Ocean Surface Topography-Science Team annual meeting, 7-11 November2023, Porto Rico

On the assimilation of reprocessed SWIM wave data in the wave model MFWAM

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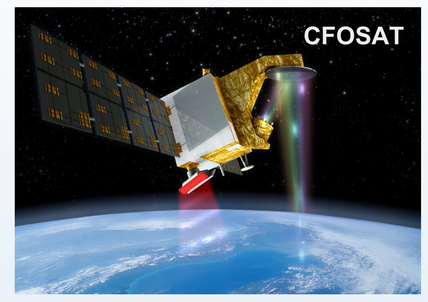
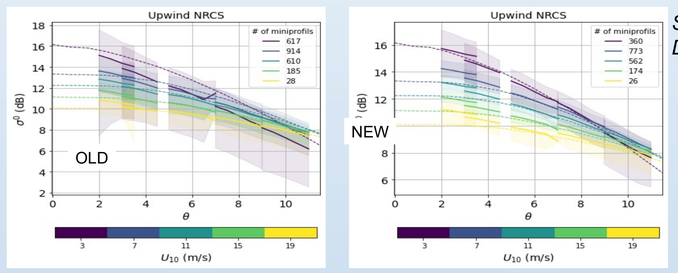


Motivation

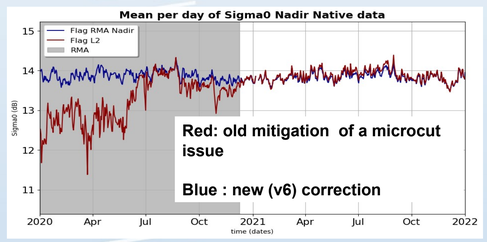
- This work aims to evaluate the impact of using level 2 SWIM wave data provided by the upgraded processing version 6. This latter leads to significant improvement in terms of sigma0 profiles for each incidence
- Evaluation of the combined assimilation of Significant Wave Height (SWH) and wave spectra on integrated wave parameters forecasting, particularly wave direction
- The upgraded processing induces a relevant implementation of Stokes drift and probability of sea ice products

Processing Version 6 : Better consistency and stability in σ_0 measurements

Mean profiles of σ_0(q) (upwind, 13 days global) for different wind speed classes



Solid lines: SWIM
Dotted lines: GPM

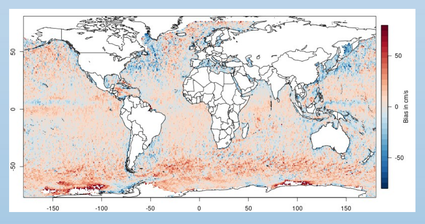


Daily mean (over the globe) of nadir σ_0

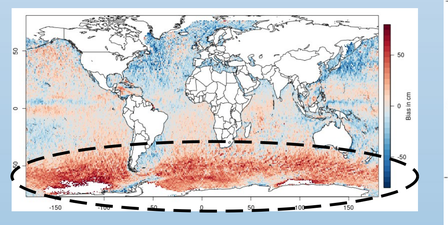
Results on the combined assimilation of SWIM SWH and wave spectra : February 2023

SWH Bias maps (in cm)

Assimilation of SWIM

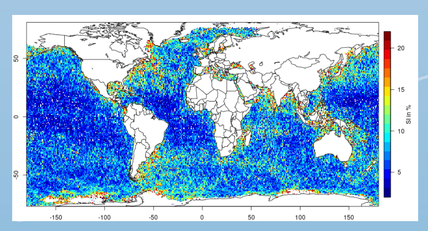


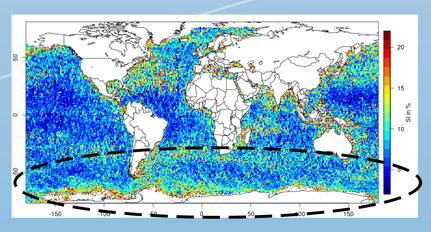
Without assimilation



Good reduction of SWH bias particularly in Southern Ocean

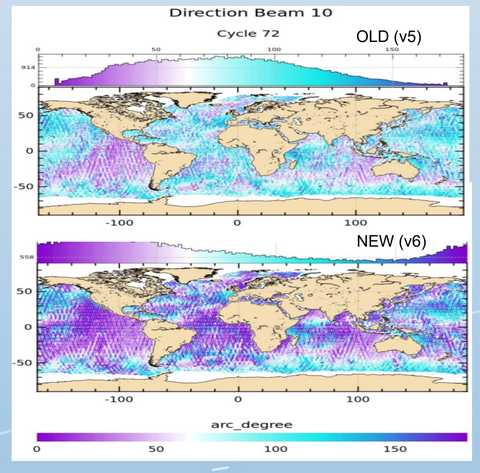
Scatter index of SWH maps (in %)

