Title: **Status of NRT & Regional Service at TUG**

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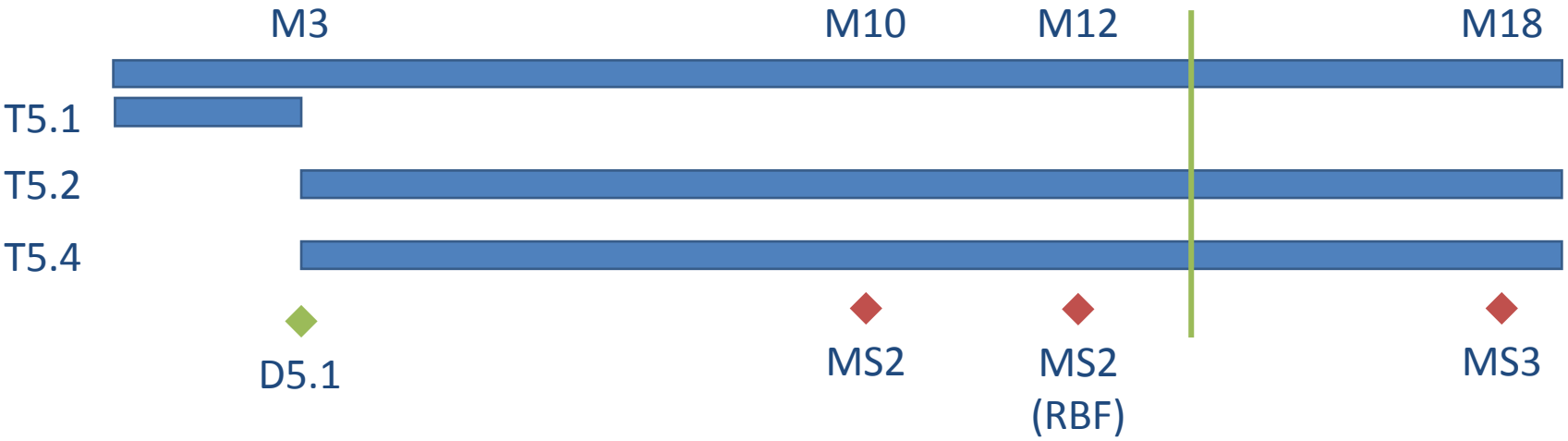
Horizon2020

Status of NRT – Time Table and Milestones

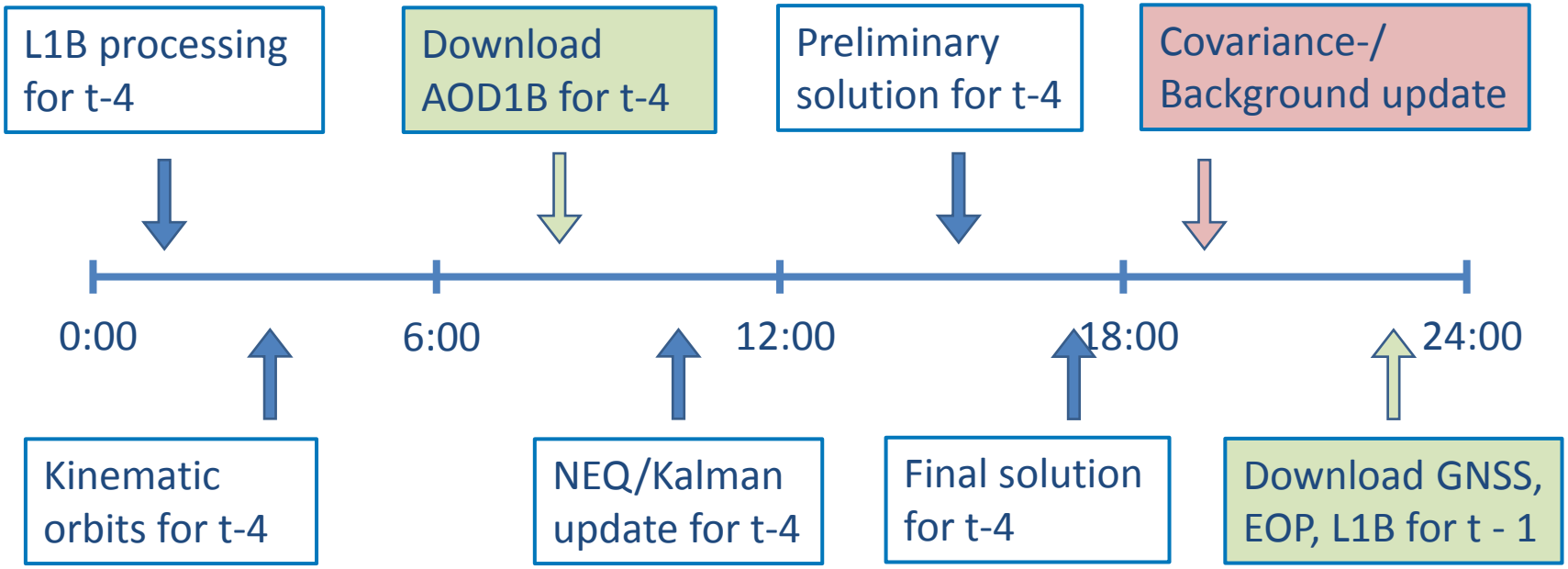


- Milestone 2 (Implementation and Preparation Review) reached
  - Implementations for NRT capability finished
  - First radial basis function (RBF) post-processing time series computed in M12 at TUG (delay of one month compared to proposal)

- Upcoming: Milestone 3 (Service Readiness, M18)
  - Marks the begin of T5.5 (Generation of Area Mean Values, M19) and 5.6 (Validation/Feedback, M19)

Status of NRT – Processing Schedule

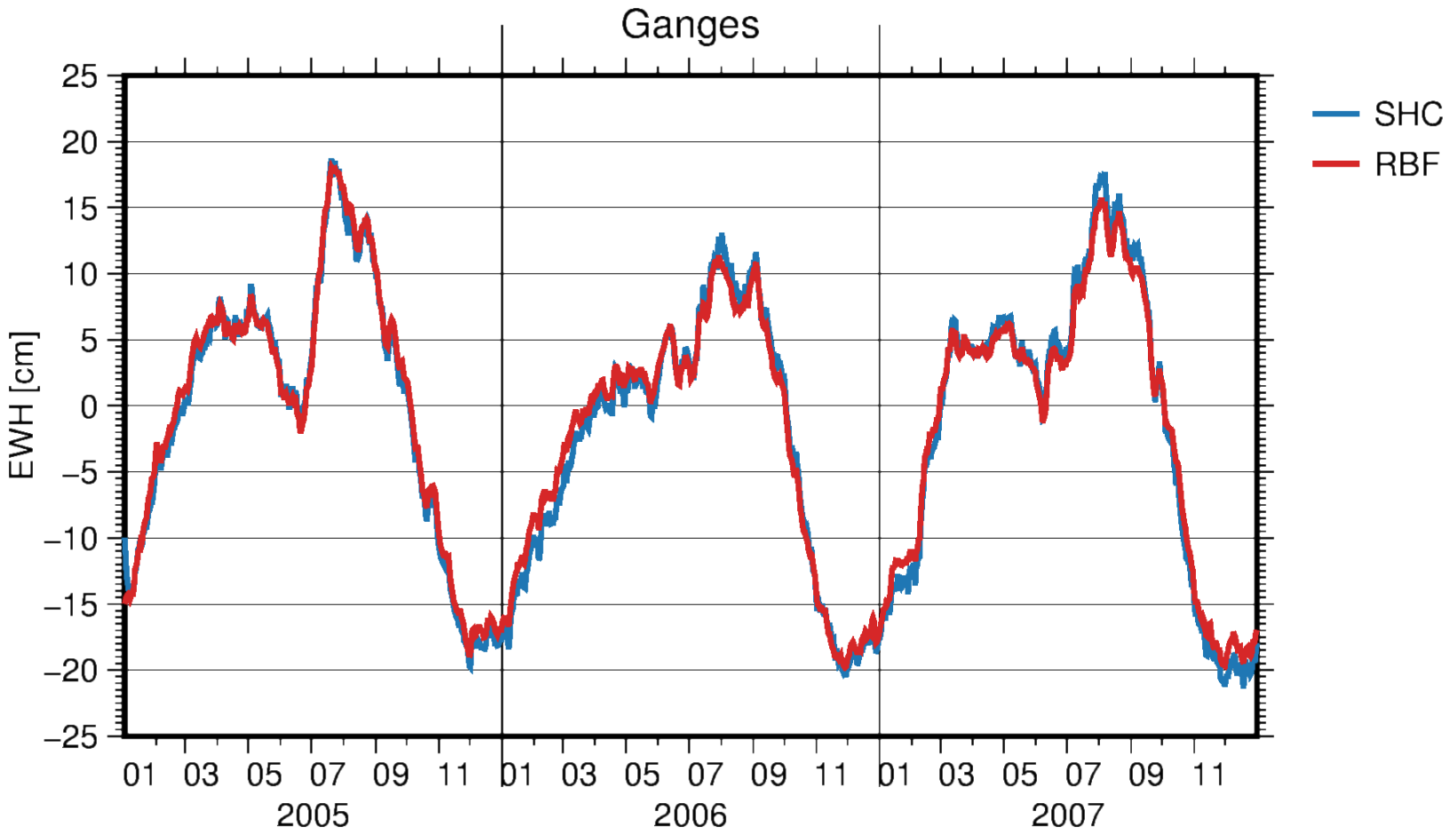
- Processing sequence executed daily
- Slight departure from D5.1:
  - Data acquisition is detached from processing



