EGSIEM

European Gravity Service for Improved Emergency Management

EGSIEM combination service: combination of GRACE monthly K-band solutions on normal equation level

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Horizon2020

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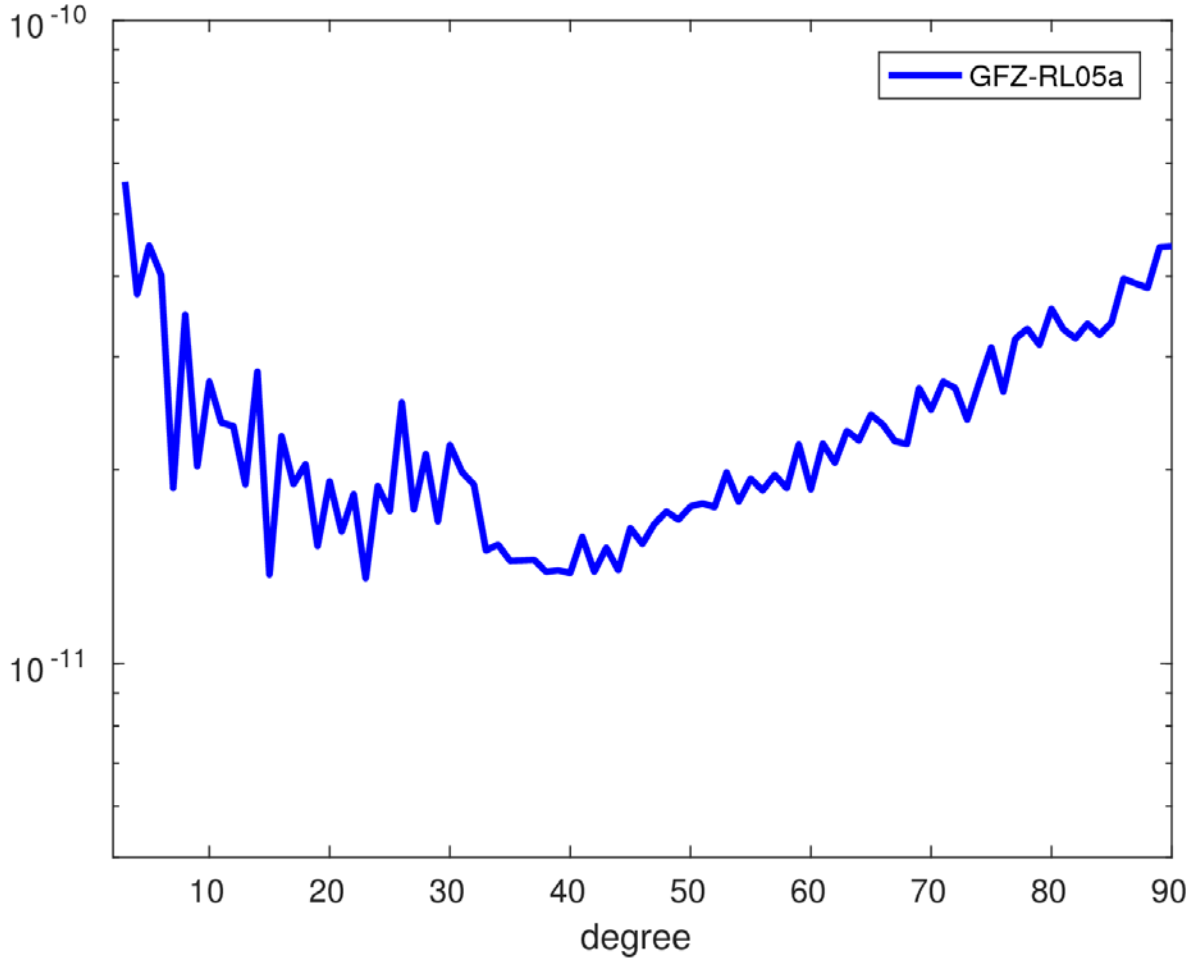
Motivation

Degree Amplitudes of Anomalies 01/2006: orders 0 - 29
SH coefficients – model fit of secular/seasonal variations



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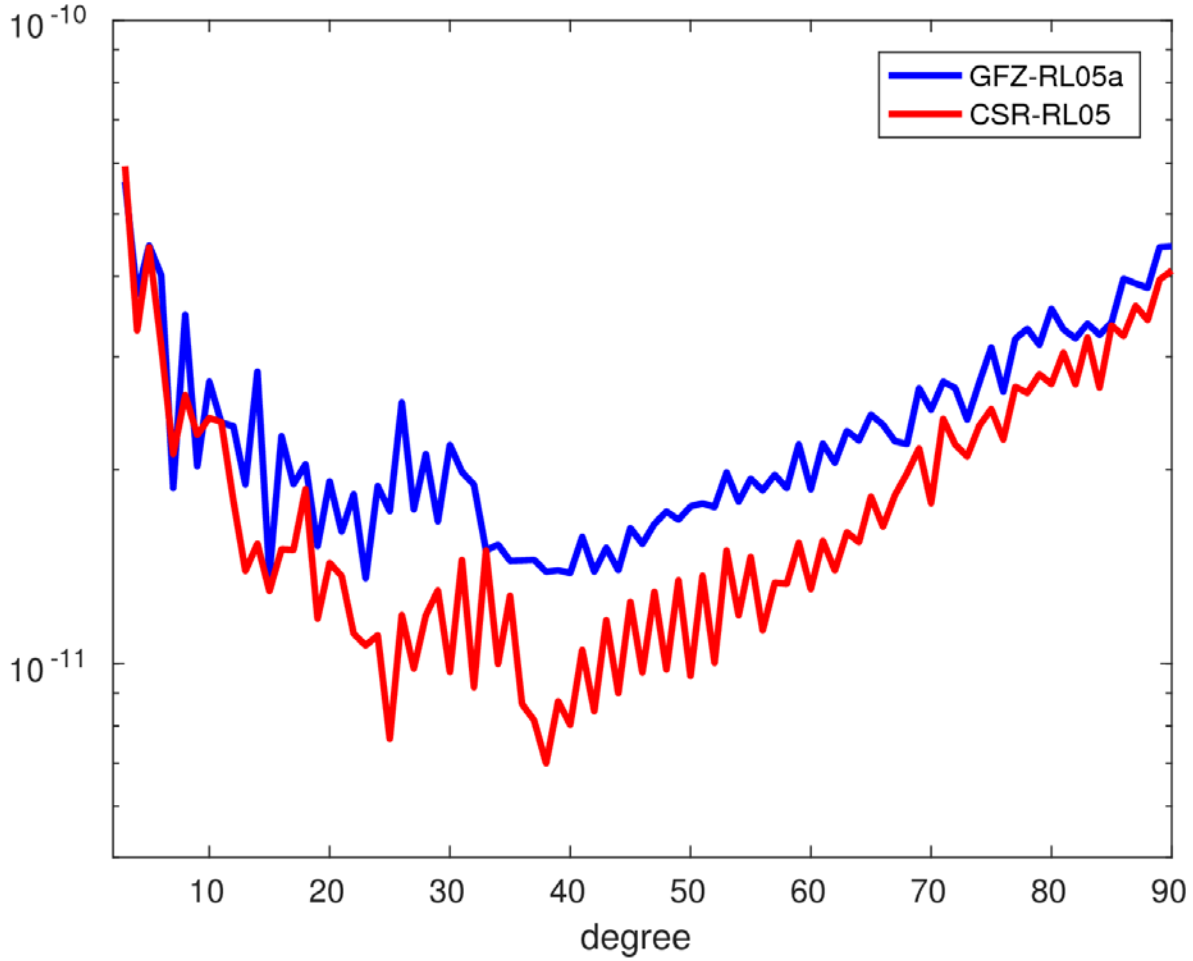

