On the impact of Saral/Altika wave data on the wave forecasting system of Météo-France

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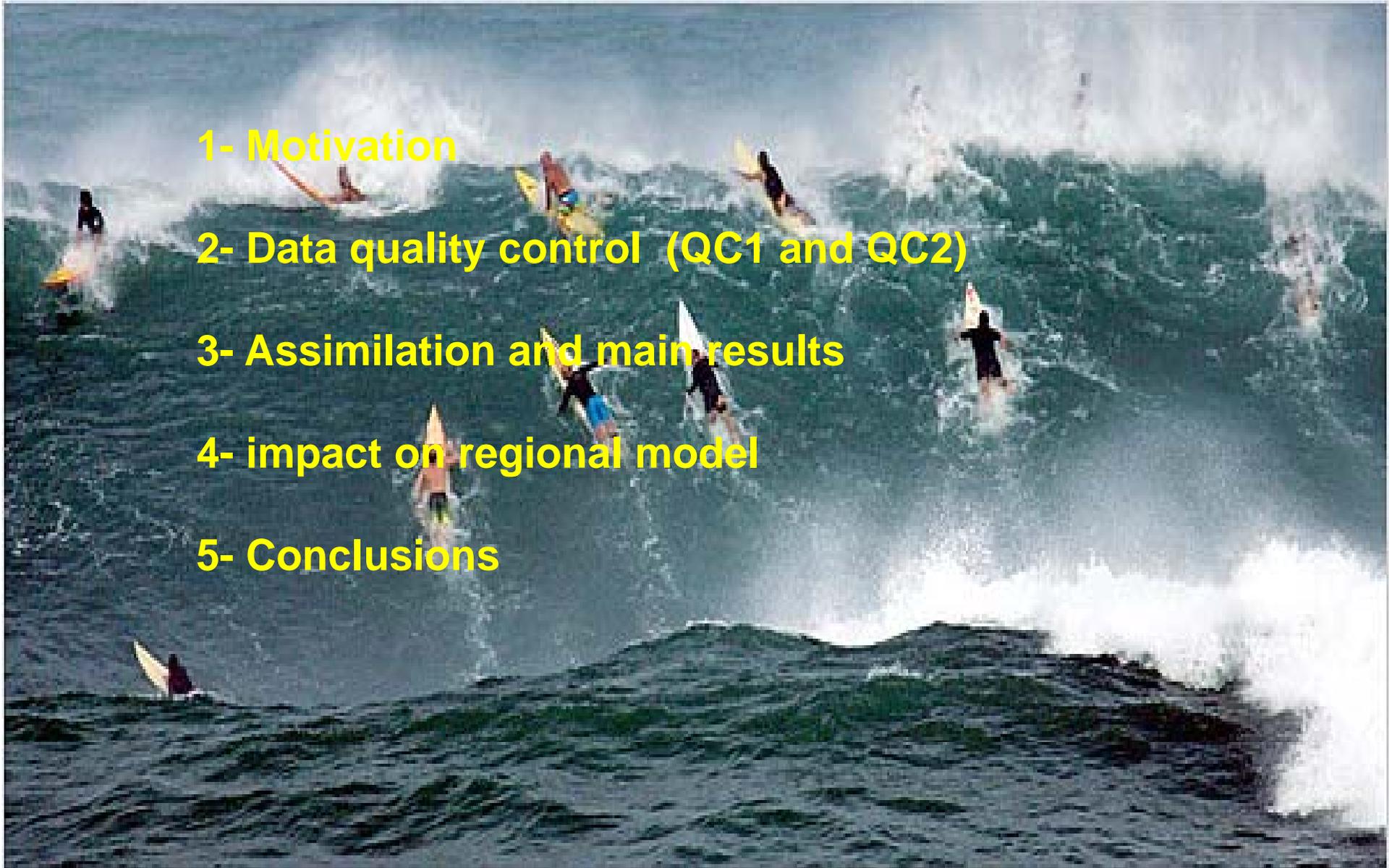Toujours un temps d'avance

OUTLINE
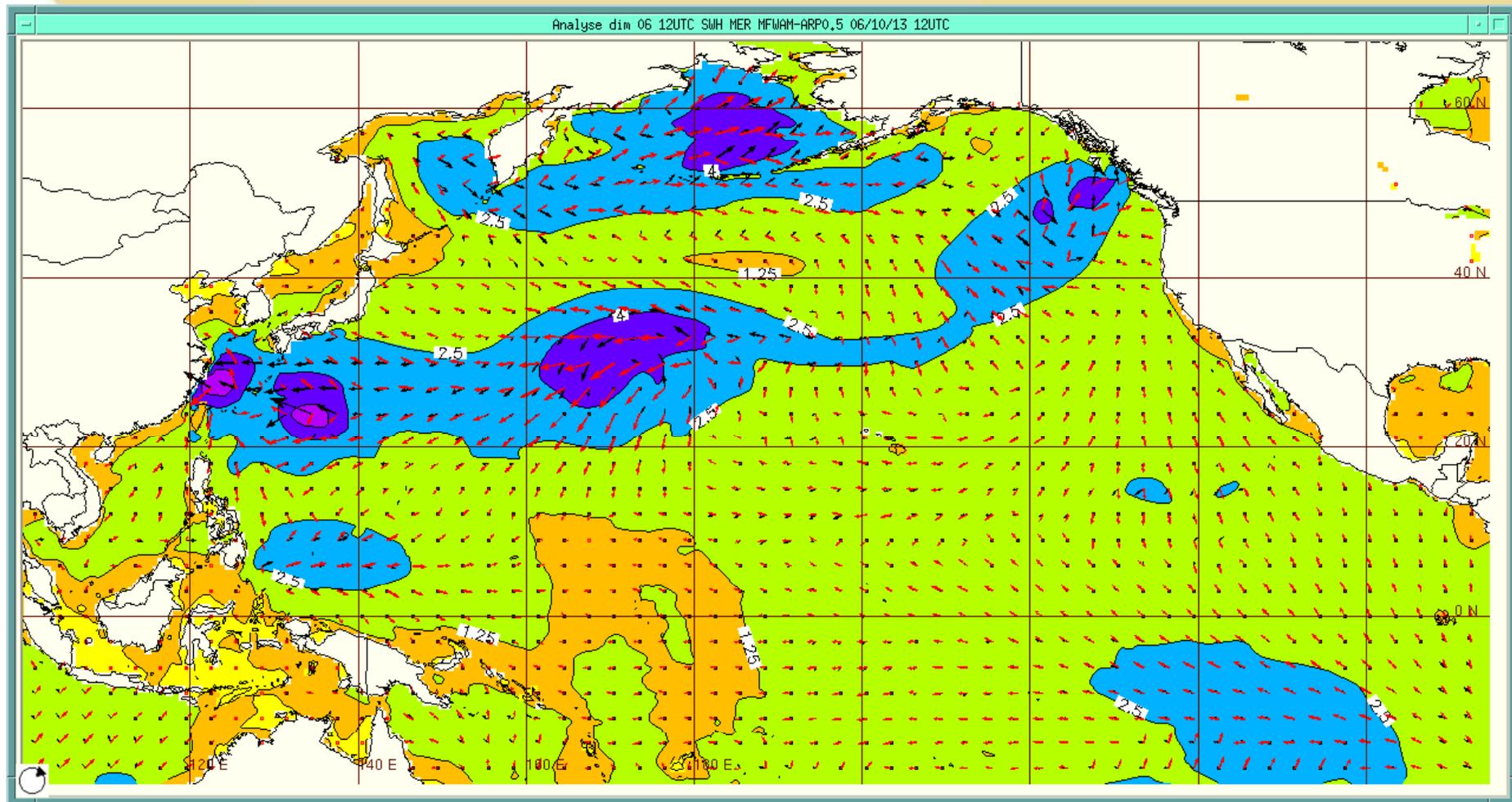
1- Motivation

2- Data quality control (QC1 and QC2)

