European Commission

EIP Water Online Market Place
Matchmaking for water Innovation
MAR Solutions - Managed Aquifer Recharge Strategies and Actions (AG128)

FREEWAT
Free and Open Source Software Tools for Water Resource Management

FREE and open source software tools for WATer resource management

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FREEWAT - Free and Open Source Software Tools for Water Resource Management

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642224

FREEWAT is an ICT project for improving Water Resource Management (WRM)

MAIN EXPECTED RESULT

Open source and public domain GIS integrated modelling platform for promoting WRM by simplifying and **strengthening the application of WFD, GWD and other water related Directives.**

FREEWAT expected main impact →

***help producing scientifically and technically sounding decision and policy making based on*:**

- data and innovative data analysis tools
- including participatory approach not only in the final stage of discussion but also during the phase of scenario generation.

Concept and Motivations/1

1. ICT tools to boost the application of the WFD and water related Directives;

2. free and open source tools, numerically based, GIS integrated to perform spatial and temporal analysis on water quantity and quality issues;

3. training technical staff at authorities and private companies on the use of state-of-the-art innovative software for water management;

4. readily available ICT tools to analyze conjunctive use of surface-and ground-water, the impacts of land use and urban sprawling and of climate change on water resource;

Concept and Motivations/2

5. use effectively data provided by the extensive monitoring required by the WFD;

6. including participatory approach earlier than only result discussion;

7. capacity building within the EU water sector;

8. supporting scientific research results to foster their real scale application and uptake by policy makers and water authorities.

Open source characteristics of the project→

Initiative "*ad includendum*" - further research institutions, private developers, etc. may contribute to the project development.

MAIN OBJECTIVES

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 FREEWAT application in an innovative participatory approach **gathering technical staff and relevant stakeholders** (policy and decision makers) in designing scenarios for proper application of water policies.

FREEWAT CONSORTIUM

http://www.freewat.eu/

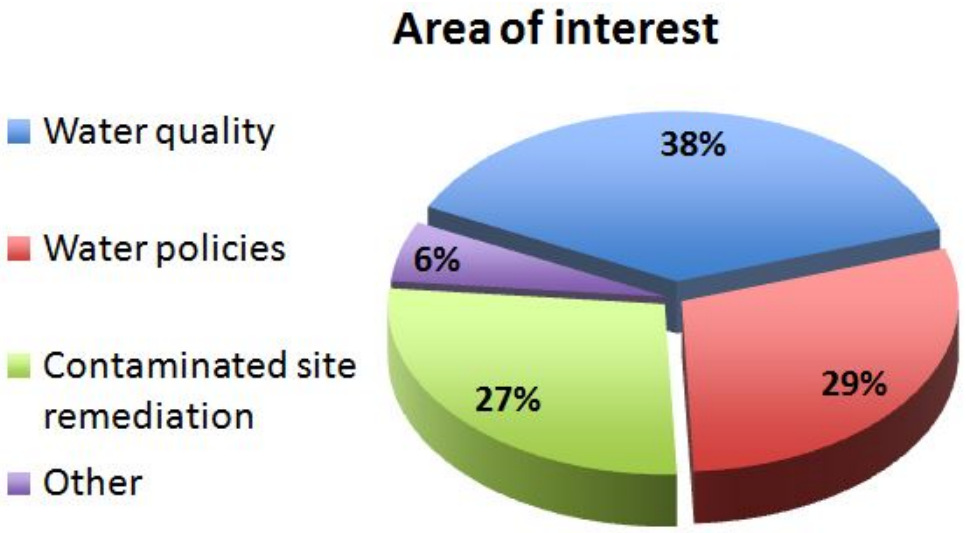
DURATION: 30 months – started April 1st 2015 – to September 2017

