

# Orbit comparison : ESOC-2011 (v7) versus CNES GDR-C

Study variable	<b>ESOC Orbit (v7)</b>
Reference variable	<b>CNES orbit (GDR-C))</b>
Missions	Jason-1 ( <i>j1</i> ), Envisat ( <i>en</i> )
Period	[19007, 22300]

Version 0: 2011/07/18

Version 1: 2011/08/26

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## Study overview

In this study, the orbit solution derived from ESOC center has been compared to the CNES orbit provided in level-2 GDR products to calculate the Jason-1 and ENVISAT sea-level height (SSH).

The impact of using these orbits on the SSH calculation have been analyzed for ENVISAT and Jason-1 :

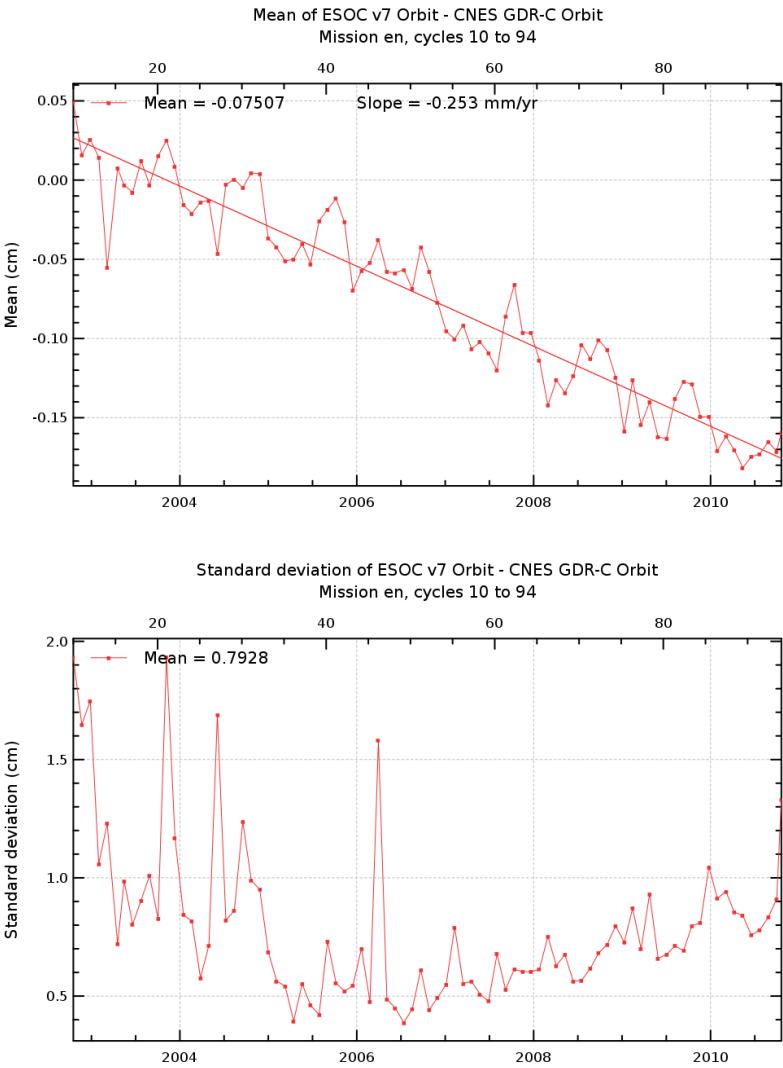
- for Jason-1 : from January 2002 (cycle 1) to January 2009 (Cycle 259)
- for Envisat: from September 2002 (cycle 9) to December 2010 (Cycle 95)

The ESOC orbits have been uploaded from the following ftp site where their standards are described:

- for Jason-1 <ftp://dgn6.esoc.esa.int/jason1/>.
- for Envisat <ftp://dgn6.esoc.esa.int/envisat/sol7/>.

The CNES orbit used in Jason-1 and Envisat products corresponds to the GDR-C standards for both missions. All the validation diagnostics displayed in this report has been performed in agreement with the Sea-Level CCI Product Validation Plan (PVP).

Diagnostic A001 (mission en)	
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.	



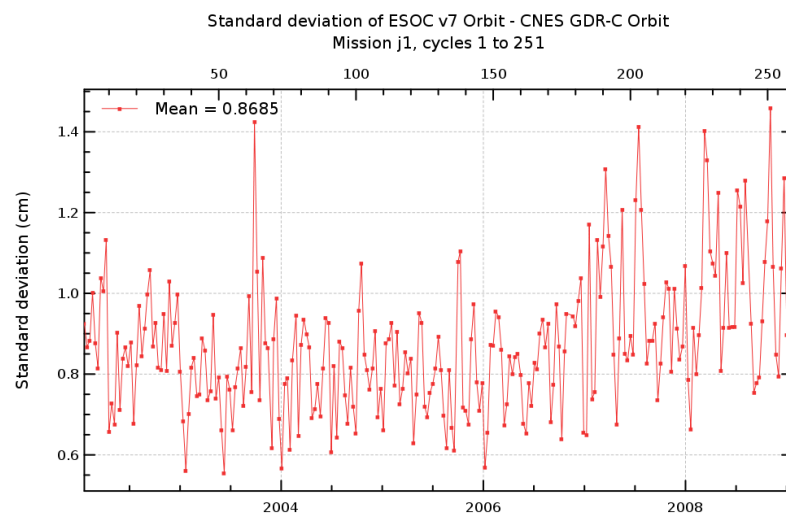
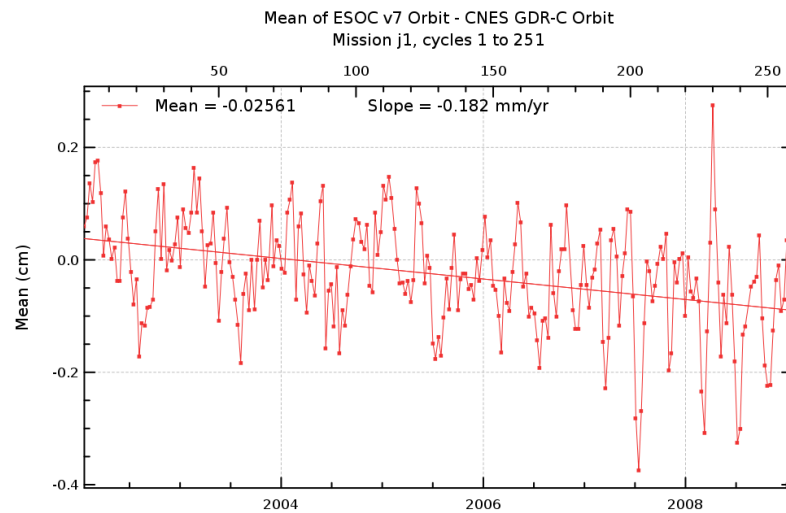
## Diagnostic A001 (mission j1)

**Name :** Temporal evolution of differences between both altimetric components

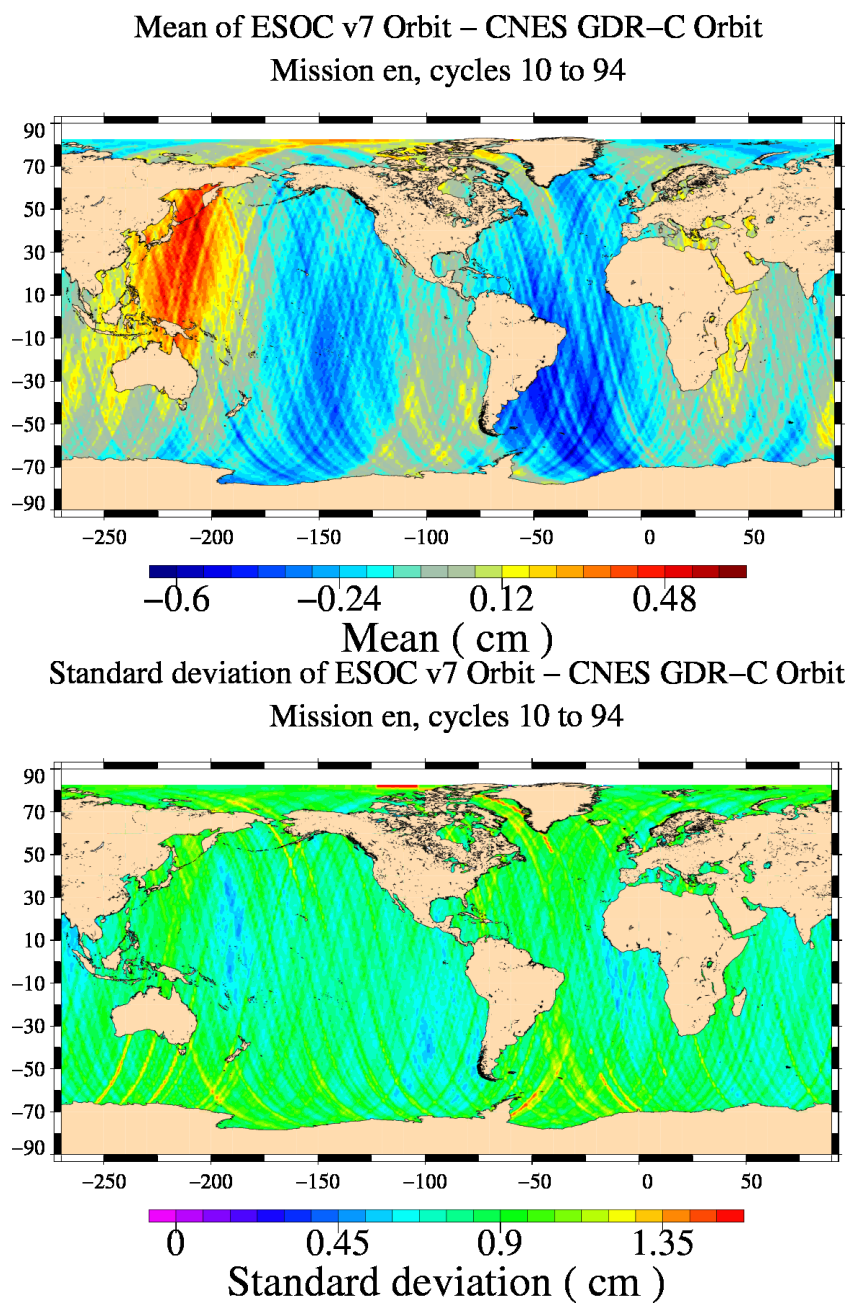
**Input data :** Along-track altimetric components

**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 type : Global internal analyses



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 A002 (mission j1)

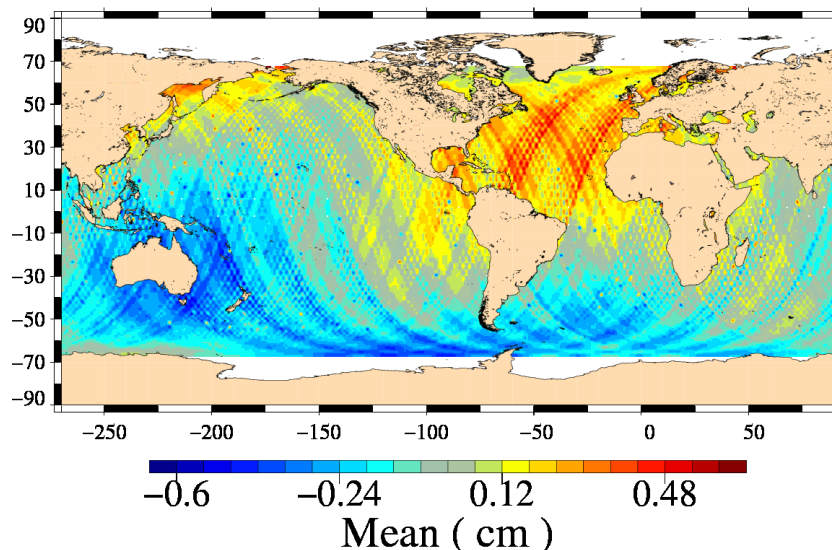
**Name :** Map of differences between both altimetric components over all the period

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

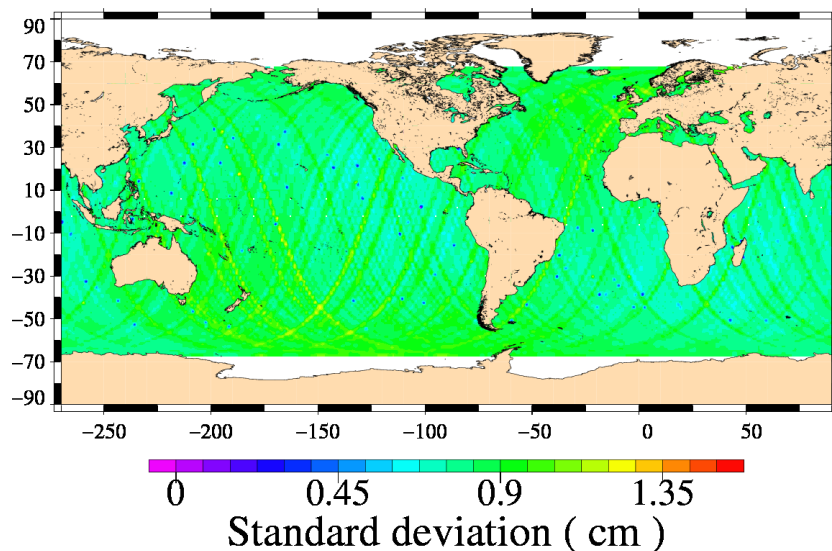
**Description :** The map of global statistics (mean, standard deviation) of differences between 2 different standards of a same altimetric component (sea surface height correction, altimeter parameter, orbit) are calculated over a given period which is the longer as possible to have obtain reliable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

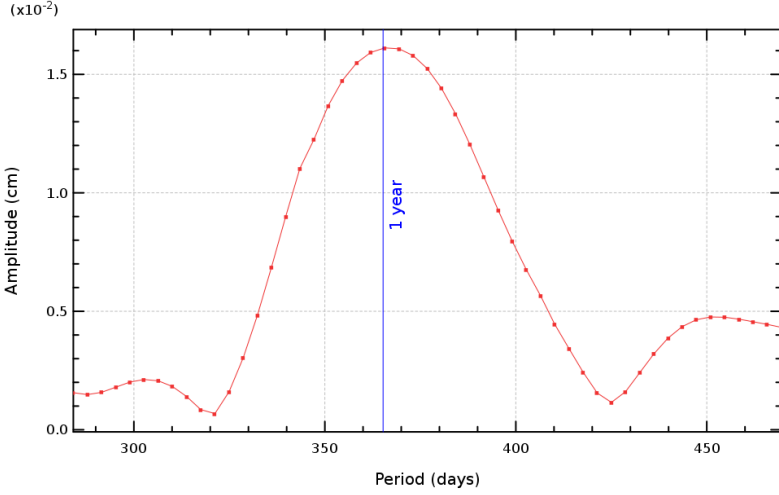
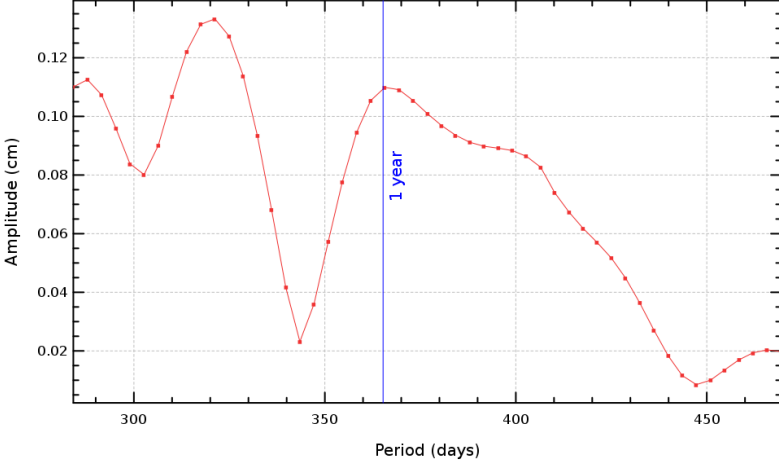
Diagnostic type : Global internal analyses

Mean of ESOC v7 Orbit – CNES GDR–C Orbit  
Mission j1, cycles 1 to 251



Standard deviation of ESOC v7 Orbit – CNES GDR–C Orbit  
Mission j1, cycles 1 to 251



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.	
<div>Periodogram of the mean of ESOC v7 Orbit - CNES GDR-C Orbit (reference period = 1 year) Mission en, cycles 10 to 94</div> <div></div> <div>Periodogram of the standard deviation of ESOC v7 Orbit - CNES GDR-C Orbit (reference period = 1 year) Mission en, cycles 10 to 94</div> <div></div>	

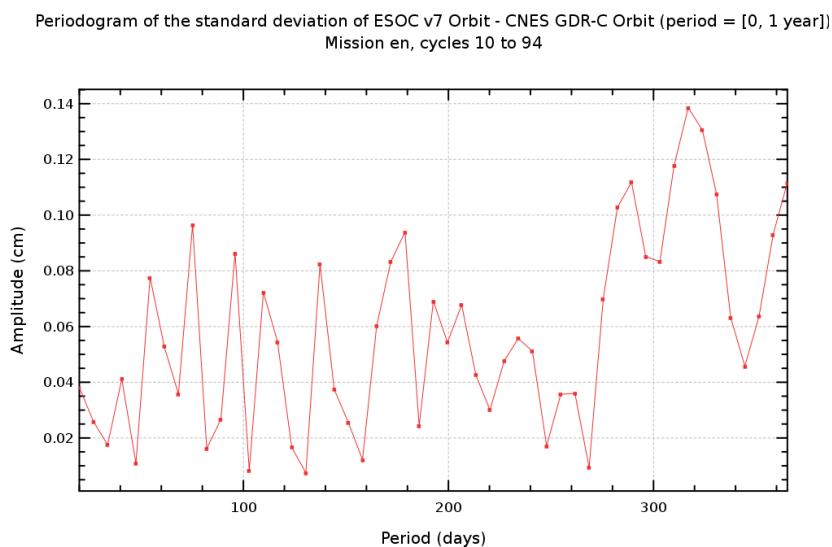
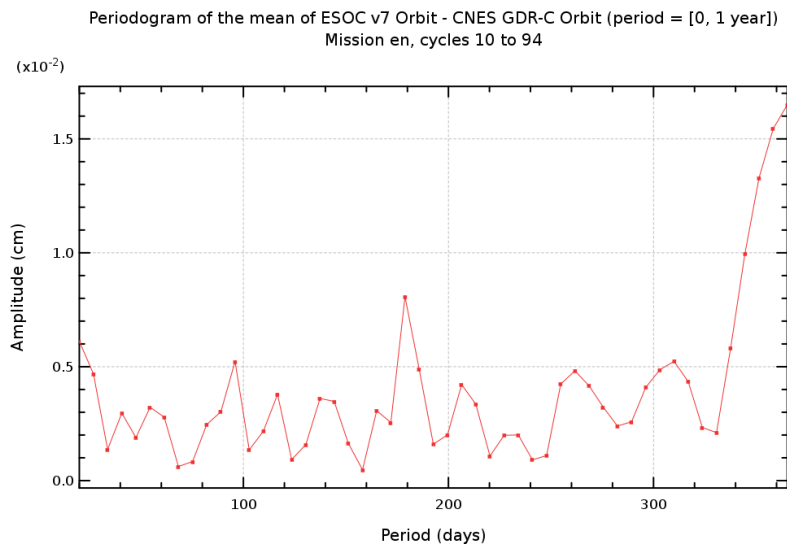
## Diagnostic A003\_b (mission en)

**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

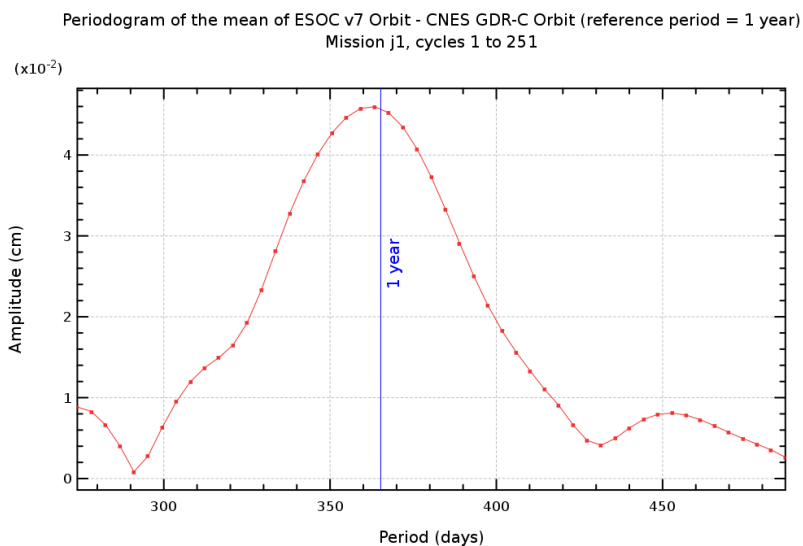


## Diagnostic A003\_a (mission j1)

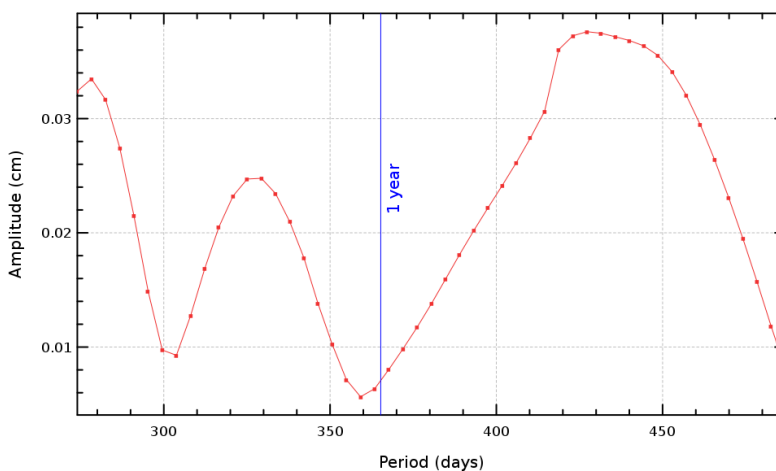
**Name :** Periodogram derived from temporal evolution of altimetric component differences

**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.



Periodogram of the standard deviation of ESO-C v7 Orbit - CNES GDR-C Orbit (reference period = 1 year)  
Mission j1, cycles 1 to 251



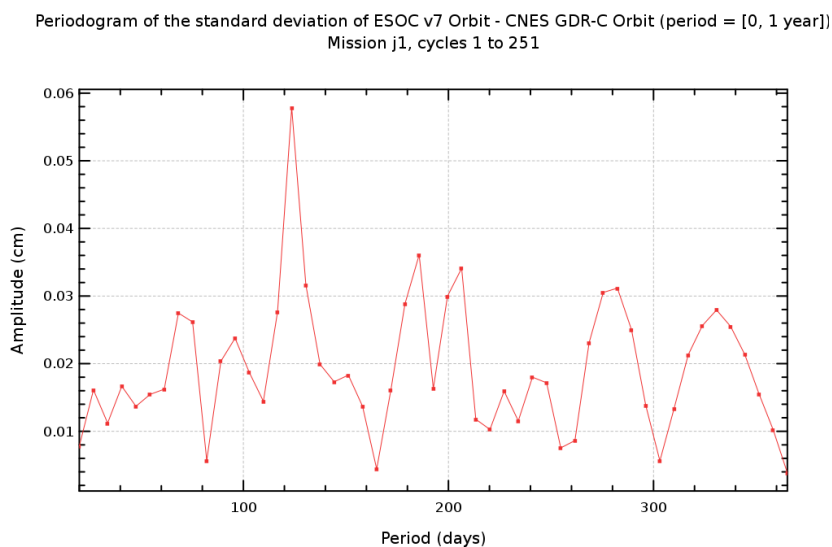
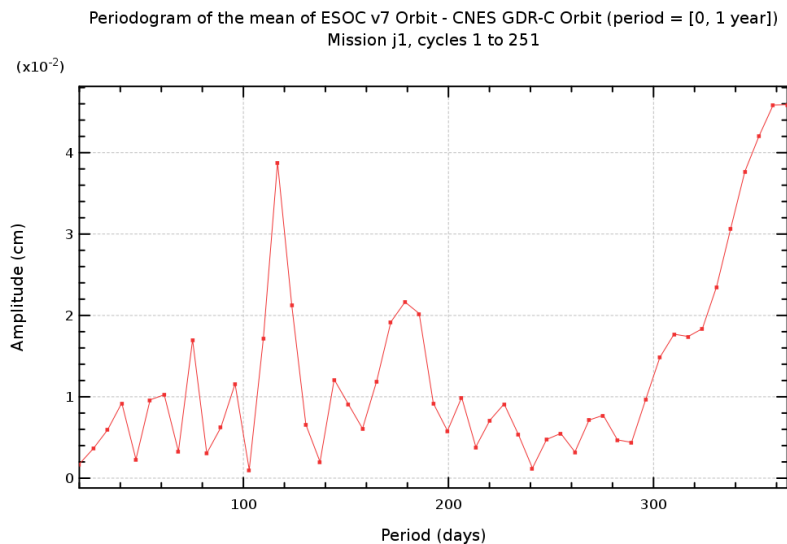
## Diagnostic A003\_b (mission j1)