3- Assimilation and main results

4- impact on regional model

5- Conclusions

Improving the sea state forecast in high wind conditions

Analyse dim 06 12UTC SWH MER MFWAM-ARP0.5 06/10/13 12UTC

Snapshot on SWH from MFWAM-Global

Typhoons FITOW and DANAS generating high sea state on Sunday 6 October 2013 at 12:00 (UTC)

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motivation

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

■ **Test of small changes on QC procedure (consequence of PATCH-V1) : new thresholds values for $\sigma 0$ and wave height**

■ **Impact of using Saral/Altika wave data in regional wave model (high resolution MFWAM-EURAT01)**

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 September 2013**

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

Threshhold values in table as for Jason-2

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 points	>=35

→ **0.3 m**

QC 2 tested for august

→ **35 db**

QC1 table

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Example of QC check for August 2013
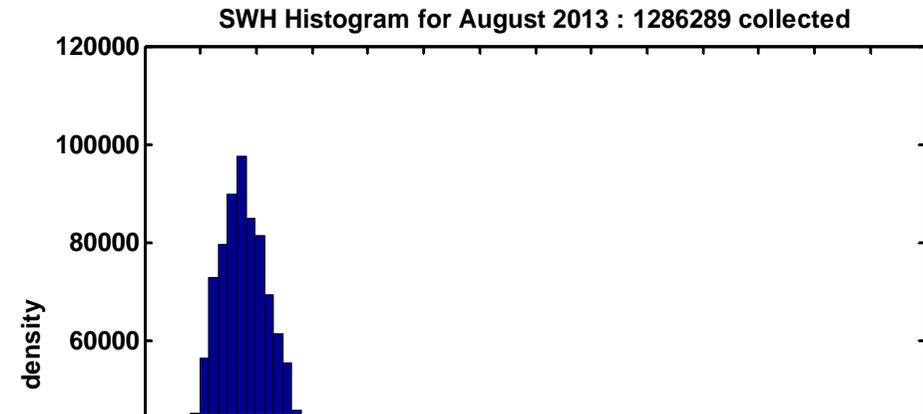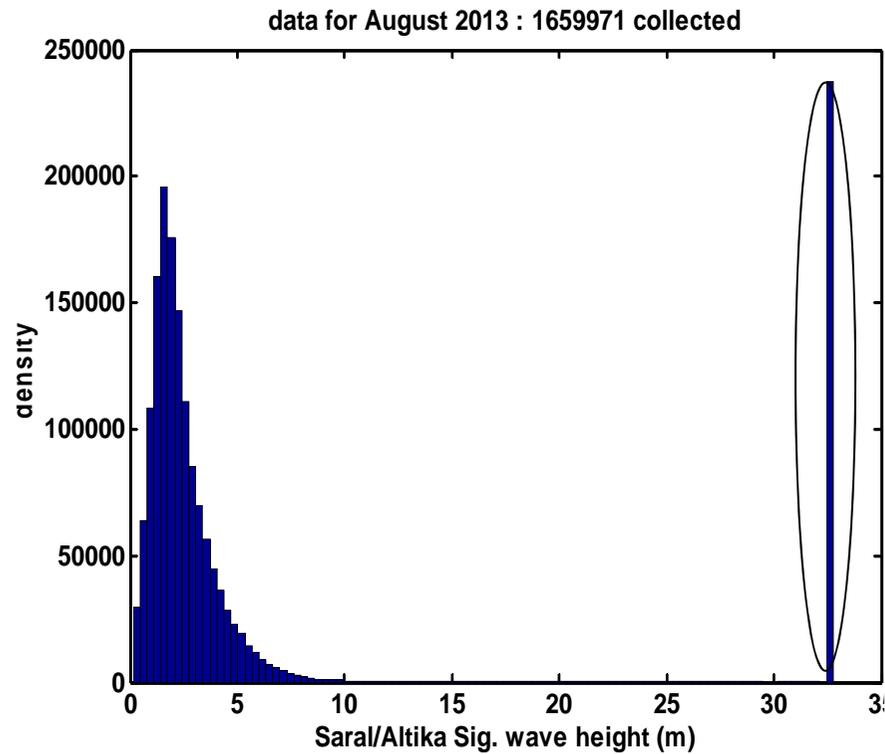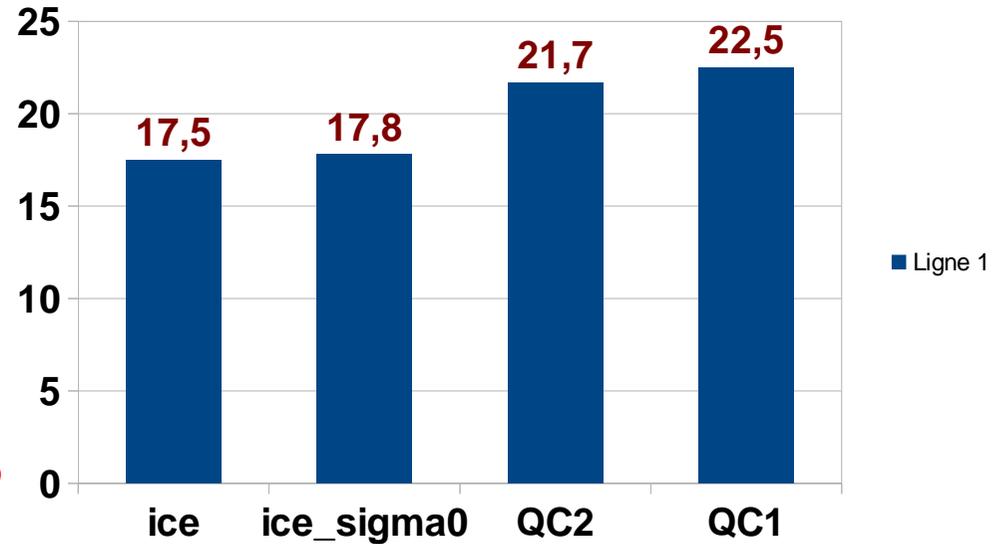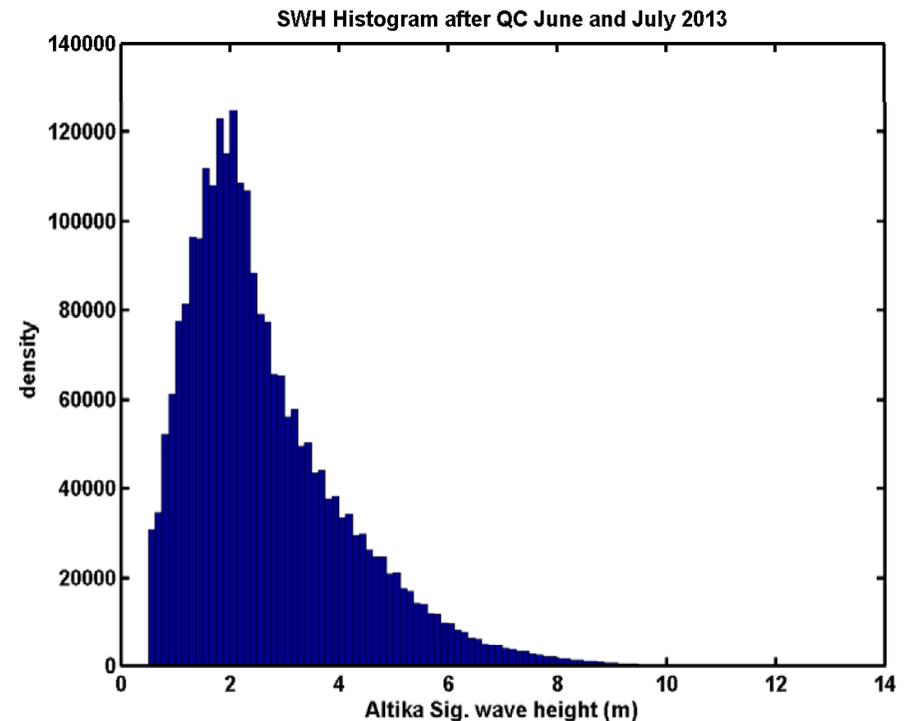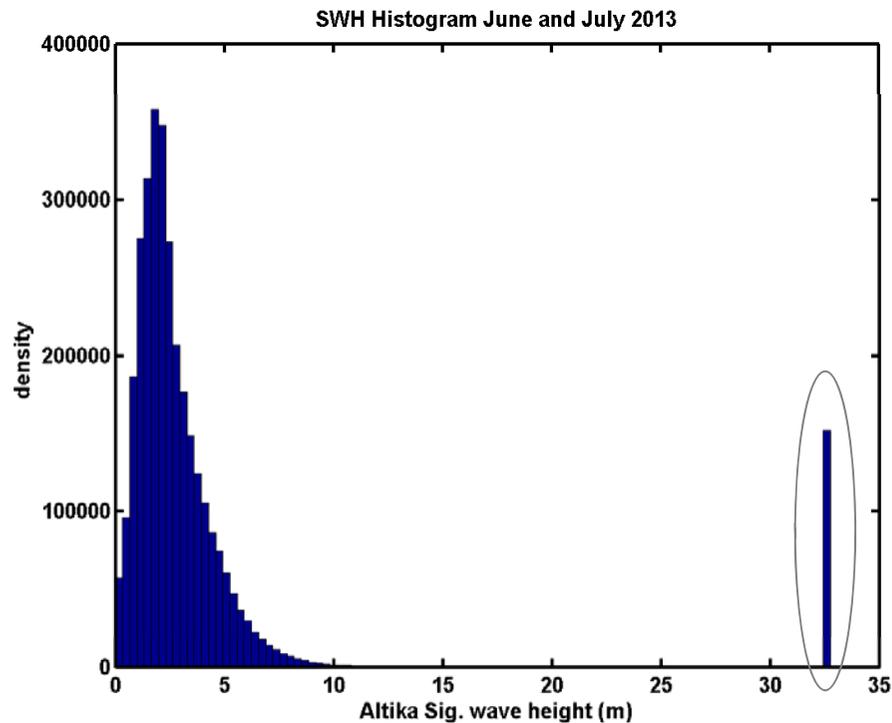