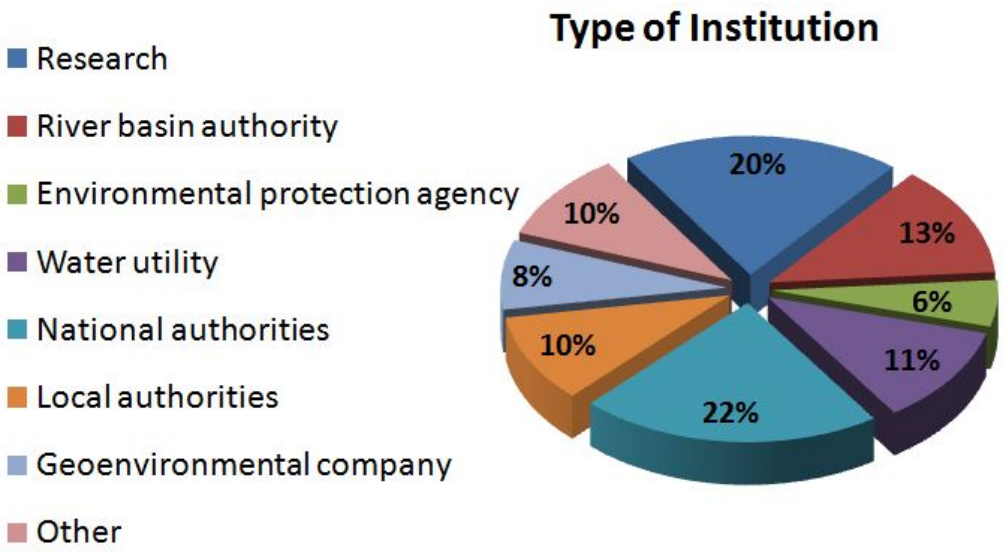
FREEWAT CAPACITY BUILDING

- Large stakeholders involvement (more than 200 stakes going to be involved)

- Web social and professional networks

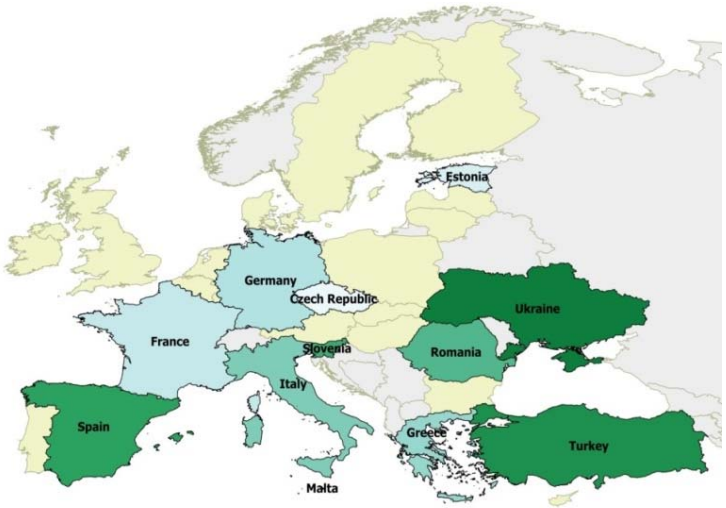
(linkedin group launche 272 followers)



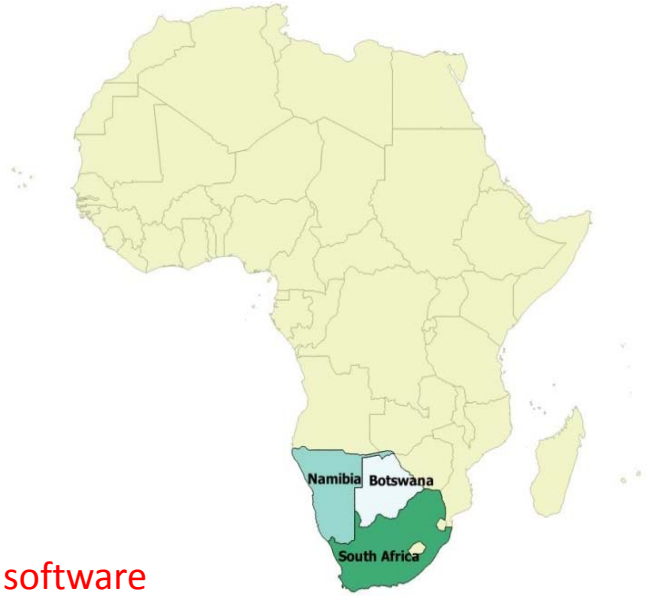


14 case studies:

