The second release of COST-G GRACE-FO combined monthly gravity fields

Ulrich Meyer[1], Martin Lasser[1], Adrian Jäggi[1], Christoph Dahle[2], Eva Boergens[2], Christoph Förste[2], Saniya Behzadpour[3,4], Igor Koch[5]

[1]University of Bern, Astronomical Institute, Switzerland
[2]German Research Centre for Geosciences, Germany
[3]Graz University of Technology, Austria
[4]Dep. of Civil, Env. and Geomatic Eng., ETH Zürich
[5]Leibniz University Hannover, Germany
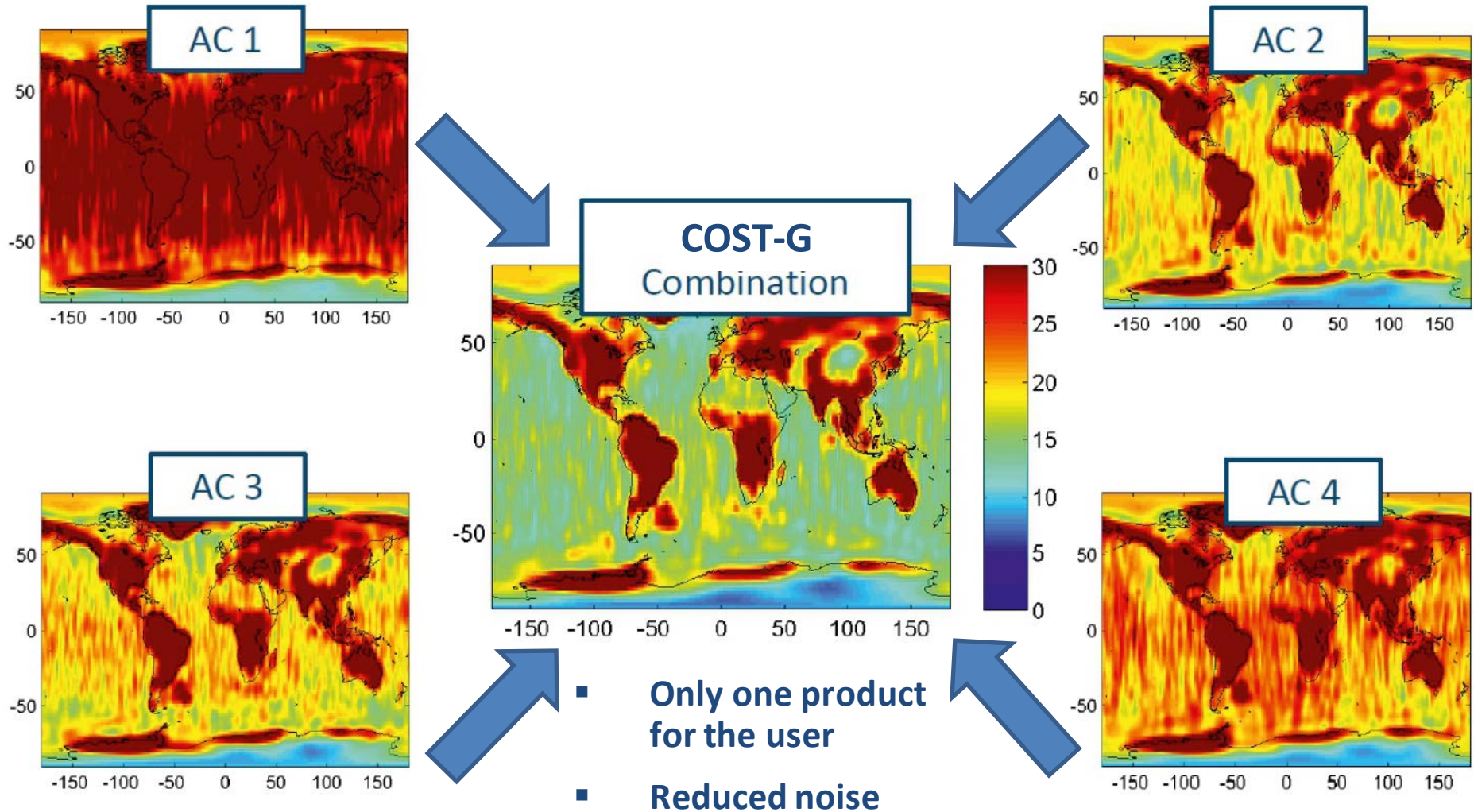
ICCC 2023

