

# Adjusted GIM ionospheric correction on Jason-1

Study variable	<b>Adjusted GIM ionospheric correction on Jason-1</b>
Reference variable	<b>CNES/AVISO GIM ionospheric correction</b>
Missions	Envisat ( <i>en</i> )
Period	[19259, 22090]

Creation date : 2011/09/06

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## Study overview

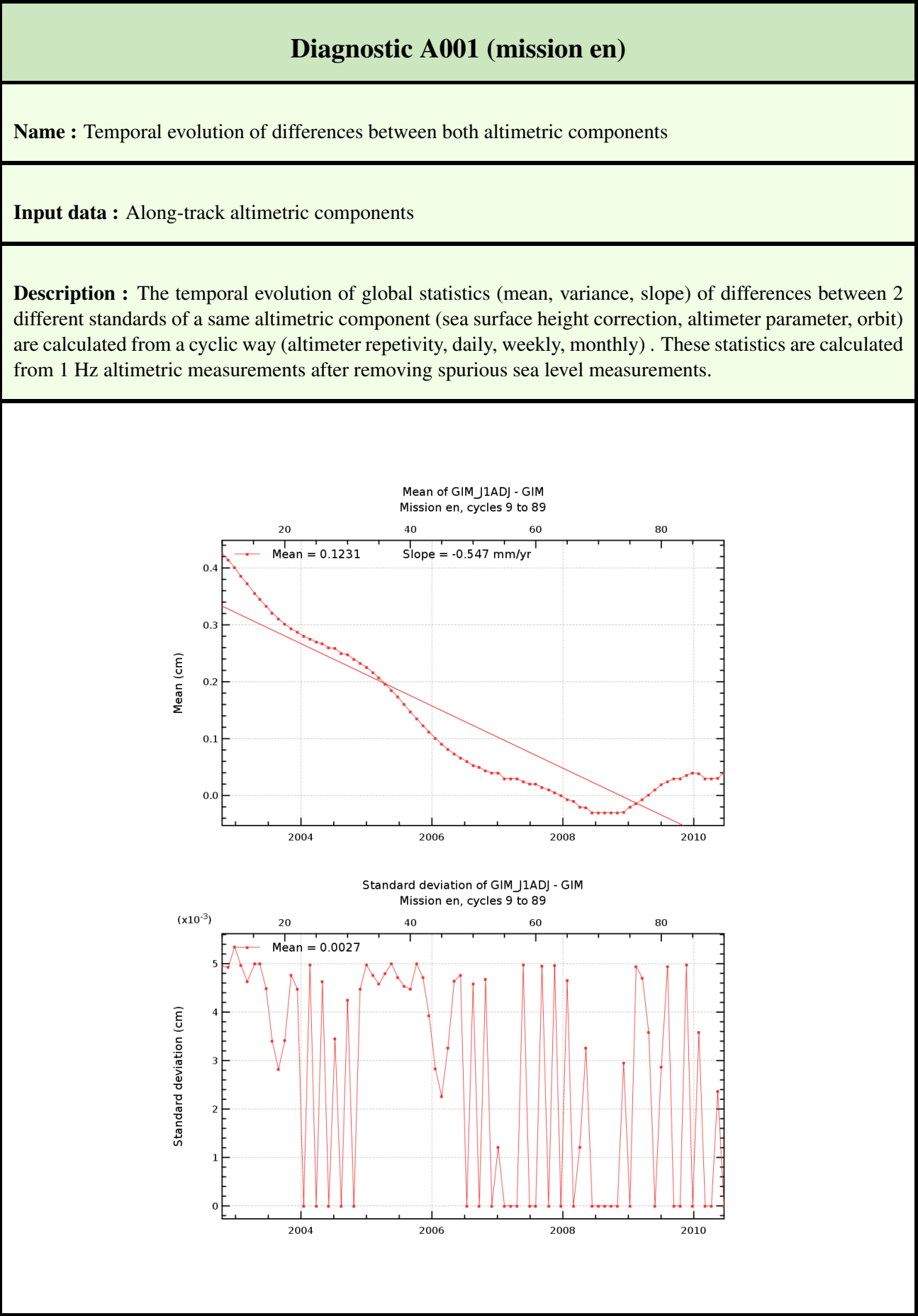
In this study, a new GIM correction based on Jason-1 has been compared to the ionospheric correction used in CNES/AVISO (GIM GDR product Level 2) product to calculate the Envisat sea-level height (SSH).

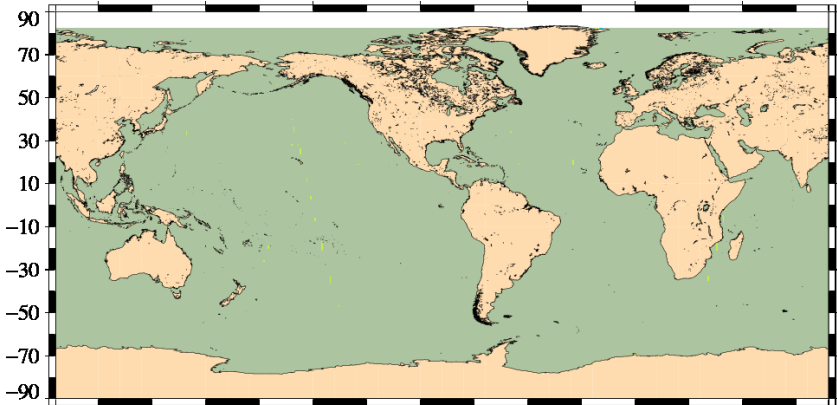
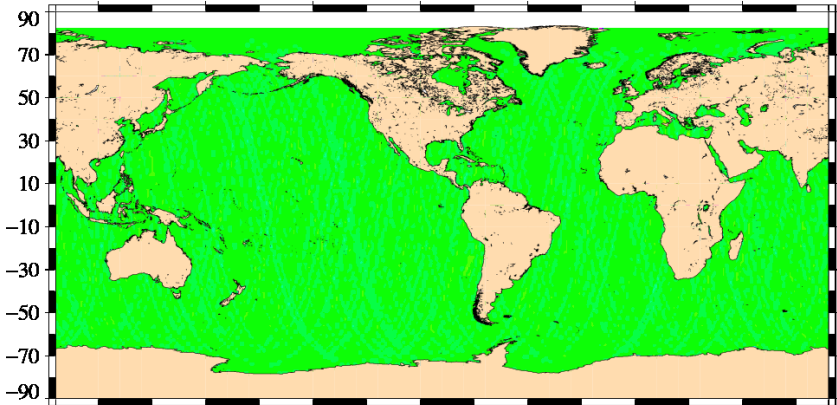
The impact of using these both ionospheric correction on the SSH calculation has been analyzed for Envisat mission from September 2002 (cycle 9) to June 2010 (cycle 90).

The Jason-1 based GIM correction has been developed in a previous study (cf Report CLS-DOS-NT-20-241 SALP-NT-P-EA-21877-CLS). Long term stability of GIM ionospheric correction does not seem to be insured, notably for high solar activities periods. Considering that the bifrequency correction (notably Jason-1's) is more reliable for long term purposes, a correction based on cross-calibration method with Jason-1 has been proposed. The low frequency component of the Jason-1 dual frequency correction selected at particular time is estimated and injected in the GIM Envisat correction.

The reference ionospheric correction is the GIM model for comparison between correction. 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).



