

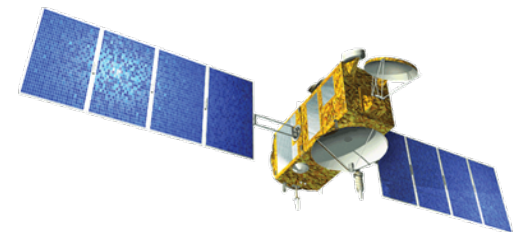
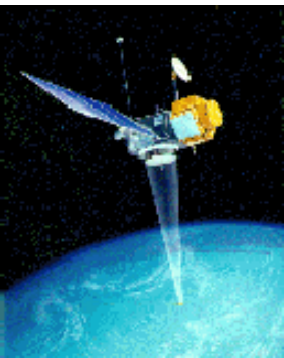


# Sub-centimeter SLR precision with the SLRF2005/LPOD2005 network



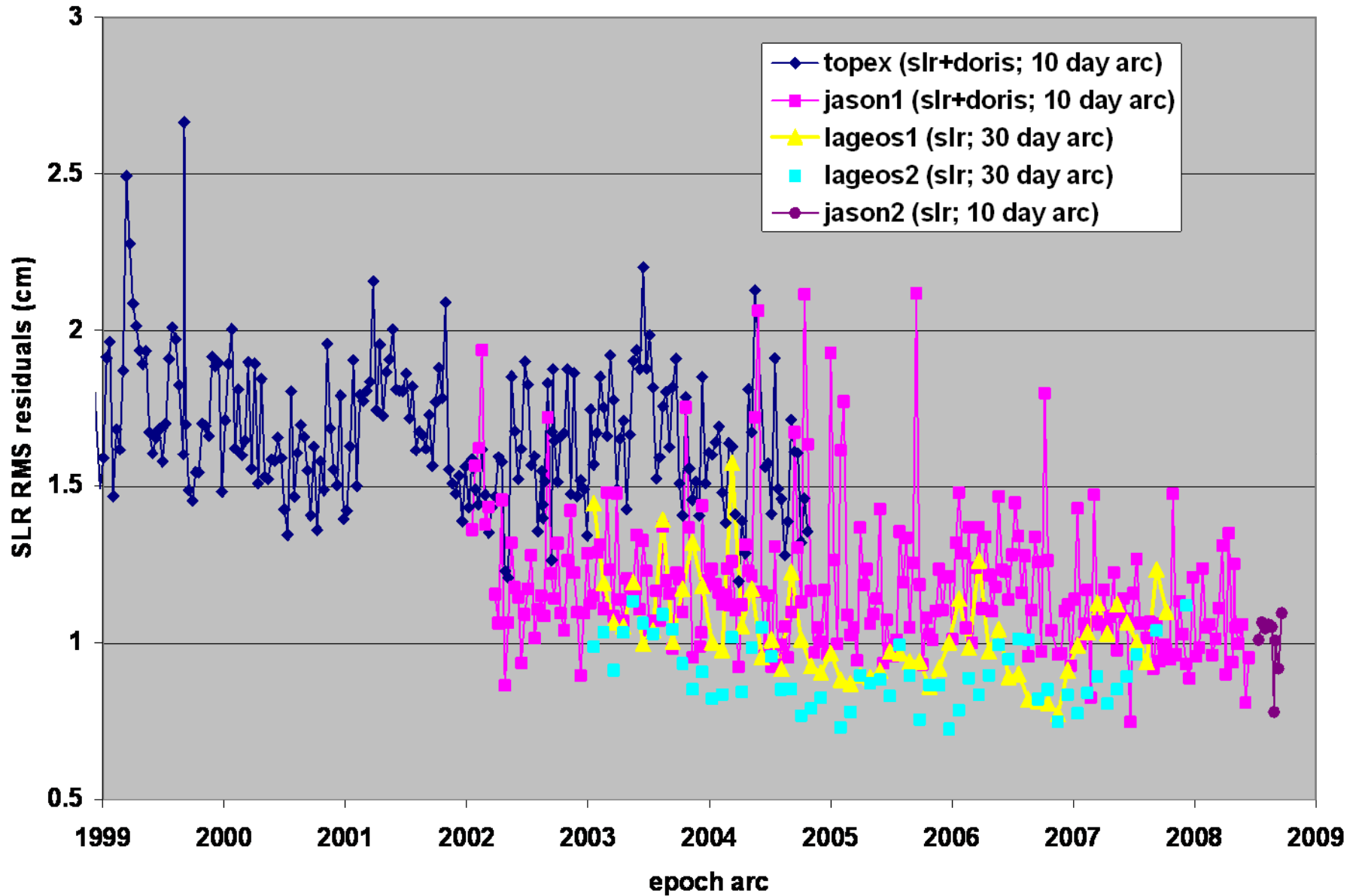
N.P. Zelensky, F.G. Lemoine, D.D. Rowlands,  
S.B. Luthcke, D.S. Chinn, J.W. Beall, B.D.  
Beckley, S.M. Klosko, P. Willis, V. Luceri

OSTST 2008 POD Splinter  
Nice, France  
November 10, 2008





# SLR processing at GSFC





# Consistent POD models across satellites

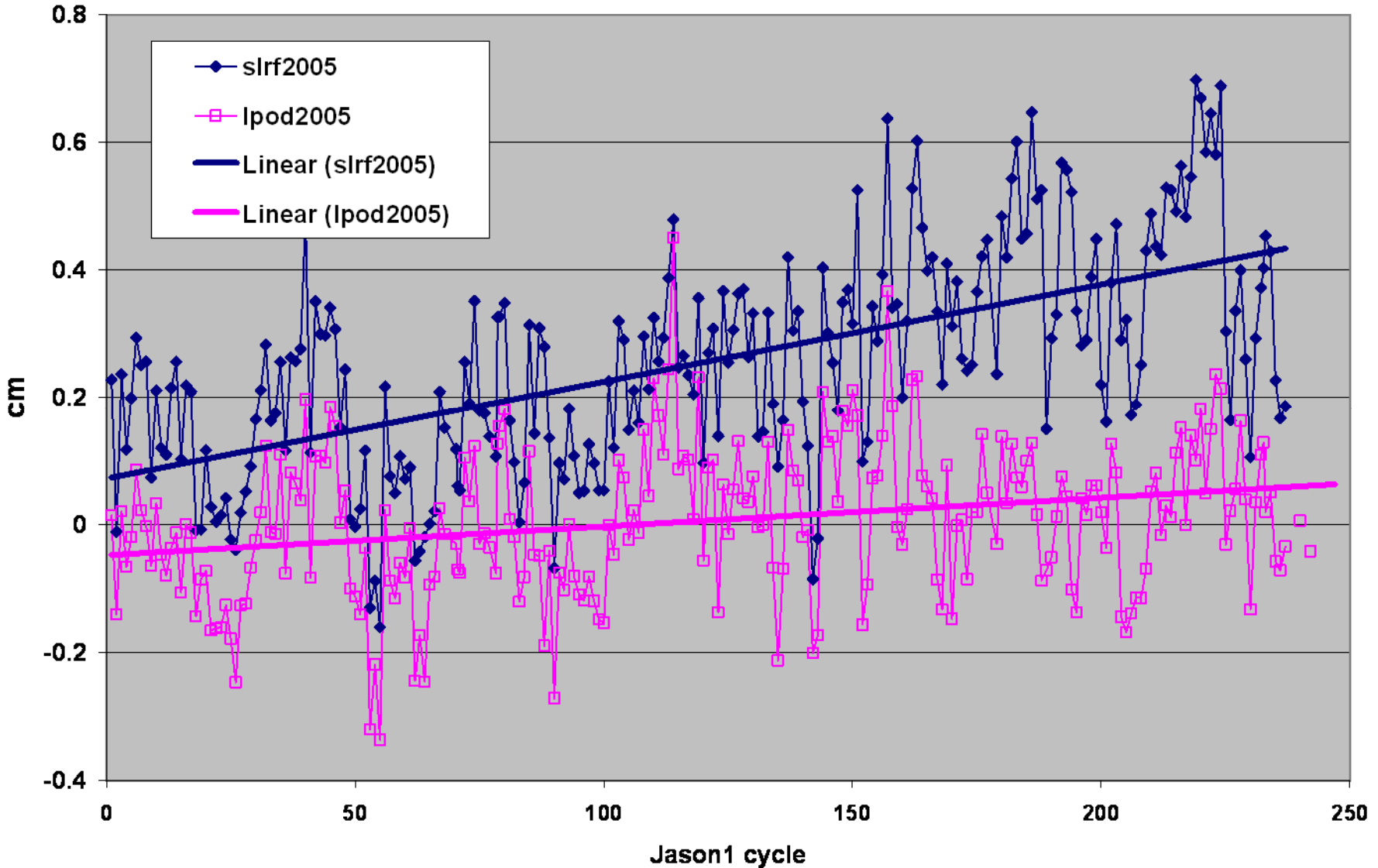
## Models include:

Reference frame and displacement of reference points	
SLR	SLRF2005 + LPOD2005 (version 6)
DORIS	DPOD2005
Earth tide	IERS2003
Ocean loading	Got4.7 all stations
Tidal CoM &EOP	Got4.7; VLBI high frequency terms
Gravity	
Static	Eigen-Gl04s
Time varying	Linear C20-dot, C21-dot, S21-dot (IERS2003) + 20x20 annual terms from GRACE
Atmospheric	ECMWF, 50x50@6hrs
Tide	Got4.7; VLBI high frequency terms



