MEET THE GSEU

GEOLOGICAL SERVICE FOR EUROPE

Supporting Quality of European Groundwater Resources

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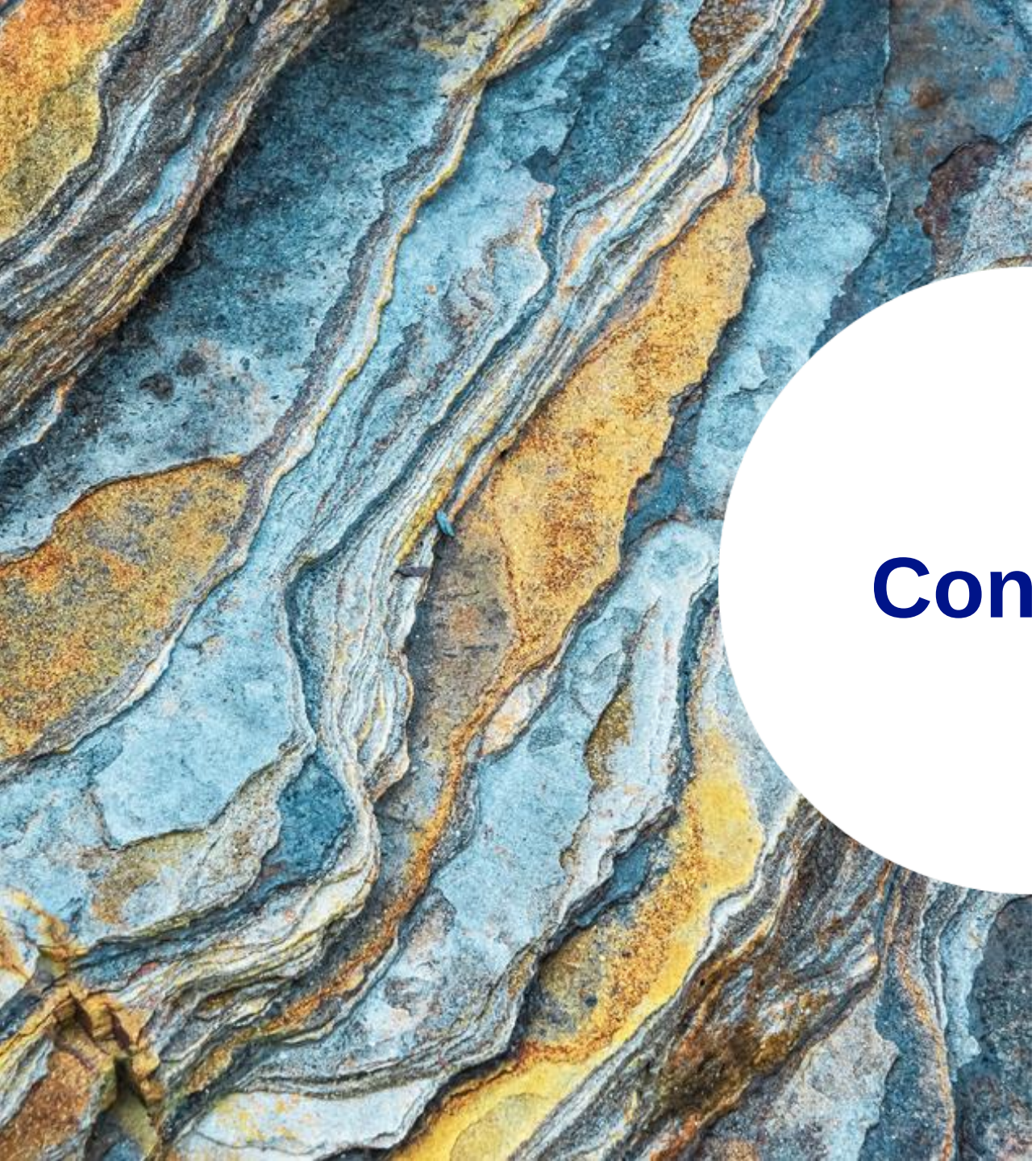
EuroGeoSurveys European Geoscience for Society
The Geological Surveys of Europe



