Performance monitoring of Envisat DORIS doppler data and orbit solutions.

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ESOC OPS-GN

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Envisat Orbit Comparison Campaign (1/2)

ESOC conducted in May 2003 an orbit comparison campaign for Envisat. The goal of this campaign was to better quantify the absolute orbit accuracy.

For the comparison cycle 12 of Envisat was selected which corresponds to a period of 35 days starting at 10.12.2002 and ending at 13.01.2003.

Six different centers contributed their POD solution to the comparison: CNES, DEOS, ESOC, GFZ, JPL and NCL

Envisat Orbit Comparison Campaign (2/2)

Total (cm)	NCL	CNES	DEOS	ESOC	GFZ	JPL-DORIS
NCL		7.22	6.25	8.07	9.23	18.82
CNES	2		8.76	8.47	9.80	18.33
DEOS	1	6		8.30	10.50	20.40
ESOC	3	5	4		10.44	20.18
GFZ	7	8	10	9		19.48
JPL-DORIS	12	11	15	14	13	

Pair-wise comparisons, RMS of total difference between orbits in cm (top triangle) and index within the total set of comparison pairs (bottom triangle: 1 = smallest overall RMS, etc.)

Final Conclusion from campaign: for best solutions total orbit error (3D) of 10 cm and a radial precision of 3 cm.

ESOC Precise Orbit Determination

ESOC generates two different precise orbits for Envisat:

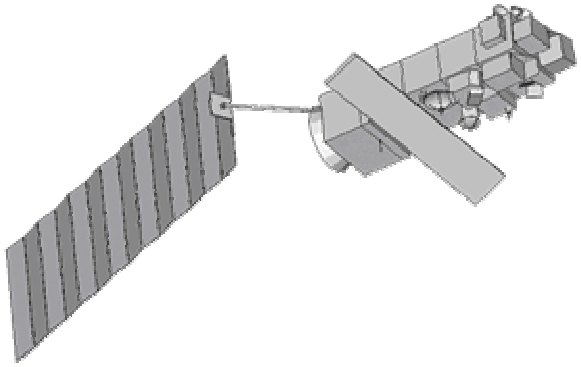
First precise orbit is a fast delivery orbit (based on SLR and altimetry) this solution has a delay of one day and is used to validate the ESOC operational orbit, the altimeter data and the CNES MOE solution.

Second precise orbit is based on Doris doppler data and SLR data and has a delay of ~6 weeks (due to availability of the Doris data). This solution is used to validate the DORIS doppler data and the CNES POE solution

POD summary for SLR+DORIS solution (1/3)

Geopotential:	GRIM5-C1 degree and order 70
Earth Rotation:	IERS C
Third bodies:	DE200
Aerodynamic:	ANGARA (MSIS-90, HWM93)
Solar radiation:	ANGARA
Albedo/IR rad.:	ANGARA

ANGARA Based on ‘ray-tracing’ using detailed geometry and physical models of satellite