8 for the application of WFD, GWD and others (EU countries) plus **1** case study in Switzerland (SUPSI, collaborating Institute)



5 devoted to rural water management: 2 EUs, Turkey, Ukraine, and Africa (through UNESCO involvement)



Training courses of the software platform for the case studies!!!

And now we are ready to move to the modelling platform!

- What comes from previously funded efforts?
- What new will be integrated into the FREEWAT platform within the FREEWAT project?
- Which other tools would you like to see there?

→ extremely useful and challenging answers about this from a questionnaire sent out to stakeholders all over Europe!!!

Previous EU and national efforts are integrated in FREEWAT

- **SID&GRID** (Regione Toscana): Surface water and groundwater flow and unsaturated zone processes in gvSIG GIS
- **MARSOL** (EU, FP7): solute transport in groundwater in MAR context
- **QUIMET** (Catalan Water Agency): GIS based hydrogeochemical analysis tools
- **REGIONE TOSCANA**: porting of SID&GRID into QGIS
- … plus not only EU-made codes

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FREEWAT SOFTWARE PLATFORM

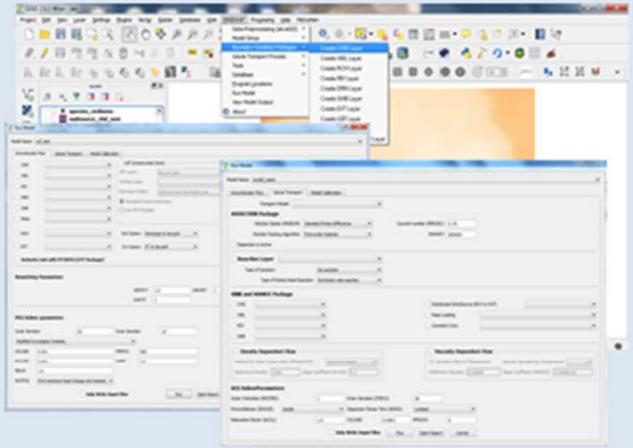
Flow & Transport model and Model Calibration

SID&GRID hydrological model

- Groundwater Flow (MODFLOW-2005) & Unsaturated zone flow
- Water flow in stream (1D Saint-Venant eq.)
- Option to activate Local Grid Refinement(s)

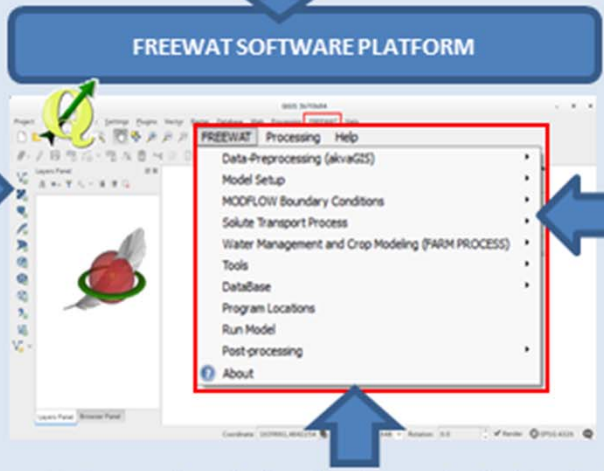
New in FREEWAT:

- Heat and solute transport in the saturated zone (SEAWAT)
- Solute transport in the unsaturated zone: UZF-MT3DMS (recent development of MODFLOW)
- Specific modules for sensitivity analysis and calibration (UCODE_2014)
- Water & Irrigation management & crop growth module (based on MODFLOW-FARM package)



Lake Packages

- Lake-groundwater interaction requires a code dynamically integrating groundwater, unsaturated zone and lake fluxes
- The package will be based on the MODFLOW – LAK7 package and on the flopy python package.



