



The **G**lobal **G**ravity-based **G**roundwater **P**roduct (G3P)

Presenter: Claudia Ruz Vargas (IGRAC)

United Nations/Ghana/PSIPW - 5th International conference on the use of space
technology for water resources management

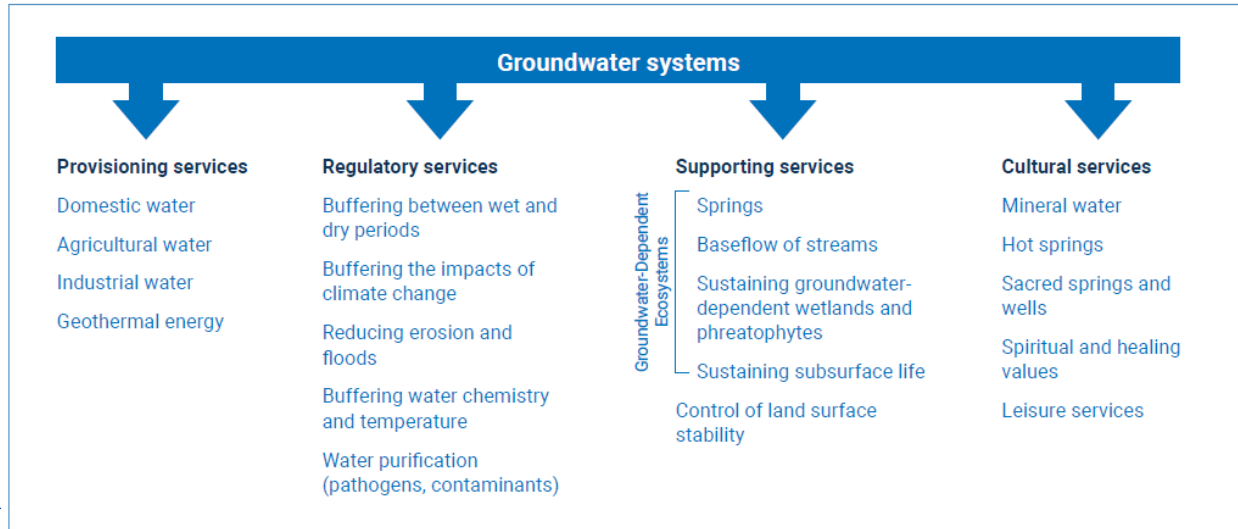
Online, 11 May 2022

<https://www.g3p.eu/>

Groundwater: an introduction

Groundwater accounts for approximately **99%** of all liquid freshwater on Earth

- Groundwater accounts for 33% of the global water withdrawals
- More than two billion people depend on groundwater as primary water resource
- It ensures ecosystem stability, energy and food security.



Groundwater on a global setting

Main pressures:

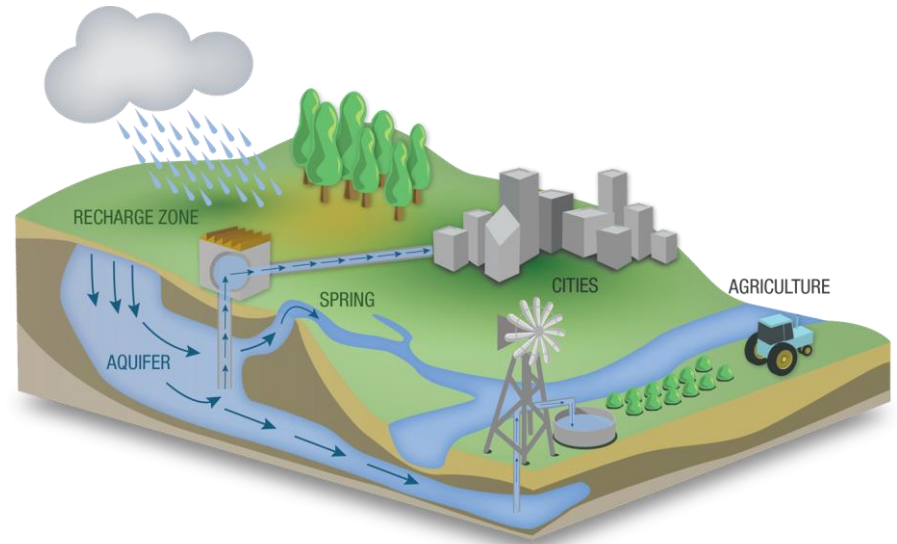
Overexploitation and climate change.

