WATER RDI CHALLENGES WATER4ALL AND GEOERA

Dominique DARMENDRAIL





Water Challenges

They are global!





Too Much, Too Little, Too Polluted, Too demanded, Too expensive,



Key litterature



Géosciences pour une Terre durable

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At Global level: Water Quality Risk



Source: P. Gleick, Pacific Institute, Water Conflict Chronology, 2018

- Water quality impacting all types of countries, even high-income ones (World Bank 2019).
- larger impacts on health, agriculture, and the environment
- Leading to significant slowdowns in economic growth
- And water conflicts



At Global level: Water quantity issues and related risks



• OECD, 2018

▶ WEF, 2019



The challenge of Water Security



Reusing / an example





How to develop a Strategic Research and Innovation Agenda?





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Proposal of Water4All SRIA Process





Water JPI SRIA 2025 as basis for Water4All SRIA

Final results

Comparison for Water4All SRIA

SRIA 2025 Research Themes and Sub-themes		
Theme A: Ecosystems		
Sub-theme A.1	Developing approaches for assessing and optimising the structure and function of ecosystem services.	
Sub-theme A.2	Developing and applying an approach to ecological engineering and ecohydrology.	
Sub-theme A.3	Managing and adapting ecosystem services to the effects of hydro-climatic extreme events.	
Theme B: Health and Wellbeing		
Sub-theme B.1	Emerging contaminants and associated risks: monitoring, remediation and assessing their effects and behaviour on nature and humans.	
Sub-theme B.2	Water dimension of anti-microbial resistance; 'one health approach.'	
Sub-theme B.3	Understanding and minimising the risks associated with water infrastructures and climate change effects.	
Sub-theme B.4	Human interaction with water.	
Theme C: Water Value and Usage		
Sub-theme C.1	Future-proofed water technologies, infrastructures and systems for developing climate change resilience.	
Sub-theme C.2	Water smart-circular economy and societies.	
Sub-theme C.3	Empowering the public, water users and stakeholders in valuing water.	
Theme D: Sustainable Water Management		
Sub-theme D.1	Optimising the Nexus approach.	
Sub-theme D.2	Adapting water resources management to deal with increased uncertainty.	
Sub-theme D.3	Enabling sustainable management of water resources.	



AND MORE



The European Green Deal



Components



Water related needs / Actions

- new EU Strategy on Adaptation to Climate Change (extreme events)
- Reduce the use and risk of chemical pesticides, fertilizers and antibiotics
- Action from 2021 on Measures to address the main drivers of biodiversity loss
- Zero pollution action plan for water, air and soil
- Transition to sustainable circular economy
- roadmap action on "Initiatives to increase and better manage the capacity of inland waterways"





MISSIONS: Not about Research, but delivery to society

 Missions implemented through dedicated calls for proposals in the Work Programmes.

EUROPEAN PARTNERSHIPS: Part of Clusters

- Cross-cutting dimension connected to Clusters challenges.
- Specific implementation modalities, depending on their level and of actions (e.g. co-programmed, co-funded, institutionalized)

FP Annual Work Programmes:

Remaining part of the Intervention Areas implemented through "normal" EC calls.



Portfolio of candidates for European Partnerships (49)

HEALTH

EU-Africa Global Health Innovative Health Initiative Chemicals Risk Assessment Fostering an ERA for Health research Large-scale innovation and transformation of health systems in a digital and ageing society Personalised Medicine Rare Diseases

One Health AMR

CLIMATE, ENERGY AND MOBILITY

Transforming Europe's rail system Integrated Air Traffic Management Clean Aviation Clean Hydrogen Built environment and construction Towards zero-emission road transport Mobility and Safety for Automated Road Transport Batteries

Clean Energy Transition

Sustainable, Smart and Inclusive Cities and Communities

EUROPEAN

RESEARCH

DAYS

Smart and zero-emission waterborne transpor

DIGITAL, INDUSTRY AND SPACE

High Performance Computing Key Digital Technologies Smart Networks and Services Al, data and robotics Photonics Europe Clean Steel - Low Carbon Steelmaking European Metrology Made in Europe Carbon Neutral and Circular Industry Global competitive space systems European Geological Service

