The production system, the FCDR and ECV sea level products: overview and objectives

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Processing steps of the X-TRACK system:

**Mission & Region**

**Level 2:**
GDRs, ALES products, auxiliary informations

Editing of all corrections
- Editing of ionospheric correction
- Editing of sea state bias correction
- Editing of wet tropospheric correction

- Regional DAC correction if available
- Regional tide correction if available

- Computing MSSH and SLA on a reference track
- Filtering SLA alongtrack (option)

- Adding auxiliary parameters
- Writing netcdf output

**Level 3:**
SLA time series along a nominal track

**USERS**
Processing steps of the X-TRACK system:

Mission & Region

Level 2:
GDRs, ALES products, auxiliary informations

Processing system adapted for the SL_CCI Bridging Phase Project:

- From 1Hz to 20Hz measurements
- From MLE4 ocean retracker to ALES coastal retracker (Passaro et al., 2014)
- ALES SSB correction (Passaro et al., 2018)

Level 3:
SLA time series along a nominal track
Geophysical corrections:

- Impact studies
- Set of corrections adapted for coastal & climate applications

Level 2:
GDRs, ALES products, auxiliary informations

Level 3:
SLA time series along a nominal track

Users
3 pilot regions

2 alimeter missions

- **Jason-1**
  Cycle 1 (2002/01) to 259 (2009/01)

- **Jason-2**
  Cycle 1 (2008/07) to 292/293 (2016/06, depending of the region)
What has been done in the ESA SL_CCI Bridging Phase:

- **X-TRACK processing software:**
  - Adapt the algorithm to ALES product provided by TUM (format & inputs)
  - Define the set of corrections & interpolation/extrapolation at 20 Hz
  - Define/adapt the X-TRACK editing for ALES & for 20Hz measurements
  - Adapt the MSSH computation to 20 Hz data
  - Adapt the post-processing step

- **X-TRACK/ALES 20Hz L3 product:**
  - Compute a first release of the product for the 3 test areas and for Jason-1 & Jason-2 (September 2018)
  - Internal validation & test on performance
  - Combine Jason-1 & Jason-2 in a single product
  - Provide the product to partners for validation and analysis: LEGOS, CNR, NOC/SKYMAT
  - Test on different corrections
  - Compute a second release of the product for the 3 test areas and for Jason-1 & Jason-2 (February 2019)
**Geophysical corrections:**

<table>
<thead>
<tr>
<th>Corrections</th>
<th>Hz</th>
<th>XT/AL Release 1</th>
<th>XT/AL Release 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ionosphere</td>
<td>1 Hz extrapolated at 20Hz</td>
<td>GDR From dual-frequency altimeter range measurements</td>
<td></td>
</tr>
<tr>
<td>Dry troposphere</td>
<td>1 Hz extrapolated at 20Hz</td>
<td></td>
<td>GDR From ECMWF model</td>
</tr>
<tr>
<td>Wet troposphere</td>
<td>1 Hz extrapolated at 20Hz</td>
<td>GDR radiometer wet tropospheric correction</td>
<td>GPD+ wet tropospheric correction (Fernandes et al., 2016)</td>
</tr>
<tr>
<td>Sea state bias</td>
<td>20 Hz</td>
<td></td>
<td>ALES SSB (Passaro et al., 2018)</td>
</tr>
<tr>
<td>Solid tides</td>
<td>1 Hz extrapolated at 20Hz</td>
<td>CTOH From tide potential model (Schureman 1958)</td>
<td>RADS From tide potential model (Cartwright and Taylor, 1971)</td>
</tr>
<tr>
<td>Pole tides</td>
<td>1 Hz extrapolated at 20Hz</td>
<td>GDR From Wahr, 1985</td>
<td></td>
</tr>
<tr>
<td>Loading effect</td>
<td>1 Hz extrapolated at 20Hz</td>
<td>CTOH FES1999 (Lefèvre et al., 2002)</td>
<td>RADS FES2014a</td>
</tr>
<tr>
<td>Atmospheric Correction</td>
<td>1 Hz extrapolated at 20Hz</td>
<td>DAC from CTOH</td>
<td>DAC from RADS</td>
</tr>
<tr>
<td>Ocean Tide</td>
<td>1 Hz extrapolated at 20Hz</td>
<td>CTOH FES 2012 (Carrère et al., 2012)</td>
<td>RADS FES2014b global tidal model</td>
</tr>
</tbody>
</table>
For each region and for both Jason-1 & Jason-2,  

