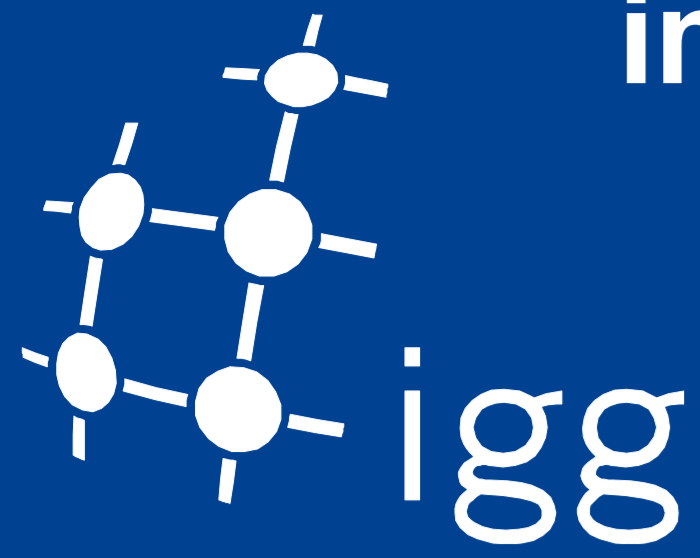


# Reprocessing of CHAMP and GRACE observations for the determination of improved static and temporal gravity field models with regional refinements (GREST-CHAMP/GRACE)



