## Ionospheric correction: GIM Reprocessed

<table>
<thead>
<tr>
<th>Study variable</th>
<th>Reprocessed GIM ionospheric correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference variable</td>
<td>CNES/AVISO GIM ionospheric correction</td>
</tr>
<tr>
<td>Missions</td>
<td>Envisat <em>(en)</em></td>
</tr>
<tr>
<td>Period</td>
<td>[19259, 22234]</td>
</tr>
</tbody>
</table>

Creation date: 2011/05/04

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**Study overview**

In this study, a reprocessed GIM correction has been compared to the ionospheric correction used in CNES/AVISO product to calculate the Envisat sea-level height (SSH).

The impact of using these both ionospheric corrections on the SSH calculation has been analyzed for Envisat mission from September 2002 (cycle 9) to October 2010 (cycle 94). The reprocessed GIM correction corresponds to a reprocessed version of the GIM correction (GIM GDR product Level 2) taking into account homogeneous solar activity coefficients. Indeed, until recently, they were updated only every two years which had introduced jumps in the temporal series. The reference ionospheric correction is the classical GIM model for comparison between corrections. As done in CNES/AVISO products, for SSH or SLA (Sea Level Anomaly), an hybrid correction is used, combining the Bi-frequency ionospheric correction (until cycle 65) and the GIM model correction (after cycle 65). All the validation diagnostics displayed in this report have been performed in agreement with the Sea-Level CCI Product Validation Plan (PVP).
Name: Temporal evolution of differences between both altimetric components

Input data: Along-track altimetric components

Description: The temporal evolution of global statistics (mean, variance, slope) of differences between 2 different standards of a same altimetric component (sea surface height correction, altimeter parameter, orbit) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly). These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.
**Diagnostic A002 (mission en)**

**Name:** Map of differences between both altimetric components over all the period

**Input data:** Along-track altimetric components

**Description:** The map of global statistics (mean, standard deviation) of differences between 2 different standards of a same altimetric component (sea surface height correction, altimeter parameter, orbit) are calculated over a given period which is the longer as possible to have obtain reliable statically results. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.
Diagnostic A003_a (mission en)

Name: Periodogram derived from temporal evolution of altimetric component differences

Input data: Along-track altimetric components

Description: The periodogram derived from temporal and global altimetric component differences is calculated from cycle by cycle monitoring of altimetric component differences (derived from diagnostic A001). It is calculated from the mean or the variance differences. The Periodogram can be calculated for all the periods, but it can be focused on a dedicated period.
**Name**: Periodogram derived from temporal evolution of altimetric component differences

**Input data**: Along-track altimetric components

**Description**: The periodogram derived from temporal and global altimetric component differences is calculated from cycle by cycle monitoring of altimetric component differences (derived from diagnostic A001). It is calculated from the mean or the variance differences. The Periodogram can be calculated for all the periods, but it can be focused on a dedicated period.
### Diagnostic A201_a (mission en)

**Name**: Temporal evolution of Sea Level Anomaly (SLA)

**Input data**: Along track SLA / SLA Grids combined between all missions

**Description**: The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids), or separating North and South hemispheres.

![Global MSL](image)

<table>
<thead>
<tr>
<th>Year</th>
<th>SLA with IONO_GIM_REPROC</th>
<th>Slope = 0.445 mm/yr [L.S.R.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>SLA with IONO_GIM</th>
<th>Slope = 0.653 mm/yr [L.S.R.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
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</tbody>
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**Input data**: Along track SLA / SLA Grids combined between all missions

**Description**: The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids), or separating North and South hemispheres.
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**Diagnostic A202.a (mission en)**

**Name**: Differences of temporal evolution of Sea Level Anomaly (SLA)

**Input data**: Along track SLA / SLA Grids combined between all missions

**Description**: The differences between temporal evolution of SLA are calculated from statistics derived from diagnostic A201 (mean, variance) using 2 different components in the SLA calculation. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) or separating North and South hemispheres.

![Graph showing differences of variances (cm²) over cycles from 2004 to 2010, with a mean value of -0.04545]
**Diagnostic A202_b (mission en)**

**Name:** Differences of temporal evolution of Sea Level Anomaly (SLA)

**Input data:** Along track SLA / SLA Grids combined between all missions

**Description:** The differences between temporal evolution of SLA are calculated from statistics derived from diagnostic A201 (mean, variance) using 2 different components in the SLA calculation. They are calculated globally, but also separating ascending and descending passes (except for SLA Grids) or separating North and South hemispheres.
Diagnostic A203_a (mission en)

Name: Map of Sea Level Anomaly (SLA) over all the period

Input data: Along track SLA / SLA Grids combined between all missions

Description: The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.
**Diagnostic A203_b (mission en)**

**Name:** Map of Sea Level Anomaly (SLA) over all the period

**Input data:** Along track SLA / SLA Grids combined between all missions

**Description:** The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

![Map of Sea Level Anomaly (SLA)](image)
Name: Map of Sea Level Anomaly (SLA) over all the period

Input data: Along track SLA / SLA Grids combined between all missions

Description: The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.
Diagnostic A204_a (mission en)

Name: Differences between maps of SLA

Input data: Along track SLA / SLA Grids combined between all missions

Description: The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except for SLA Grids).
Diagnostic A204.b (mission en)

Name: Differences between maps of SLA

Input data: Along track SLA / SLA Grids combined between all missions

Description: The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except for SLA Grids).
**Diagnostic A206.a (mission en)**

**Name:** Periodogram derived from temporal evolution of Sea Level Anomaly (SLA)

**Input data:** Along track SLA / SLA Grids combined between all missions

**Description:** The periodogram derived from temporal evolution of SLA (global, northern or southern hemisphere) can be done over all periods or focusing on particular periods, such as annual, semi annual or 60 day signal. Therefore mean of SLA differences are computed (every day or cycle), and time data series are plotted as a periodogram.
**Name**: Periodogram derived from temporal evolution of Sea Level Anomaly (SLA)

**Input data**: Along track SLA / SLA Grids combined between all missions

**Description**: The periodogram derived from temporal evolution of SLA (global, northern or southern hemisphere) can be done over all periods or focusing on particular periods, such as annual, semi annual or 60 day signal. Therefore mean of SLA differences are computed (every day or cycle), and time data series are plotted as a periodogram.

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![Periodogram of SLA differences, north and south hemispheres](image1)

*Periodogram of SLA differences, north and south hemispheres (reference period = 1 year)*

Mission en, cycles 10 to 93

![Periodogram of SLA differences, north and south hemispheres](image2)

*Periodogram of SLA differences, north and south hemispheres (period = [0, 1 year])*

Mission en, cycles 10 to 93