Consequences of groundwater depletion:

- Decrease of agricultural productivity
- Land subsidence
- Sea-level rise
- Seawater intrusion
- Loss of springs and wetlands
- Ecosystem degradation

Main challenges:

Overcome the lack of information to improve the groundwater management.



Groundwater monitoring and its limitations

Poor **in-situ monitoring** capabilities in many regions, with **sparse and un-representative** groundwater monitoring networks, largely unknown storage capacities and inaccessibility of data.

Lack of information results in a decrease of the groundwater management.

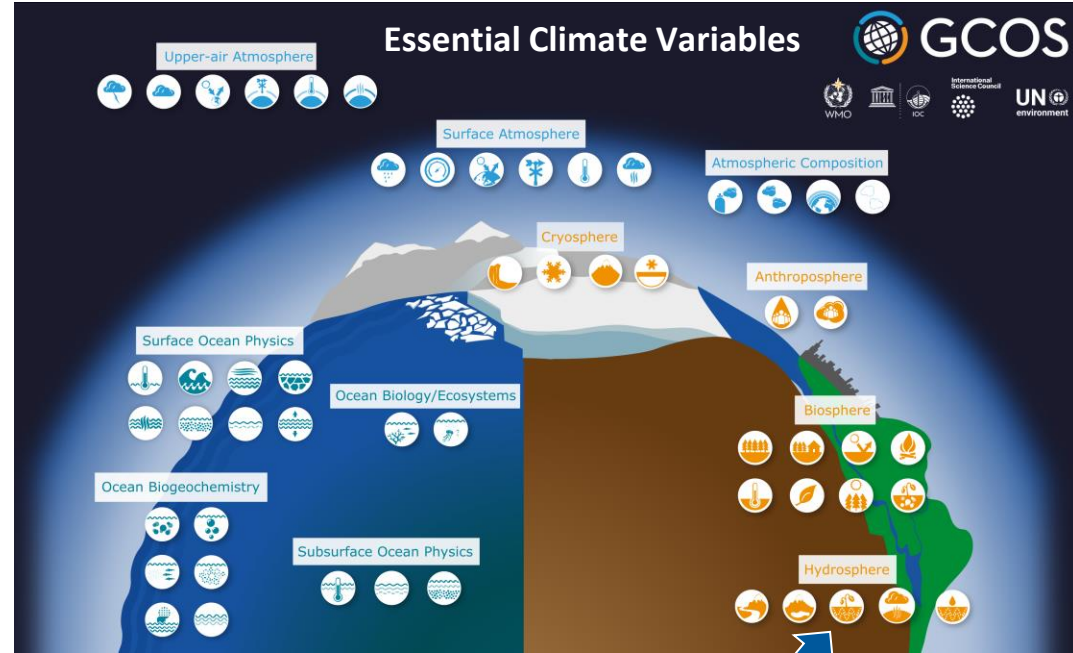


Spatially quantification of groundwater storage changes may contribute to fill the monitoring gap. This can be achieved through satellite technologies

A gap to be filled by G3P

GCOS (the Global Climate Observing System) defined **groundwater** as one of the **Essential Climate Variables** (ECVs)

- Copernicus Services provide many ECV data sets



- **But:** no product yet for the ECV Groundwater



H2020 Programme

G3P is funded in response to the Earth observation call

LC-SPACE-04-EO-2019-2020

“Copernicus evolution – Research activities in support of cross-cutting applications between Copernicus services”