A. Eicker, E. Kurtenbach, T. Mayer-Gürr, A. Shabanloui, and J. Kusche

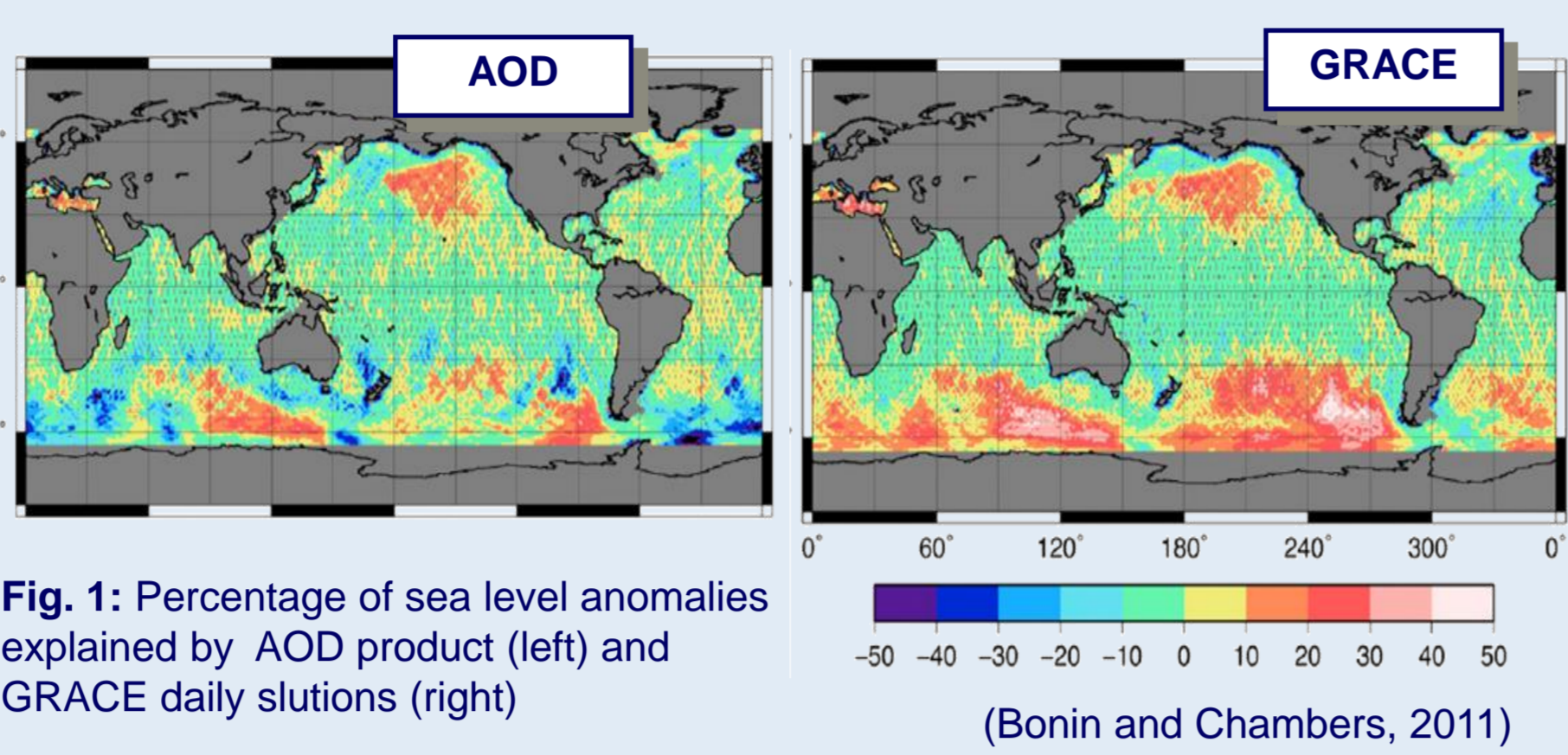


## GRACE gravity field processing at IGG Bonn

### Global models (ITG-Grace2010 time series)

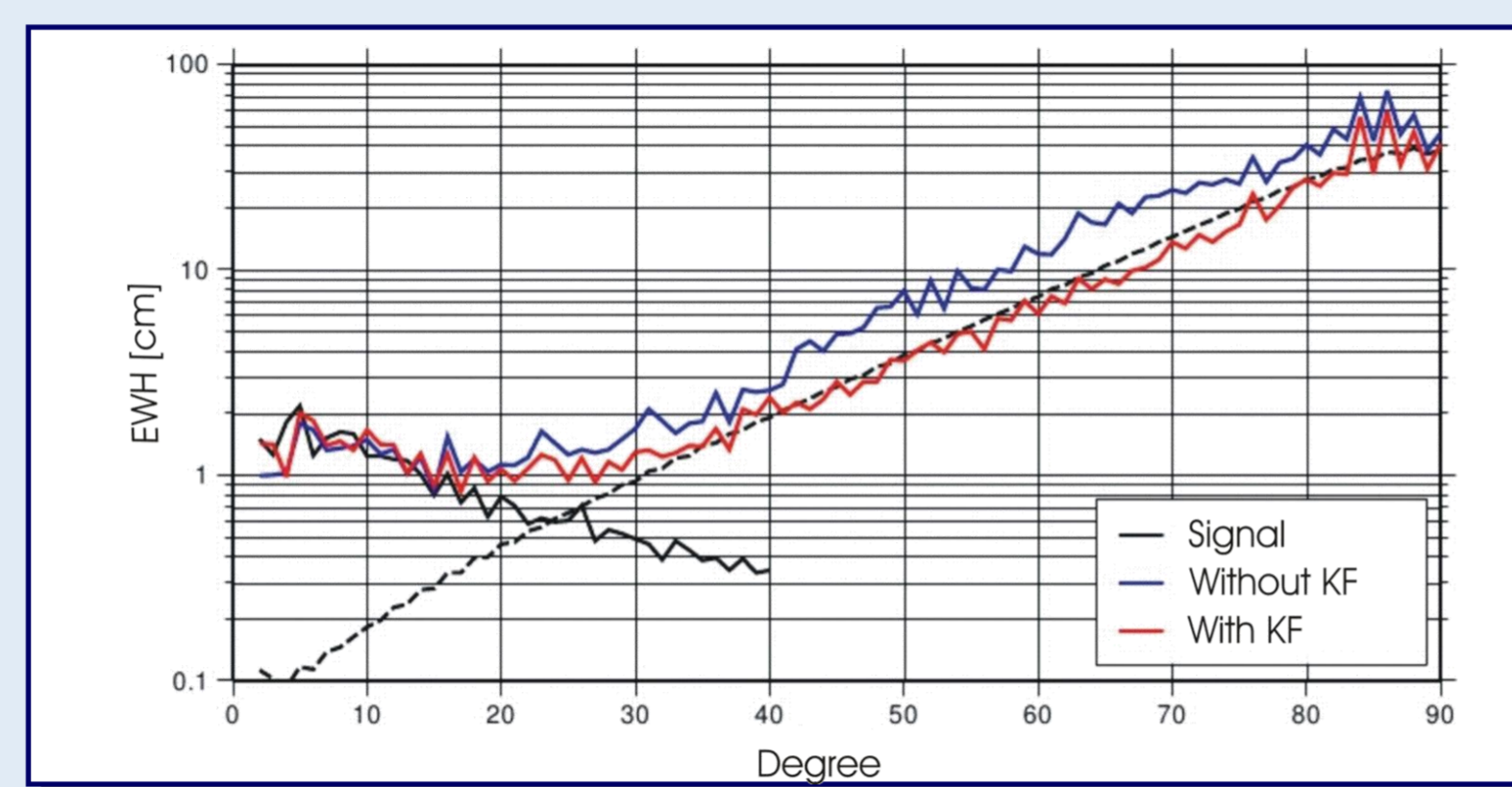
#### Daily Kalman filter solutions

- stochastic prior information from geophysical models