FOOD, BIOECONOMY, NATURAL RESOURCES, AGRICULTURE AND ENVIRONMENT

Accelerating farming systems transition Animal health: Fighting infectious diseases Environmental Observations for a sustainable EU agriculture

Rescuing biodiversity to safeguard life on Earth A climate neutral, sustainable and productive Blue Economy

> Safe and Sustainable Food System for People, Planet & Climate

> > Circular bio-based Europe

Nater4All: Water security for the planet

PILLAR III AND CROSS-PILLAR EIT Climate KIC EIT Health EIT Manufacturing EIT Food EIT InnoEnergy EIT Manufacturing EIT Raw Materials EIT Digital EIT Urban Mobility EIT Cultural and Creative Industries

Innovative SMEs

European Open Science Cloud (EOSC)



European Commission



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Considering pertinent actors' eligibility conditions

Pillar B. Research and innovation Development

- Generate new knowledge and innovation
- Up to operational scale

Pillar C. Science – Policy - End-users interface

• Connect Science and innovation to policy-makers and operators

Pillar A. Joint vision & SRIA

For actions at all levels

Pillar E. Internationalisation

- Global dimension critical mass
- Strategic collaboration

Pillar D. Demonstrating Solution efficiency

- Deploying at local scale, with the relevant actors
- From pilot to full implementation



European Partnerships Candidates – Relevant for Water4All

WATER ALL

DIGITAL, INDUSTRY AND SPACE

European Metrology European Geological Service

FOOD, BIOECONOMY, NATURAL RESOURCES, AGRICULTURE AND ENVIRONMENT

Rescuing biodiversity

Blue Economy

Accelerating farming systems transition

Food Systems

Environmental Observations for a sustainable EU agriculture

PILLAR III AND CROSS-PILLAR EIT Climate KIC

European Open Science Cloud (EOSC)



HEALTH Chemicals Risk Assessment

One Health AMR?

CLIMATE, ENERGY AND MOBILITY

Sustainable, Smart and Inclusive Cities and Communities

Smart and zero-emission waterborne transport

GEOERA (Products & Data) relevant for Water4All?

- Groundwater part of the Global Water Cycle
 - important link of the hydrological cycle through the maintenance of wetlands and river flows
 - 0
- Crucial for all life and Economy on the Earth
 - GW 75% of resources used for Drinking water in Europe (EC, December 2019)
- Groundwater playing an important role for mitigating Climate Change
 - Modification of precipitations (temporally and spatially) and evapotranspiration (increasing)
 - Acting as a buffer through dry periods and for contamination transfer
 - Recharging actively when possible for providing resources when necessary
- Trade-offs from other sectors (Energy production, Raw materials exploitation, ...)







How to optimise synergies between Water4All and GSE? Personal views!

- Developping SRIAs in close cooperation
- Exchanging on needs and means for developing solutions
- Transforming this in implementation plans which complement



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Thanks for your Attention







Too much, too little and/or too polluted

Groundwater in the bigger picture and introduction of the four GeoERA groundwater projects and their contributions to the GeoERA information platform, EU and UN policies and goals

Klaus Hinsby (GEUS, khi@geus.dk),

Laurence Gourcy (BRGM), Hans Peter Broers (TNO), Anker L. Højberg, (GEUS) and Marco Bianchi (BGS)

on behalf of the GeoERA Groundwater TEAM

Presentation for the GeoERA groundwater webinar 13.11.2020





Too much - too little and/or too polluted

Water resources in a changing climate

1.2 billio	in people in the world at risk from flooding today, up to 1.6 billion by 2050
€43	6 billion lost during the last 35 years due to floods and droughts in Europe
	11% of European population affected by water scarcity in 2017
Nнy	66% of freshwater consumed by Agriculture in Europe, up to $80%$ in the world
	60% of European water bodies still of an insufficient quality
AIER	78% of global employment is water-dependant
	1.88 million signatures to the Right2Water citizen initiative
844	4 million people in the world without water access, 2,3 billion without sanitation
der der ser se	

Courtesy: Christian Holmegaard Mossing /NIRAS

CONTENTS

- 1. Groundwater in the bigger picture (EU Green Deal, UN SDGs and Planetary Boundaries)
- 2. GeoERA and Water4All contributions to Horizon Europe
- 3. The four GeoERA groundwater projects and their main contributions to the GeoERA information platform / EGDI and *FAIR access to groundwater data

*Wilkinson et al., 2016. The FAIR Guiding Principles for scientific data management and stewardship. Sci Data 3, 160018.

