



FREEWAT

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



ict4water.eu

Open Workshop

Fostering inclusive and sustainable economic growth, employment and decent work (SDG#8) through ICT job creation tools for ensuring water security (SDG#6)

September 30th 2016

UNESCO

7 Place de Fontenoy - 75007 Paris

A new inventory of groundwater research and knowledge (EIGR): the KINDRA contribution to ICT4water

EIP Water Online Market Place

Matchmaking for water Innovation

MAR Solutions - Managed Aquifer Recharge Strategies and Actions (AG12B)

Peter van der Keur (GEUS)

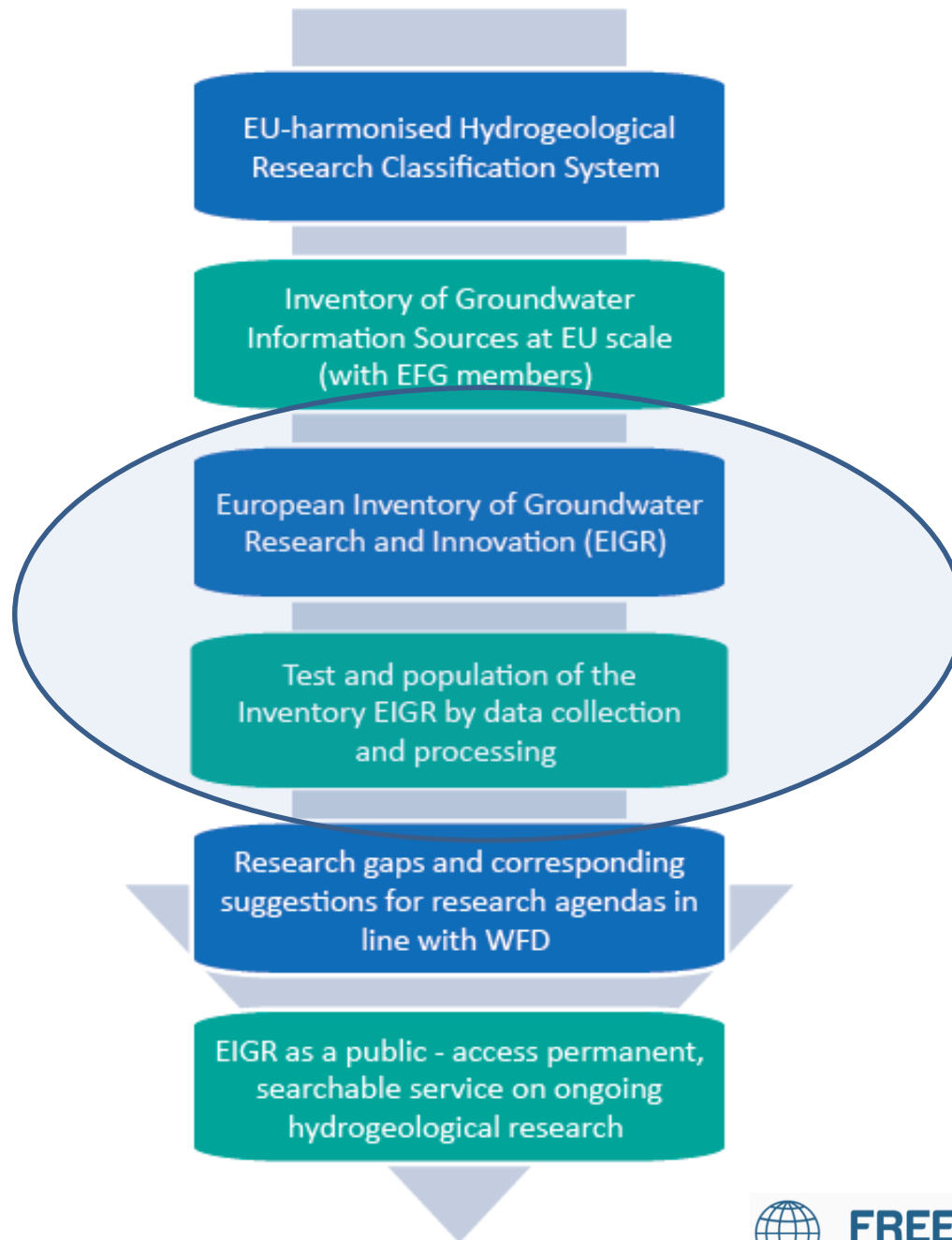


United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme

Development of EIQR as an information and Communication Technology Tools (ICT) sector to reach the SDG6 target: availability and sustainable management of groundwater



Project organisation

WP4 - Dissemination and communication (LPRC)

Dissemination and management
 Dissemination and support services
 Leveraging dissemination and dialogue

WP1 - Methodology framework development (SAPIENZA)

harmonised framework for reporting hydrogeology-related research and innovation (programmes, projects, results, agendas, etc) in Europe:

-Hydrogeological Research Classification System – HRC – SYS

-European Inventory of Groundwater Research-EIGR

2015



WP2 - Data collection and processing (EFG)

EU- wide assessment of existing practical and scientific knowledge on hydrogeology-related research and innovation in Europe:

- National workshops on Hydrogeology
- Data collection and processing
- country reports

2016



WP3 - Research gaps and recommendations (GEUS)

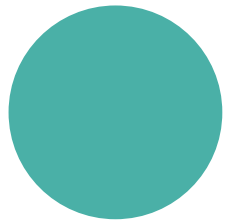
Identify research gaps in hydrogeology research that have relevance for the implementation of the Water Framework and Groundwater Directives (WFD and GWD)

- Hydrogeology research evaluated
- Research gaps identified
- Recommendations formulated

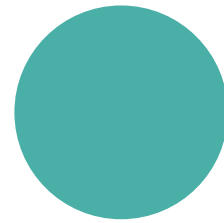
WP5 - Project management (SAPIENZA)

Quality Assurance and Risk Management
 Project Coordination
 Project management
 Exploitation of results and IPR

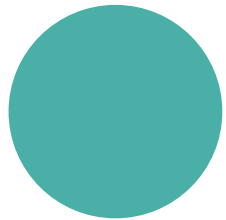
Added values of KINDRA EIGR:



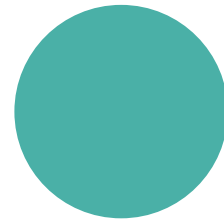
The KINDRA inventory are **exclusively dedicated to groundwater**, differently from other databases



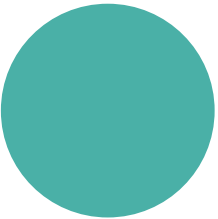
Combining research and knowledge enables and ensures **access and relevance for academics, practitioners and policy makers**



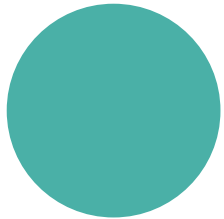
A **dedicated classification system** has been created to classify your research, papers, projects, reports, databases, etc.



