Jason-1 POD with SLR and DORIS Tracking

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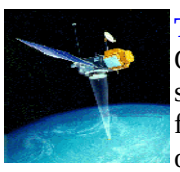
Jason-1 was injected into the T/P orbit, flying just 72 seconds ahead of T/P for verification. The Mission objective is T/P level accuracy, and goal is to reach 1-cm orbits. SLR, DORIS, and GPS tracking are available.

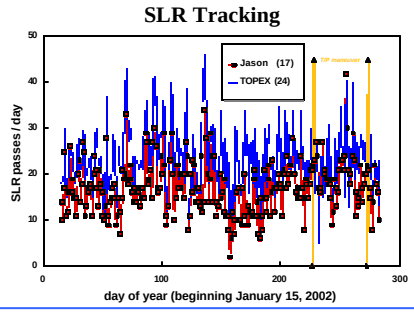


TOPEX/POSEIDON (T/P) orbits produced at GSFC with a 2-3 cm radial accuracy, have become a standard for other altimeter satellites, and are useful for evaluating orbit improvement strategies. T/P orbits are based on SLR and DORIS tracking.

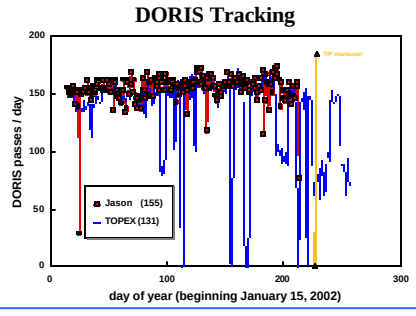
Summary

- **Inter-comparison orbits are based on T/P standards and ITRF2000 (with updates from CSR)**
- **Initial tests have shown Jason SLR+DORIS orbits are close to T/P accuracy even before tuning**
- **Strong SLR tracking continues following the mid-August T/P maneuver**
- **Estimated LRA offset slightly improves SLR measurement modeling**
- **SLR mean residuals and other tests indicate the pre-launch LRA phase center correction is accurate**
- **DORIS fits progressively degrade over cycles 1-20, and although do not appear to affect radial orbit accuracy, are of concern**
- **Increasing DORIS weight improves SLR+DORIS POD for Jason, but not for T/P**
- **Reduced dynamic approach offers a 1-cm improvement in radial orbit accuracy before tuning**

SLR Tracking



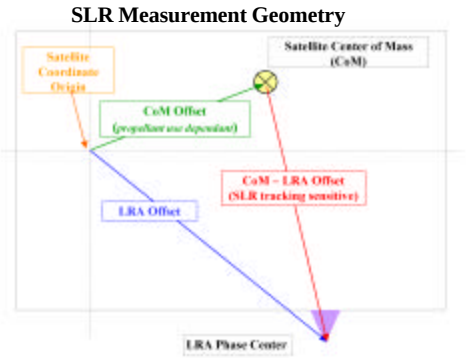
DORIS Tracking



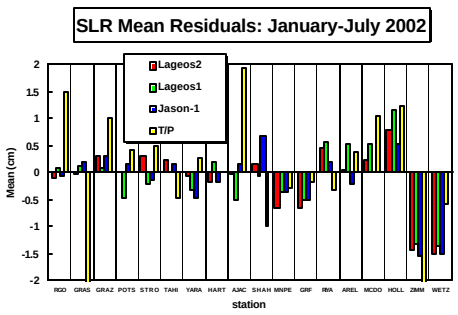
Tracking Data

- *T/P moved from verification to tandem configuration mid-August*
- *Strong SLR tracking continues following mid-August maneuver*
- *High density DORIS tracking allows reduced-dynamic approach*

SLR Measurement Geometry



SLR Mean Residuals: January-July 2002



Jason LRA Offset Adjustment using cycles 1-20

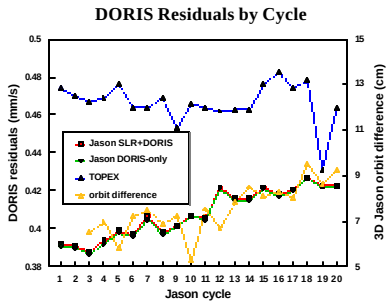
description	LRA phase center correction (cm)	LRA offset spacecraft body-fixed coordinates (cm)			SLR residuals (cm) over cycles 1-20		SLR residuals (cm over cycles 21-25 (independent data)	
		X	Y	Z	Mean	RMS	Mean	RMS
a-priori [1]	-4.9	117.1	59.8	68.28	-0.060	1.897	-0.214	1.799
estimated LRA offset	-4.9	115.8	59.8	68.58	+0.049	1.835	-0.130	1.721
formal sigma		0.10	0.10	0.06				
estimated LRA offset and phase center	-5.1	115.8	59.8	68.40	+0.0836	1.836	-0.103	1.736

