



CNES Ocean program

Juliette Lambin, CNES

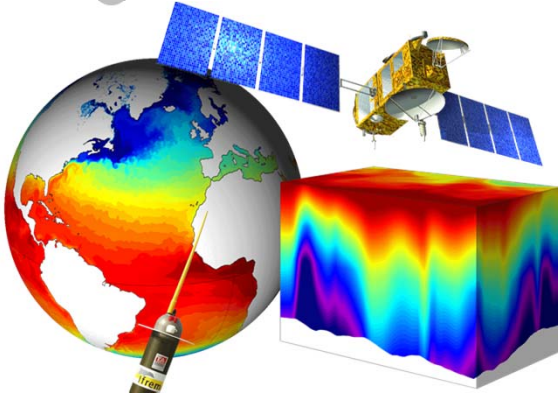
Monday, April 15th, 2013

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Smos & Aquarius Science Workshop
IFREMER, Brest, France, 15 - 17 April 2013.

- **Latest news from CNES ocean program**
- **SMOS: CNES participation and recent developments**
- **Future plans and conclusions**

CNES involvement in oceanography



Promote the development of operational oceanography

- ◆ Secure the « reference mission » continuity and performance: TP/J1/J2/J3/J-CS
- ◆ Contribute to the altimetry constellation: ERS/ENVISAT/SENTINEL-3, Hy-2A
- ◆ Enhance synergies between altimetry missions through AVISO/DUACS
- ◆ Involvement in CORIOLIS, partnership with Mercator...

Future of altimetry: new instruments

- ◆ AltiKa: Ka-band altimetry
- ◆ Contribution/Interest in Delayed Doppler altimetry (Cryosat, Sentinel-3...)
- ◆ SWOT: wide-swath altimetry

Explore new measurements of ocean parameters

- ◆ SMOS: ocean surface salinity
- ◆ CFOSAT: directional wave spectrum
- ◆ Ocean colour

SARAL

Satellite for Argos and ALtiKa

Cooperation with ISRO

(India Space Research organization)

Ka-band nadir altimetry mission

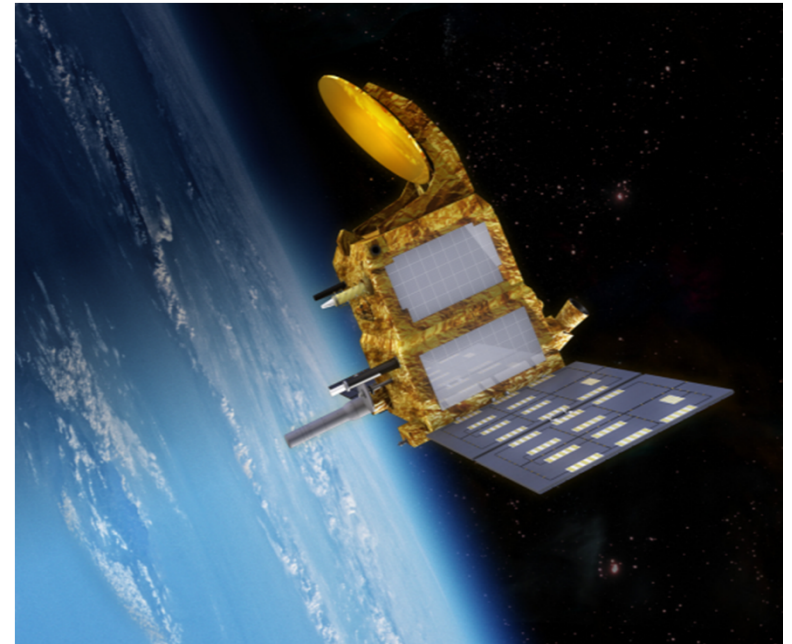
- Higher precision, shorter along-track sampling
 - ◆ Gap filler between ENVISAT & SENTINEL3
 - ◆ Same orbit as ENVISAT (35 days, SSO)
 - ◆ New Ka-band altimeter, higher precision, compact design, integrated radiometer/altimeter
 - ◆ POD: DORIS, LRA
 - ◆ Other CNES payload Argos-3 instrument, X-band telemetry