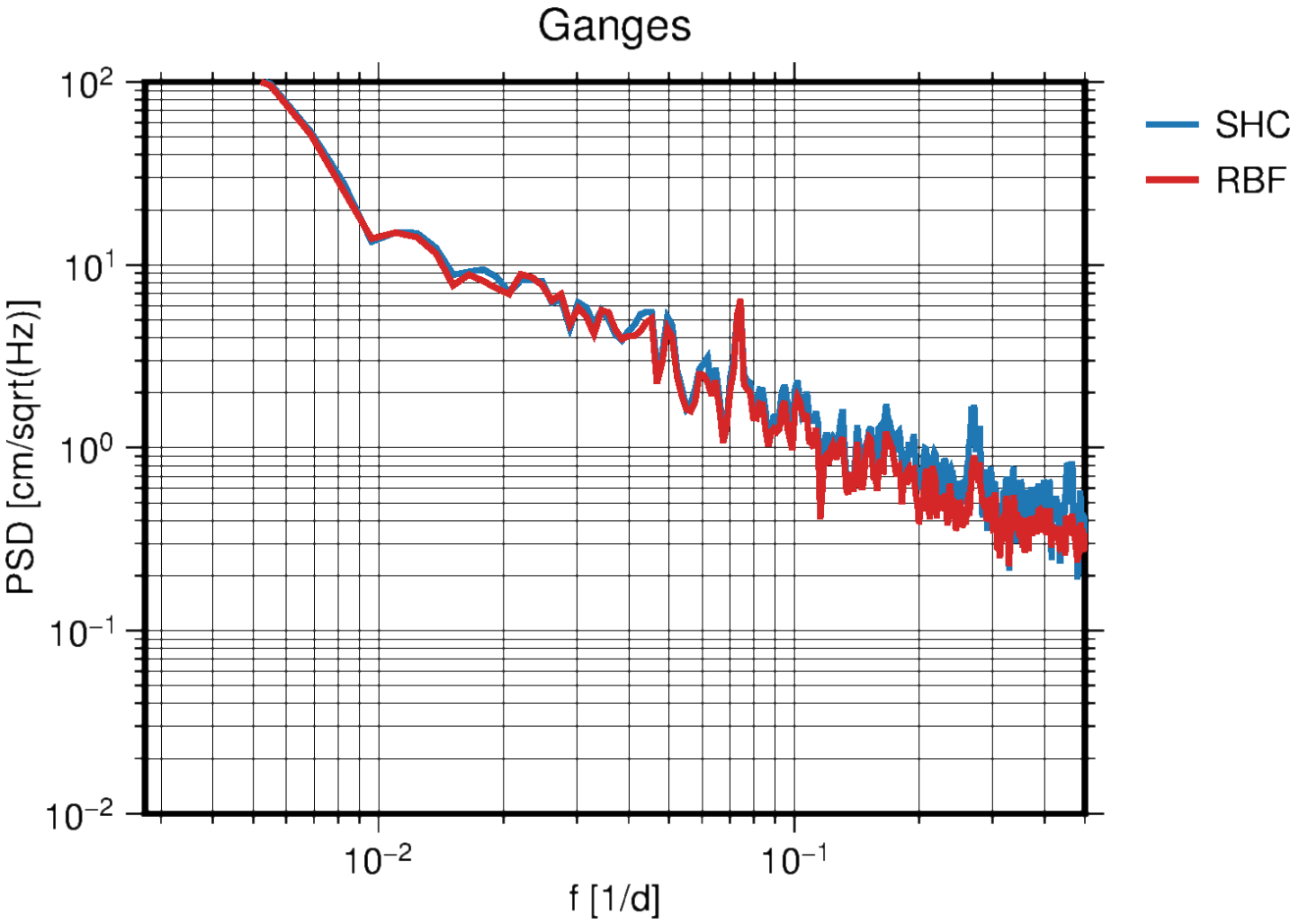
Status of NRT – Regional (RBF) Representations

- Radial basis functions representations fully implemented for gravity field solutions and process model
- Evaluated using a post-processing time series from 2003-02 to 2015-04
- Very good agreement with SHC solutions
- Kalman filter operates on normal equation level:
  - RBF representations can be easily integrated and run in parallel with SHC solutions

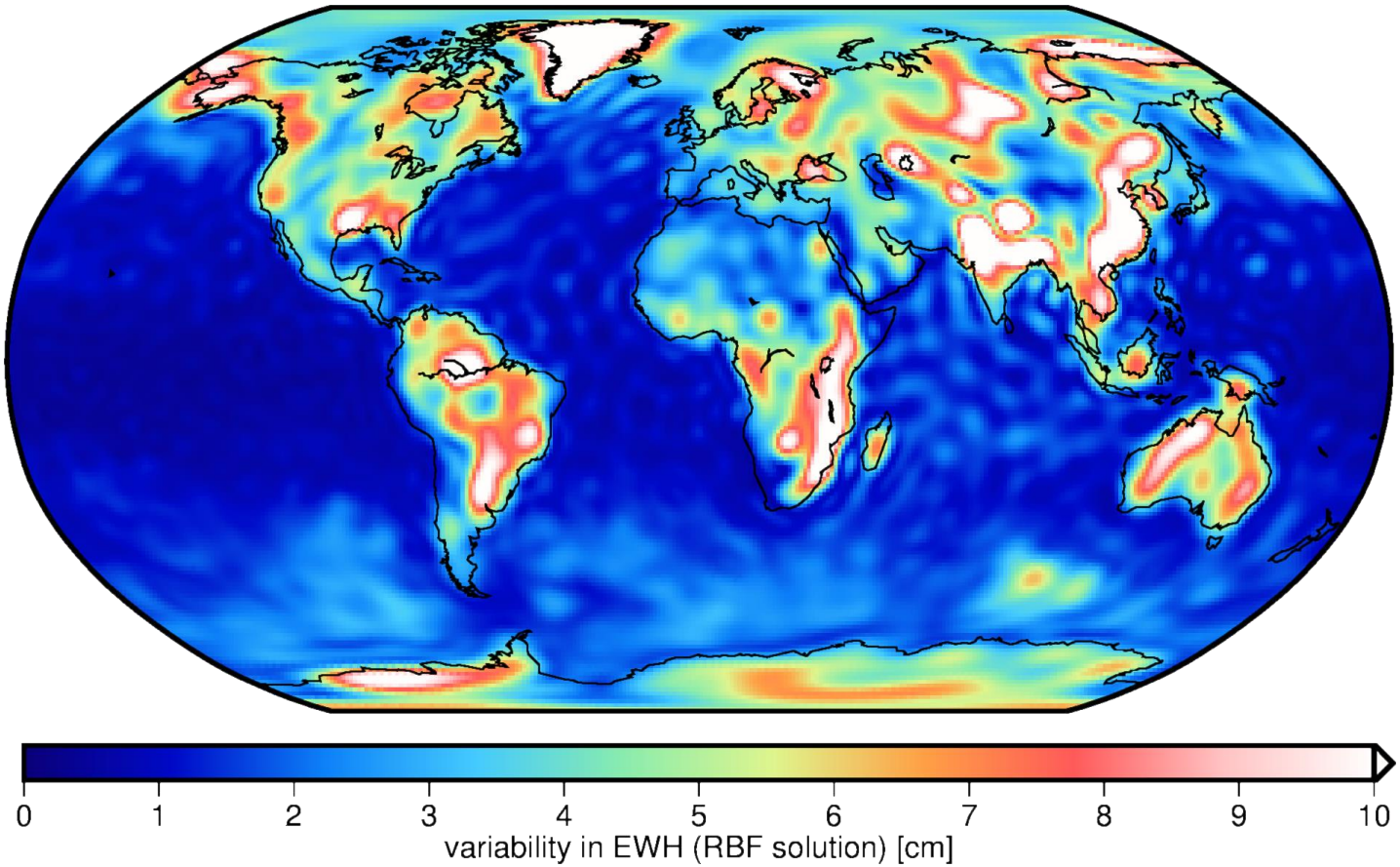
Status of NRT – Regional (RBF) Representations



Status of NRT – Regional (RBF) Representations



Status of NRT – Regional (RBF) Representations



Status of NRT – Processing Methods

- Improved processing methods from task T2.2 implemented
  - Exception: accelerometer calibration values based on force models (solar flux not available in NRT)

- Kinematic Orbits
  - Estimated daily, using three days of clocks and orbits including previous and following epoch

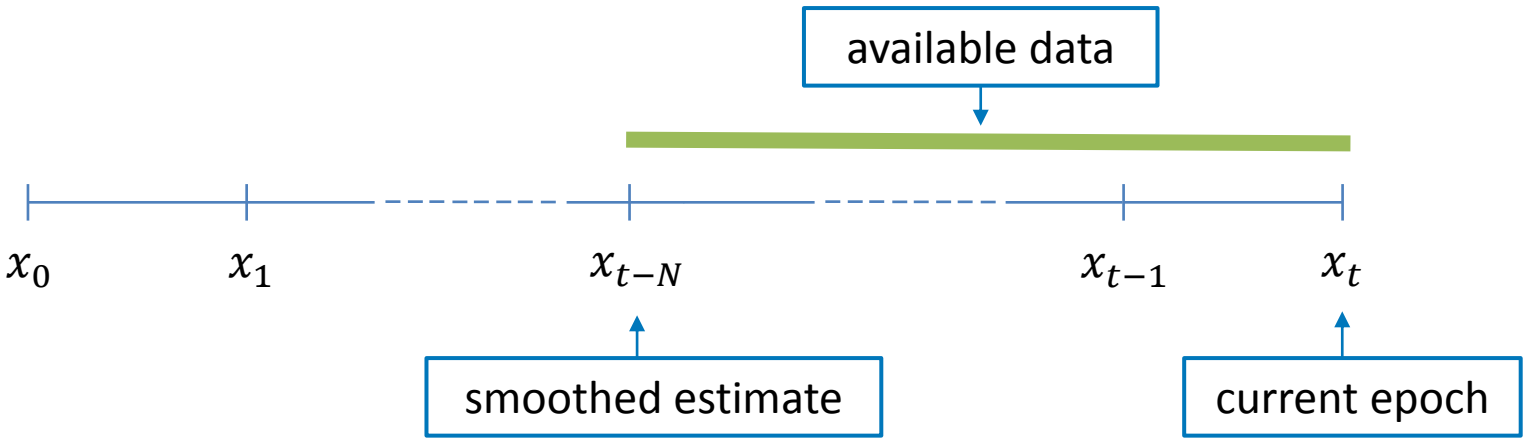
- Instrument Error covariance estimation from one month of data
  - Continued 14 days into the future
  - Daily estimation of arc weights with fixed covariance function

- Background model update
  - Annual/secular variations estimated for complete time span (2003-today)
  - Updated every 14 days using daily normal equations