Histograms of Saral sig. wave heights

Example of QC1 check (June and July 2013)

Before QC1
Nb of data : 3272808

After QC1
Nb of data : 2516442

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

Histograms of Saral sig. wave heights

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

1-day global coverage of SARAL/Altika 20130401
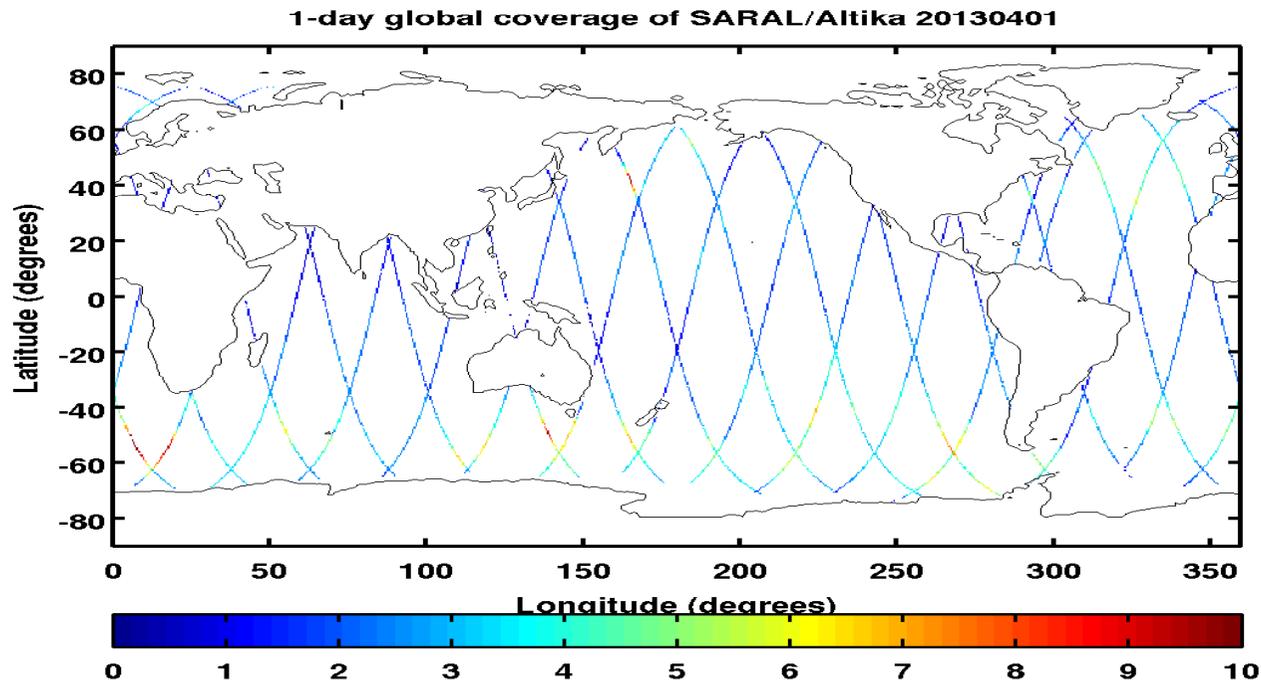
Saral wave obs are collocated with model grid points : Super-observations

