IGRAC

Utilities and Network Seminar

Amsterdam | April 30th, 2026

Groundwater: Making the invisible visible

From data to action

Elisabeth Lictevout – Director

unesco

Ministerie van Infrastructuur en Waterstaat

WORLD METEOROLOGICAL ORGANIZATION

From DATA to INFORMATION for decision-making:

In many cases, management has been initiated with very limited information

What is the lowest level of data needed?

MONITORING

- Groundwater levels
- Groundwater abstraction rates
- Groundwater quality

Increase the knowledge base (Other studies)

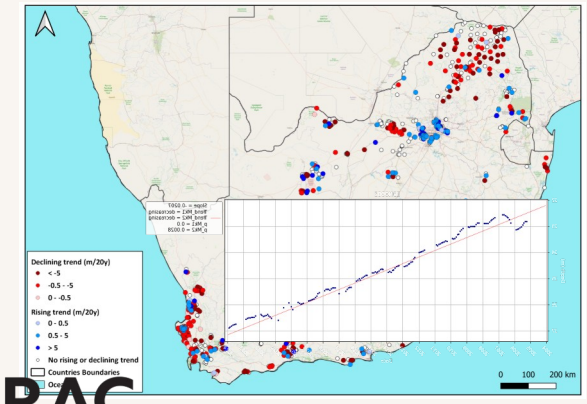
Adapt groundwater management

State of groundwater (quantity and quality)

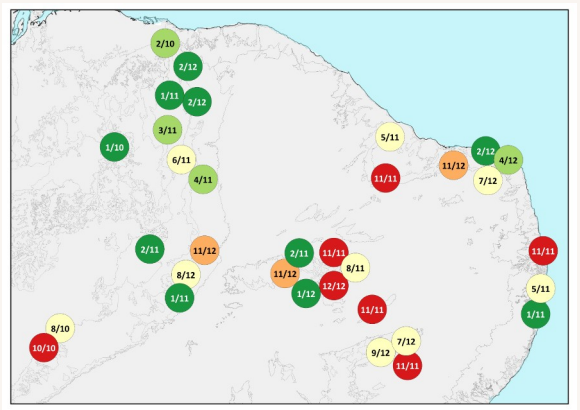
Groundwater status and trends indicators