Context of Action

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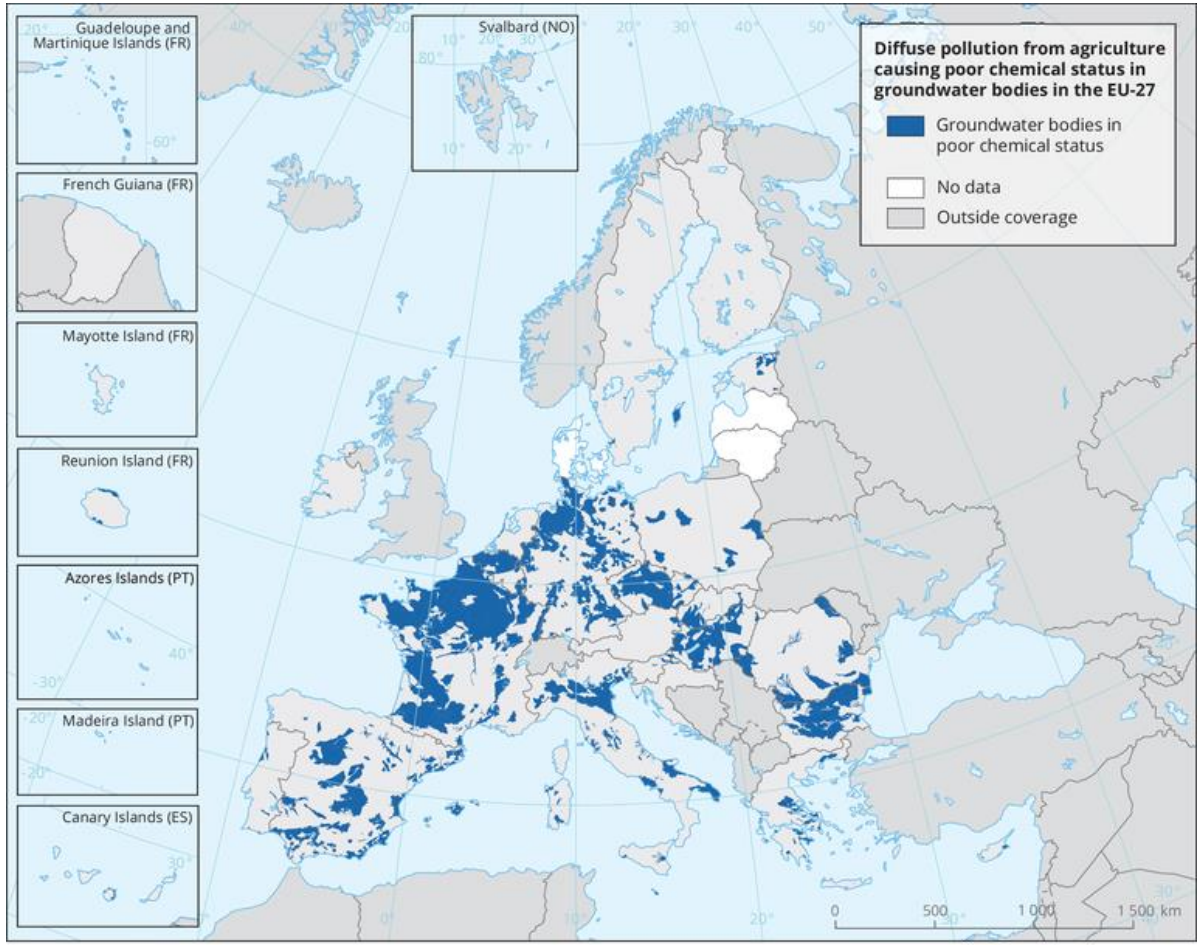
Overall Context

Groundwater quality vary widely over Europe due to varying geological, hydrogeochemical and hydrological conditions, but also due to varying drivers and pressures related to land use and anthropogenic activities leading to groundwater contamination patterns.

Moreover, **groundwater observation networks** differ in monitoring setups from country to country, and across Europe, which further complicates an EU wide assessment of groundwater chemical status.

The proposed work aims at **improving the understanding of these groundwater quality patterns and dynamics** based on (geo)statistical, machine learning and geochemical analysis of European groundwater quality dataset and mapping of determining factors and indicators.