It is developed **BY and FOR hydrogeologists and other "groundwater people"**, to **promote networking** and enlarge our community

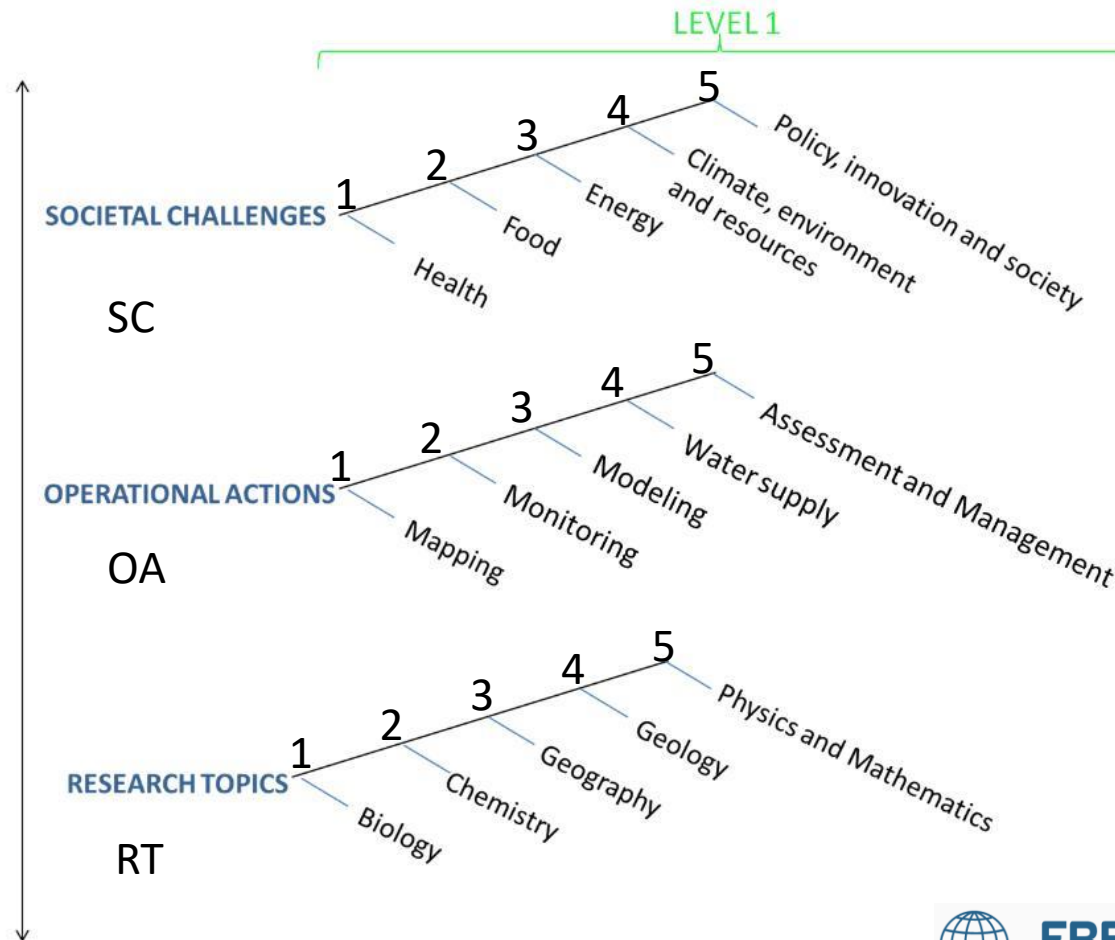


It provides harmonised international access to information on national and European research and knowledge **before research is finally published**

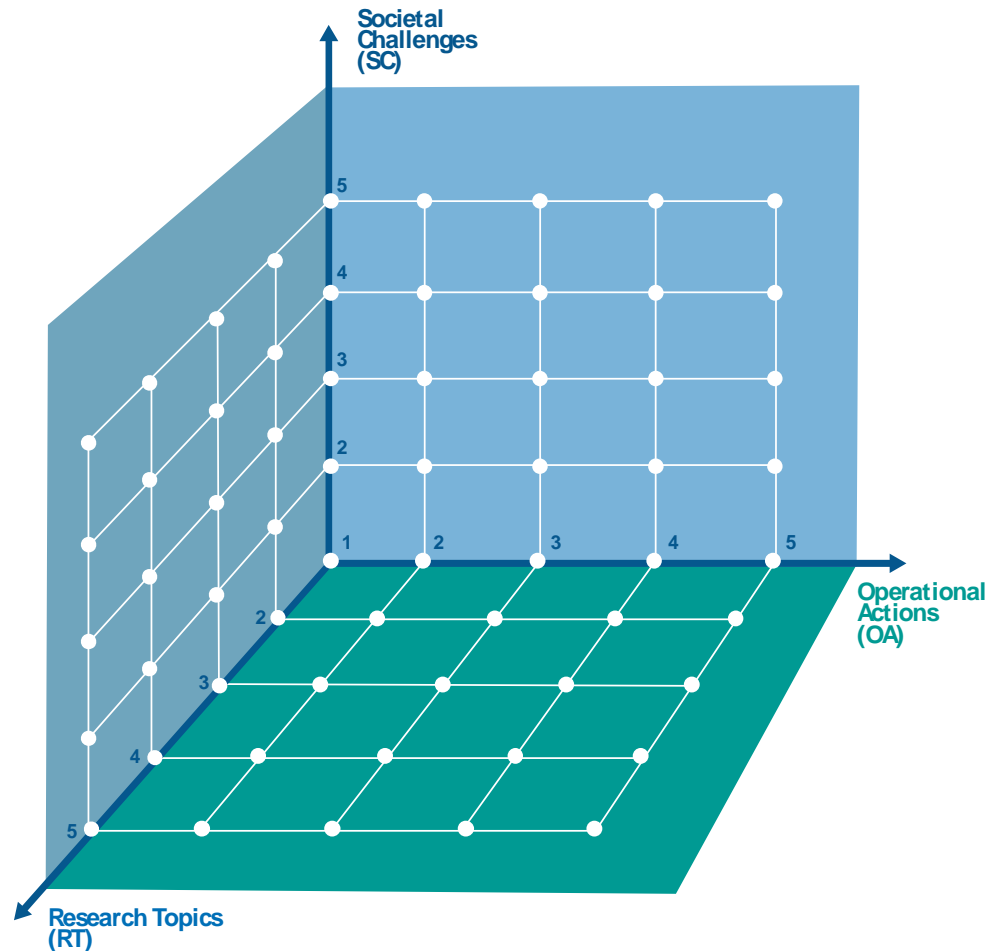


Database analyses will be used for **EU policy support** and to **increase the visibility and awareness of the importance of groundwater research in the societal challenges**

Definition of main categories for groundwater research classification (and related keywords from searches)



Classification System Approach (HRC-SYS)



The classification system previews the interaction among the three main categories through a **3D approach**, where along each axis the 5 overarching groups are indicated. This also results in a **2D representation** for each of the Societal Challenges, where Operational Actions and Research Topics intersect in a 5x5 matrix.