Status:

- ◆ Launched by PSLV (ISRO) on Feb 26th
- ◆ Validation phase on-going

Data policy : ~ the same as JASON missions

PI: Jacques Verron (LEGI)



SARAL first results

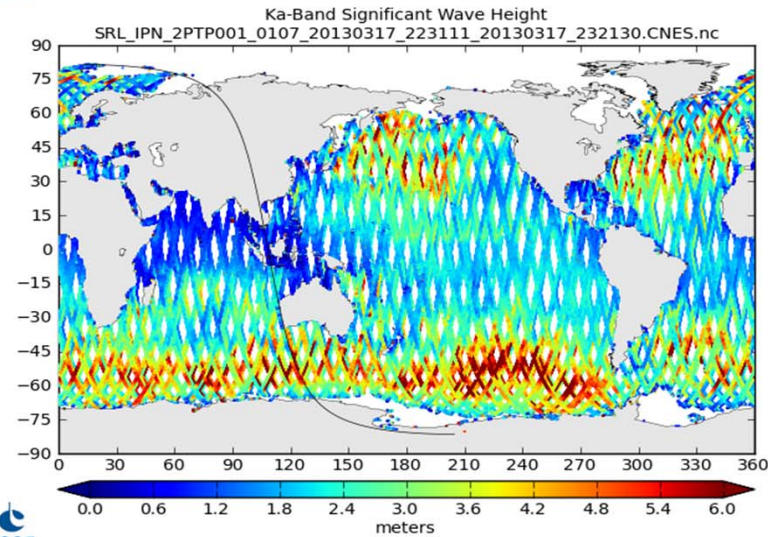
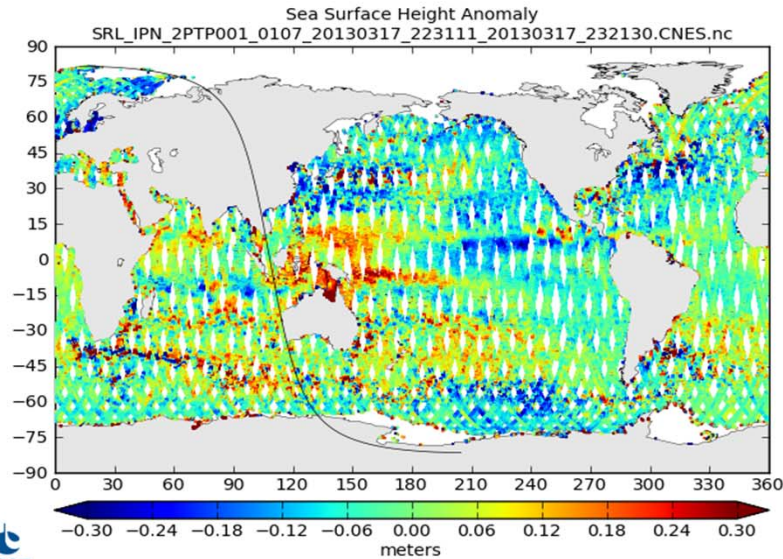
Excellent performance:

Altimeter noise	Specifications	Measured on ground	In flight data
1Hz range	1.5 cm	0.9 cm	0.9 cm
1Hz SWH	6.3 cm	5.7 cm	5 cm
1Hz Sigma0	0.2dB*	NA	0.012 dB

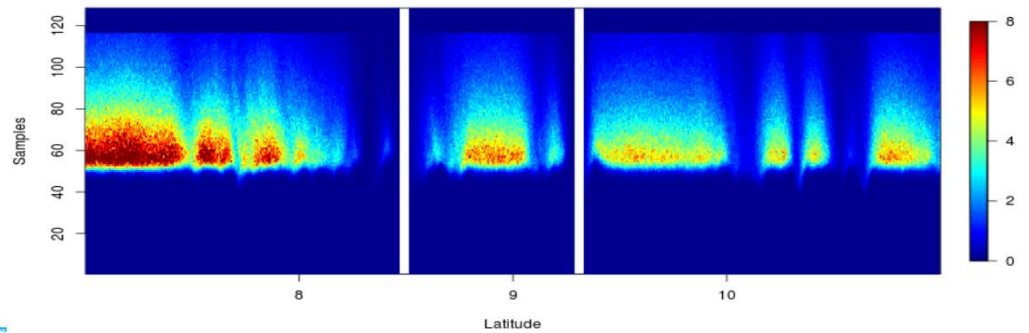
Real-time orbi > 5cm rms (no fine tuning yet)

