# The impact of Saral/Altika wave data on the wave forecasting system of Météo-France : update

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***Saral/Altika first verification workshop , Toulouse 27-29 August 2013***

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# OUTLINE

1- Motivation

2- Data quality control

3- Test runs

4- Results

5- Conclusions

# motivation

- Only Jason-2 is used in the operational wave forecasting system : the need of using one more altimeter is crucial in order to get more accurate sea state parameters

- Evaluate the impact of the assimilation of Saral/Altika wave data on the wave forecasting System

- Assessement of data quality control procedure

- Preparing Saral/Altika wave data for operational use

# Saral/Altika wave data and QC procedure

- **Saral NRT products are downloaded in NETCDF format from ftp.saral.oceanobs.com : period 31 March to 1 August 2013**

- **Quality control procedure is implemented to prepare the data the assimilation in the wave model :**

| | |
|---|---|
| Land flag | 0 |
| RMS_SWH/4.15 | <=0.3 m |
| SWH Min | 0.5 m |
| SWH Max | 13 m |
| Ice flag | 0 |
| σ0 Min | 5 db |
| σ0 Max | 30 db |
| Number of valid pointd | >=35 |

**Threshhold values in red as for Jason-2**

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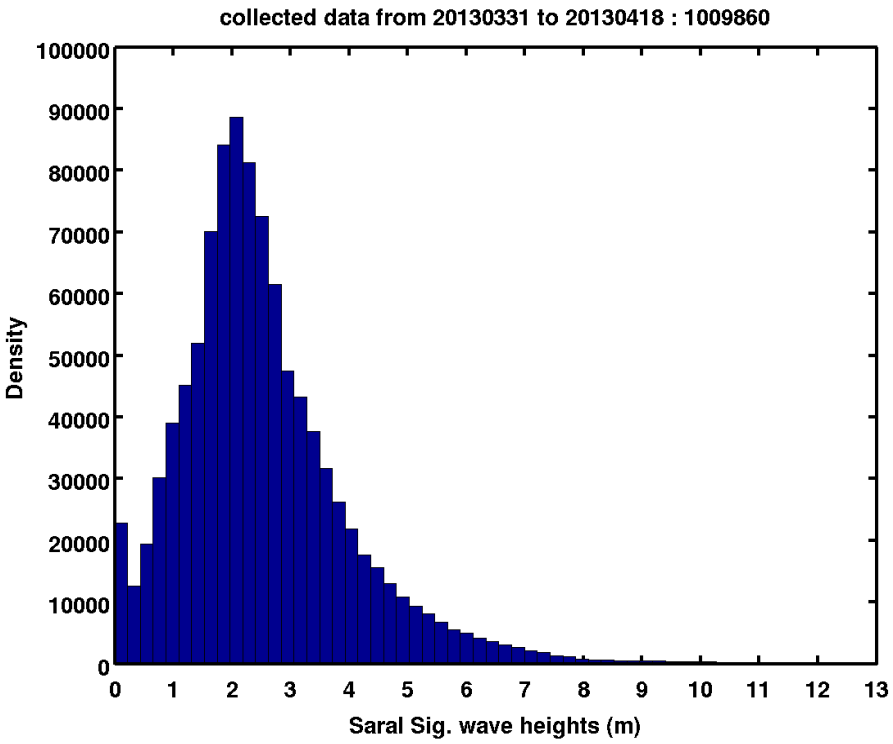
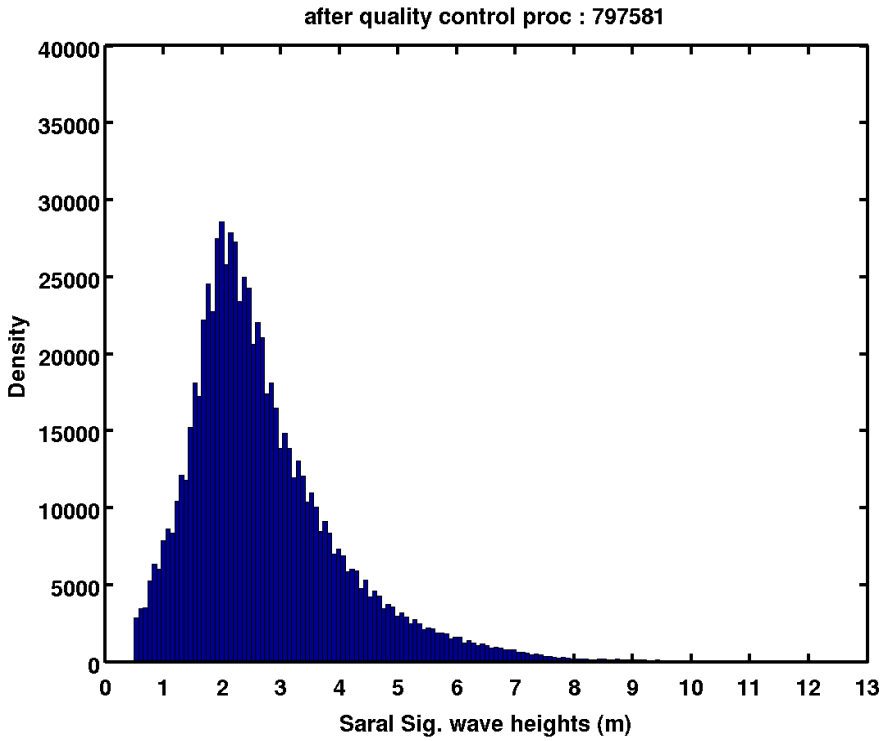
# Example of QC check (cycle 1 : 31/03 to 18/04)




**Before QC**
**Nb of data : 1009860**

**After QC**
**Nb of data : 797581**

→ ~21 % Saral Sig. Wave heights are rejected before the assimilation

**Histograms of Saral sig. wave heights**

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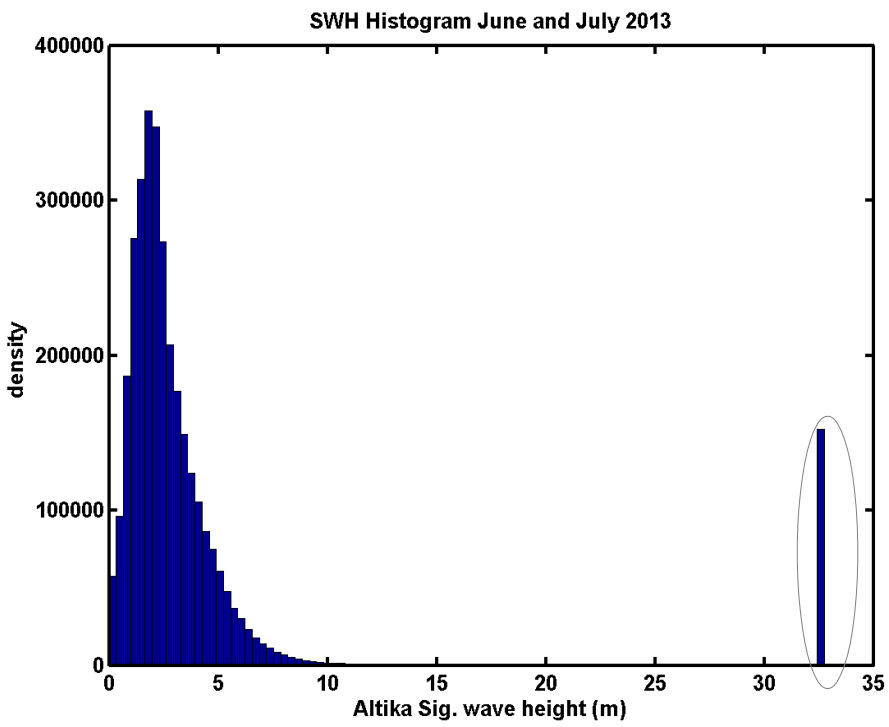
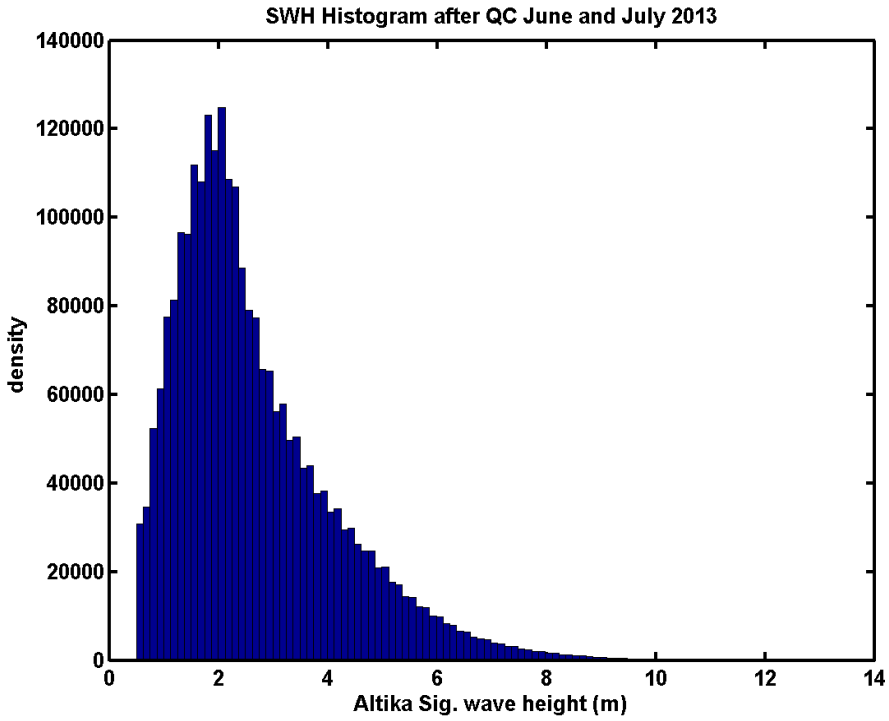
# Example of QC check (June and July 2013)




