SL_cci Annual Review 1: New external contributions
WP2110

L. Zawadzki, M. Ablain, J-F. Legeais
1. New External Contributions*
   1. Orbits
   2. Ocean Tide Correction

2. Planning 2015

*Contributions of SL_cci partners are analyzed in a different WP
1. New External Contributions
   1. Orbits
      1. Jason-1 CNES GDR-E (preliminary)
      2. Jason-2 CNES GDR-E (preliminary)
   2. Ocean Tide Correction
2. Planning 2015
1. New External Contributions
   1. Orbits
      1. Jason-1 CNES GDR-E (preliminary)
      2. Jason-2 CNES GDR-E (preliminary)
   2. Ocean Tide Correction

2. Planning 2015
Technical Improvements (w.r.t CNES GDR-D):

- **New Gravity field** EIGEN-GRGS.RL03.MEAN-FIELD (annual, semi annual fit + trend estimated per year)
- Calibrated semi-empirical **Solar Radiation Pressure** model on the solar panels
- Reduction of the **South Atlantic Anomaly** Doris station downweighting

See Ollivier’s Talk, OSTST 2014 (Konstanz)
## Climate Applications

<table>
<thead>
<tr>
<th>Temporal Scales</th>
<th>Jason-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-term evolution (trend)</td>
<td>Round Robin Data Package (RRDP)</td>
</tr>
<tr>
<td>Interannual signals (&gt; 1 year)</td>
<td>CNES GDR-E vs GDR-D</td>
</tr>
<tr>
<td>Annual and semiannual Signals</td>
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</tbody>
</table>

### Global Mean Sea Level

- Long-term evolution (trend)
- Interannual signals (> 1 year)
- Annual and semiannual Signals

### Regional Mean Sea Level

- Long-term evolution (trend) +
- Annual and semiannual Signals

### Mesoscale

- Signals < 2 months +

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**Sea Level CCI – Phase II 1st annual review – Jan. 29th-30th 2015**
SLA trends:

**Global MSL**
Mission j1, cycles 1 to 537

- SLA with POE_E
  - Slope = 2.83 mm/yr [L.S.R. = 0.0632]
- SLA with POE_D
  - Slope = 2.91 mm/yr [L.S.R. = 0.0633]

**SLA with POE_E trends - SLA with POE_D trends**
Mission j1, cycles 1 to 537

**New Orbits: Jason-1 CNES GDR-E**

**New Gravity field**

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Fig.: Differences between Sea Level Anomaly trends: SLA with CNES GDR-E vs SLA with CNES GDR-D orbits

Sea Level CCI – Phase II 1st annual review – Jan. 29th-30th 2015
Comparison to in situ:

Valid mean differences without annual and semi-annual signals for REF

East / West boxes

- East box
  - Slope = -0.119 mm/year [L.S.R. = 0.257]
- West box
  - Slope = 1.95 mm/year [L.S.R. = 0.185]

Valid mean differences without annual and semi-annual signals for ETU

East / West boxes

- East box
  - Slope = 0.69 mm/year [L.S.R. = 0.312]
- West box
  - Slope = 1.07 mm/year [L.S.R. = 0.196]

See Couhert et al. 2014 ASR

Fig.: Left: SLA - DHA mean differences for each hemisphere (East/West) computed with the GDR-D (Left) and GDR-E (Right) orbit solutions

<table>
<thead>
<tr>
<th>East/West boxes trend differences (mm/yr)</th>
<th>GDR-D</th>
<th>GDR-E</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Argo 900 dbar</td>
<td>-2.10</td>
<td>-0.40</td>
<td>-1.8</td>
</tr>
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</table>

Tab.: Hemispheric differences (East/West) of trends of the SLA - DHA mean differences computed with the GDR-E and GDR-D orbit solutions
SSH Crossovers:

SSH crossovers: VAR(SSH with POE_E) - VAR(SSH with POE_D) (SL2)
Mission J1, cycles 1 to 537

Fig.: Differences between temporal evolution of SSH crossovers: SSH with CNES GDR-E vs SSH with CNES GDR-D orbits
Sea Level CCI – Phase II 1st annual review – Jan. 29th-30th 2015
1. New External Contributions
   1. Orbits
      1. Jason-1 CNES GDR-E (preliminary)
      2. Jason-2 CNES GDR-E (preliminary)
   2. Ocean Tide Correction