# Increase in mean SLR residuals means trouble

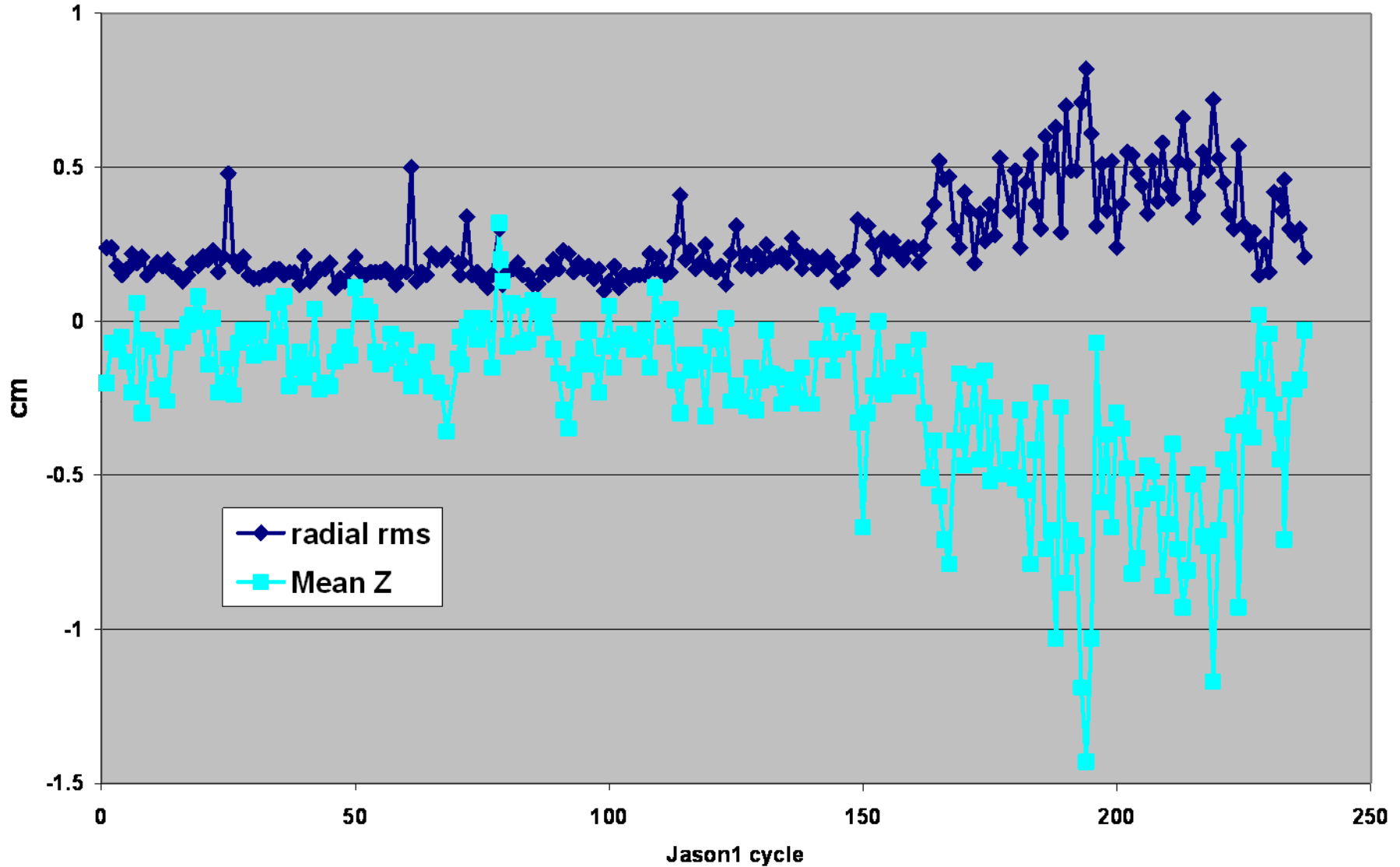
## Jason-1 Mean SLR residuals





# Only a few SLR station position/bias errors will affect the SLR/DORIS orbit

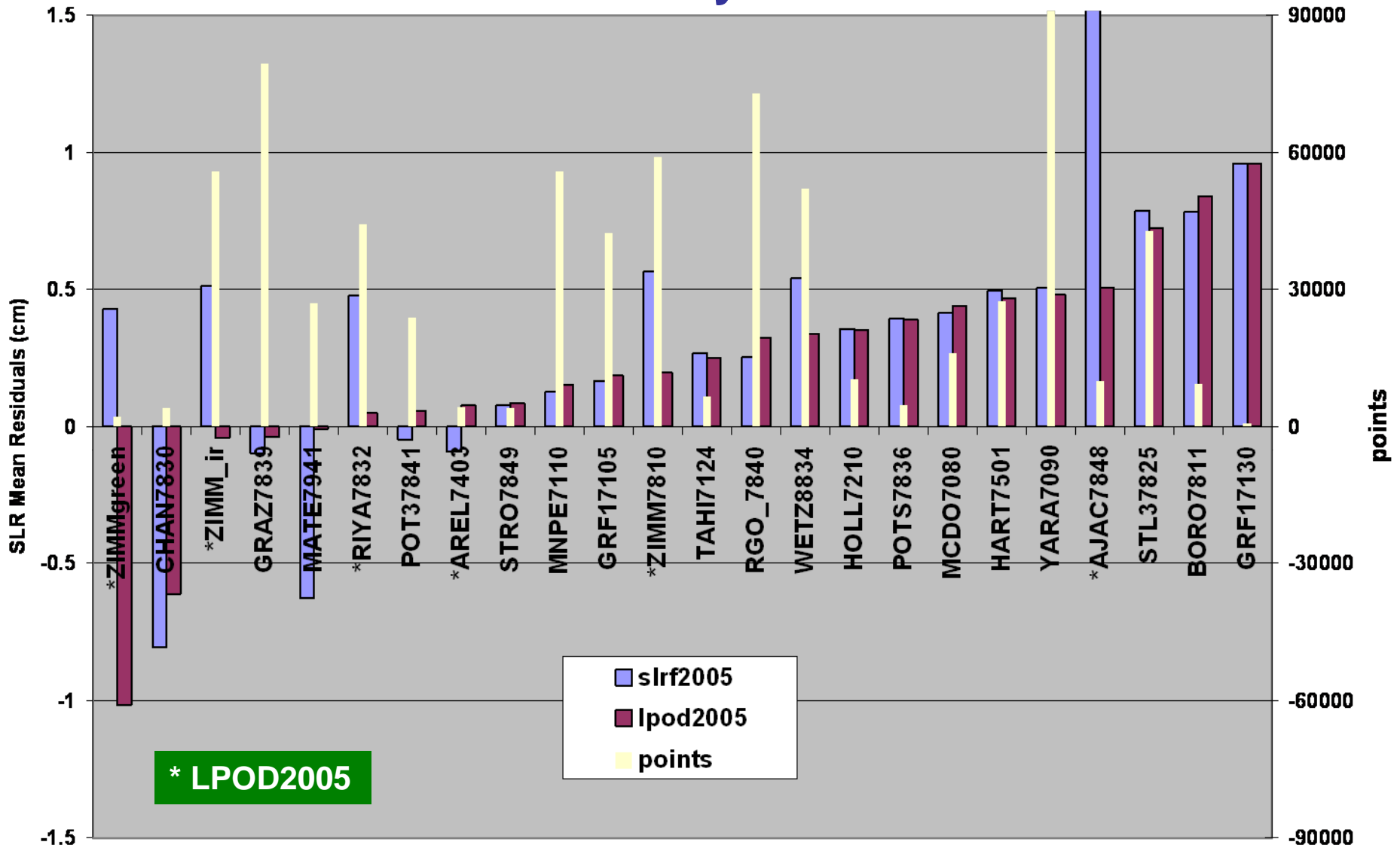
Jason1 orbit differences (lpod2005-slrf2005)