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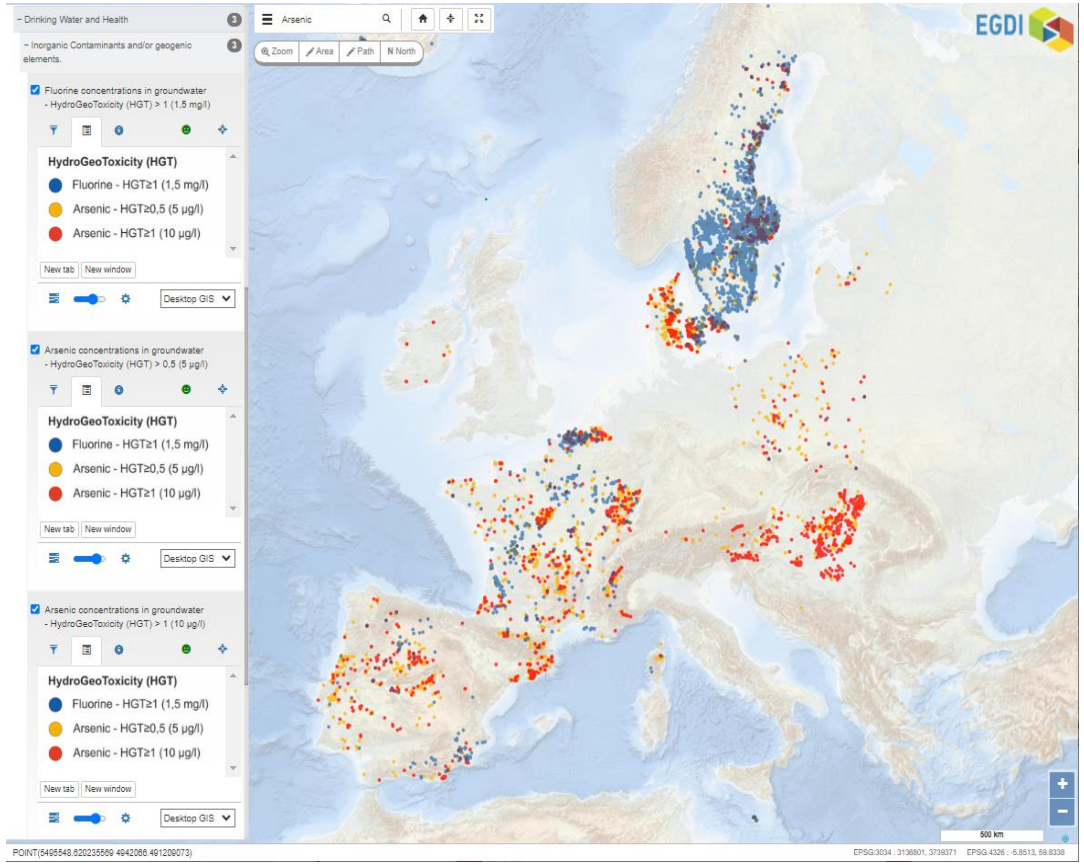
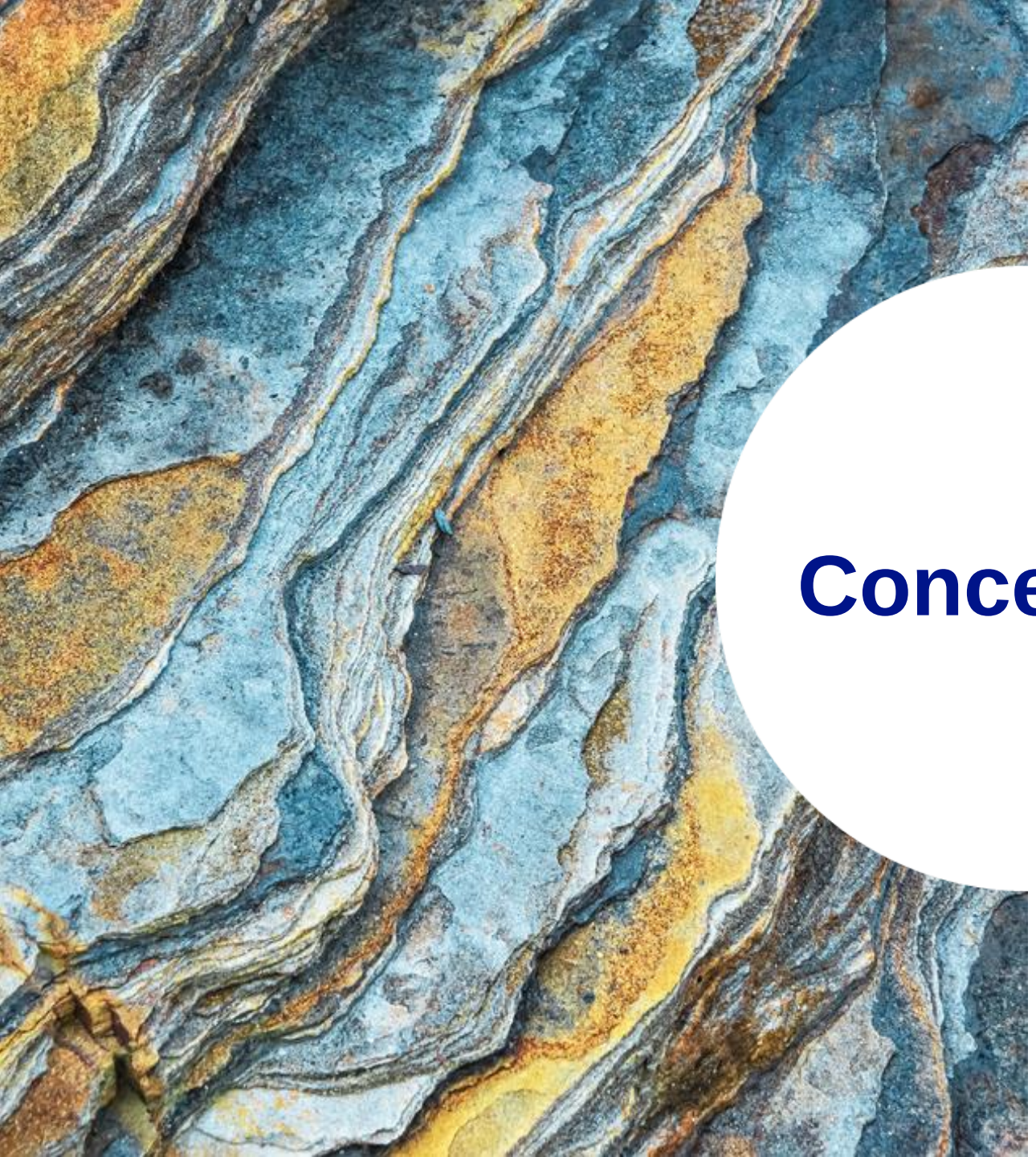
Groundwater Quality needs

