



DORIS Time Bias estimated using Jason-1, TOPEX/Poseidon, and ENVISAT orbits

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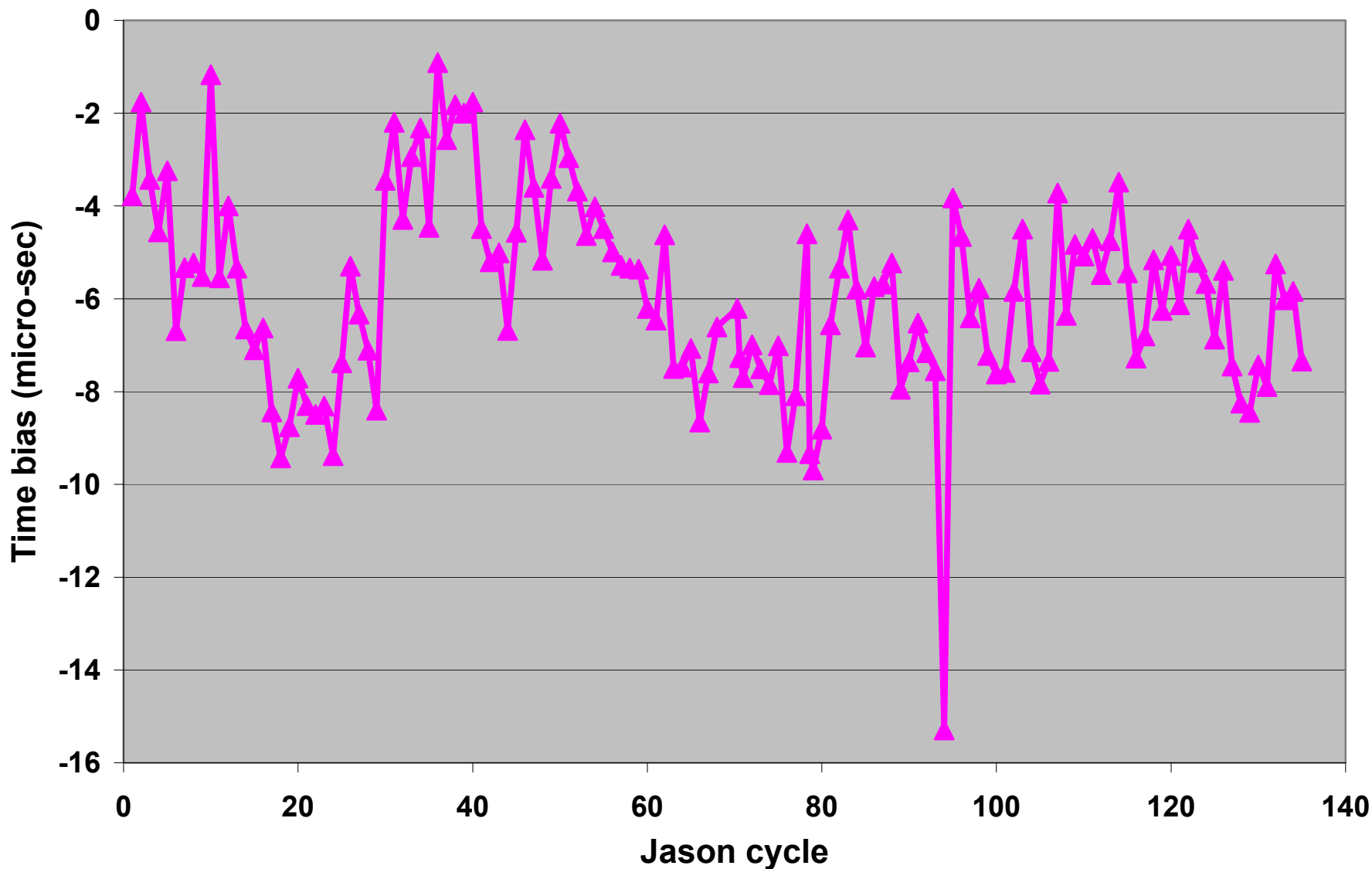
IDS Workshop