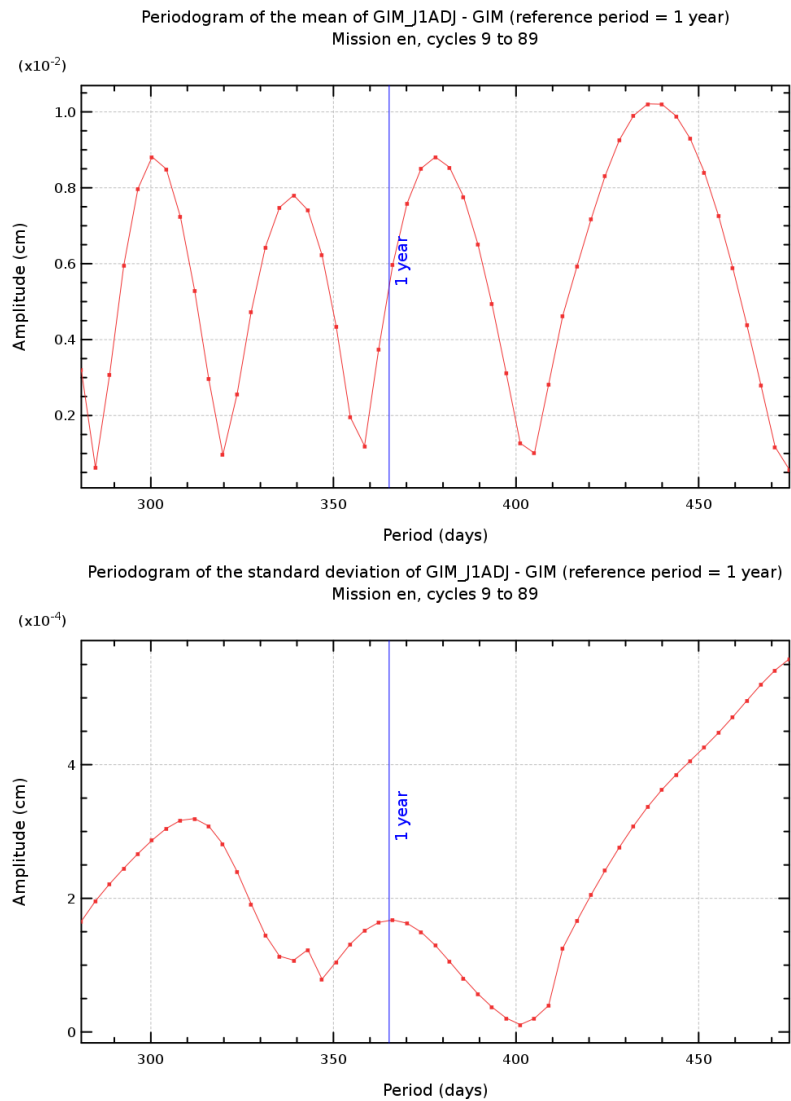
Diagnostic A002 (mission en)	
Name : Map of differences between both altimetric components over all the period	
Input data : Along-track altimetric components	
Description : The map of global statistics (mean, standard deviation) of differences between 2 different standards of a same altimetric component (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.	
<div>Mean of GIM_J1ADJ – GIM Mission en, cycles 9 to 89</div>  <div>-0.1 0.033333 0.166667 0.3</div> <div>Mean ( cm )</div> <div>Standard deviation of GIM_J1ADJ – GIM Mission en, cycles 9 to 89</div>  <div>0.1 0.1167 0.1333 0.15</div> <div>Standard deviation ( cm )</div>	

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.



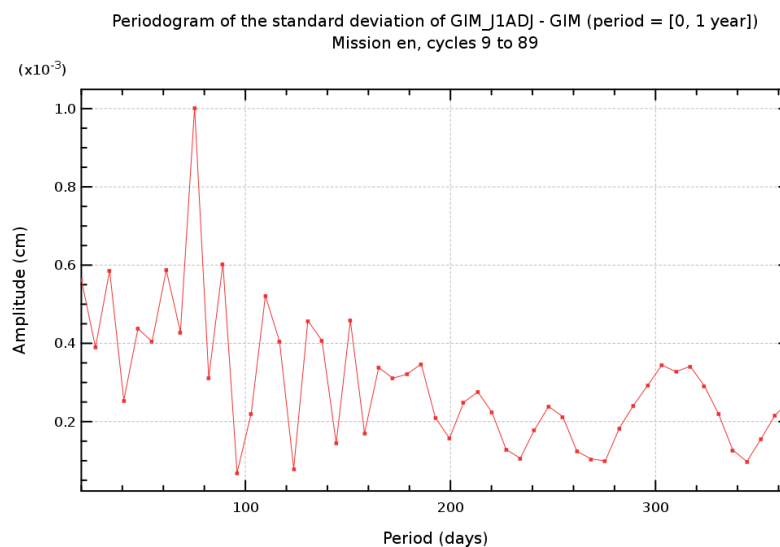
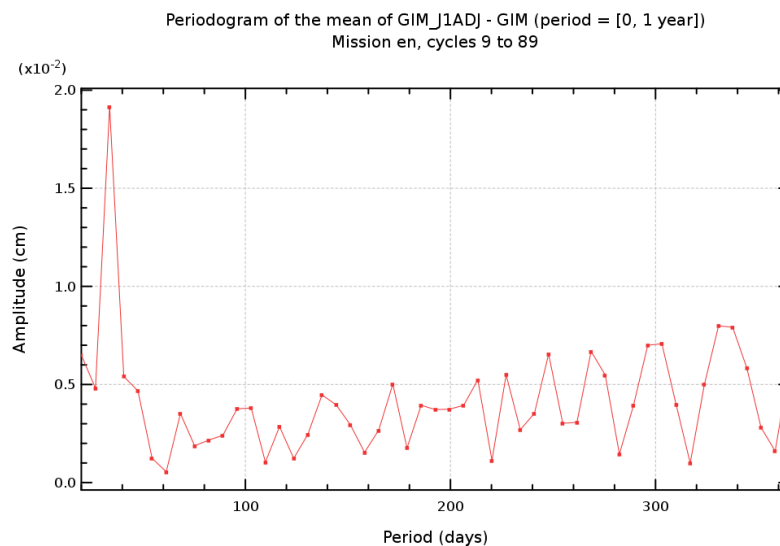
## Diagnostic A003\_b (mission en)

**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.

Diagnostic type : Global internal analyses



Diagnostic type : Global internal analyses	Diagnostic A201 a (mission en)	
	Name : Temporal evolution of Sea Level Anomaly (SLA)	
	Input data : Along track SLA	
	<p>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.</p>	
	<div>Global MSL Mission en, cycles 9 to 89</div>	

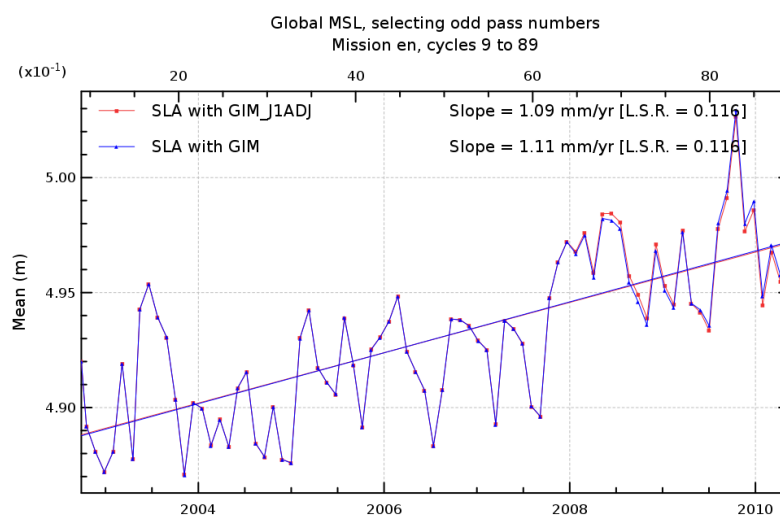
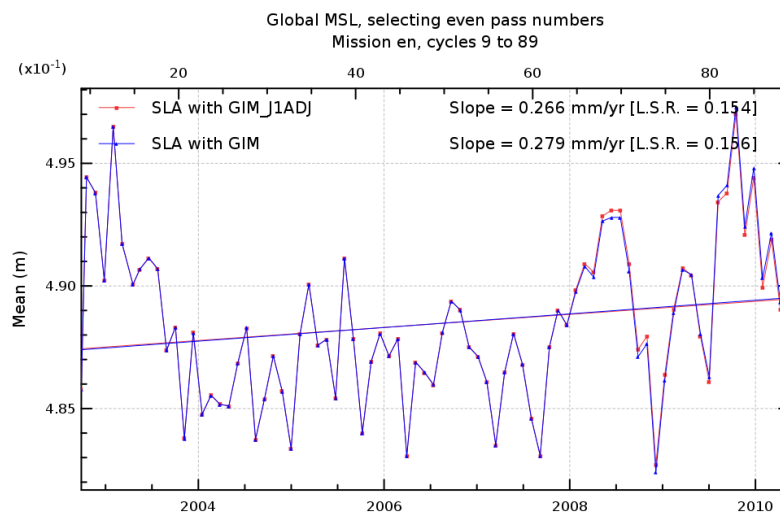
## Diagnostic A201\_b (mission en)