There is a need for a groundwater quality **mapping** system based on harmonised approaches at EU scale:

- focusing on chemical properties that are relevant for environmental protection,
- taking into account the **properties of the subsurface** for trend detection and **groundwater quality patterns**,
- considering mobility and persistence of contaminants related to **drivers, pressures and uses under conditions of climate change**.





Concept and Methodology

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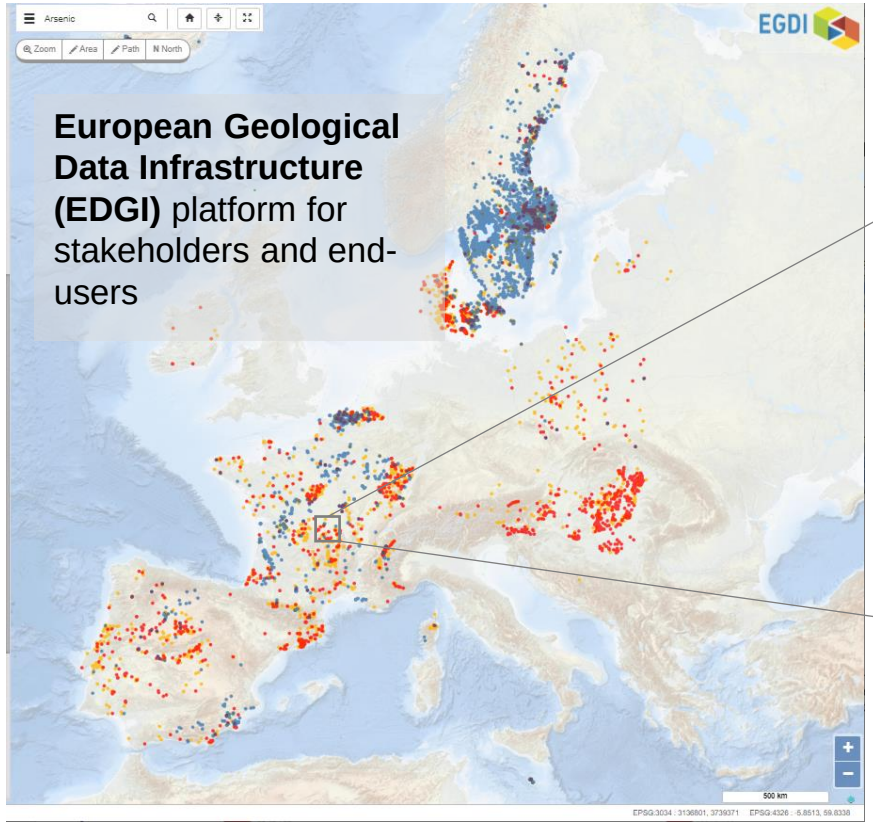
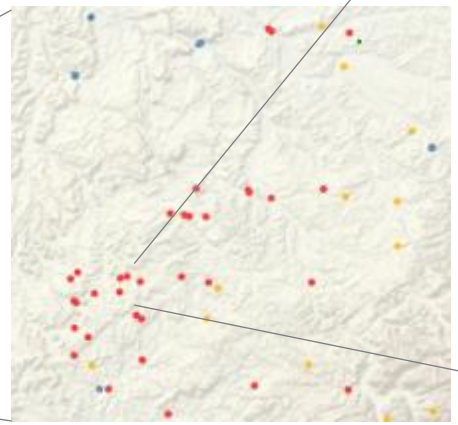
Concept

Determining the best way for **long-term sustainable management** and the efficient **protection of GW resources** under various pressures requires a good understanding of the **intrinsic characteristics of GW** and the **processes controlling water quality**.

