Developing Advanced Gravity Products and Services at CNES through the SAGSA Project

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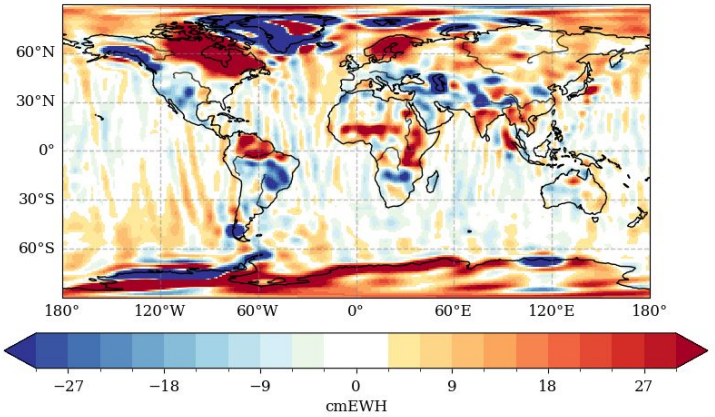
CNES satellite gravity solutions

Since the launch of the GRACE mission, the CNES has been developing several satellite gravity solutions, including:

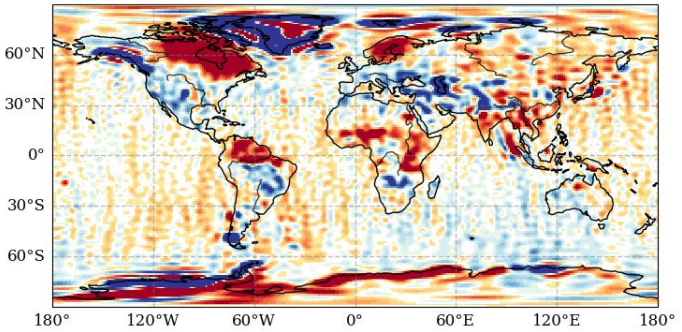
- L2 GRACE/-FO unconstrained solution (Lemoine et al., 2007), contributing to the Combination Service for Time-Variable Gravity Fields (COST-G).
- L2 hybrid solution combining SLR and GRACE/-FO measurements stabilised through a truncated Singular Value Decomposition (SVD), provided at monthly and 10-days time intervals (Lemoine et al., 2019).
- L3 GRACE/-FO ensemble, combining solutions from different analysis centers with various post-processing corrections available since 2019 (Blazquez et al., 2018)

Currently, CNES **Level-2 solutions** are available on the **OMP** and **ICGEM** data portals.

Cholesky solution, 07-2025 (DDK5)