1. CoM (x,y,z) values are 94.2,0.0, 0.0 cm.

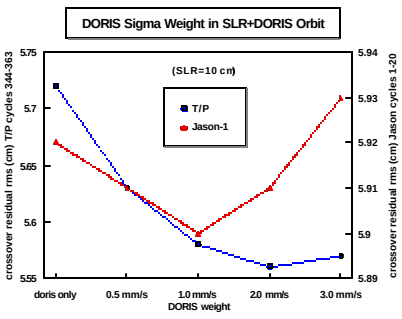
SLR. *Adjustment of the LRA offset may compensate for errors in modeling the offset, CoM, and phase center. The phase center correction depends on characterization of the corner cube response coupled with receiver technology. For T/P, the correction is significant and varies between receiver technologies. From the mean residuals chart above several stations show considerable T/P LRA correction errors, even with state-of-the-art station-specific models. For Jason, the correction is modeled as a common bias applied across all stations. The mean residuals chart indicates station dependency does not appear to be an issue for Jason. The chart also suggests biases may be present for several important stations.*

Although the adjusted LRA offset values improve the SLR fit, the orbit is affected only very slightly (0.1 cm radially). The predominant adjustment in X, coupled with no adjustment in Y, suggests a correction to CoM. The LRA offset in Z adjustment is coupled with the correction to the phase center.

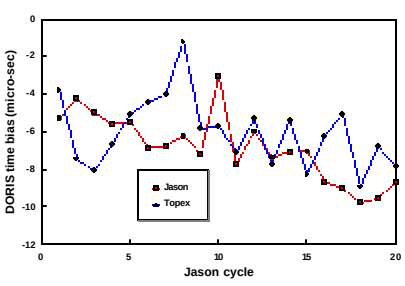
DORIS Residuals by Cycle



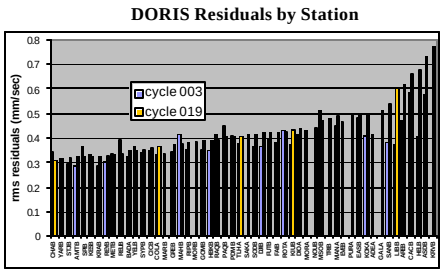
DORIS Sigma Weight in SLR+DORIS Orbit



DORIS time bias wrt SLR

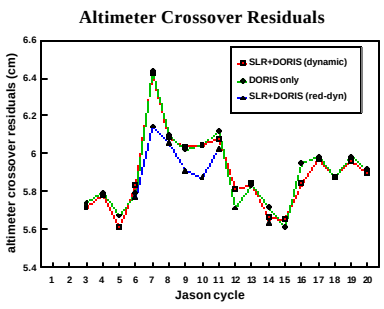


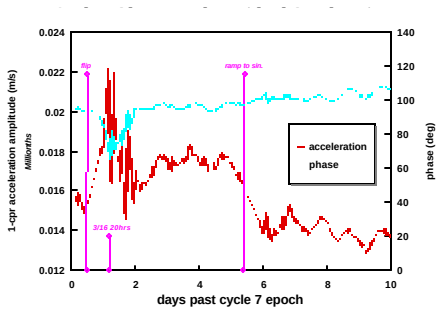
DORIS Residuals by Station



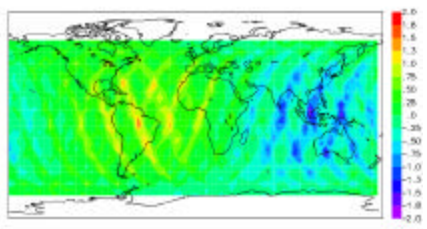
DORIS. *DORIS residuals, or the mis-closure between the observed and modeled measurement,s, are seen to progressively increase over the 20 Jason cycles. Associated is the progressive divergence between the SLR+DORIS and DORIS-only orbits, although the radial component shows no systematic divergence. In fact, there is no evidence of radial accuracy degradation (see altimeter crossover fits below), and compared to T/P, the Jason DORIS still contributes more to POD accuracy (see DORIS sigma weight chart above). Although small, there may be an associated trend in the DORIS time bias.The progressive degradation in fits is largely due to the the degradation in about 10 stations, although many other stations appear to be affected as well.*

Altimeter Crossover Residuals





Radial Difference Dynamic- Reduced_Dynamic (cm)



Reduced-Dynamic. *The reduced-dynamic orbits offer a radial improvement of more than 1 cm , judging by the crossover residuals (see above). The combined residual rms over 7 cycles is 5.92 cm for the reduced-dynamic, 6.03 cm for the SLR+DORIS, and 6.04 cm for the DORIS-only orbits. The reduced-dynamic solution recovers the amplitude and phase of 1-opr cross-track and along-track accelerations due to mis-modeled forces. The recovered parameters are constrained to be smooth and are spaced every 28 minutes (1/4 period). The high density and precision of DORIS tracking allows this approach. The most dramatic improvement occurs for Cycle 7. Cycle 7 POD remains a puzzle. The recovered accelerations show significant divergence from nominal force modeling when none is expected. The orbit difference plot indicates some geographically correlated error may be removed using this technique.*