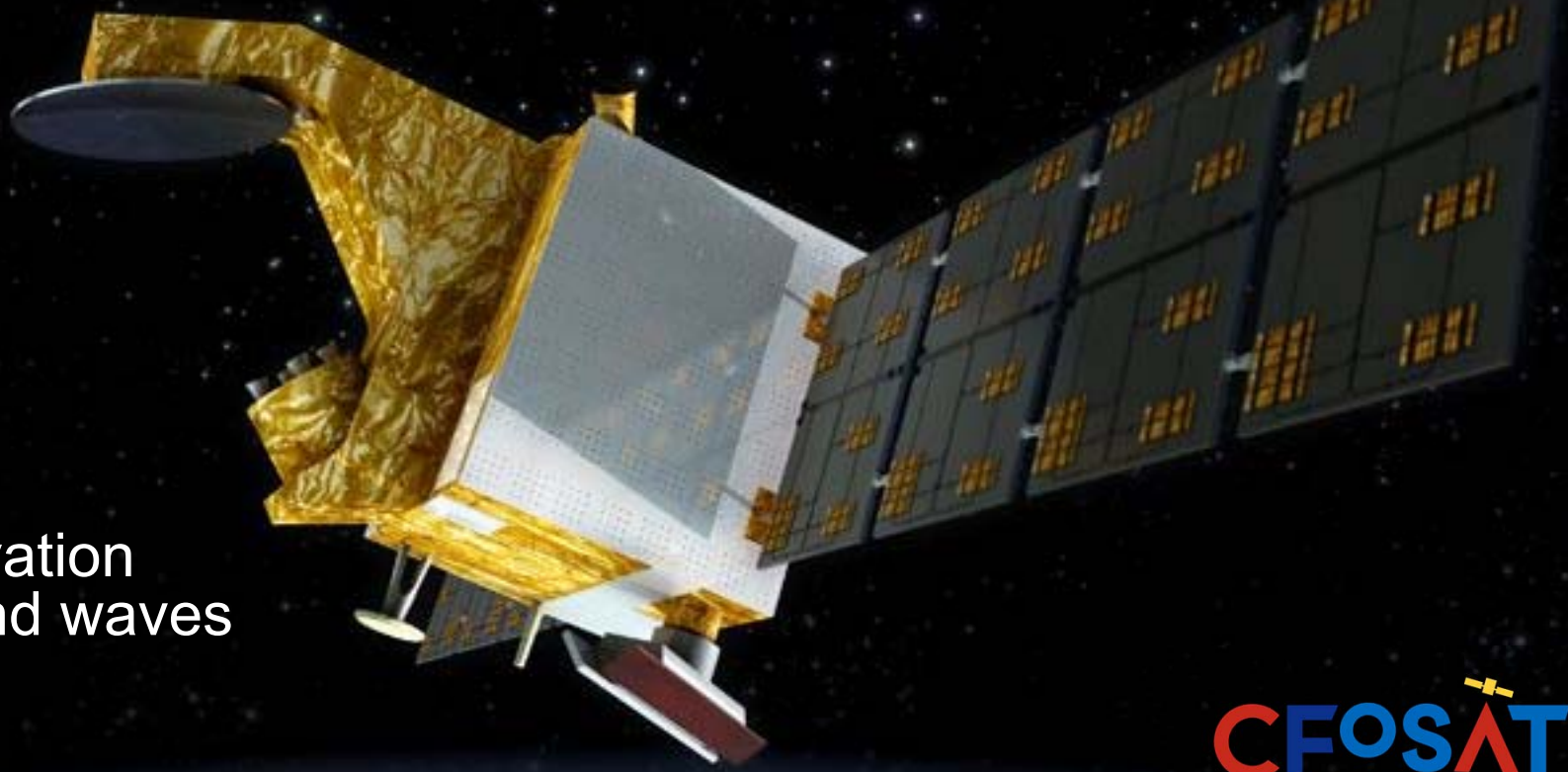
CFOSAT: China France Oceanography SATellite



New products
for the observation
of wind and waves

CFOSAT

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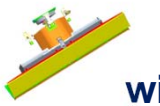
(2) LATMOS, CNRS, UVSQ, UPMC, Guyancourt, France