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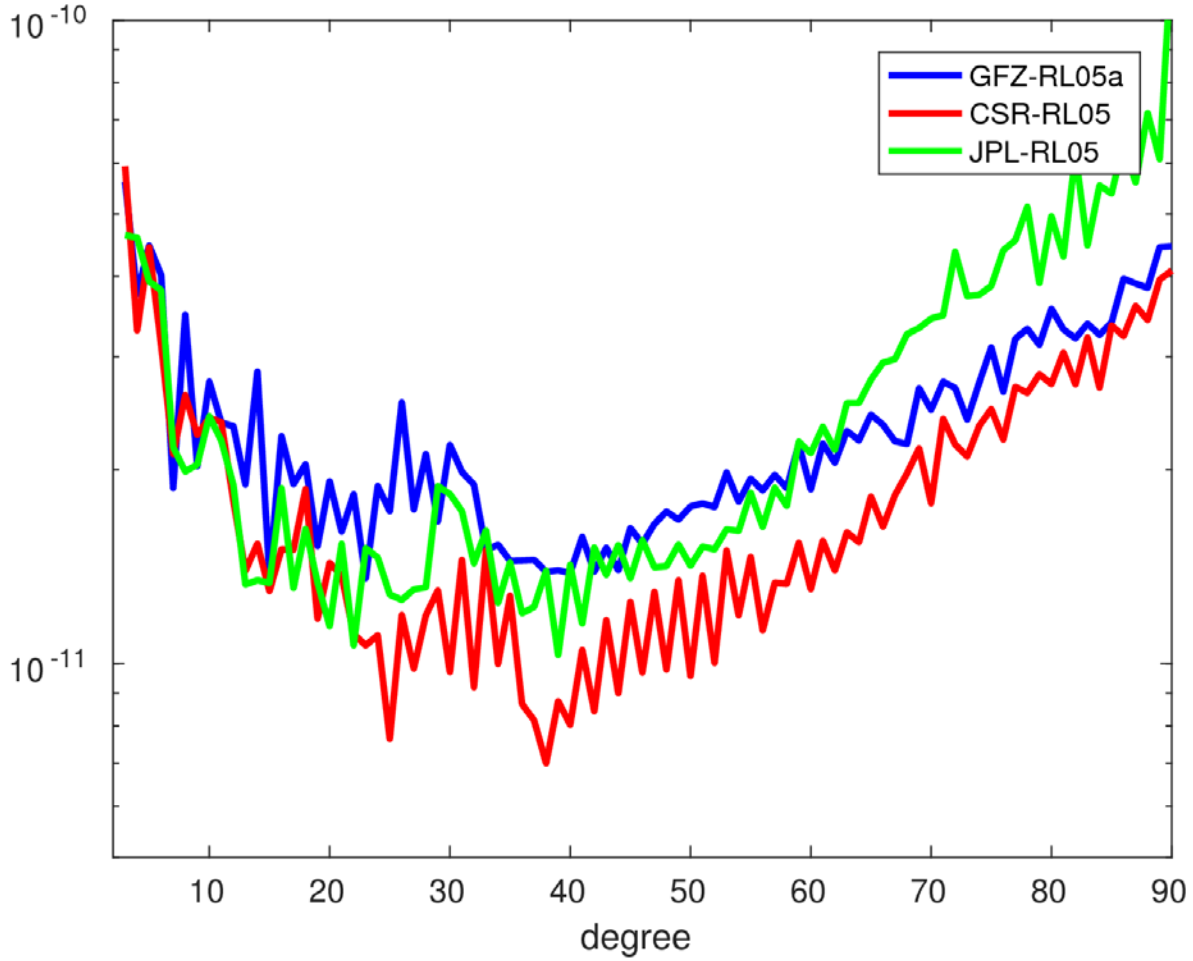
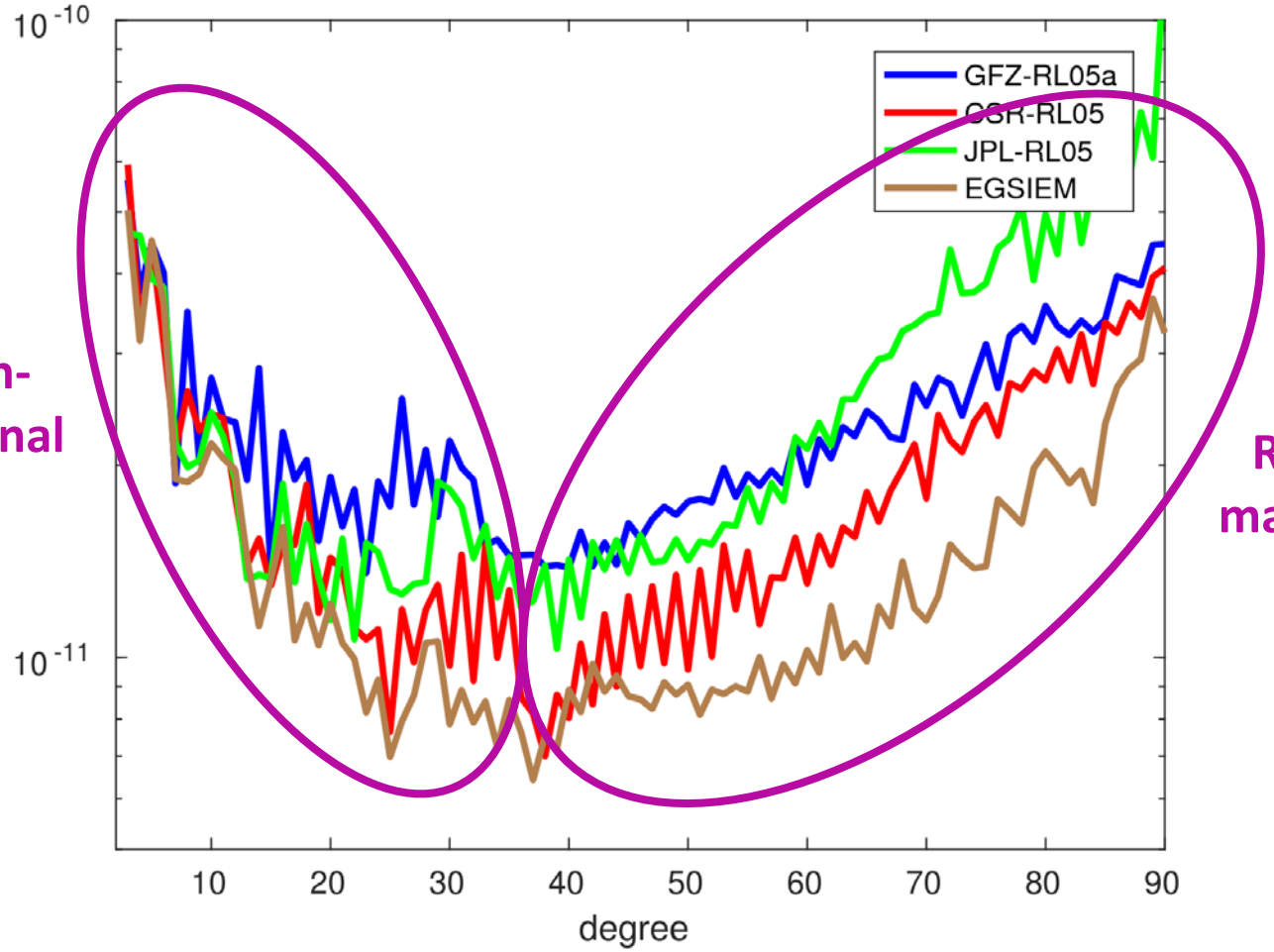


Motivation

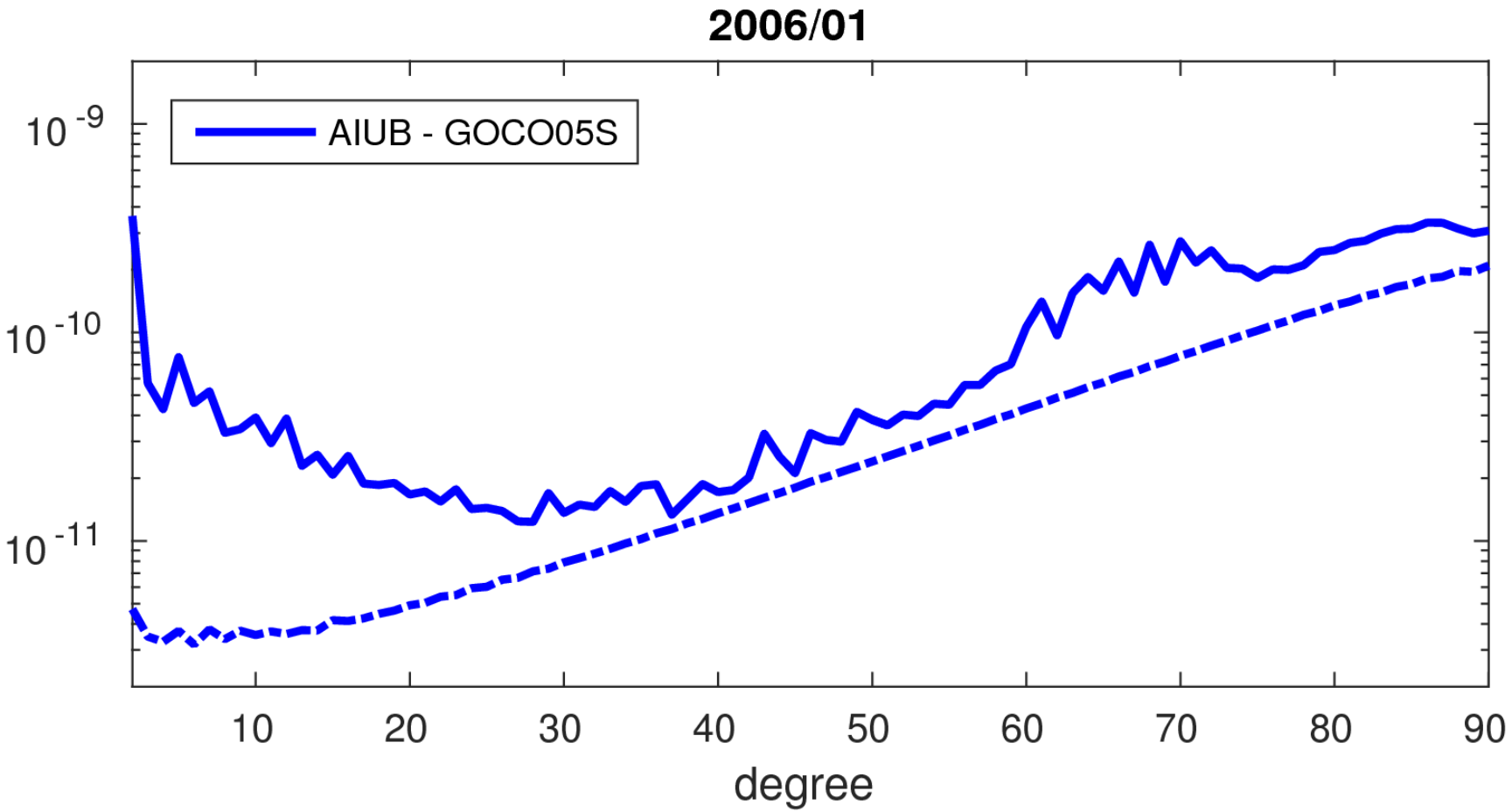
Degree Amplitudes of Anomalies 01/2006: orders 0 - 29
SH coefficients – model fit of secular/seasonal variations

