

EGSIEM combination service: combination on normal equation level

Uli Meyer

EGSIEM Final Review Meeting

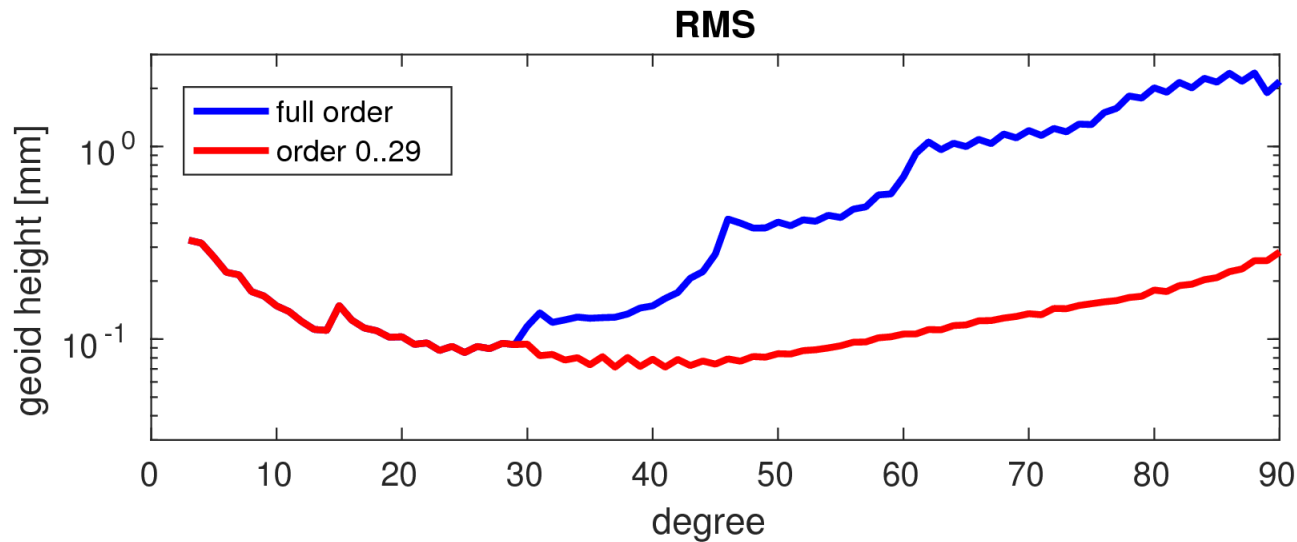
Bern

February 8 / 9th, 2018

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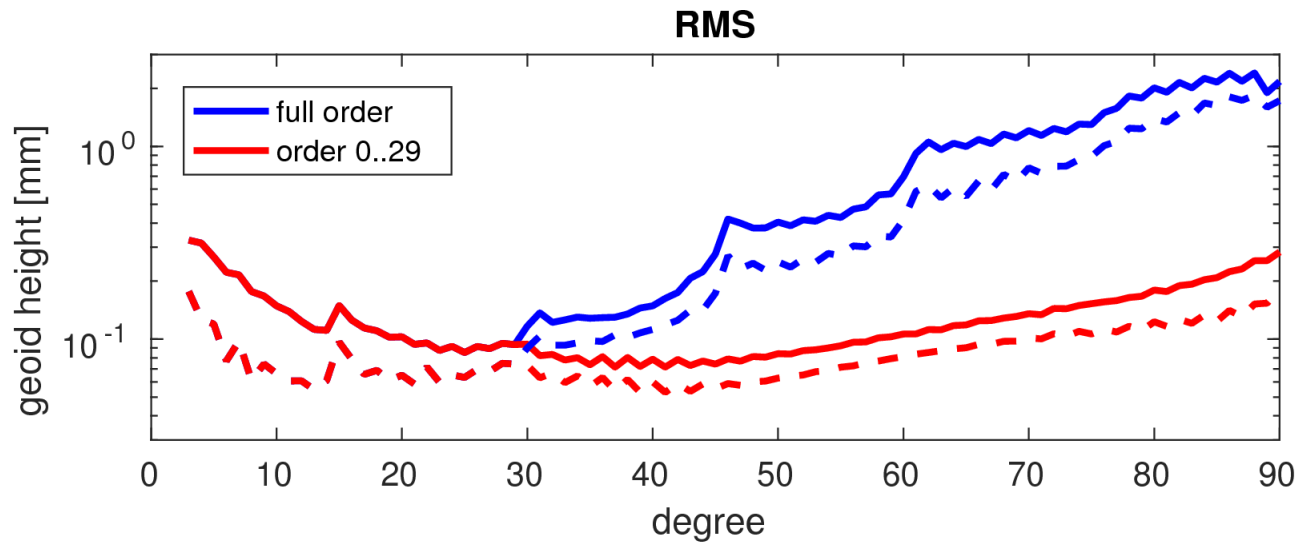
- Noise Assessment
- Combination of gravity fields
 - weights by VCE on solution level
 - empirical rescaling of NEQs
 - Final combination on NEQ-level
- Combination of de-aliasing products

Noise Assessment



Anomalies:  
differences to model

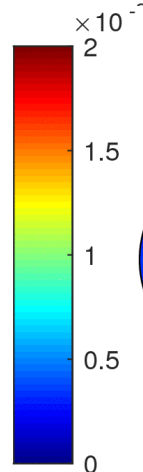
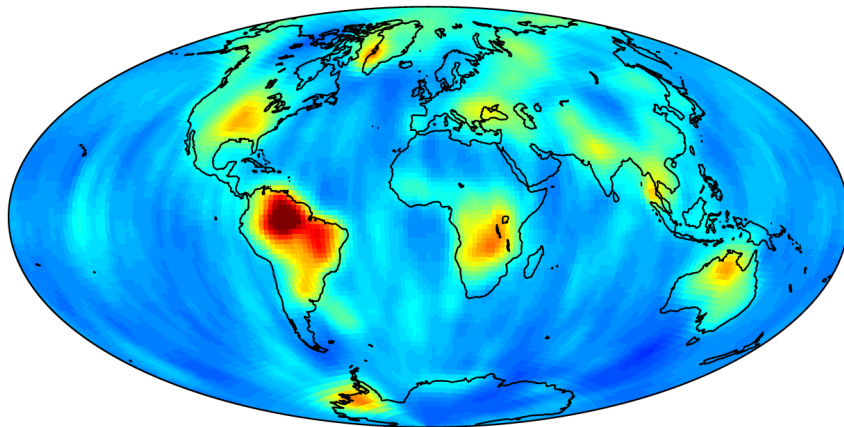
Noise Assessment