March 13-15

Venice, Italy



Jason DORIS time bias estimated in SLR/DORIS 10-day solution





DORIS TAI time tag estimated using pseudo-range



$$T = t + a_0 + a_1 (t - t_0) + a_2 (t - t_0)^2 + a_3 (t - t_0)^3$$

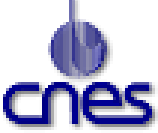
where

- T = final DORIS time tag (TAI start of count interval)
- t = initial DORIS time tag (satellite clock start of count interval)
- t_0 = start of 10-day cycle span (satellite clock time)
- a_0 = estimated satellite clock offset + estimate error δa_0 .
- a_1 = estimated satellite clock drift + estimate error δa_1 .
- a_2 = estimated satellite clock drift-rate + estimate error δa_2 .
- a_3 = estimated satellite clock acceleration-rate + estimate error δa_3 .

Error in T ($\delta T_{\text{polynomial}}$) is believed to be about 1 μs , given 300 m pseudo-range precision



DORIS time bias estimate with orbits referencing SLR or GPS time



DORIS Time Bias Test Solution Strategy	
model / parameter	description
assumed models	<ul style="list-style-type: none"> • specified 10-day test orbit • ITRF2000 reference frame
estimated parameters	<ul style="list-style-type: none"> • DORIS measurement bias / pass • DORIS troposphere scale / pass • DORIS time bias / 10 days or as specified

Time bias estimate components:

$$\delta\check{T} = \delta T_{\text{polynomial}} + \delta T_{\text{orbit}} + \delta T_{\text{noise}} + \delta T_{??}$$

where

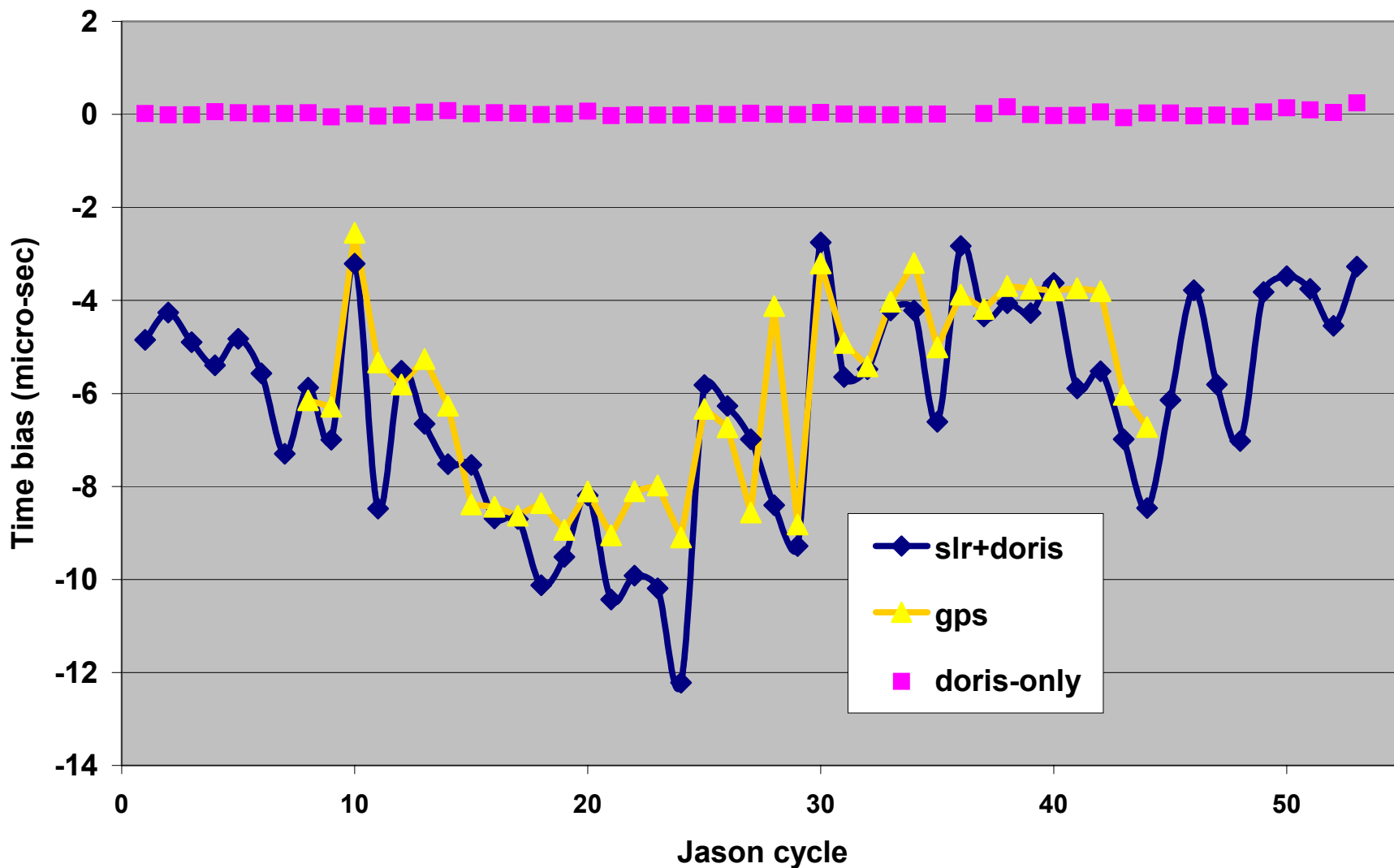
- polynomial = error in TAI time tag estimate
- orbit = error in orbit used to estimate time bias
- noise = DORIS time bias estimate precision
- ?? = ??



