



NASA HEADQUARTERS
SCIENCE MISSION DIRECTORATE
EARTH SCIENCE DIVISION

Ocean Surface Topography at NASA HQ

NADYA VINOGRADOVA

(NEW) NASA PROGRAM SCIENTIST



A word cloud of names in various colors and sizes, including Volkov, Hamlington, Thompson, Maximenko, Gille, Ray, Lemoine, Arbic, Bonin, Qiu, Haines, Strub, Farrar, Desai, Willis, Fenty, Wilkin, Han, Zhao, Brown, Melnichenko, and Samelson.

[illegible]



OSTST SYNERGIES WITHIN NASA-PO

1. NASA SEA LEVEL CHANGE SCIENCE TEAM

- Team Lead: Ben Hamlington, ODU
- Period: 2017 – 2020

2. ECCO: UNDERSTANDING SEA LEVEL, ICE, AND EARTH'S CLIMATE

- Team Lead: Ichiro Fukumori, JPL
- Period: 2016 – 2020



OSTST 2017

CNES program status

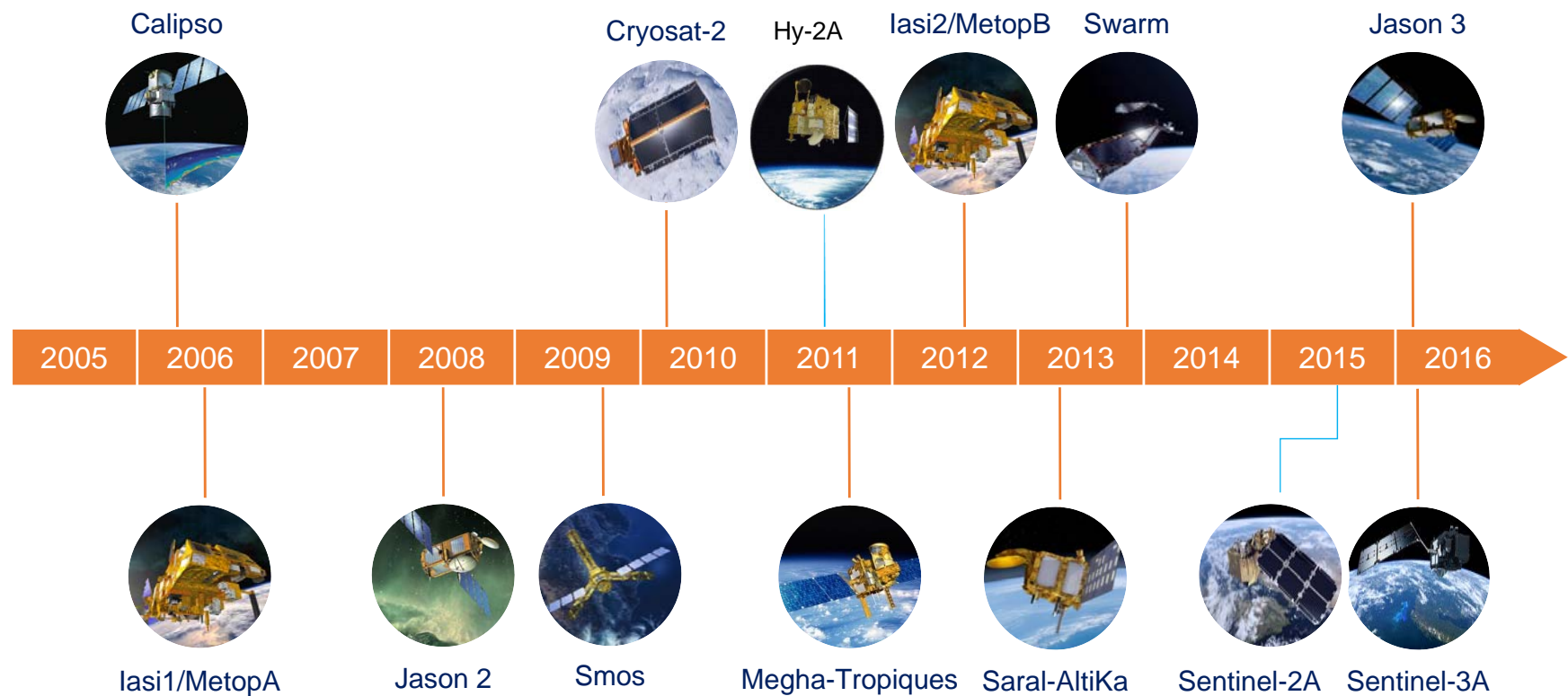
Juliette Lambin

Changes in CNES Earth Observation Programme Team

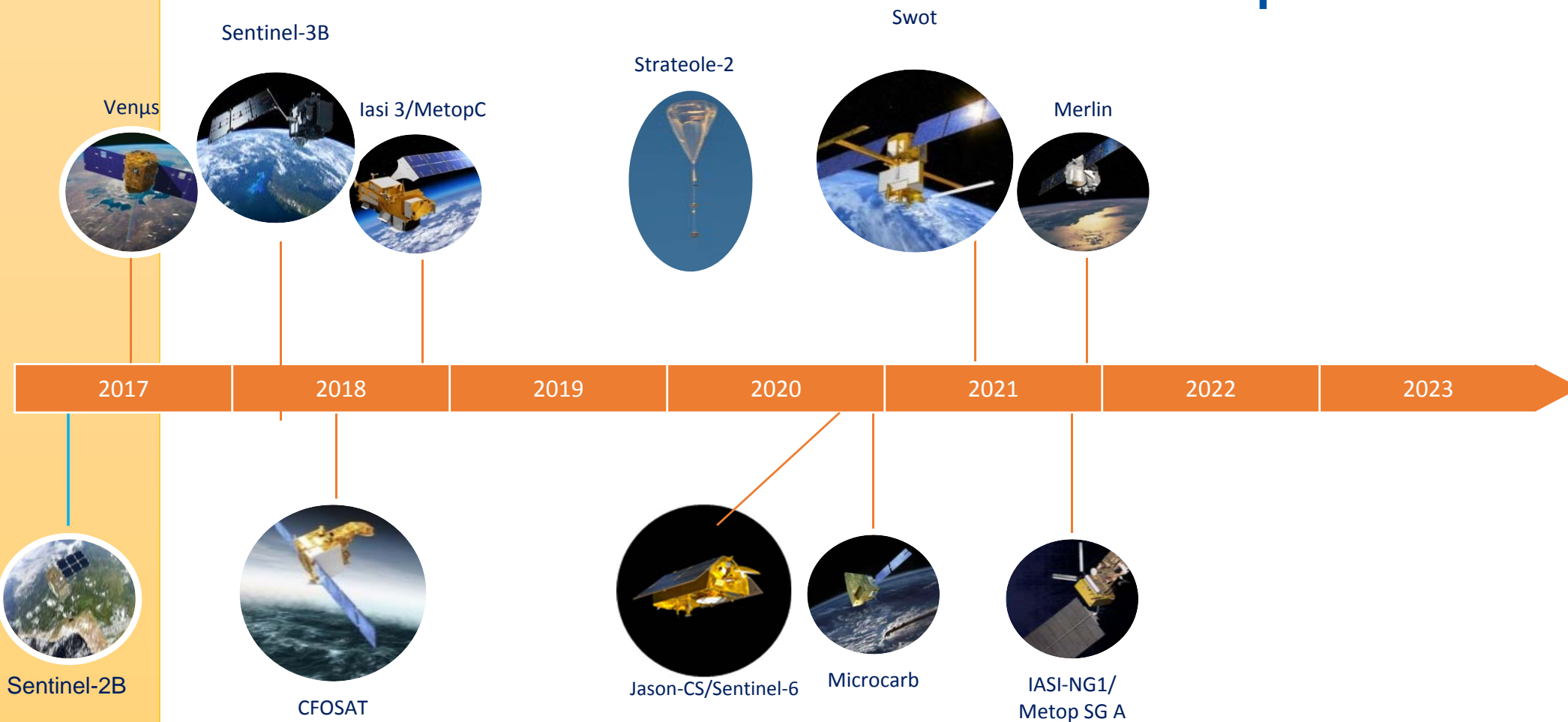
New points of contacts for your activities :

