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MILESTONE REPORT M8a

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Roer-to-Rhine stakeholders' events: results and lessons learnt

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1 ROER-TO-RHINE REGIONAL WORKSHOP

The regional workshop on subsurface management and planning for the Roer-to-Rhine area of interest (WP3) was foreseen as a presential workshop involving stakeholders from all countries/regions inside the area. This was originally foreseen as an interactive session to inform the target groups about the potential applications and valorisation of the deep subsurface once the first results of the methodology would be available, and the possible footprint with respect to current and future activities. The placement of the workshop within the project's timeline is represented below:



Due to unprecedented circumstances related to the COVID-19 pandemic, this workshop had to be converted to an online format. The chosen approach was to focus on specific themes separately in order to attract different stakeholder groups. The goal was to discuss each theme in the perspective of subsurface management, inviting attendees to join the final session which would bring all themes together.

The themes chosen were:

- **Geoheritage & geotourism**, to discuss the link between surface geology and subsurface processes using geomanifestations
- **Groundwater**, to discuss the importance of these resources and how to incorporate models in the structural framework
- **Geothermal energy**, to discuss the relevance of the structural framework and geomanifestations to indicate potential in a region
- **Subsurface interactions**: to bring all previous themes together and highlight the importance of subsurface management and spatial planning.







One or two external guest speakers were invited to introduce each of the first three themes, followed by a project presentation bringing the elements presented by the guest(s) into the structural framework model and/or geomanifestations. The final theme was introduced and developed by project partners. The speakers are detailed below:

Theme	Invited external speaker(s)	Project speaker(s)
Promoting geoheritage and geotourism	Glen Burridge (European Federation of Geologists) Mónica Sousa (Portuguese Association of Geologists)	Kris Piessens (Geological Survey of Belgium)
Framing groundwater	Koen Beerten	Kris Piessens
resource management	(Belgian Nuclear Research Center)	(Geological Survey of Belgium)
Framing geothermal	Estelle Petitclerc	Kris Piessens
resource management	(Geological Survey of Belgium)	(Geological Survey of Belgium)
Subsurface interactions	-	Kris Piessens
		(Geological Survey of Belgium)
		Isaline Gravaud
		(French Geological Survey)

To keep the original objectives, interactive sessions using live polls were organised after the presentations in order to get the audience's feedback.

The events were live streamed on YouTube, and can be accessed through the following links:

- Day 1: Promoting geoheritage and geotourism
- Day 2: Framing groundwater resource management
- Day 3: Framing geothermal resource management
- Day 4: Subsurface interactions







2 RESULTS

The results presented in this chapter are compiled from the data collected by the webinar platform (Zoom) and polling platform (PollEverywhere), and presented in the event's reports automatically generated by these. Some free text entries from the audience were rewritten for correctness.

2.1 Event performance

Theme	Date and time	Number of attendees	YouTube views	Total outreach
Promoting geoheritage and geotourism	22 June 2020 9:30-11am	105	284	389
Framing groundwater resource management	23 June 2020 9:30-11am	44	67	111
Framing geothermal resource management	24 June 2020 9:30-11am	57	60	117
Subsurface interactions	26 June 2020 9:30-11am	35	71	106

Some metrics about each event are presented below:







2.2 Composition of the audience



What is your background?







Where are you based? Please click on the map (use the one on the top right if you are based outside Europe).









2.3 Feedback from the audience

2.3.1 Theme-specific topics

Day 1: Geoheritage & Geotourism

How to better communicate and promote geoheritage and geotourism?

- Translate our heavy jargon rich language into simple one
- More information about the sites, small courses about geoheritage
- Geological guides
- Picture of a landscape
- Link geology to what is seen in popular movies/series
- Activities for the general public
- Train geoscientists to communicate effectively. Be like the general people. Don't bring people to geosciences (lecture). Bring the geosciences to the people (empathy)
- Conducting similar webinars for academic Institutions.
- Schools, press
- Develop a wider, global network of all the various geoheritage organizations.
- Geology in school!
- Important is to present that "normal" things in the geological frame. Always, the story is fundamental. And the charisma of the storyteller.
- Focus on children, put every scientific fact into a story. People get personalised with stories that are close to them.
- Teacher training, (virtual) field trips, website, apps
- Real field trips
- Through the tourism industry and government agencies
- Start communicating at school, including fieldtrips
- Field trip, geological guides
- Getting geology into school curriculum is really important
- Virtual field trips







How can we make geological information even more understandable?

