



Programmatic Session

NASA



NASA 2013-2016 OSTST Grants

- 28 Projects selected from 8 NASA ROSES research themes
- ~50% success rate (59 proposals received)
- 2/3 returning investigators; 1/3 new from last cycle. 90 PI's, Co-I's, and Collaborators.
- Areas with increased support include coastal oceans and the role of meso-scale eddies and tides



NASA 2013-16 OSTST Grants (cont.)

- NASA also supports core activities of Project Scientist (Josh Willis), Cal/Val Lead (Bruce Haines) and annual OSTST meetings.
- OSTST funding has been stable, but “sequestration cuts” (~8-10%/yr) may impact future funding.
- OSTST investigators are encouraged to provide NASA HQ (eric.j.lindstrom@nasa.gov) with new results as brief PPT’s and PDF’s of publications.



NASA/CNES SWOT

- 2013 selected PI's for Science Definition Team
- Includes oceanographers & surface hydrology experts to advise NASA/CNES through Phase A/B

NASA Sea Level Science Team

- Currently reviewing proposals for new science team to support cross-disciplinary projects (oceanography, geodesy, solid earth, cryosphere, outreach, etc.) to better understand and respond to sea level rise.



Programmatic Session

NOAA



NOAA Program Status

J-3 Ground Segment

- First time in Jason series that one agency will control both satellites, J-2 & J-3, simultaneously
- NOAA internal testing successfully completed; 4-partner testing well underway

J-3 Funding

- Received all requested FY13 funds
- FY14 request included in President's budget to Congress

J-CS Funding

- Not yet formally approved program
- However, some support going to JPL for preliminary design work

J-3 Launch Status

- Working closely with NASA to maintain scheduled March 2015 launch
- SpaceX wants to discontinue Falcon 9 v1.0 and upgrade to v1.1 (much larger rocket) at no cost to program.
- First successful launch of v1.1 from Vandenberg, Sept 29, 2013.
- Any certification issues could delay launch





Programmatic session

EUMETSAT

With contribution of all partners



Jason-2 (including also SARAL)

- JSG (and EUMETSAT Council) have approved extension up until June 2015
- Process has started at EUMETSAT for a further extension of routine operations up until end of 2017, including close-out activities in the first half of 2018
- No major issue in routine operations (see CNES' slides)



Jason-3

- Contribution from ESA has been secured
- Good progress of discussion with the European Commission to secure pre operation and operation cost
- EUMETSAT ground system is ready and system tests have started
- Close monitoring of satellite activities which are funded by EUMETSAT
- V1.1 successful launch is a significant milestone
- Launch in March 2015 is critical for continuity and programme affordability
- See detailed status in Jason-3 project presentation



Jason-CS or rather now Sentinel 6 / Jason-CS

- Preparation of next Potential Participant Meeting:
 - Discussions with the EUMETSAT Member States having expressed interest in joining this optional programme
 - Presentation of the main technical and programmatic features of the programme
- Preparation of System Requirements Review:
 - Review of system documentation:
 - End-User Requirements document (EURD)
 - Mission Requirements Document (MRD)
 - System Requirements Document (SRD)
 - ...
 - Also management and operation concept documentation
- Discussions on going with partners, EC, ESA, NOAA, NASA and CNES on detailed sharing of responsibilities and framework for agreements

JASON-CS PARTNERSHIP



ESA: development of Jason-CS A, LEOP



EUMETSAT: System responsible, Jason-CS B (part), development of ground segment, operations



CNES: expert support



EU: funding of operations and Jason-CS B (part)



NOAA: provision of some payload, launcher, ground station and part of ground segment



NASA/JPL: development of payload instruments

JASON-CS PAYLOAD

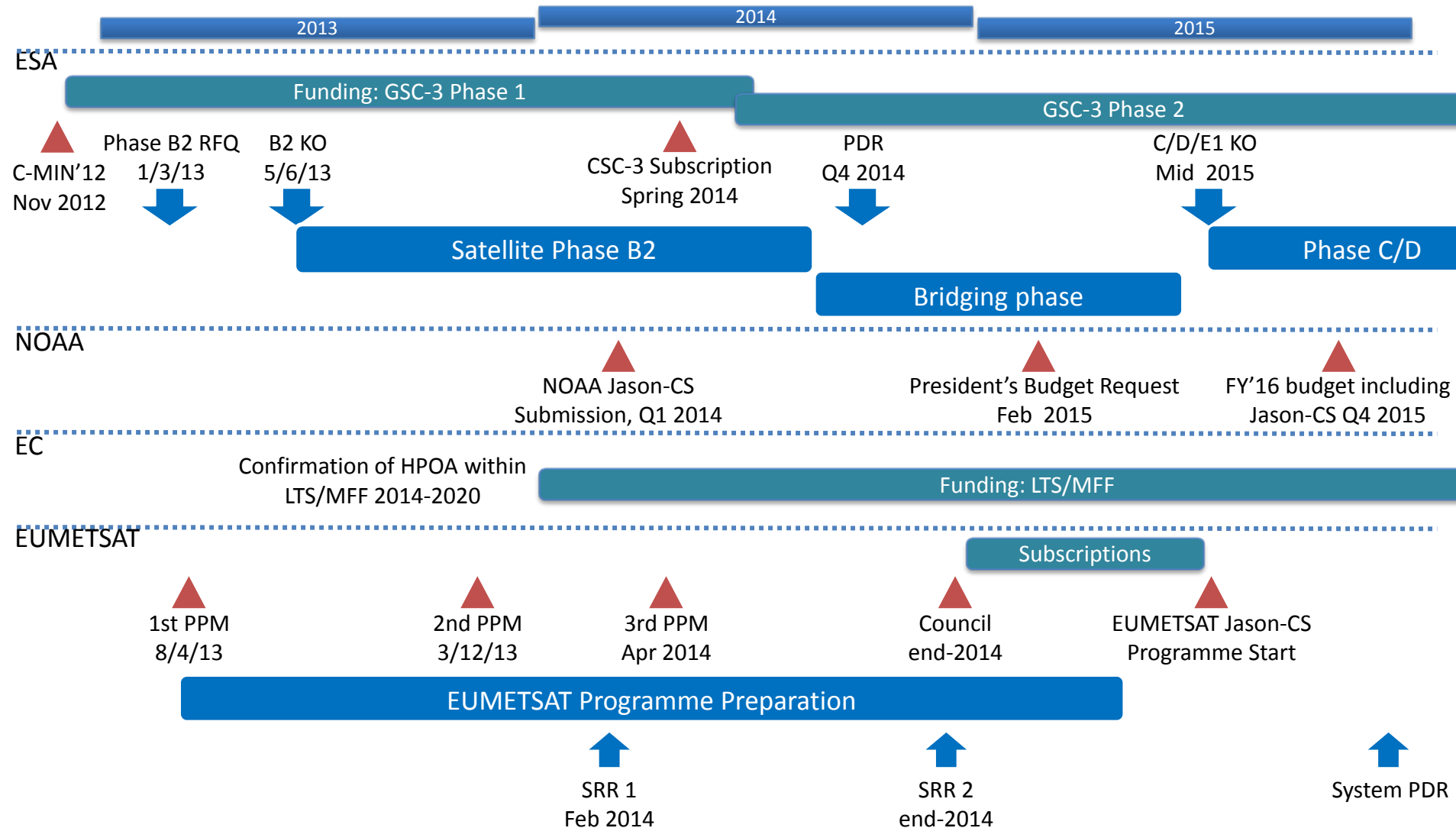
- **Topography:**

- Poseidon-4 radar altimeter (Jason heritage) with interleaved mode
- Microwave radiometer AMR-C (Jason heritage)
- GNSS Receiver (S3 heritage)
- DORIS Receiver
- Laser Retroreflector
- High-Resolution Microwave Radiometer (option)

- **Radio Occultation:**

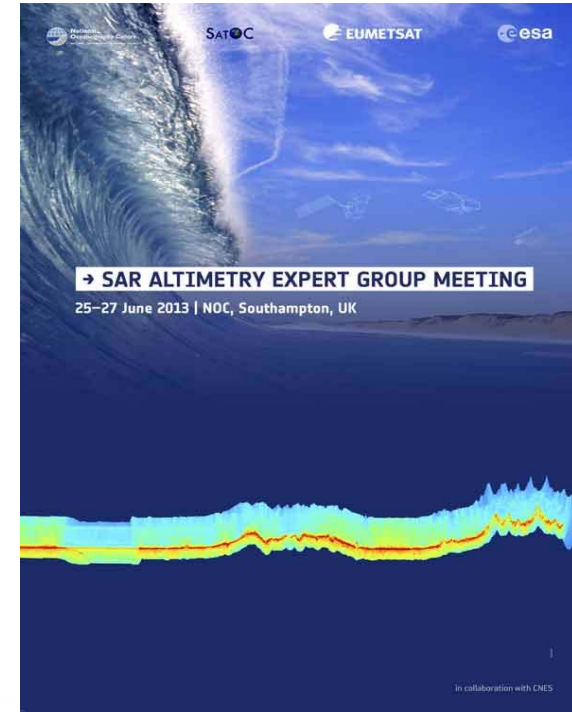
- TrIG (COSMIC-2 heritage)