Includes non-seasonal signal



Represents mainly noise

Individual Contributions



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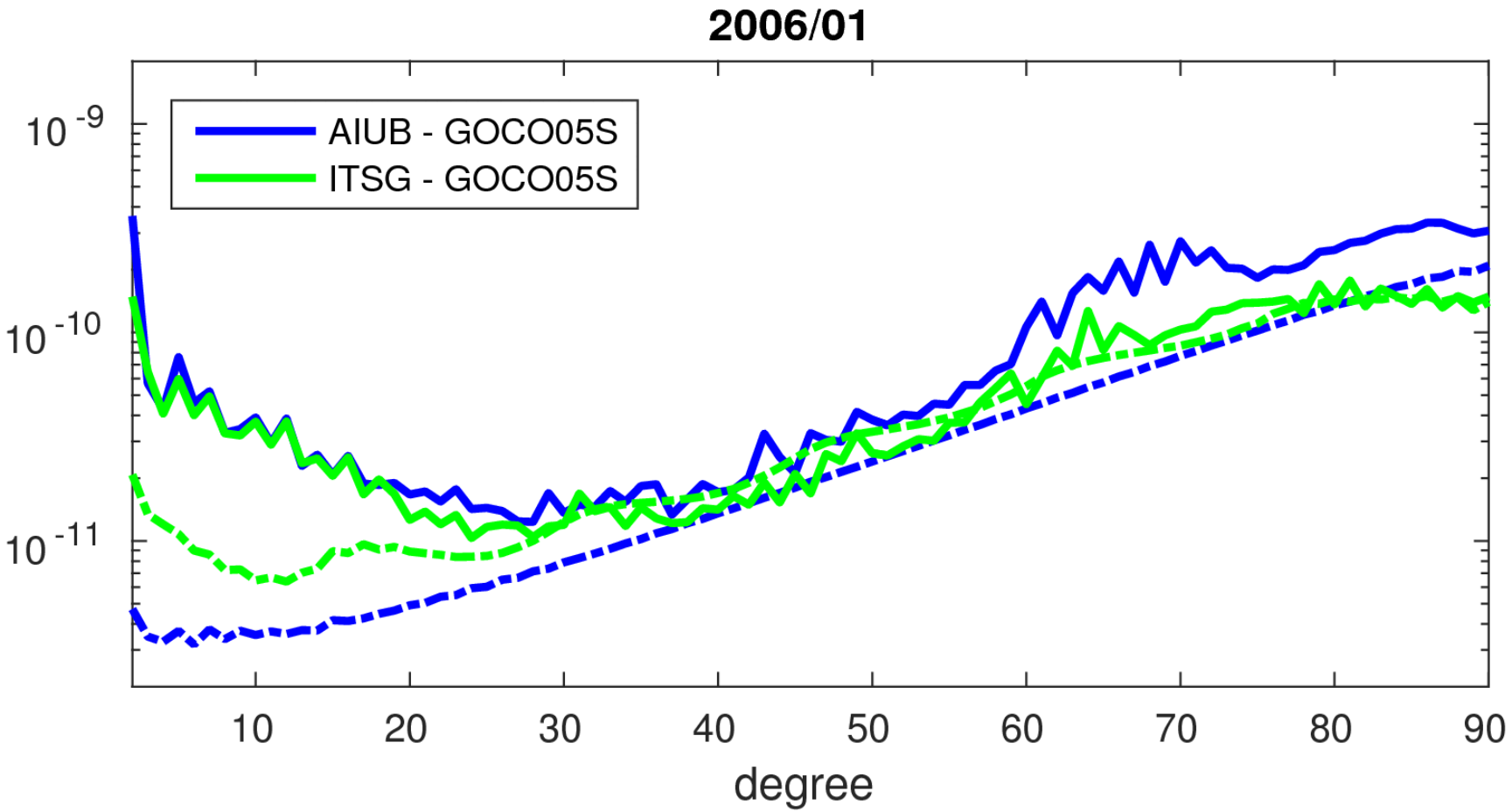

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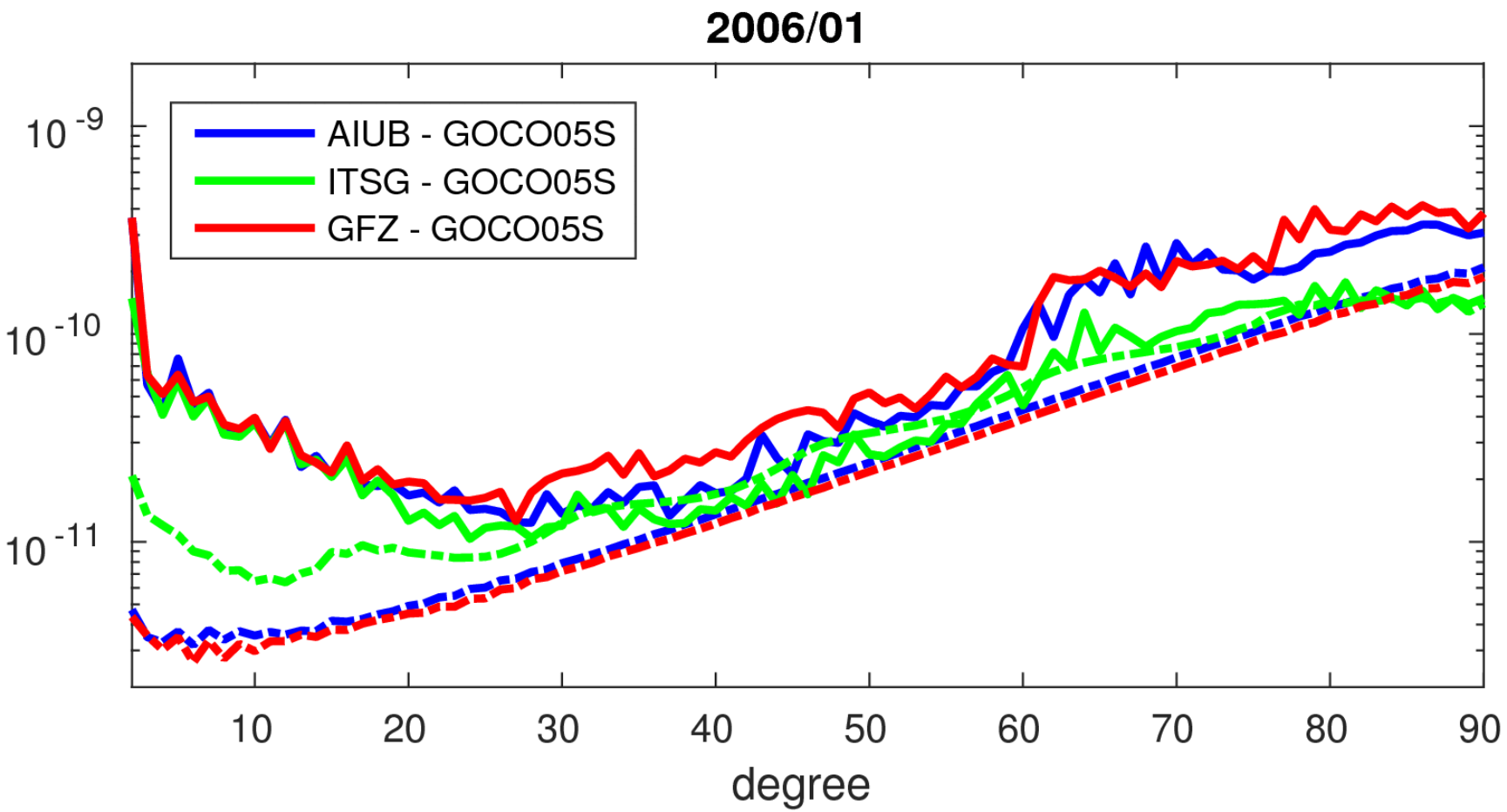