- signal content confirmed by external validation (e.g. against altimetry data)



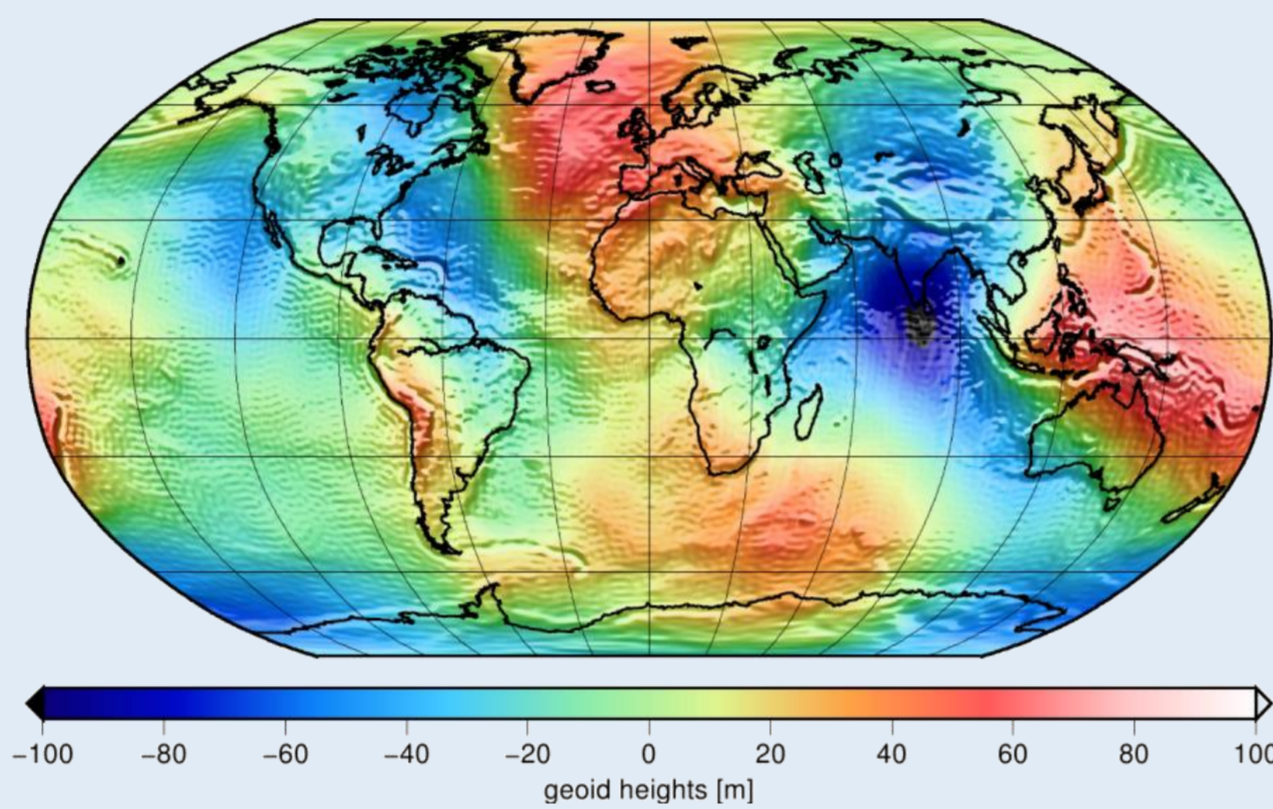
#### Monthly solutions

improved de-aliasing using daily solutions as additional background model to remove short-term mass variations  
=> Less filtering necessary, improved spatial resolution