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

**Input data :** Along track SLA

**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.

Diagnostic type : Global internal analyses





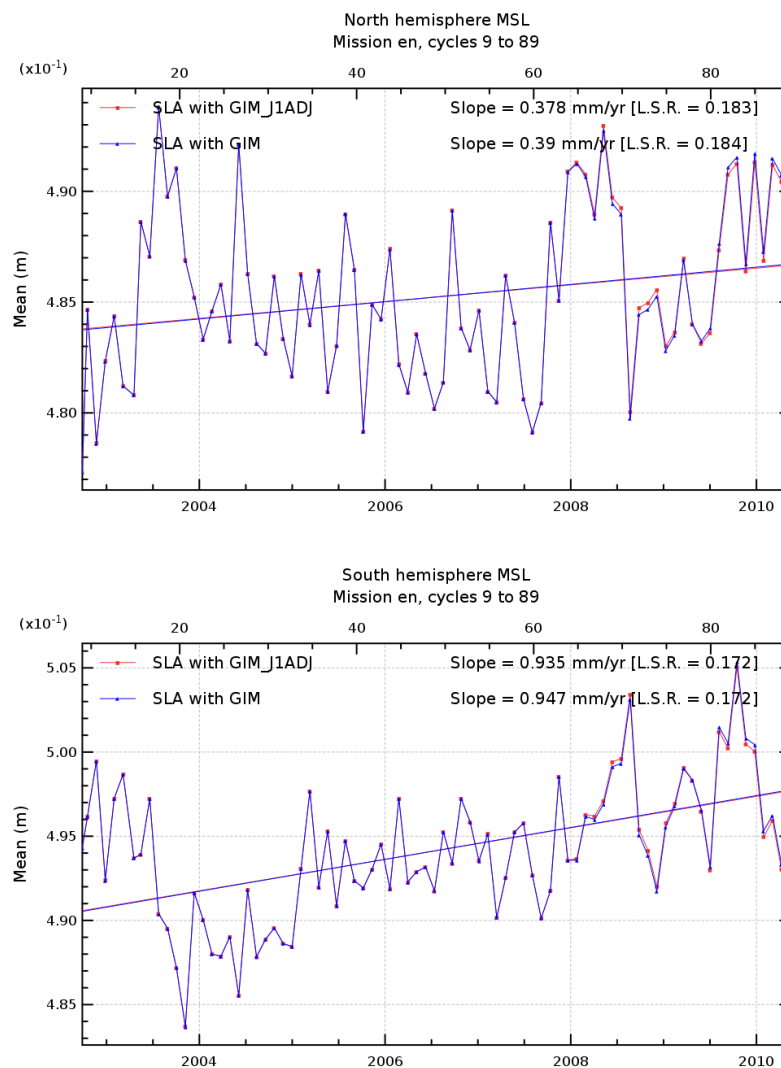
## Diagnostic A201\_c (mission en)

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

**Input data :** Along track SLA

**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.

Diagnostic type : Global internal analyses



## Diagnostic A201\_d (mission en)

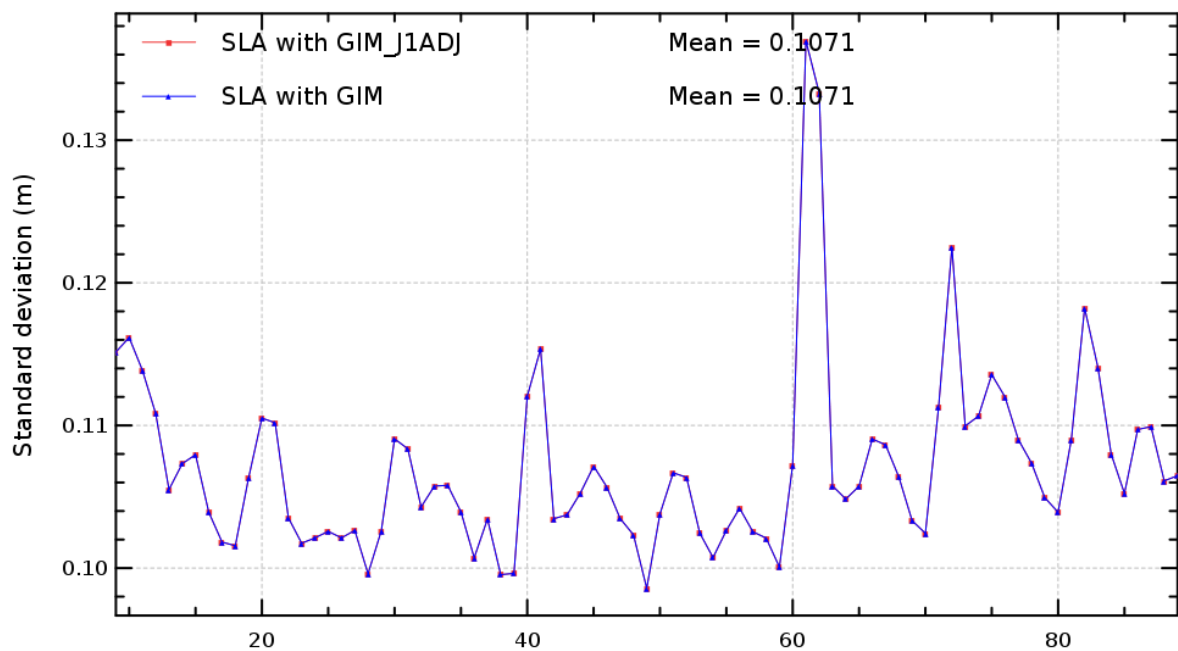
**Name :** Temporal evolution of Sea Level Anomaly (SLA)

**Input data :** Along track SLA

**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.

Diagnostic type : Global internal analyses

Global MSL  
Mission en, cycles 9 to 89



## Diagnostic A201\_e (mission en)

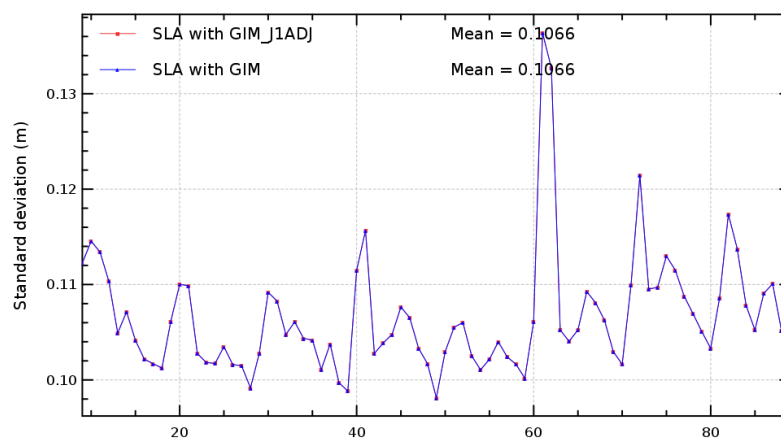
**Name :** Temporal evolution of Sea Level Anomaly (SLA)