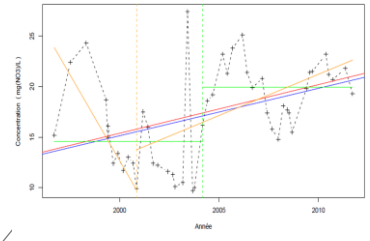
Identification and collection of groundwater quality monitoring data on a **pan-EU scale is crucial. Information gathered needs to be harmonized, analyzed and assessed for its ability to facilitate the creation of comprehensive GW quality maps.**

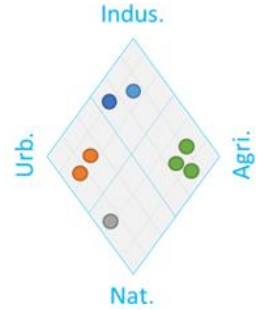
This process ensures not only that GW data is **available**, but also that it is **consistent** and **relevant** to the effective mapping of GW quality.





Groundwater quality monitoring points





Groundwater quality pattern and anthropogenic groundwater facies

Added values:
Re-use of previously obtained information
European Geological surveys collaboration
Exchange of knowledge
GW quality indicators in relation to anthropogenic impact

https://www.europe-geology.eu/

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Mapping Groundwater Quality

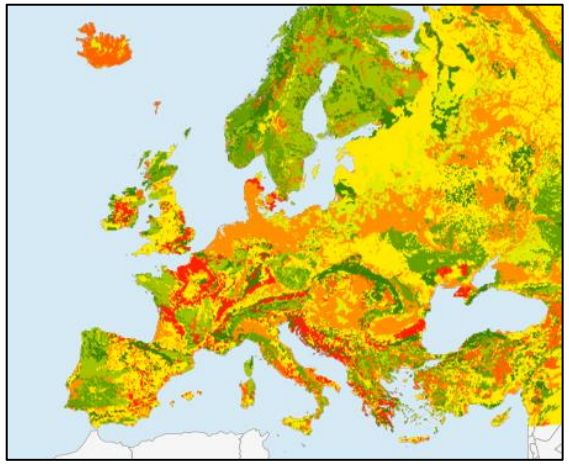
EGDI

Data Tools | Scientific themes | About EGDI | English

EuroGeoSurveys

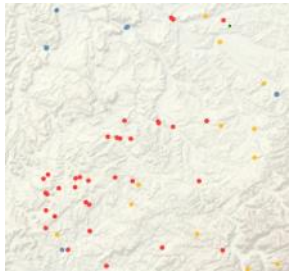
Welcome to European Geological Data Infrastructure (EGDI)

EGDI map viewer

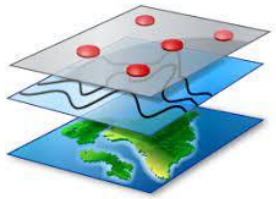


GeoERA GROUNDWATER

Re-use of previous information



Groundwater quality data across EU

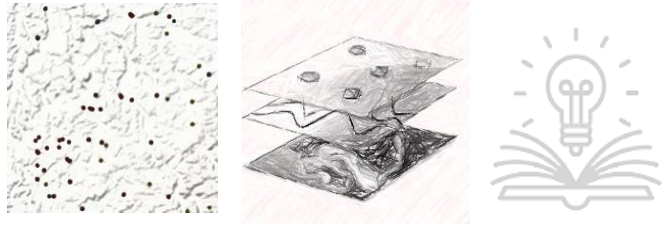


Base geoinformation (hydrogeological maps)

Knowledge background

Transnational, harmonized data gathering, monitoring and evaluation of groundwater quality patterns and trend identification

EU Geological surveys collaboration



New EU hydrogeochemical data, base data and knowledge background

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Two main focus over Europe

Groundwater quality patterns in relation to geological, hydrogeological and hydrological conditions

Groundwater quality evolution in relation to drivers, pressures and competing uses

Compounds

Natural compounds

Groundwater quality patterns in relation to natural conditions over Europe

Dissolved elements that can naturally occur in groundwater

- Major ions
- Trace metals (As, Fe, Mn, F…)
- Physico-chemical parameters : pH, redox (Eh), conductivity, temperature, O_2

Anthropogenic pollutants

Groundwater quality evolution in relation to drivers, pressures and competing uses

Dissolved elements in groundwater that can be influenced by anthropogenic activities

- Pesticides (Atrazine, metolachlor…)
- Industrials compounds (TCE, PCE…)
- Other organic pollutants (PFAS, Pharmaceutics, CECs, etc…)

