

CSR RL05

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EGU2012

The GRACE reprocessing would not have been possible without the support of the UT-TACC (<http://www.tacc.utexas.edu/>) and their world-class supercomputers.

Overview

- What Changed from RL04 to RL05?
 - Models...
 - Level-1B Data: Mainly an improvement in knowledge of alignments between star camera, accelerometer and K-Band system. Findings have been described in previous meetings:
 - Parameter Changes: Generally the same approach as RL04...
- Outcomes: Signal in RL05 is the same as in RL04, but noise is significantly reduced
 - The Obvious: Reduced north/south stripes
 - The Subtle: Reduced east/west banded errors
 - Also in there: Reduced “glitches” in many of the months
 - User may destripe to taste, but the regularized version of these fields (to come) should require no post-processing for most applications.

Background Model Changes

Model	RL04	RL05
Mean Gravity	GIF22a (360)	GIF48 (360)
3 rd Body Pert	DE 405	DE 405
Body Tides	IERS-2003	IERS-2003
Ocean Tides	FES04 + SCEQ	GOT4.8 + SCEQ
Pole Tide (Solid)	IERS-2003 (linear mean-pole model)	IERS-2010 (cubic mean-pole model)
Pole Tide (Ocean)	IERS-2003 (linear mean-pole model)	IERS-2010 (cubic mean-pole model)
Atmosphere + non-tidal Oceans	AOD1B_RL04 (ECMWF + OMCT)	AOD1B_RL05 (ECMWF + OMCT)
Secular Rates	C20, C30, C40, C21/S21 (empirical)	<u>No Rates Used</u>

Findings (without details...)

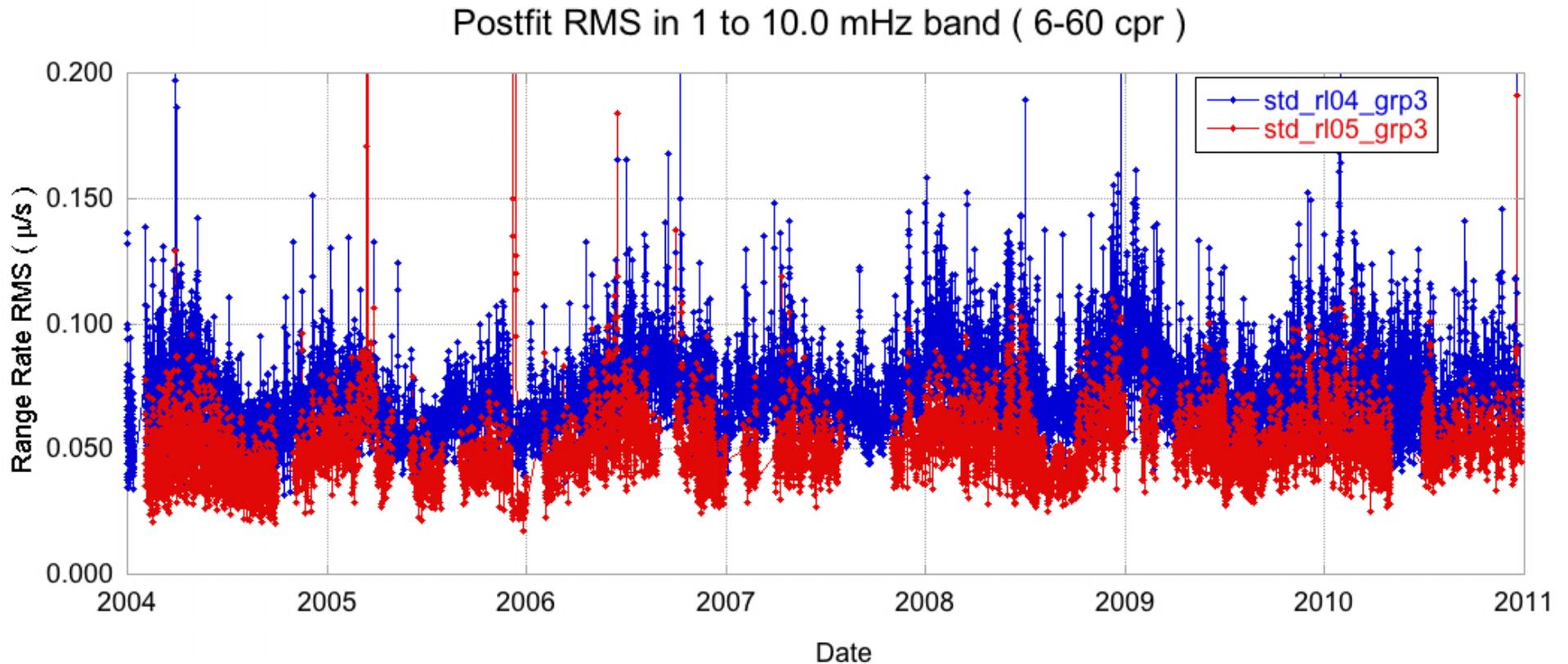
- **C20 estimates** for RL05 (2004-2010) are better than RL04, but SLR estimates for C20 are still better
 - Quality of C20 estimates for 2011 remains to be seen
 - RL05 compatible TN05 (SLR Estimates) will be available shortly
 - The (2,1) and (2,2) terms from GRACE are better than those from SLR
- **Important:** Rates for C20, C30, C40, C21 & S21 are no longer included in the background model
- **AOD1B**
 - AOD1B_RL05 substantially improves the outcomes over the Southern Oceans.
 - AOD1B_RL05 does not have some of the coastal artifacts that were present in the AOD1B_RL04
 - Over enclosed seas (Hudson Bay, Baltic Sea, Mediterranean, Black Sea, Gulf of Carpentaria, etc), AOD1B_RL05 is poorer at de-aliasing