The European Green Deal – a high priority goal

6 ambitions of the von der Leyen Commission



The European Green Deal

innovation programme under grant agreement No 731166

Integrated, sustainable and just exploitation of water resources is required to meet the objectives of the "EU Green Deal" and the UN SDGs

10,6%

18,2%



THE GLOBAL GOALS

Sustainable management of water resources plays an important role in nearly all 17 SDG's

Water use in Europe by economic sector, 2017



https://www.eea.europa.eu/dataand-maps/indicators/use-offreshwater-resources-3/assessment-4



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Planetary Boundaries

Groundwater quantity and quality is affecting and/or is affected by all 10 Planetary Boundaries



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"Fresh water—the bloodstream of the biosphere—is at the center of the planetary drama of the Anthropocene. Water fluxes and stores regulate the Earth's climate and are essential for thriving aquatic and terrestrial ecosystems, as well as water, food, and energy security." (Gleeson et al., 2020).







WATER

Thematic Cluster 6: Food, bioeconomy, natural resources and environment



OUR MISSION:

TO CONTRIBUTE TO EU AND UN SUSTAINABILITY GOALS BY DEVELOPING A WORLD LEADING SUBSURFACE INFORMATION PLATFORM (EGDI)



The four GeoERA groundwater projects and their main contributions to EGDI:





Hydrogeological processes and Geological settings over Europe controlling dissolved geogenic and anthropogenic elements in groundwater of relevance to human health and the status of dependent ecosystems Laurence Gourcy, BRGM (I.gourcy@brgm.fr)







The project





Information from pilot areas will be available to all stakeholders and the public via map viewers etc. on EGDI during 2021



WP5 – **Nitrate and pesticides transport from soil to groundwater** Presence of pesticides and nitrate in groundwater depend on the pressure but also on the processes that occur from soil to GW such as denitrification – upper GW levels are more vulnerable but deepest part of aquifer can reflect OLD pressures

Travel times for nitrate in the unsaturated zone









WP8 - Effective monitoring of emerging contaminants

Linking the presence of emerging contaminant to the vulnerability of aquifers, groundwater age and today's pressure -> review of conditions affecting the presence of CEC

Groundwater vulnerability is driving the project

HOVER challenge – From local hydrogeological understanding to pan-EU overview helping GW management

Travel time, groundwater age, vulnerability concepts important for management :

- Protecting the areas of high vulnerability
- Linking pressure and impact taking into account lag times for contaminants travelling from soils to aquifer
- Recommend monitoring of specific contaminants depending on hydrogeological settings
- Understanding spatial distribution of geogenic and anthropogenic contaminants
- Proposing efficient programme of measures

-> links with TACTIC (vulnerability to climate change, recharge) and RESOURCE (groundwater depth/volumes) and VoGERA (vulnerability to pollution)

TRCTIC GROUNDWATER

TACTIC, Webinar 13th November 2020

TACTIC

 Tools for Assessment of ClimaTe change ImpacT on Groundwater and Adaptation Strategies

> Anker Lajer Højberg, Senior researcher, GEUS (alh@geus.dk) TACTIC Coordinator

Innovation Fund Denmark









Climate change challenges

"...observed climate changes are already having widespread impact on ecosystems, economic sectors and human health and well-being in Europe." - European Environmental Agency "More extreme weather conditions are anticipated...and the impact is expected to increase in the future ." - JRC

- Impacts of climate change experienced today
- Impacts expected to increase in future
- The cost is immense

Improved knowledge and tools to assess climate change impact are needed to support EU policy

"Cost of climate change in Europe could reach 4 % of GDP if no policy measures are adopted" – Horizon, the EU research and innovation Magazine

"The Greatest Threat To Global Security: Climate Change Is Not Merely An Environmental Problem" – UN Security Council



TACTIC contribution

- Numerous CC studies already
- But most ignores the groundwater system
 - Impact on groundwater
 - A freshwater buffering system
 - Can enhance or dampening impacts from extreme weather events and vital for assessment of the CC impacts

TACTIC Vision

Improve use and access to data and knowledge acquired by the GSOs of the subsurface system in CC impact assessments and adaptation