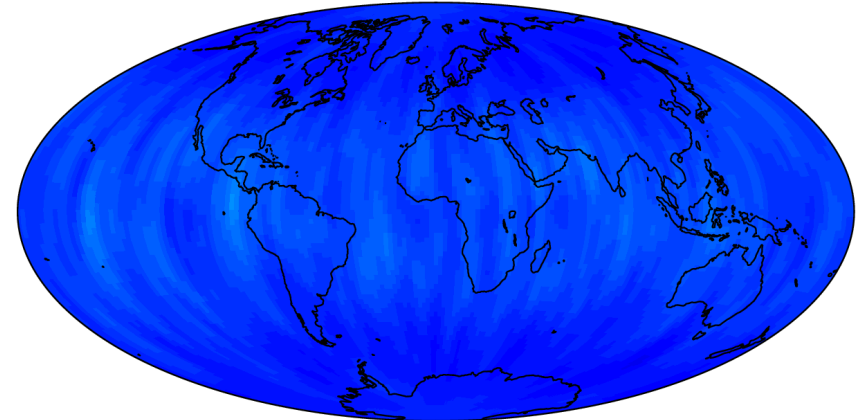
Anomalies: 
 differences to model

Differences: 
 differences to mean

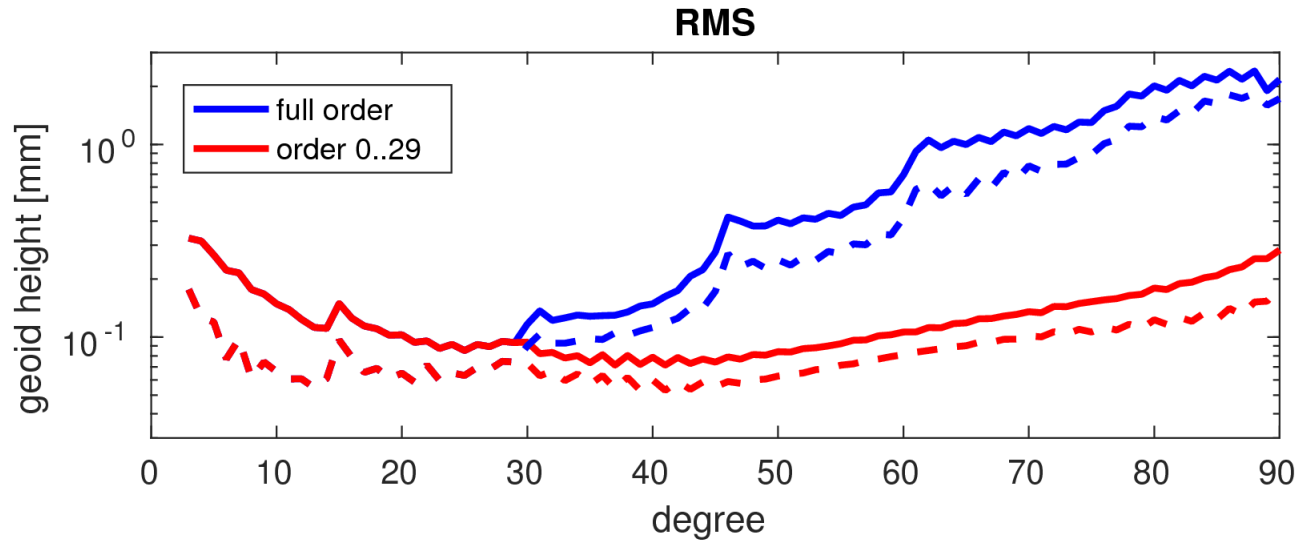
RMS of anomalies



RMS of differences to mean



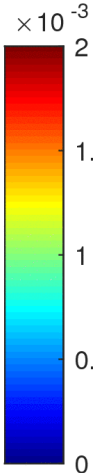
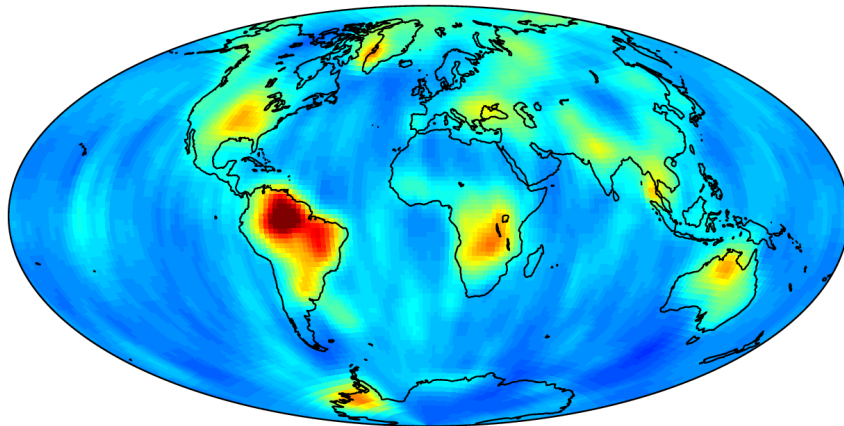
Noise Assessment



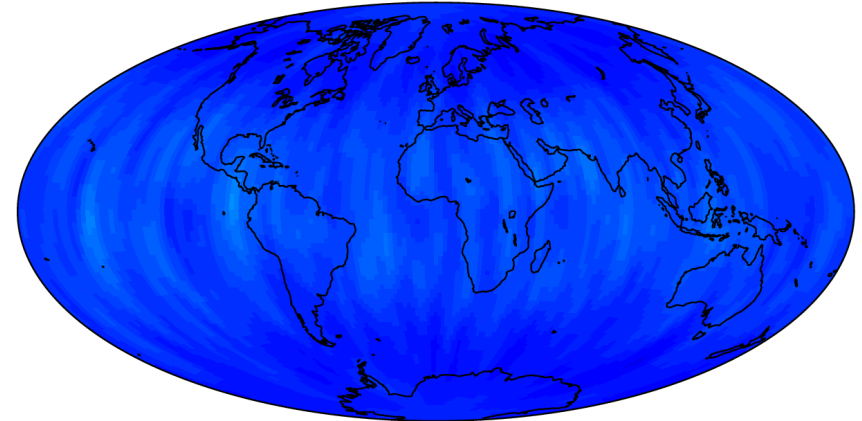
Differences to mean
to derive relative
weights. — — —