**Input data :** Along track SLA

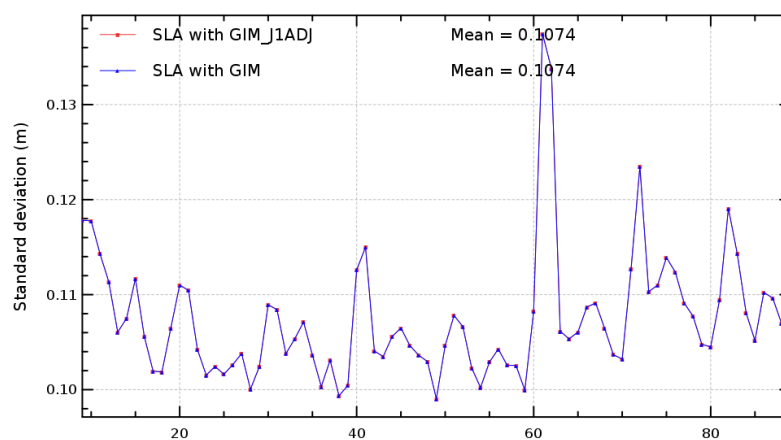
**Description :** The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements 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.

Diagnostic type : Global internal analyses

Global MSL, selecting even pass numbers  
Mission en, cycles 9 to 89



Global MSL, selecting odd pass numbers  
Mission en, cycles 9 to 89



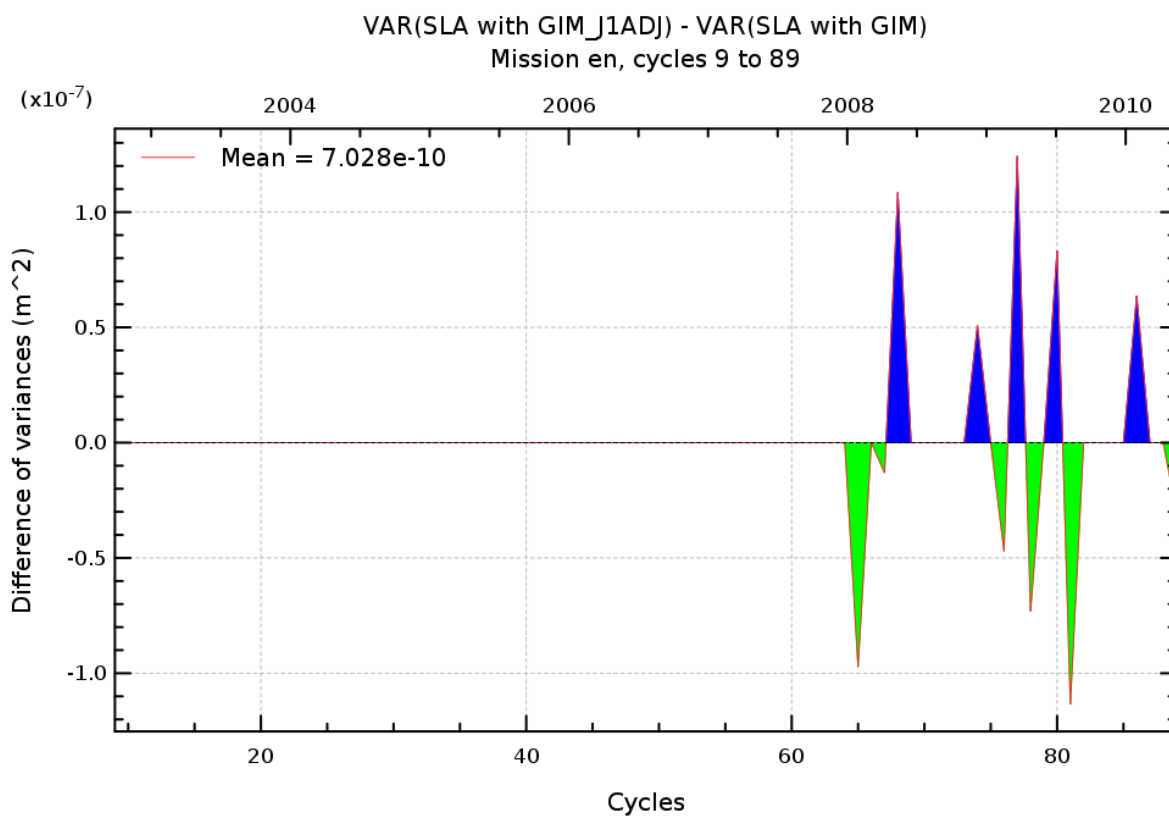
**Diagnostic A202\_a (mission en)**

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

**Input data :** Along track SLA

**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 type : Global internal analyses



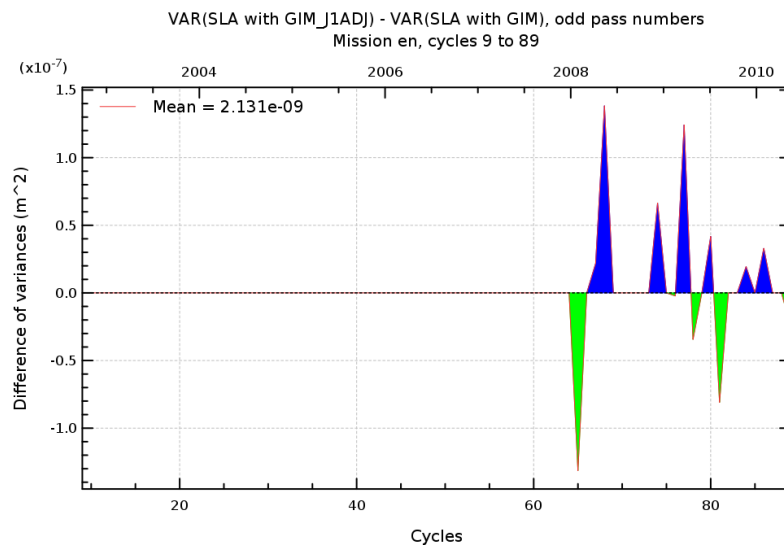
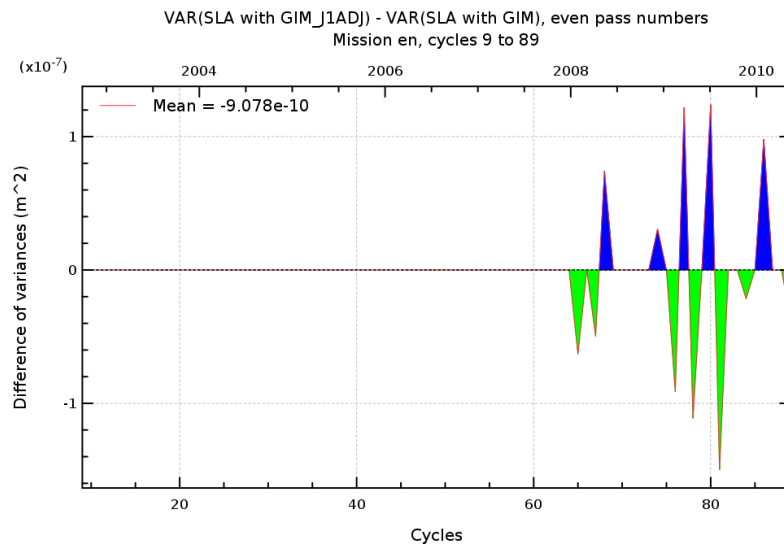
## Diagnostic A202\_b (mission en)