+ drought indicators

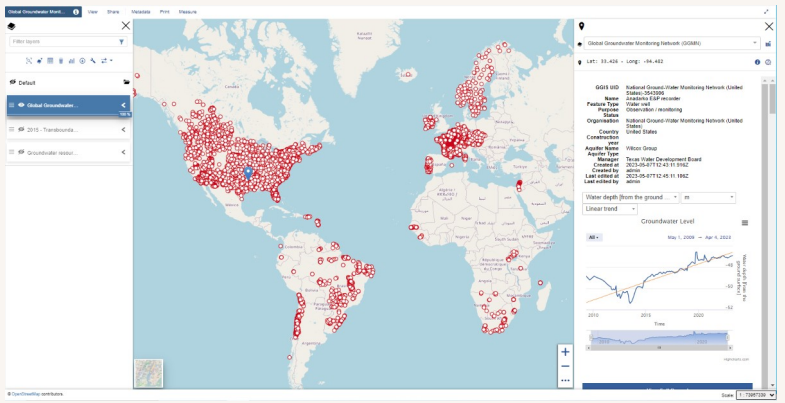
Groundwater level trends



Groundwater level ranking

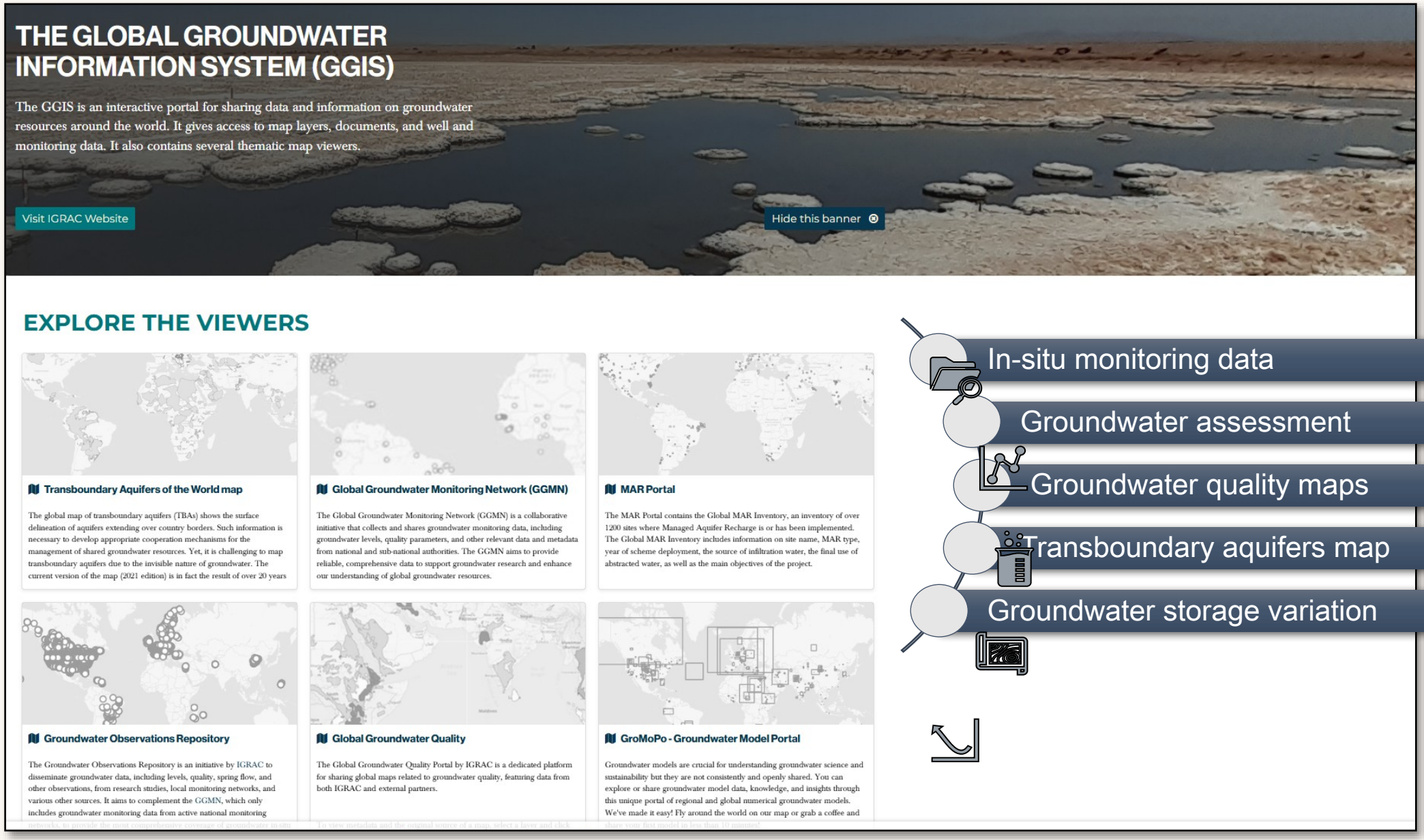


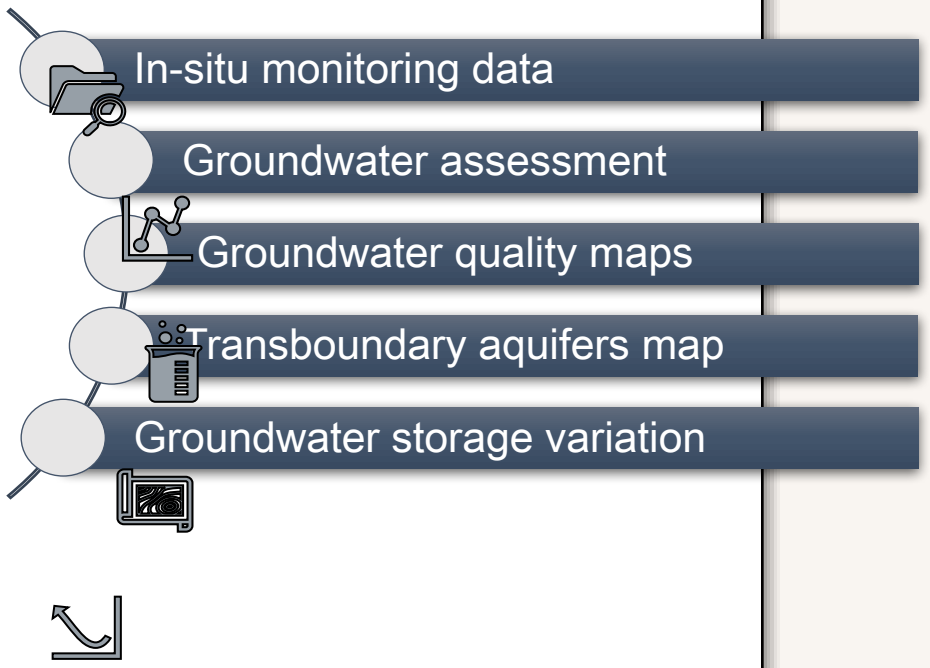
Groundwater Information System



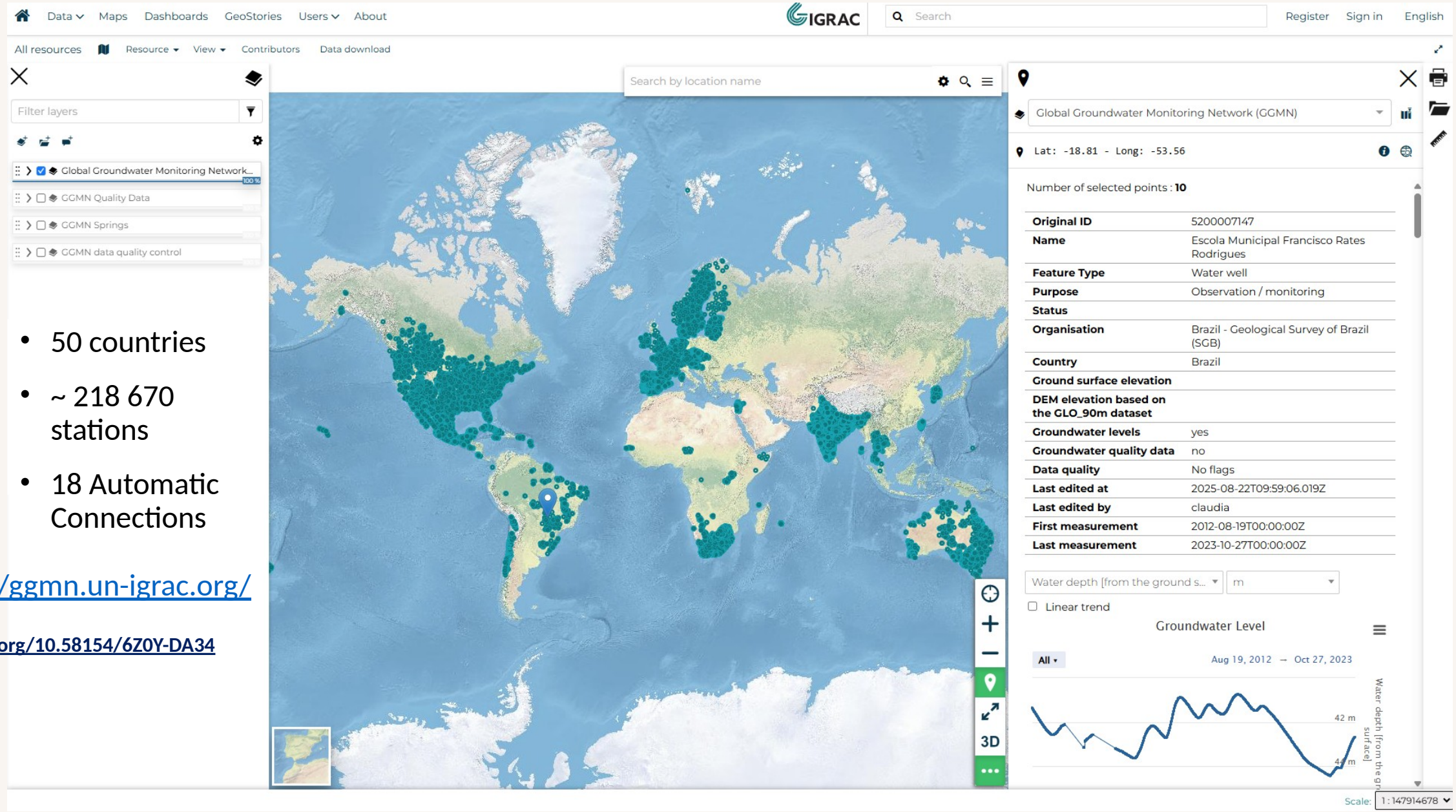
IGRAC

GROUNDWATER MONITORING WORLDWIDE





GROUNDWATER MONITORING WORLDWIDE



- 50 countries
- ~ 218 670 stations
- 18 Automatic Connections

https://ggmn.un-igrac.org/

https://doi.org/10.58154/6Z0Y-DA34

THE CHALLENGE: KNOWLEDGE IS BURIED IN LITERATURE

Automated discovery, extraction and analysis of scientific knowledge

What is data mining

An automated pipeline that searches, reads, and extracts knowledge from thousands of papers consistently and reproducibly

Why data mining matters

Thousands of papers