Anomalies over quite
regions to indepently
assess quality. — — —

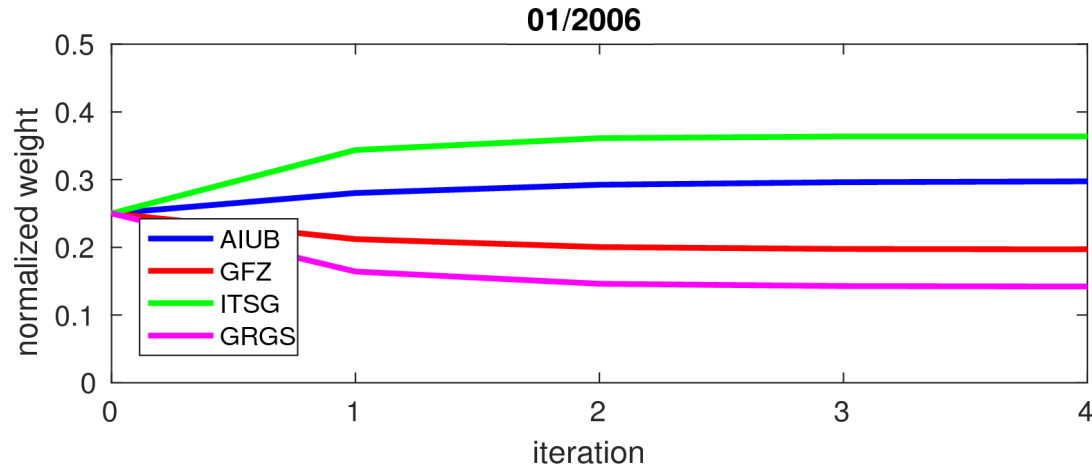
RMS of anomalies



RMS of differences to mean

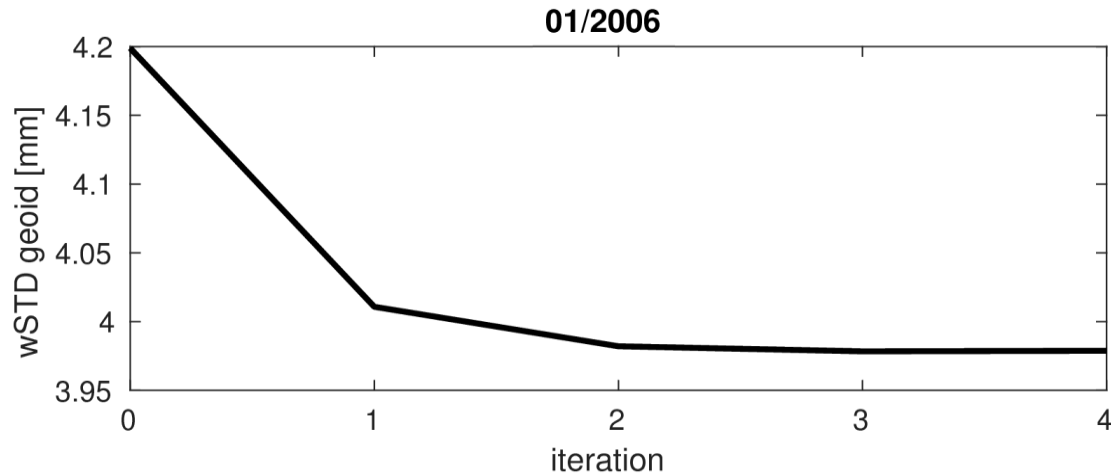


Variance component estimation on solution level



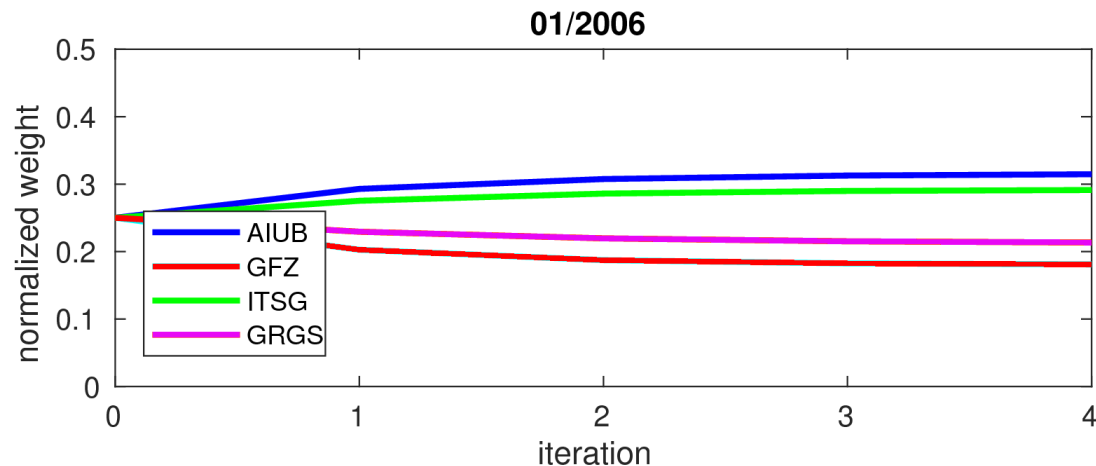
Variance component estimation on solution level taking all SH coefficients into account with equal weights

| Solution: | weight |
|-----------|--------|
| GRGS | 0.14 |
| GFZ | 0.19 |
| AIUB | 0.29 |
| ITSG | 0.38 |

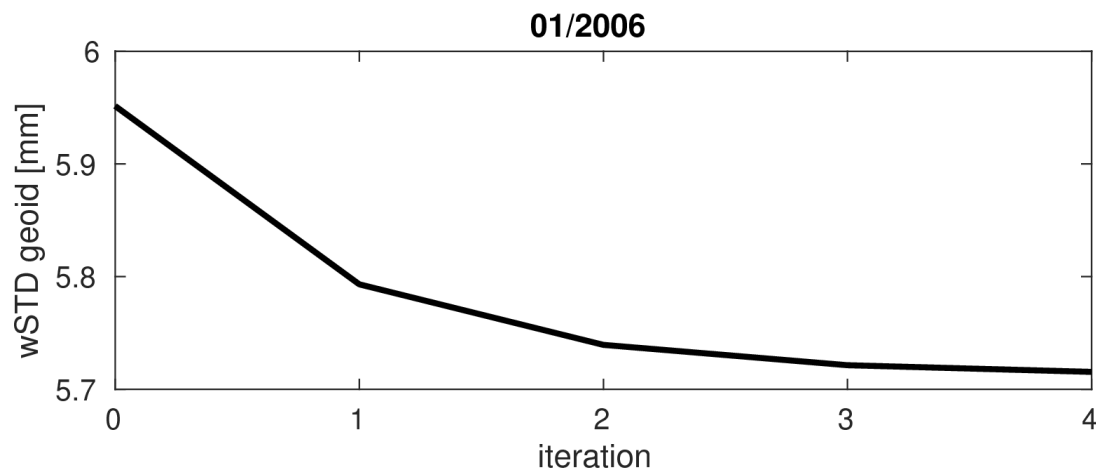


RMS of anomalies restricted to ocean areas as quality criterion.

Variance component estimation on solution level

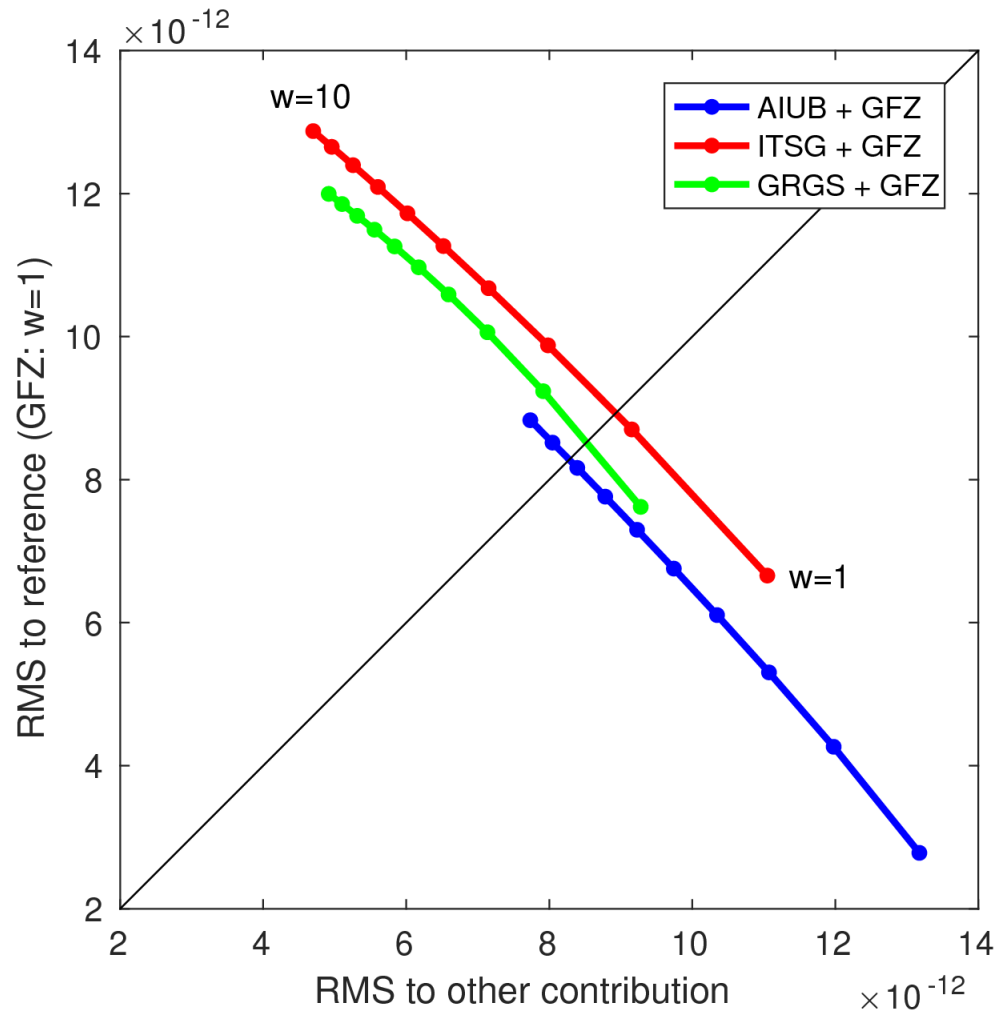


| Solution: | weight |
|-----------|--------|
| GRGS | 0.21 |
| GFZ | 0.18 |
| AIUB | 0.31 |
| ITSG | 0.29 |