# LPOD2005 improves station performance and reduces mean residuals

## Jason1 cycles 1-237



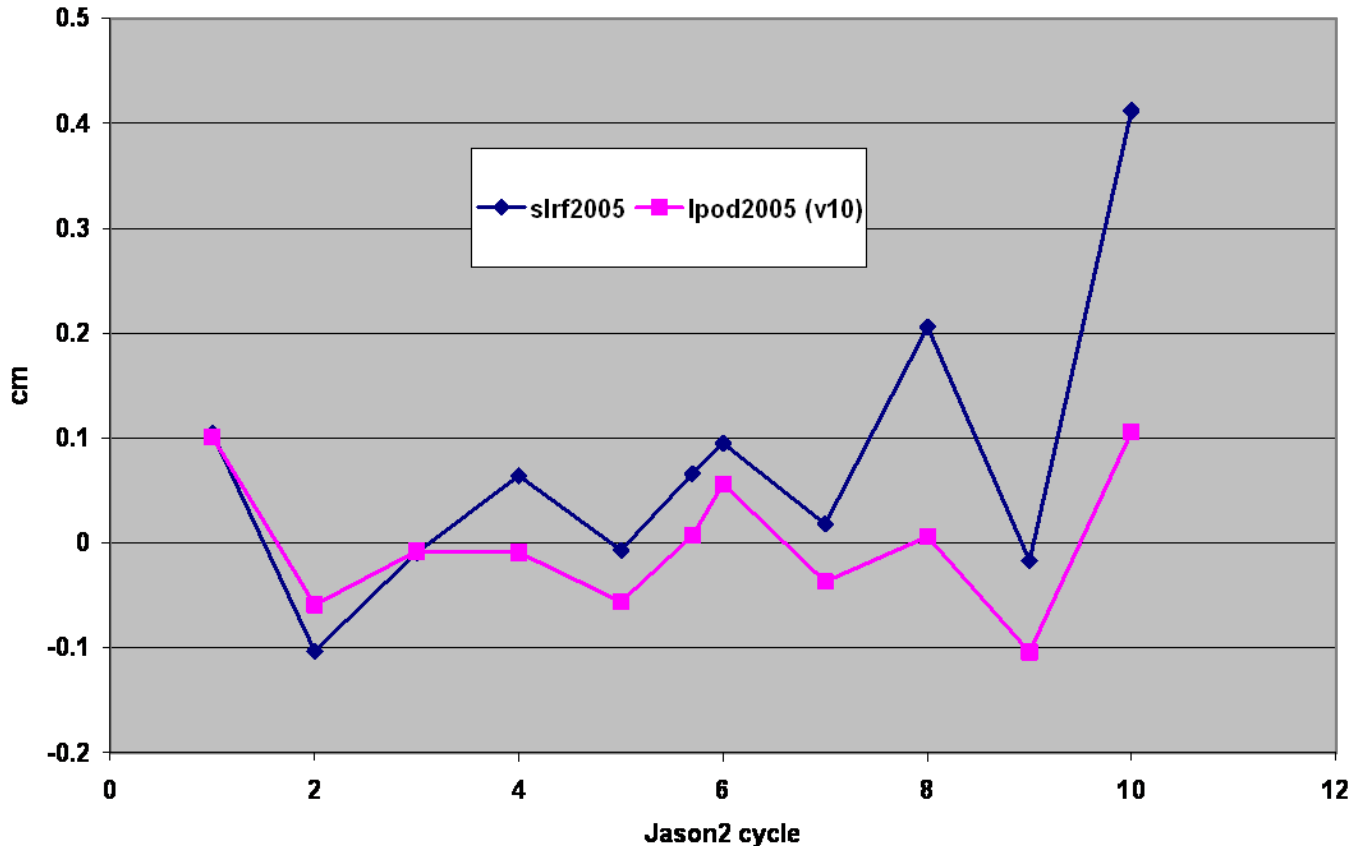
GSFC bias strategy consistent with



# Jason-2 tests confirm Jason-1 results

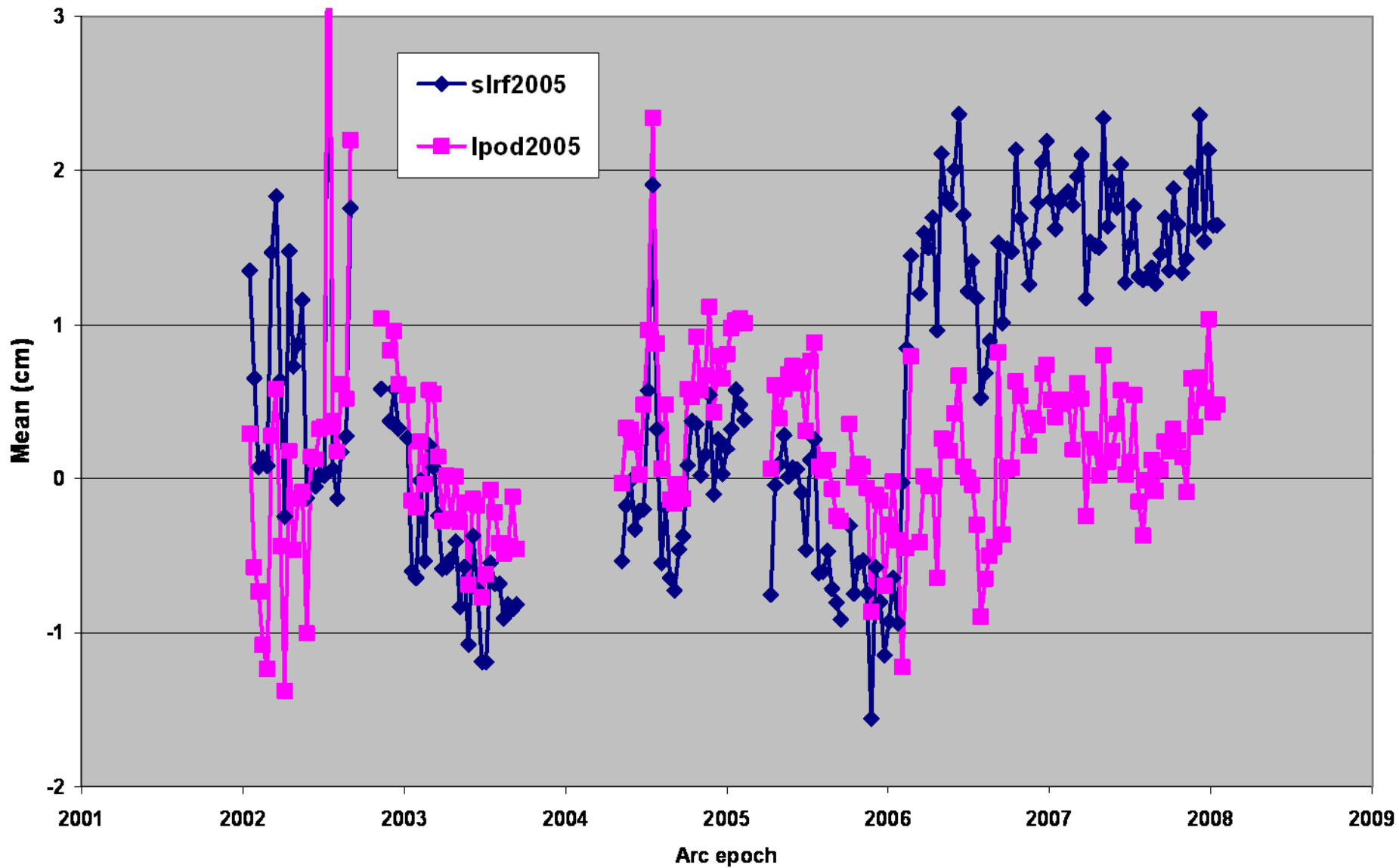
Jason2 LPOD2005 evaluation SLR-only cycles 1-10	slr (cm)		xover rms (cm)
	mean	rms	
slrf2005	<b>0.075</b>	<b>1.032</b>	<b>5.734</b>
lpod2005 (v10)	<b>0.000</b>	<b>0.930</b>	<b>5.693</b>

Jason-2 SLR-only Mean residuals





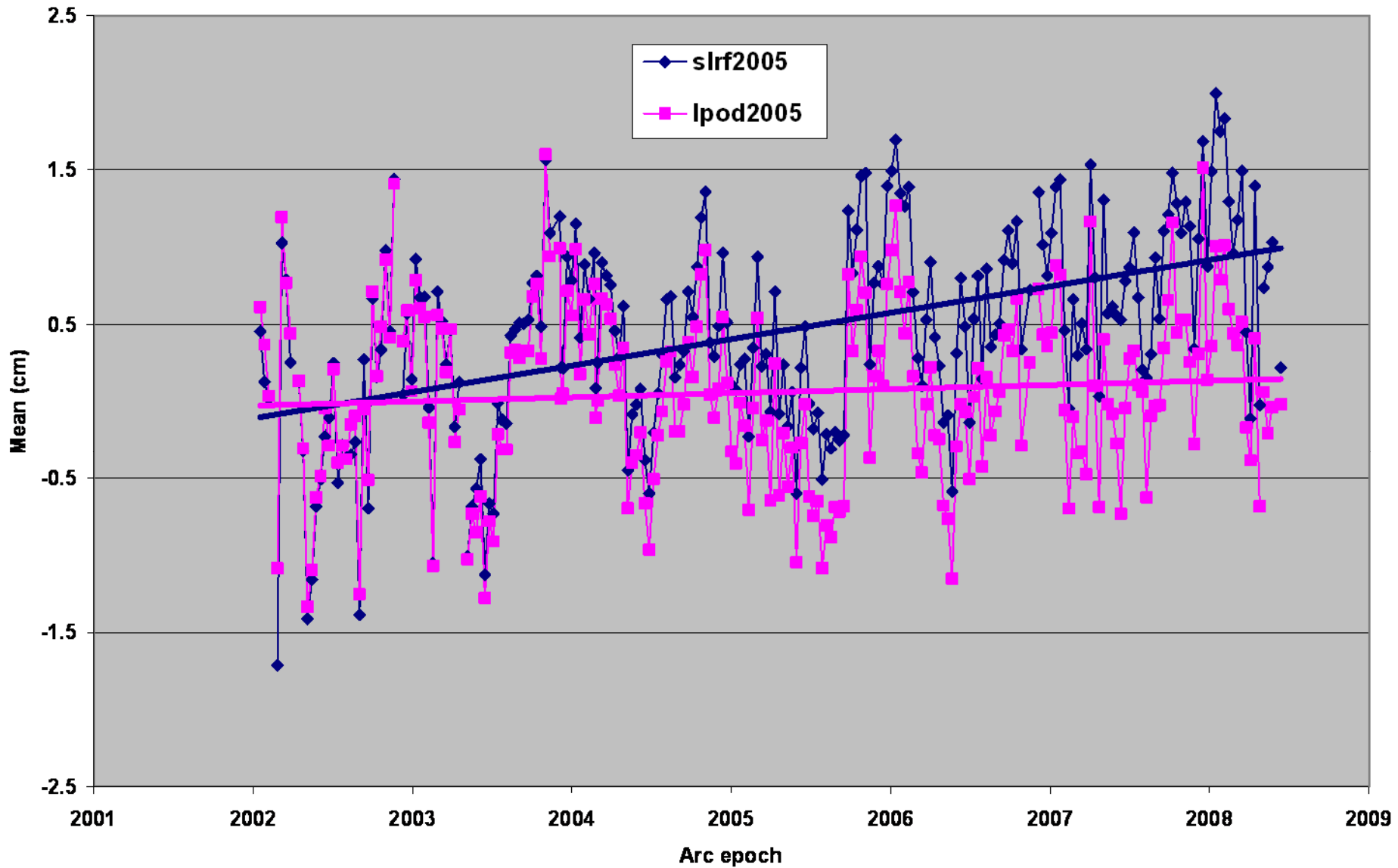
# Jason1 Zimmerwald (blue) mean SLR residuals





