CNES POD Activities

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A proven expertise

Precise Orbit Determination (POD) aims at deriving satellite trajectories with highest accuracy
- Last achievement: 5 mm in the radial direction / 9 mm 3D (DORIS+GNSS orbits)

A team of 7 people from the CNES Orbit Determination Department defines and computes precise and homogeneous orbit solutions for the following satellite altimetry missions:

Experience gained with the past altimeter missions initiated by TOPEX/Poseidon (1992) and continued through Jason-1, Envisat, OSTM/Jason-2, HY-2A, and with the currently flying satellites
- State of the art force and geometric models implemented in CNES ZOOM orbit estimation software
- Expertise on DORIS/GNSS/SLR measurements (member of the IDS/IGS/ILRS Working Groups)
- Periodically define and produce an updated set of orbits and geophysical standards to address short-term and long-term orbit errors impacting mean sea level change estimates
POE-F Orbital Standards

Main updates for DORIS-only orbits
Comparison for ENVISAT CNES POE-F versus CNES POE-E
Used dataset

- Reference data: all cycles from 6 to 113 (May 2002 to April 2012) reprocessed into a homogeneous standard (so called V3.0 version)

- Analysis span over cycle 007 (17/06/2002) to cycle 113 (08/04/2012)

- Reference orbit: CNES POE-E
- Studied orbit: CNES POE-F
Direct comparison between CNES POE-F and CNES POE-E with FLAG_VAL
Global bias: \(~-0.03\text{cm}\)
No significant trend (\(~0.02\text{mm/yr.}\))

22/10/2010: Envisat moved to a new lower orbit
Maps of differences of orbit

Geographically correlated difference with a maximum of \(~0.2\, cm\)
Differences of orbits per year

6 months available for 2002

Geographical patterns are higher for 2005-2006 compared to other years

4 months available for 2012
Impact on along-track SLA performances
Difference of SLA variance

➔ No significant impact on global SLA std,
But geographically correlated patterns
Impact of CNES POE-F on performances at crossovers
Temporal evolution at crossover

Means at crossovers
(selection on |latitude|<50°, bathy<-1000m, oceanic variability < 0,2) :

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<table>
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<tbody>
<tr>
<td>CNES POE-F</td>
<td>-0.36 cm</td>
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<tr>
<td>CNES POE-E</td>
<td>-0.47 cm</td>
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22/10/2010 : Envisat moved to a new lower orbit
Mean of SSH difference at Crossover per year (CNES POE-E)

6 months available for 2002

4 months available for 2012

22/10/2010 : Envisat moved to a new lower orbit
Mean of SSH difference at Crossover per year (CNES POE-F)

6 months available for 2002

Small reduction of geographical patches of mean difference at crossovers from POE-E (previous slide) to POE-F in pacific ocean and indian ocean

22/10/2010: Envisat moved to a new lower orbit

4 months available for 2012
Slight decrease (-0.13 cm²) of the variance of SSH at crossovers for CNES POE-F wrt CNES POE-E:

- cycle 95 (drifting orbit): not significant wrt coverage cycles 108 & 109 (end of 2011)
Impact of CNES POE-F on long term drift of SLA (MSL)
Small impact on annual signal, Higher in southern hemisphere than in northern
Global and regional MSL trends

- No significant impact on global MSL trend
- North/South patterns (~0.5mm/yr)
No significant impact on GMSL trend and regional trends differences up to +/-0.5mm/yr

Mean of the difference of SSH at crossover is slightly reduced (from 0.47cm to 0.36cm in average)

Variance at crossovers is slightly reduced using POE-F instead of POE-E for cycle 016 onwards