



# FREEWAT

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



EIP Water Online Market Place

Matchmaking for water Innovation

*MAR Solutions - Managed Aquifer  
Recharge Strategies and Actions  
(AG128)*

## The Horizon 2020 FREEWAT project: FREE and open source software tools for WATER resource management

EIP Water Conference 2016

How is water innovation succeeding in Europe?  
Leeuwarden, The Netherlands - 10 February 2016



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INSTITUTE  
OF LIFE  
SCIENCES



Scuola Superiore  
Sant'Anna



# www.freewat.eu

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

# Concept and Motivations

1. free and open source tools, numerically based, GIS integrated, to perform to analyse conjunctive use of surface- and ground-water, and to boost the application of the WFD and water related Directives;
2. use effectively data provided by the extensive monitoring required by the WFD;
3. training technical staff at authorities and private companies on the use of state-of-the-art innovative software for water management;
4. including participatory approach earlier than only result discussion;

Open source characteristics of the project→

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



# WHY PUSHING WITH SIMULATIONS?

The **EU Water Framework Directive** recognizes as relevant modelling activities for:

- testing hypothesis on conceptual models;
- validating scenarios to be included in River Basin Management Plans;
- water resource evaluation and forecasting;
- large engineering works impact assessment;
- evaluation of effectiveness of proposed contaminated water remediation activities.