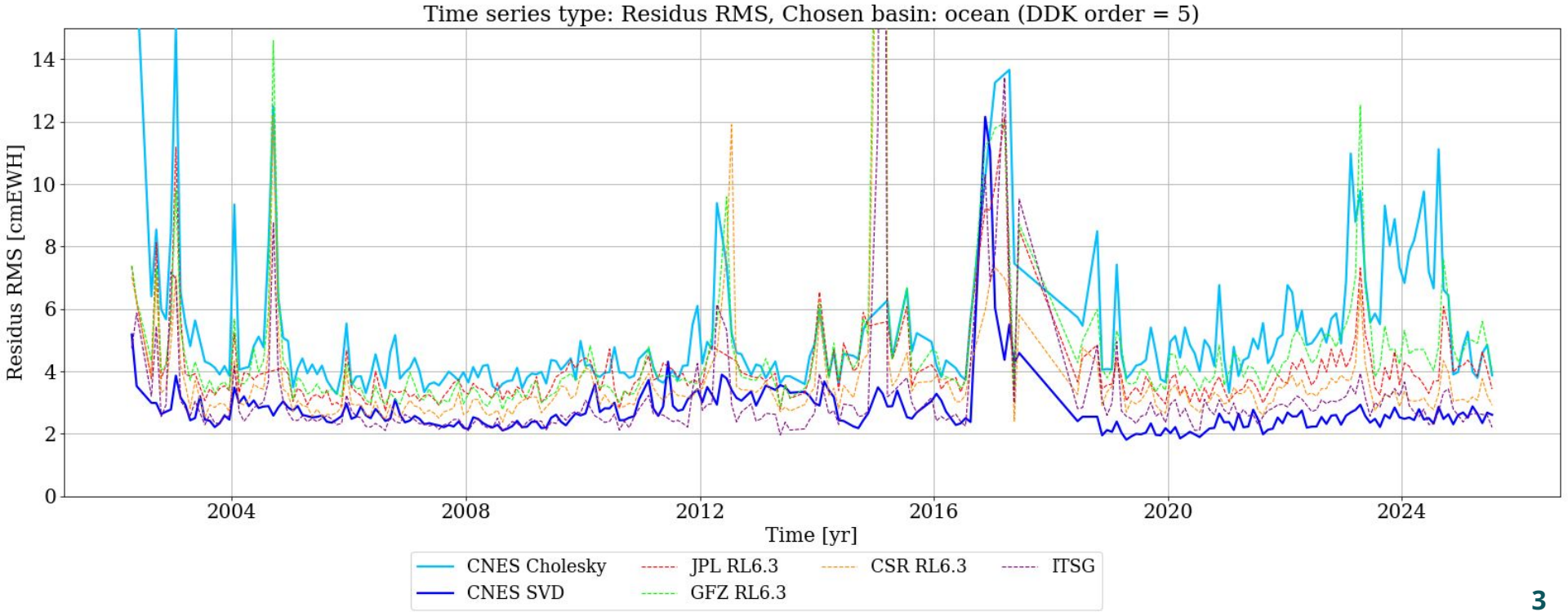
SVD solution, 07-2025



CNES satellite gravity solutions

The CNES Solutions are up to date with the latest available data from GRACE-FO satellites.

The noise level over the oceans from CNES solutions remains comparable with other centers.

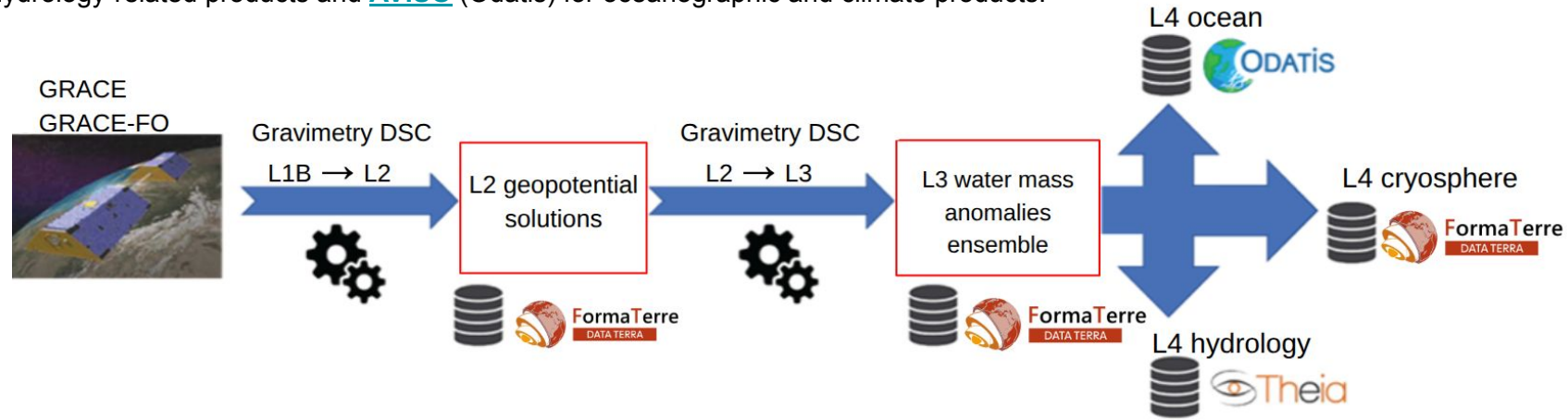


The SAGSA project and its scope

The **SAGSA project**, funded by **CNES** and led by **Magellium**, is dedicated to developing a **Data and Services Center for satellite gravimetry**. Its mission is to ensure the **development, production, and distribution** of all CNES satellite gravity products, ranging from the creation of global gravity field models to supporting a wide spectrum of applications in:

- **Oceanography** (e.g., sea level budget closure),
- **Climate sciences** (e.g., ocean heat content, Earth's energy imbalance),
- **Hydrology** (e.g., terrestrial water storage anomalies or individual components of the water mass balance such as river discharge),
- **Cryosphere monitoring** (e.g., regional ice mass balance assessments).

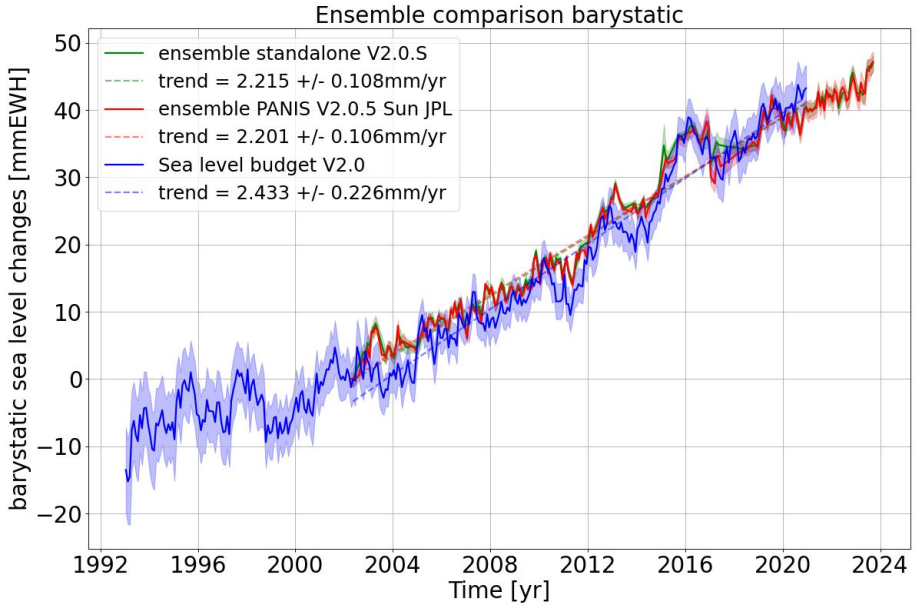
By **late 2025 to early 2026**, the distribution of **Level-1 to Level-3 data** will be transitioned to the **CNES GEODES platform**, as part of the **FormaTerre project**. Meanwhile, **Level-4 products** will be made accessible through specialized platforms, such as **Hydroweb.next** (Theia) for hydrology-related products and **AVISO** (Odatis) for oceanographic and climate products.



