MAR SOL MANAGED AQUIFER RECHARGE SOLUTIONS

THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION HORIZON 2020 FREEWAT

European Commission

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 management

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Joint International Workshop
EU FP7 MARSOL and EU HORIZON 2020 FREEWAT projects and EU EIP MAR Solutions - Managed Aquifer Recharge Strategies and Actions (AG128)

Pisa - April 21st 2015

INSTITUTE OF LIFE SCIENCES
Scuola Superiore Sant'Anna

TEASISTEMI
ENERGY AND ENVIRONMENT TECHNOLOGIES

PROVINCIA di Lucca

iah aih
MAR Commission

FREEWAT BACKGROUND

Or:

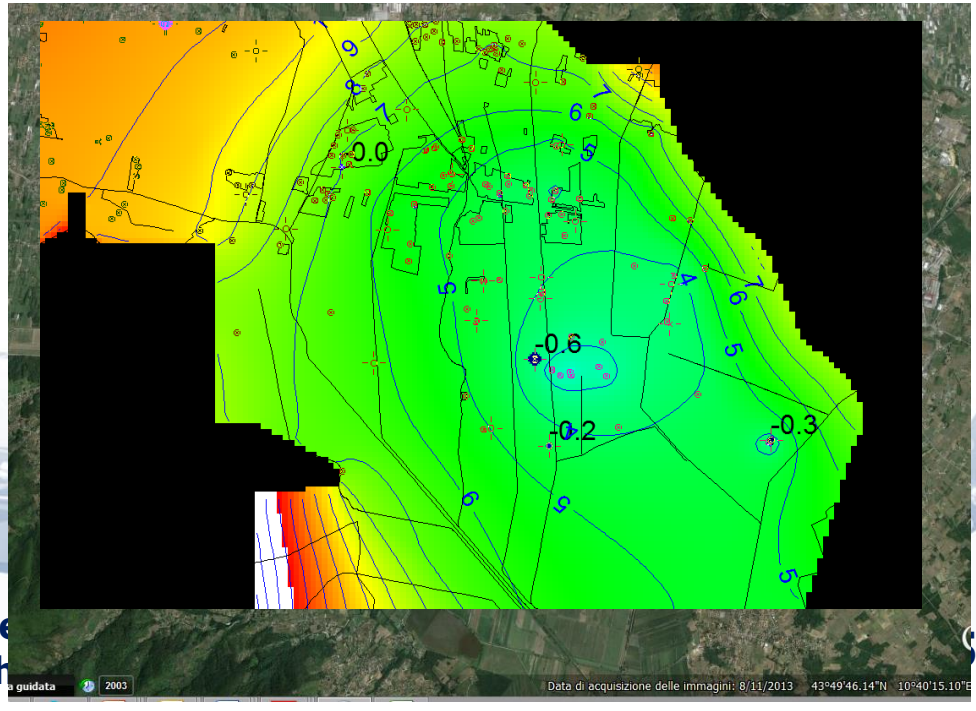
What pushed me and some colleagues to go and submit the FREEWAT proposal under the heavy competition of EU HORIZON 2020 WATER 4a call…

Few examples of water mismanagement

Few examples of water mismanagement

LUCCA PLAIN

Large cone of depression due to huge aquifer exploitation and concurrent uses between paper mill and drinking water supply



