. Moreover it is also possible to set the shadow height depending on the polygon features. In this way the user can easily draw building with 3D effects and simulate a city plan map.

Finally, this symbology is compatible with the qgis2web plugin (https://plugins.qgis.org/plugins/qgis2web/) and the user can export the map as a complete and standalone webpage with just few clicks.

Another big feature for the symbology is the addition of the geometry generator. Using this symbology type, the user can use geometric functions to style the features: for example to combine the centroid of a polygon with a buffer for each feature.

The new trace digitizing tool allows the user to digitize/create features in one layer by tracing features of another layer. With this new method the feature creation is very comfortable and easy to use.

An important feature added are the qgis variables. These variables are like custom expressions that the user can define and use as global, project and even layer level. A very simple example of variable is @qgis_version: the user can use this variable in expressions, atlas and other useful application and the value given will be different depending on the
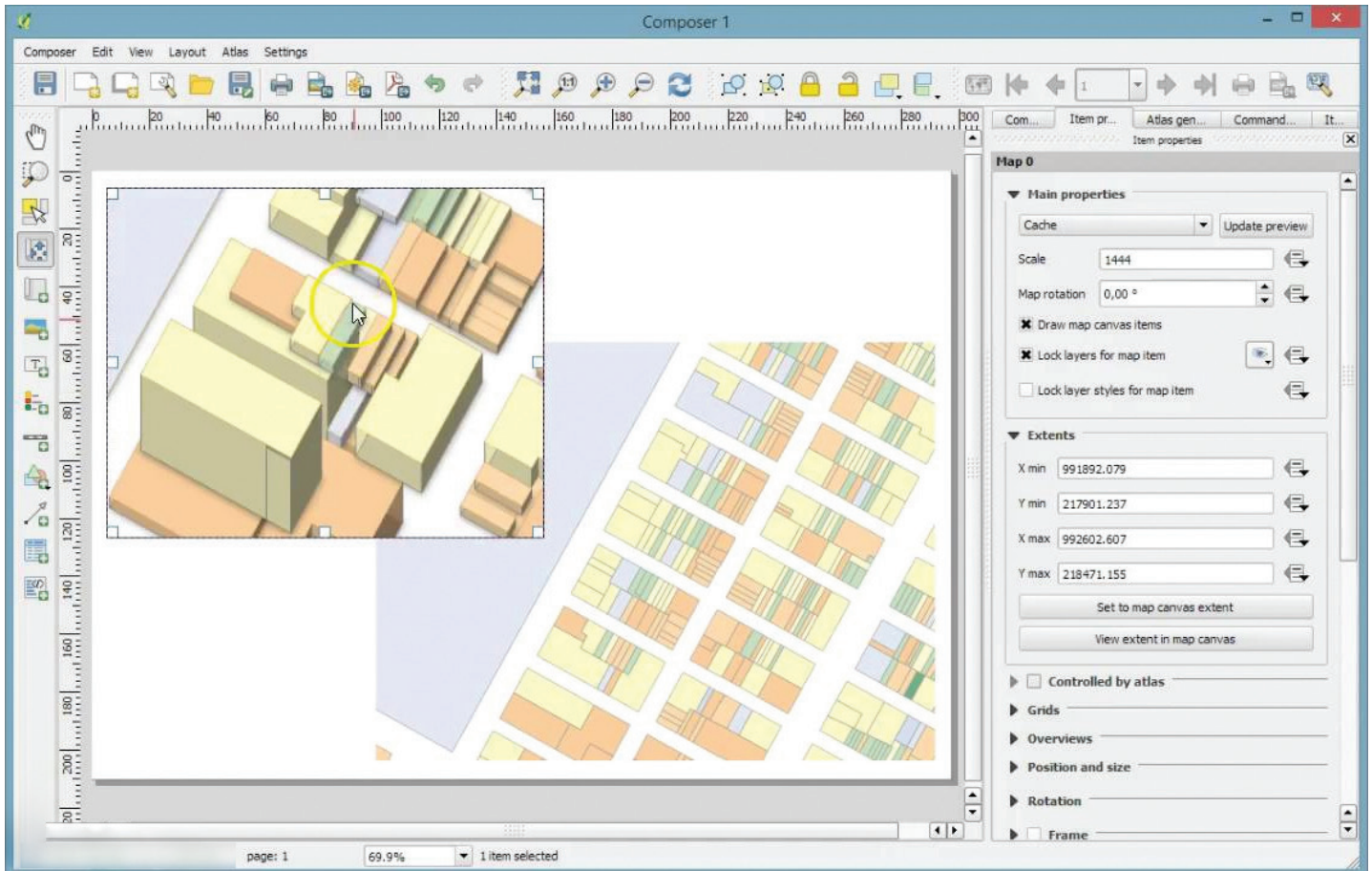
▲ **2.5D style in the print composer**

