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Towards ITRF2008:- Status of DORIS Data Processing

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GEOSCIENCE AUSTRALIA

Global DORIS (+SLR) Data Processed

Spot-2	020623 – 070624	Weekly Arcs
Spot-4	030105 – 070624	Weekly Arcs
Spot-5	020616 - 070624	Weekly Arcs
Jason-1	020324 – 070624	Weekly Arcs
Envisat	020623 - 070624	Weekly Arcs
Jason-1 (SLR)	020106 – 080817	Weekly Arcs
Envisat (SLR)	020623 - 080712	Weekly Arcs

Computation Standards (Geodyn0712)

Reference Frame:

- ITRF2005 and SLRF2005 apriori
- IERS2003 Precession and Nutation
- IERS2003 model for Solid Earth Tides
- Ocean Loading based on GOT4.7 Ocean Tide Model
- DE1403 (GSFC) Planetary Ephemeris
- EOP05-C04 apriori EOPs

Computation Standards

Orbit Modelling:

- 7-day arc (except for manoeuvres)
- GGM02C Earth Gravity Field
- Time varying gravity ([2,0];[1,1];[21])
- Annual Time Varying Gravity [20X20]
- Atmospheric Gravity [50X50; NCEP 6 min. data – compiled by Petrov]
- Ocean Tides – GOT4.7 [Ray]
- Atmospheric Density – MSIS

Computation Standards

- Satellite specific macro-model for SRP
- Solar Radiation Pressure scale factor 1/arc constrained (CNES Macromodels)
- Satellite mass changes and satellite centre of mass offset changes applied as per http://ids.cls.fr/html/analysis_coord/documents.html
- Elevation Cutoff 12 degrees

Computation Standards

Estimated Parameters:

- Arc Set
 - Satellite state vector
 - Drag: 6-hourly
 - General Acceleration – $2/\text{arc}$ – along and cross track $1/\text{rev}$
 - Range rate measurement biases for all satellite/site combinations pass-by-pass (DORIS only)
 - Troposphere scale factor pass-by-pass (DORIS only)

Computation Standards

Estimated Parameters:

- **Arc Set**
 - SLR range bias (ILRS AWG rules – “site qualification”)
- **Global Set**
 - Station Coordinates (SLRF2005)
 - Xpole, Ypole (daily at noon)

Computation Standards

- Constraints for SINEX:
 - All global parameters 1m equivalent (station coordinates, pole)
- Data Weighting:
 - Range Rate 2 mm/sec
 - SLR Range as per ILRS AWG “Site Qualification”

Results: Orbit Quality and Comparison

Average WRMS of DORIS Orbit Fits (mm/sec)

	2004	2005	2006	2007
SPOT-2	0.45 (56)	0.44 (58)	0.44 (56)	0.44 (25)
SPOT-4	0.47 (57)	0.45 (55)	0.44 (56)	0.46 (27)
SPOT-5	0.42 (61)	0.40 (61)	0.39 (72)	0.40 (28)
Envisat-1	0.49 (61)	0.42 (61)	0.41 (72)	0.42 (28)
Jason-1	0.43 (49)	0.40 (51)	0.40 (51)	0.42 (18)

(XX) = # of arcs

Results: Orbit Quality and Comparison

Average WRMS of SLR Orbit Fits (cm)

(SLR-only orbits)

	2004	2005	2006	2007
Envisat-1	1.2 (39)	1.2 (43)	1.3 (68)	1.3 (28)
Jason-1	1.2 (43)	1.2 (43)	1.4 (43)	1.3 (44)

Arcs with manoeuvres not included

(XX) = # of arcs

Results: Orbit Quality and Comparison SLR Data Fits to DORIS Orbits Fits (cm)

	2005	2006	2007
Envisat-1		1.9 (63)	1.8 (28)
Jason-1	20 (51)		

Jason-1 WRMS of the SLR data to the DORIS determined orbits range from 3 cm [arc 050417] to 68 cm [arc 050731]. The fits for the SLR determined orbits for the respective arcs are 1.1 cm and 1.4 cm. The fits for the DORIS determined orbits are at the 0.4 mm/sec level. Since the modelling is identical, this implies that there are issues with the DORIS saa data. (Addressed later)

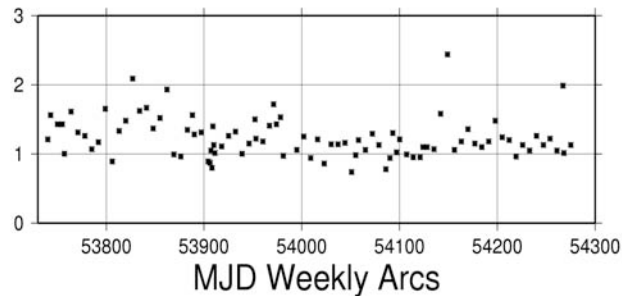
(XX) = # of arcs

Results: Orbit Quality and Comparison Envisat-1 DORIS vs SLR-only Orbits 060122 – 070624 (manoeuvres excluded)

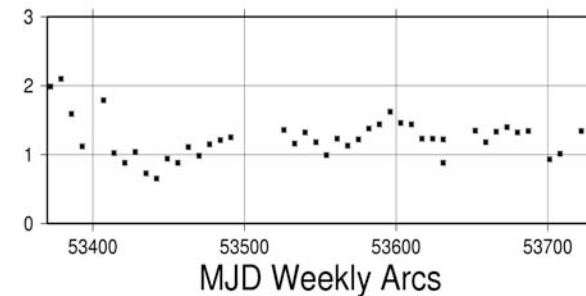
Envisat-1	Radial (cm)	Cross (cm)	Along (cm)
Mean Diff	0	-0.28	1.4
RMS wrt Mean Diff	0.2	0.5	2.4
Mean RMS (all arcs)	3	5	15