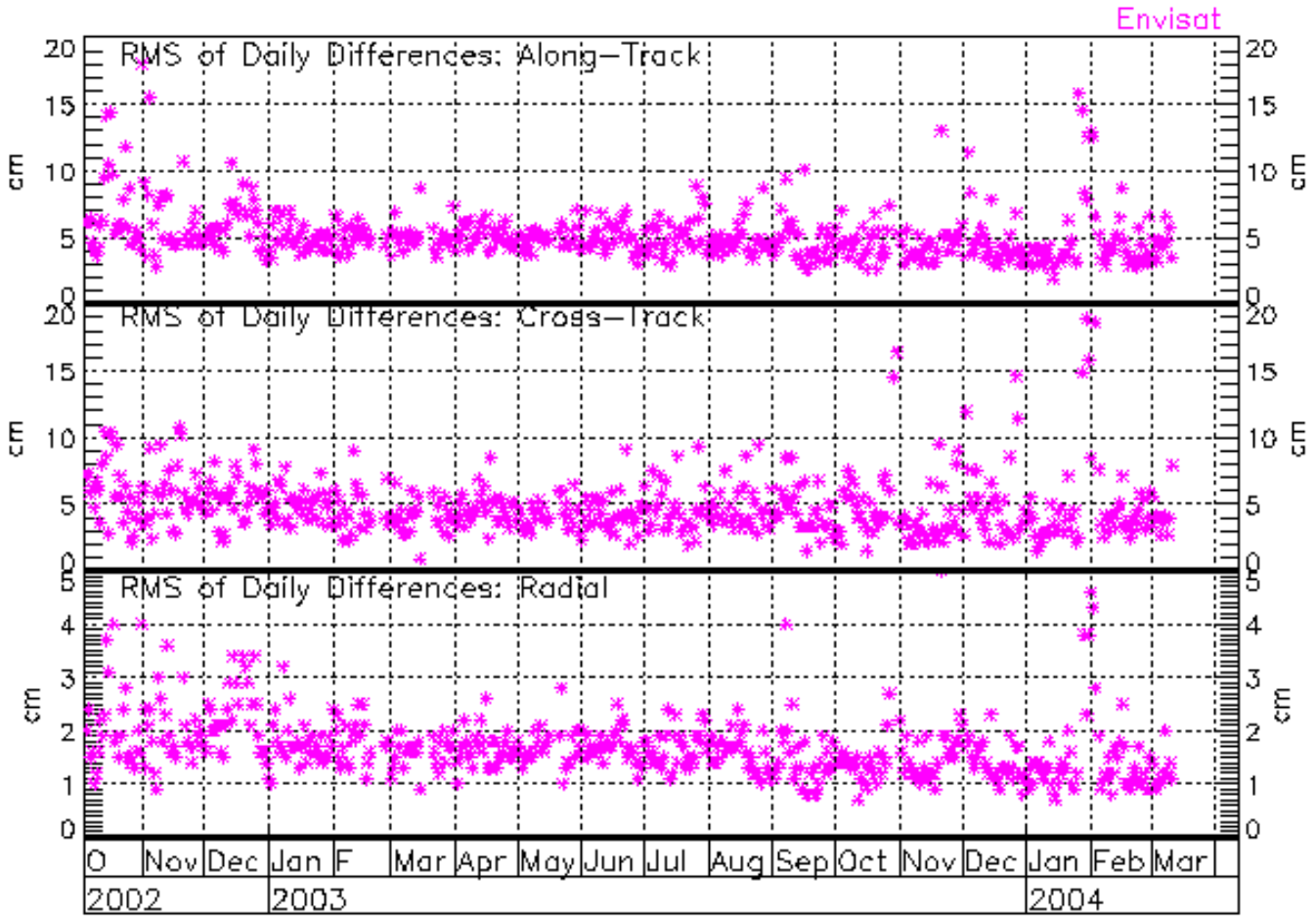
POD summary for SLR+DORIS solution (2/3)

SLR station position:	ITRF-2000 position and velocity
DORIS station pos.:	ITRF-2000 position and velocity
SLR weight:	sigma of ~4.0 cm
DORIS weight:	0.50 mm/s
Laser corrections:	according to IERS-96
DORIS corrections:	from data file and IERS-96
Attitude:	Yaw-Steering mode

POD summary for SLR+DORIS solution (3/3)