TOP LEVEL TECHNICAL AND PROGRAMMATIC ROADMAP



SAR Workshop

- Held at NOC, Southampton, 26-27 June 2013
 - Sponsored by ESA, EUMETSAT, NOC and SATOC Ltd
- Over 60 attendees from across the world
- 10 invited talks by SAR altimetry experts
- LOTS of discussion time
- Presentations available on:
 - www.satoc.eu/projects/CP40/meetings.html



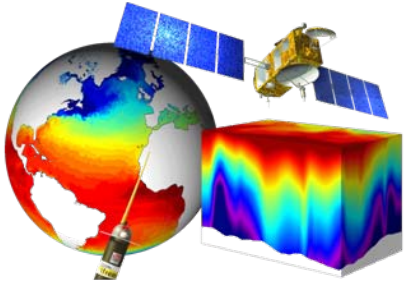


Last but not least

A new Logo is in preparation.....



CNES OCEAN CONSTELLATION STATUS – J. LAMBIN



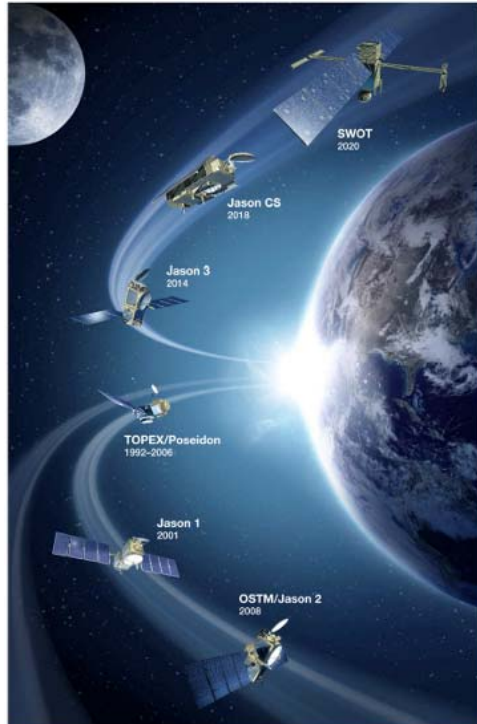
Ocean sciences are an important component of CNES Earth observation programs

- Science and Operational oceanography
- Altimetry past, present and future missions
- Other ocean parameters: salinity, wave spectrum, ocean color...

Altimetry:

- TOPEX/POSEIDON, JASON-1, SWOT with NASA
- ENVISAT, CRYOSAT, SENTINEL-3 with ESA
- JASON-2, JASON-3 with NASA, EUMETSAT, NOAA
- JASON-CS in support to ESA and EUMETSAT
- SARAL with ISRO
- Hy-2A with China

- OSTST support
- SALP: multimission mission center => AVISO

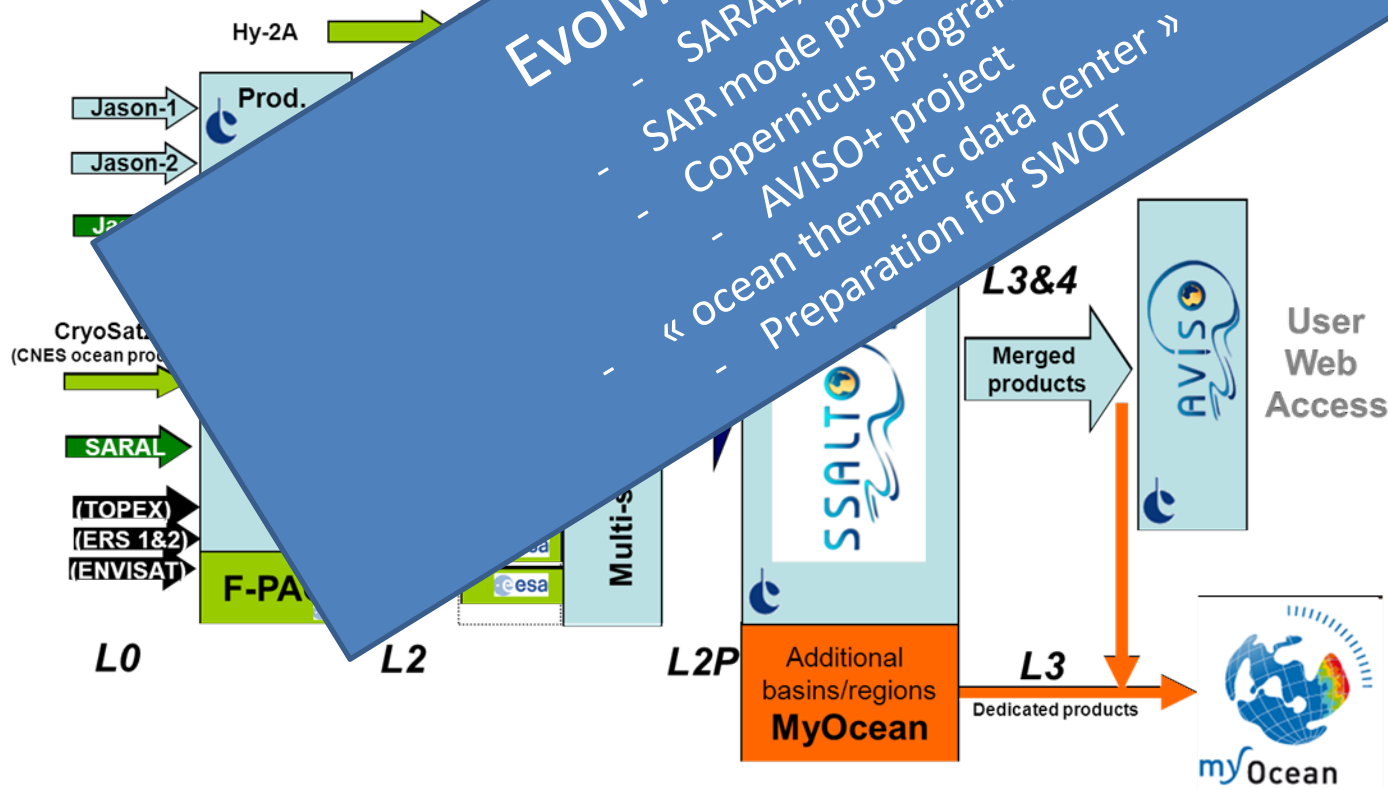


SALP: ALTIMETRY ON THE GROUND

Multi-mission ground segment in altimetry: Processing

- Calibration-validation
- Intercalibration – homogeneization
- Multi-mission product
- Distribution, user support
- Evolutions and reprocessing

SERVICE
ALTIMETRIE
&
LOCALISATION
USE

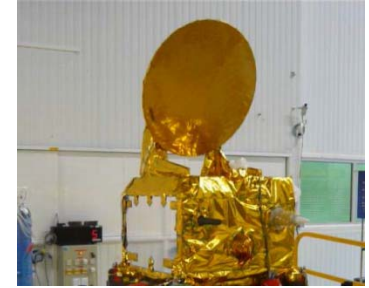


From AltiKa to SARAL - SARAL launched on Feb 25, 2013!

AltiKa: new altimeter concept, studied at CNES since 1996

- ◆ Higher radar frequency: Ka-band (35 GHz)
 - » Enhance precision, improved along track sampling
 - » Nicely complement Ku/C/S frequencies (low sea state, hydrology, ice)
- ◆ Microwave radiometer embedded => compact design

AltiKa et
Argos-3,
July 2011



SARAL: mission decided in cooperation ISRO-CNES

- ◆ Common interest in ocean observation, gap filler need between Envisat and Sentinel-3, compatible with Argos-3 need
- ◆ MoU signed in 2007: Satellite for **AR**gos and **AL**tika

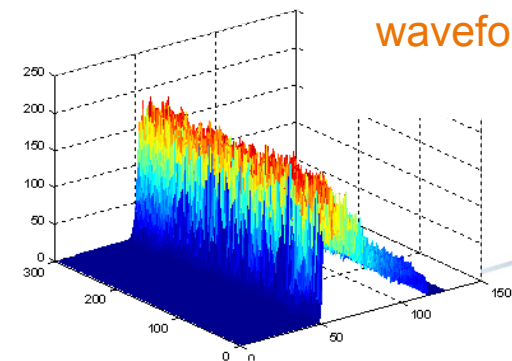
⇒ launched on Feb 25, 2013 by ISRO (PSLV). Extremely rapid and efficient early operation phase: first data arrived the morning after!

