

# GRACE-FO RL06 Level-2 Gravity Fields and Mascon Solutions from CSR: Assessments and Future Plans

Himanshu Save (save@csr.utexas.edu), Srinivas Bettadpur, Peter Nagel, Nadege Pie, Steven Poole, Mark Tamisiea and Zhigui Kang

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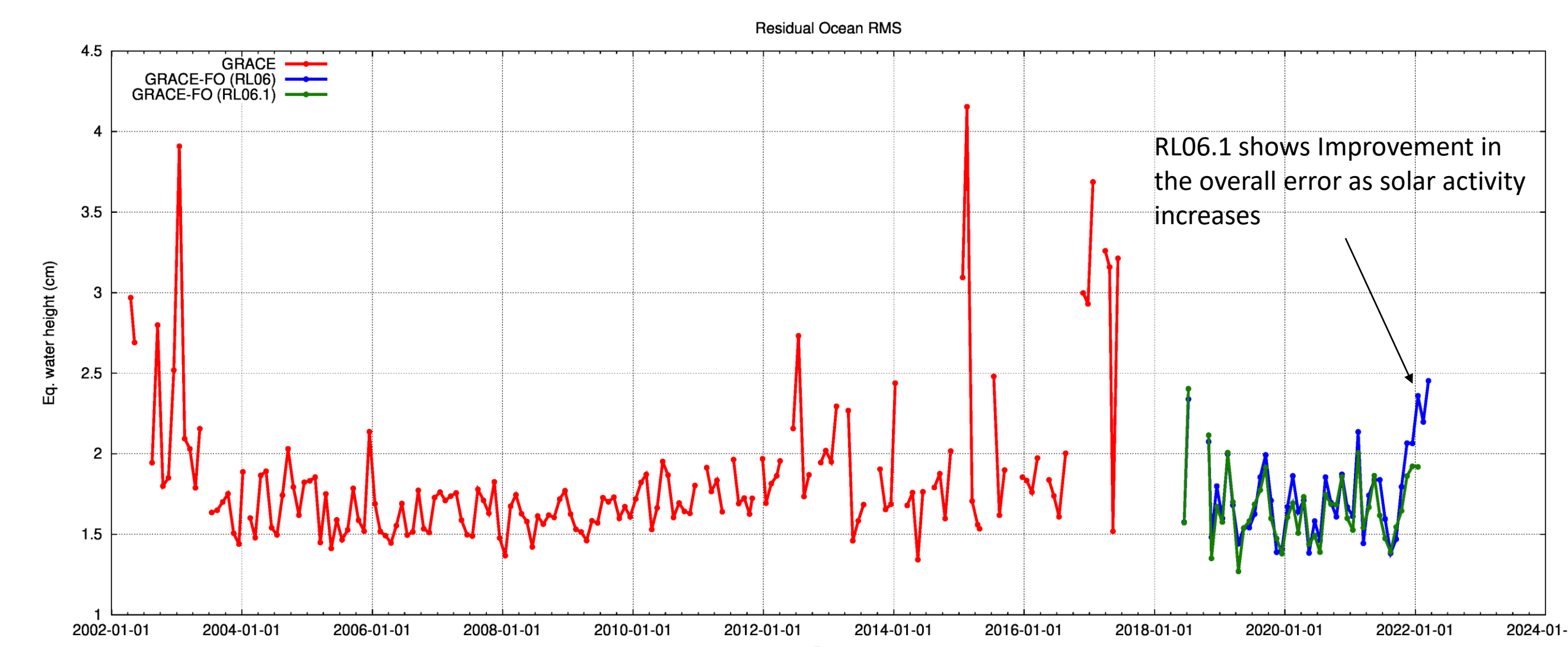
Center for Space Research, The University of Texas at Austin, 3925 W. Braker Lane, Suite 200, Austin, TX 78759, USA