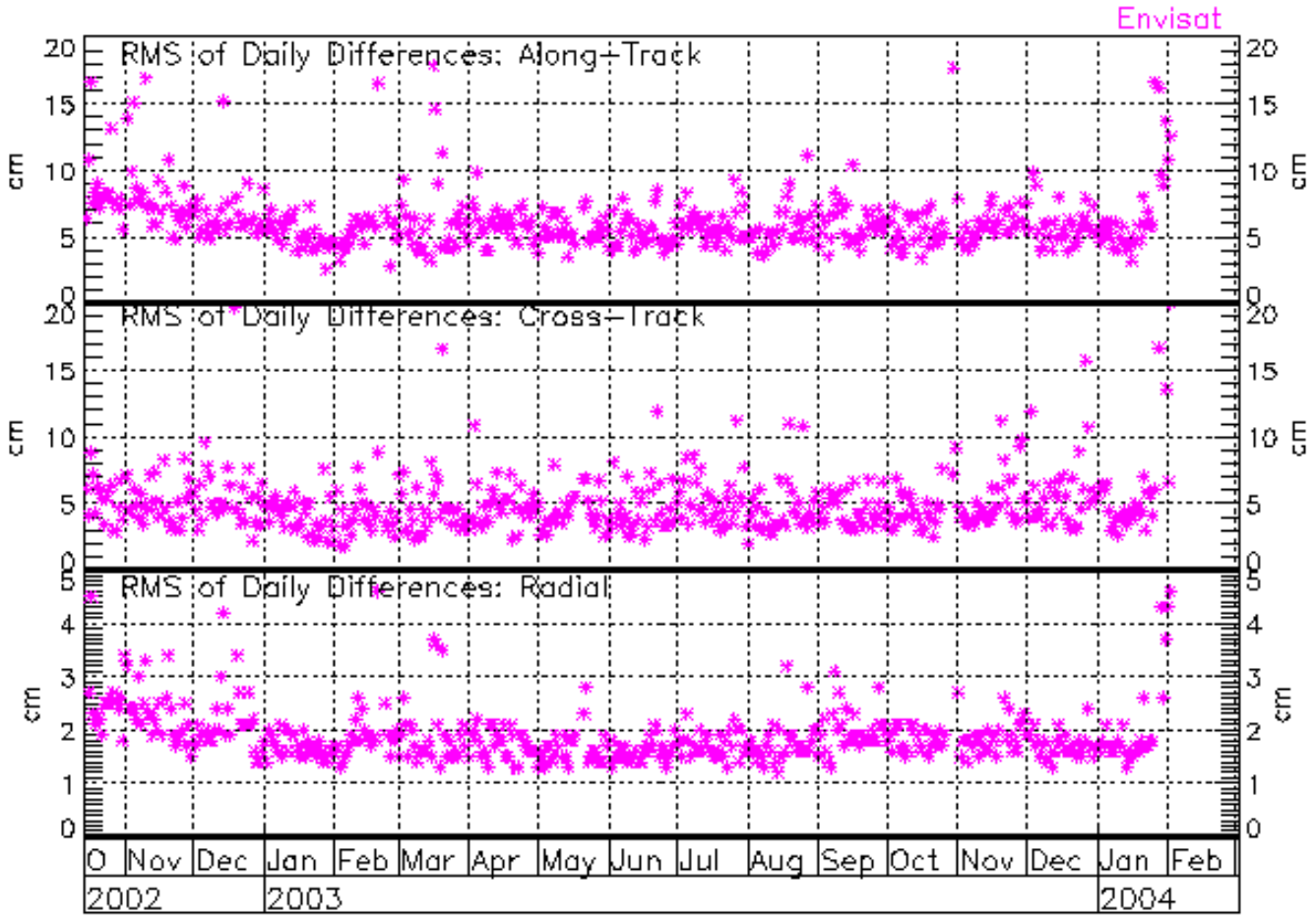
- 5 day arcs with overlap of first and last day
- Total of 117 satellite parameters per arc:
  - Initial position and velocity
  - Aerodynamic drag (10 per day)
  - Solar radiation once per arc
  - 3 sets per day Along and Cross 1-CPR accelerations
- DORIS range-rate bias per pass per station

