

# ***The V03 Level-1 Release***

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GRACE Science Team Meeting  
Austin, Texas



All at Jet Propulsion Laboratory, California Institute of Technology

GRACE Science Team Meeting, Austin Texas, 10-12 October 2017  
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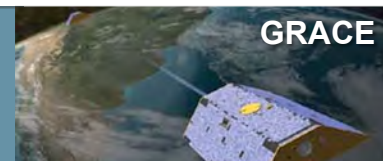
# V03 Overview



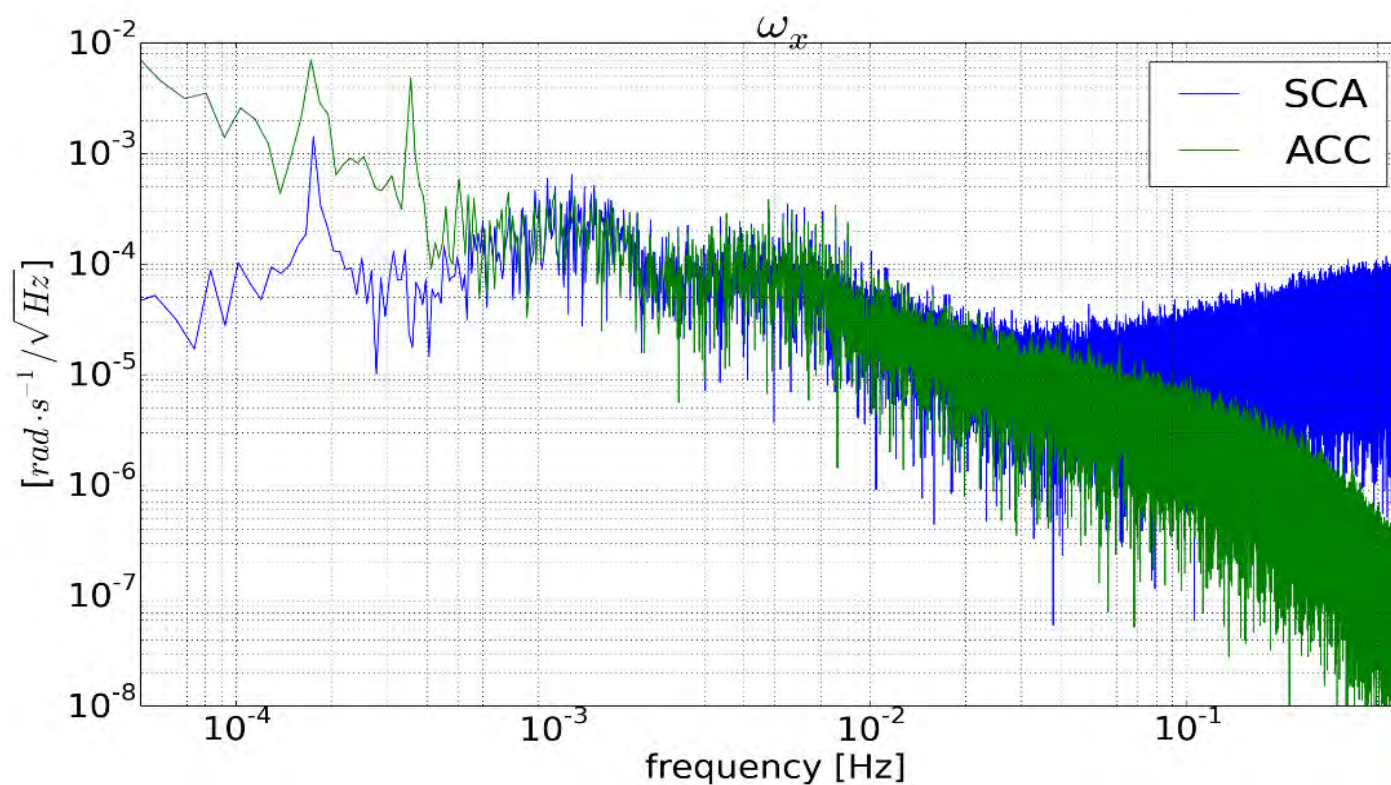
- Updated attitude solution for the GRACE spacecraft
  - New release of SCA1B and KBR1B products
- Corrected errors in stellar aberration computation and weighting of star camera axes
- Kalman filter algorithm to optimally combine the SCA and angular ACC data
- Comprehensive analysis and modeling of the SCA and ACC signal and error profiles
- All software and processing was done in the GRACE-FO software libraries and will be compatible for the GFO mission



