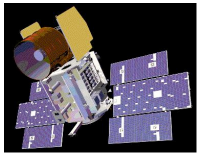

Maximizing ICESat's Contribution to Understanding Ice Sheet Surface Mass Balance

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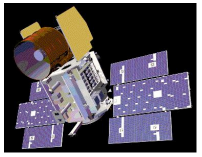
NASA Goddard Space Flight Center

ICESat Science Team Meeting
CSR, Univ. TX, Austin, TX
Feb. 21-23, 2007

Overview

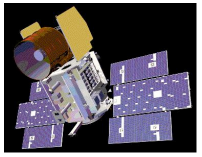


- **Summary of range residual analysis calibration, validation and correction. Focus on pointing.**
  - **Scan Maneuver calibrations**
  - **Validation - *C. Martin, J. DiMarzio***
  - **Xover validation**

- Summarize current ice sheet mass flux estimates from GRACE mascon solutions.

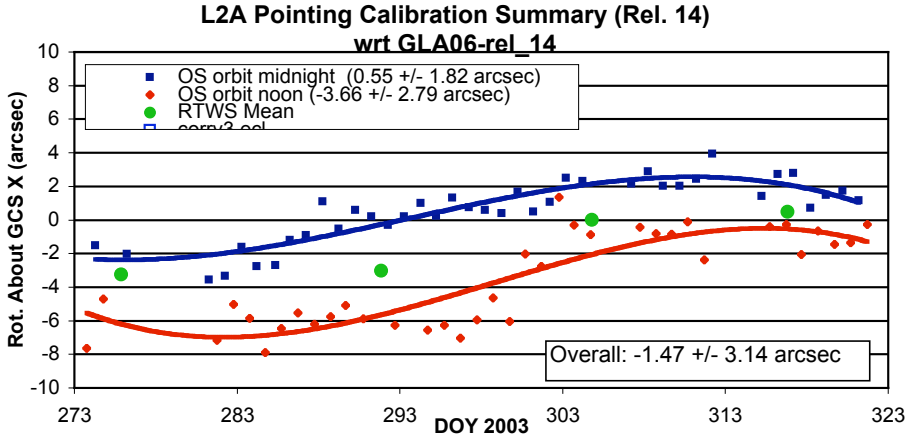
- Discussion of future efforts.

Scan Maneuver Calibrations

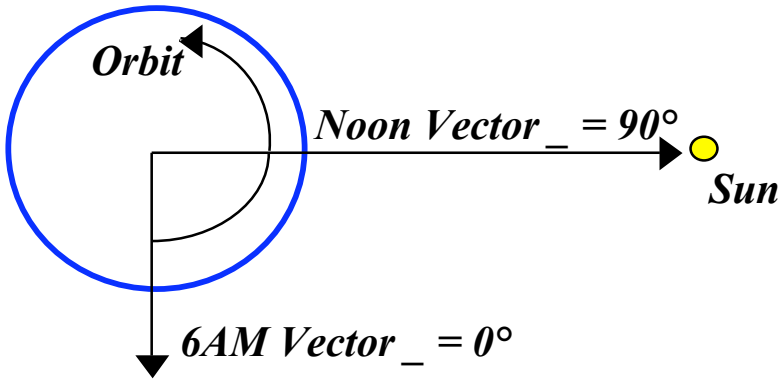


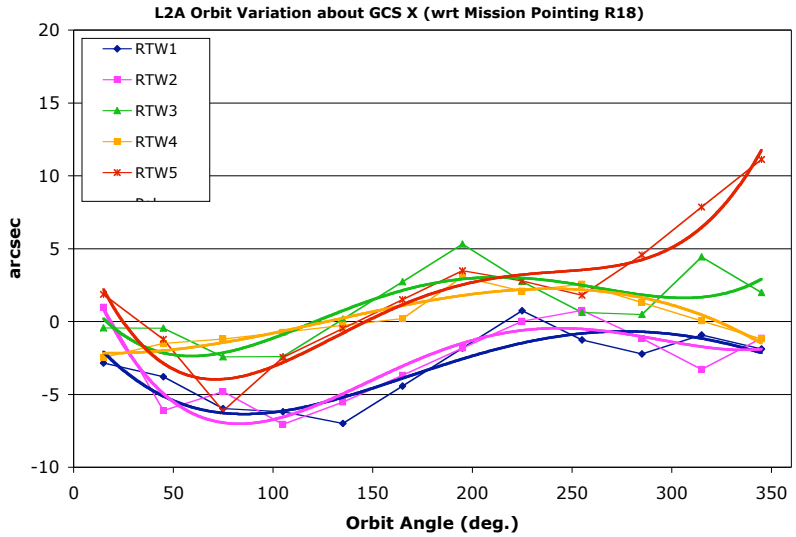
Using OSs capture pointing bias trends and orbital variation about both GCS X and Y

L2A GCS X Example

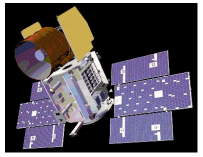


Using RTWSs estimate orbital pointing variation as a step function in orbit angle for both GCS X and Y



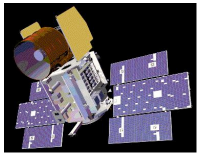


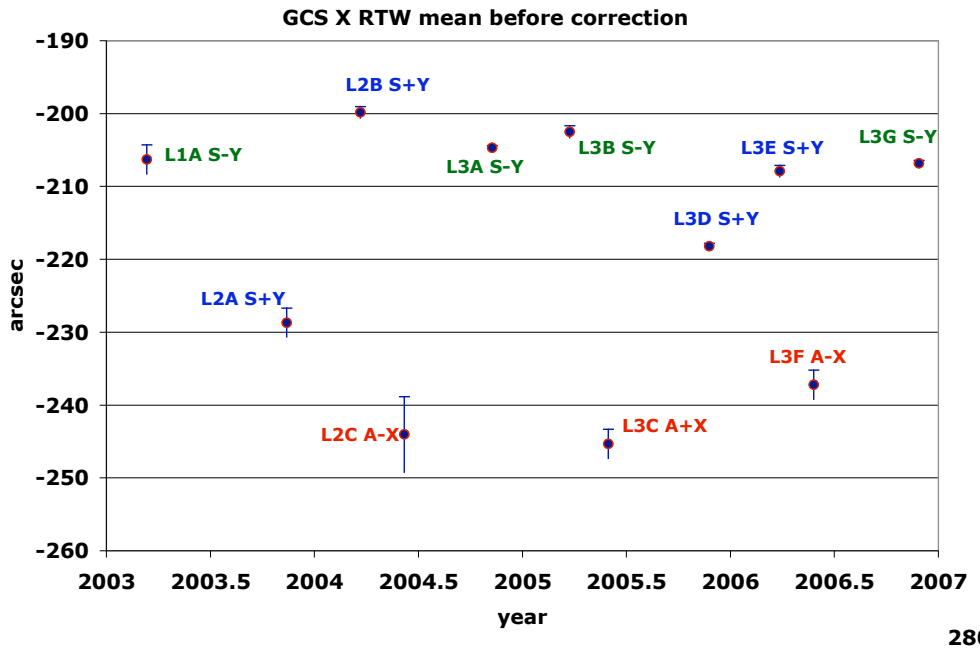
SM Cal./Val. Correction Summary
"long-arc" estimate

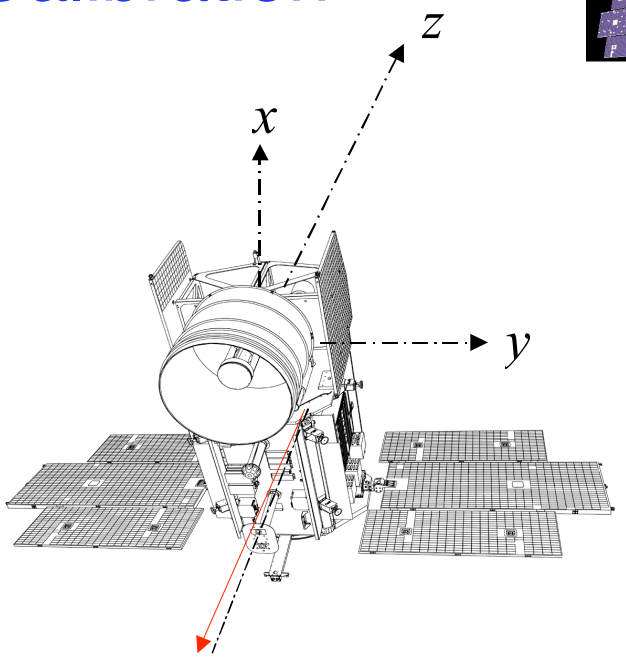


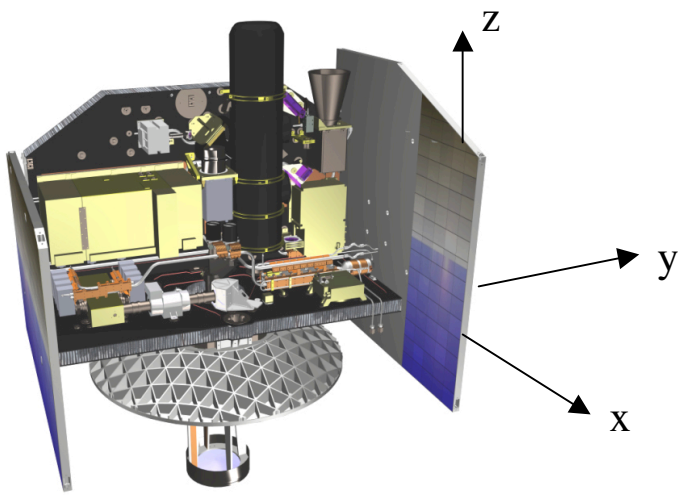
Obs. Period	Date	Release cal/val correction	Pointing accuracy (arcsec)	Horizontal accuracy (m)	Vertical Accuracy 1° slope (cm)
L1A Sailboat -Y L1B Airplane X	2/20/03 - 3/21/03 3/21/03 - 3/29/03	17	1.59 ± 3.20	4.63 ± 9.31	8.1 ± 16.3
L2A Sailboat Y	9/25/03 - 11/19/03	328 corrv2	0.00 ± 1.30	0.00 ± 3.78	0.0 ± 6.6
L2B Sailboat Y	2/17/04 - 3/21/04	22 corrv2	0.00 ± 1.24	0.00 ± 3.60	0.0 ± 6.3
L2C Airplane -X	5/18/04 - 6/21/04	17	12.96 ± 18.37	37.70 ± 53.43	65.8 ± 93.3
L3A Sailboat -Y	10/3/04 - 11/8/04	22 corrv2	0.00 ± 0.95	0.00 ± 2.75	0.0 ± 4.8
L3B Sailboat -Y	2/17/05 - 3/24/05	542 corrv2	0.02 ± 1.44	0.02 ± 4.20	0.1 ± 7.3
L3C Airplane X	5/20/05 - 6/23/05	547	5.89 ± 5.66	17.13 ± 16.45	29.9 ± 28.7
L3D Sailboat Y	10/21/05 - 11/24/05	529 corrv2	0.02 ± 0.98	0.07 ± 2.86	0.1 ± 5.0
L3E Sailboat Y	2/22/06 - 3/28/06	537 corrv2	0.00 ± 1.17	0.00 ± 3.41	0.0 ± 6.0
L3F Airplane -X	5/24/06 - 6/26/06	538	30.90 ± 6.94	89.87 ± 20.19	156.9 ± 35.2
L3G Sailboat -Y	10/25/06 - 11/27/06	328	1.70 ± 3.66	4.95 ± 10.65	8.6 ± 18.6