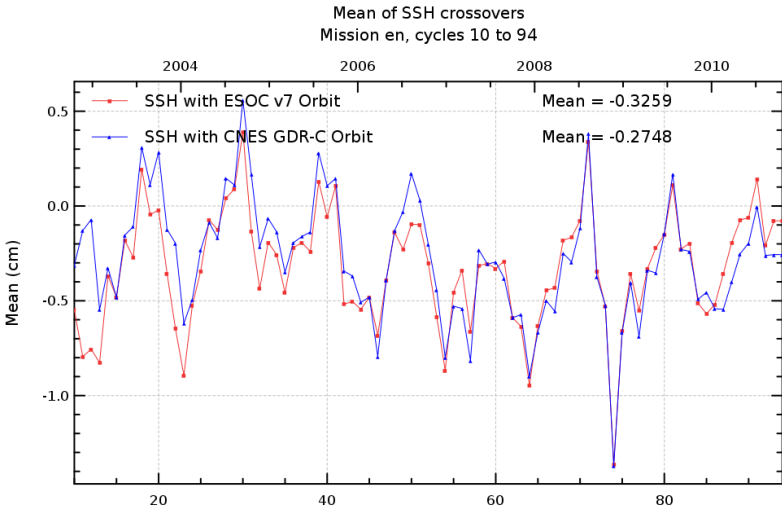
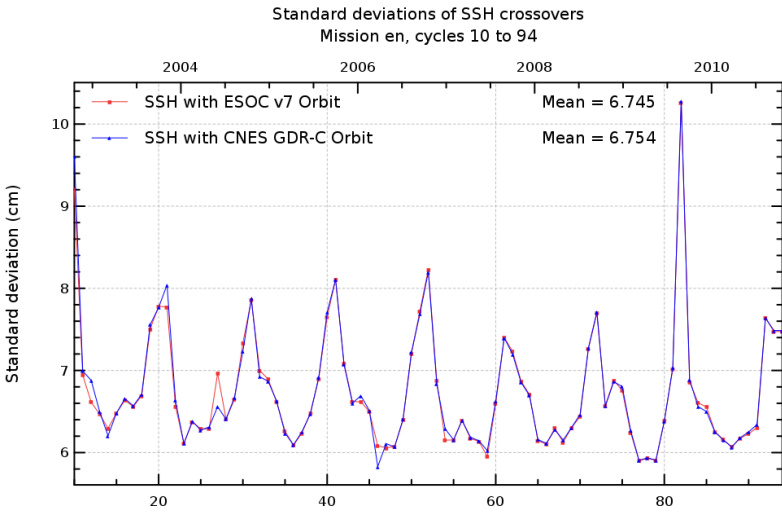
**Name :** Periodogram derived from temporal evolution of altimetric component differences

**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 A101 (mission en)	
Name : Temporal evolution of SSH crossovers	
Input data : Sea Surface Height (SSH) crossovers	
<p><b>Description :</b> The temporal evolution of global statistics (mean, standard deviation) of SSH differences are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).</p>	
<div><div><div>Mean of SSH crossovers</div><div>Mission en, cycles 10 to 94</div><div></div></div><div><div><div>Standard deviations of SSH crossovers</div><div>Mission en, cycles 10 to 94</div><div></div></div></div></div>	

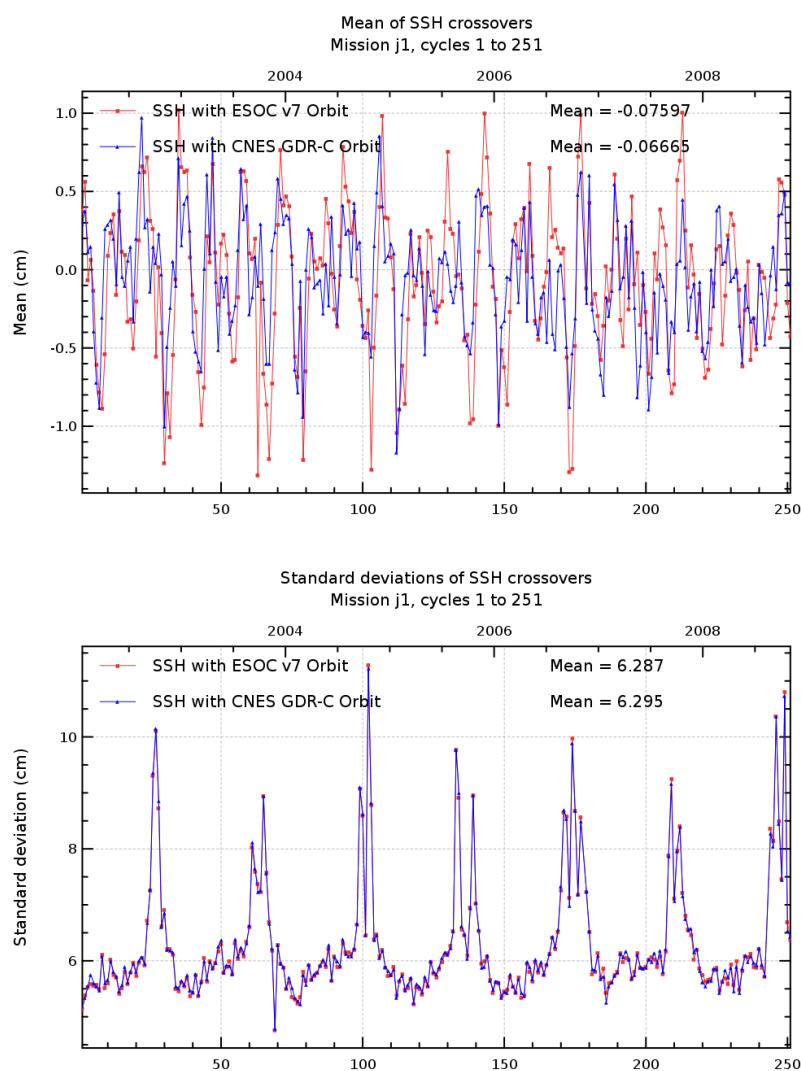
## Diagnostic A101 (mission j1)

**Name :** Temporal evolution of SSH crossovers

**Input data :** Sea Surface Height (SSH) crossovers

**Description :** The temporal evolution of global statistics (mean, standard deviation) of SSH differences are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).

Diagnostic type : Global internal analyses



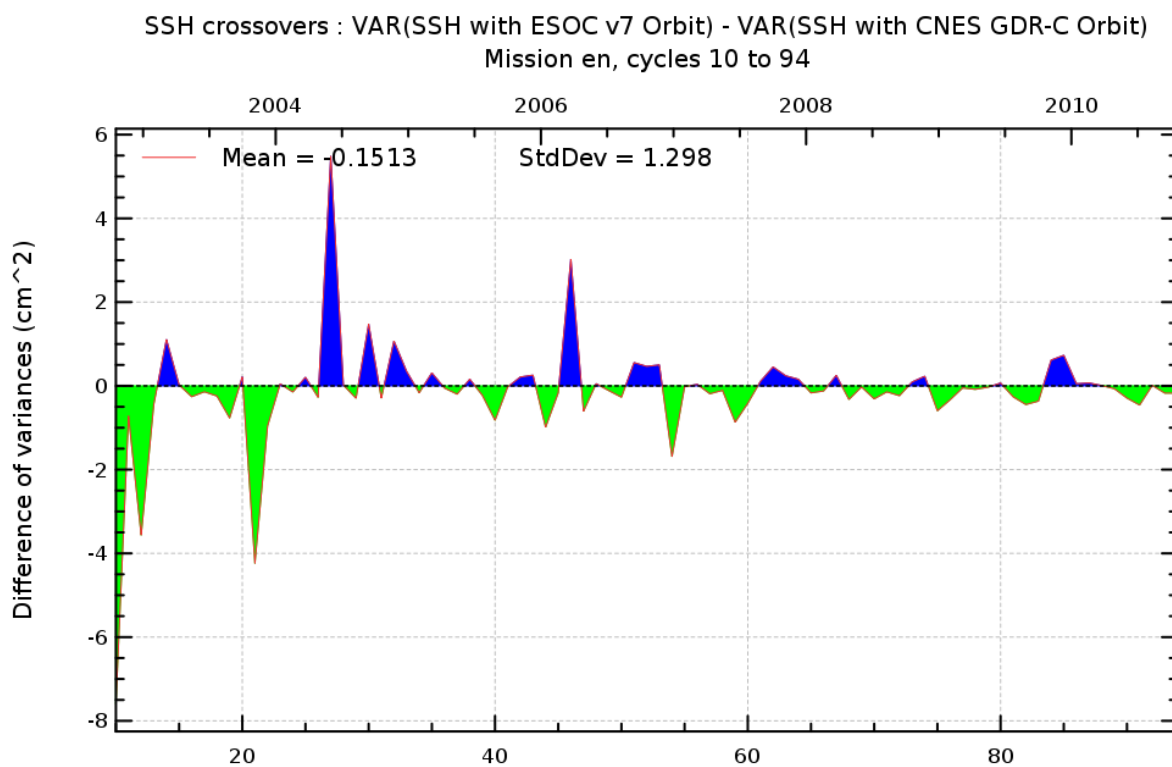
**Diagnostic A102 (mission en)**

**Name :** Differences between temporal evolution of SSH crossovers

**Input data :** Sea Surface Height (SSH) crossovers

**Description :** The difference of temporal evolution between the global statistics (mean, standard deviation) of SSH differences are calculated using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).

Diagnostic type : Global internal analyses



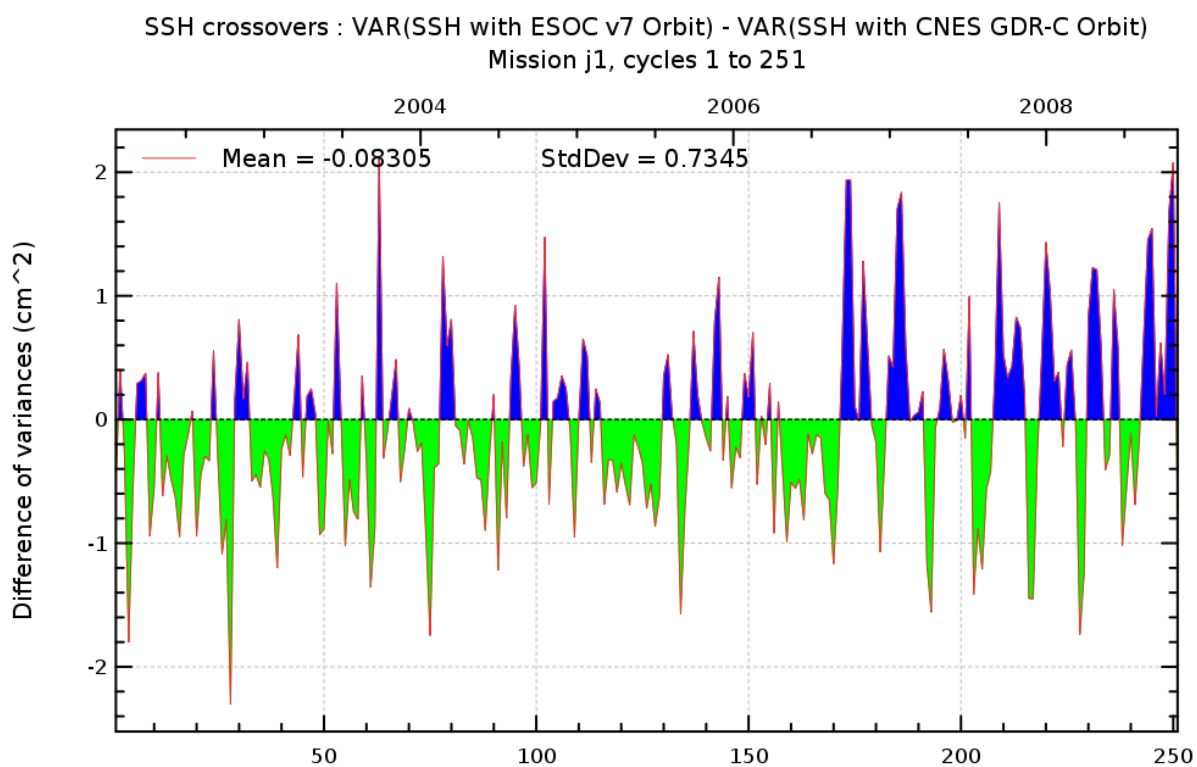
## Diagnostic A102 (mission j1)

**Name :** Differences between temporal evolution of SSH crossovers

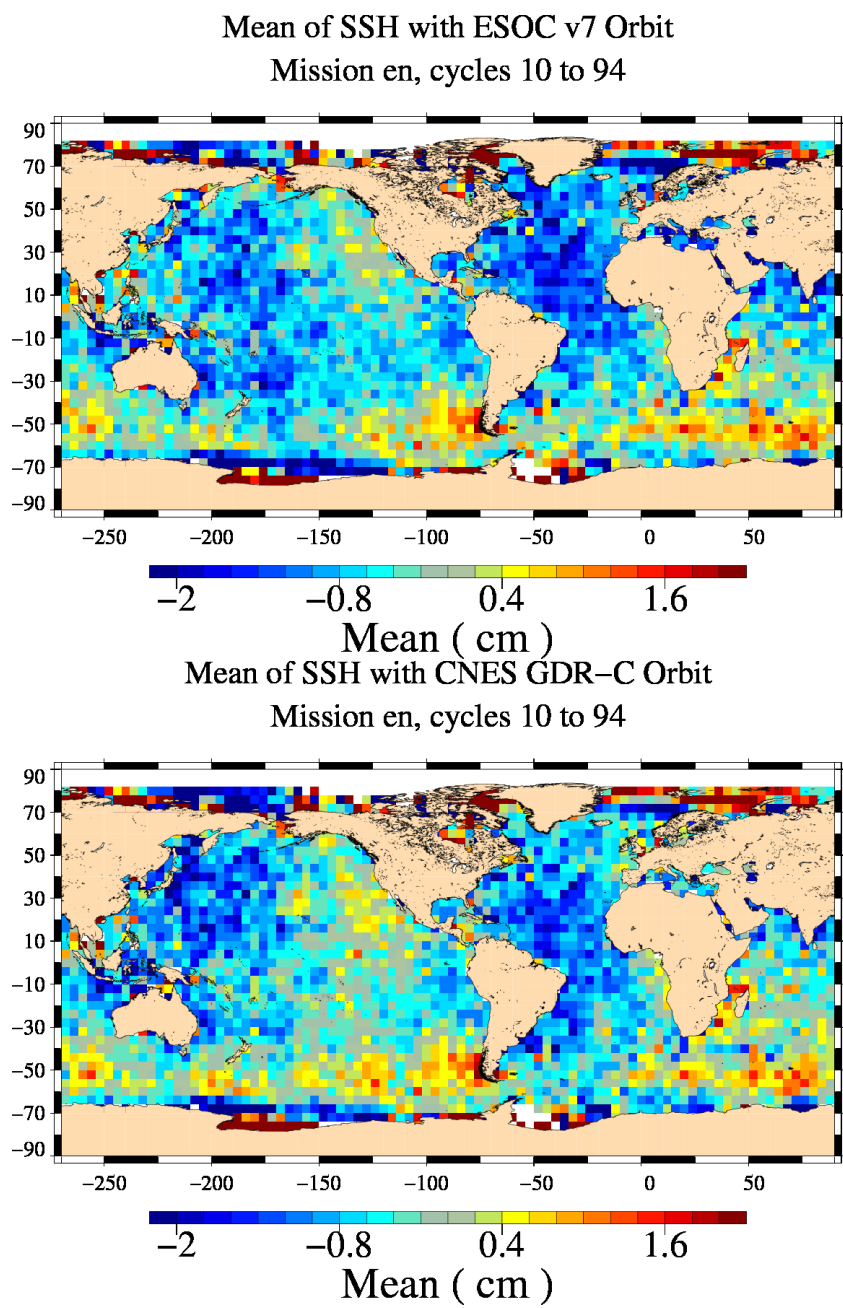
**Input data :** Sea Surface Height (SSH) crossovers

**Description :** The difference of temporal evolution between the global statistics (mean, standard deviation) of SSH differences are calculated using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).

Diagnostic type : Global internal analyses



Diagnostic A103 (mission en)	
Name :	Map of SSH crossovers
Input data :	Sea Surface Height (SSH) crossovers
Description :	The differences between maps of SSH crossovers differences (mean, variance) are calculated using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).



## Diagnostic A103 (mission j1)

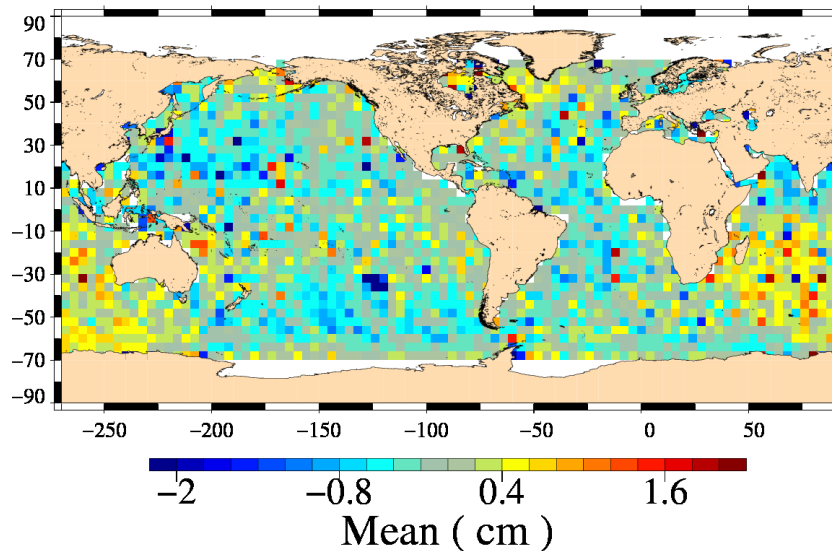
**Name :** Map of SSH crossovers

**Input data :** Sea Surface Height (SSH) crossovers

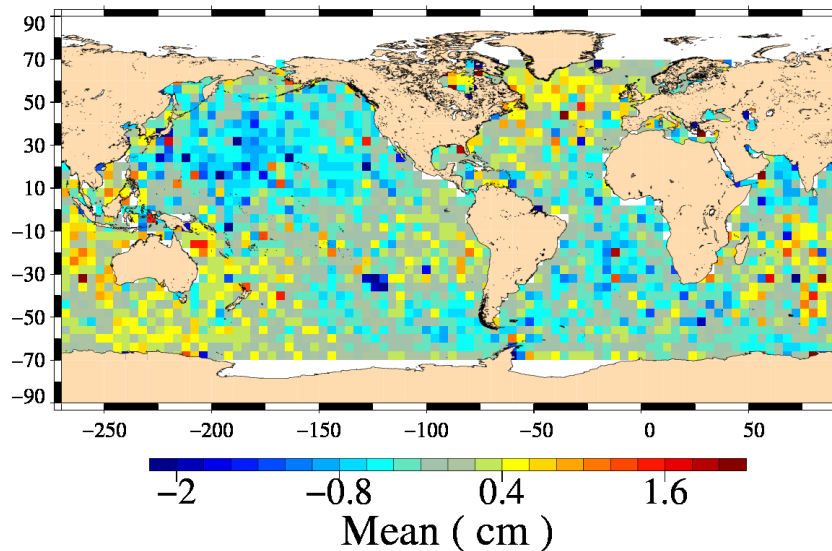
**Description :** The differences between maps of SSH crossovers differences (mean, variance) are calculated using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).

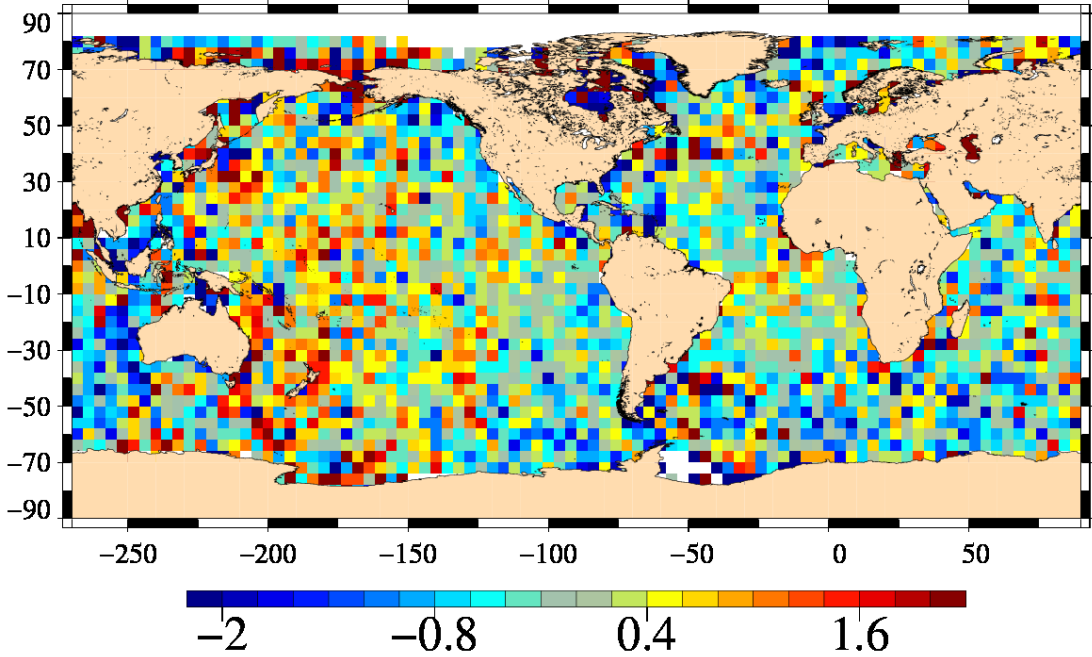
Diagnostic type : Global internal analyses

Mean of SSH with ESOC v7 Orbit  
Mission j1, cycles 1 to 251



Mean of SSH with CNES GDR-C Orbit  
Mission j1, cycles 1 to 251



Diagnostic type : Global internal analyses	Diagnostic A104 (mission en)
	Name : Differences between maps of SSH crossovers
	Input data : Sea Surface Height (SSH) crossovers
	Description : The differences between maps of SSH crossovers (derived from diagnostic A103) are calculated from the SSH crossover differences (mean, standard deviation) using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).
	<div>VAR(SSH with ESOC v7 Orbit) – VAR(SSH with CNES GDR–C Orbit)</div> <div>Mission en, cycles 10 to 94</div> <div><div>SSH crossovers : difference of variances ( cm^2 )</div></div>

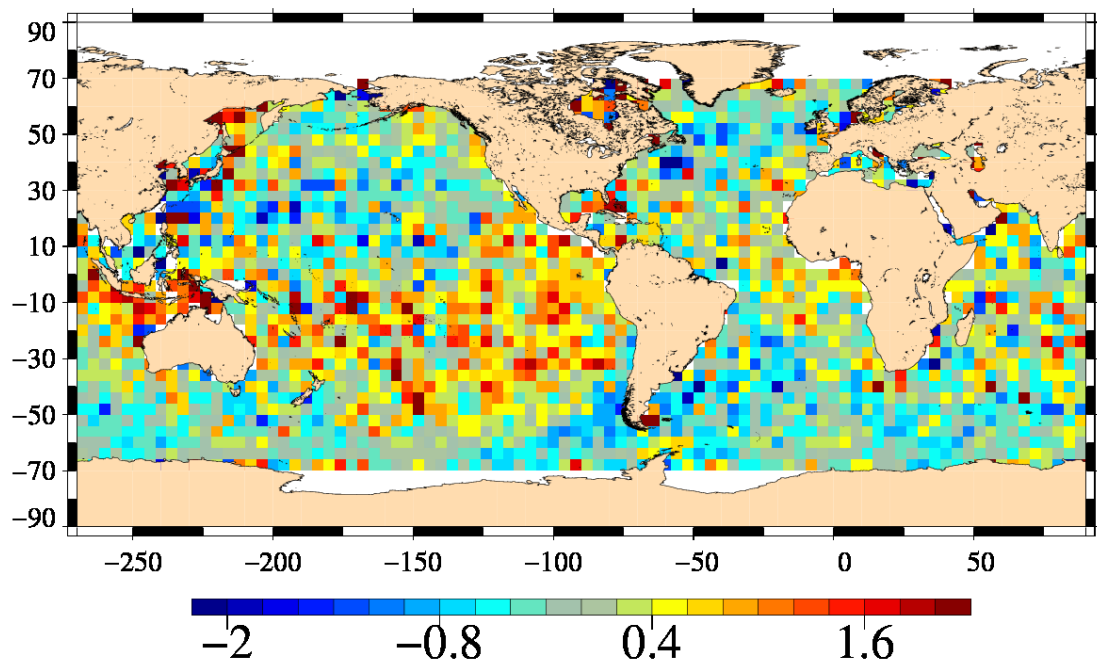
## Diagnostic A104 (mission j1)

**Name :** Differences between maps of SSH crossovers

**Input data :** Sea Surface Height (SSH) crossovers

**Description :** The differences between maps of SSH crossovers (derived from diagnostic A103) are calculated from the SSH crossover differences (mean, standard deviation) using successively both altimetric components in the SSH calculation. SSH crossovers are the differences between ascending and descending passes for time differences between both passes lower than 10 days (in order to reduce the effect of the oceanic variability).

