COST-G

Combination Service for Time-variable Gravity Models

Combination Service for Time-variable Gravity Fields (COST-G) – one year of operational service

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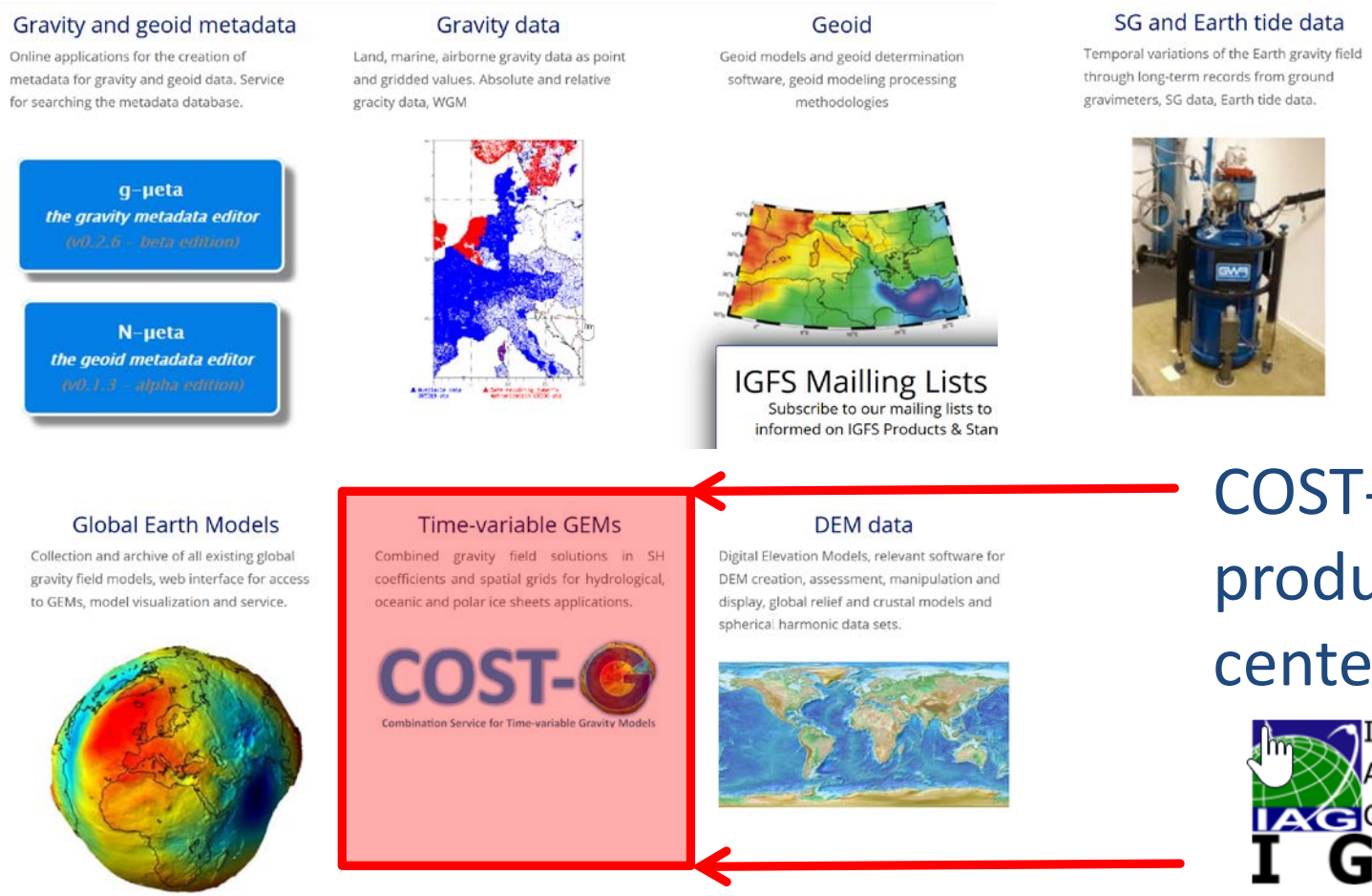
43rd COSPAR Scientific Assembly

28 January – 4 February 2021, Sydney, Australia

Introduction



COST-G is a product center of the International Association of Geodesy IAG IGFS

http://igfs.topo.auth.gr/

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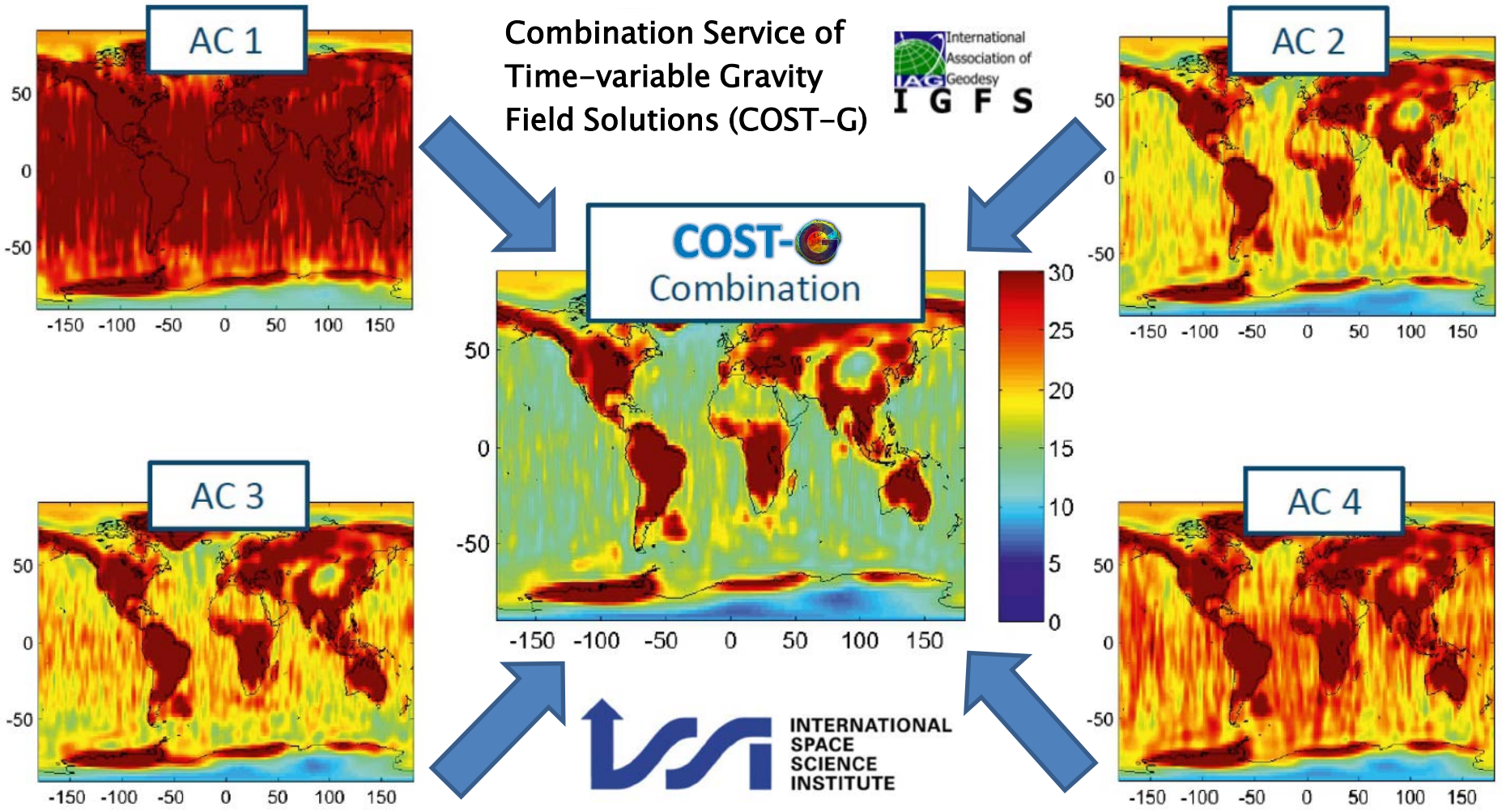
Introduction



Improved and consolidated product integrating the strengths of all ACs

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COST-G Website

Welcome to COST-G

The International Combination Service for Time-variable Gravity Fields (**COST-G**) is a product center of the International Gravity Field Service (IGFS) and is dedicated to the combination of monthly global gravity field models. COST-G stems from the activities of the former H2020 project European Gravity Service for Improved Emergency Management (EGSIEM).