3D conceptual illustration of main categories of the HRC-SYS groundwater research classification system

(125 research combinations defined at the intersections – size of circles indicate amount of publications / the scientific output)



Societal challenges

- Policy & innovation 5
- Climate & environ. 4
- Energy 3
- food 2
- health 1

Mapping

monitoring

modelling

Water supply

Operational actions

Biology

Chemistry

Geography

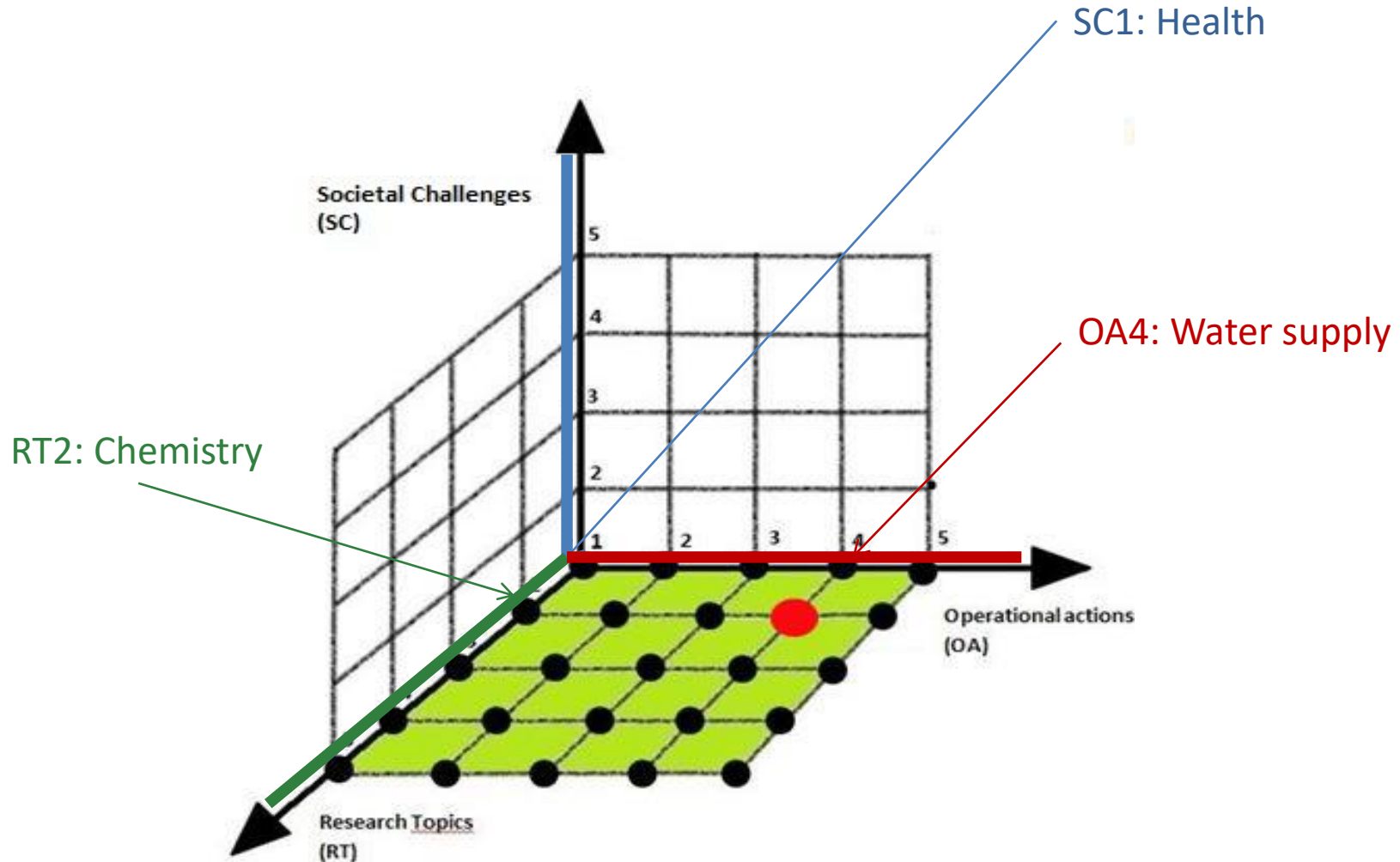
Geology

Math & phys

Operational actions

Research topics

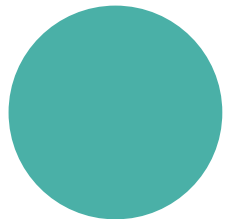
Example: 2D PLOT FOR SC1: HEALTH



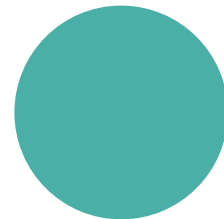
The EIQR is populated by the following national experts of the EFG:

	Country	Organisation	Expert's name
1	Belgium	Belgium-Luxembourg Union of Geologists	(1) Alain Dassargues (2) Dirk de Coste
2	Croatia	Croatian Geological Society	Kosta Urumović
3	Czech Republic	Czech Association of Economic Geologists	Michal Vaněček
4	Denmark	Geological Society of Denmark	Lisbeth Flindt Jørgensen
5	Finland	The Finnish Union of Environmental Professionals	Ulpu Väisänen
6	France	French Geological Society	Patrick Lachassagne
7	Germany	Professional Association of German Geoscientists	Walter Lenz
8	Greece	Association of Greek Geologists	Triantafillos Kaklis
9	Hungary	Hungarian Geological Society	Nóra Gál
10	Ireland	Institute of Geologists of Ireland	Henning Moe
11	Italy	Italian National Council of Geologists	Andrea Del Bon
12	The Netherlands	Royal Geological and Mining Society of the Netherlands	Jan Stafleu
13	Poland	Polish Association of Minerals Asset Valuers	Barbara Tomaszewska
14	Portugal	Portuguese Association of Geologists	Mónica Sousa
15	Serbia	Serbian Geological Society	Vesna Ristic Vakanjac
16	Slovenia	Slovenian Geological Society	Mihael Brenčič
17	Spain	Official Spanish Association of Professional Geologists	Silvino Castaño Castaño
18	Switzerland	Swiss Association of Geologists	Pierre Christe
19	Ukraine	Ukrainian Association of Geologists	Alexander Bobrov
20	United Kingdom	Geological Society of London	Andy McKenzie

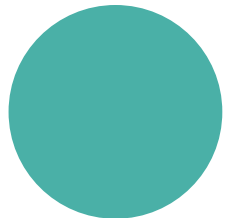
Resource types for population of the EIGR (only metadata):



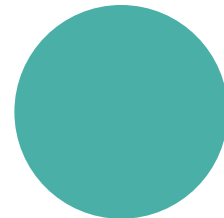
Research and applied
research projects (e.g. EU
and Interreg projects)



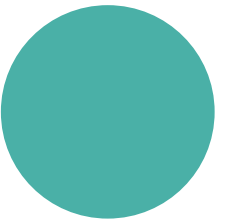
Technical reports and
guidances



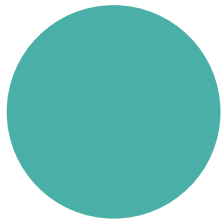
Surveys including relevant
data and maps