Please visit <http://www.csr.utexas.edu/grace/RL05.html> for further details (over the next few days)

Next Steps

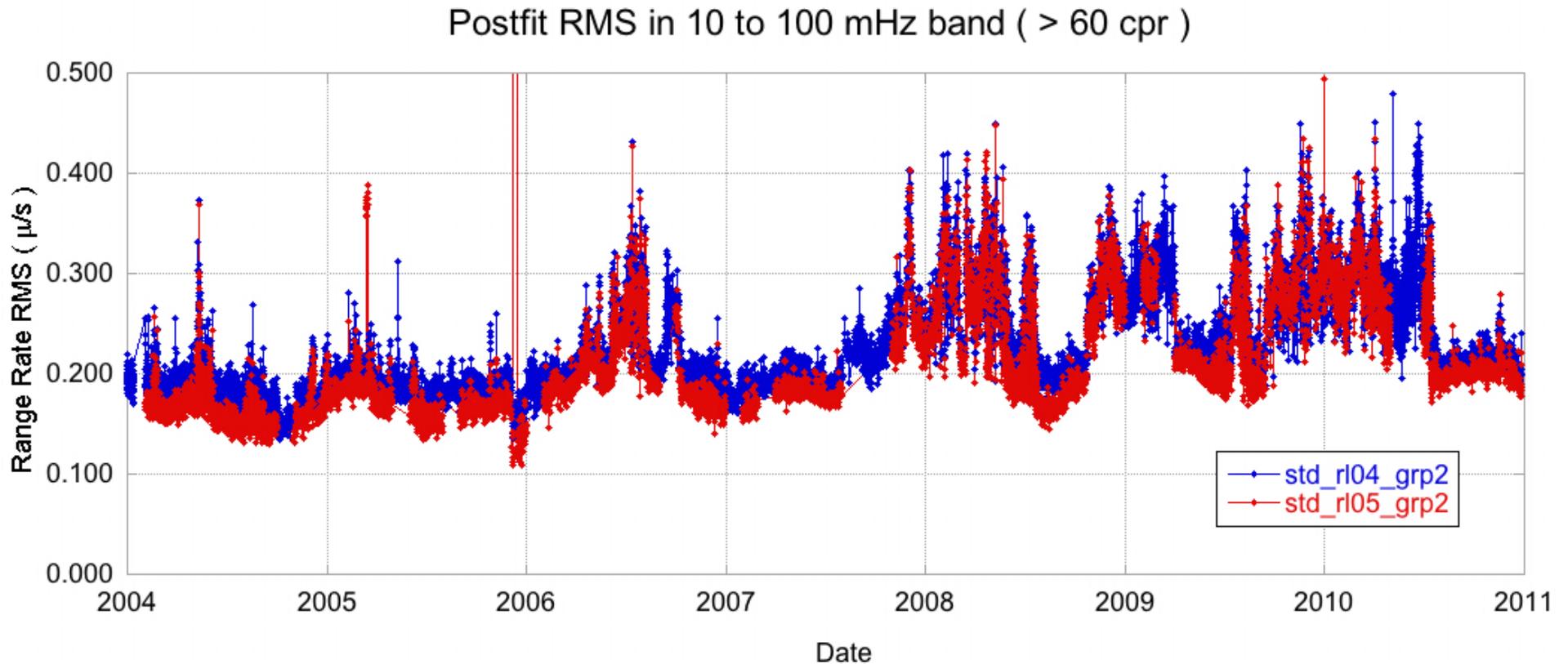
- Complete the processing for 2011, 2002, 2003 and 2012
- Regularized data products are in development, and should be available in the summer
- Produce GGM04
- The distribution of the RL04 fields will continue for a short period until transition to RL05 is completed.

Data Fit Improvements (1)



In this frequency band, we see greatest improvement due to combination of Level-1B data improvements and the gravity field background model improvements.

