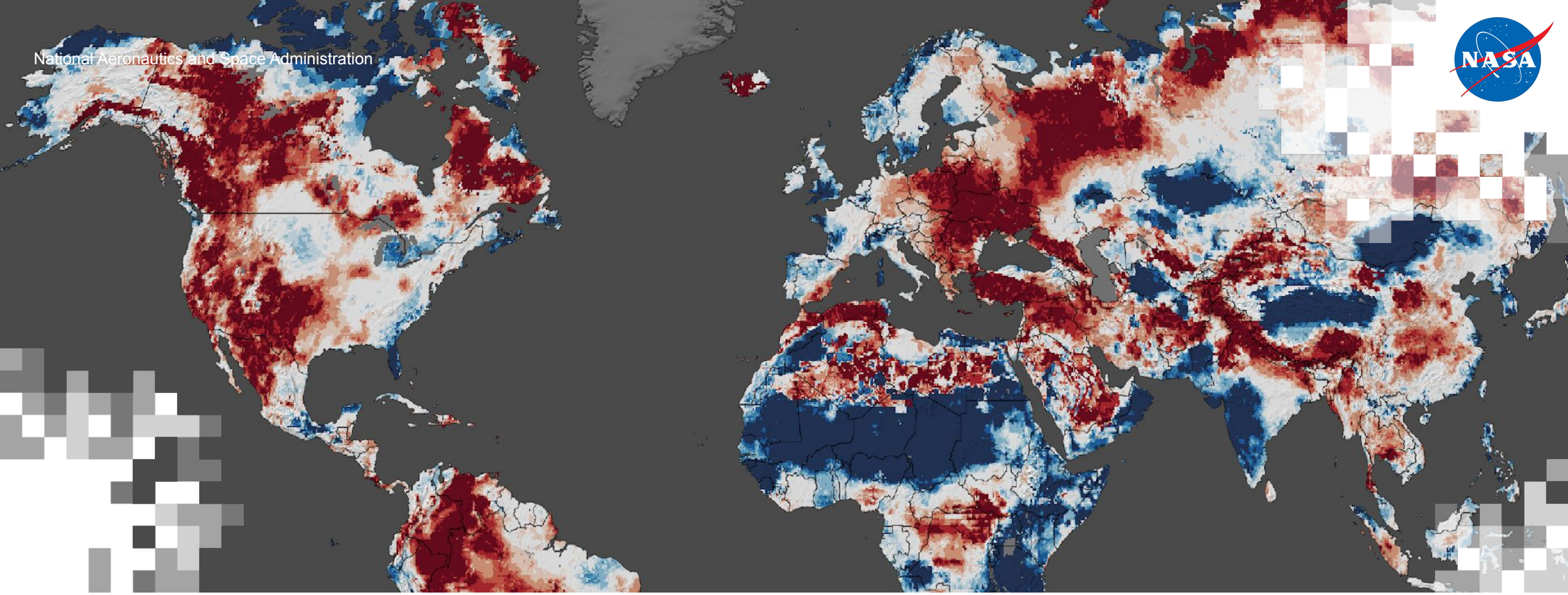


Monitoring Groundwater Changes for Water Resources Management

Exercise 1: Use GRACE/GRACE-FO Data Analysis Tool for Assessing Terrestrial Water Storage Changes

April 23, 2026

Exercise 1 - Objectives

In this exercise you will:

- Explore the GRACE/GRACE-FO JPL Interactive Data Browser & Analysis Tool for data analysis.
- Examine global maps of monthly terrestrial water thickness (TWT) anomalies* for selected months and years.
- Make a time series of TWT for Amazon river basin from April 1, 2002, to January 2026 (the duration of available GRACE and GRACE-FO data).

Be sure to note down the answers to the questions when directed in the instructions. Some of these questions will be included in the homework assignment at the end of the training.