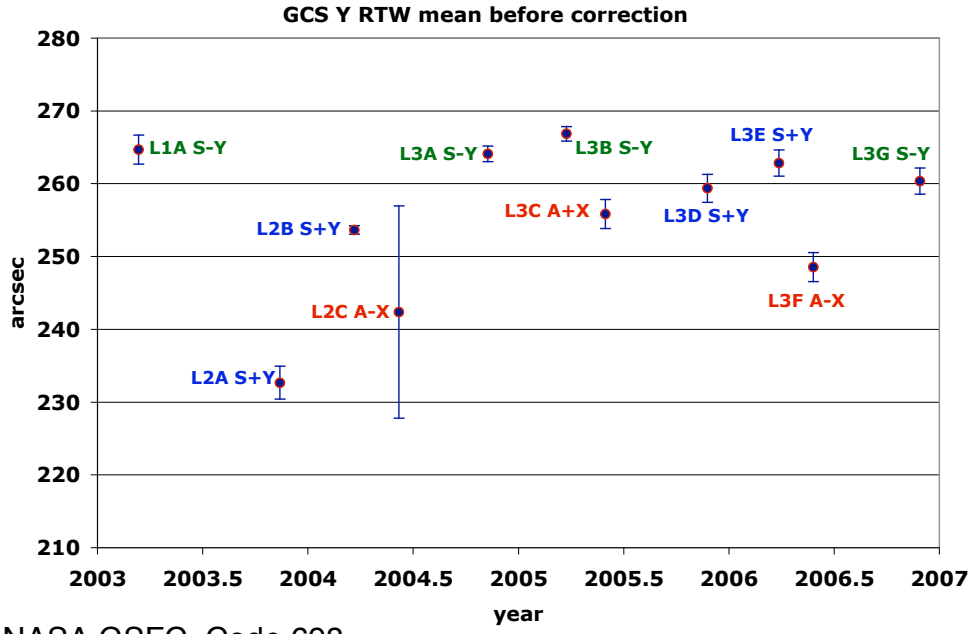
Initial Pointing Bias Calibration











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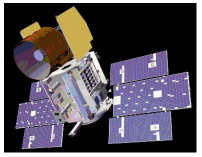
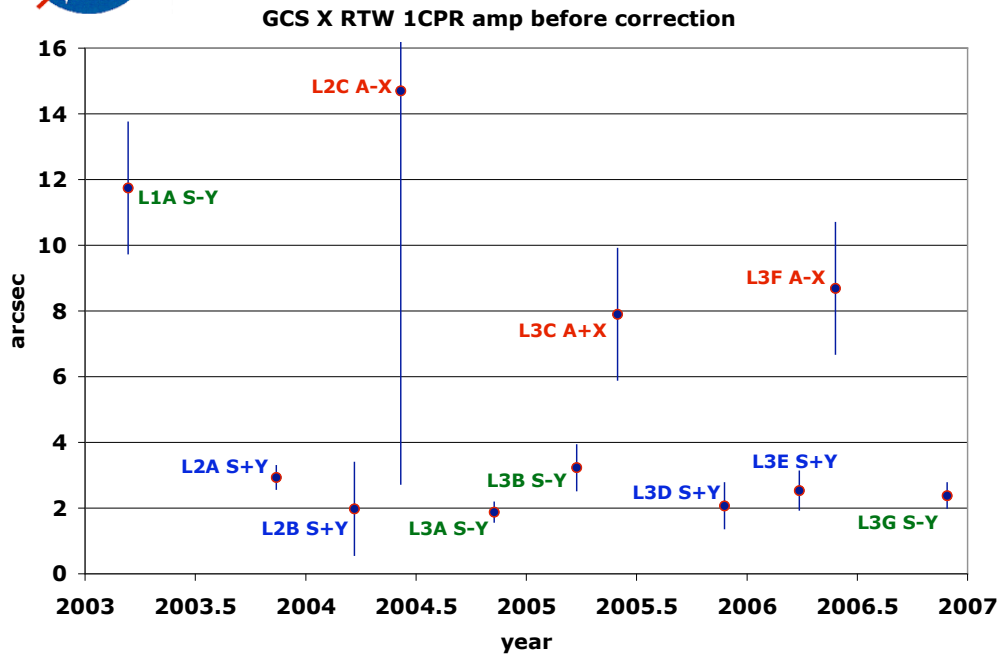
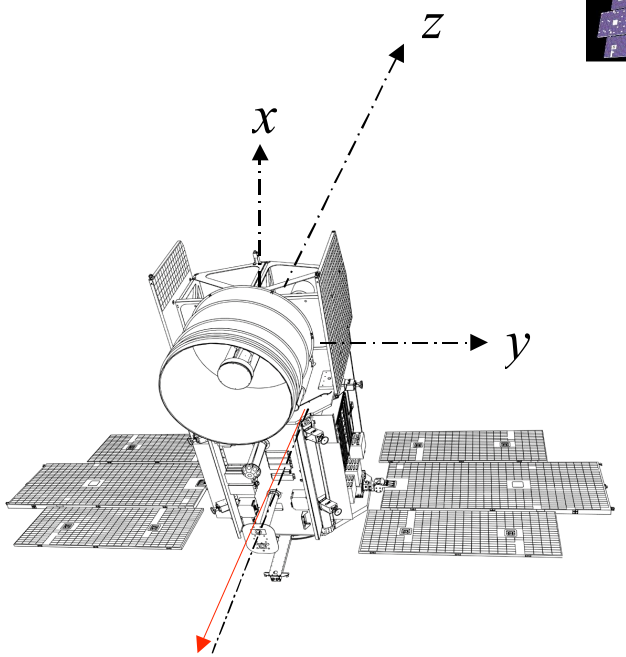
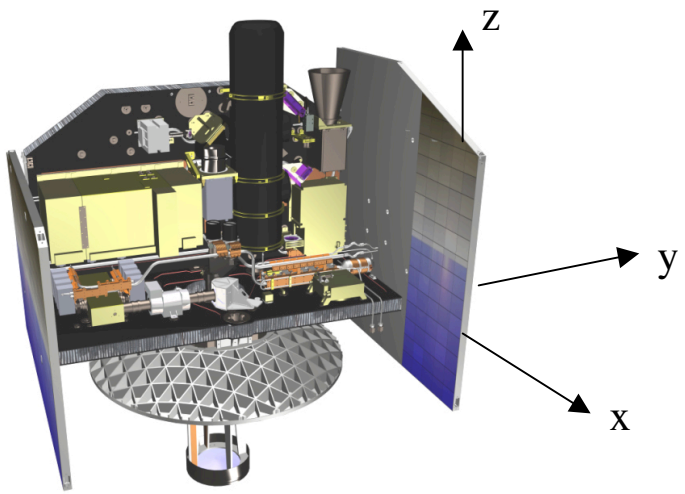
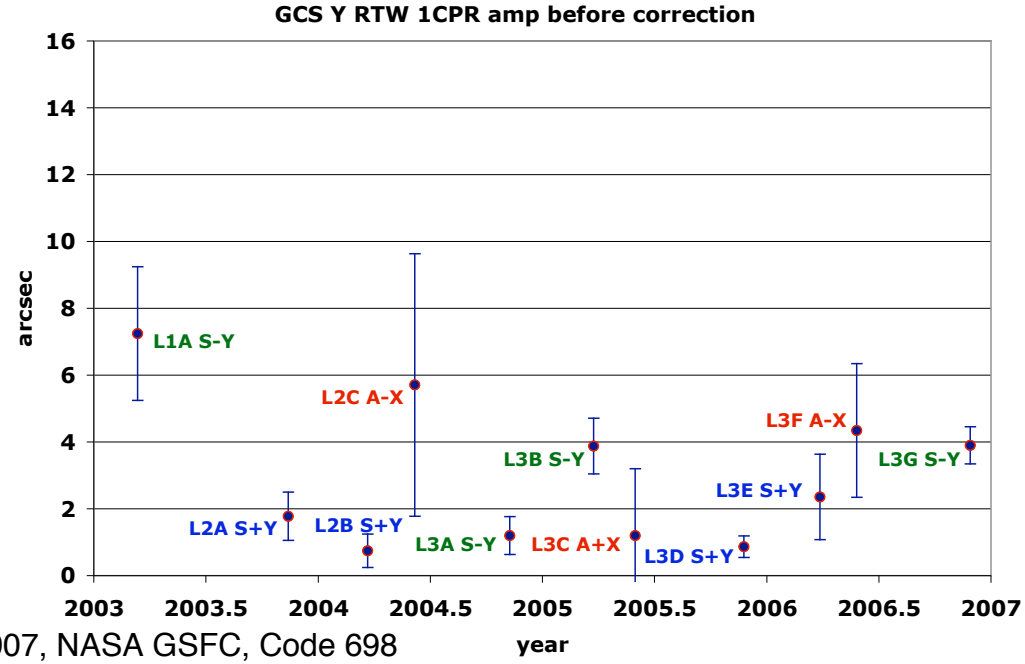
RTWS 1CPR amp. before corrections











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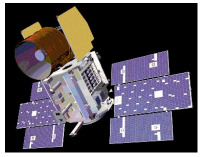
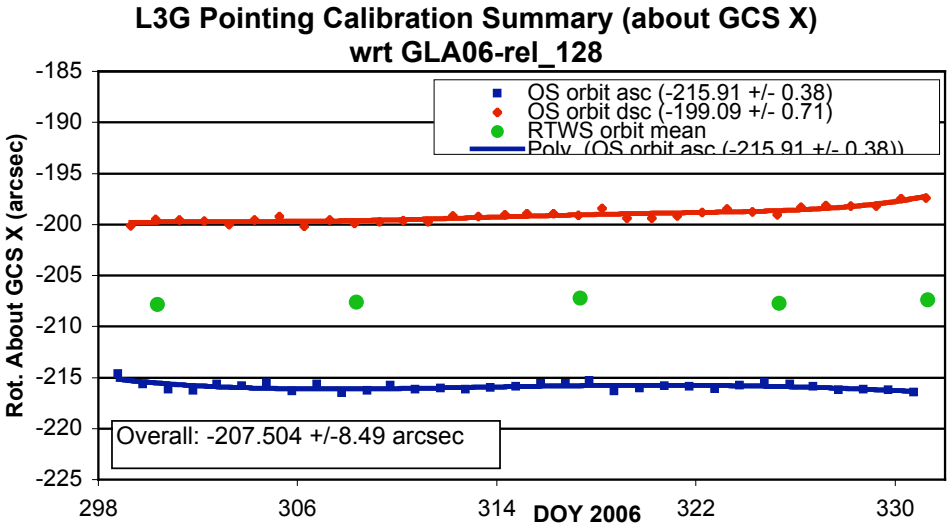
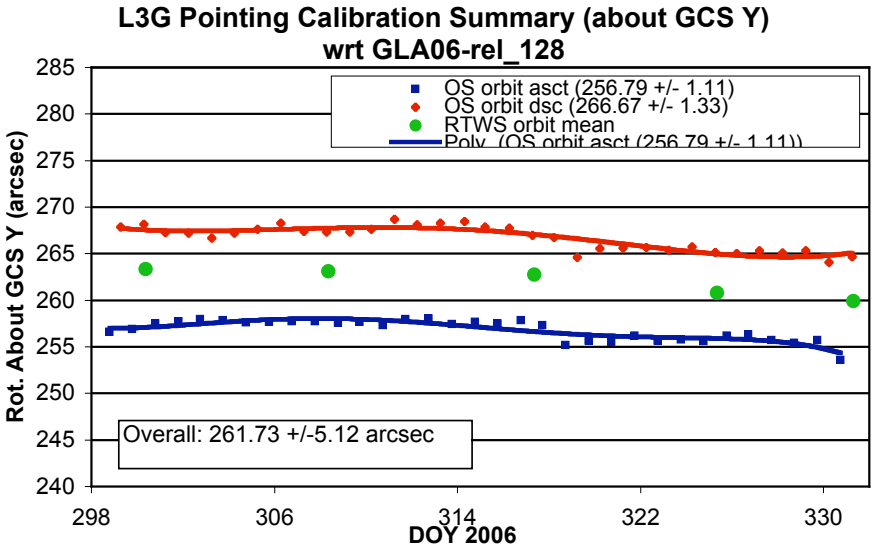
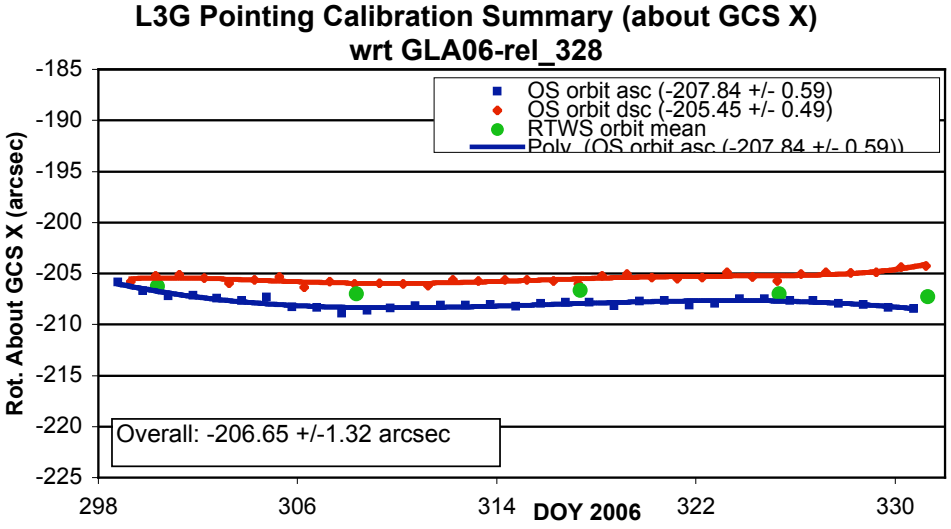
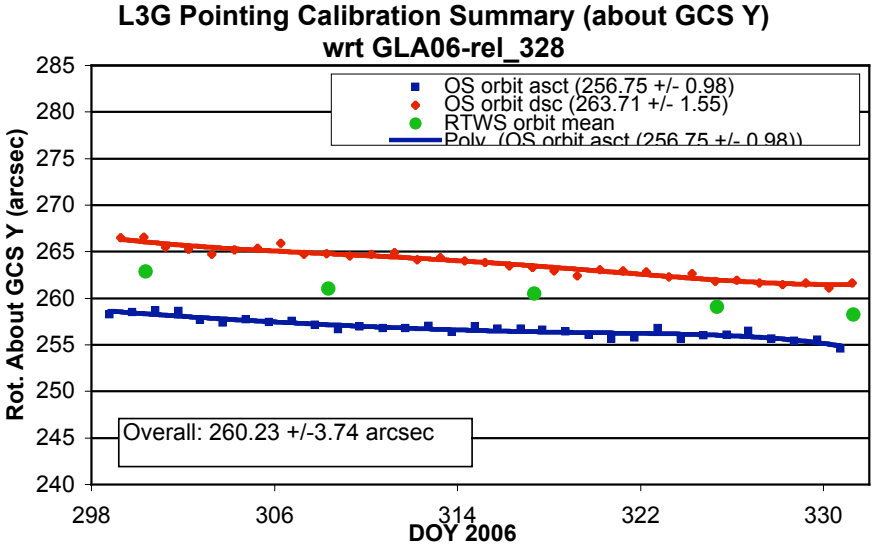
L3G OS Calibrations … work in progress