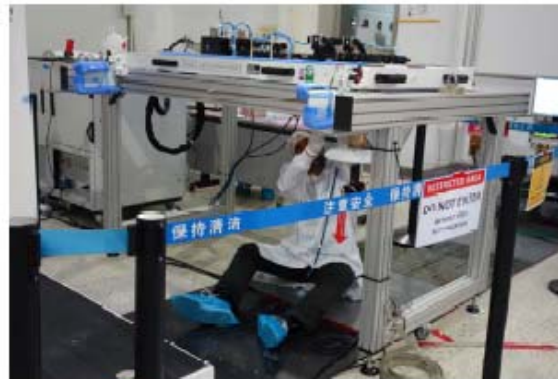
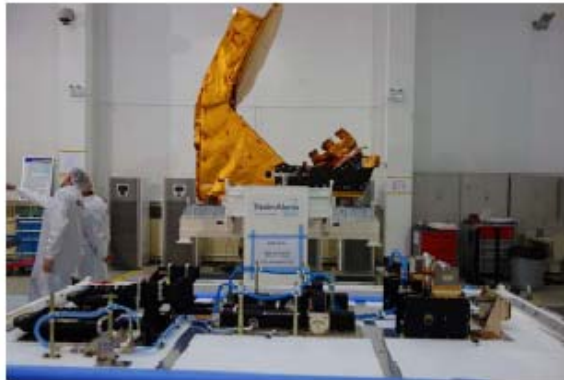
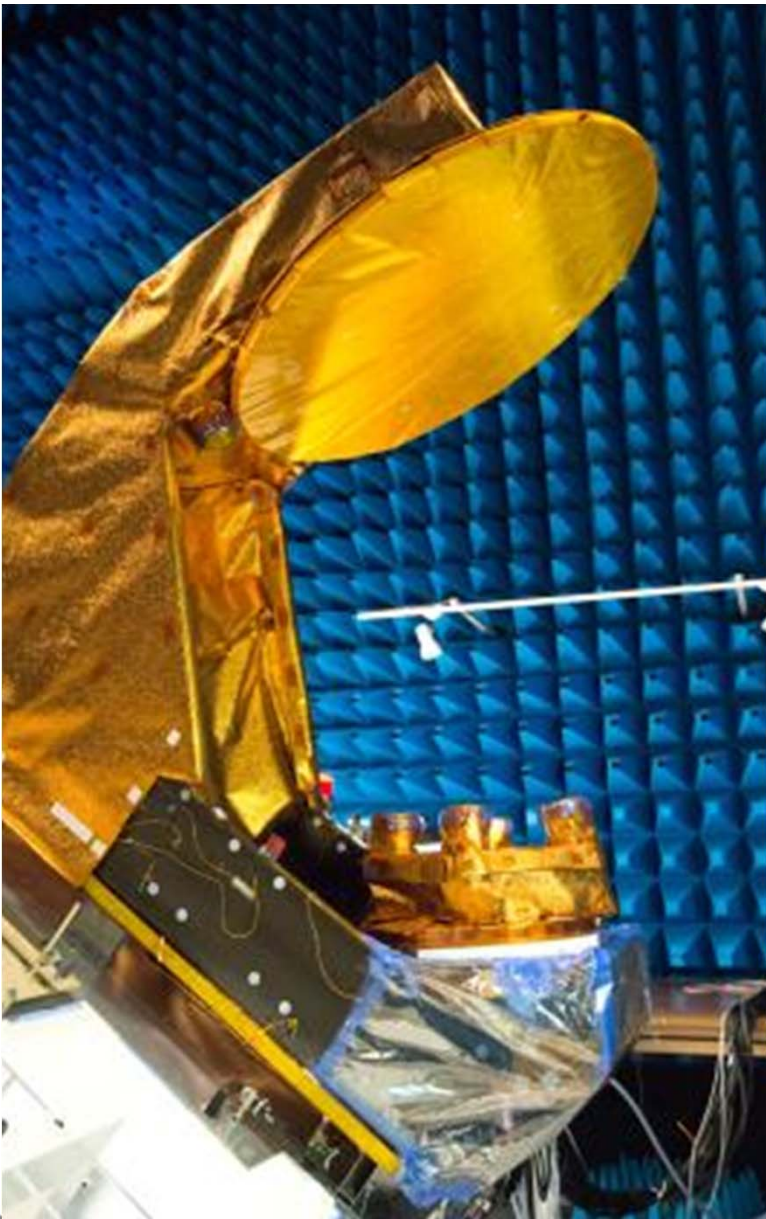
- ❖ Juliette Lambin has replaced Pascale Ultré-Guérard on June 1st as head of CNES EO programme : juliette.lambin@cnes.fr
- ❖ Temporary vacancy on the ocean program management:
 - Philippe Escudier left the team on June 1st
 - Amaury Larue de Tournemine will take over starting January 1st , 2018
 - Amaury.LarueDeTournemine@cnes.fr
 - In the mean time, and for urgent matters: juliette.lambin@cnes.fr
- ❖ Anne Lifermann in charge of coastal zones, cryosphere:
anne.lifermann@cnes.fr
- ❖ Selma Cherchali in charge of Land Surfaces (including hydrology):
selma.cherchali@cnes.fr