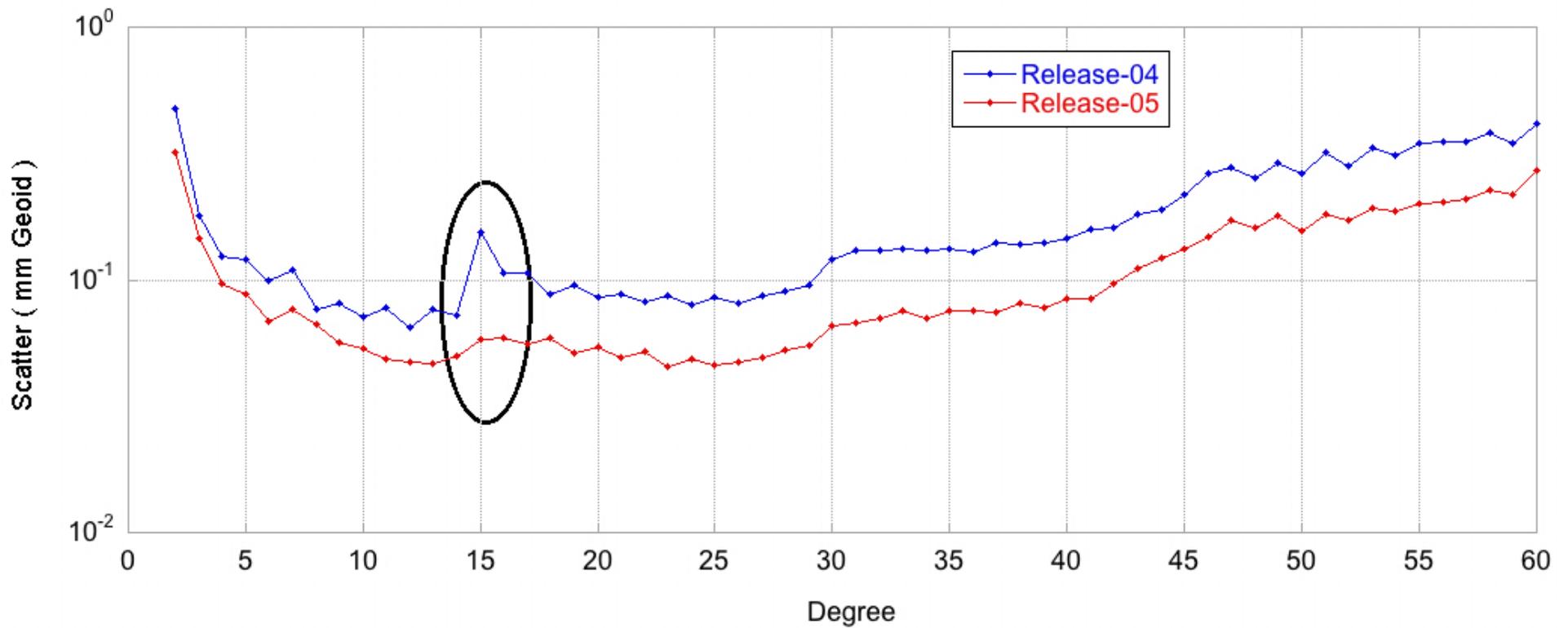
Data Fit Improvements (3)



Slight improvement in the high frequency noise is also seen.