Observation-Analysis Tool (OAT)

OAT (Observations Analysis Tool) is a tool thought to bring time series data processing capabilities in FREEWAT in order to support advanced model calibration. It is designed to facilitate:

- the import of time series data into FREEWAT,
- the analysis of measures including visualization and elaboration,
- the management of data,
- the usage of these data in FREEWAT models calibration.

Hydrogeochemical and Hydrogeological Analysis Tools

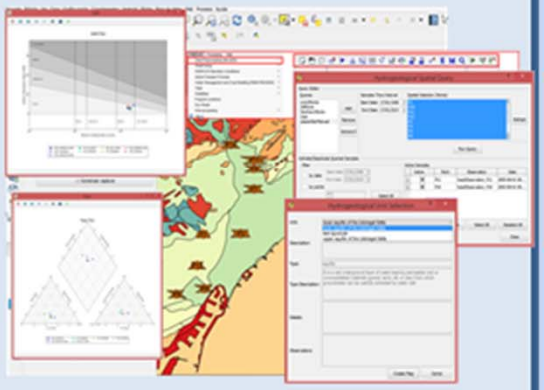
These instruments improve the management, analysis, calculations and interpretations of hydrochemical and hydrogeological data.

Hydrochemical Analysis Tools

These instruments for analysis cover a wide range of methodologies for querying, interpreting, and comparing groundwater quality data such as ionic balance calculations, chemical time-series analysis, correlation of chemical parameters, and calculation of various common hydrogeochemical diagrams (Salinity, Schöeller-Berkaloff, Piper, and Stiff).

Hydrogeological Analysis Tools

This set of tools is devoted to a better interpretation of the groundwater units. It include tools to analyze and visualize different hydrogeological measurements. Thus, contour maps and further spatial operations and the depth or thickness of the hydrogeological units could be generated using customized queries.



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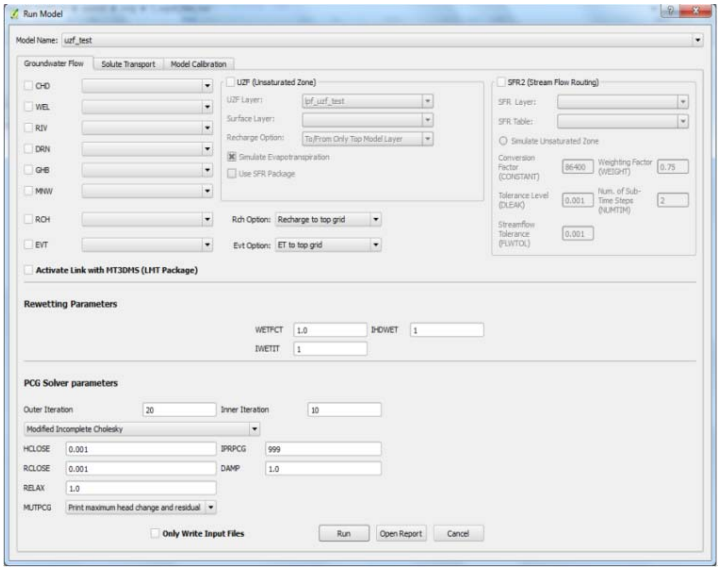