PSLV
25 Feb 2013



« beautiful »
waveforms on 26
feb 2013

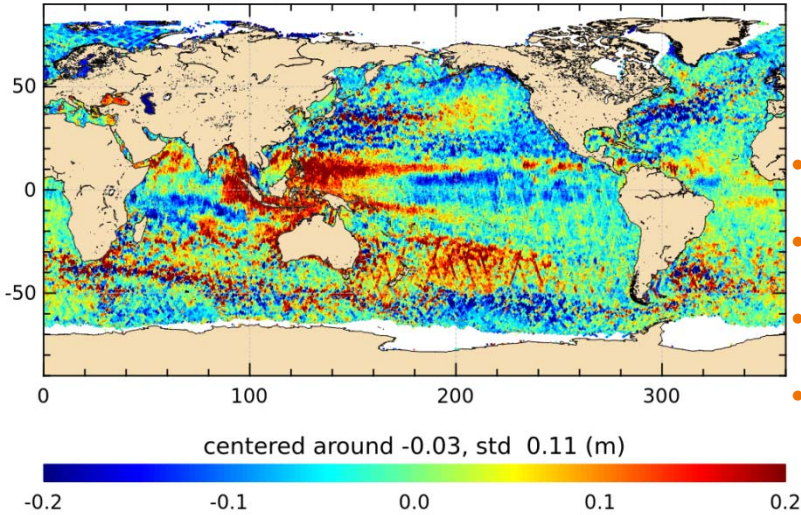
Data (OGDR/IGDR/GDR) fully available already



AltiKa Performance (CNES/CLS)

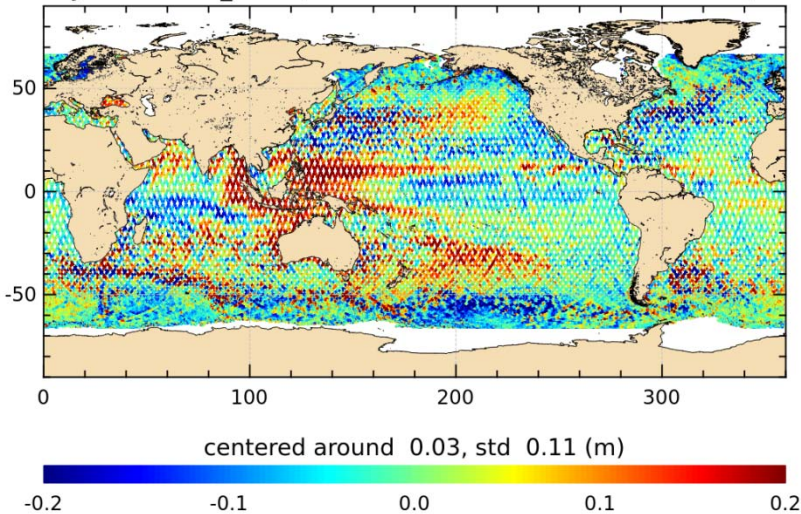
Ka-band SLA

Saral valid_all (2013-04-27 23:32 - 2013-06-01 23:32)



Ku-band SLA

Jason-2 valid_lat66 (2013-04-27 23:32 - 2013-06-01 23:32)

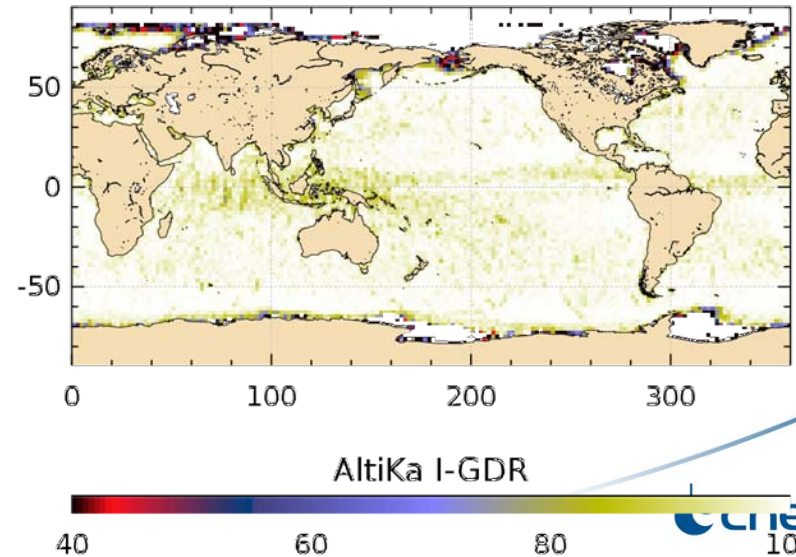


Altimeter parameter	Specifications	Measured on ground	In flight data
1Hz range	1.5 cm	0.9 cm	0.9 cm
1Hz SWH	6.3 cm	5.7 cm	5 cm
1Hz Sigma0	0.2dB*	NA	0.012 dB

*includes the noise and the non-calibrated drift error

- meet or exceed requirements
- less impact from rain than feared
- OGDR, IGDR GDR already distributed
- Orbit inclination slightly different from ENVISAT, correction maneuvers needed

% of data valid on thresholds



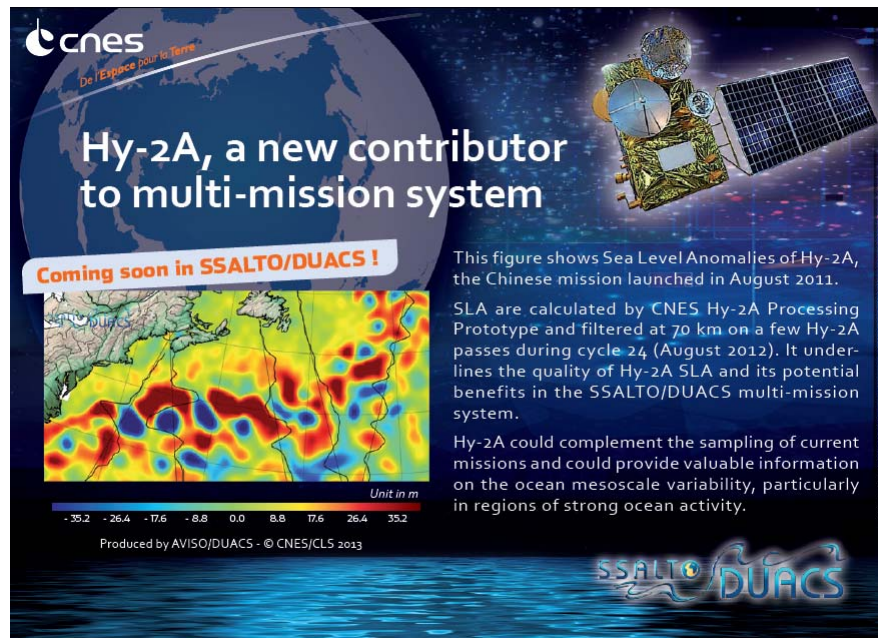
Hy-2 progress status

Routine S-IGDR delivery from NSOAS to CNES started

Routine processing of S-IGDR at CNES is starting

Integration into DUACS system on-going....

See Nicolas Picot's talk for more detail.