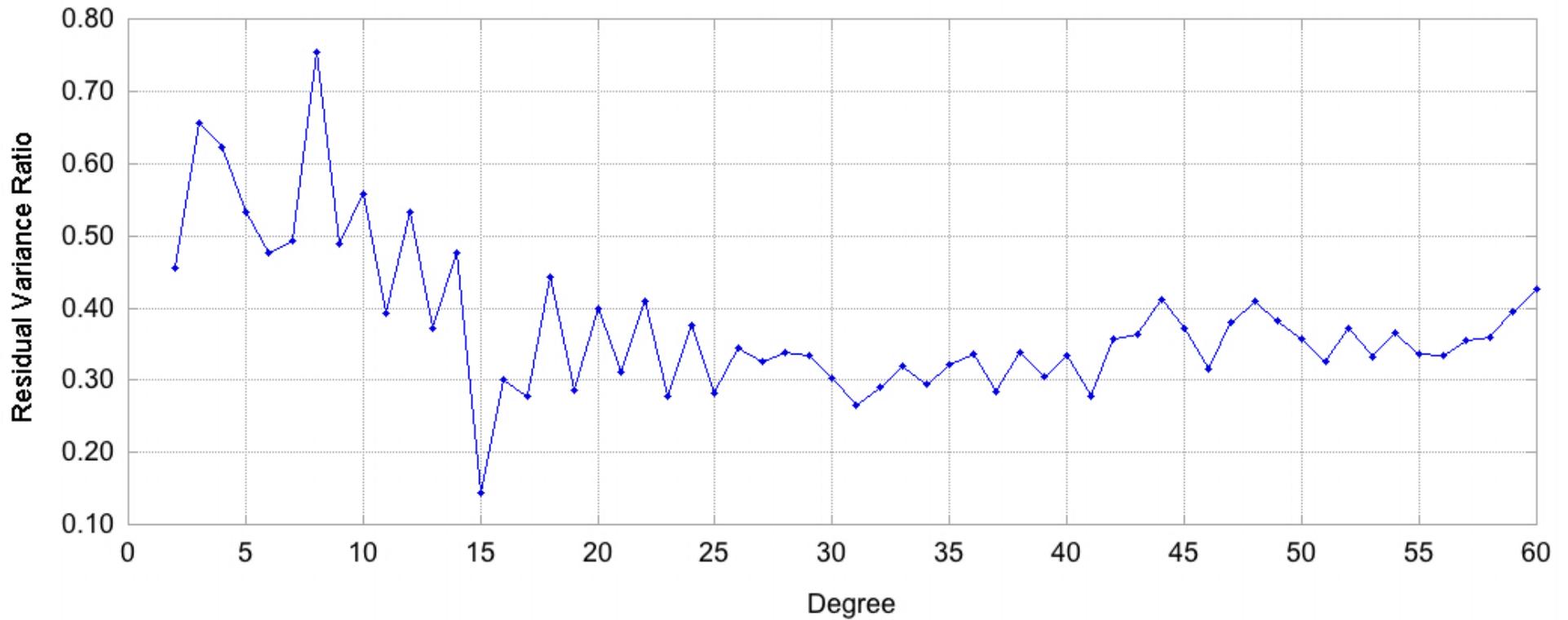
Error Upper Bound Estimate

Scatter relative to seasonal & trends fit



A Factor 2 to 3 Improvement

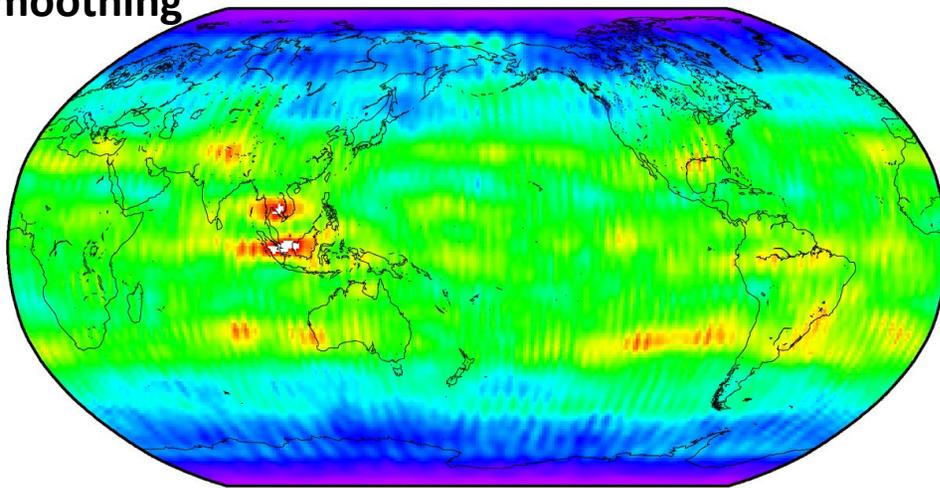
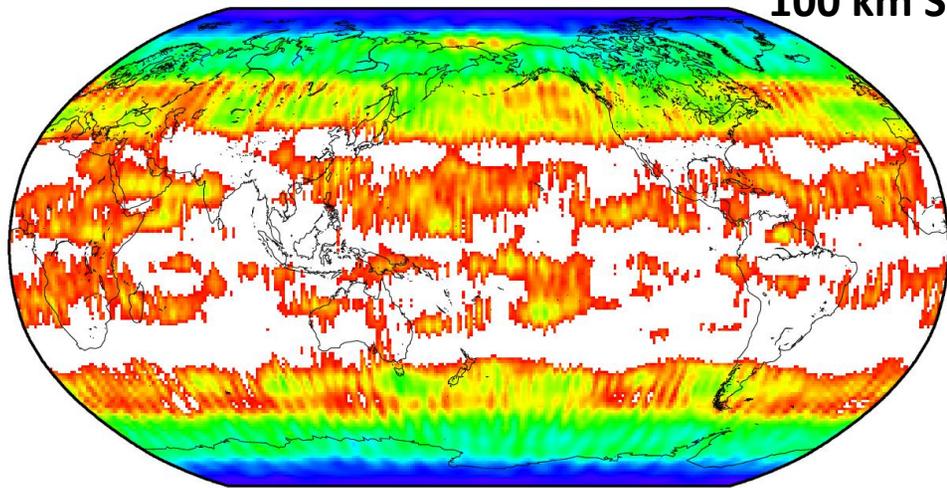
Ratio of residual variance ($RL05_error^2/RL04_error^2$)