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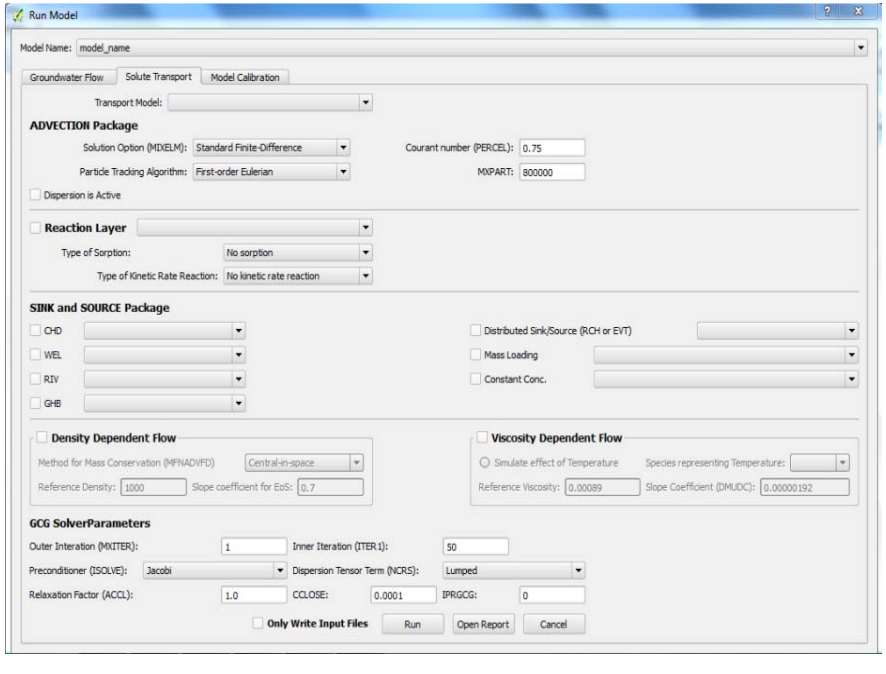