Millions of scientific articles published each year — impossible to read manually

Multiple languages

Research exists in Spanish, French, Arabic and more. Manual translation is impractical

Scattered data tables

Groundwater data are buried inside PDF tables & figures

THE PIPELINE: 5 AUTOMATED STAGES

1

Define Keywords

Multi-language

2

Query APIs

Journals, grey literature & web

3

Screen & Clean

Remove duplicates & irrelevant papers to the topic, Remove missing information

4

LLM Extraction

RAG: read abstracts & tables, retrieves the relevant information

5

Output & Dashboard

Excel dataset & interactive view

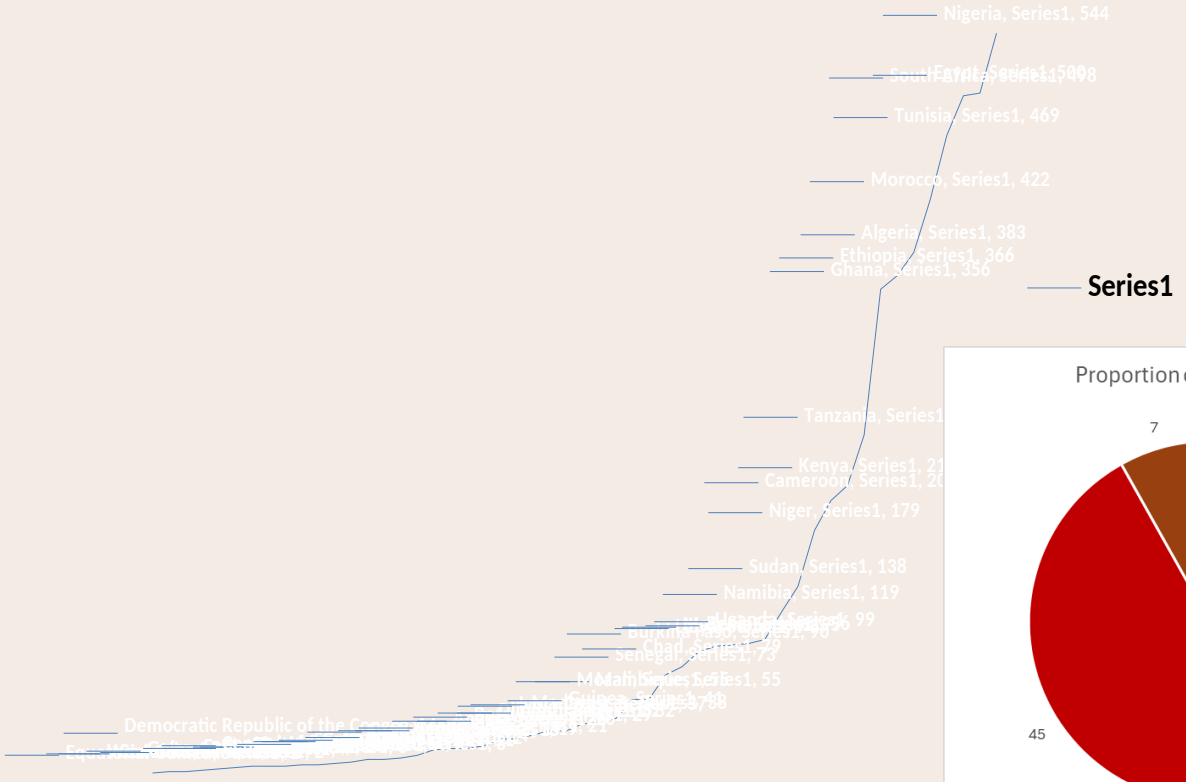
Orchestrated by Apache Airflow — each stage runs automatically in sequence as a scheduled DAG (Directed Acyclic Graph)