Session 04 – GRACE, Hydrology and Ice Mass Balance
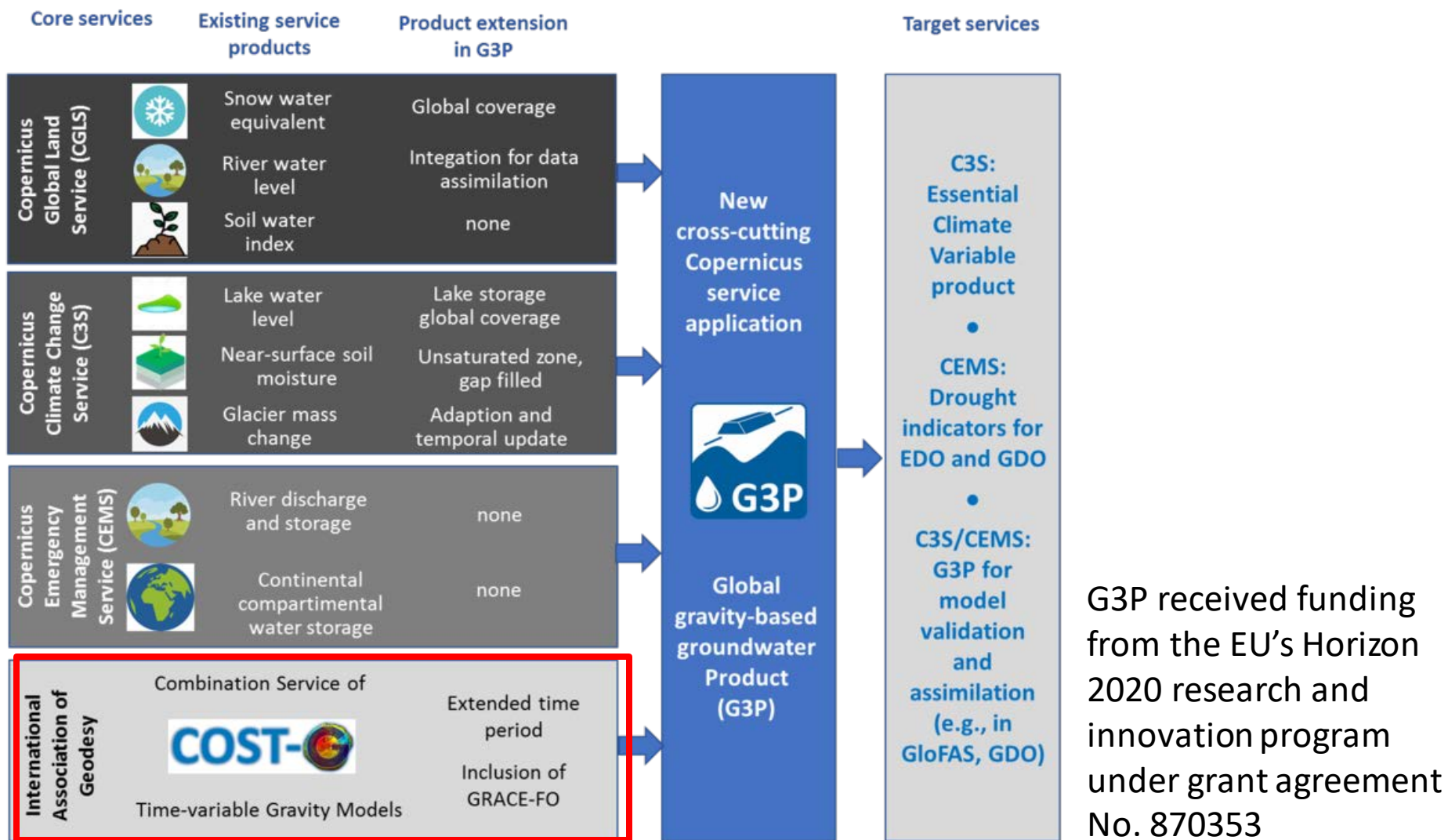
Contents