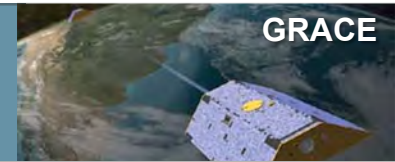
# Parameterization of the Attitude Kalman Filter



- Reduced high frequency noise in spacecraft attitude reconstruction from assimilation of angular acceleration measurements
- Attitude Kalman filter allowed for a cross check of each instrument

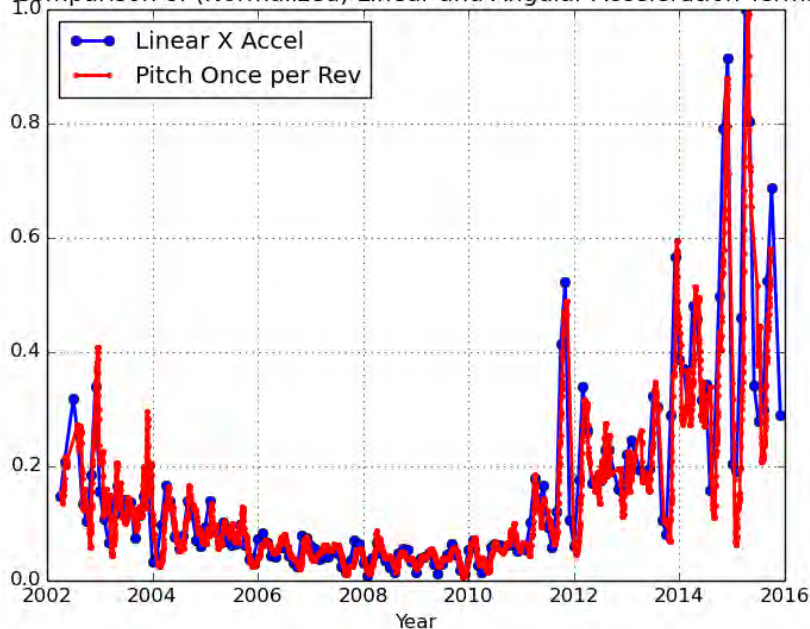


# Instrument Error Profile

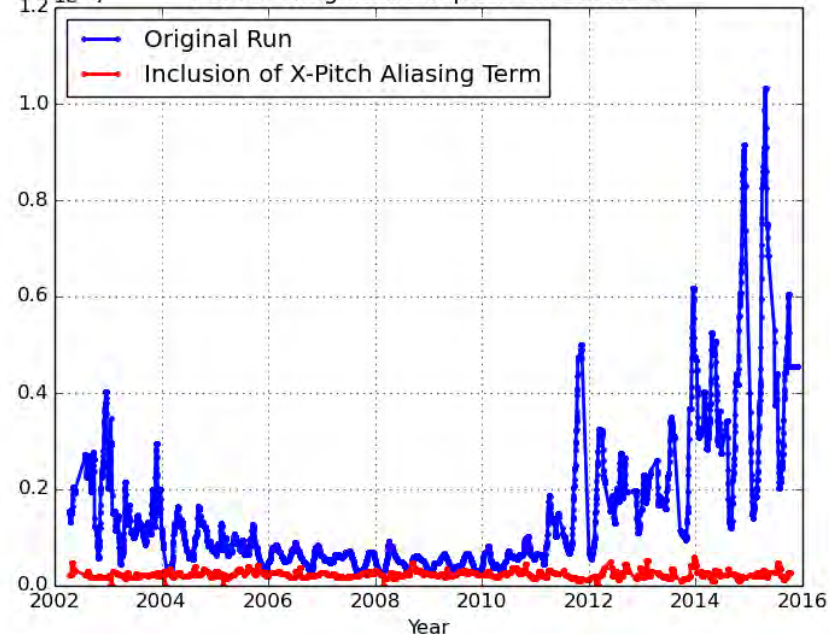


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Comparison of (Normalized) Linear and Angular Acceleration Terms



Per-rev magnitude in pitch on GRACE-A



- Model repeating errors in the SCA field of view<sup>1</sup>
- Identification of differential scale factors, aliasing, and magnetic signatures in ACC