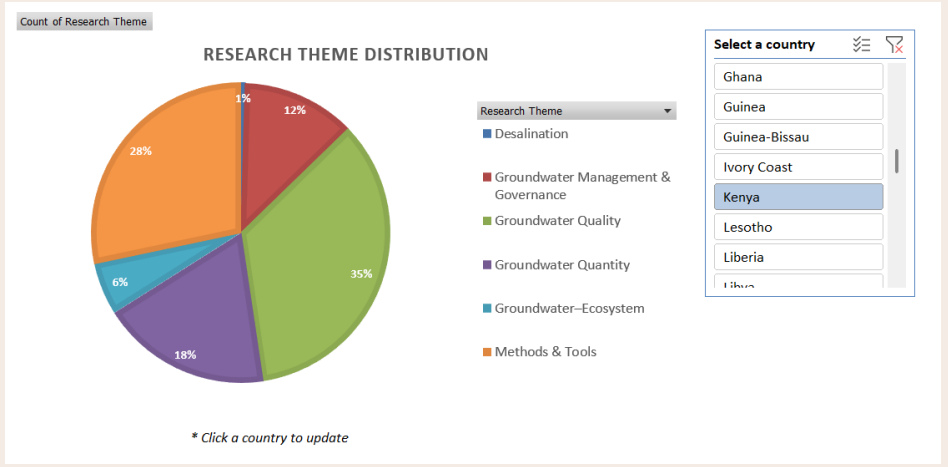
Interactive dashboard
Groundwater in Africa

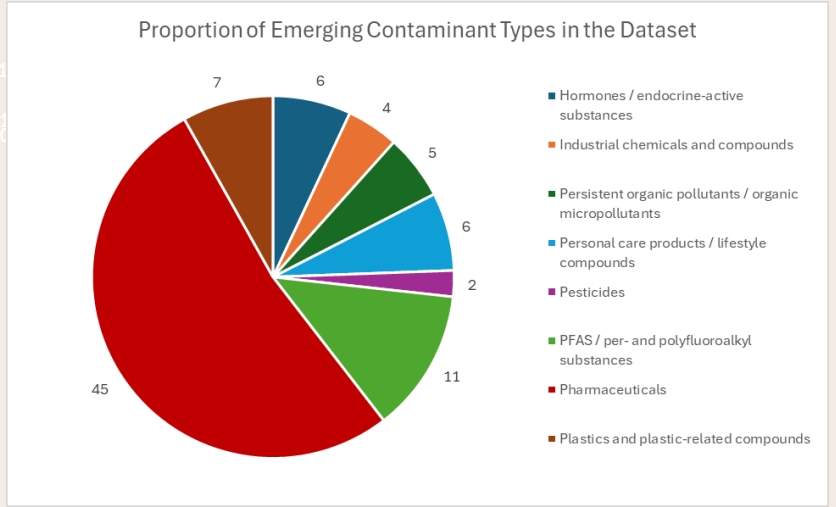
5,168
scientific papers identified

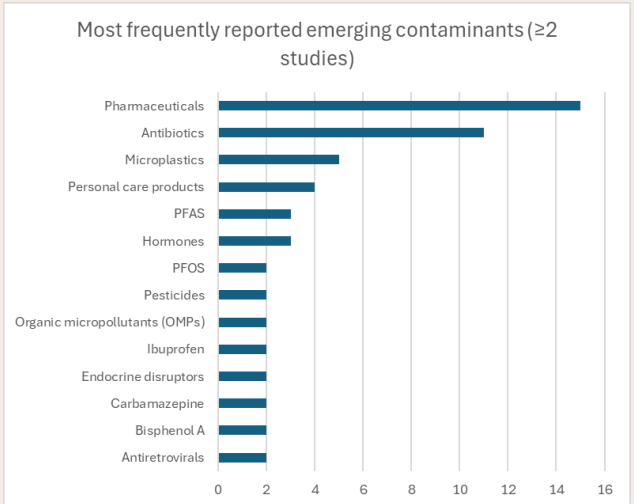
54
African countries covered

Groundwater Research Papers per African Country (n = 5168)