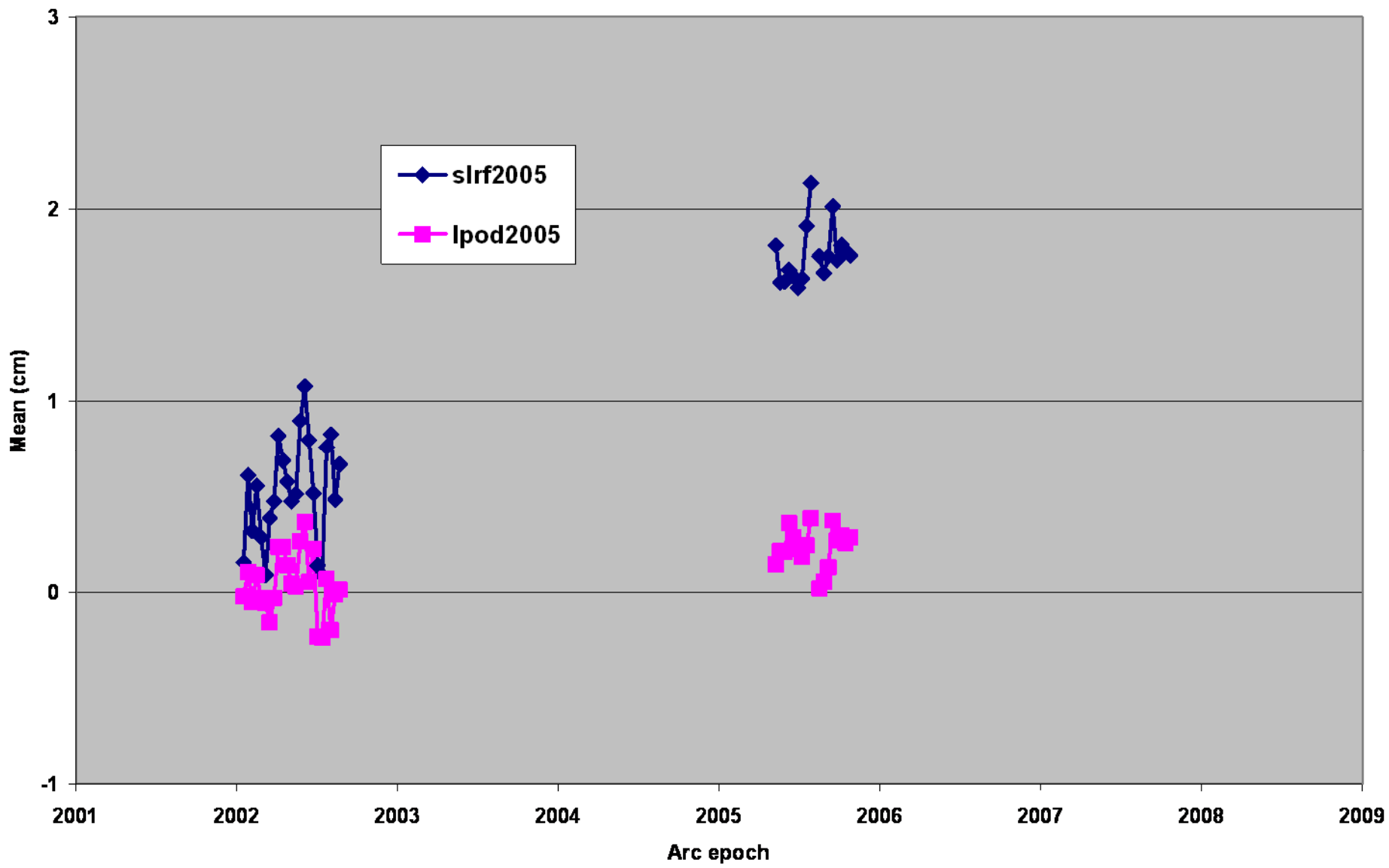


# Jason1 Riyadh mean SLR residuals





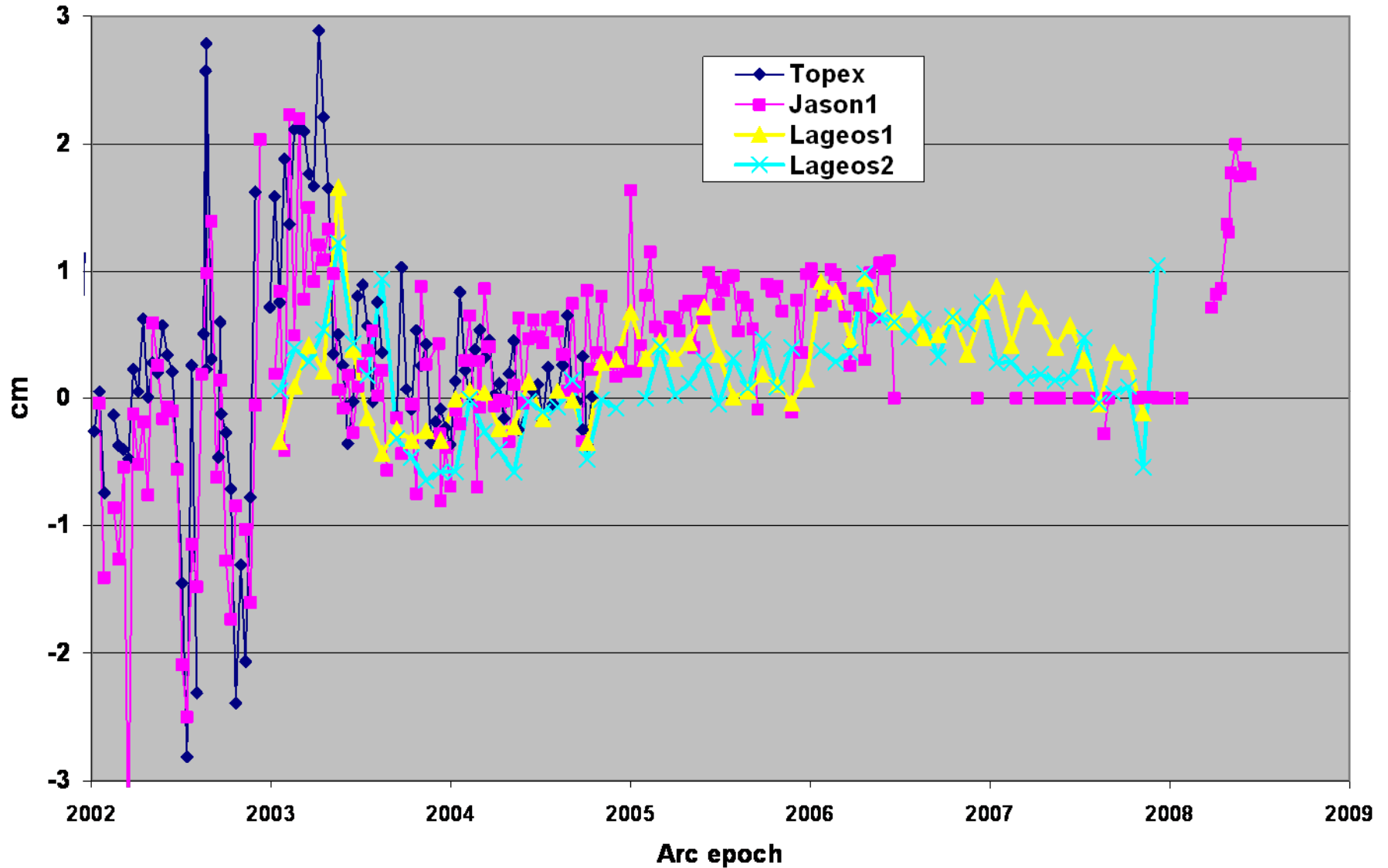
# Jason1 Ajacio mean SLR residuals





# Wettzell mean SLR residuals

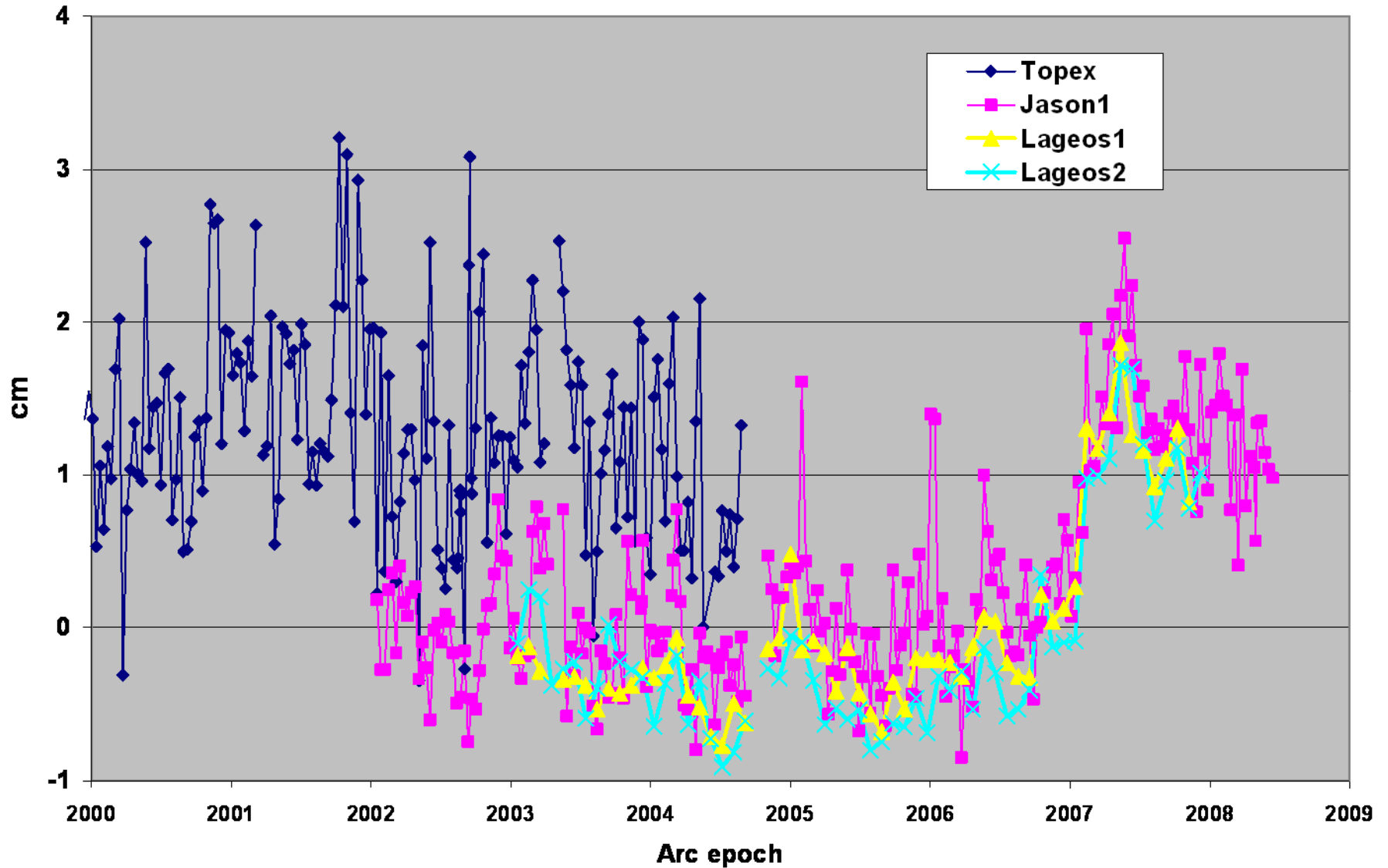
WETZ 8834 SLRF2005 Mean residuals; Ipod2005 orbit