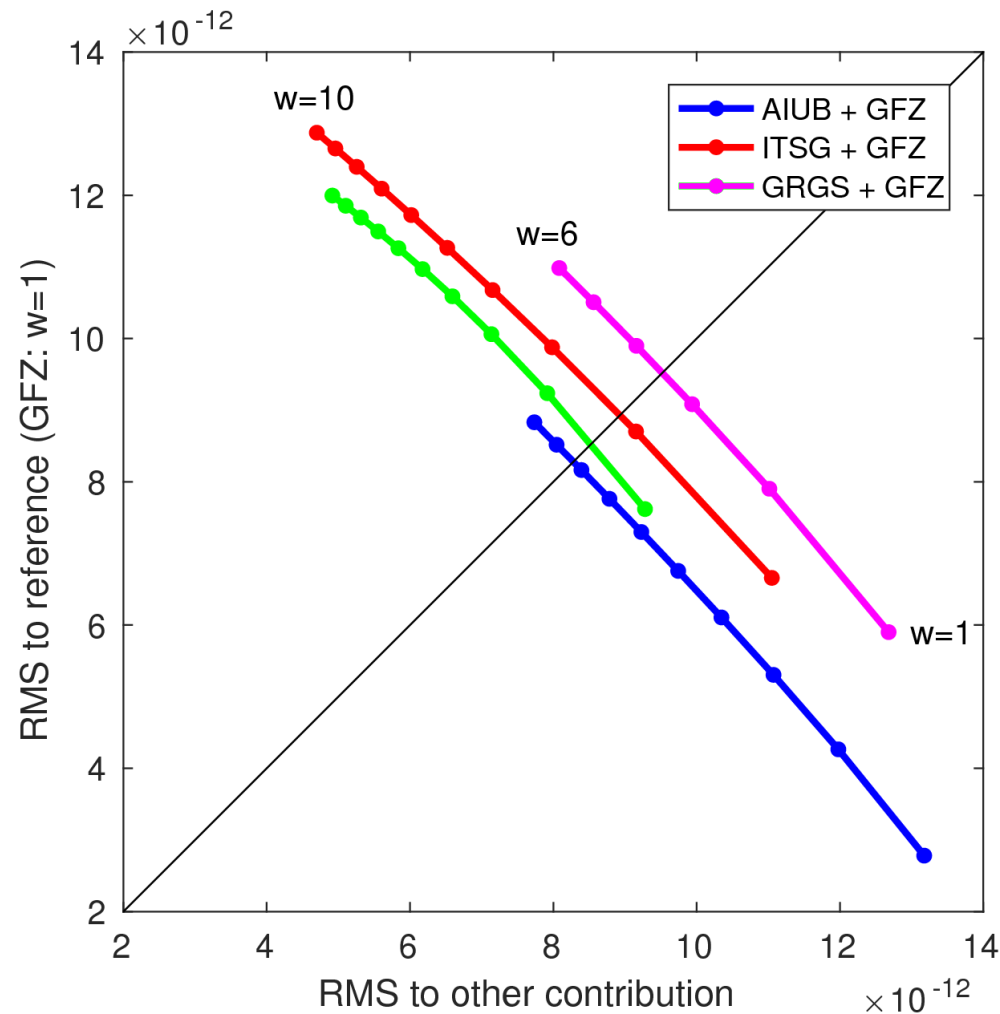
RMS of anomalies restricted to ocean areas as quality criterion.

Combination on Normal Equation Level



| equalizing weight | |
|-------------------|------|
| GRGS | 1.60 |
| GFZ | 1.00 |
| AIUB | 8.34 |
| ITSG | 2.21 |

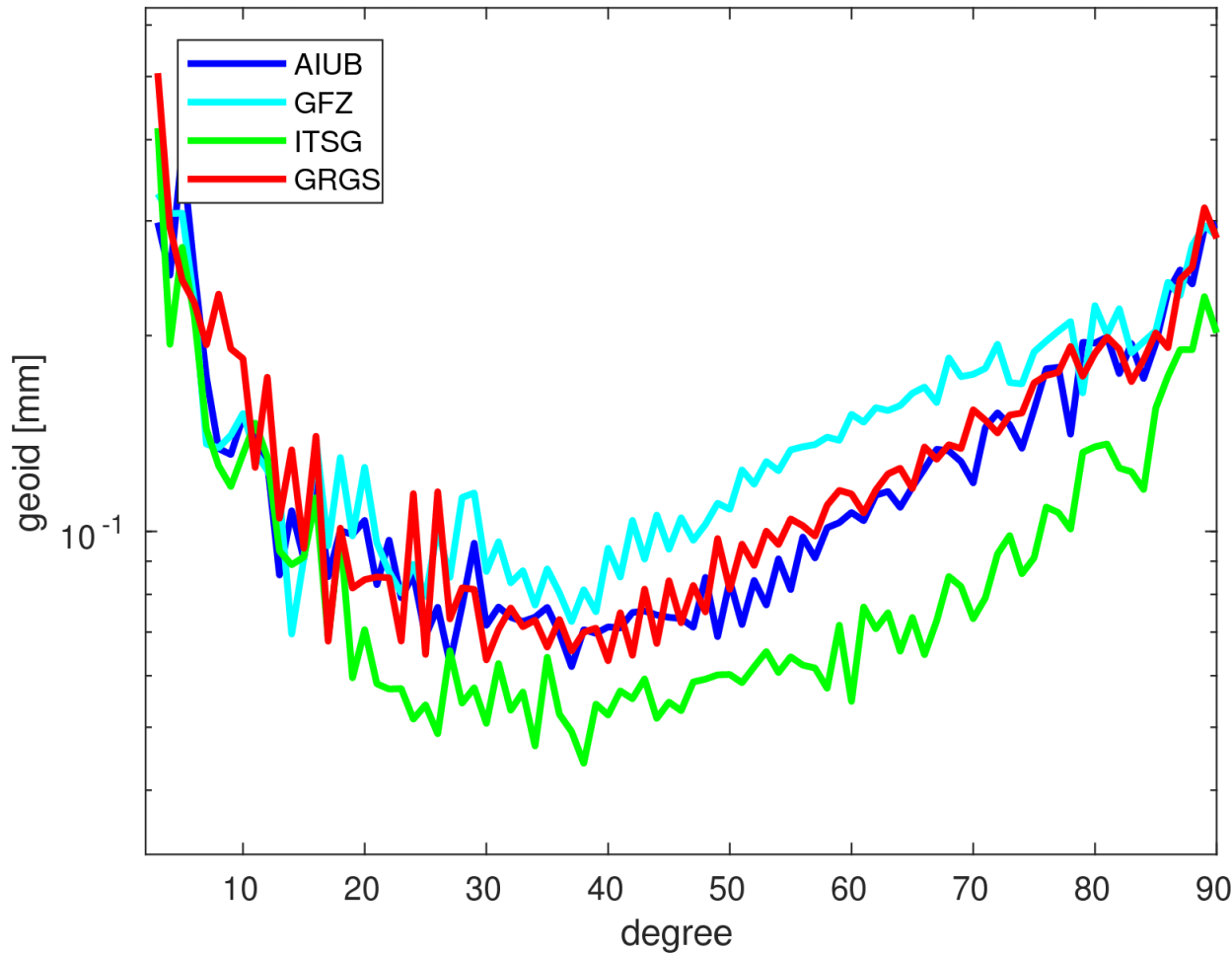
Combination on Normal Equation Level



| equalizing weight | |
|-------------------|------|
| GRGS | 3.56 |
| GFZ | 1.00 |
| AIUB | 8.34 |
| ITSG | 2.21 |