#### Static gravity field model

ITG-Grace2010s has been chosen as satellite-only basis for the standard gravity field model EGM2008

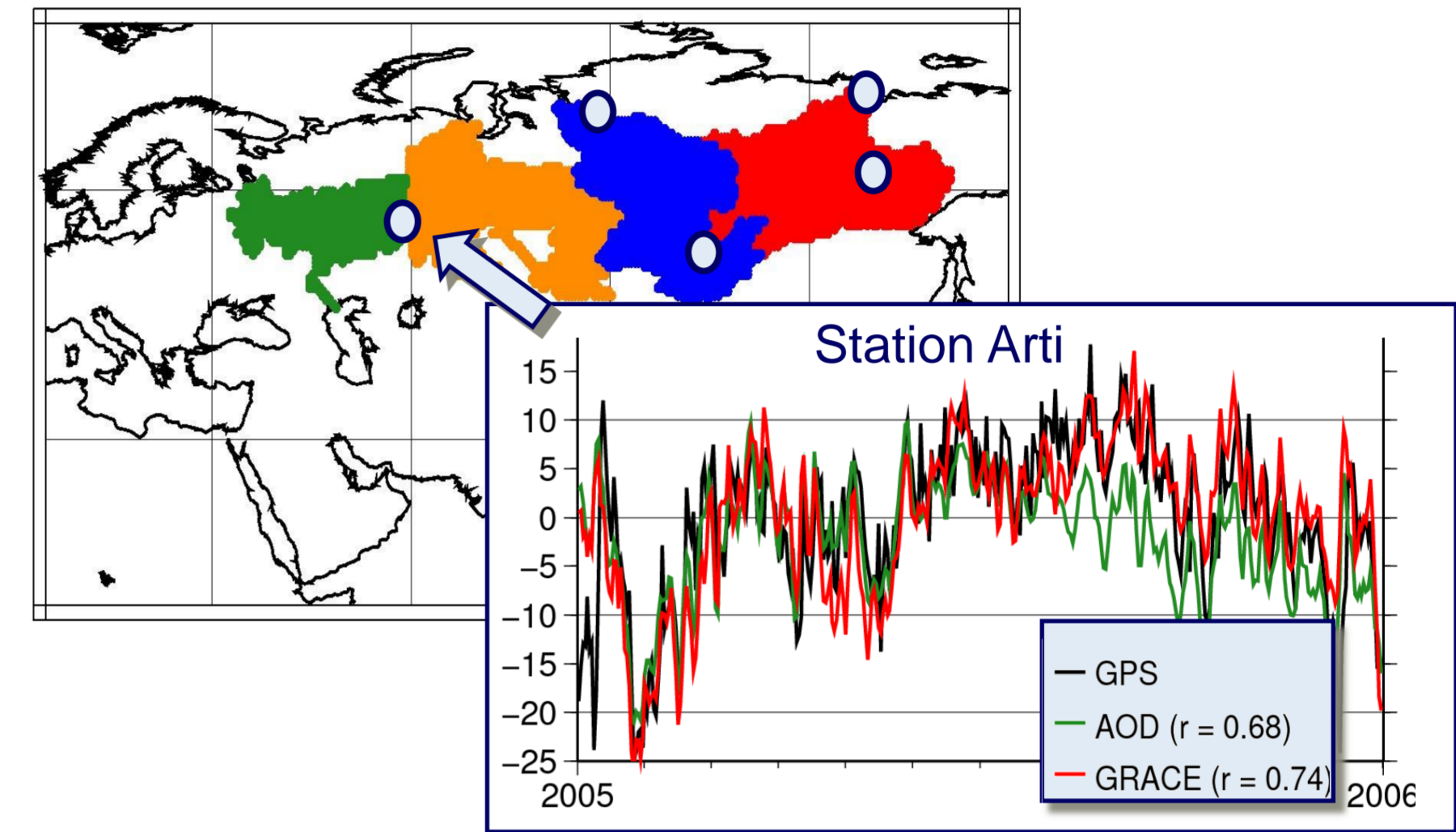


### Regional solutions

- modelled by space localizing radial basis functions
- tailored to the investigation of specific regional phenomena

#### Examples:

- daily solutions for river basins in Siberia



- mass trend for Greenland (see below)

#### Next release

The continuation of the ITG-Grace time series for the complete time span using the new level 1B data (L1B-RL02) and de-aliasing product (AOD1B-RL05) is currently in progress.