X-over analysis Jason2 – SARAL indicate good consistency

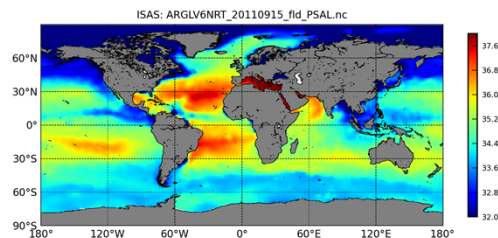
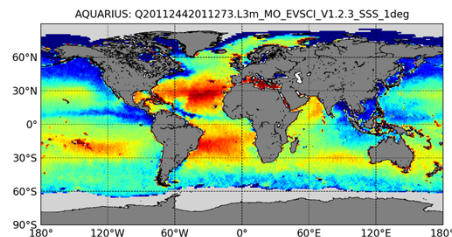
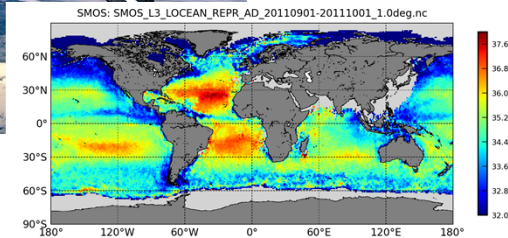
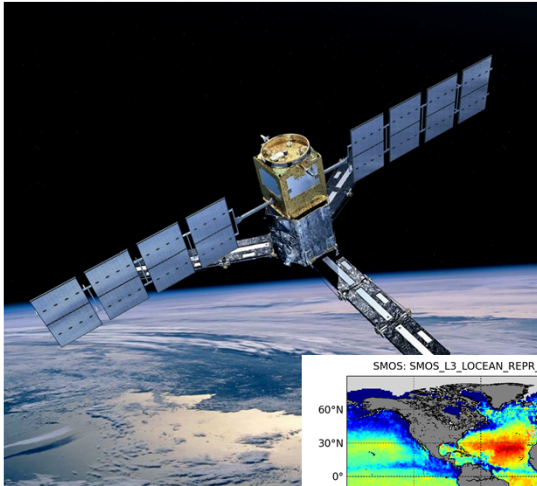
Rain impact under control



ALTIKA WAVEFORMS (corrected by KCAL) - Cycle 998 pass 279



SMOS: CNES (and IFREMER) activities



CNES contribution to SMOS:

- PROTEUS S/C bus + X-band TM
- Control center and operations
- Mission center: CATDS: Centre Aval de Traitement des Données Smos
 - ◆ Level 3-4 products SM and OS

Status

- Satellite: excellent behavior. Could last several years longer
- Satellite control center: OK
- CATDS:
 - ◆ Official transfer of operations to Ifremer in Dec '12
- Importance of Expertise centers (SM and OS) activities for Level1 processing
- Support to Cal/val program

Upcoming activities

CNES Science Prospective Seminar

- Will take place in La Rochelle, April 2014
- Call for Ideas issued in late 2012
 - ◆ One “salinity” mission submitted : SMOS Next
- Study of proposals in parallel on science interest and feasibility: 2013-2014
 - ◆ by CNES science committees (TOSCA, CERES)
 - ◆ by PASO team at CNES (actually, for SMOS-NEXT phase 0 starting)
- Any inputs welcome...

