

GENERAL INFORMATION

Dataset Title: TUD-L2B-5dayEWH-GRACE.v1.0exp: Novel and Global 0.5°x0.5° 5-day GRACE equivalent water height gridded product (experimental version)

Author: Michal Cuadrat-Grzybowski, PhD candidate

Email: M.Cuadrat-Grzybowski-1@tudelft.nl

Institution: Delft University of Technology, Space Engineering Department

DOI: [10.4121/a685e7cf-1b84-4007-b206-89ae1c71dd6c.v1](https://doi.org/10.4121/a685e7cf-1b84-4007-b206-89ae1c71dd6c.v1)

DESCRIPTION

General description of the dataset:

This dataset is a Level-2B (gridded) GRACE product (EWH, units: [cm]) with 5-day to sub-weekly time resolution solely derived from GRACE residual Level-1B data.

The dataset spans the period: April 2002 to August 2016.

Additional (python) software (see `\plotting_tools`) is provided to facilitate plotting of results.

Lastly, several quality checks (see `\quality_checks`) were performed on the dataset with a summarising Validation report. The bin count (in .nc format) per month of LGD monthly observations can also be found in the directory (file: `bin_count.nc`).

Dataset file name:

TUD-L2B-5dayEWH_2002_2016.nc

Dataset format:

NetCDF (.nc)

Details:

Period: April 2002 to August 2016.

Dimensions:

- lat: Latitude, range: [-90, 90], units: (degrees North).
- lon: Longitude, range: [-180, 180], units: (degrees East).
- time: Time, units: seconds since 2000-01-01 00:00:00 UTC (automatically converted when using xarray).

Variables:

`ewh_hf_lgd`: High-frequency Equivalent Water Height (EWH), units: cm.

Date of dataset publication (YYYY-MM-DD):

2026-01-28

Keywords:

ACCESS INFORMATION

Licenses:

Dataset License: Creative Commons Attribution-ShareAlike 4.0 International (CC BY-SA 4.0),

Software License: Software License: Apache License 2.0.

Dataset DOI: [10.4121/a685e7cf-1b84-4007-b206-89ae1c71dd6c.v1](https://doi.org/10.4121/a685e7cf-1b84-4007-b206-89ae1c71dd6c.v1)

When using this dataset, please cite it as: Cuadrat-Grzybowski, Michal (2026): TUD-L2B-5dayEWH-GRACE.v1.0exp: Novel and Global 0.5°x0.5° 5-day GRACE equivalent water height gridded product (experimental version). Version 1. 4TU.ResearchData. dataset. [10.4121/a685e7cf-1b84-4007-b206-89ae1c71dd6c.v1](https://doi.org/10.4121/a685e7cf-1b84-4007-b206-89ae1c71dd6c.v1)

VERSIONING AND PROVENANCE

Last modification date (YYYY-MM-DD): 2026-01-28

METHODOLOGICAL INFORMATION

Original dataset:

Residual Level-1B (including pre-fit and post-fit) range-rate data has been provided by the Center for Space Research (CSR), Texas, USA. These data were derived from the RL06 processing strategy, up to spherical harmonic degree and order 180. DOI: <https://doi.org/10.18738/T8/VY3U8L>

Residual Level-1B data are classified as:

- **Pre-fit range-rate:** Gravity retrieval input vector of reduced range-rate observations (from standard Level-1B).
- **Post-fit range-rate:** Obtained after least-squares fitting: $d = A \cdot x$, where A is the design matrix and x is the estimated parameter vector.
- **Geo-fit range-rate:** Portion of the post-fit signal expressed only in terms of monthly Spherical Harmonic coefficients.
- **Post-fit residuals:** The difference between pre-fits and post-fits, retaining sub-monthly geophysical gravity signals and unmodeled background model residuals (e.g., AOD1B RL06).

We thank CSR for providing us and making this data public. This research would not have been possible without it.

Methodology:

Step 0: Computation of Line-of-Sight Gravity Differences (LGDs)

- Numerical differentiation of range-rate residuals.
- Band-pass filtering within [0.9, 11] mHz frequency range.
- Application of frequency transfer function $Z(f)$ on residual range-accelerations derived by Ghobadi-Far et al. 2018.

Step 1: Processing of the monthly LGD geo-fits

- Spatial gridding of geo-fits into a 2 x 2 degree mesh using the median operator to remove outliers and orbital-fit artefacts.
- Re-sampling of the 2 x 2 degree mesh to a 0.5 x 0.5 degree mesh using linear spatial interpolation.