## Regionally refined GRACE solutions

### Design of the radial basis functions

Gravitational functional:

$$s(\mathbf{x}) = \sum_{i=1}^I a_i \Phi(\mathbf{x}, \mathbf{x}_i)$$

Spline kernel:

$$\Phi(\mathbf{x}, \mathbf{x}_i) = \sum_{n=2}^{\infty} \sum_{m=-n}^n k_n Y_{nm}(\mathbf{x}) Y_{nm}(\mathbf{x}_i)$$

Shape coefficients:

$$k_n = \frac{\sigma_n}{\sqrt{2n+1}}$$

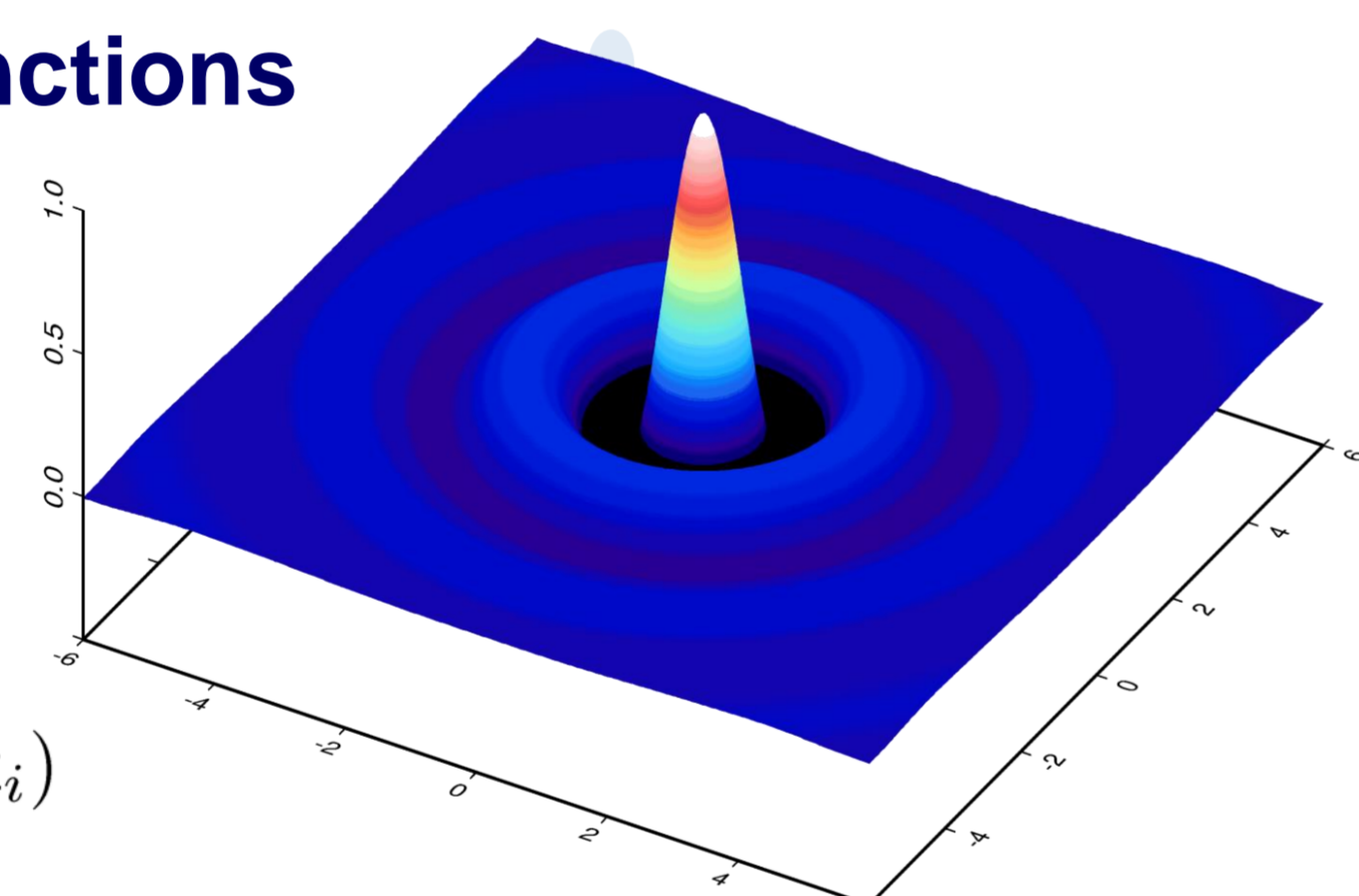


Fig. 2: Exemplary spline kernel. The shape of the spline kernel is adapted according to the signal content of the gravity field