QGIS version installed on the machine.

Besides the graphical interface, a lot of enhancements behind the scenes were made: running algorithms, selecting features and saving new layers is now faster than in previous versions.

Matteo Ghetta
Scuola Superiore Sant'Anna, Pisa

▲ **Abandoned river meander to be used as infiltration pond in MAR scheme in LIFE REWT project (www.liferewat.eu)**

FREEWAT Participation

The ICT4Water Cluster at the ICT2015 exhibition in Lisbon, 20–22 October 2015

The H2020 FREEWAT Project along with the ICT4Water Cluster sister's projects attended the ICT 2015 exhibition – Innovate, Connect, Transform, which was held on 20–22 October 2015 in Lisbon, Portugal, organised by the European Commission, together with the Fundação para a Ciência e a Tecnologia.

The ICT 2015 event comprised a number of parallel activities:

- A policy conference presenting the new Commission's policies and initiatives on Research & Innovation in ICT (Horizon 2020 Programme);
- An interactive exhibition showcasing the best results and impact of most recent EU ICT Research & Innovation;
- Many networking opportunities to enhance quality partnerships, help participants find partners, connect Research and Innovation and trigger collaboration;
- Horizon 2020 Work Programme 2016–2017 thematic sessions, offering detailed information on the funding opportunities in ICT sector;
- The Startup Europe Forum, offering a set of activities profiling EU policy actions for startups and SMEs, innovators, private and public investors.

For more info:

https://ec.europa.eu/digital-single-market/en/ict2015

Almost 550 participants attended #EIPWater2016

On February 9th and 10th, the 2016 European Innovation Partnership (EIP) on Water Conference took place in Leeuwarden. The first day was dedicated to the EIP Action Groups meetings and networking, providing a thought-provoking and pragmatic exchange about innovation and how innovation partnerships in the water sector are progressing in Europe.

The FREEWAT project advancements were presented at the ICT4WATER cluster meetings and in the MAR to MARKET Action Group meeting on the 9th February. The FREEWAT project is involved in the latter group activities and during the meeting several potential synergies and exploitation cases were highlighted among AG partners and large collaborative projects, such as H2020 SUBSOL.

Leuwardeen is an inspiring place for anyone involved in water: The Netherlands have of course put water high on their national agenda and Leeuwarden (in the province of Fryslan) has created a stimulating environment by bringing together a wide variety of public and private stakeholders and great minds to research, develop, test and commercialise water solutions.

Speakers during the February 10th one-day conference (with almost 550 participants, scientists, innovators, policy-makers, economists, engineers, resource managers and investors from over 50 countries) appealed to stakeholders to be mission-driven and ambitious, with governmental agencies not simply taking on the role of facilitating private sector engagement, but being an integral part of the innovation chain by setting the roadmap, helping partners to navigate along it and ultimately being part of the team that celebrates the accomplishments. Among the speakers, Marianna Mazzuccato highlighted as this approach by state agencies led, for example, to the development of the internet and the smartphone, which took far too long and was far too crazy to have been attractive to private sector investors and developers.

The presentation by the City of London provided a good example of how such a big mission is absolutely critical to be able to master the stresses of climate change, rapid population growth and ageing infrastructure and avoid once more facing the "perfect storm" disaster that the city was facing after consecutive winter droughts in 2011 and 2012.