Step 2: Spatial interpolation of 5-day to sub-weekly post-fit residuals time-series to a 0.5 x 0.5 degree mesh.

Step 3: Summing of geo-fit monthly background grid with 5-day post-fit residuals grid, creating high-frequency geo-fit grids.

Step 4: From LGD to EWH [cm]:

1. Linear regression model:

$$\text{EWH [cm]} = S [\text{cm}/(\text{nm}/\text{s}^2)] * \text{LGD} [\text{nm}/\text{s}^2] + B [\text{cm}]$$

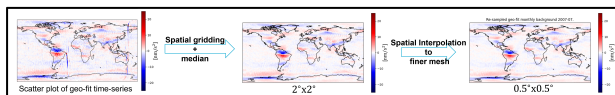
1. Synthesis of ITSG-Grace2018 daily spherical harmonic coefficients to EWH [cm] on a 0.5 x 0.5 degree grid

- Mean field: GGM05c
- GIA: not removed

2. Least-squares regression model:

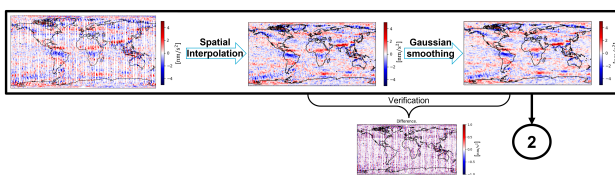
- Yearly obtained scaling (S) and bias (B) via least-squares fitting using ITSG-Grace2018 daily solutions (Mayer-Guerr, T. 2018, Kvas et al. 2019)
- Temporal interpolation to 5-day/sub-weekly resolution of scaling and bias to avoid large discontinuities between yearly boundaries
- Application of linear regression to high-frequency geo-fit LGDs

Images for Step 1 to Step 3



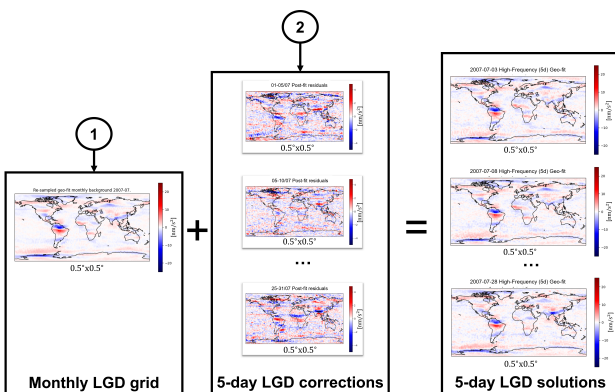
1

images/assets_methods/0_geofits.png



2

images/assets_methods/1_postfit_res.png



images/assets_methods/2_synthesis.png

Instrument- or software- specific information needed to interpret the data:

Python 3.10+, matplotlib, numpy, xarray, pandas, netCDF4 OR own tool provided.

REFERENCES

Bettadpur, Srinivas; Save, Himanshu; Tapley, Byron; Nagel, Peter; Kang, Zhigui; Poole, Steven; Pie, Nadege; Ries, John, 2025, "CSR RL06 GRACE geofit and postfit dataset", <https://doi.org/10.18738/T8/VY3U8L>, Texas Data Repository, V1

Ghobadi-Far, K., Han, S.-C., Weller, S., Loomis, B. D., Luthcke, S. B., Mayer-Guerr, T., & Behzadpour, S. (2018).

A transfer function between line-of-sight gravity difference and GRACE intersatellite ranging data and an application to hydrological surface mass variation.

Journal of Geophysical Research: Solid Earth, 123, 9186-9201.

<https://doi.org/10.1029/2018JB016088>

Kvas, A., Behzadpour, S., Ellmer, M., Klinger, B., Strasser, S., Zehentner, N., & Mayer-Guerr, T. (2019).

ITSG-Grace2018: Overview and evaluation of a new GRACE-only gravity field time series.

Journal of Geophysical Research: Solid Earth, 124.

<https://doi.org/10.1029/2019JB017415>

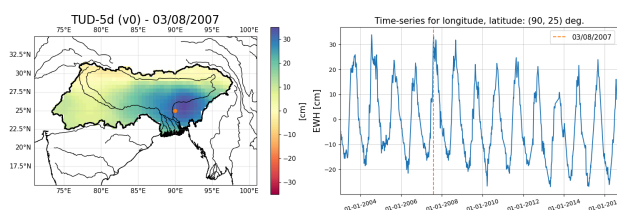
Mayer-Guerr, T., Behzadpur, S., Ellmer, M., Kvas, A., Klinger, B., Strasser, S., & Zehentner, N. (2018).