- Experiments are always more interesting. More monitoring activities for not geologist. Maybe a platform where they can send interesting photos of geology localities.
- VR can be used to visualize geology in an attractive way. It can also be used to demonstrate the geological development of certain sites
- Start with a picture of a landscape, then make notes on this picture (with coloured rock layered, faults, ...) and a really clear legend, possibility to click on difficult words to have a definition
- With analogies to current events
- Make a documentary with Sir Richard Attenborough speaking about Geology
- Simplified language
- Rocks are also present in cities (building stones)
- Draw simple lines in the images
- Make glossaries readily available and accessible
- Get people who don't know about geology to test what we provide see if they can understand it
- Images, models/activities that allow people to see/experience processes
- Look at how science-led archaeology does it. Many overlapping concepts. Not at plate tectonic scales but many overlaps.
- 4D
- Using images and understandable maps
- Illustrating with graphs and schemes in the real images of the sites, mapping, 3d-visualization
- Making analogies
- Go out into a landscape (immersion), good teachers
- Through short YouTube movies (capsules)
- Nice stories and images 😇
- Connect to the normal world of ordinary people
- Relate it to the person
- Basic animation videos
- Think like a 12-years old child
- Use simple real-world examples to illustrate our terms
- Use emotion that creates neurological anchors.
- Clear 3D images



Day 2: Groundwater





How can we make hydrogeology more understandable to everyone?

• Teach it in high school

- Animated output from groundwater flow models of e.g. groundwater flow and contaminant transport will be of increasing importance
- Start from the perspective of the broader public! Summer droughts, climate change, ... And then go deeper. And present the results on the platforms they are on: Youtube, Facebook, Instagram,...
- Yes, it is possible, introducing some concepts in high school and reorganizing the information for ordinary people choosing the key points of hydrology.
- Convert science questions into societal questions so they can resonate to policy makers
- For non-specialists: make it highly visual
- Education
- With short movies and analogies with everyday life objects
- Really everyone...? Fairies and trolls made a good start
- I think there is a strong need to create knowledge material which is less technical and involves more illustrations, videos
- Explain simply the combination between hydraulic laws and the specific heterogeneity in the subsurface.
- With pictures/3D models, local examples on pollution issues







Day 3: Geothermal

Showing geomanifestations in the structural framework is an intuitive way of indicating geothermal potential



What information about geothermal energy needs to be better explained to the public?

- If it will be for the large public: Will I get it at home? Soon? Or never?
- Explain "potential" to the public: it's not an 0/1-potential... it's on a scale of 0-100 so potential is a difficult (technical?) answer.
- How it relates to them and their lives, houses, costs, and any disruption due to installation or production. Put the people in the foreground, not all the technical data. Answer "What does it mean to me and my life?"
- First explain the word "geothermal" and the principle of increasing heat with depth. Then, show example of existing exploitations.
- Total amount of energy available in each basin
- Linked more with the needs at local level. Tapping on the public acceptance
- Potential of 'direct use'
- The heat is there, we want to extract it in a safe way
- How it may affect local population, what is the risk, what is the profit for locals
- Risks and risk mitigation
- Difference deep vs shallow







Day 4: Subsurface interactions



Subsurface management is a pressing issue and we should be discussing it more







It is easier to understand geological information about the subsurface (e.g. cross-sections, 3D models) once these are contextualised in the structural framework



Which subsurface uses would you like to see integrated into our case studies?

- Maybe a sci-fi one: "functional areas" like living/sleeping underground and the possibilities to use the underground space instead of use more space on the earth.
- Raw material potential maps
- Nuclear waste storage
- It is important to communicate about examples close to people. In Belgium: different kind of groundwater exploitations and geothermy in the Mons Basin.
- All! Waste management, water, energy, etc. You may need to build in the ability to add in biological aspects of the subsurface too.
- Geotechnical parameters
- All obvious uses were already mentioned
- Energy storage, hydrogen storage, CO₂ storage
- Mine dewatering and repumping
- CO₂ storage
- Deep geothermal
- Wind farms, since they may be sealing off important geological resources