3 data sets are compared:  

- X-TRACK 1Hz: the standard 1-Hz X-TRACK product computed from the 1-Hz measurements provided from GDRs products (MLE4 retracker),  
- X-TRACK 20Hz: a 20-Hz X-TRACK product version computed from the 20-Hz measurements provided from GDRs products (MLE4 retracker),  
- the combined 20-Hz ALES/X-TRACK product: computed from the 20-Hz measurements retracked with ALES (called XT/AL 20Hz hereinafter).

The same geophysical corrections, except for XT/AL 20Hz, where the ALES SSB is used.
Mean distance to the coast (ghssh) of the first point available - SUMMARY

> 80% valid (in km)

<table>
<thead>
<tr>
<th>Region</th>
<th>Mission</th>
<th>XT 1Hz</th>
<th>XT 20Hz</th>
<th>XT/AL 20Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDSEA</td>
<td>J1</td>
<td>6,9</td>
<td>4,2</td>
<td>3,4</td>
</tr>
<tr>
<td></td>
<td>J2</td>
<td>5,2</td>
<td>1,4</td>
<td>1,2</td>
</tr>
<tr>
<td>NEA</td>
<td>J1</td>
<td>6,2</td>
<td>4,1</td>
<td>3,9</td>
</tr>
<tr>
<td></td>
<td>J2</td>
<td>5,8</td>
<td>1,9</td>
<td>1,9</td>
</tr>
<tr>
<td>WAF</td>
<td>J1</td>
<td>9,3</td>
<td>6,1</td>
<td>4,8</td>
</tr>
<tr>
<td></td>
<td>J2</td>
<td>7,6</td>
<td>4,5</td>
<td>3,4</td>
</tr>
<tr>
<td>ALL</td>
<td>J1</td>
<td>7,47</td>
<td>4,8</td>
<td>4,03</td>
</tr>
<tr>
<td></td>
<td>J2</td>
<td>6,2</td>
<td>2,6</td>
<td>2,17</td>
</tr>
</tbody>
</table>
XTRACK/ALES 20Hz SLA vs standard X-TRACK 1Hz SLA

Example of Jason2 SLA – track 213 in Bay of Biscay - cycle 100

X-TRACK 1Hz  X-TRACK 20Hz  XT/ALES 20Hz
XTRACK/ALES 20Hz SLA vs standard X-TRACK 1Hz SLA

Example of Jason2 SLA – track 213 around Oleron Island - cycle 100

X-TRACK 1Hz

X-TRACK 20Hz

XT/ALES 20Hz
XTRACK/ALES 20Hz SLA vs standard X-TRACK 1Hz SLA

Example of Jason2 SLA – track 20 near Gibraltar - cycle 100

<table>
<thead>
<tr>
<th>Distance to the coast (km)</th>
<th>Northern coastal area</th>
<th>Southern coastal area</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of valid data</td>
<td>% of valid data</td>
<td></td>
</tr>
<tr>
<td>Std (SLA) in m</td>
<td>Std (SLA) in m</td>
<td></td>
</tr>
</tbody>
</table>
Work planed

- Improve the processing system
  - corrections of pb that may be identified during the SL-CCI Bridging Phase (bias and better inter-mission calibration)
  - optimization of the set of corrections
  - optimization of the editing
  - computation of a quality flag parameter

- Adapt the processing system
  - more altimetry missions
  - more regions
  - SAR altimetry data

- An homogeneous multi-mission coastal altimetry product:
  - inter-calibration between the different missions
  - development of a regional mapping approach optimized for coastal altimetry

- Regular product improvement & releases