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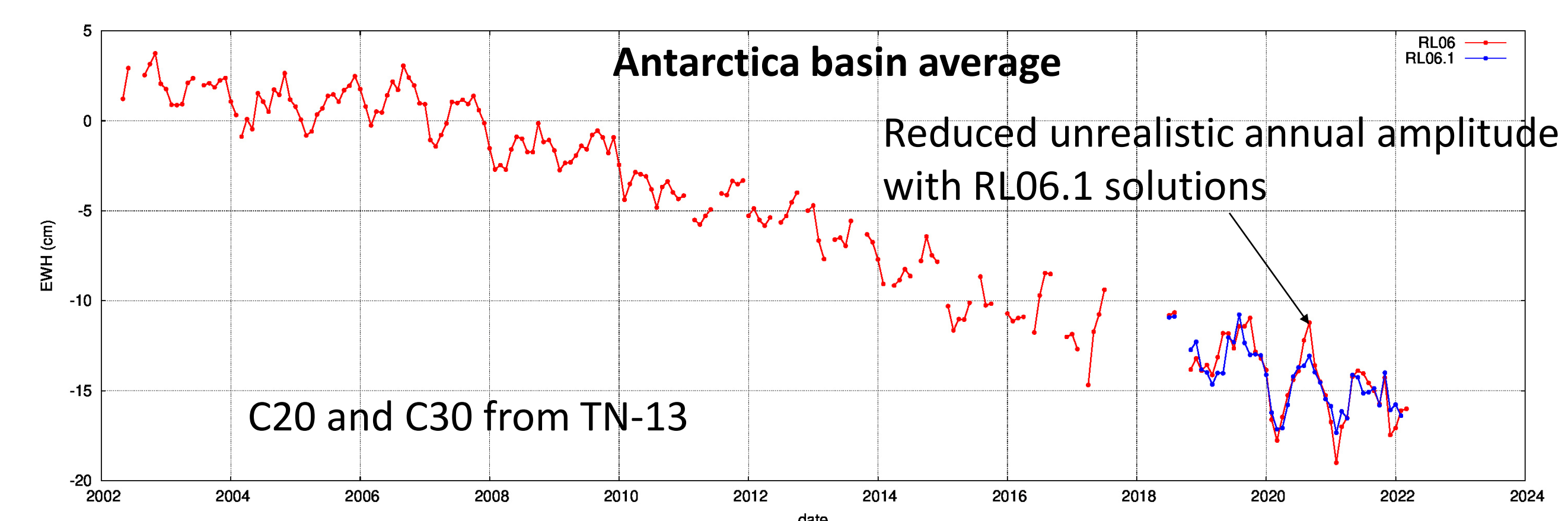
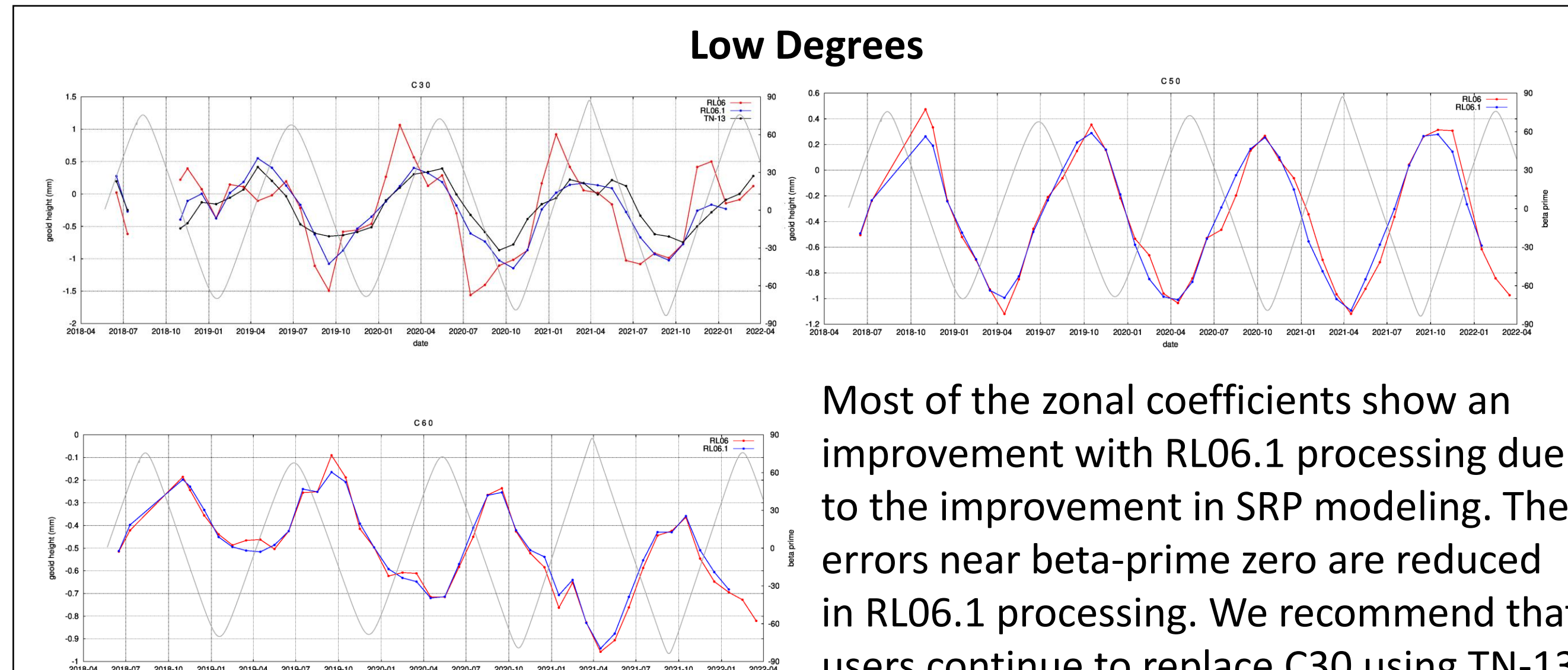
## CSR RL06 Spherical Harmonic Solutions

CSR has released GRACE-FO RL06 solutions up to Mar 2022 and **RL06.1 solutions** up to Jan 2022. GRACE-FO SDS has re-processed (RL06.1) the mission data with improved GF2 accelerometer data