# Herstmonceux mean SLR residuals

RGO 7840 SLRF2005 Mean residuals; Ipod2005 orbit





# Conclusions

- SLR processing now at the 1-cm level for Jason and Lageos, and 1.5-cm for Topex
- At this level differentiating between station biases and position /velocity error is difficult, but critical for further improvement.
- SLRF2005 offers a comprehensive station set, a significant improvement over the ITRF2005-SLR scaled station set.
- LPOD2005 significantly improves primary stations Zimmerwald, Riyadh, and Ajacio.
- Herstmonceux shows a 1.2 cm bias beginning about Feb 12, 2007. Other stations show trends – see the poster!
- Should POD standards for the next ITRF require a common bias strategy and atmosphere time-varying gravity modeling?

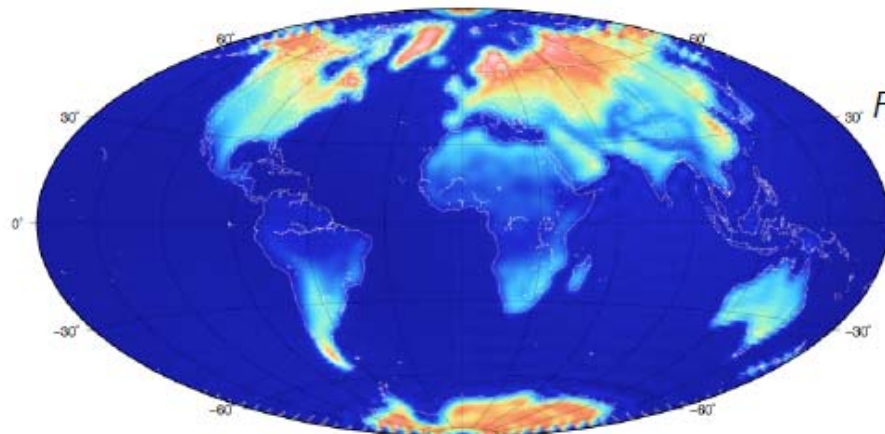


# Atmosphere and Ocean Background Modeling

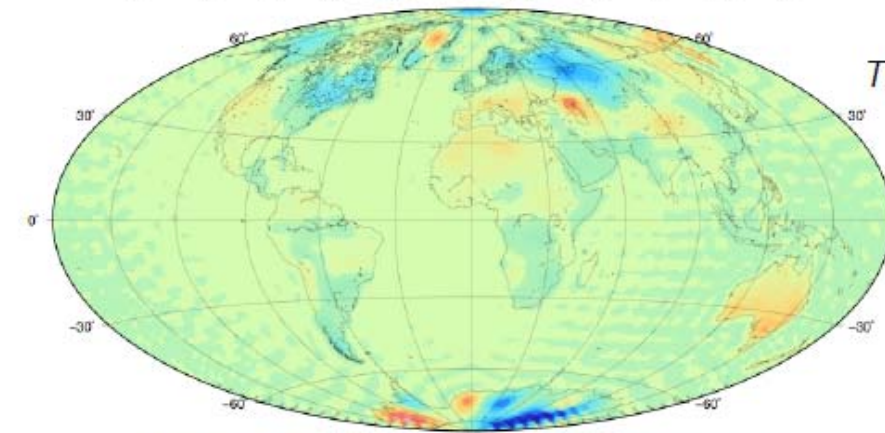
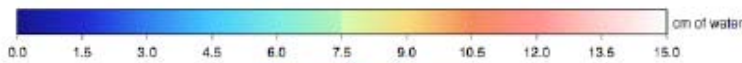
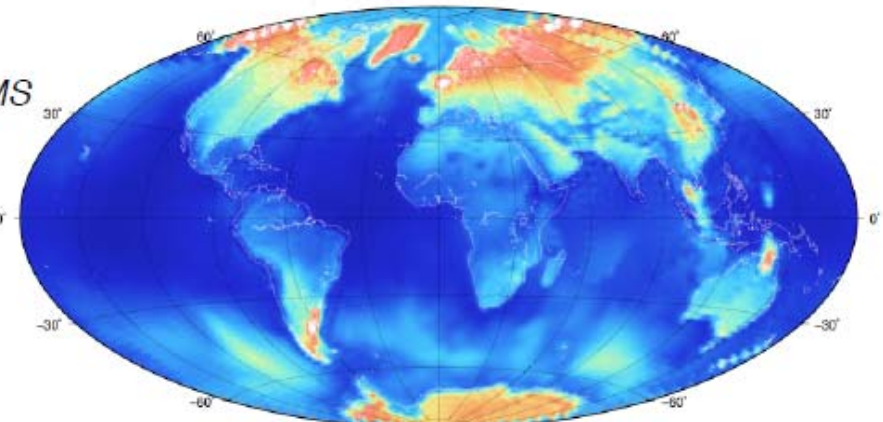
NCEP-6hr./ IB

Apr03-Apr07

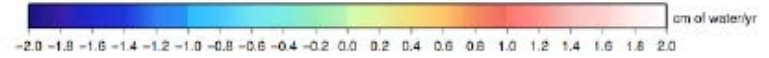
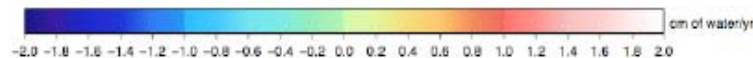
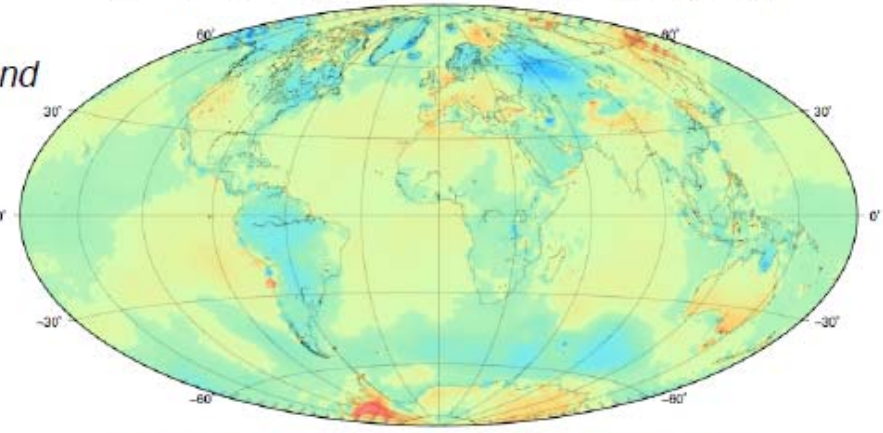
ECMWF-3hr. / MOG2D



RMS



Trend





# BACKUP



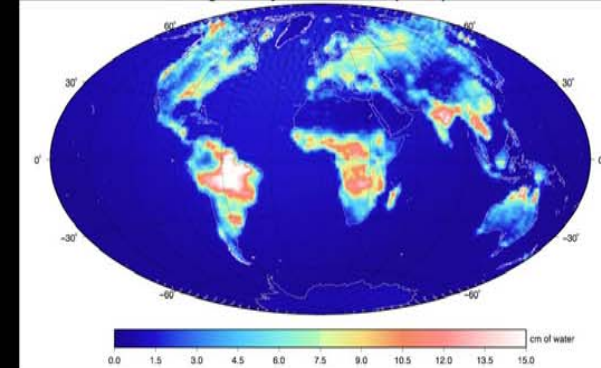
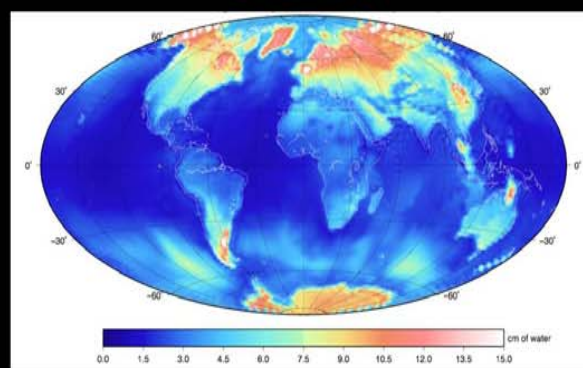
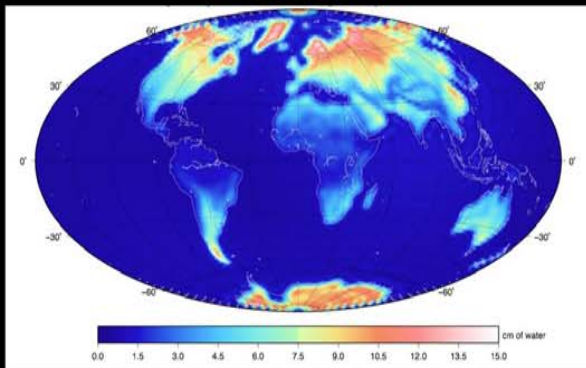
# Time Varying Gravity Components