Two slides on... CFOSAT

China-France Oceanography SATellite

China-France Cooperation

- ◆ Currently in phase C/D
- ◆ **Launch NO LONGER expected end of 2014**

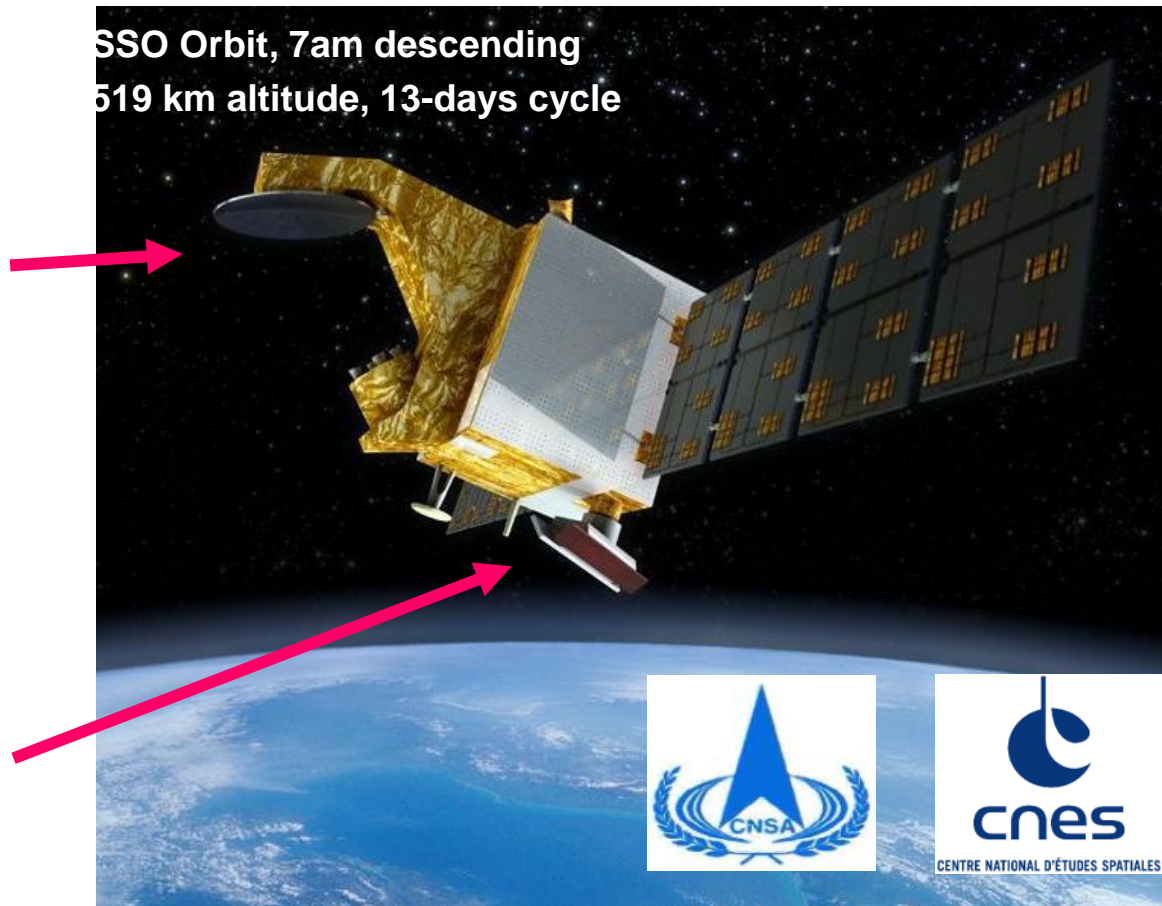
SWIM, new spaceborne instrument

- ◆ 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

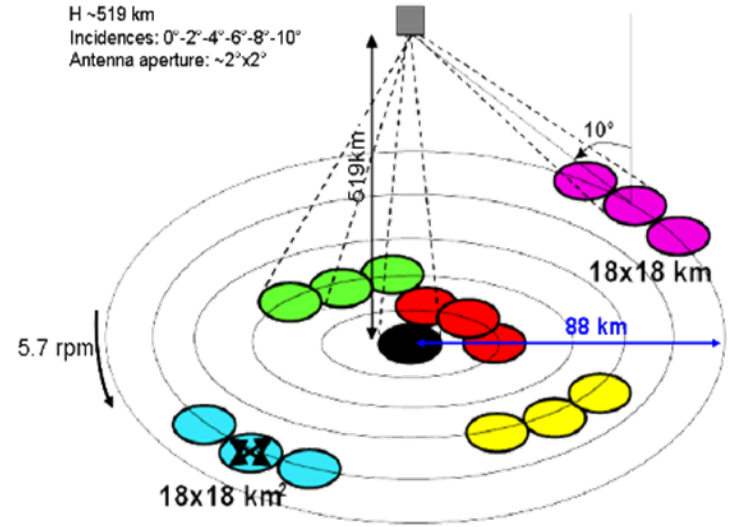
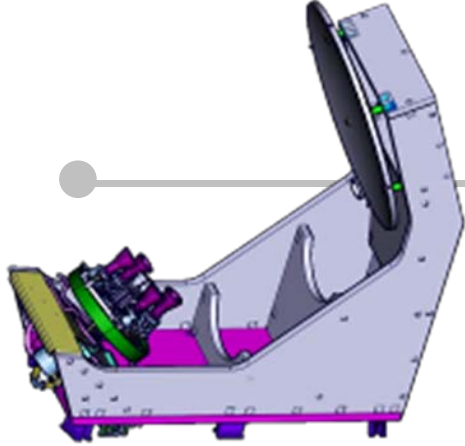


Access to 2D wave spectrum with high angular resolution and with global scale

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:

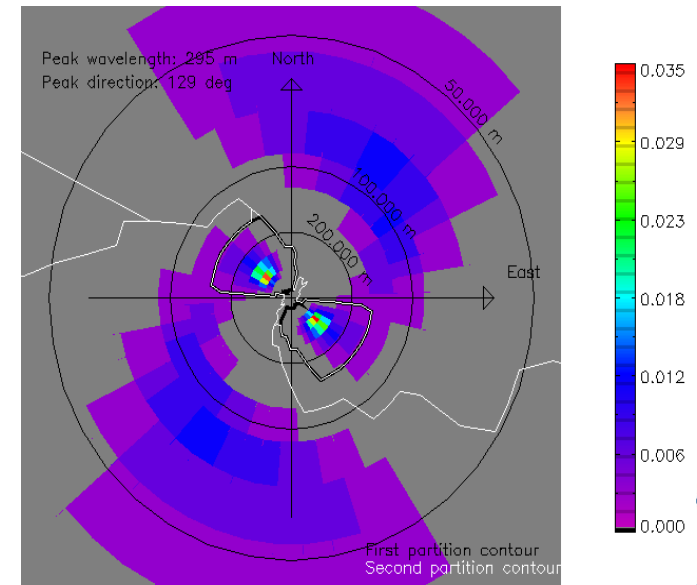
Directional wave spectrum in the wavelength range 70-500 m

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

SWH and wind speed from nadir

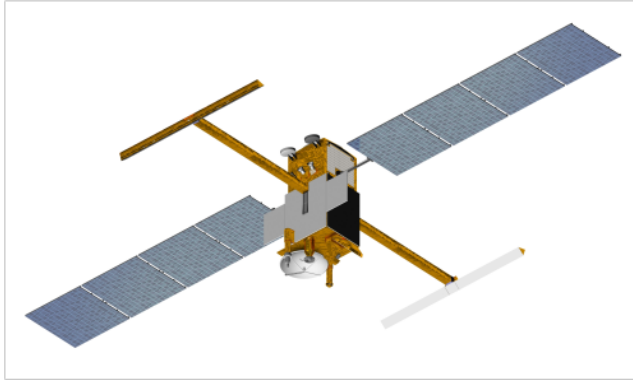
Normalized radar cross-section from 0° to 10°

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



Airborne instrument in 2012 (KUROK)

SWOT status

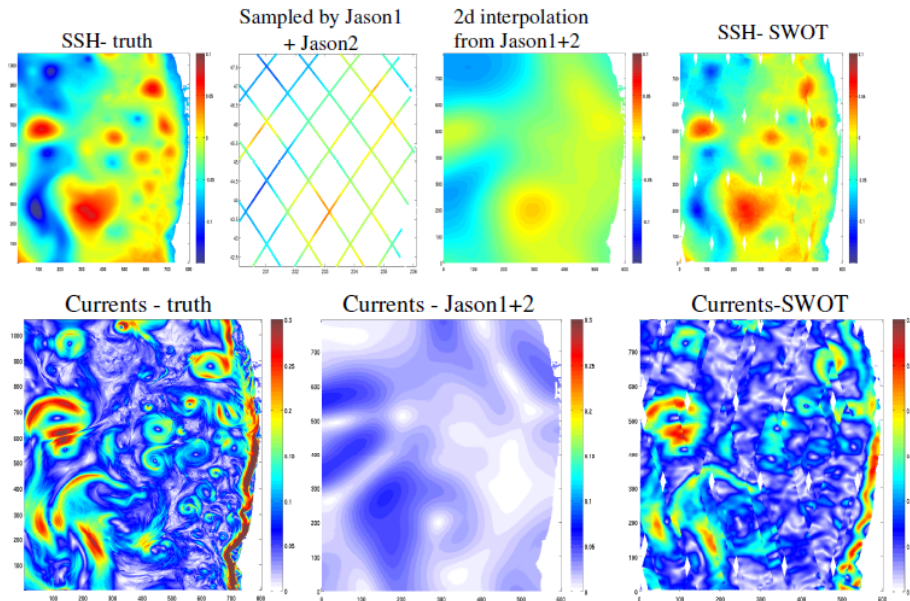


Recent and upcoming events;

- System requirement review, 2-3 October 2013.
- First important stage towards « Phase B » (expected mid 2014)

Thanks to the team !