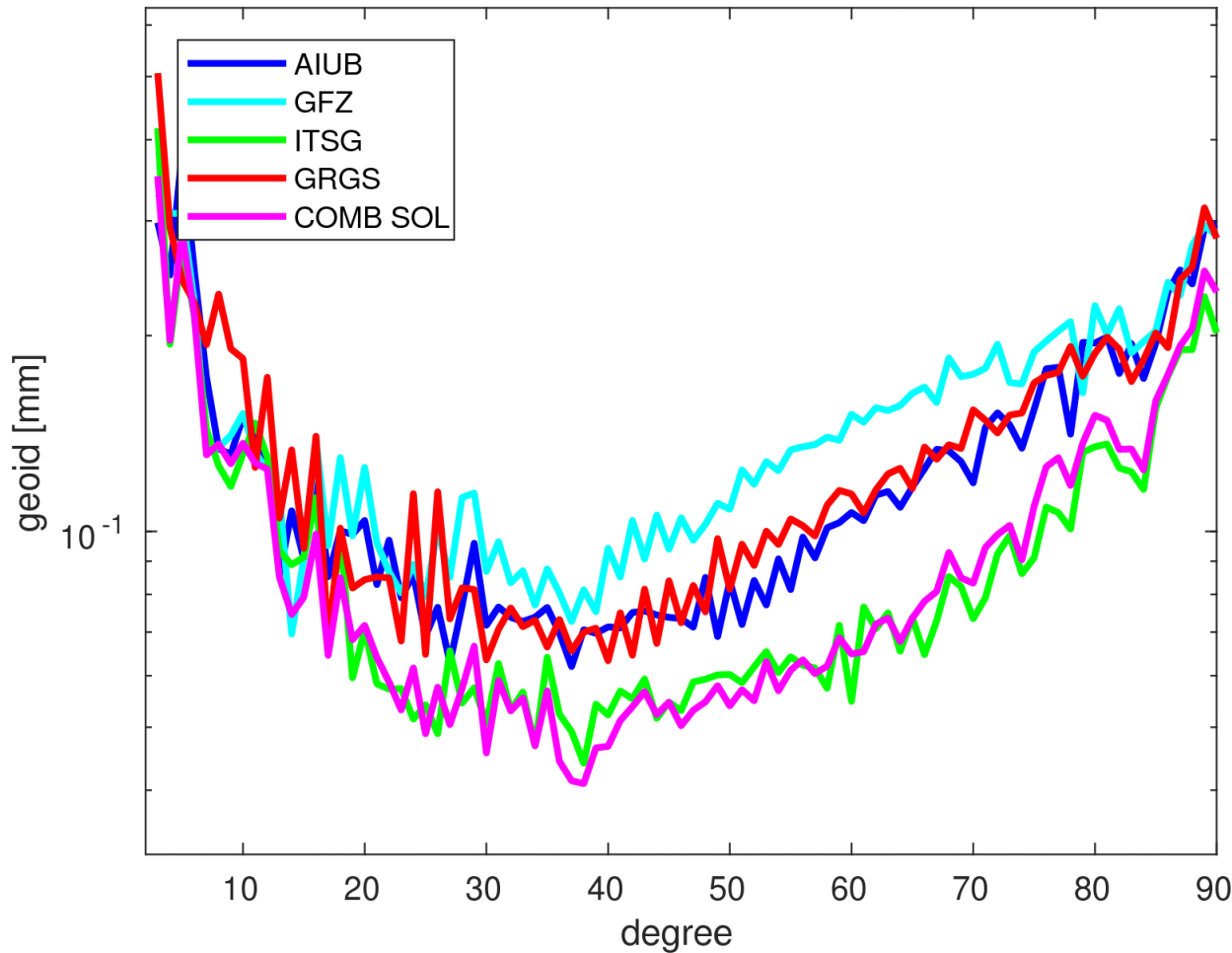
Combination: 2006/01

Anomalies up to order 29



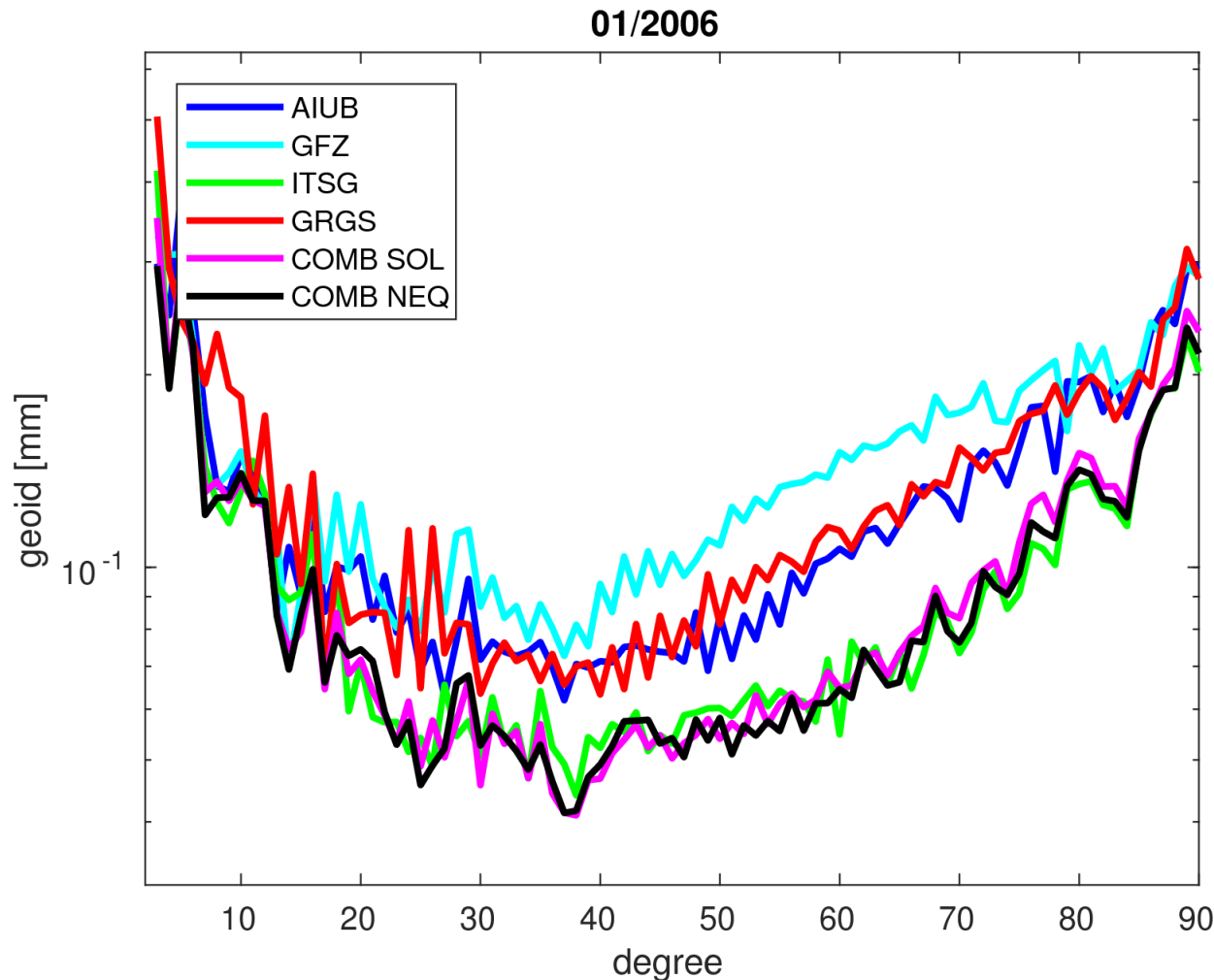
Combination: 2006/01

Anomalies up to order 29



| Solution: | weight |
|-----------|--------|
| GRGS | 0.14 |
| GFZ | 0.19 |
| AIUB | 0.29 |
| ITSG | 0.38 |

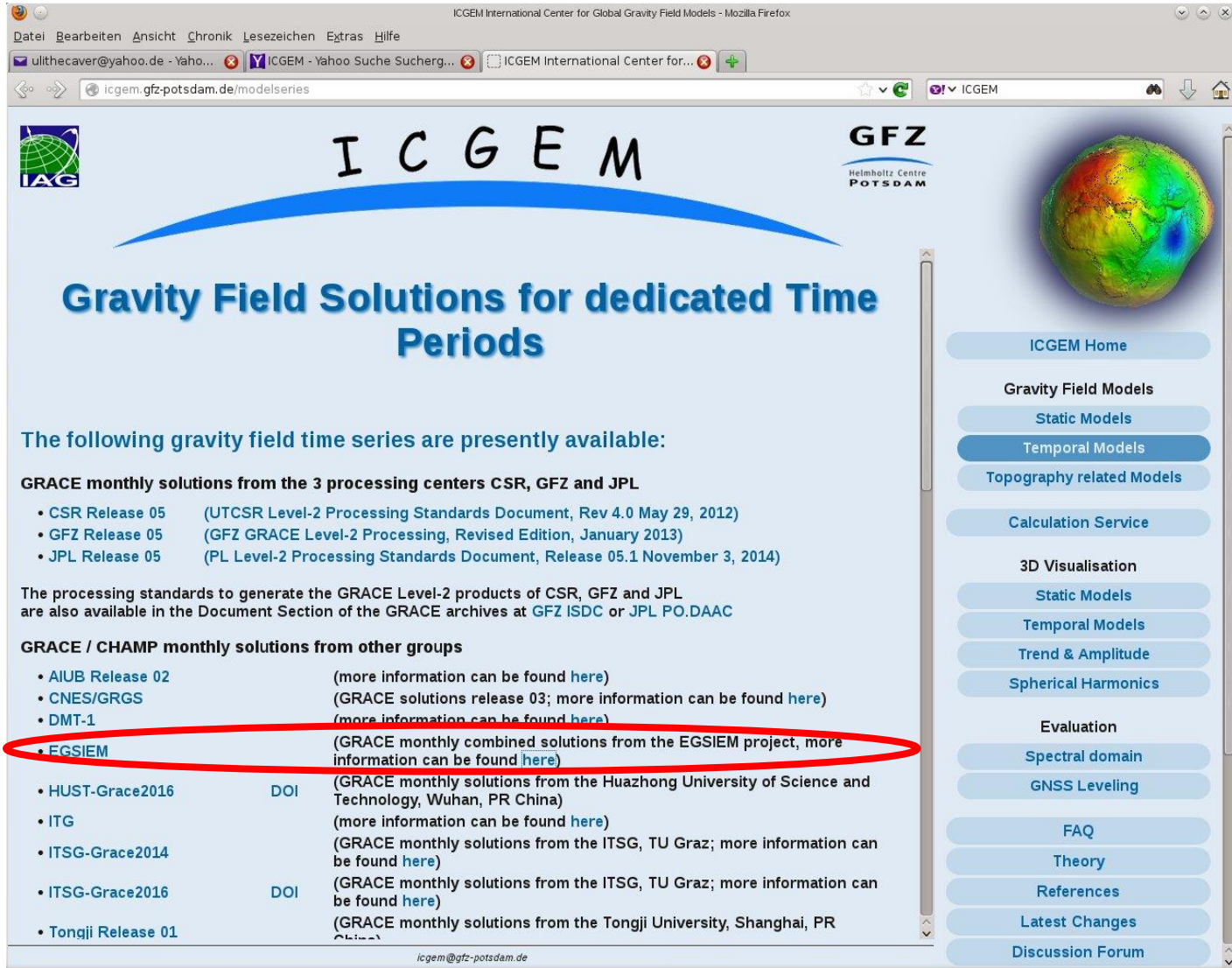
Combination: 2006/01



| Solution: | weight |
|-----------|--------|
| GRGS | 0.14 |
| GFZ | 0.19 |
| AIUB | 0.29 |
| ITSG | 0.38 |

| final weight | |
|--------------|-------|
| GRGS | 4.20 |
| GFZ | 1.00 |
| AIUB | 14.50 |
| ITSG | 3.56 |

Dissemination



The screenshot shows the ICGEM website interface. At the top, the ICGEM logo is displayed in large letters, with the GFZ logo (Helmholtz Centre Potsdam) to the right. Below the logo, the main heading reads "Gravity Field Solutions for dedicated Time Periods". A list of available gravity field time series is provided, including GRACE monthly solutions from CSR, GFZ, and JPL, and GRACE/CHAMP monthly solutions from other groups. The "EGSIEM" entry is circled in red. A sidebar on the right contains navigation links such as "ICGEM Home", "Gravity Field Models", "Static Models", "Temporal Models", "Topography related Models", "Calculation Service", "3D Visualisation", "Evaluation", "Spectral domain", "GNSS Leveling", "FAQ", "Theory", "References", "Latest Changes", and "Discussion Forum".

ICGEM

GFZ
Helmholtz Centre
POTSDAM