**Before QC**
**Nb of data : 3272808**

**After QC**
**Nb of data : 2516442**

→ ~23 % Saral Sig. Wave heights are rejected before the assimilation

**Histograms of Saral sig. wave heights**

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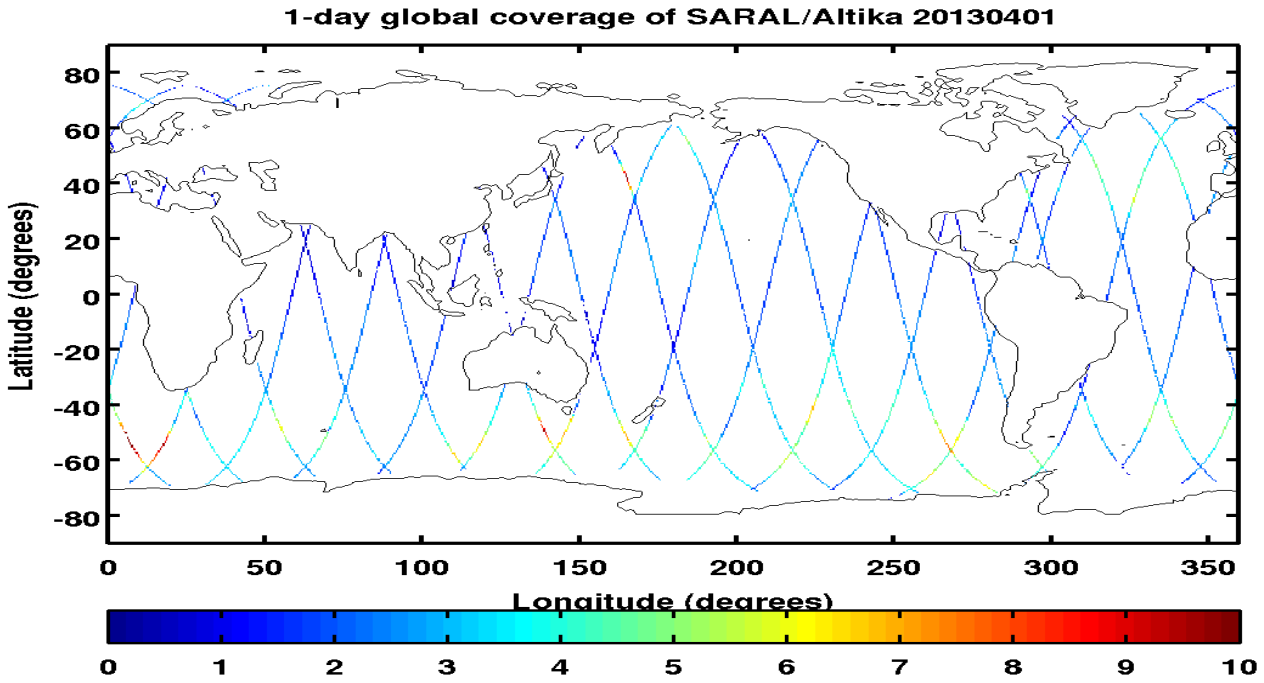
# Distribution of Saral data on wave model grid

- Assimilation of altimeters
  - → Optimal interpolation on SWH (Significant wave height)
  - → Correction of wave spectra using empirical laws and assumptions




**Saral wave obs are collocated with model grid points : Super-observations**

**Example of 1-day global coverage of SARAL Sig. wave height (~5800)**

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# Description of runs :
# from 31 March 2013 to 1 August 2013

- **Test runs set-up**
  - Wave model MFWAM (global coverage 0.5x0.5° irregular grid), wave spectrum in 24 frequencies (starting 0.035 Hz) et 24 directions
  - ECMWF analyzed winds every 6 hours
  - Assimilation time step 6 hours

→ **Assimilation** of Saral/Altika Sig. wave heights

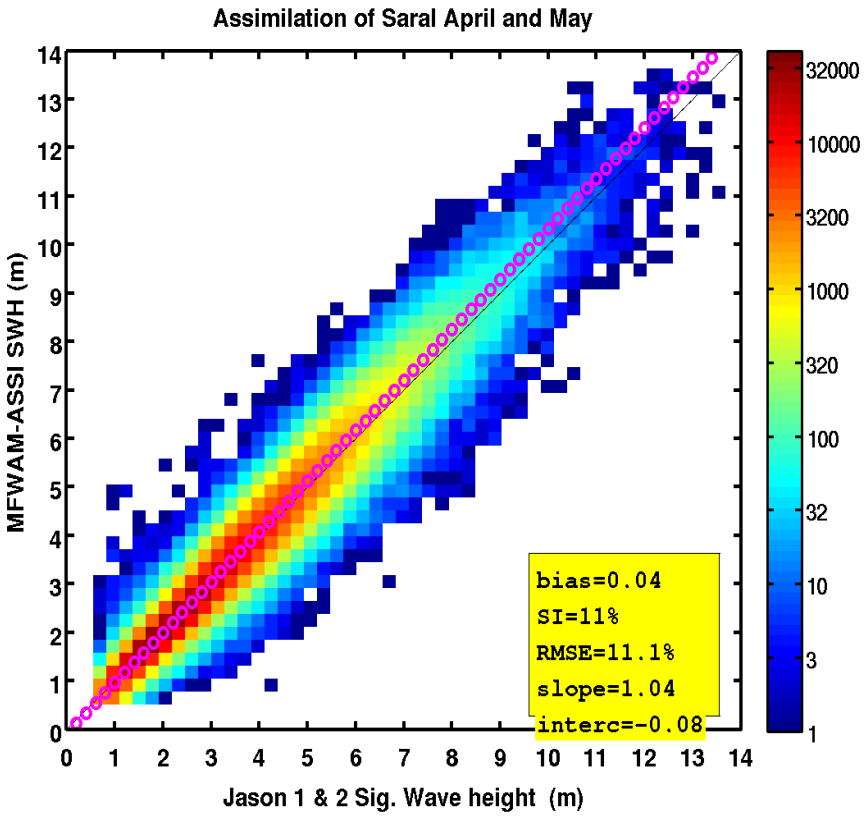
→ **Assimilation** of Saral and Jason-2 sig. wave heights

→ Outputs from the operational forecasting system (**MFWAM with assimilation of Jason 1 & 2**)