Other ocean missions in development

Two slides on... CFOSAT

China-France Oceanography SATellite

China-France Cooperation

- ◆ Currently in phase C/D
- ◆ Launch expected end of 2014

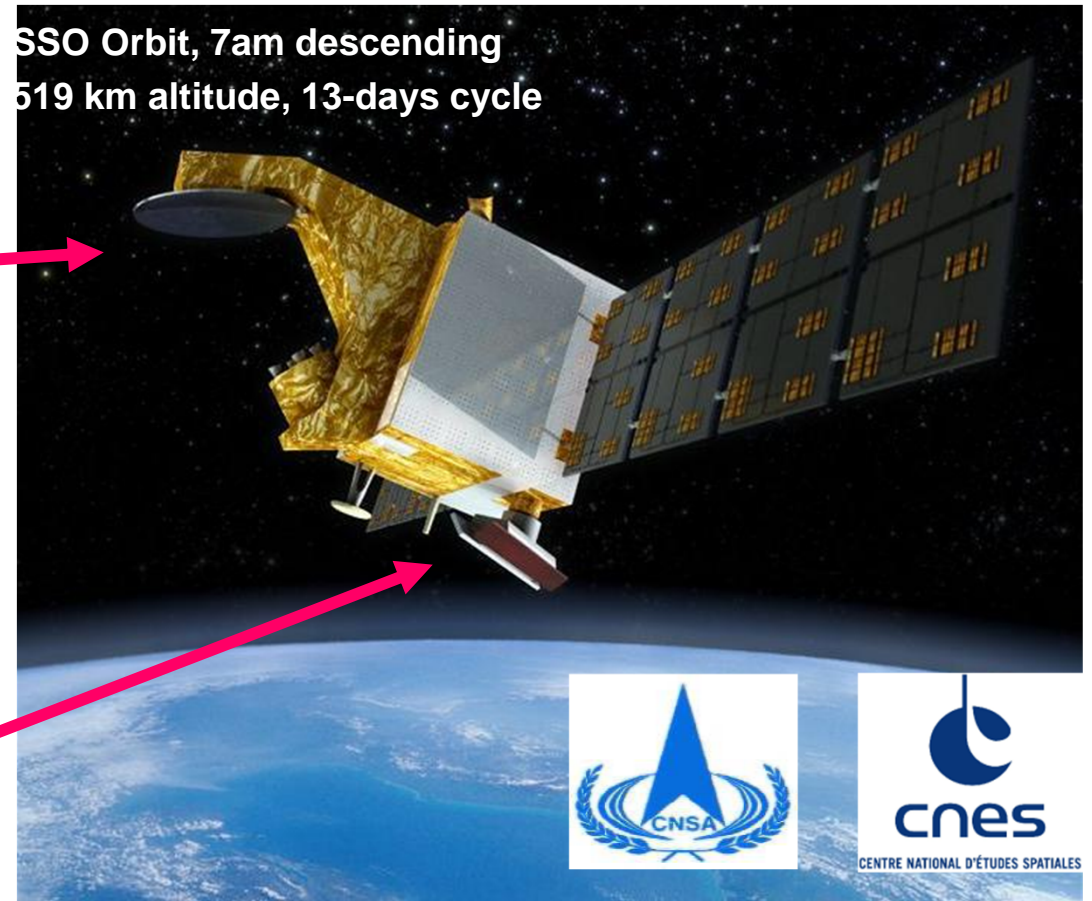
SWIM, new spaceborne instrument

- ◆ technology innovations (antenna, on-board digital processing)
- ◆ Nadir channel ~altimeter

SCAT, new concept of wind scatterometer

- ◆ Ku-band, rotating fan-beam

SSO Orbit, 7am descending
519 km altitude, 13-days cycle

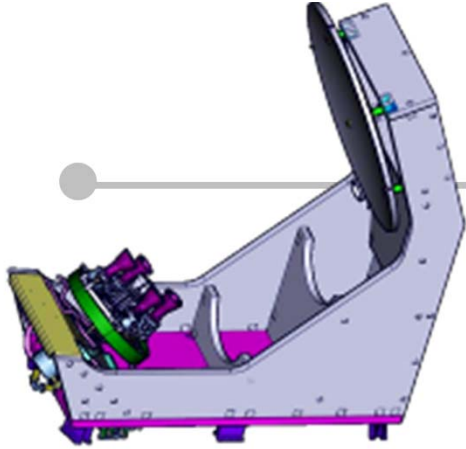


Access to 2D wave spectrum with high angular resolution and with global scale

Joint measurements of winds and waves

PI: Danièle Hauser (CNRS/LATMOS)