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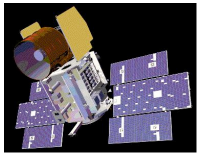
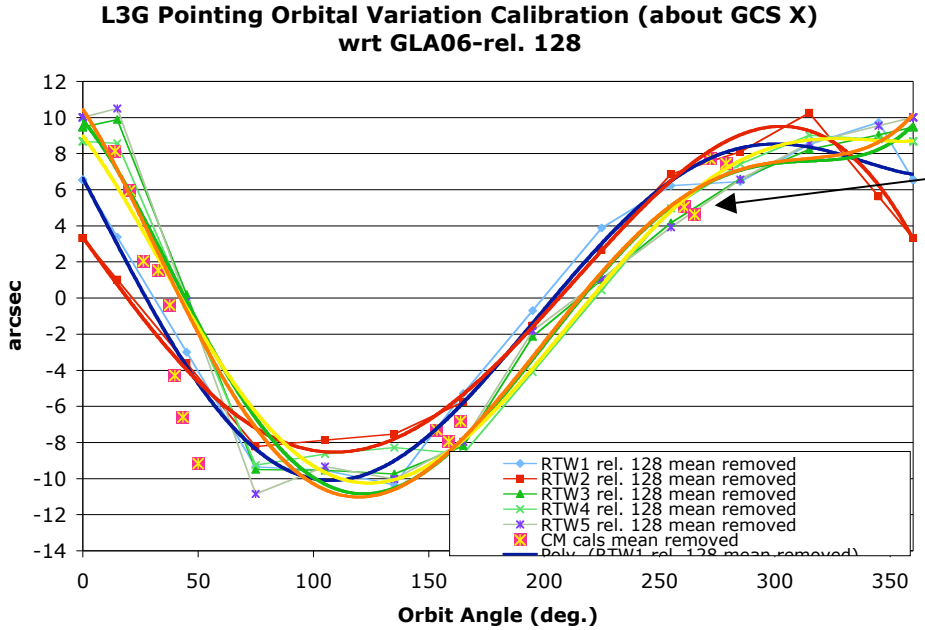
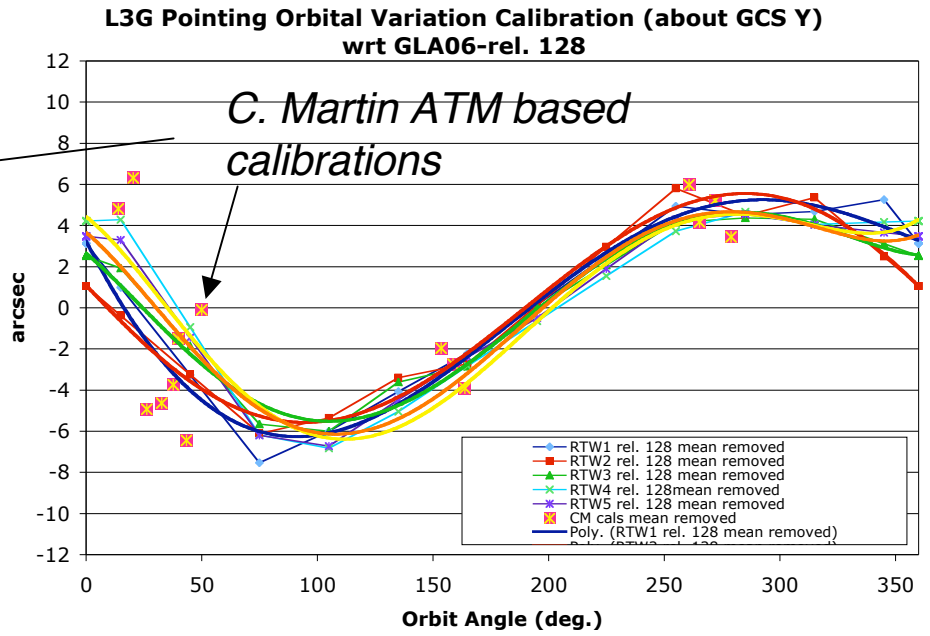
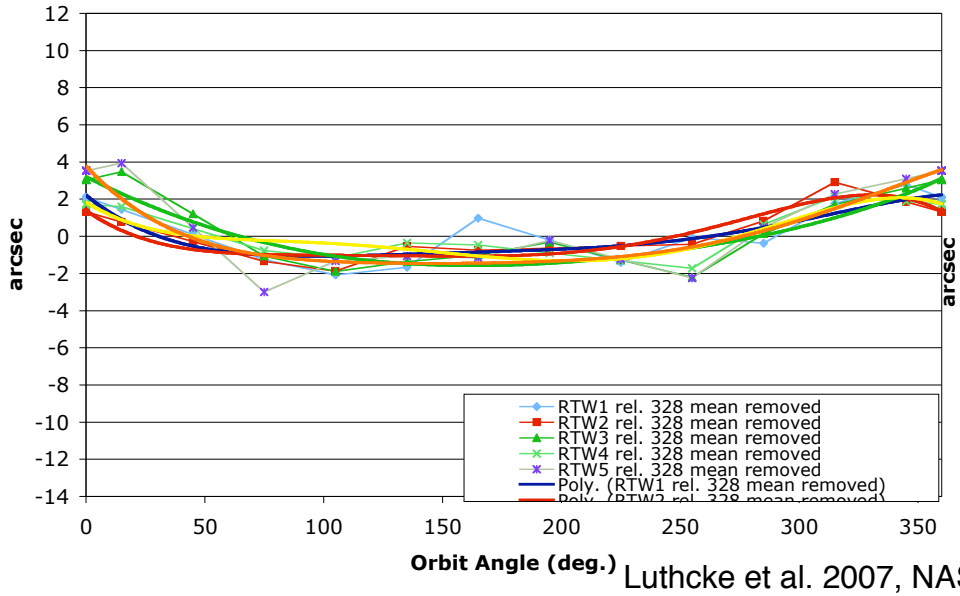
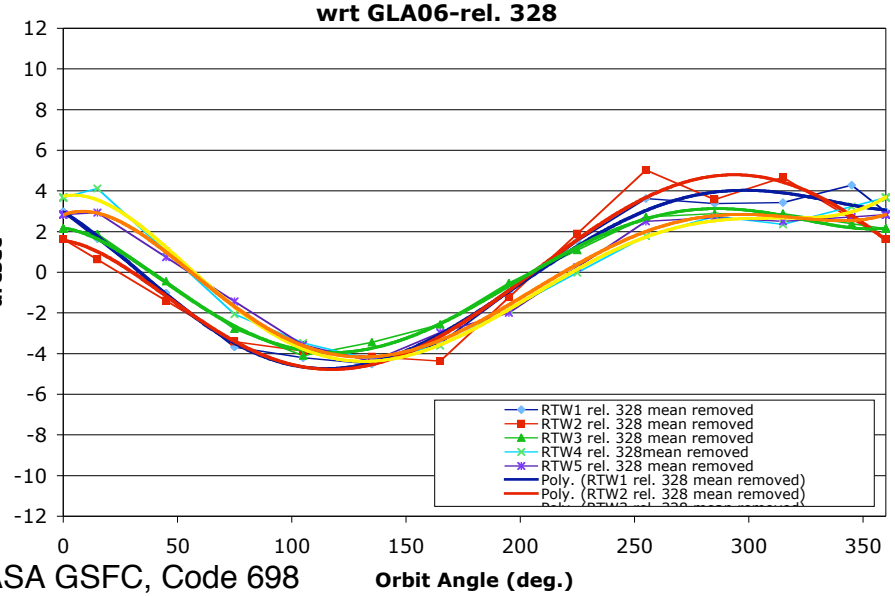
L3G RTW Calibrations … work in progress