Adaption to temporal gravity field variations:

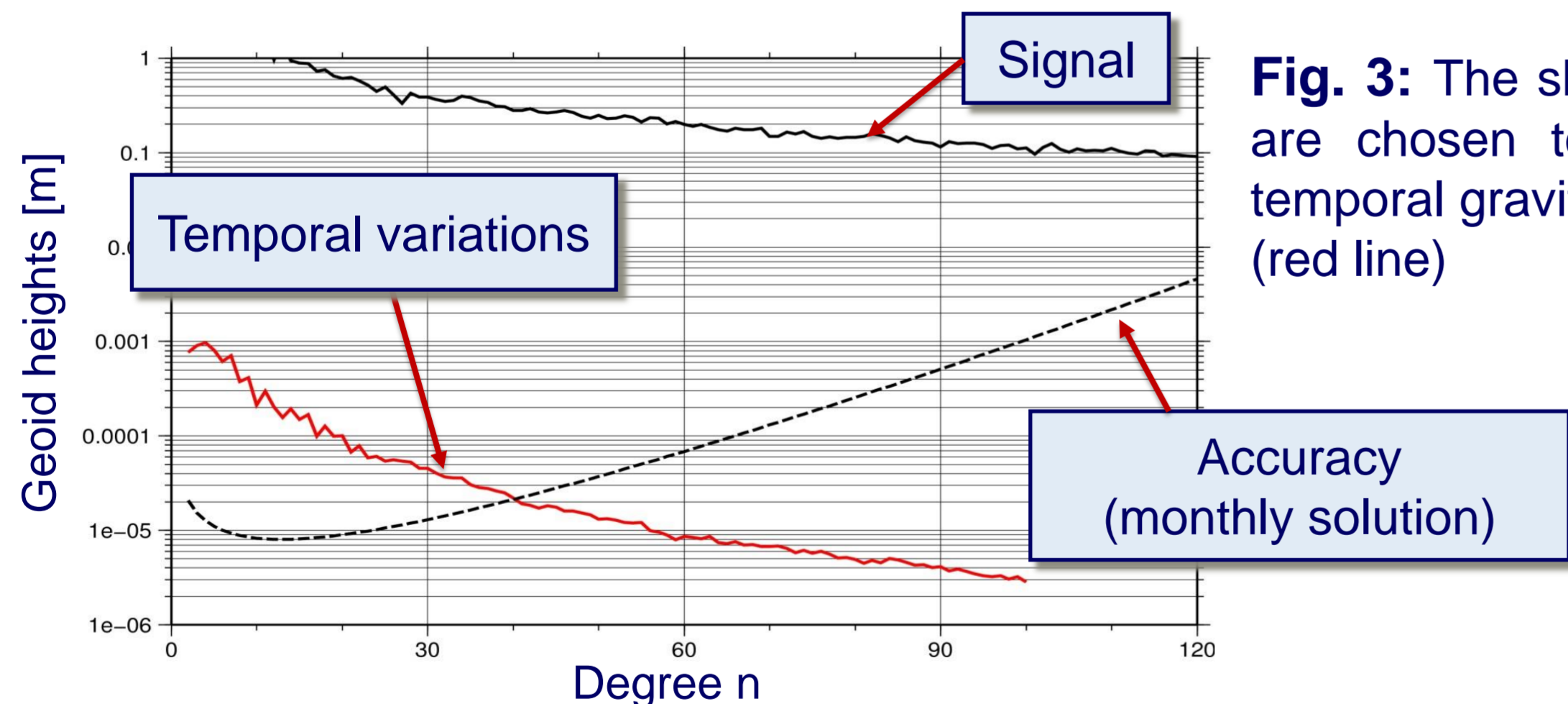


Fig. 3: The shape coefficients are chosen to represent the temporal gravity field variations (red line)