VAR(SSH with ESOC v7 Orbit) – VAR(SSH with CNES GDR–C Orbit)  
Mission j1, cycles 1 to 251



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 10 to 94</div> <table><caption>Estimated data points from the Global MSL graph</caption><tr><th>Mission Cycle</th><th>Year (approx.)</th><th>ESOC v7 Orbit Mean (cm)</th><th>CNES GDR-C Orbit Mean (cm)</th></tr><tr><td>10</td><td>2004</td><td>48.7</td><td>48.7</td></tr><tr><td>20</td><td>2004.5</td><td>48.8</td><td>48.8</td></tr><tr><td>30</td><td>2005</td><td>48.9</td><td>48.9</td></tr><tr><td>40</td><td>2005.5</td><td>49.0</td><td>49.0</td></tr><tr><td>50</td><td>2006</td><td>49.1</td><td>49.1</td></tr><tr><td>60</td><td>2006.5</td><td>49.2</td><td>49.2</td></tr><tr><td>70</td><td>2007</td><td>49.3</td><td>49.3</td></tr><tr><td>80</td><td>2007.5</td><td>49.4</td><td>49.4</td></tr><tr><td>90</td><td>2008</td><td>49.5</td><td>49.5</td></tr><tr><td>100</td><td>2008.5</td><td>49.6</td><td>49.6</td></tr><tr><td>110</td><td>2009</td><td>49.7</td><td>49.7</td></tr><tr><td>120</td><td>2009.5</td><td>49.8</td><td>49.8</td></tr><tr><td>130</td><td>2010</td><td>49.9</td><td>49.9</td></tr><tr><td>140</td><td>2010.5</td><td>50.0</td><td>50.0</td></tr><tr><td>150</td><td>2011</td><td>50.1</td><td>50.1</td></tr></table>		Mission Cycle	Year (approx.)	ESOC v7 Orbit Mean (cm)	CNES GDR-C Orbit Mean (cm)	10	2004	48.7	48.7	20	2004.5	48.8	48.8	30	2005	48.9	48.9	40	2005.5	49.0	49.0	50	2006	49.1	49.1	60	2006.5	49.2	49.2	70	2007	49.3	49.3	80	2007.5	49.4	49.4	90	2008	49.5	49.5	100	2008.5	49.6	49.6	110	2009	49.7	49.7	120	2009.5	49.8	49.8	130	2010	49.9	49.9	140	2010.5	50.0	50.0	150	2011	50.1
Mission Cycle	Year (approx.)	ESOC v7 Orbit Mean (cm)	CNES GDR-C Orbit Mean (cm)																																																														
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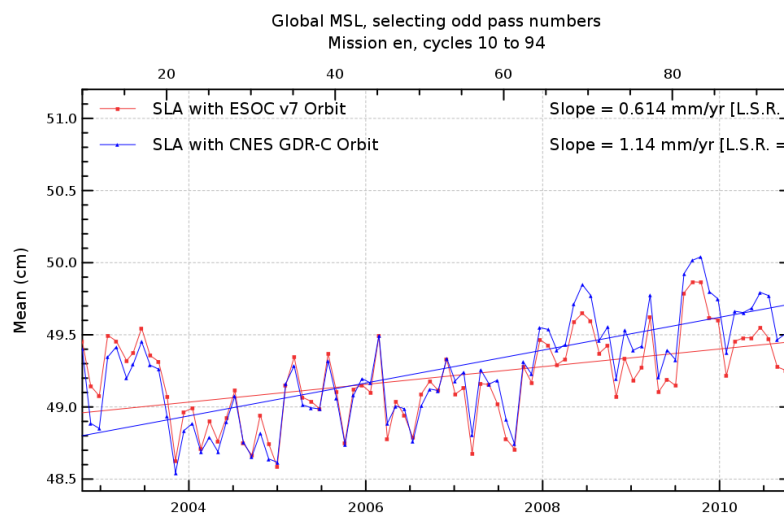
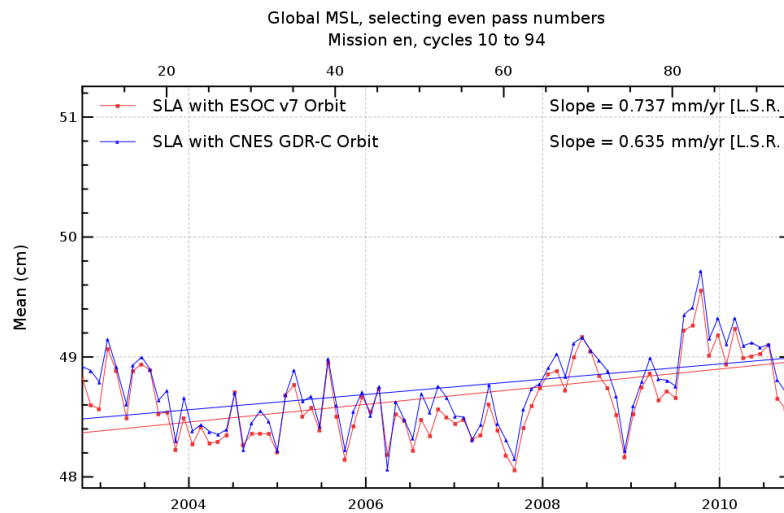
## Diagnostic A201\_b (mission en)

**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



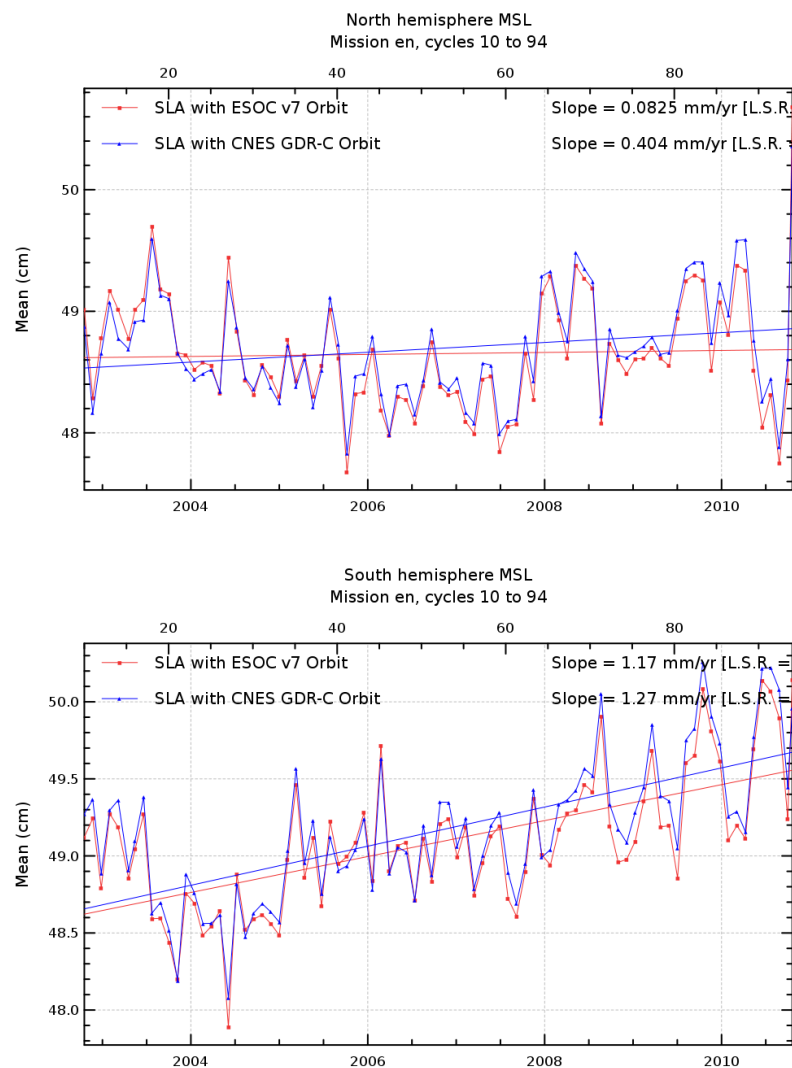
## Diagnostic A201\_c (mission en)

**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)

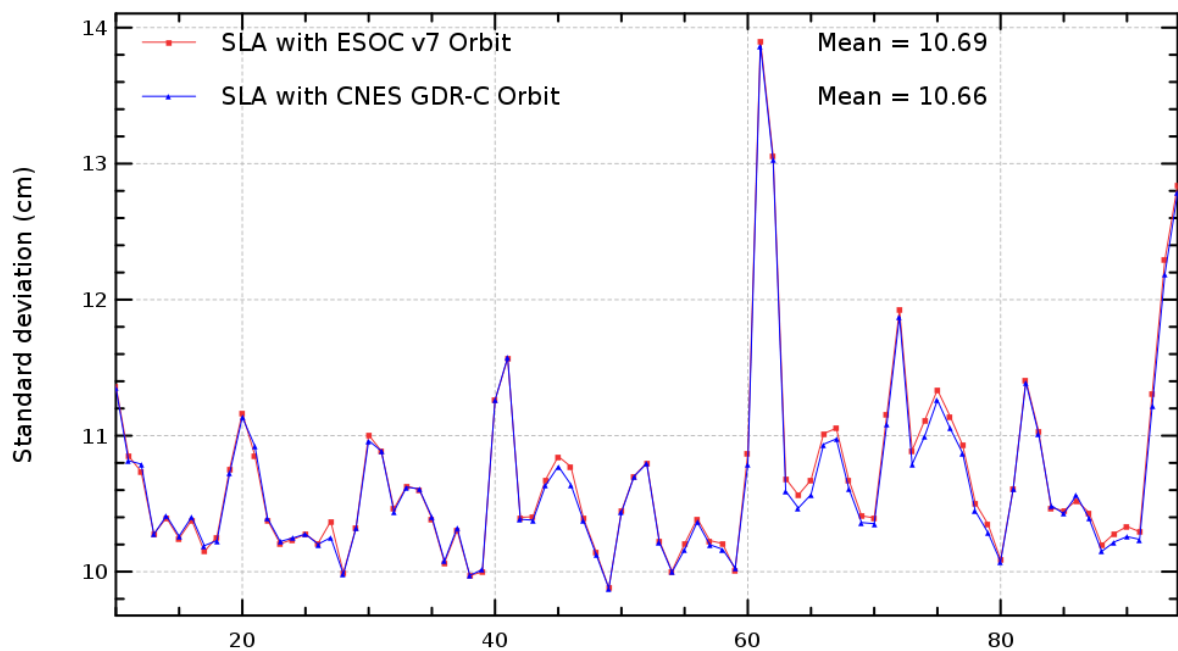
**Name :** Temporal evolution of Sea Level Anomaly (SLA)

**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 10 to 94



## Diagnostic A201\_e (mission en)

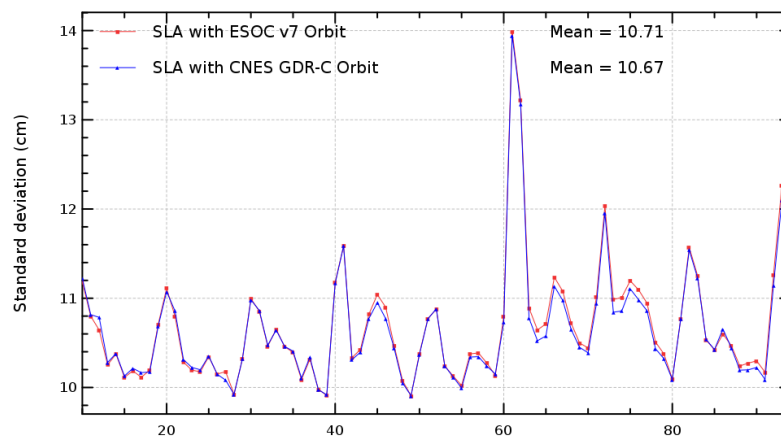
**Name :** Temporal evolution of Sea Level Anomaly (SLA)

**Input data :** Along track SLA

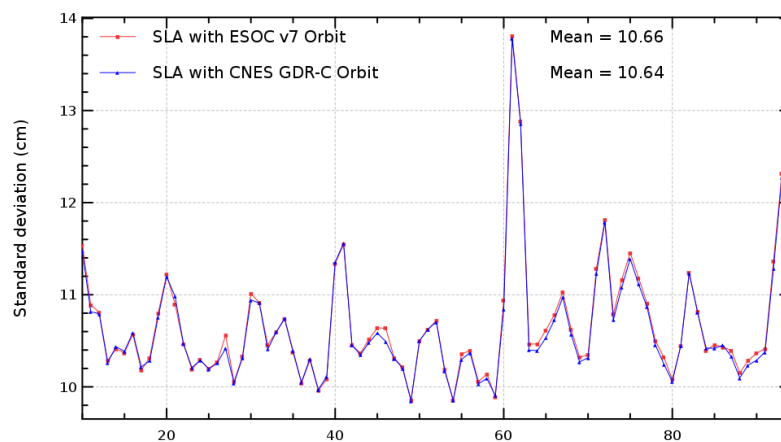
**Description :** The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements 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 10 to 94



Global MSL, selecting odd pass numbers  
Mission en, cycles 10 to 94



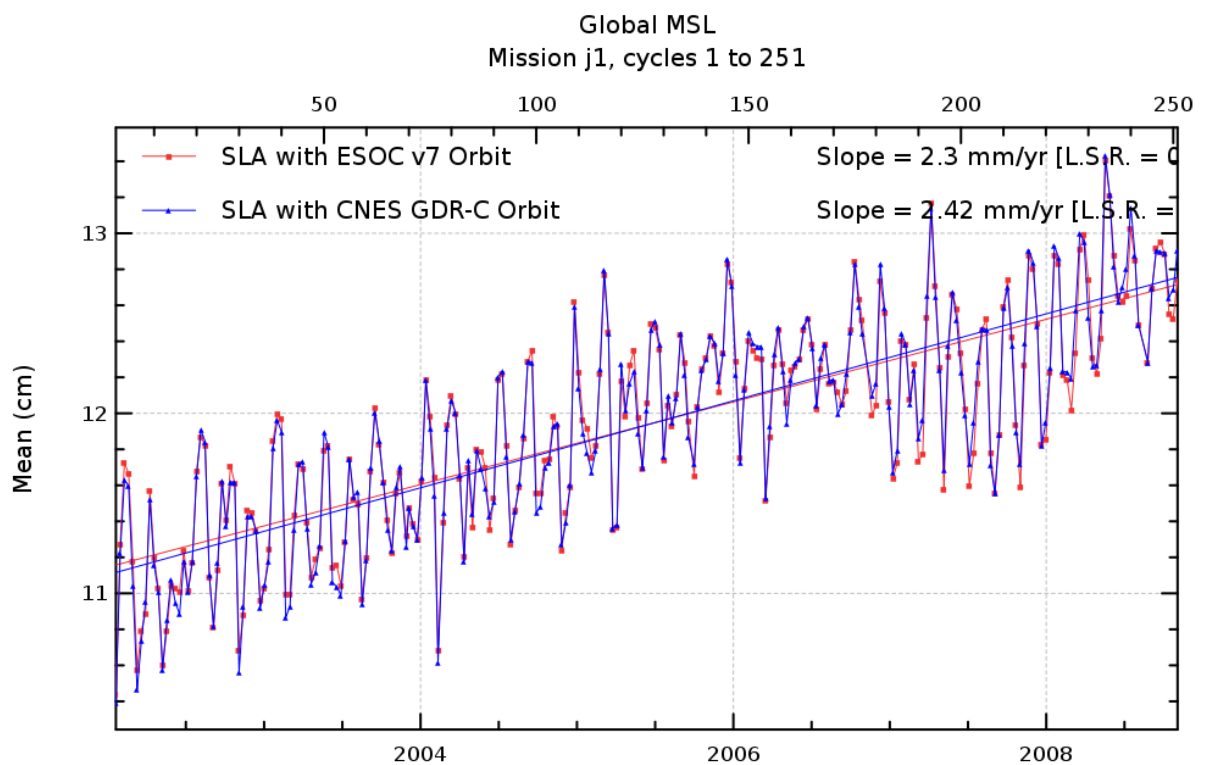
## Diagnostic A201\_a (mission j1)

**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



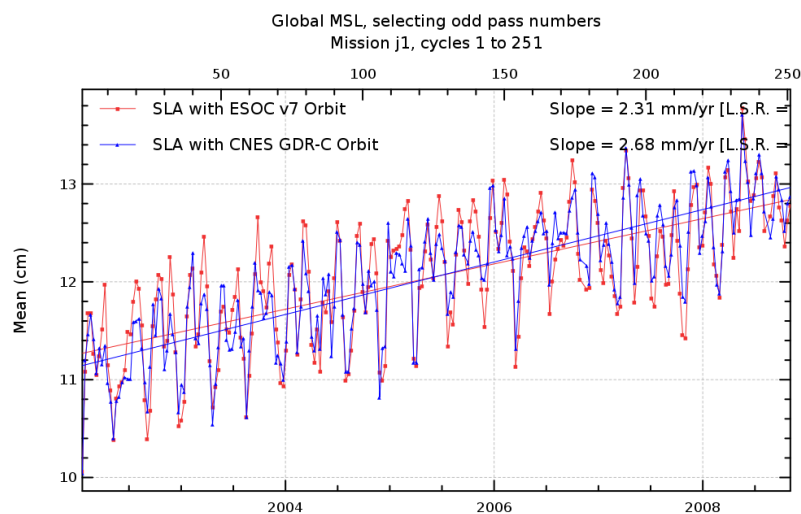
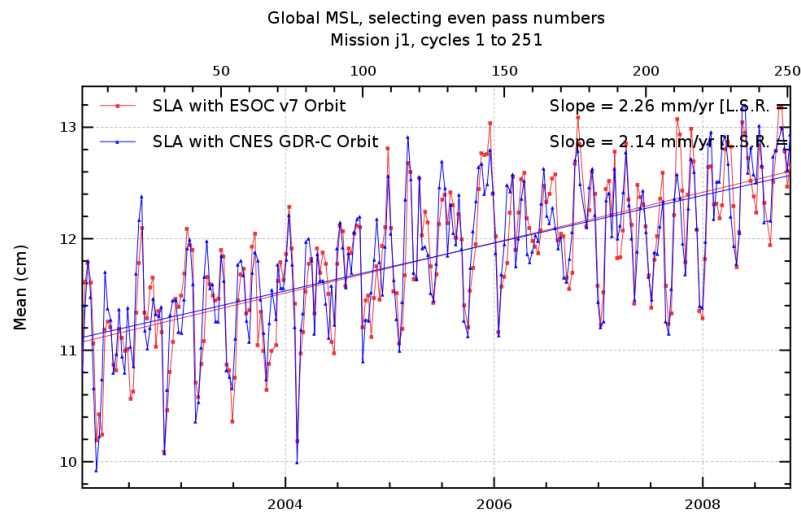
## Diagnostic A201\_b (mission j1)

**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.

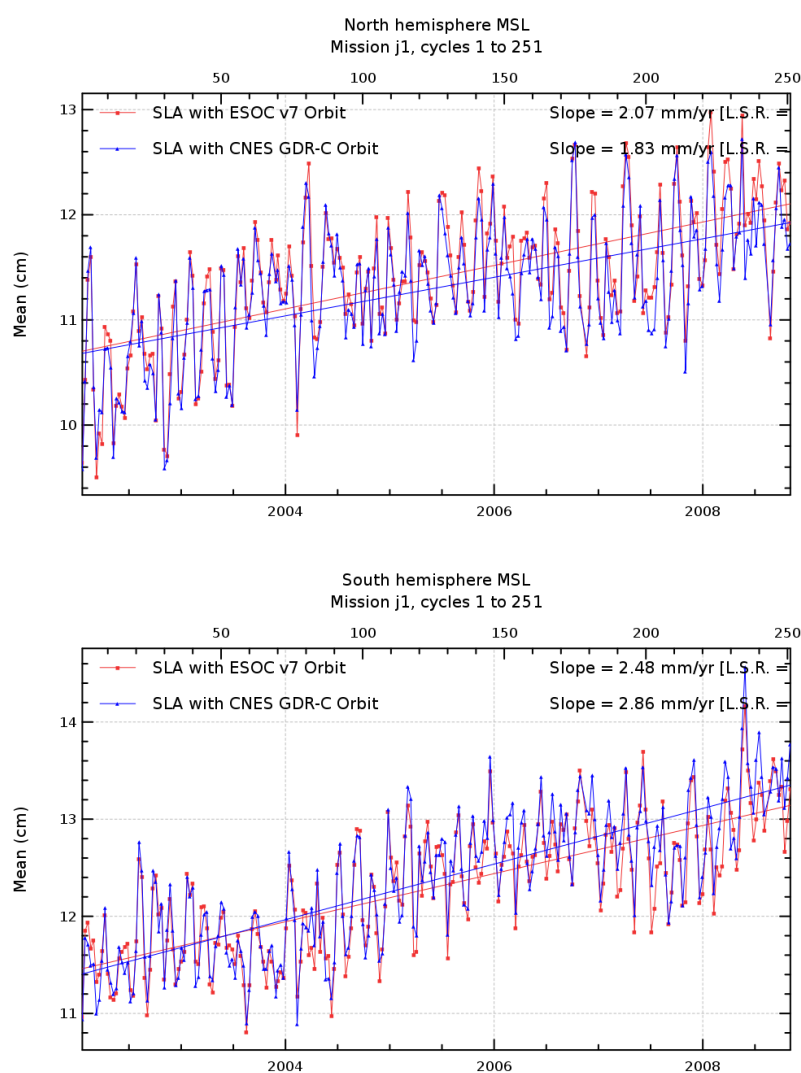
Diagnostic type : Global internal analyses



