New era for altimetry and new challenges, La Rochelle, November 1-4, 2016

On the update of the assimilation in the operational wave model MFWAM with Jason-3 and Sentinel 1A and 1B missions

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MOTIVATION:

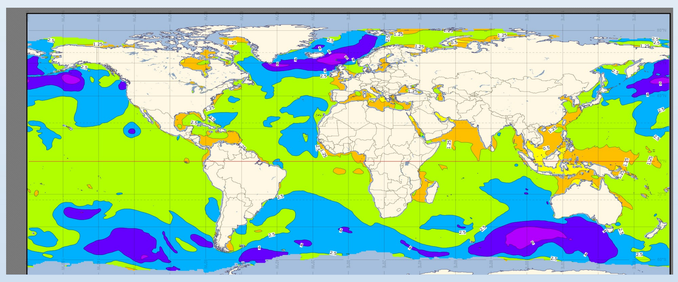
The improvement of the wave forecasting system of Météo-France Is a key process to ensure reliable marine security bulletins and High quality of wave products for global and regional Copernicus Marine Environement and Monitoring Services (CMEMS).
It is then a crucial task to update the assimilation system with qualified altimeters and spectral wave data.
Since 19 october 2016 the assimilation system uses operationnally 4 altimeters wave data from Jason-3, Jason-2 (interleave), Saral and Cryosat-2. This will improve the data coverage over all ocean basins.
This work shows the first results from the operational wave system MFWAM using near real time from 4 altimeters. In other respects The second objective of this work is preparing the use of SAR wave spectra from Sentinel-1A in the wave forecasting system of Météo-France.

The operational wave model MFWAM

The global wave model of Météo-France MFWAM is based on ECWAM-IFS code (cycle 38R2), with dissipation source term developed in Ardhuin et al (2010). The model was upgraded in november 2014 with improvements from the work in Mywave FP7 European research project.
The global model grid size is 0.2° with a resolution of the wave spectrum of 30 frequencies and 24 directions. Two lines of the Global MFWAM with dissferent atmospheric forcing IFS-ECMWF and ARPEGE systems.

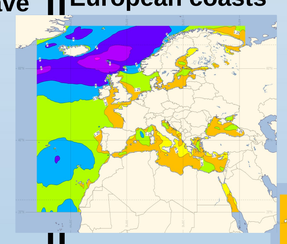
The Operational wave forecasting system of Meteo-France

Global MFWAM 0.2° : IFS-ECMWF and ARPEGE operational lines

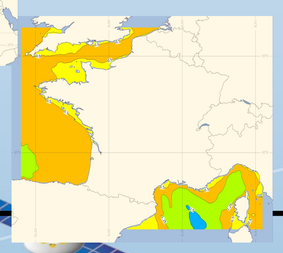


Boundary conditions for regional

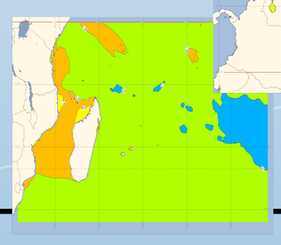
European coasts



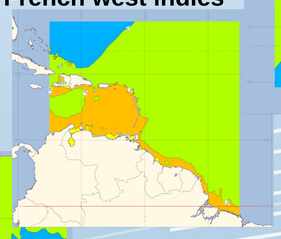
French coasts



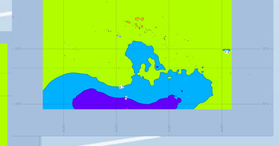
La Réunion



French west indies



French Polynesia and Pacific



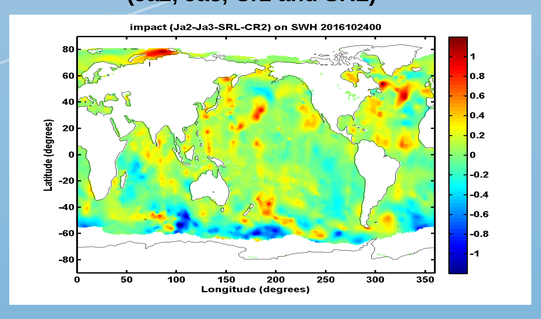
The global and regional MFWAM are assimilating Jason-2 & 3, Saral, Cr2 6-hourly and 3-hourly, respectively.

Snapshots of SWH from SYNOPSIS Visualizing system

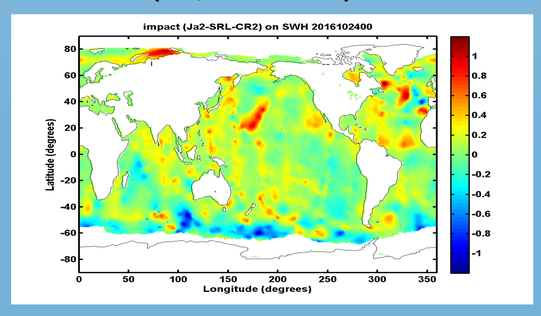
Regional MFWAM (0.1 and 0.025°) are forced by winds from IFS-ECMWF and high resolution AROME atmospheric systems

Impact of the Jason-2 inter-leave orbiton the analysis

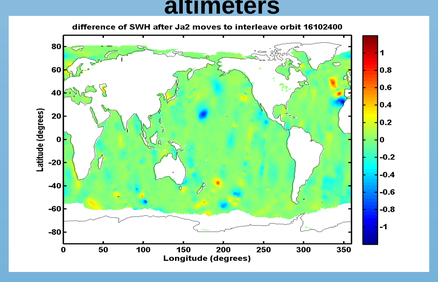
Significant wave height on 24 October 2016 (Ja2, Ja3, Cr2 and SRL)