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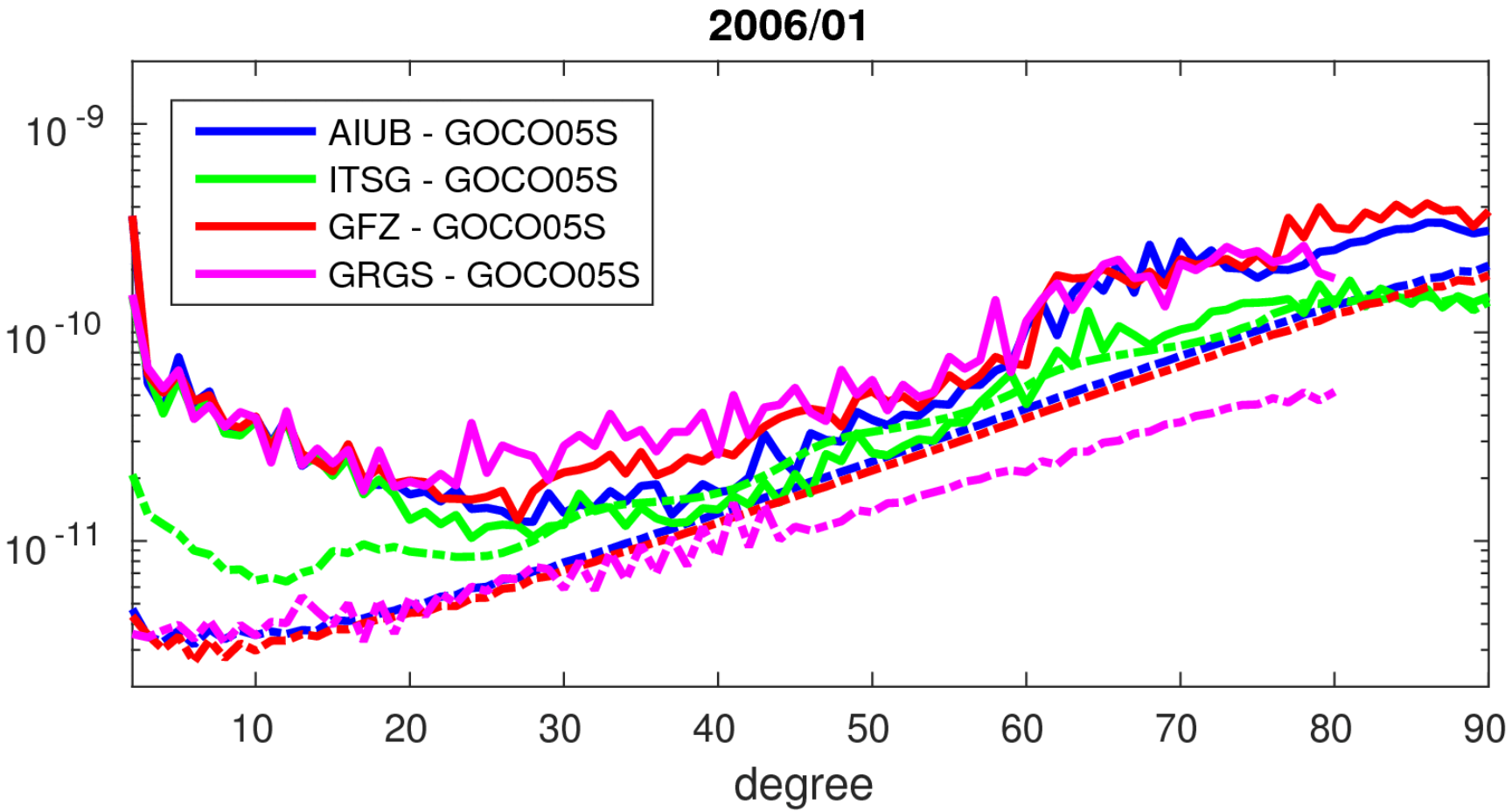


Individual Contributions

Why are formal errors so different?

Formal errors depend on the noise model applied!

Error propagation of kinematic orbits and K-band observations

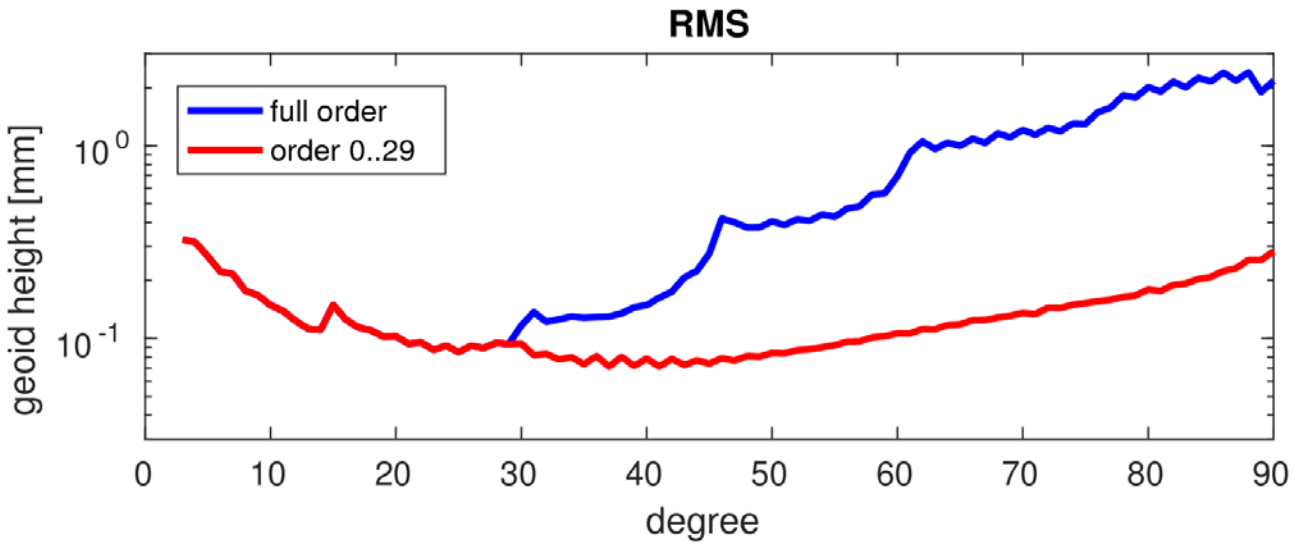
Optimistic

Realistic (empirical)

Errors of observations: GPS, K-band, accelerometers, star cameras

Errors of background models and de-aliasing: ocean tides, short periodic atmosphere and ocean variations (AOD)