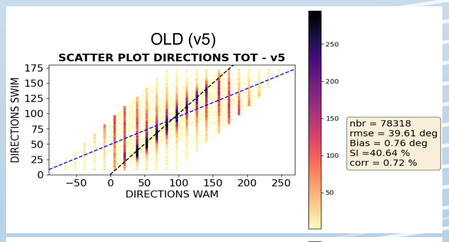


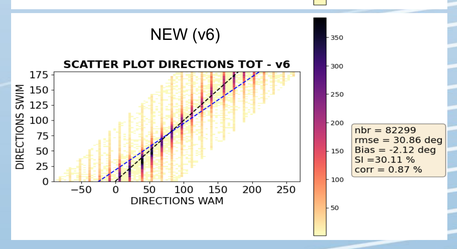


The smaller the scatter index is, the better the performance of the model

important improvement on wave directions





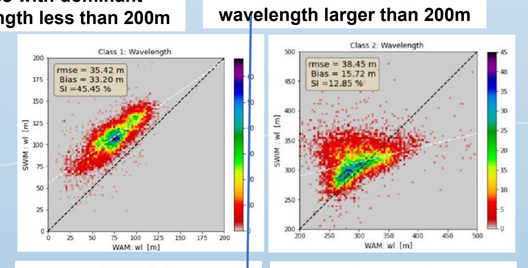


Interest of SWIM data (complementarity with SAR)

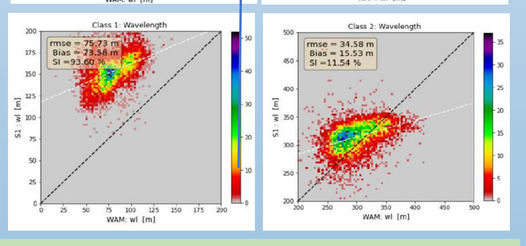
cases with dominant wavelength less than 200m

cases with dominant wavelength larger than 200m

dominant wavelength SWIM versus model (MFWAM)



dominant wavelength Sentinel-1 versus model(MFWAM)



SWIM : better performance than S-1 for wavelengths < 200m (wind waves or short swell)

Key messages

➔ The impact of the assimilation of upgraded wave spectra shows an improvement of the estimate of SWH, peak period and dominant wave direction.

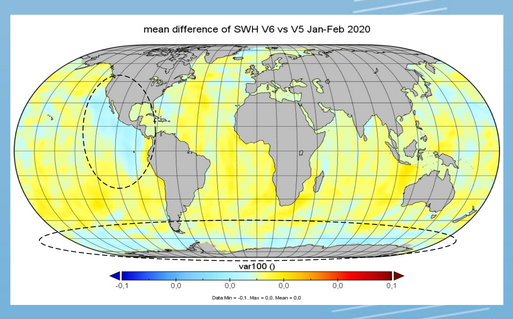
➔ Validation with buoys indicates a slight improvement of peak period in the range between 14-18 sec.

➔ Better sigma0 rprofiles from upgraded processing leads to improvement on the estimate of sea ice probability retrieved from SWIM.

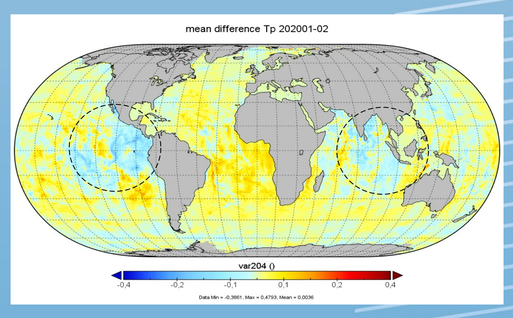
➔ Improved estimate of sea ice probability and Stokes drift from SWIM : good perspectives for ocean/wave coupling

Mean difference of wave parameters from assimilation of SWIM spectra between V6 and V5 : Jan-Feb . 2020

SWH



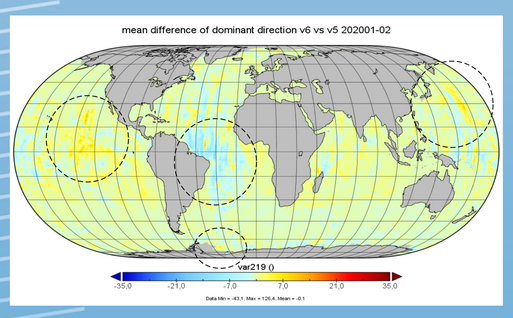
Peak period



Red color indicates an increase of the parameter, while Blue color stand for a decrease of the parameter.