- AirSWOT first check-out campaign March-April 2013
- Next AirSWOT meeting in Paris 14-15 November 2013
- Next SDT (Science Definition Team) meeting 14-16 January, Washington, DC



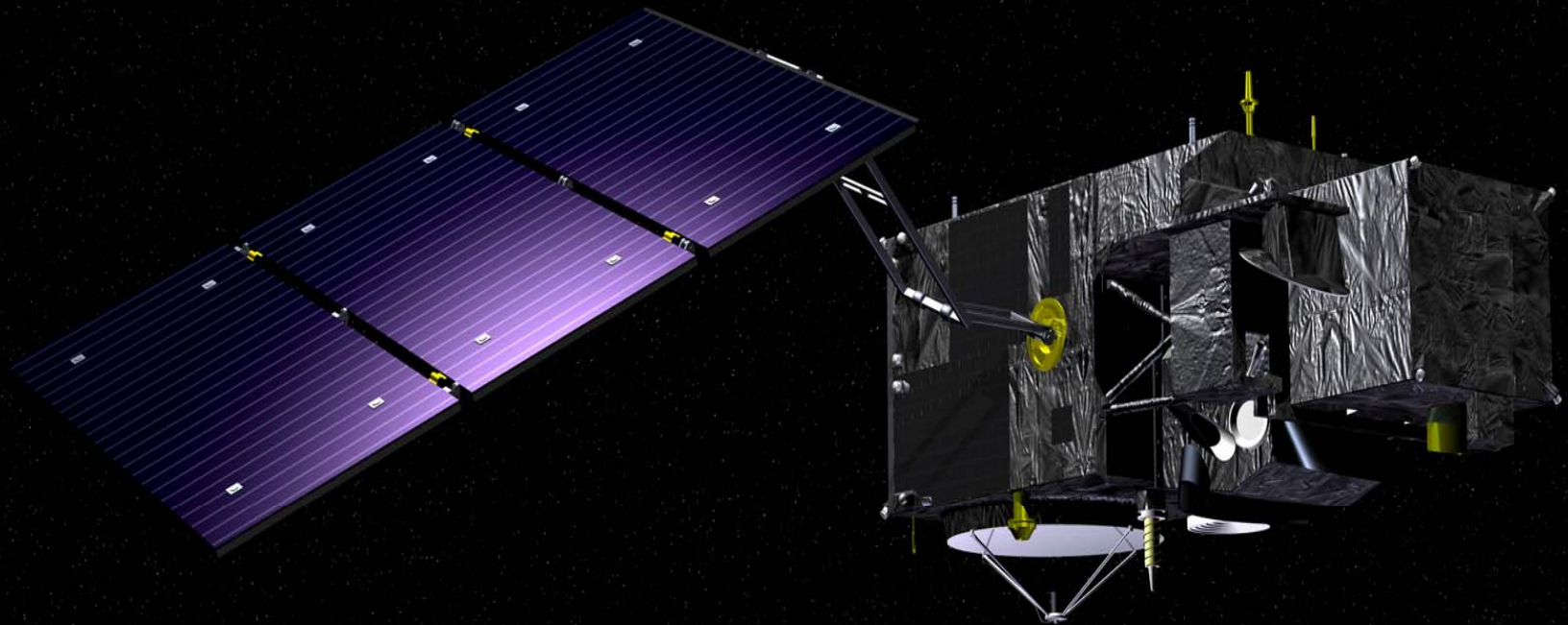


ESA Earth Observation Programme and Missions Status

Pierre Féménias & Jérôme Benvéniste

European Space Agency

Earth Observation Programme



The Sentinel-3 Mission: Development and Operations

Sentinel-3 Status: General



Development status

- Most equipment required for Sentinel-3A and -3B already delivered
- Topographic Payload (SRAL, MWR and DORIS) for Sentinel-3A already delivered
- Sentinel-3A Satellite integration well advanced (to be completed by early 2014)
- Sentinel-3B Platform integration almost completed

Launch of the Sentinel-3A currently foreseen for end 2014

- Precise launch period (3 months) to be agreed between ESA and Eurockot by end 2013

S3B launch date tentatively planned 12-24 months from S3A launch

- Depends on release of associated EC budget

S3A Satellite being prepared at Prime facilities (Cannes-F) for instrument integration



S3B Platform undergoing electrical integration at Platform Responsible facilities in Rome (I)

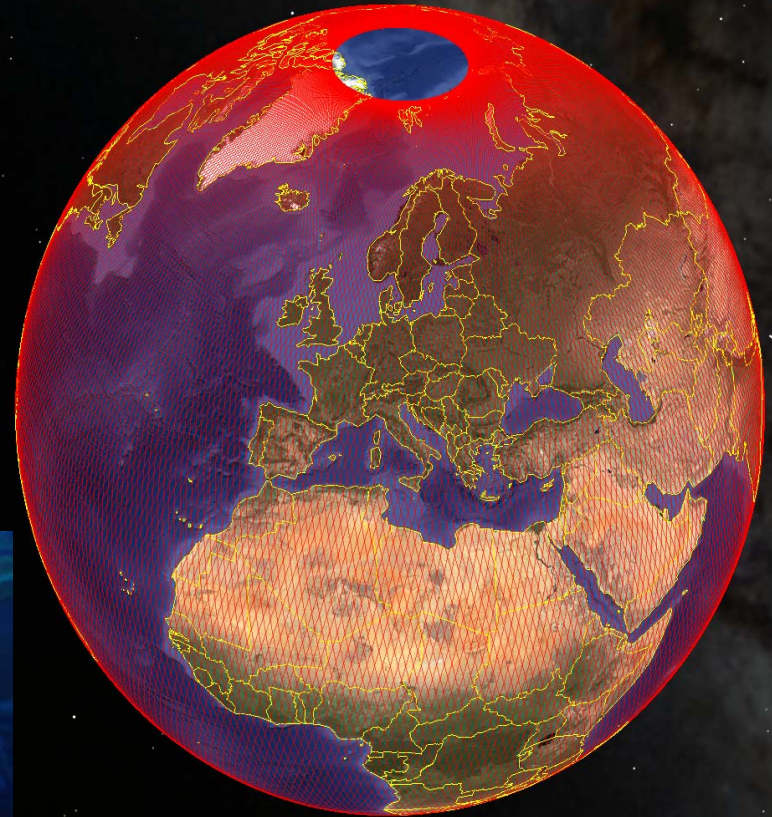


Topography Mission – Ground Tracks & User Product Handbook



Sentinel-3A and -3B ground tracks
can be downloaded in Google
Earth KML format from:

<https://sentinel.esa.int>



The screenshot shows the ESA Sentinel Online website. The main content area is titled '- SENTINEL-3' and contains the following text:

The main objective of the SENTINEL-3 mission is to measure sea surface topography, sea and land surface temperature, and ocean and land surface colour with high accuracy and reliability to support ocean forecasting systems, environmental monitoring and climate monitoring.

The SENTINEL-3 Mission Guide provides a high-level description of the mission objectives, satellite description and ground segment. It also covers an introduction to heritage missions, thematic areas and services, orbit characteristics and coverage, instrument payloads and data products.

The SENTINEL-3 mission will be jointly operated by ESA and EUMETSAT to deliver operational ocean and land observation services.

The categories are:

Overview
Gives a brief description of the heritage missions (ERS, ENVISAT and CRYOSAT-2) as well as the main thematic areas and services (e.g. ocean, land).

Mission Objectives
Describes primary and secondary objectives of the SENTINEL-3 mission.

Satellite Description
Describes the satellite platform and the communication links, as well as the orbit characteristics and the geographical coverage.

Ground Segment
Describes the Flight Operations Segment (FOS), the Payload Data Ground Segment (PDGS).

Instrument Payload
Describes the main instruments of the SENTINEL-3 mission: Ocean and Land Colour Instrument (OLCI), Sea and Land Surface Temperature Radiometer (SLSTR), SAR Radar Altimeter (SRAL), MicroWave Radiometer (MWRI) and Precise Orbit Determination (POD) instruments.