The Conference ended up with the Leeuwarden Declaration: Why and how to drive water innovation in Europe.

This declaration presents key findings and an European innovation action agenda that address the urgent need to accelerate the development and uptake of innovation – i.e. innovative approaches, technology and governance – in the European water sector.

*part of this content was derived from the EIP Water February 2016 newsletter

FREEWAT consortium grows: IGRAC and IST-SUPSI join the FREEWAT consortium

During this period the EC officially accepted and signed the amendment to the FREEWAT project to include IGRAC http://www.un-igrac.org and IST-SUPSI http://www.supsi.ch/ist_en.html as full partners of the FREEWAT Consortium.

igrac

International Groundwater Resources Assessment Centre

SUPSI

University of Applied Sciences of Southern Switzerland

FREEWAT presented during Mišič Water Day 2015, 09 December 2015

The traditional yearly national one-day conference for all those involved in water sector in Slovenia took place in Maribor, Slovenia on the 09th December 2015.

▲ Conference participants

During the Conference entitled the 26th Mišičev vodarski dan 2015 (26th Mišič Water Day 2015), the FREEWAT project was presented and dissemination material distributed.
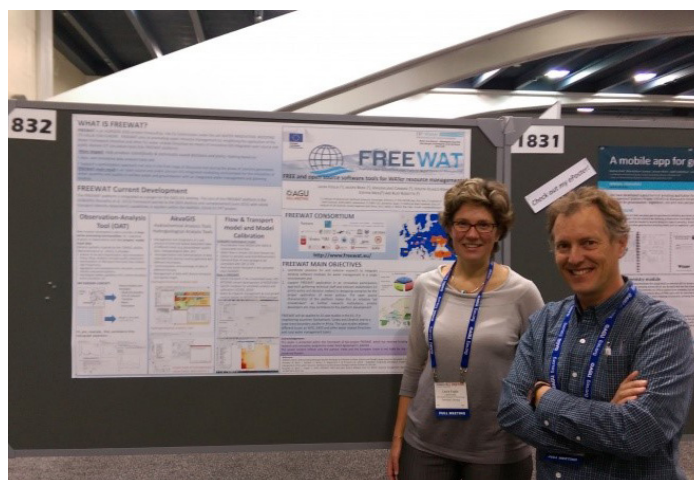
▲ The IEI partner group at the Slovenian Conference

American Geophysical Union, Fall meeting, 15 December 2015, San Francisco, California

AGU FALL MEETING
San Francisco | 14–18 December 2015

The FREEWAT project was presented by Laura Foglia, Enric Vazquez and Steffen Mehl at the American Geophysical Union meeting. An interesting discussion ensued about

▲ Laura Foglia (TUDa) and Enric Vazquez (IDAEA-CSIC) at the AGU meeting

future FREEWAT application outside the EU. Suggestions were made to use FREEWAT for teaching groundwater modeling classes in some universities in the US.

www.agu.confex.com/agu/fm15/meetingapp. cgi/Paper/69086

H2020 FREEWAT met FP7 WISDOM, 25th January 2016

The FREEWAT project was presented during a talk which was held by Rudy Rossetto on 25th January addressing Innovation and Governance in the water sector. This talk was delivered during the FP7 WISDOM (http:// www.wisdom-project.eu) seminar in La Spezia (Italy).


▲ **Participants at the seminar**

Both projects are part of the ICT4WATER EU cluster (www.ict4water.eu). Synergies and potential cooperation among the two projects were discussed.

FREEWAT at the Sustainable Groundwater Management Act Conference at University of California, Davis (US), 8–9 February 2016

The FREEWAT project was presented by Laura Foglia (TUDa) and Steffen Mehl (Chico University – US) at the conference "Role of models and Data in implementing SGMA" at University of California, Davis (www.grac.org/ role-of-models.asp).

