



Knowledge Inventory for hydrogeology research

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KINDRA project: aims, expectations and final results

KINDRA final conference MAKING GROUNDWATER VISIBLE, ACCESSIBLE and TREASURED Brussels, February 27th, 2018



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Making Groundwater visible, accessible & treasured



Water is a key-topic in modern society. **Groundwater** is the hidden but fundamental component of the water cycle, difficult to assess, evaluate and communicate.



KINDRA seeks to help achieve a better understanding of the groundwater topic by providing an overall view of the scientific knowledge that exists across Europe.



b) By collecting existing information on groundwater research & knowledge in a public access metadata searchable tool (EIGR)



Making groundwater visible:

by dissemination activity along the project, but also raising its role on technical and decision-makers tables inside the "water" community



Making groundwater treasured:

Making groundwater accessible:

a) by classifying groundwater issues,

intersecting its themes (operational actions)

topics) with reference to societal challenges

in a multidisciplinary approach (research

By analyzing gaps&trends in groundwater research & knowledge, to define recommendations aimed at safeguarding groundwater resources in Europe



Aims of the project (2015-2017)

To create an inventory of GW knowledge and use the inventory to identify critical research challenges in line with the implementation of the WFD and new innovation areas within integrated water resources management based on the latest research.

Classification	 Joint Panel of Experts (10 experts)
Inventory	 20 third parties (national representatives of EFG network)
Disseminatio n	 EFG dissemination capacity Collaboration with JPE, CIS WG- C, IAH, WssTP, ICT4water cluster, etc.

EU-harmonised Hydrogeological Research Classification System

Inventory of Groundwater Information Sources at EU scale (with EFG members)

European Inventory of Groundwater Research and Innovation (EIGR)

Test and population of the Inventory EIGR by data collection and processing

Research gaps and corresponding suggestions for research agendas in line with WFD

EIGR as a public - access permanent, searchable service on ongoing hydrogeological research





Is a GW research analysis useful/necessary? Results from an end user survey (2015)

161 responses received on a online survey, including five groups of questions





How you would like to access information on GW R&K?



We need a GW classification system?





Where is KINDRA located inside water issues?



How to classify groundwater research?

A list of about 240 keywords have been organized in a *tree hierarchy*, identifying *three main categories*: Societal Challenges (SC), Operational Actions (OA) and Research Topics (RT). In each of these three categories, *5 overarching groups* have been defined for easy overview of main research areas, representing level 1. The intersections among SC, OA and RT define the coordinates of each information groundwater related



be

The novelty of the classification is not semantic, but it is based on the idea to compare the technical activities (OA) by an interdisciplinary approach (RT), with the societal challenges (SC), taking into account that the "water" topic has a great importance in European society

The European Inventory of Groundwater Research (EIGR): 2178 records published



Content of EIGR : national contribution by Linked Third Parties of EFG





Content of EIGR: not only research but also knowledge

Not only peer review papers, but mainly reports, guidelines, databases, etc.



FROM EUROPEAN RESEARCH SINCE 2000



Content of EIGR: Classification of 'research' and 'knowledge'





Policy, Innovation

and Society Climate,

Energy

Food

Health

Content of EIGR: occurrence (and bias) in 2D diagrams





Content of EIGR:



TRL (technology readiness level) and PRL (policy readiness level) indicators





 Are the EIGR record representative, due the limited number of metadata (and linked bias)?
 Hydrogeological significance ("quality assurance")



JRA Are the EIGR record representative, due the limited number of metadata (and linked bias)? Comparison with SCOPUS database (entire search)

calcite

ion exchange

dissolution

water

nitrogen

sodium

mineral

alkalinity

water-rock interaction

hydrochemistry

2007-2016

isotope fracture coastal aquife water chemistry ithology limestone aline intrusion electrical resistivity coal deposits residence tim rehole permeability carbon dioxide numerical models karst sedimentology adulter porosity heterogeneity wells groundwater resource flow modeling

nixing

oundwater quality recharge numerical model vadose zone subsurface flow water level model computer simulation water wells

water flow groundwater recharge modelling water table lake performance assessme hydrological modeling uncertainty analysis north america united states spain catchment hydrology river water water budget water content climatology drainage water quality wetland river basins river

climate model soil profile climate change soil far east india soil surveys soil property water resource

surface water resources Water management water supply water demand nutrient Irrigation land use ecology ecosystem water conservation eutrophication agriculture cultivation environmental protection zea mays

sulfate trace element reaction kinetics sulfin chloride chemical analysis chlorination oxidation dissolved organic carbon adsorption iron carbon particle size experimental study sediment biodegradation degradation

redox conditions

concentration (composition) remediation bacteria phylogeny concentration (process) unclassified drug microbiolog groundwater pollution genetics arsenic contamination isolation and purification filtration chemistry pollution water purification potable water nitrate waste management leachate water pollutants, chemica landfill water contamination

environmental monitoring procedures environmental pollutants analysis geography pollution control waste treatment environment water pollution bioaccumulation toxicity aquatic environment risk assessment health risk

pollution exposure health environmental exposure human rural area

conservation of natural resour



Challenges of the project (to be tackled in the future)



Bias in RT Geology and in SC Climate, Environment, Resources need to be solved by interdisciplinary approach



Sufficient number of inserted records, allowing the analysis of gaps&trends, to be compared with larger research databases



Looking for editors: the EIGR has to be continuously filled with new records, but its "attraction capacity" is limited at the moment



How to manage the EIGR after the end of the project: role of other projects, international associations or entities



Would EIGR be linked and/or merged with other international databases on groundwater: technical issues (compatibility) and real interest by future users



Record upload in the EIGR: formal insertion control and quality assurance control of the records; how to dedicate resources for this activity



The classification system can be adopted by groundwater community after the project? Is it reflecting the research & knowledge in hydrogeology at European scale? Final users at national scale would have advantages in adopting this approach?



Next steps: recommendations to EC and life after the project

✓ From gaps & trends analysis recommendations for policy implementation need to be addressed

 ✓ Your opinion as experts, potential users, local and international organizations would be very useful (please fill the questionnaire!)

 \checkmark how to increase the number of records (and the attractiveness) of the EIGR



 \checkmark Synergies of KINDRA with other existing or further projects (SUBSOL, GeoERA, etc.)

 \checkmark Possible adoption, merging, inclusion, of EIGR in existing groundwater databases (WINS, GGIS, GeoERA Invormation Platform/EGDI etc.)

 \checkmark Dissemination of the KINDRA approach among associations, working groups, international EU platforms/clusters, and at national level





Thanks for your attention!

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Environmental and Water Agency of Andalusia REGIONAL MINISTRY OF ENVIRONMENT AND SPATIAL PLANNING

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