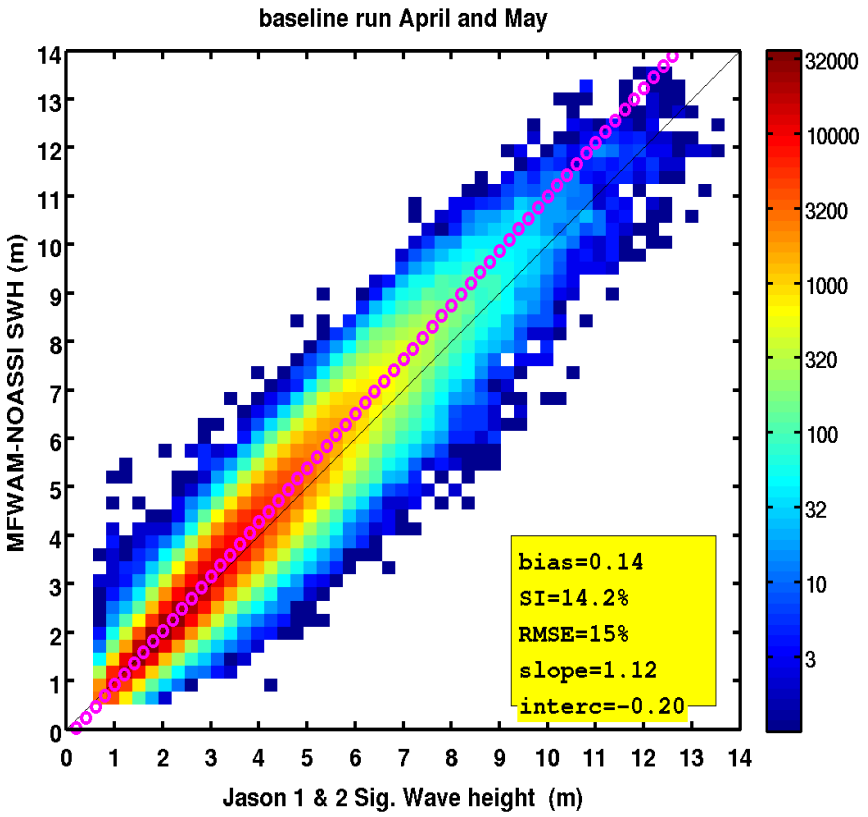
→ **Baseline** run of MFWAM without assimilation

# Assimilation of Saral/Altika Sig. Wave heights Validation with Jason 1 &2

Assimilation of Saral




Without assimilation




Bias = 0.04
SI = 11%
RMSE = 11.1%
Slope = 1 .04
Intercept = -0.08

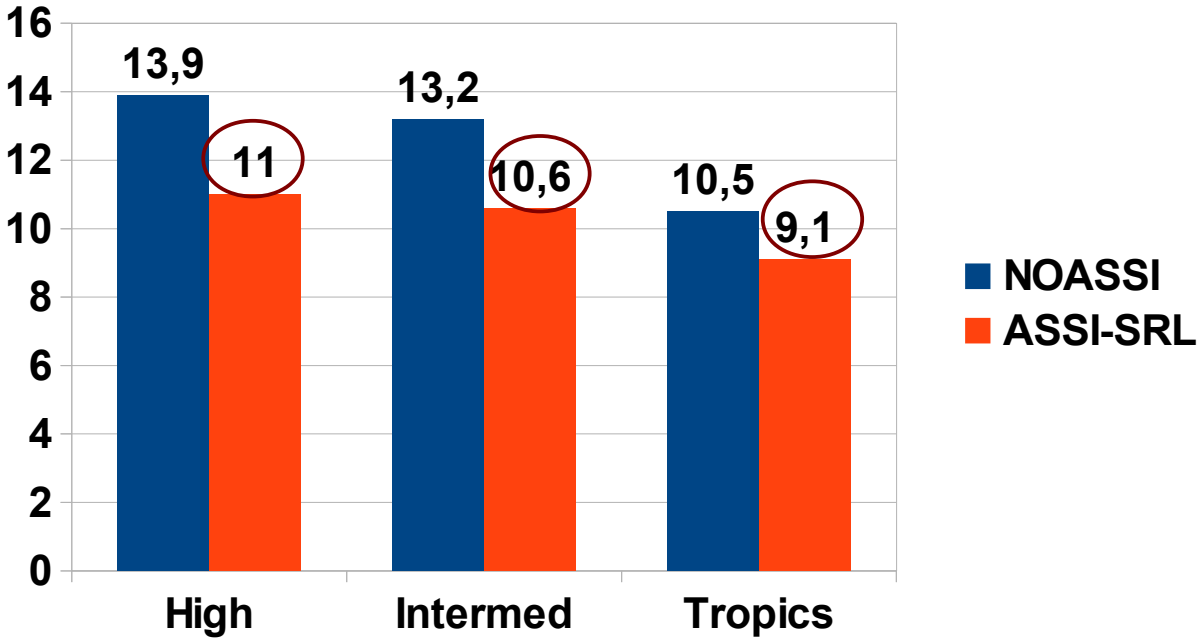
Data collected : 792877

April and May 2013

Bias=0.14
SI=14.2%
RMSE=15%
Slope=1.12
Intercept=-0.20

# Assimilation of SARAL/Altika in MFWAM in different ocean basins : April and May

Scatter Index of SWH (%)




| | High | Intermed | Tropics |
|---|---|---|---|
| Collected data : | 290257 | 311068 | 191552 |

High Lat |Φ|> 50°
Intermediate lat 20°<|Φ|<50°
Tropics |Φ|<20°

Validation with Jason 1 & 2

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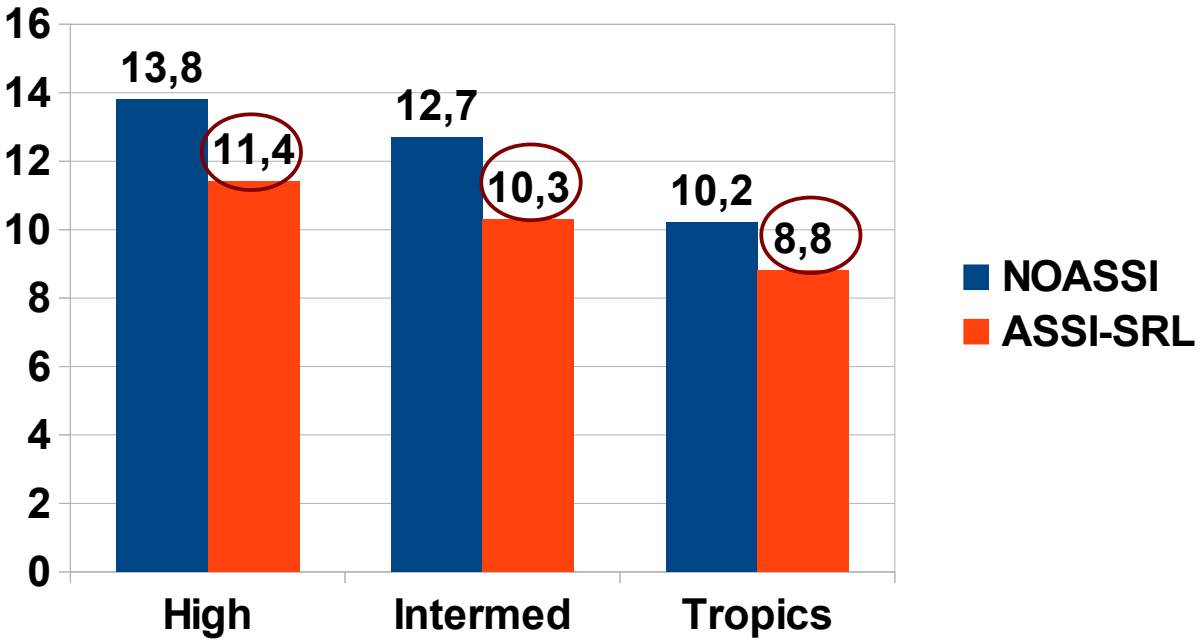
# Assimilation of SARAL/Altika in MFWAM in different ocean basins : June and July

Scatter Index of SWH (%)