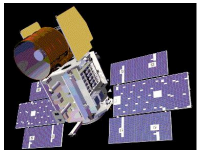




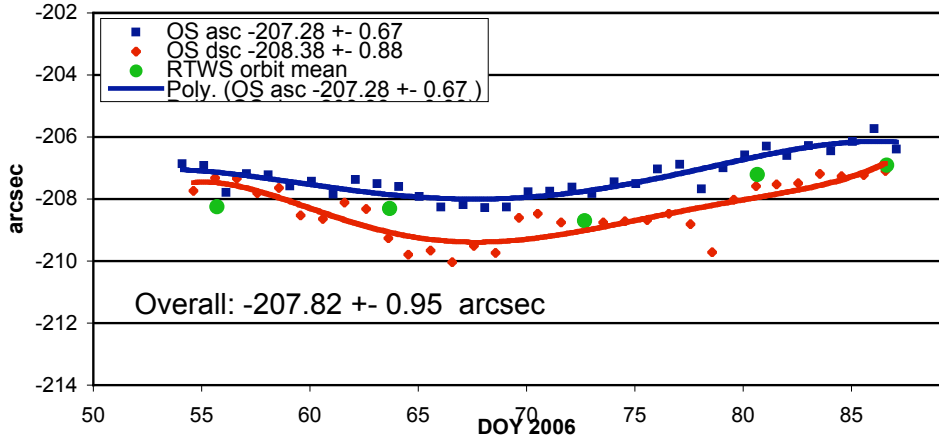




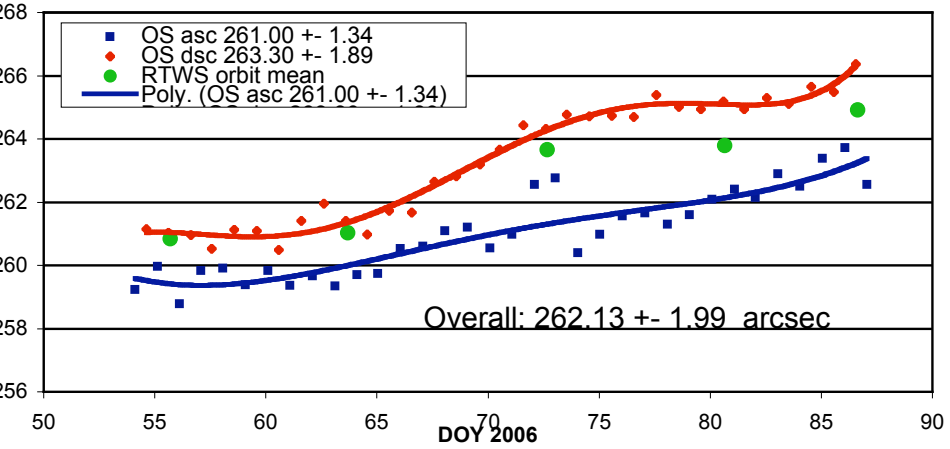
L3E OS Calibrations



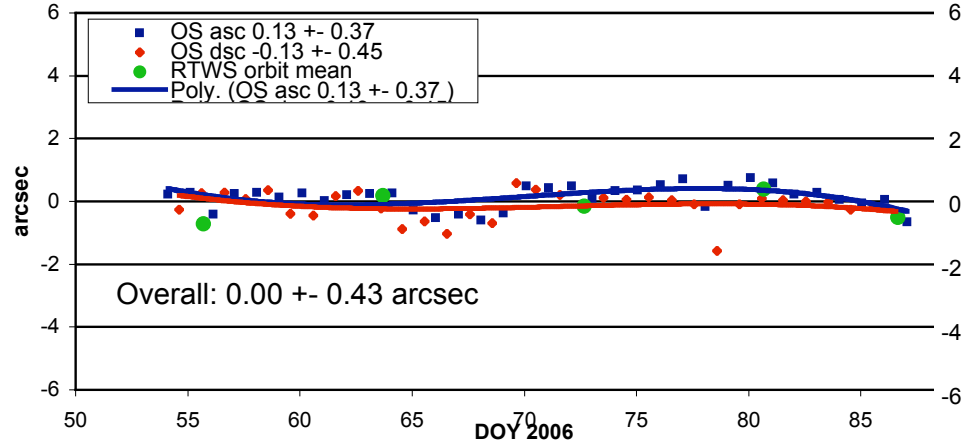
L3E Pointing Calibration Summary (about GCS X)
rel. 537 wrt GCS



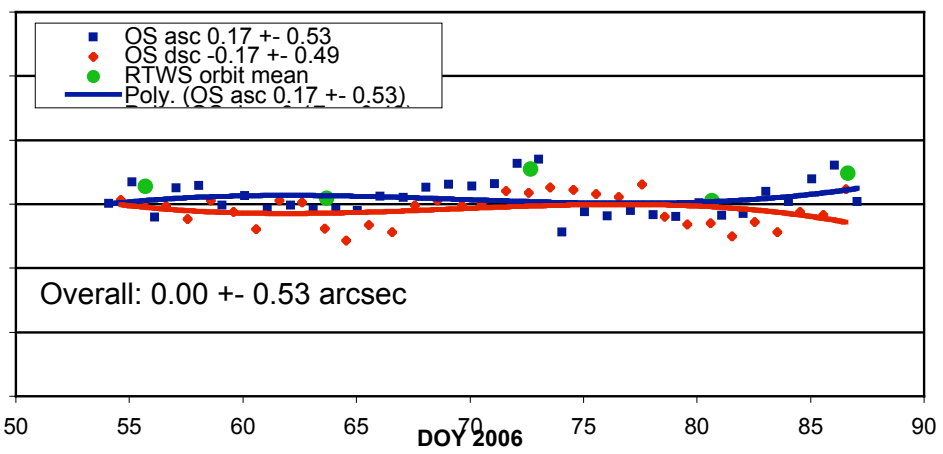
L3E Pointing Calibration Summary (about GCS Y)
rel. 537 wrt GCS



L3E Pointing Calibration Summary (about GCS X)
rel. 537 corrv2 wrt GCS



L3E Pointing Calibration Summary (about GCS Y)
rel. 537 corrv2 wrt GCS



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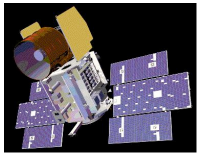
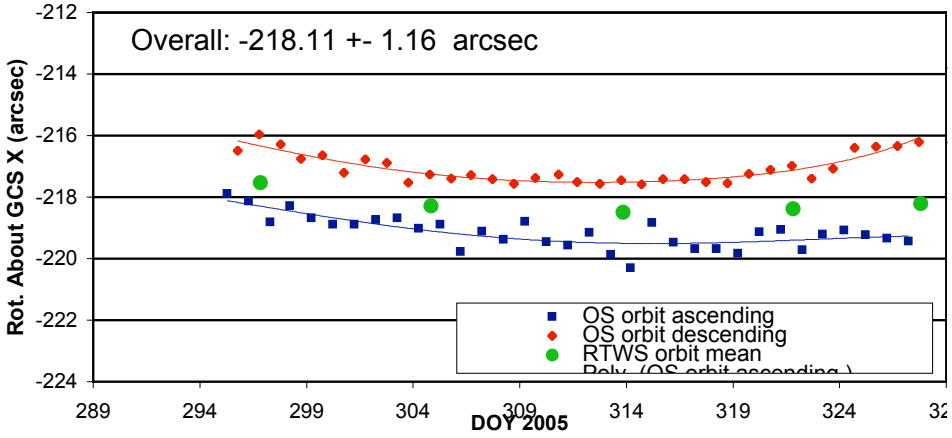
L3D OS Calibrations



L3D Pointing Calibration Summary (about GCS X)
wrt obatt, GLA06-rel_529



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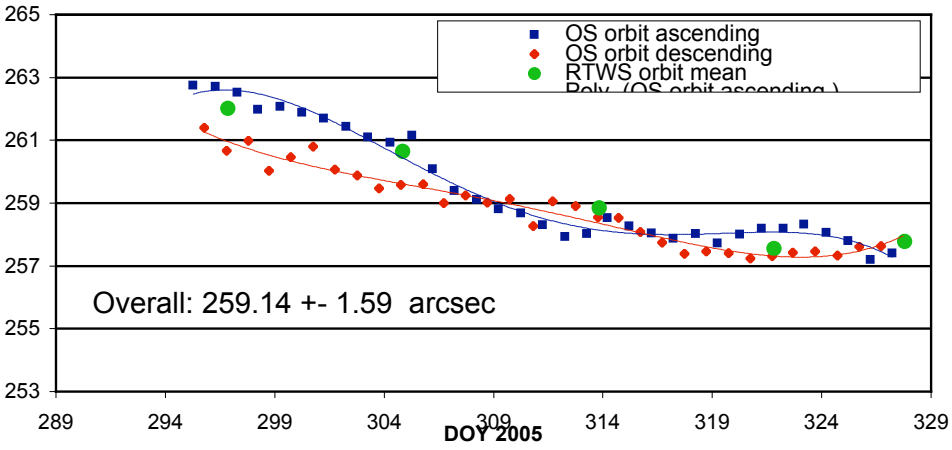
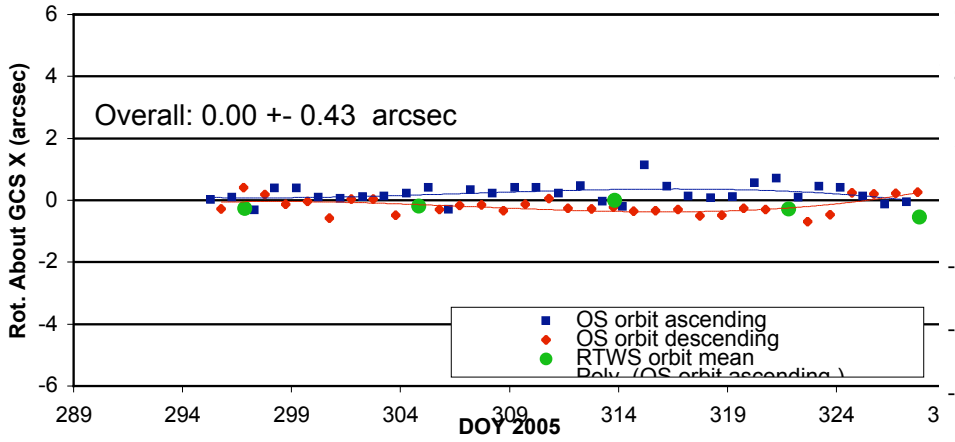


L3D Pointing Calibration Summary (about GCS X)
wrt obatt, GLA06-rel_529 corrv2



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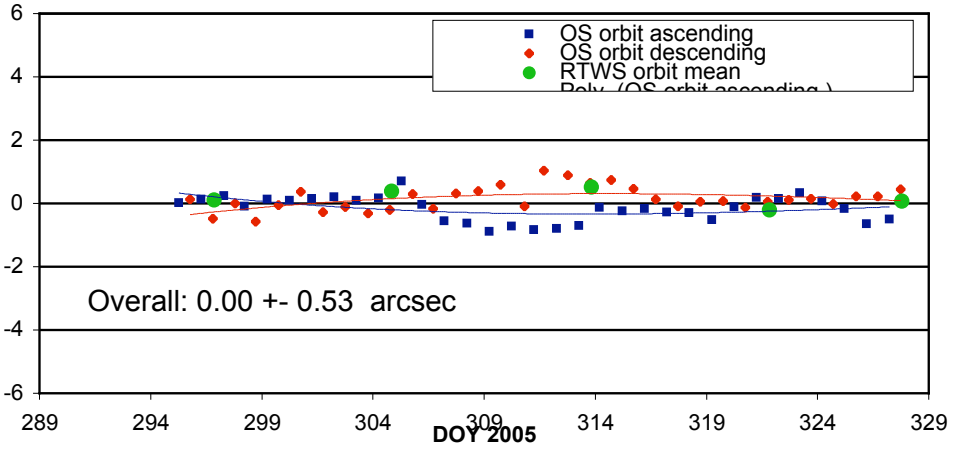
wrt obatt, GLA06-rel_529 corrv2