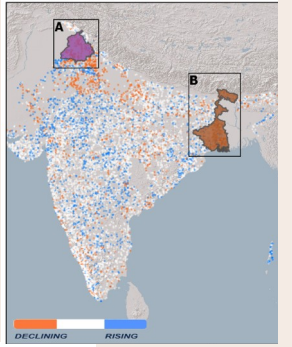


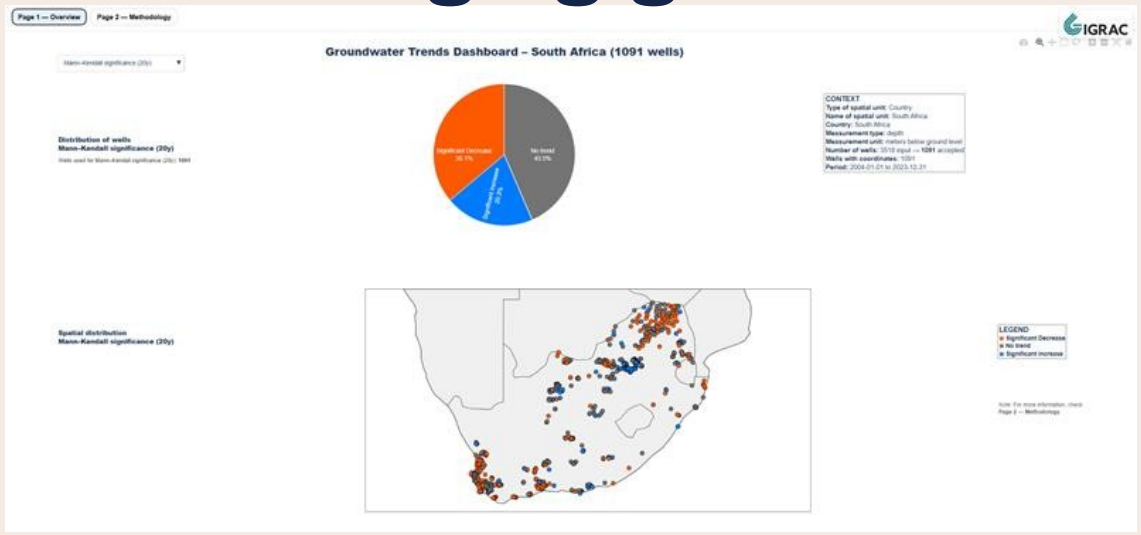


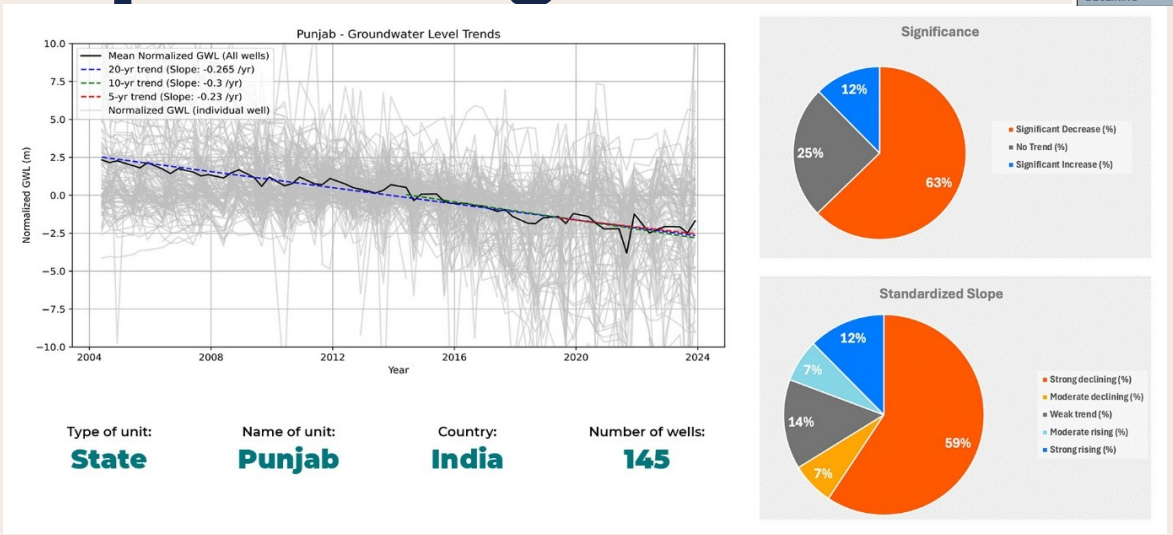


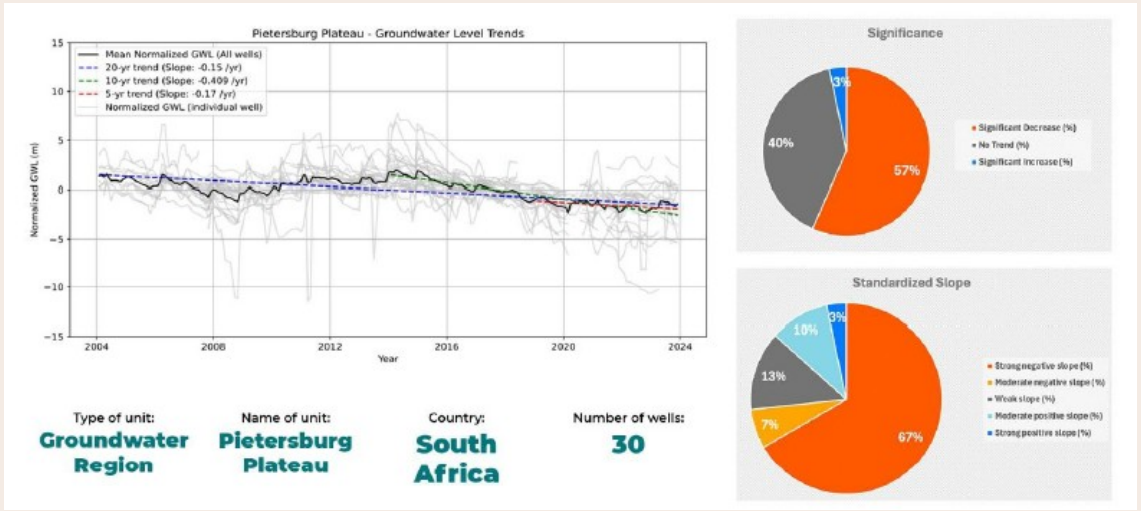
Interactive dashboard

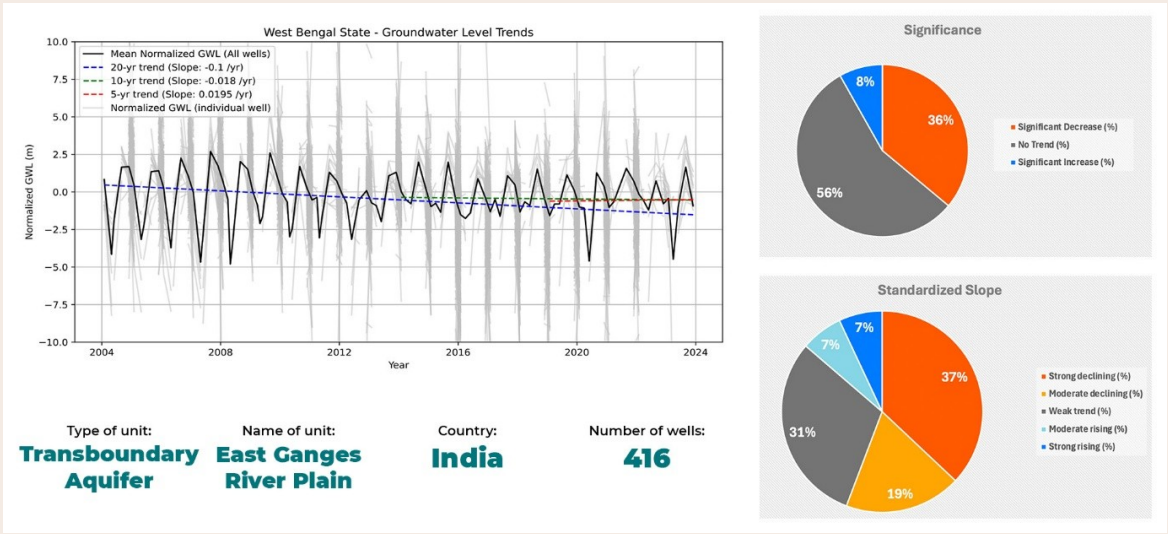
Leveraging groundwater in political agendas





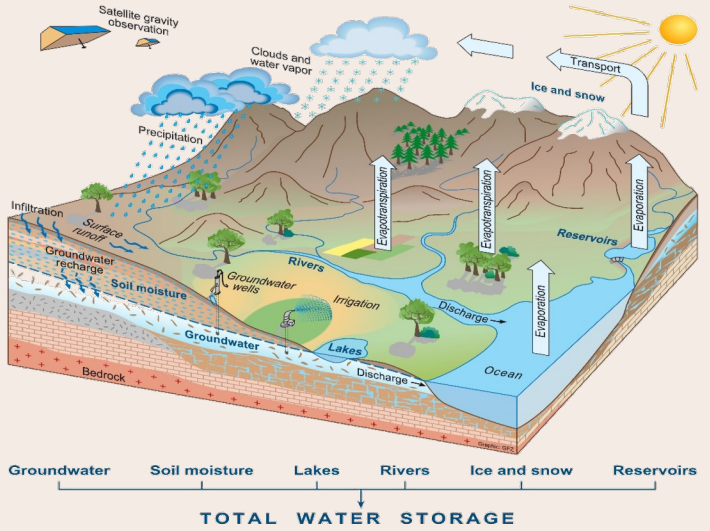