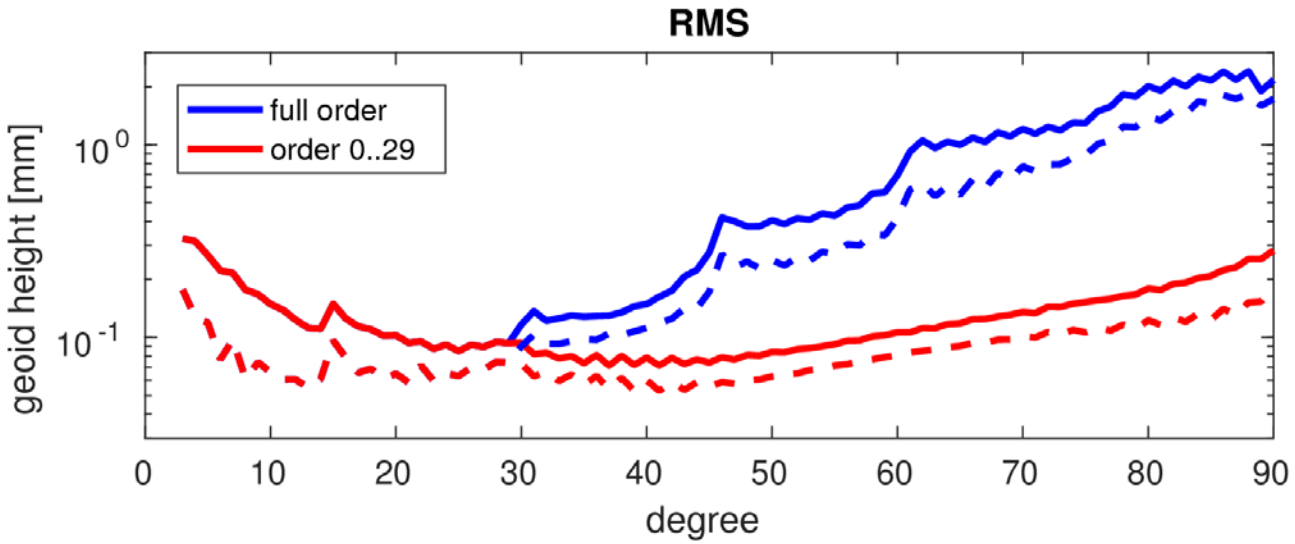
Noise Assessment



Anomalies:

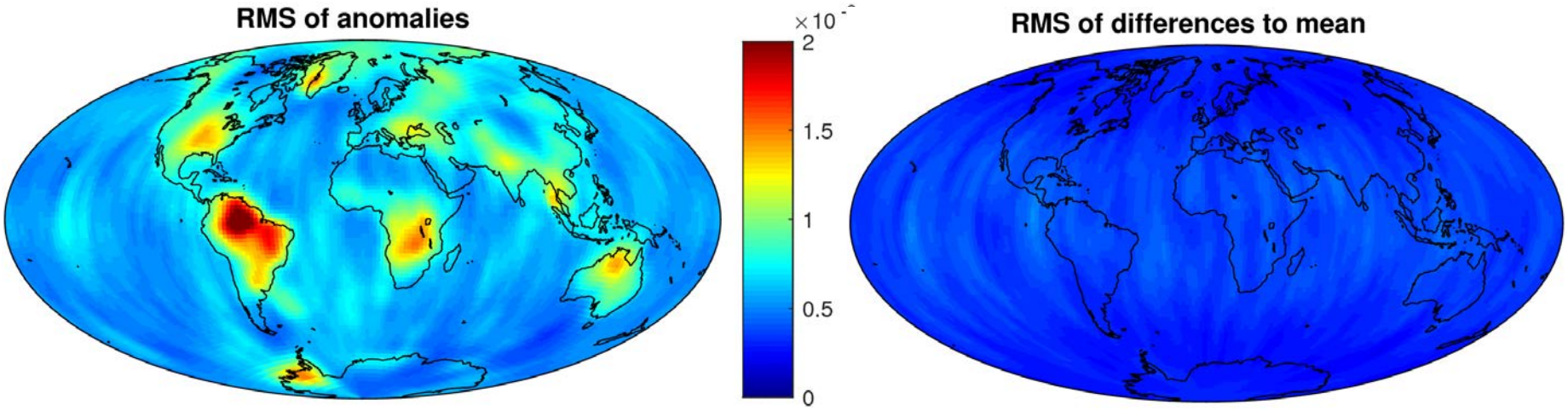
differences to model

Noise Assessment

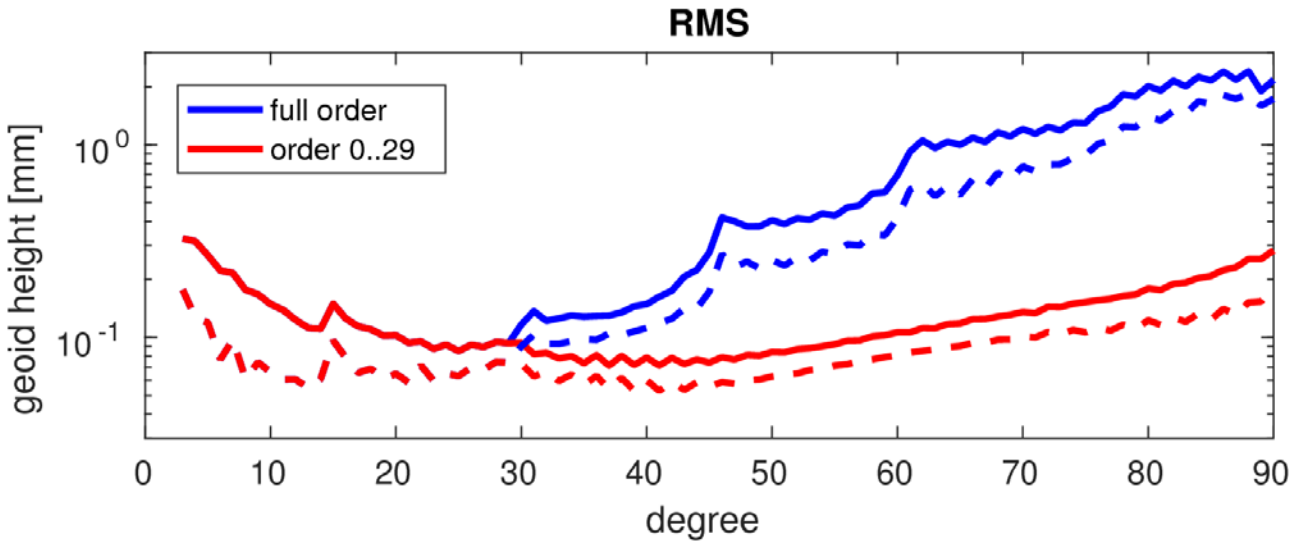


Anomalies: differences to model

Differences: differences to mean

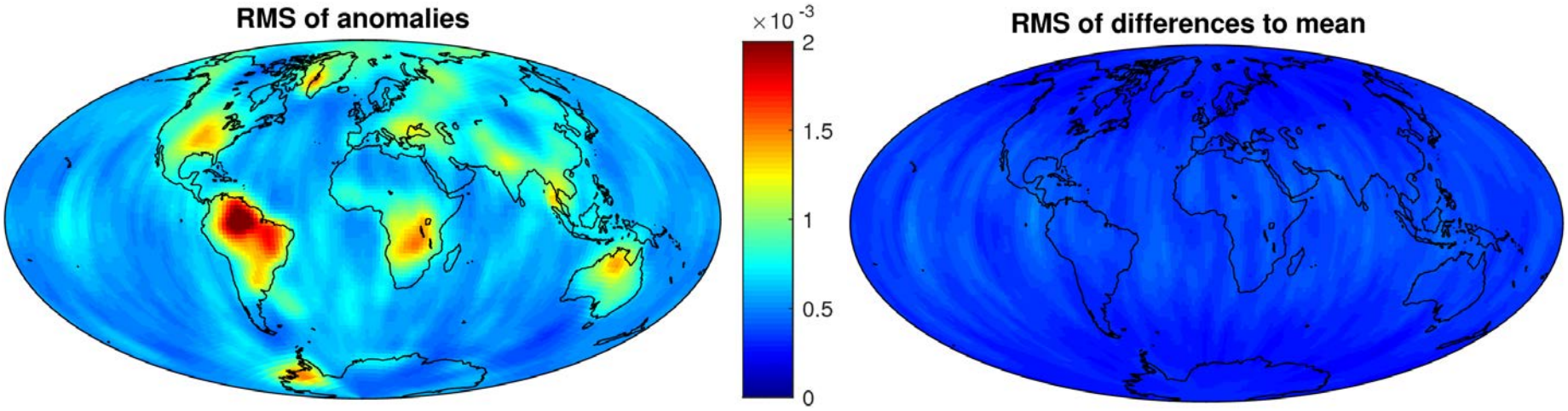


Noise Assessment

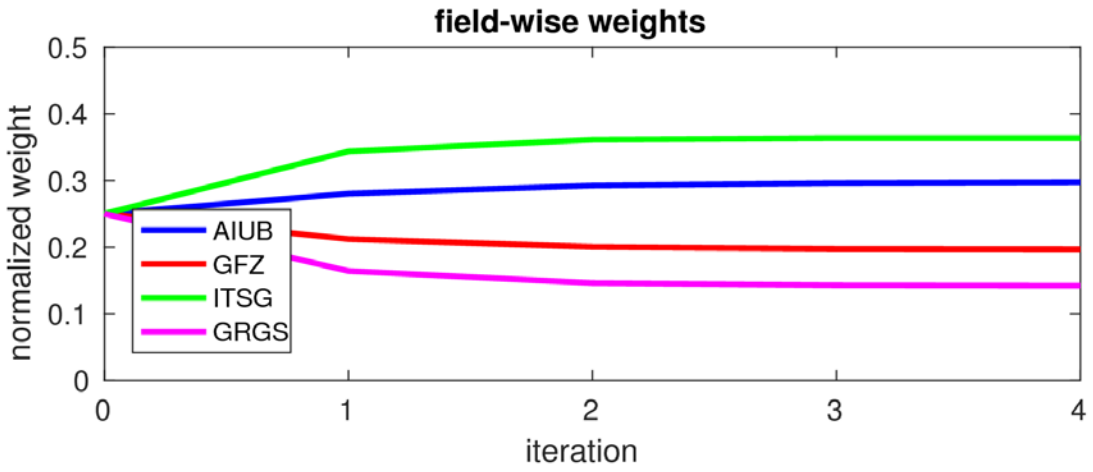


Differences to mean to derive relative weights.