Time bias estimates referencing SLR, GPS, and DORIS time



Jason DORIS time bias estimated over 10-day GSFC orbit





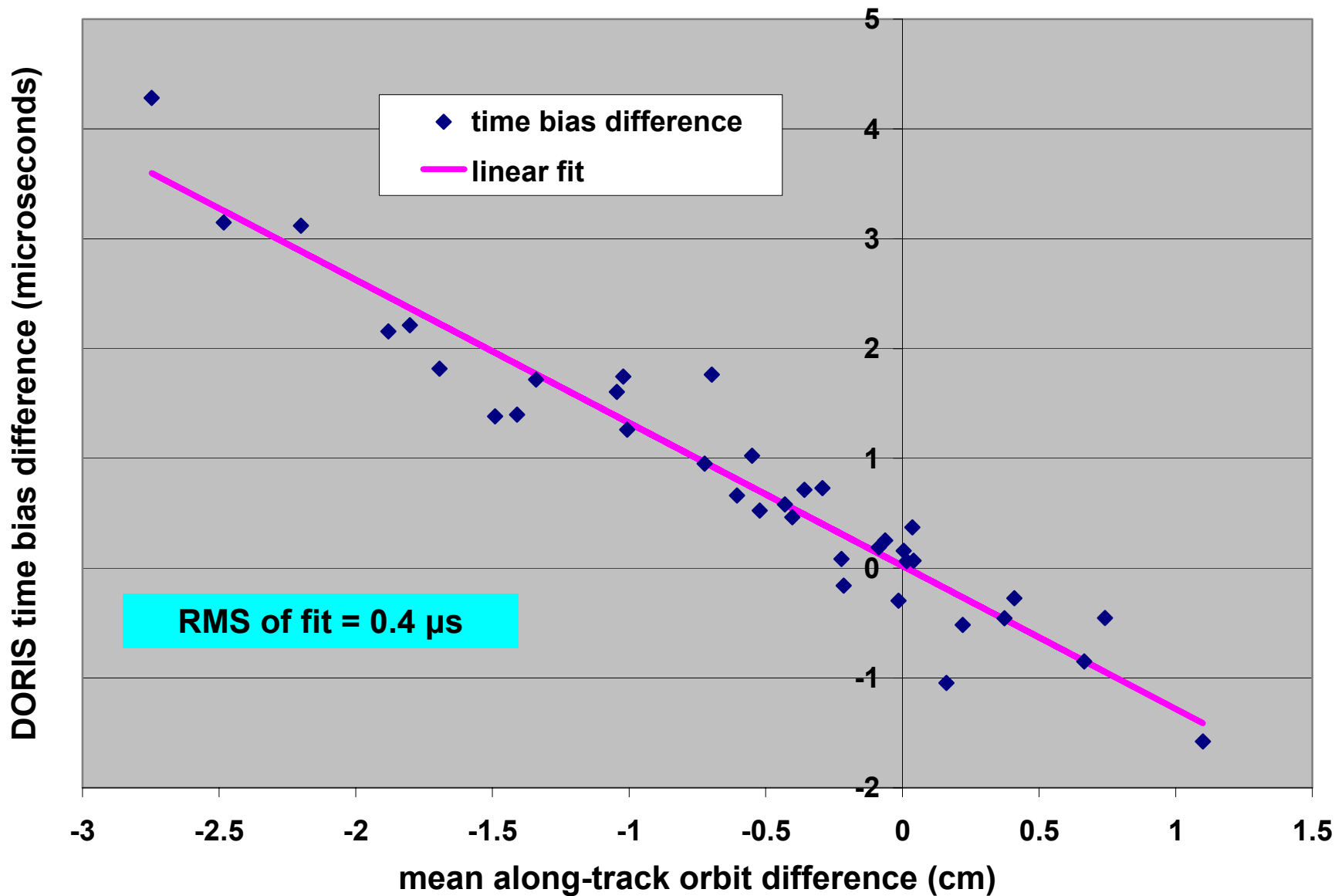
Linear relationship between time bias differences and mean orbit differences

TOPEX time bias δT (μs) (Error-Truth)	DORIS RMS residuals (mm/s)	Error - Truth orbit difference (cm)		
		Radial RMS	3-D total RMS	along-track Mean
0	.472	---	---	---
- 06	.472	0.001	4.174	+4.168
- 10	.472	0.002	6.970	+6.960
- 30	.472	0.005	20.902	+20.873
- 60	.472	0.010	41.791	+41.774

satellite	data points	intercept (cm)		slope (cm/ μ)		correlation coefficient	RMS fit (cm)
		estimate	error	estimate	error		
TOPEX	5	0.000	0.003	-0.6956	0.0001	1.000	0.0045
Jason	5	-0.004	0.003	-0.6957	0.0001	1.000	0.0037