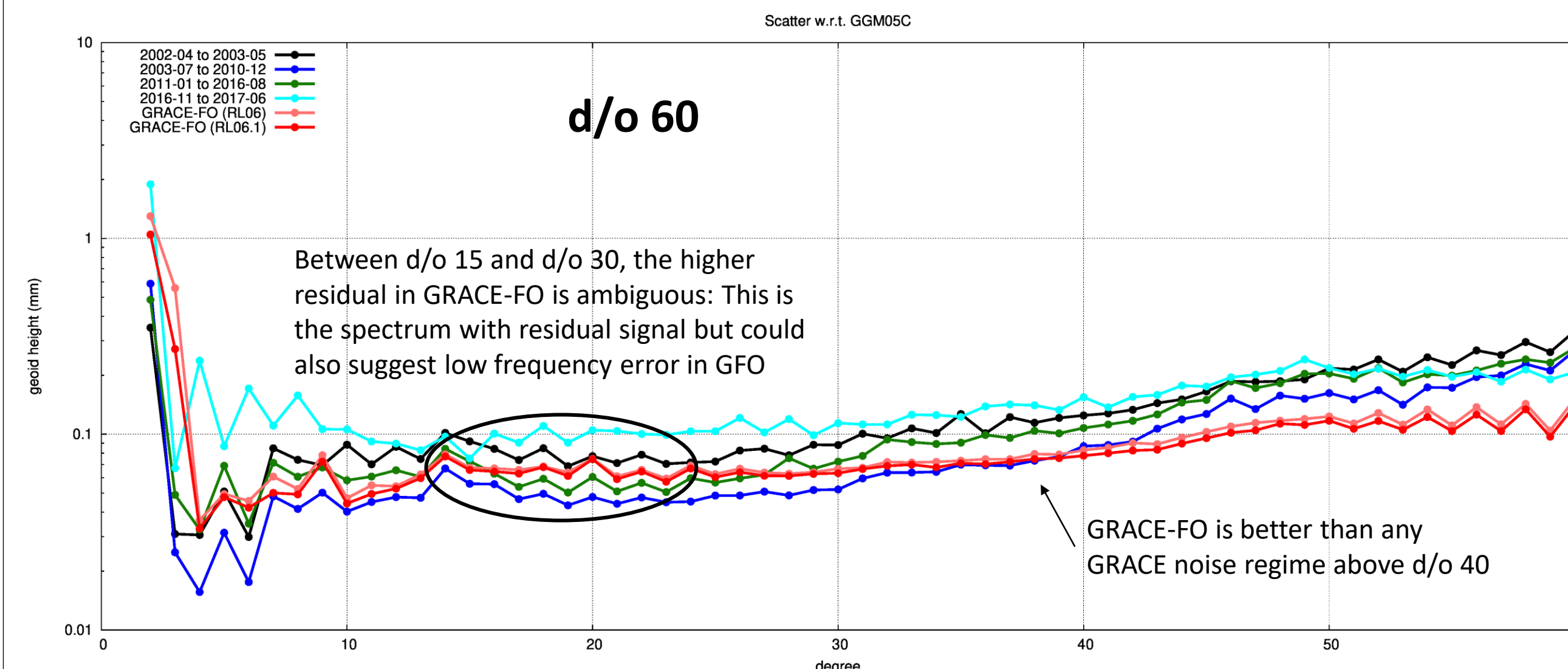
- RL06.1 processing uses newly released ACX (accelerometer) dataset
- ACX includes information from the defective GF2 accelerometer that improves transplanted acc data
- Improves the differential SRP, drag and any residual thruster leak signals in the ACC transplant data