The event included poster presentations for which the 'FREEWAT, a HORIZON 2020 Project to Build Open Source Tools for Water Management: A European Perspective'

was presented, as well as a Conference during which the topics discussed included Data & Models in the New Groundwater Sustainability Plans, Data Needs and Sources for Sustainable Groundwater Management, Water Budgets With & Without Models, Case Studies - Evaluating & Managing Undesirable Results using Data and Models, Getting More Out of a Model, Leveraging Existing Resources & Assessing Uncertainty and Surface-Water Availability, Reliability, and Potential Use.
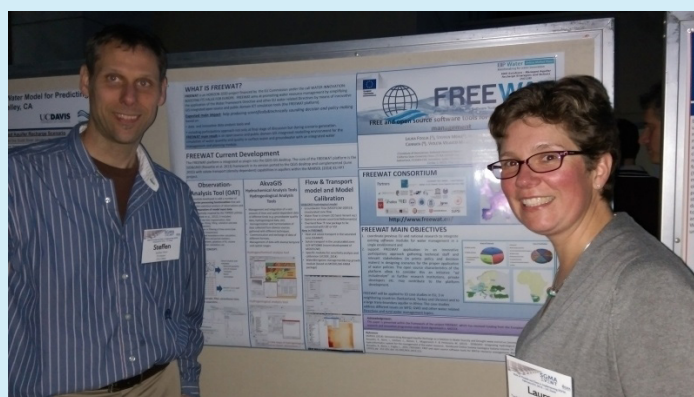
▲ **Laura Foglia (TUDa) and Steffen Mehl (Chico University – US)**

SGMA stands for Sustainable Groundwater Management Act and it represents the new regulation that has been approved in California at the end of 2014 for promoting groundwater management. It is the California equivalent of the EU Water Framework Directives and more details can be found at (water.ca.gov/ groundwater/sgm/index.cfm). Stakeholders, consultants and academics attended the conference and many consultants and stakeholders showed significant interest on our FREEWAT development and asked to test our beta version.

FREEWAT at the XVII Meeting of GRASS and GFOSS Italian Users, 11 February 2016

Massimiliano Cannata (IST-SUPSI) presented H2020 FREEWAT at the yearly meeting of GRASS and GFOSS Italian Users in Parma (Italy). The purpose of this meeting was twofold: the exchange of information and experience between GRASS users and in general of FOSS for the treatment of geographic information and the possibility for new or potential users to be provided

with information about the features of these systems and meet developers and experienced users.

This meeting, at its XVII edition, saw the participation of about 200 people from academia, the private sector and public administrations. It has been a great opportunity to disseminate the FREEWAT project and to provide an update on the state of the works. The presentation raised large interest both on the modeling participatory approach and on the innovative technology adopted so that the most asked question was: "when the code will be available so that I could use it?"

▲ FREEWAT Project being presented by Massimiliano Cannata (IST-SUPSI)

Further info on the meeting at http://meetingrass2016.unipr.it

FREEWAT met FATIMA, Avignon (France), 2-4 March 2016,

Rudy Rossetto, FREEWAT project coordinator, was invited to take part and to give a presentation on FREEWAT activities and expected results at the 2nd H2020 FATIMA (www.fatima-h2020.eu/) plenary meeting in Avignon - France, 2-4 March 2016.

FATIMA addresses effective and efficient monitoring and management of agricultural resources to achieve optimum crop yield and quality in a sustainable environment. It covers both ends of the scale relevant for food production, viz., precision farming and the perspective of a sustainable agriculture in the context of integrated agri-environment

management. It aims at developing innovative and new farm capacities that help the intensive farm sector optimize their external input (nutrients, water) management and use, with the vision of bridging sustainable crop production and fair economic competitiveness.

▲ R. Rossetto (FREEWAT project coordinator), Z. Boukalova (METCENAS, FREEWAT and FATIMA projects partner) and Anna Osann (FATIMA coordinator)

Potential cooperation among the two projects was discussed, especially related to the optimisation of the use of the water resource in the rural environment and the related capabilities available in the FREEWAT platform to deal with such issues.