Data Products
Defines all data products available per instrument:

- OLCI data products

The right sidebar contains a 'Missions' section with links to Sentinel-1, Sentinel-2, and Sentinel-3. Below that is a 'Key Resources' section with links to Sentinel Data Access, Sentinel-3 Handbook, Data Availability and Quality, Sentinel-3 ESA Special Publication, and FOS Status and News. At the bottom is a 'Sentinel-3 News' section with links to 'Exploring the Sentinel's potential', 'Green light for GMES Copernicus', 'Securing operational EU funding for GMES', 'Pressure now on to launch ESA's Sentinel', and 'Radar altimetry gains altitude in Venice'.

Change of observation scenario: *LRM* → *SAR*

- ✓ Original operational baseline: split between LRM and SAR mode
- ✓ Autumn 2012: Request by the Copernicus user community to extend usage of SAR mode for the S-3 SRAL instrument up to 100% of Earth coverage -> ESA/EUMETSAT assessment approved by EC now for implementation, subject to a detailed cost/schedule assessment and final go ahead by EC
- ✓ **S-3 would be the first mission to provide 100% SAR altimetry coverage!!**

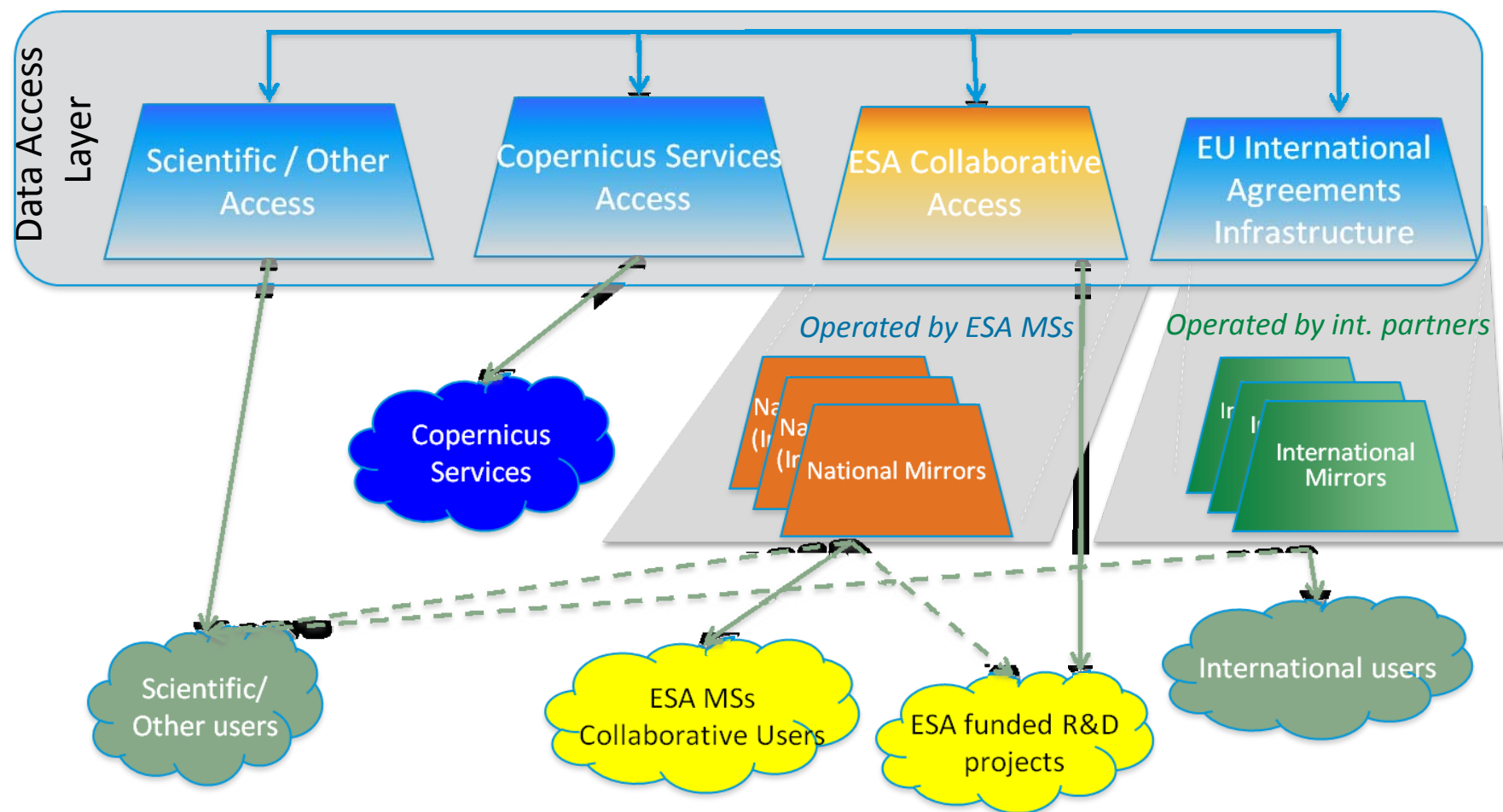
SAR technology is new and complex → Further work required to understand all in-orbit conditions and emerging processing systems. Noting CryoSat experience.

ESA considers beneficial that S3 SAR L1 products are made available to the users.

Expected advantages

- Foster a new generation of SAR altimetry specialists maintaining Europe at the competitive edge
- Enhance maintenance and development of existing and new products over the Earth surface (ocean, ice and land) within GMES
- Enhance uptake, application, and quality control (e.g. transponder calibration) of SRAL SAR data products by the GMES user community
- Possibly reduce large-scale reprocessing efforts (because starting from intermediate L1 products rather than from L0)

Product Level	Product Description	Relevance for
L1A	Unpacked L0 data processed to engineering parameters with geo-location information	SAR processing specialists allowing fundamental studies on SAR processing such as Doppler beam formation and calibration studies using ground-based Transponders
L1B-SC	Geo-located, Calibrated gathered azimuth formed complex (I and Q) power echoes after slant/Doppler range correction	geophysical retrieval algorithm developers (over ocean, land and ice surfaces), surface characterisations studies (e.g. impact of sea state bias, wave directional effects etc) and QC systems
L1B	Geo-located, Calibrated Multi-looked power waveforms	geophysical retrieval algorithm developers and QC systems



Principles of Sentinels data policy: "Users shall have **free, full and open** access to Copernicus Sentinel data and Copernicus service information" !

- S3VT-ALT established as the result of a joint ESA Eumetsat AO
- How to get involved?
 - **Attend the S3VT splinter on Friday from 11:30 – 12:30**
 - **Submit** a proposal to the S3VT via the Rolling AO at <http://earth.esa.int/aos/S3VT>
 - **Attend** the First S3VT meeting in ESA ESRIN, Frascati, Italy on 26-29 November 2013

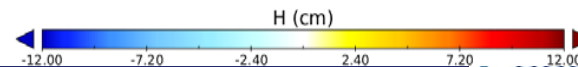
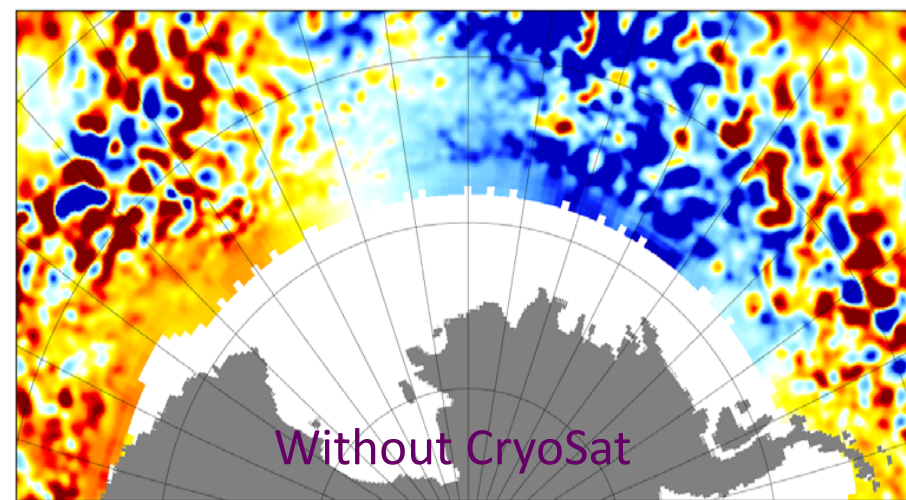
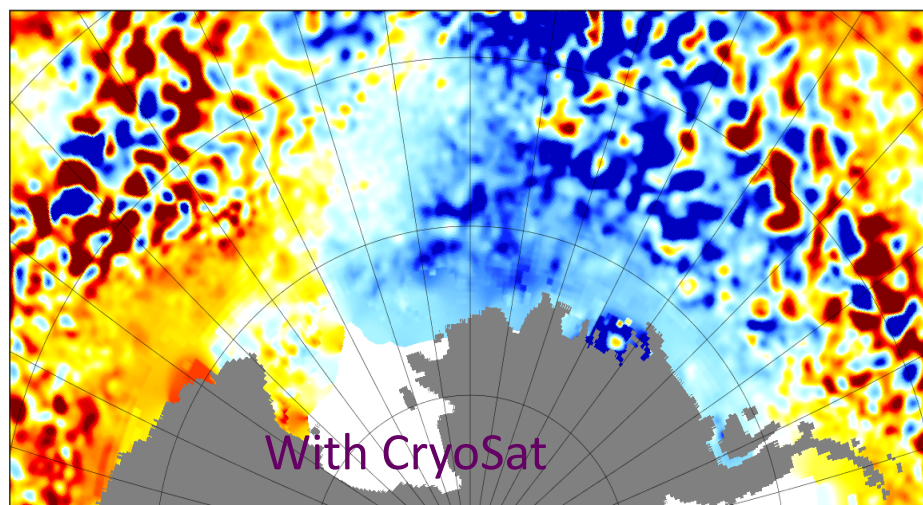