Collected data : 156454 213471 135645

High Lat |Φ|> 50°
Intermediate lat 20°<|Φ|<50°
Tropics |Φ|<20°

Validation with Jason 1 & 2

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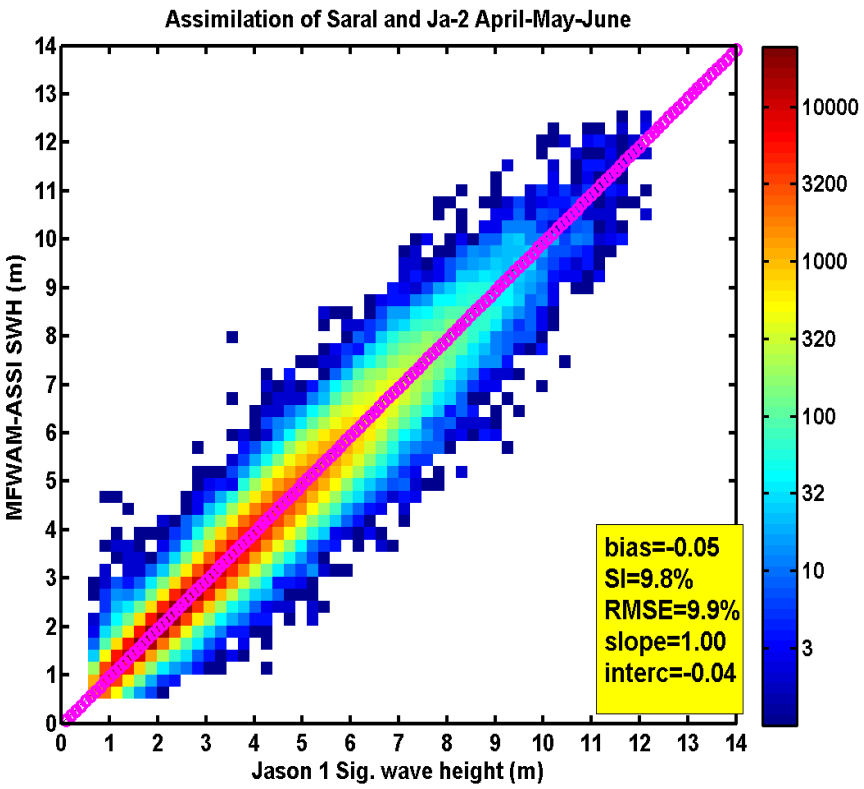
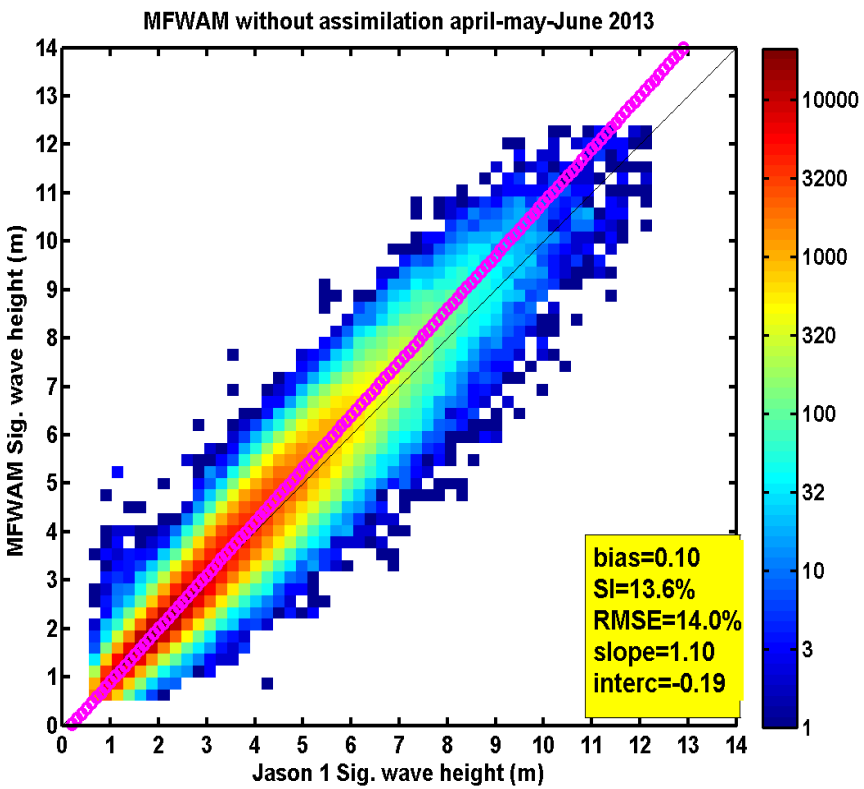
# Assimilation of Saral and Jason-2 Sig. Wave heights : Validation with Jason-1

Assimilation of SRL and JA-2




Without assimilation




Bias = -0.05
SI = 9.8%
RMSE = 9.9%
Slope = 1 .00
Intercept = -0.04

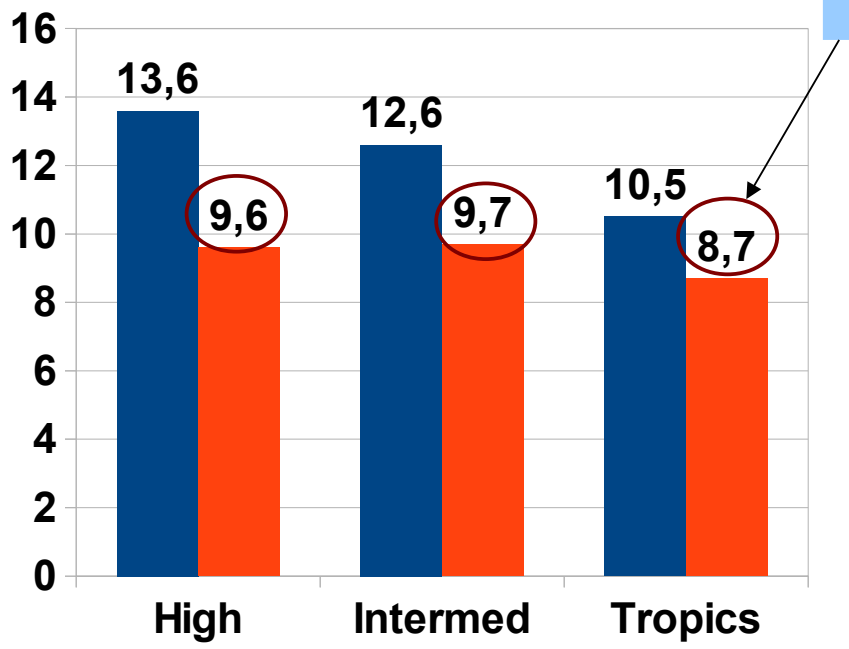
**Data collected : 533551**

**April-May-June 2013**

Bias=0.10
SI=13.7%
RMSE=14.2%
Slope=1.10
Intercept=-0.21

# Assimilation of Saral and Jason-2 in MFWAM in different ocean basins : April, May and June (until 21)

Scatter Index of SWH (%)




great performance !

Collected data : 189097 212371 132083

Validation with Jason-1

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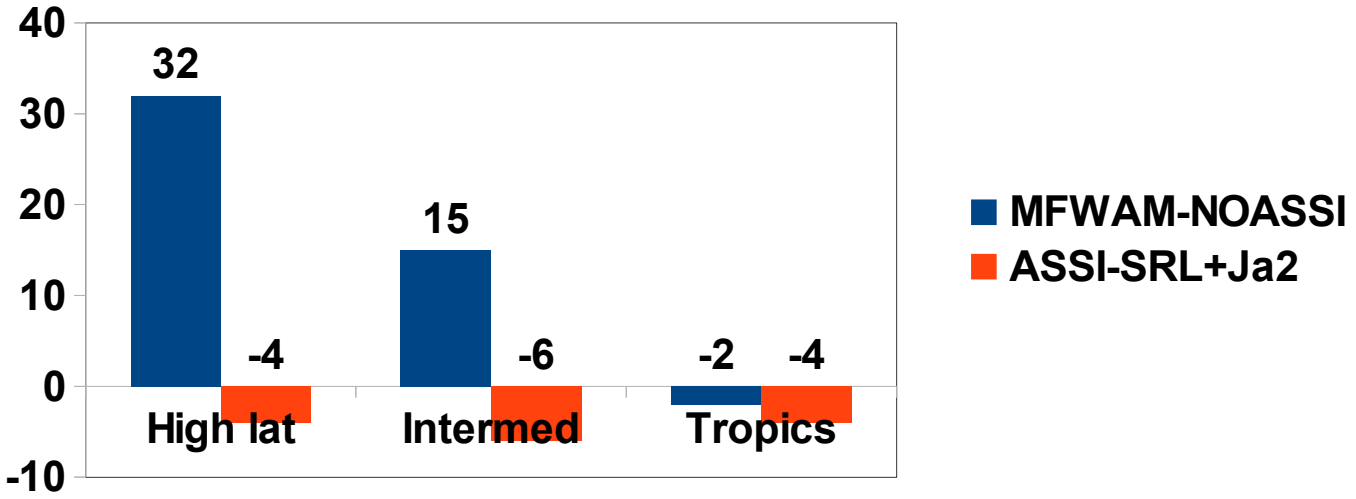
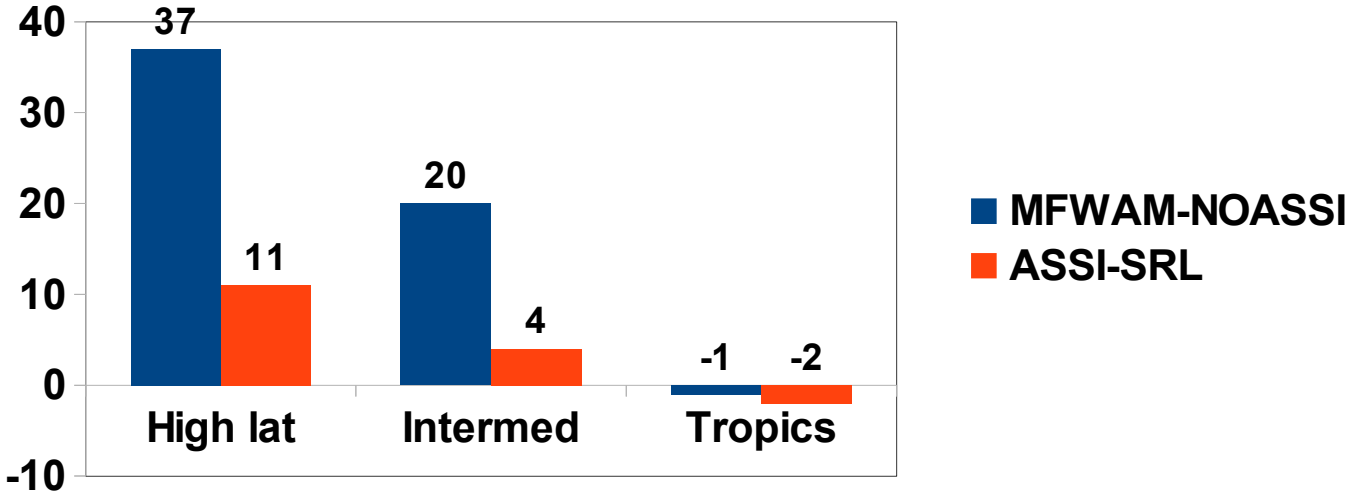
# Bias of MFWAM in Southern Hemisphere