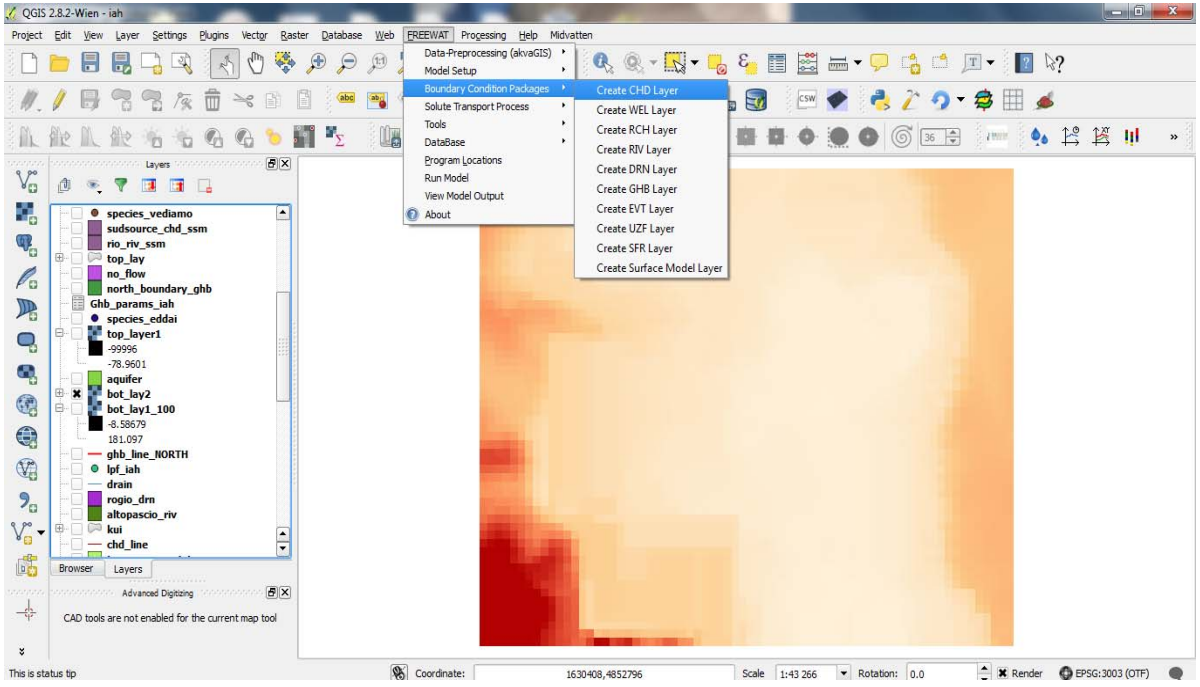

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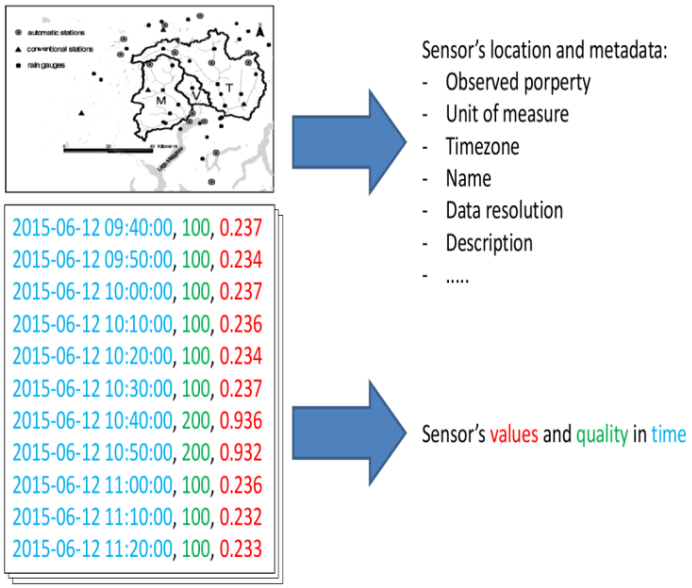