*Changes with respect to January 2004 to December 2009 baseline period

Positive (negative) anomaly shows increase (decrease) in terrestrial water storage in terms of equivalent water thickness.

1. Examine Global Terrestrial Water Storage Maps

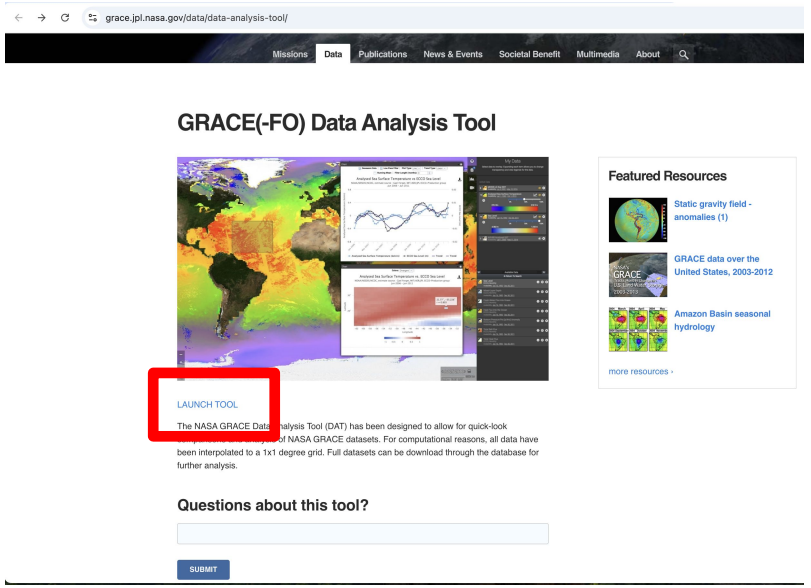
- Open JPL Interactive Data Browser & Analysis Tool
- Select **Launch Tool** at the bottom left below the map (see top image).

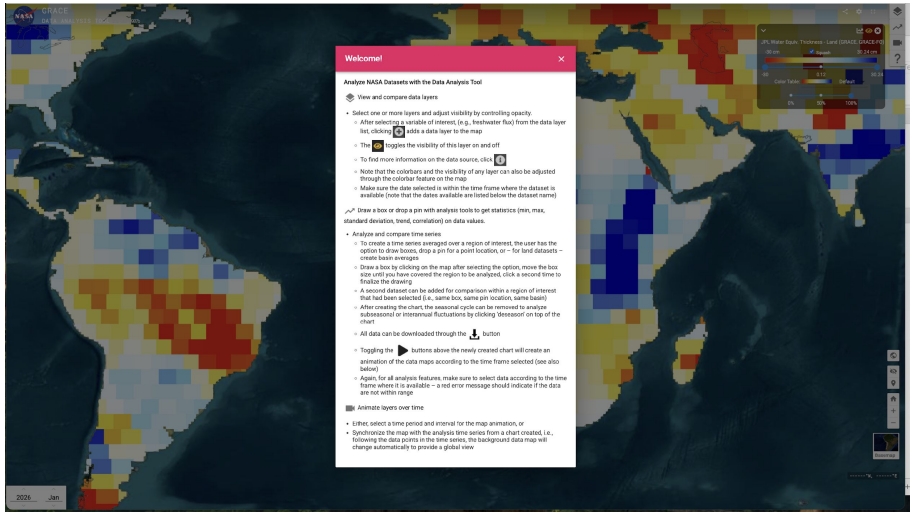
  - The Data browser will open with a **Welcome!** window (see bottom image).

  - Read the navigation guidance in the **Welcome!** window.

  - Close the **Welcome!** window by clicking x on the top right corner.

  - The global terrestrial water thickness (TWT) change map can now be seen.