Gravity Field Solutions for dedicated Time Periods

The following gravity field time series are presently available:

GRACE monthly solutions from the 3 processing centers CSR, GFZ and JPL

- CSR Release 05 (UTCSR Level-2 Processing Standards Document, Rev 4.0 May 29, 2012)
- GFZ Release 05 (GFZ GRACE Level-2 Processing, Revised Edition, January 2013)
- JPL Release 05 (PL Level-2 Processing Standards Document, Release 05.1 November 3, 2014)

The processing standards to generate the GRACE Level-2 products of CSR, GFZ and JPL are also available in the Document Section of the GRACE archives at [GFZ ISDC](#) or [JPL PO.DAAC](#)

GRACE / CHAMP monthly solutions from other groups

- AIUB Release 02 (more information can be found [here](#))
- CNES/GRGS (GRACE solutions release 03; more information can be found [here](#))
- DMT-1 (more information can be found [here](#))
- **EGSIEM** (GRACE monthly combined solutions from the EGSIEM project, more information can be found [here](#))
- HUST-Grace2016 DOI (GRACE monthly solutions from the Huazhong University of Science and Technology, Wuhan, PR China)
- ITG (more information can be found [here](#))
- ITSG-Grace2014 (GRACE monthly solutions from the ITSG, TU Graz; more information can be found [here](#))
- ITSG-Grace2016 DOI (GRACE monthly solutions from the ITSG, TU Graz; more information can be found [here](#))
- Tongji Release 01 (GRACE monthly solutions from the Tongji University, Shanghai, PR China)