CFOSAT : A China/France world premiere for oceanography

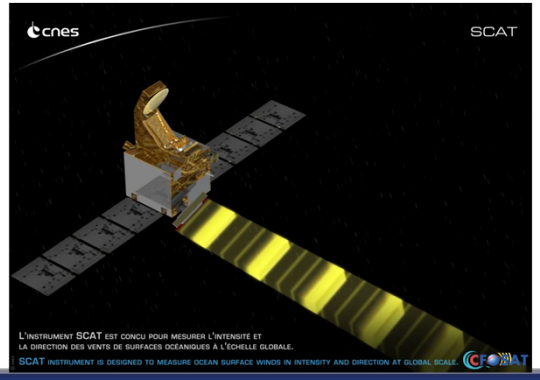
Main Objective : Measure at the global scale ocean surface wind and waves spectral properties



SCAT

wind scatterometer

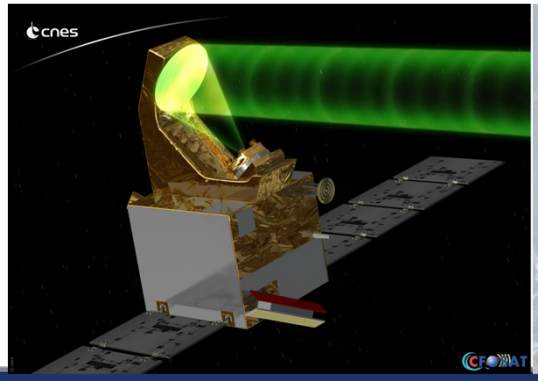
- Fan beam concept
  - Large swath
  - Rotating antenna: 3 rpm
- Incidences between 26° and ~50°
- Provides
  - σ0
  - Ocean wind vectors



SWIM

Wave scatterometer

- Ku band real aperture radar,
- Sequential illumination with 6 incidence angles : 0°, 2°, 4°, 6°, 8°, 10°
- Rotating antenna (all azimuth direction acquisition): 5,6 rpm
- Provides :
  - Directional wave spectra
  - Significant wave height and wind speed
  - σ_0 mean profiles, 0 to 10°