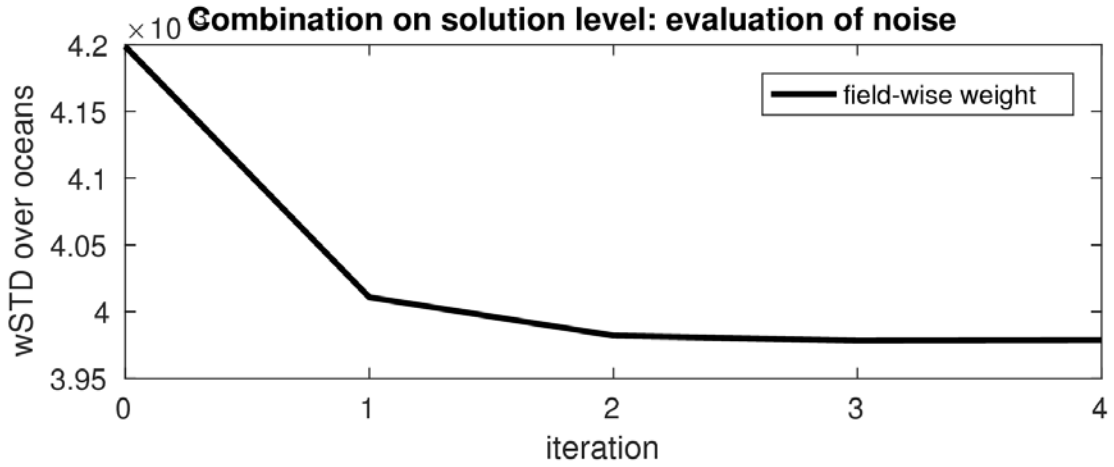
Anomalies over quiet regions to independently assess quality.



Variance component estimation on solution level



Variance component estimation on solution level taking into account all SH coefficients up to degree and order 80 with equal weight.



RMS of anomalies restricted to ocean areas as quality criterion.

Combination on Normal Equation Level

Achieve equal impact of individual contributions on pairwise combinations:

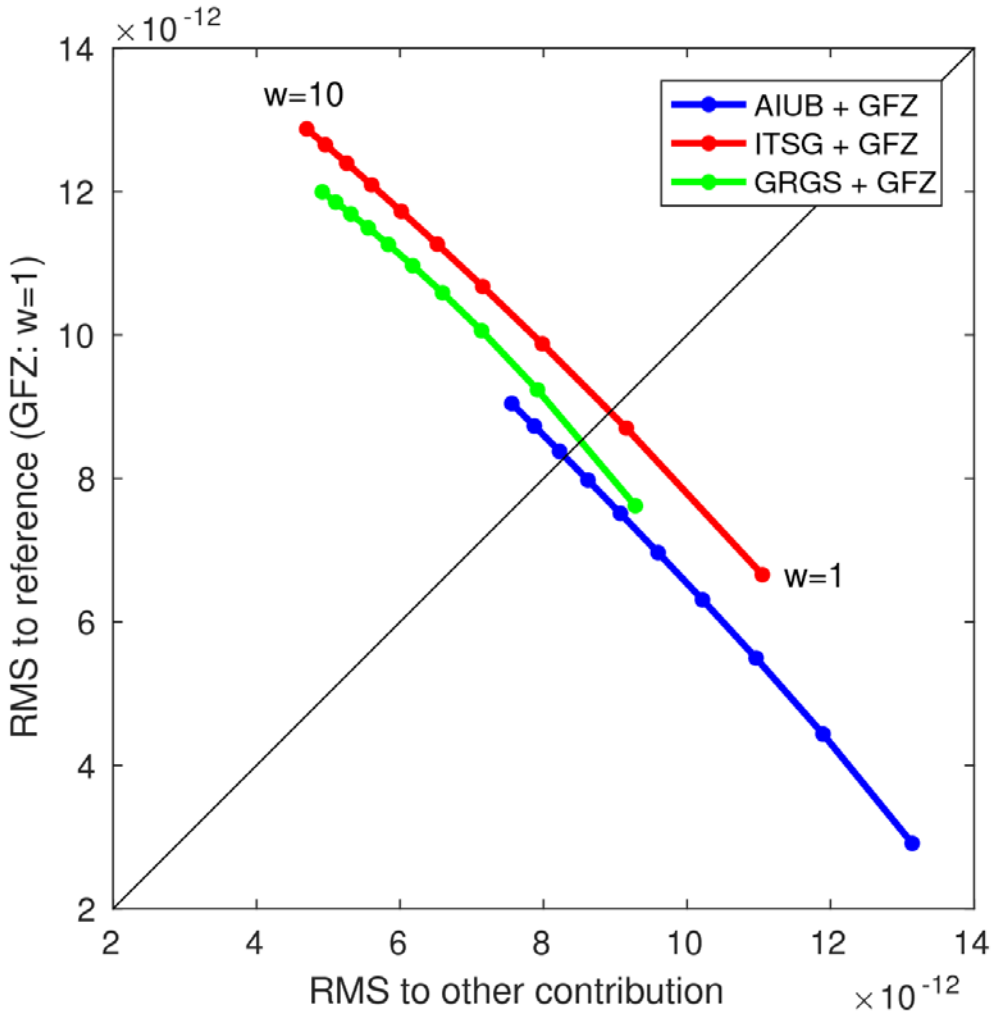
$$(\boldsymbol{N}_{\mathrm{ref}} + w_i \boldsymbol{N}_i)\boldsymbol{dx} = \boldsymbol{b}_{\mathrm{ref}} + w_i \boldsymbol{b}_i$$

The impact is measured by:

$$\mathrm{RMS}_i = \sqrt{\frac{\sum_{l,m}(K^{\mathrm{comb}}_{l,m} - K^{i}_{l,m})^2}{n_{\mathrm{coef}}}}$$

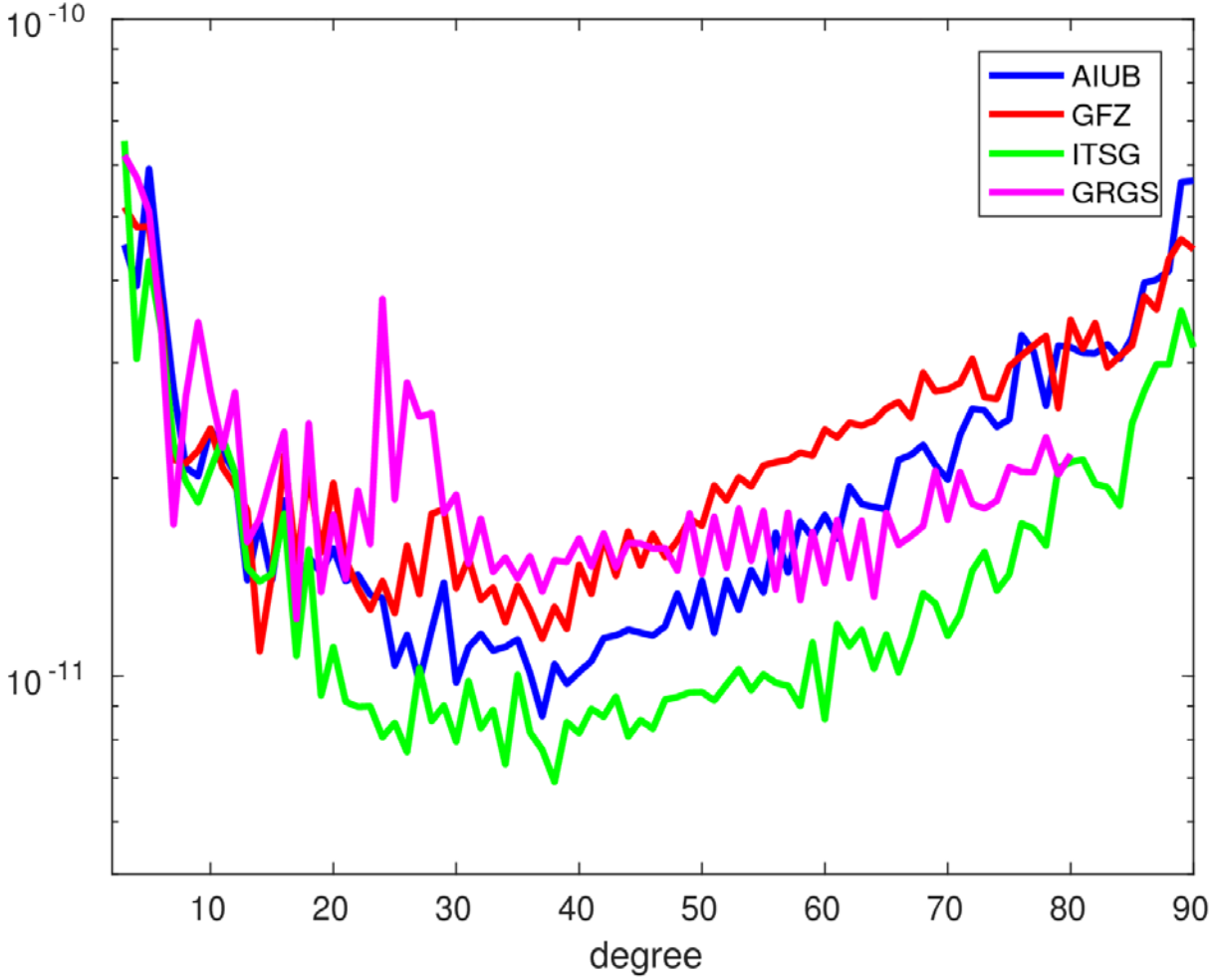
Equal impact is achieved for: $\dfrac{\mathrm{RMS}_i}{\mathrm{RMS}_{\mathrm{ref}}} = 1$

