Large scale time variability from high-low SST - filling the gap between GRACE and GFO

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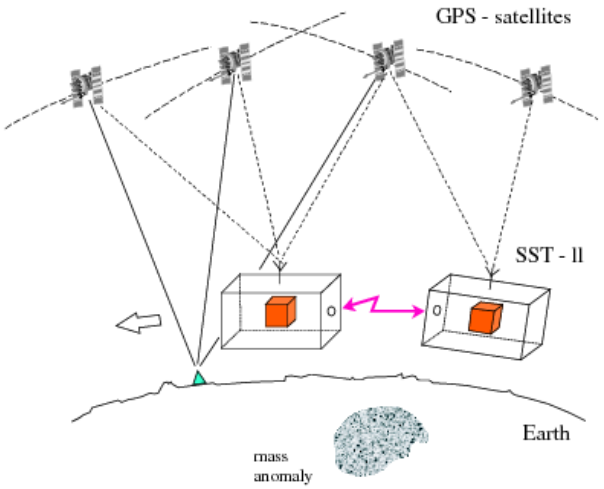
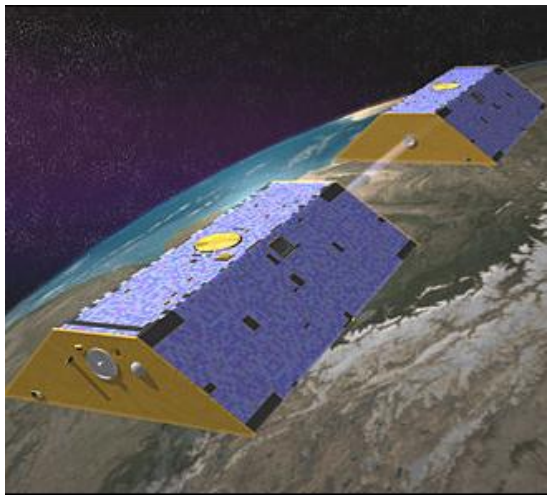
GRACE und GRACE Follow-On (GFO)

Low-low





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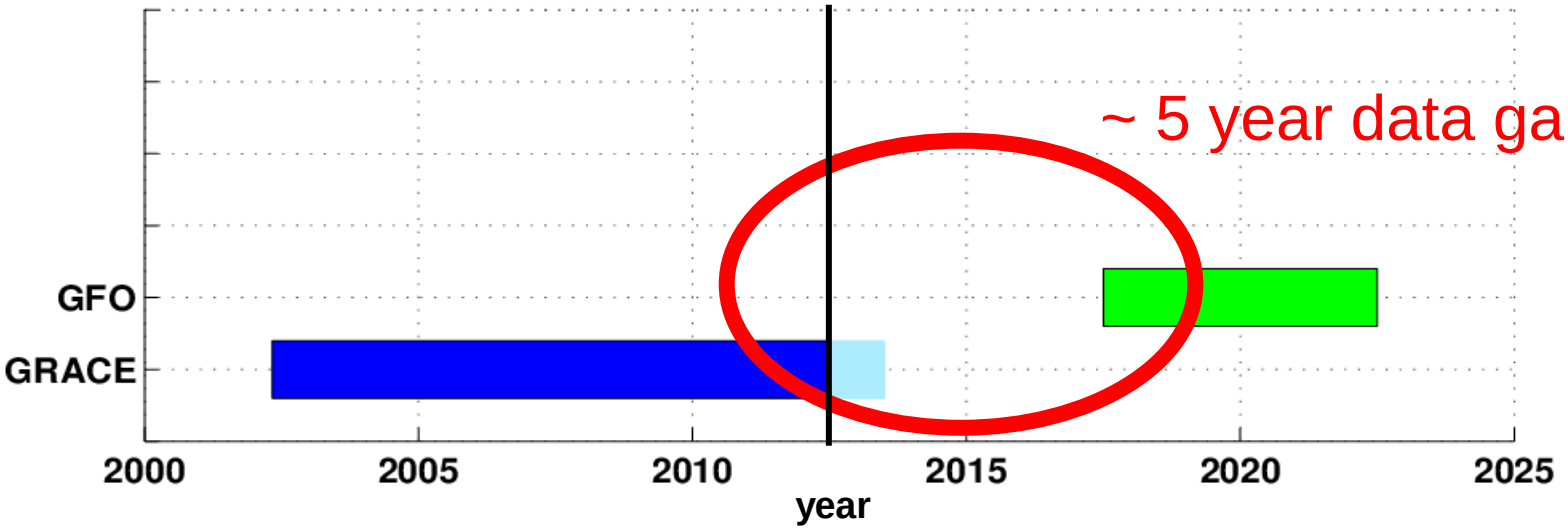
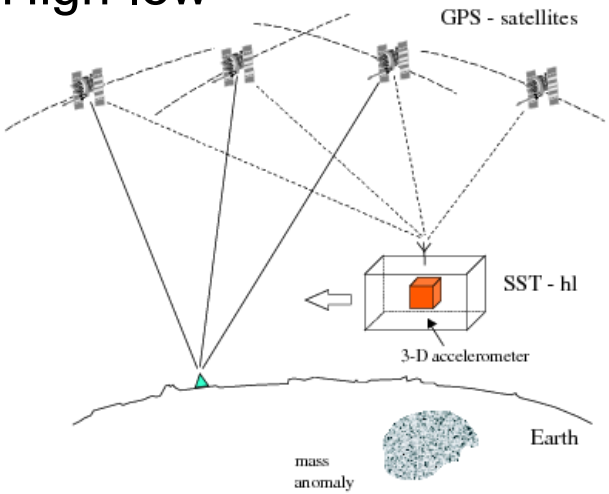
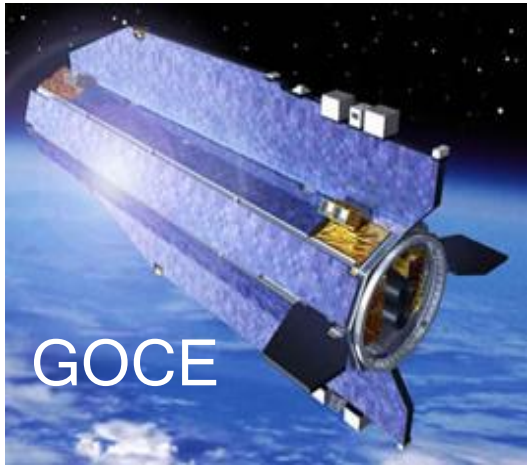
- K-Band (Laser)
- GPS
- Accelerometer