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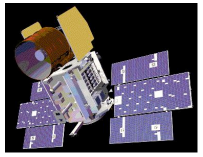
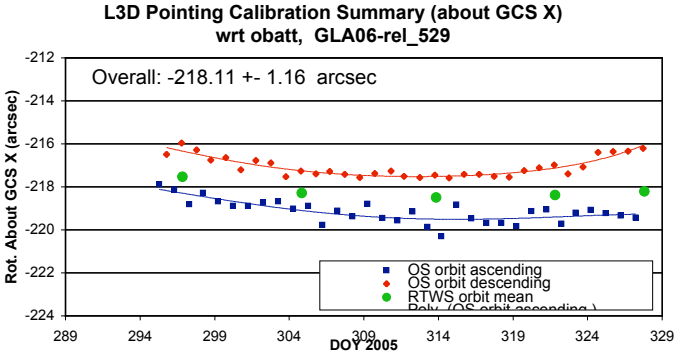
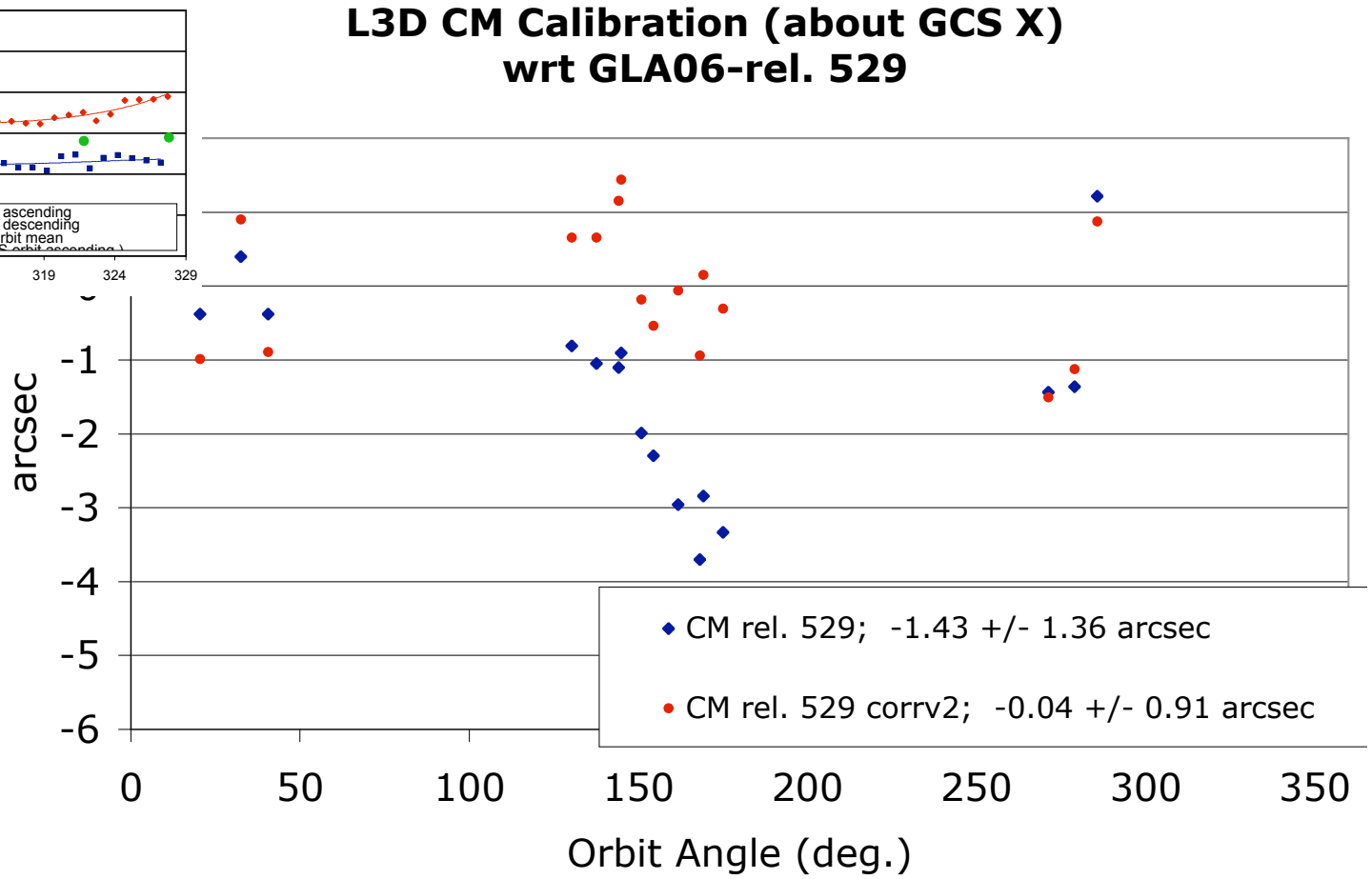
L3D Validation, *C. Martin* Calibration







Calibration based on Airborne Topographic Mapper (ATM) surveyed strips along ICESat tracks in Antarctic Dry Valleys and in Mojave Desert as reference surfaces (which have little vegetation or snow)

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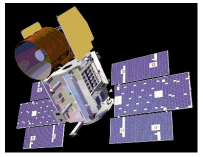
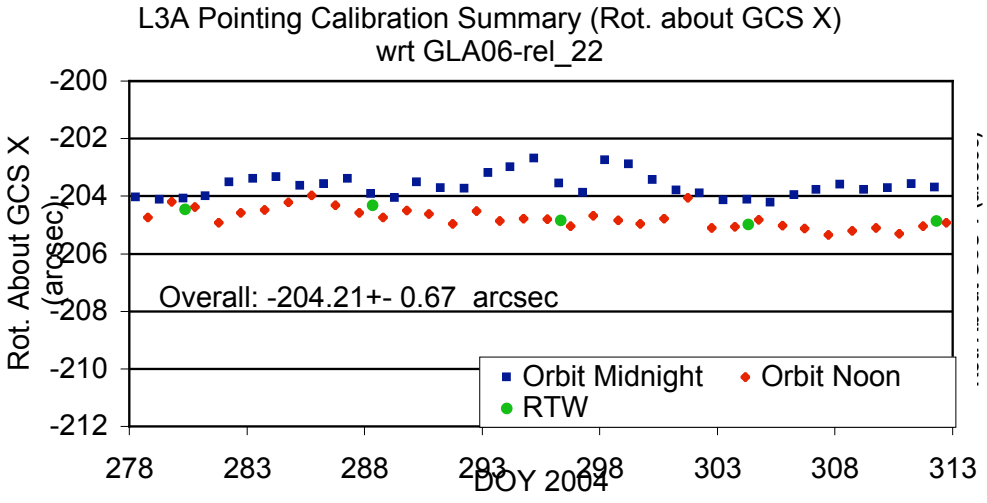
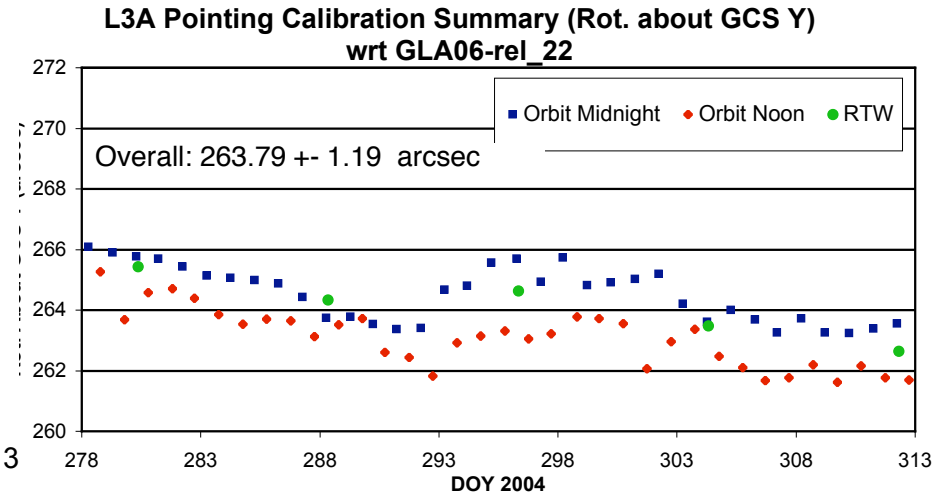
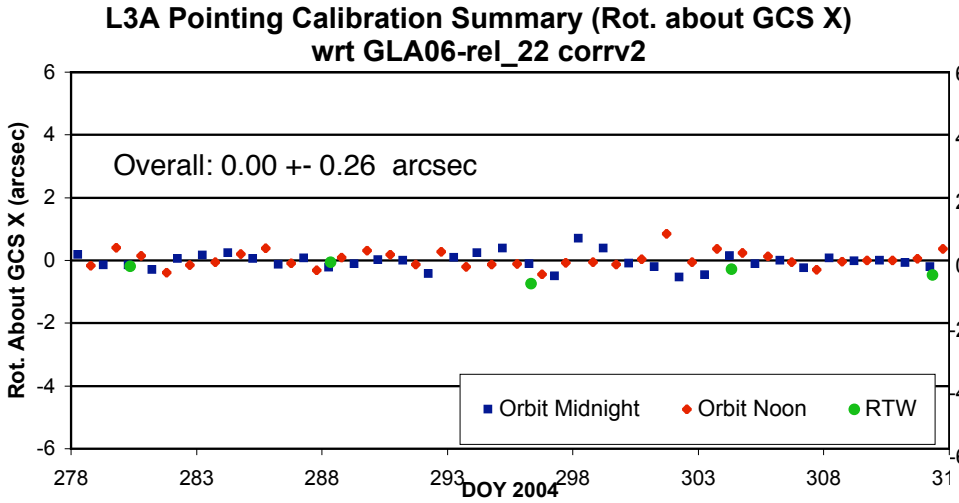
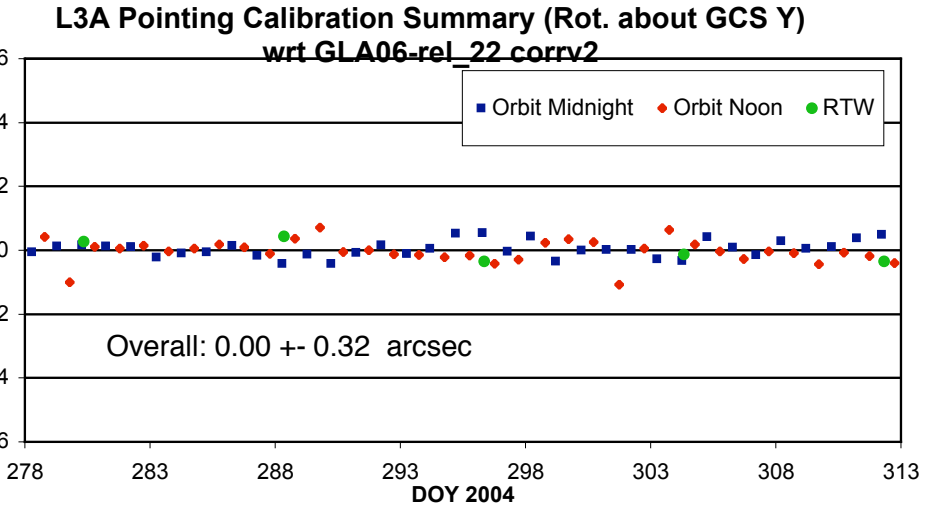
L3A OS Calibrations