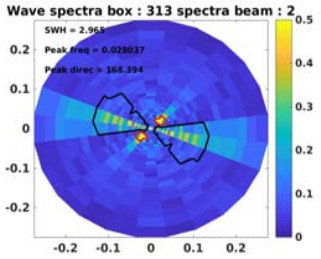


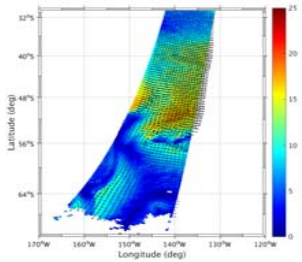
cnes

Mission status

2018 October 29th Successful launch :

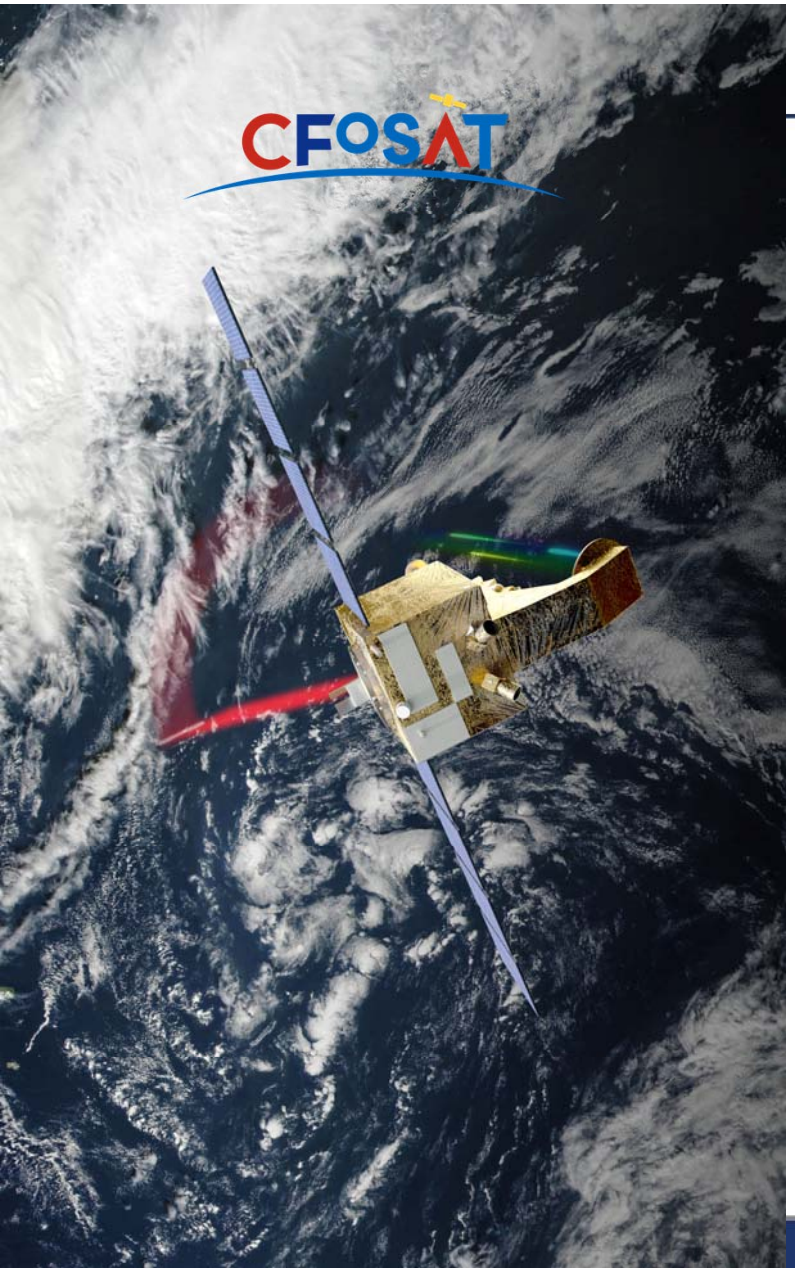
- Very precise injection with the Long March 2 launcher
- Instruments switched ON
  - SCAT : October 31st
  - SWIM : November 1st
- Both ground segments functional less than one week after launch
  - First SWIM wave spectra and SCAT wind map produced on November 4th