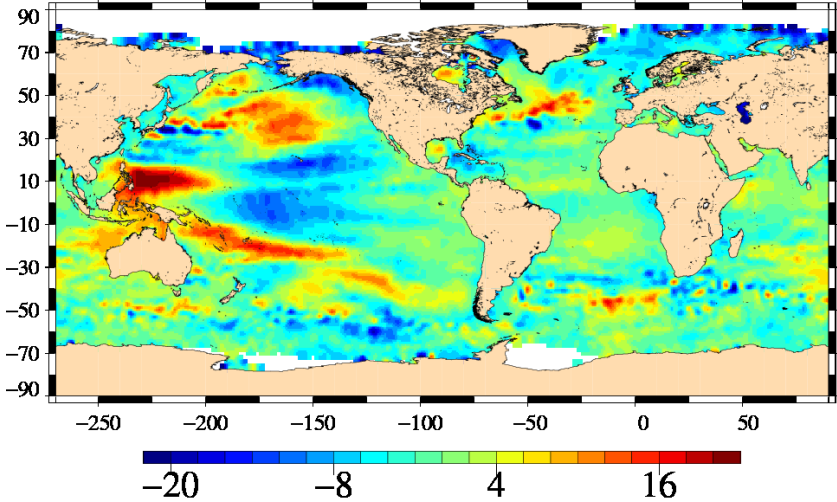
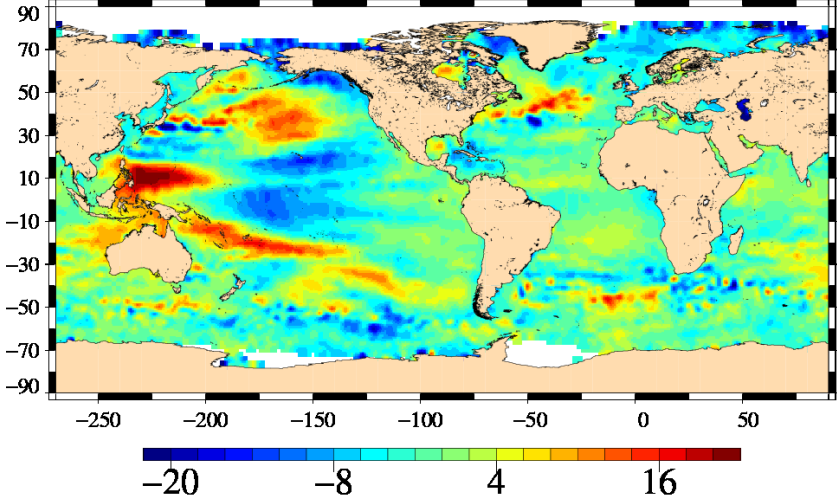
**Name :** Differences between temporal evolution of Sea Level Anomaly (SLA)

**Input data :** Along track SLA

**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 type : Global internal analyses



Diagnostic type : Global internal analyses	Diagnostic A203_a (mission en)	
	Name : Map of Sea Level Anomaly (SLA) over all the period	
	Input data : Along track SLA	
	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.	
	<div>SLA with GIM_J1ADJ trends Mission en, cycles 9 to 89</div>  <div>Trends (mm/yr)</div> <div>SLA with GIM trends Mission en, cycles 9 to 89</div>  <div>Trends (mm/yr)</div>	

## Diagnostic A203\_b (mission en)

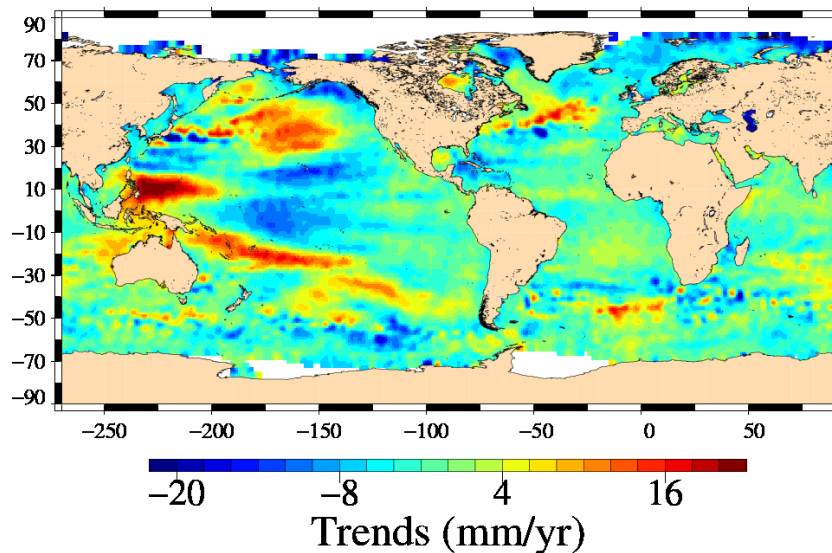
**Name :** Map of Sea Level Anomaly (SLA) over all the period

**Input data :** Along track SLA

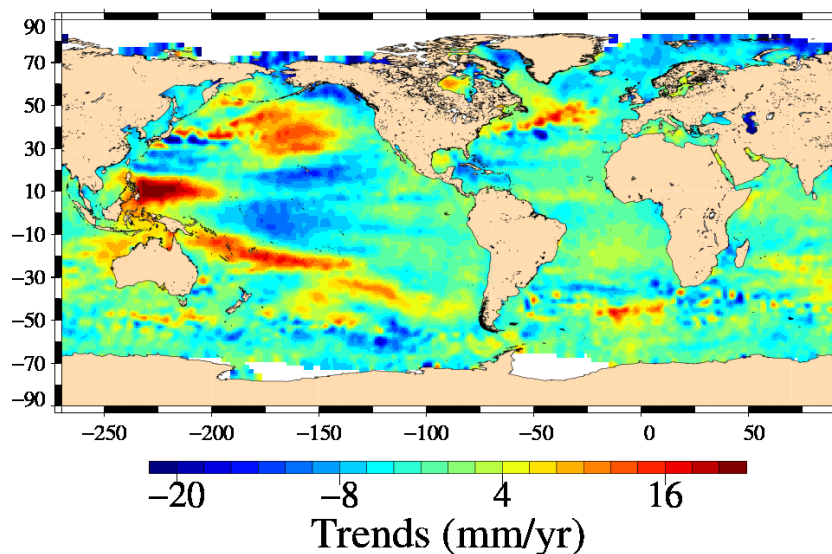
**Description :** The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

Diagnostic type : Global internal analyses

SLA with GIM\_J1ADJ trends : even pass numbers  
Mission en, cycles 9 to 89



SLA with GIM trends : even pass numbers  
Mission en, cycles 9 to 89



## Diagnostic A203\_c (mission en)

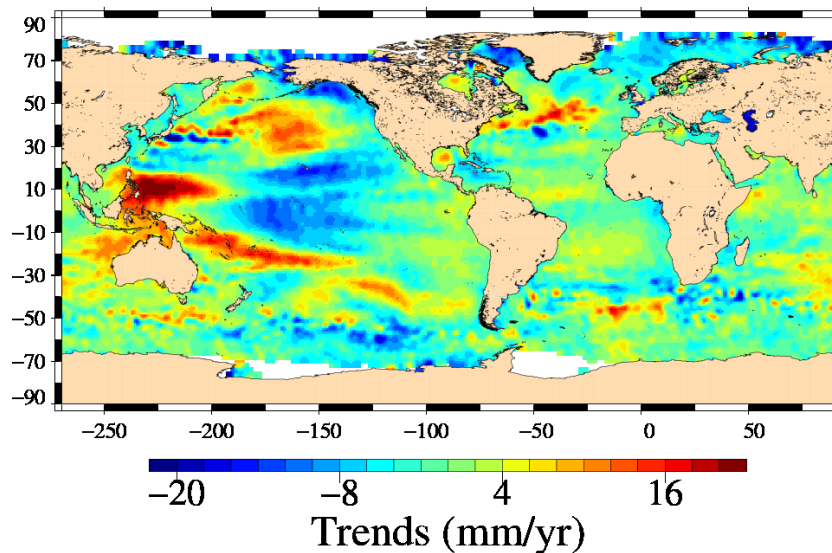
**Name :** Map of Sea Level Anomaly (SLA) over all the period