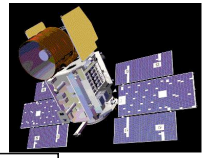




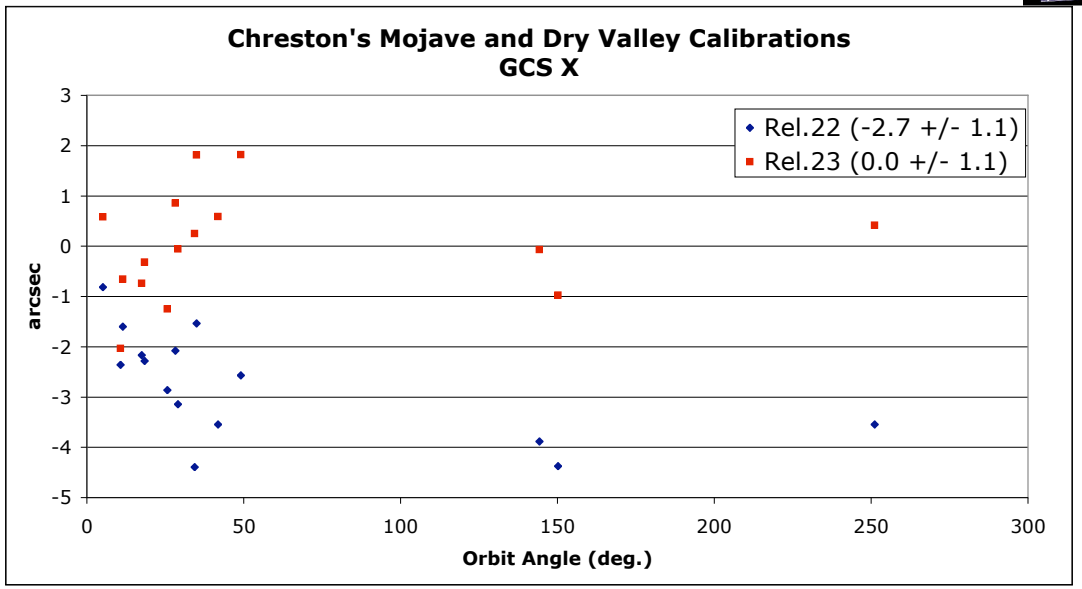


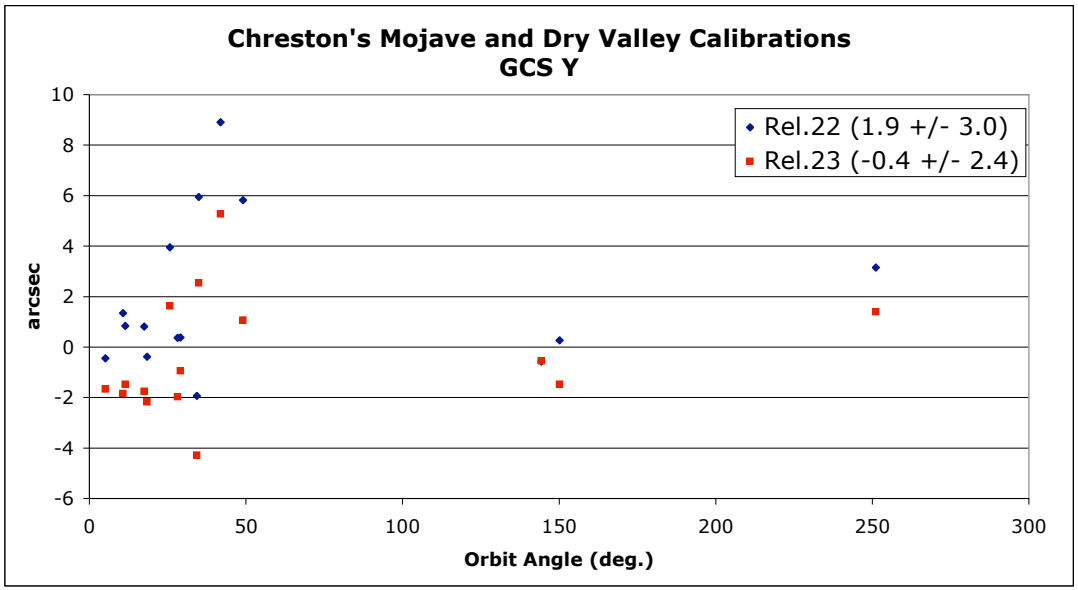


L3A Validation, *C. Martin* Calibration

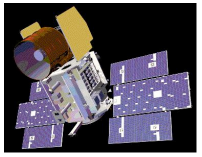


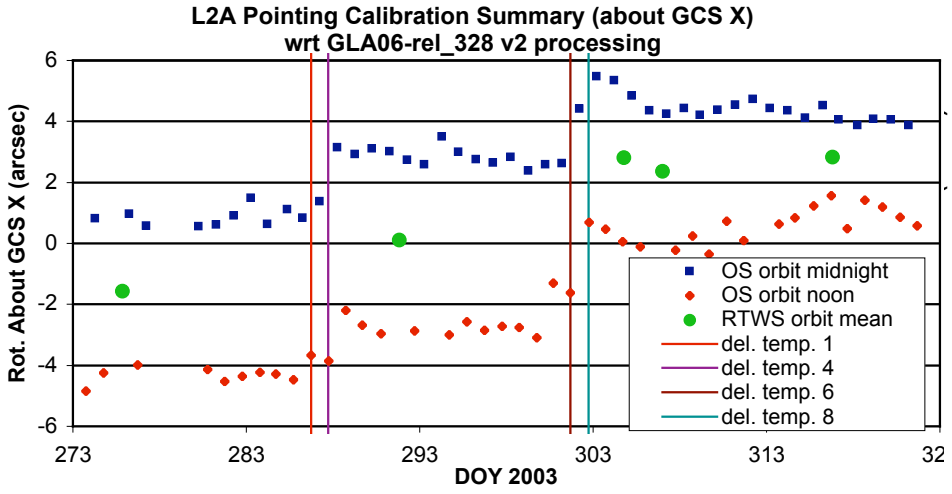
Calibration based on Airborne Topographic Mapper (ATM) surveyed strips along ICESat tracks in Antarctic Dry Valleys and in Mojave Desert as reference surfaces (which have little vegetation or snow)