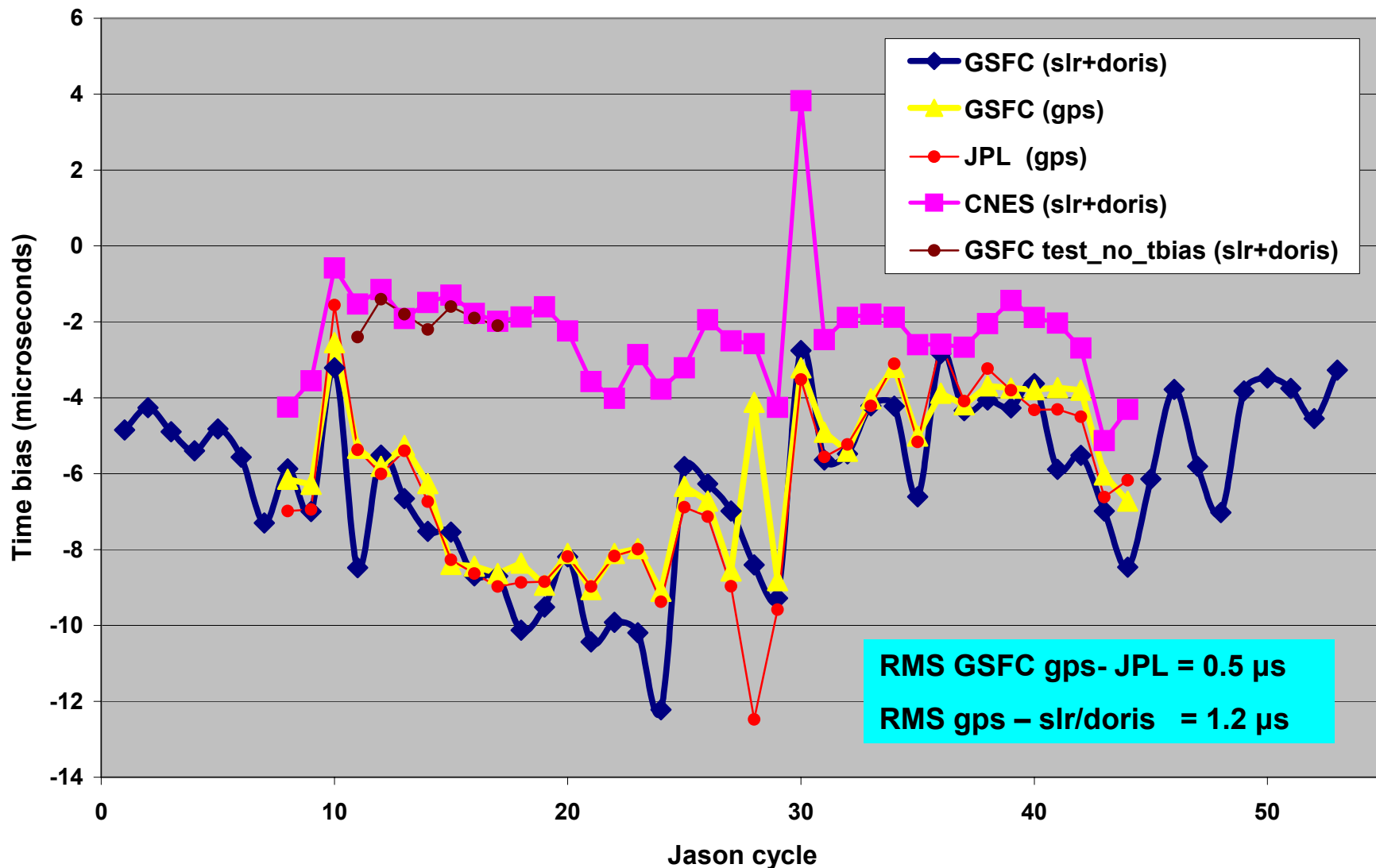


GPS – SLR/DORIS time bias difference by orbit difference (cycle 8-44)