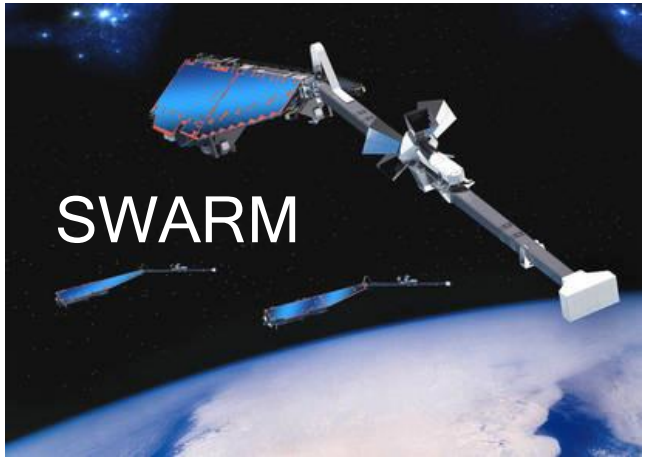
Other gravity field missions

High-low





© ESA



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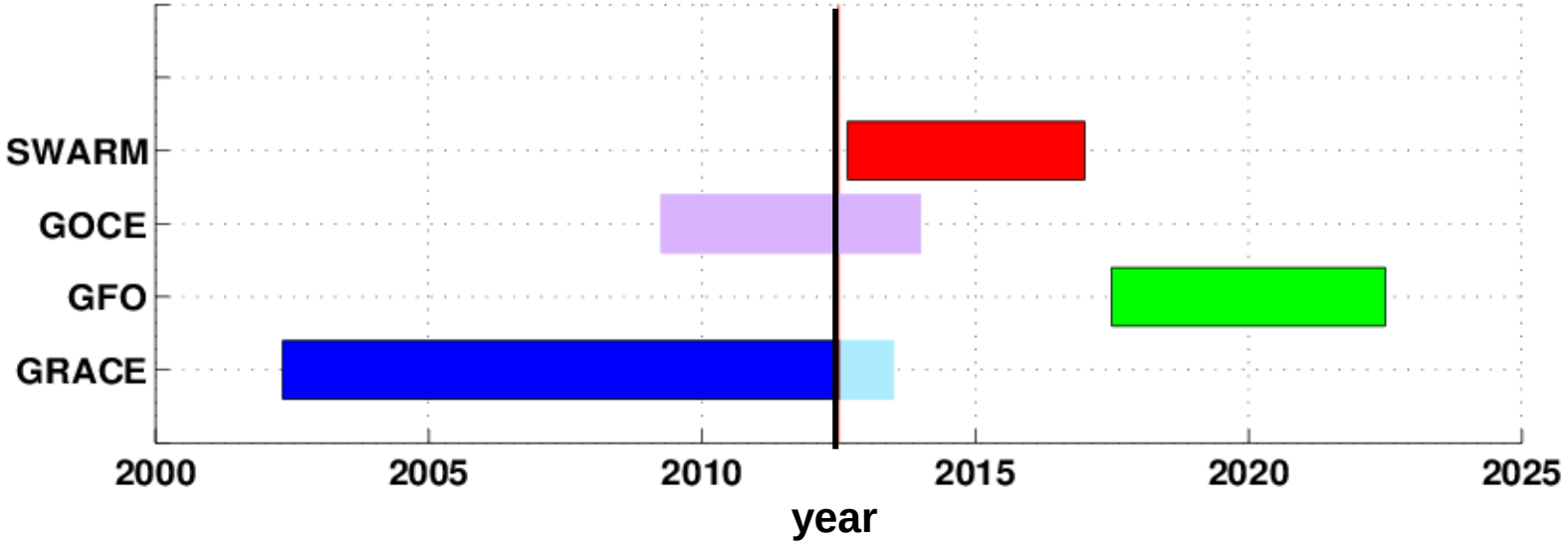
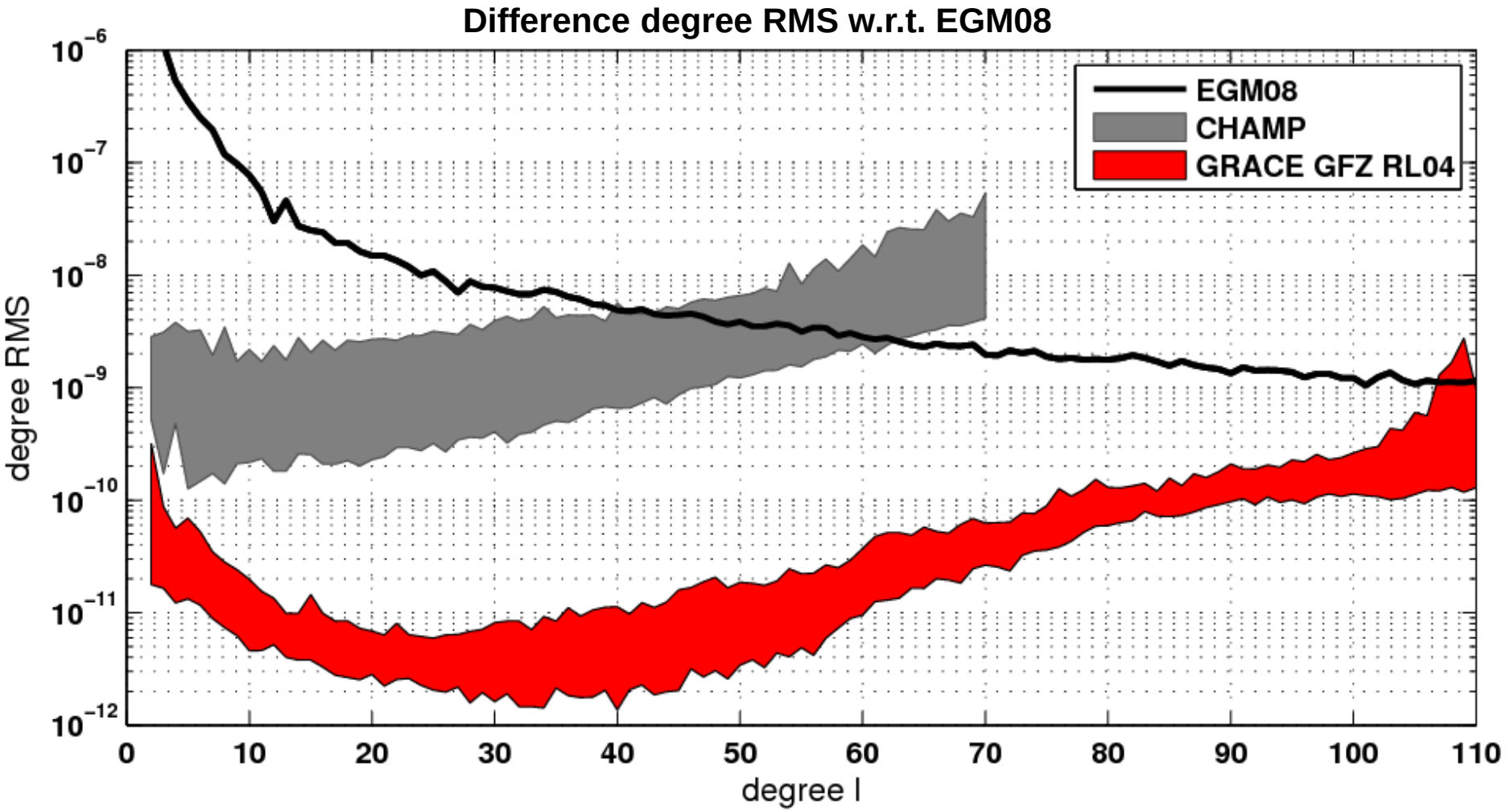


Previous CHAMP studies

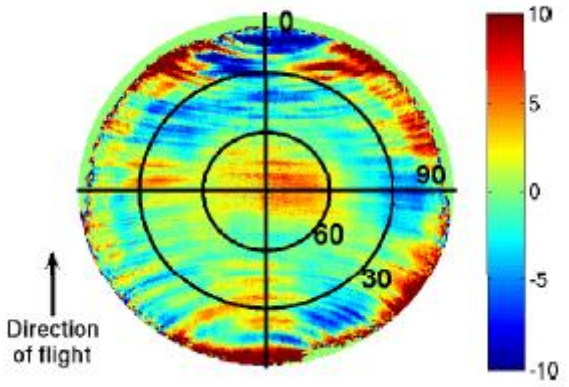


CHAMP REPROCESSING

Data reprocessing

GPS positions:

- 10 s sampling
- empirical absolute antenna phase center model
- …



Prange 2010

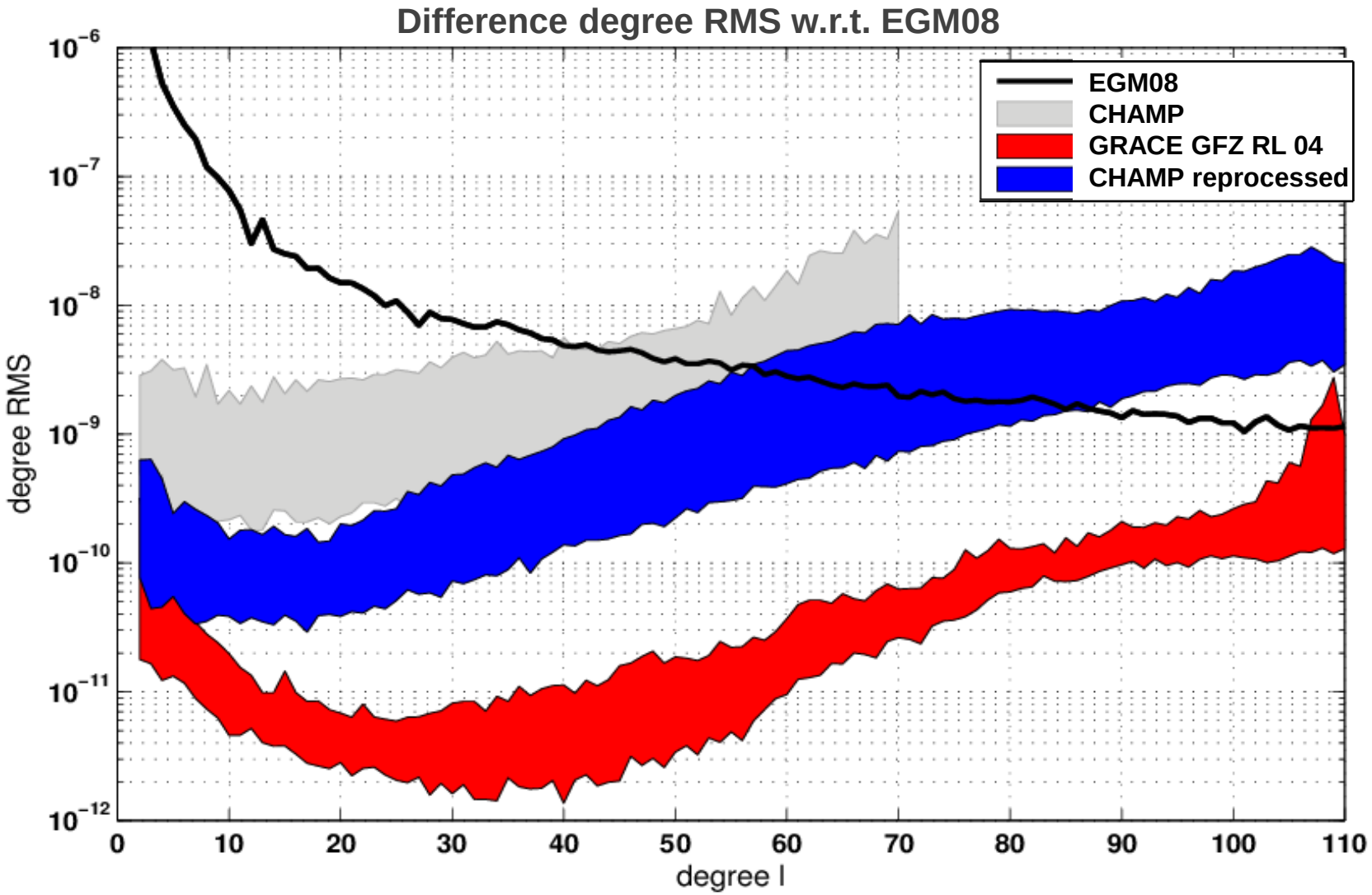
Approach:

- acceleration approach
- no accelerometer data used
- no regularization and no *a priori* model / information

Background models:

- JPL ephemeris DE405
- Solid Earth tides & solid Earth pole tides (IERS conventions)
- Ocean tides (FES 2004)
- Ocean pole tides (IERS conventions, Desai 2002)
- Atmospheric tides (N1-model, Biancale and Bode 2006)
- Relativistic corrections (IERS conventions)
- AOD1B-product (Flechtner 2008)