Earth Observation mission in operations



Earth Observation missions in development





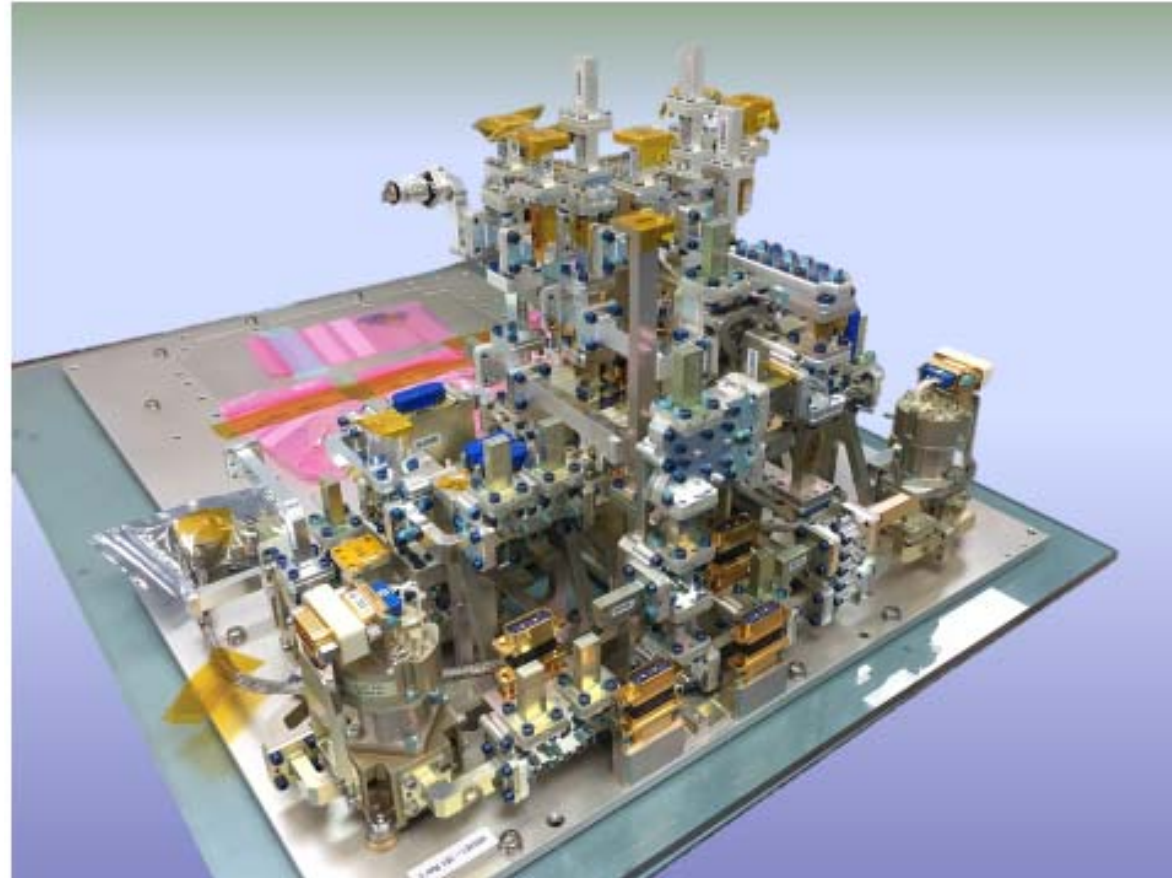
CFO SAT

... cnes ...
SWIM in China



cnes

SWOT KaRIN RFU



And beyond : phases O/A studies (best of relevant to OSTST)

❖ Constellation study for HR altimetry in Copernicus NG

- Constellation URD document (focused on user needs for global, systematic, sustained observation)
 - 50 km / 5 days requirement (and precision accuracy set accordingly) + climate reference series
 - Mixed nadir/swath constellation solutions (as a rule of thumb: 1 swath~5 nadir missions)
- Exchanges at technical level with ESA to push further studies
- *Point of contact: Cécile Cheymol, Gérald Dibarboure (interim J Lambin)*
- Phase A in preparation (hopefully 2018): refine the swath instrument requirement, in particular wrt hydro needs

❖ Alti-Cryo: Ka-Ku band nadir altimeter for cryosphere monitoring

- Interactions with ESA Cryosat Enhanced studies → common user requirement meeting in spring 2017
- *Point of contact: Anne Lifermann, Amandine Guillot*

❖ Ocean surface current monitoring → SKIM concept proposed for EE9

- Heritage from SWIM/CFOSAT, but Ka-band, Doppler capability: “Surface Kinematics Mission”
- *PI: Fabrice Ardhuin, Ifremer; Point of contact CNES: Jean-Claude Lalaurie, Céline Tison*

EUMETSAT Oceanography Programme

François Parisot
Jason-CS Programme Manager



EUMETSAT activities in support of Copernicus

(Committed under Agreement)

Building Block I

Operations (Sentinel-3, Jason-3, Sentinel-6 / Jason-CS) and delivery of operational data and support services to the Copernicus Marine Service

Building Block II

Operations (Sentinel-4, Sentinel-5 as part of MTG and EPS-SG) and delivery of operational data and support services to the Copernicus Atmosphere Service

Building Block III

Deliver selected Mission Data services, incl. Third Party data (building on operational cooperation established by EUMETSAT with U.S., China, India,...)