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

- **Wave model set-up**
  - Wave model MFWAM (global coverage 0.5x0.5° irregular grid),
    wave spectrum in 30 frequencies (starting 0.035 Hz) and 24 directions
  - ECMWF analyzed winds every 6 hours
  - Assimilation time step 6 hours

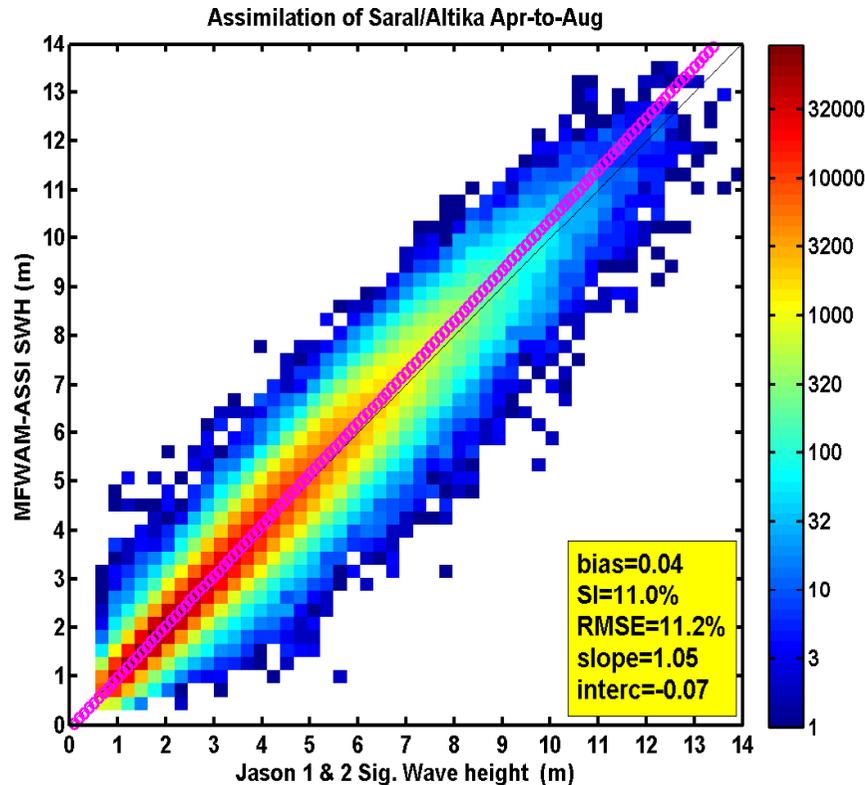→ **Assimilation** of Saral/Altika Sig. wave heights

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

→ Outputs from the operational forecasting system (**MFWAM with assimilation of Jason 1 & 2**)
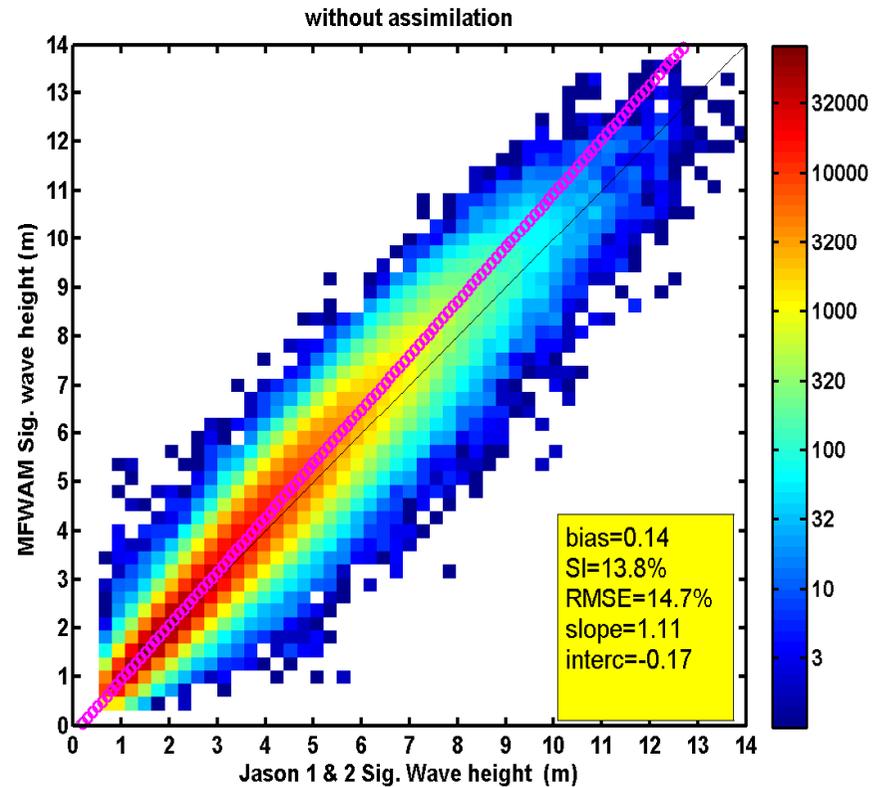
→ **Baseline** run of MFWAM without assimilation

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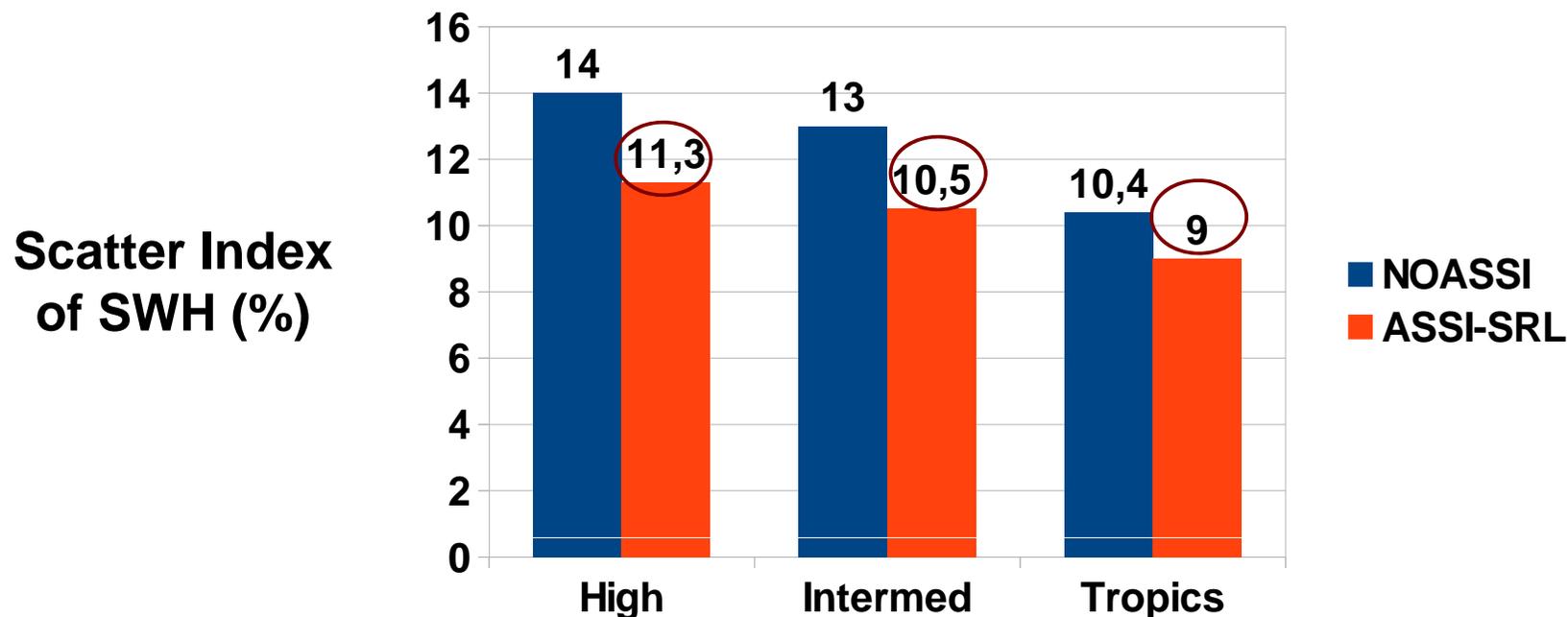
Assimilation of Saral