CHAMP monthly gravity field solutions



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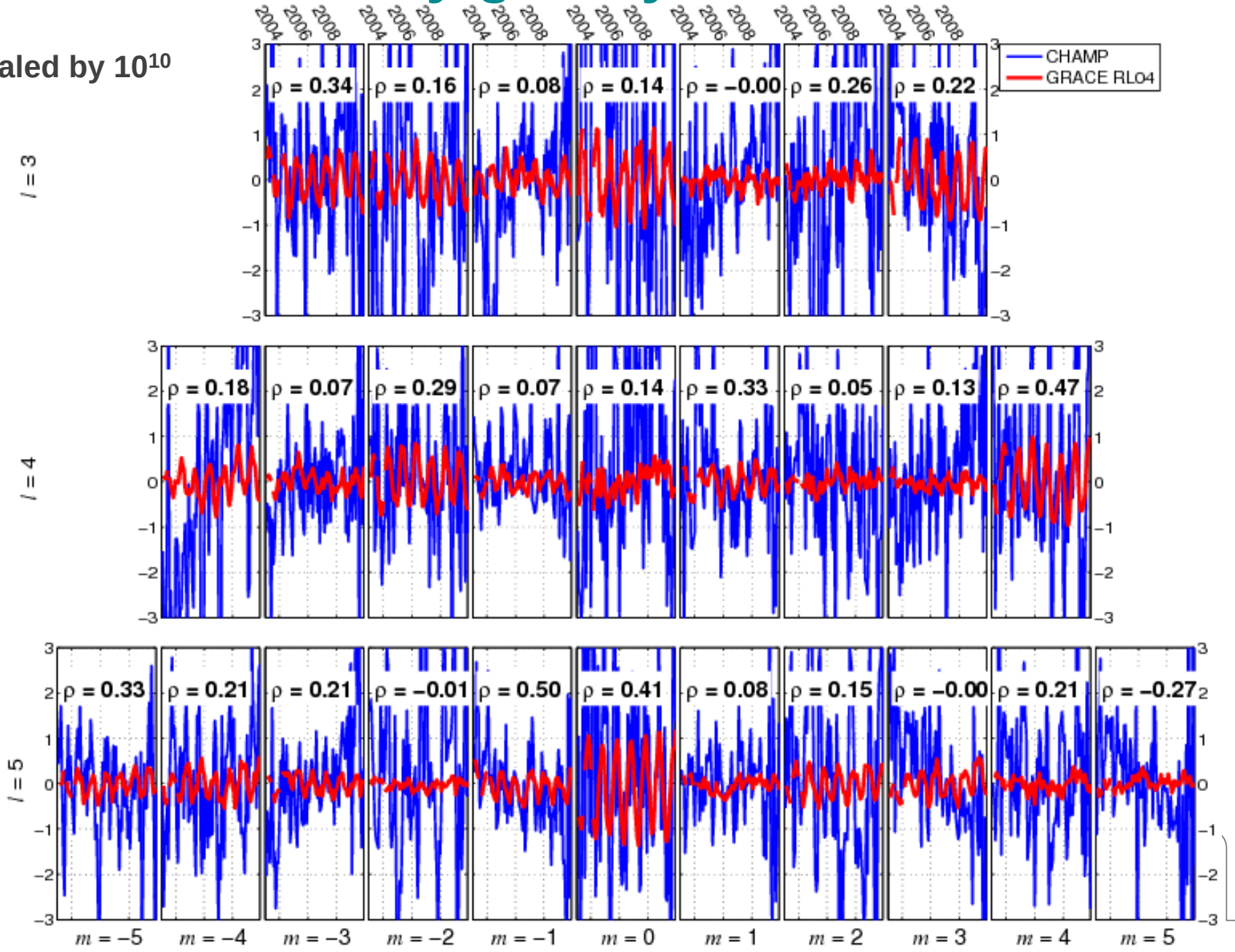
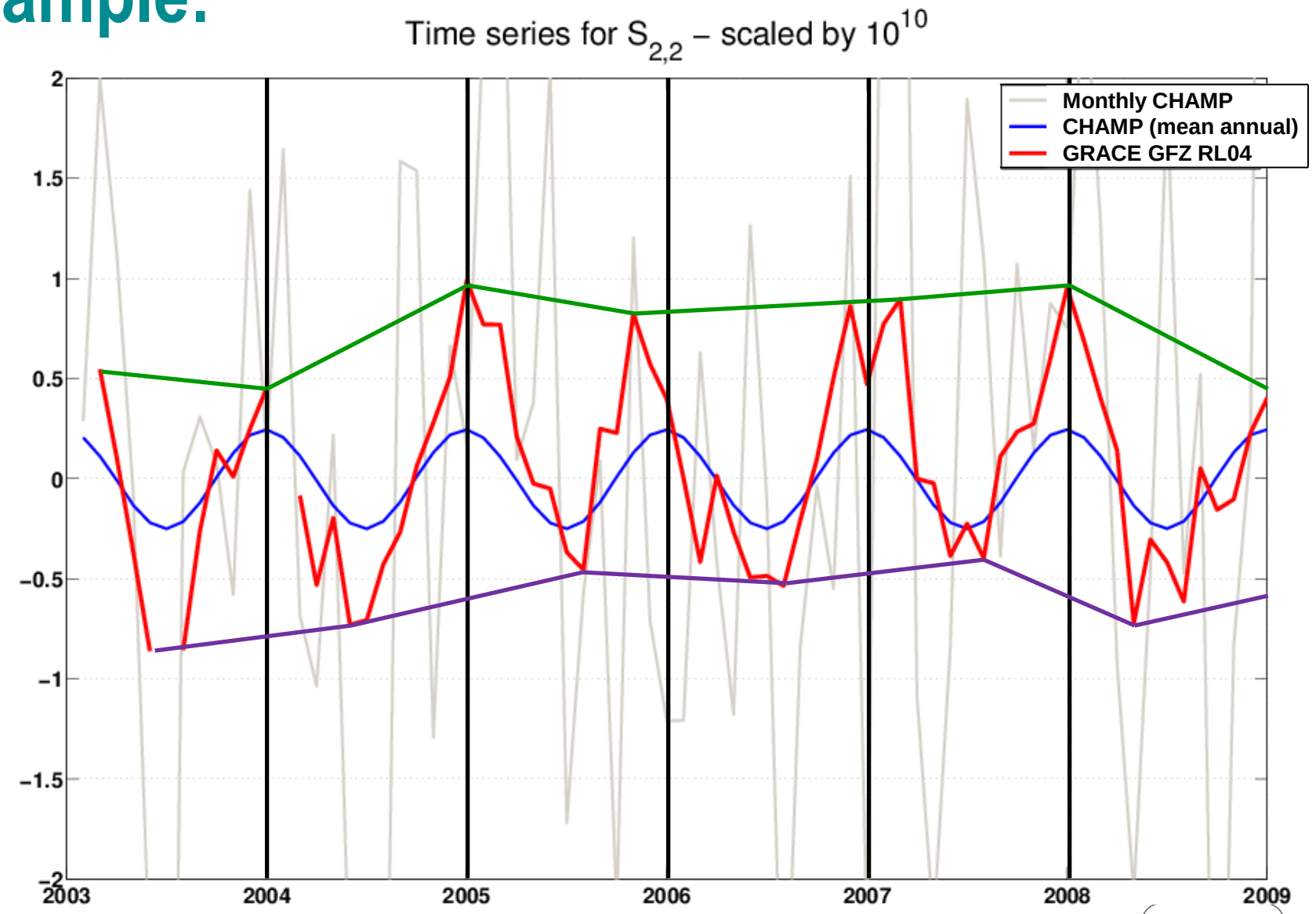
CHAMP monthly gravity field solution