As part of the H2020-SPACE-2018-2020 activity
“Leadership in Industrial Technologies - Space Part”



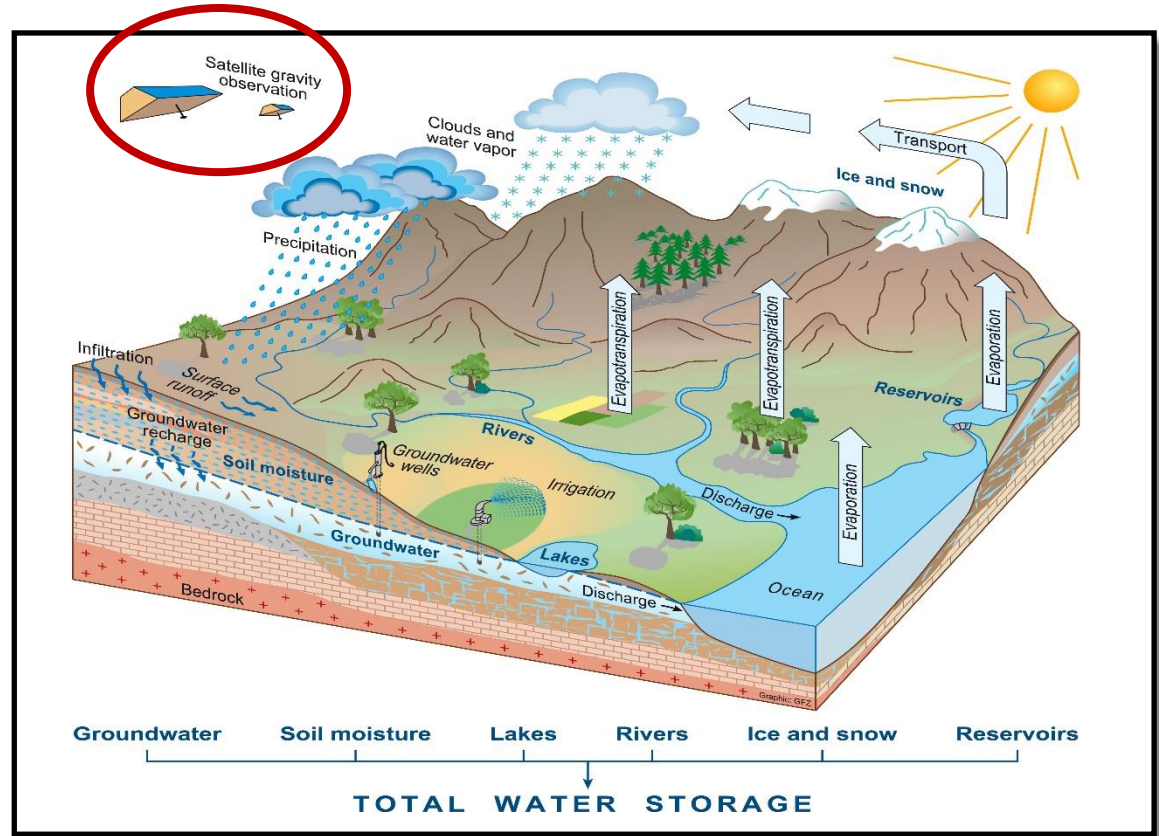
G3P objectives

Development of a product of groundwater storage variations

- for later operational implementation into the Copernicus Climate Change Service (C3S), Lot *Land hydrology & cryosphere*
- by a cross-cutting combination of GRACE / GRACE-FO satellite gravity data with water storage data based on existing Copernicus services
- global coverage
- 0.5° spatial resolution
- from 2002 until present
- monthly temporal resolution