Please use the top menu to visit the various parts of our website!

The service started its work in 2019 and the website is still under construction. More features will be available soon! We apologize for any inconvenience. For any questions, please contact us.

Best regards,
Your COST-G Team.

https://cost-g.org/

Latest News

November 4th 2020

Benchmark data for verifying background model implementations in orbit and gravity field determination software available here (Martin Lasser et al. 2020)

June 16th 2020

COST-G RL01 Level 2B and Level-3 products are available and the GravIS portal has been updated!

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COST-G Website

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Latest News

November 23rd 2020

COST-G GRACE-FO monthly models are now available!

November 4th 2020

Benchmark data for verifying background model implementations in orbit and gravity field determination software available here (Martin Lasser et al. 2020)

https://cost-g.org/

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Permanent Components of COST-G

COST-G accomplishes its objectives through the following permanent components and roles:

- **Central Bureau (CB) & Analysis Center Coordinator (ACC)**
  - AIUB
- **Analysis Centers (ACs)**
  - AIUB, CNES, GFZ, TUG
- **Level-3 Center (L3C)**
  - GFZ
- **Validation Centers (VCs)**
  - GRGS, GFZ
- **Product Evaluation Group (PEG)**
  - A. Eicker, A. Groh, B. Meyssignac
- **Candidate ACs:** LUH, Chinese ACs

GRACE/GRACE-FO SDS (CSR, JPL) contribute as partner ACs to COST-G combinations.

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Current/Planned Combinations

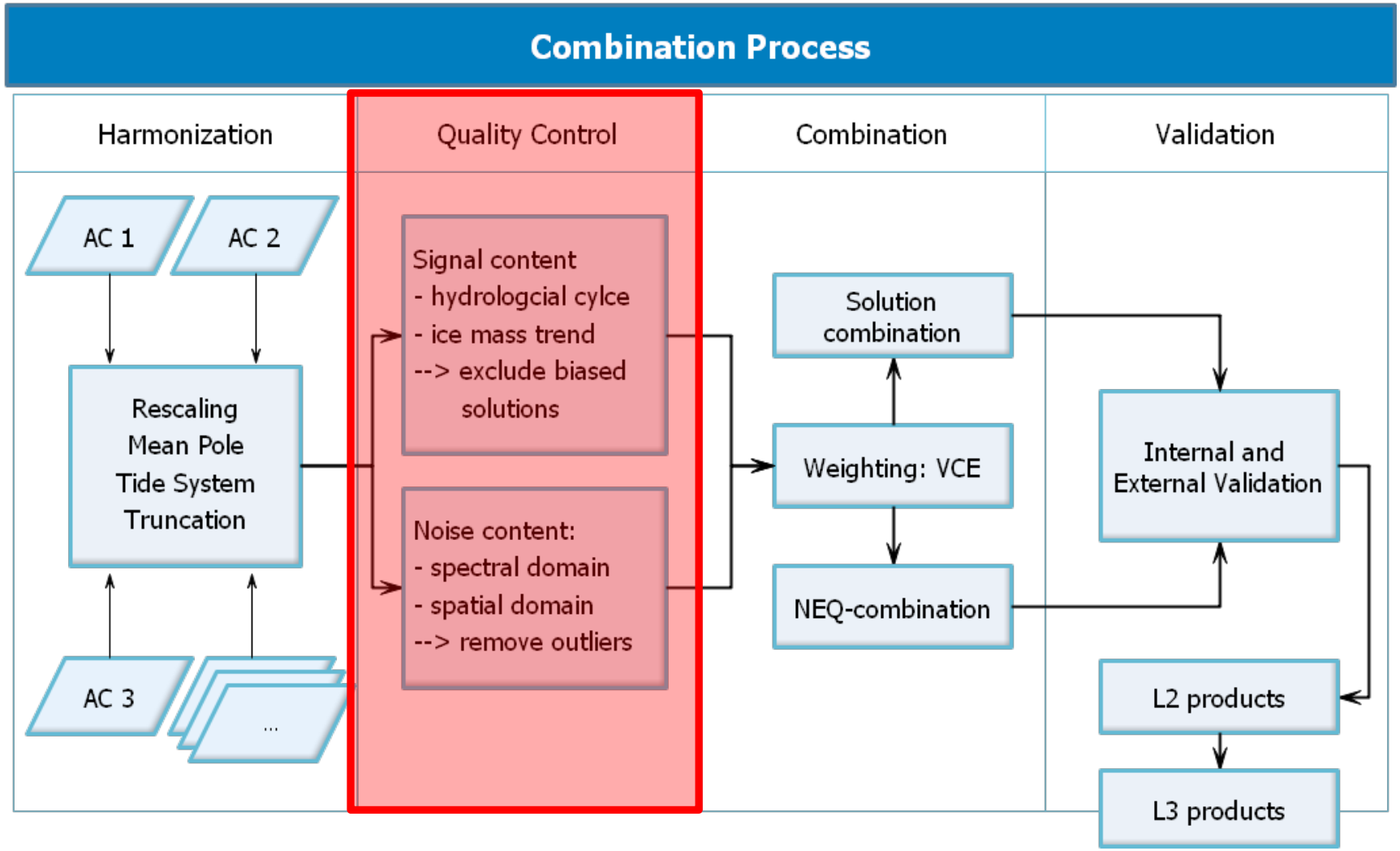
The COST-G ACs adopt different analysis methods but apply agreed-upon consistent processing standards to deliver time-variable gravity fields currently from:

- **GRACE/GRACE-FO low-low satellite-to-satellite tracking (ll-SST)**
- **Swarm high-low satellite-to-satellite tracking (hl-SST)**

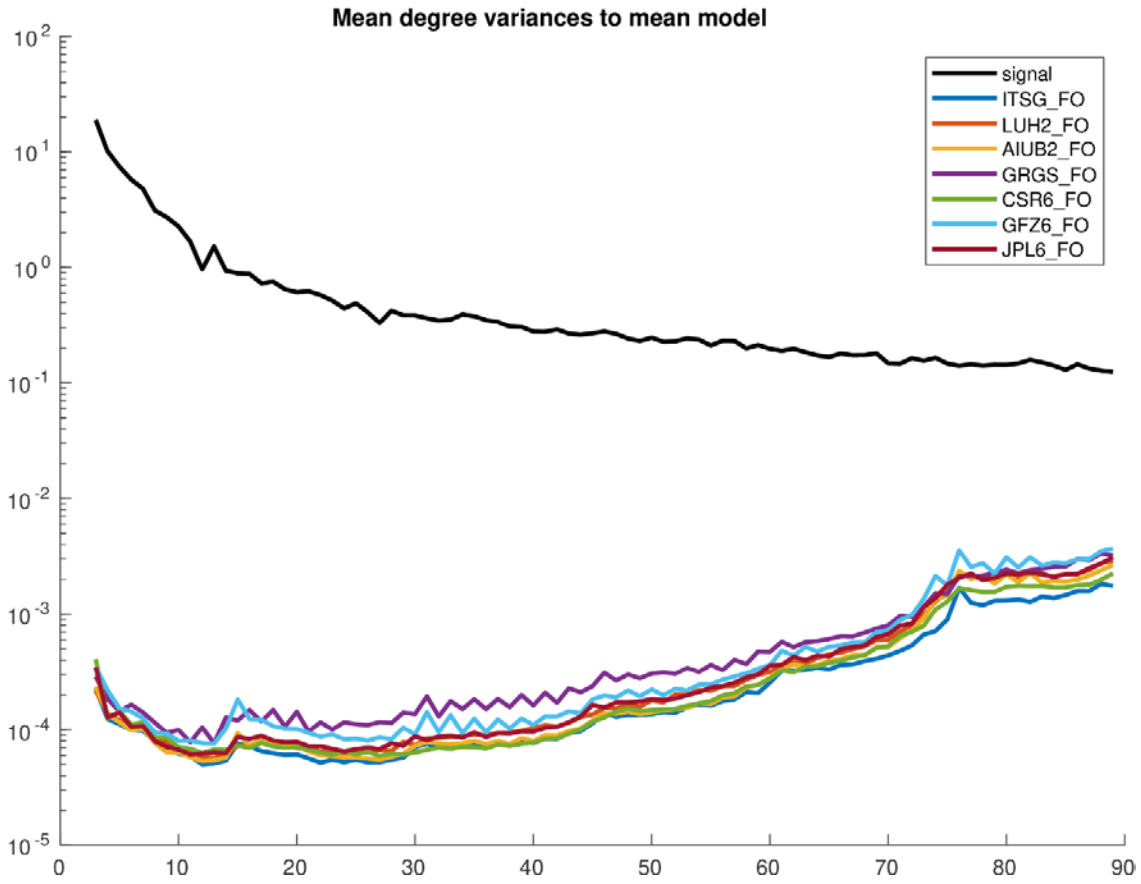
Extensions are discussed for:

- **Satellite Laser Ranging (SLR) to cannonball satellites**

COST-G Quality Control



Quality Control – Noise Levels (spectral domain)



GRACE-FO time-series:

COST-G ACs:

- AIUB-GRACE-FO_op
- GFZ-RL06 (GFO)
- GRGS-RL05: free solution
- ITSG-Grace_op

COST-G candidate AC:

- LUH

COST-G partner ACs:

- CSR-RL06 (GFO)
- JPL-RL06 (GFO)

Degree-wise comparison of spherical harmonic coefficients to a deterministic signal model derived from the monthly means of all time-series (GRACE-FO).

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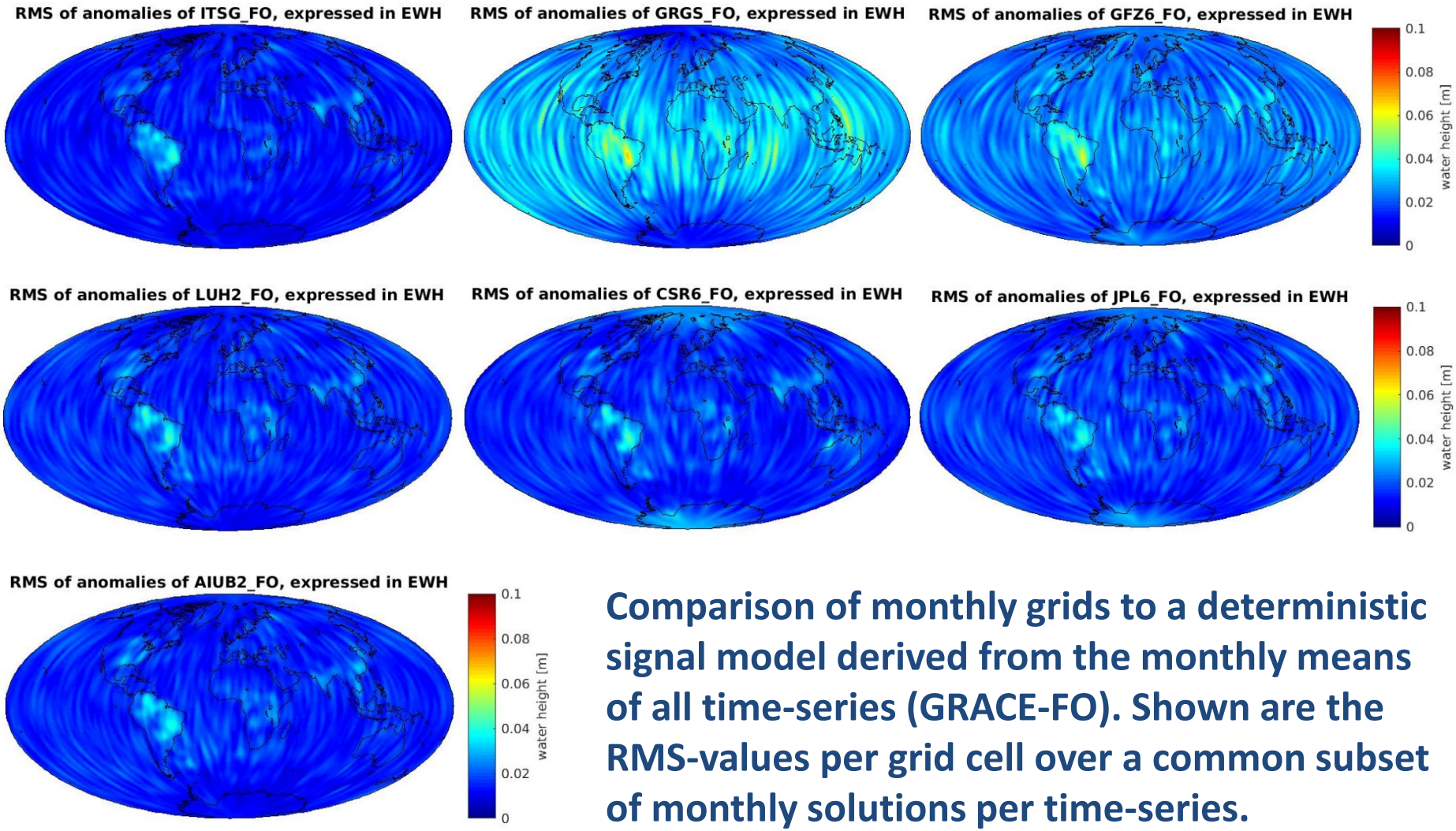
Quality Control – Noise Levels (spatial domain)



Comparison of monthly grids to a deterministic signal model derived from the monthly means of all time-series (GRACE-FO). Shown are the RMS-values per grid cell over a common subset of monthly solutions per time-series.

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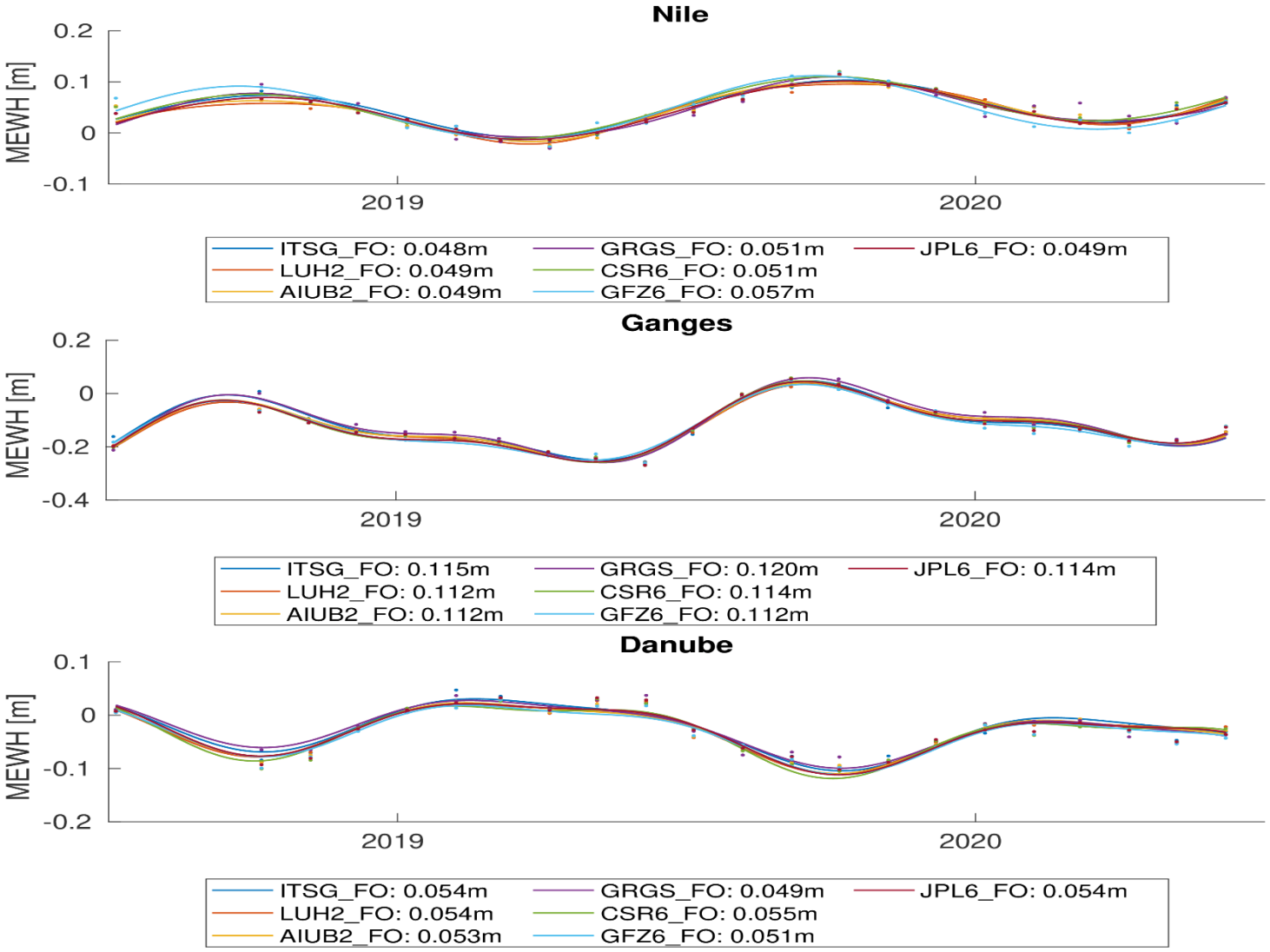
Quality Control – Signal Content (Hydrology)