**Diagnostic type : Global internal analyses**

**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 A201\_d (mission j1)

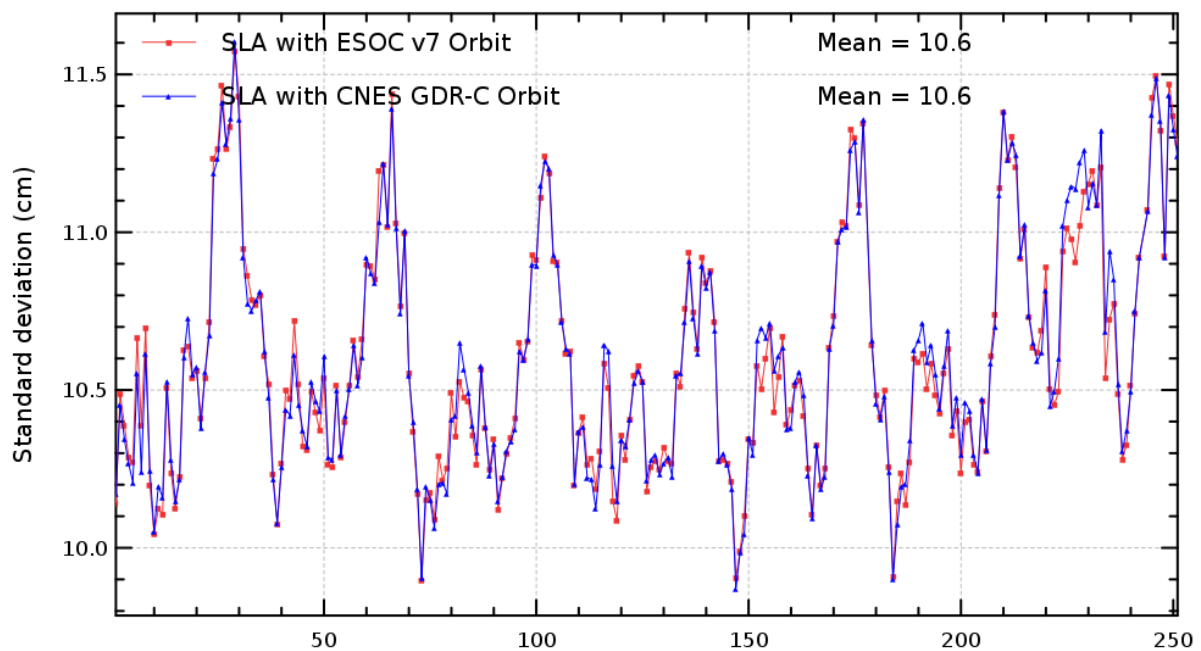
**Name :** Temporal evolution of Sea Level Anomaly (SLA)

**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 j1, cycles 1 to 251



## Diagnostic A201\_e (mission j1)

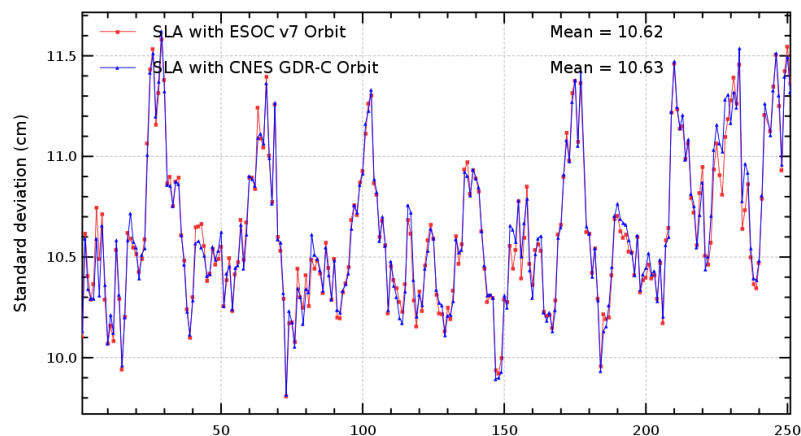
**Name :** Temporal evolution of Sea Level Anomaly (SLA)

**Input data :** Along track SLA

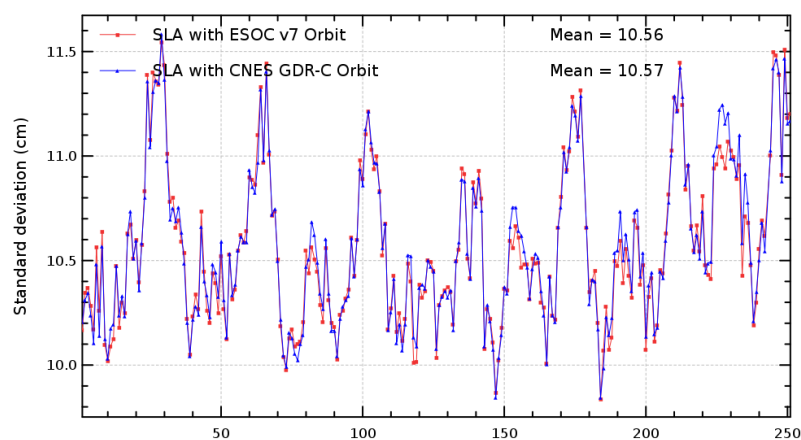
**Description :** The temporal evolution of SLA statistics (mean, standard deviation) are calculated from a cyclic way (altimeter repetitivity, daily, weekly, monthly) using successively both altimetric components in the SLA calculation. These statistics are calculated from 1 Hz altimetric measurements 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 j1, cycles 1 to 251



Global MSL, selecting odd pass numbers  
Mission j1, cycles 1 to 251



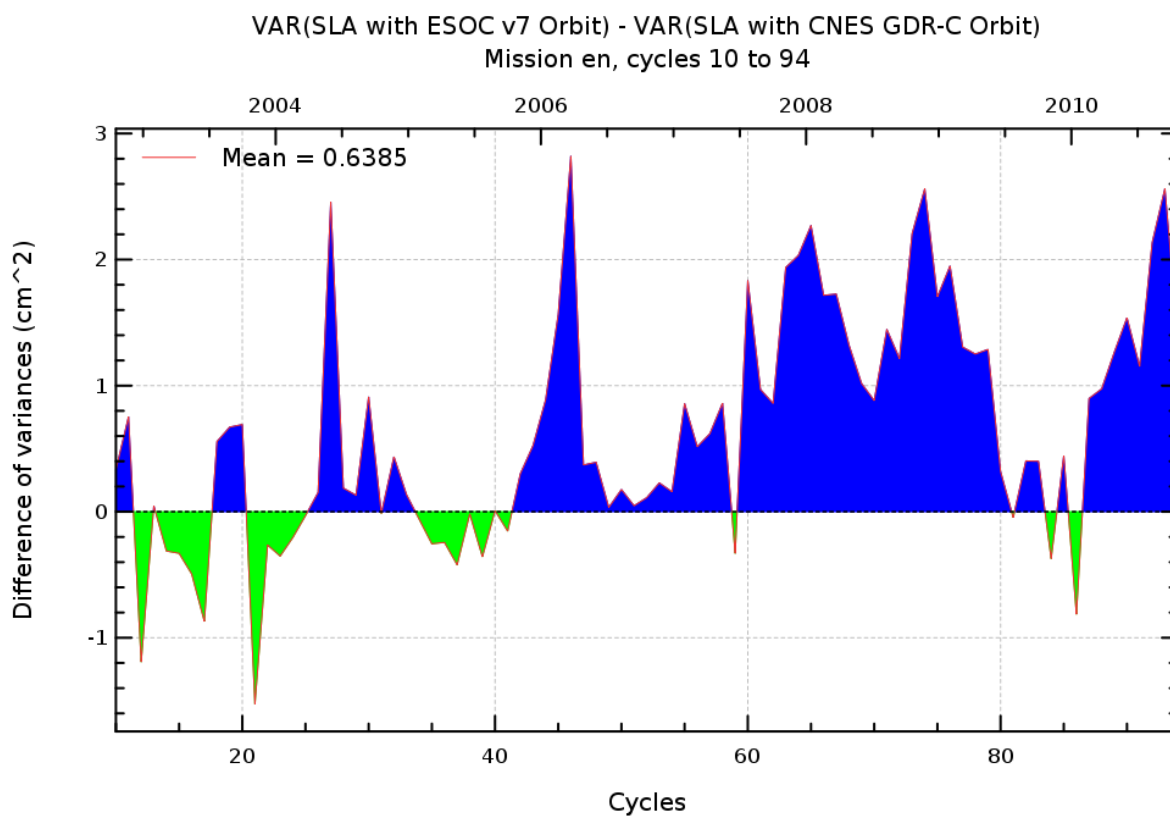
**Diagnostic A202\_a (mission en)**

**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



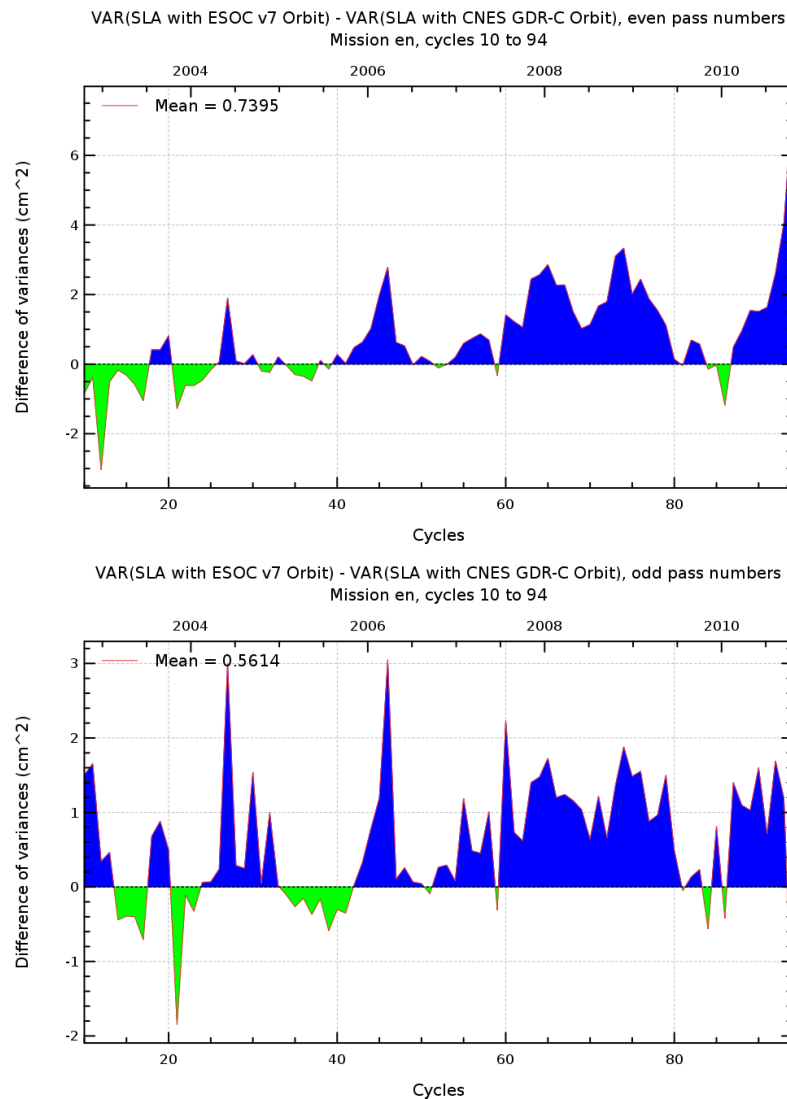
## Diagnostic A202\_b (mission en)

**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



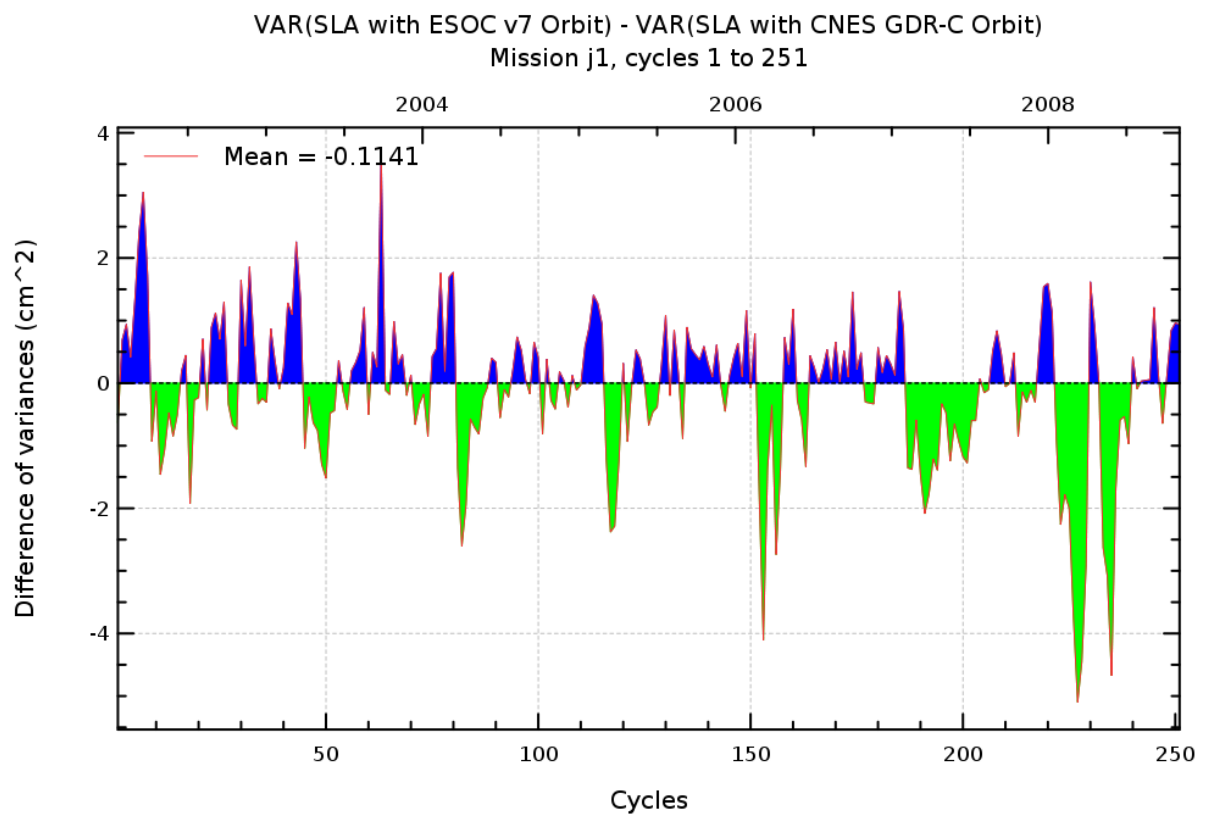
## Diagnostic A202\_a (mission j1)

**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



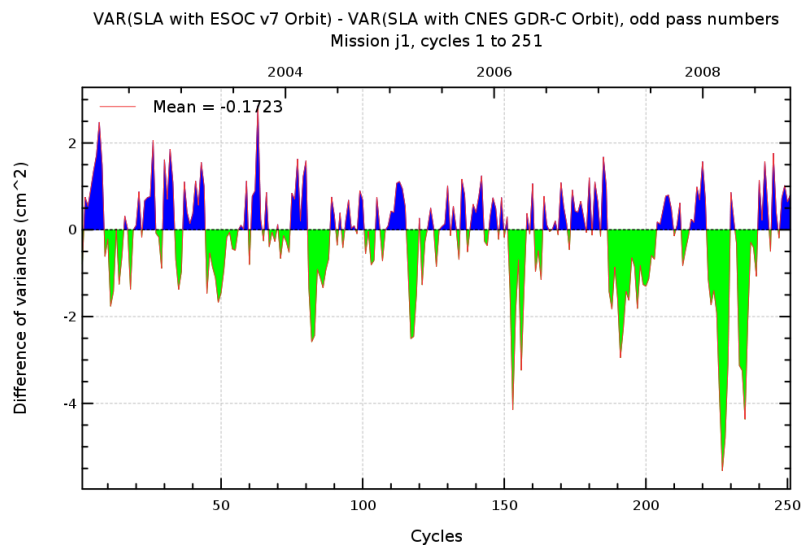
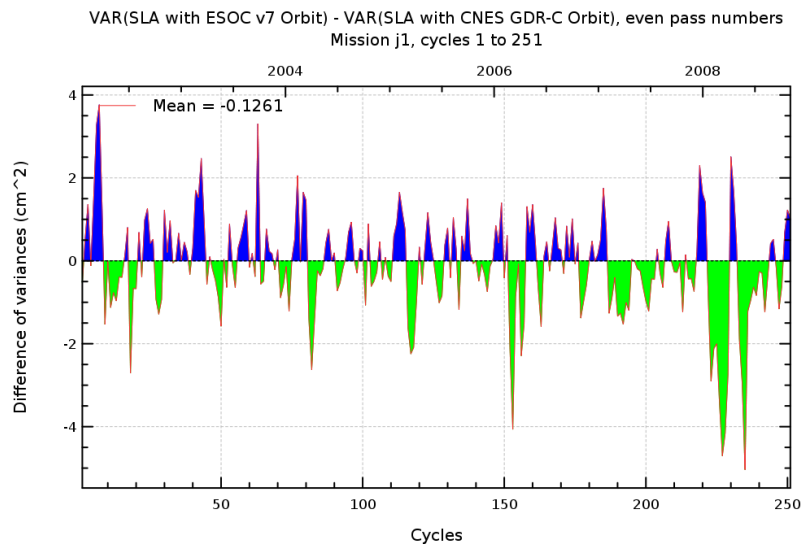
## Diagnostic A202\_b (mission j1)

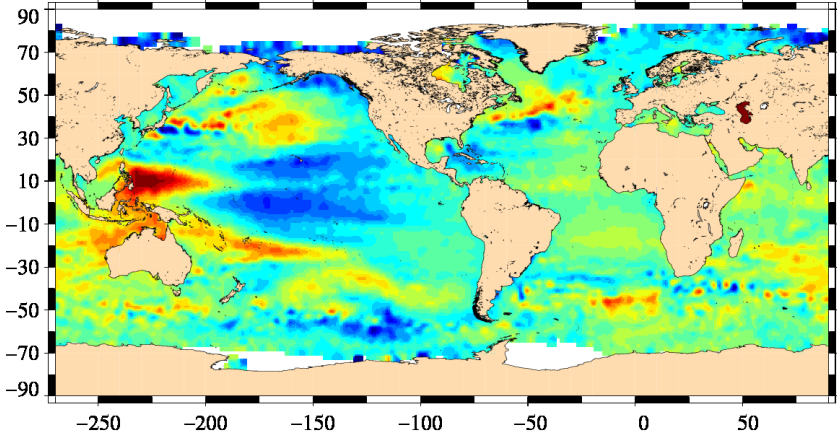
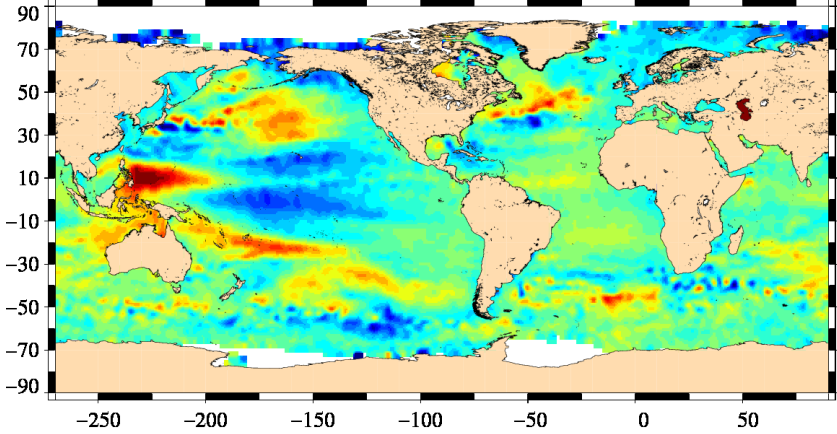
**Name :** Differences between temporal evolution of Sea Level Anomaly (SLA)

**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 ESOC v7 Orbit trends Mission en, cycles 10 to 94</div> <div><div>-22.08537 -8.70674 4.6719 18.05054</div><div>Trends (mm/yr)</div><div>SLA with CNES GDR-C Orbit trends Mission en, cycles 10 to 94</div><div><div>-20.7908 -8.06115 4.6685 17.39815</div><div>Trends (mm/yr)</div></div></div>	

## Diagnostic A203\_b (mission en)

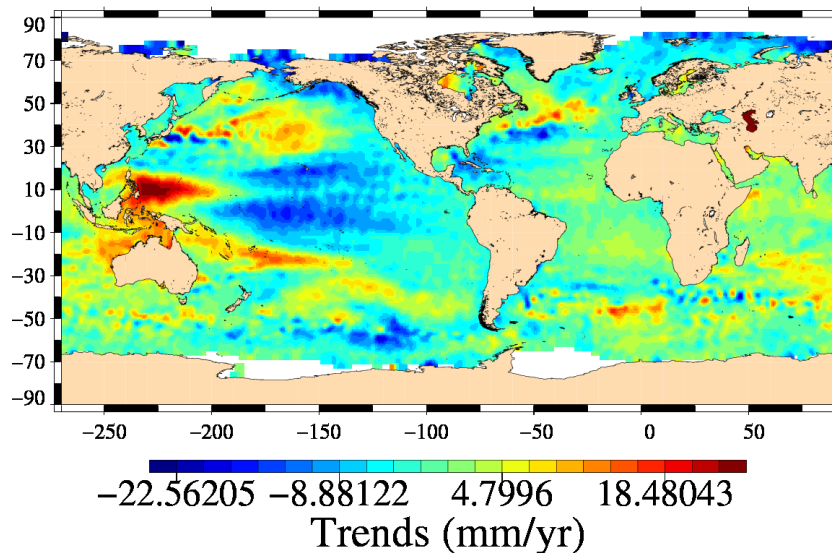
**Name :** Map of Sea Level Anomaly (SLA) over all the period

**Input data :** Along track SLA

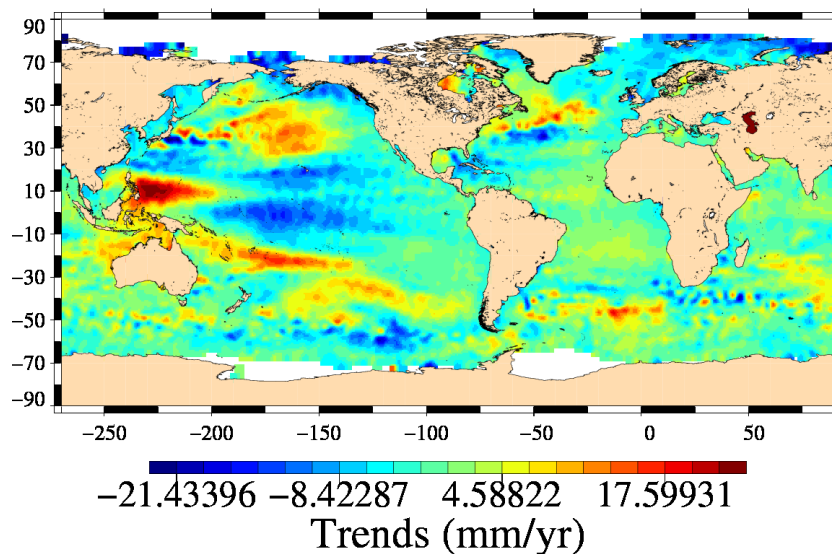
**Description :** The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

Diagnostic type : Global internal analyses

SLA with ESOC v7 Orbit trends : even pass numbers  
Mission en, cycles 10 to 94



SLA with CNES GDR-C Orbit trends : even pass numbers  
Mission en, cycles 10 to 94



## Diagnostic A203\_c (mission en)

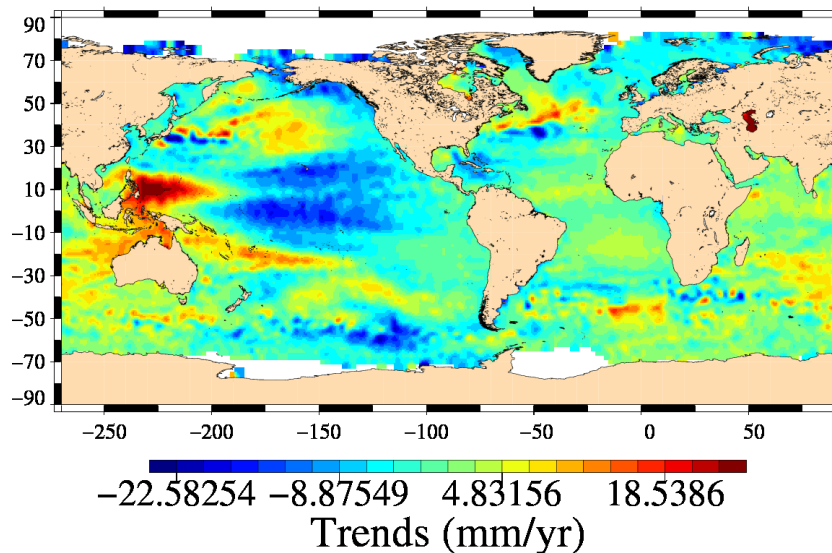
**Name :** Map of Sea Level Anomaly (SLA) over all the period