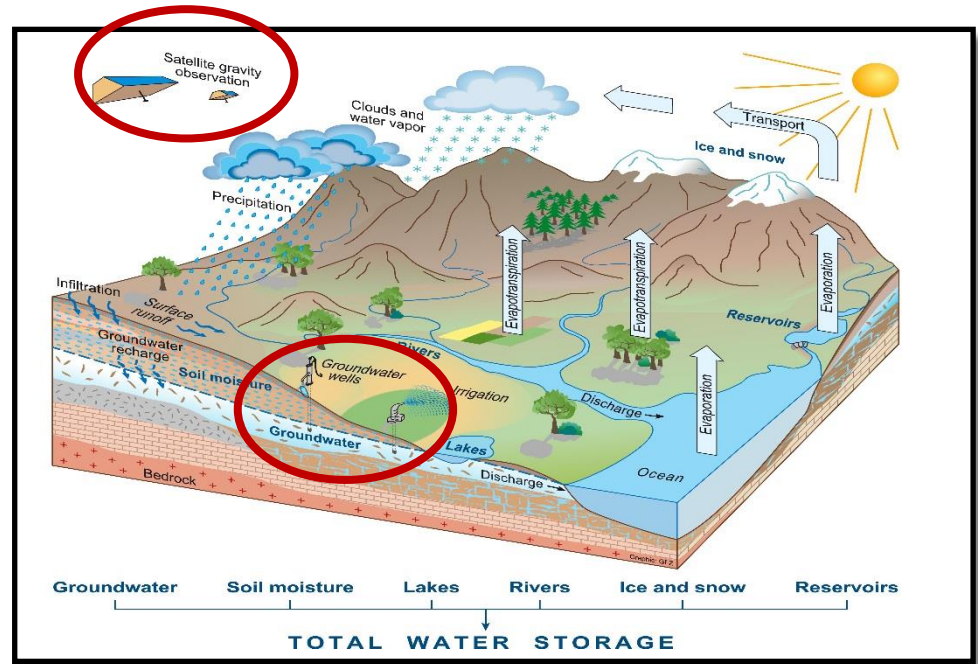
G3P concept

Satellite gravimetry with
GRACE (2002-2017) and
GRACE-FO (2018-)
observes
Total Water Storage (TWS)
variations



G3P concept

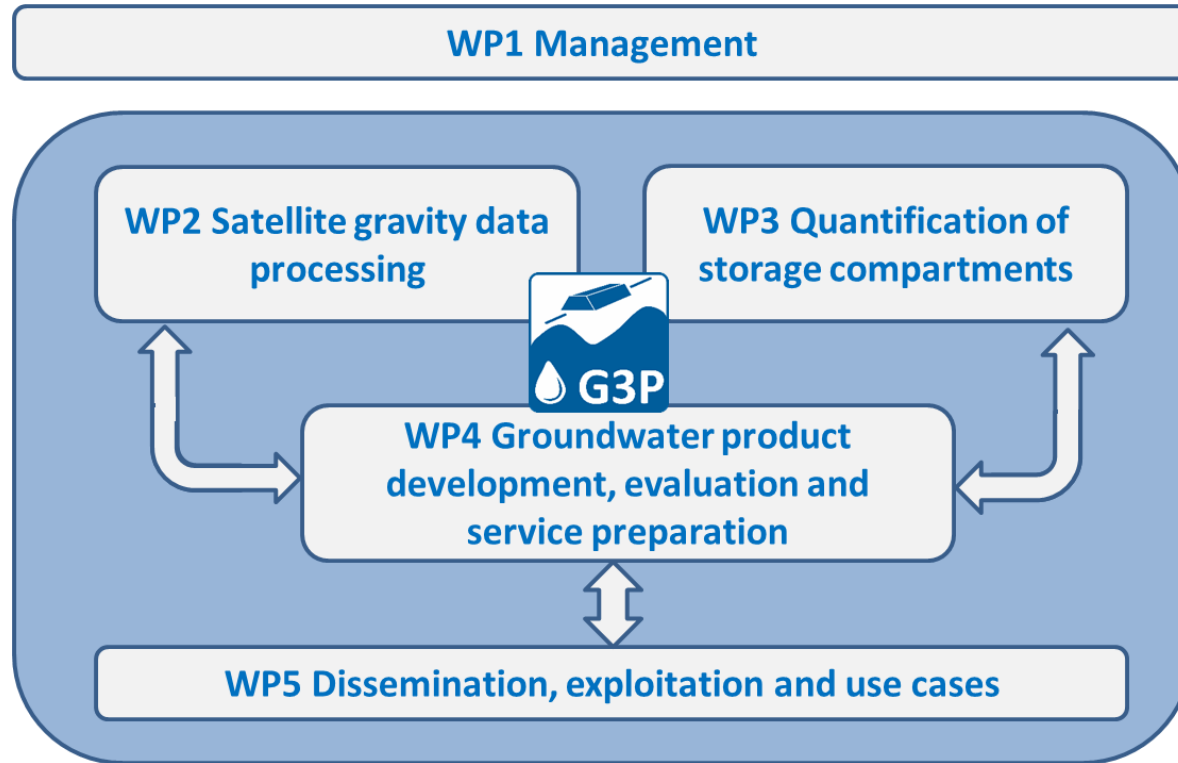
- Satellite gravimetry observes Total Water Storage (TWS) variations
- Resolving for groundwater storage variations follows a subtraction approach:



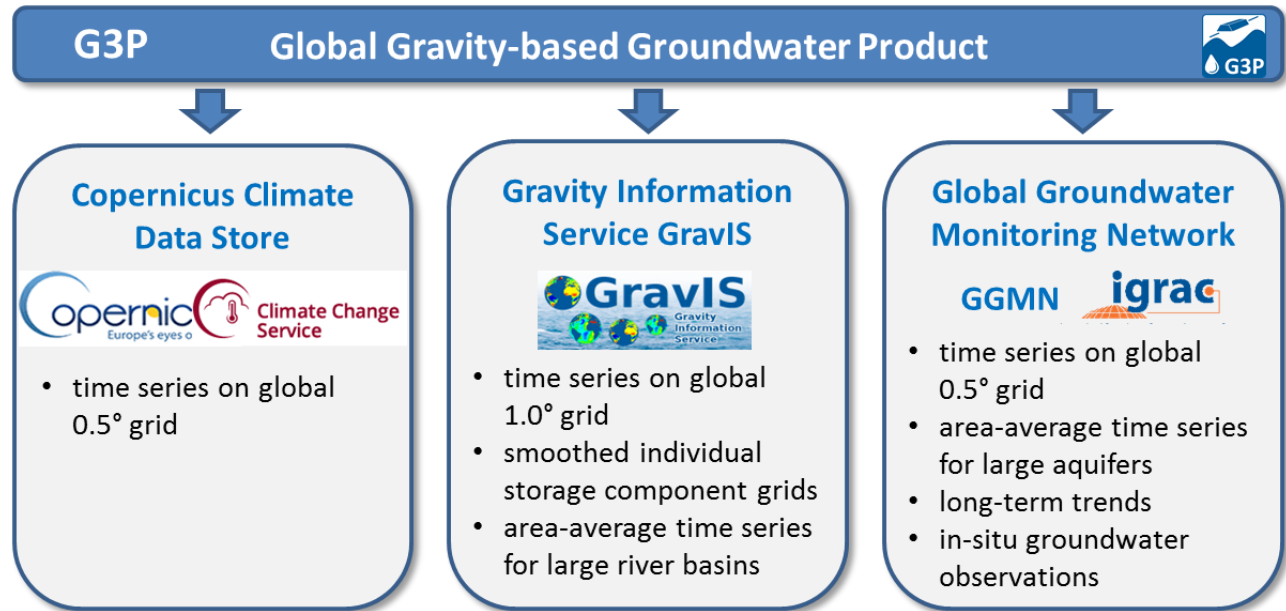
Groundwater = TWS - glaciers - snow - soil moisture - storage in surface water bodies



G3P work package structure



G3P – Product dissemination



Readiness at the end of the project:

✓ running prototype

✓ implemented

✓ implemented

+ global groundwater resources assessment report based on G3P results

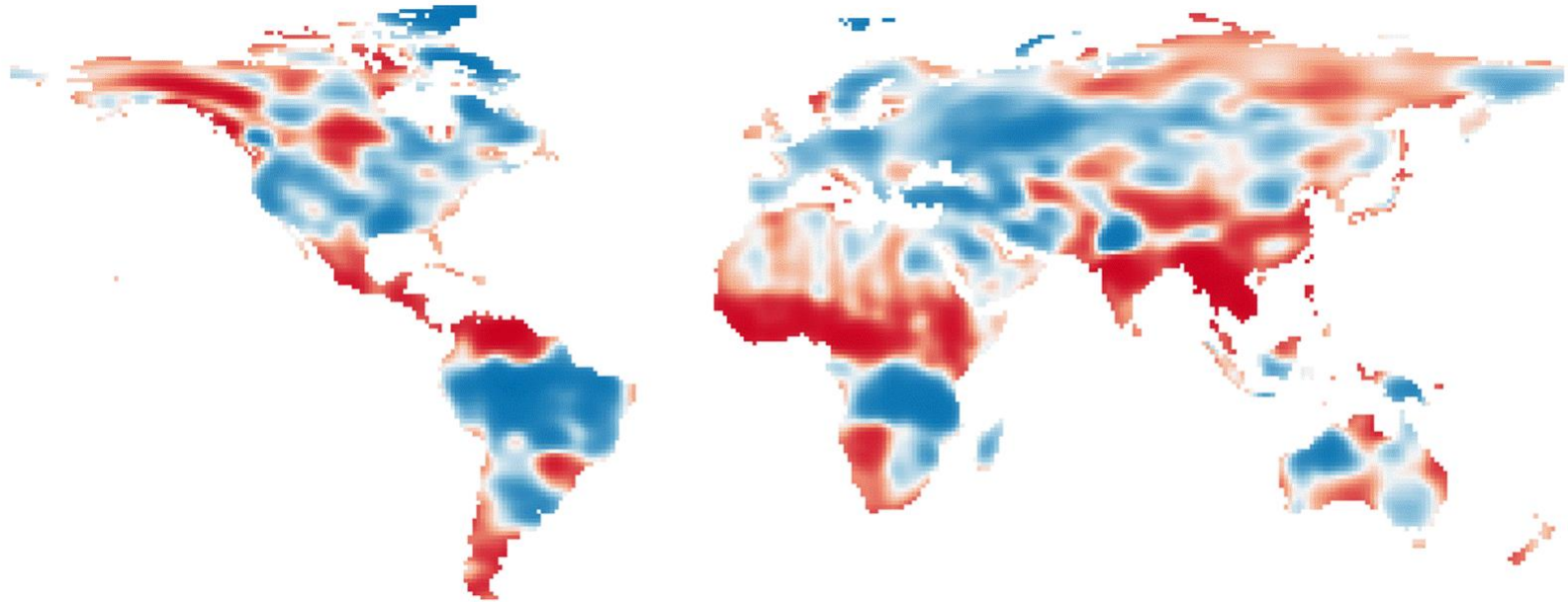
<http://gravis.gfz-potsdam.de/home>

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

G3P – Specific objectives

- Processing and making accessible the **latest satellite gravity data** (GRACE / GRACE-FO) as water storage products
- Setting up G3P as a **new cross-cutting application** of the existing product portfolio of three Copernicus core services
- **Advancing existing Copernicus service products** to match the requirements for G3P development
- Developing and evaluating a **G3P-based Groundwater Drought Index**, with use case for Southern Spain
- **Assessing global groundwater resources** and the status of large aquifers worldwide