ITSG-Grace2018 - Monthly, Daily and Static Gravity Field Solutions from GRACE.

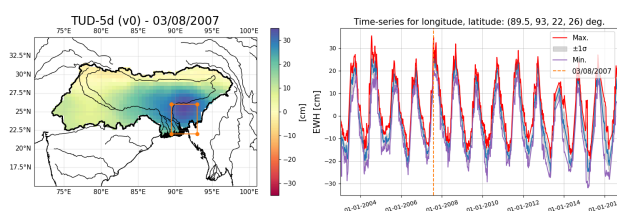
GFZ Data Services.

<http://doi.org/10.5880/ICGEM.2018.003>

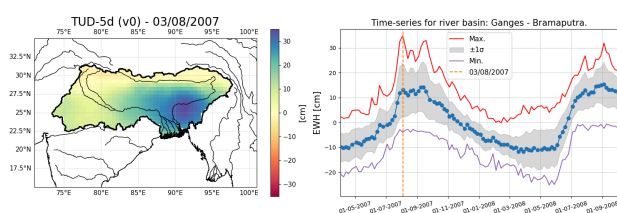
Results



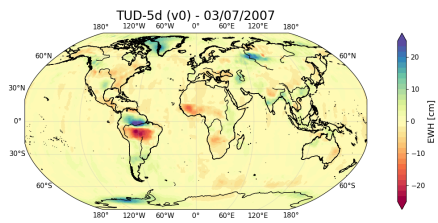
images/assets_results/GBM_point.png



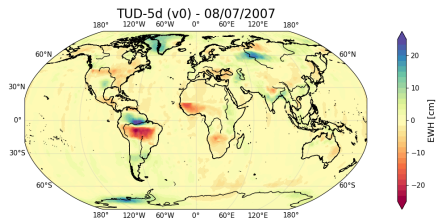
images/assets_results/GBM_region.png



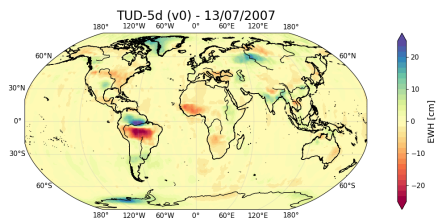
images/assets_results/GBM_river_basin.png



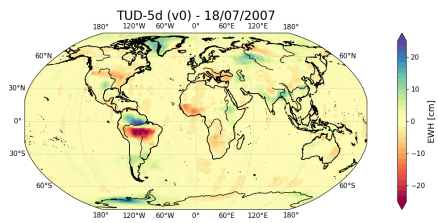
images/assets_results/hfewh_2007_07_03.png



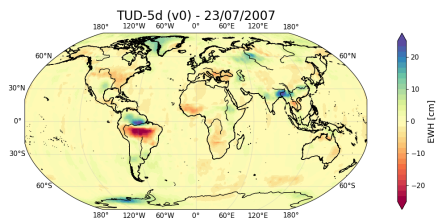
images/assets_results/hfewh_2007_07_08.png



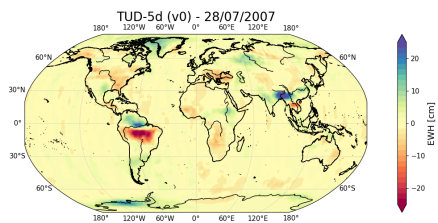
images/assets_results/hfewh_2007_07_13.png



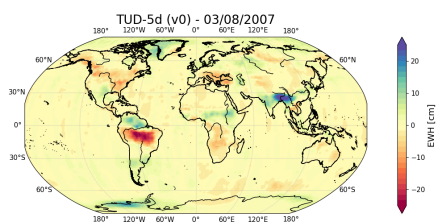
images/assets_results/hfewh_2007_07_18.png



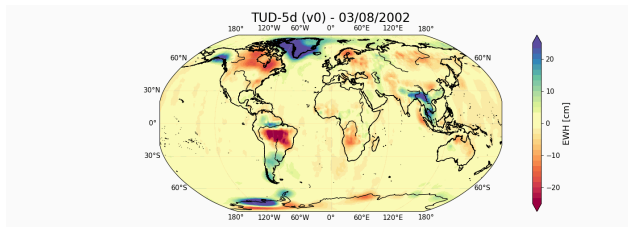
images/assets_results/hfewh_2007_07_23.png



images/assets_results/hfewh_2007_07_28.png



images/assets_results/hfewh_2007_08_03.png



images/assets_results/hfewh_from_lgds.gif