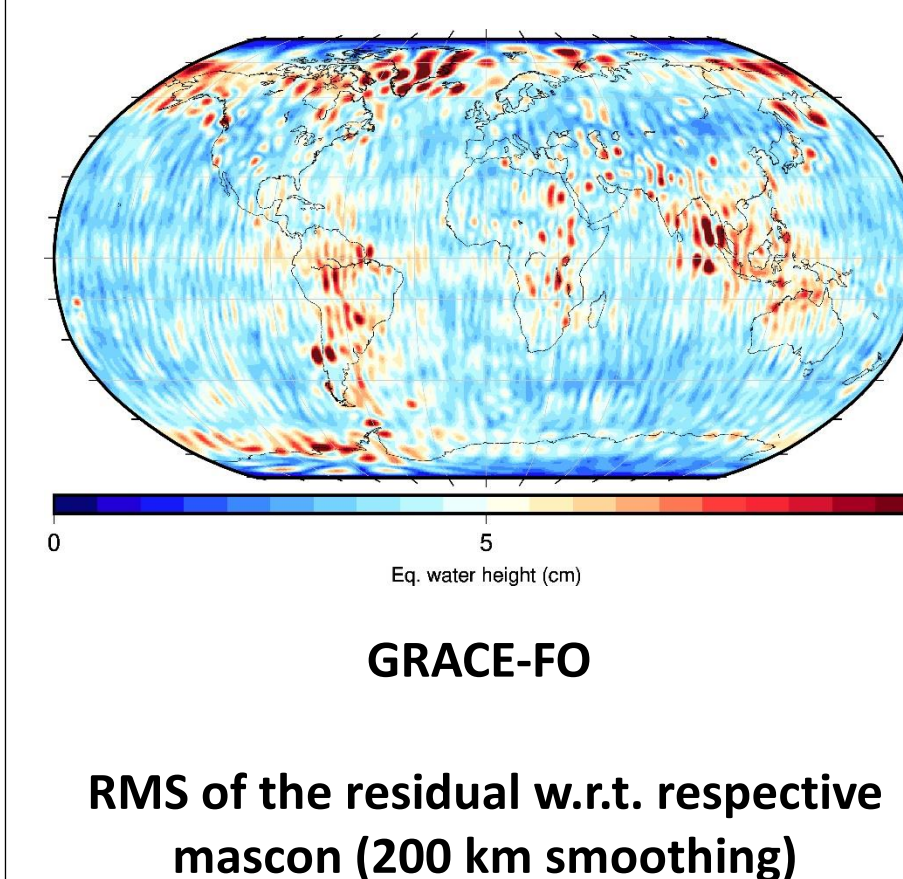
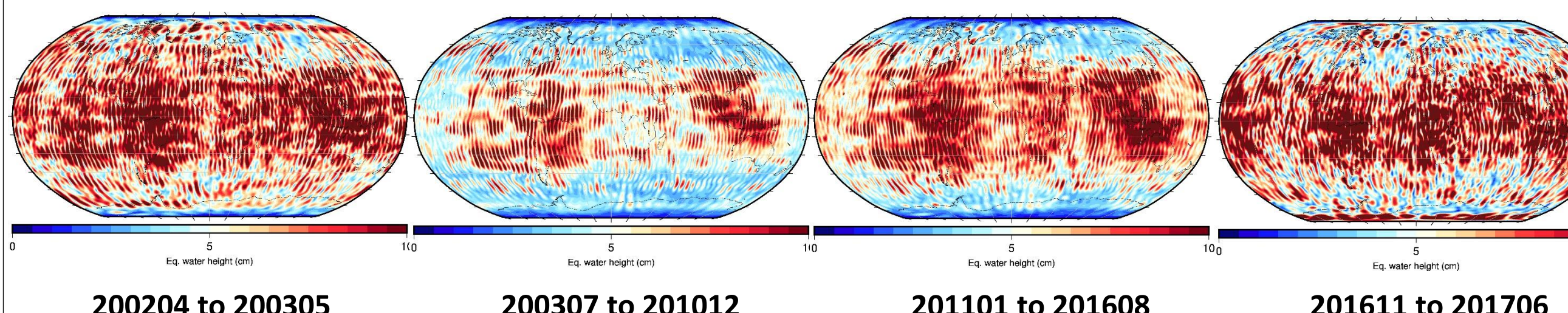
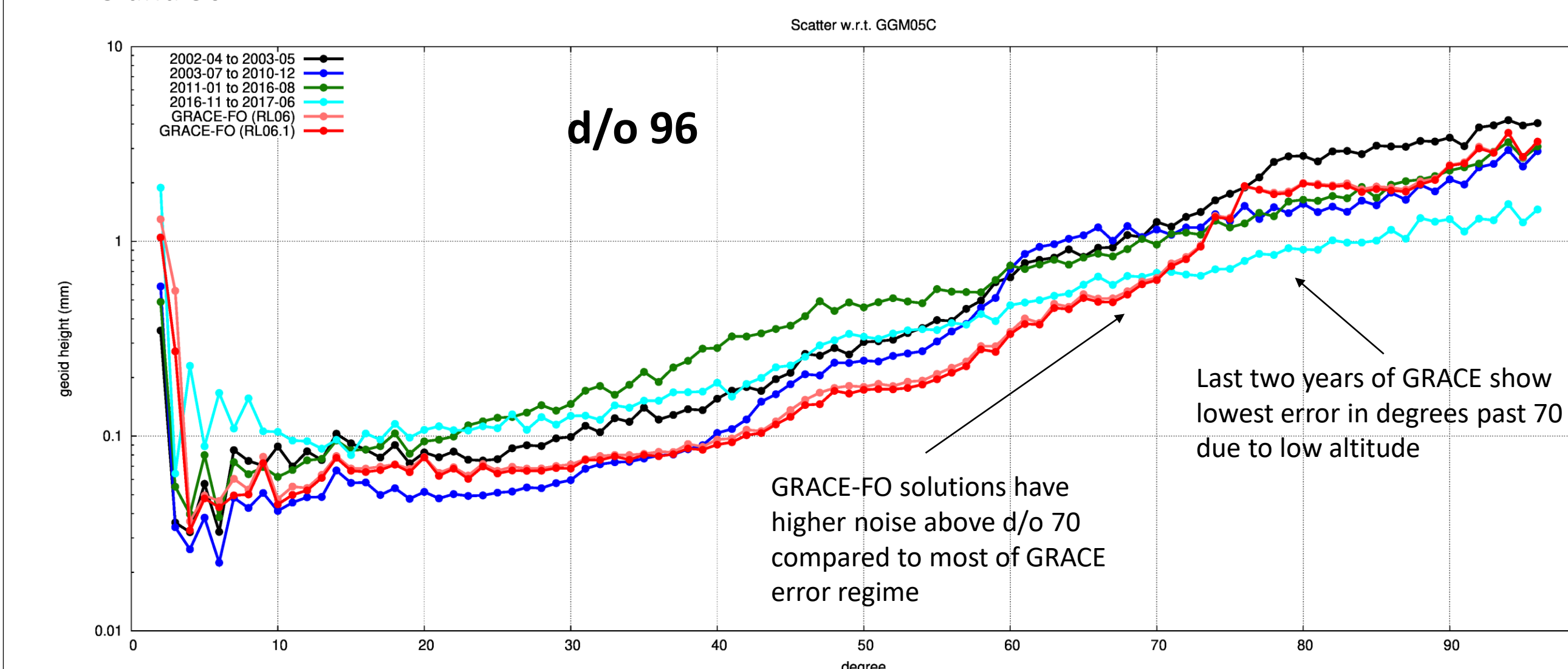
Residuals of d/o 60 SH w.r.t 12 parameter fit gives the upper bound of the error in the SH solutions. Plot of RMS of the SH error over the ocean shows that the RL06.1 processing reduces the error over the ocean compared to increasing error in RL06 due to increasing solar activity.