(Subject to EU request)

Building Block IV

Support to Copernicus Climate Change monitoring service

Building Block V

Support to EC for User Requirements for Copernicus Marine, Atmosphere and Climate Services

Data service for Marine Environment Monitoring

Building
Block I



S3A STM Operational Product Release Status

• SRAL/MWR ► all products operational

- L1 and Marine L2 NRT and STC data released on 13 Dec 2016
- L1 and Marine L2 NTC data released on 19 Jan 2017
- L1A and L1B-S STC data released on 6 March 2017
- L1A and L1B-S NTC data released on 12 April 2017

• Altimetry L2P/L3 Service ► operational

- L2P NRT operational data released on 27 June 2017
- L2P STC operational data released on 27 June 2017
- L3 NRT operational data released on 27 June 2017
- L2P NTC operational data released on 27 June 2017
- L3 NTC operational data released on 27 June 2017

• SRAL/MWR Reprocessing

- 1st full mission reprocessing for SRAL/MWR completed and validated covering data from 15/06/16 to 15/04/17 with processing baseline 2.15 (current baseline) all L1 (L1A, L1B, L1BS) & L2 user products.
- 2nd full mission reprocessing planned in Q4 2017 to cover period from March 2016 to ~November 2017 including SAMOSA 2.5
- Reprocessing of Altimetry L2P/L3 products covering the period of June 2016 to April 2017 started
- Reprocessed data will be made available via the EUMETSAT Data Centre (all) and also from CODA ([L1B and L2]) as this needs to be upgraded to enable the retrieval of reprocessed datasets.

	ODA/CODA*			EUMETCast			Data Centre		
	NRT	STC	NTC	NRT	STC	NTC	NRT	STC	NTC
Level 0	✓ (special users)						✓ (special users)		
Level 1									
SRAL	✓	✓	✓	✓	✓		✓	✓	✓
MWR	✓		✓	✓			✓	✓	✓
Level 2									
SRAL/MWR	✓	✓	✓	✓	✓		✓	✓	✓
	AVISO/CMEMS			EUMETCast					
Level 2P									
SRAL	✓ (AVISO)	✓ (AVISO)	✓ (AVISO)	✓	✓				
Level 3									
SRAL	✓ (CMEMS)	✓ (CMEMS)	✓ (CMEMS)						

Production & Dissemination Status

Green = operational
Orange = only for special users
Grey = not applicable

Sentinel-3B Status

- Sentinel-3B activities continue both in house and jointly with ESA, including all changes required to enable dual satellite operations and to implement the changes for the 140° phasing and tandem operations (as agreed by the EC)
- First Cal/Val Checkpoint successfully completed
- In house implementation, configuration and testing activities continue as planned
- Successful generation and archiving of all S3B L0, L1 and L2 products in all timeliness categories using test data created by “rebadging” the live S3A dataflows
- Regular progress meetings with ESA on the space and ground segment continue with the next ones planned in October/November
- The satellite development activities are on track with the latest planning information from ESA indicating the following dates:
 - FAR Board – 12 December 2017
 - Launch – Feb/March 2018
- Decision on launcher (Vega/Rockot) is not yet taken but is expected shortly

EUMETSAT Satellite Data Access

- Sign up and login at:
<https://eoportal.eumetsat.int>
- Also subscribes to release notices



MONITORING WEATHER AND CLIMATE FROM SPACE

EARTH OBSERVATION PORTAL - MY ACCOUNT

MY DATA ACCESS

MY PROFILE

MY DATA LICENCES

HELP

LOGOUT

My Data Access



EUMETCAST SATELLITE

Access to near real-time data through DVB satellite with a guaranteed service level.

Available data: Meteosat, Metop, Jason, Copernicus Sentinel-3 marine data and third party products.

➔ [Subscribe](#)



COPERNICUS ONLINE DATA ACCESS

Download service via Internet for Copernicus data.

Available data: Sentinel-3 marine data.

➔ [Access](#)



DATA CENTRE

Ordering and delivery service for historical and long-term archive data.

Available data: Meteosat, Metop, Jason and Copernicus Sentinel-3 marine data.