Status of NRT – Processing Methods

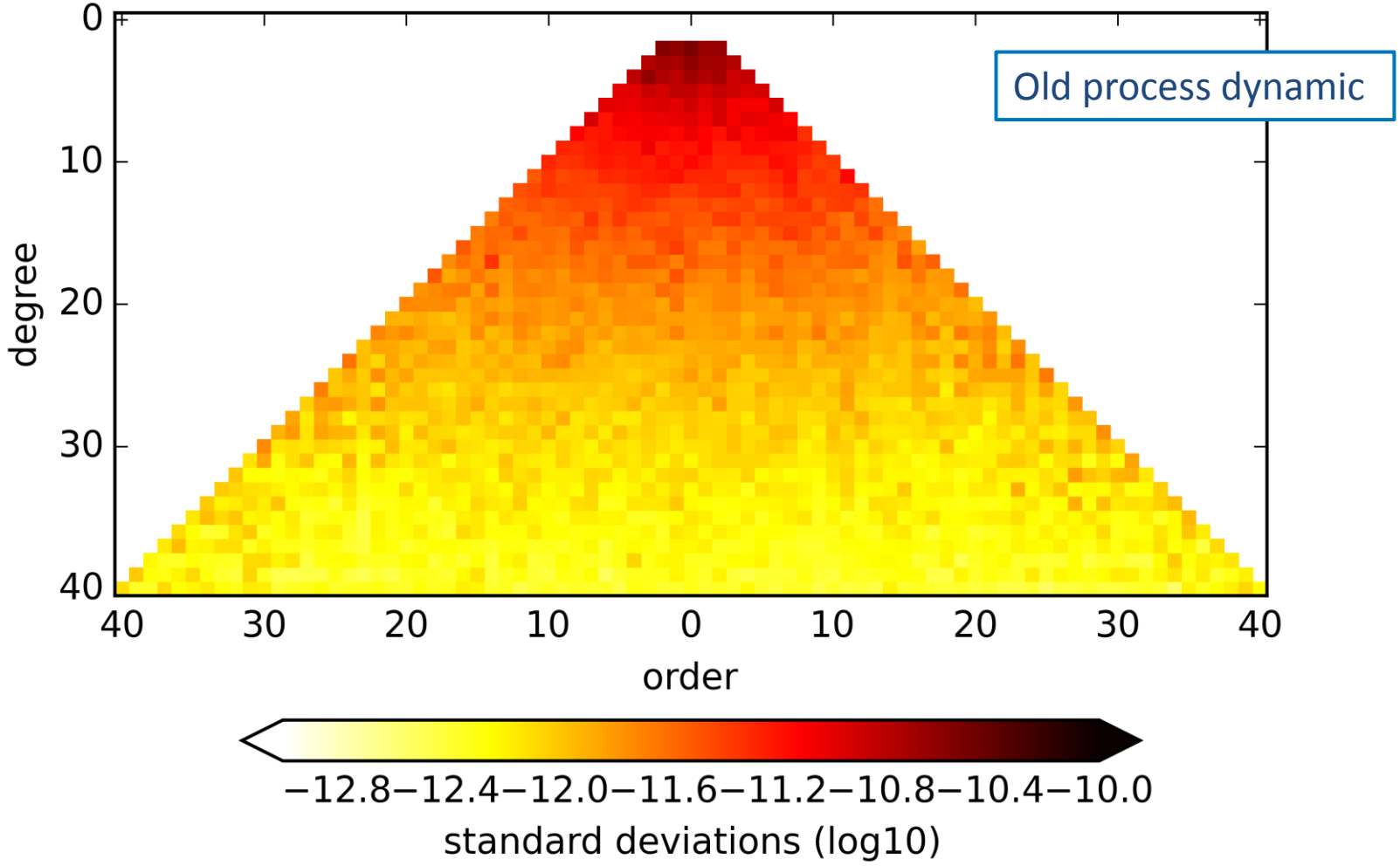
- Improved state-space model:
  - Regional constraints to increase redundancy
  - Improved prediction/less filter artifacts

- Current estimated latency possibly allows for fixed-lag smoothing with one lag epoch



Status of NRT – Processing Methods

main diagonal of auto-covariance



Status of NRT – Processing Methods

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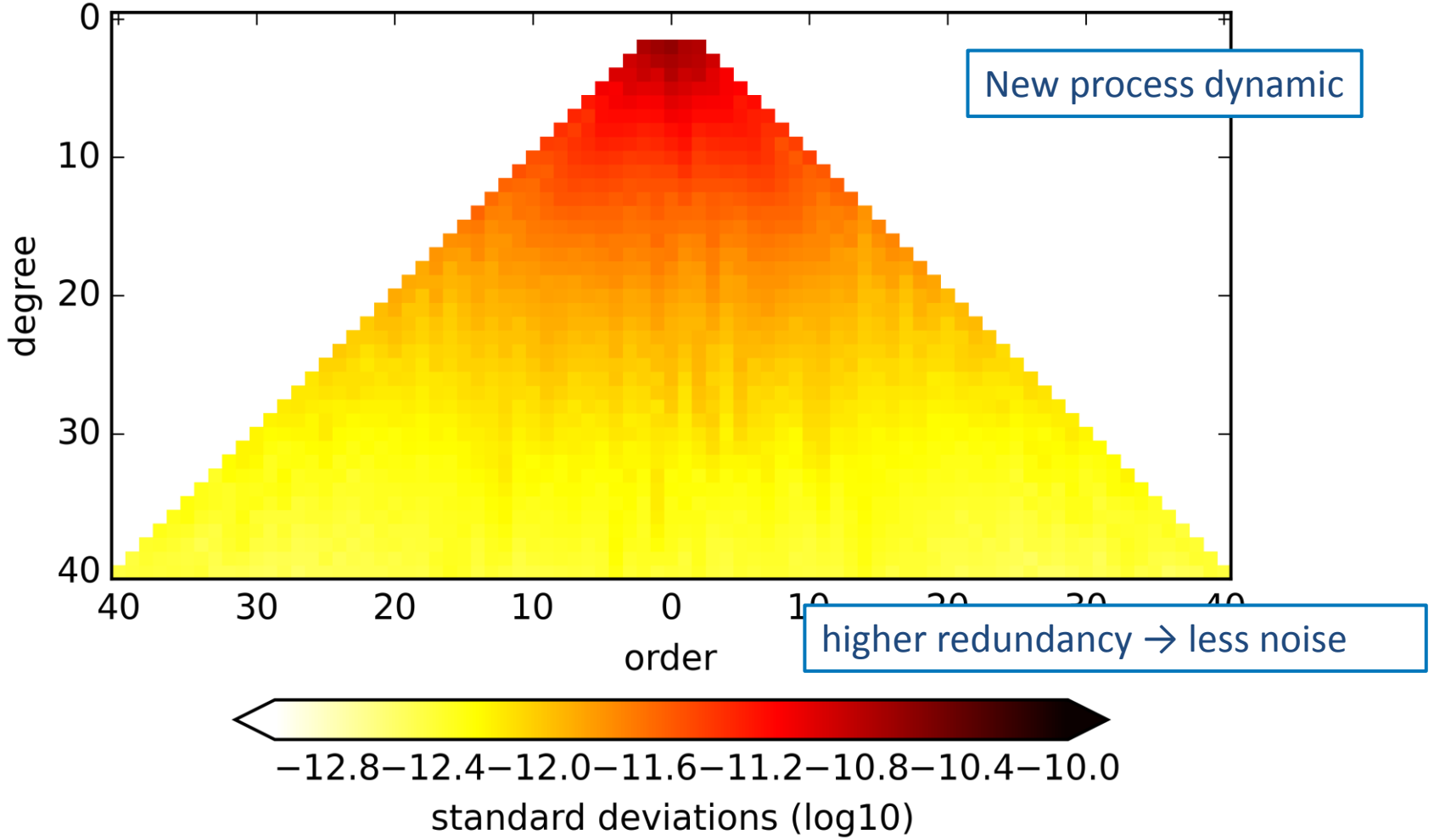
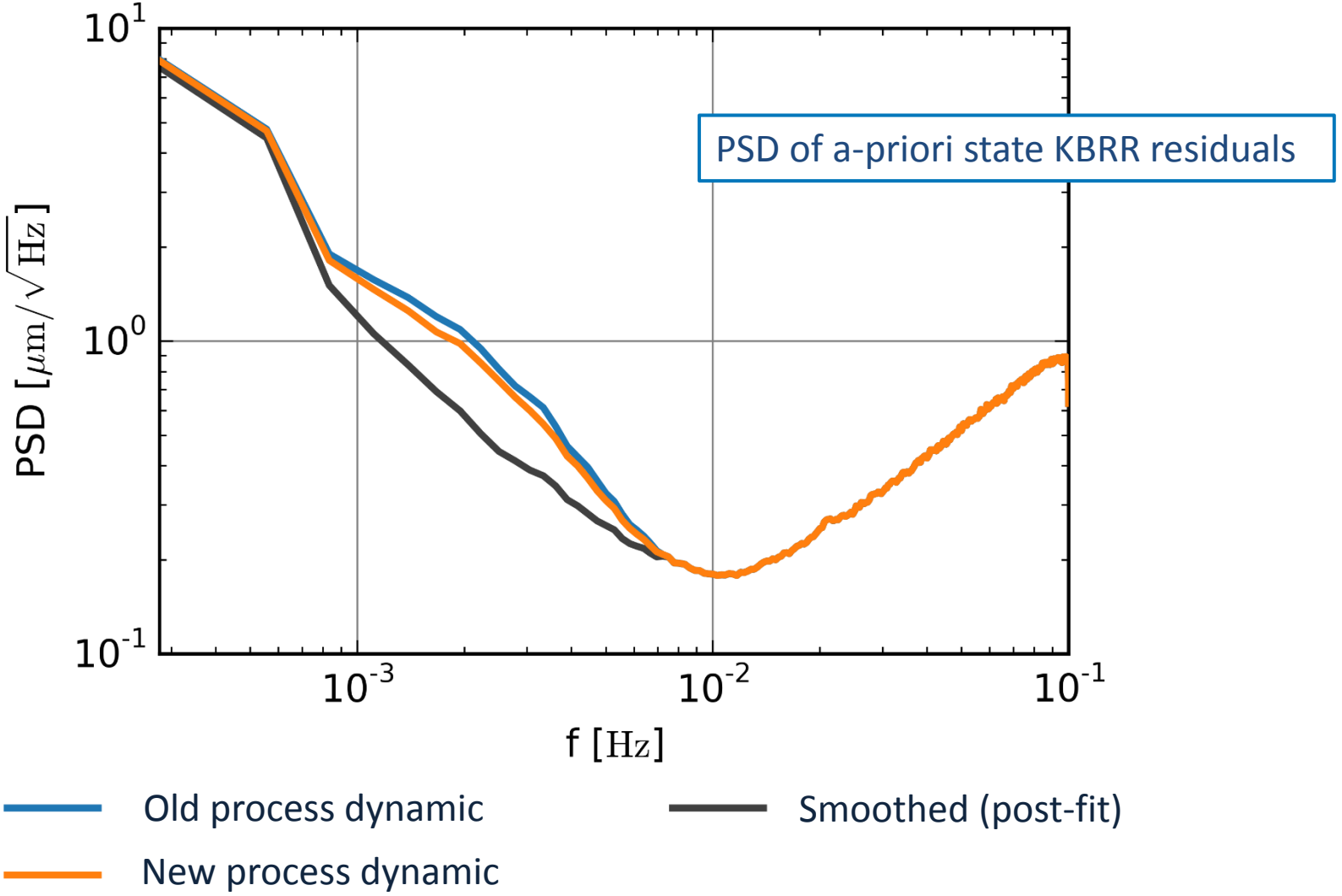