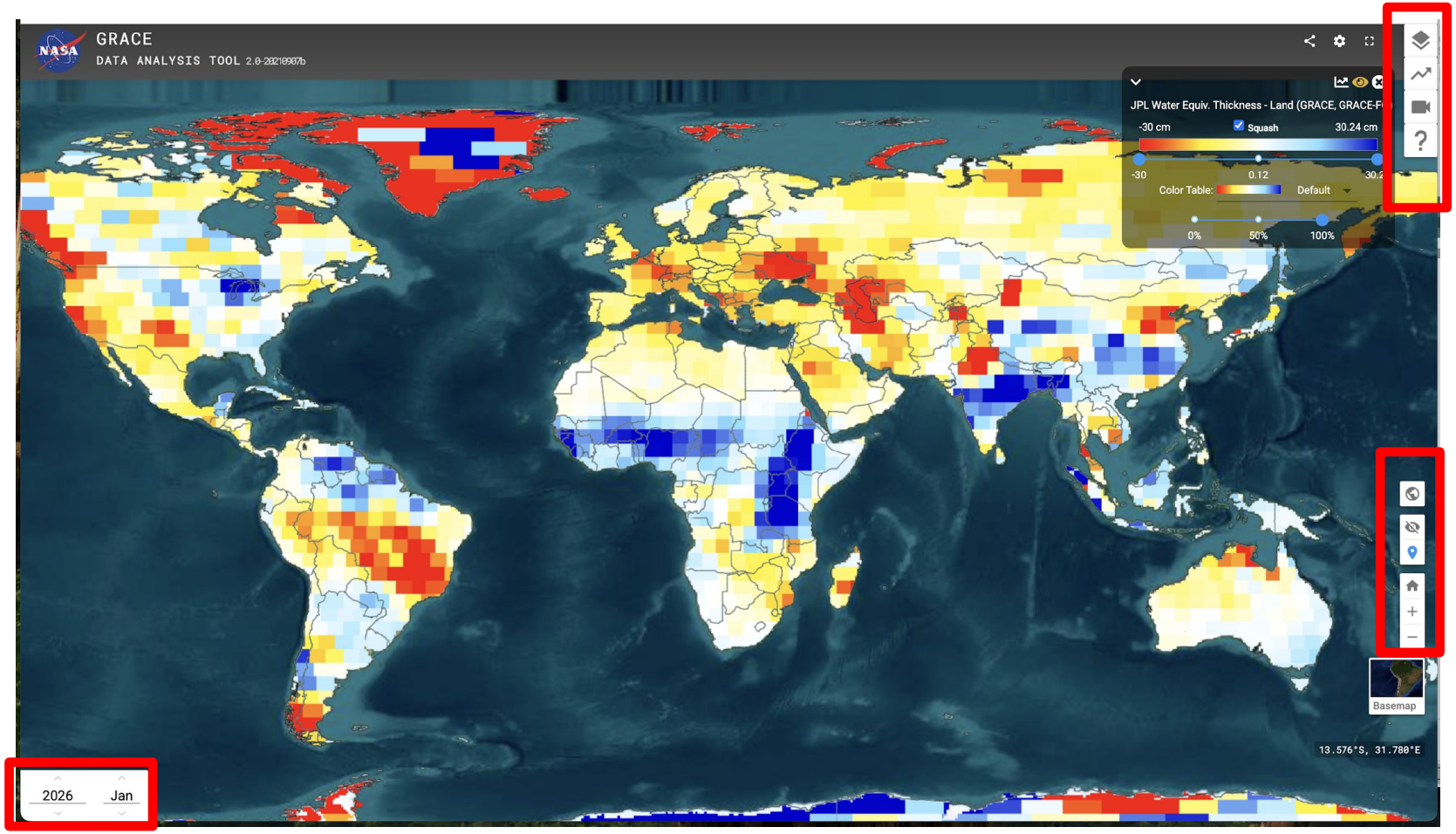


2. Examine Global Terrestrial Water Storage Maps

- Examine the map, color bar, and analysis options

- Hover over each button to see a brief description of the functionality.