Books and book chapters



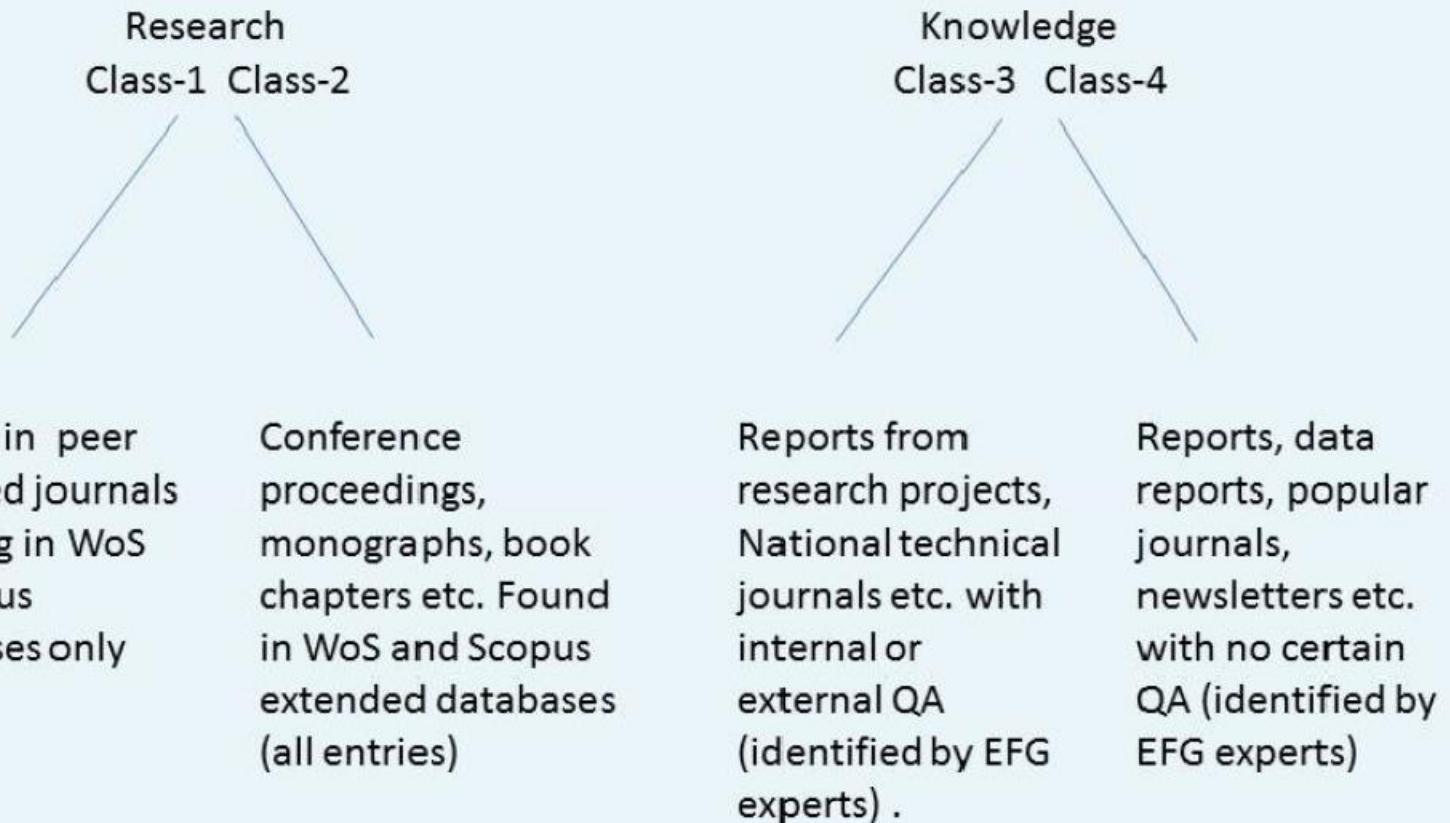
Consulting reports for
ministries and other
authorities



Monographs etc., etc.,

Classification of 'research' and 'knowledge' based on the degree of Quality Assurance

Definition of research and knowledge classes 1 to 4.



The EIGR user interface (Geonetwork)- for groundwater research upload and viewing

The screenshot displays the KINDRA web application interface. At the top, the KINDRA logo is accompanied by the text "Knowledge Inventory for hydrogeology research" and the website URL "www.kindraproject.eu". A navigation bar includes links for "Home", "Contact us", "Links", "About", and "Help". Below this, there are tabs for "Simple Search" and "Advanced Search", and a "Show map" button. The main content area is titled "FIND INTERACTIVE MAPS, GIS DATASETS, SATELLITE IMAGERY AND RELATED APPLICATIONS" and shows "Aggregated results matching search criteria : 1-10/12 (page 1/2), 0 selected". A search filter is set to "all: none" and results are sorted by "Change date".

Three search results are visible:

- QUANTITATIVE AND QUALITATIVE HYDROGEOLOGICAL STUDY OF THE ALLUVIAL AQUIFER OF SOMES-SZAMOS (ROMANIA-HUNGARY)**
Abstract: The research project carried out by a group of teams formed by Belgium, Romanian and Hungarian partners, in the scope and supported by the NATO Science for Peace programme, was intended to develop co...
Keywords: Groundwater, numerical modeling, quality, quantity, alluvial aquifer, modeling, flow
Schema: iso19139
Extent: 17.223455+40.4534095 43.94677459692549 28.077947592033492 46.56153870949176
- GEO-POWER**
Abstract: GEO-POWER project is part funded by the Interreg IVC Programme. The Interregional Cooperation Programme INTERREG IVC, financed by the European Union's Regional Development Fund, helps Regions of Euro...
Keywords: Shallow geothermal energy, Action plan, Ground coupled heat pumps, Geothermal energy, CA D3.2.2 Extraction
Schema: iso19139
Extent: -11.5 35.3 43.2 61.4
- COMBINED HEAT, POWER AND METAL EXTRACTION FROM ULTRA-DEEP ORE BODIES**
Abstract: The CHPM2030 is a H2020 project aiming to develop a novel technology which combines geothermal resource development, minerals extraction and electro-metallurgy in a single interlinked process. METAL...

The left sidebar contains a "WHAT?" and "WHERE?" search section with a map of Europe. Below the map is a "Search" button and a "Reset" button. A list of categories is provided, including "OPERATIONAL ACTIONS" (Assessment and Management, Mapping, Modeling, Monitoring, Water Supply) and "RESEARCH TOPICS" (Biology, Chemistry, Geography, Geology, Physics and Mathematics). "SOCIAL CHALLENGES" include Climate, Environment and Resources, Energy, Food, Health, and Policy, Innovation and Society. A "GeoRSS" section lists "Combined Heat, Power and Metal extraction from ultra-deep ore bodies" and "Project CLWAT".