scaled by 10^{10}

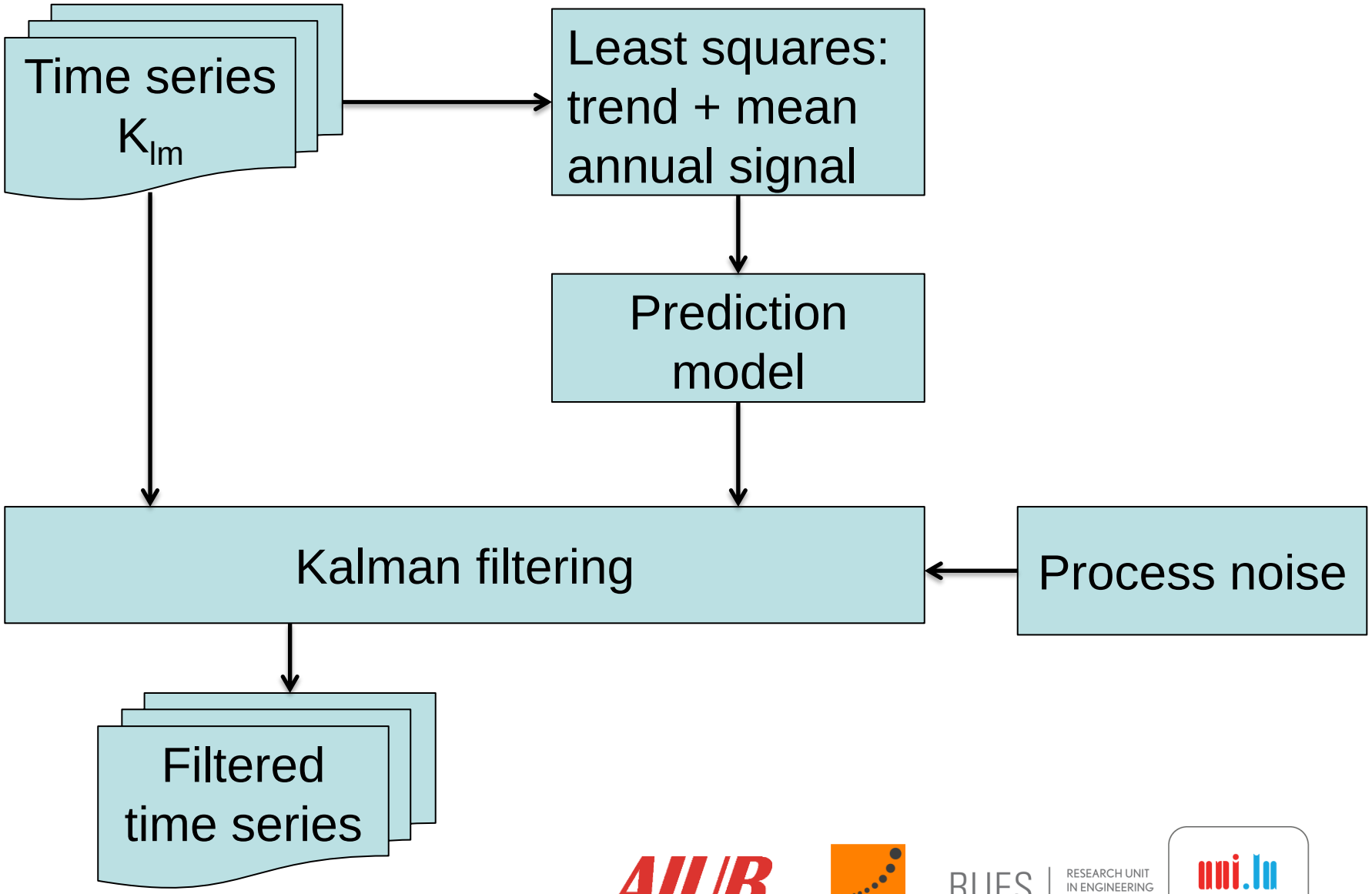


FILTERING

Example:

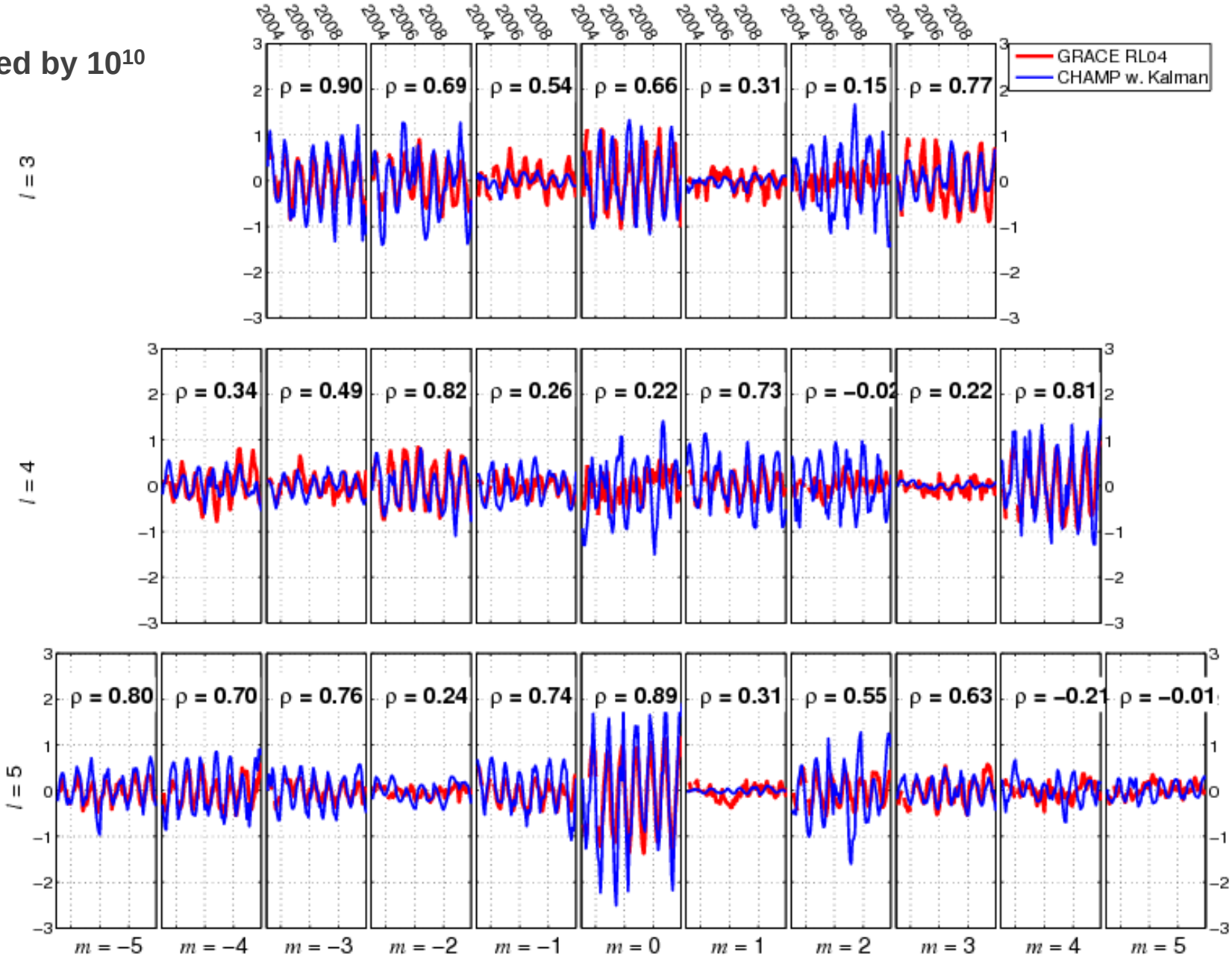

Time series for $S_{2,2}$ – scaled by 10^{10}
Monthly CHAMP
CHAMP (mean annual)
GRACE GFZ RL04
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
2003
2004
2005
2006
2007
2008
2009