Atmospheric gravity (NCEP-6hr)

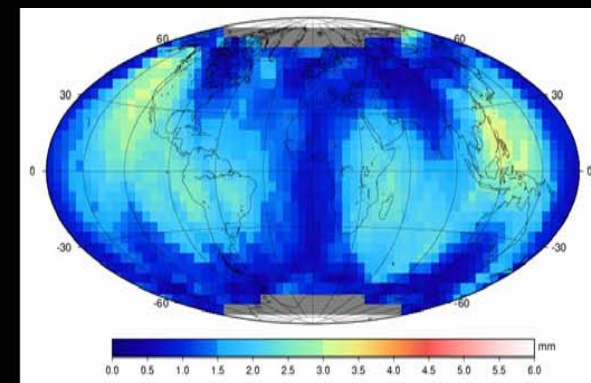
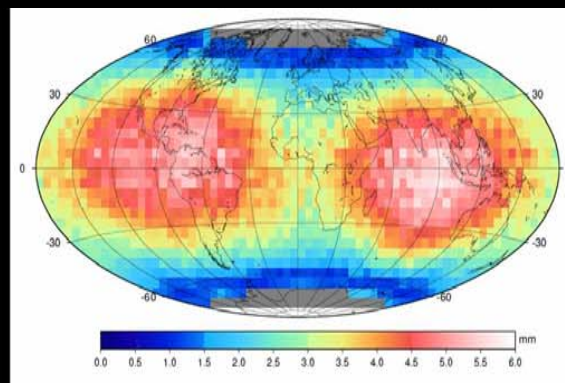
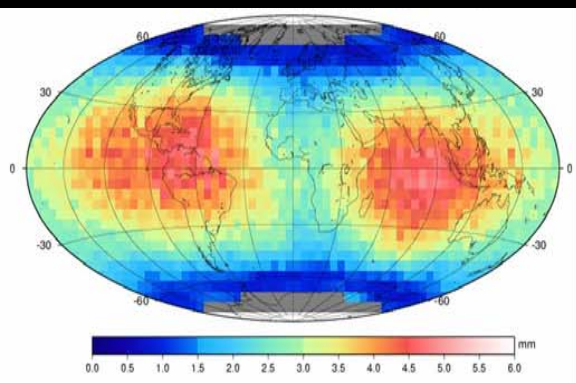
Atgrav(ECMWF-3hr)+Ocean(MOG2D)

Hydrology (GLDAS)

Signal (RMS cm of water)



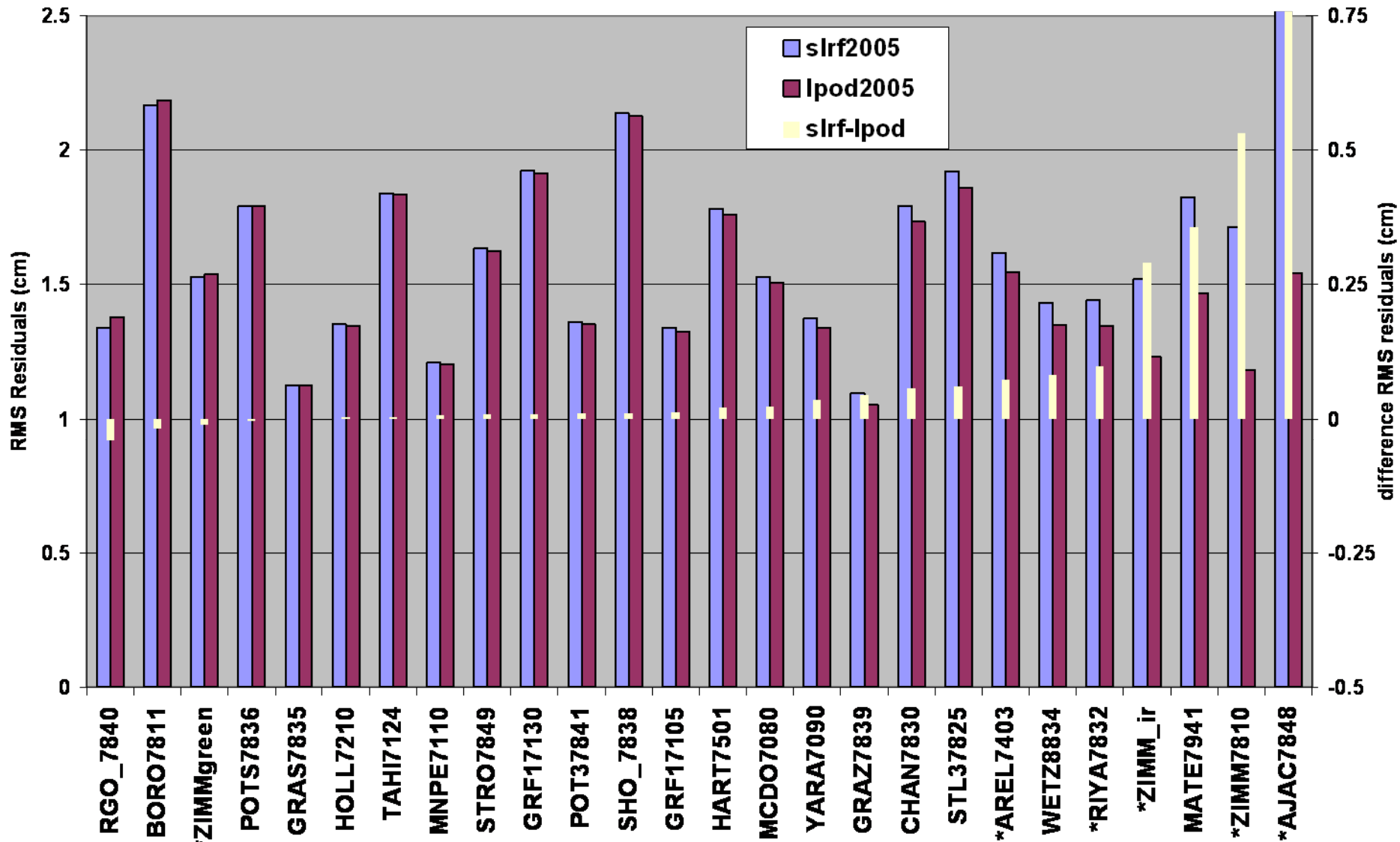
Jason radial orbit RMS (mm)







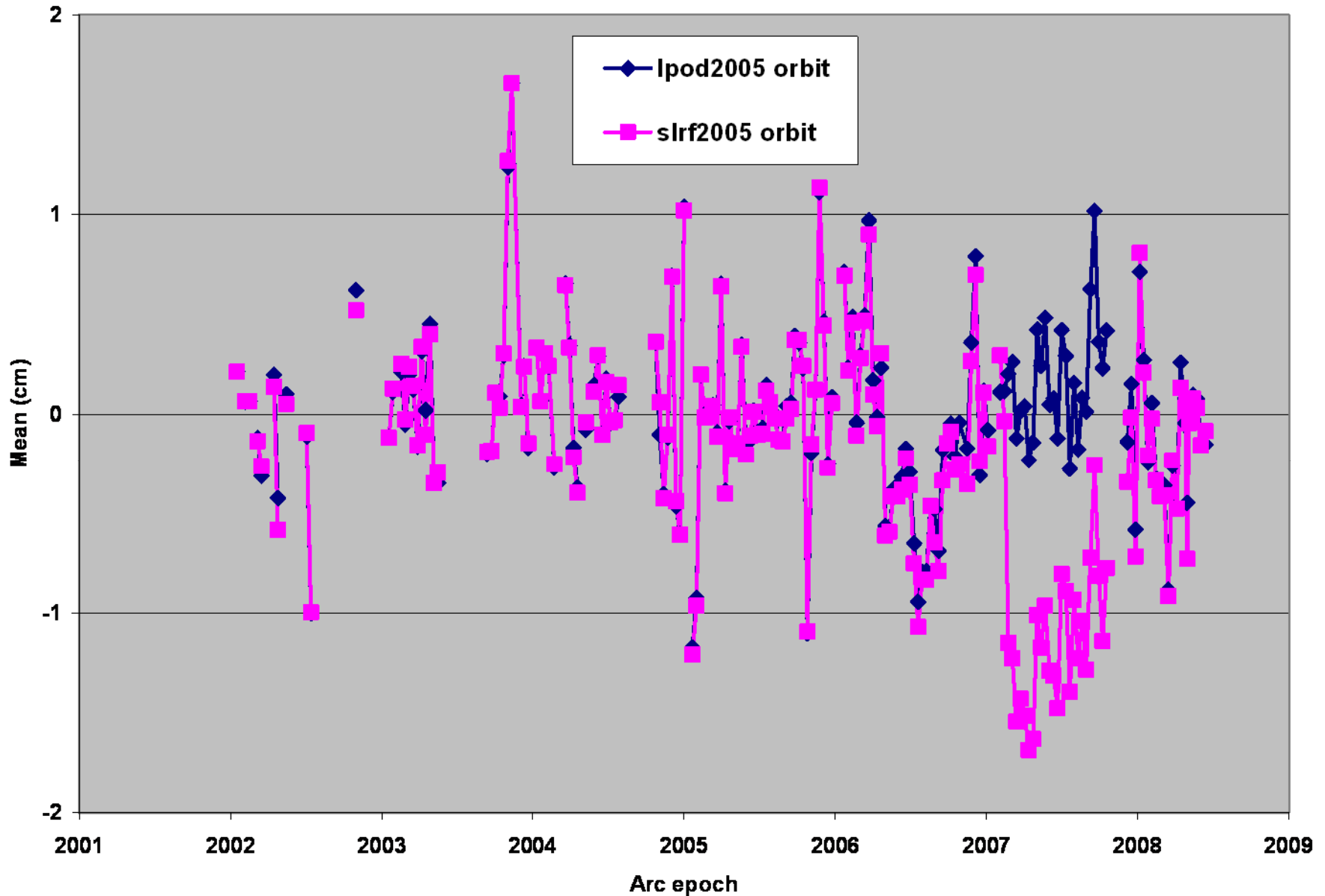
# Jason1 station performance; cycles 1-237; 24 primary stations