ESOC POD vs. CNES POE Orbit



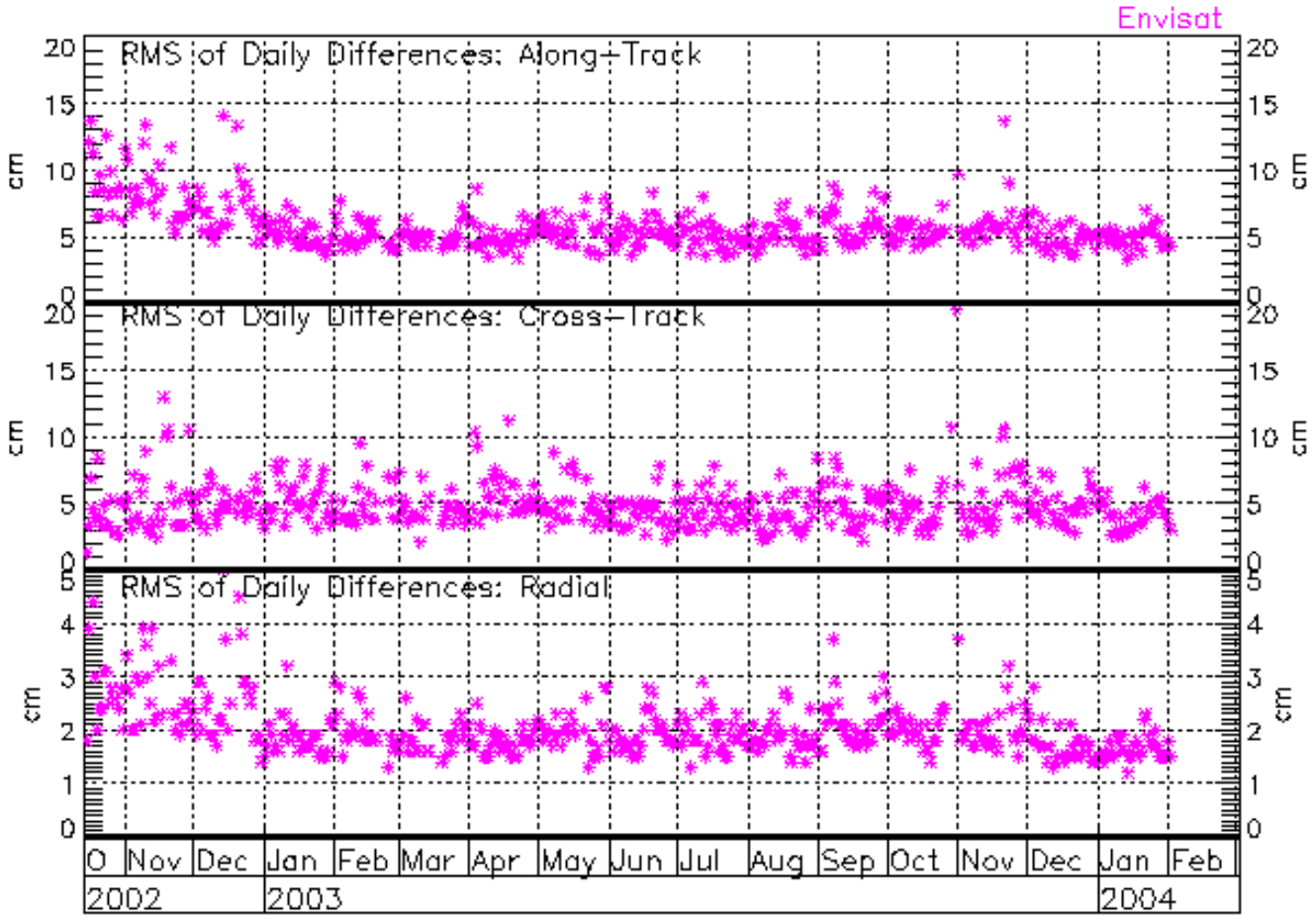
Difference between ESOC final POD solution and CNES POE (in cm).