**Input data :** Along track SLA

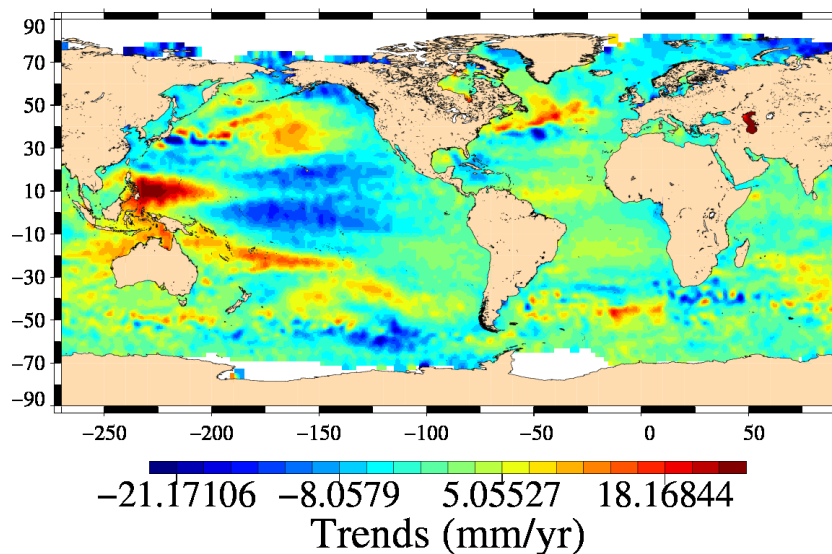
**Description :** The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

Diagnostic type : Global internal analyses

SLA with ESOc v7 Orbit trends : odd pass numbers  
Mission en, cycles 10 to 94



SLA with CNES GDR-C Orbit trends : odd pass numbers  
Mission en, cycles 10 to 94



## Diagnostic A203\_a (mission j1)

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

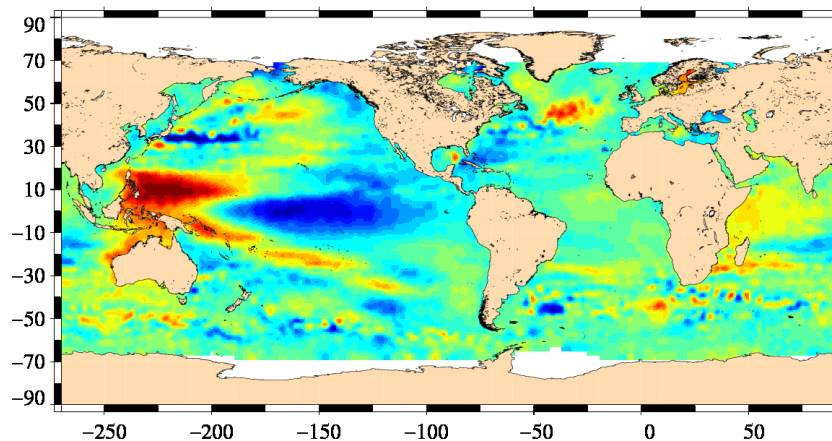
**Input data :** Along track SLA

**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 ESOC v7 Orbit trends

Mission j1, cycles 1 to 251

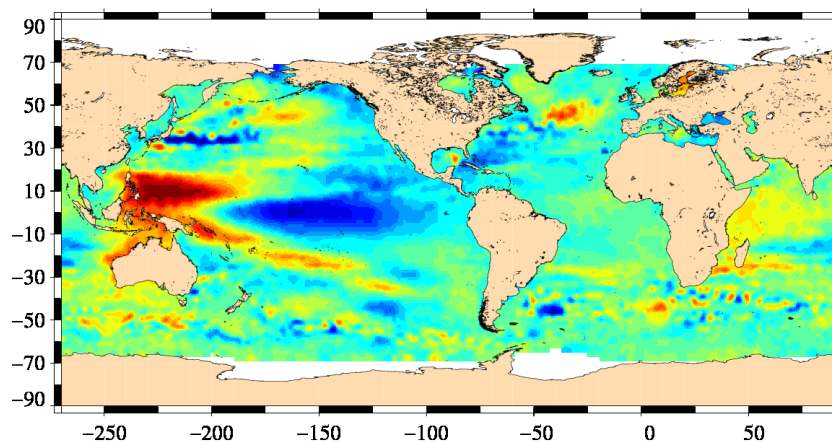


-23.61932 -8.11148 7.39636 22.9042

Trends (mm/yr)

SLA with CNES GDR-C Orbit trends

Mission j1, cycles 1 to 251



-23.72851 -8.06823 7.59204 23.25232

Trends (mm/yr)

## Diagnostic A203\_b (mission j1)

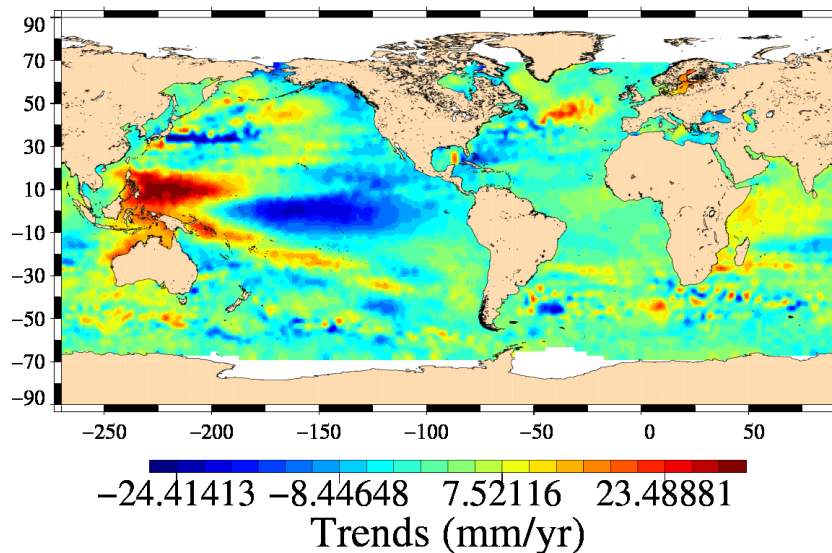
**Name :** Map of Sea Level Anomaly (SLA) over all the period

**Input data :** Along track SLA

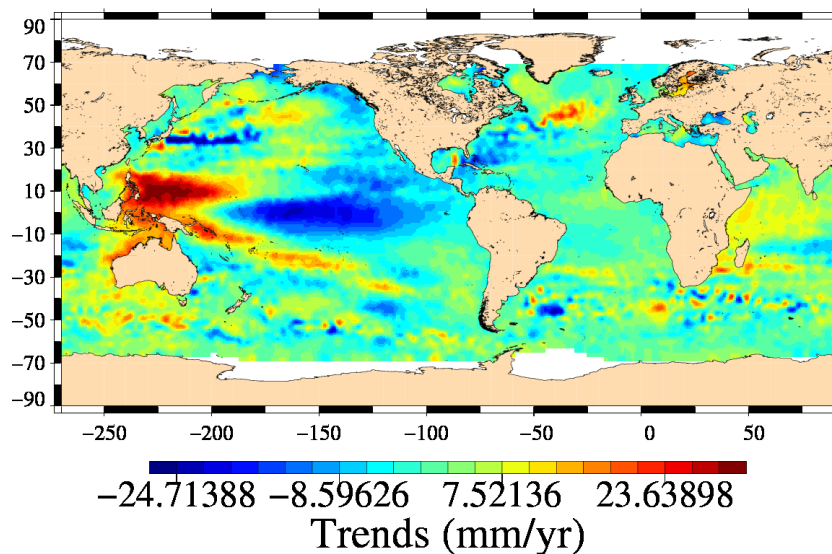
**Description :** The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

Diagnostic type : Global internal analyses

SLA with ESOc v7 Orbit trends : even pass numbers  
Mission j1, cycles 1 to 251



SLA with CNES GDR-C Orbit trends : even pass numbers  
Mission j1, cycles 1 to 251



Diagnostic A203\_c (mission j1)

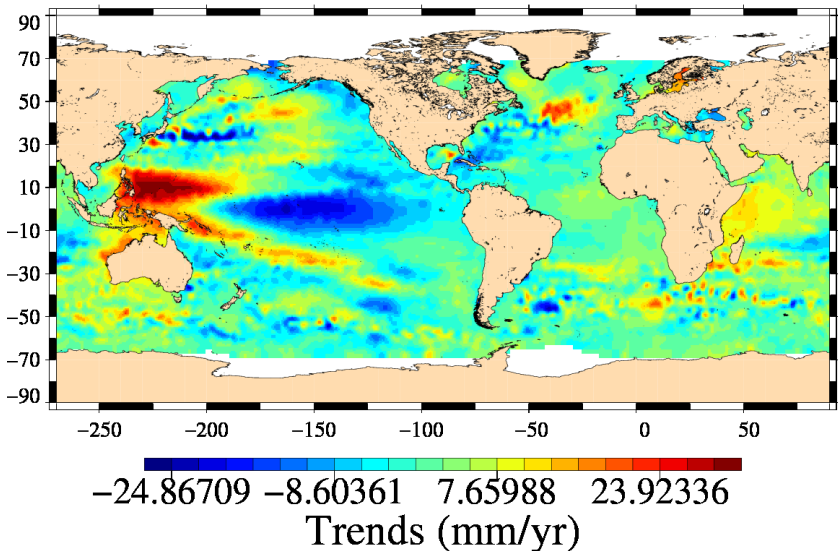
Name : Map of Sea Level Anomaly (SLA) over all the period

Input data : Along track SLA

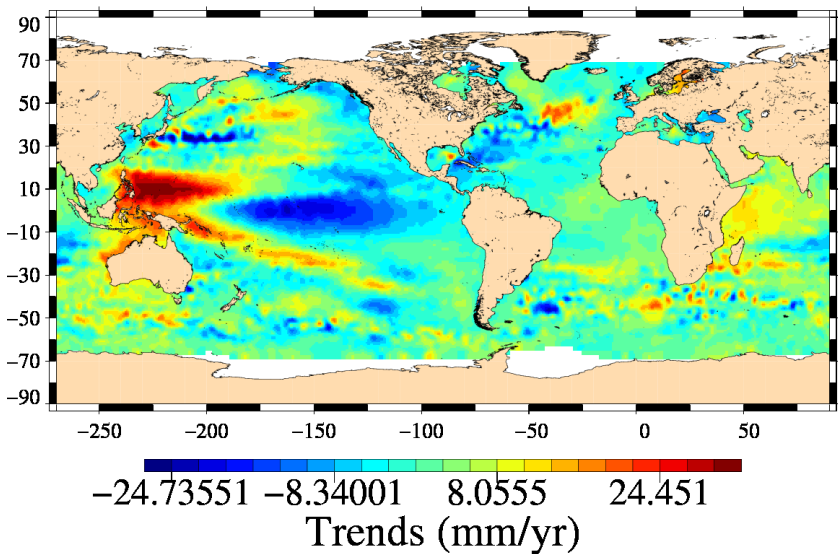
Description : The map of global statistics (mean, standard deviation) of SLA are calculated using successively both altimetric components in the SLA calculation over a large period. These statistics are calculated from 1 Hz altimetric measurements after removing spurious sea level measurements.

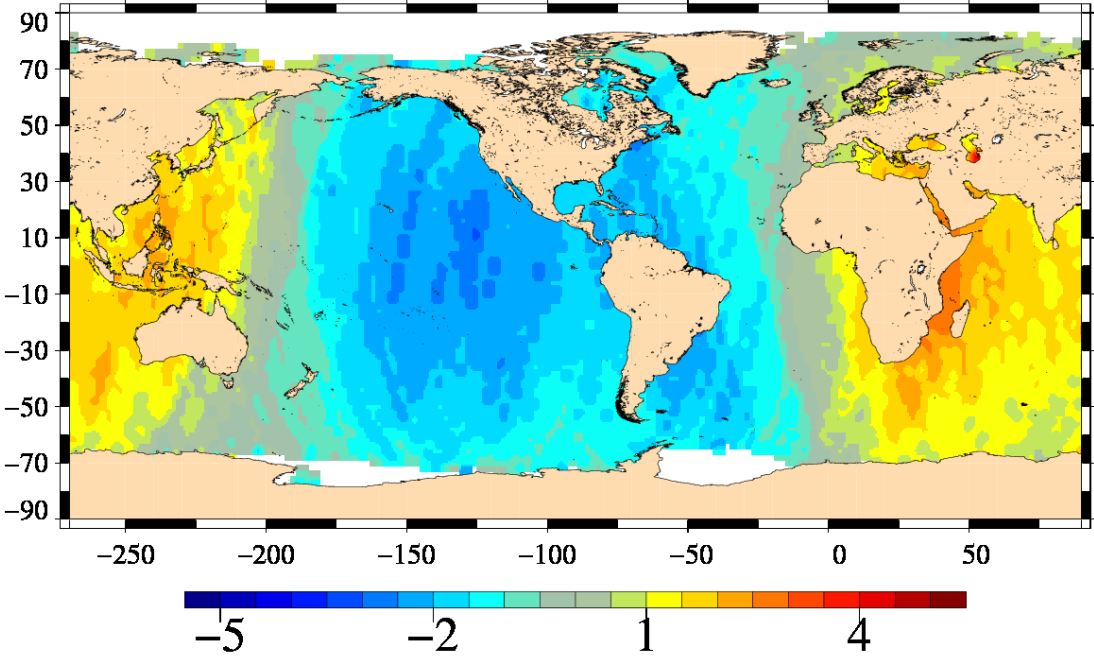
Diagnostic type : Global internal analyses

SLA with ESOC v7 Orbit trends : odd pass numbers  
Mission j1, cycles 1 to 251



SLA with CNES GDR-C Orbit trends : odd pass numbers  
Mission j1, cycles 1 to 251



Diagnostic type : Global internal analyses	Diagnostic A204_a (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).	
	<div>SLA with ESOC v7 Orbit trends – SLA with CNES GDR–C Orbit trends</div> <div>Mission en, cycles 10 to 94</div> 	

## Diagnostic A204\_b (mission en)

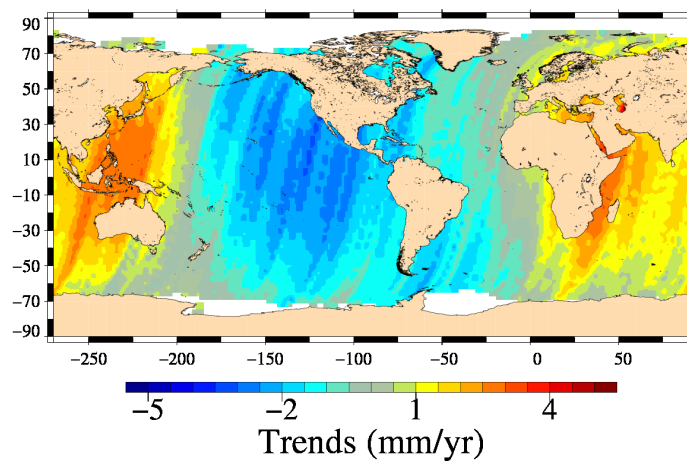
**Name :** Differences between maps of SLA

**Input data :** Along track SLA

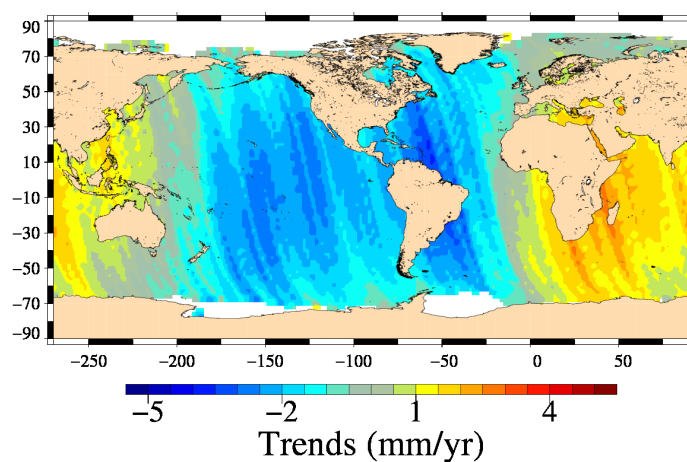
**Description :** The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except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

Diagnostic type : Global internal analyses

th ESOC v7 Orbit trends – SLA with CNES GDR–C Orbit trends : even pass 1  
Mission en, cycles 10 to 94



th ESOC v7 Orbit trends – SLA with CNES GDR–C Orbit trends : odd pass 1  
Mission en, cycles 10 to 94



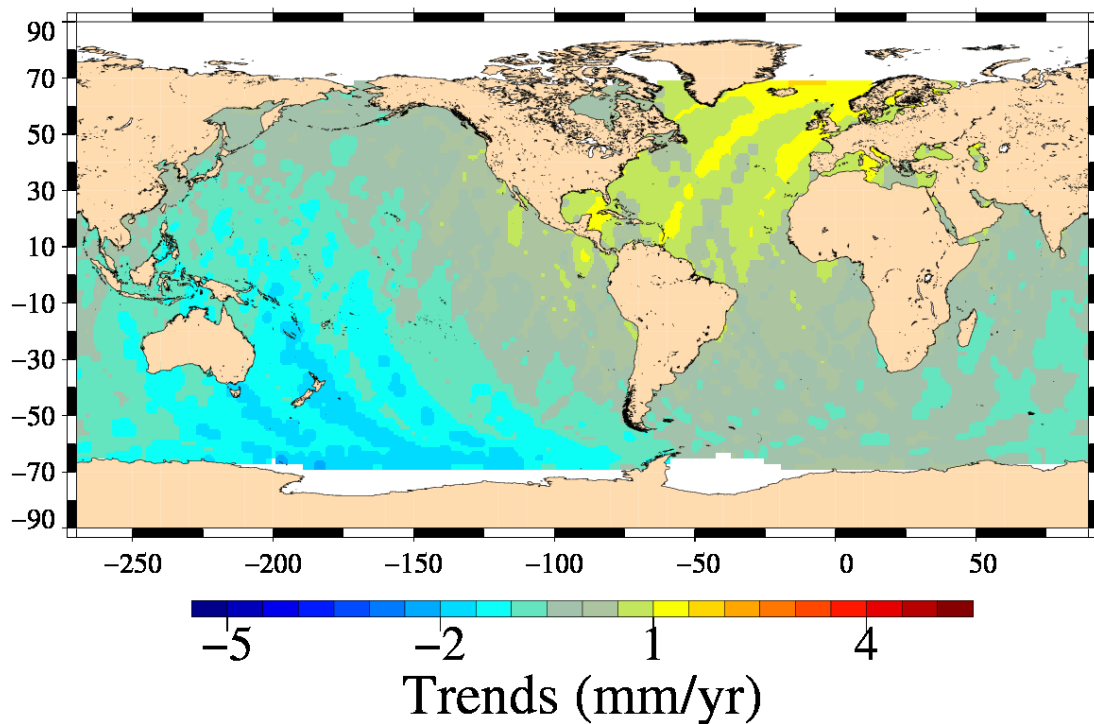
## Diagnostic A204\_a (mission j1)

**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).

SLA with ESOC v7 Orbit trends – SLA with CNES GDR–C Orbit trends  
Mission j1, cycles 1 to 251



## Diagnostic A204\_b (mission j1)

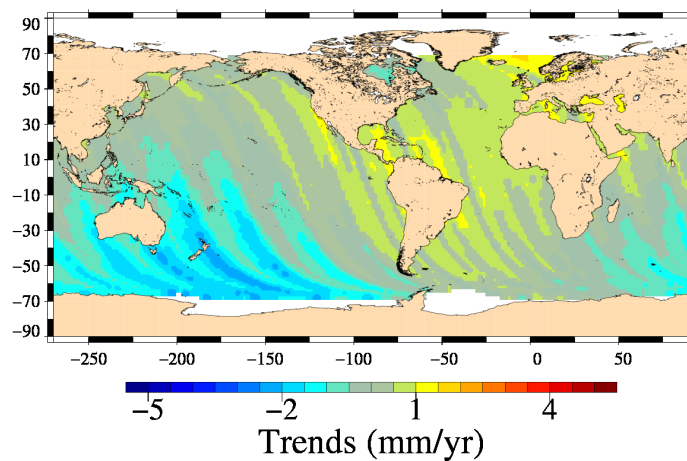
**Name :** Differences between maps of SLA

**Input data :** Along track SLA

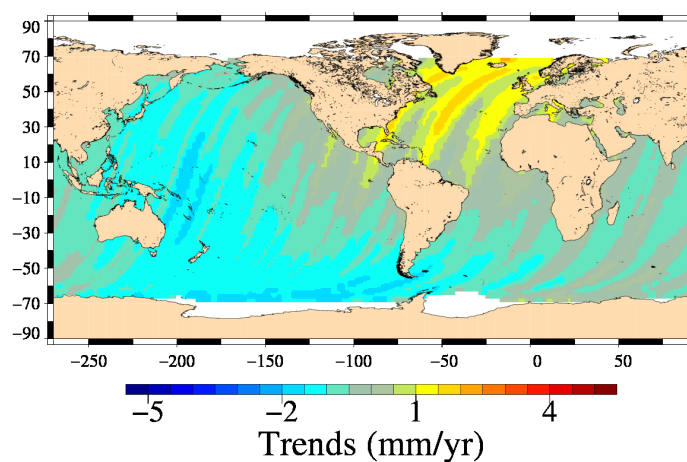
**Description :** The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except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

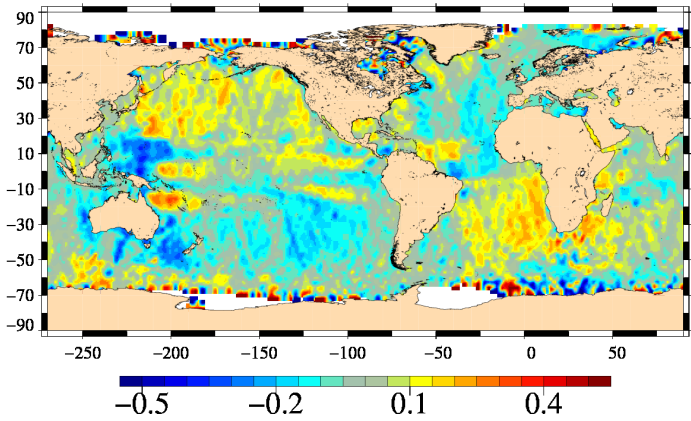
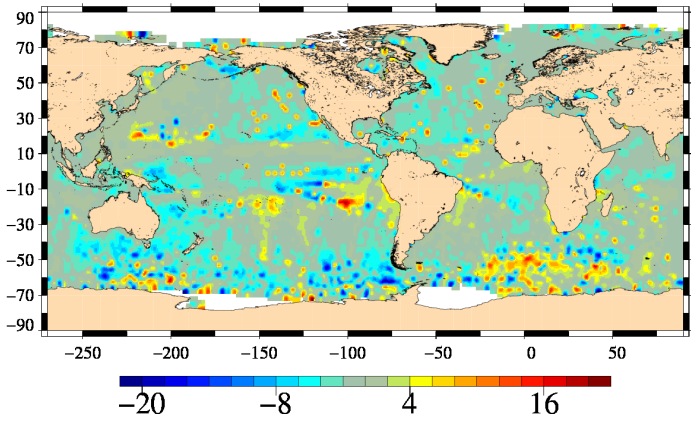
Diagnostic type : Global internal analyses

th ESOC v7 Orbit trends – SLA with CNES GDR–C Orbit trends : even pass  
Mission j1, cycles 1 to 251



th ESOC v7 Orbit trends – SLA with CNES GDR–C Orbit trends : odd pass  
Mission j1, cycles 1 to 251



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).	
	<p>Amplitude differences of SLA with ESOC v7 and with GDR-C orbits: Annual signal Mission en, cycles 10 to 94</p>  <p>Amplitude (cm)</p> <p>Phase differences of SLA with ESOC v7 and with GDR-C orbits: Annual signal Mission en, cycles 10 to 94</p>  <p>Phase (degree)</p>	