<http://kindra.kindraproject.eu/geonetwork/srv/eng/main.home>



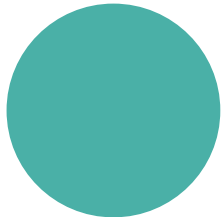
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Free and Open Source Software Tools for Water Resource Management
EU HORIZON 2020 Project



EIGR Data Catalogue

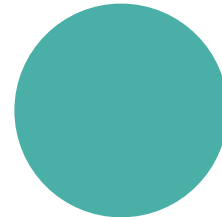
- **Repository of Metadata** concerning Research and Knowledge linked to Groundwater Research through Europe since 2000.
- The **ISO 19139 Metadata template** is adapted, making it compatible with the specifications of the HRC-SYS.
- Compliance with all the **INSPIRE specifications**
- A **EIGR User Manual** has been drafted in order to allow users to upload contents to the EIGR
- **Tools** are being developed to exploit the information uploaded

Future data processing: indicators and tools to be adopted for gap and trend analysis

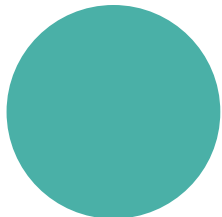


Main categories

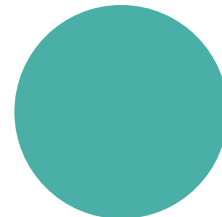
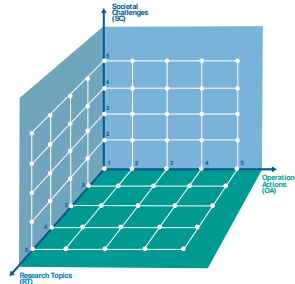
- Societal challenges
- Research topics
- Operation actions



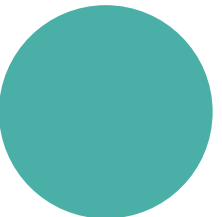
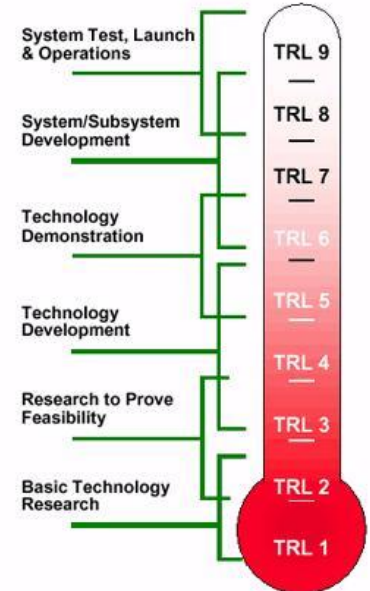
Research and Knowledge classes: R1 R2 K3 K4



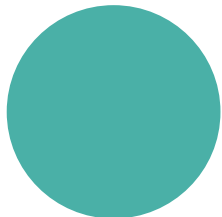
Keyword list related to the main categories: cube approach



Technology Readiness Levels classification

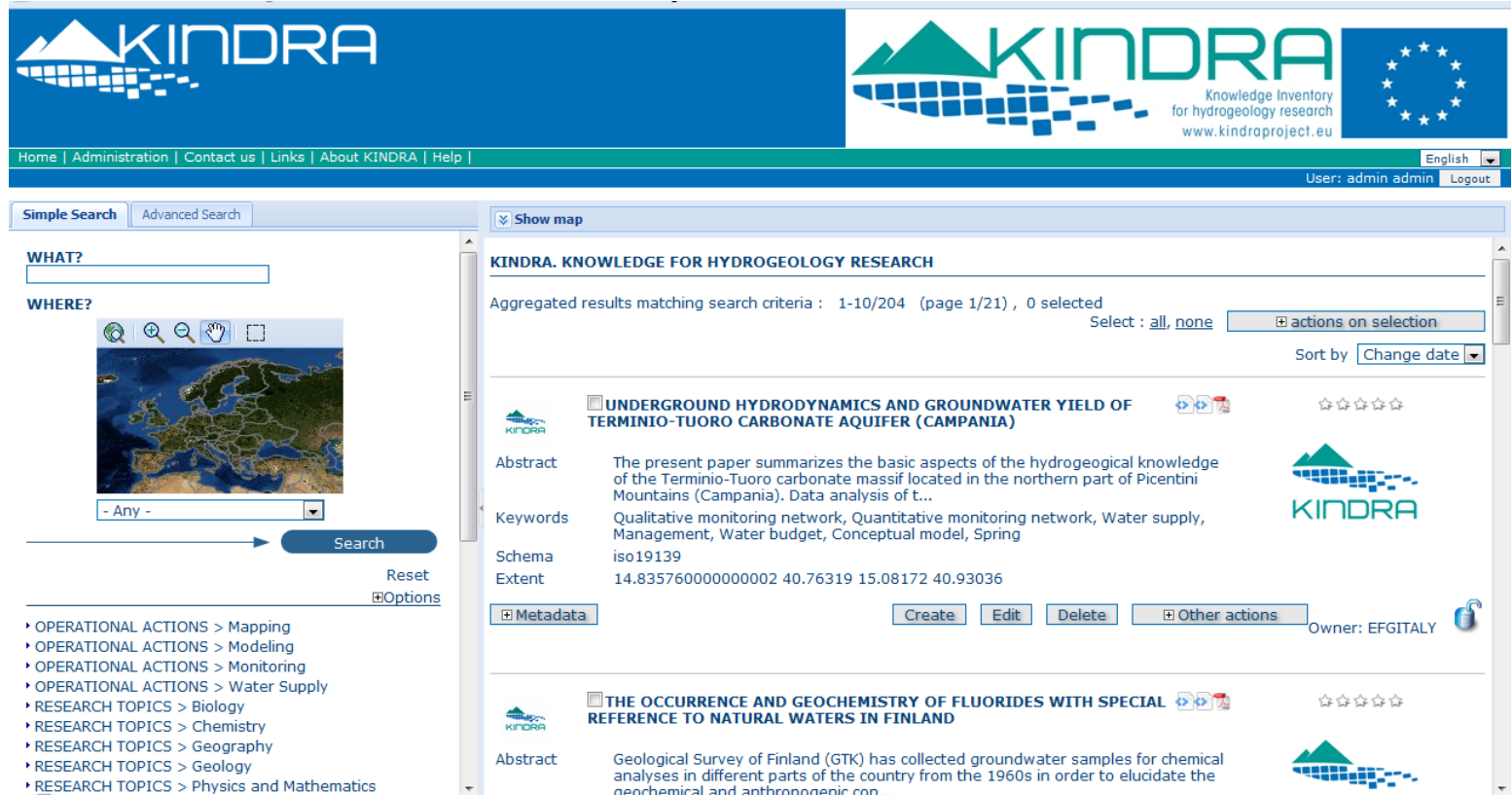


Geographical location of the classified document



Patents

EIGR user interface



The screenshot displays the KINDRA web application interface. At the top, there is a navigation bar with the KINDRA logo and the text 'Knowledge Inventory for hydrogeology research www.kindraproject.eu'. Below this is a secondary navigation bar with links for 'Home', 'Administration', 'Contact us', 'Links', 'About KINDRA', and 'Help'. A user login bar shows 'User: admin admin' and 'Logout'.