Status of NRT – Processing Methods

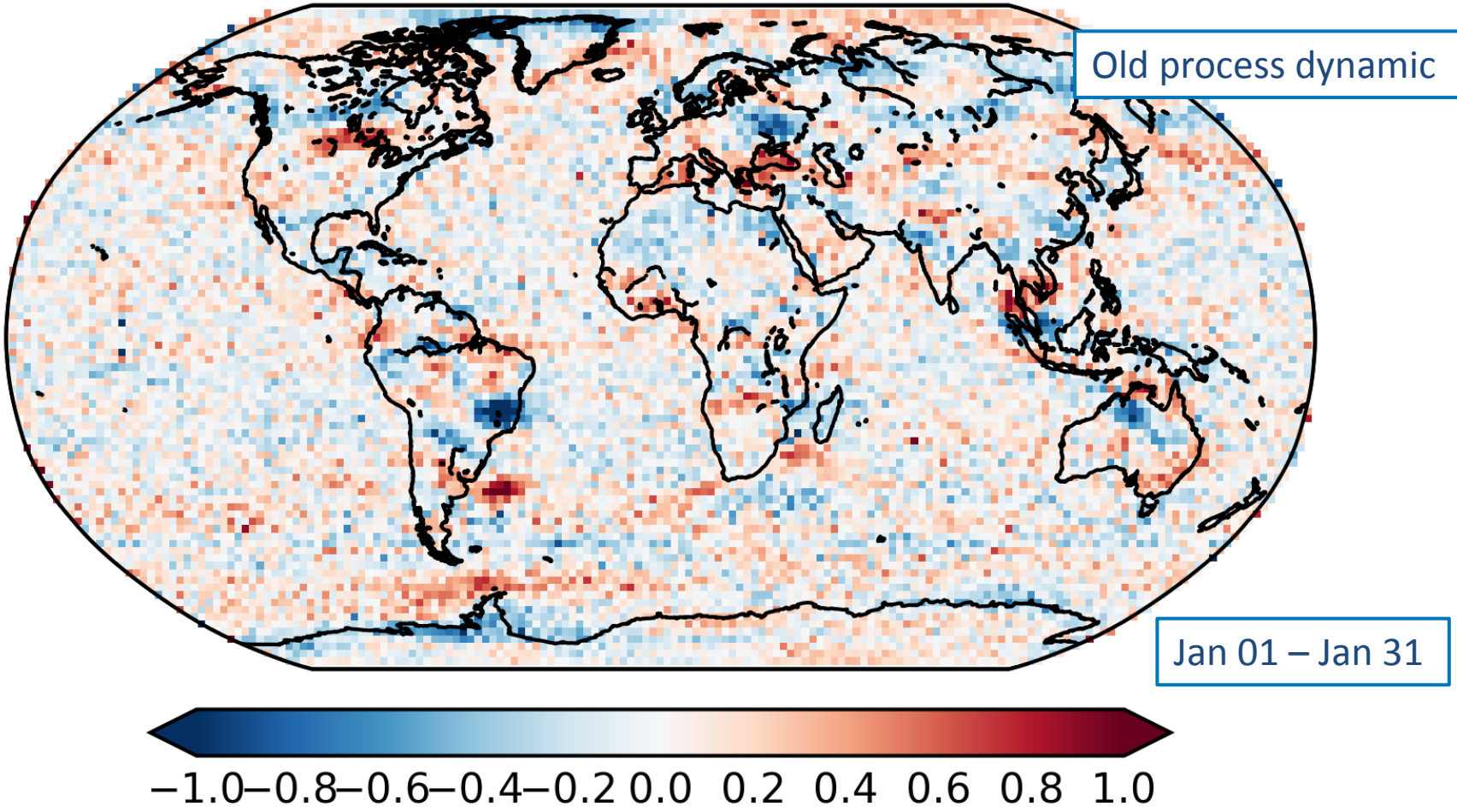
- Question 1:
  - How well does the predicted state fit the GRACE observations?
  - Comparison of a-priori range rate residuals in time and space domain

- Question 2:
  - Are there Kalman filter artifacts in the computed gravity field solutions?
  - Non-geophysical signals in area mean time series