**Degree Variance of the error: DDV of the residual of SH w.r.t. mascon solutions. SH error as a scatter for each GRACE error regime and comparing it with scatter for GRACE-FO.**



- GRACE-FO d/o 60 fields have smaller errors at degrees greater than 40 as compared to GRACE
- GRACE-FO also sees higher errors in mid-degrees as compared to most of the GRACE regime – between 15 and 30



Four different error regimes for GRACE identified

RMS of the residual w.r.t. respective mascon solutions is an estimate of upper bound of the error in the CSR RL06 GSM d/o 60

**@200 km** smoothing, the GRACE-FO solutions has lower total noise as compared to 2004-2010 and significantly lower than 2011-2016 GRACE solutions

## CSR RL06 Mascons V2

The CSR GRACE and GRACE-FO RL06 mascon solutions are available for download at <http://www.csr.utexas.edu/grace/>

Quarter degree NetCDF files

- Corrected (degree 1, C20, C30, GIA, GAD etc) mascon grids in NetCDF format

- Separate component NetCDF files (C20, C30, GIA, GAD, Degree 1) to “undo” corrections are provided

- Land/Ocean mask

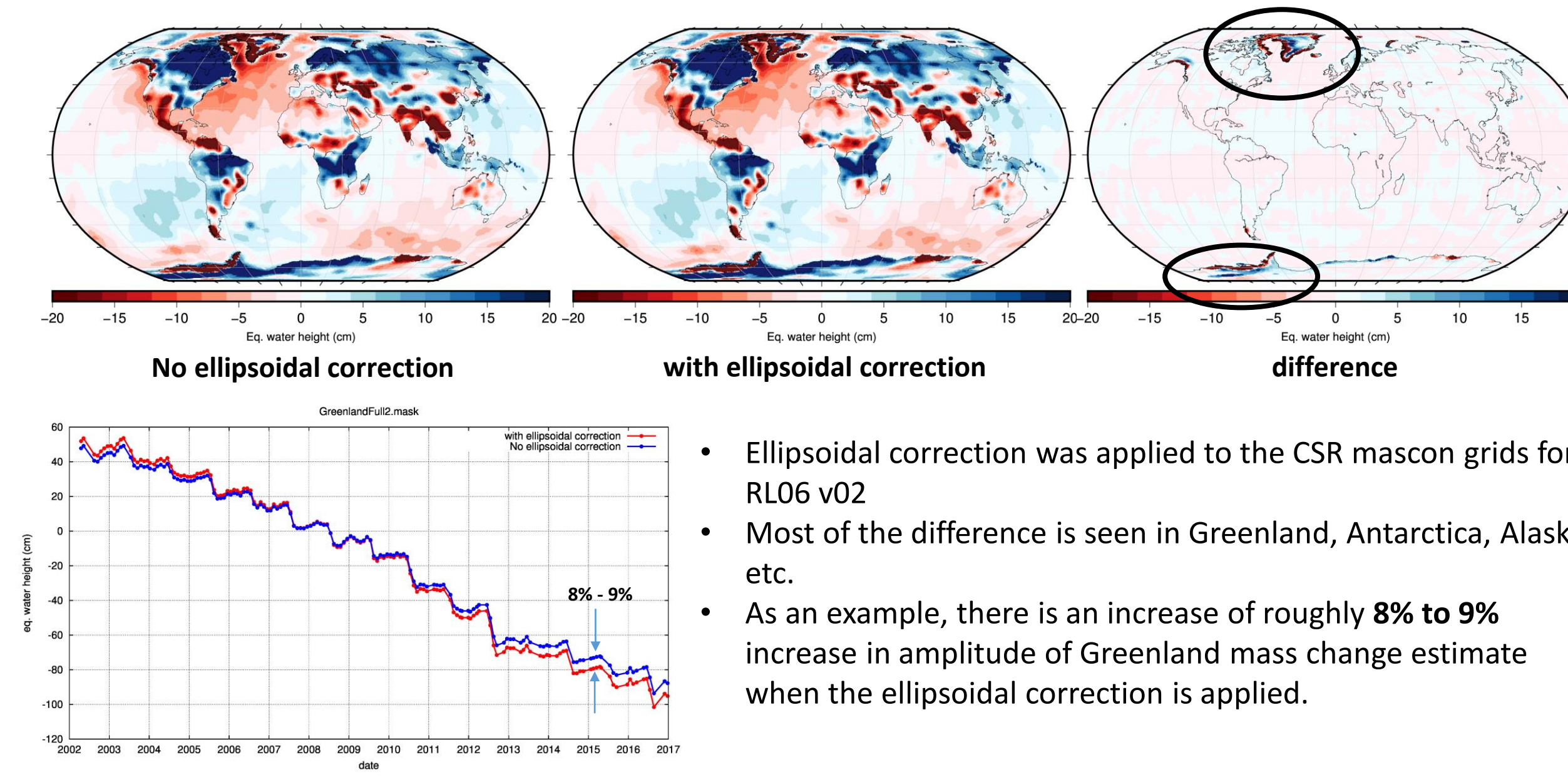
Each hexagon mascon partly over land and ocean is split estimated independently