Without assimilation

Bias = 0.04
SI = 11%
RMSE = 11.2%
Slope = 1 .04
Intercept = -0.07

Data collected : 1661664

April to Aug 2013

Bias=0.14
SI=13.8%
RMSE=14.7%
Slope=1.11
Intercept=-0.17

**Assimilation of SARAL/Altika in MFWAM
in different ocean basins : April to August 2013**
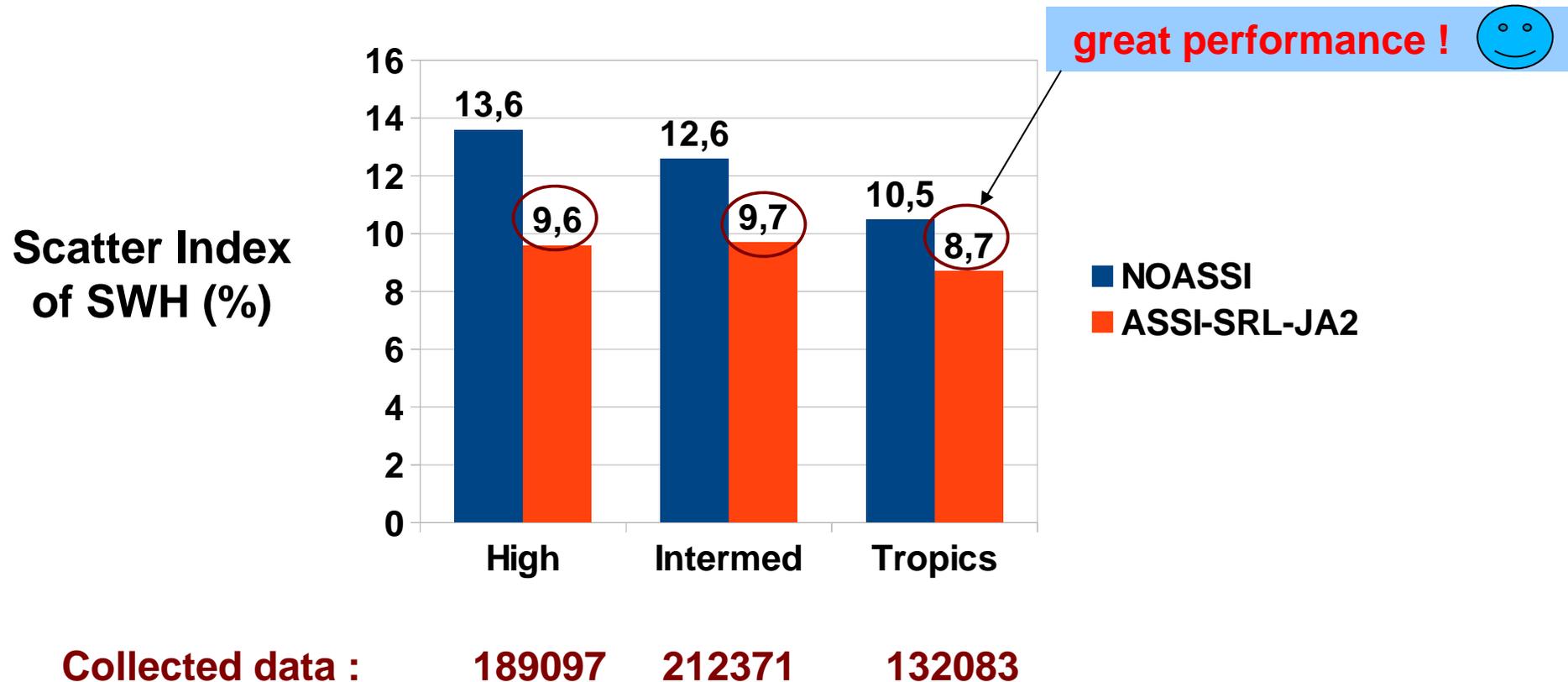
Scatter Index
of SWH (%)