External factors

Drivers of natural groundwater quality

- Geological settings
- Hydrochemical conditions
- Hydrodynamics

Drivers, pressures and competing uses that can influence groundwater quality

- Use of compounds
- Land use

► **Static analyses of groundwater quality**

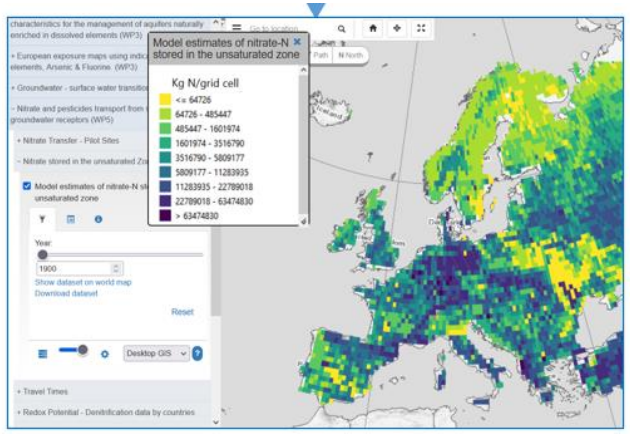
► **Trend analyses of groundwater quality**

Methods applied to GW Quality

Geostatistics, Statistics, Machine Learning: assessment and classification of factors controling large-scale patterns in GW quality

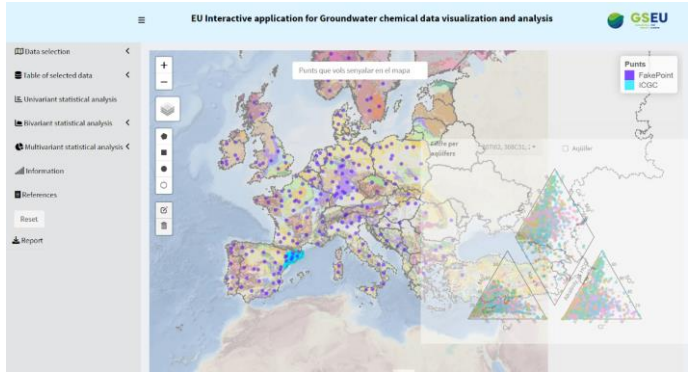
Matrix of human activity vs. groundwater pollutants: Link between human activities and emission of potentially harmful pollutants into groundwater

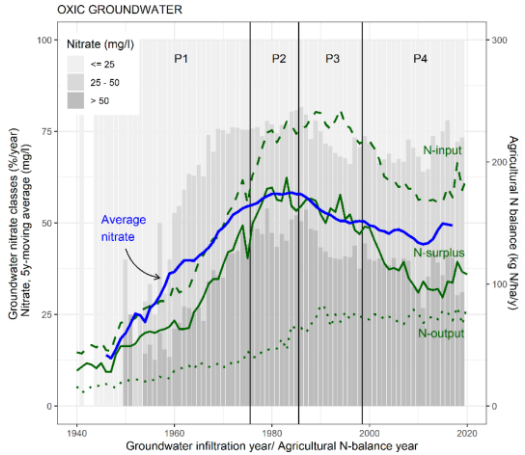
GW quality indicator and trend : Mapping selected groundwater pollutants and their evolution under drivers and pressure



*EU **map of probability for pollutants occurrences** in GW*

*A Shiny WebAPP made in R (open-source) for **online groundwater chemical data visualization and analysis** as an intelligent data management (IDM) system*