H2020 FREEWAT at SMAGUA, 8-10 March 2016

The 22nd edition of the International Water and Irrigation Exhibition (SMAGUA) was held in Zaragoza from 8 to 10 March 2016. SMAGUA gathered 780 exhibitors and 32800 visitors, all of them related to water issues. SMAGUA is not only the most important fair and exhibition regarding water in Spain, with over 40 years of experience, but it is also an important reference in Latin America.

This year SMAGUA focused on innovation and the efficient use of water and energy. The exhibition involved 130 delegations from eleven different countries, strengthening commercial and technical collaboration among them.

A SMAGUA special meeting was dedicated to Peru and the challenges this country is facing regarding water availability and irrigation management. Peruvian stakeholders from the Ministry of Agriculture and Irrigation, National Water Authority, SEDAPAL and University of Ayacucho attended the meeting. The Minister of Rural Development and Sustainability of the Government of Aragon and the General Director of the Aragon Water Institute attended the meeting as well. Miguel Garcia Lapresta, the Amaltea's CEO, introduced FREEWAT to the audience, pointing out especially the possibilities that the modelling platform opens to improve the efficient use of water in agriculture. Further contacts to be held in Lima in late 2016 will seek for future collaborations between Aragon and Peru, where FREEWAT might play an important role.

www.feriazaragoza.es/Archivos/Descargas/ Smagua/2016/Bolet%C3%ADn%20 Postferia%20SMAGUA.16.pdf

FREEWAT at GIS-Forum 2016, Kharkiv (Ukraine), 15-18 March 2016

The Ukrainian GIS-Forum is an annual conference which attracts key stakeholders from the sectors of geospatial enterprise, research, education, and public administration.

▲ **FREEWAT Project being presented by Daria Svidzinska (TSNUK)**

The FREEWAT platform and activities were presented by Daria Svidzinska (TSNUK). The presentation raised interest among attendees, interested in when the tools will be available for public use. The Organising Committee suggested that a practical workshop be delivered at next year's conference.

More information can be found at the GIS-Forum web-page: http://gis-forum.org.ua

This year's program can be found at: http:// gis-forum.org.ua/schedule

Workshop Integrating MODFLOW (USGS) in QGIS, 21st April 2016

A workshop on integrating the MODFLOW code (USGS) in QGIS was held at Scuola Superiore Sant'Anna, Piazza Martiri della Libertà, Pisa.

During the event, the capabilities of such integration were presented and discussed.

The discussion also included issues such as synergies among spatial databases and numerical models (including codes for solute transport in aquifers) and optimisation of information flux.

Training the Trainers Courses started in Malta, 01-05 May 2016

The first of the Training the Trainers courses kicked off in Malta during the first week of May.

These training courses were being delivered by the FREEWAT core team (SSSA, TEA, TUDa, IDAEA-CSIC, IST-SUPSI) and took place during three months.

▲ **Trainers at the course held in Malta**

Upcoming Water Events

50th Anniversary of the Consejo Superior de Investigaciones Científicas (CSIC),
12-13 May 2016, Barcelona, Spain

The FREEWAT project will be presented at this event, which will take place over two days in Barcelona.

https://50aniversariocihs.wordpress.com/2016/02/09/jornadas-celebracion-50-aniversario-cihs-1966-2016

Citizen Observatories for Water Management,
7-9 June 2016, Venice, Italy

The Conference will focus on the potential of Citizen Science in the European water innovation landscape, and in particular in the fields of flood risk management, environmental monitoring and meeting the challenges of the European Water Framework Directive (2000/60/EC) and Flood Directive (2007/60/EC).

CQWM
Citizen
Observatories for
Water
Management

http://www.conwater2016.eu/index.php/en

Geosciences and Information Technology Annual Meeting,
13 – 15 June 2016, Torino, Italy

The Geosciences and Information Technologies group forms part of the Italian Geological Society, and brings together information technology in support of geosciences.

http://www.gitonline.eu/GITTMP/index.html
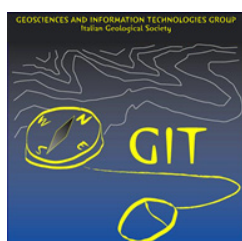
13th IWA Leading Edge Conference on Water and Wastewater Technologies (LET2016),
13-16 June 2016, Jerez de la Frontera, Spain