ESOC POD vs. DEOS POD Orbit



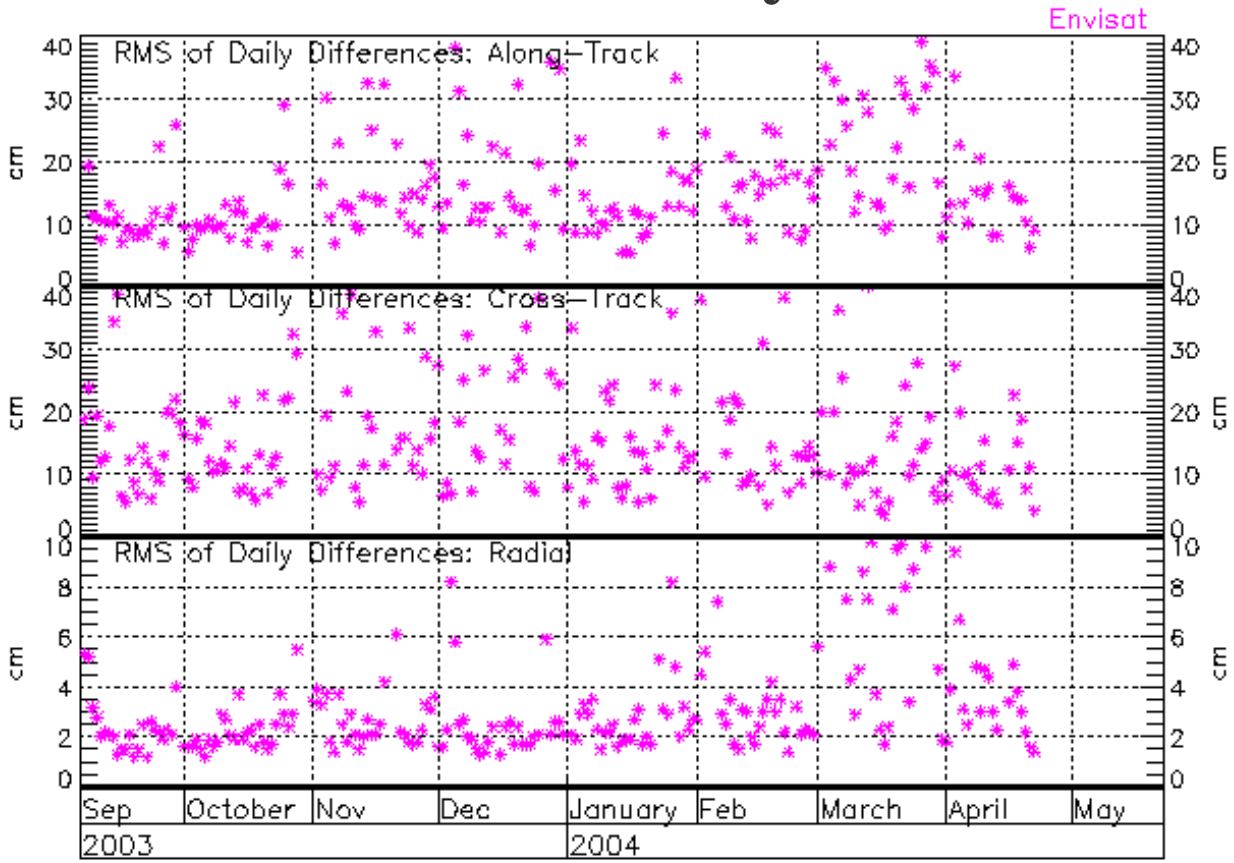
Difference between ESOC POD solution and DEOS POD solution (in cm).

CNES POE vs. DEOS POD Orbit



Difference between CNES POE and DEOS POD solution (in cm).