**Resolution is still roughly 250 – 300 km** depending on the latitude

[GSU] **Spherical harmonic representation of the mascon solutions in GSM format** (RL06\_GSM – GGM05C). Provided at d/o 720 only to represent sharp discontinuities along the coast

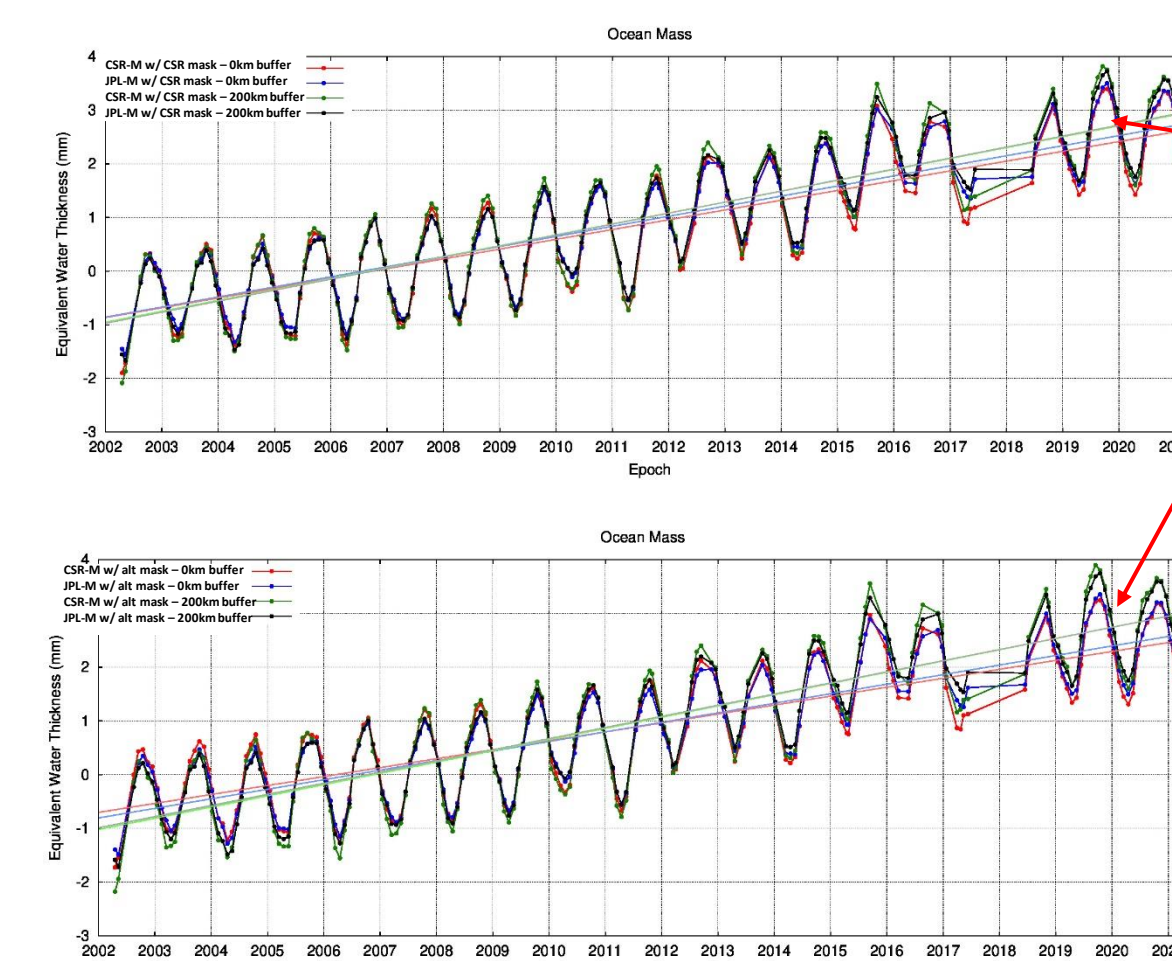
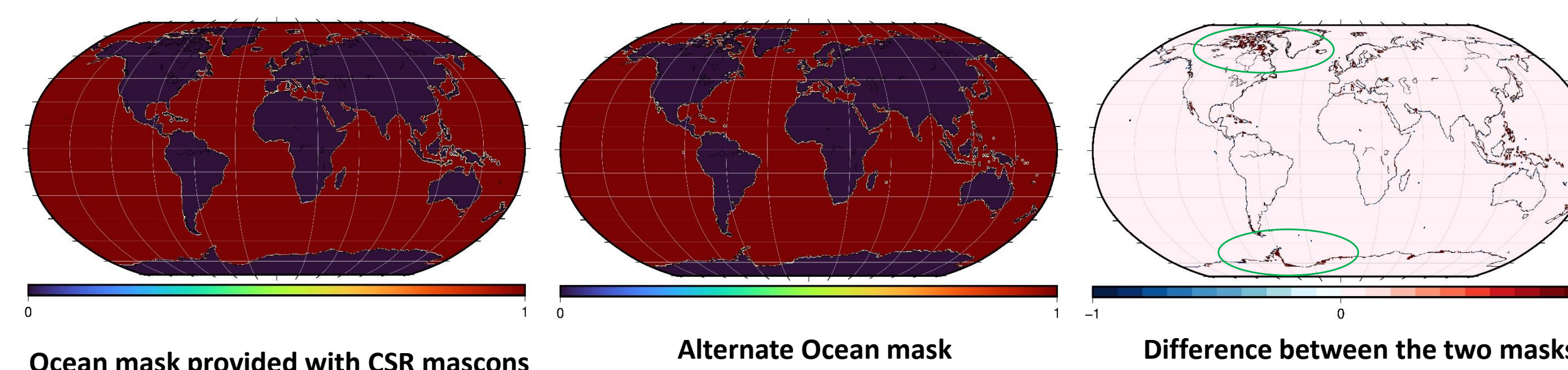
**Ellipsoidal correction was applied to the mascon grids for RL06v2**