Bias in cm




Bias in cm

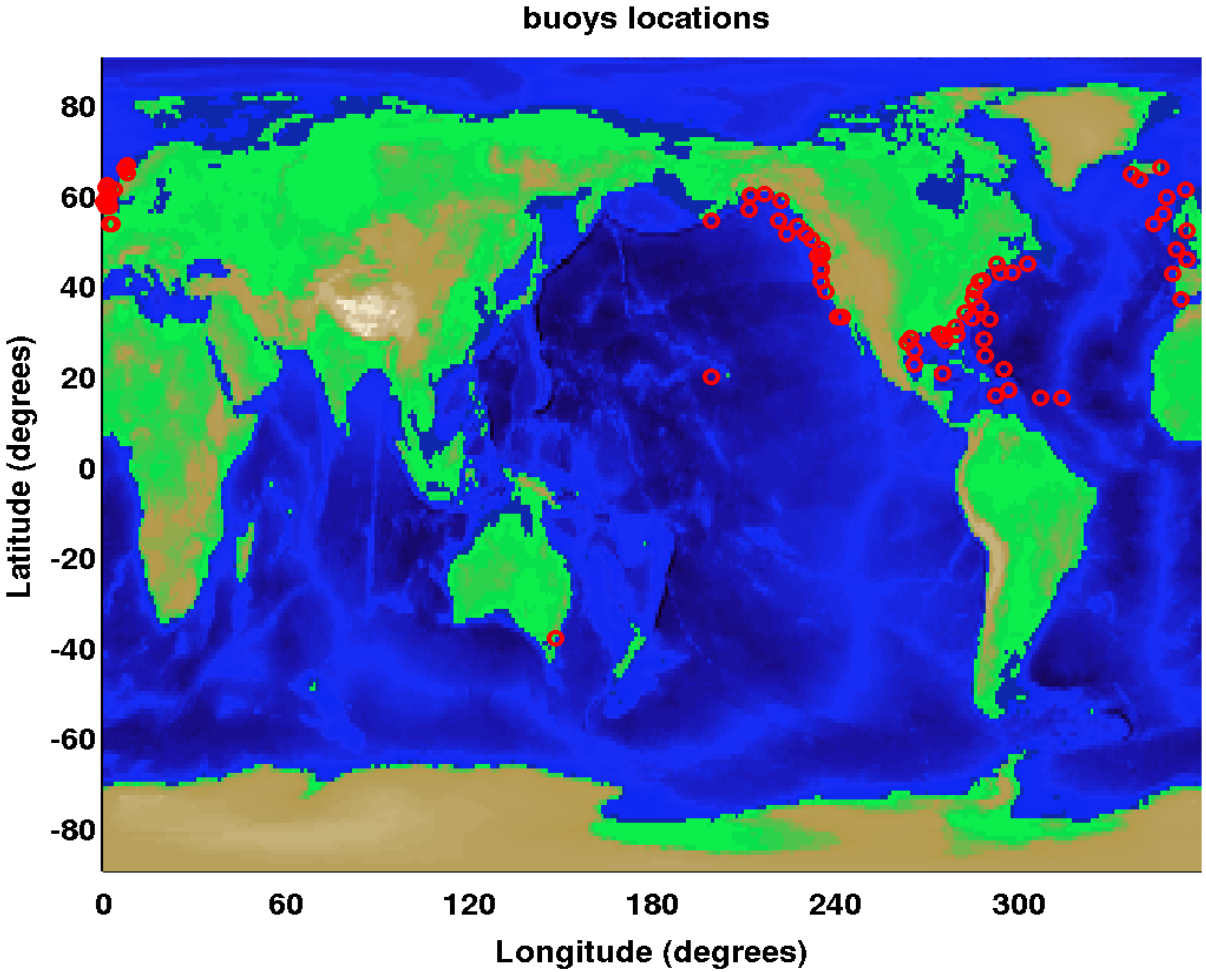


# VALIDATION OF SWH WITH BUOYS DATA

**Data are collected from the JCOMM model intercomparison archive produced by J. Bidlot (ECMWF))**

Bouée 03FR le 16 mars 1999

Photo Météo-France

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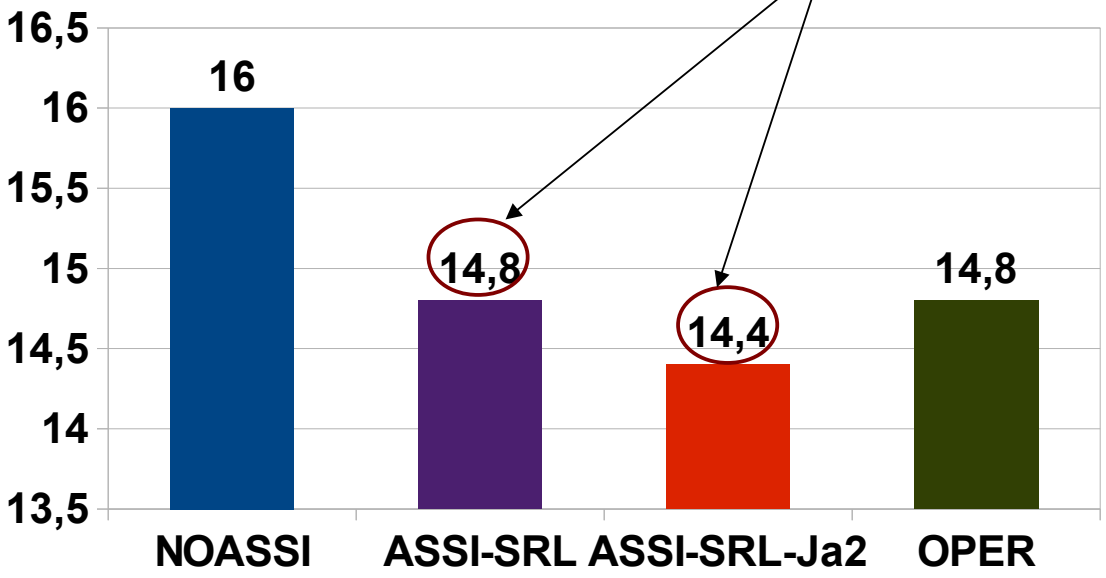
# Validation with buoys Sig. Wave heights

Use of Saral is very promising !