2. Planning 2015
Technical Improvements (w.r.t CNES GDR-D):

- **New Gravity field** EIGEN-GRGS.RL03.MEANFIELD (annual, semi annual fit + trend estimated per year)
- **C3,1/S3,1 geopotential coefficients** adjusted during the orbit determination process
- Upgrade of the modelisation of the **center-of-mass** of the total Earth system position
- Calibrated semi-empirical **Solar Radiation Pressure** model on the solar panels
- Improved stochastic solution + minor evolutions

See Ollivier’s Talk, OSTST 2014 (Konstanz)
## New Orbits: Jason-2 CNES GDR-E

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<th>Climate Applications</th>
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<th>Jason-2</th>
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<td>Round Robin Data Package (RRDP)</td>
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Sea Level CCI – Phase II 1st annual review – Jan. 29th-30th 2015
New Orbits: Jason-2 CNES GDR-E

SLA trends:

New Gravity field + Harmonic 31 relaxed

Fig.: Differences between Sea Level Anomaly trends: SLA with CNES GDR-E vs SLA with CNES GDR-D orbits

Sea Level CCI – Phase II 1st annual review – Jan. 29th-30th 2015
SSH Crossovers:

Fig.: Differences between temporal evolution of SSH crossovers: SSH with CNES GDR-E vs SSH with CNES GDR-D orbits

Sea Level CCI – Phase II 1st annual review – Jan. 29th-30th 2015
1. New External Contributions
   1. Orbits
   2. Ocean Tide Correction: GOT4V10

2. Planning 2015
Technical Improvements (w.r.t GOT4.8):

- Assimilation of Jason-1 and Jason-2 data only for the computation of the S2 wave:

- Conclusions OSTST 2010 (Lisbon): TOPEX/Poseidon SSH contains an error that is assimilated in altimetry-based ocean tide models via the semi-diurnal wave S2.

- Reduction of 58.77-day error in Jason-1 and Jason-2 Sea Level Anomalies

- See RRDP on SL_cci ftp and website

See Zawadzki’s Poster, OSTST 2014 (Konstanz)
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<th>Jason-1 &amp; Jason-2</th>
<th>Envisat</th>
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<td><strong>GOT4.10 vs GOT4.8</strong></td>
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Fig.: Amplitudes of the 58.77-day signal in TOPEX/Jason-1/Jason-2 Global MSL, with GOT ocean tide corrections.
Global MSL: Periodic signals

Fig.: Amplitudes of the 58.77-day signal in TOPEX/Jason-1/Jason-2 Global MSL, with GOT ocean tide corrections

Sea Level CCI – Phase II 1st annual review – Jan. 29th-30th 2015
Fig.: Amplitudes of the 58.77-day signal in TOPEX/Jason-1/Jason-2 Global MSL, with GOT ocean tide corrections.
Global MSL: Periodic signals

Fig.: Amplitudes (mm) of the 58.77-day signal in Jason-1 Global MSL, with GOT ocean tide corrections

Sea Level CCI – Phase II 1st annual review – Jan. 29th-30th 2015
Regional MSL: Periodic signals

Fig.: Amplitudes of the 58.77-day signal in **Jason-1 SLA MSL**, with **GOT4.8** ocean tide correction
Regional MSL: Periodic signals

Fig.: Amplitudes of the 58.77-day signal in **Jason-1** SLA MSL, with **GOT4.10** ocean tide correction

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1. New External Contributions
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   2. Ocean Tide

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Planning 2015

**Orbits**
- CNES GDR-E Jason-1
- CNES GDR-E Jason-2
- GSFC ?

**Geophysical Corrections**
- Ocean Tide: FES2014

**Propagation Corrections**
- Troposphere:
  - JMR GDR-E (Jason-1)
  - MWR V3 (Envisat)
Conclusions & Perspectives

The quality of SL_cci ECV V2.0 will benefit from new orbits and corrections

Several orbits and corrections must still be integrated in the database and tested

Selection of standards planned for June 2015