➔ [Access](#)

Access to the data/products from the Copernicus services

- Atmosphere monitoring service:
 - <http://atmosphere.copernicus.eu/>
 - <https://atmosphere.copernicus.eu/catalogue#/>
- Marine Environment Monitoring service:
 - <http://marine.copernicus.eu/>
 - <http://marine.copernicus.eu/services-portfolio/access-to-products/>
- Climate Change service:
 - <https://climate.copernicus.eu/>
 - <https://climate.copernicus.eu/climate-data-store>
 - <https://climate.copernicus.eu/resources/data-analysis/average-surface-air-temperature-analysis>

Summary Take Home Message

- Copernicus altimeter missions
 - Jason-2 (in Extension of Life: “geodetic orbit”)
 - Jason-3 (operational reference mission)
 - Sentinel-3A (operational meso-scale mission)
- Sentinel-3A
 - Provides **high-resolution** (SAR) altimetry **globally**
 - Level L1A, L1B, L1BS and L2 products are **fully operational**
- Sentinel-6/Jason-CS
 - Interleaved mode (LRM/SAR) altimetry
 - Continues reference mission with enhanced performances
- Discussions started with ESA and the EC on post S3 and post S6 missions (follow on of the EUMETSAT Altimetry Programme)

Back up slides

Sentinel-3A Operations Status

- Satellite
 - Operating nominally with a very good availability of the instruments (reaching 100%), with only few exceptions caused by SLSTR anomalies in March and July
 - Routine activities such as orbit maintenance manoeuvres, security key changes and regular calibration activities are running smoothly
- Flight Operations Segment continues to support all routine S3A activities
 - S3 Mission Control System is performing the nominal satellite commanding activities
 - S3 Flight Dynamics Facility performs regular analyses and contributes to orbit maintenance and collision avoidance planning activities
 - S3 Mission Planning Facility performs the nominal and ad-hoc instrument commanding supporting e.g. regular calibration and validation tasks and ad-hoc investigation of instrument anomalies
- Marine PDGS
 - All Marine Products are now declared operational
 - PDGS is now close to or exceeding availability targets for all products
- S3A Routine Operations Readiness Review to be held on 16 October with ESA to formalise the start of the full operations

EUMETCast: guaranteed real time access for all users in the EU Copernicus marine/atmospheric satellite data



- Same state of the art technology as digital TV broadcast (DVBS-2)
- User access via low cost off the shelf station
- No limit to number of users, no dependence on local infrastructures
- Integrated data stream for broad range of applications: EUMETSAT and Copernicus marine data
- Supports demanding timeliness requirements, high and low volumes, with 99.9% reliability
- Secure and controlled delivery (selection of users, data...)

Ocean Surface Topography Science Team Meeting (OSTST)

October 23-27, 2017

“The 25th Anniversary of TOPEX/Poseidon”



NOAA Jason Altimetry Program

Eric Leuliette

NOAA Program Scientist



NOAA Jason Program

Retirements 31 December 2016

- Laury Miller, Program Scientist
- John Lillibridge, Project Scientist



Monterey Bay, California



Moody Point, Maine



NOAA Jason Program

- *Ground system*
 - Continue Jason-2 and Jason-3 production and distribution
 - Transition of data distribution from DDS (Data Distribution Service) to PDA (Production Distribution and Access)
 - Technical refresh next year
- *Science Program*
 - Project, National Weather Service, and OSTST support
 - OceanWatch/CoastWatch/PolarWatch
 - Sentinel-3A Validation Team/Operation IceBridge

NOAA/NESDIS Jason Science Program

During FY16-18 the NOAA Jason Science Program supported/will support:

Project Team

- **Jason Measurement System Engineer** (Alejandro Egido)
- **Jason cal/val** (tide gauge comparison and AMR)

NOAA Jason Data Assimilation Projects

Upgrading National Weather Service (NWS) ocean DA systems

- NWS Climate Prediction Center: MOM-5 model/ Climate Forecast System → **for improved seasonal & ENSO predictions**
- NWS Environmental Modeling Center: HYCOM model → **for Improved hurricane intensity forecasting**