### References

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- Kurtenbach E., Eicker A., Mayer-Gürr T., Holschneider M., Hayn M., Fuhrmann M., Kusche J. (2012): Improved daily GRACE gravity field solutions using a Kalman smoother, doi: 10.1016/j.jog.2012.02.006, Journal of Geodynamics

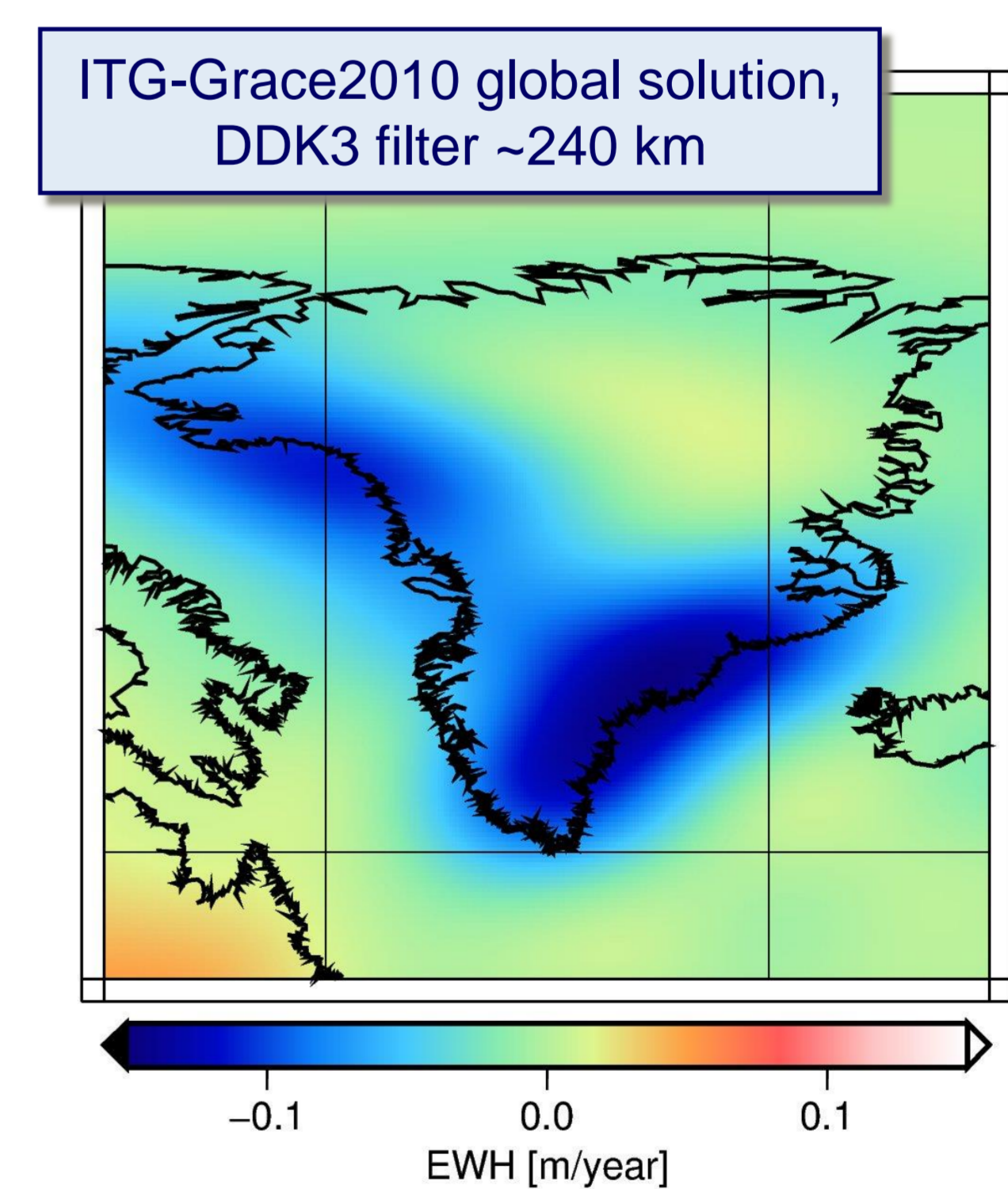
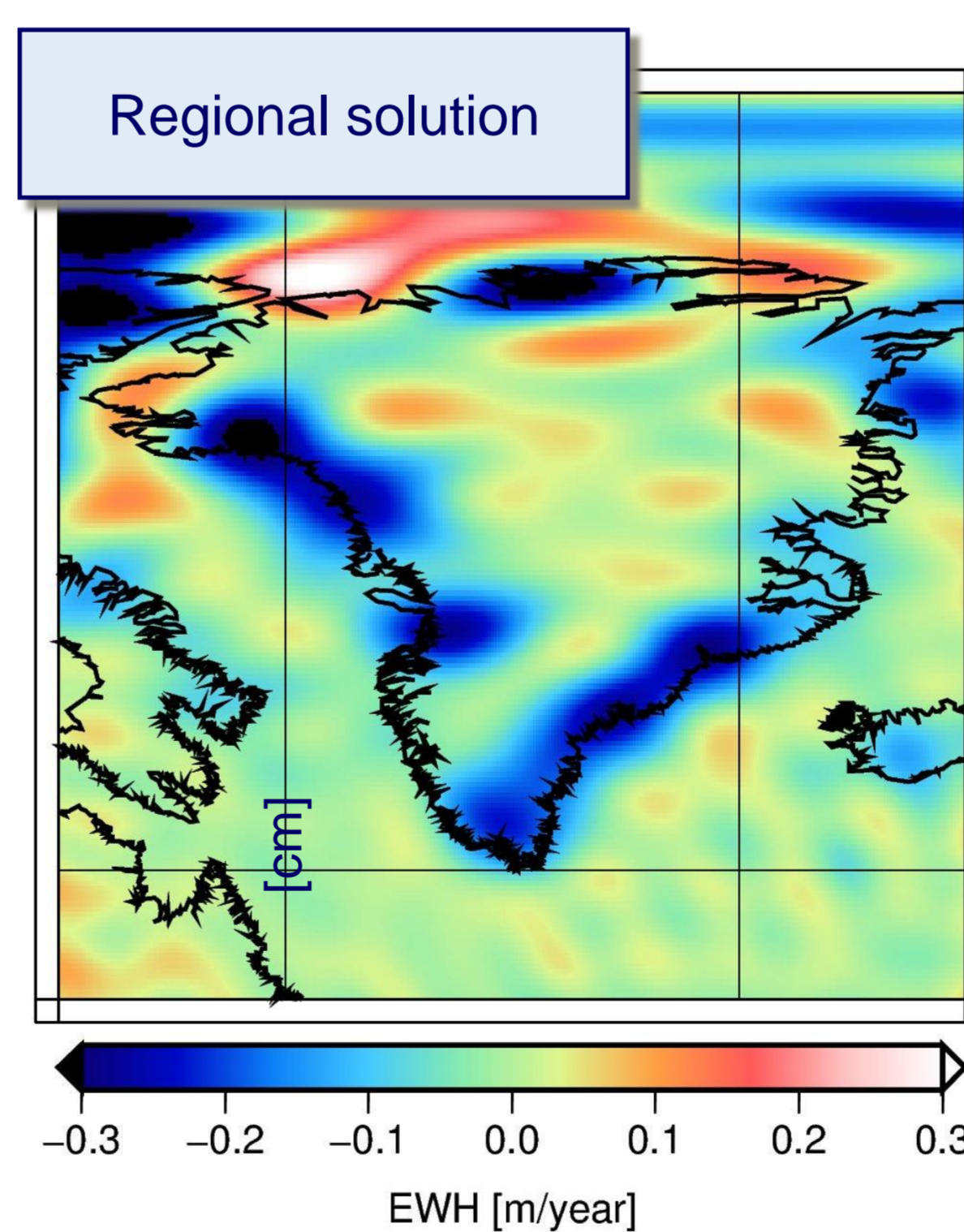
## Acknowledgements

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### Application: Ice mass trend in Greenland

- regional solutions for the Greenland area derived from GRACE level 1B data
- radial basis functions with nodal point distance and spline kernel corresponding to a spatial resolution of  $\sim N=120$
- optimized regularization by variance component estimation

→ improved spatial resolution



### Comparison: ICESat

- The regional modelling approach is well suited for comparison and combination with independent regional data sets
- Example: ICESat mass trend represented in the same basis of spline functions
- good agreement of spatial trend patterns