**Input data :** Along track SLA

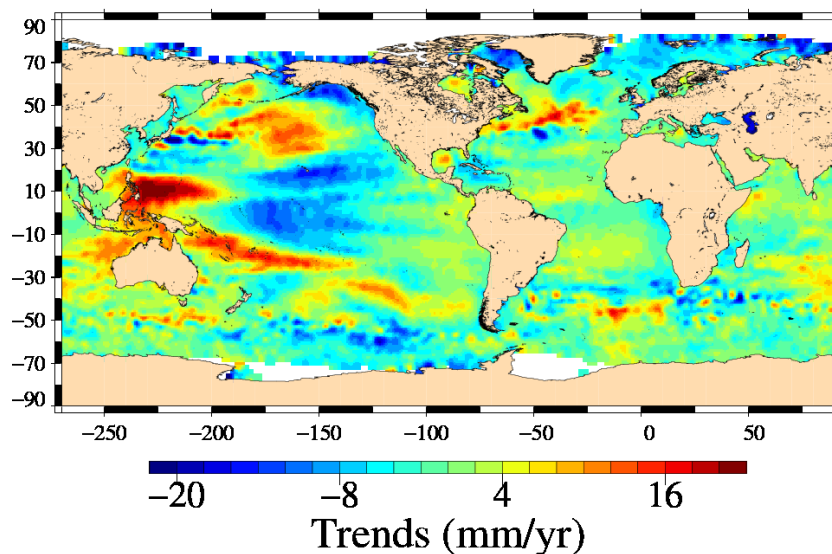
**Description :** The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

Diagnostic type : Global internal analyses

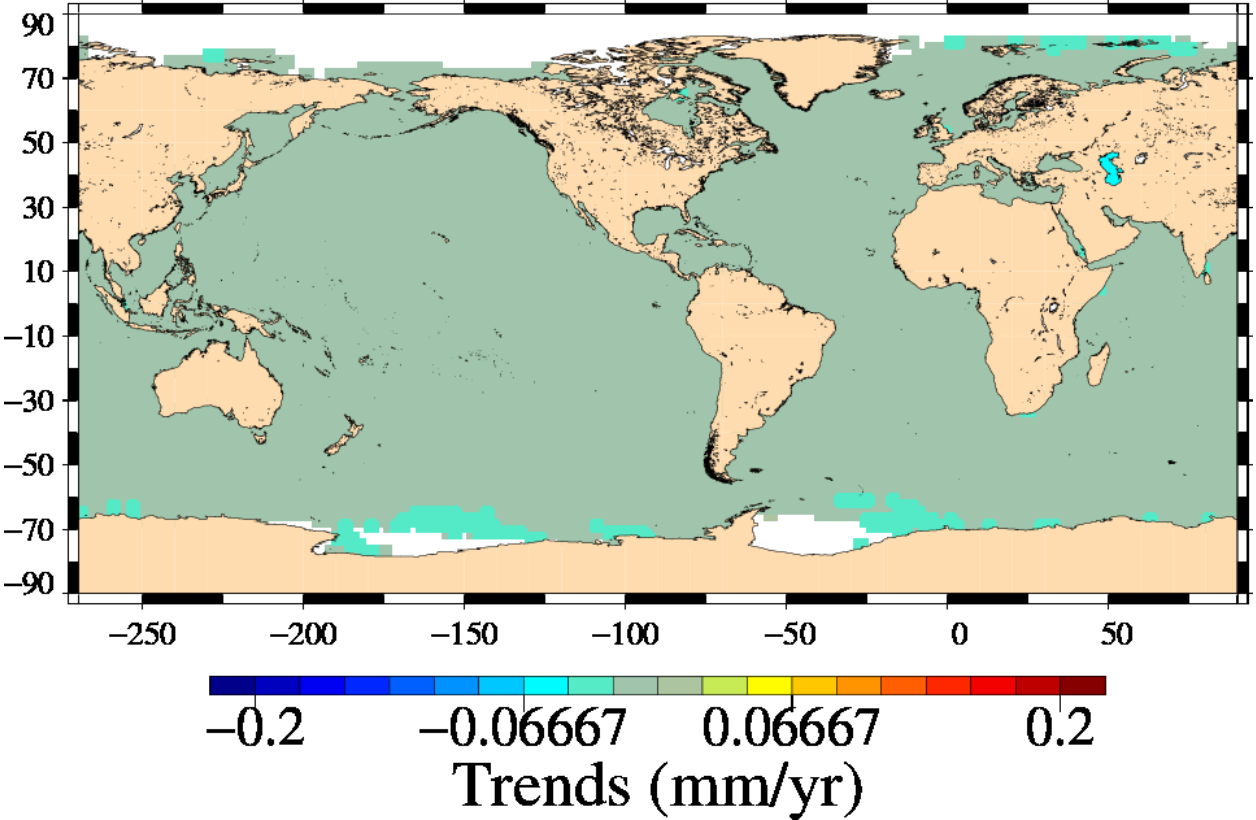
SLA with GIM\_J1ADJ trends : odd pass numbers  
Mission en, cycles 9 to 89



SLA with GIM trends : odd pass numbers  
Mission en, cycles 9 to 89





Diagnostic type : Global internal analyses	<b>Diagnostic A204_a (mission en)</b>
	<b>Name :</b> Differences between maps of SLA
	<b>Input data :</b> Along track SLA
	<b>Description :</b> 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).
	<div><div><div>SLA with GIM_J1ADJ trends – SLA with GIM trends</div><div>Mission en, cycles 9 to 89</div></div></div>

## Diagnostic A204\_b (mission en)

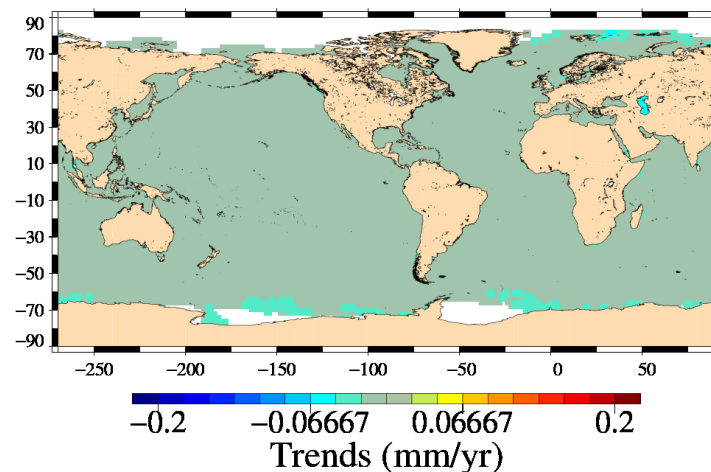
**Name :** Differences between maps of SLA

**Input data :** Along track SLA

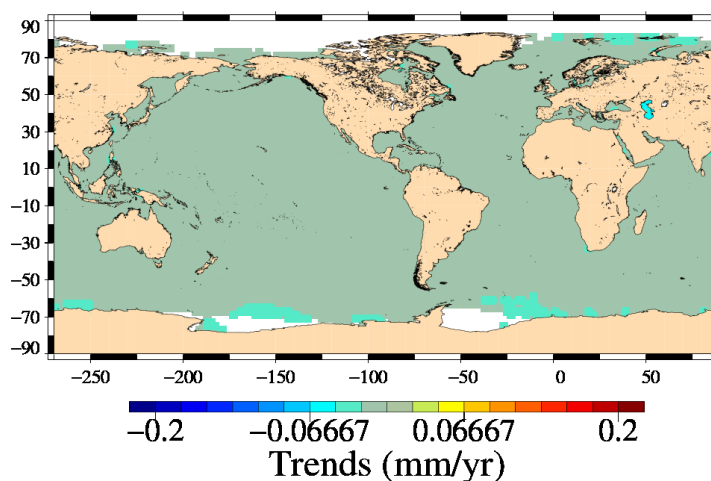
**Description :** The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except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