TACTIC impacts

Advance

Advance scientifically sound climate change impact assessments

- Local/national assessments
- Support EU policy on member state actions

Experiences varies among GSOs

Harmonise

Harmonise assessments and results – prerequisite for EU policy-making

- Common approaches
- Cross-comparison

Multiple tools and approaches available

Access

Make data and results available for future assessments and applications

- Assessments by GSOs
- Third parties "on-top" services
- New research and innovation

Data, results and knowledge currently difficult to access







TACTIC objective and approach

TACTIC will develop an *infra-structure among European Geological Survey Organisations* for collaboration to advance and harmonise climate change assessments within the GSOs.

TACTIC Toolbox and guidelines

- TACTIC Toolbox
 - Identify usable tools
- Guideline
 - Selecting approach and Harmonising

Pilots

- Demonstrate in pilots (41 pilots)
- Different challenges
- Facilitating knowledge sharing

Interaction with GIP

- Collect and harmonise data
- Provide easy access to data and results in GIP









TACTIC outputs – infra structure

- Collect and develop tools and approaches
- Provide specific guidance
- Harmonise assessments
- Develop standardised TACTIC climate change scenarios
- Identify standardised outputs

Enhance and harmonise future assessments, make assessments accessible

Model ensemble

- 15 models (3 RCP x 15 GCM)
- GCM biascorrected







TACTIC outputs - Pilot assessments

- Assess CC impact on
 - Groundwater levels
 - Groundwater recharge
 - GW-SW interaction
 - Flood/drought
- Effect of adaptation strategies
- Pilot reports
- Collaboration with authorities and stakeholders

Pilot specific results utilized by national/ regional authorities and stakeholders



Change in groundwater heads





European recharge map and satellite data

Combining pilot assessments and satellite data for recharge estimate at EU-scale



Pan-EU map of groundwater recharge - combining pilot assessments and satellite data







Thank you for your attention







VoGERA Correction

Vulnerability Of shallow Groundwater resources to deep sub-surface Energy Related Activities

GeoERA Webinar Series

13 November 2020

Marco Bianchi, BGS, marob@bgs.ac.uk







Energy related activities in the sub-surface

- 1. Conventional oil and gas
- 2. Shale gas
- 3. Coal bed methane

- 4. Geothermal (low/high enthalpy)
- 5. Energy and gas storage
- induce physical and chemical changes in the subsurface
- introduce new chemical substances
- cause the movement of pre-existing fluids (brine, hydrocarbons)







Objective of the VoGERA project

To improve scientific understanding of the vulnerability of shallow groundwater from deep sub-surface energy-related activities.

- Protect groundwater resources
- Allow informed and responsible use of the deep sub-surface
- Develop a European-wide approach that is consistent across energy activities







VoGERA

Project structure



6 Partners BGS TNO VMM SCK CEN MBFSZ GEUS





WP 3 – Process understanding

Used evidence to assess possible pathways between deep systems and shallow groundwater (e.g. fault zones, abandoned wells) at pilot locations

Geothermal



* * This projec
* * innovation

VoGERA

WP 4 – Conceptual framework for vulnerability characterisation



Developed a set of conceptual models for potential contaminant pathways between industrial activity in the deep sub-surface and shallow groundwater resources.





VoGERA

WP 4 – Conceptual framework for vulnerability characterisation

Developed a consistent screening methodology for characterizing the vulnerability of shallow groundwater from deep industrial activities

Testing ongoing at pilot sites







Anticipated outcomes

- Improved understanding of groundwater vulnerability related to a range of energy related deep sub-surface activities in Europe
- Consistent approach for assessing groundwater vulnerability across Europe
- Improved sub-surface spatial planning and decision making to protect (shallow) groundwater



Sustainable development and use of the subsurface requires an *easy and* <u>FAIR*</u> access to subsurface information and data –

 *FAIR = Findable, Accessible, Interoperable and Reusable <u>https://www.go-fair.org/fair-principles/</u>
 Wilkinson et al., 2016. The FAIR Guiding Principles for scientific data management and stewardship. Sci Data 3, 160018.





Thank you for attending the webinar GeoERA Groundwater Resources

Part of the GeoERA Webinar series (9–13 November 2020)

Stay connected: geoera.eu