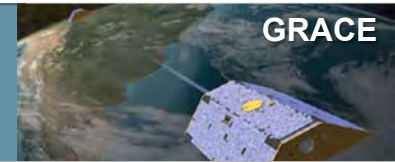
<sup>1</sup>Harvey N. (2016) GRACE star camera noise, Adv Space Res

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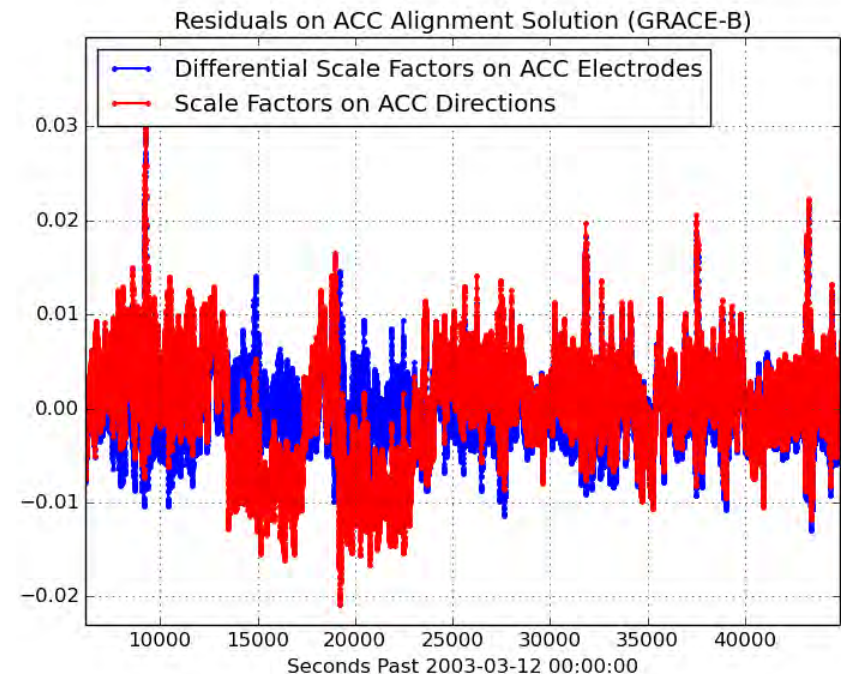
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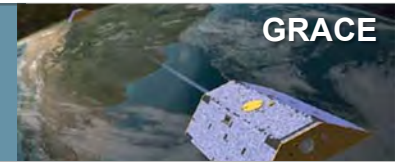
# Modeling the Spacecraft Alignment