\* LPOD2005



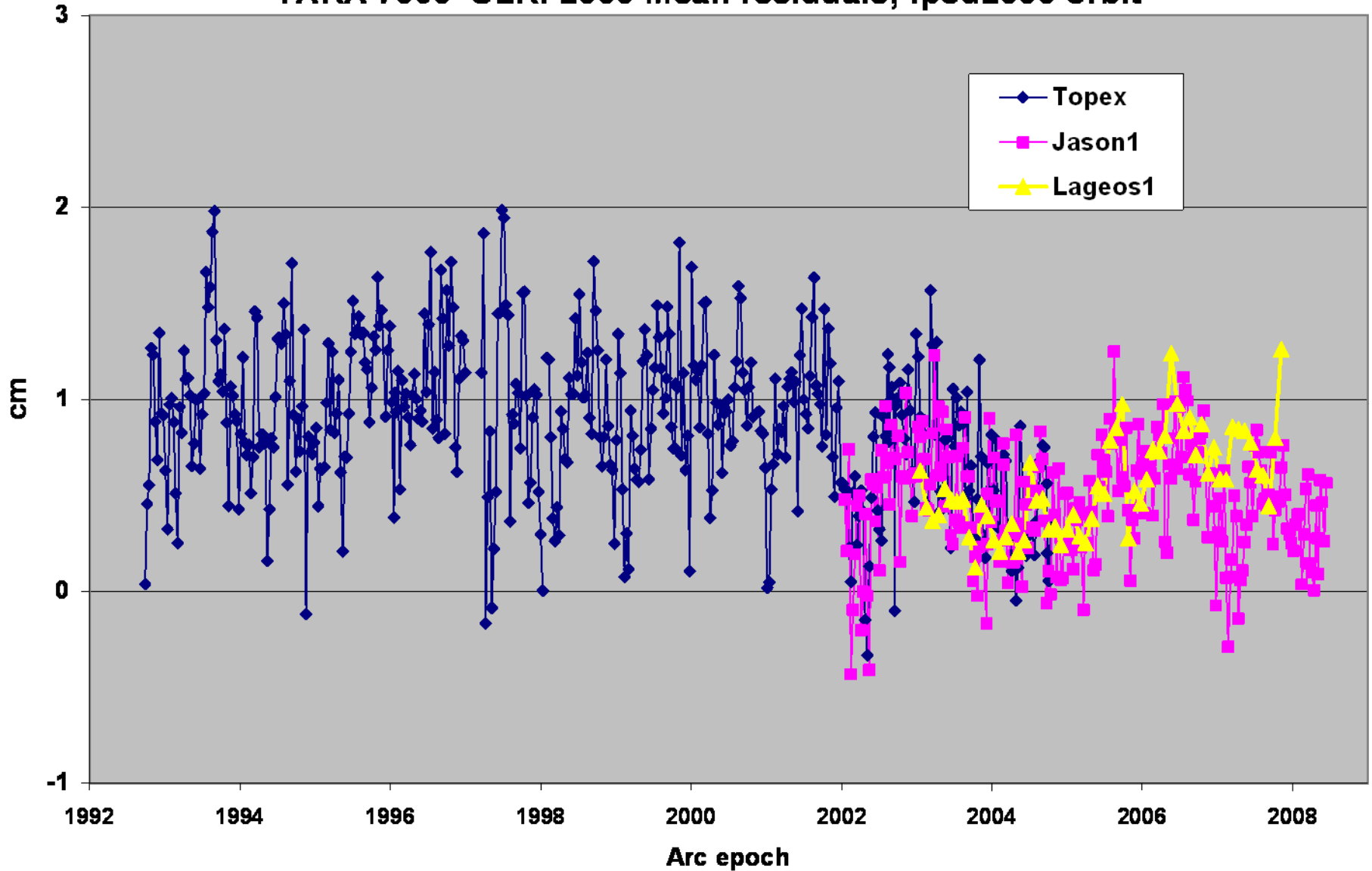
# Example slrf2005-only Jason1 orbit corrupts Matera (7941) evaluation