Conference Theme: Evaluating Impacts of Innovation

The leading edge technology conference (LET) is devoted to innovation in the field of water technology, allowing to bring research and development to rapid practical application. This IWA initiative improves the instruments for water management, and widens their scope, with a focus on integrating urban water systems and river basins.

www.let2016.org

Water Innovation Europe 2016, WssTP Stakeholder Event,
21-23 June, Brussels, Belgium

Water Innovation Europe 2016 is addressing 'Water Smart: European Solutions for a smart water society

Water Innovation Europe 2016

http://www.waterinnovationeurope.eu

13th International Conference on Modelling, Monitoring and Management of Water Pollution,
27 – 29 June 2016, San Servolo, Venice, Italy

Water Pollution 2016 is the 13th International Conference in the series of Modelling, Monitoring and Management of Water Pollution. The conference, which has always been very successful, provides

WATER POLLUTION 2016

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San Servolo, Venice, Italy
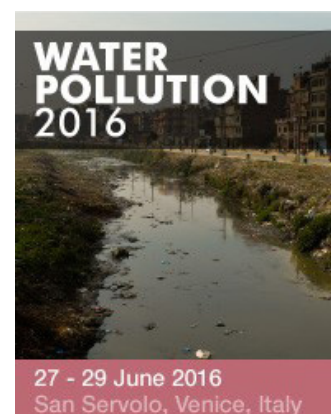
a forum for discussion amongst scientists, managers and academics from different areas of water contamination. The wealth of information exchanged in this international meeting continues to be of great benefit for water pollution problems.

http://www.wessex.ac.uk/conferences/2016/water-pollution-2016

Sustainable groundwater in agriculture: linking science and policy,
28 – 30 June 2016, San Francisco, California

This three-day international conference will again bring together leading scientists, policy analysts, policy and decision makers, and agricultural and environmental stakeholder groups to define and highlight the science, challenges, and potential policy solutions in agricultural groundwater resources management and groundwater quality protection that will provide a sustainable future at regional, national, and global scales.

Conference Themes: Groundwater Management, Governance, Policy, and Regulation, Agricultural Water Use, Conjunctive / Integrated Management; Socio-Economic Aspects of Agricultural Groundwater; Climate, Energy, and Agricultural Groundwater; Agricultural Groundwater Quality and Contamination, Regulation; Groundwater at the Agriculture-Urban Interface; Groundwater Linkages to Groundwater-dependent Ecosystems; Forecasting and Modeling.

http://ag-groundwater.org/

4th IAHR Europe Congress,
27-29 July 2016, Liege, Belgium

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

SmartH2O Summer School,
21-25 August 2016, Monte Verità - Switzerland

Modelling, Simulation, Analytics and ICT for Behavioural Change

This Symposium and Summer School aims at exploring the perspective of urban water demand management for the next years.

Several topics are going to be addressed, with a particular attention on modelling and understanding the behaviour of water consumers, the drivers of such behaviour, the role of social norms, economic leverages and water demand management strategies to promote behavioural change, and the role of Information and Communication Technologies to support the design, implementation and deliver smart solutions for urban water demand management.

http://www2.idsia.ch/cms/smartwater

35th International Geological Congress,
27 August- 4 September 2016, Cape Town, South Africa

South Africa will be hosting the 35th 'World Cup of Geosciences' in 2016, the prestigious International Geological Congress (IGC), which is undoubtedly the most important activity of the International Union of Geological Sciences (IUGS).

The objectives of the IGC are the following.

- Contribute, in collaboration with and under the auspices of the IUGS, to the advancement of fundamental and applied research in the geological sciences.
- Provide a general assembly of geoscientists, spanning a wide range of geoscience disciplines, where ideas and information can be freely exchanged.
- Emphasize the geological specialties or challenges of the host country or region.
- Provide the opportunity, by way of geological excursions, to examine geological problems and features in the field.

http://www.35igc.org

FREEWAT

Free and Open Source Software Tools for Water Resource Management

EU HORIZON 2020 Project

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