Example: fit of seasonal variations in selected river basins (GFO).

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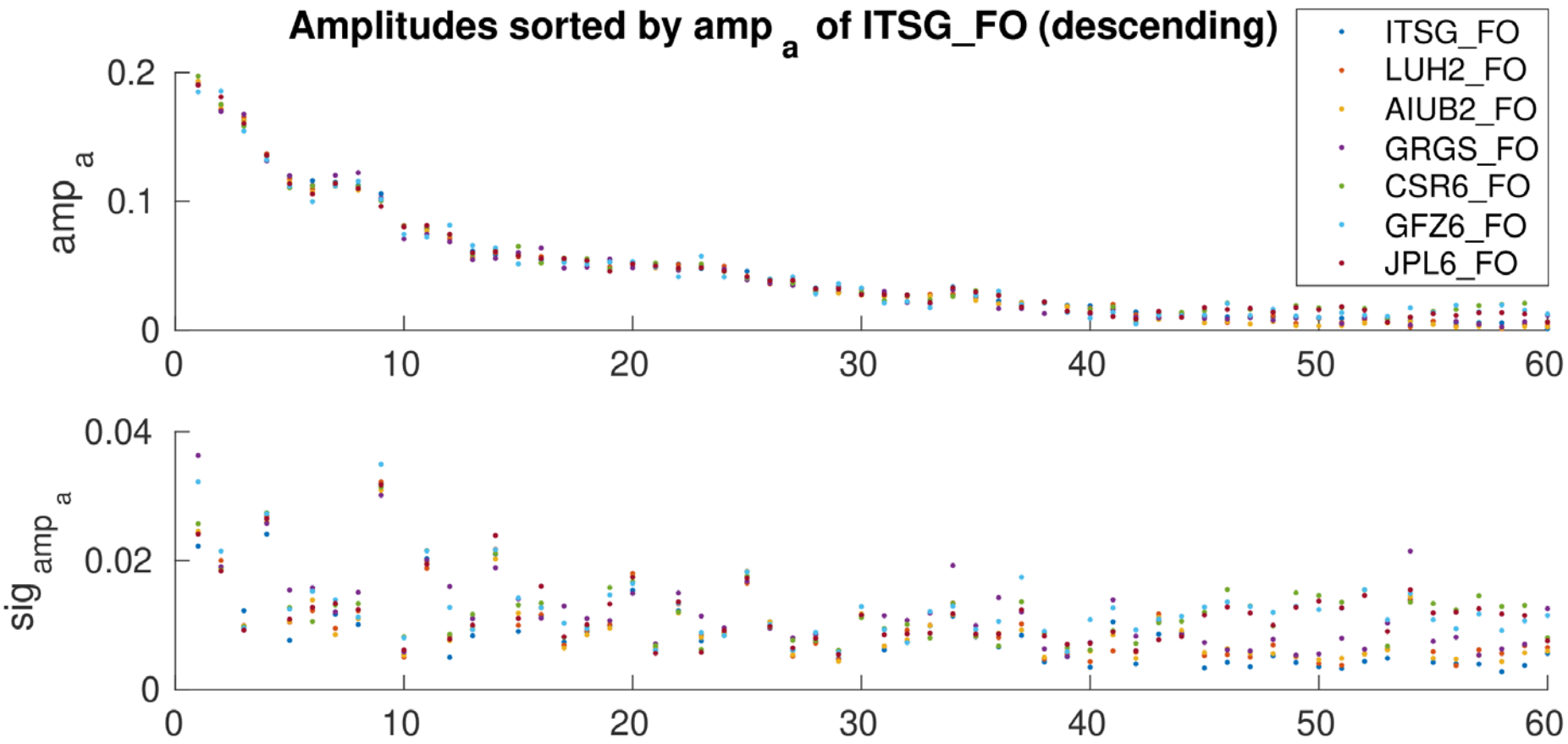
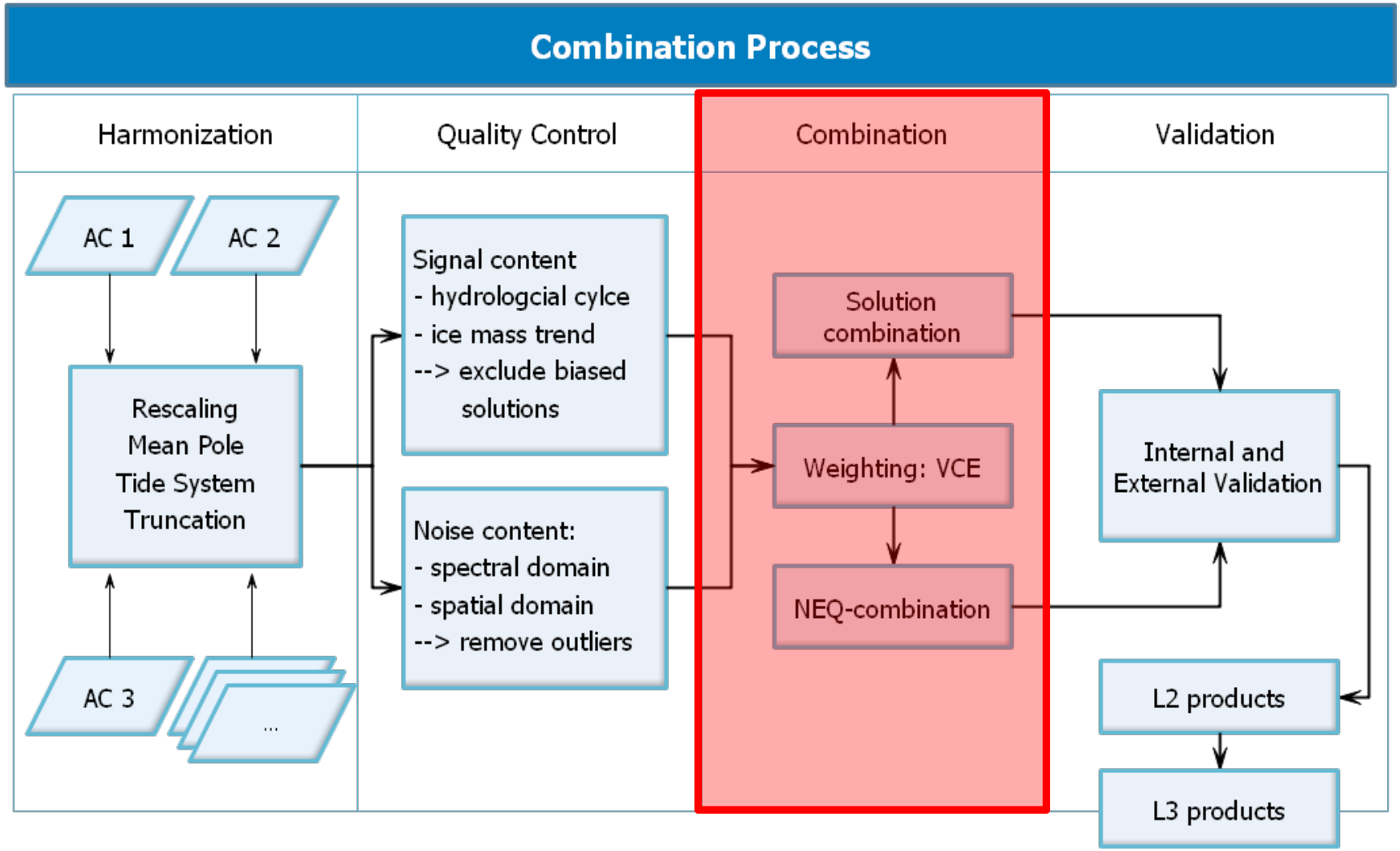
Quality Control – Signal Content (Hydrology)



Comparison of amplitudes **amp$_a$** of seasonal mass variations and their formal errors **sig$_{amp}$** in 60 major river basins.