2018 December 17th SWIM commissioning keypoint:

- Functional behavior validated
- Very good instrument performances observed



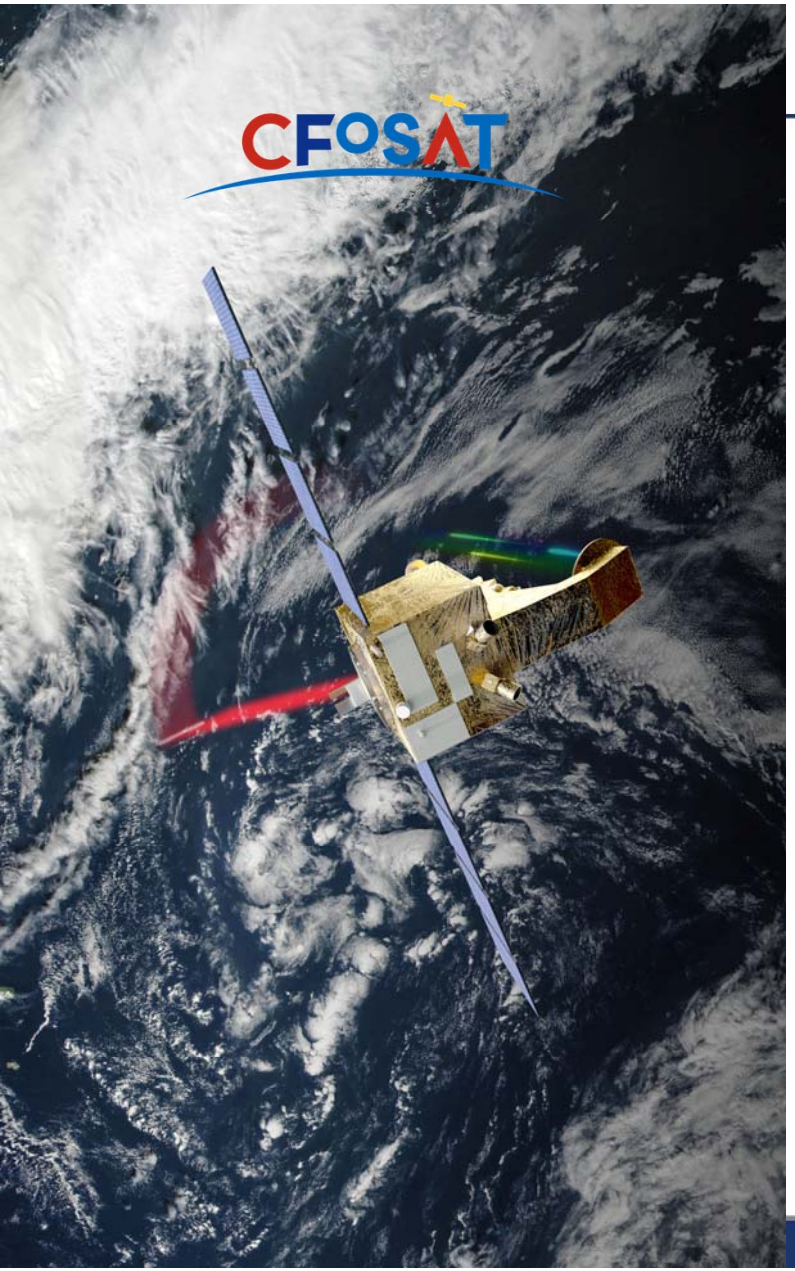
Mission status

2019 July 1-3 : CAL/VAL workshop

- CAL/VAL analyses of verification phase presentations
  - Report on “the SWIM CAL/VAL at the end of the verification phase”: **available**

2019 September 23rd – 26th: 1st international Science Team Meeting in Nanjing (China)

- 80 international attendees
- CAL/VAL synthesis for both instruments
- First feedbacks from scientific teams
- Agreement on data quality
- Data release recommendation



Mission status

CFOSAT Science Team established

- More than 50 scientific teams leaded by:
  - France
    PI: Danièle Hauser (LATMOS)
    Co- PI: Lotfi Aouf (Météo-France)
  - China
    PI : LIU Jianqiang (NSOAS)

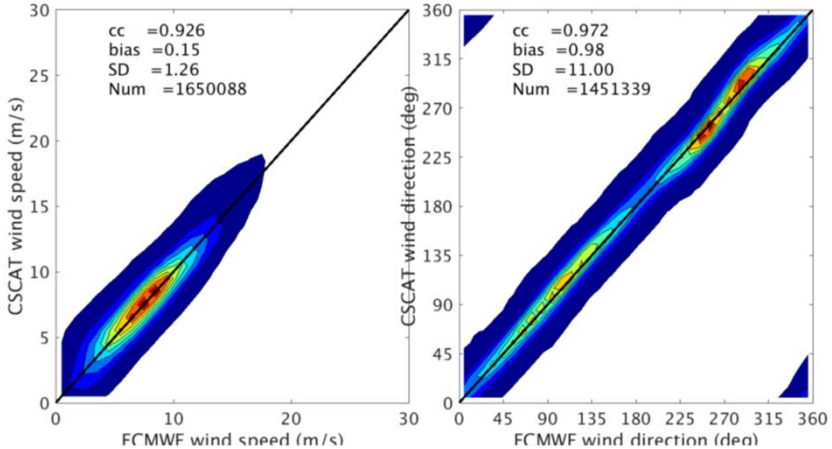
2019 November: data release to all scientific users

- Data already available to science team
- CNES/CNSA Joint Steering Committee expected for formal open worldwide
- CFOSAT enters in routine exploitation