# FREEWAT Consortium

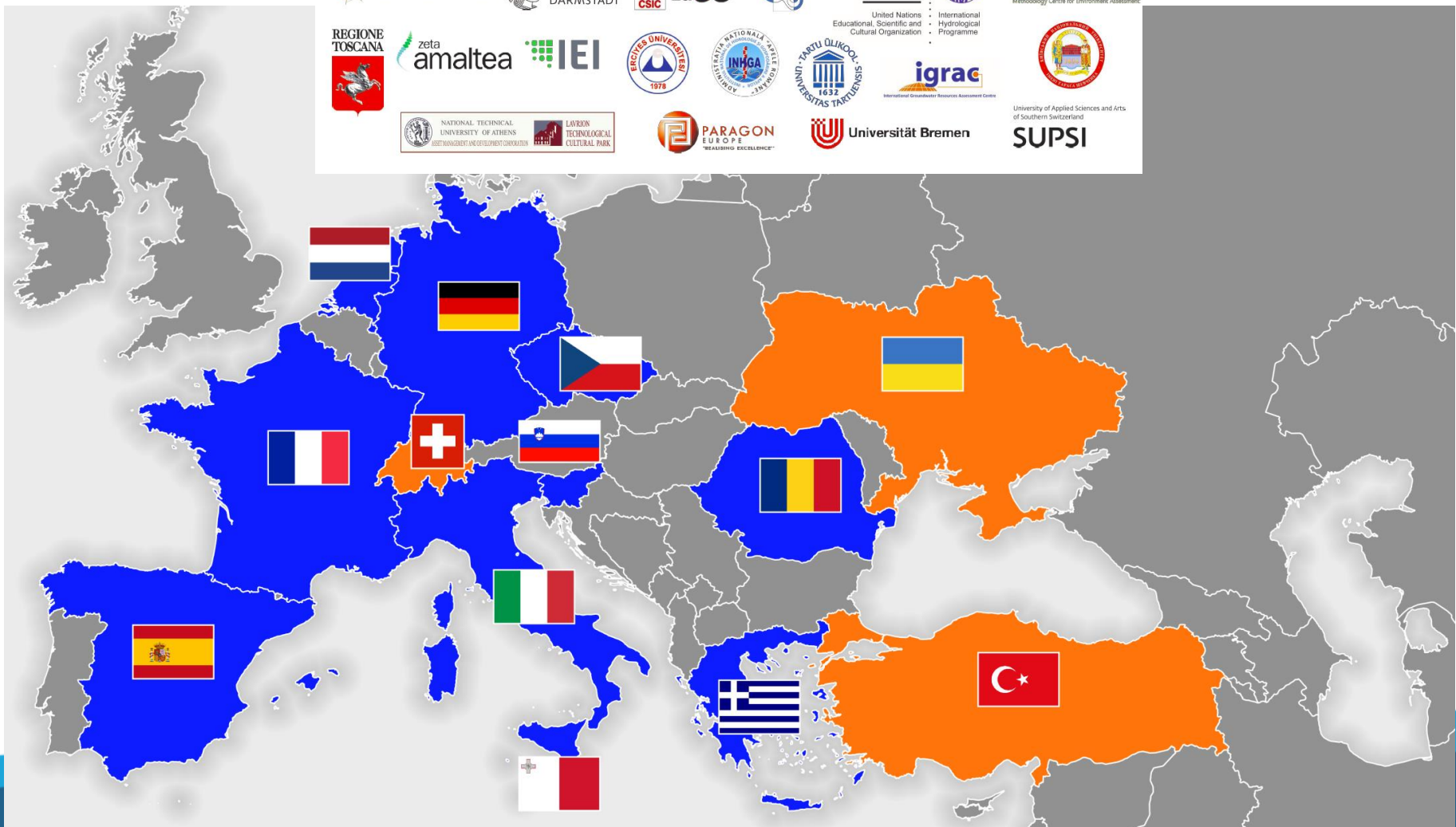
## Partners



Scuola Superiore Sant'Anna

Coordination: Rudy Rossetto - r.rossetto@sssup.it

Institute of Life Sciences, Scuola Superiore Sant'Anna (Italy)





# FREEWAT 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.

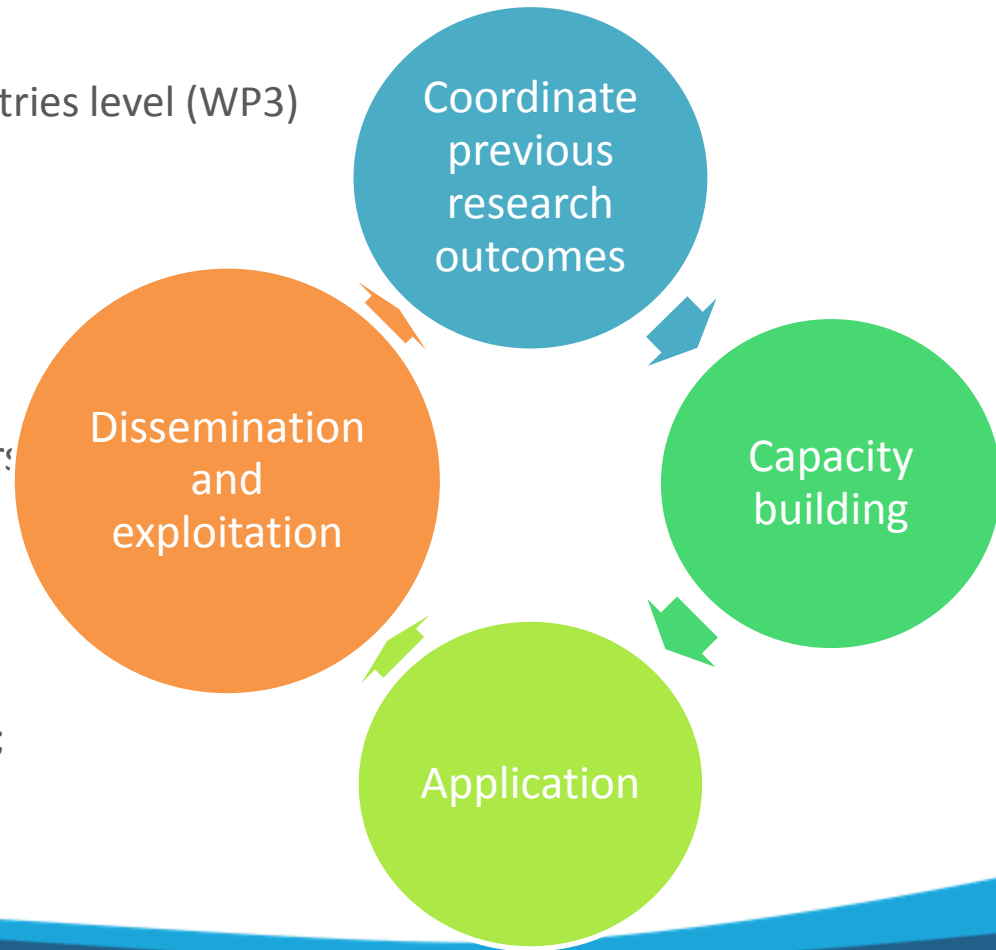
# FREEWAT circular economy

## *SOFTWARE DEVELOPMENT AND CAPACITY BUILDING*

- Building the software platform (WP2)
- Training the trainers (WP3)
- National scale training at Consortium countries level (WP3)