## Diagnostic A205\_b (mission en)

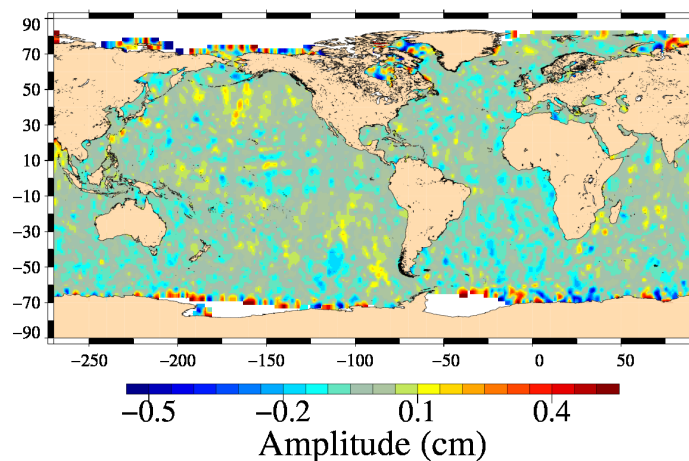
**Name :** Differences between maps of SLA (2)

**Input data :** Along track SLA

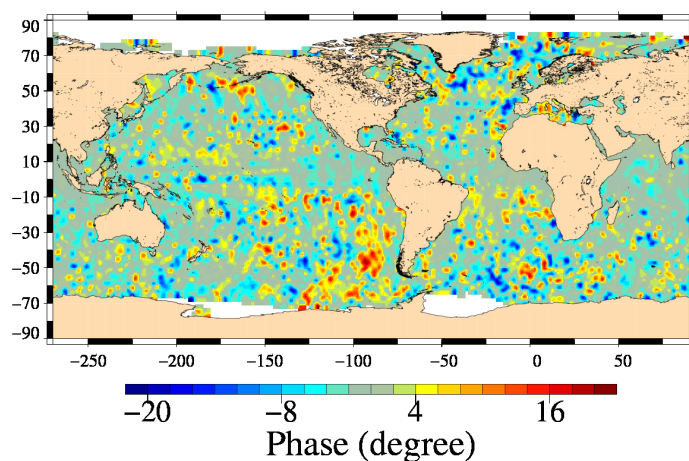
**Description :** The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except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

Diagnostic type : Global internal analyses

ude differences of SLA with ESOC v7 and with GDR-C orbits: Semi-annual  
Mission en, cycles 10 to 94



e differences of SLA with ESOC v7 and with GDR-C orbits: Semi-annual si  
Mission en, cycles 10 to 94



Diagnostic A205\_a (mission j1)

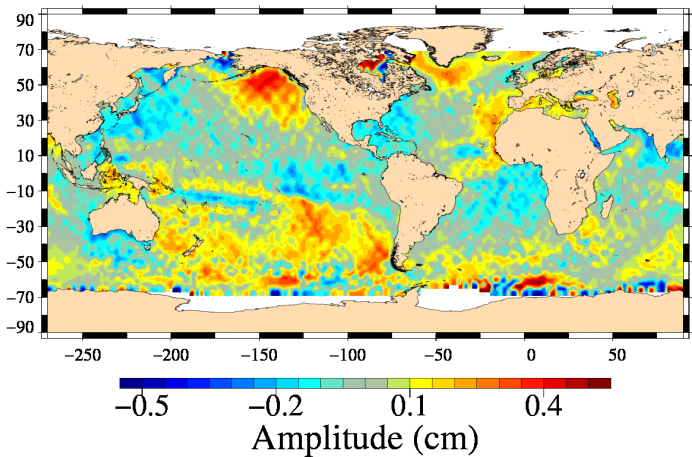
Name : Differences between maps of SLA (2)

Input data : Along track SLA

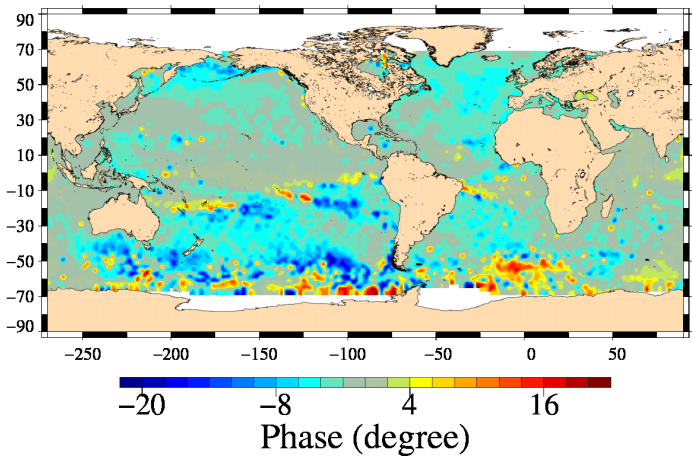
Description : The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except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

Diagnostic type : Global internal analyses

Amplitude differences of SLA with ESOC v7 and with GDR-C orbits: Annual signal  
Mission j1, cycles 1 to 251



Phase differences of SLA with ESOC v7 and with GDR-C orbits: Annual signal  
Mission j1, cycles 1 to 251



Diagnostic A205\_b (mission j1)

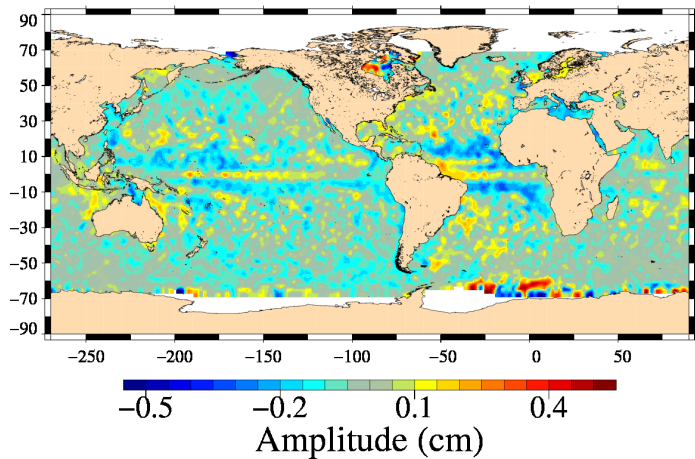
Name : Differences between maps of SLA (2)

Input data : Along track SLA

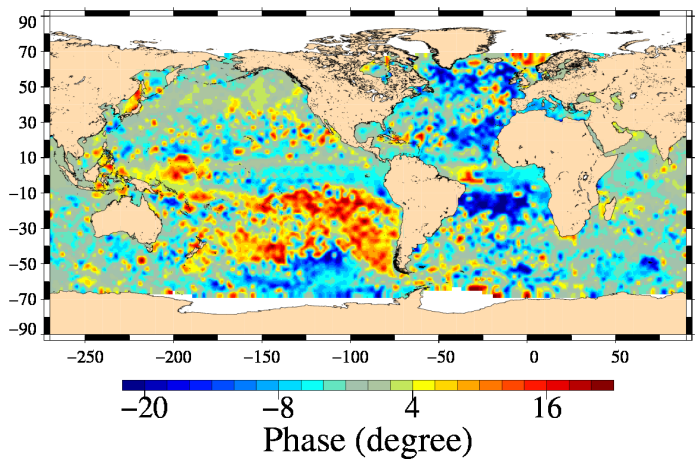
Description : The difference of SLA maps (mean, standard deviation, slope) is calculated from maps derived from diagnostic A203 using successively both altimetric components in the SLA calculation over a given period. This can be done globally, or separating in ascending and descending passes (except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

Diagnostic type : Global internal analyses

Amplitude differences of SLA with ESOC v7 and with GDR-C orbits: Semi-annual Mission j1, cycles 1 to 251



Phase differences of SLA with ESOC v7 and with GDR-C orbits: Semi-annual Mission j1, cycles 1 to 251

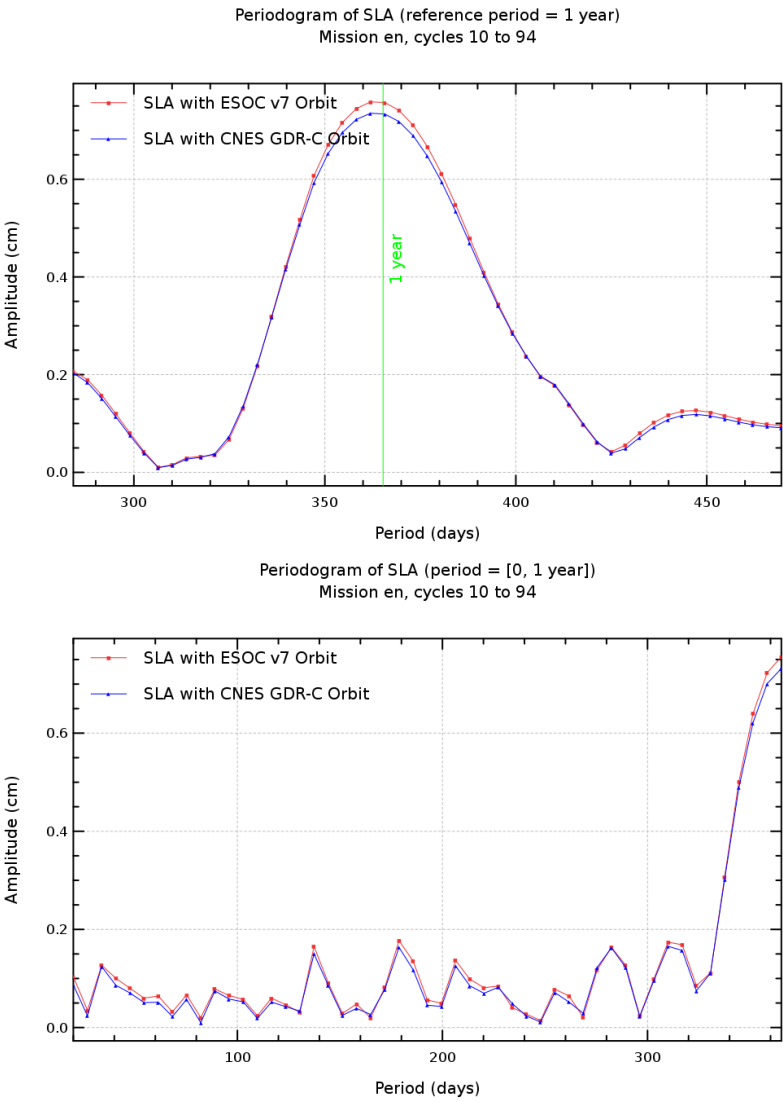


Diagnostic A206\_a (mission en)

**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)

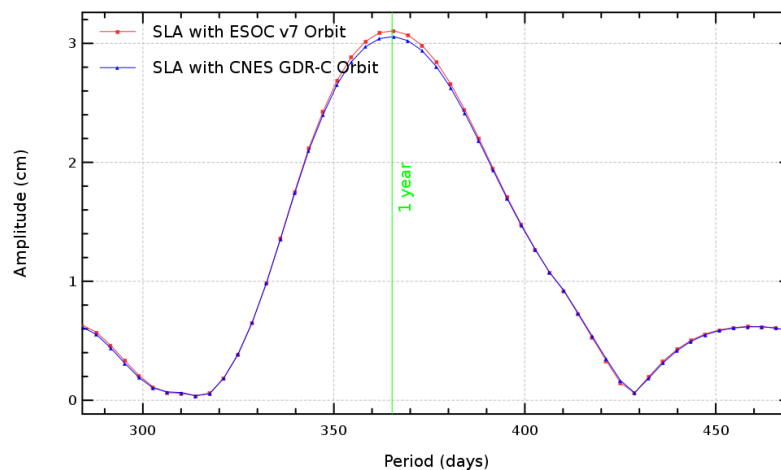
**Name :** Periodogram derived from temporal evolution of Sea Level Anomaly (SLA)

**Input data :** Along track SLA

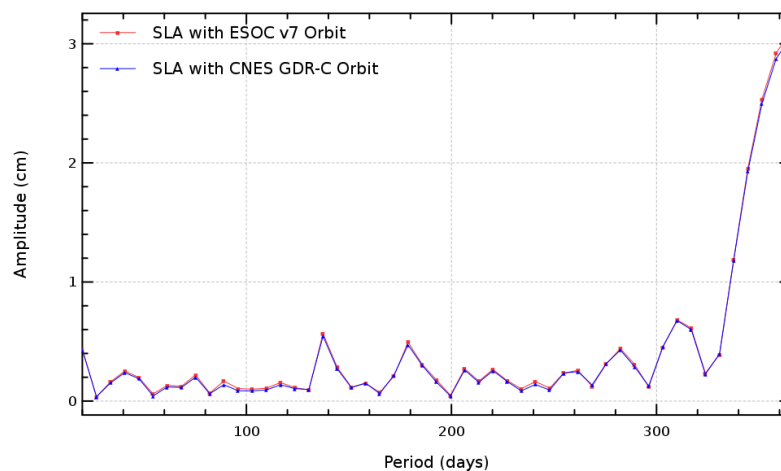
**Description :** The periodogram derived from temporal evolution of SLA (global, northern or southern hemisphere) can be done over all periods or focusing on particular periods, such as annual, semi annual or 60 day signal. Therefore mean of SLA differences are computed (every day or cycle), and time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

Diagnostic type : Global internal analyses

Periodogram of north hemisphere SLA (reference period = 1 year)  
Mission en, cycles 10 to 94



Periodogram of north hemisphere SLA (period = [0, 1 year])  
Mission en, cycles 10 to 94



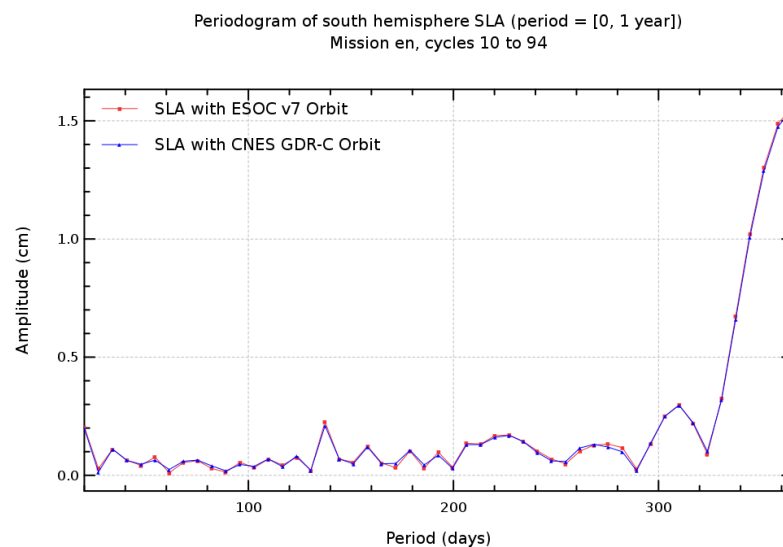
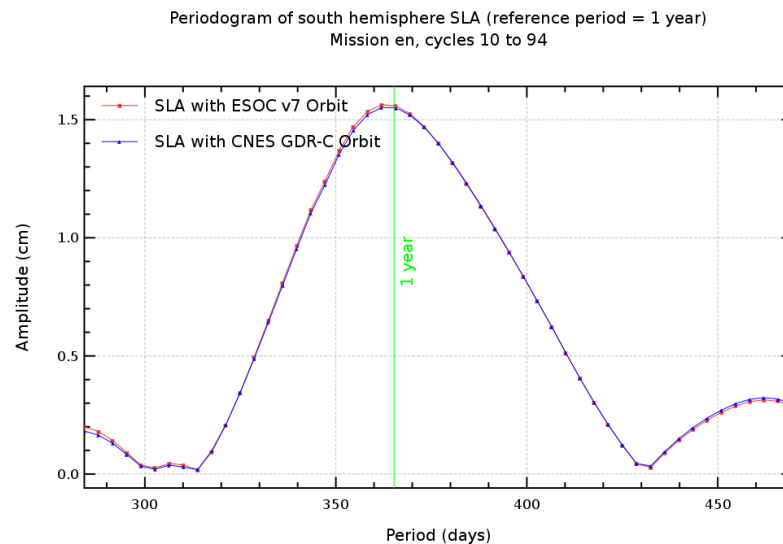
## Diagnostic A206\_c (mission en)

**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



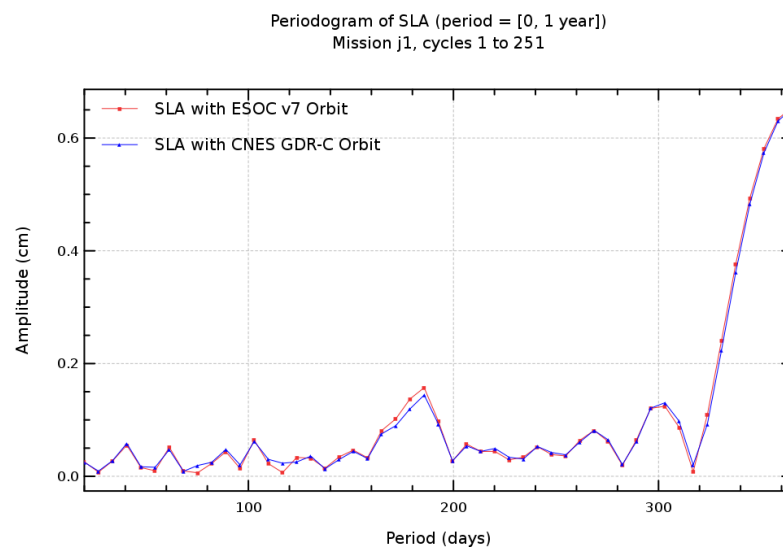
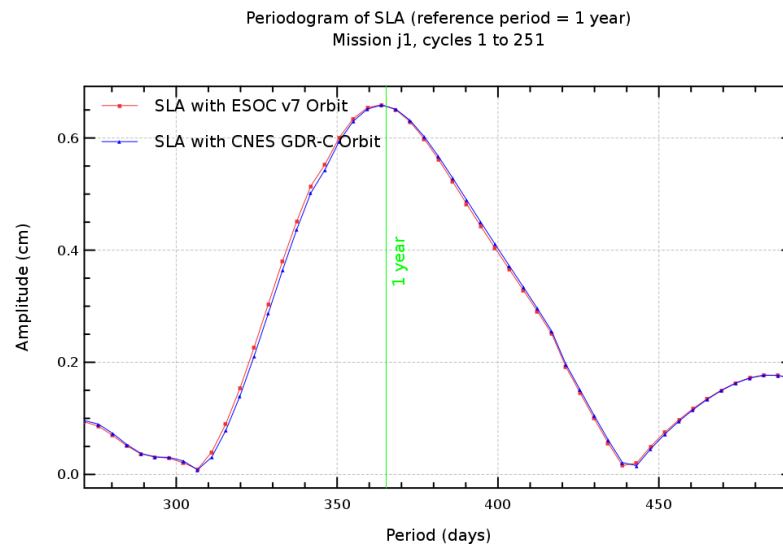
## Diagnostic A206\_a (mission j1)

**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



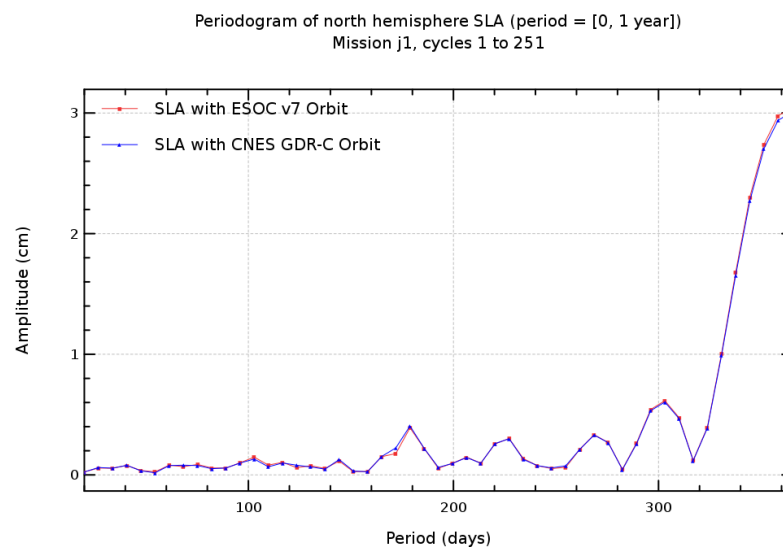
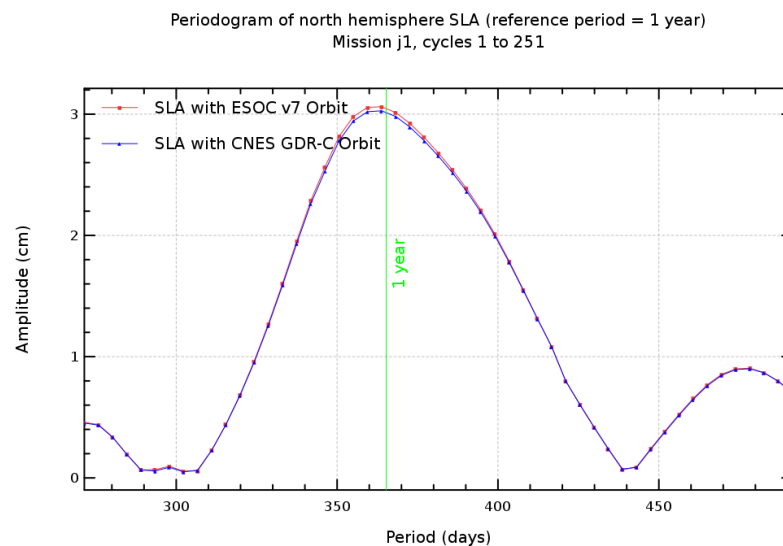
## Diagnostic A206\_b (mission j1)

**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



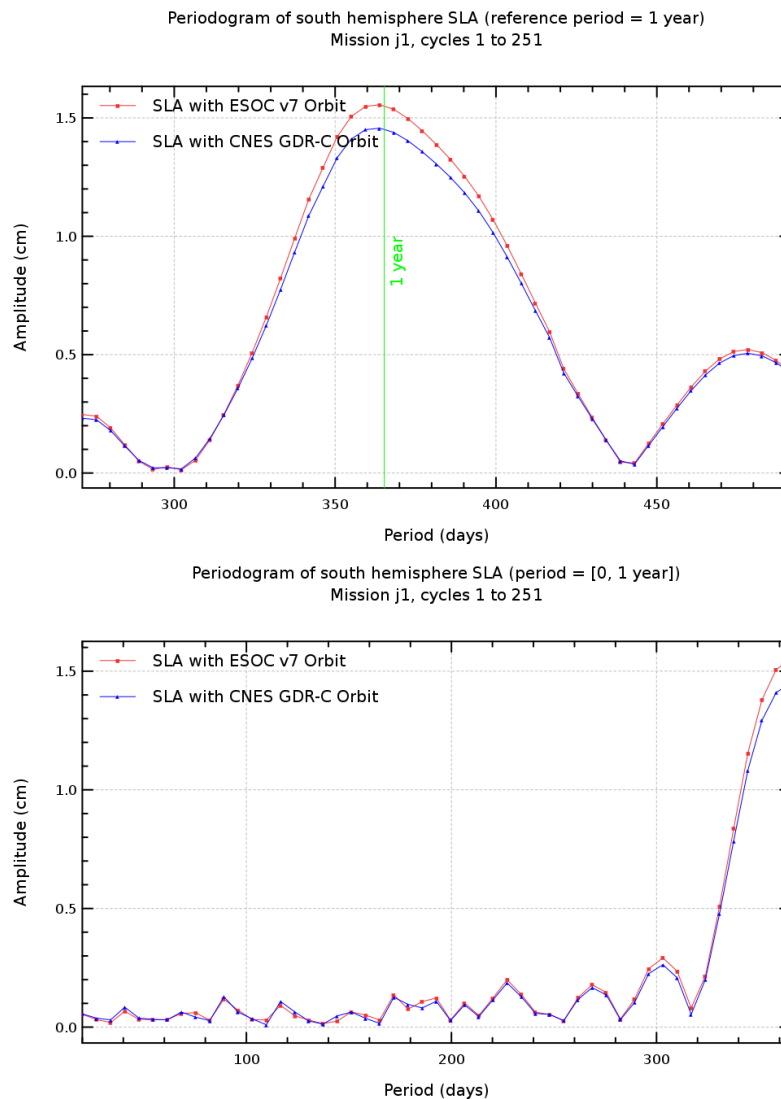
## Diagnostic A206\_c (mission j1)