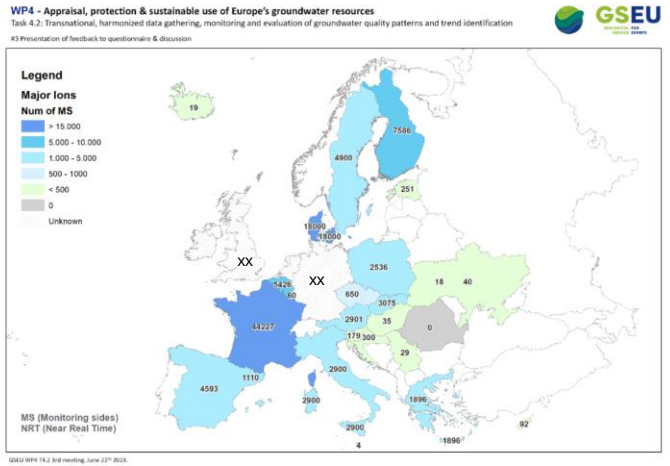


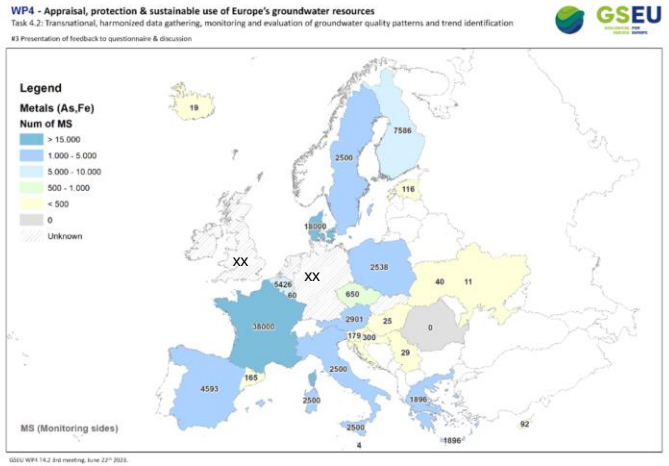


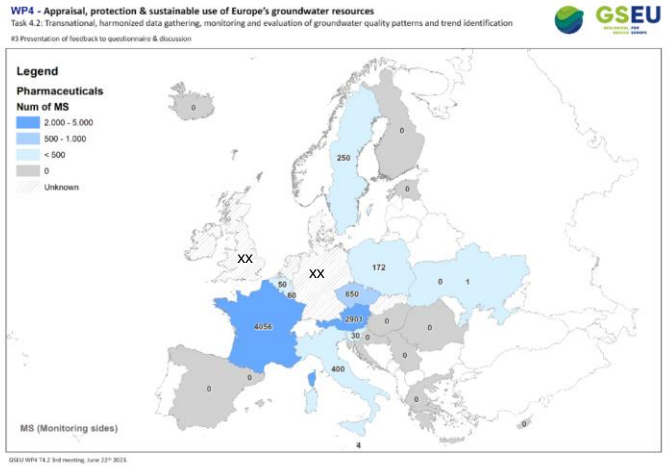
***Nitrate trend assessment** based on state-of-the-art machine learning aided techniques and geostatistical techniques*

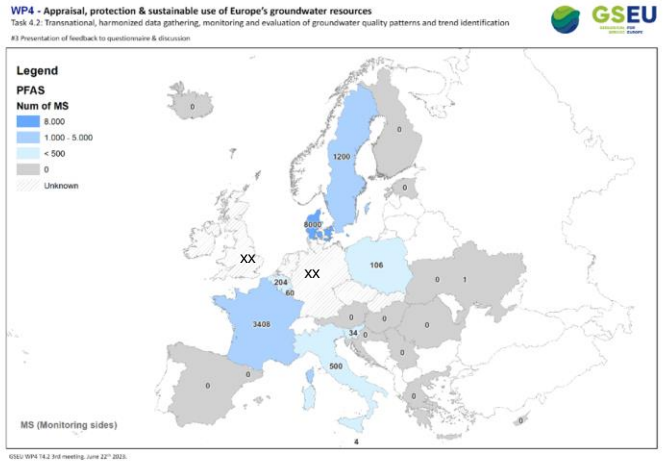
Inventory of available data across Europe

- Collection of GW quality data : 28 countries answered the questionnaire about monitoring sites and the availability of time series datasets.
- Challenges: heterogeneous kind of accessibility; in some cases, data is not publicly available









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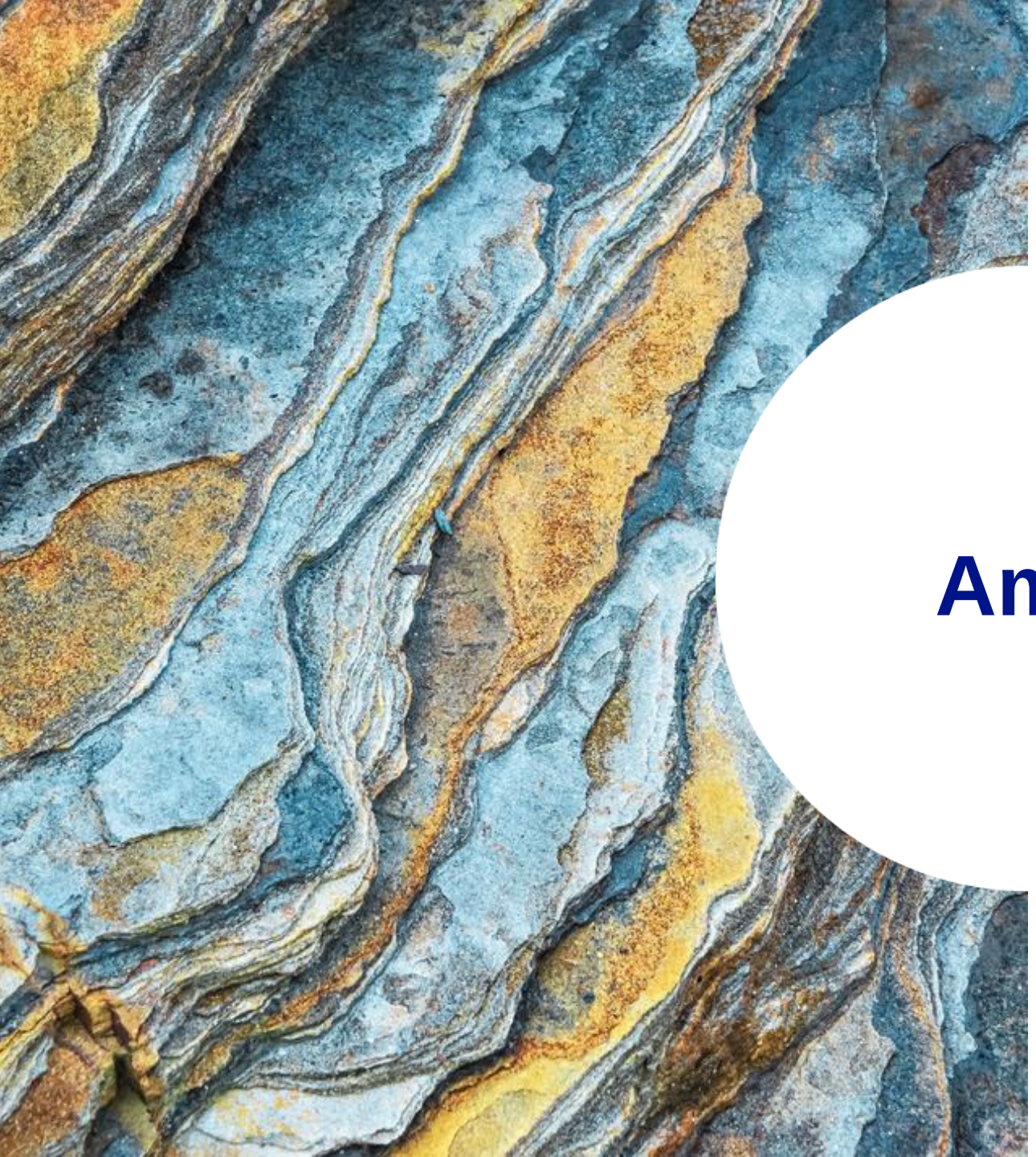