SWIM instrument



Surface Waves Investigation and Monitoring

Real aperture radar in Ku-band

6 incidence angles: 0°, 2°, 4°, 6°, 8° et 10°

Rotation speed: 5.7 rpm

Will measure:

Directional wave spectrum in the wavelength range 70-500 m

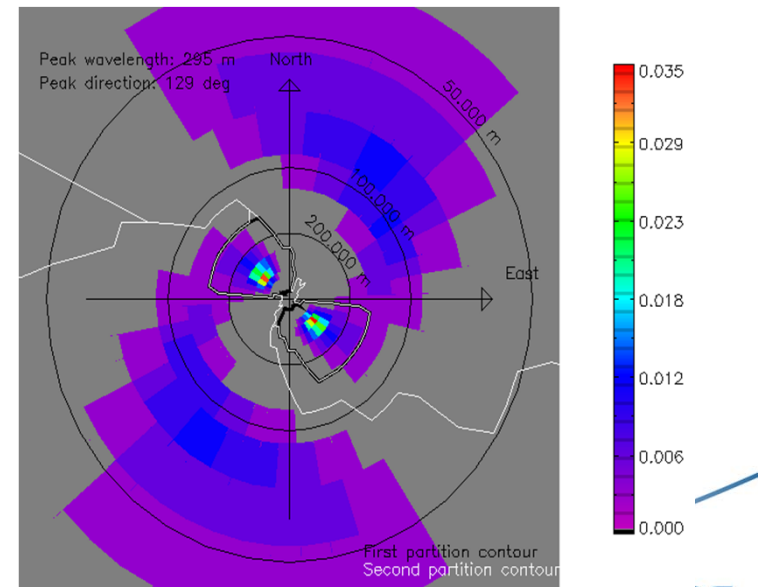
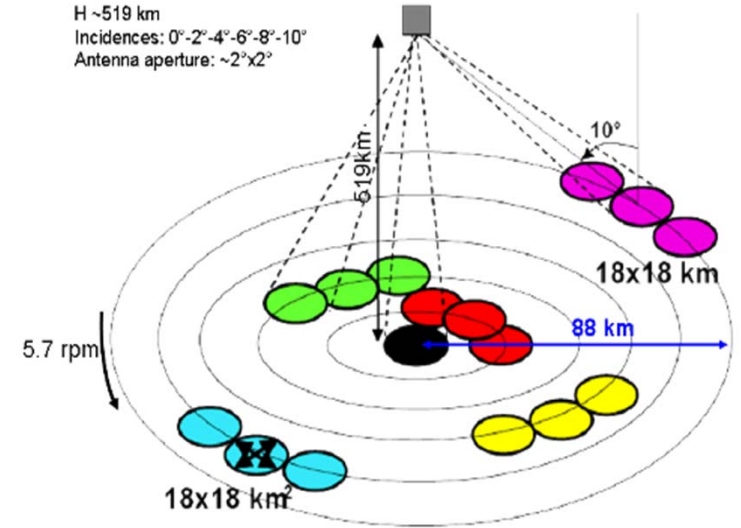
Accuracy: 10% on wavelength, 15° on direction, 15% on spectral level around the peak

SWH and wind speed from nadir

Normalized radar cross-section from 0° to 10°

Absolute accuracy of ±1 dB, relative accuracy between incidences ± 0.1 dB

Airborne instrument in 2012 (KUROK)



GMES - Copernicus



Sentinel-1 (A & B):

- SAR Imaging radar SAR
 - ◆ Continuity ASAR/ENVISAT
 - ◆ Launch end 2013
- Ocean parameters:
 - ◆ Sea state
 - ◆ Surface currents,
 - ◆ Ship detection,
 - ◆ Slick detection...