Applications and data distributions

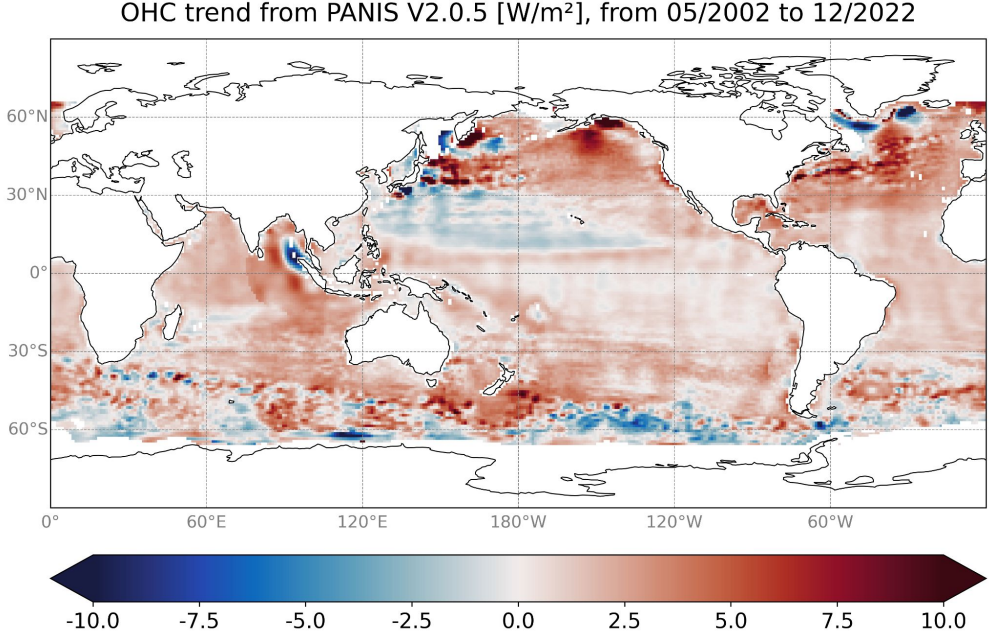
Level-4 Sea Level Budget products on AVISO

(Barnoud et al., 2021; Barnoud et al., 2023; Bouih et al., 2025)



Level-4 OHC and EEI Products on AVISO

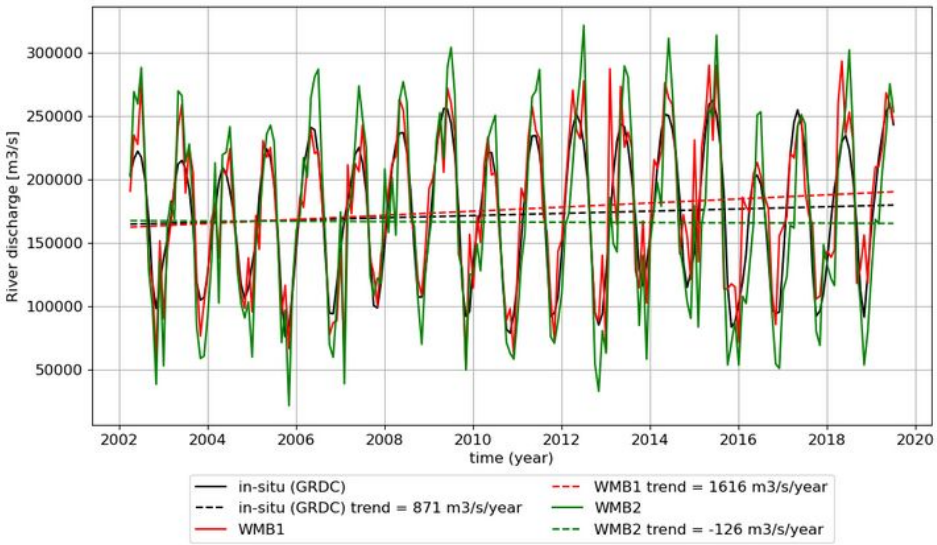
(Meyssignac et al., 2019; Marti et al., 2022; Marti et al., 2024)