Status of NRT – Processing Methods

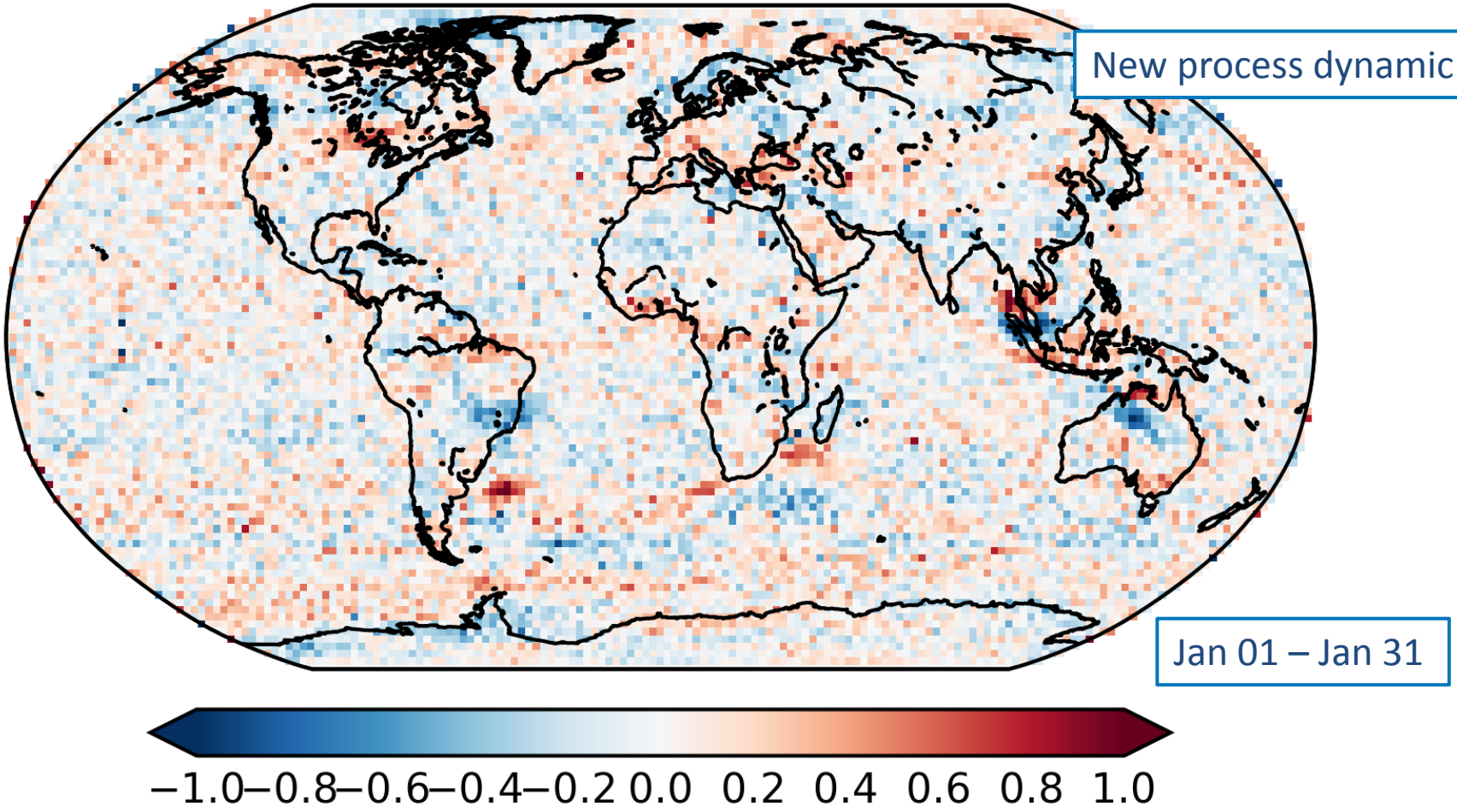


Status of NRT – Processing Improvements



decorrelated daily KBRR residuals, monthly 2x2 degree bins

Status of NRT – Processing Improvements



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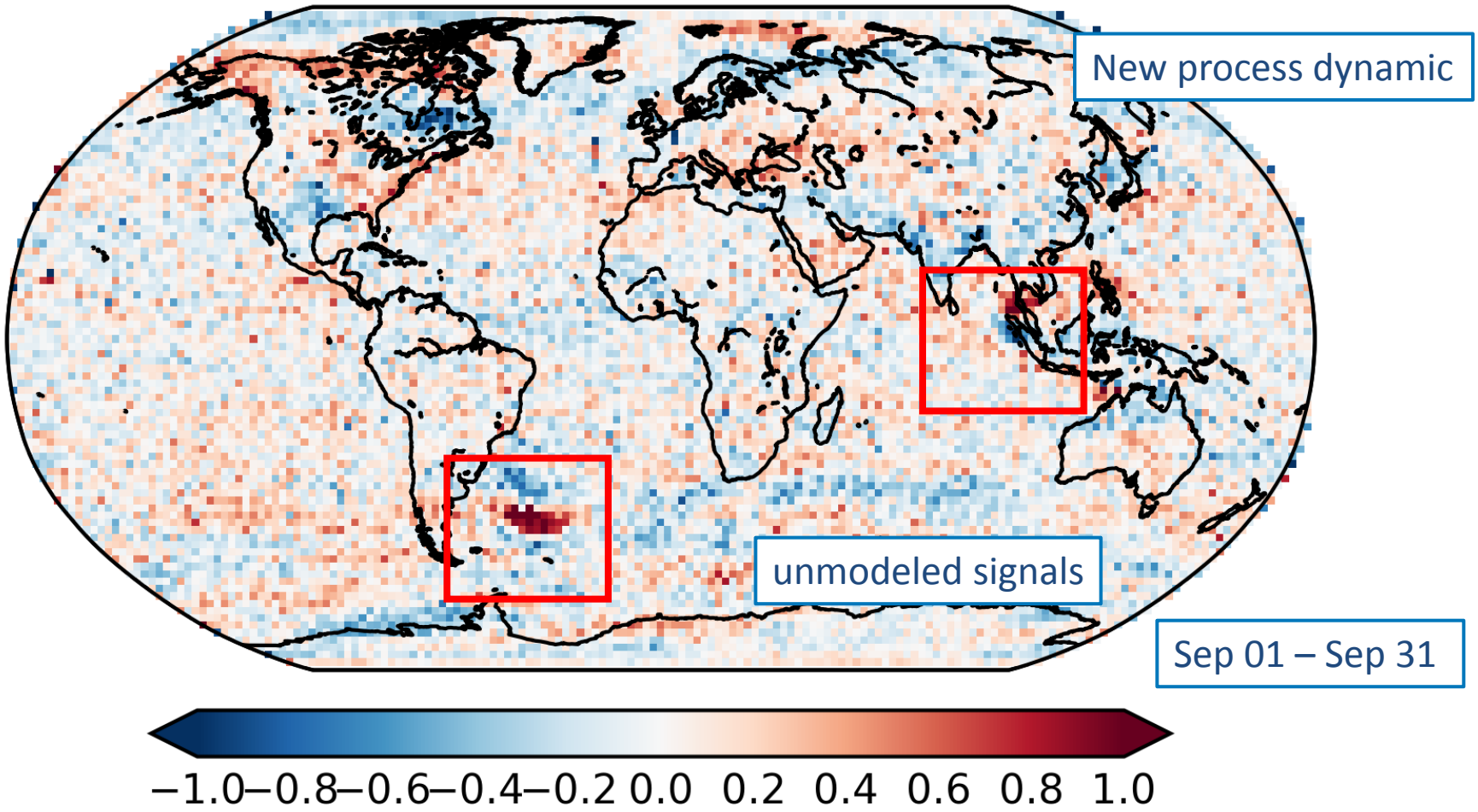
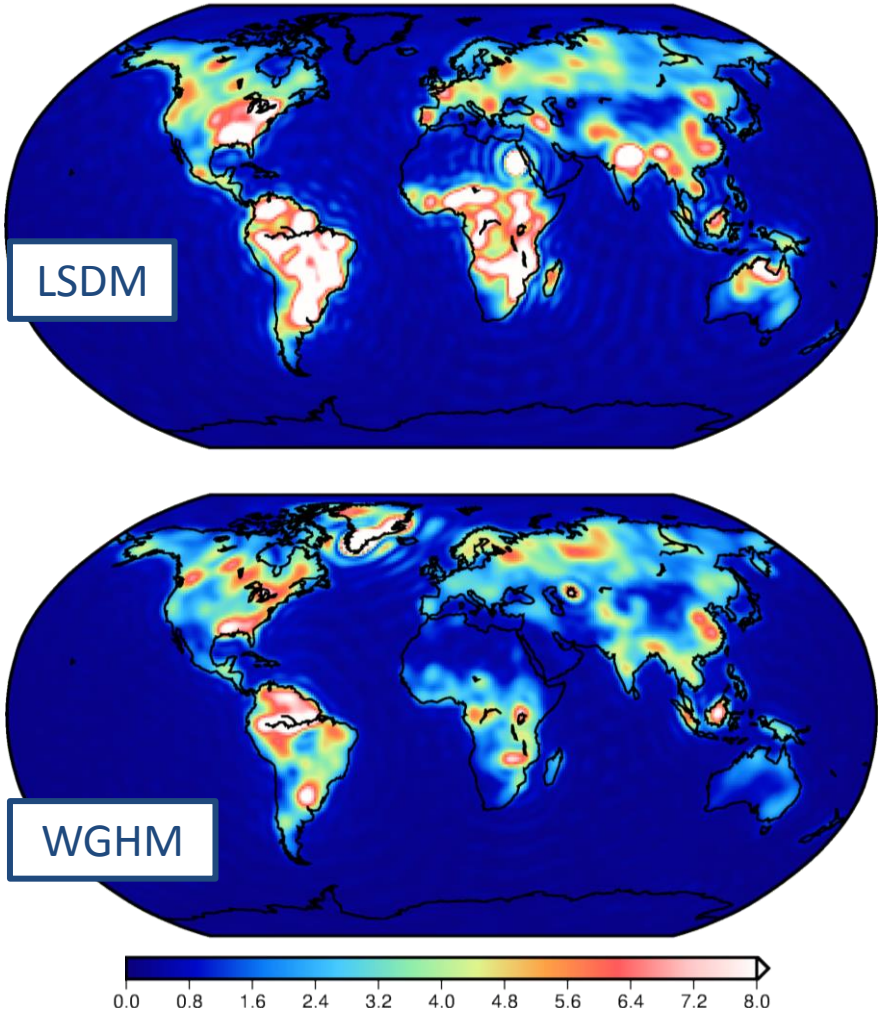


decorrelated daily KBRR residuals, monthly 2x2 degree bins

Process Dynamic Comparison

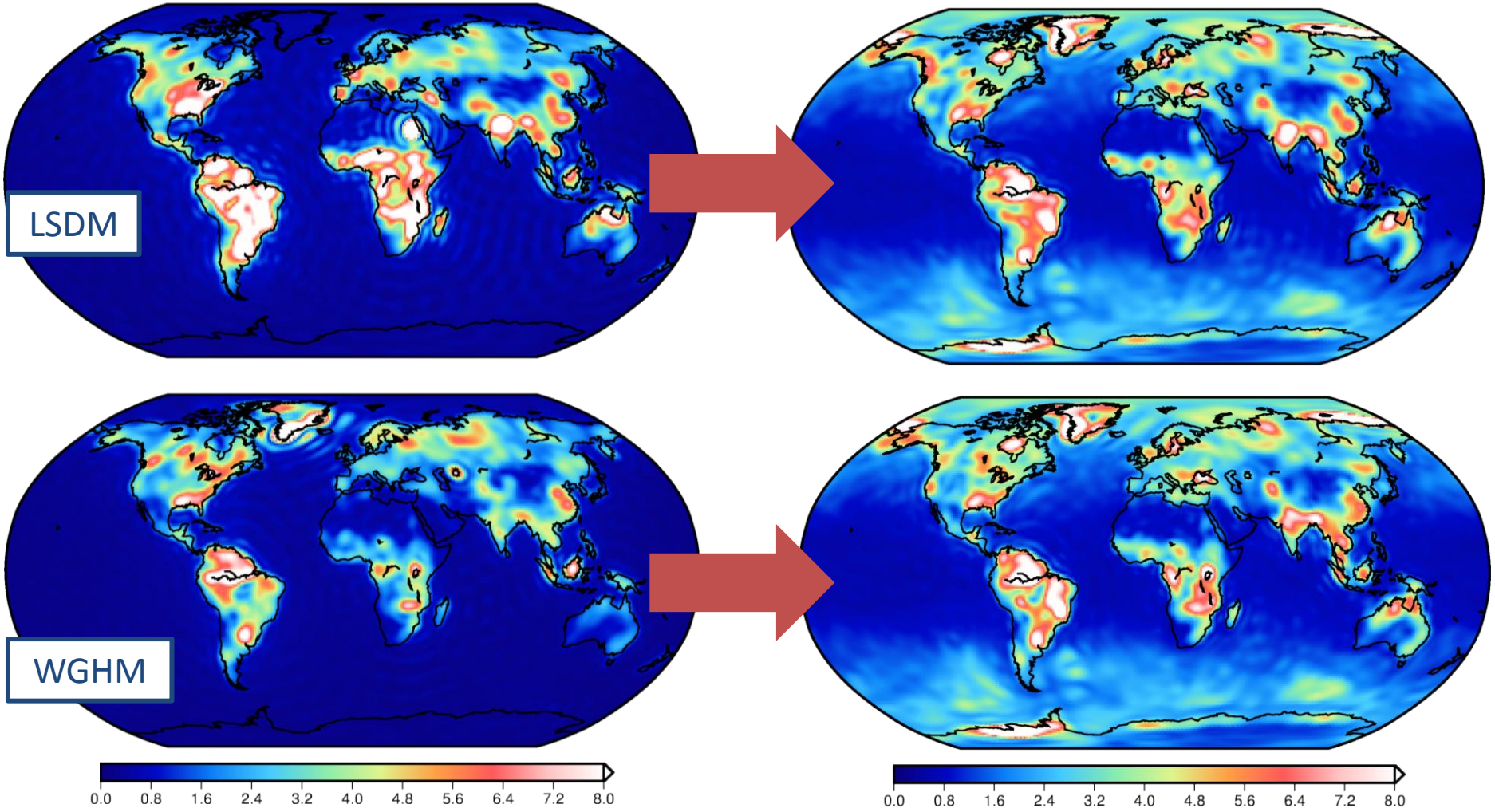
- Setup: two Kalman smoothed time series from 2003-02 to 2008-12
- Process dynamic computed from 1995-01 to 2003-01
  - Identical setup, just swap of hydrological model
  - GRACE_WGHM: process dynamic from ESA ESM AOI + WGHM
  - GRACE_LSDM: process dynamic from ESA ESM AOI + LSDM
- Comparison with monthly GRACE solutions (CSR) and model values