Significant wave height on 24 October 2016 (Ja3, Cr2 and SRL)

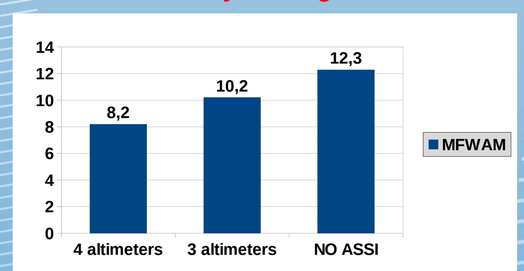


Difference of impact 3 and 4 altimeters

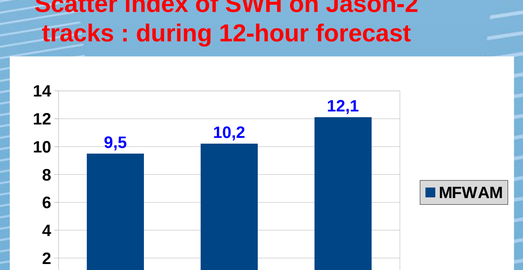


Evaluation of the first week (19-25 October) of using 4 altimeters in operations

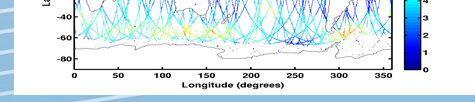
Scatter index of SWH on Jason-2 tracks : Analysis for gloabl



Scatter index of SWH on Jason-2 tracks : during 12-hour forecast



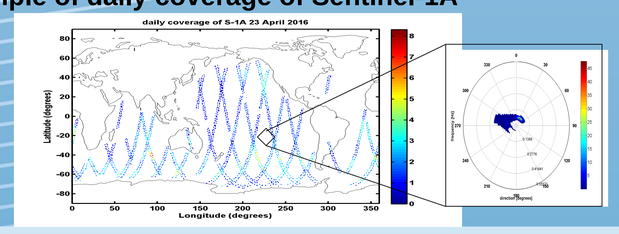
4 Altimeters are used in operations since 19 October 2016



Daily coverage of Jason-2 & 3, Saral And Cryosat-2

Preparation of using SAR wave spectra of Sentinel-1A

Example of daily coverage of Sentinel-1A



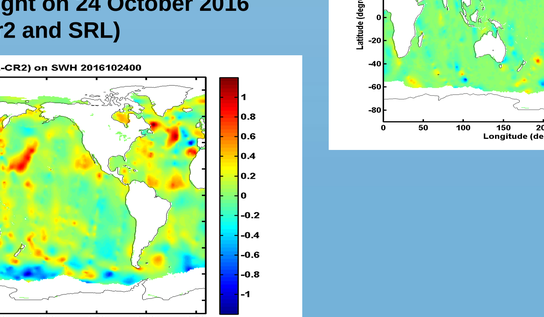
Sentinel-1A provides SAR wave spectrum (Level 2 products) with a resolution of 60 frequencies from 0.04 to 0,23 Hz and 72 directions.

Results on combined assimilation of 3 altimeters (Ja2-Saral and Cr2) and SAR wave spectra from Sentinel-1A

Analysis on 29 August 2016 at 0:00 (UTC)

Significant wave height (m)

Peak Period (sec)



Validation with buoys data for August 2016

Sig. Wave Height

Scatter Index (%)

Peak Period Tp

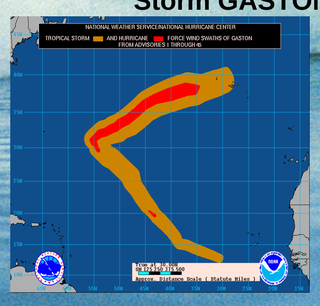
WITHOUT ASSIMILATION
ASSIMILATION of JA2-Saral-CR2+Sentinel-1A

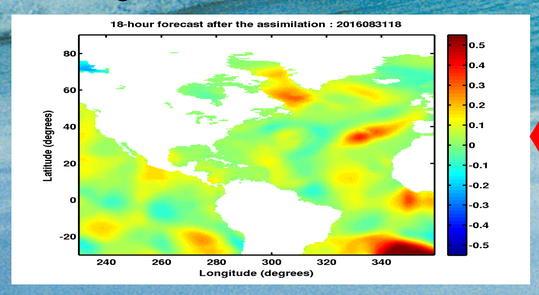
Buoys locations

CONCLUSIONS AND FUTURE WORKS

- Jason-2 & 3 have been successfully assimilated in the operational model MFWAM, and the first validation shows enhanced impact Induced by the move to interleave orbits of Jason-2.
- The work is in progress for qualifiying SAR wave spectra of S-1A and 1B to operational use. ESA will provide soon the NRT Sentinel-1 level 2 wave spectra on the GTS (end 2016).
- The validation of Sentinel-3A is on going and new processing will be implemented in order to improve the wave products for operational use.
- In preparation of CFOSAT mission, combined assimilation of altimeters, SAR and SWIM spectra is the working plan of the future works.

Focus on tropical Storm GASTON 28-31 Aug 2016





Impact of the assimilation of Ja2-CR2-SRL and spectra S-1A : 18-hour forecast 31 August at 18:00 (UTC)