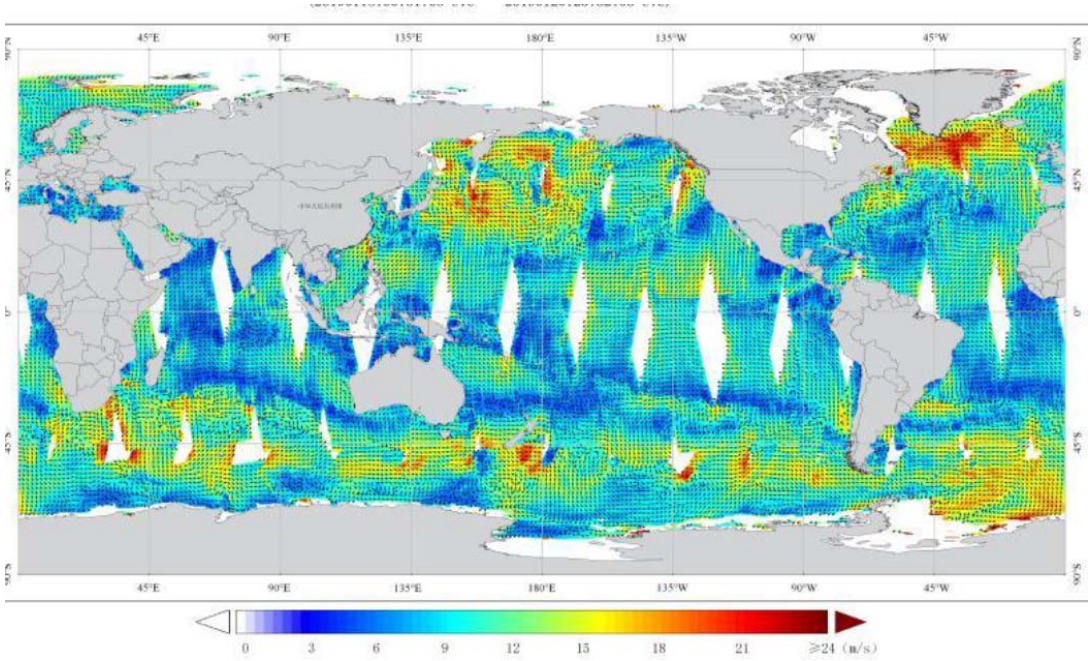
CFOSAT SCAT: firsts results

Wind products

- Wind vectors globally consistent with ECMWF model data
  - Wind speed : 1.3 – 1.4m/s RMS discrepancies
  - Wind direction : 15 - 17 ° RMS discrepancies



- Good wind fields consistency with NDBC buoy
  - wind speed about 1.0m/s,
  - wind direction about 16°.

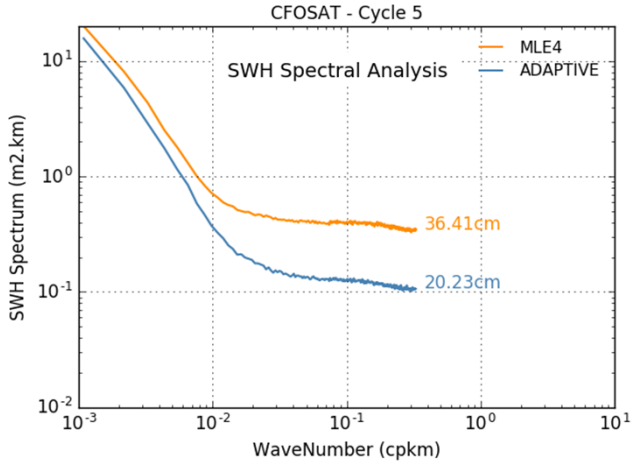


CFOSAT SWIM: firsts results (1/3)

Nadir products

- Operational implementation of the Adaptive retracking Algorithm
- Despite SWIM low measurement rate (5Hz vs 20Hz), remarkable results:
  - Very good consistency with model and altimetry missions
  - Improved performances w.r.t. current operational altimetry retracking

    ➔SWH and Sigma0 restitution noise reduction



See A. Ollivier specific presentation in CFOSAT Splinter (Thursday 11:20)

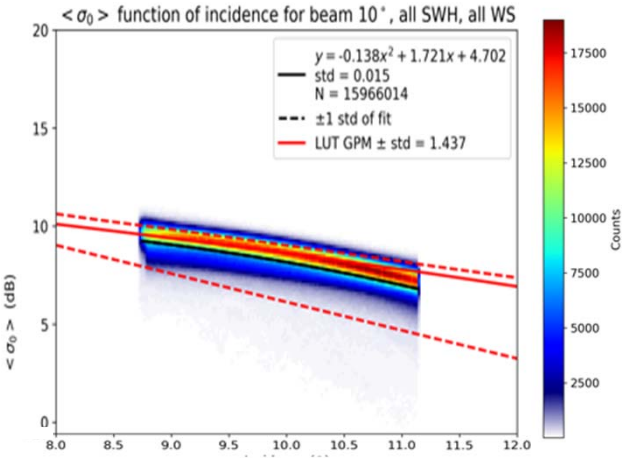
Example :
10°beam results

CFOSAT SWIM: firsts results (2/3)

Off-nadir sigma0 product: sigma0 profiles

- Ocean surface :
  - Trends consistent with TRMM/GPM
- Sea ice and land surface
  - good sensitivity and consistent with literature