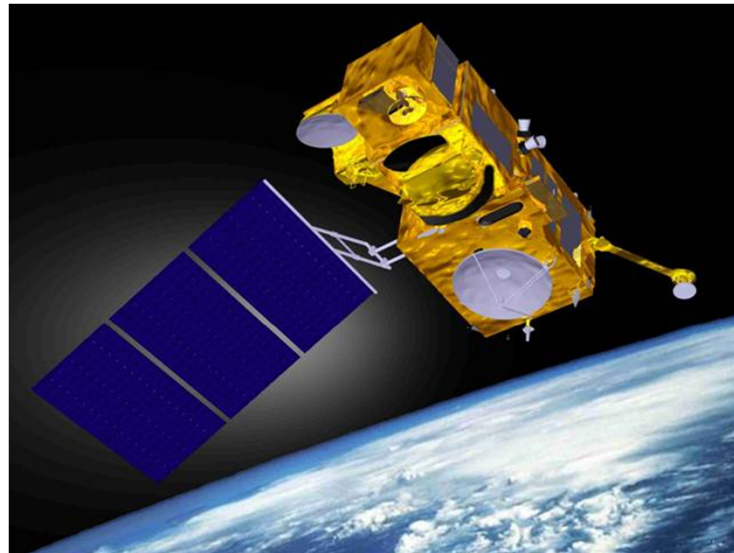
Sentinel-3 (A & B) :

- 3 Instruments (continuity envisat)
 - ◆ TOPO: Altimetry payload (altimeter, radiometer, POD)
 - ◆ OLCI: ocean color
 - ◆ SLSTR: sea surface temperature

Launch: ~2014 et ~2017

Also in GMES Space component: Jason-CS (not yet approved):

- Reference altimetry mission, continuity of Jason-3
- Launch 2018?



One slide on... **SWOT**

Surface Water and Ocean Topography

Hydrology and Oceanography mission

Global, repeated high-resolution elevation measurements of ocean and inland water bodies

Baseline payload :

- Ka-band interferometric altimeter (KaRIn)
- Traditional altimetry payload

CNES budget secured in March'11 through General Investment Fund

NASA/CNES Cooperation scheme approved

Mission Concept Review successfully passed in Sept 2012

Phase A just started at NASA...