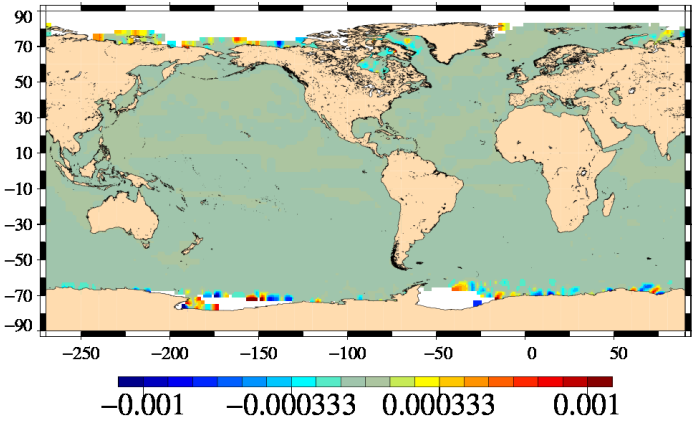
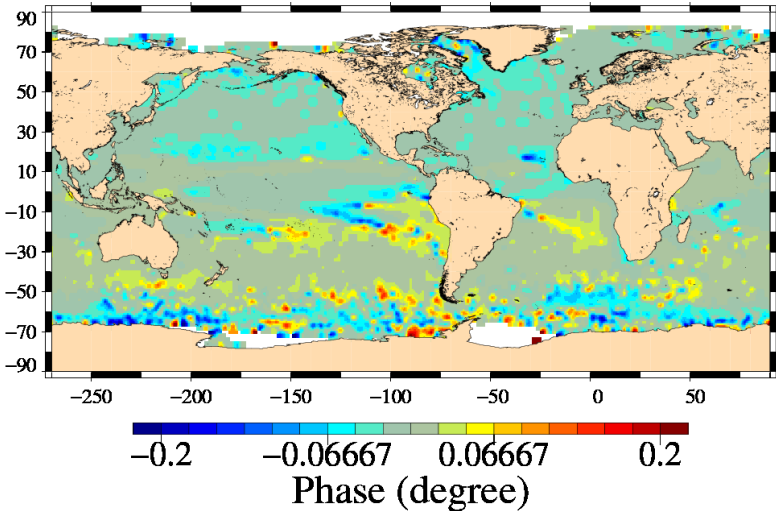
Diagnostic type : Global internal analyses

SLA with GIM\_J1ADJ trends – SLA with GIM trends : even pass numbers  
Mission en, cycles 9 to 89



SLA with GIM\_J1ADJ trends – SLA with GIM trends : odd pass numbers  
Mission en, cycles 9 to 89



Diagnostic type : Global internal analyses	Diagnostic A205_a (mission en)	
	Name : Differences between maps of SLA (2)	
	Input data : Along track SLA	
	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).	
	<div>SLA with GIM_J1ADJ amplitude – SLA with GIM amplitude : annual signal Mission en, cycles 9 to 89</div> <div><p>Amplitude (m)</p></div> <div>SLA with GIM_J1ADJ phase – SLA with GIM phase : annual signal Mission en, cycles 9 to 89</div> <div><p>Phase (degree)</p></div>	

## Diagnostic A205\_b (mission en)

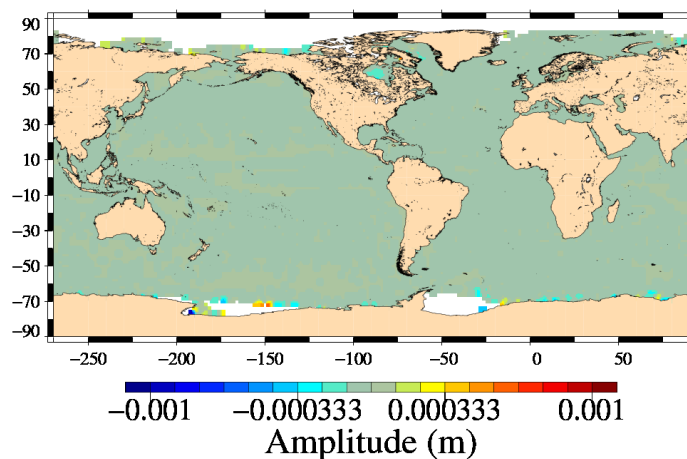
**Name :** Differences between maps of SLA (2)

**Input data :** Along track SLA

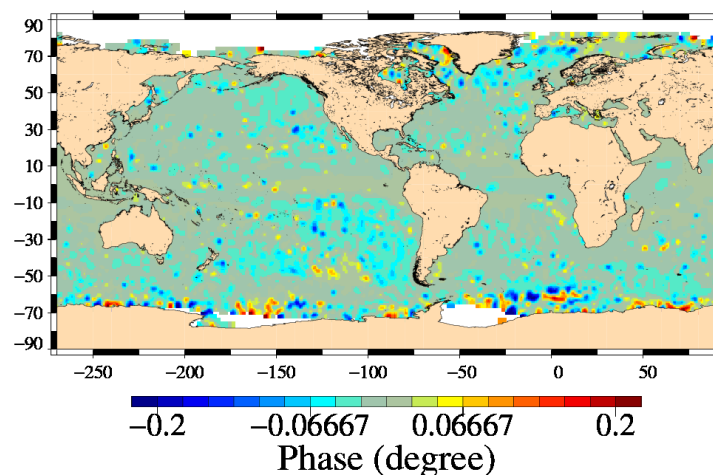
**Description :** The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except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

Diagnostic type : Global internal analyses

A with GIM\_J1ADJ amplitude – SLA with GIM amplitude : semi-annual signal  
Mission en, cycles 9 to 89



SLA with GIM\_J1ADJ phase – SLA with GIM phase : semi-annual signal  
Mission en, cycles 9 to 89