- Introduction to COST-G

- COST-G GRACE-FO RL02 developments:
  - weighting scheme
  - accelerometer transplant product
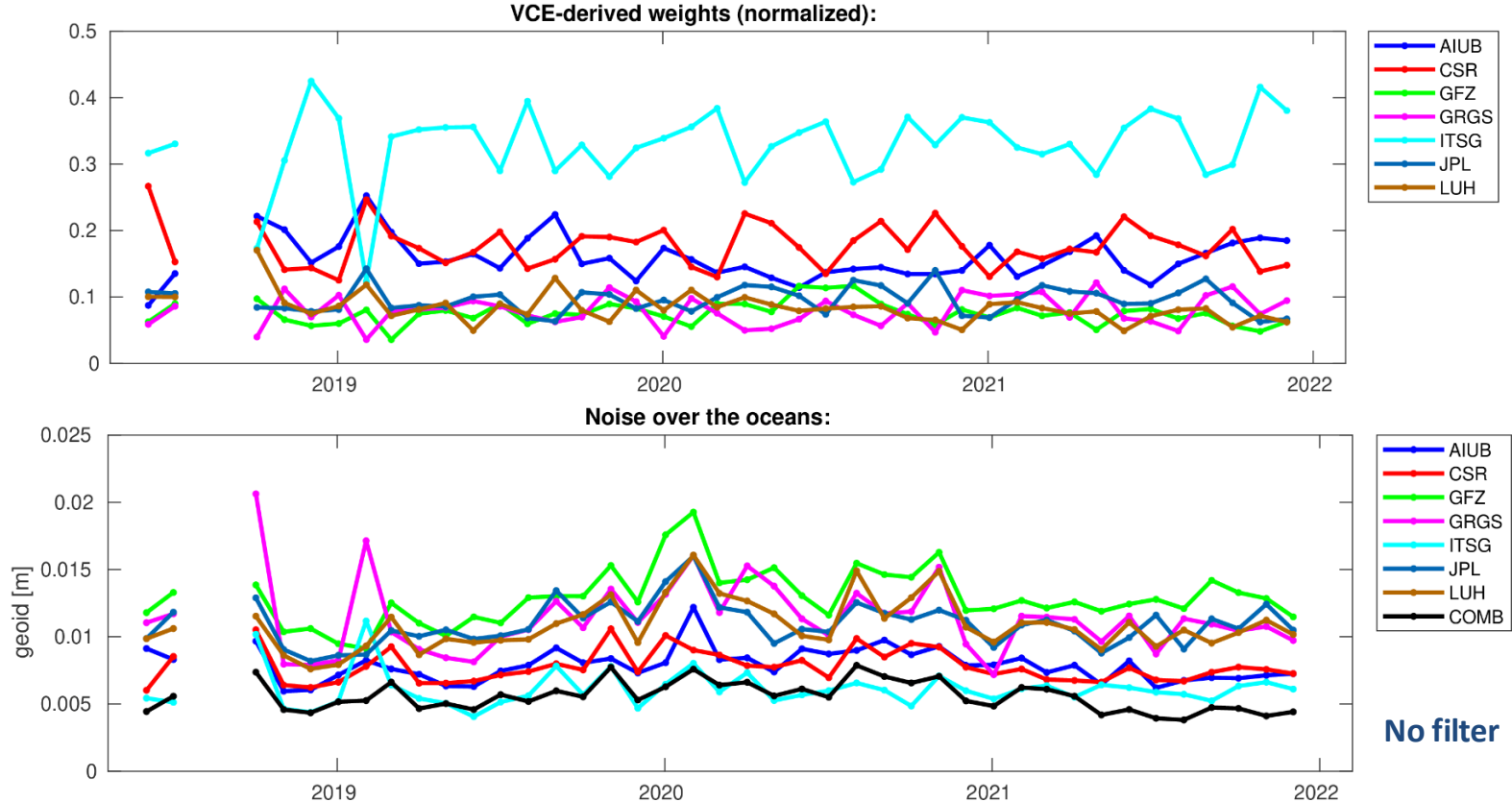 - new time-series