CAN WE MONITOR GROUNDWATER FROM SPACE?

GRACE/GRACE-FO satellite gravity data: Total water storage



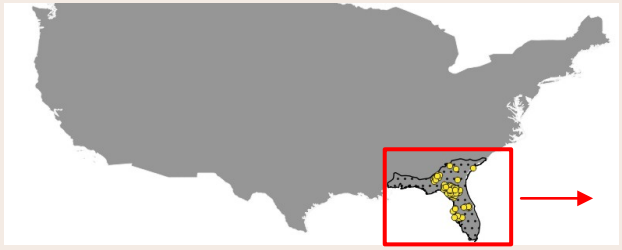
Source: G3P project. Groundwater storage trend 2002-2016

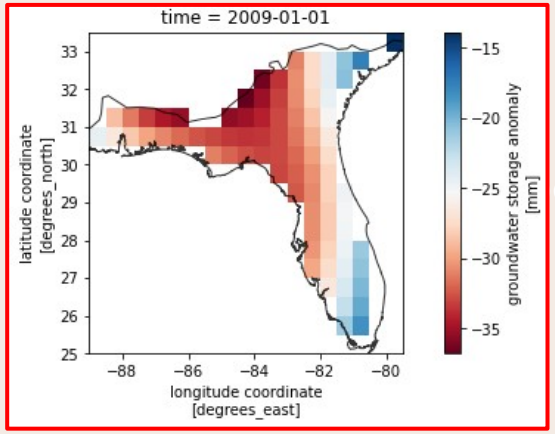
Groundwater = TWS - glaciers - snow - soil moisture - storage in surface water bodies

CAN WE MONITOR GROUNDWATER FROM SPACE?