The main content area is divided into several sections:

- Search Tools:** Includes 'Simple Search' and 'Advanced Search' tabs. A 'WHAT?' search input field and a 'WHERE?' map tool are present. The map tool shows a map of Europe with a search area highlighted. Below the map is a dropdown menu set to '- Any -' and a 'Search' button.
- Map Control:** A 'Show map' checkbox is visible.
- Search Results:** The title is 'KINDRA. KNOWLEDGE FOR HYDROGEOLOGY RESEARCH'. It shows 'Aggregated results matching search criteria : 1-10/204 (page 1/21) , 0 selected'. There are options to 'Select : all, none' and 'actions on selection'. The results are sorted by 'Change date'.
- Result 1:**
 - Title:** UNDERGROUND HYDRODYNAMICS AND GROUNDWATER YIELD OF TERMINIO-TUORO CARBONATE AQUIFER (CAMPANIA)
 - Abstract:** The present paper summarizes the basic aspects of the hydrogeological knowledge of the Terminio-Tuoro carbonate massif located in the northern part of Picentini Mountains (Campania). Data analysis of t...
 - Keywords:** Qualitative monitoring network, Quantitative monitoring network, Water supply, Management, Water budget, Conceptual model, Spring
 - Schema:** iso19139
 - Extent:** 14.835760000000002 40.76319 15.08172 40.93036
 - Actions:** Metadata, Create, Edit, Delete, Other actions
 - Owner:** EFGITALY
- Result 2:**
 - Title:** THE OCCURENCE AND GEOCHEMISTRY OF FLUORIDES WITH SPECIAL REFERENCE TO NATURAL WATERS IN FINLAND
 - Abstract:** Geological Survey of Finland (GTK) has collected groundwater samples for chemical analyses in different parts of the country from the 1960s in order to elucidate the geochemical and anthropogenic con...

On the left side of the interface, there is a vertical menu with the following categories:

- OPERATIONAL ACTIONS > Mapping
- OPERATIONAL ACTIONS > Modeling
- OPERATIONAL ACTIONS > Monitoring
- OPERATIONAL ACTIONS > Water Supply
- RESEARCH TOPICS > Biology
- RESEARCH TOPICS > Chemistry
- RESEARCH TOPICS > Geography
- RESEARCH TOPICS > Geology
- RESEARCH TOPICS > Physics and Mathematics

Information Search Tool

EIGR data repository (1/2)

- Information inserted in the EIGR must be as complete as possible.
- This is to allow the **tools** we are developing to carry out a thorough **information analysis**.
- The EIGR will not only serve as a **repository of knowledge**, but as a tool that will allow for **queries and searches** based on keywords, **generating statistics, diagrams and other functions** to help support the exploitation of the catalogued information.

EIGR data repository (2/2)

The inclusion of resources into the EIGR is carried out by completing a number of fields included in the EIGR Metadata template

The **EIGR Metadata** template is divided into four Main Sections:

- RESOURCE IDENTIFICATION INFORMATION
- DISTRIBUTION INFORMATION
- DATA QUALITY INFORMATION
- METADATA INFORMATION

RESOURCE IDENTIFICATION INFORMATION

Series: (Information concerning the series or collection to which the resource belongs to.)

Name: (Name of the series or collection to which the resource belongs to.)

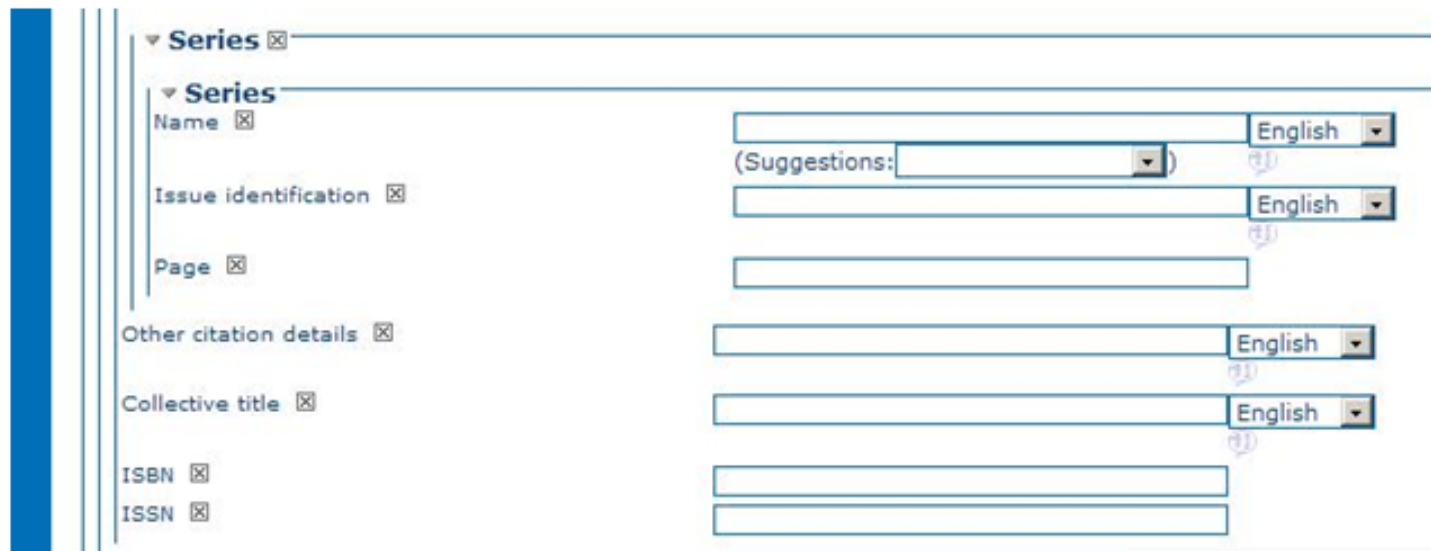
Issue identification: (Issue of the series or collection to which the resource belongs to.)

Page: (Details on which pages of the publication the resource was published.)

Collective title: (Title of the collective series or collection to which the resource belongs to.)

ISBN: (International Standard Book Number.)

ISSN: (International Standard Serial Number.)



The screenshot shows a web form with a sidebar on the left containing expandable sections: Series, Name, Issue identification, Page, Other citation details, Collective title, ISBN, and ISSN. The main form area contains input fields for each of these sections, with language dropdown menus set to 'English'. A 'Suggestions:' dropdown is visible next to the Name field.