Applications and data distributions

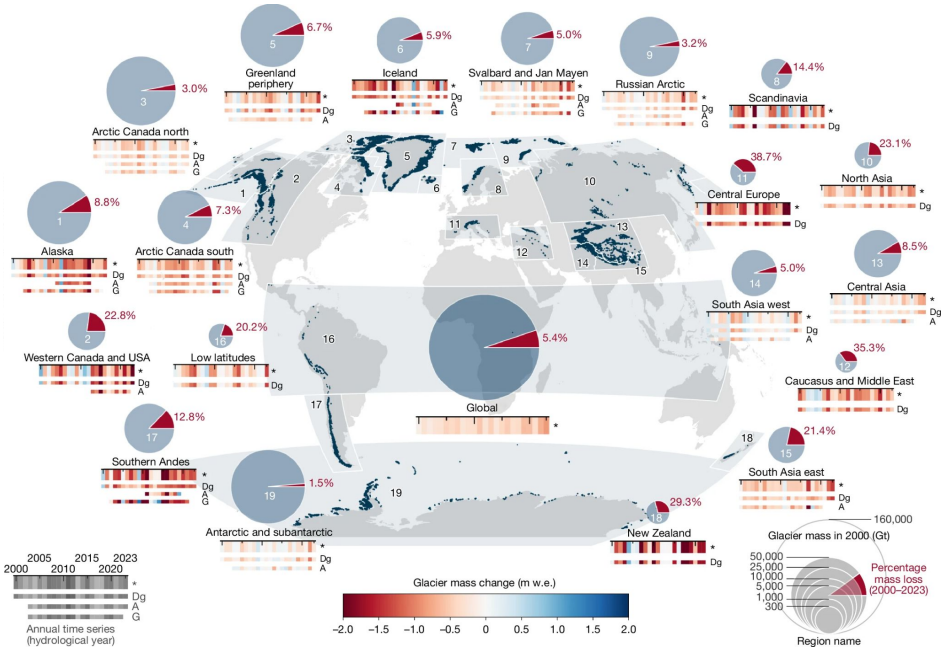
Level-4 River Discharge Products
Example of the Amazon

WAMBOR & F3O project, Kern et al., (2025, submitted)



Glacier mass change from IMBIE (2023) and Glambie team (2025)

Magellium / CNES contributed to Satellite Gravity Products over Arctic Glaciers



Conclusions and perspectives

L2B monthly EWH (GEODES)
L2B monthly Geoid Height (GEODES)
L2B monthly Gravity anomaly (GEODES)

L2B 10 days EWH (GEODES)
L2B 10 days Geoid Height (GEODES)
L2B 10 days Gravity anomaly (GEODES)

Barystatic and Manometric sea level (AVISO)
OHC, GOHC, OHU, GOHU products (AVISO)

GRACE
GRACE-FO

Gravimetry DSC
L1B → L2

L2 geopotential solutions

Gravimetry DSC
L2 → L3

L3 water mass anomalies ensemble

L4 ocean

ODATIS

L4 cryosphere

FormaTerre
DATA TERRA

L4 hydrology

Theia

L2A Cholesky (GEODES)
L2A SVD monthly (GEODES)
L2A SVD 10 days (GEODES)

L3 expert (GEODES)
L3 simplified (GEODES)

Terrestrial water storage (Theia)

Glacier mass balances (GEODES)

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Acknowledgments

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Relevant data distribution portals:

- https://grace.obs-mip.fr/catalogue/?currentSelection=fa2fdef3-5a65-46e5-8849-0fadec69de91
- https://icgem.gfz-potsdam.de/home
- https://geodes.cnes.fr/
- https://www.aviso.altimetry.fr/en/home.html
- https://www.theia-land.fr/blog/product/hydroweb-next/

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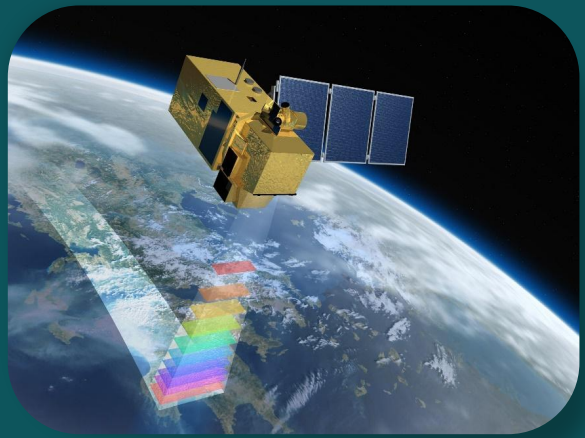

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