COST-G – Combination



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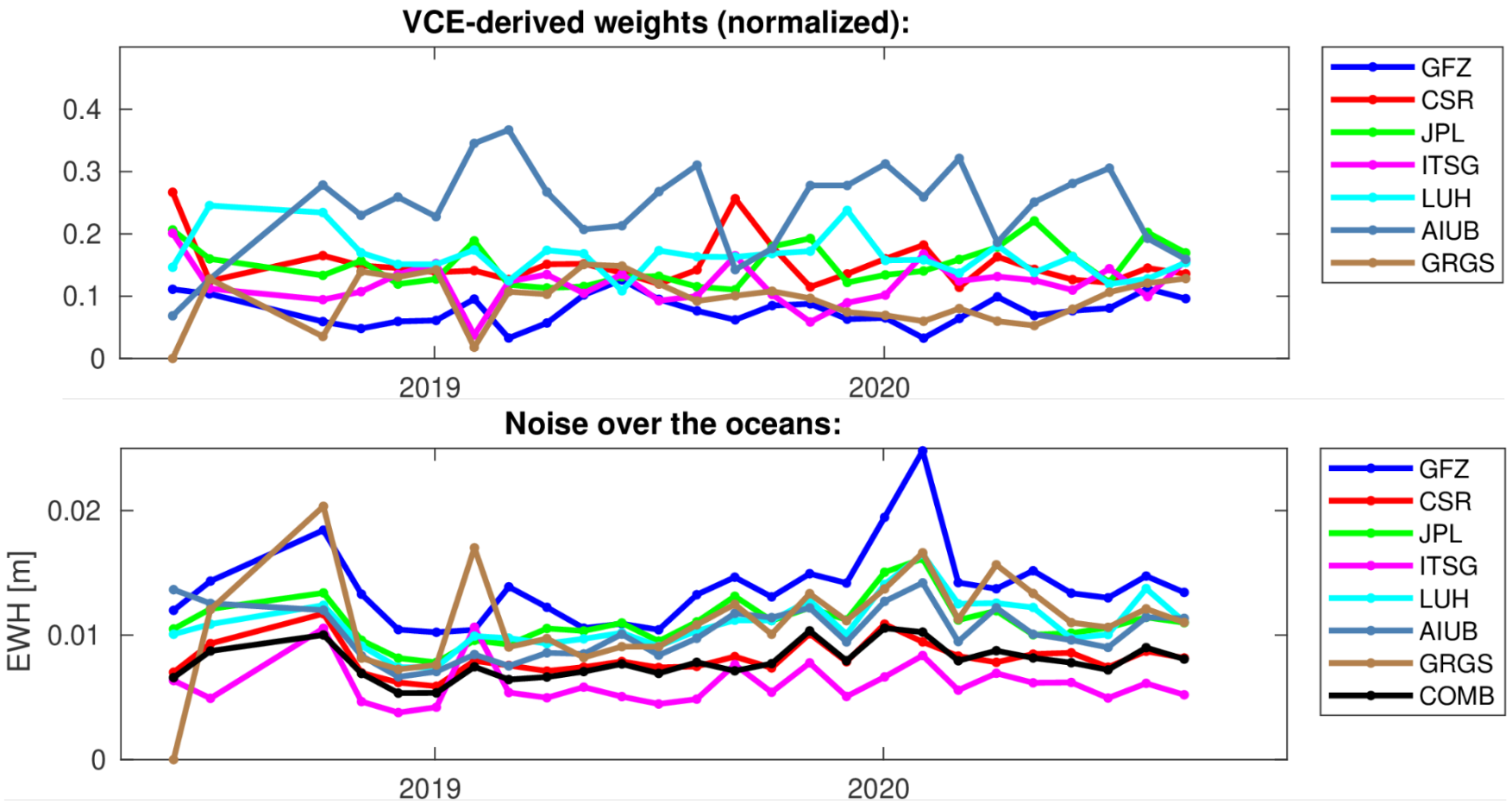
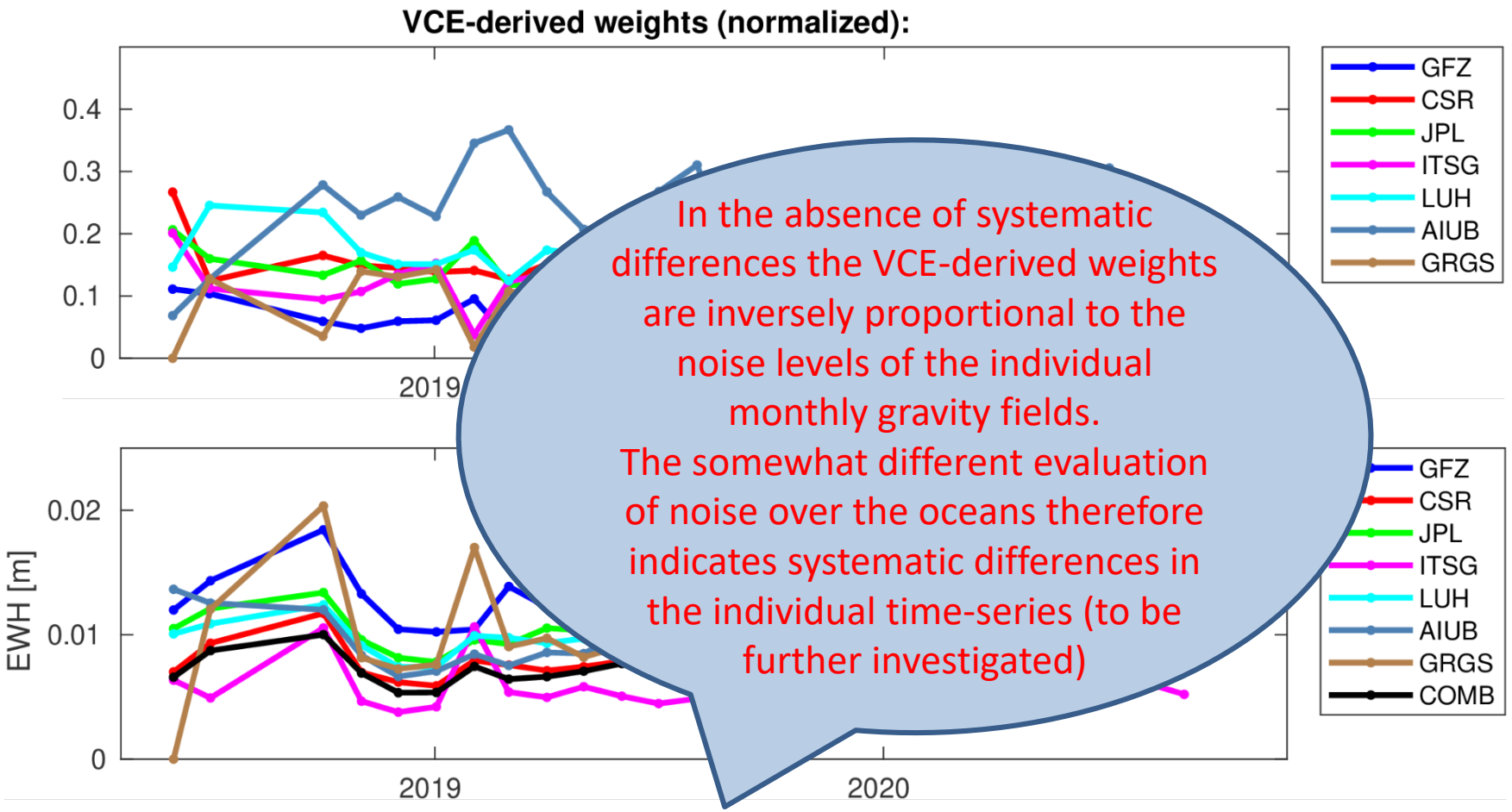
Combination applying Variance Component Estimation