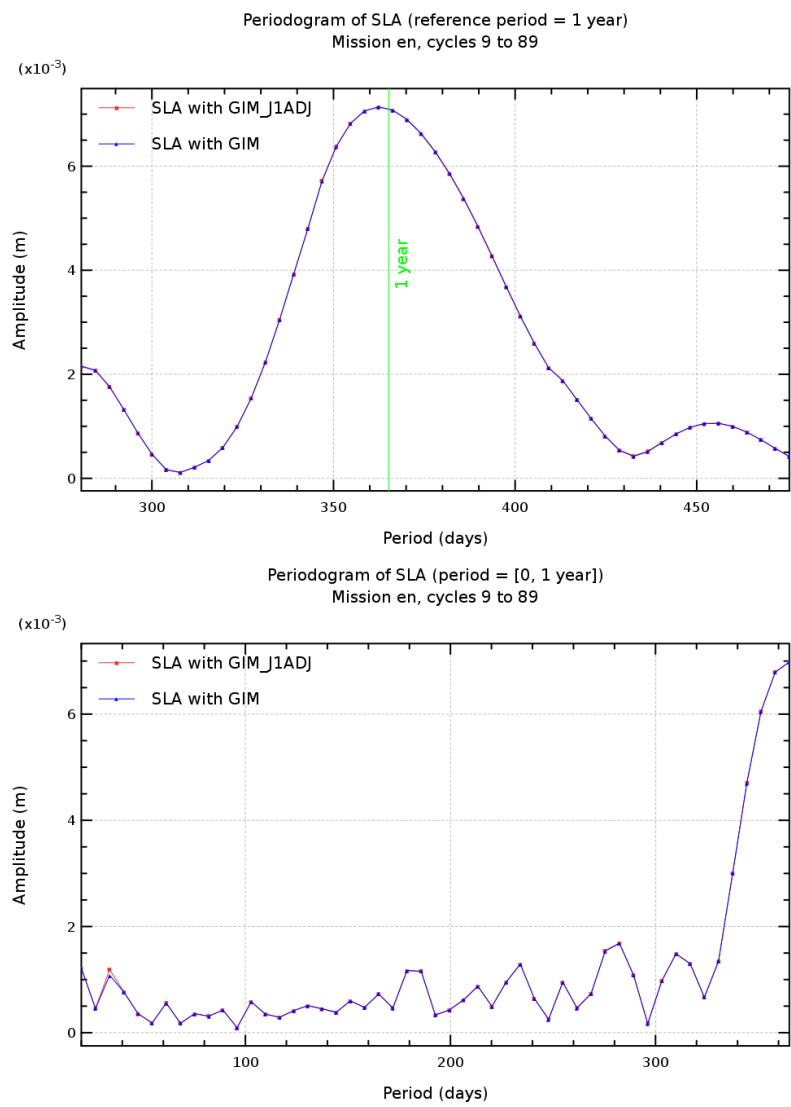


Diagnostic A206\_a (mission en)

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

**Input data :** Along track SLA

**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.



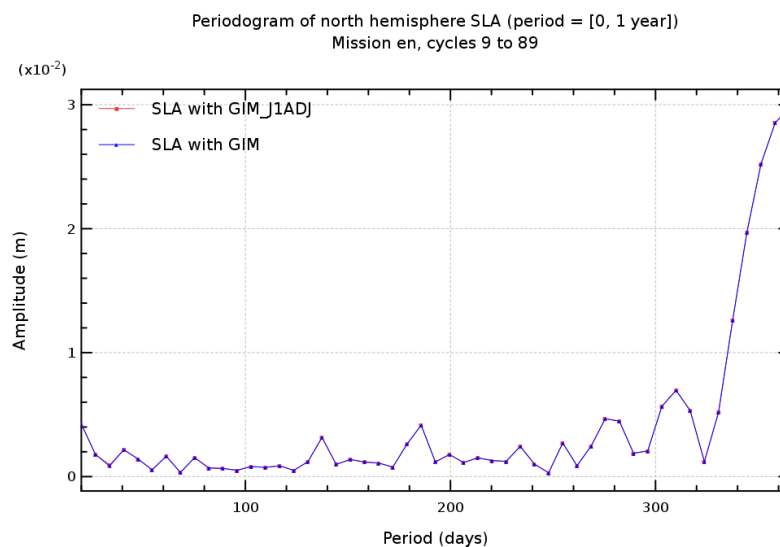
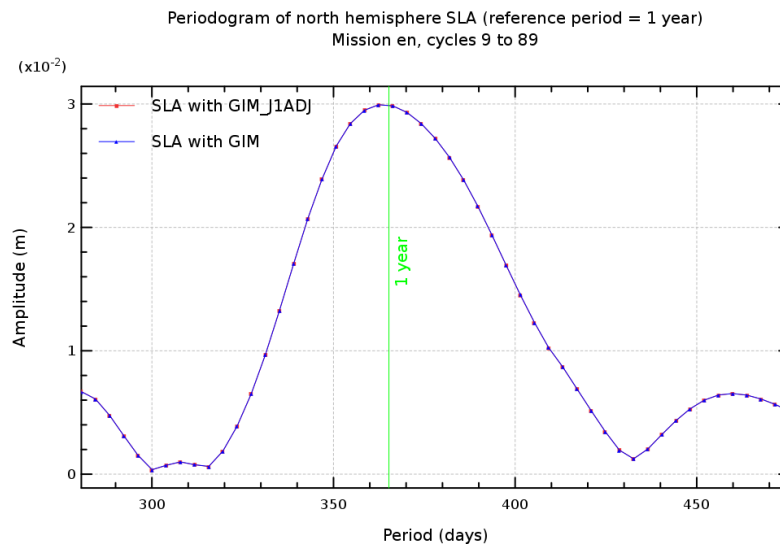
## Diagnostic A206\_b (mission en)

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

**Input data :** Along track SLA

**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.

Diagnostic type : Global internal analyses



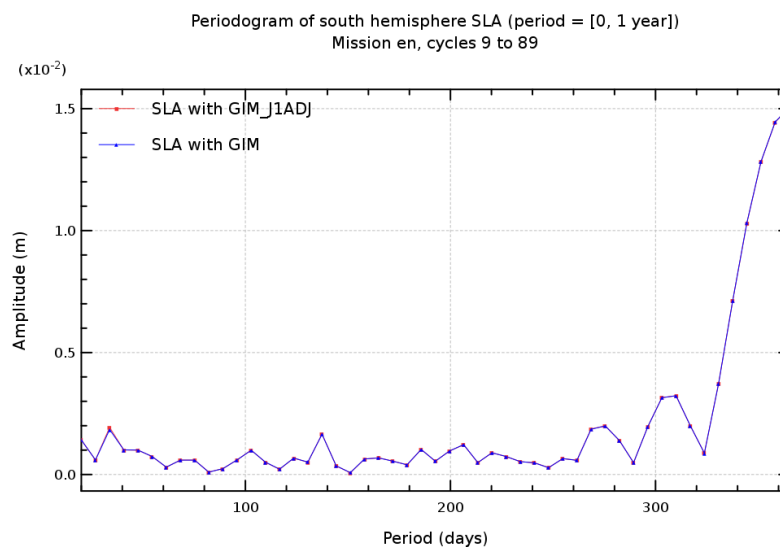
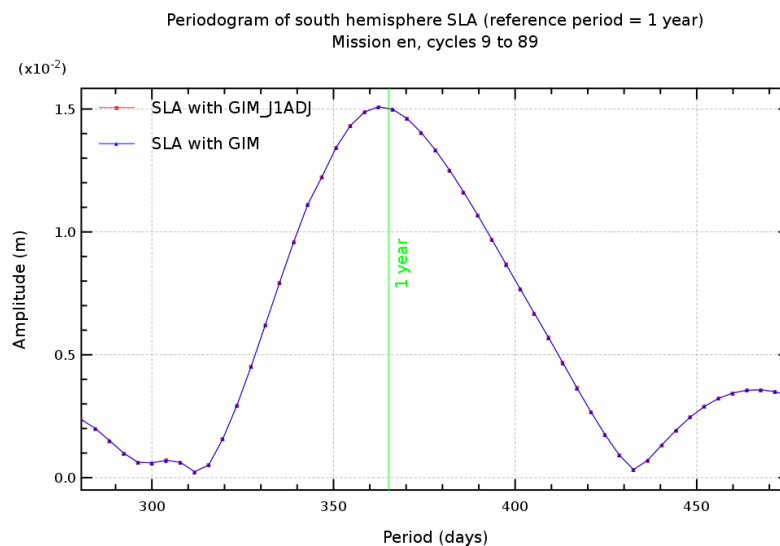
## Diagnostic A206\_c (mission en)

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

**Input data :** Along track SLA

**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.

Diagnostic type : Global internal analyses



**Diagnostic A209 (mission en)**

**Name :** Differences between maps of SLA (3)

**Input data :** Along track SLA

**Description :** The differences between maps of SLA are calculated from the SLA differences (mean, standard deviation) using successively both altimetric components in the SLA calculation.

Diagnostic type : Global internal analyses

**VAR(SLA with GIM\_J1ADJ) – VAR(SLA with GIM)**  
**Mission en, cycles 9 to 89**