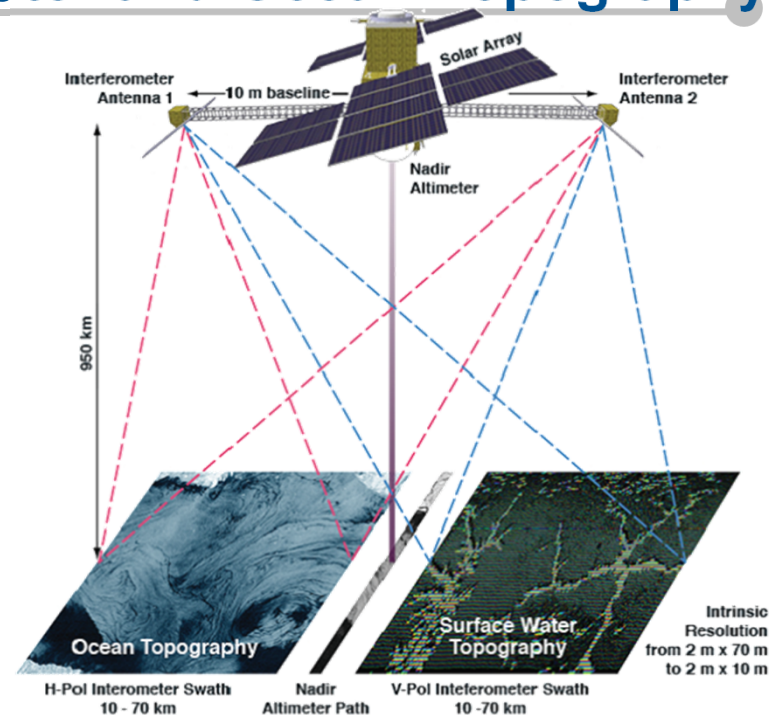
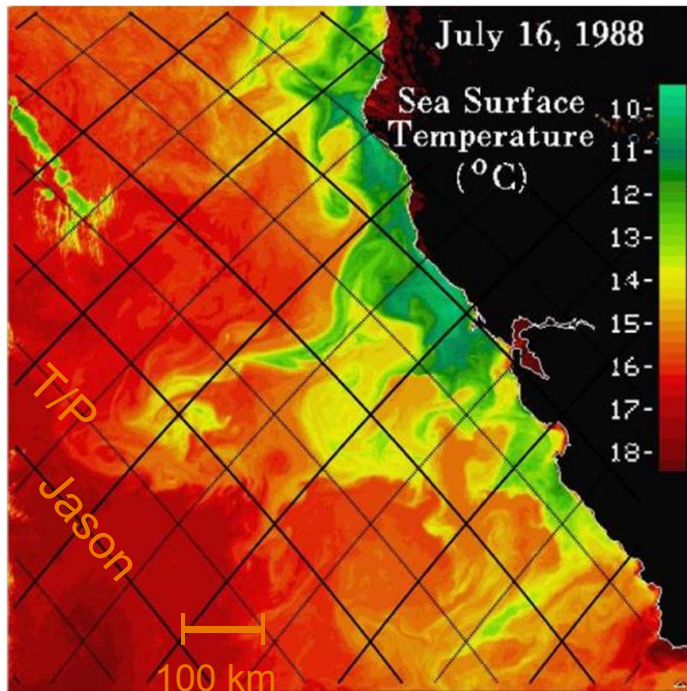
CNES involvement:

- Participation in KaRIn
- DORIS, Altimeter
- Platform
- Ground segment



Mission SWOT:

Surface Water and Ocean Topography



- Mission proposée dans le cadre d'une collaboration NASA/CNES, pour un lancement vers 2020
- Le futur de l'altimétrie (cartographie haute résolution, côtier)
- Une révolution à venir en hydrologie

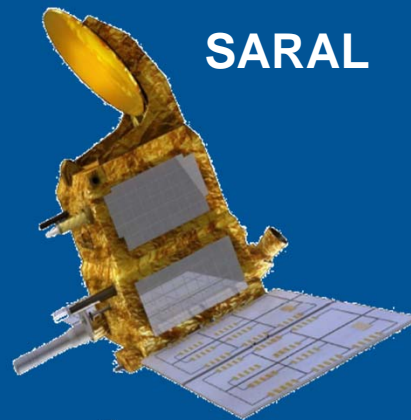
Conclusions

SMOS is a fairly unique mission in the CNES ocean programs

- First mission dedicated to salinity
- One of the first land/ocean combined mission
 - ◆ Very rich interaction, despite added complexity
- Interest of combination SMOS/AQUARIUS
- First mission with such an advanced partnership with Ifremer

The story is not finished

- ◆ Still some progress ahead
- ◆ Interest of combination SMOS/AQUARIUS and of combinations SMOS-other
- ◆ SMOS-Next perspectives



SARAL

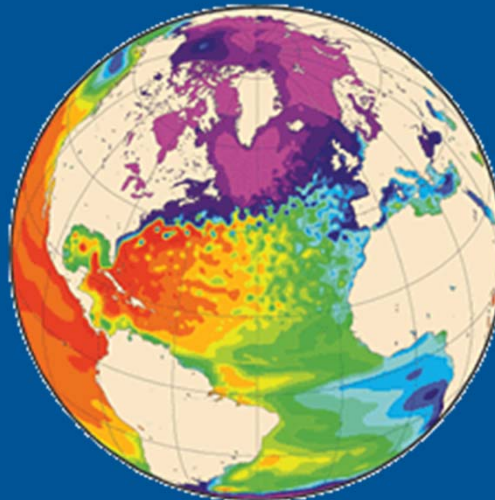
Jason series



Thank you !



SMOS



CFOSAT



SWOT