Natural groundwater flow direction altered and inverted

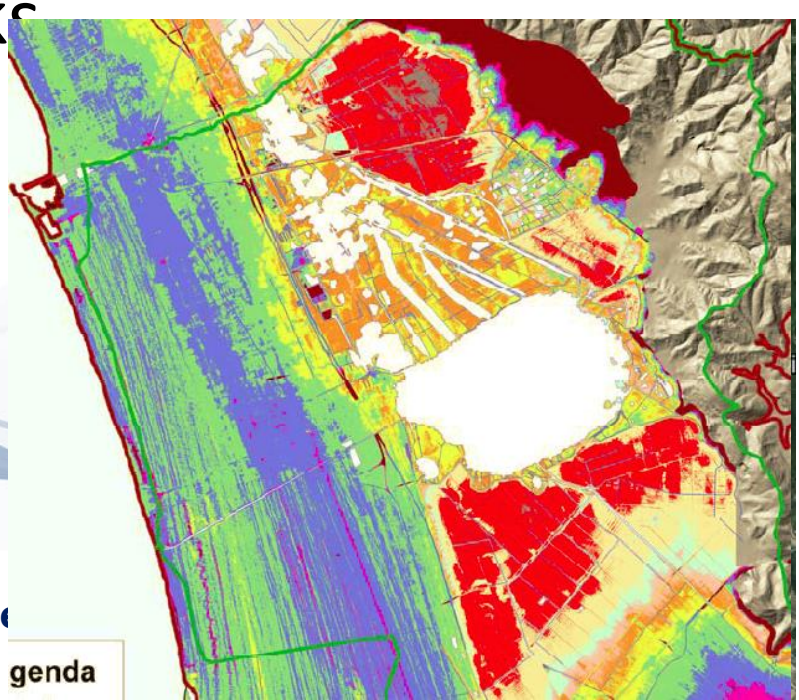
Few examples of water mismanagement

MASSACIUCCOLI LAKE

One of the last coastal lake in Italy

Struggle for conquering palustrine land by means of land reclamation works

Quality status heavily altered by eutrophication phenomena along with water stress in summer time



Resourc
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genda

Few examples of water mismanagement

GROSSETO PROVINCE

An area particularly prone to suffer the impact of climate change events

Unbalanced coastal aquifers

What about the management of licensing groundwater abstractions?

HOW WE DEAL AT PRESENT WITH THESE ISSUES

1) Very good monitoring network (daily data for lots of parameters!)

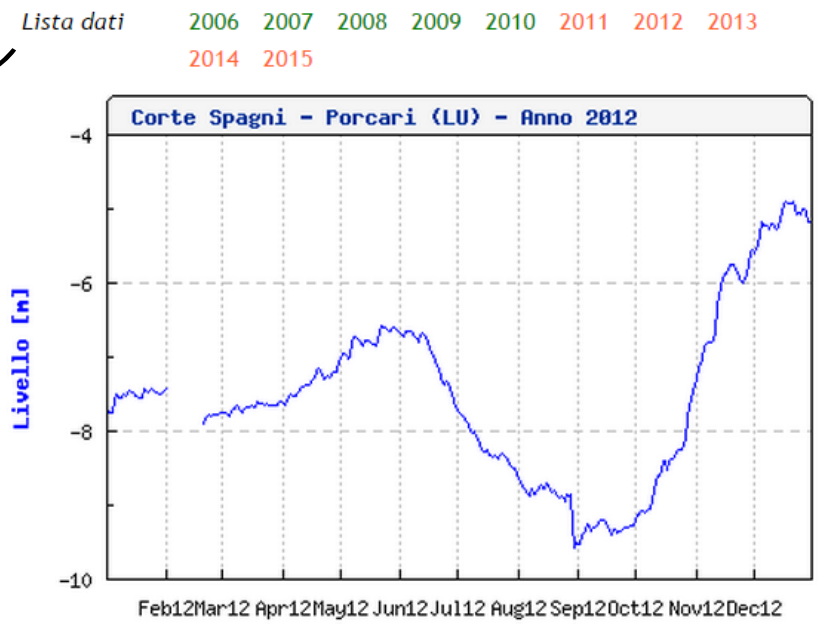
2) Very nice staff at authorities and professionals

… but trained in the 70s,80s, 90s
… hard time that time for ICT

WHAT WE DO WITH GATHERED DATA :

Most of the times:

1. *nice excell sheets*
2. *or nice graphs …*
3. *or shapefiles*
4. *or at best spatial databases*



QUESTIONS:

Can we get more out of this data?

Is this methodology really informative for water management?

Do we have appropriate tools to deal with such water resource management issues?