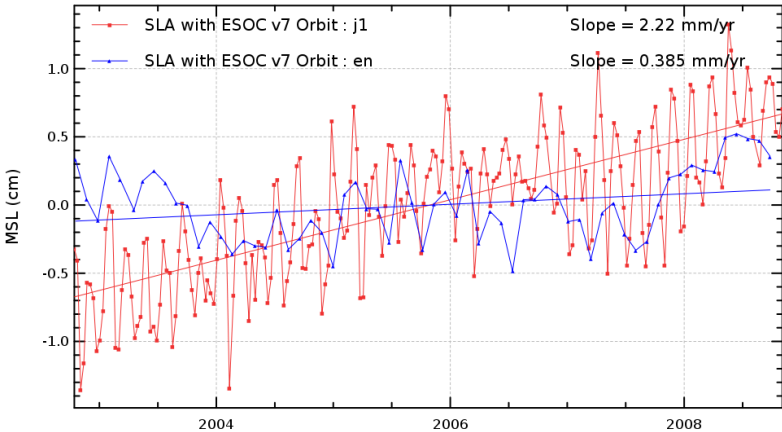
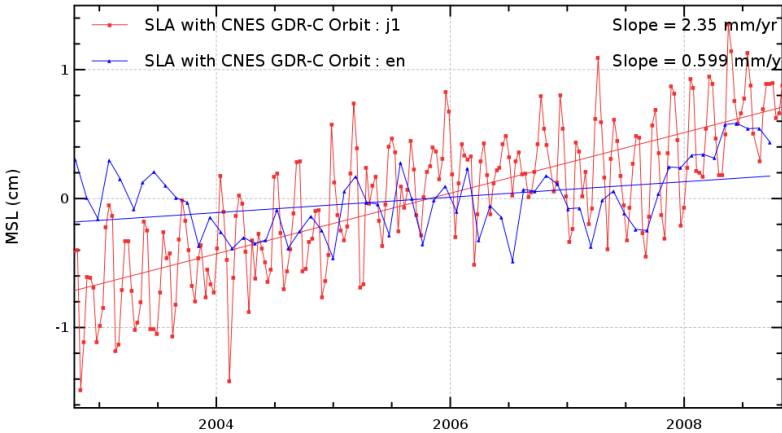
**Name :** Periodogram derived from temporal evolution of Sea Level Anomaly (SLA)

**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 B201_a	
Name : Temporal evolution of Sea level Anomaly (SLA) for 2 missions over the same period	
Input data : Along track SLA	
<p><b>Description :</b> Temporal evolution of SLA statistics (mean, standard deviation) of 2 or more missions are computed over the same period as longest as possible using successively both components in the SLA calculation. This can be done globally, or separating in ascending and descending or in northern and southern hemisphere. In order to assure comparability, statistics are computed using sea level standard calculation (mean per box of 2x2 and weighted by cosine of latitude for the global mean) limited to 66 latitude.</p>	
<div><div><div>Global MSL</div><div>Missions j1 (cycles 28 to 251) and en (cycles 10 to 72)</div><div></div></div><div><div>Global MSL</div><div>Missions j1 (cycles 28 to 251) and en (cycles 10 to 72)</div><div></div></div></div>	

## Diagnostic B201\_b

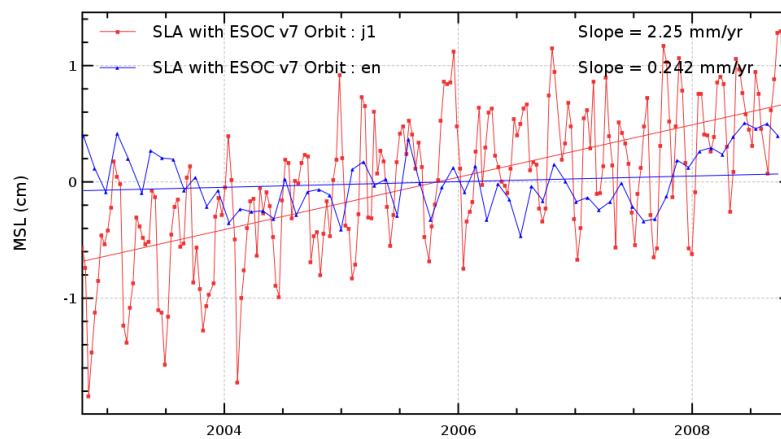
**Name :** Temporal evolution of Sea level Anomaly (SLA) for 2 missions over the same period

**Input data :** Along track SLA

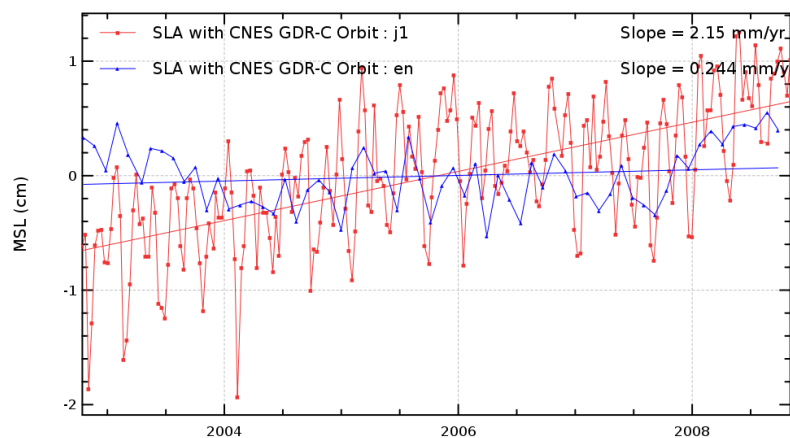
**Description :** Temporal evolution of SLA statistics (mean, standard deviation) of 2 or more missions are computed over the same period as longest as possible using successively both components in the SLA calculation. This can be done globally, or separating in ascending and descending or in northern and southern hemisphere. In order to assure comparability, statistics are computed using sea level standard calculation (mean per box of 2x2 and weighted by cosine of latitude for the global mean) limited to 66 latitude.

Diagnostic type : Global multi-mission comparisons

Global MSL, selecting even pass numbers  
Missions j1 (cycles 28 to 251) and en (cycles 10 to 72)



Global MSL, selecting even pass numbers  
Missions j1 (cycles 28 to 251) and en (cycles 10 to 72)



## Diagnostic B201\_c

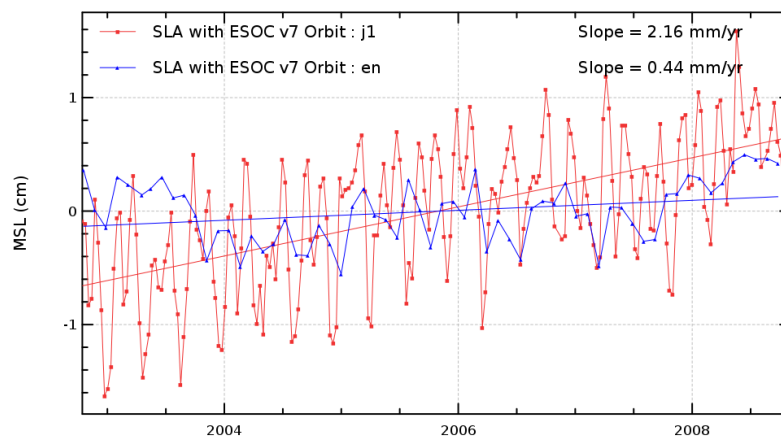
**Name :** Temporal evolution of Sea level Anomaly (SLA) for 2 missions over the same period

**Input data :** Along track SLA

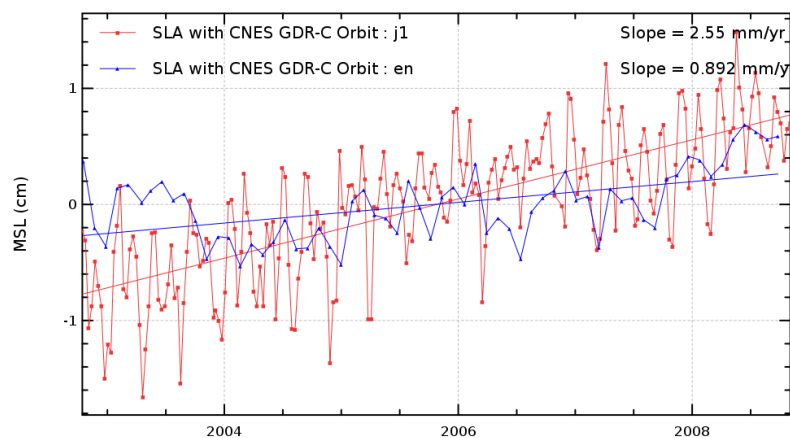
**Description :** Temporal evolution of SLA statistics (mean, standard deviation) of 2 or more missions are computed over the same period as longest as possible using successively both components in the SLA calculation. This can be done globally, or separating in ascending and descending or in northern and southern hemisphere. In order to assure comparability, statistics are computed using sea level standard calculation (mean per box of 2x2 and weighted by cosine of latitude for the global mean) limited to 66 latitude.

Diagnostic type : Global multi-mission comparisons

Global MSL, selecting odd pass numbers  
Missions j1 (cycles 28 to 251) and en (cycles 10 to 72)



Global MSL, selecting odd pass numbers  
Missions j1 (cycles 28 to 251) and en (cycles 10 to 72)



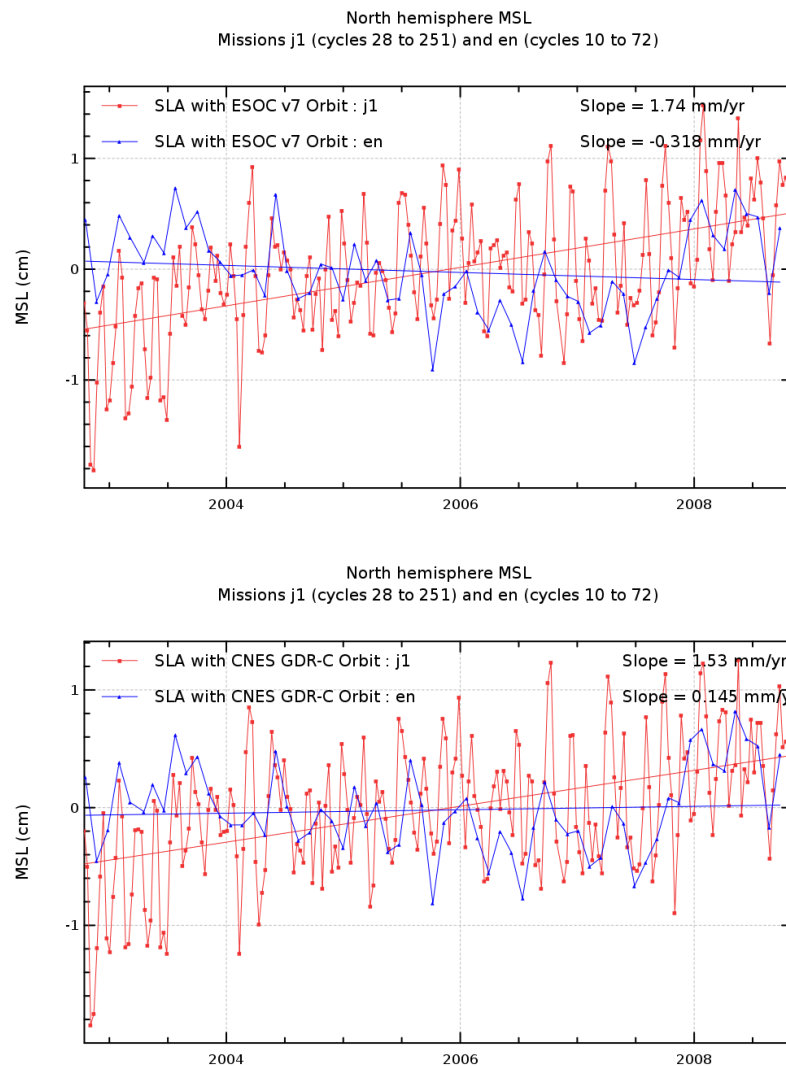
## Diagnostic B201\_d

**Name :** Temporal evolution of Sea level Anomaly (SLA) for 2 missions over the same period

**Input data :** Along track SLA

**Description :** Temporal evolution of SLA statistics (mean, standard deviation) of 2 or more missions are computed over the same period as longest as possible using successively both components in the SLA calculation. This can be done globally, or separating in ascending and descending or in northern and southern hemisphere. In order to assure comparability, statistics are computed using sea level standard calculation (mean per box of 2x2 and weighted by cosine of latitude for the global mean) limited to 66 latitude.

Diagnostic type : Global multi-mission comparisons



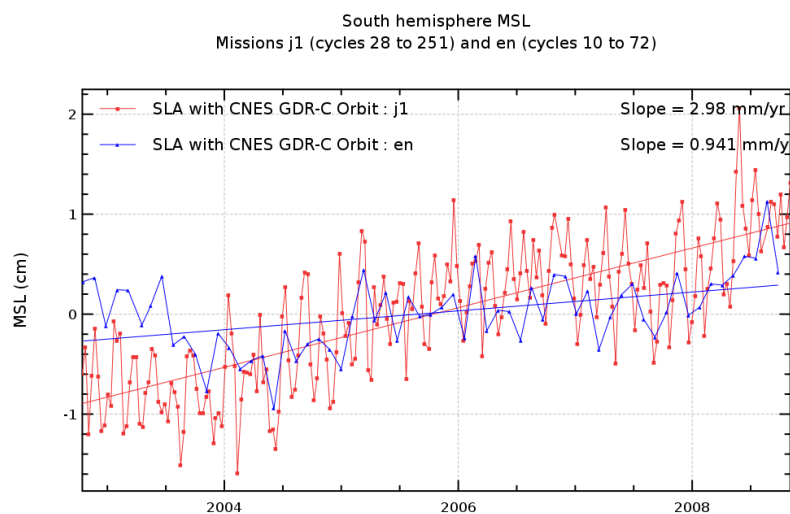
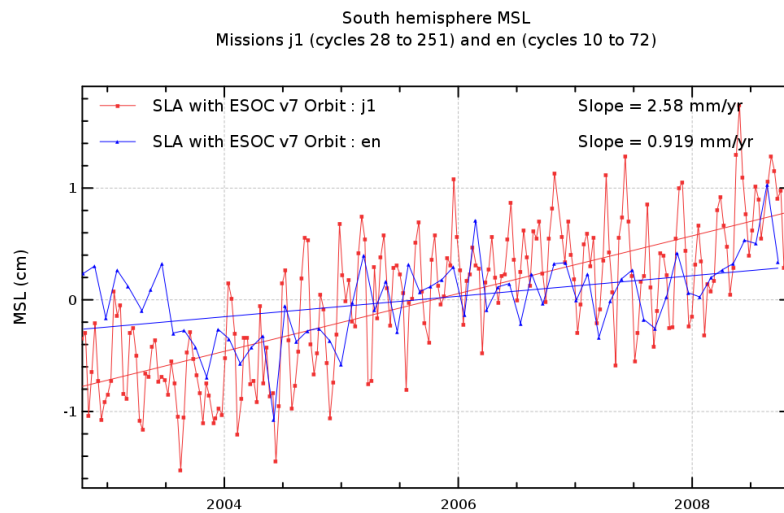
## Diagnostic B201\_e

**Name :** Temporal evolution of Sea level Anomaly (SLA) for 2 missions over the same period

**Input data :** Along track SLA

**Description :** Temporal evolution of SLA statistics (mean, standard deviation) of 2 or more missions are computed over the same period as longest as possible using successively both components in the SLA calculation. This can be done globally, or separating in ascending and descending or in northern and southern hemisphere. In order to assure comparability, statistics are computed using sea level standard calculation (mean per box of 2x2 and weighted by cosine of latitude for the global mean) limited to 66 latitude.

Diagnostic type : Global multi-mission comparisons

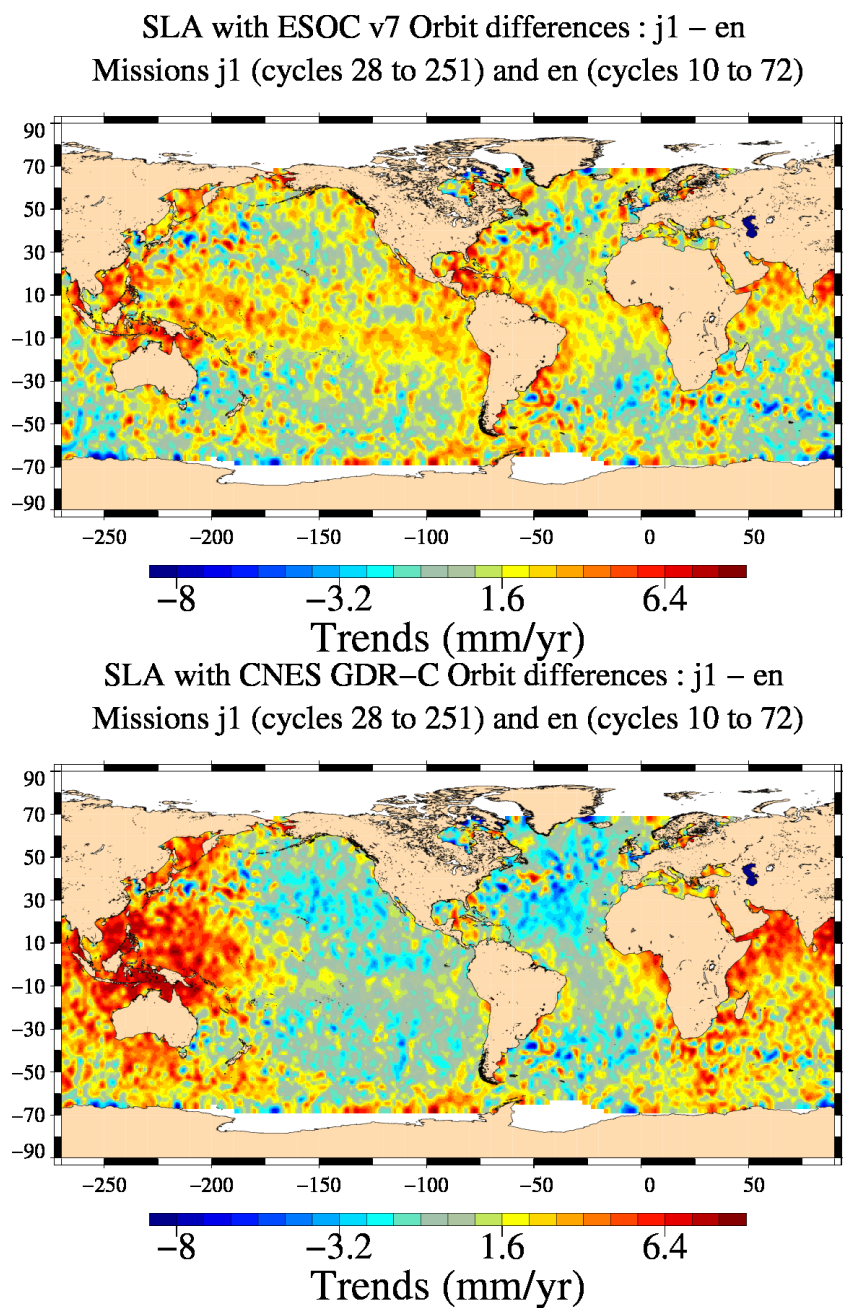


Diagnostic B202\_a

**Name :** Differences between maps of Sea Level Anomaly (SLA) for 2 missions over the same period

**Input data :** Along track SLA

**Description :** The differences between maps of SLA (mean, variance or slope) derived from 2 altimetric missions are computed over the same period (as long as possible) using successively both altimetric components in the SLA calculation. Maps are calculated globally, they can be also calculated separating ascending and descending passes.



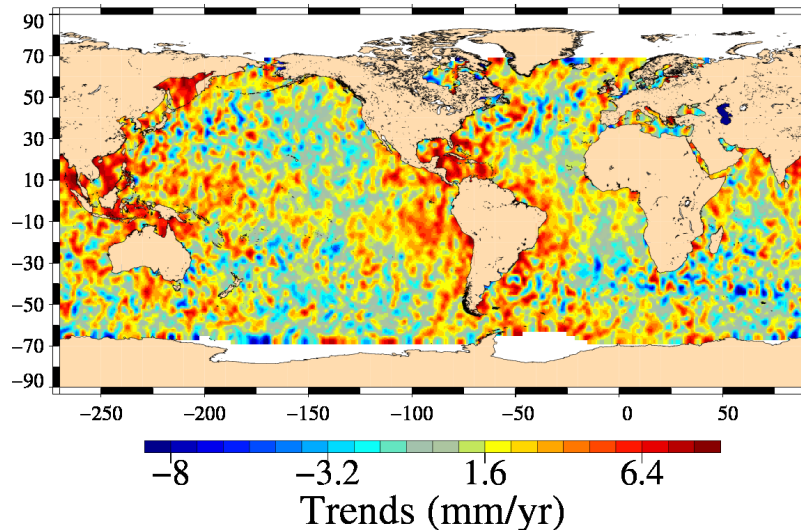
## Diagnostic B202\_b

**Name :** Differences between maps of Sea Level Anomaly (SLA) for 2 missions over the same period

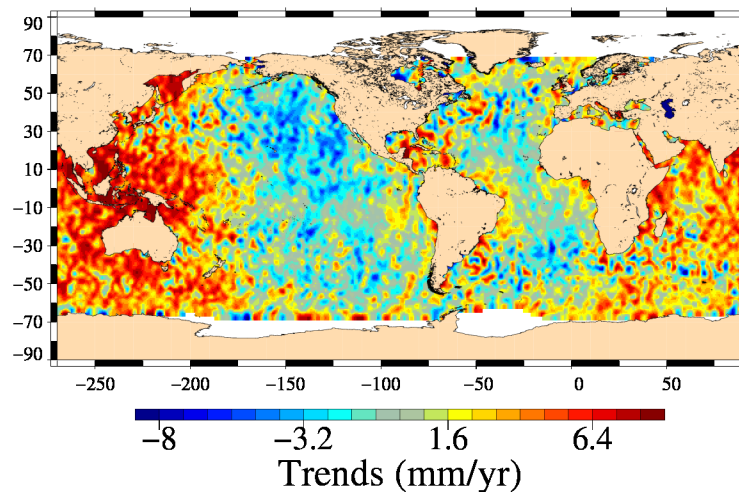
**Input data :** Along track SLA

**Description :** The differences between maps of SLA (mean, variance or slope) derived from 2 altimetric missions are computed over the same period (as long as possible) using successively both altimetric components in the SLA calculation. Maps are calculated globally, they can be also calculated separating ascending and descending passes.