Scatter index of SWH (%)




**NOASSI : without assimilation**
**ASSI-SRL : assimilation of SARAL/Altika**
**ASSI-SRL-JA2 : assimilation of SARAL and Jason-2**
**OPER : Operational MFWAM with assimilation of Jason-1 & 2**

April-May-June 2013 (29005 collected data)

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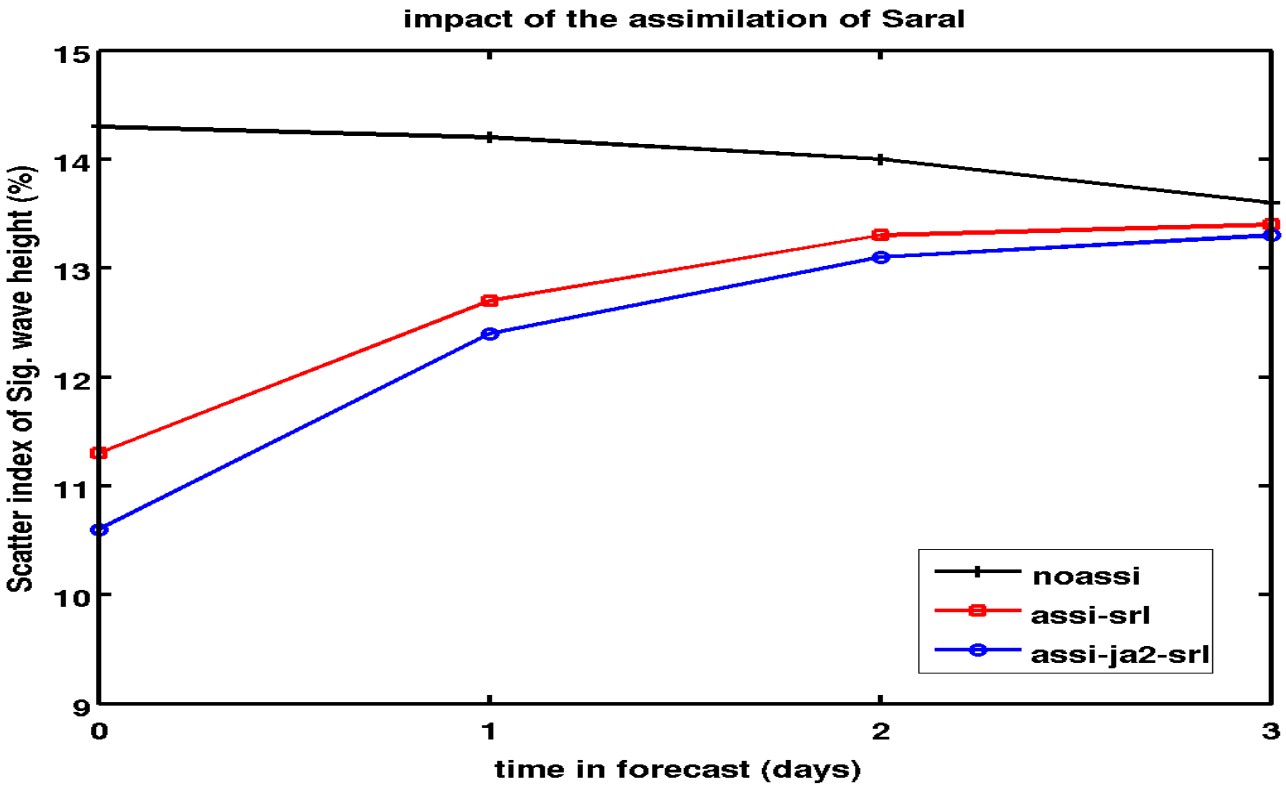
# The impact of the assimilation in the period of forecast Sig. Wave heights

Scatter index of SWH (%)




**1 is 0-24h average period, 2 is 24-48h,…**

Blue : assimilation of Saral and Jason-2
Red : assimilation of Saral only
Black : without assimilation

**Comparison with Jason 1 & 2**

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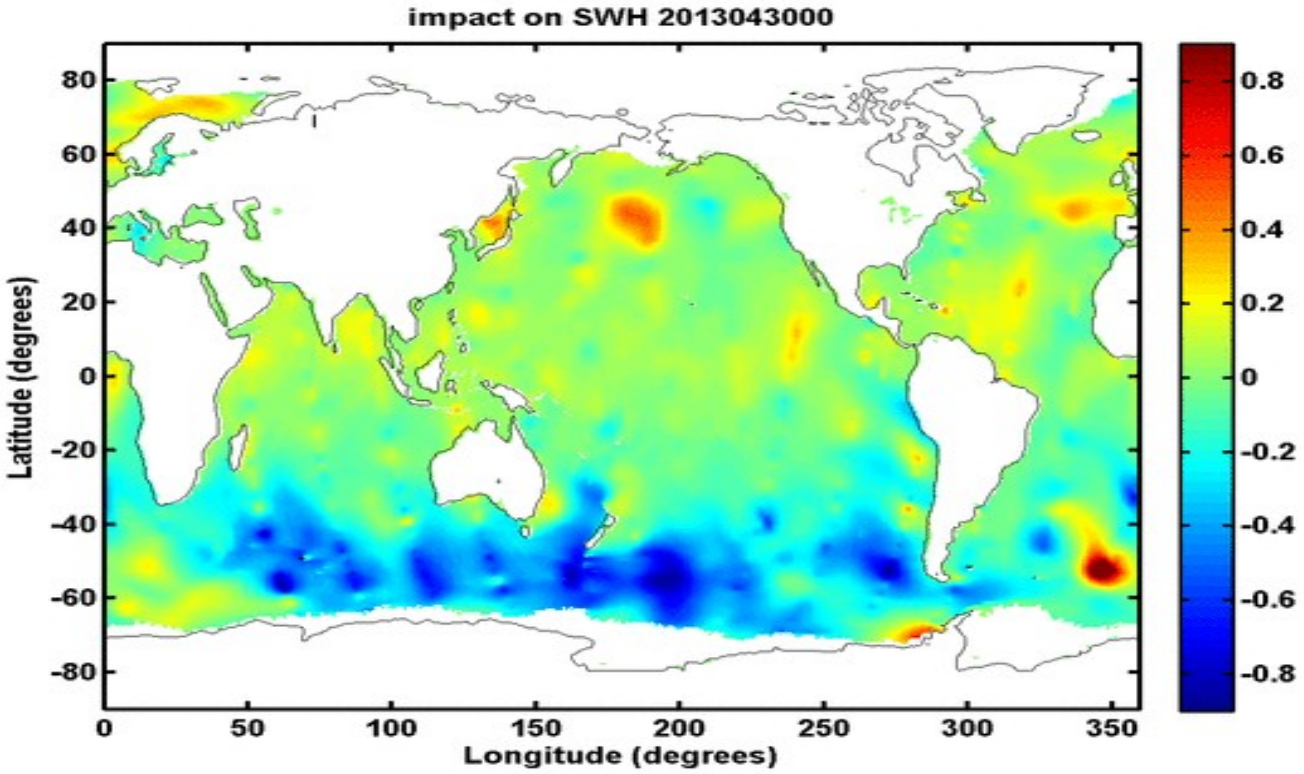
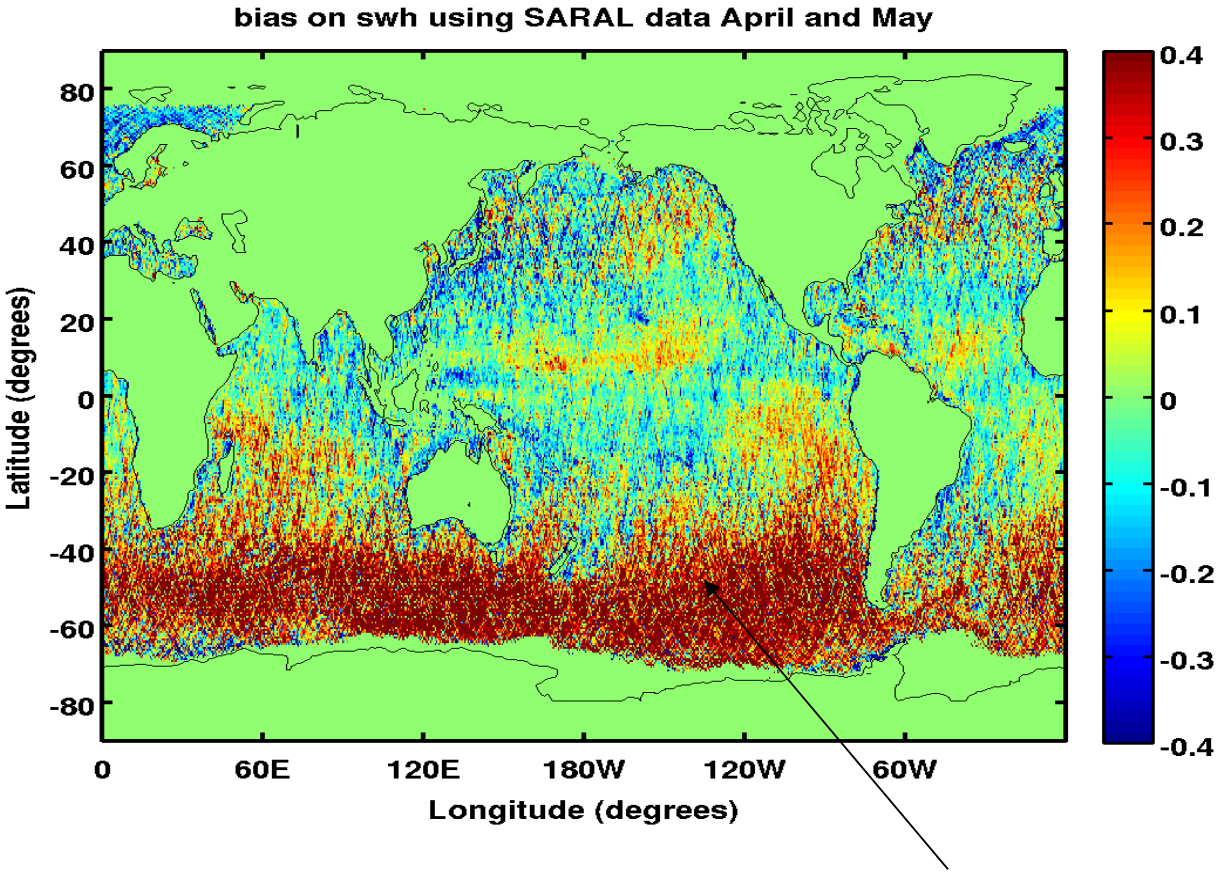
# The impact of the assimilation of Saral/Altika SWH : Forecast period