[icgem@gfz-potsdam.de](#)

ICGEM Home
Gravity Field Models
Static Models
Temporal Models
Topography related Models
Calculation Service
3D Visualisation
Static Models
Temporal Models
Trend & Amplitude
Spherical Harmonics
Evaluation
Spectral domain
GNSS Leveling
FAQ
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References
Latest Changes
Discussion Forum

Auxiliary products: dealiasing (GAA, B, C, D)

GA-products are monthly means of AOD-components:

- **A: atmosphere (integrated)**
- **B: ocean**
- **C: ocean + atmosphere (= A+B)**
- **D: ocean + surface pressure (oceans only)**

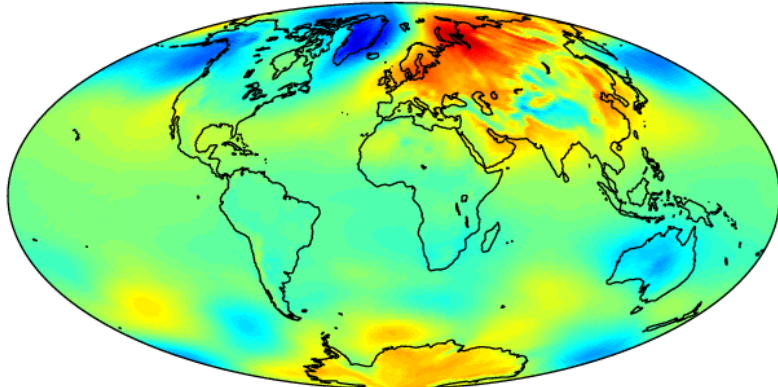
Hydrology: restore A

Oceanography: restore B

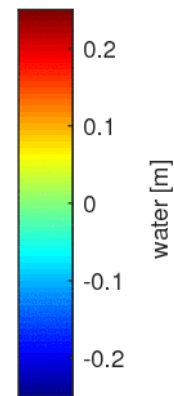
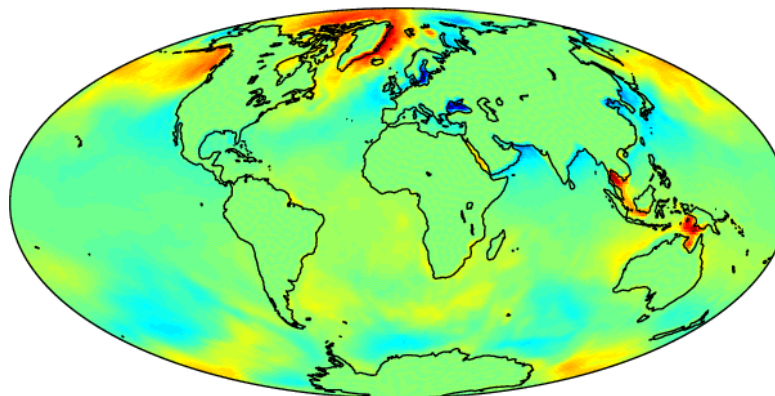
Ocean Bottom Pressure: restore D

Monthly mean of Dealiasing Products: AIUB

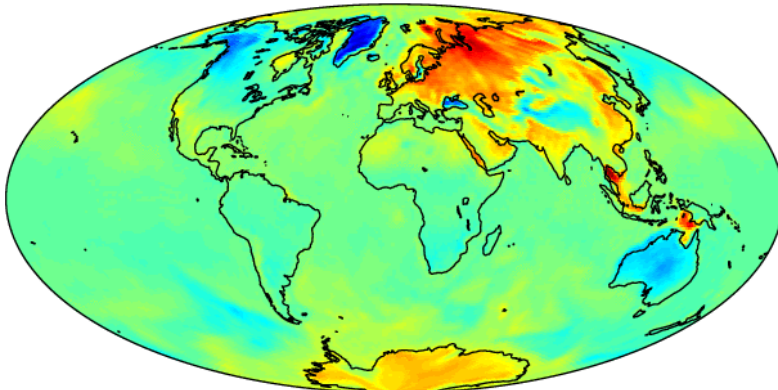
ATM: 2006/01



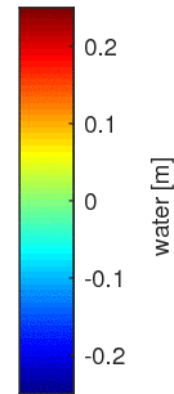
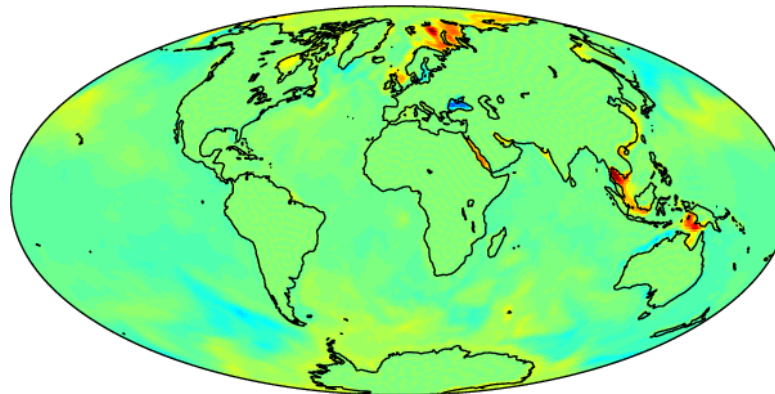
OCN: 2006/01



GLO: 2006/01



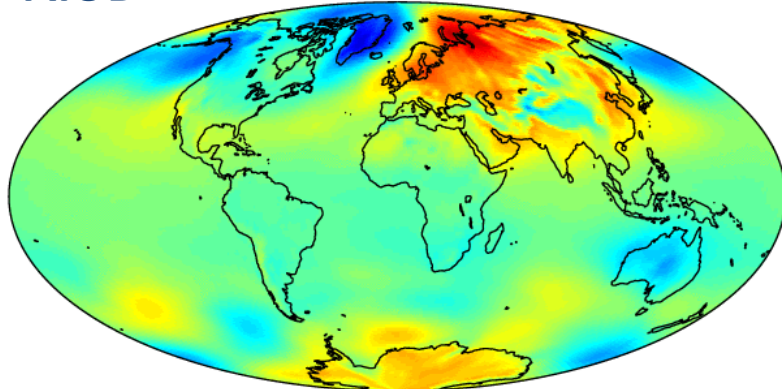
OBA: 2006/01



Monthly mean of Dealiasing Products: ATM

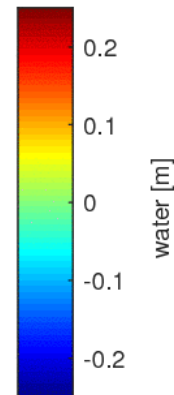
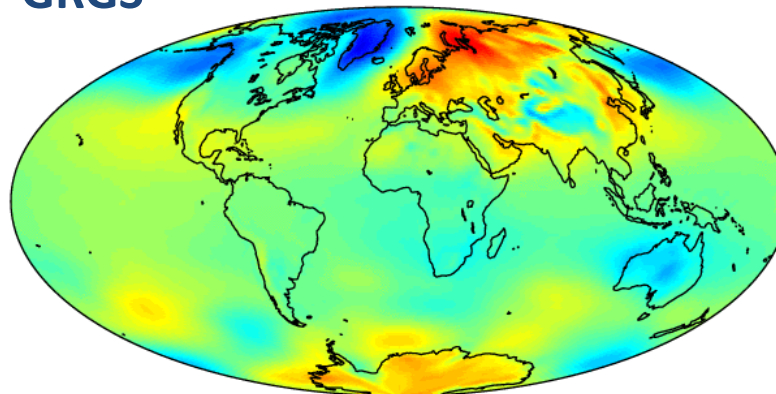
AIUB