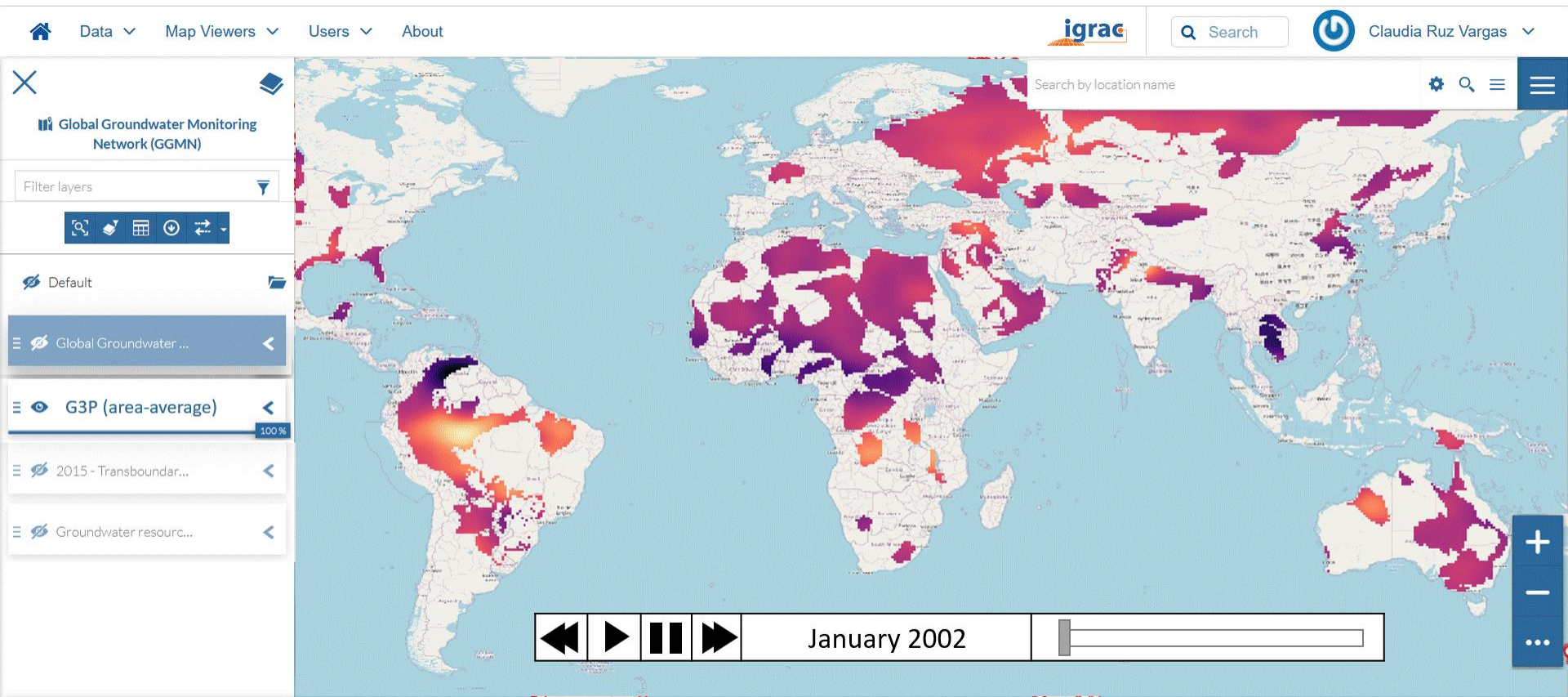
G3P - First results



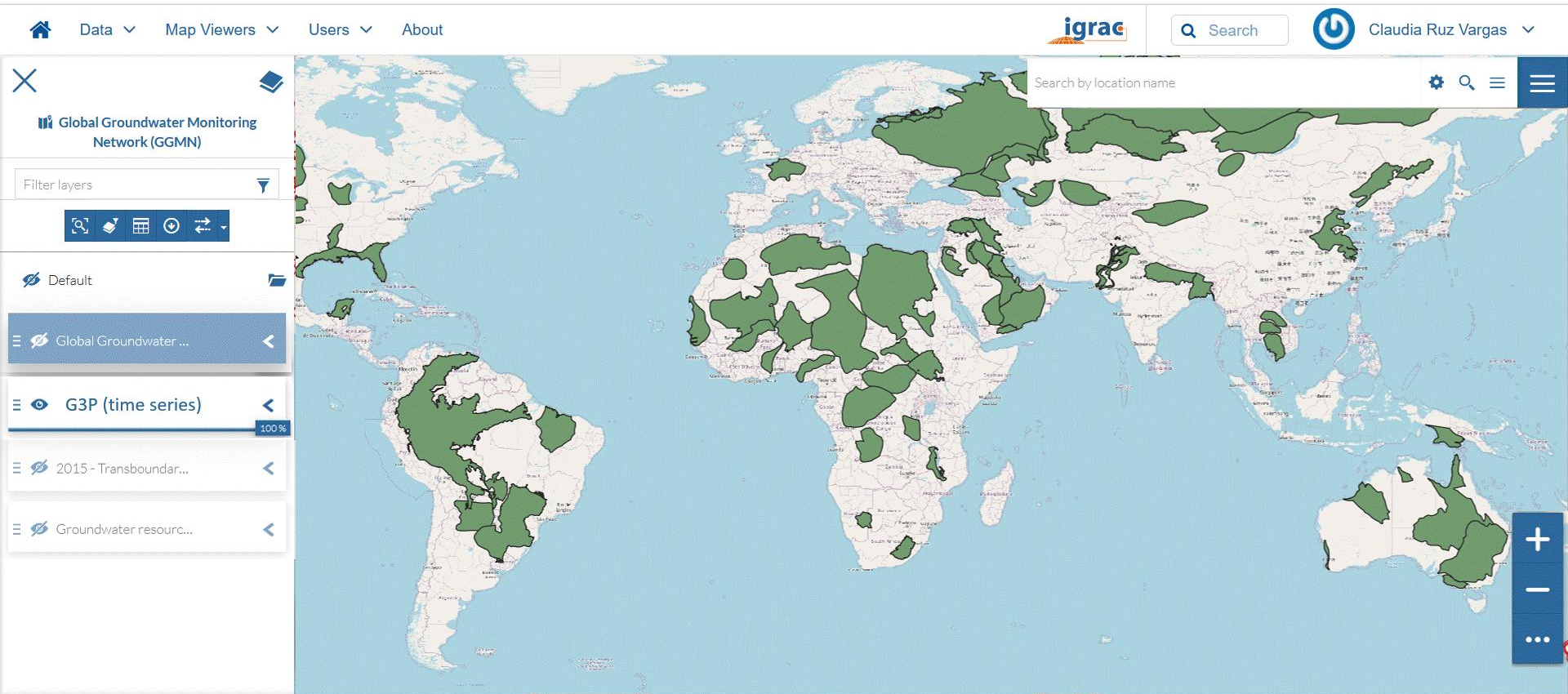
01/04/2002

~ -300,+300 mm

G3P – Dissemination of results (coming soon)



G3P – Dissemination of results (coming soon)



*Mockup for demonstration

G3P – Project office

Project Coordinator:

Prof. Dr. Andreas Güntner

GFZ German Research Centre for Geosciences

+49 331 288-1559

andreas.guentner@gfz-potsdam.de

Project Manager:

Dr. Julian Haas

GFZ German Research Centre for Geosciences

+49 331 288-1896

julian.haas@gfz-potsdam.de

G3P Dissemination:

Claudia Ruz Vargas

International Groundwater Resources Assessment
Centre (IGRAC)

+31 15 215-2339

claudia.ruz-vargas@un-igrac.org

<https://www.g3p.eu/>



The **G**lobal **G**ravity-based **G**roundwater **P**roduct (G3P)

Presenter: Claudia Ruz Vargas (IGRAC)

United Nations/Ghana/PSIPW - 5th International conference on the use of space
technology for water resources management

Online, 11 May 2022

<https://www.g3p.eu/>