**Difference between runs of MFWAM with and without assimilation**

**2-day forecast starting from 30 April 2013, by step of 6 hours**

# Validation MFWAM Operational with SARAL Sig. Wave heights




**MFWAM without assimilation**

**High positive bias of SWH in South. Hemis.**

**Bias map for April and May 2013**

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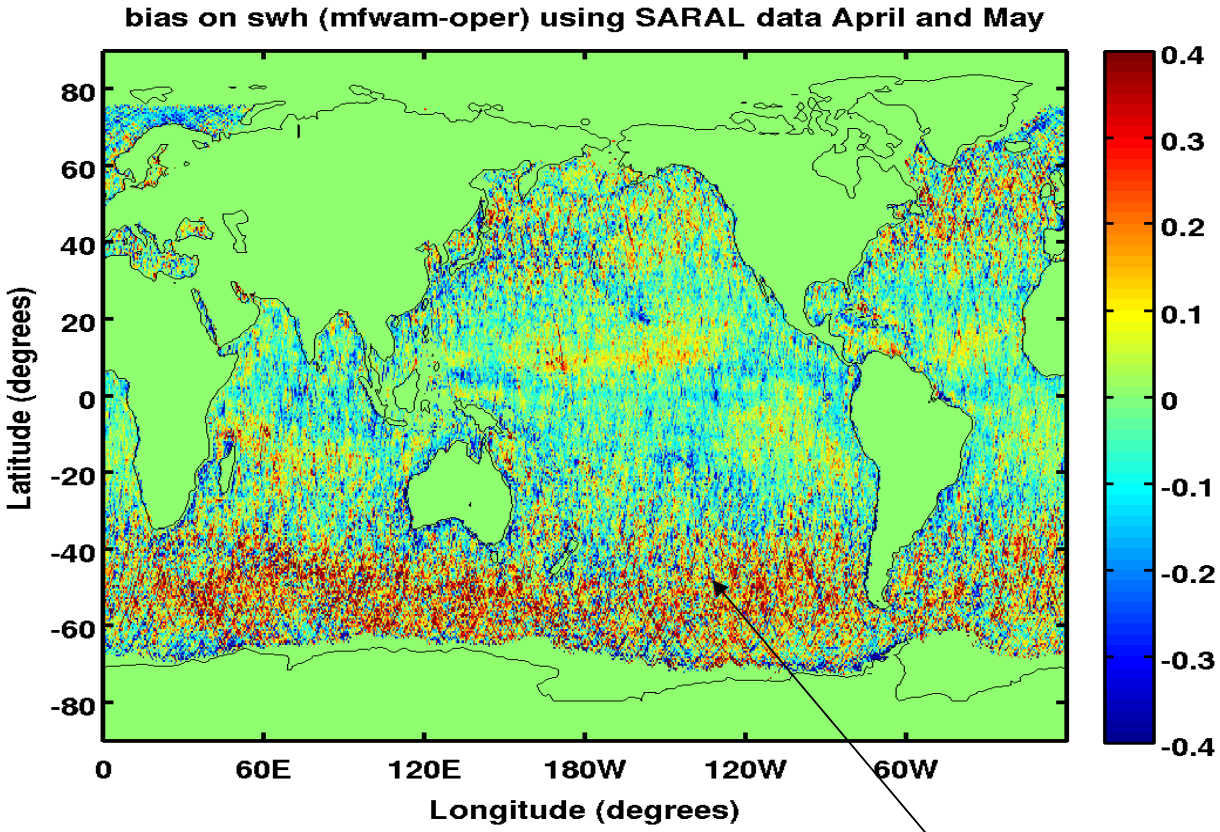
# Validation MFWAM Operational outputs with SARAL Sig. Wave heights




**MFWAM Operational with assimilation of Ja-1 & 2**

**bias of SWH is significantly reduced**

**Bias map for April and May 2013**

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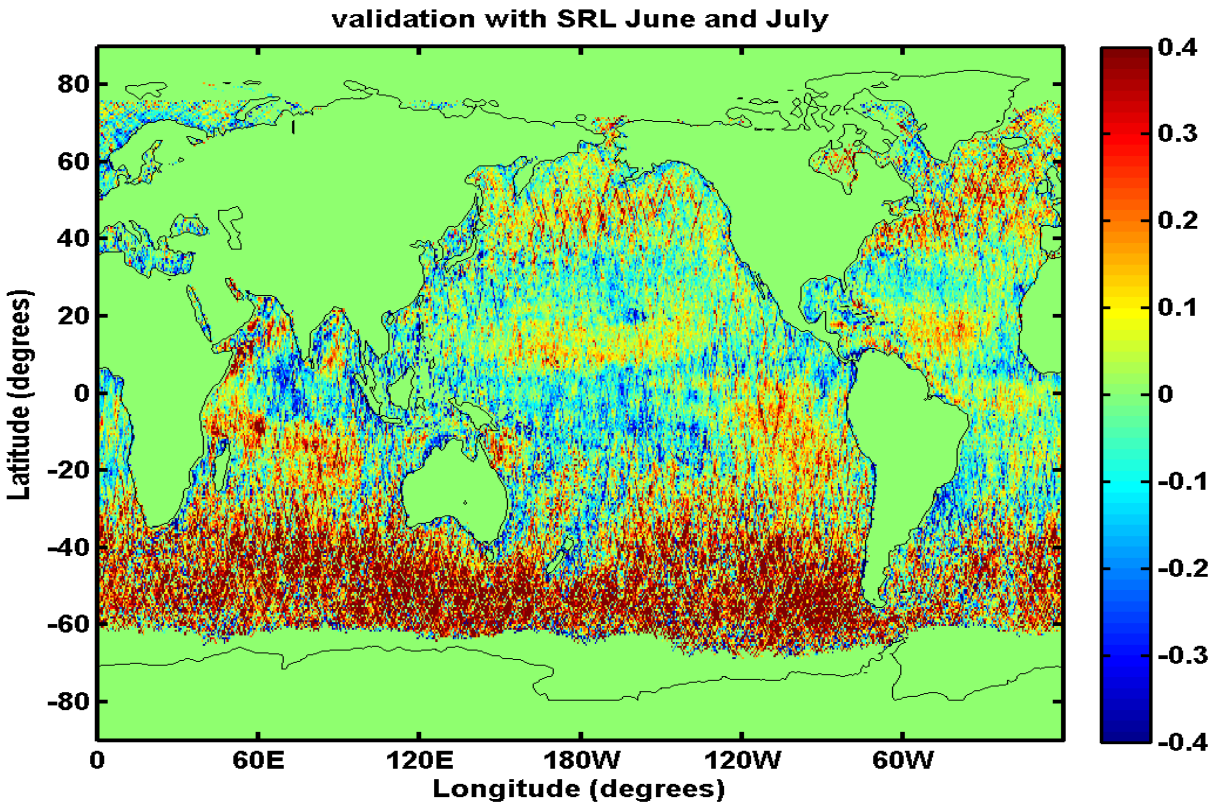
# Validation MFWAM Operational with SARAL Sig. Wave heights