- Validation/Dissemination

COST-G: Concept

AC 1

AC 2

COST-G Combination

AC 3

AC 4

- Only one product for the user
- Reduced noise

COST-G within the G3P project

G3P received funding from the EU's Horizon 2020 research and innovation program under grant agreement No. 870353

GRACE-FO Operational Combination

Weights do not reflect the noise over the oceans of AC solutions:
Highest weight: AIUB   **Lowest noise: ITSG**

Revision of the Weighting Scheme

VCE-derived weights (normalized):

Noise over the oceans:

No filter

Weights better reflect the noise over the oceans of AC solutions:
Highest weight: ITSG   **Lowest noise: ITSG**

Further Improvements of the Combined Solution

VCE-derived weights (normalized):

Noise over the oceans:

Empirical Noise Modeling of AIUB AC solution (Ph.D. work of M. Lasser)
GFZ time-series based on ACT product from G3P (as AIUB, GRGS, ITSG, LUH)
=> Combination outperforms all individual solutions in 2021

COST-G

Further Improvements of the Combined Solution

VCE-derived weights (normalized):

Noise over the oceans:

No filter
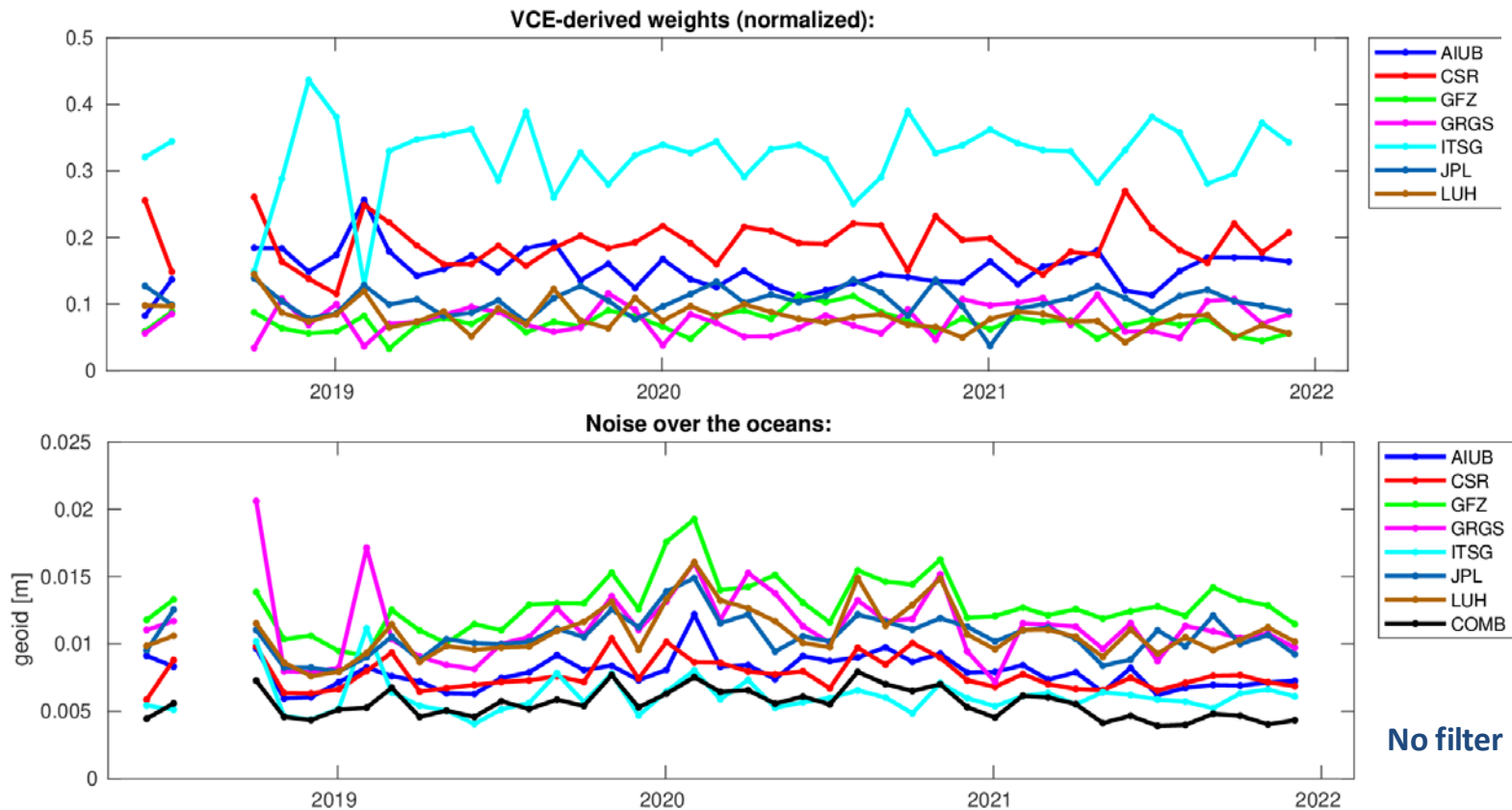
CSR and **JPL** RL06.1 time-series based on new JPL-ACT product;
the main effect is on C30, which in case of using either the G3P-ACT
or the new JPL ACT has not to be replaced by SLR-derived values.