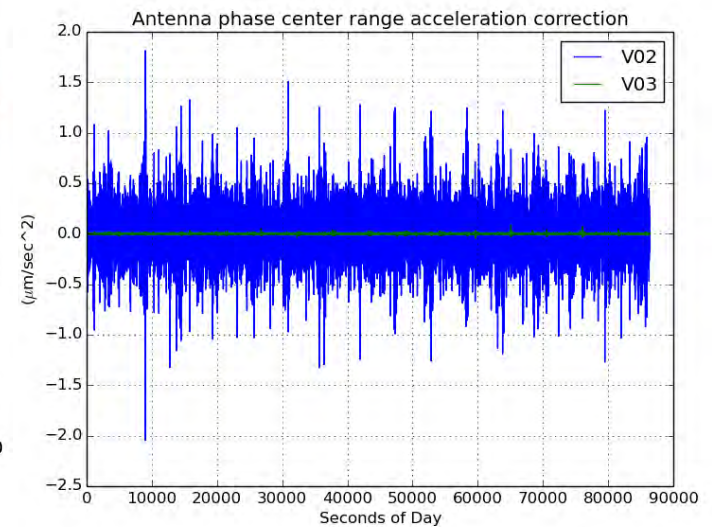
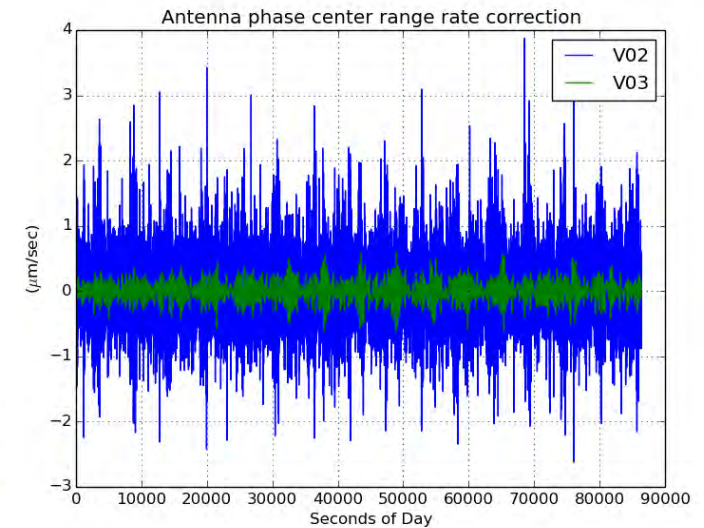
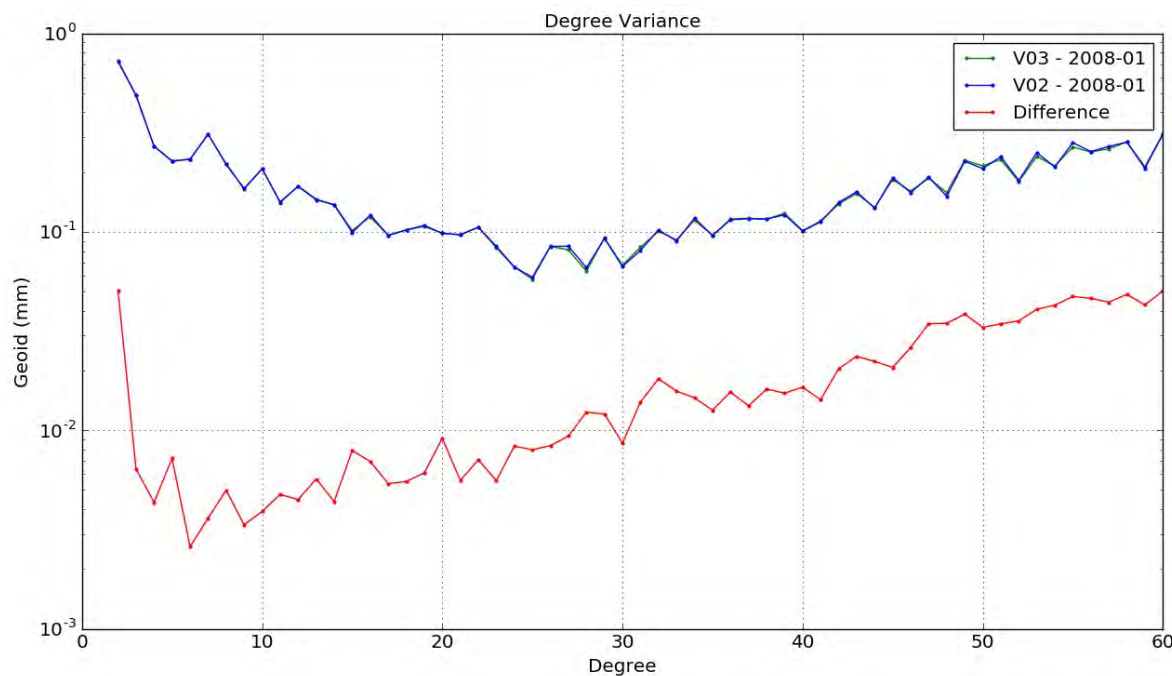
- Independent assessment of the spacecraft alignment with the attitude Kalman software during the KBR calibration maneuver
- Scale factors between electrodes on the accelerometers can vary by up to 1%, variations that were previously unmodeled
- Camera 1 was fixed in the current reprocessing strategy after a long term analysis showed inter-camera drift varies by 200 arcsecs over the mission
- Accelerometer Characterization Maneuver planned for GRACE-A prior to mission end



# Processing Status

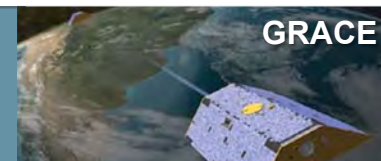


- 5 years of SCA1B and KBR1B products delivered to JPL, UTCSR, GFZ with the rest in process
- Minimal scientific impact for most of the mission, some improvement in higher noise environments