- NOASSI
- ASSI-SRL

Collected data :   549685   683667   428312

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

Validation with Jason 1 & 2

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Assimilation of Saral and Jason-2 in MFWAM in different ocean basins
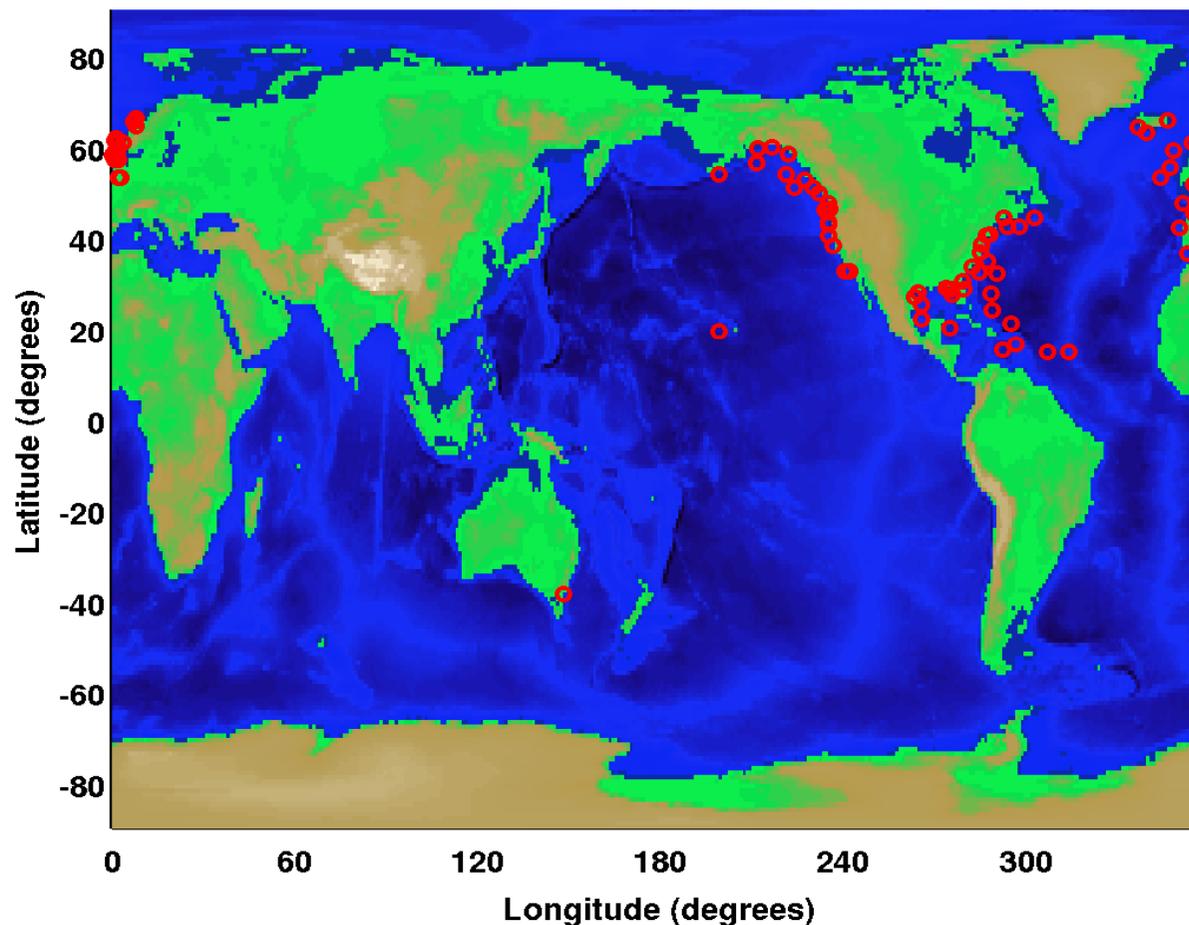
Validation with Jason-1 : April, May and June (until 21)

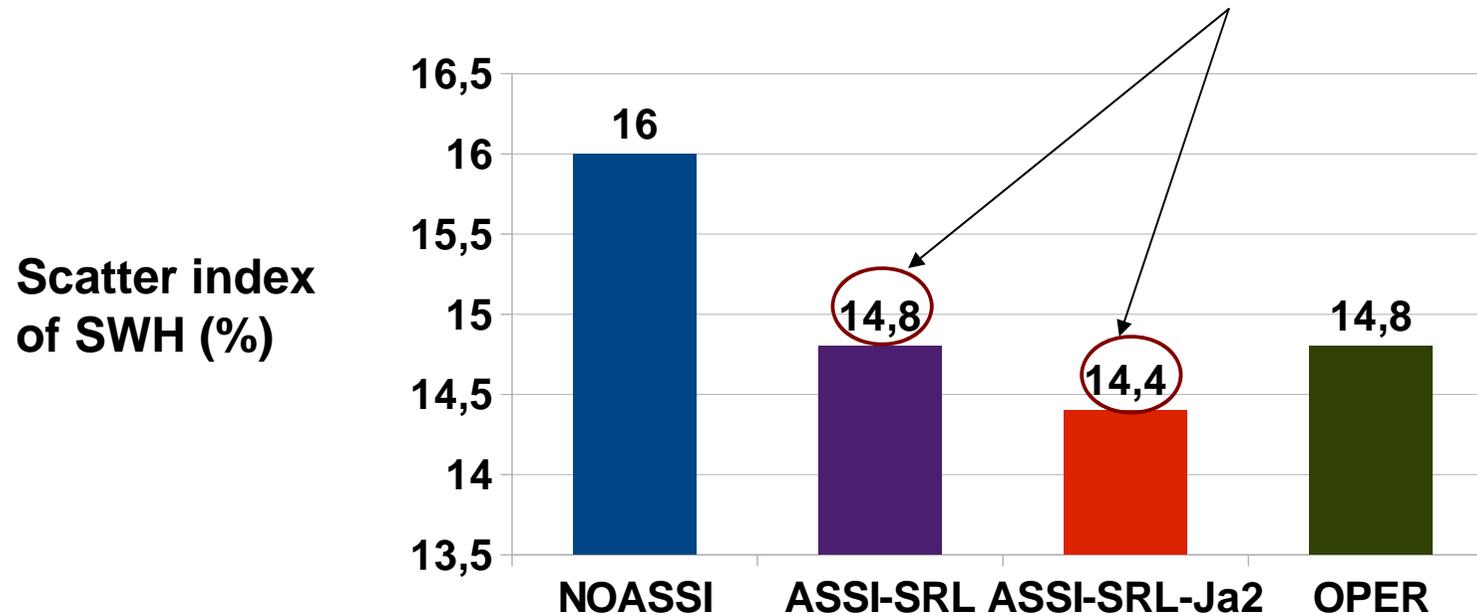# VALIDATION OF SWH WITH BUOYS DATA

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

buoys locations

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 (%)
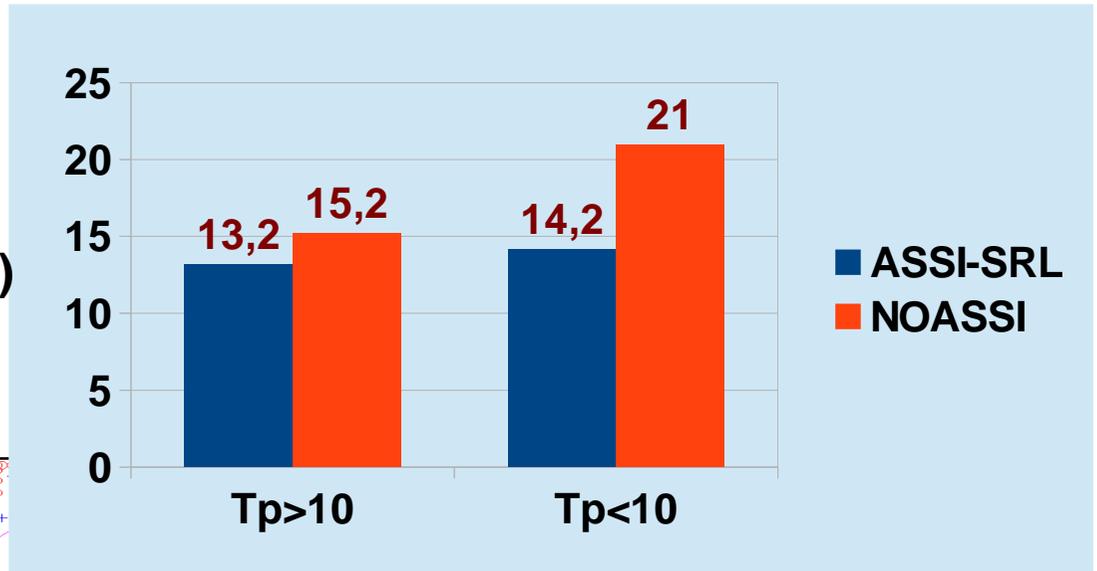