- Look at the Water Equivalent Thickness data values across the map.



Month & Year

3. Examine Global Terrestrial Water Storage Maps

- Examine the global groundwater map from 2021–2025.

- Using the up/down arrows in the time window **[year, month]** in the bottom left corner of the map, change the year **from 2025 to 2021, one year at a time, keeping the month to January**. Watch how the TWT amplitudes vary globally.

Note down the following for your homework:

- What are the units of TWT?
- Which years have relatively higher TWT (less water deficit) over California (USA) in January? (Click on "Show Map Labels" for boundary lines)
- In northern and central/southern India, note whether TWT is positive or negative in January 2023.

- Now **change the month to July** and change the **year to 2021.**

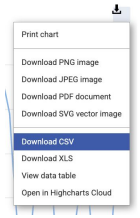
Note the following for your homework:

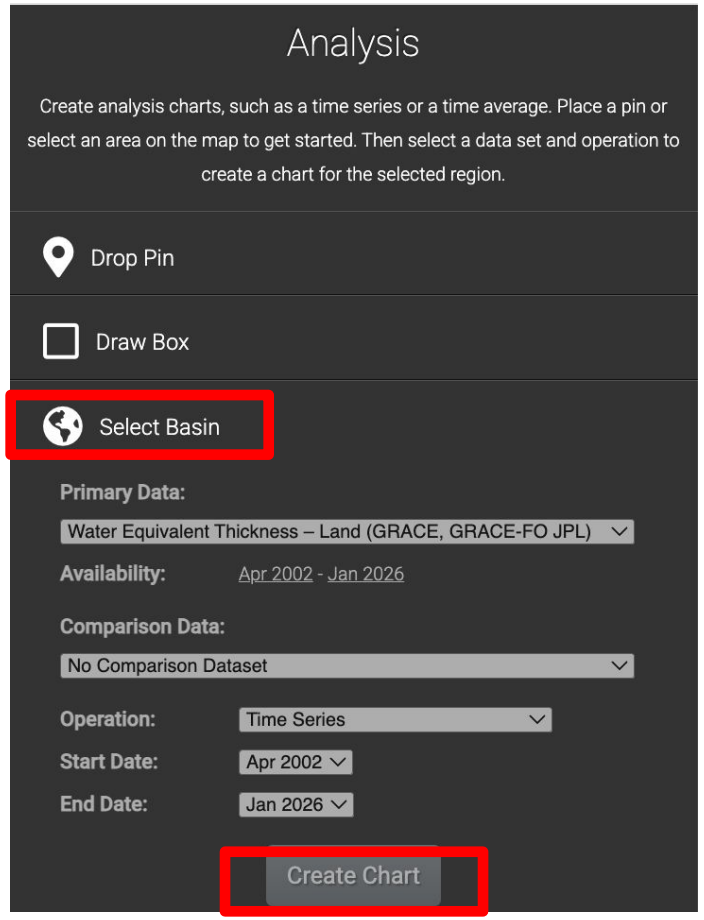
- In India, take a screenshot of the map for year 2022 and month July and save to your computer.
- In northern Brazil, is there a total water deficit or gain in July 2022?

4. Examine Terrestrial Water Storage Time Series for Amazon River Basin

- Examine time series of TWT in Amazon river basin.

  - Select from the top right options
  - An **Analysis** window will open
  - Choose **Select Basin**, move the computer cursor over South America and select **Amazon** basin. (Note the basin name and description display as you move the cursor over different regions.)
  - Keep all other options the same and select **Create Chart.**
  - A monthly time series will be plotted.
  - Move the cursor along the time series to see the TWT amplitude.
  - Download the time series as csv file using the down arrow on the time series wondow.





Note the following for your homework:

- Which year and month had the least TWT – or maximum deficit of TWT and how much was the amplitude?
- Do you see any trend in TWT?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Thank You!