Validation: Improvement of TWS Signal-to-Noise Ratio
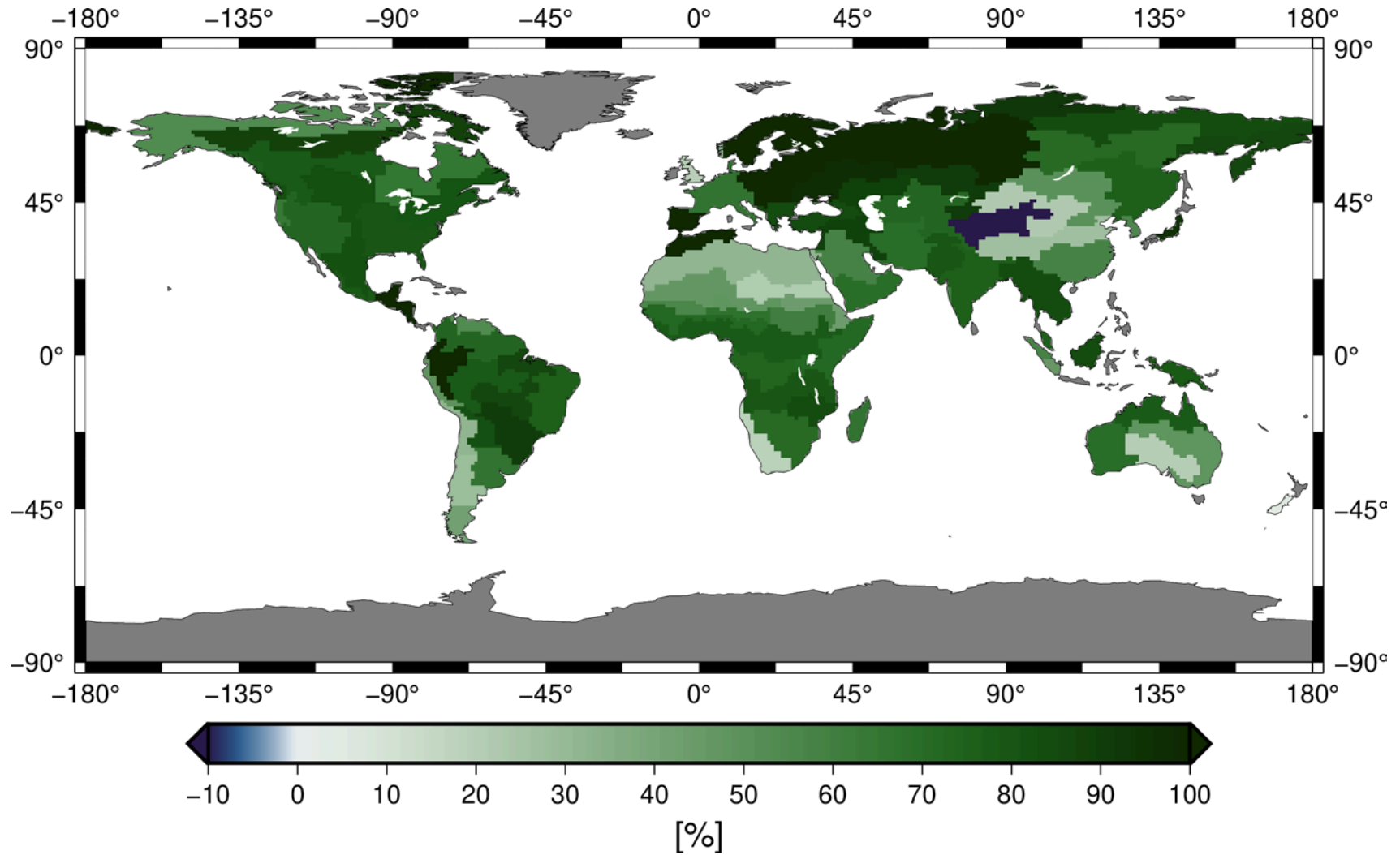
Validation: GOCE orbit fit

**3D-RMS values [cm] of the orbit fit residuals (mean values from the involved arcs)
Parametrization: 6 orbital elements, accelerometer biases 1/arc (3 directions)**

Model/Month	March			April			June			December		
	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021
COST-G FSM	5,53	5,77	6,30	5,37	5,72	6,39	5,39	5,86	6,63	5,48	6,05	7,78
COST-G operational	6,42	7,10	7,27	6,36	7,06	7,84	6,40	7,36	7,62	6,94	7,51	7,57
COST-G (G3P)	5,92	6,76	6,79	5,99	6,55	7,30	5,85	6,68	6,86	6,38	6,77	7,21
ITSG-Grace_operational_n96	5,94	6,95	7,11	5,93	6,69	7,08	5,68	6,33	6,77	6,17	6,95	7,36

COST-G products: Level-2 (spherical harmonic)