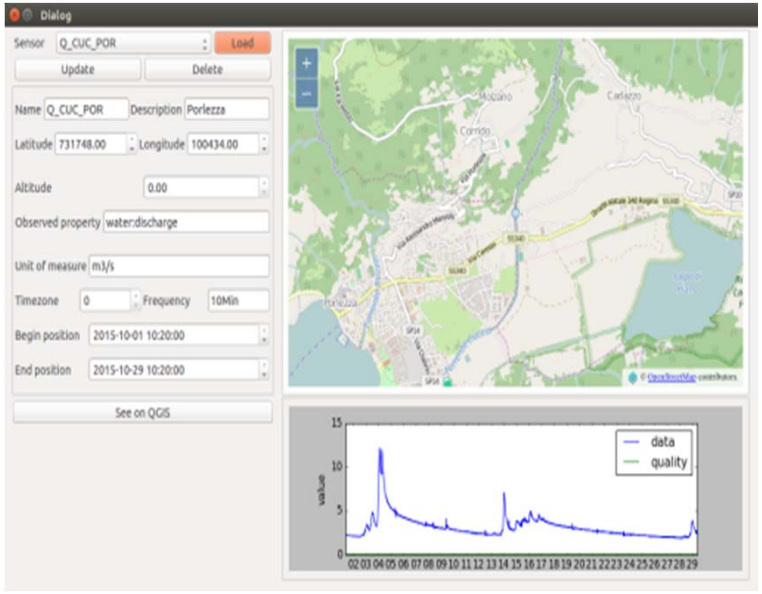

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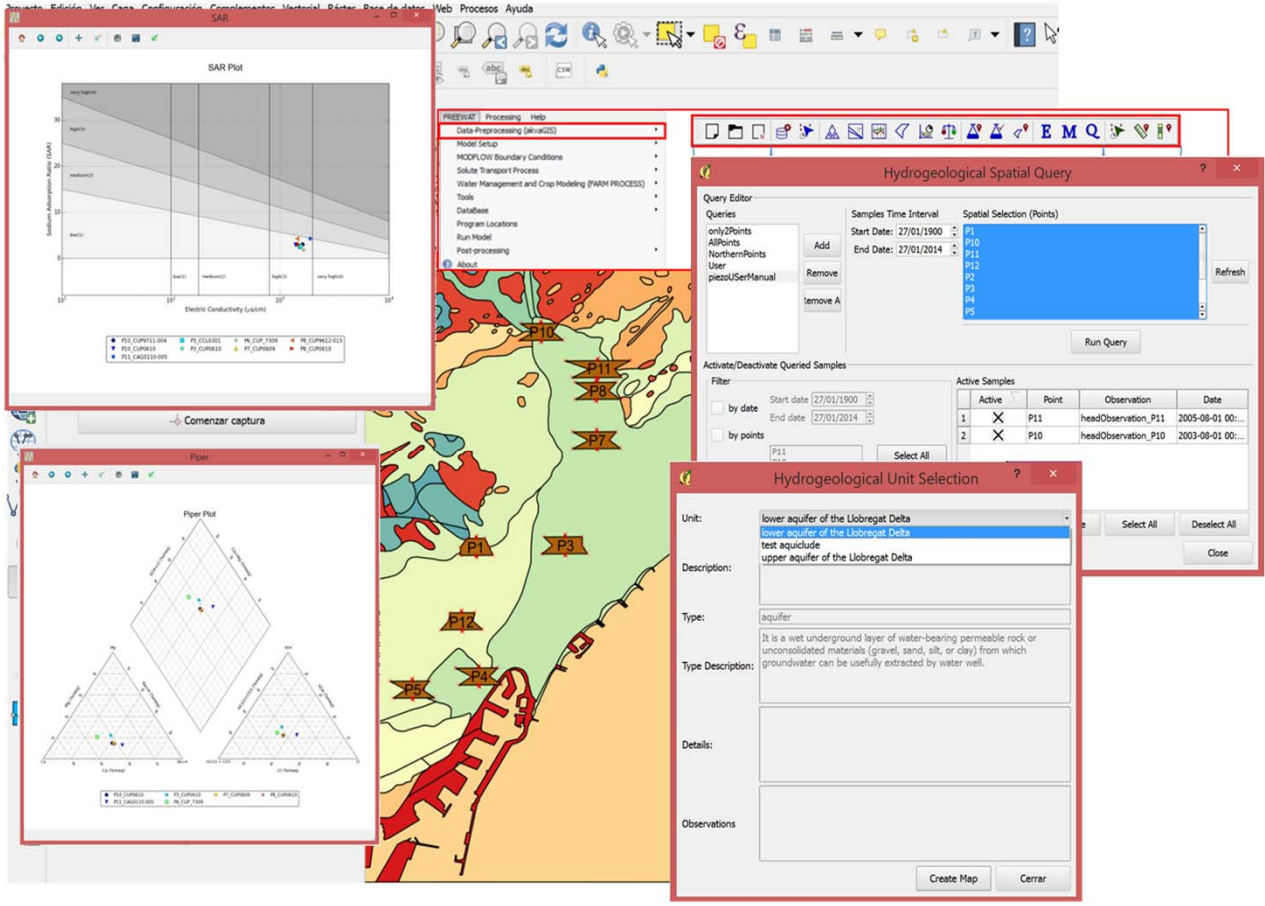