RL04res_sig

100 km Smoothing

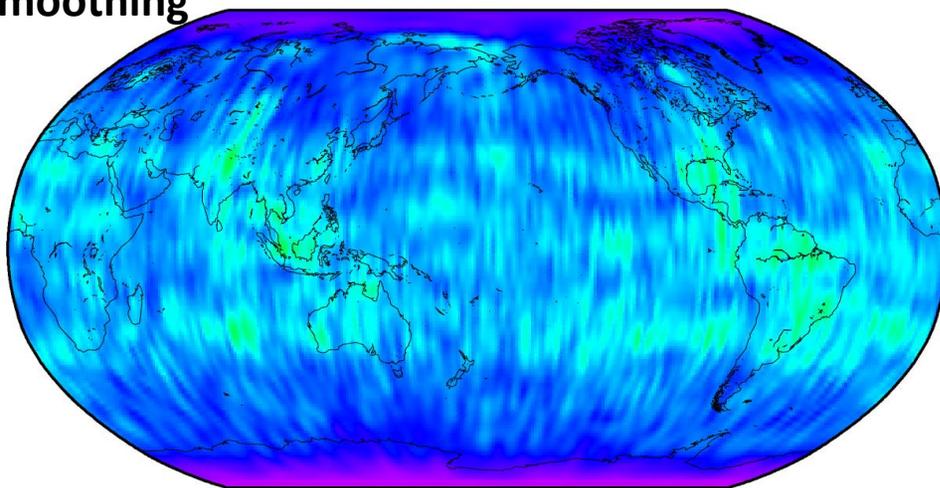
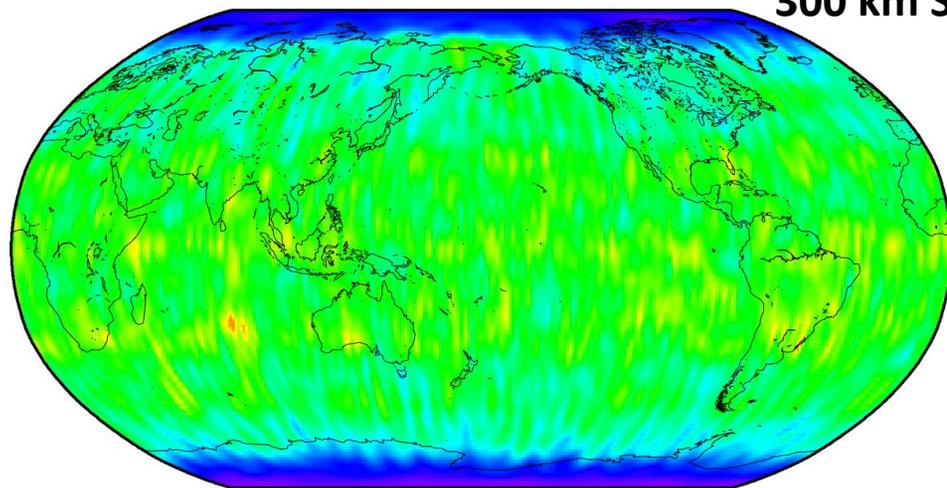
RL05res_sig



RL04res_sig

300 km Smoothing

RL05res_sig

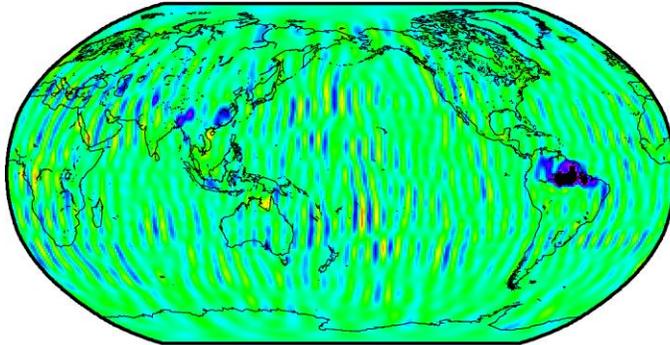


RL04res_sig StDev (muGal)

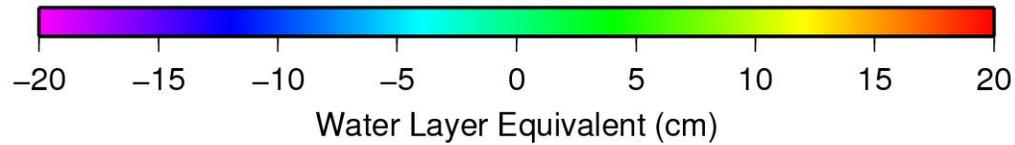
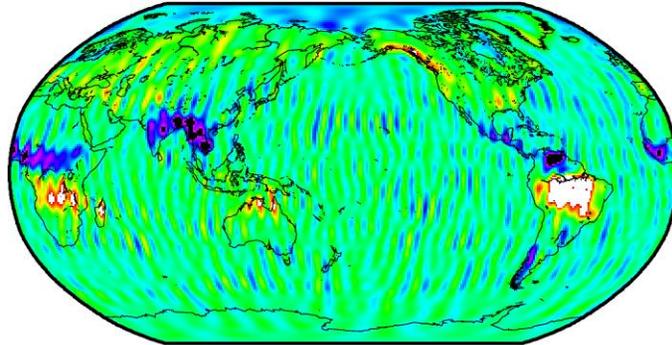
RL05res_sig StDev (muGal)