Kalman filtering

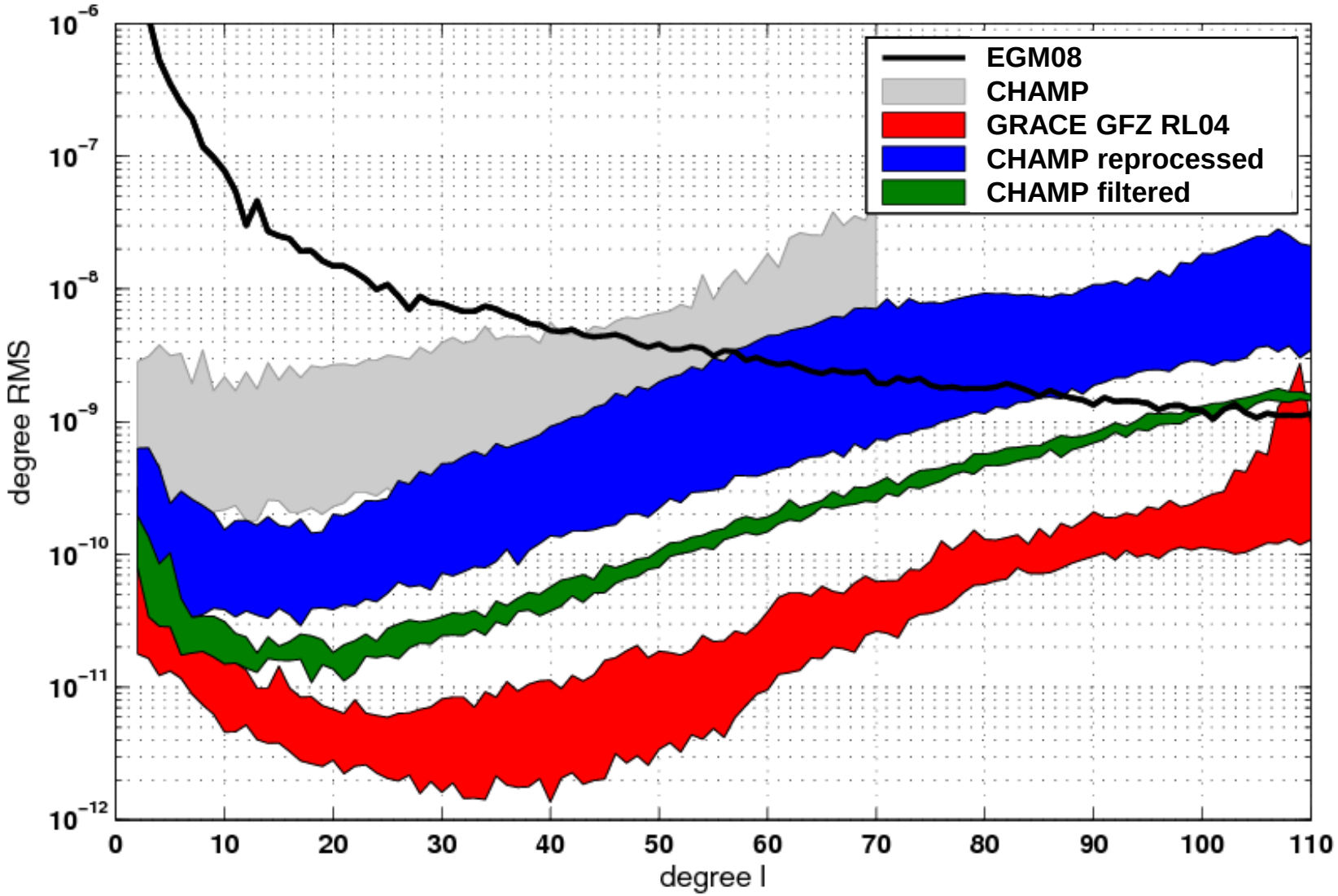


Filtered monthly gravity field solution

scaled by 10^{10}



Filtered monthly gravity field solution



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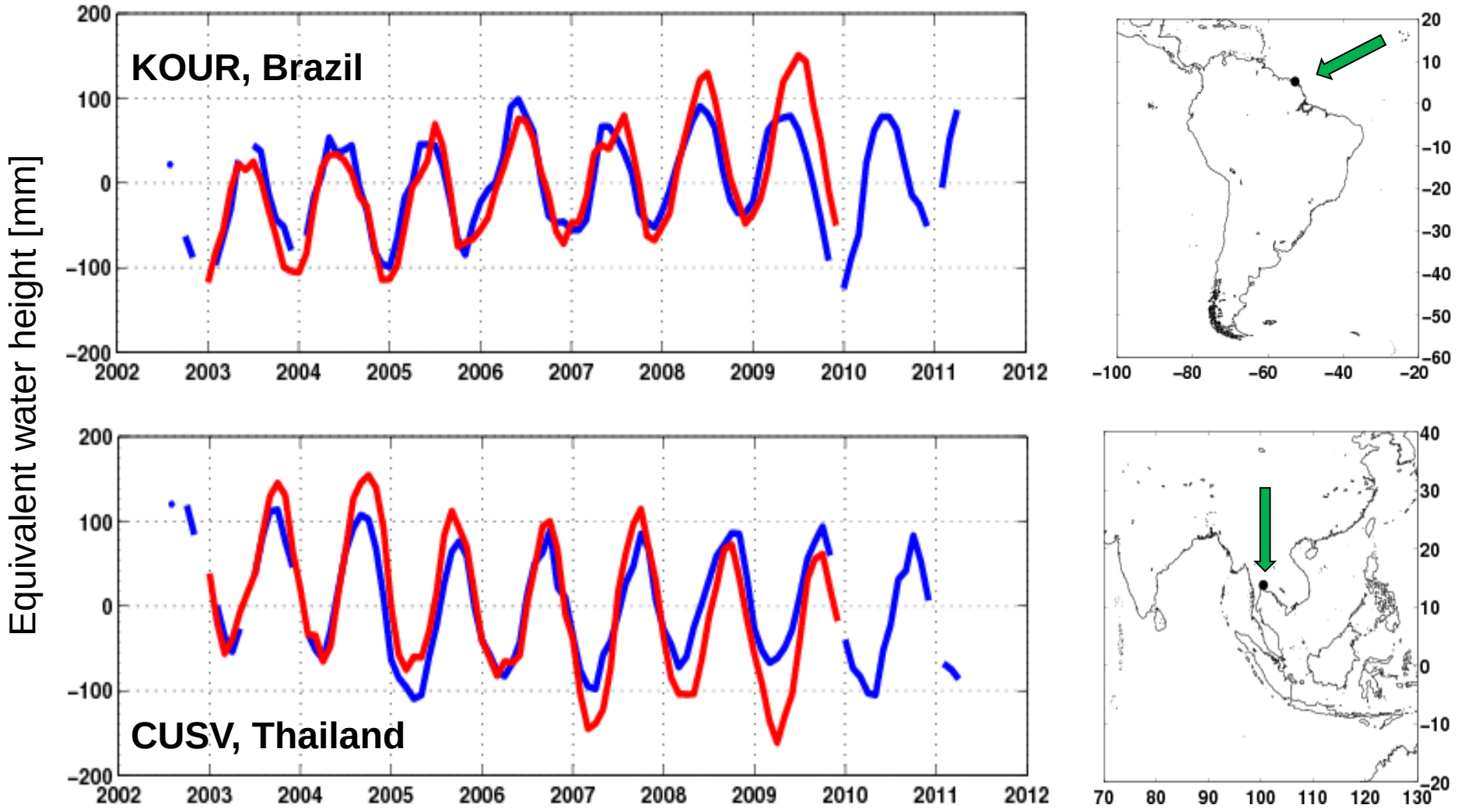
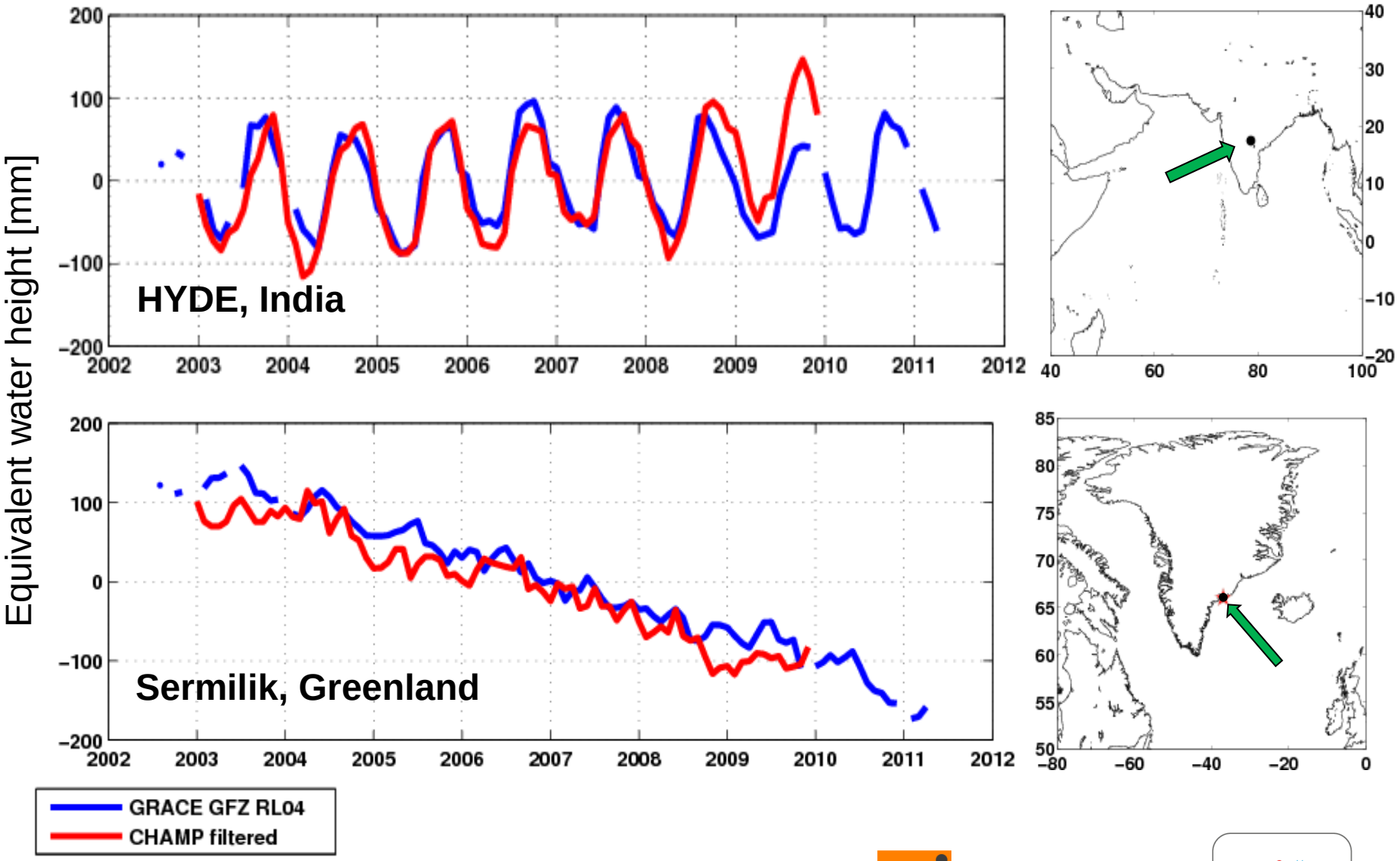
SOME VALIDATION