NOASSI : without assimilation
ASSI-SRL : assimilation of SARAL/Altika
ASSI-SRL-JA2 : assimilation of SARAL and Jason-2
OPER : Operational MFWAM with assimilation of Jason-1 & 2

April-May-June 2013 (29005 collected data)

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Perfomance of the assimilation of Saral/Altika at the peaks

Blue for assimilation with saral
Red is reference run

Scatter Index (%)

impact of Altika on the peak
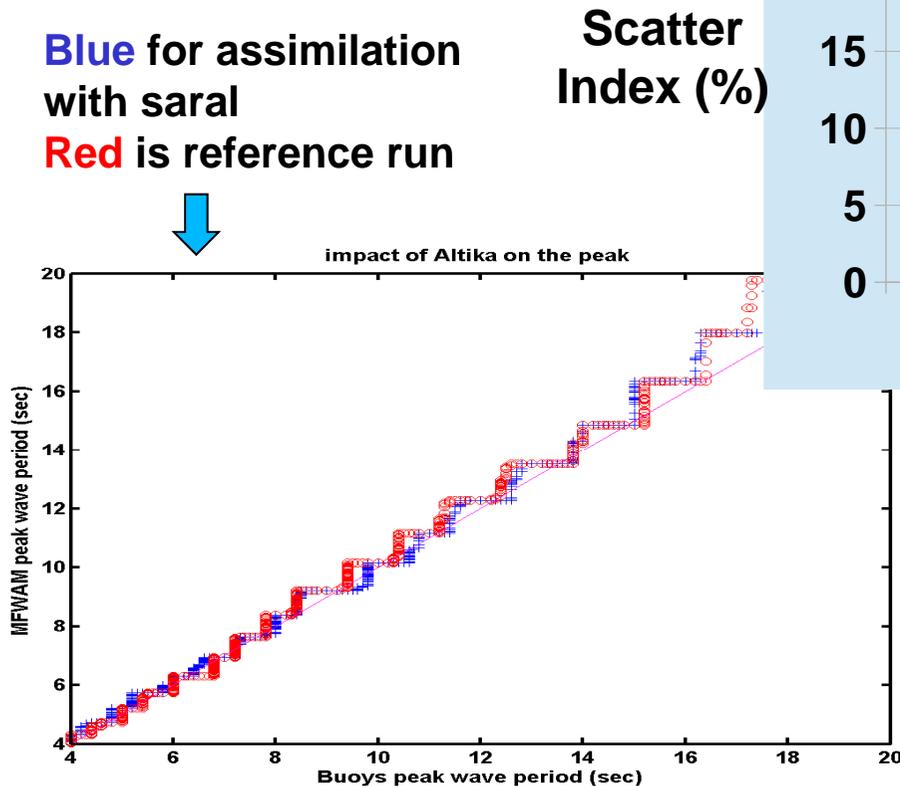
Scatter index is well reduced in wind sea and swell wave systems

Comparison with NDBC buoys located on North America : Jun-Jul-Aug 2013

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Impact of the QC2 on the assimilation system Experiment for August 2013
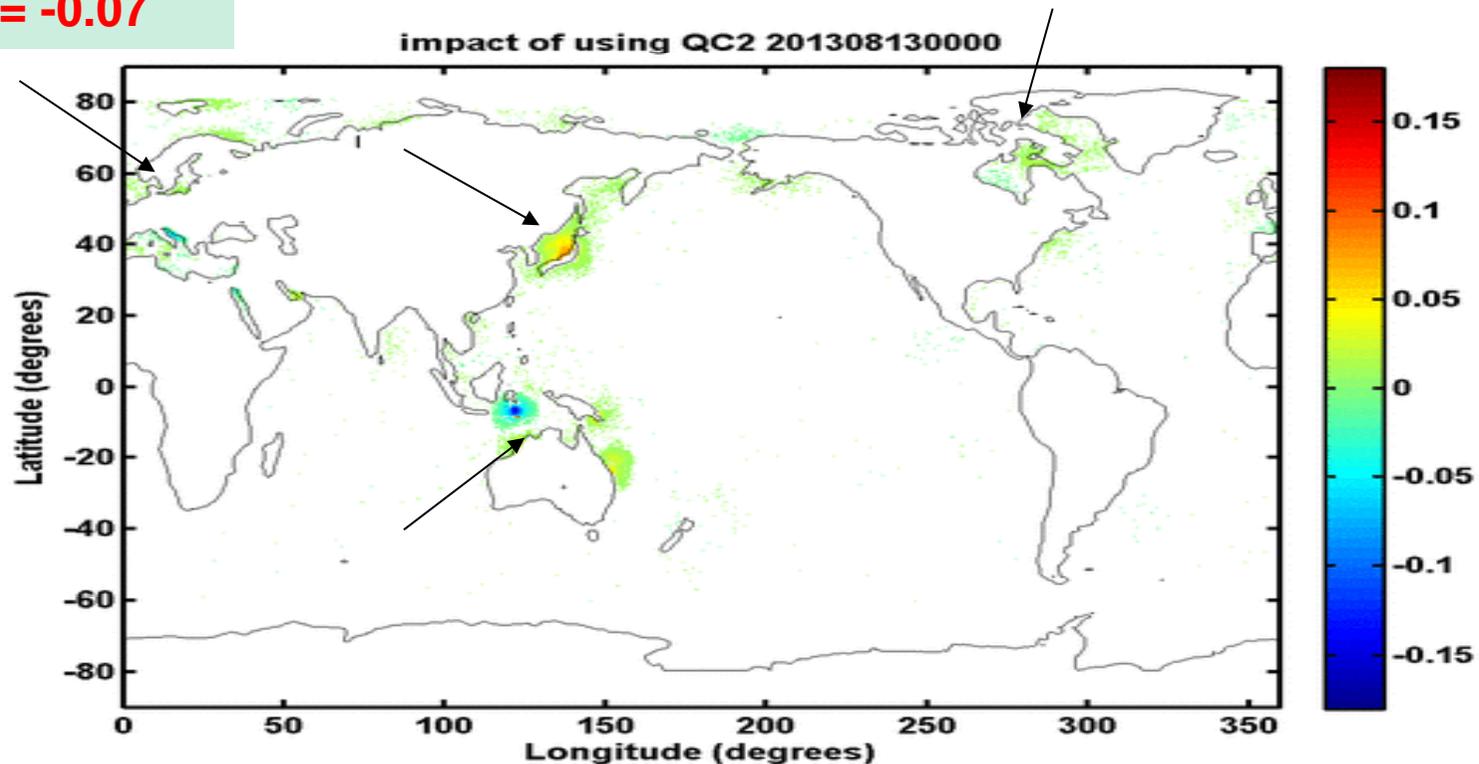
Bias = 0.06
SI = 11.1%
RMSE = 11.3%
Slope = 1 .04
Intercept = -0.07