Unione europea
Fondo sociale europeo

REGIONE TOSCANA

POR FSE 2007-2013
Fondo Sociale Europeo
Programma Operativo
Regione Toscana

Ministero del Lavoro, della Salute e delle Politiche Sociali
Direzione Generale per le Politiche per l'Orientamento e la Formazione

SID&GRID

Hydroinformatics and simulation for water resource management

EU POR FSE 2007-2013

April 2010 --- March 2013

Partners:

Dep. of Matematica, Uni. of Firenze

Land Lab, Scuola Superiore S.Anna, Pisa

CNR-ISTI, KDD Lab, Pisa

Ingegnerie Toscane S.r.l.

Autorità di Bacino del Fiume Serchio Lucca

H_2O Ingegneria S.r.l., Pisa

Florentina Studiorum Universitas

ISTI
ISTITUTO DI SCIENZA E TECNOLOGIE DELL'INFORMAZIONE "A. FAEDO"

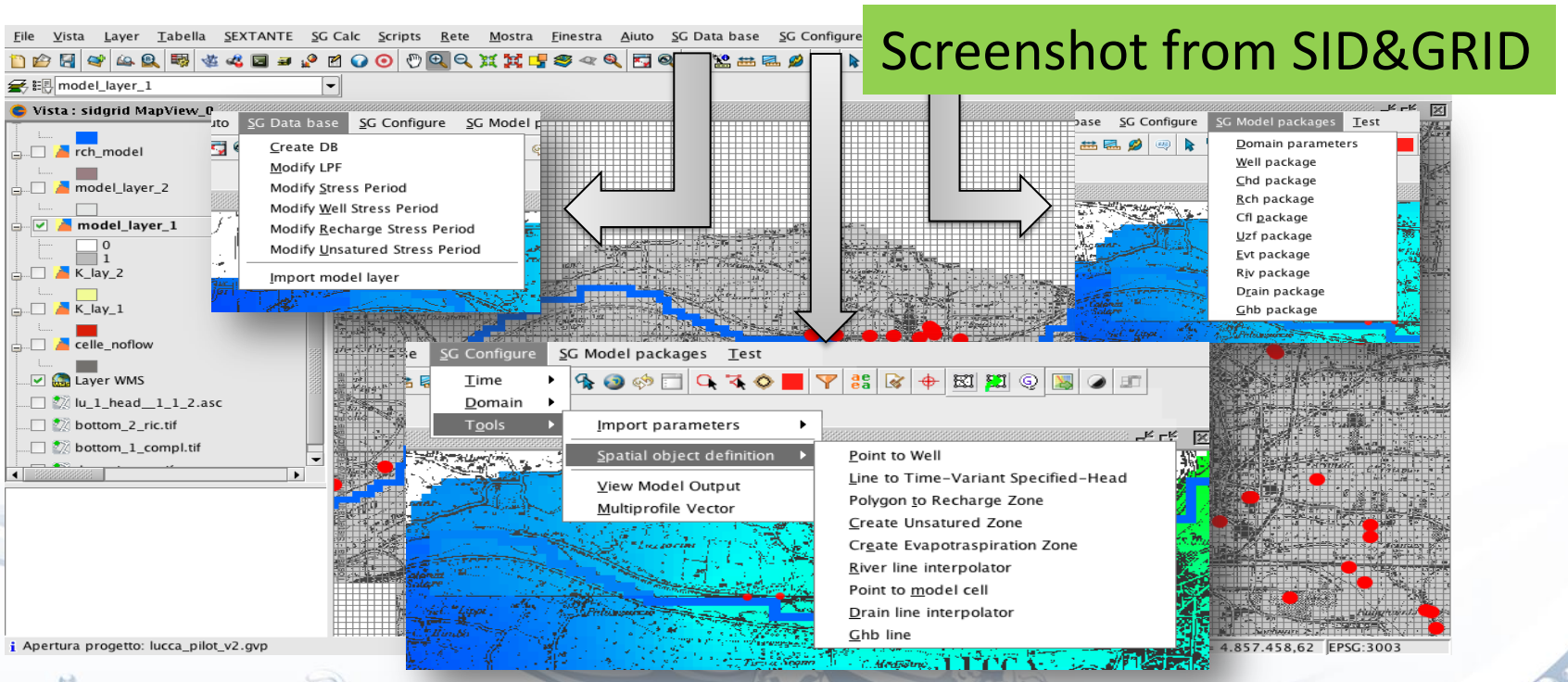
santAnna
school of advanced studies

INGEGNERIE TOSCANE

Autorità di Bacino
BACINO PILOTA DEL FIUME SERCHIO

SID&GRID?