Time series


KOUR, Brazil
CUSV, Thailand
Equivalent water height [mm]
GRACE GFZ RL04
CHAMP filtered

Time series:


Equivalent water height [mm]
HYDE, India
Sermilik, Greenland
GRACE GFZ RL04
CHAMP filtered

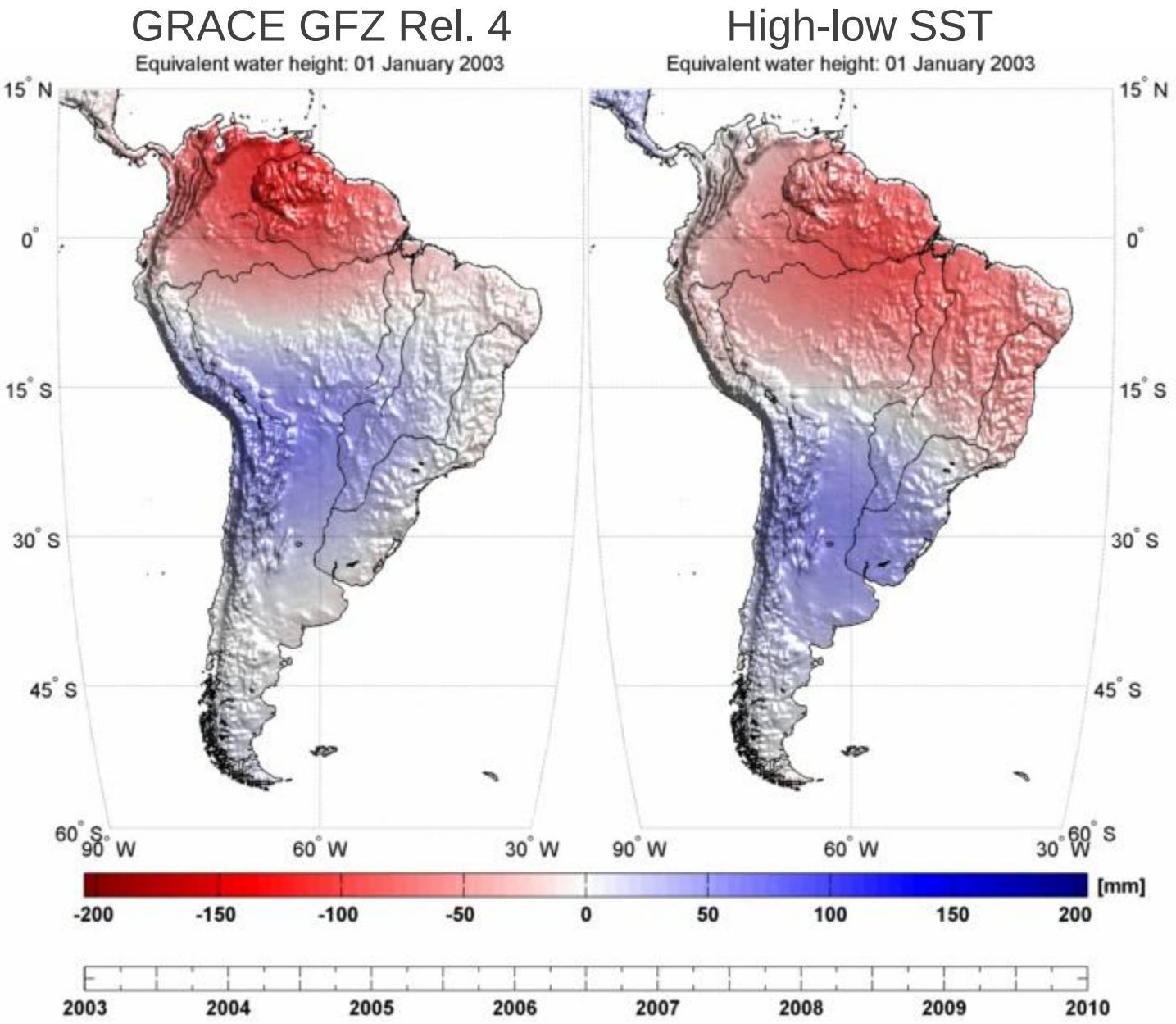
SUMMARY

Summary

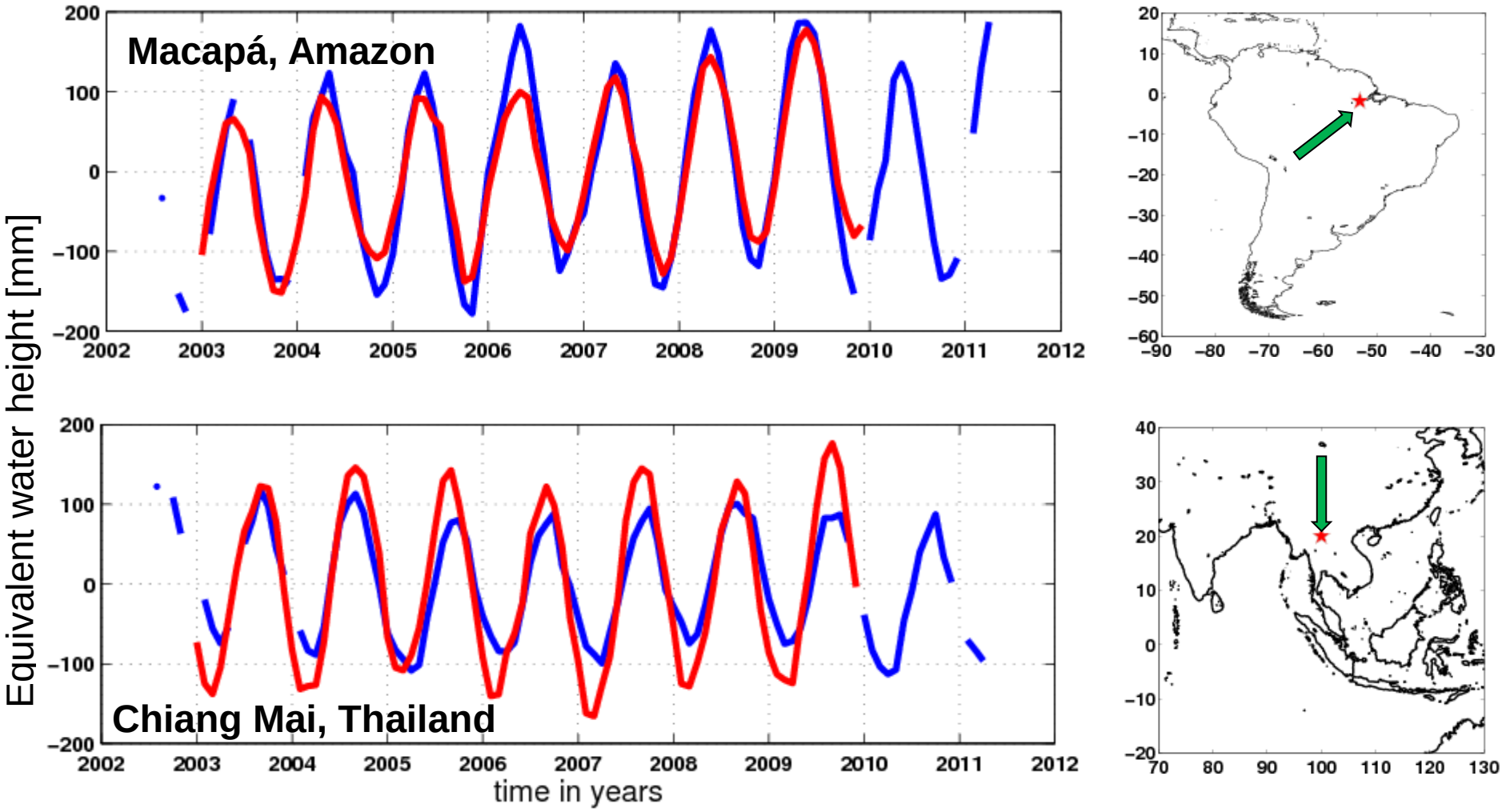
- Time variable gravity field from high-low SST
- Filtering (Kalman)
- Further improvements
  (e.g. considering correlations between coefficients)