Process Dynamic Comparison



Variability from 1995 to 2003 in EWH [cm]

Process Dynamic Comparison



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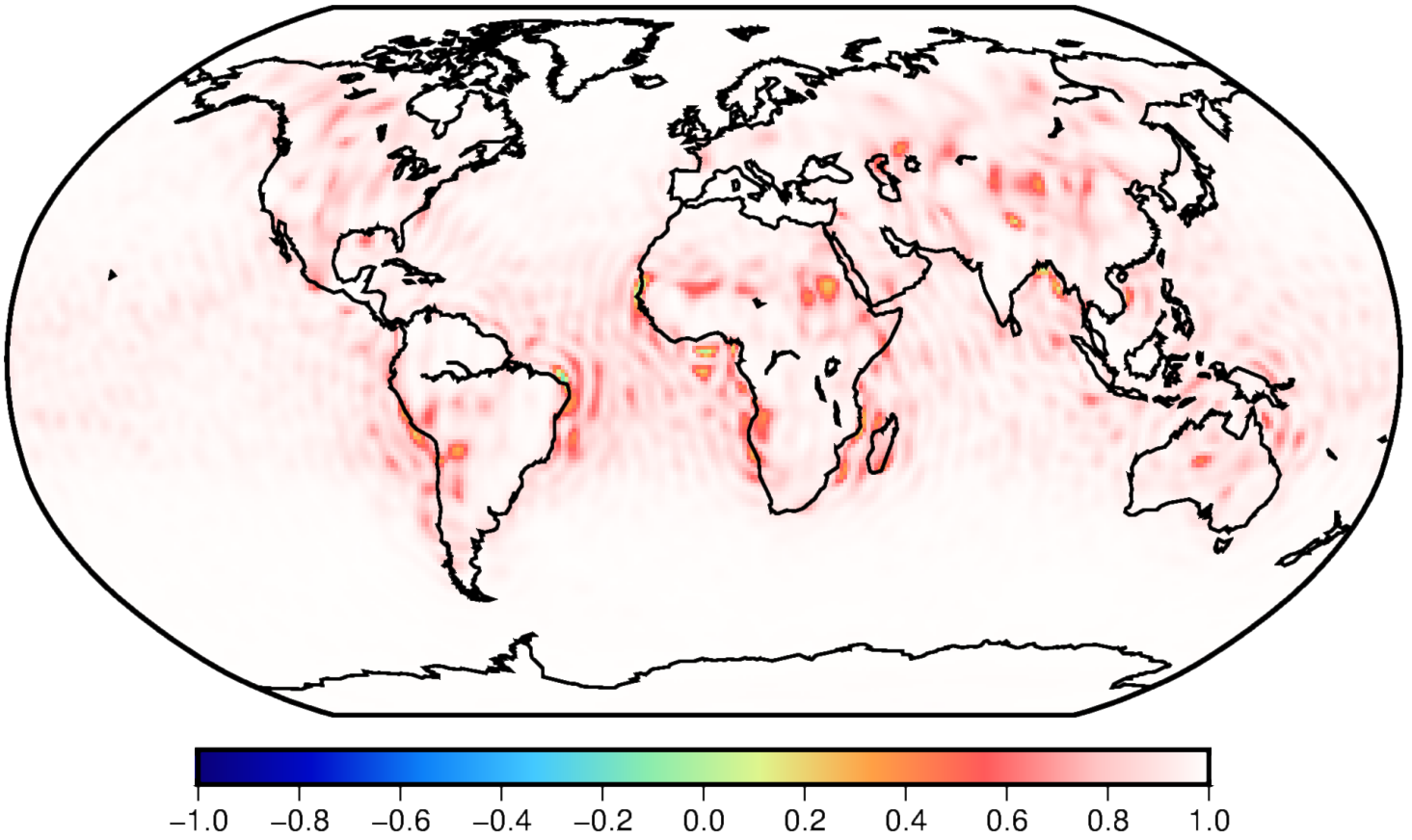
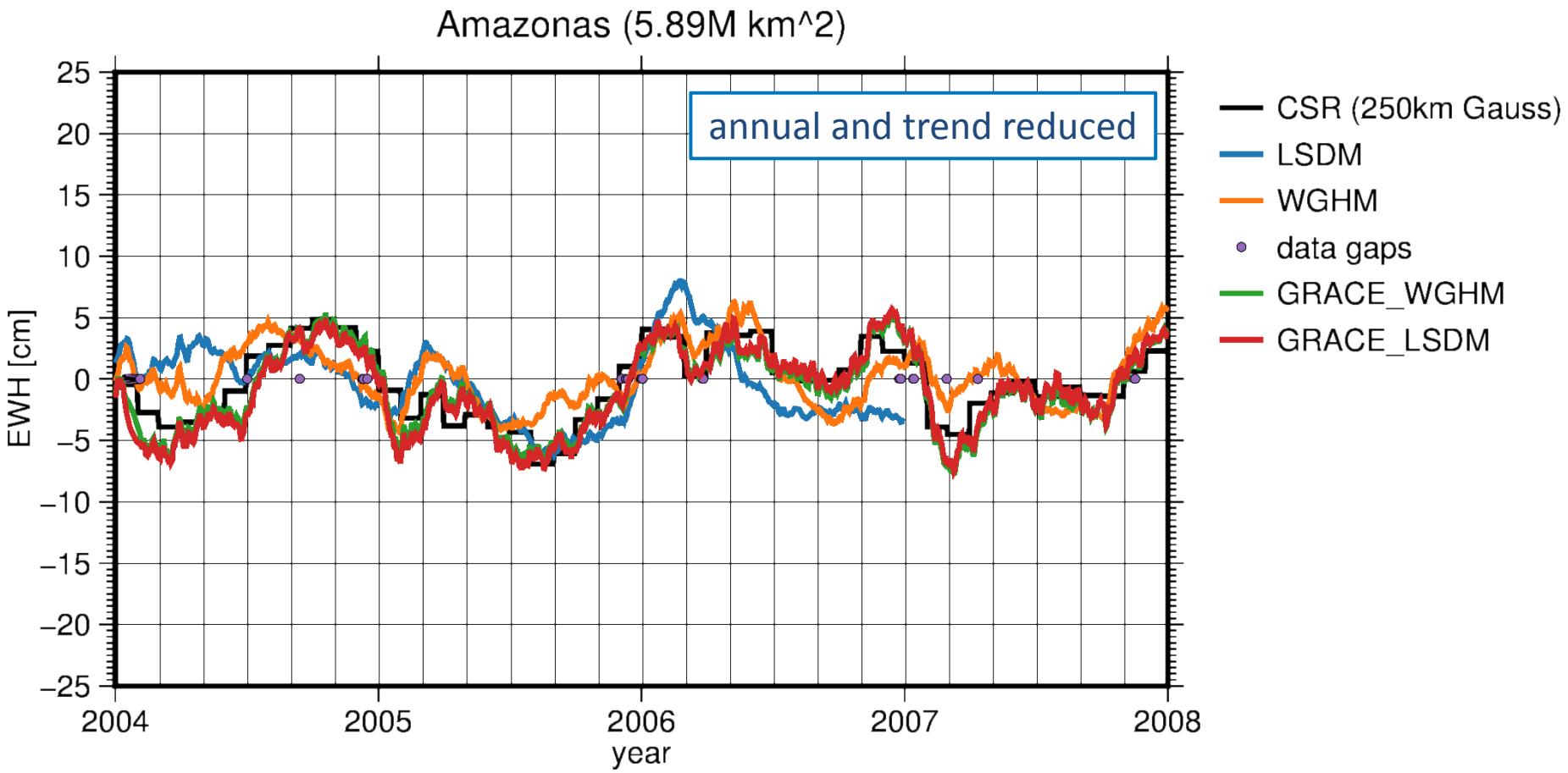


Correlation coefficient between both GRACE time series (2003 to 2008)

Process Dynamic Comparison



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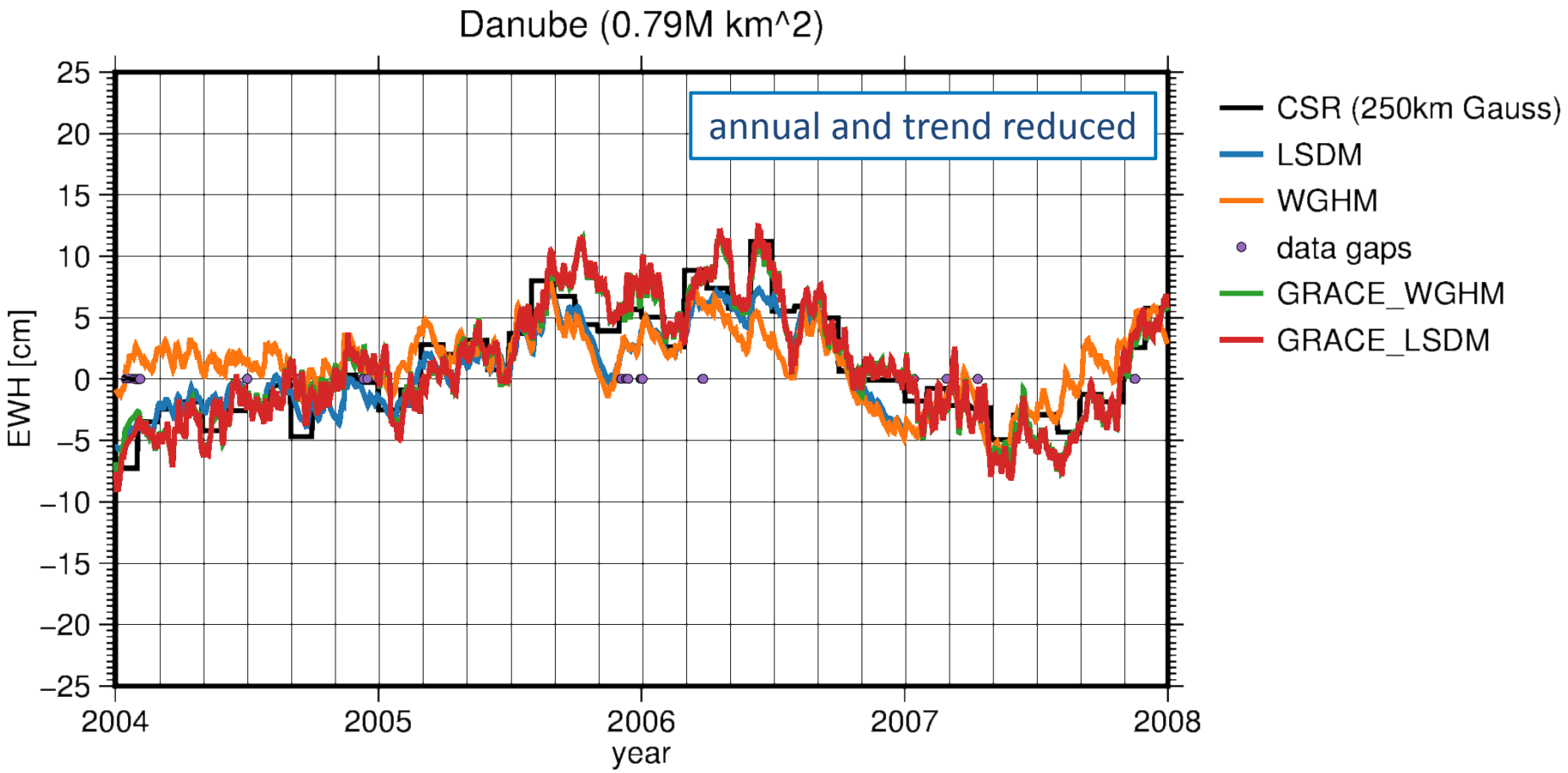