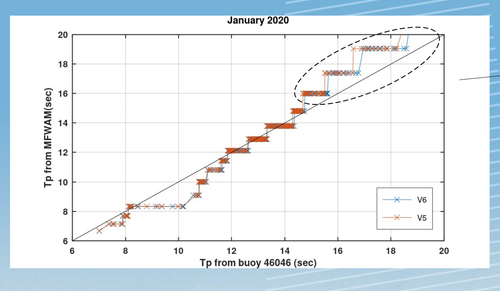
Negative values for SWH affect long waves regions (SO and NE Pacific)
Negative values for Tp in east tropical pacific and indian ocean (cyclonic season)

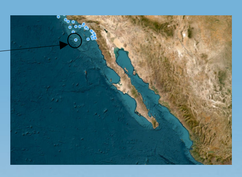
Mean difference of dominant wave direction between V6 and V5 : Jan-Feb . 2020



Dominant direction is affected in the tropical and mid latitude ocean regions, and in the MIZ (Weddell sea)

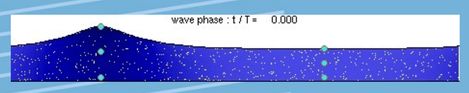
Validation at buoy 46047 (Baja California)



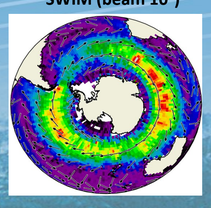


➔ **Slight improvement of Tp (9-10 sec and 14-18 sec) when using V6 SWIM wave spectra**

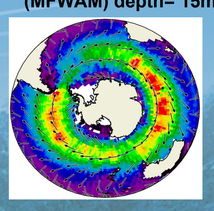
Stokes drift estimated from the SWIM wave spectra



SWIM (beam 10°)



MODEL (MFWAM) depth= 15m)



- Stokes drift from SWIM, estimated over wavelengths larger than 30 m)

=> representative of Stokes drift at 15 m depth

- By extrapolating the wave spectrum for waves shorter than 30m, surface Stokes drift can also be estimated

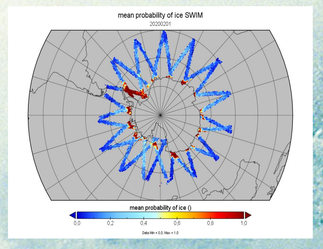
Good consistencyof Stokes drift between MFWAM and SWIM In Southern Ocean

Impact of SWIM sea ice products

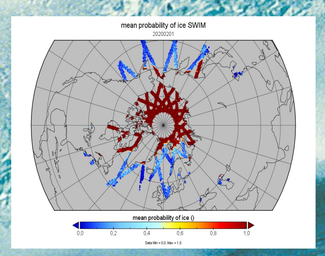
SWIM Mean Probability of Sea Ice

1 February 2020

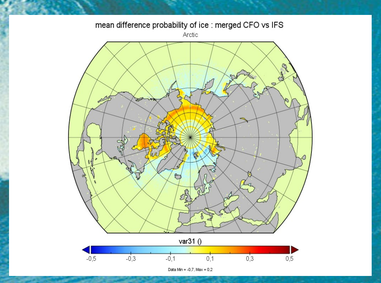
Southern Ocean and MIZ

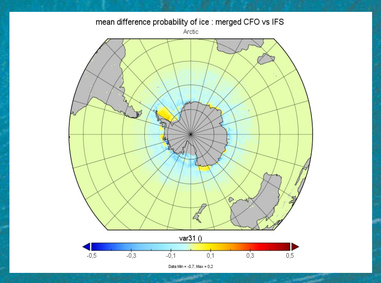


Arctic Ocean



Average difference of probability of ice Merged CFOSAT vs IFS :January 2020



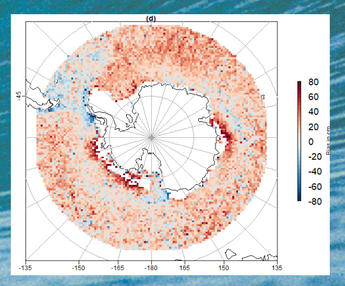


➔ **Red color indicates an overestimation of ice fraction, while blue color Indicates an underestion**

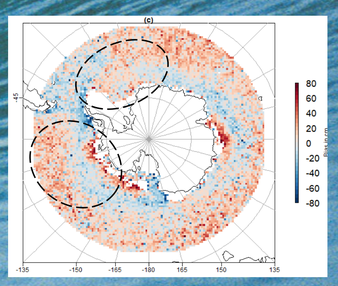
Validation of Significant Wave height (SWH) from model runs Comparison with altimeters (Jason-3, S3A&B and SARAL January-February 2020

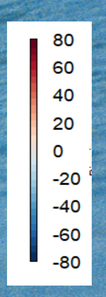
SWH Bias maps in cm (maximum range 80cm)

IFS sea ice



Merged CFOSAT-IFS ice





➔ **Significant reduction of SWH bias particularly in Weddel and Amundsen seas For latitudes below 45°S the SWH bias decreases from 12 to 3 cm in average.**