## *APPLY THE FREEWAT PLATFORM (WP4/5/6)*

- **Postulate the problem you have to solve;**
- Gather the data;
- Discuss the data with relevant stakeholders;
- Start the model implementation;
- Involve the stakeholders during model implementation and calibration;
- Apply the model for solving your problem;
- Producing policies!



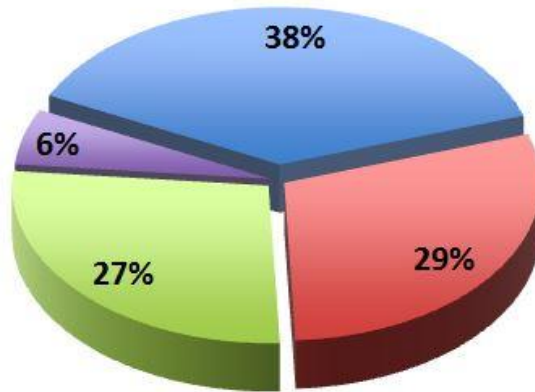


# FREEWAT CAPACITY BUILDING

- Large stakeholders involvement (more than 200 stakes involved)
- Web social and professional networks  
(linkedin group yet 320 followers – twitter: 180 followers @h2020freewat)

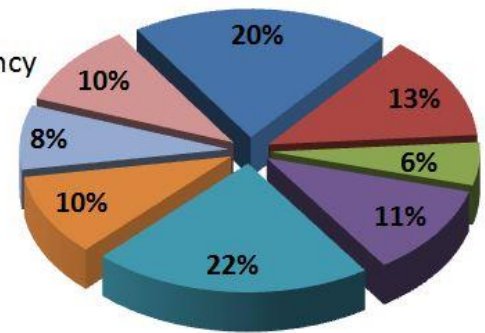
**Area of interest**

- Water quality
- Water policies
- Contaminated site remediation
- Other



- Research
- River basin authority
- Environmental protection agency
- Water utility
- National authorities
- Local authorities
- Geoenvironmental company
- Other

**Type of Institution**







# WHAT IS FREEWAT TODAY?



## A QGIS integrated modelling environment in its beta age!!!

**FREEWAT** Processing Help

- Data-Preprocessing (akvaGIS)
- Model Setup**
- MODFLOW Boundary Conditions
- Solute Transport Process
- Water Management and Crop Modeling (FARM PROCESS)
- Calibration/Sensitivity
- Tools
- DataBase
- Program Locations
- Run Model
- Post-processing
- About

**Extensive testing going on**

**Create Transport Model**

Flow Model Name: ex\_mt3d

Set a name for Transport Model: mymodel

Mass Unit: KG

Insert information on chemical species:

species_name	mobile
s1	yes

If you have more than 5 species, load CSV file:  Browse

```

#original data
CUC2.plot(quality=True)

#hydrograph separation
#with two parameter digital filter
#=====
CUCd = CUC2.process(
    method.Resample(freq='10', how='mean',
                    fill='ffill', how_quality='sum'))
base, runoff = CUCd.process(method.Hysep(mode='TPDF'))
CUCd.plot()
base.plot()
runoff.plot()