Combination applying Variance Component Estimation



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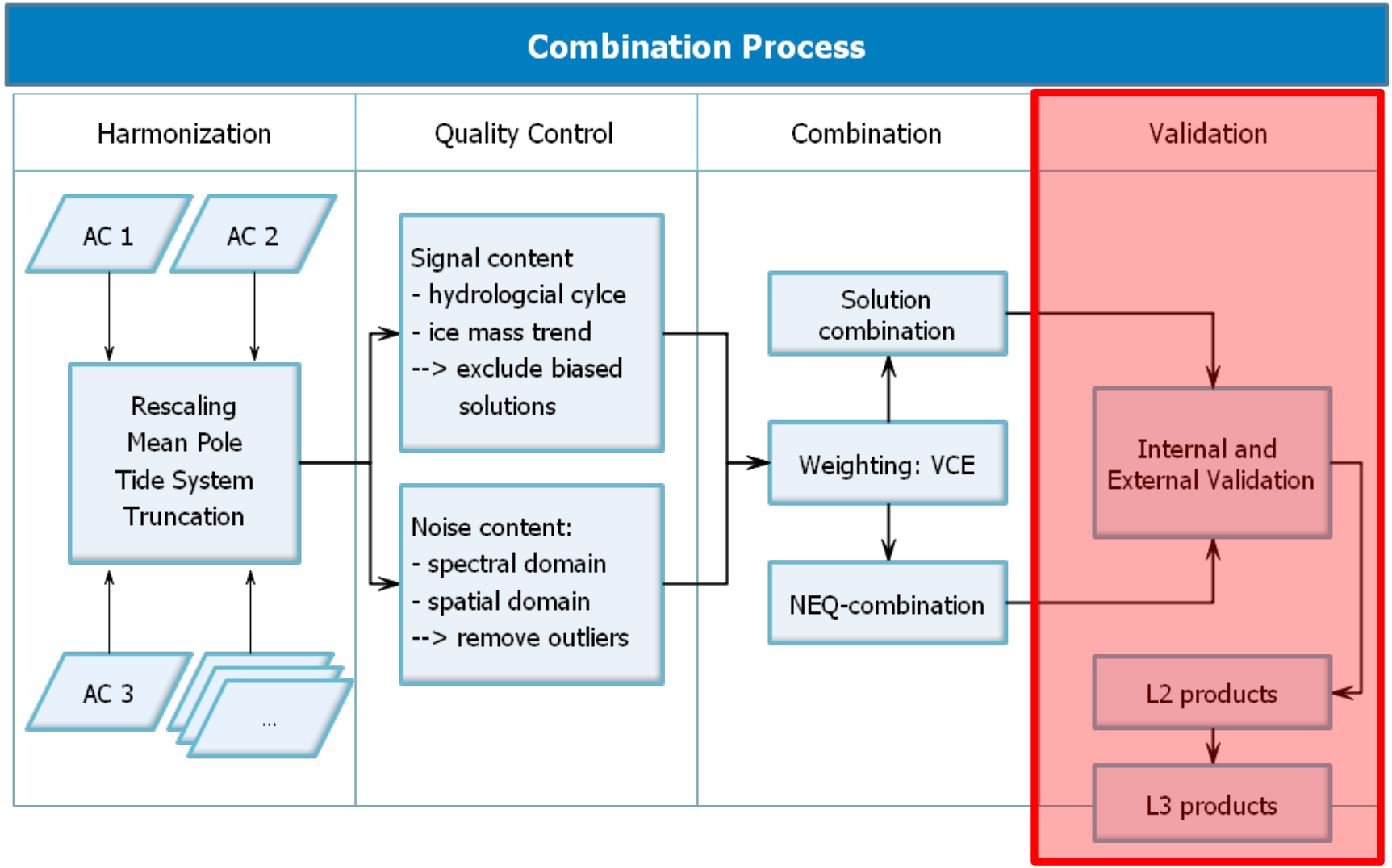
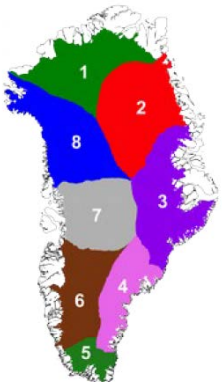
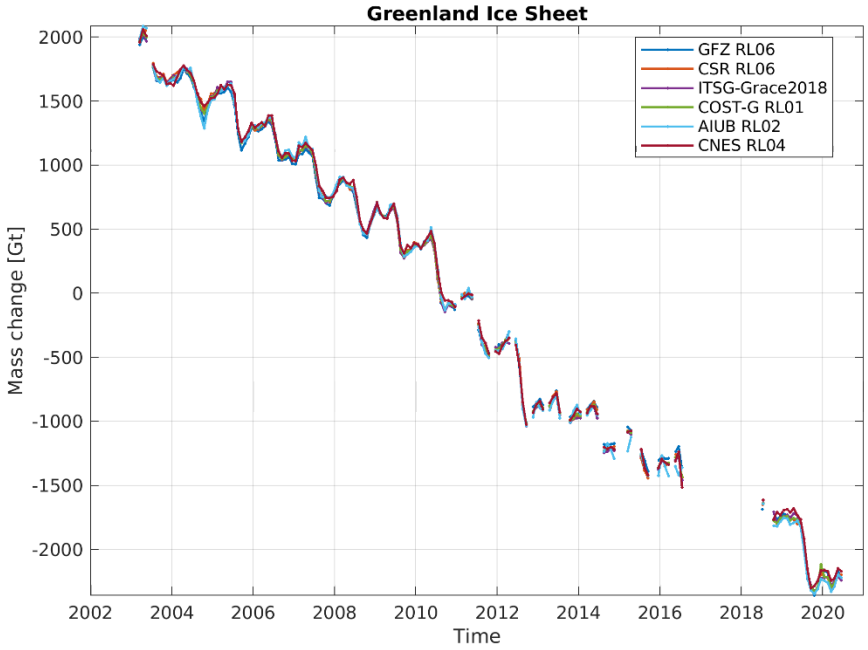
COST-G – Validation

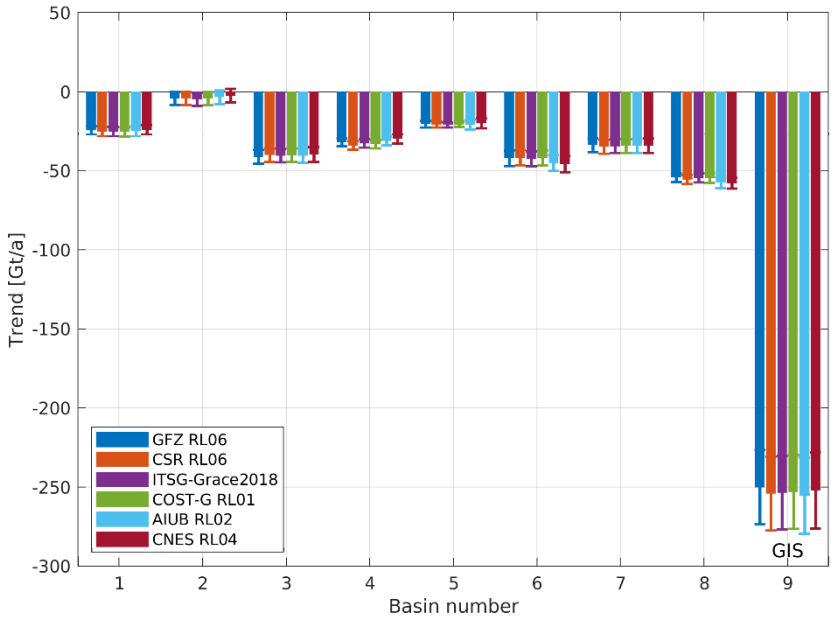


Basin-Averaged Greenland Ice Mass Changes

Basin-integrated Greenland/Antarctic Ice Sheet (GIS/AIS) mass changes based on the sensitivity kernel approach by TU Dresden







Trends are calculated from GRACE and GRACE-FO results (from a fitted linear, quadratic and seasonal model).