SLA with ESOC v7 Orbit differences : j1 – en, even pass numbers  
Missions j1 (cycles 28 to 251) and en (cycles 10 to 72)



SLA with CNES GDR-C Orbit differences : j1 – en, even pass numbers  
Missions j1 (cycles 28 to 251) and en (cycles 10 to 72)



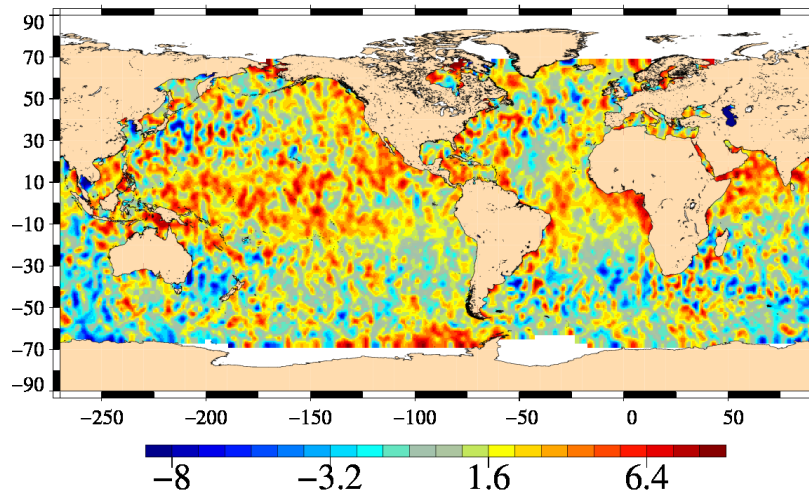
## Diagnostic B202\_c

**Name :** Differences between maps of Sea Level Anomaly (SLA) for 2 missions over the same period

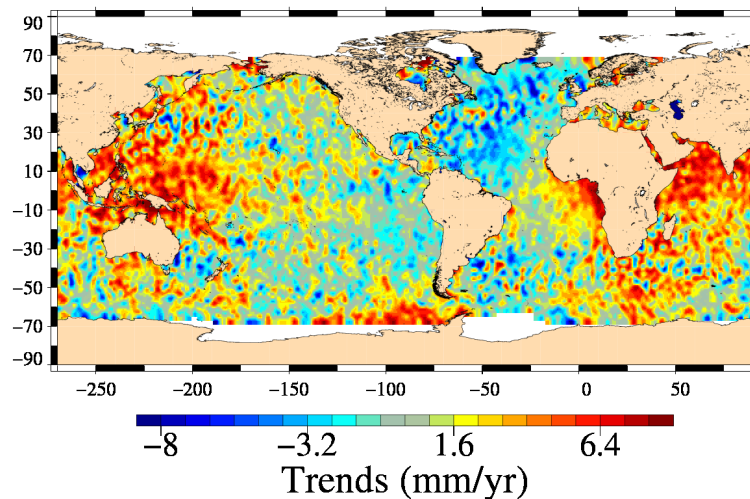
**Input data :** Along track SLA

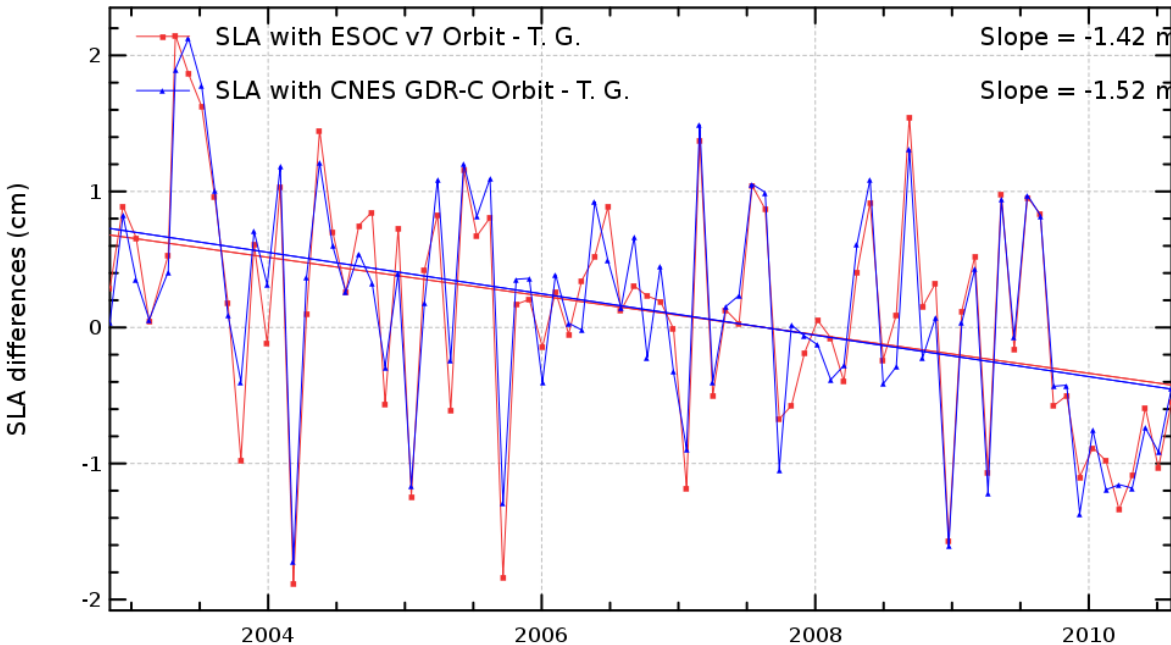
**Description :** The differences between maps of SLA (mean, variance or slope) derived from 2 altimetric missions are computed over the same period (as long as possible) using successively both altimetric components in the SLA calculation. Maps are calculated globally, they can be also calculated separating ascending and descending passes.

SLA with ESOc v7 Orbit differences : j1 – en, odd pass numbers  
Missions j1 (cycles 28 to 251) and en (cycles 10 to 72)



Trends (mm/yr)  
SLA with CNES GDR-C Orbit differences : j1 – en, odd pass numbers  
Missions j1 (cycles 28 to 251) and en (cycles 10 to 72)



Diagnostic type : Altimetry and in-situ data comparison	Diagnostic C001 (mission en)						
	Name : Temporal evolution of SSH differences between tide gauges and altimetry measurements						
	Input data : Tide gauges SSH measurements						
	Description : The temporal evolution of global statistics (mean, variance, slope) of SSH differences between tide gauges and altimeter measurements are calculated from a cyclic way (altimeter repetitivity) using successively both altimetric components in SSH calculation. The altimetric and tide gauges data are colocated with criteria of maximum of correlation, and tide gauges used are derived from global networks (GLOSS/CLIVAR, REFMAR).						
	<div>SLA differences : altimetry measurements - tide gauges Mission en, cycles 10 to 94</div>  <p>The graph displays the Sea Level Anomaly (SLA) differences between altimetry measurements and tide gauge data from 2004 to 2010. The y-axis represents SLA differences in centimeters, ranging from -2 to 2. The x-axis shows years from 2004 to 2010. Two data series are plotted: 'SLA with ESOC v7 Orbit - T. G.' (red line with square markers) and 'SLA with CNES GDR-C Orbit - T. G.' (blue line with square markers). Both series show significant inter-annual variability. Linear regression lines are shown for each series, with slopes of -1.42 cm/yr for the ESOC v7 orbit and -1.52 cm/yr for the CNES GDR-C orbit.</p> <table><caption>Summary of SLA Differences Data</caption><tr><th>Orbit</th><th>Slope (cm/yr)</th></tr><tr><td>ESOC v7 Orbit - T. G.</td><td>-1.42</td></tr><tr><td>CNES GDR-C Orbit - T. G.</td><td>-1.52</td></tr></table>		Orbit	Slope (cm/yr)	ESOC v7 Orbit - T. G.	-1.42	CNES GDR-C Orbit - T. G.
Orbit	Slope (cm/yr)						
ESOC v7 Orbit - T. G.	-1.42						
CNES GDR-C Orbit - T. G.	-1.52						

## Diagnostic C001 (mission j1)

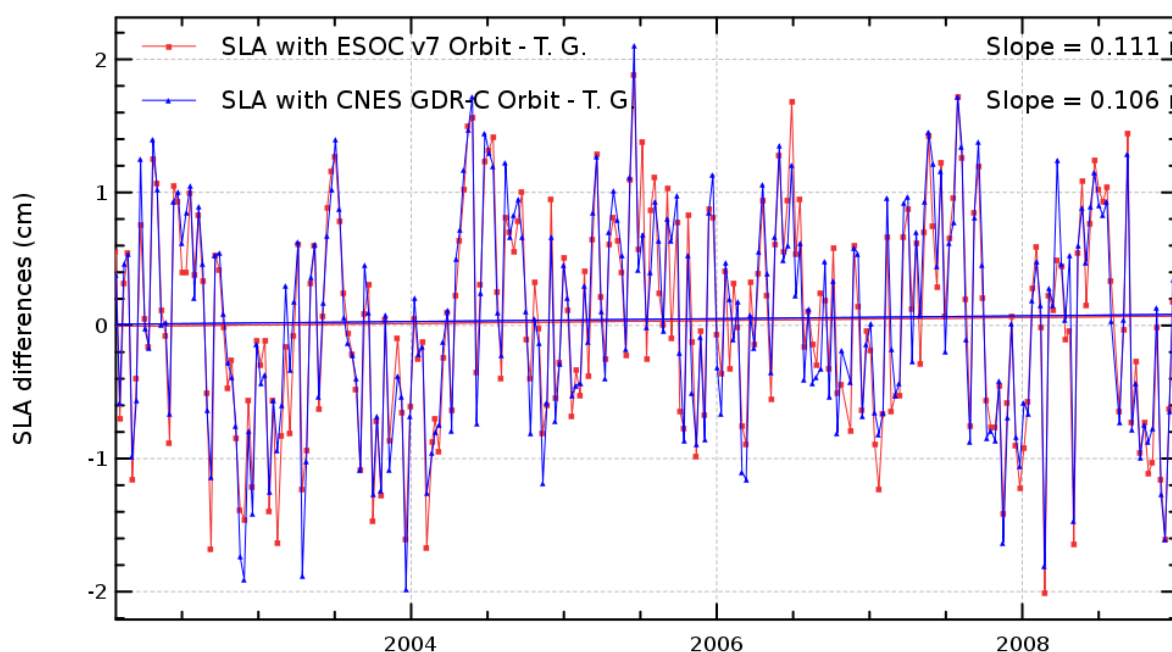
**Name :** Temporal evolution of SSH differences between tide gauges and altimetry measurements

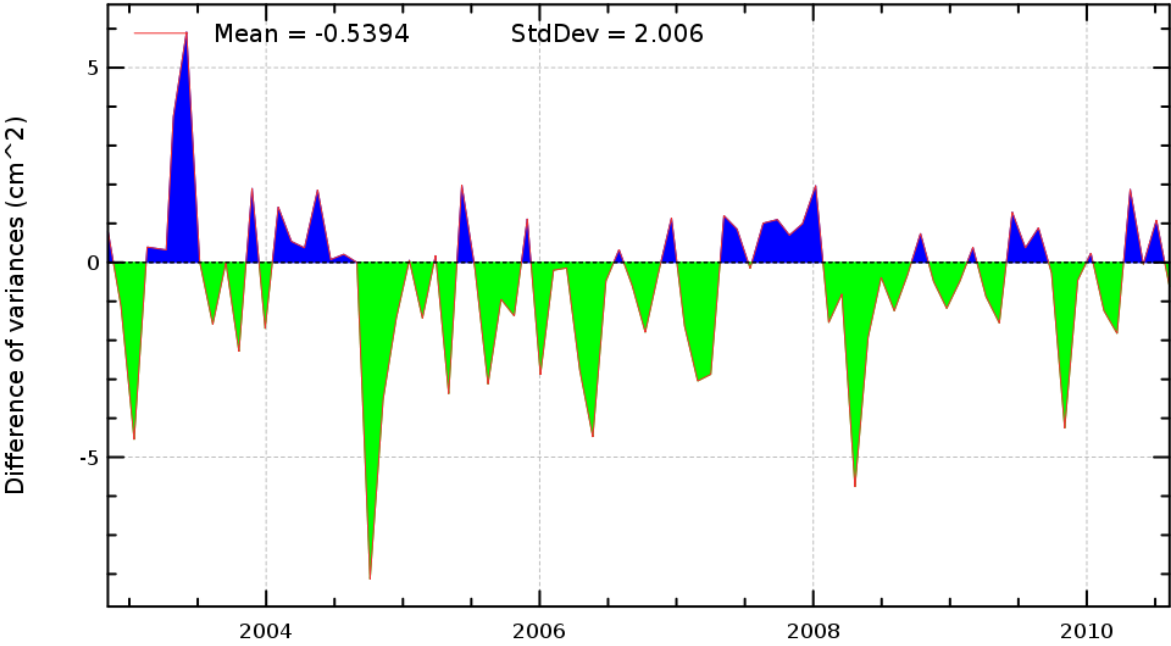
**Input data :** Tide gauges SSH measurements

**Description :** The temporal evolution of global statistics (mean, variance, slope) of SSH differences between tide gauges and altimeter measurements are calculated from a cyclic way (altimeter repetivity) using successively both altimetric components in SSH calculation. The altimetric and tide gauges data are colocated with criteria of maximum of correlation, and tide gauges used are derived from global networks (GLOSS/CLIVAR, REFMAR).

Diagnostic type : Altimetry and in-situ data comparison

SLA differences : altimetry measurements - tide gauges  
Mission j1, cycles 1 to 251



Diagnostic C002 (mission en)	
Name : Differences of temporal evolution of SSH differences between tide gauges and altimetry measurements	
Input data : Tide gauges SSH measurements	
Description : The difference between temporal evolution of global statistics of differences between tide gauge and altimeter data differences are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in altimetric SSH calculation. The altimetric and tide gauges data are collocated with criteria of maximum of correlation, and tide gauges used are derived from global networks as GLOSS/CLIVAR.	
<div>Difference of variances : VAR(SLA with ESOC v7 Orbit - T. G.) - VAR(SLA with CNES GDR-C Orbit - T. G.) Mission en, cycles 10 to 94</div> <div></div>	

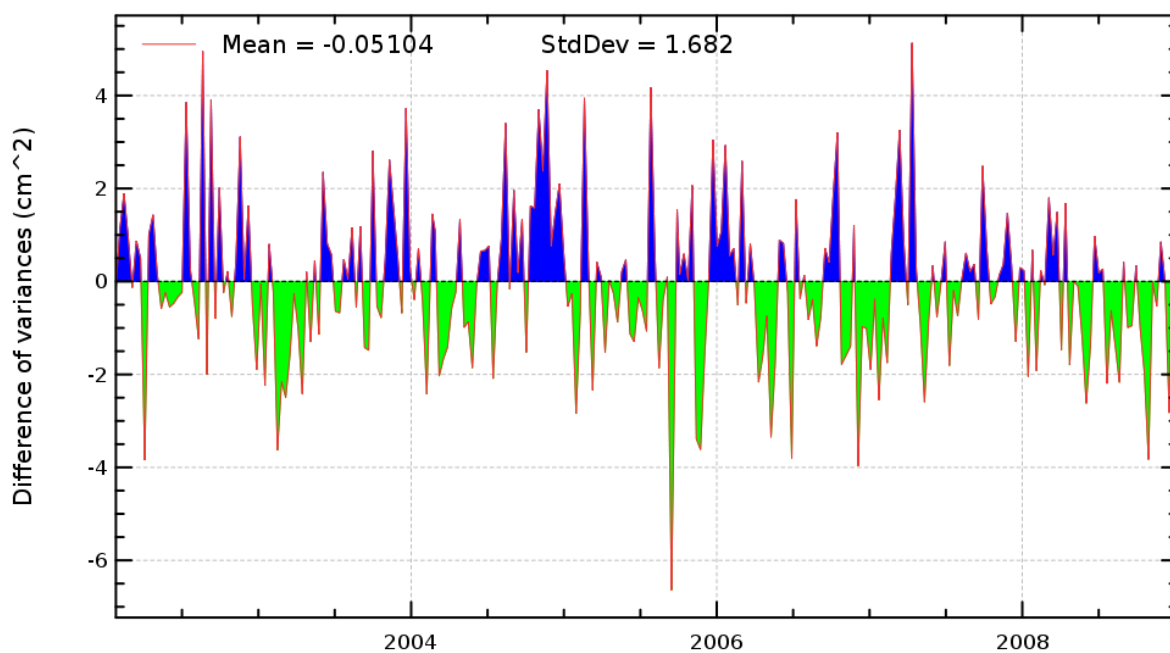
## Diagnostic C002 (mission j1)

**Name :** Differences of temporal evolution of SSH differences between tide gauges and altimetry measurements

**Input data :** Tide gauges SSH measurements

**Description :** The difference between temporal evolution of global statistics of differences between tide gauge and altimeter data differences are calculated from a cyclic way (altimeter repetivity, daily, weekly, monthly) using successively both altimetric components in altimetric SSH calculation. The altimetric and tide gauges data are collocated with criteria of maximum of correlation, and tide gauges used are derived from global networks as GLOSS/CLIVAR.

Difference of variances :  $\text{VAR}(\text{SLA with ESOC v7 Orbit} - \text{T. G.}) - \text{VAR}(\text{SLA with CNES GDR-C Orbit} - \text{T. G.})$   
Mission j1, cycles 1 to 251



Diagnostic C003 (mission en)	
Name : Periodogram derived from temporal evolution of SSH differences between tide gauges and altimetry	
Input data : Tide gauges SSH measurements	
Description : The periodogram derived from temporal evolution of altimetric and tide gauges SSH differences is calculated using successively both altimetric components in the altimetric SSH. The periodogram is calculated from the mean or variance statistics and it can be displayed for all the whole time period or a dedicated one	
<div>Periodogram of SLA differences : altimetry measurements - tide gauges (ref. period = 1 year) Mission en, cycles 10 to 94</div> <p>This line graph shows the amplitude of SLA differences versus period in days for a reference period of 1 year. The x-axis ranges from 250 to 500 days, and the y-axis ranges from 0.0 to 0.4 cm. Two data series are plotted: 'SLA with ESOC v7 Orbit - T. G.' (red line with square markers) and 'SLA with CNES GDR-C Orbit - T. G.' (blue line with triangle markers). Both series show a prominent peak at approximately 370 days, with a vertical blue line labeled '1 year' at this position. The amplitude at the peak is about 0.4 cm. There are smaller peaks around 310 days and 460 days.</p> <div>Periodogram of SLA differences : altimetry measurements - tide gauges (period = [0, 1 year]) Mission en, cycles 10 to 94</div> <p>This line graph shows the amplitude of SLA differences versus period in days for a period range of [0, 1 year]. The x-axis ranges from 0 to 350 days, and the y-axis ranges from 0.0 to 0.4 cm. The same two data series are plotted. The graph shows multiple peaks, with the highest peak at approximately 150 days, reaching an amplitude of about 0.35 cm. Other significant peaks occur at approximately 100, 200, and 300 days.</p>	

## Diagnostic C003 (mission j1)

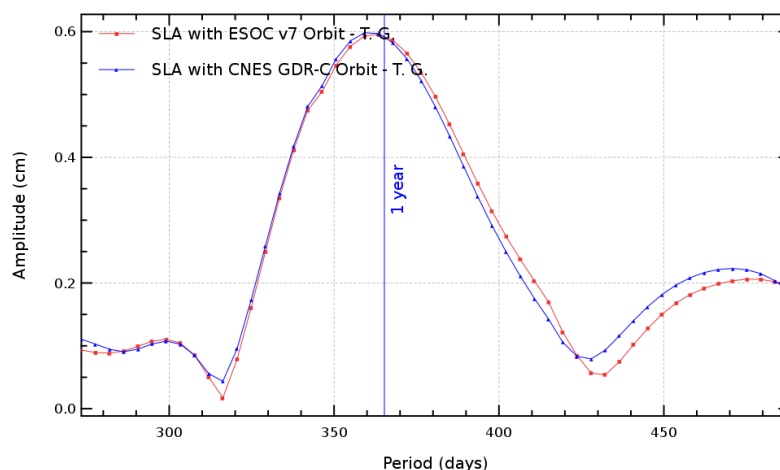
**Name :** Periodogram derived from temporal evolution of SSH differences between tide gauges and altimetry

**Input data :** Tide gauges SSH measurements

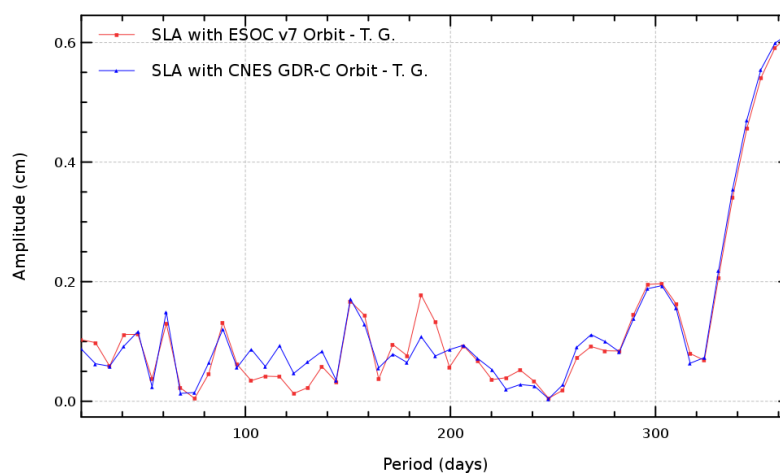
**Description :** The periodogram derived from temporal evolution of altimetric and tide gauges SSH differences is calculated using successively both altimetric components in the altimetric SSH. The periodogram is calculated from the mean or variance statistics and it can be displayed for all the whole time period or a dedicated one

Diagnostic type : Altimetry and in-situ data comparison

Periodogram of SLA differences : altimetry measurements - tide gauges (ref. period = 1 year)  
Mission j1, cycles 1 to 251



Periodogram of SLA differences : altimetry measurements - tide gauges (period = [0, 1 year])  
Mission j1, cycles 1 to 251



**Diagnostic C004 (mission en)**

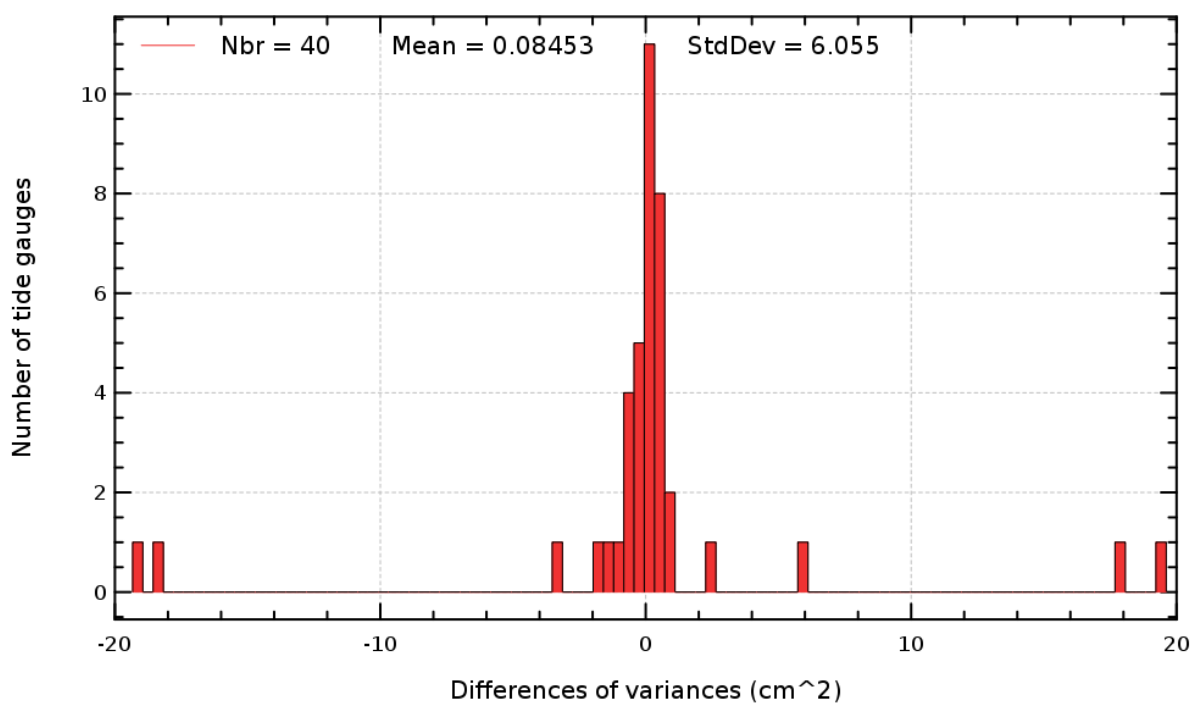
**Name :** Histograms of differences between tide gauges and altimeter SSH differences

**Input data :** Tide gauges SSH measurements

**Description :** The difference of histograms between altimeter and tide gauge SSH differences is computed from the elementary statistics (mean, variance) at each tide gauge using successively both altimetric components in the altimetry SSH.

Diagnostic type : Altimetry and in-situ data comparison

gram of the difference of variances :  $\text{VAR}(\text{SLA with ESOC v7 Orbit} - \text{T. G.}) - \text{VAR}(\text{SLA with CNES GDR-C C})$   
Mission en, cycles 10 to 94



## Diagnostic C004 (mission j1)

**Name :** Histograms of differences between tide gauges and altimeter SSH differences

**Input data :** Tide gauges SSH measurements

**Description :** The difference of histograms between altimeter and tide gauge SSH differences is computed from the elementary statistics (mean, variance) at each tide gauge using successively both altimetric components in the altimetry SSH.

gram of the difference of variances :  $\text{VAR}(\text{SLA with ESOC v7 Orbit} - \text{T. G.}) - \text{VAR}(\text{SLA with CNES GDR-C C})$   
Mission j1, cycles 1 to 251