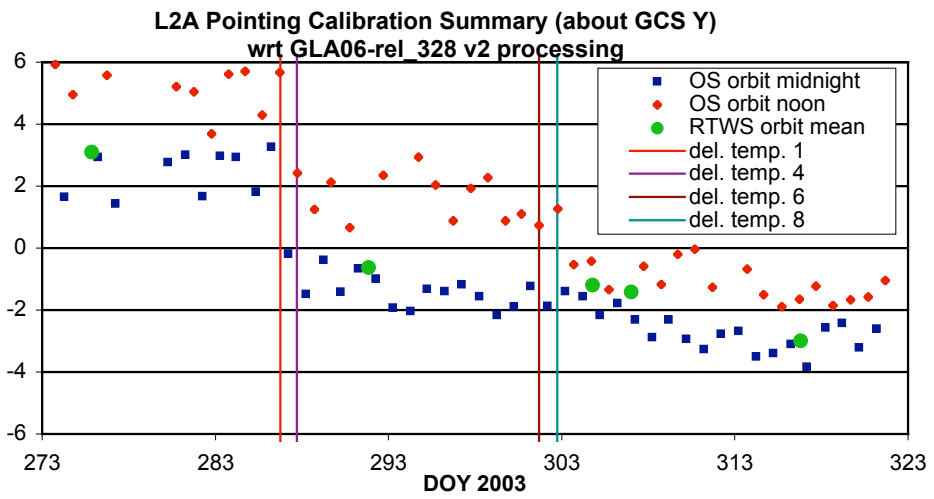


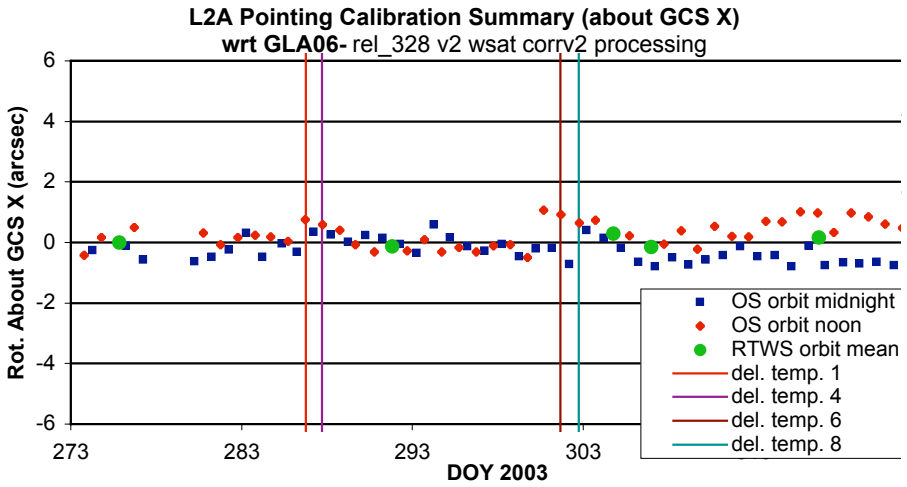


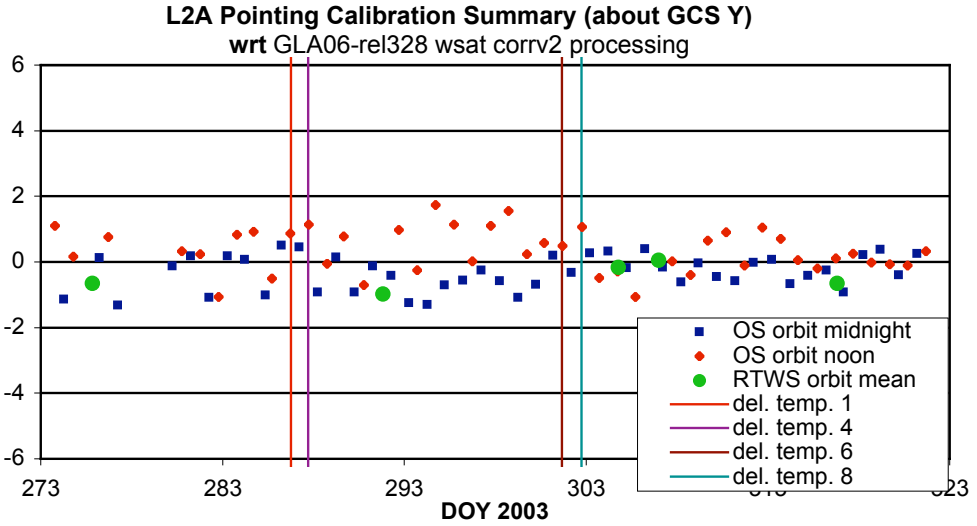
L2A OS Calibrations



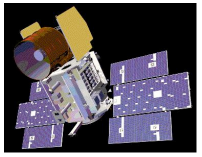


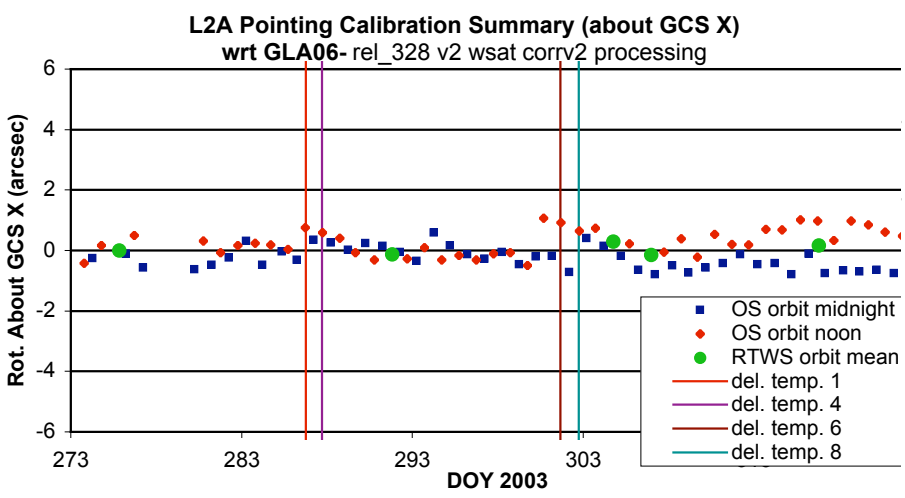


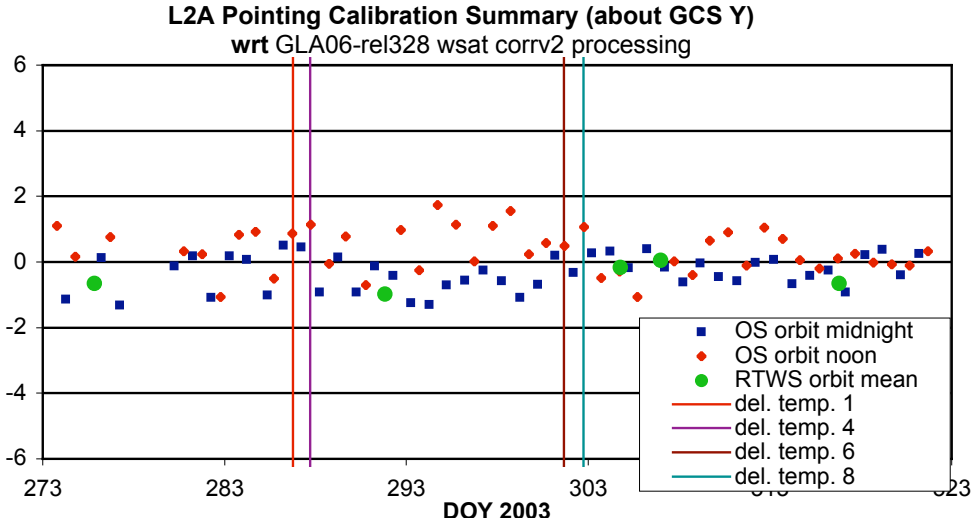


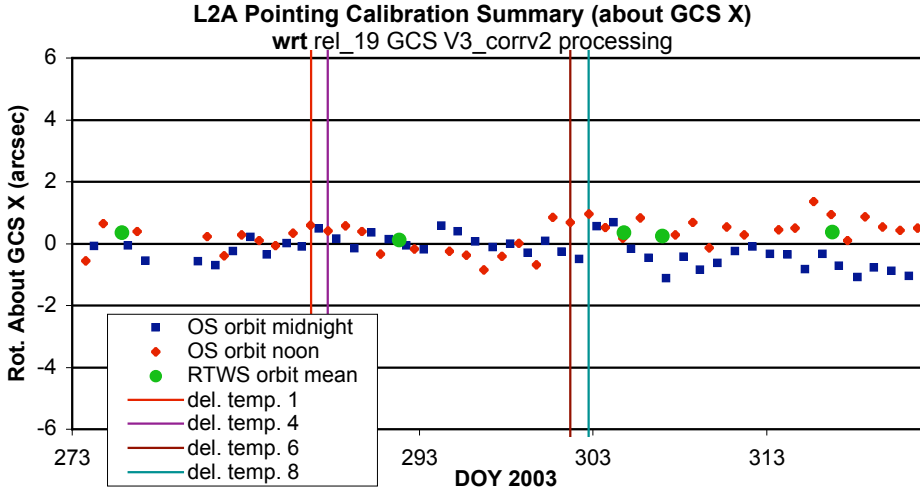


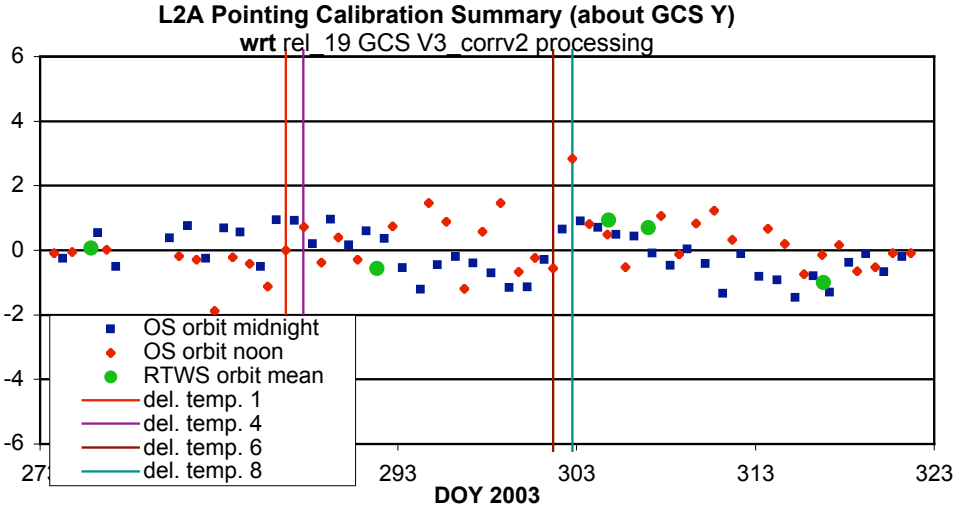
L2A OS Calibrations











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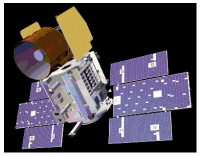
L2A Ice Sheet Xover Summary

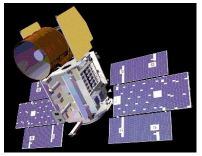


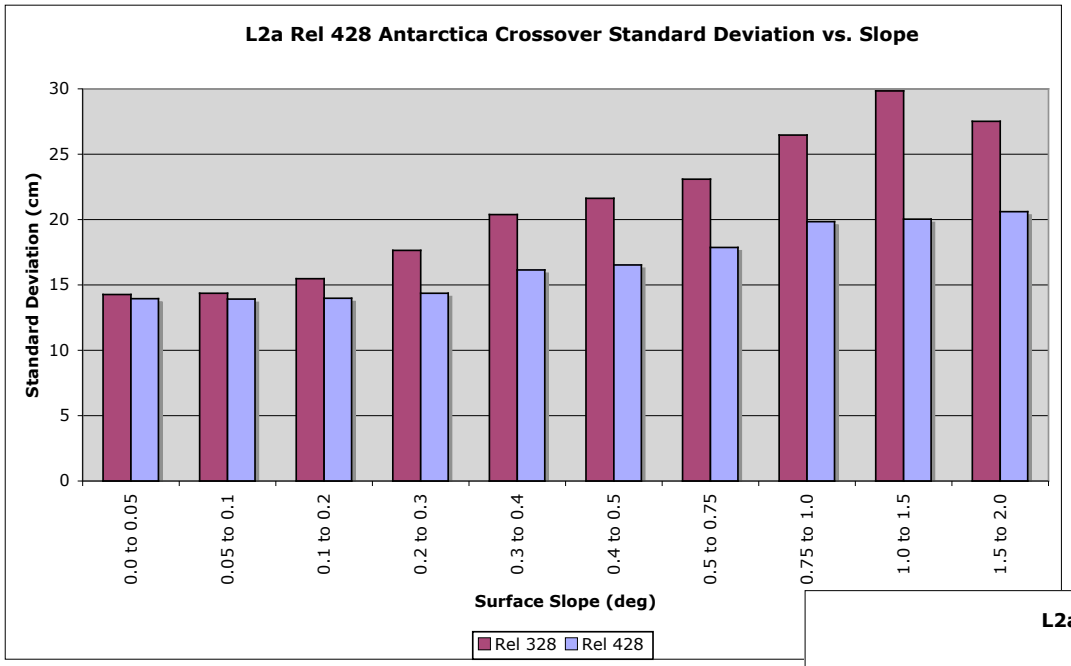
Centimeters	Antarctica		Greenland	
	rms	%ΔVar.	rms	%ΔVar.
L2A rel19	13.77	from rel19	18.18	from rel19
rel19 corrv2	12.91	-12.15	16.36	-18.97
rel19 corrv2*	12.48	-17.83	14.66	-34.94
rel328	11.83	-26.16	13.03	-48.67
rel328 corrv2	11.40	-31.48	11.80	-57.87

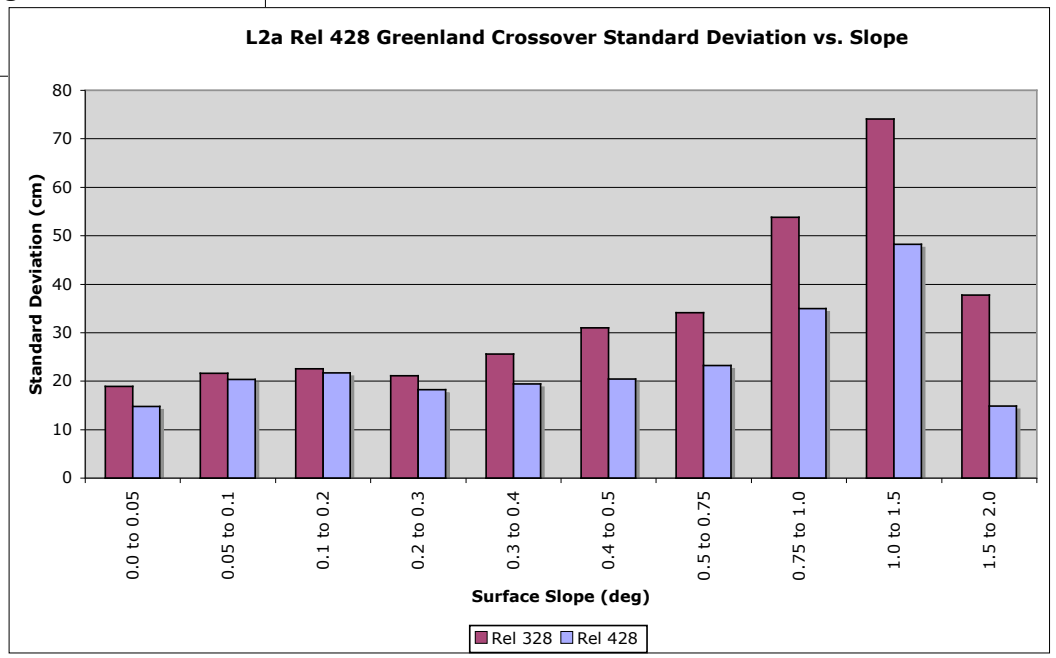
8-day xover; <0.6 deg. slope

** Combination SM and 8-day Xover solution*

L2A Ice Sheet Xover Performance - *J. Dimarzio*







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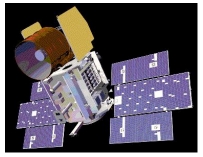
Ice Sheet Xover Summary



Centimeters	Antarctica		Greenland	
	rms	%ΔVar.	rms	%ΔVar.
L2A rel328	11.83		13.03	
rel328 corrv2	11.40	-7.20	11.80	-17.91
L2B rel22	9.01		12.81	
rel22 corrv2	8.94	-1.55	11.48	-19.68
L3A rel22	20.25		26.18	
rel22 corrv2	19.39	-8.37	23.24	-21.23
L3B rel542	16.23		22.33	
rel542 corrv2	15.60	-7.60	21.43	-8.56
L3D rel529	8.94		11.47	
rel529 corrv2	8.68	-5.86	11.28	-3.17
L3E rel537	7.83		8.72	
rel537 corrv2	7.55	-7.02	7.75	-21.01

8-day xover; <0.6 deg. slope

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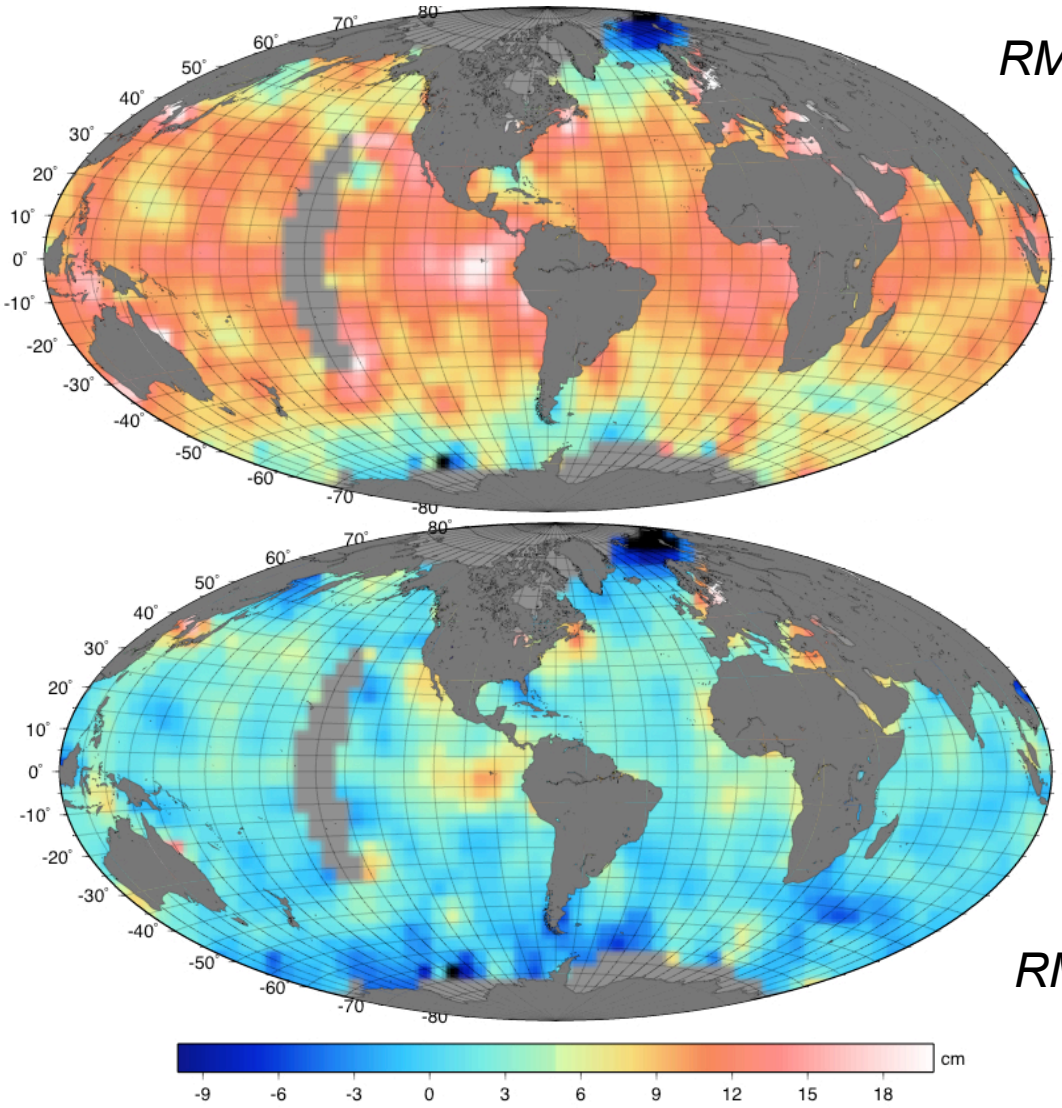
L2a Descending - Ascending Sea Surface Anomalies



RMS = 10.75 cm

Difference between Laser 2a descending and ascending altimeter derived sea surface anomalies (SSA) before (top: Release 19) and after scan-derived SPE correction is applied (bottom: Release 21).