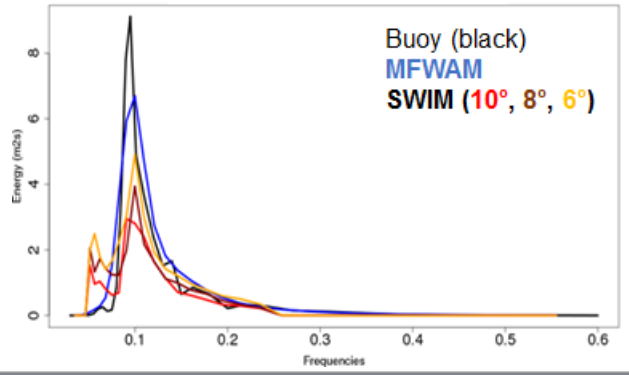
Incidence dependency
(all SWH al Wind speed)



Wave spectra

- 1D spectra
  - Shape consistent with model and buoy data
  - Good wavelength estimation
  - Some parasite peaks to be filtered out

Omni directional spectra

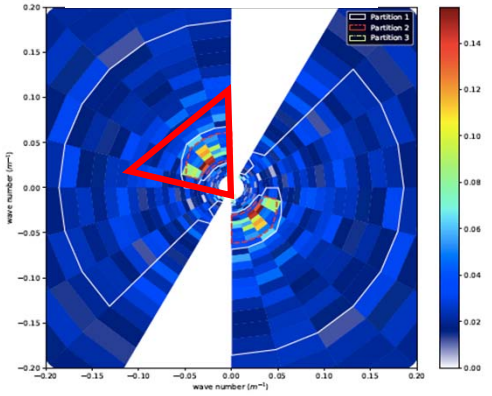


CFOSAT SWIM: firsts results (3/3)

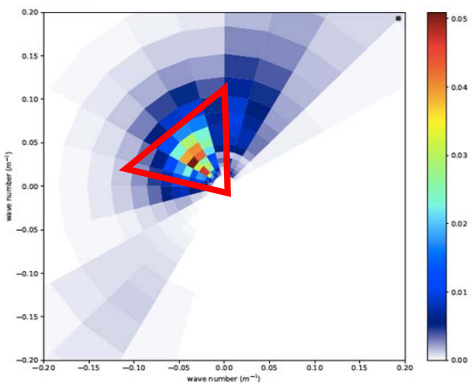
Wave spectra

- 2D spectra :
  - Overall good correlation with model spectra,
  - waves detected for wavelengths from ≈60m to ≈600m,
  - overall good agreements for wavelength and directions
  - some bias in wave height, on going work

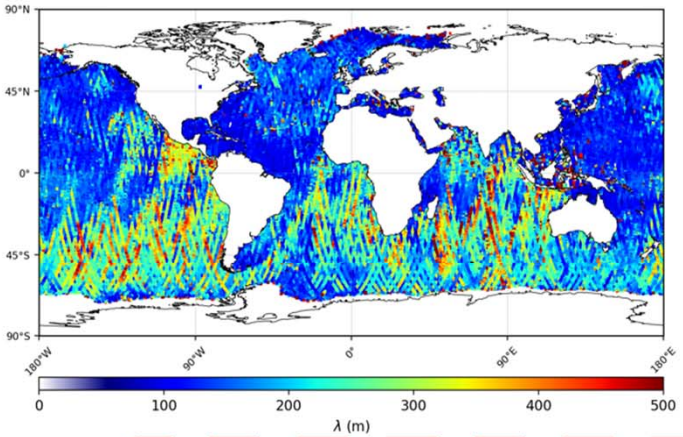
SWIM 2D wave slope spectrum (10°)