<http://www.congrexprojects.com/2013-events/13m56/introduction>

CryoSat-2 - Ocean Products



	FDM	IOP	GOP
Orbit	DORIS Navigator	DORIS MOE	DORIS POE
Meteo Corrections	No	Yes	Yes
IB & DAC	No	No & Yes	Yes & Yes
Delivery from sensing	<3 hours (for 70% of cases)	<3 days	<30 days
Release to community	January 2013	Jan 2014	Jan 2014



OSTST Oct 2013, Boulder, CO

Courtesy S. Labroue et al. "20 Years altimetry Symposium"



Mission Status

- Cryosat-2 mission fully funded until Feb 2017

Science products

- Reprocessing completion by Dec. 2013
- Full set of CryoSat Ocean Products to be released by Jan. 2014
 - ➔ Release of IOP & GOP Ocean Products
- Processing Baseline C expected for spring next year (will include free-board, new MSS (UCL) , increase of SAR L1B range window sampling to 256, SPR fix, etc)
- Reprocessing of Baseline C by 2015

Cal/Val & Workshops

- Cal/Val campaigns: Spring 2014 (and 2016 TBC)
- CryoSat 4th Workshop: 1Q 2015

Cryosat-2 Launch Date: 08 Apr 2010

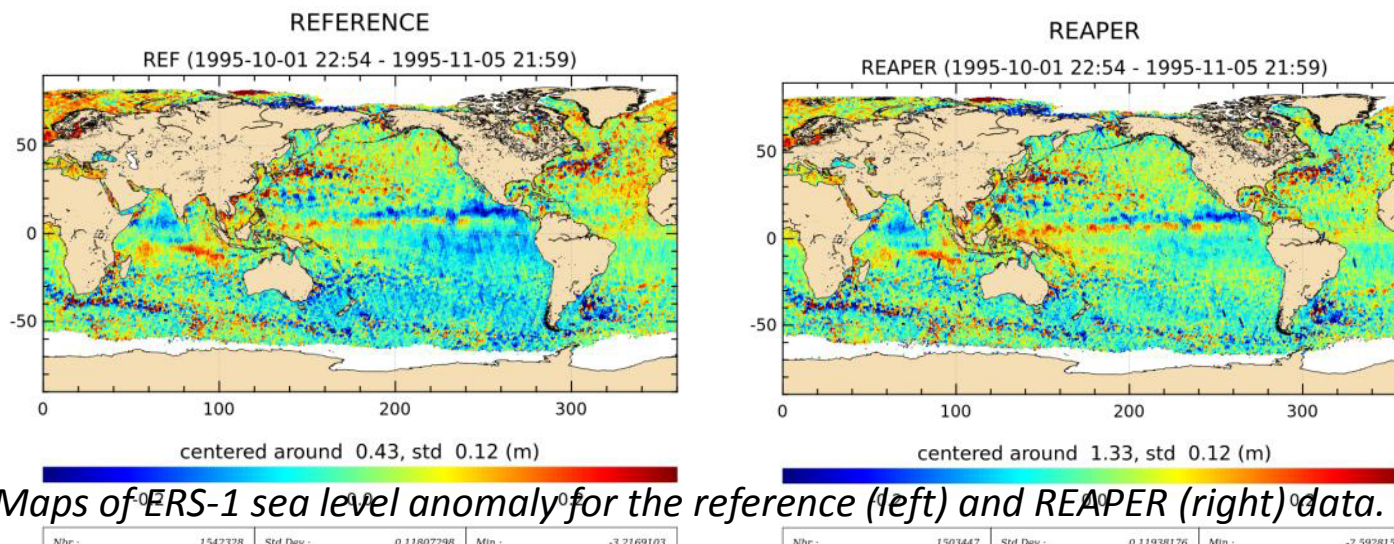
THANK YOU !

For more information: Pierre.Femenias@esa.int

BACK-UP SLIDES

ERS-1, ERS-2 & Envisat Altimetry

- From July 1991 to April 2012, more that 20 years of valuable ESA Altimetry data on the same 35d repeat cycle.
- In Phase F, ESA aims at improving the OFL science data for ensuring long term data preservation, harmonisation, data processing & performance improvement, inter-calibration, support to CDR.
- ERS-1 & ERS-2 **REAPER 1** → Intended data delivery by end 2013
 - Shall be aligned to Envisat Altimetry V2.1 (current version)
- ERS **REAPER 2** data intended in Q1 2015 → Your feed-back on **REAPER 1** is welcome !
- Two Envisat altimetry reprocessing campaigns planned in coming 4 years



Mission Status

- Process of maximizing mission return has led to a further and final lowering of the GOCE orbit, now 31 km below initial mapping orbit
- Flawless mission operations at 224 km altitude, at the limit of the system capability. Our 'swan song' performance is in its final act.
- After more than four years mapping Earth's gravity with unrivalled precision, GOCE's mission is nearing its end and the satellite will soon reenter our atmosphere.

Science products

- New MDT models out in 2013, incl. DTU12MDT and CNES-CLS 2013 MDT which include GOCE, altimetry and drifter data
- Release 5 gravity field models expected around mid-2014

Cal/Val & Workshops

- 5th International GOCE User Workshop in late September/early October 2014 (date tbc)

GOCE Launch Date: 17 Mar 2009

the swan is about to land...



Mission Status

- SMOS mission operations part of the Earth Observation Envelope Programme-4 until February 2017, pending SMOS Extension Review & Ministerial Council end 2014 (Spain to confirm their contribution beyond 2014, which will fund most of SMOS operations contracts)

Science products

- The space segment - payload and platform - is functioning well with minor anomalies
- 1st complete reprocessing of SMOS data up to level 2 completed, 2nd campaign in planning
- Ocean Salinity: **Approaching the mission objectives** (accuracy of 0.1 psu for a 10-30 day average for an open ocean area of 200 km x 200 km)

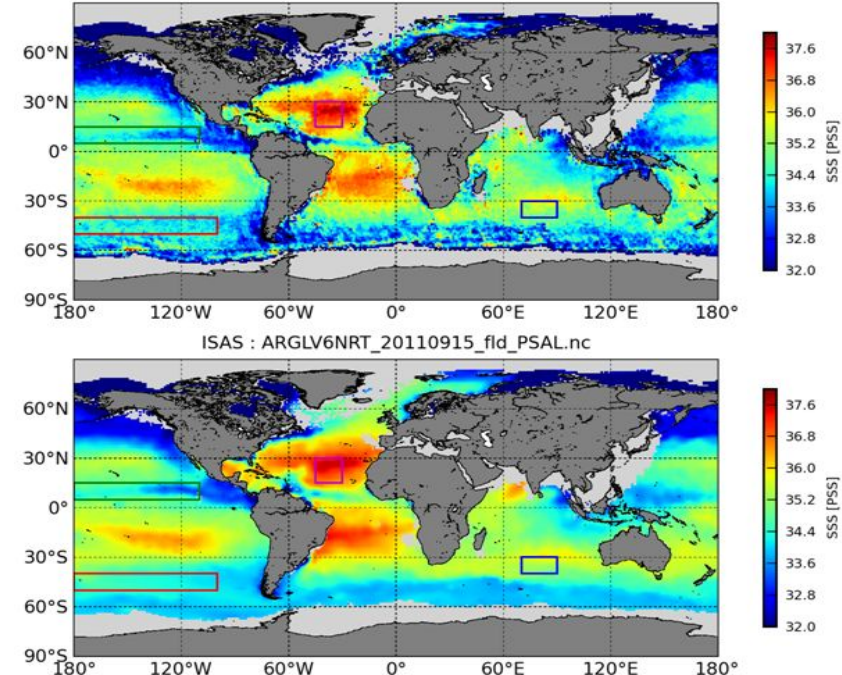
More information on

- ESA's SMOS webpage <http://earth.esa.int/SMOS>
- CESBIO's SMOS blog http://www.cesbio.ups-tlse.fr/SMOS_blog/