Orbit Fits: SLR only and SLR data fit to DORIS only Orbits

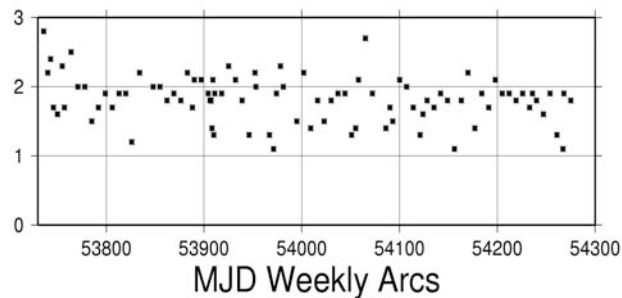
Envisat SLR FITS (cm)



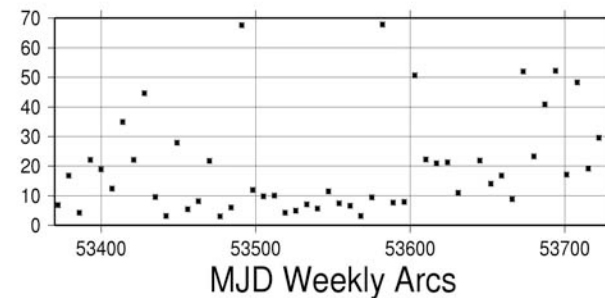
Jason SLR FITS (cm)



Envisat SLR-DORIS FITS (cm)

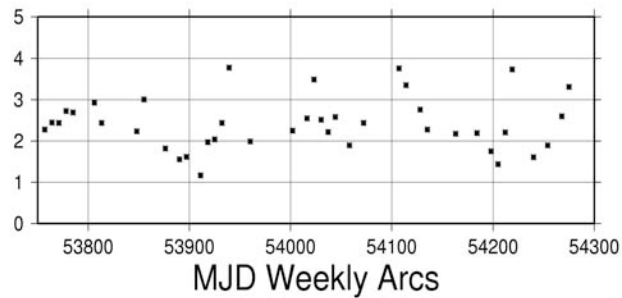


Jason SLR-DORIS FITS (cm)

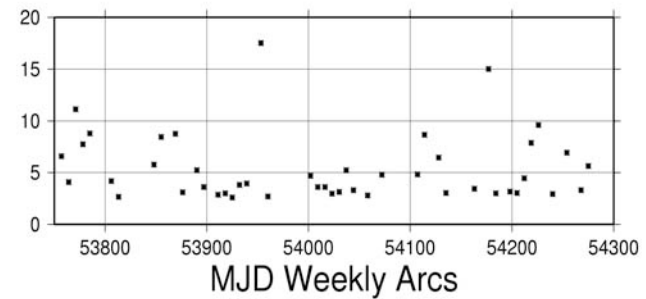


RMS of ENVISAT Orbit Differences: DORIS only – SLR only (cm)

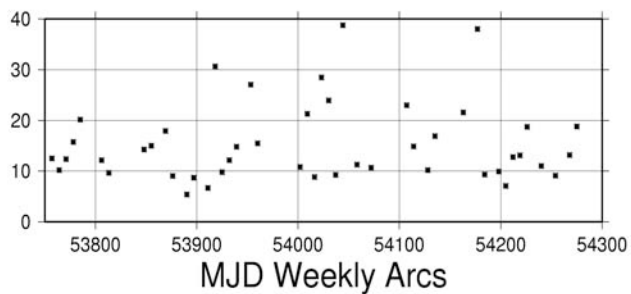
Radial



Cross Track



Along Track



IDS Submission Status

- SINEX files
 - Completed for 2004 – 2007.5
- SINEX files provided for testing:
 - 2005 in weekly arcs
 - Typically 4-satellite combination Spot-2, Spot-4, Spot-5 and Envisat
 - Some discrepancies in CoM and Scale to be addressed

Conclusions

- DORIS orbit fits have been achieved at the 0.4 mm/sec WRMS for all satellites.
- A comparison of orbits between GA and GSFC show excellent agreement – consistent for each arc and across all arcs for all five satellites.
- The Envisat DORIS orbits tested against SLR data are consistent at the level of 2 cm mean of the WRMS. However, for Jason-1 the mean of the WRMS of the orbit fits was 20 cm – ranging from 3 cm to 68 cm.

Conclusions

- The mean differences for the Envisat DORIS orbits to the SLR determined orbits are marginal but show a mean RMS of the differences at the 3, 5 and 15 cm level for the radial, cross and along track components. This is expected from two differently determined state vectors – mapping as a 1/rev in the trajectory.

Conclusions (Suggestions for Round Table Discussion)

- SLR data through the DORIS orbits is a good indicator of the accuracy and quality of the DORIS data. Therefore for consistency, Jason-1 DORIS data should be “calibrated” against a “standard” data set – that is, Envisat (since Envisat DORIS/SLR agree well).
 - A “bootstrap” system is suggested –
 - Envisat DORIS/SLR
 - Jason DORIS / Envisat DORIS
 - Jason DORIS/SLR

Conclusions (Suggestions for Round Table Discussion)

- For Jason-1 Check SLR residuals for DORIS orbits for the same pass over co-located stations (Stromlo, Yaragadee, Greenbelt, Monument Peak etc.)

Outstanding Issues

- Complete testing of SINEX solutions
- Provide the multi-year solution for ITRF2008 as per IDS