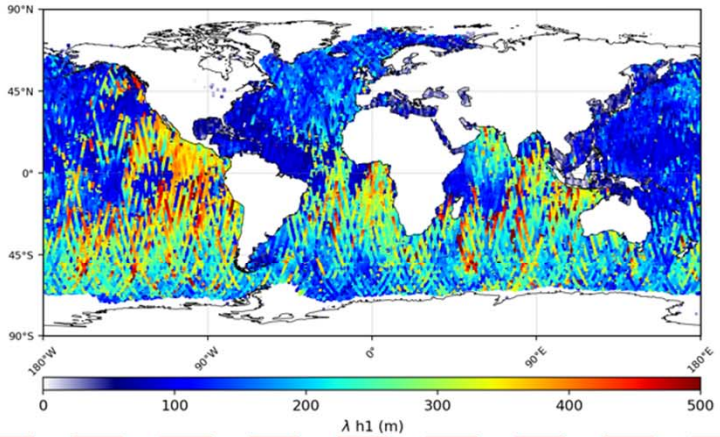
MFWAM 2D wave slope spectrum



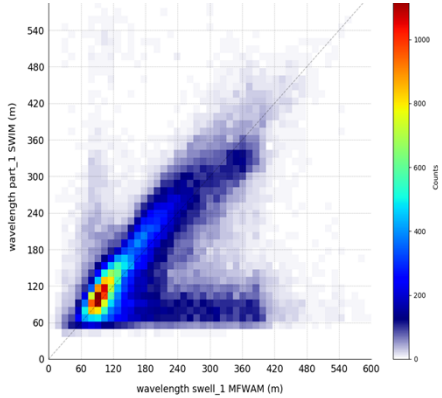
SWIM wavelength (26/04/2019 to 09/05/2019)



MFWAM wavelength (26/04/2019 to 09/05/2019)



SWIM versus MFWAM wavelength (26/04/2019 to 09/05/2019)

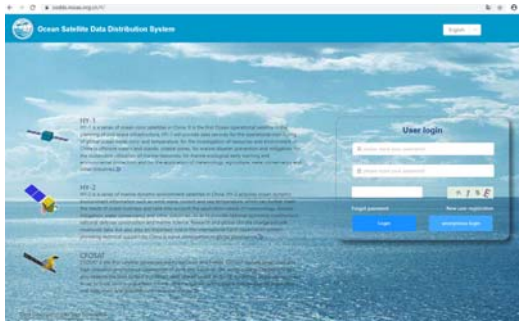


See D. Hauser presentation in CFOSAT Splinter (Thursday 11:00)

Conclusion

CFOSAT data will be available very soon (November)

- SWIM data
  - On AVISO website : https://www.aviso.altimetry.fr/en/missions/current-missions/cfosat.html
- SCAT Data
  - On NSOAS website https://osdds.nsoas.org.cn
  - And on AVISO website



CFOSAT data are ready to use for science

- All SWIM performances and limitations described in the document
  REPORT ON THE SWIM CAL/VAL AT THE END OF THE VERIFICATION PHASE (AVISO website)

SWIM: a very innovative instrument

- Strong potential for many applications
- Processing and products will keep improving
- Feedbacks from users welcomed

CFOSAT data are here.

Make the most of them!

Thank you for your attention!

BACKUP

SWIM NRTProducts

L1a
Calibrated waveform, geocoded @ 0, 2, 4, 6, 8, 10°
+ nadir waveform non calibrated, compensated for Instrument automatic gain

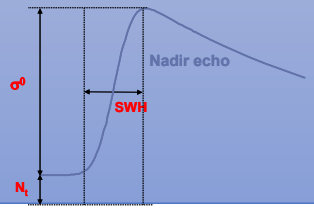
Nadir products (0°)

Wave products (6°, 8°, 10°)

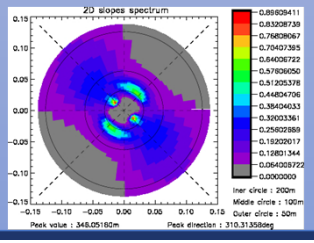
σ^0 products (0°, 2°, 4°, 6°, 8°, 10°)

L1b
- Modulation spectrum

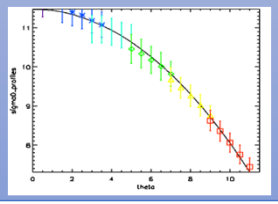
L2
- SWH, wind speed
- Ice and land properties



L2
- Omnidirectional and 2-D wave spectra
- Partitioning and associated parameters (Hs, peak wave number and peak direction)