Comparing Annual Cycles

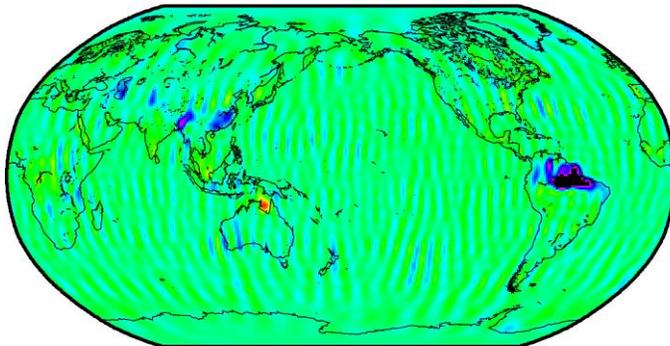
RL04Annual Cosine



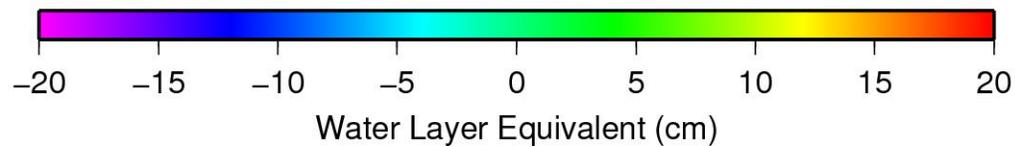
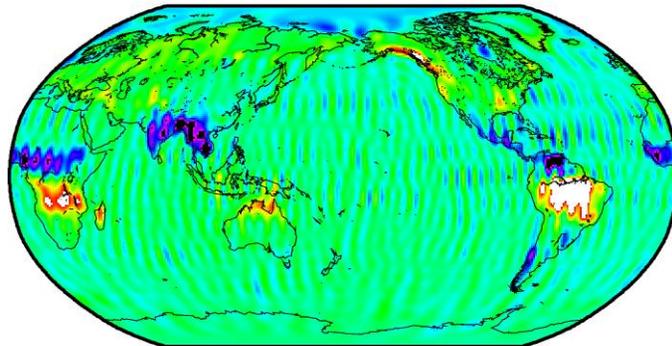
RL04Annual Sine



RL05Annual Cosine



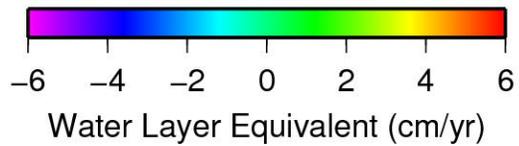
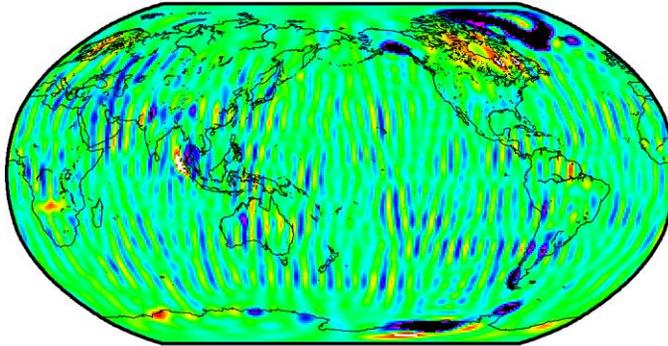
RL05Annual Sine



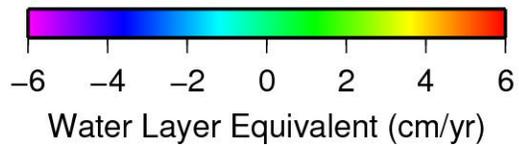
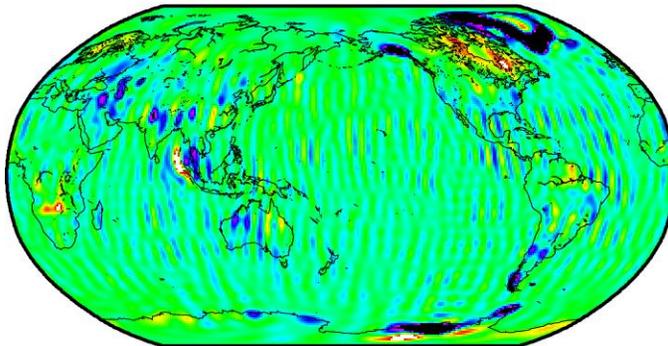
No de-stripping, 100-km Gaussian smoothing