**MFWAM without assimilation**

**High positive bias of SWH in South. Hemis.**

**Bias map for June and July 2013**

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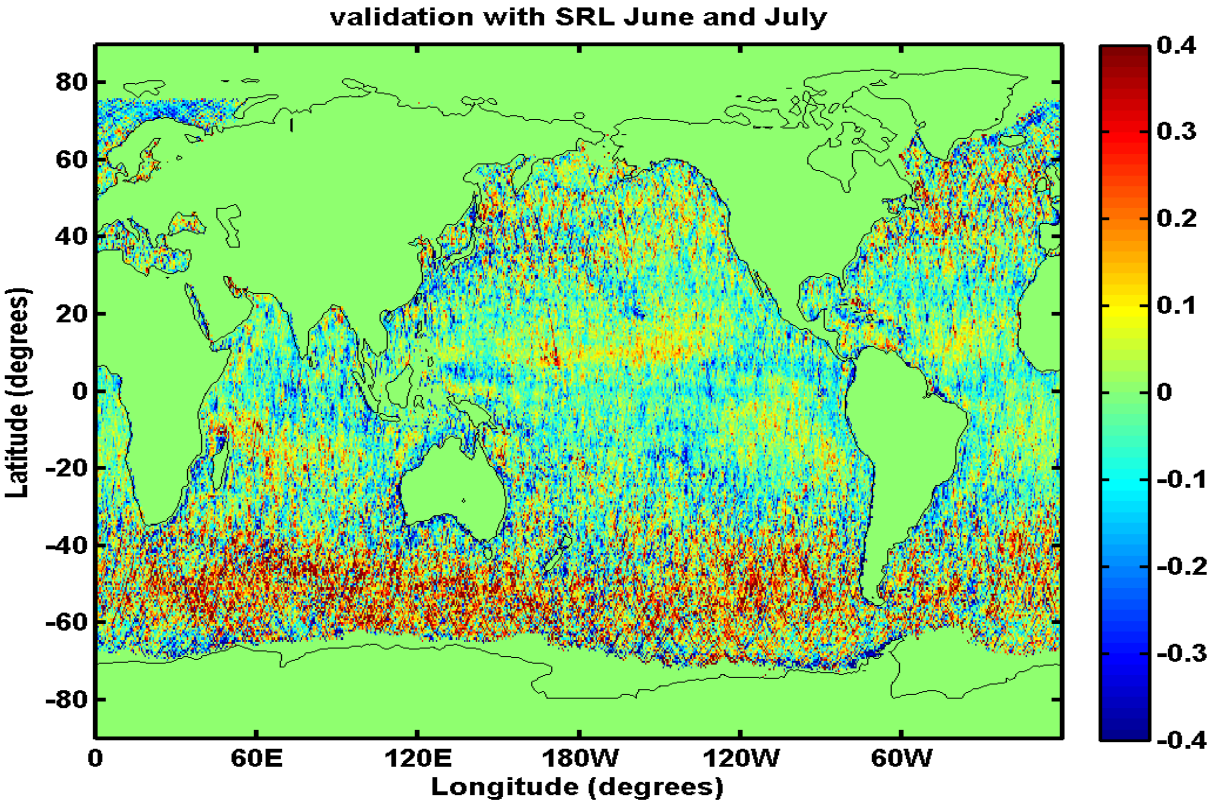
# Validation MFWAM Operational outputs with SARAL Sig. Wave heights




**MFWAM Operational with assimilation of Ja-1 & 2**

**bias of SWH is significantly reduced**

**Bias map for June and July 2013**

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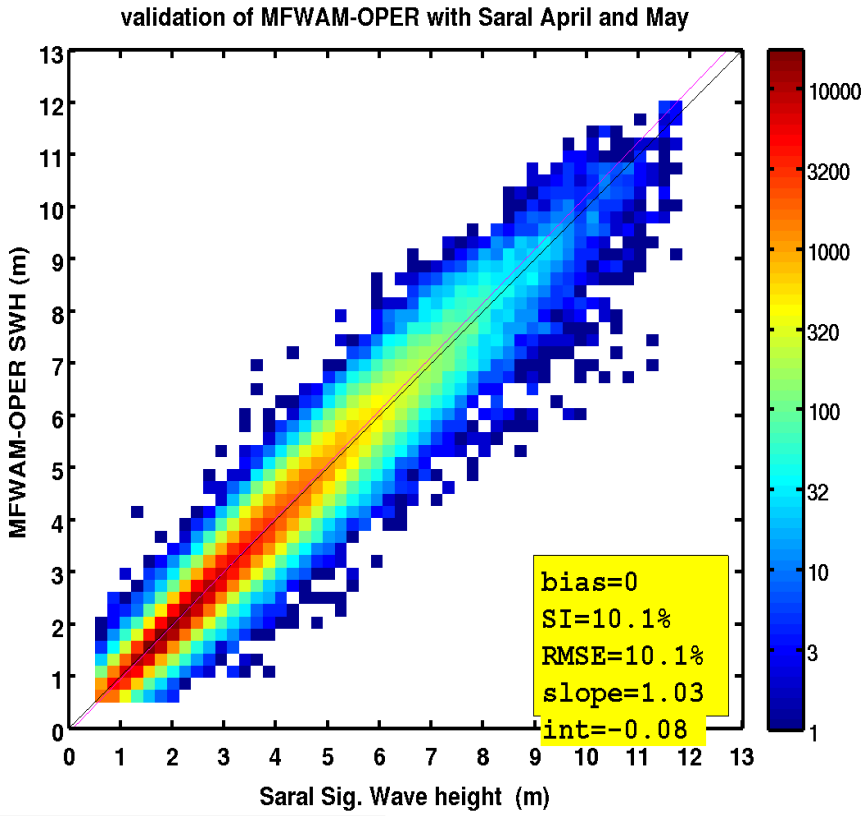
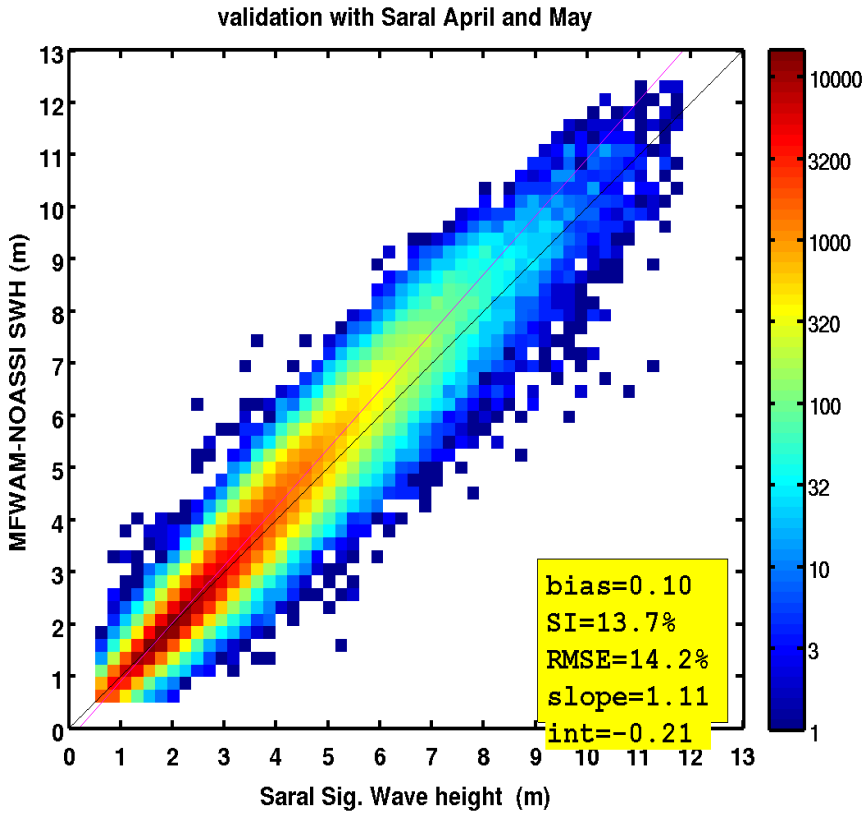
# Validation of MFWAM with SARAL Sig. Wave Heights

## MFWAM Operational




## MFWAM without assimilation




Bias = 0.
SI = 10,1%
NRMS = 10.1%
Slope = 1 .03
Intercept = -0.08

Data collected : 343523

April and May 2013

Bias=0.10
SI=13.7%
NRMS=14,2%
Slope=1.11
Intercept=-0.21

# Conclusions

- The runs for June and July showed the same tendency : good quality of Saral/Altika significant wave heights

- positive impact on the wave analysis and forecast : ready to be used operationnaly in MFWAM (waiting for the availability of Altika on the GTS in BUFR format)

- The use of Saral with Jason-2 showed very promising results (the SWH errors are greatly reduced SI<9% in the tropics)

- The work is in progress concerning the use of Saral/Altika in regional model MFWAM-Réunion (0.25°) !