- Expectations for SWARM:
  - better GPS receiver
  - three satellites

Thank you


GRACE GFZ Rel. 4
Equivalent water height: 01 January 2003
High-low SST
Equivalent water height: 01 January 2003
15° N
0°
15° S
30° S
45° S
60° S
90° W
60° W
30° W
[mm]
-200
-150
-100
-50
0
50
100
150
200
2003
2004
2005
2006
2007
2008
2009
2010

BACKUP



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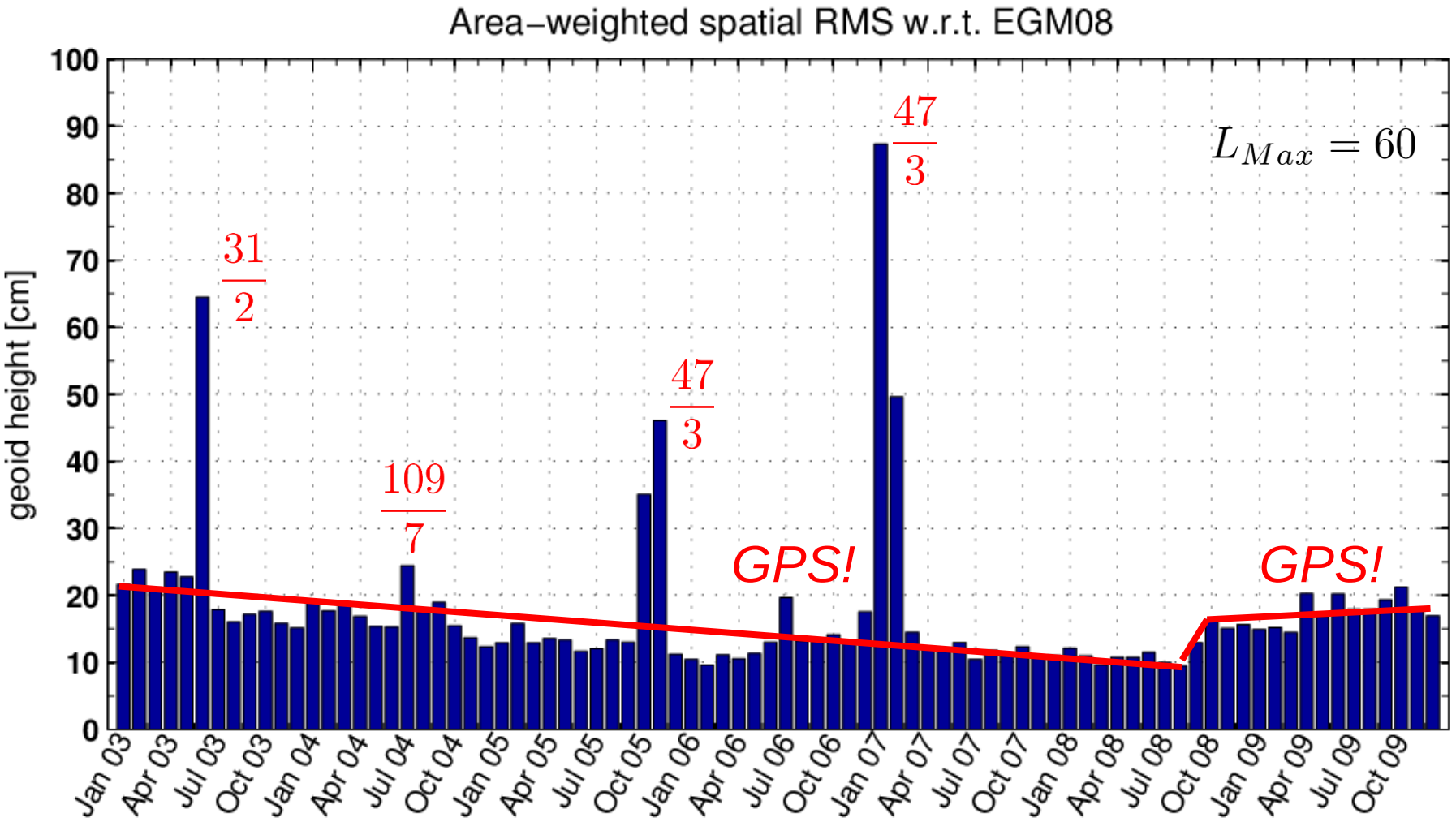
CHAMP monthly gravity field solutions