Open source and public domain GIS integrated 3D hydrological model for simulating the whole hydrological cycle (surface water +unsat. zone+ groundwater), or unsaturated zone +groundwater only or only groundwater flow.



Lots of training done, LINKEDIN User Group, bunch of case studies implemented, Scientific publications and international collaborations

RESULTS

Encouraging … but not completely satisfactory …

Sinergy between GIS and modelling is relevant as it boosts monitoring data value and it allows analysis in space and time of the water resource

ON THE OTHER HAND

… thousand of data as results …

you must be very good in providing easily readable outcomes!!!

… if you do not involve policy makers and stakes … you are half way down!

THE LONG PATH TO A NEW WAY TO WATER MANAGEMENT/1

ground water

Issue Paper/

Groundwater Modeling in Integrated Water Resources Management—Visions for 2020

by Jens Christian Refsgaard[1], Anker Lajer Højberg[2], Ingelise Møller[3], Martin Hansen[2], and Verner Søndergaard[3]

Abstract

Groundwater modeling is undergoing a change from traditional stand-alone studies toward being an integrated part of holistic water resources management procedures. This is illustrated by the development in Denmark, where comprehensive national databases for geologic borehole data, groundwater-related geophysical data, geologic models, as well as a national groundwater-surface water model have been established and integrated to support

WHY PUSHING WITH MODELLING?

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.

ALL MODELS ARE WRONG … but some are useful!

(G. Box)

The call

Hard Job !

5 out 42 financed throughout all EU

FREEWAT Concept and Motivations:

Lots of Needs of:

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

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

3. of having free and open source tools, numerically based, GIS integrated in order to perform spatial and temporal analysis on water quantity and quality issues;

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

5. of changing the approach from lumped-yearly averaged water balances as base of decision making to water balances spatially distributed and time-series driven;

6. of effectively using data provided by the extensive monitoring required by the WFD;

7. of capacity building within the EU water sector;

8. of including participatory approach earlier than result discussion;

9. of supporting adequately scientific research results in order to foster their real scale application and replication and uptake by policy makers and water authorities.

WHY FREEWAT?

Open source and public domain GIS integrated modelling environment for promoting WRM by simplifying and strengthen the application of WFD, GWD and other water related DIrectives.

Open source characteristics of the platform →

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

FREEWAT expected main impact →

help producing relevant decisions based on:

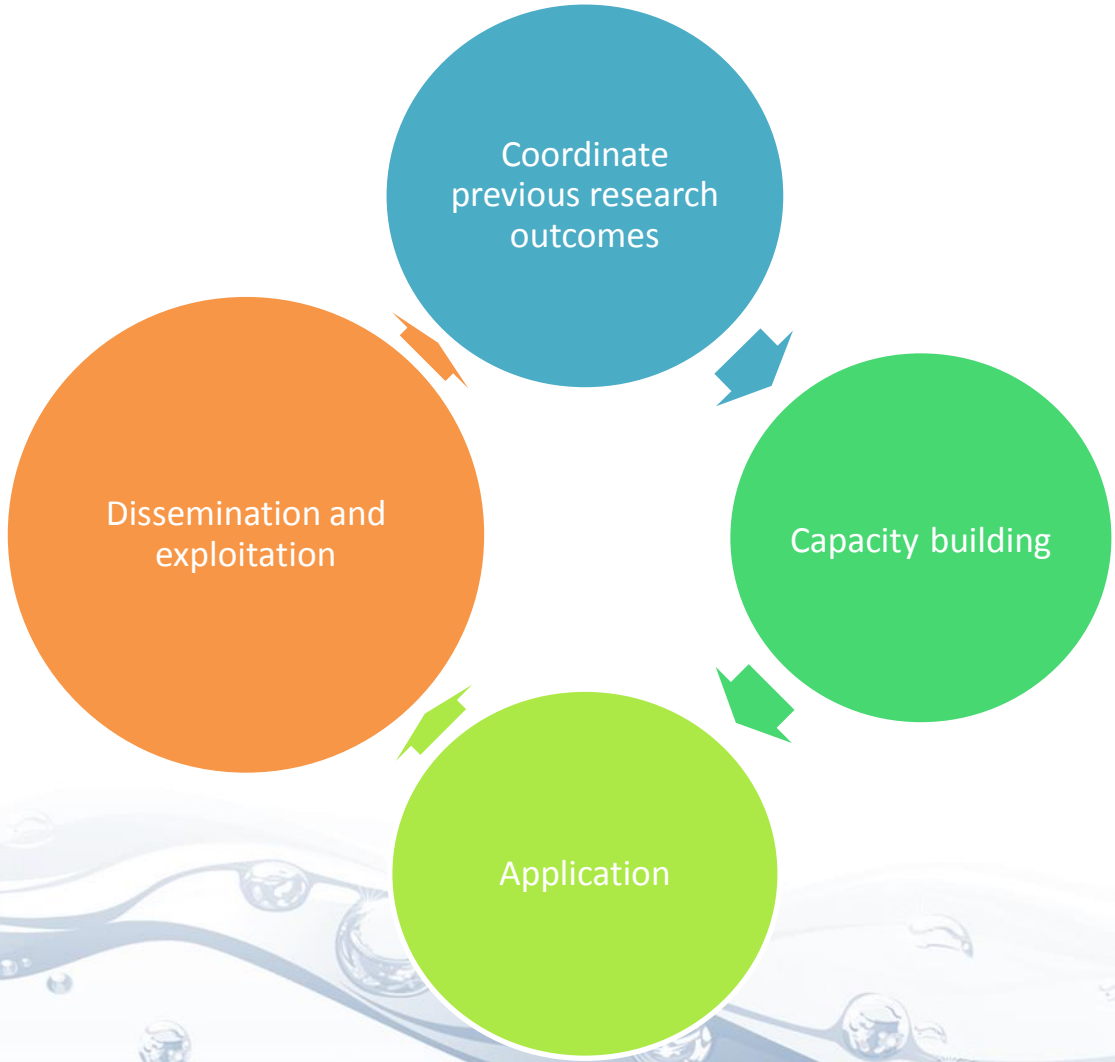
- data and innovative data analysis and
- including participatory approach not only in results discussion.

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



FREEWAT CONSORTIUM

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

Which EU and national previous efforts will be integrated in FREEWAT?

- **SID&GRID** (Regione Toscana): Surface water and groundwater flow and unsaturated zone processes
- **MARSOL** (EU, FP7): solute transport in groundwater
- **QUIMET** (Catalan Water Agency): GIS based hydrogeochemical analysis tools
- … plus not strictly EU codes

And potentially:

- **NITRATOS** (EU, LIFE)
- **FEDER12** (France): 3D databases, namely **PostGIS 3D**, to be able to store and manipulate 3D objects and 3D meshes
- …

FREEWAT NEW MODULES

For:

- water management and planning
- calibration, uncertainty and sensitivity analysis
- solute transport in the unsaturated zone
- management of water in agriculture
- tools for dealing with groundwater quality issues
- tools for the analysis, interpretation and visualization of hydrogeological data.