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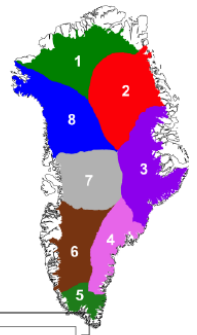
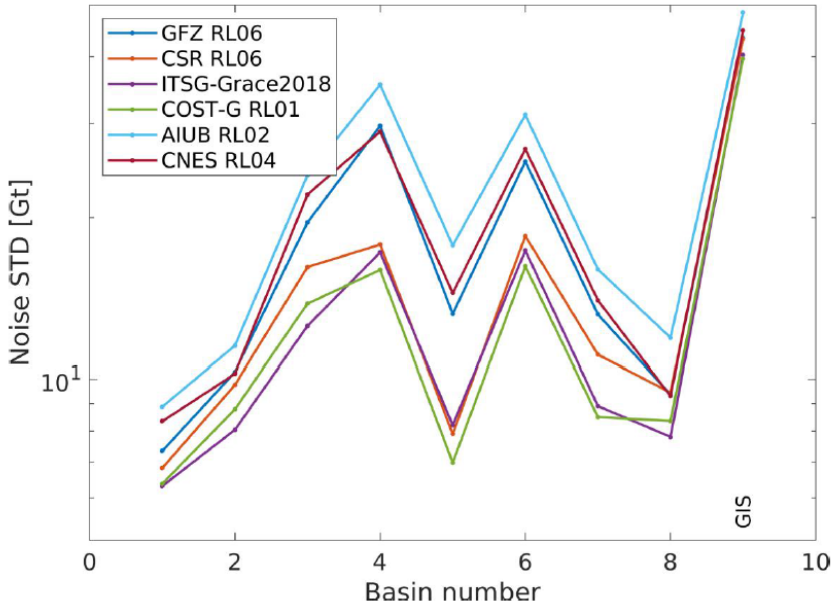
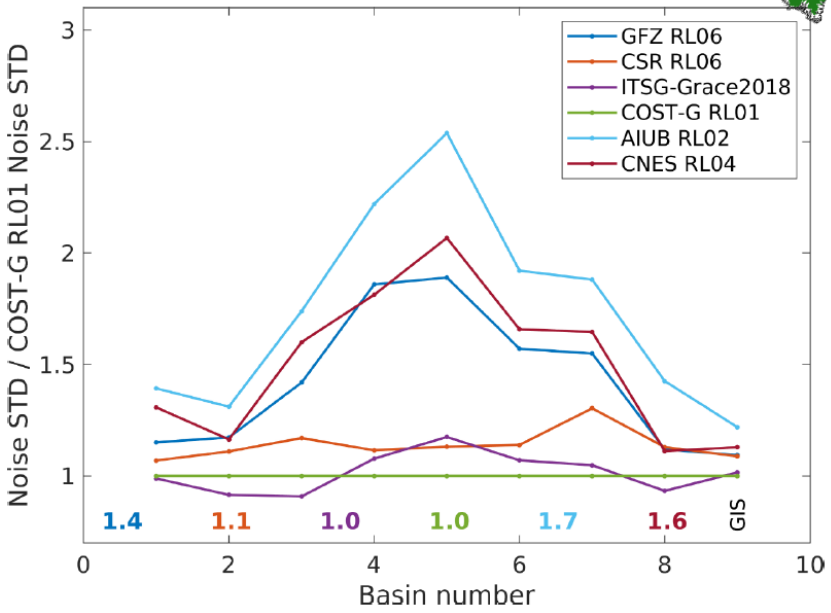
Basin-Averaged Greenland Ice Mass Changes

- Noise measure for each basin time series and ratio to the noise measure of the COST-G time series (numbers indicate the median of all basin ratios). Basin 9 denotes the entire GIS.

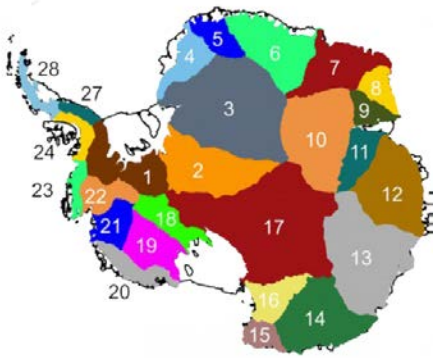


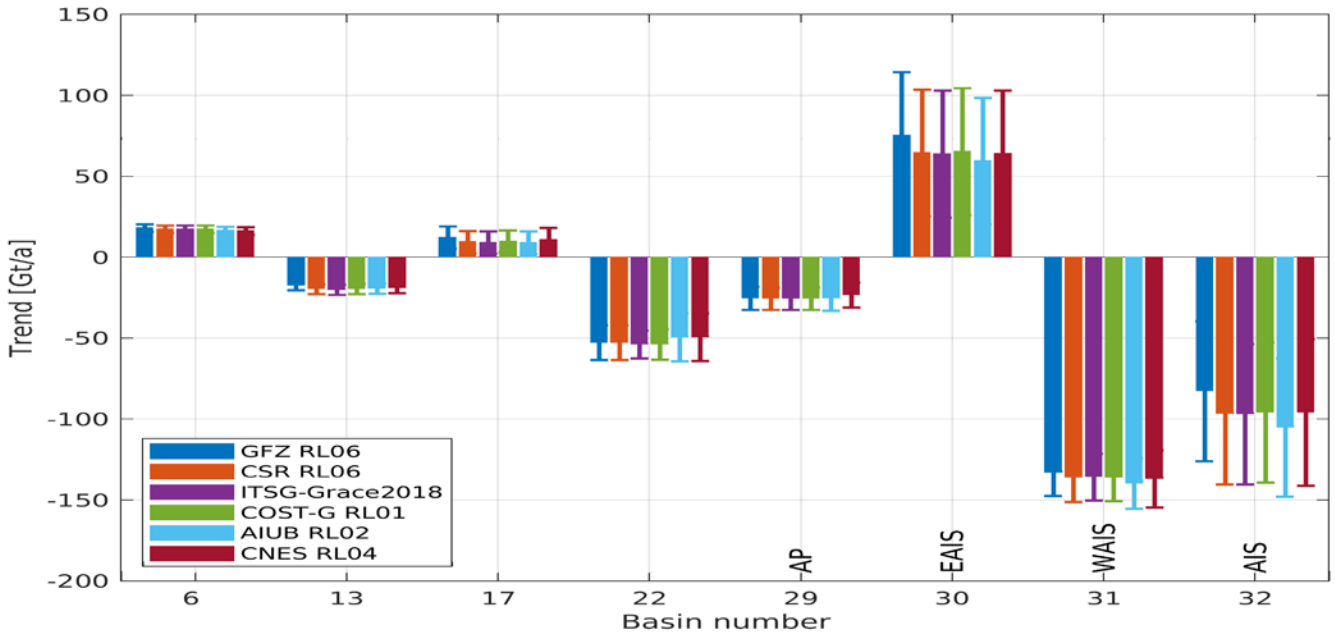




Basin-Averaged Antarctic Ice Mass Changes

Trends are calculated from GRACE and GRACE-FO results (from a fitted linear, quadratic and seasonal model).