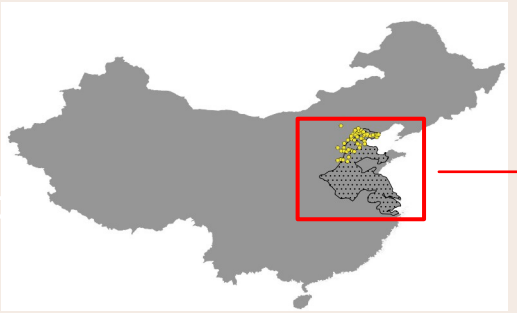
Global Gravity-based Groundwater Product (G3P):

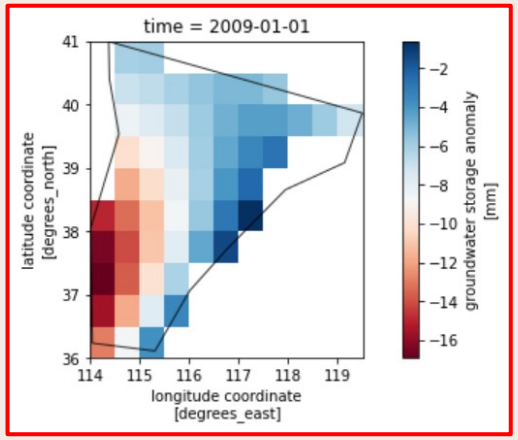
Validation with in-situ data



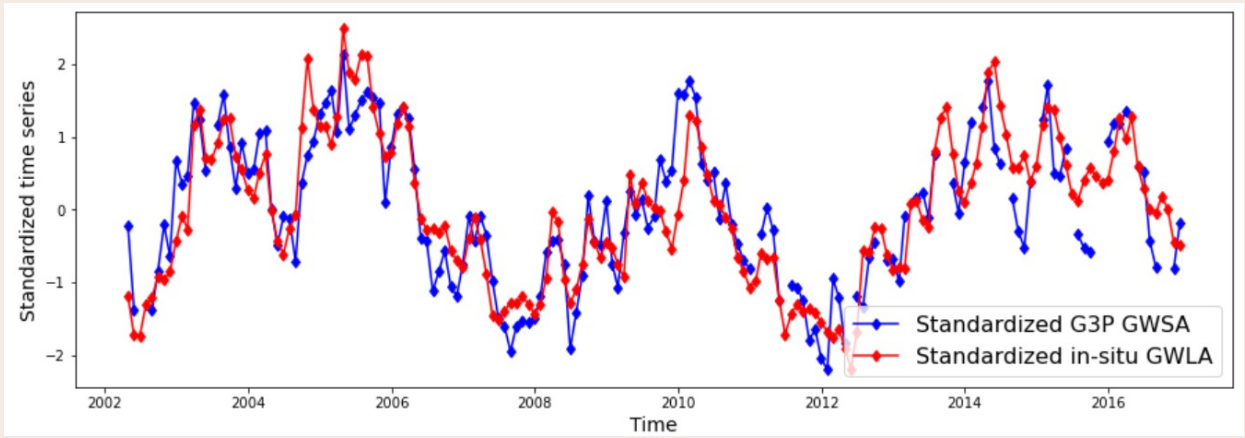


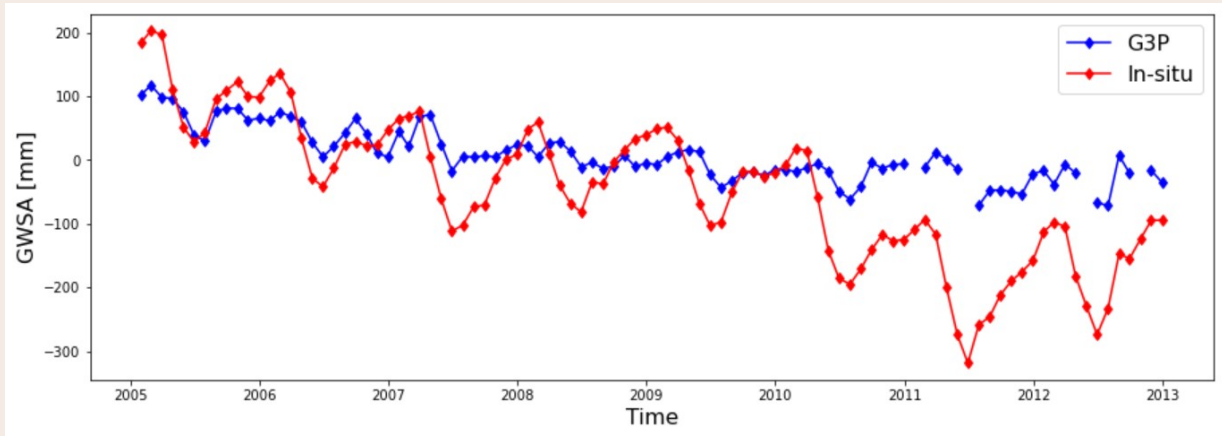
Floridian aquifer, USA





North China aquifer system



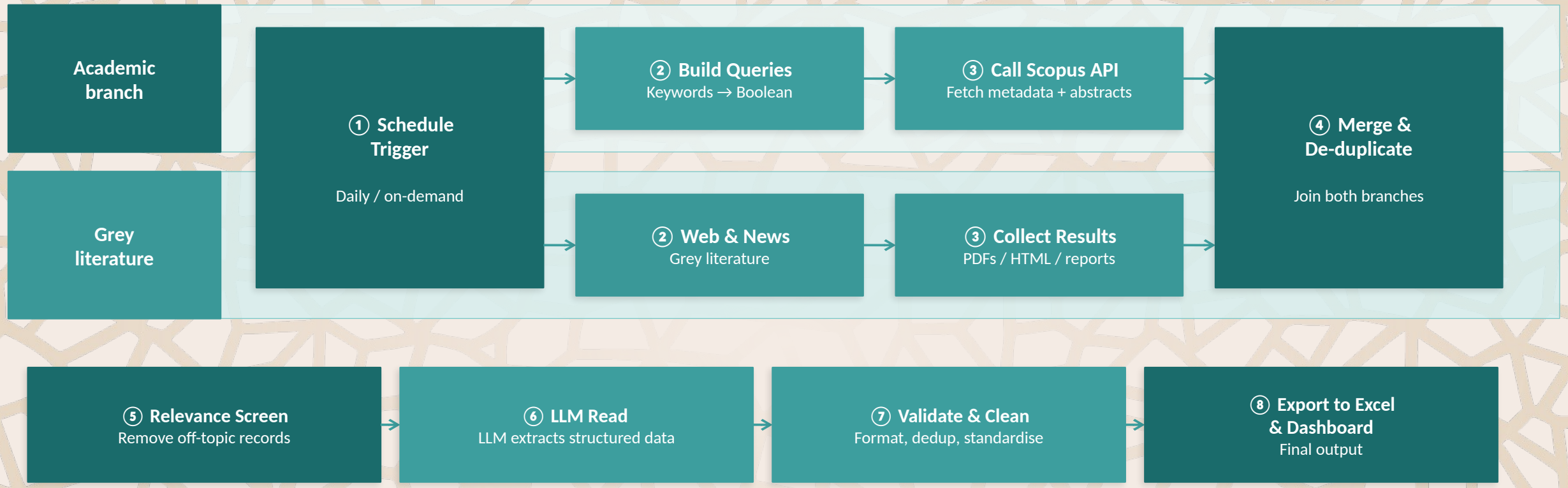


Thank you for your attention

Elisabeth.lictevout@un-igrac.org