### Ellipsoidal Correction



- Ellipsoidal correction was applied to the CSR mascon grids for RL06 v02
- Most of the difference is seen in Greenland, Antarctica, Alaska, etc.
- As an example, there is an increase of roughly **8% to 9%** increase in amplitude of Greenland mass change estimate when the ellipsoidal correction is applied.

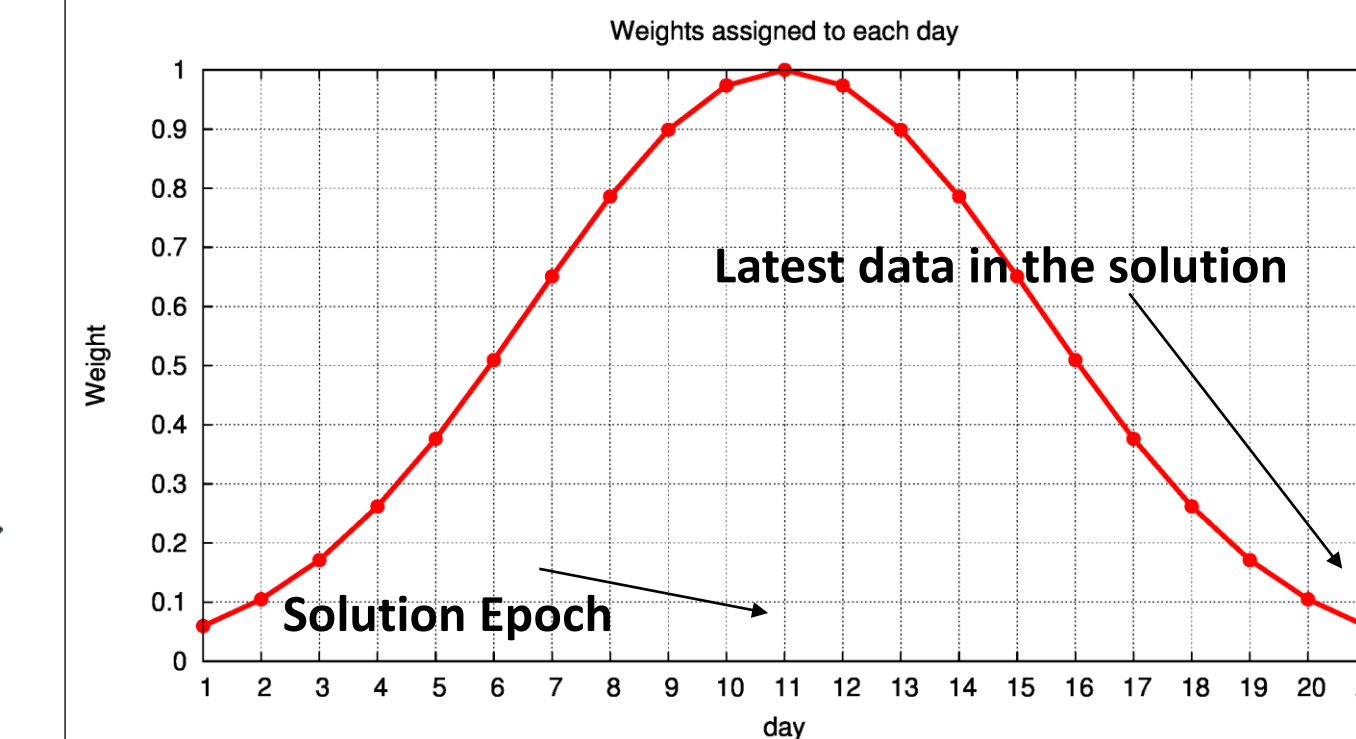
### Using the correct ocean mask



- Used two different ocean mask for this test
- Slight difference between the two masks near Greenland and Antarctica coast.
- The two masks give same results if we use 200km buffer
- The two masks give different results for ocean mass trend if we integrate all the way to the coastline.
- It is critical to use the land/ocean mask provided along with corresponding center mascon solutions for all basin average computation.