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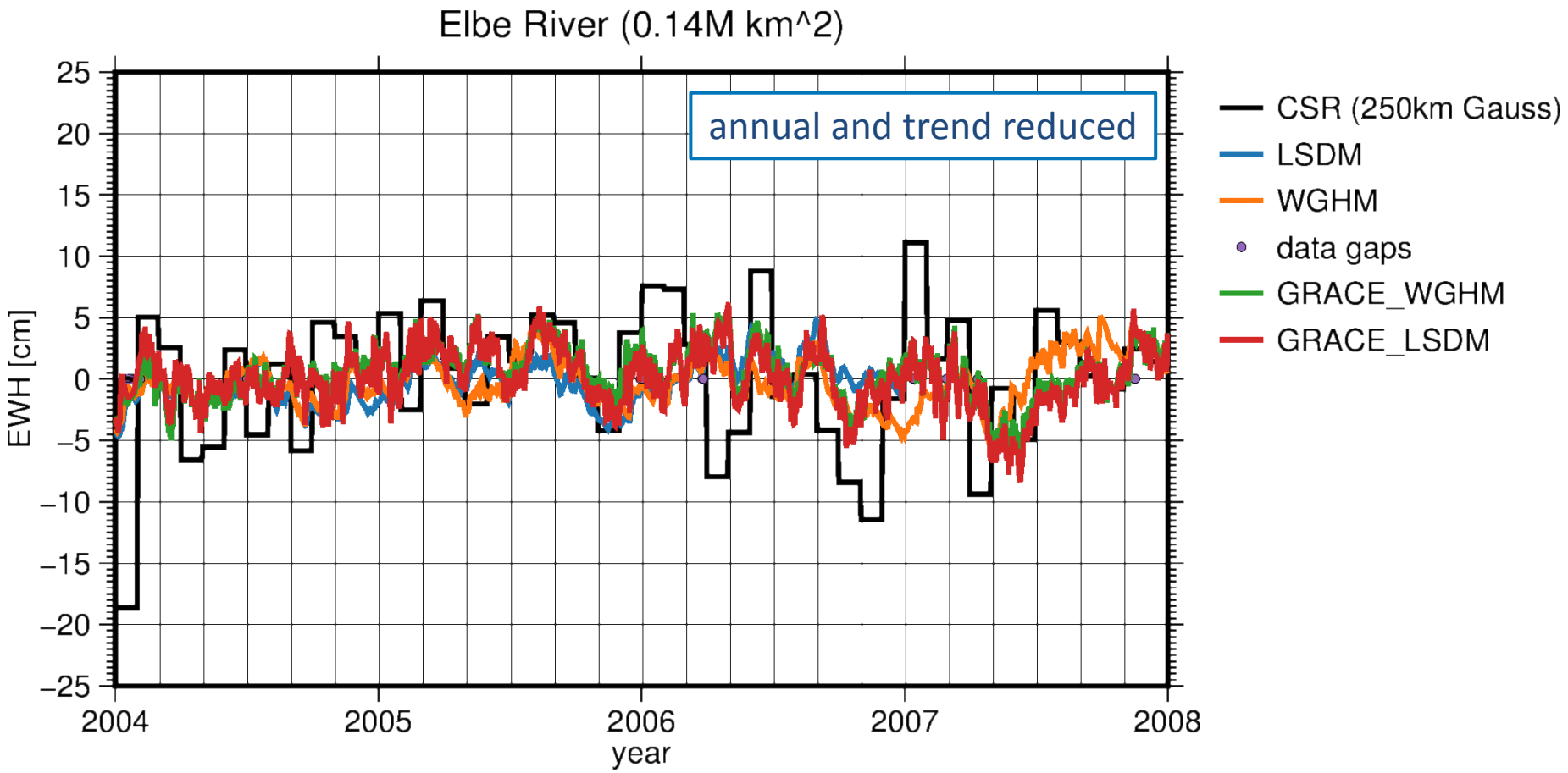

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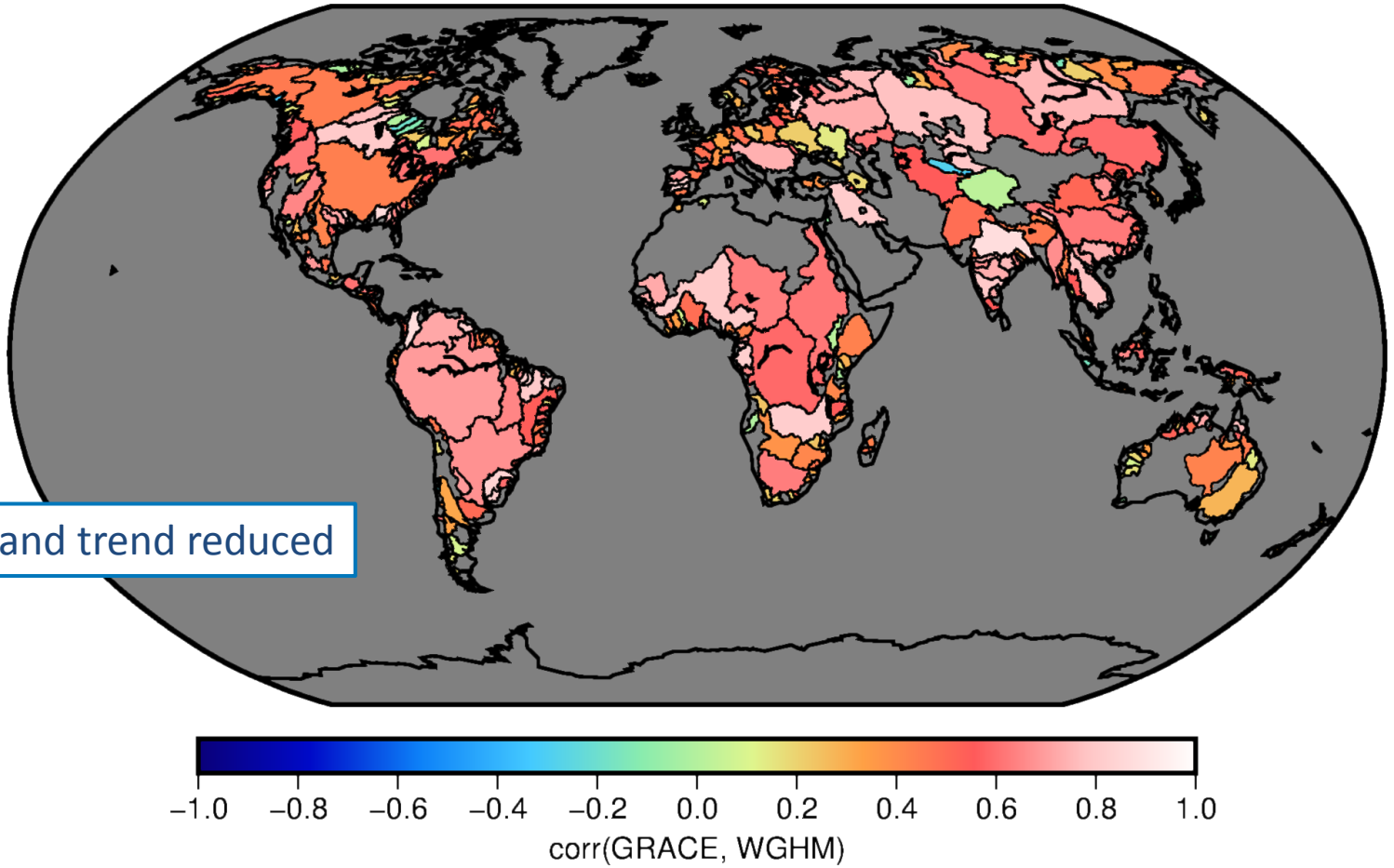


annual and trend reduced

Correlation coefficient of area mean values from 2003 to 2008

Preparations for Service Readiness at TUG

- Continuous run with final data (M13-)