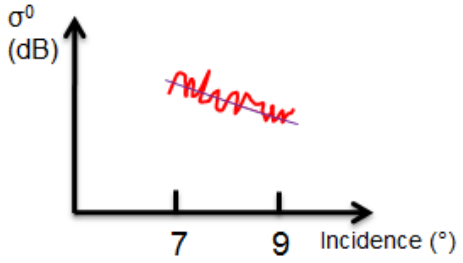


L2
- σ^0 mean profiles versus incidence and azimuth

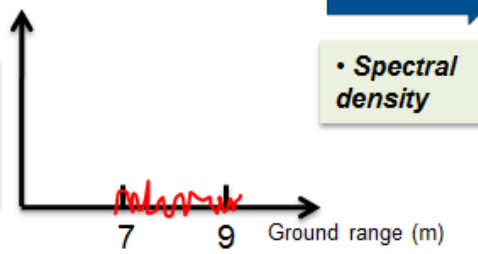


SWIM NRT Wave products

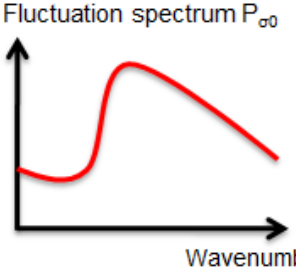
L1a: Calibrated wave form, geocoded
(per cycle, per azimuth, incidence = 6, 8 or 10°)



• ***Mean trend suppression***
• ***Ground projection***



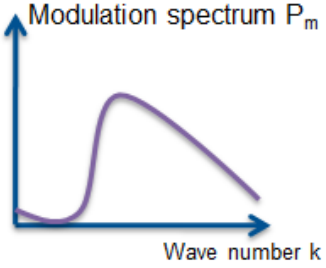
• ***Spectral density***



$P_{\sigma 0} = P_{IR}.P_m + P_{sp}$

• ***Speckle + IR correction***

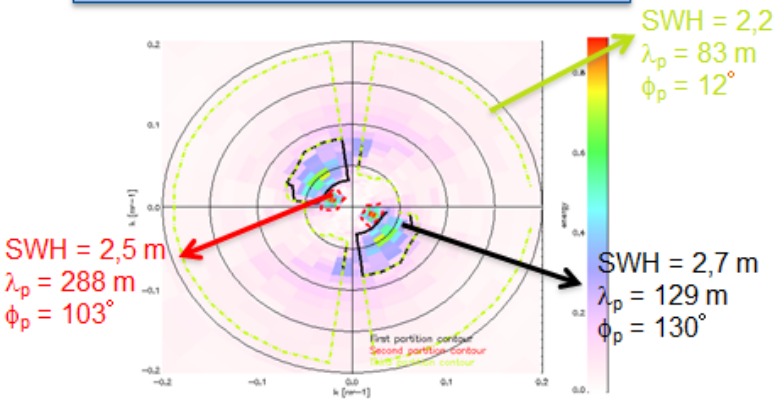
L1b: modulation spectrum
(per cycle, per azimuth, incidence=6, 8 or 10°)



$P_w = P_m/MTF$

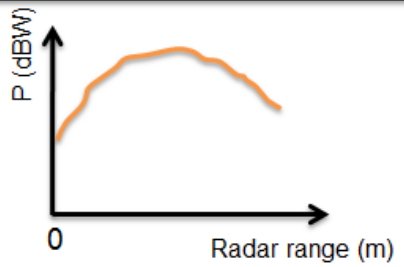
- ***Transfer function estimation and wave slope spectrum computation***
- ***15°-azimuth averaging***
- ***Partitioning and physical parameter computation***

L2: wave slope spectrum and partitions
(per box, per beam or merged)

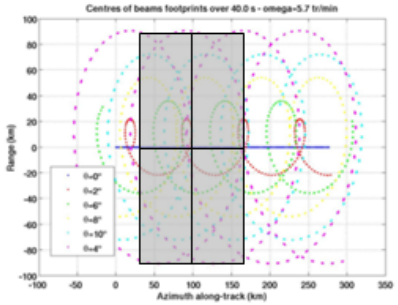


SWIM NRT σ^0 profile

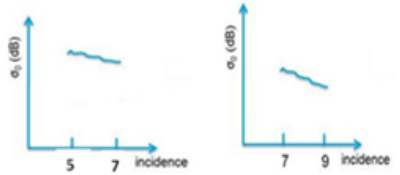
L0: non calibrated wave form (per cycle, incidence, azimuth)



- ***σ^0 estimate from radar equation***
- ***Geocoding***



L1a: Calibrated wave form, geocoded (per cycle, incidence, azimuth)



- ***Combining incidences within boxes***

L2: Normalized radar cross-section profiles
From 0° to 11° (per 15°-azimuth range) at a scale of 70 x 90 km and associated radiometric accuracy