```

**Calculate exceedance time**

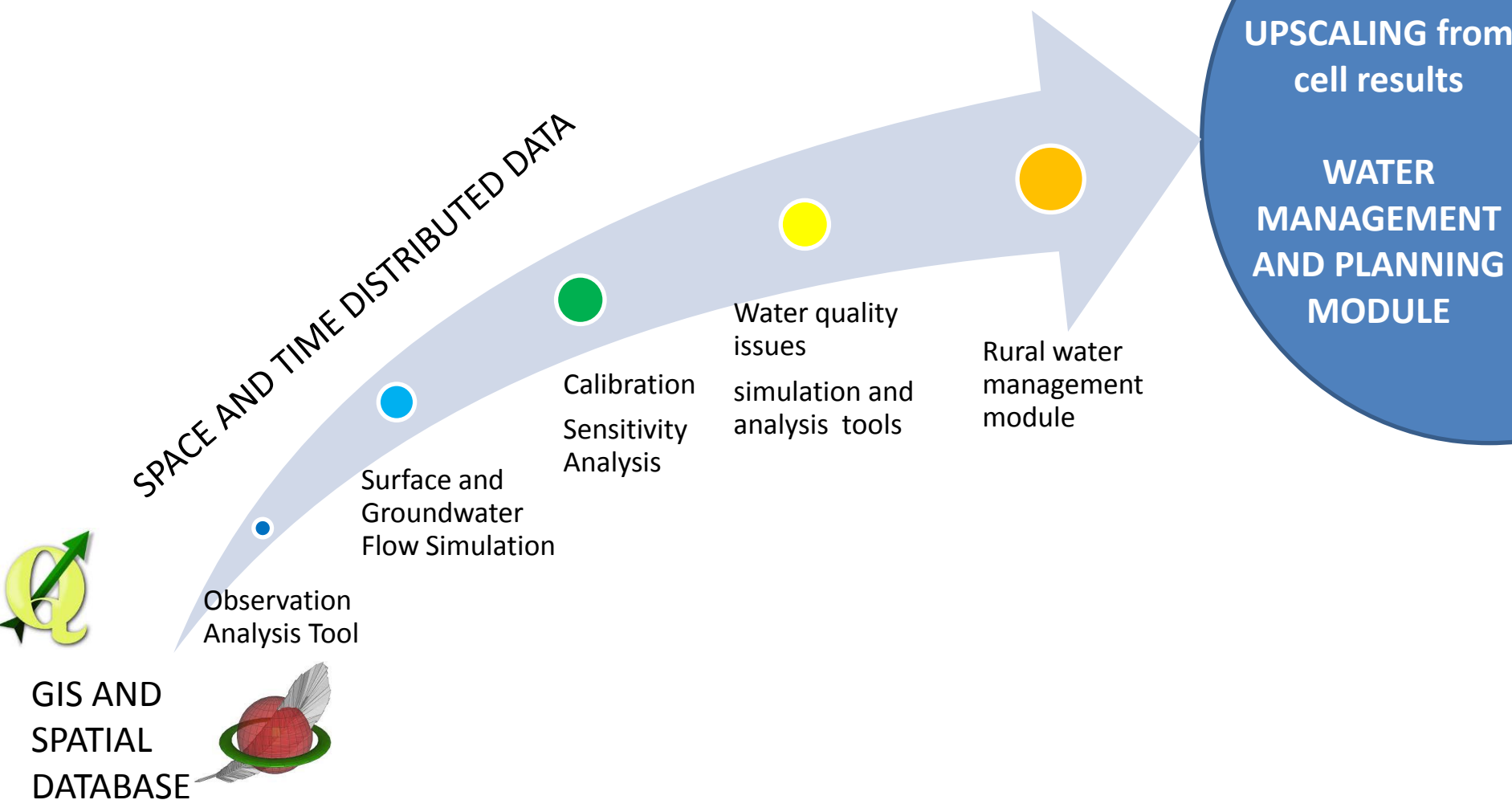
```

In [25]: #Exceedance values from exceedanc
A = CUC2.process(method.Exceedance(percp=10, 90, 90))
print "-----"
print "Percentage: %s%%" % A[0][0]
print "Value[1]: %s\m3/s" % A[0][1]
print "-----"
print A
-----
Percentage : 5.0 %
Value      : 1.967 m3/s
-----
[[ 5.  1.967]
 [ 50. 2.781]
 [ 95. 4.968]]