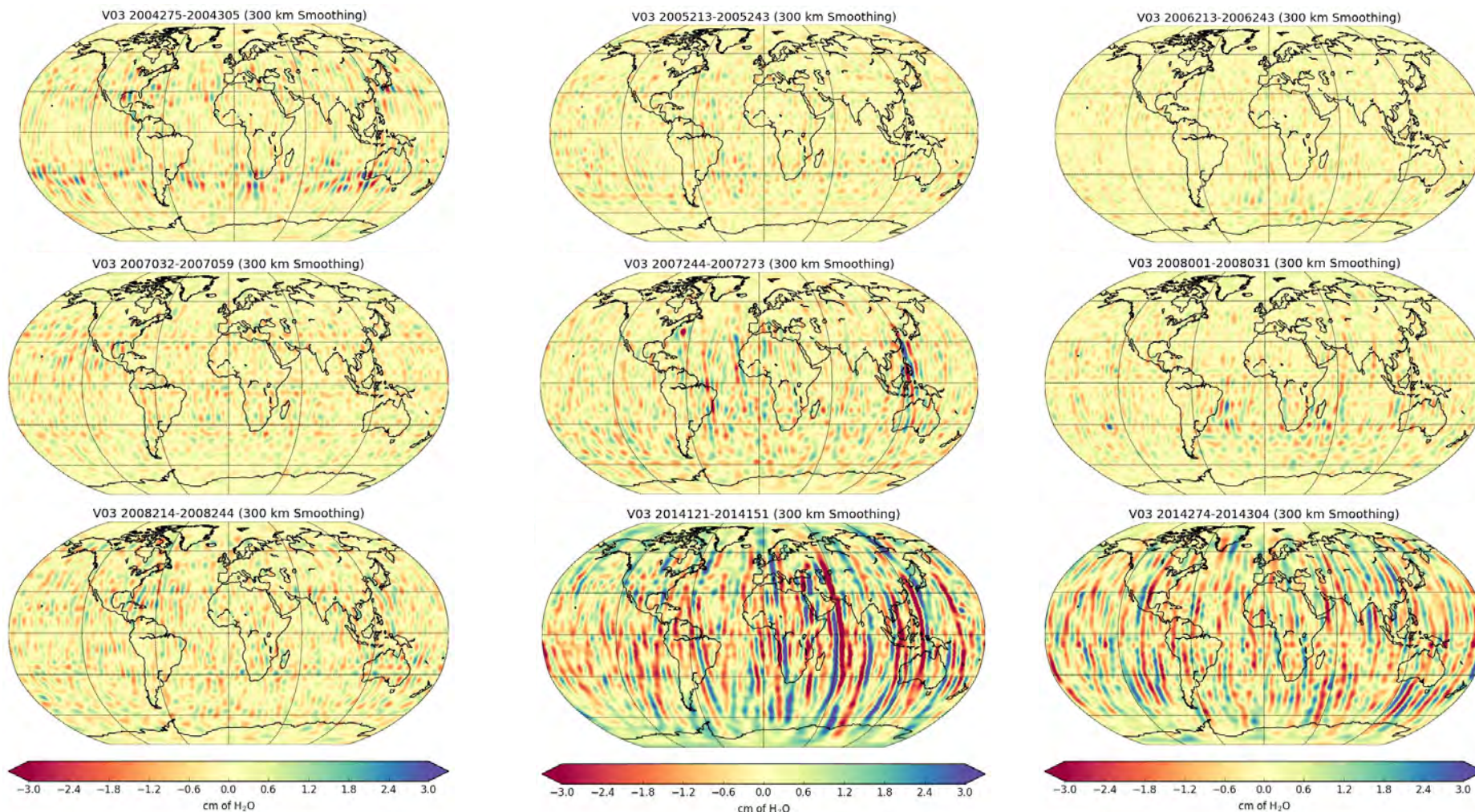




# Impact on Level-2 Products



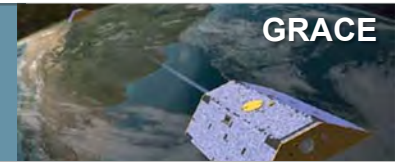
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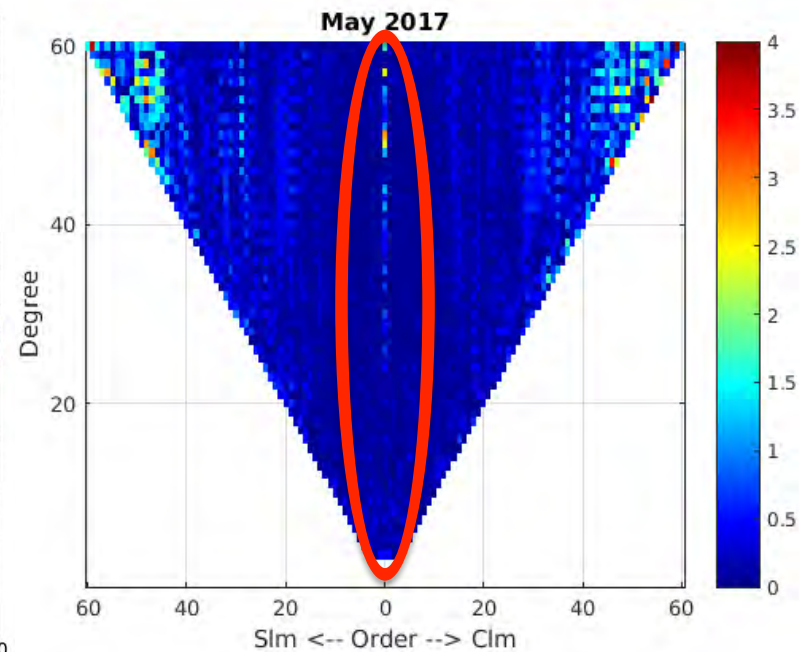
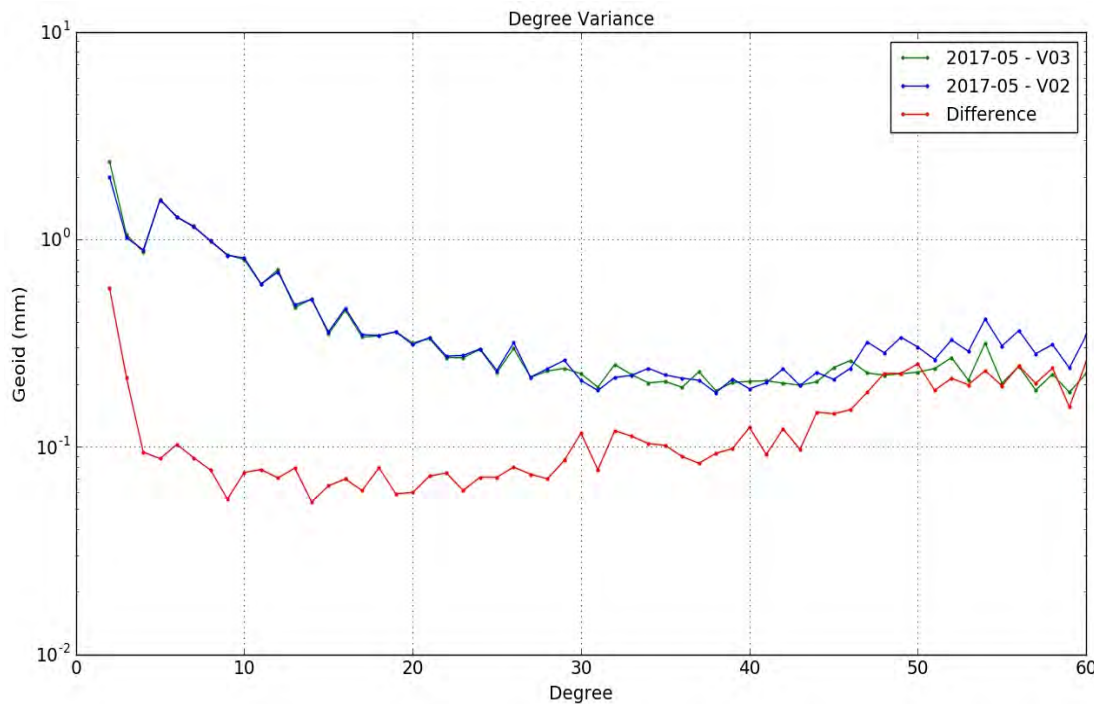
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# V03 in May 2017



- In April 2017 the angle of attack difference between the two spacecraft was removed to improve the accelerometer transplant solution
  - Leads to increased noise in KBR range correction