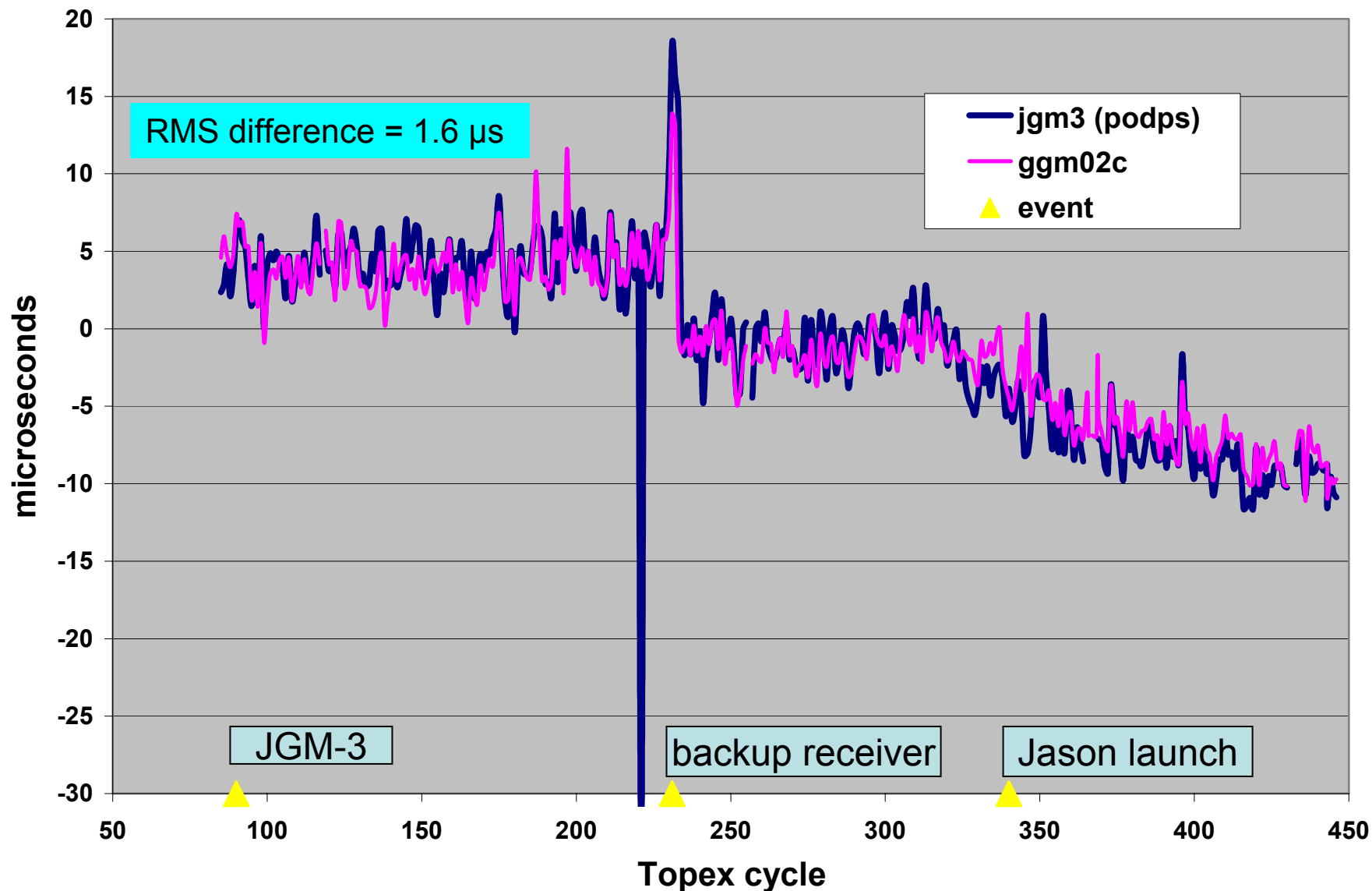


DORIS time bias estimated with Jason orbit computed at GSFC, JPL and CNES



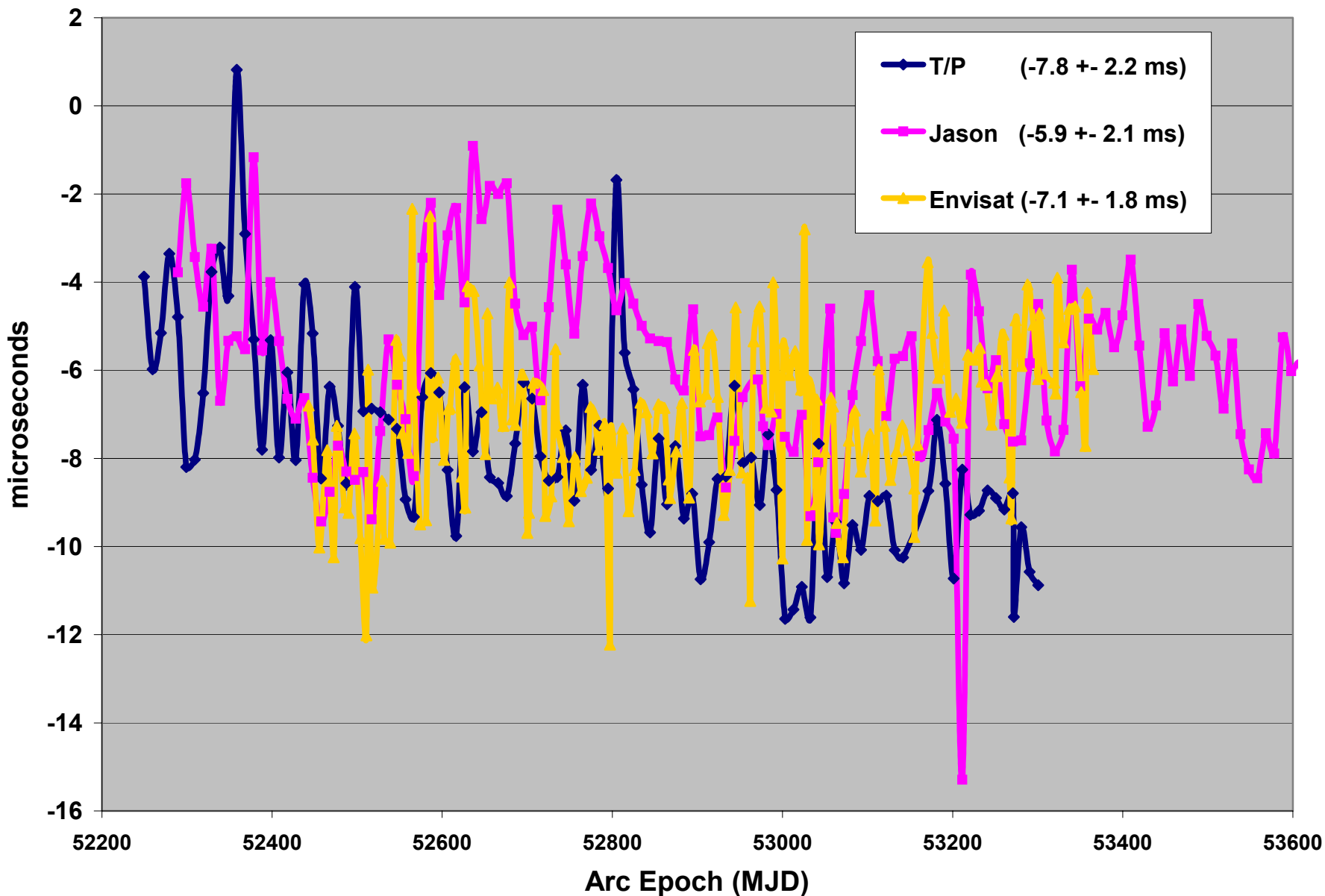


T/P DORIS time bias estimated with GSFC SLR/DORIS orbits cycles 93-446



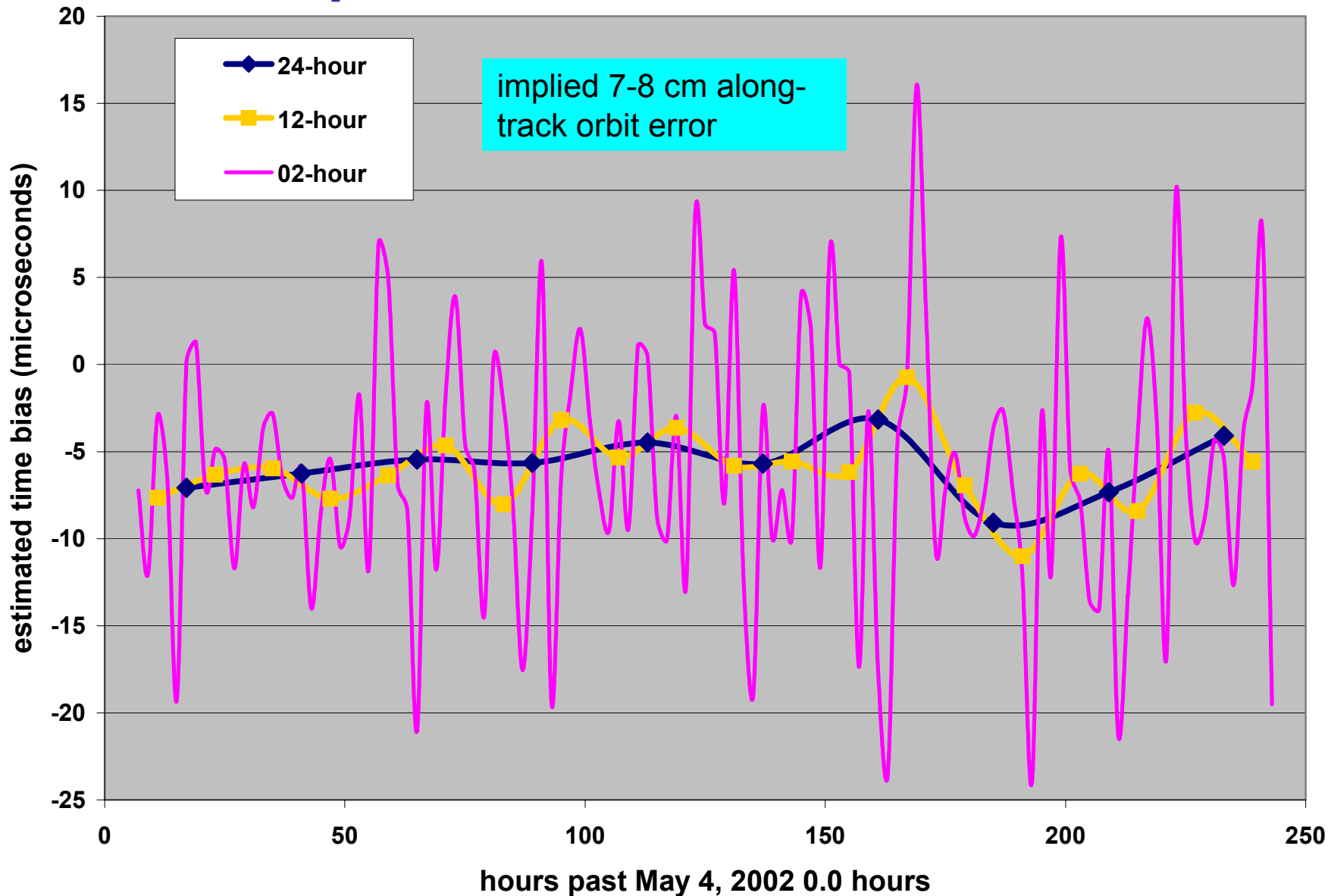


Time bias estimated using GSFC SLR/DORIS T/P, Jason, and ENVISAT orbits



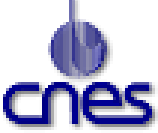


Time bias estimates using 1-day and shorter spans of Jason GPS-based orbits





Summary



- $\delta\dot{T} = \delta T_{\text{polynomial}} + \delta T_{\text{orbit}} + \delta T_{\text{noise}} + \delta T_{??}$
(6-7 μs 1 μs 1-2 μs 0.4 μs 6 μs)
- Major component of DORIS time bias remains unknown. One possibility is the Doppler count start time assumed by the receiver is off.
- Comparing GPS – SLR/DORIS Jason time biases and orbits show there is no offset between GPS and SLR times.
- Estimating DORIS time biases over 1-2 hour intervals may provide an independent measure of along-track error for GPS or SLR-based orbits.