```



# FREEWAT architecture





# FREEWAT USER MANUAL

## **Volume 1**

**Groundwater modeling using MODFLOW-OWHM  
(One Water Hydrologic Flow Model)**

**by Giovanna De Filippis<sup>(1)</sup>, Matteo Ghetta<sup>(1)</sup>,  
Rudy Rossetto<sup>(1)</sup>**

## **Volume 3**

**Water management and crop-growth mod**

**by Giovanna De Filippis<sup>(1)</sup> and Rudy Rossetto<sup>(1)</sup>**

**Release Beta 1.0**

**V.a.1**

## **Volume 5**

**Observation Analysis Tool**

**by Massimiliano Cannata<sup>(1)</sup>**

**Release Beta 1.0**

**V.a.1**

January 31<sup>st</sup>, 2016

## **Volume 2**

**Heat and Solute Transport in Subsurface Water Flow**

**by Iacopo Borsi<sup>(1)</sup>**

## **Volume 4**

**AkvaGIS (Hydrochemical Analysis Tools and  
Hydrogeological Analysis Tools)**

**by Alejandro Serrano<sup>(1)</sup>, Rotman Criollo<sup>(1)</sup> and  
Violeta Velasco<sup>(1)</sup>**

**Release Beta 1.0**

**V.a.1**

## **Volume 6**

**MODFLOW OBServation process**

**by Laura Foglia<sup>(1)</sup> and Steffen Mehl<sup>(2)</sup>**

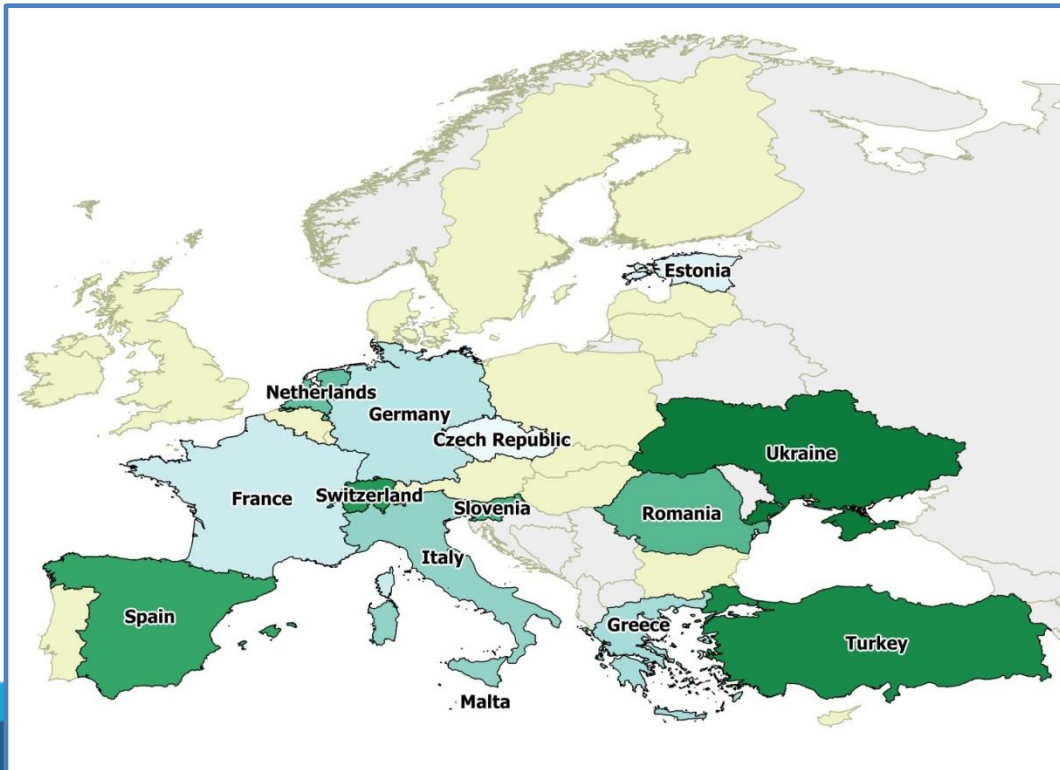
**Release Beta 1.0**

**V.a.1**

# FREEWAT case studies

14 case studies:

- 8 for the application of WFD, GWD and others (EU countries) plus 1 case study in Switzerland
- 5 devoted to rural water management: 2 EUs, Turkey, Ukraine, and Africa (through UNESCO involvement)





# **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 licences (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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 **ict4water.eu**

## Thank you for your attention!



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

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