Comparing Trends

RL04Slope



RL05Slope

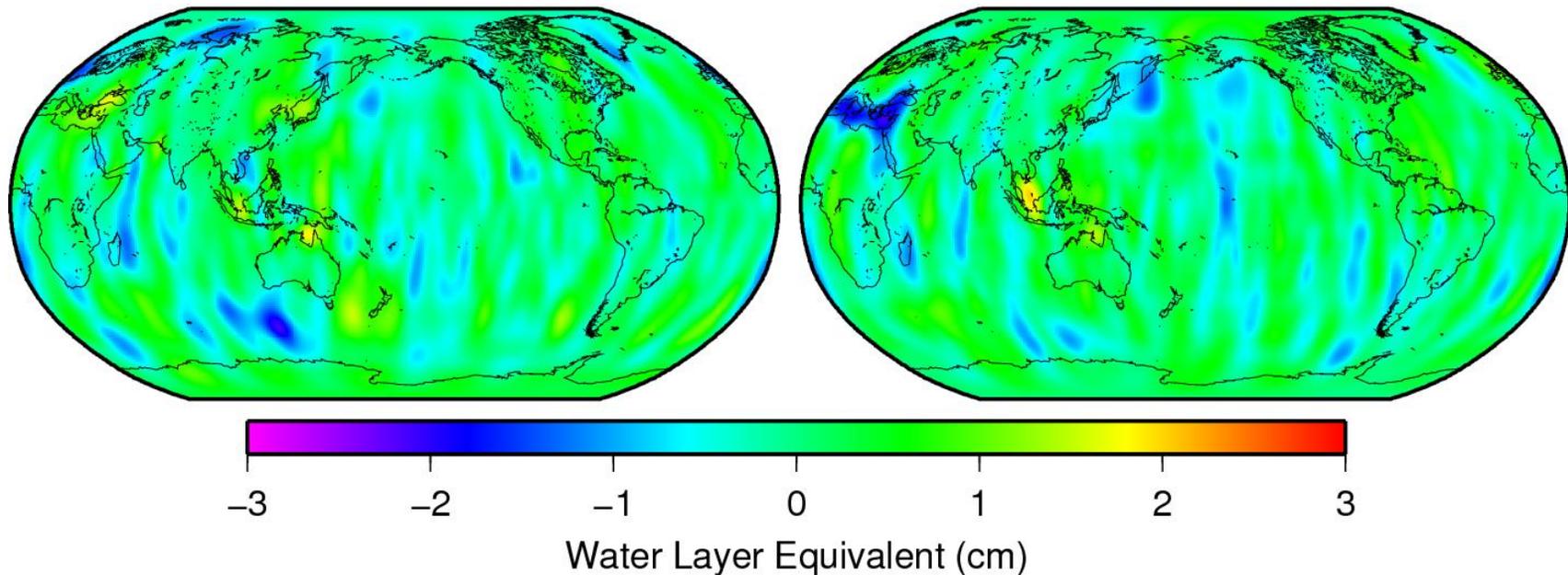


No de-striping,
100 km Gaussian smoothing
Rates not restored for the
RL04 image

Change in Annual Cycle from RL04 to RL05

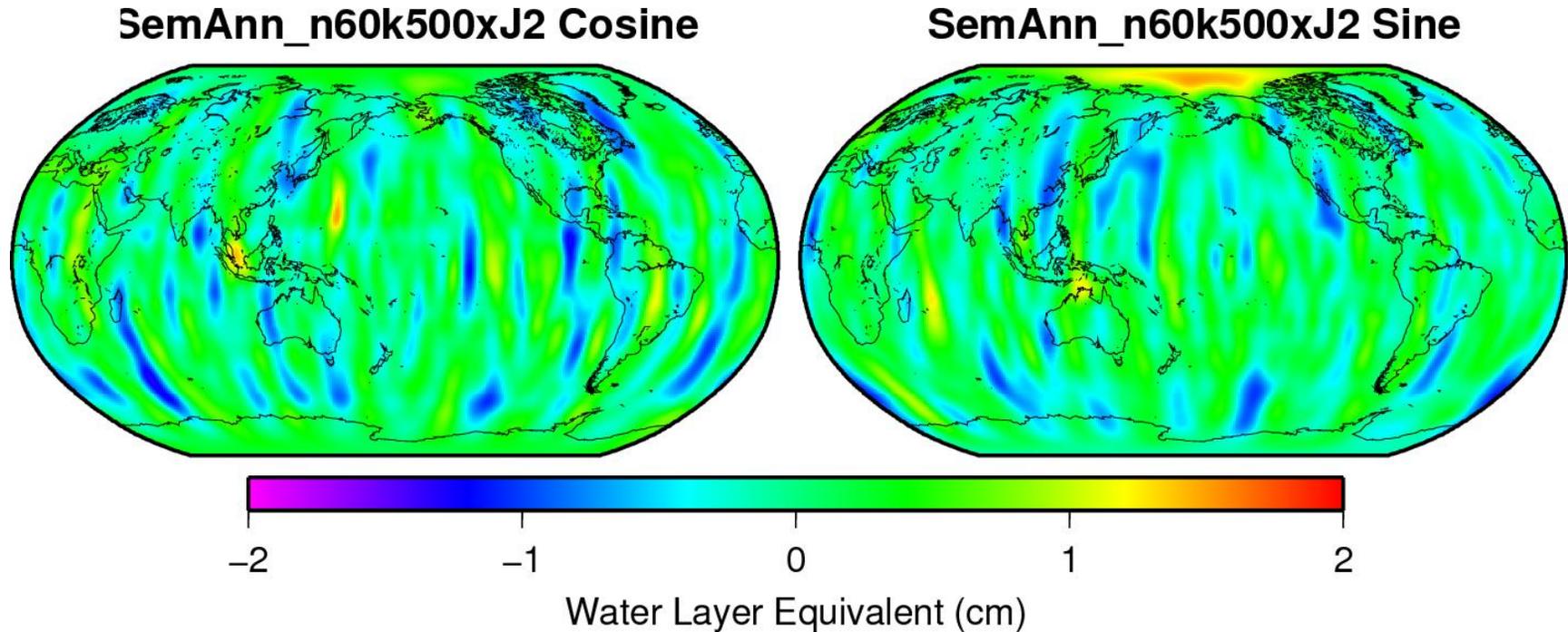
.nnWatlyr_n60k500xJ2 Cosine

AnnWatlyr_n60k500xJ2 Sine



Small signal changes (sub-cm) over land, except for stripy patterns.
Changes over some spots over oceans are related to AOD1B changes.
Seasonal cycle fit to difference of RL04 and RL05 variability for span 2004-2010.

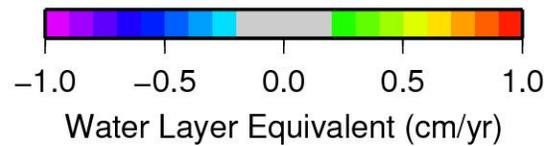
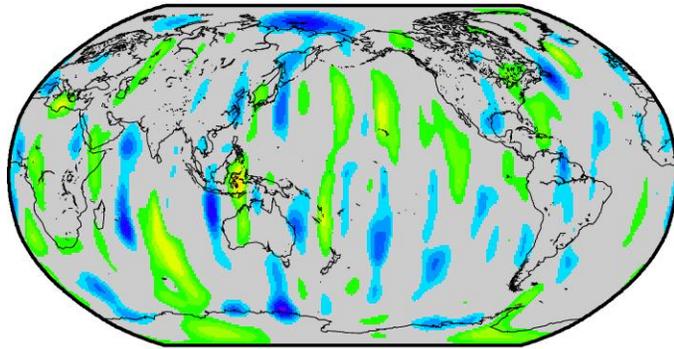
Change in semi-Annual Cycle from RL04 to RL05



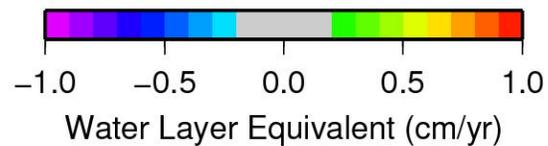
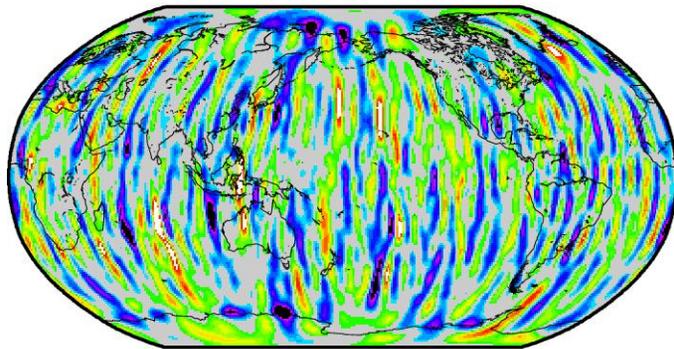
Small signal changes (sub-cm) over land, except for stripy patterns.
Changes over some spots over oceans may be related to AOD1B & tide model changes.
Seasonal cycle fit to difference of RL04 and RL05 variability for span 2004-2010.

Change in Trends from RL04 to RL05

SlopeWatlyr_n60k500xJ2



SlopeWatlyr_n60k300xJ2



Generally shows stripy differences
Close look at few coastal spots
also shows effects of removal of
artifacts from AOD1B_RL04

Summary

- Signals in RL05 is the same as in RL04, but noise should be substantially lower
 - Data products available at the usual archives at PO.DAAC and ISDC.
- Most Important Usage Notes:
 - Continue to replace C20 with SLR estimates
 - Rates for C20, C30, C40, C21/S21 need not be restored with RL05
- Please contact us at: grace@csr.utexas.edu if you have any questions or with your feedback.

Please visit <http://www.csr.utexas.edu/grace/RL05.html> for further details