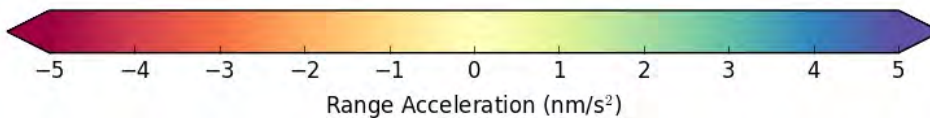
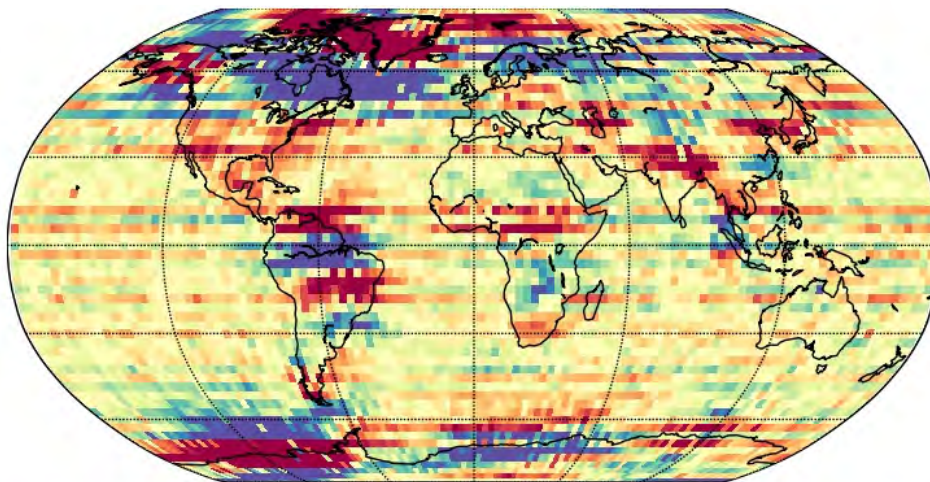


# V03 in May 2017



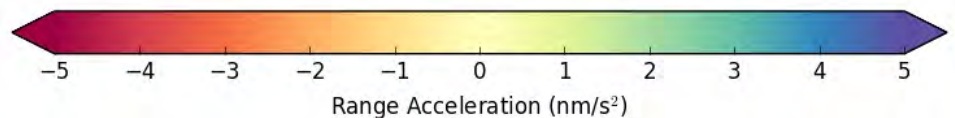
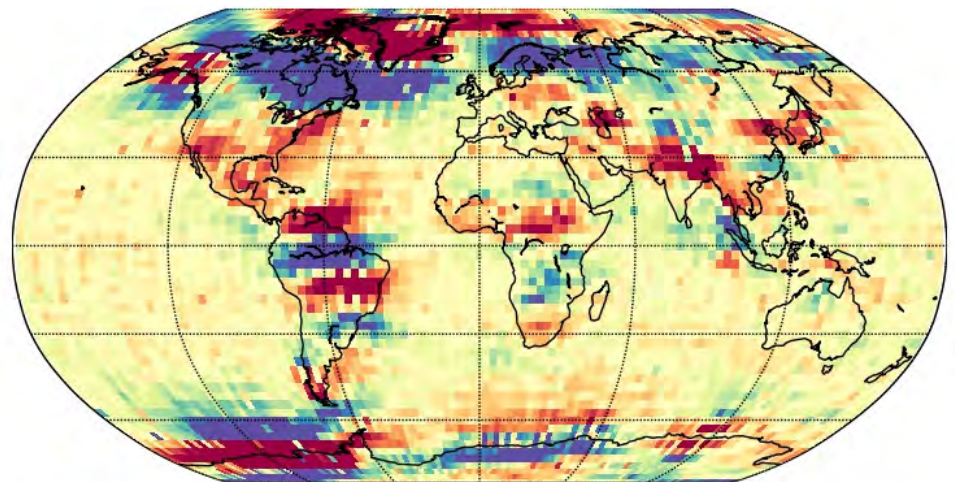
## V02 Level-1 Data

Errors manifest in zonal harmonics leading to latitudinal banding in the gravity field