Combination on Normal Equation Level



equalizing weight	
GRGS	1.60
GFZ	1.00
AIUB	7.81
ITSG	2.21

Combination: 2006/01



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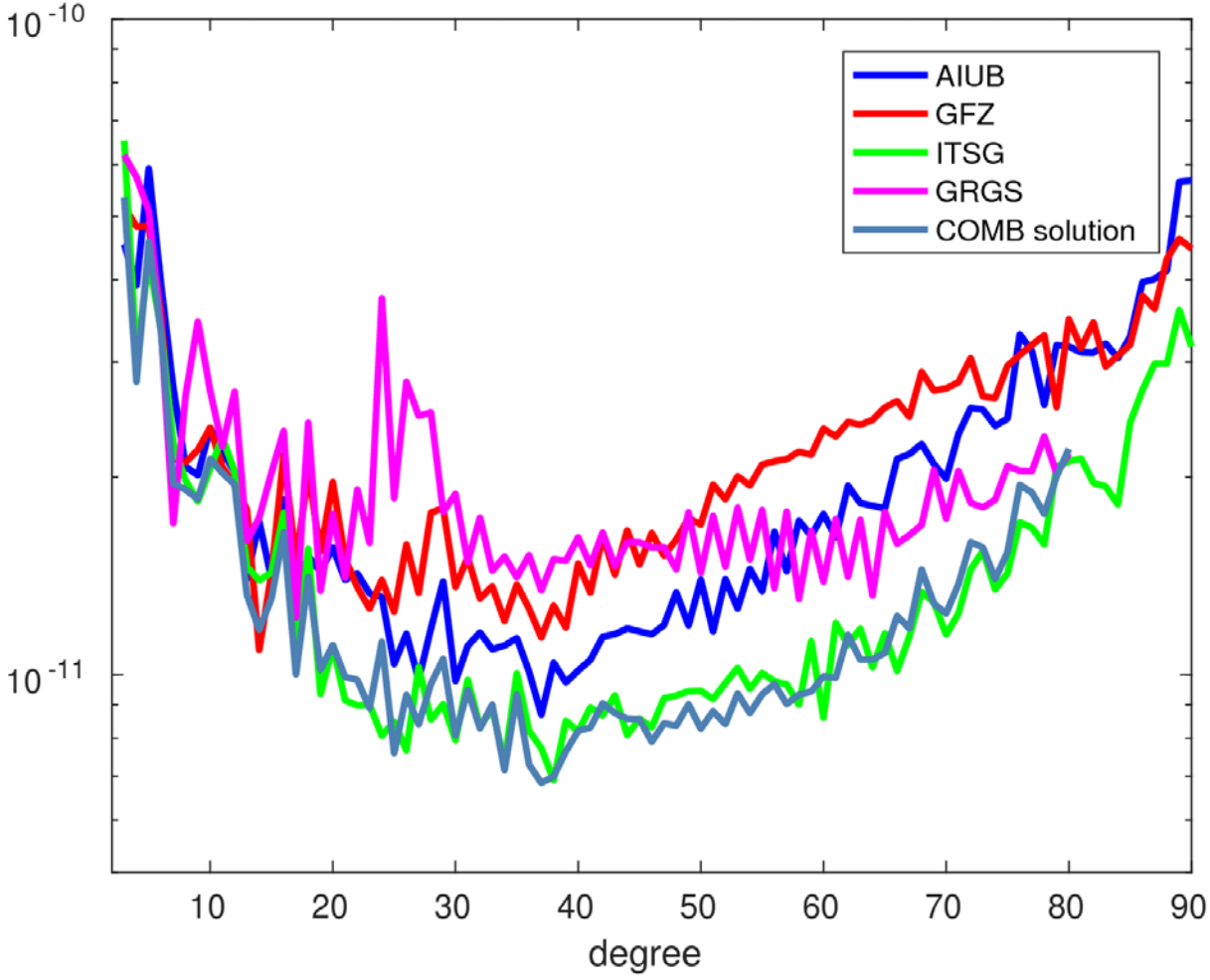

Solution:	weight
GRGS	0.14
GFZ	0.19
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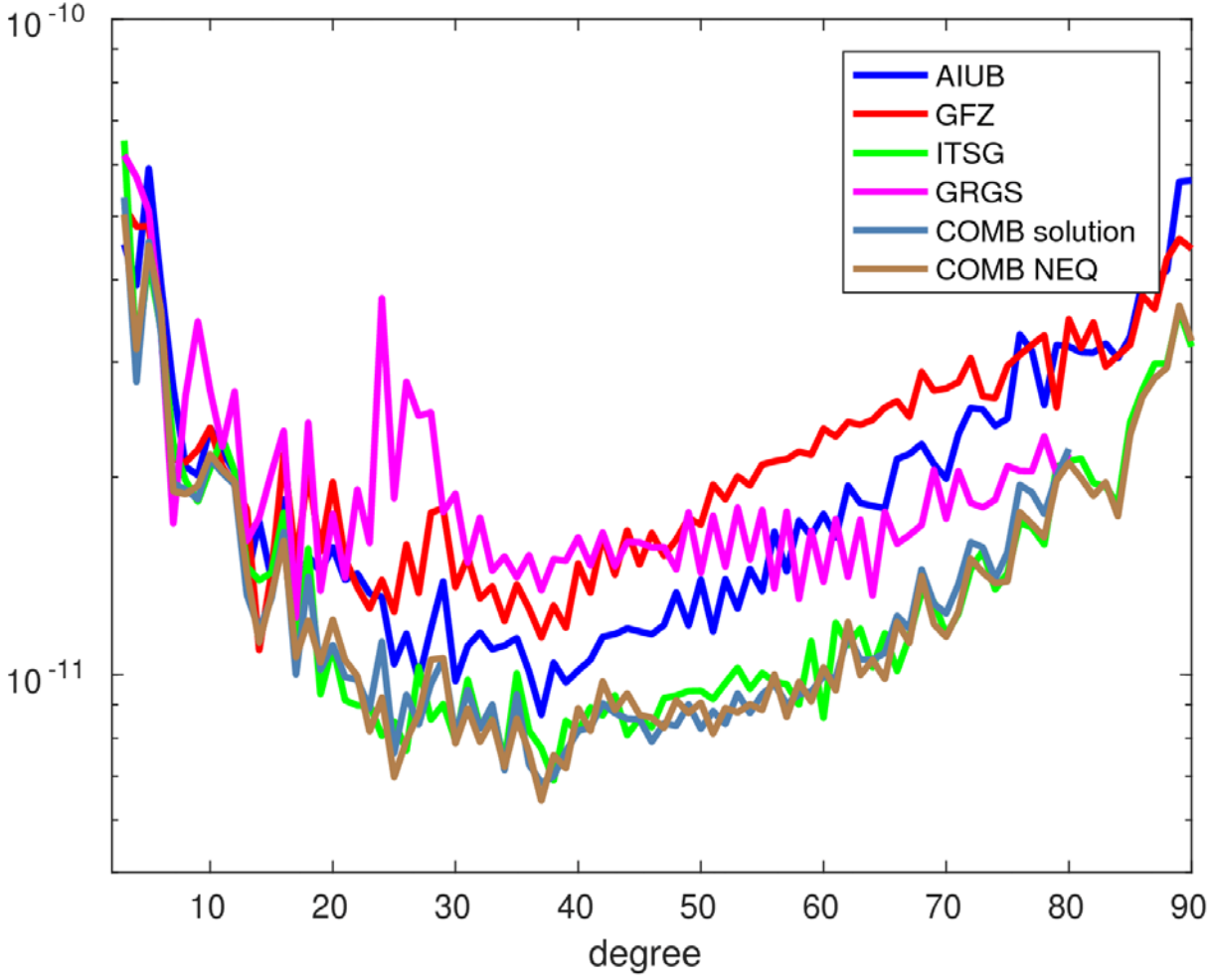