2.3.2 General feedback about the project and the events









What are the pros and cons of the GeoConnect³d way of presenting information?

a) Pros

- Methodical/logical progression of ideas to explain complex geology
- People have poor grasp of spatial relationships, so map-based is great.
- Showing policy makers and broader public how complex the underground is.
- Enabling global connectivity and outreach in developing common visions across nations
- Visual results and a framework context
- Fast to integrate results
- Makes you think about the limits of geological units as controls on their history, properties, potential uses
- Three-dimensional GIS has to be used systematically to present information to non-geologists
- Easy to understand
- Reaches wider audience (virtual)

b) Cons

- It may not work for all types of sites? Good for the examples presented
- Not sure you would understand it well if you don't have a geology background
- Not all people are geographically literate (map reading, 3D-vision). Not all people see characteristics of rocks. Not all people are scientifically literate. Geology has many technical concepts/words.
- It may be a little too complicated, so the introduction needs to be simplified a bit. Maps are great!
- Many difficult names in Geology difficult to get around
- A lot of information to retain that was made communicating opinions
- Make it less technical. People want analogy and metaphor (the language of the masses)
- You still need people to vulgarize and explain
- Even if all stakeholders have not a scientific background, it is important to simplify but it is more important to keep it scientifically correct: it is a challenge
- Still technical (people don't necessarily know what a fault is, how to read graphs)
- Not all stakeholders have a scientific background, so vulgarise as much as possible
- How can you deal with uncertainty?
- Showing deep seismicity data is difficult to understand for stakeholders because you don't have fault info there
- Too much information when zooming on Wallonia
- Semi-con: maybe an application in the future open for users to contribute and use
- It assumes that people understand maps and 3D models -- so that limits you to an expert audience.
- Difficulty to provide info at depth
- Need to understand geology vocabulary and English and to be familiar with maps and the representation of reality with symbols
- Challenging to implement all kinds of geo-information
- Very dependent on technology.







What did you like most about this session?

Day 1: Geoheritage & Geotourism

- Glen's talk gave me the sense that we are doing many of these things already in Great Britain and Ireland but funding is still crux.
- The pertinence of the presentation. The moderators were very clear and efficient.
- Travelling with Monica's pictures!
- Combination of story(telling)/images/maps
- Great presentations
- Link with literature and mythology
- This interactive bit is good
- To understand the current strategy and the ways you are moving forward.
- Geology should interest everyone and not only geologists
- GeoPark idea
- Good to know that geology is trying to appeal to the public. Good to see that we all realize the importance of geology.
- The share
- Nice presentation, easy to follow, smiley people and good energy
- Scaffolding of presentations was useful in describing your ideas great presenters
- The communication between the speakers, and the informal way of communicating. The examples given of the sites.
- Could participate from home
- Openness to questions, comments, ideas and criticism. Well done
- Learned about new geology sites for me!
- Variety of talks. Professionalism
- Live presentation
- Very interesting presentations and discussions.

• The lock down virtual travel

Day 2: Groundwater

- I enjoyed it and hope to learn from you to produce something similar for other GeoERA information products
- Groundwater is an interesting subject. It's nice to interact about it.
- I really liked the yesterday's session about geological heritage. This one was more technical and less about general aspects of groundwater. But YOU ARE DOING GREAT!!! Keep up the good work!!!
- Nice to see the zoom-in zoom-out option, it makes the tool attractive also for teaching!
- Easy to use tool, also with this answers/questions
- Awesome background support
- The informal conversation, the dialogue and the visual explanations
- Not overloaded with tens of presentations, focussed on a few







(continued) What did you like most about this session?

Day 3: Geothermal

- You did a good job
- Interesting subject matter, importance of good 3D models
- Flow rate, temperature
- Interesting review
- The presentations and the interactive poll
- Good, focused content/presentations, question interactions
- Interesting update on technical advances and what BGS is doing.
- Lots of stuff I didn't see before!
- The focus on Belgium
- Interactive poll
- The unpredictability of it

Day 4: Subsurface interactions

- Accessible, even for non-geology people.
- All presentations, interpretation by Kris
- Good meeting. Introduced to the issues that are studied in the project. However, I need to thoroughly trace the page and see what access to information looks like.
- A good start to bring geology and subsurface management to the public. Important to include the public.
- 3-D models of neighbouring areas put into context at the same scale to give correct spatial perspective
- Nice visualizations + link to almost all areas of economy & ecology
- The interaction (the Q&A and the pool). Good organisation! Thank you
- Easily accessible, good topic, highlighting the importance of good 3D models.
- Learning about your 2D and 3D depictions of the geology. You are showing how it can be done.
- Very clear, and comprehensive what are targeting, thank you!