## Experimental products at CSR

### QL and Regularized sliding window mascons (RSWM)



- 21 – day sliding window solution
- Two flavors (QL and definitive RSWM)
- Quicklook (QL) – automated
- QL gravity field solutions can be made available at a latency of up to 3 days
- RL06 definitive 21-day sliding window solutions (RSWM) for whole GRACE/GRACE-FO period
- SLR C20 and C30 replacement and geocenter for QL is being developed for correct scientific interpretation

### Weekly sliding window solutions

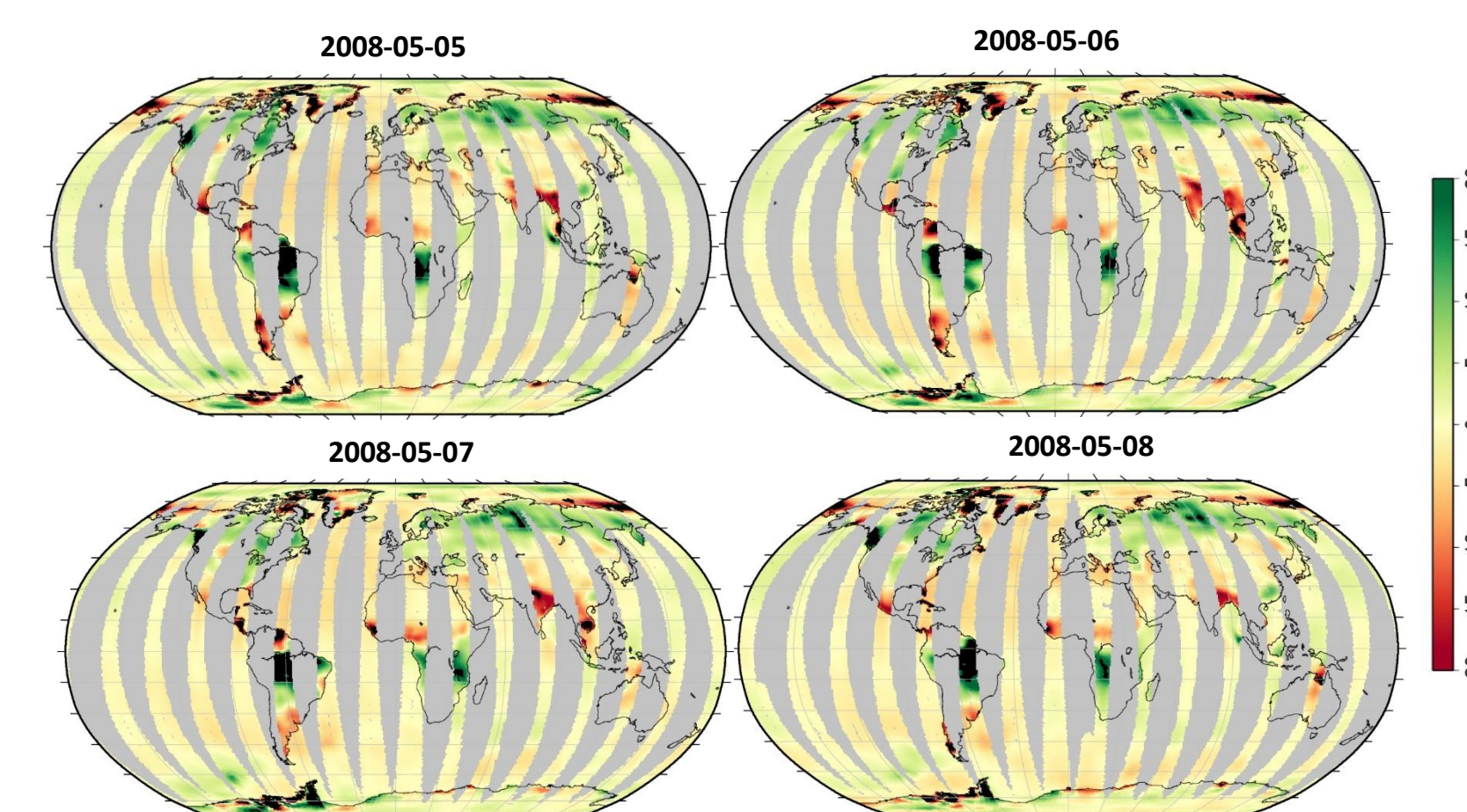
- 28 – day solutions are prepared for L1 data QA/QC.
- Solutions span slides by one week at a time
- Comparable to monthly field solution quality

### 5-day mascon solutions

- Mascon solutions that only use 5 days of data have been developed
- Produced every 5 days
- Developed for many applications, especially for early flood detection studies and applications
- Could be implemented in QL to provide quicker access to 5-day mass anomaly fields at a latency of 2-3 days.

### Daily Swath solutions

- Estimate gravity field for the “daily swath” of observed ground track
- RL06 data processing in progress.
- Allows for daily assimilation of GRACE data for hydrology and ocean models



### GRACE-FO mascon solutions based on range acceleration

- Range-acceleration SH solutions are consistently better than the corresponding range-rate solutions
- Range acceleration mascons do not exhibit N-S striping as you free up the regularization
- The errors in these solutions are more localized as compared to range-rate solutions
- Mascon solutions are less dependent on the exact patterns of constraints applied to the mascons.