Basin numbers:
29: Ant. Peninsula (AP)
30: East Ant. (EAIS)
31: West Ant. (WAIS)
32: AIS

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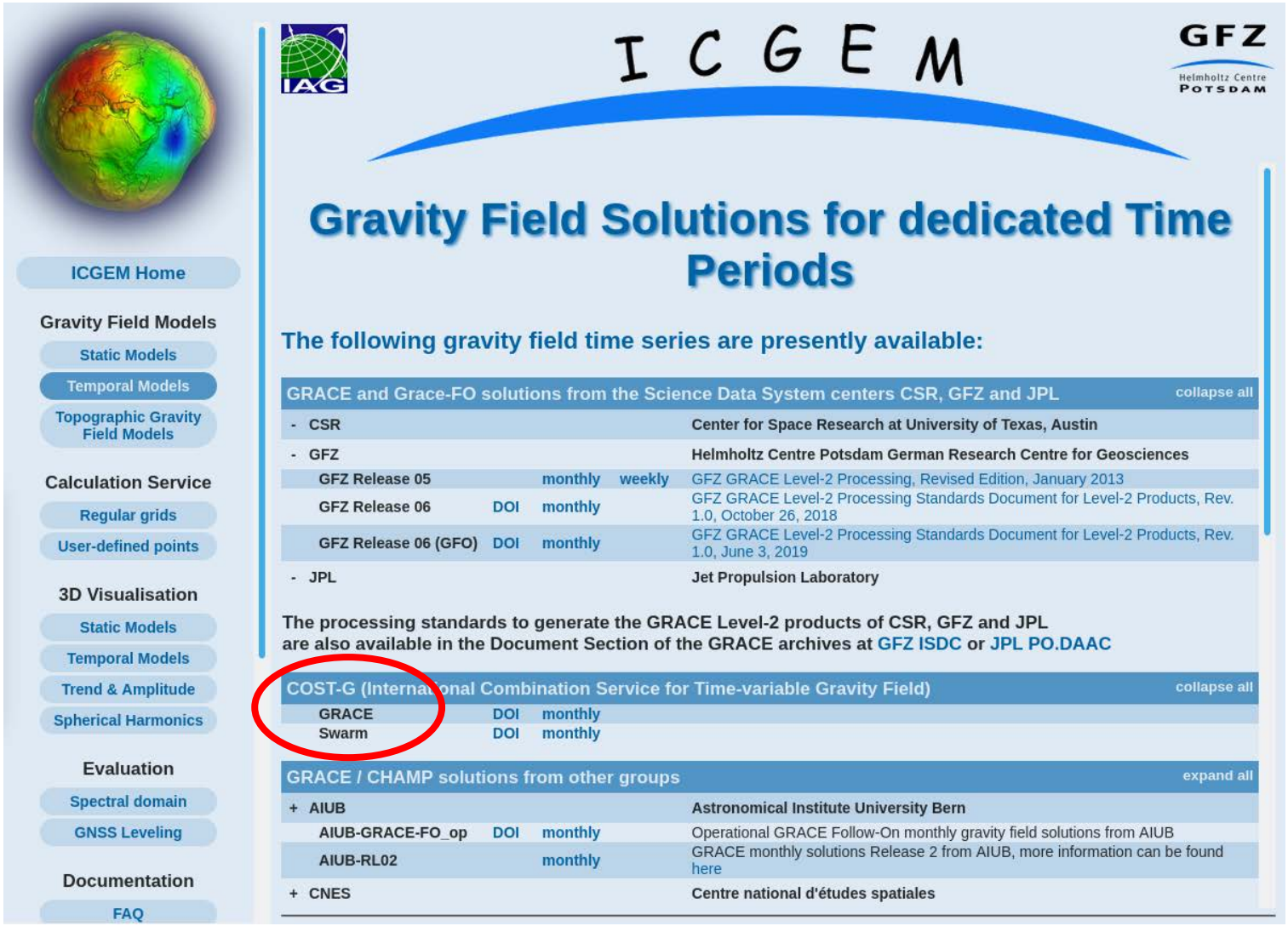
Comparison to Altimetry

QUALITY CRITERIA:

- Correlation: aim for 100%
- Scale factor: aim for 1

	Correlation (Black Sea)	Scale factor (Black Sea)	Correlation (Caspian S.)	Scale factor (Caspian S.)
CSR-RL06	71.8 %	1.23	98.2 %	1.64
GFZ-RL06	71.5 %	1.25	97.8 %	1.66
JPL-RL06	69.2 %	1.27	97.6 %	1.61
ITSG	72.3 %	1.21	98.3 %	1.62
COST-G	79.6 %	1.07	98.3 %	1.63

Level-2 Product Availability



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Level-2 Product Availability

- **Monthly combined GRACE gravity field models:**
  - from Apr. 2002 to Jun. 2017 available at ICGEM
  - http://icgem.gfz-potsdam.de/series/02_COST-G/GRACE
- **Monthly combined Swarm gravity field models:**
  - from Dec. 2013 to “present” available at ICGEM
  - http://icgem.gfz-potsdam.de/series/02_COST-G/Swarm
- **Monthly combined GRACE-FO gravity field models:**
  - from May 2018 to “present” available at ICGEM
  - http://icgem.gfz-potsdam.de/series/02_COST-G/Grace-FO

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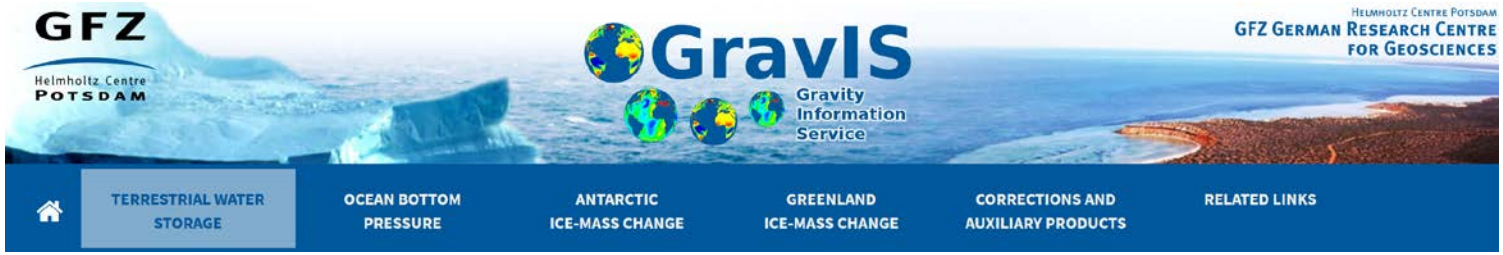
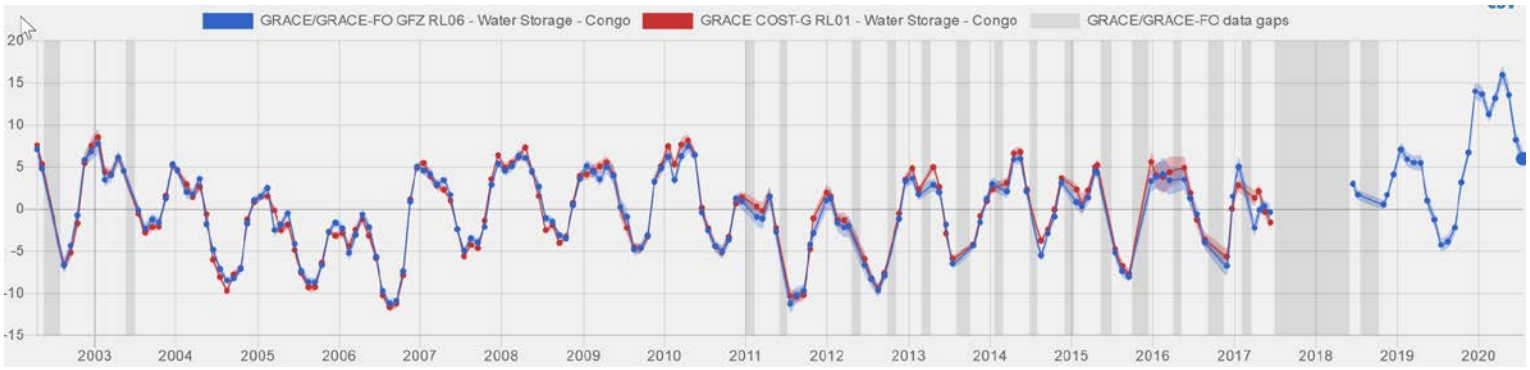
Level-3 Product Availability

- **Monthly combined GRACE/GRACE-FO gravity field models:**
  - **from Apr. 2002 to to "present" available at ISDC, GravIS**
  - **ftp://isdcftp.gfz-potsdam.de/grace/GravIS/COST-G/Level-3**





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Summary and Outlook

- **COST-G combined Level-2 products for GRACE (repro), Swarm (operational), and GRACE-FO (operational) are available from ICGEM.**
- **COST-G Level-3 products for GRACE and GRACE-FO are available via GFZ's GravIS portal (http://gravis.gfz-potsdam.de/).**
- **Inclusion of further candidate Analysis Centers (Chinese ACs) is planned for 2021 (benchmark testing and quality control are currently being performed).**

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