COST-G products: Level-3 (post-processed grids/time-series)
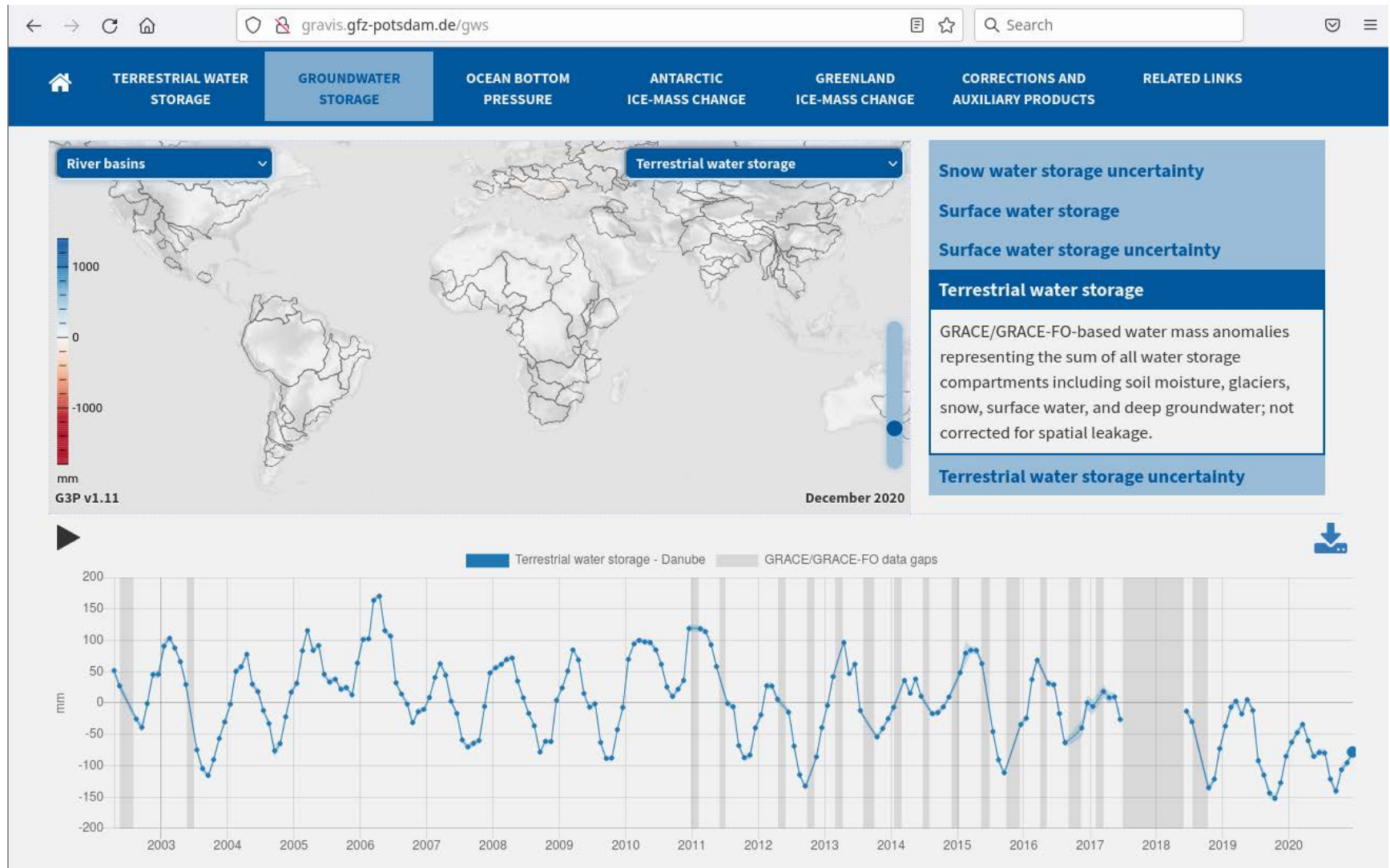
Summary and Outlook

- **COST-G GRACE-FO RL02 Level-2 products (spherical harmonic coefficients) are available from ICGEM (http://icgem.gfz-potsdam.de/series/02_COST-G/ Grace-FO_RL02).**

- **COST-G GRACE-FO RL02 Level-3 products for (grids/time-series) are available via GFZ's GravIS portal (http://gravis.gfz-potsdam.de/gws).**

- **COST-G GRACE RL02 consistent to GRACE-FO RL02 and including Chinese Analysis Centers is under preparation for presentation at IUGG 2023.**