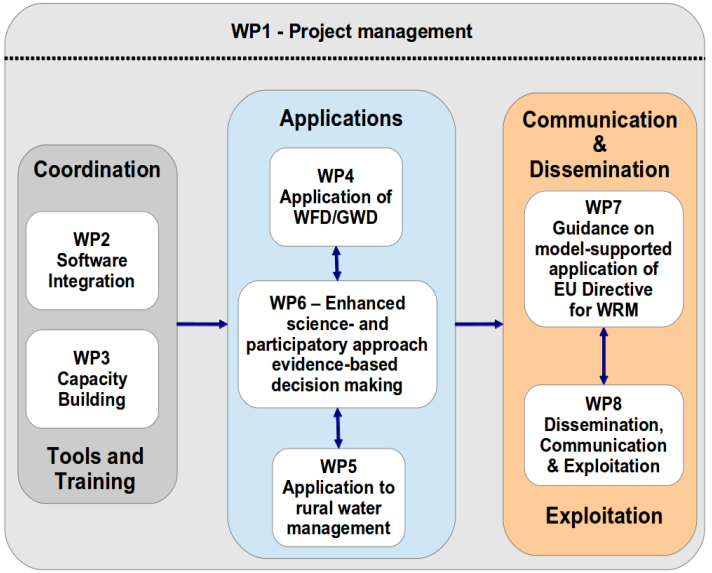
FREEWAT APPROACH

SOFTWARE DEVELOPMENT AND TRAINING

- Building the software platform (WP2)
- Training the trainers (WP3)
- Spreading the word of using FREEWAT (WP3)

APPLY THE MODEL (WP4/WP5/WP6)

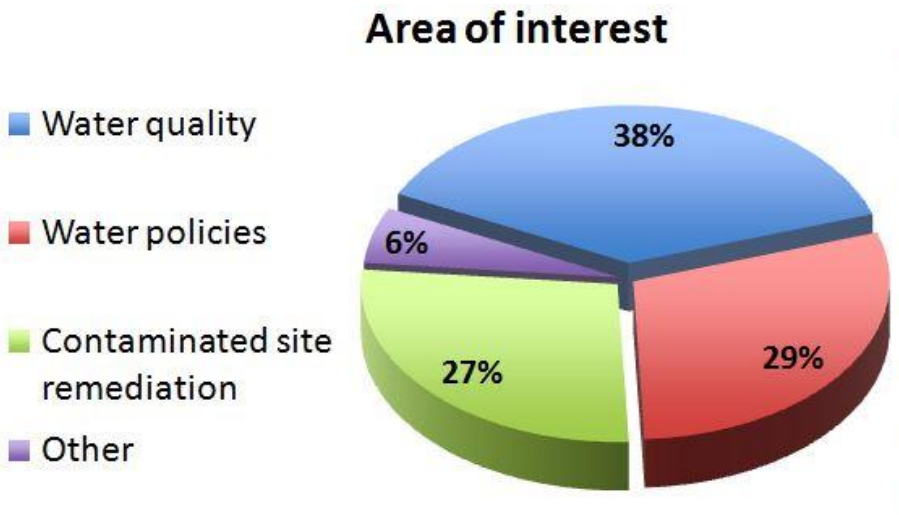
- **Postulate the problem you have to study**;
- Gather the data;
- Discuss the data with relevant stakeholders;
- Start the model implementation;
- Involve the stakeholders during model implementation and calibration;
- Apply the model for solving your problem;
- Producing policies!