➡ Same performance for both QC1 and QC2

The use of QC2 is affecting mainly the shallow water areas (close to coastlines)

impact of using QC2 201308130000

Difference between SWH of the assimilation with QC1 and QC2 (example of 1-day 20130812)

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The assimilation of Altika in regional and high resolution MFWAM- EURAT01

Domain : 32°W-42°E and 20°N-72°N
Grid resolution of 10km (irregular grid)
Wind forcing from the atmospheric model
ARPEGE-0.1° (every 3 hours)
Boundary conditions from MFWAM-Global

The assimilation is performed from 7 to 15 July 2013, with a step of 3 hours

assimilation of Altika in MFWAM-EURAT01 201307120000
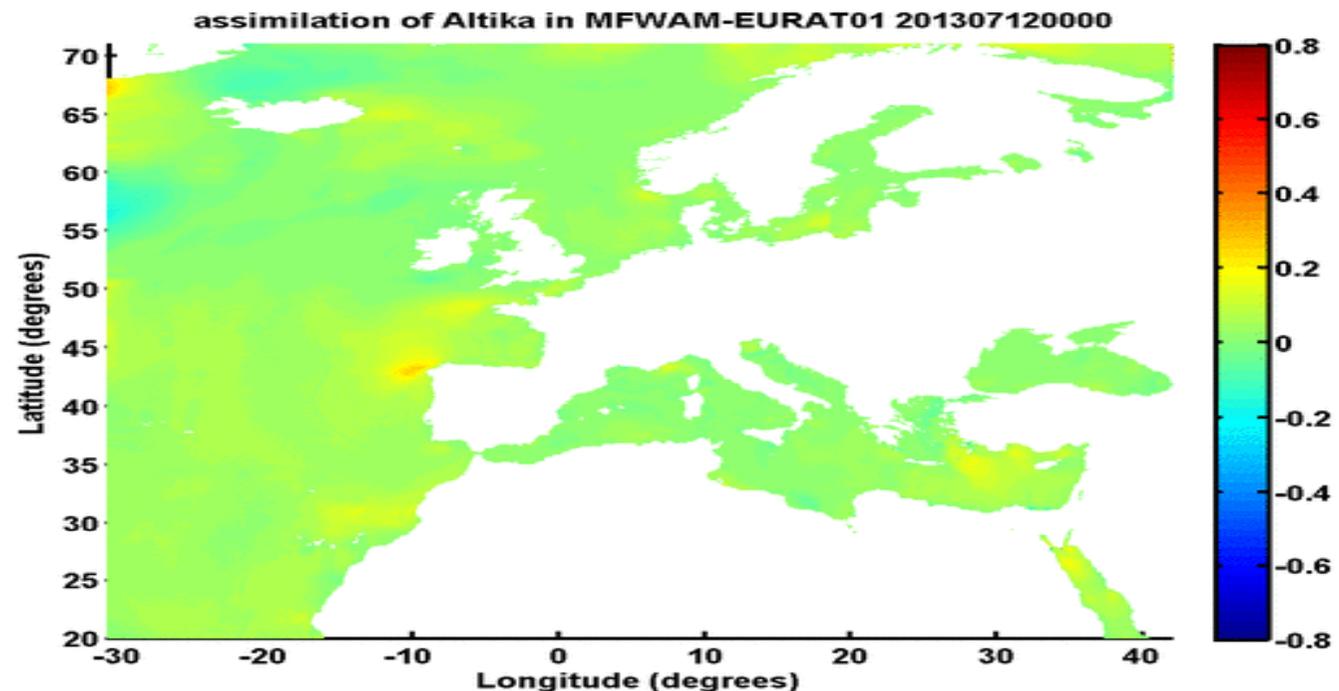
1-day (by a step of 3 hours) difference of SWH from the Assimilation run and the operational MFWAM-EURAT01 (without assimilation)

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Validation of the assimilation of Saral/Altika in MFWAM-EURAT01 : preliminary results

assimilation of Altika in MFWAM-EURAT01 201307130000

Orbit tracks of Jason-2 for the day 20130712
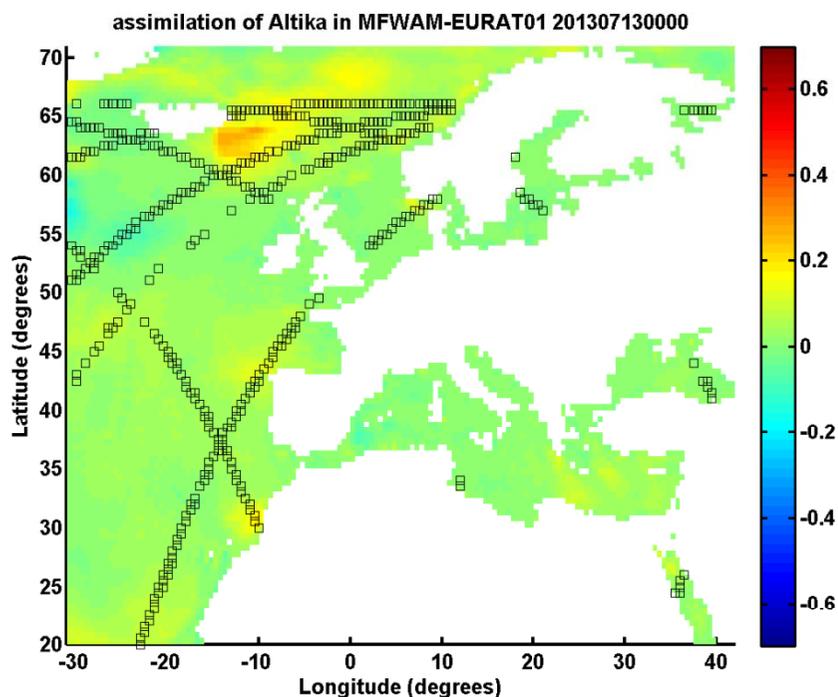
	ASSI	OPER
Bias	0.	0.07
Scatter Index(%)	14.5	15.9
RMSE	14.5	16.5
Collected	2343	

Statistical analysis

Comparison with Jason-2 Sig. Wave Heights 7-13 July 2013

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Conclusions

■ **The sea state forecast is well improved after using Saral/Altika Si significant wave height : thanks to the good quality of Saral wave data**

■ **Positive impact on the wave analysis and forecast : ready to be used operationnaly in MFWAM (Altika in BUFR format on the GTS today)**

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

■ **The use of QC2 is successful, more data are included in the system without degrading the performance**

■ **Positive impact showed by the assimilation of Saral/Altika in regional model MFWAM-EURAT01. We look forward to implement the assimilation for cyclonc season at the Indian ocean MFWAM-La réunion**

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