RESOURCE IDENTIFICATION INFORMATION

Abstract*: (a brief narrative summary of the content of the resource)

Purpose: (Purpose for which the resource was created)




Credit: (Recognition of the organizations or programs who contributed to the resource and/or are responsible for funding, amount of funding or total budget. The field may be included as many times as may be required according to the amount of existing organizations)
































Abstract *	must be known with good accuracy: effective evapotranspiration and infiltration, especially in lowland areas where the run-off is minimal. Three different experimental plots cultivated with maize were equipped with tensiometers and soil moisture probes to monitor every day the water movement in the unsaturated zone. Other relevant parameters of the various soil layers, as	English
Purpose <input checked="" type="checkbox"/>	The main goal of this study were to assess whether simple approaches to calculate the PET, like Hargreves and Turk ones, can substitute complex ones like Penman-Monteith and to assess the	English
Credit <input checked="" type="checkbox"/> <input type="checkbox"/>	The work was financially supported by AGRI-UNIFE and ENVIREN laboratory, respectively under Contratto di	English
Credit <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Dr. Fabio Vincenzi Dr. Umberto Tessari and Dr. Corinne Corbau are acknowledged for their technical and	English
Credit <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	data and the Servizio Geologico Sismico e dei Suoli of Emilia-Romaagna region is acknowledae	English

RESOURCE IDENTIFICATION INFORMATION

Descriptive Keywords*: (The keyword value is a commonly used word, formalized word or phrase used to describe the subject. They help narrowing a full text search and allow for structured keyword search)

NOTE! Insertion of keyword is mandatory

Descriptive keywords   

Keyword [*]  	Recharge	English 
Keyword [*]   	Unsaturated zone	English 
Keyword [*]   	Infiltration	English 
Keyword [*]   	Evapotranspiration	English 
Keyword [*]   	Groundwater recharge	English 
Keyword [*]   	Modeling	English 
Keyword [*]   	Soil	English 
Keyword [*]   	water flow	English 

RESOURCE IDENTIFICATION INFORMATION

Resource constraints: (Provides information about constraints that apply to the resources)

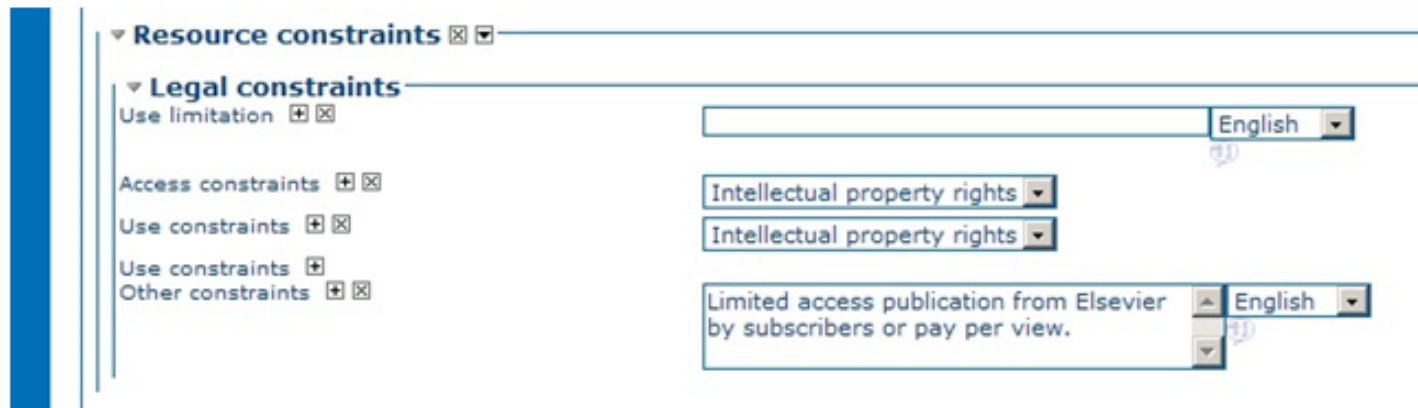
Legal constraints: (Restrictions and legal prerequisites for accessing and using the resource or metadata)

Use limitations: (Limitation affecting the fitness for use of the resource, for example if it is not apt to be employed for further research efforts due to specific conditions)

Access constraints: (Restrictions to assure the protection of privacy or intellectual property, and any special restrictions or limitations on obtaining the resource: License, Patent, Pending Patent, restricted, Trademark, Copyright)

Use constraints: (Restrictions to assure the protection of privacy or intellectual property, and any special restrictions or limitations on using the resource: License, Patent, Pending Patent, restricted, Trademark, Copyright)

Other constraints: (Other constraints or legal prerequisites for accessing and using the resource)



▼ **Resource constraints** ☒ ▼

▼ **Legal constraints**

Use limitation ☒ + English ▼

Access constraints ☒ + Intellectual property rights ▼

Use constraints ☒ + Intellectual property rights ▼

Use constraints ☒ + Limited access publication from Elsevier by subscribers or pay per view. English ▼

Other constraints ☒ +

RESOURCE IDENTIFICATION INFORMATION

Topic categories*: These are the overarching categories defined by the HRC-SYS: Societal Challenges (SCs), Operational Actions (OAs) and Research Topics (RTs). It is mandatory to classify the record individuating at least one main SC, one main OA and one main RT.



▶ **Topic category** ☒ ▾

▼ **Topic category** ⊕ ☒ ⊞

Topic category code

▼ **Topic category** ☒ ⊞ ▾

Topic category code

▼ **Topic category** ⊕ ☒ ⊞

Topic category code

RESOURCE IDENTIFICATION INFORMATION

Extent: (Spatial reference of the resource)

Geographic Element: (The geographic component of the extent referring to the resource)

Geographic bounding box: This is the geographic position of the resource given as a bounding box where the following items can be specified:

West longitude:

East longitude:

North latitude:

South latitude:

▼ Extent [x] [y]