How would you rate this event?







3 EVALUATION OF RESULTS

As originally planned, the evaluation of the results of the workshop is focused on the joint (interactive) identification of subsurface management challenges and related research needs.

A summary of the most frequently mentioned (and most upvoted) points identified by the audience and presented in the previous chapter can be found below:

Better ways to communicate geological knowledge

- 1. Using simplified language making use of analogies and relatable aspects of the public's everyday lives.
- 2. Converting science questions into societal questions so they can resonate to policy makers.
- 3. Making use of modern visualisation possibilities (e.g. 3D, 4D).
- 4. Explaining how subsurface uses may affect local populations, including risks, risk mitigation and profit for locals.
- 5. Organising real and virtual field trips.
- 6. Getting geology in the school curriculum.

Weaknesses of the structural framework model

- 7. Language used is too technical.
- 8. Limited to experts since it assumes people understand maps and 3D models.
- 9. It is important to simplify, but it is essential to keep it scientific rigour.
- 10. Not clear how uncertainty is being dealt with.

Subsurface uses to incorporate in the structural framework model

- 11. Deep geothermal.
- 12. All possible uses, including waste management, water, energy, etc.; possibly also biological aspects of the subsurface.
- 13. CO₂ storage.







The following questions were identified by the audience that can be addressed and/or (partly) answered based on the research and data gathered in GeoConnect³d. Challenge numbers refer to the list above:

Challenges	GeoConnect ³ d approach
1 and 2	Looking into the subsurface management challenge from the point of view of the clean energy transition and benefits for the future of the society
3, 7 and 8	Assuming people interested and/or involved are familiar with geographical maps, the online structural framework can make use of country and region borders to locate geological information in a familiar view, only then linking the surface data with 3D information
9	The structural framework model defines and references all of its elements in a way that advances in geoscience can be incorporated if happening in the future, making it a robust model
10	The structural framework model represents uncertainty as haloes around the limits, an explicit way to show the limitations of geological information
11	Actively seeking collaboration with other GeoERA projects (HOTLIME and MUSE) on the topic of geothermal energy; possible to make use of their networks for more collaboration specifically on deep geothermal energy

The remaining challenges listed give some indications of potential topics of public interest for post-GeoERA research. These include:

- Linking surface to subsurface by making use of existing information that is attractive and relatable to the general public, e.g. sites of interest for geoheritage and geotourism.
- Incorporating geo-energy subsurface uses that are not covered in GeoERA: energy storage, CO₂ storage.
- Incorporating subsurface uses that might not be directly related to geo-energy and the clean energy transition, but that are of high importance for society: waste management, water resource management, biological aspects etc.
- Studying and demonstrating risks and risk mitigation for specific subsurface uses.
- Allowing for data addition from the public into the models available online.







4 LESSONS LEARNT

1. External perception of GeoConnect³d

- The presentation of the methodology and preliminary results yielded a majorly positive response from the public in all sessions.
- Many of the challenges and limitations identified and brought up by the audience are already being addressed by the project, but were not explicitly presented and discussed during the webinars due to time restrictions.
- Visualisation was mentioned in all sessions as an important tool for communicating complex geological concepts and highlighted as one of the project's strengths.

2. Online live event format

- The webinar format proved to be successful to attract a large number of interested parties from varied backgrounds, although still mostly within the geosciences.
- This format also allowed for a regional workshop to be scaled up to other countries outside the Roer-to-Rhine area of interest, bringing different perspectives that would have not existed in a presential event.
- Increasing views of the events on YouTube show that the interest in the themes continues to exist, and that streaming to YouTube is an effective way to store the videos of the events and continue to advertise them afterwards.
- The interactivity of the sessions through the use of live polls was frequently mentioned as a positive experience.
- The condensed format with focus on specific themes was frequently mentioned as a good approach.