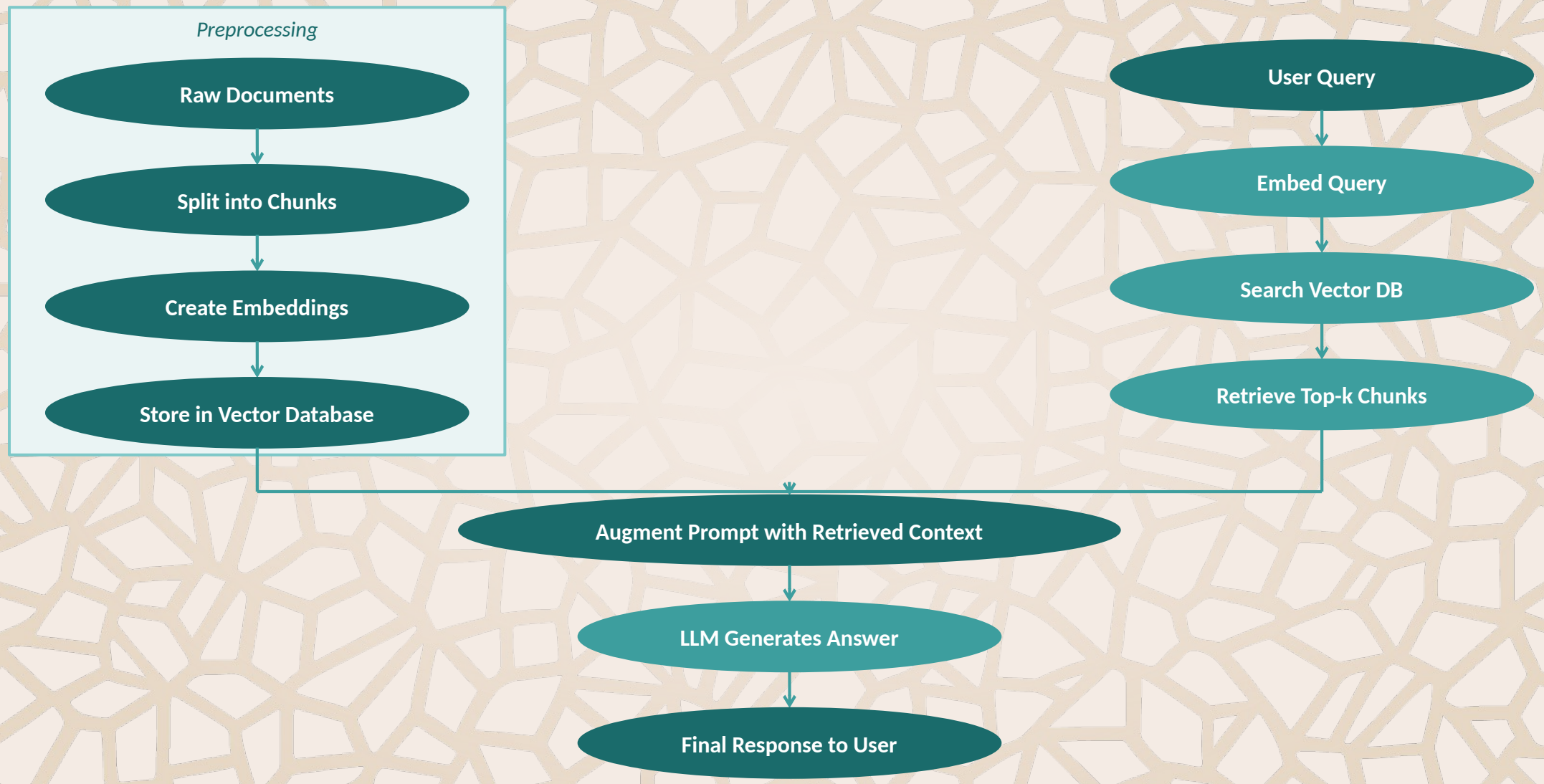
https://un-igrac.org/ - https://ggis.un-igrac.org/

How It Runs: Apache Airflow for MAR Project (Extra)



Each box is an independent Airflow task — if one fails, only that task re-runs, not the whole pipeline.

RAG Architecture: How It Works (used in G4DR and stage 6 in MAR) (Extra)



RAG (Retrieval-Augmented Generation) — grounds LLM answers in your document knowledge base