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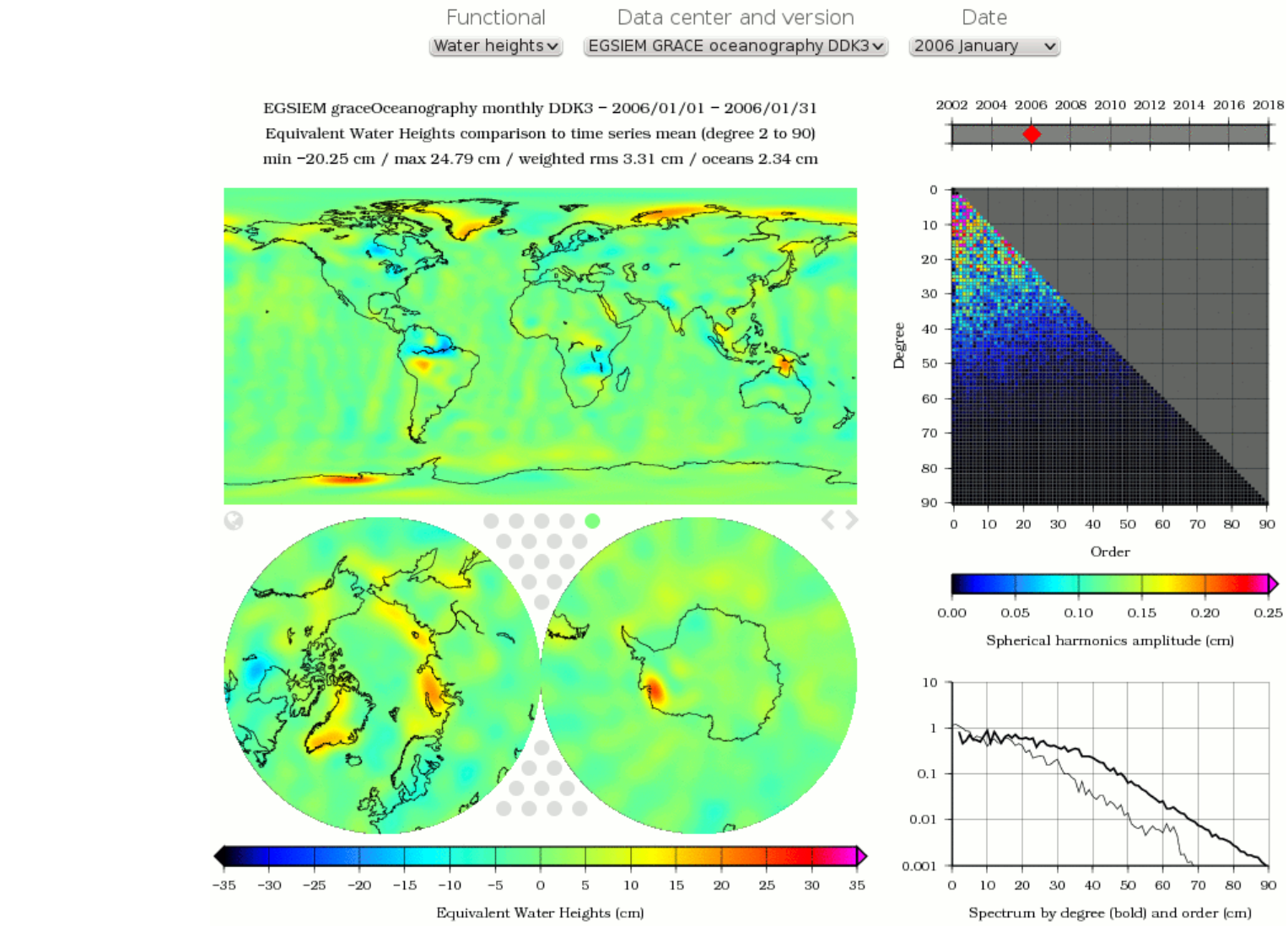
L3-Products: www.egsiem.eu -> Data -> EGSIEM-Plotter



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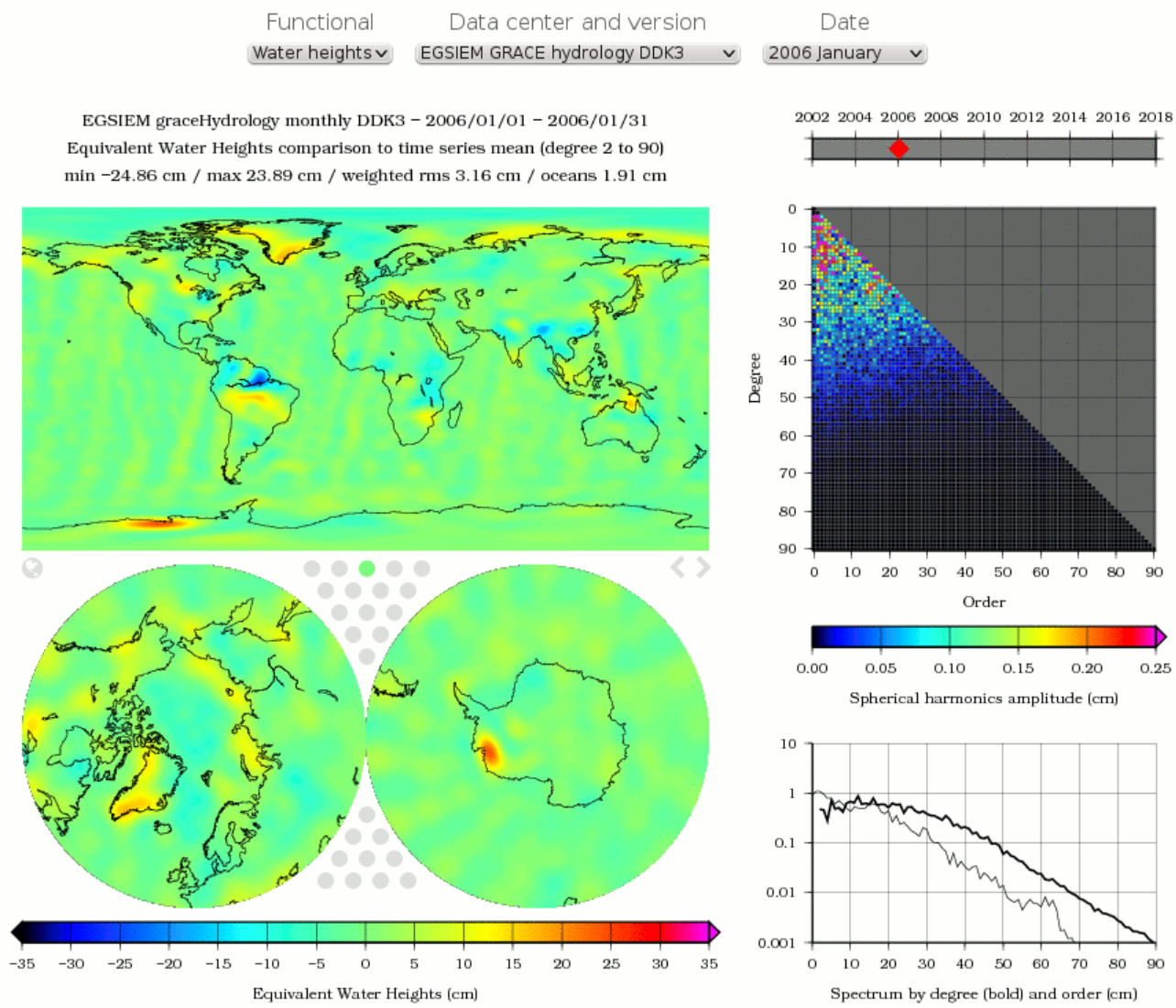

Conclusions

- 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.
- 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