## V03 Level-1 Data

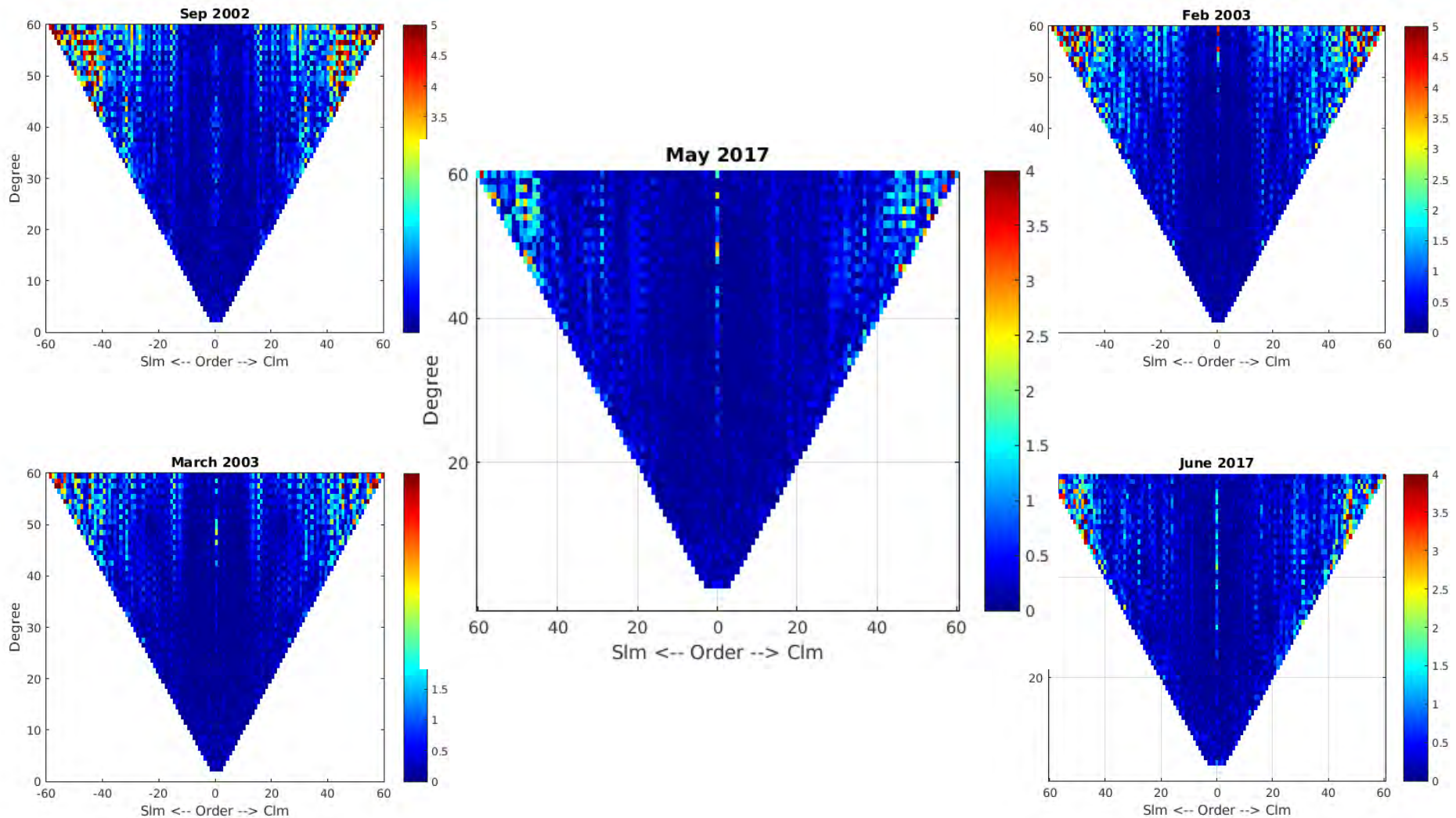
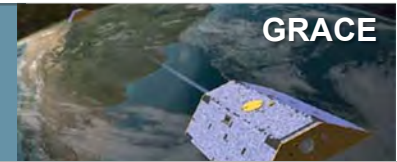
Reduced high frequency noise in the attitude solution improves



GEO-FIT plots: monthly gravity field correction mapped into range accelerations



# ...and it could help in other months too



# Summary



- 5 years of V03 data products have been delivered with the rest expected to be completed within 2017
- Most years show no significant improvement or degradation
- Selected months of 2017, 2002 and 2003, in particular can benefit from the reduced high frequency noise in the attitude solution
- V03 attitude processing strategy will be applied to GRACE-FO, where we may gain additional benefits from the IMU and LRI instrument data