Ambition

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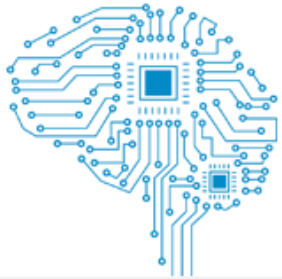
Transnational, Harmonised Data Gathering, and Evaluation of Groundwater quality patterns and trend identification

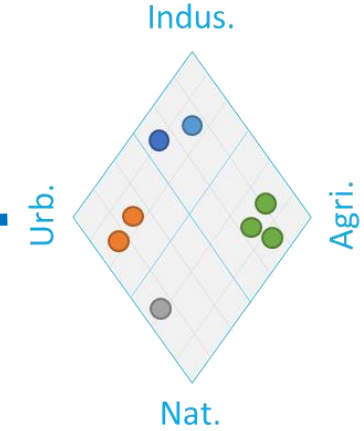
Groundwater quality patterns in relation to geological, hydrogeochemical and hydrological conditions over Europe

Groundwater quality evolution in relation to drivers, pressures and competing uses



Analysis
[e.g. GIS based, Geostatistics, Machine learning…] . . .

Trends
- GW quality
- pressure on GW

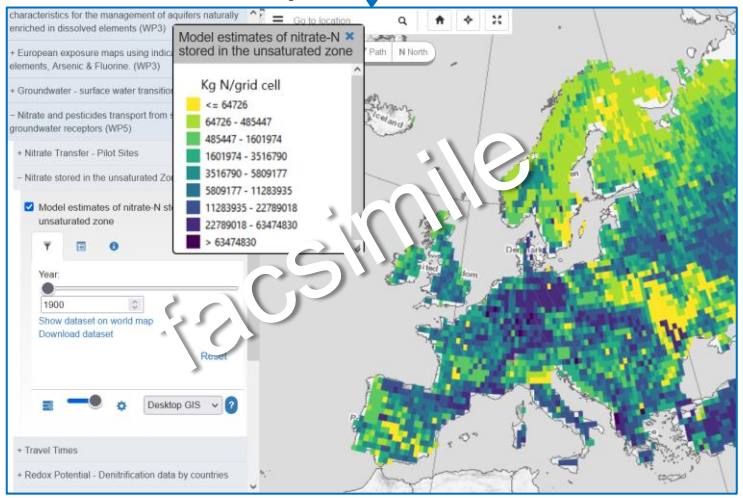


GW pollution pattern

Pan European data collection of aquifers

Representative data gathering
- Hydrogeochemical & Hydrological conditions
- Groundwater quality

Example of outcomes



EU map of probability for pollutants occurrences in GW

Drivers and pressures

GW Pollutants

MATRIX

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Relevance of this project to EU Groundwater Policy

- Evaluation of groundwater quality patterns, improving the understanding of natural groundwater quality and **natural background level** such as specified in the Groundwater Directive.
- Assessment of **GW Quality pattern** regarding different types of contaminants in relation to competing uses and increasing water demands under conditions of climate change.
- Support for current and future **GW Monitoring** to assess water quality at pan-EU scale.

Thank you for your attention

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