SMOS Launch Date: 2 Nov 2009

SMOS data

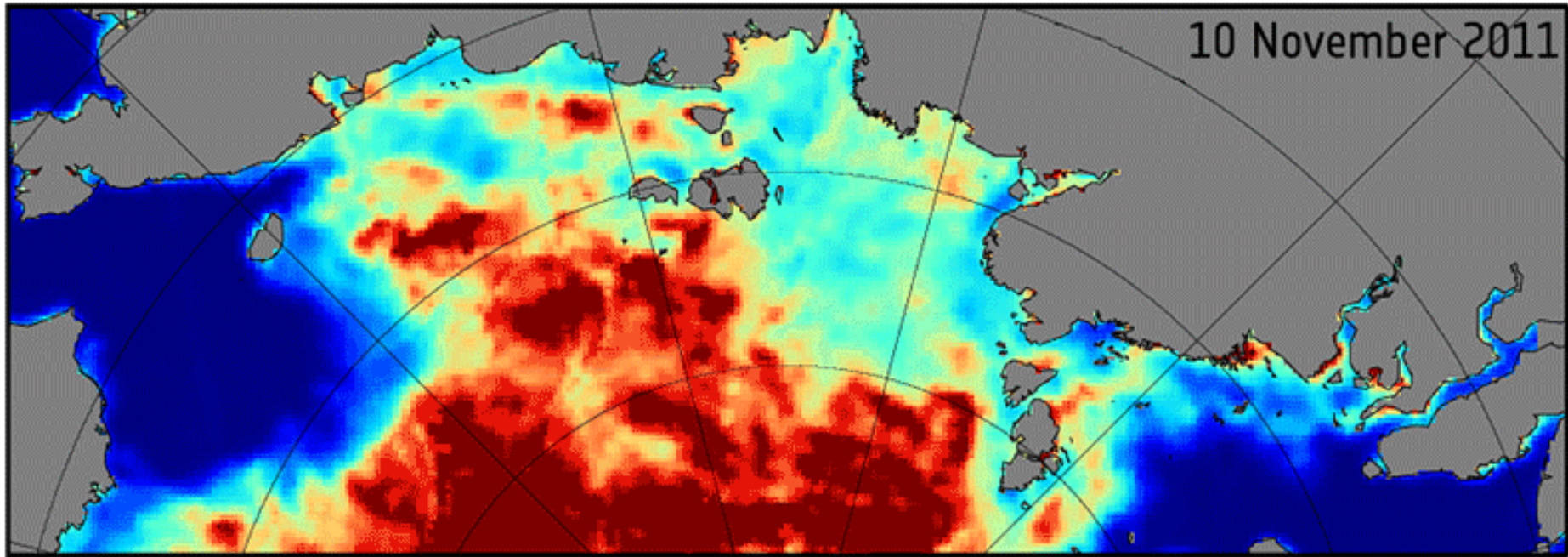
SMOS[A]: SMOS_REPR_L3_LOCEAN_A_20110901-20111001_1.0deg_wind3-12.nc



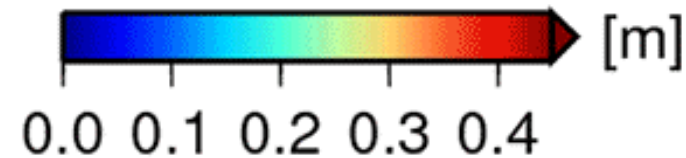
© J. Boutin, LOCEAN

ARGO: interpolated data

Sea Ice Mapping



Arctic Sea Ice Thickness from ESA's SMOS satellite



The information from SMOS is most reliable for ice that is thinner than 1 m (University of Hamburg)

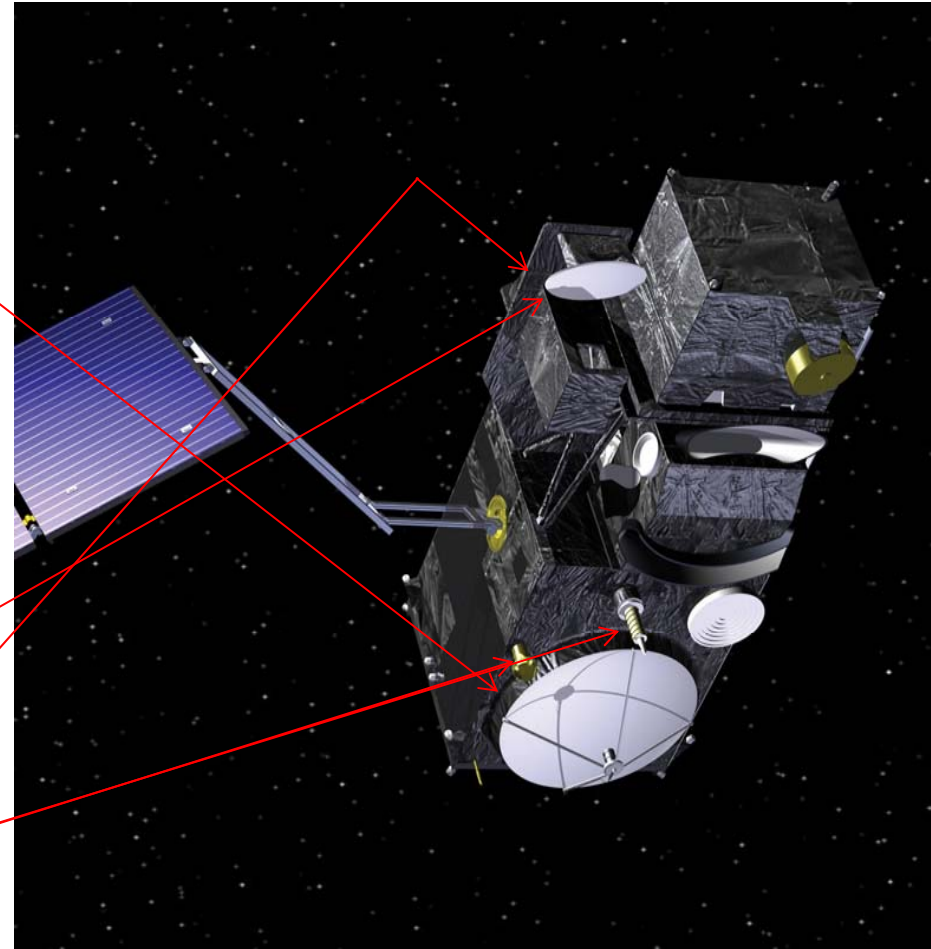
- Altimeter Toolbox
- Promote access and processing of low level data (un-averaged individual echoes at full bit rate)
- To prototype a Coastal Altimetry algo and product for SAR mode
- To develop a River and Lake product for SAR mode
- To develop a Land Altimetry product for SAR mode
 - **ITTs Q4 2013 to Q1 2014 (1.3 Meuros)**

- Organize training in SAR Altimetry
 - **End 2014 (announcement end 2013)**



- To further develop **Ice** Altimetry algorithms (2014)

- SRAL
 - **Dual freq. Ku & C-band** radar altimeter
 - 2 measurement modes:
 - *LRM, conventional pulse-limited mode*
 - **SAR, high along-track resolution (300m)**
 - 2 tracking modes: **Open or Closed-Loop**
 - Technology inherited from CryoSat and Jason-2
 - Instrument Prime: Thales France – Toulouse
- MWR
 - Dual freq. 23.8 & 36.5 GHz
 - Noise injection radiometer, with cold sky calibration
 - Technology inherited from Envisat
 - Instrument Prime: Casa – Spain
- POD Instruments
 - Dual-freq. **GPS** receiver, RUAG - Austria
 - **DORIS** navigation receiver, CNES/TSA - France
 - **Laser Retro-Reflector**



S-3 Future L1b user products