ATM: 2006/01

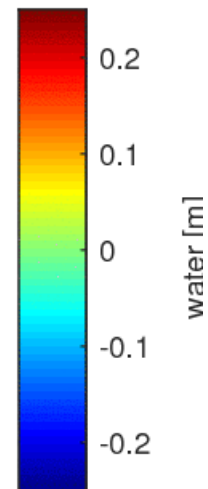
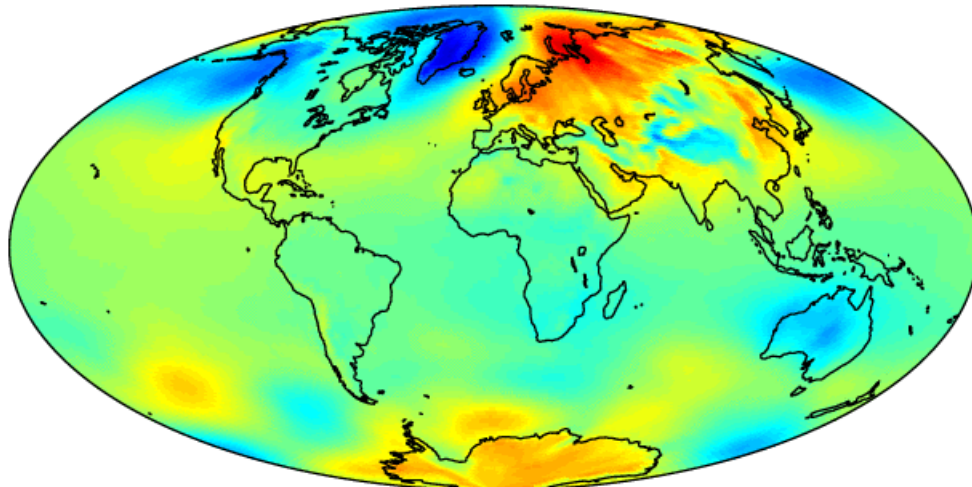


GRGS

ATM: 2006/01



ATM (mean): 2006/01



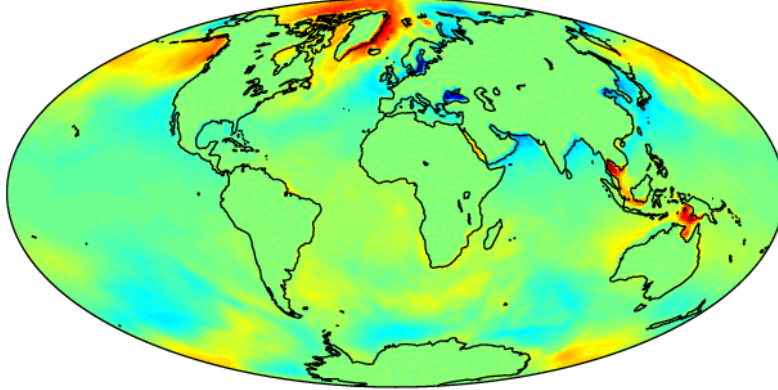
Mean:

$w1 * \text{AIUB} +$
 $w2 * \text{ITSG} +$
 $w3 * \text{GFZ} +$
 $w4 * \text{GRGS}$

Monthly mean of Dealiasing Products: OCN

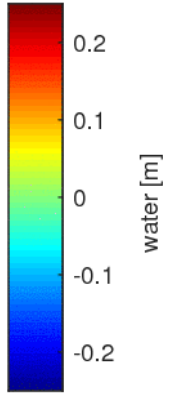
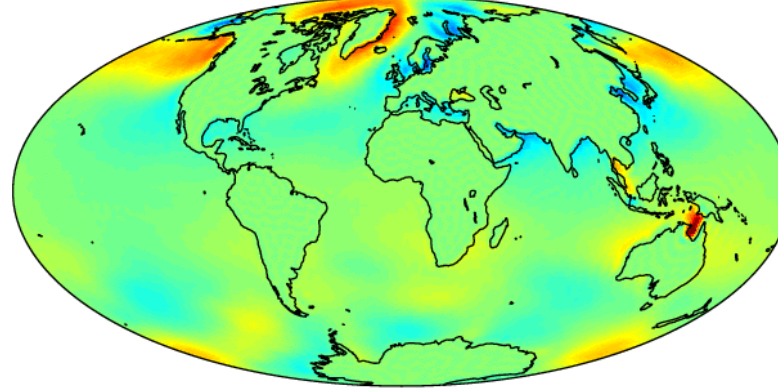
AIUB

OCN: 2006/01



GRGS

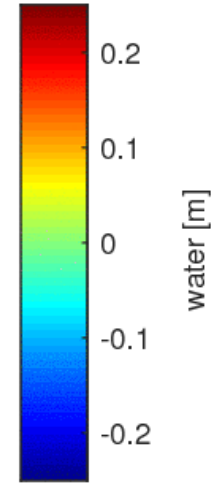
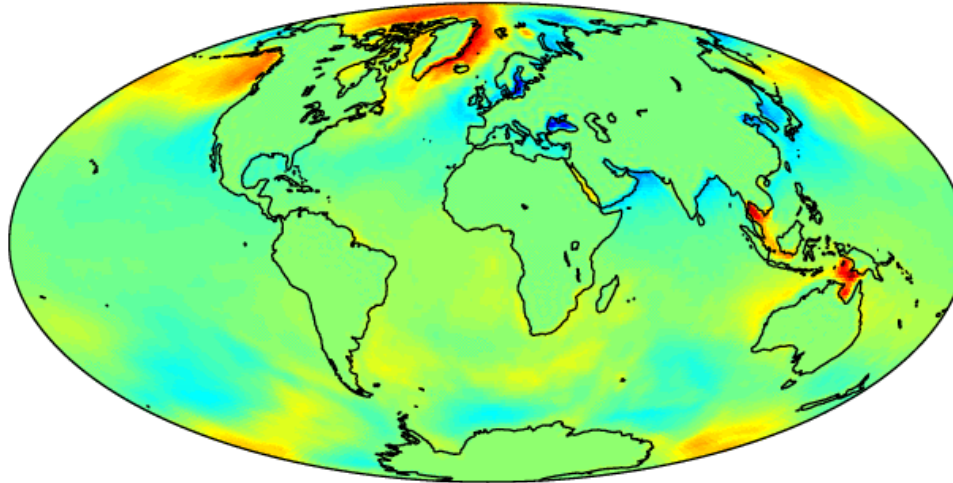
OCN: 2006/01



OCN (mean): 2006/01

Mean:

$w1 * \text{AIUB} +$
 $w2 * \text{ITSG} +$
 $w3 * \text{GFZ} +$
 $w4 * \text{GRGS}$



Conclusions

- EGSiem monthly gravity field combination on NEQ-level is operational.
- Noise assessment by variance component estimation on solution level.
- Relative weights based on noise levels.
- Monthly weighted means of ATM and OCN de-aliasing products for L3-generation.
- The EGSiem combination service provides two test years (2006 + 2007):
 - SH-coefficients (Level-2): www.icgem.de
 - grids and de-aliasing (Level-3): www.egsiem.eu