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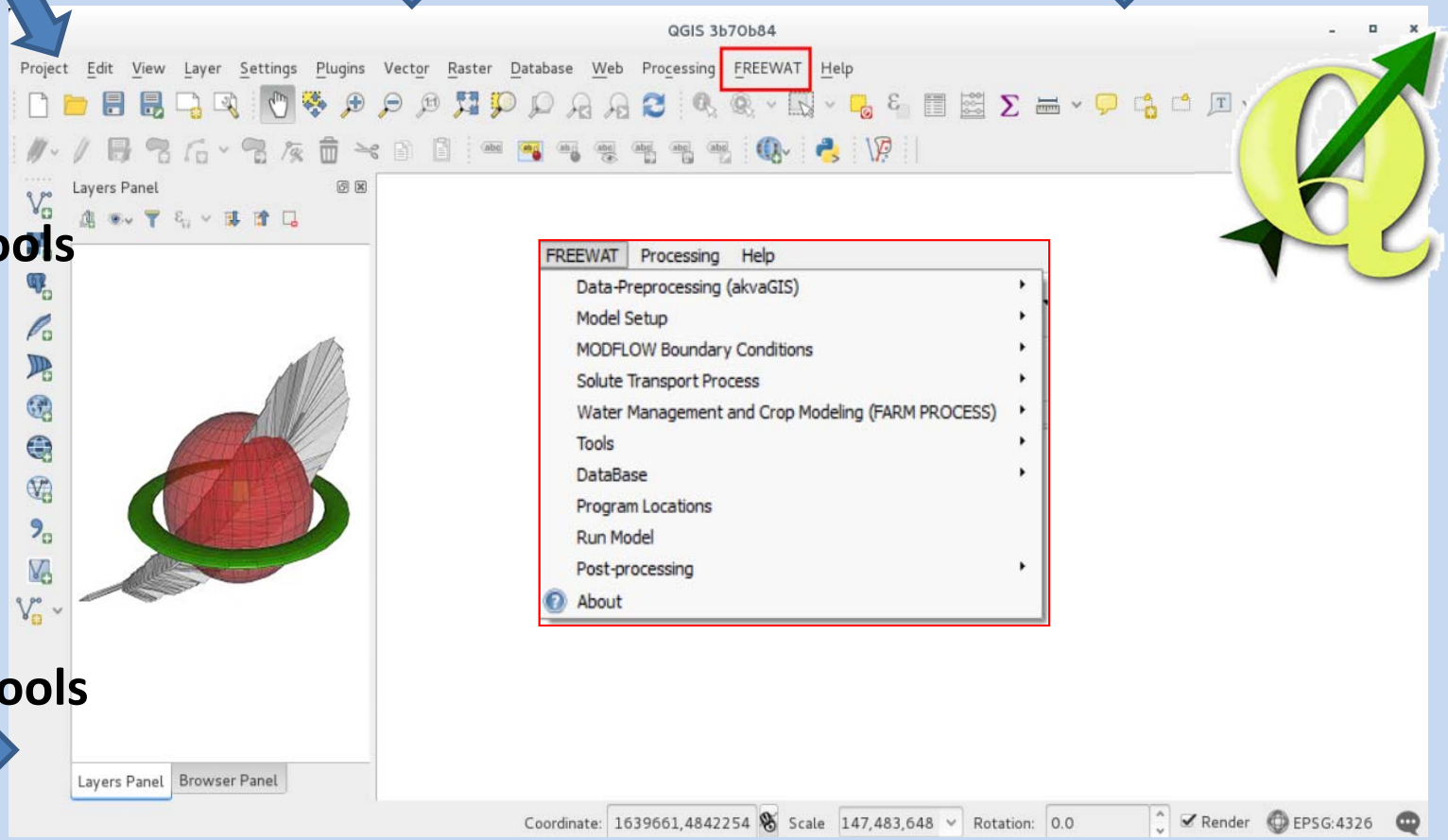

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FREEWAT PLATFORM ADVANTAGES vs. commercial simulation platform

- **Unite the power of GIS geo-processing and post-processing tools in spatial data analysis to that of simulation software**
- **The chance for public authorities to build a high informative and dynamically growing representation of a hydrologic system (i.e. river basin) where performing data storage and planning analysis**
- **WRM modules thought for decision-making and policy applications**
- **No cost for licenses (money can be moved to development of client tailored applications)**

POTENTIAL DRAWBACKS

How to manage some code interdependencies

Need for continuation after project life potentially market-dependant

A GROWING LARGE COMMUNITY OF DEVELOPERS TO BE BUILT

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EU HORIZON 2020 Project

Thank you for your attention!

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