▼ Geographic bounding box

WGS 84 Google Mercator

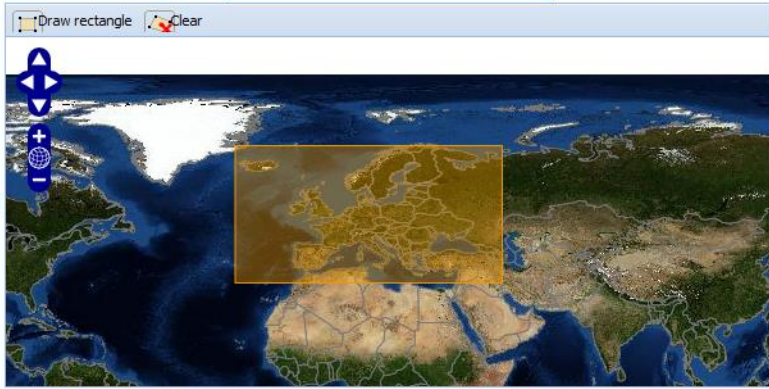
North bound

West bound

East bound

South bound

Draw rectangle Clear



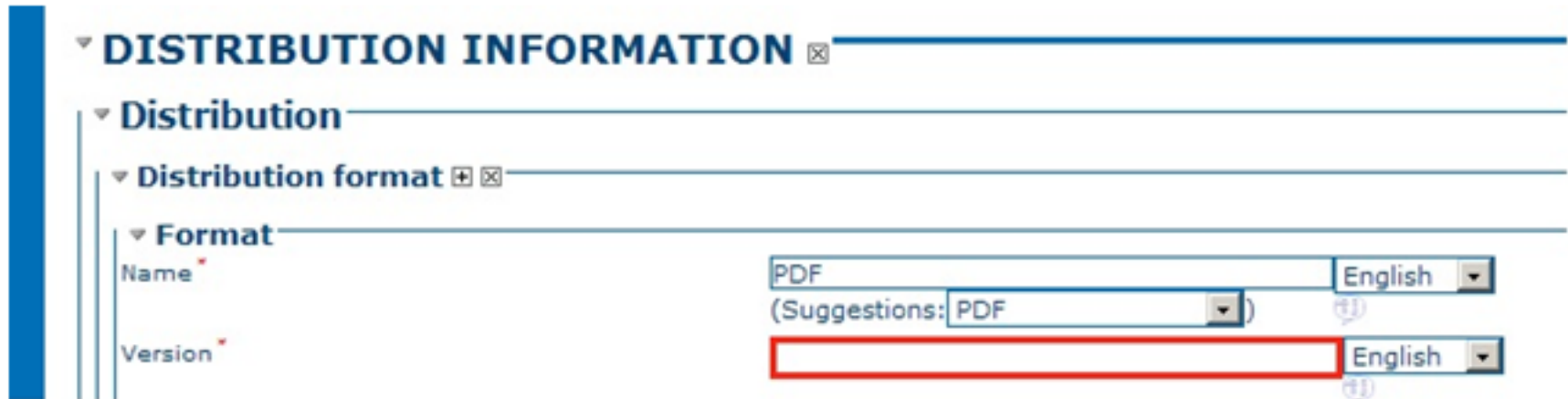
DISTRIBUTION INFORMATION

Distribution format: (Provides a description of the format of the data to be distributed)

Format*: (Description of the availability of the resource, be it either a file, message, storage device or transmission method)

Name*: (name of the data transfer format)

Version*: (version of the format)



The screenshot shows a web form with a sidebar on the left containing a tree view of sections: 'DISTRIBUTION INFORMATION', 'Distribution', 'Distribution format', and 'Format'. The 'Format' section is expanded, showing two input fields: 'Name' and 'Version'. The 'Name' field contains the text 'PDF' and has a dropdown menu set to 'English'. Below the text is a suggestion box that says '(Suggestions: PDF)'. The 'Version' field is empty and has a dropdown menu also set to 'English'. A red rectangular box highlights the 'Version' input field.

DISTRIBUTION INFORMATION

Online resource: (defines the online sources or link(s) from which the resource can be obtained)

Linkage: (Location (address) for online access using a Uniform Resource Locator (URL) address)

Protocol: (Connection protocol to be used)

Name of the resource

Description: (Detailed text description of what the online resource is/does)

▼ OnLine resource

▼ Linkage

URL

Protocol (Suggestions:)

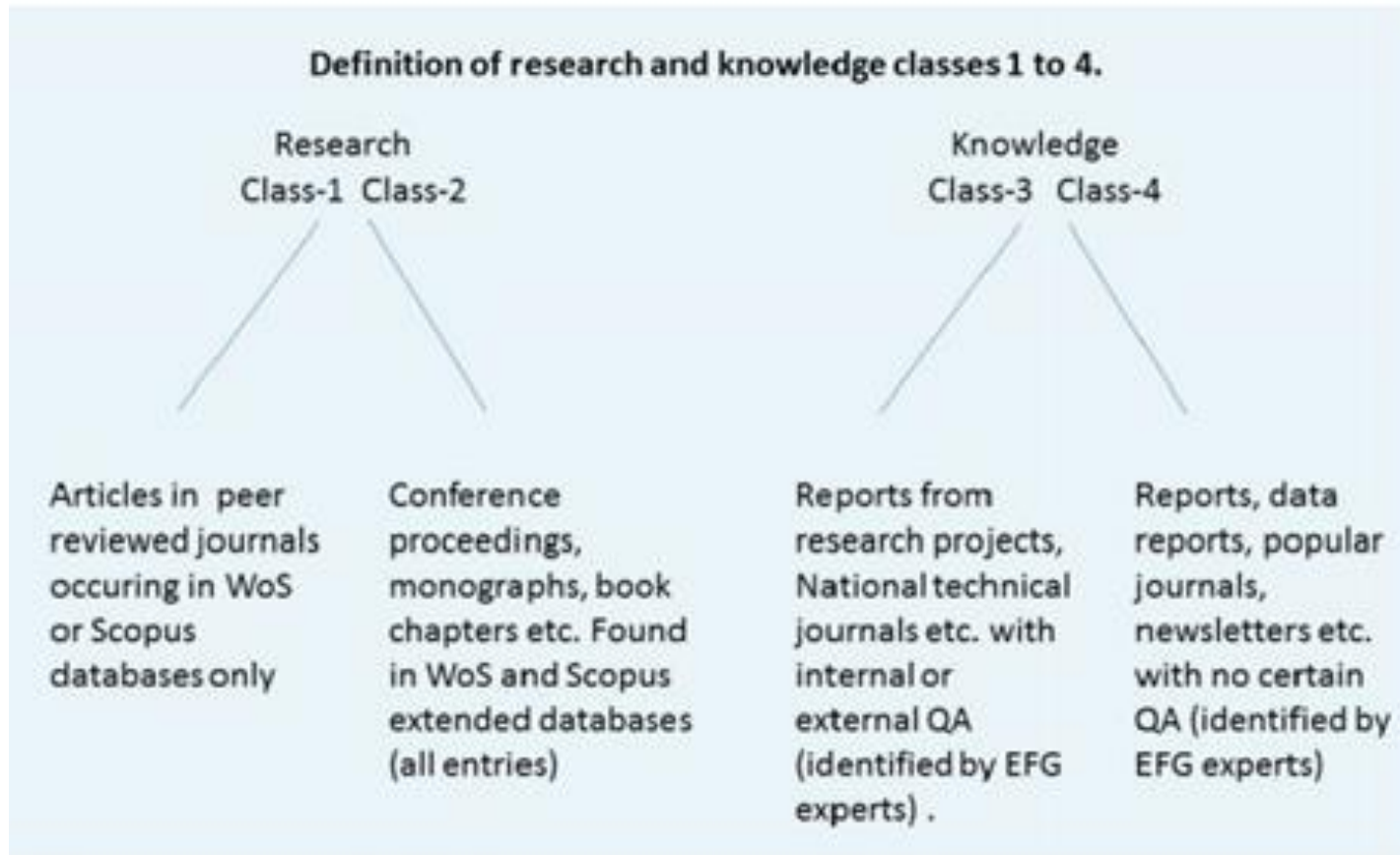
Name of the resource

Description

Online location:

DATA QUALITY INFORMATION

Provides an overall assessment of the resources by classifying the work according to Research and Knowledge classes and TRL as defined by the HRC-SYS.



EIGR ICT

The development of **EIGR as an Information and Communication Technology Tools (ICT)** and subsequent use by professionals in the groundwater sector is helping the water sector to reach the SDG6 target to ensure availability and sustainable management of (ground)water

It does so by:

- providing an ICT which:
 - (1) **supports the research, practitioner and decision making community** by providing an **information tool useful for targeting sustainable groundwater management**
 - (2) is used to **identify research gaps and trends** to be addressed to support SDG6 targets
- increasing the **visibility of the groundwater** topic and enhancing the **awareness of groundwater availability and sustainability**

Thank you for your attention !