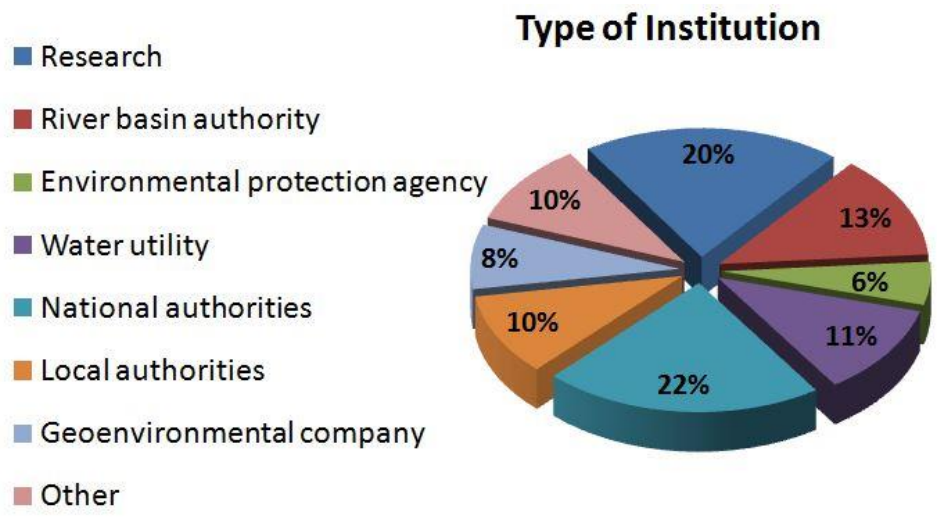


FREEWAT CAPACITY BUILDING

- Large stakeholders involvement (a total of about 200 stakes going to be involved)

- Web social and professional networks

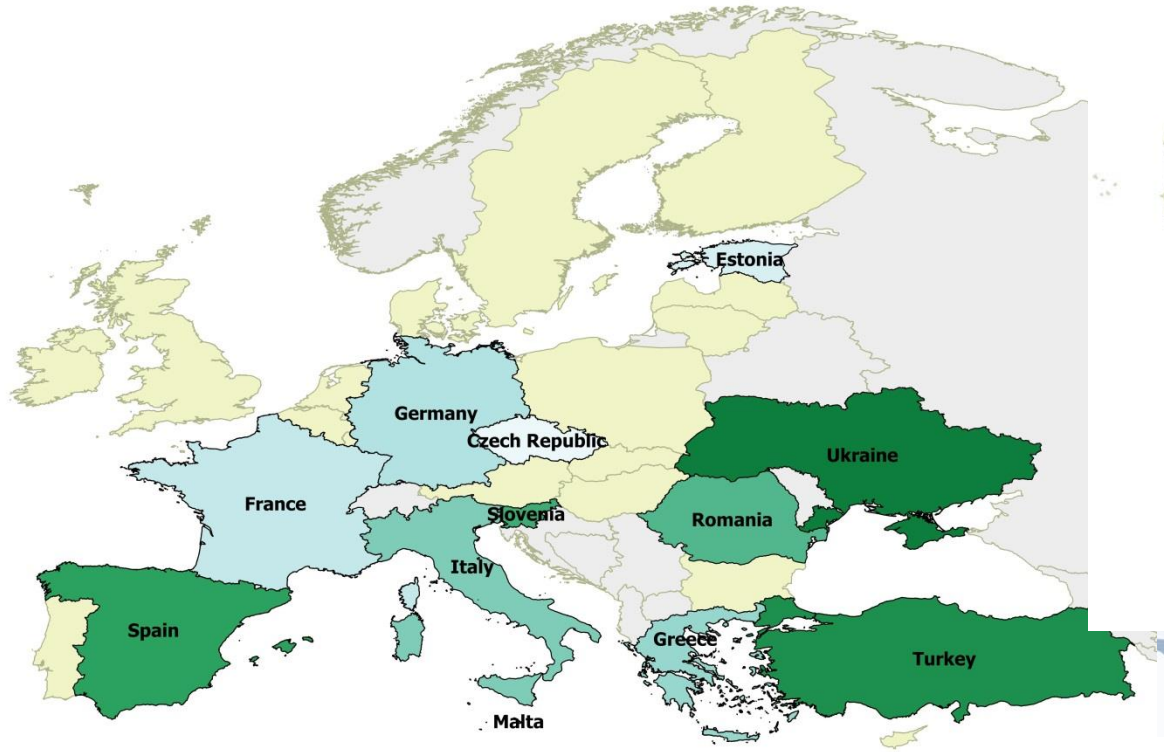




FREEWAT CASE STUDIES

13 case studies:

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



FREEWAT SYNERGIES

Advantages of using Numerical Modeling in Water Resources Management and Managed Aquifer Recharge schemes

Pisa, April 21st 2015

Thank you for your attention!