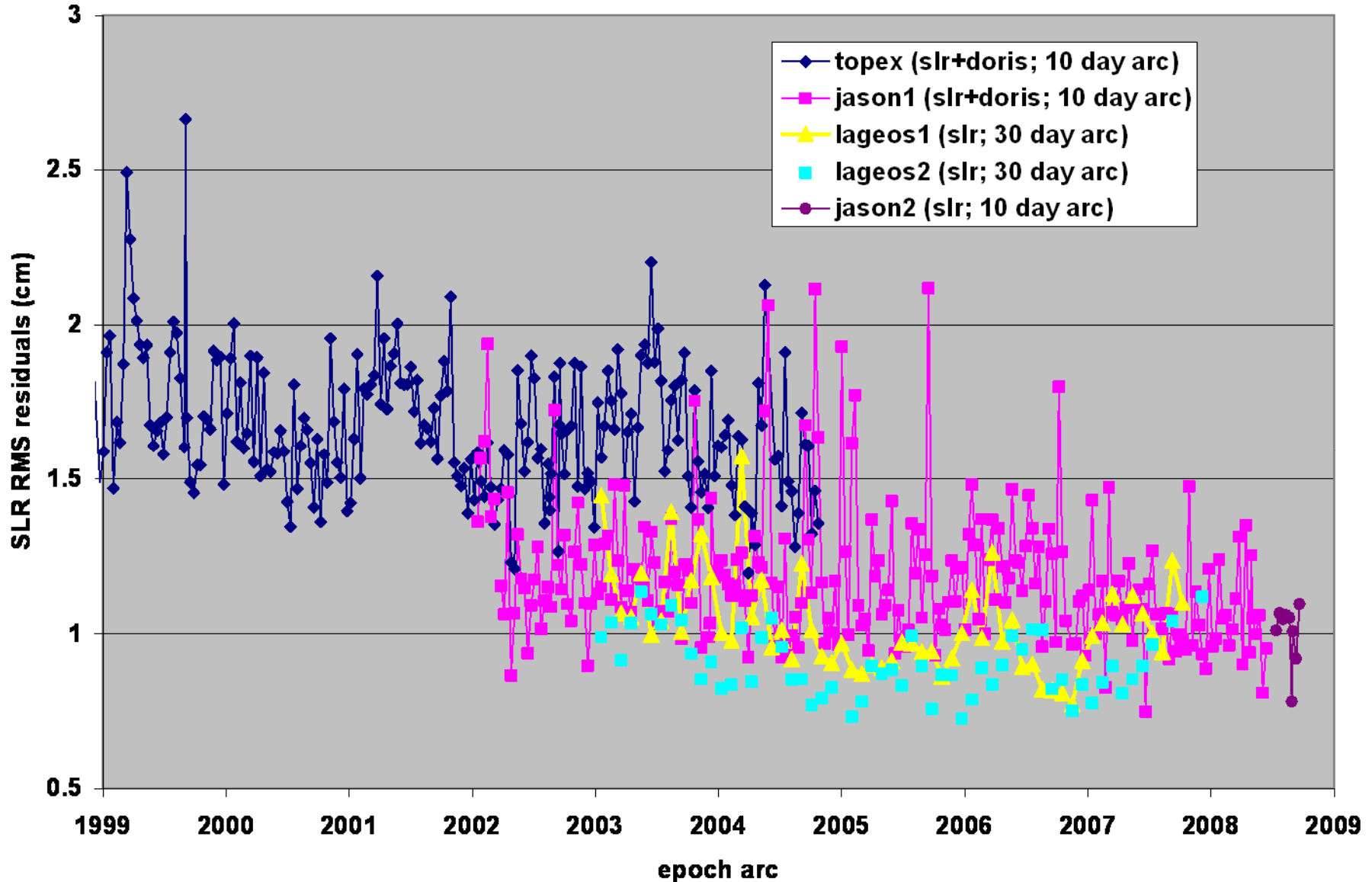
# Yarragadee mean SLR residuals

YARA 7090 SLRF2005 Mean residuals; Ipod2005 orbit



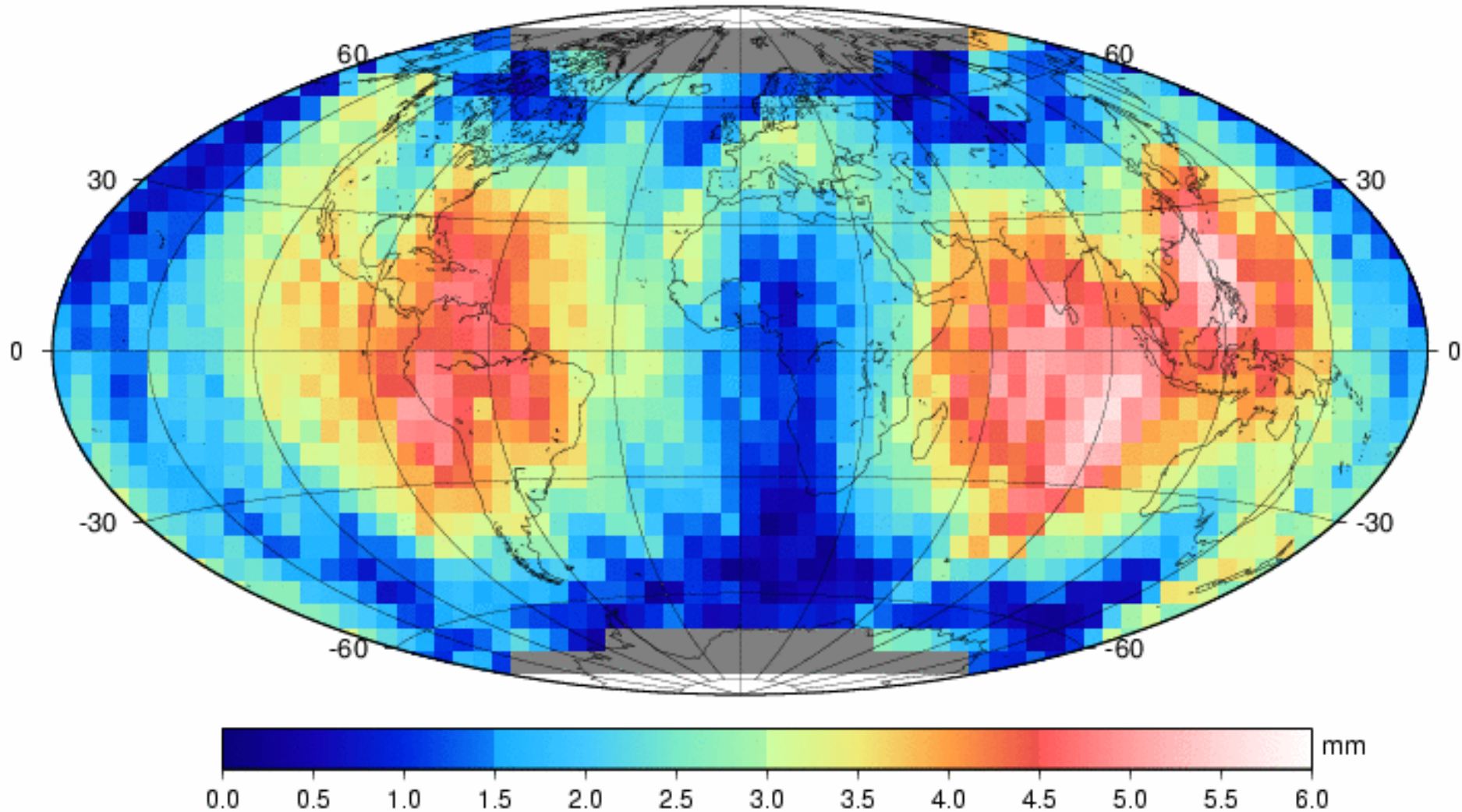


# SLR processing at GSFC



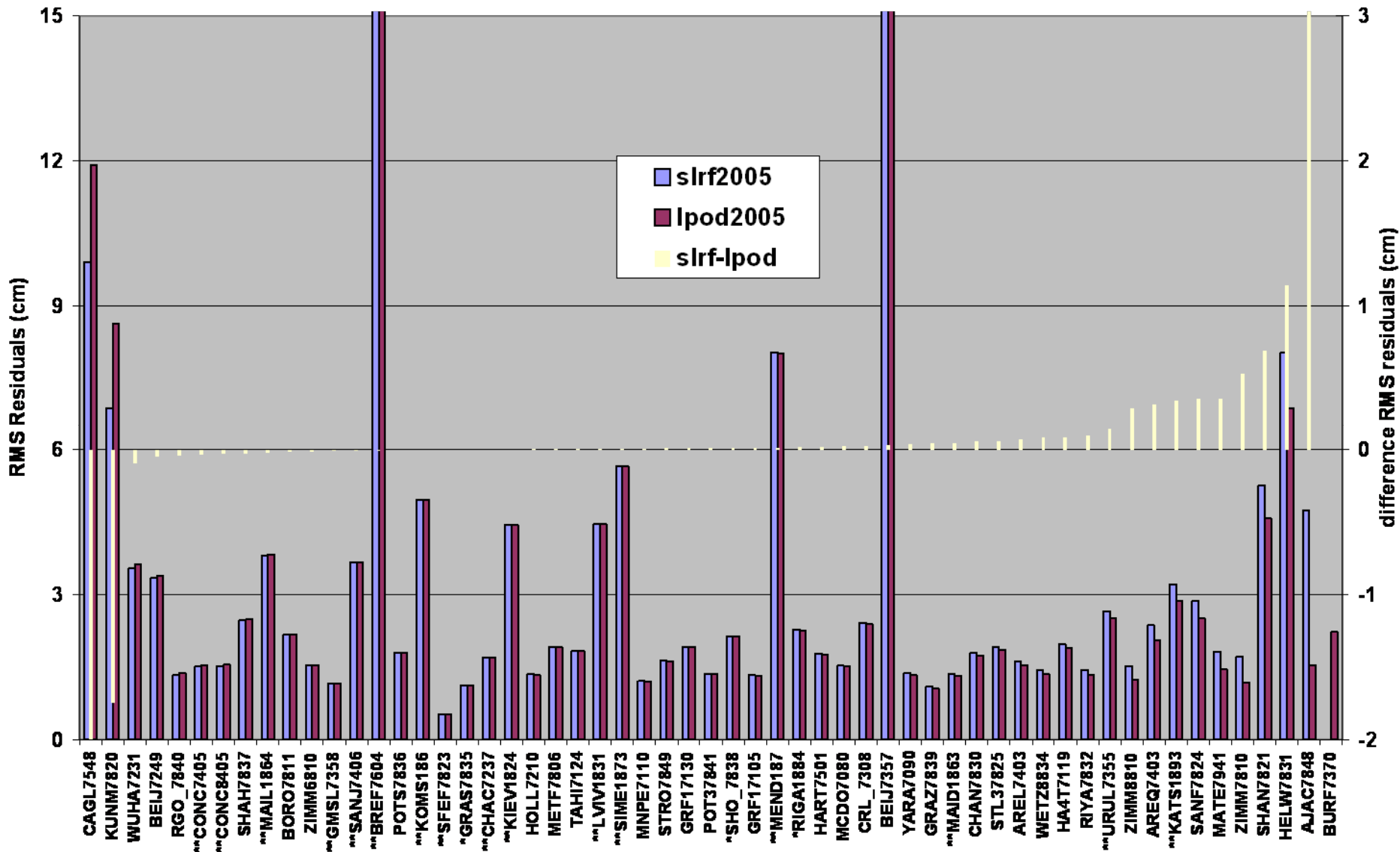


# Jason1 radial 5-mm annual amplitude due to time varying gravity





# Jason1 station performance; cycles 1-237; all 57 stations



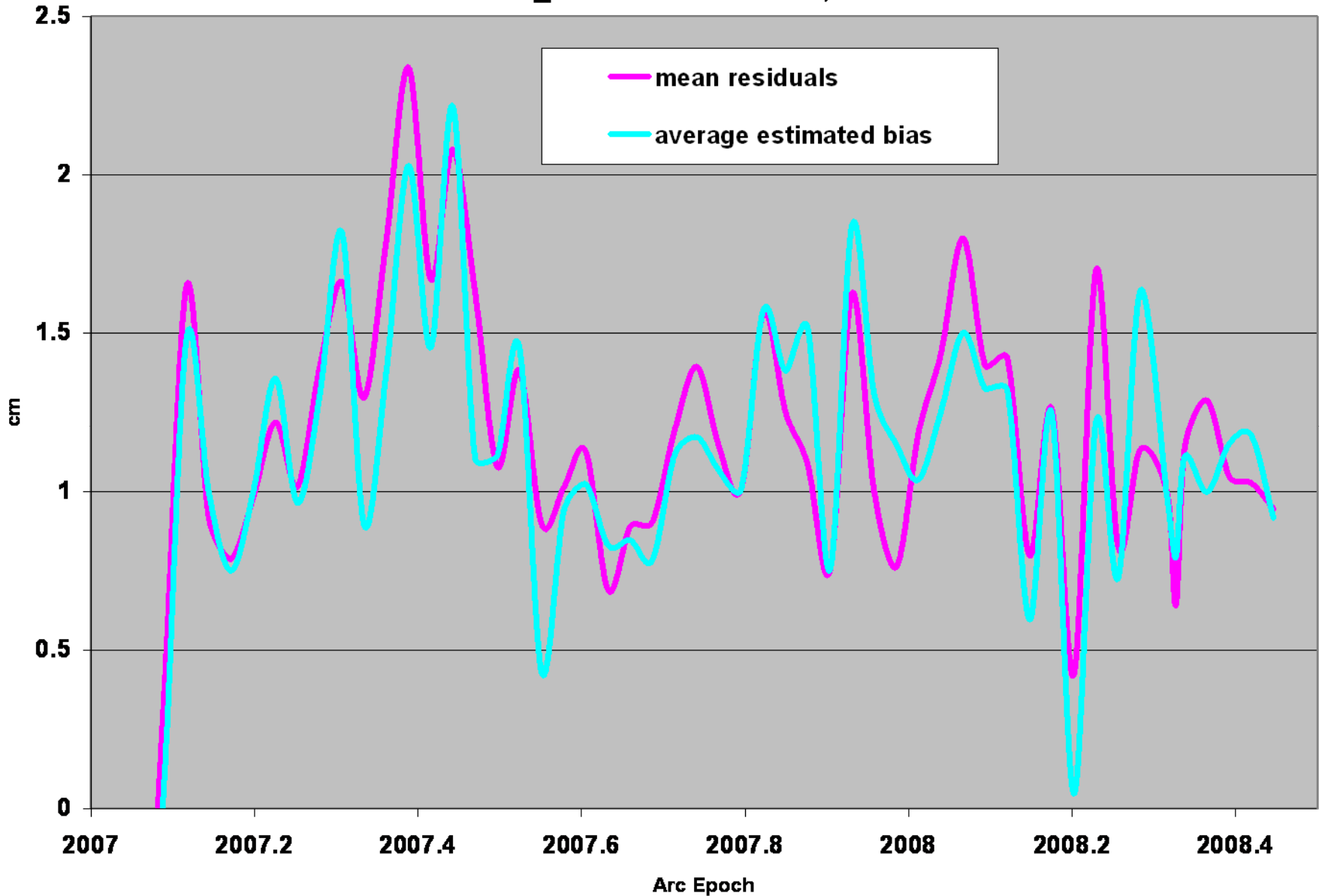
\*\* adjust bias per pass;

\* adjust bias per arc



# Mean SLR residuals correspond to range bias

Jason1 RGO\_7840 SLR residuals; slrf2005 orbit





# Goddard SLRF2005 mean residuals

## GRF 7105 Mean SLR residuals