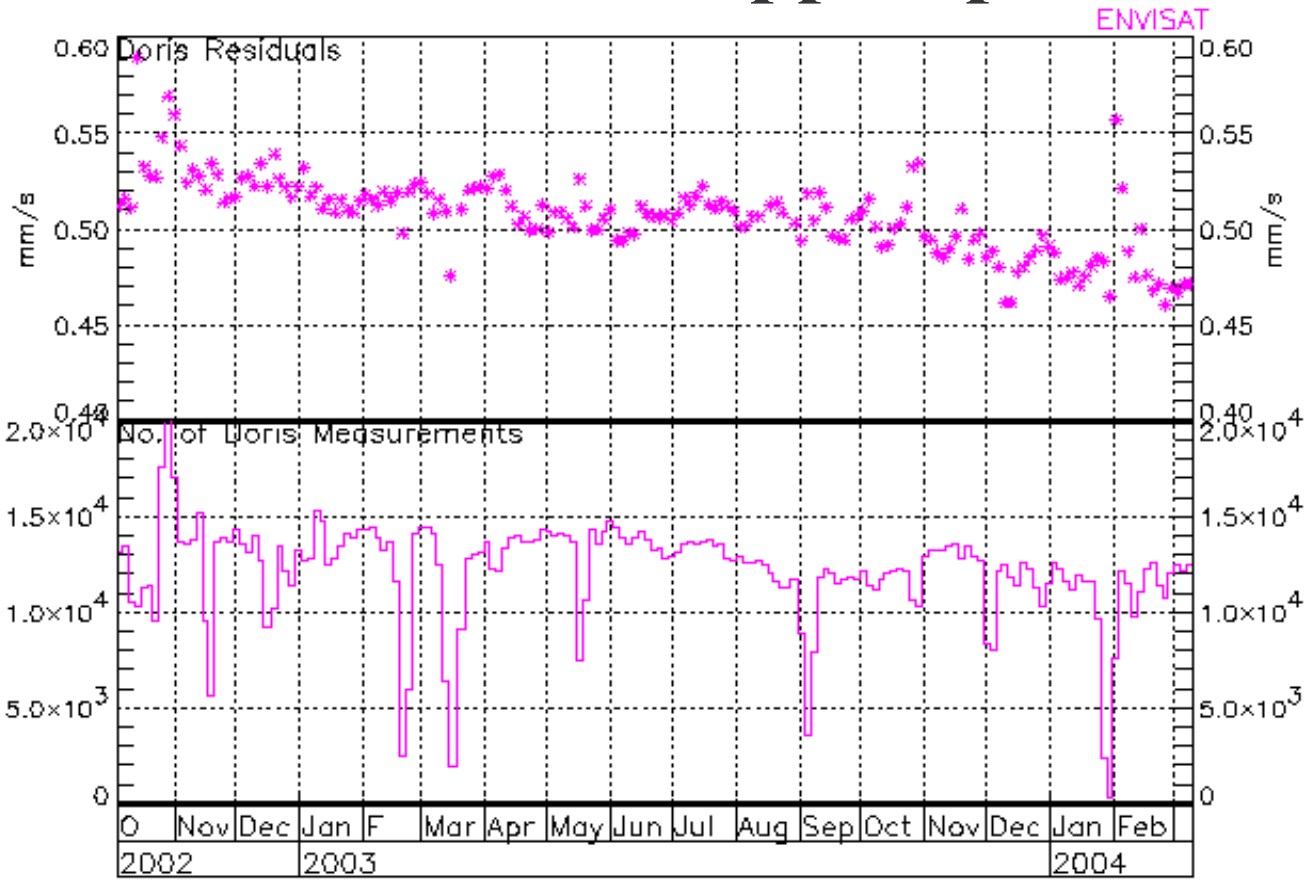
ESOC Fast Delivery vs. CNES MOE Orbit



Precision of ESOC Fast Delivery orbit is estimated to be ~15 cm in along and cross track direction and ~4 cm in radial direction

Difference between ESOC Fast Delivery and CNES MOE orbit solution (in cm). Large difference for March 2004 is due to unavailability of certain geophysical corrections on the Altimeter product

ESOC Doris Doppler processing



Doris Doppler residuals and number of measurements used. Value is for three day period. Notice decrease in residuals and drop (15%) in number of measurements since June/July 2003.

Summary

•Very good performance of CNES POE, DEOS and ESOC precise orbit solution. Difference between ESOC and CNES solution decreases over time. Radial error estimated to be below 3 cm for all solutions.

•CNES MOE and ESOC Fast Delivery orbit show very good radial agreement (below 4 cm) Along and Cross track difference of the order of ~15 cm.

•Very few DORIS doppler data gaps since launch of ENVISAT. Most gaps are a result of external reasons (not DORIS related). Small (15%) decrease in number of DORIS measurements since June/July 2003. ESOC solution shows a reduction in DORIS residuals over time (from ~0.52 mm/s to ~0.48 mm/s)