RMS = 5.23 cm

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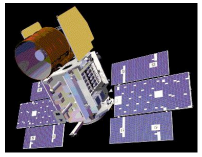
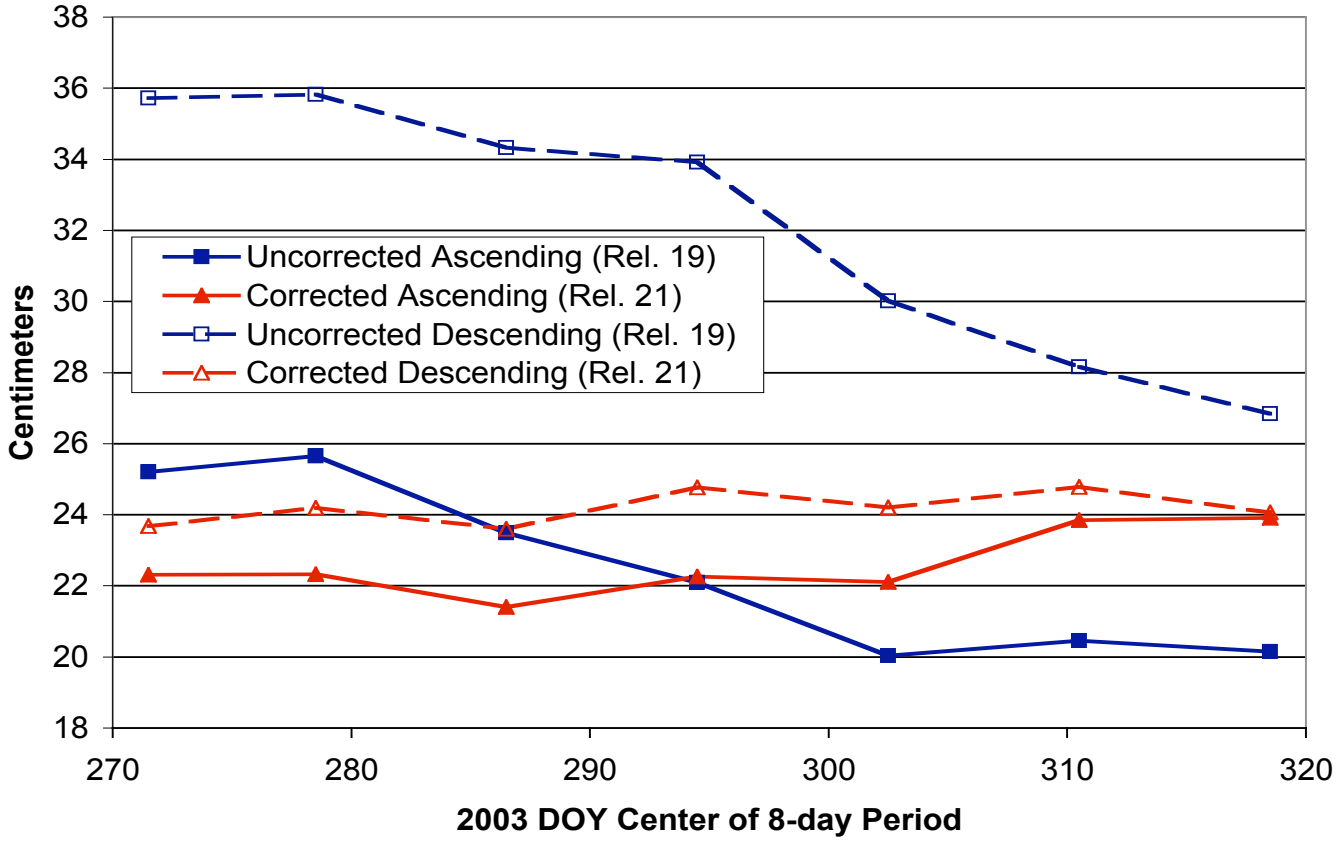
L2a Global Range Bias Estimate





Range bias formally estimated using ~nadir ocean altimeter range observations, GSFCMSS00, GOT00 Tides, and IB.

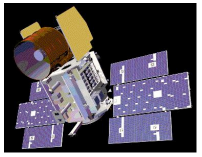
Descending - Ascending mean±stdev

Rel. 19: 9.67 ± 1.82 cm

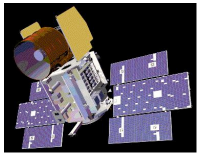
Rel. 21': 1.59 ± 0.83 cm

Range Bias:

Rel. 21': 23.37 ± 0.61 cm



Ocean Sweep (OS)



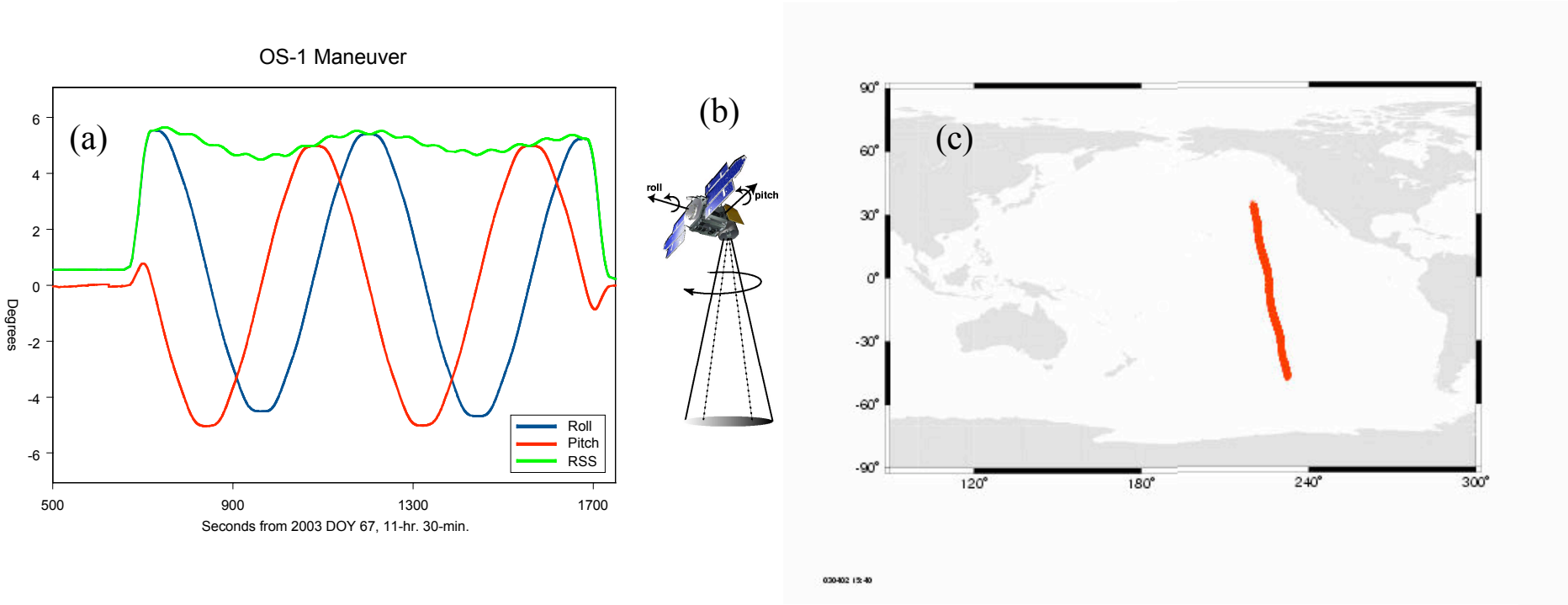
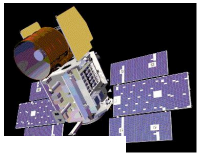
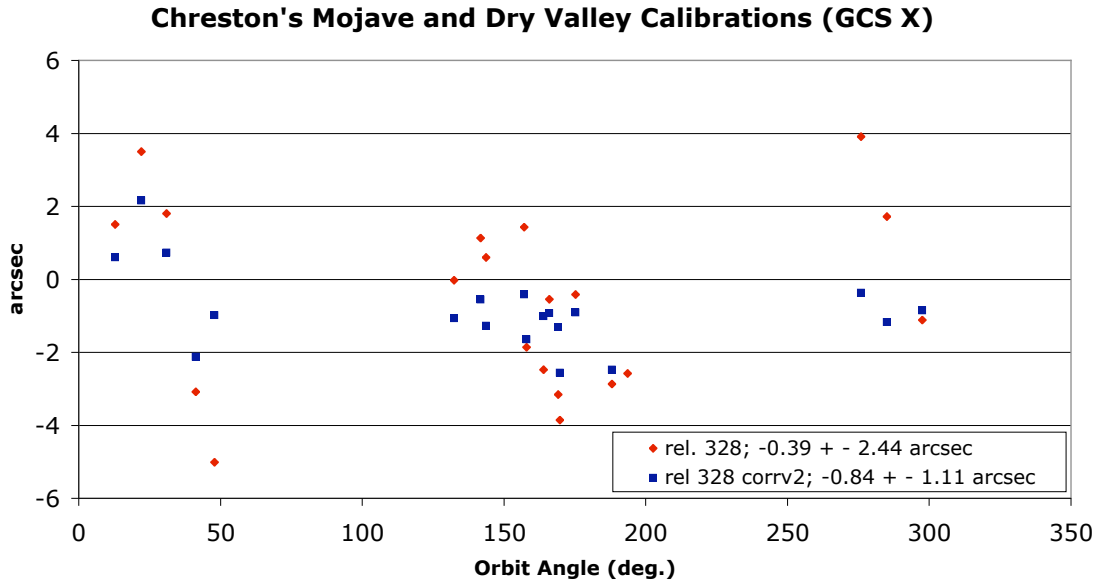


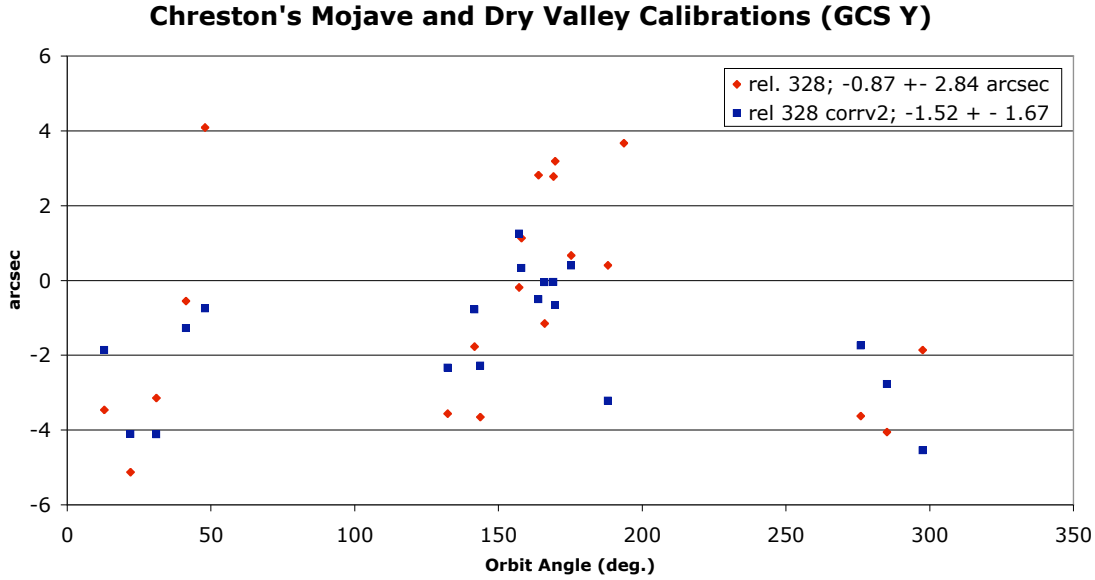
Figure 1. (a) ICESat Ocean Sweep maneuver #1 (OS-1) roll and pitch from nominal attitude profile. (b) cartoon of ocean sweep maneuver. (c) geographic location and extent of OS-1.

L2A Validation, *C. Martin* Calibration



Calibration based on Airborne Topographic Mapper (ATM) surveyed strips along ICESat tracks in Antarctic Dry Valleys and in Mojave Desert as reference surfaces (which have little vegetation or snow)





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