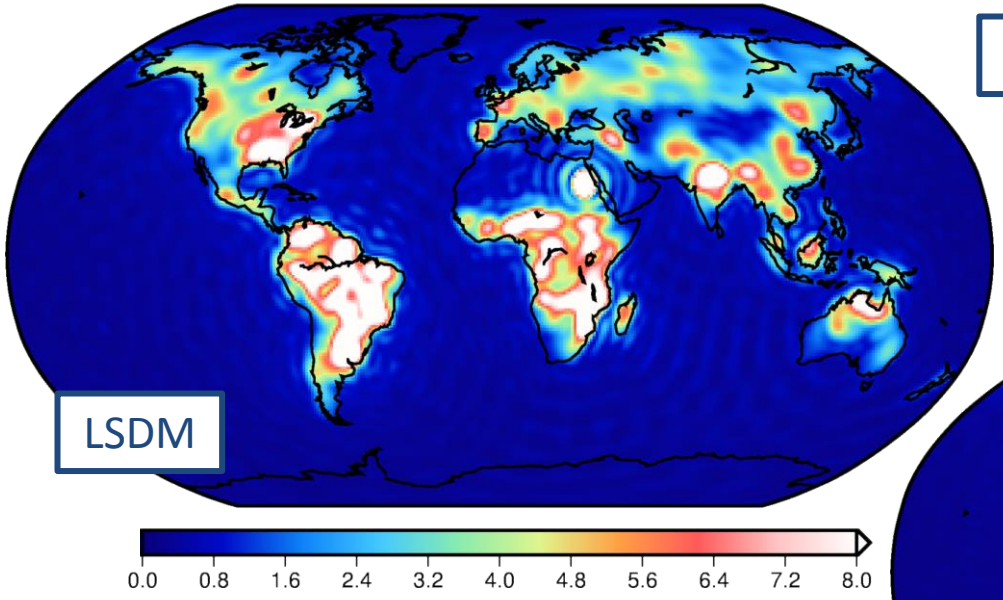
- Migrate software framework from testing to production environment (M17-M18)
  - Software freeze of both automation and processing parts
  - Deployment on production hardware

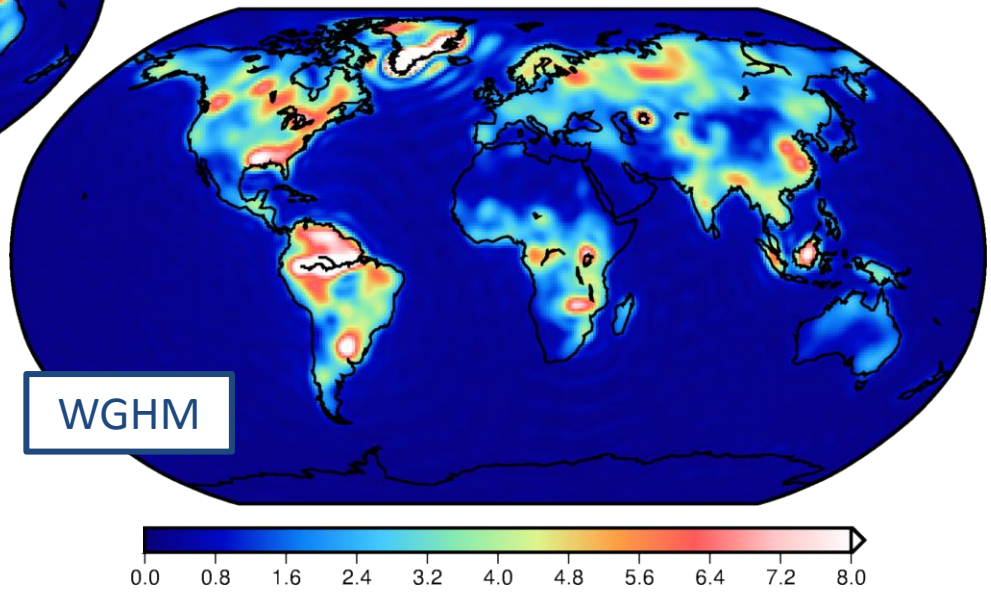
- Generate test data sets (EWH grids and SHC) for T5.5 and T5.6
  - Evaluate NRT L3 processing chain

- Milestone 3 will be reached on time

Process Dynamic Comparison (Backup)

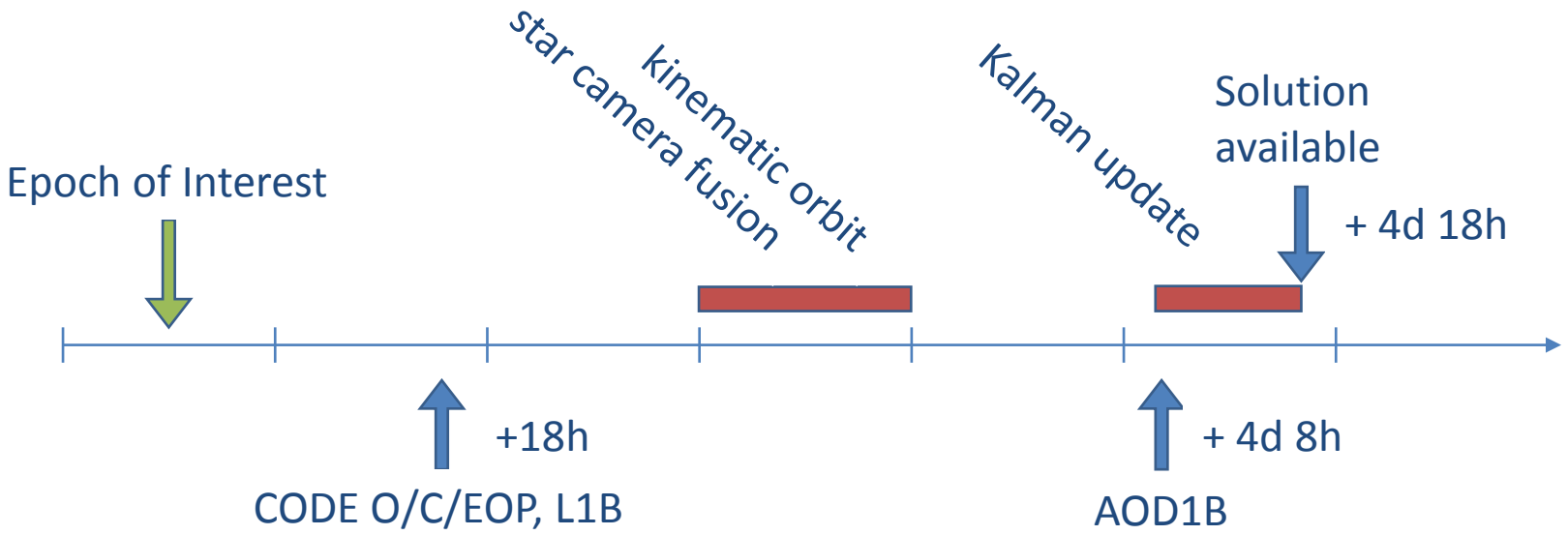
Variability from 1995 to 2003 in EWH [cm]





In General: LSDM has larger amplitudes

Status of NRT – Data Availability



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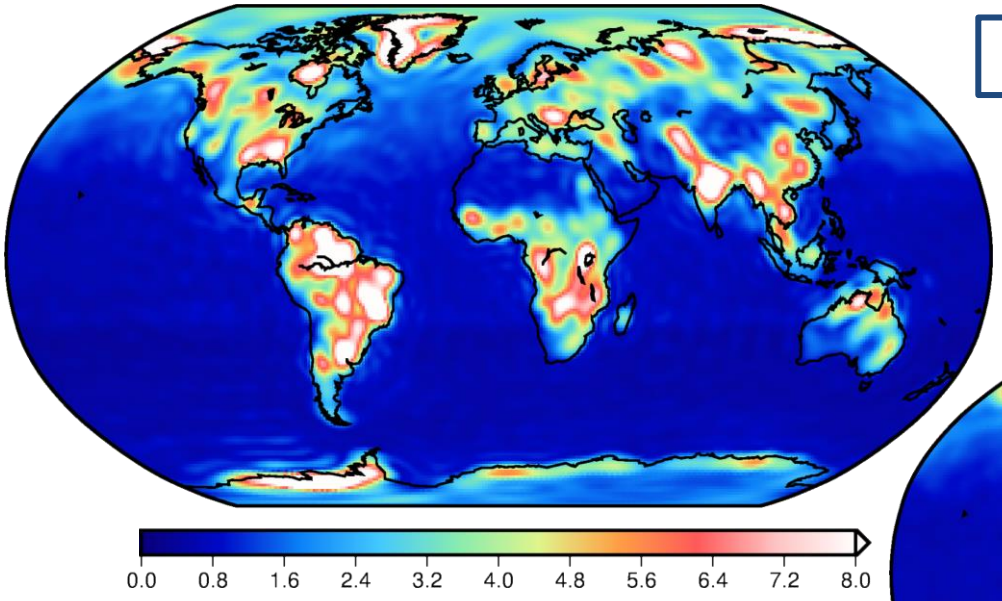
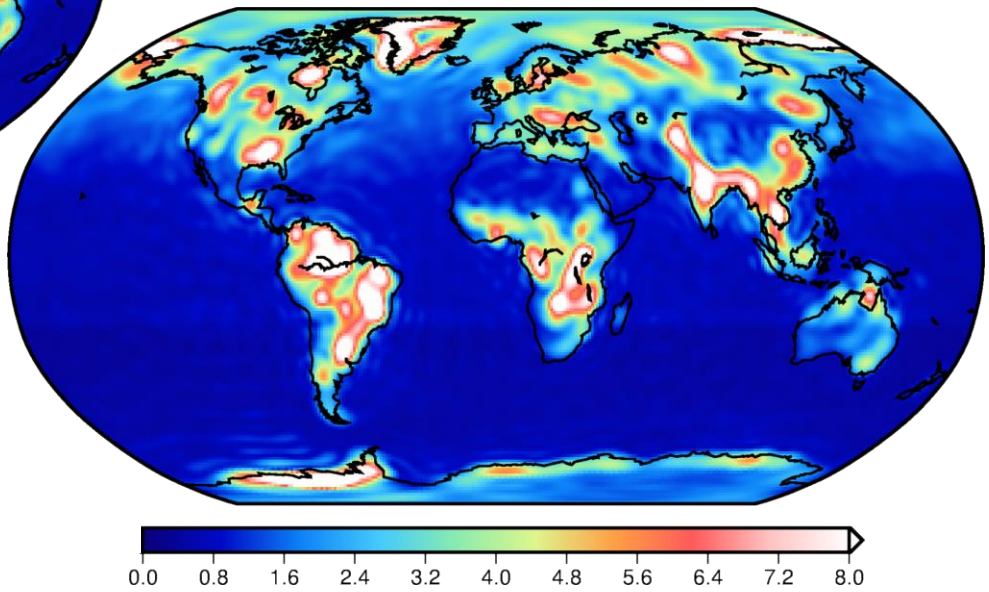


GRACE (LSDM Process Dynamic)



GRACE (WGHM Process Dynamic)