NOAA/Ocean Surface Topography Science Team

NOAA participation in funding the OSTST is mandated by the 4-partner MOU

- NOAA and NASA completed the review of 56 proposals received in response to the four-year Ocean Surface Topography Science Team (OSTST) call in ROSES 2016.
- Review panel recommended funding 26 (46%) of the proposals.
- From these, NOAA selected 5 proposals to be funded from the NOAA Jason program for a total commitment of \$3M for 2017-2020
 - Funded through NOAA Cooperative Institutes

PI	Institution	Title
Chambers	University of South Florida	Analysis of kinetic energy and structure functions from along-track and crossover altimeter data
Egido	University of Maryland	Development of fully-focused SAR altimetry for oceanographic applications
Farrell	University of Maryland	Altimetry of the arctic ocean and subpolar seas: investigating changes in circulation and dynamic topography
Penny	University of Maryland	Operational ocean data assimilation to improve upper ocean current estimates for global ocean monitoring, coupled climate forecasts, and coupled hurricane forecasts
Vandemark	University of New Hampshire	Multi sensor air-sea interaction process studies using the satellite altimeter constellation

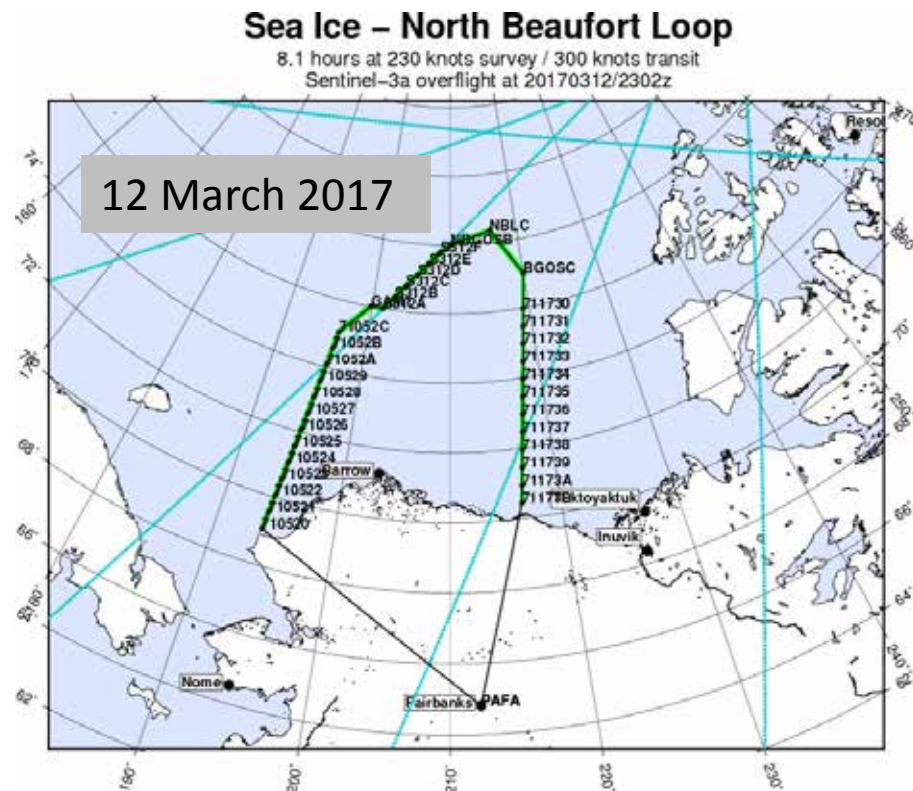
Contribution to Sentinel-3A VT

NASA IceBridge 2017 Under-flight of Sentinel-3A

NOAA/LSA, in partnership with ESA and EUMETSAT, requested the NASA OIB 2017 Arctic Campaign under-fly > 300 km of Sentinel-3A over sea ice

11 March 2017: Two long S3A tracks in the Chukchi Sea (under-flights > 12 hours from S3A overpasses)

12 March 2017: One short under-flight in northern Beaufort Sea, as part of “North Beaufort Loop” flight



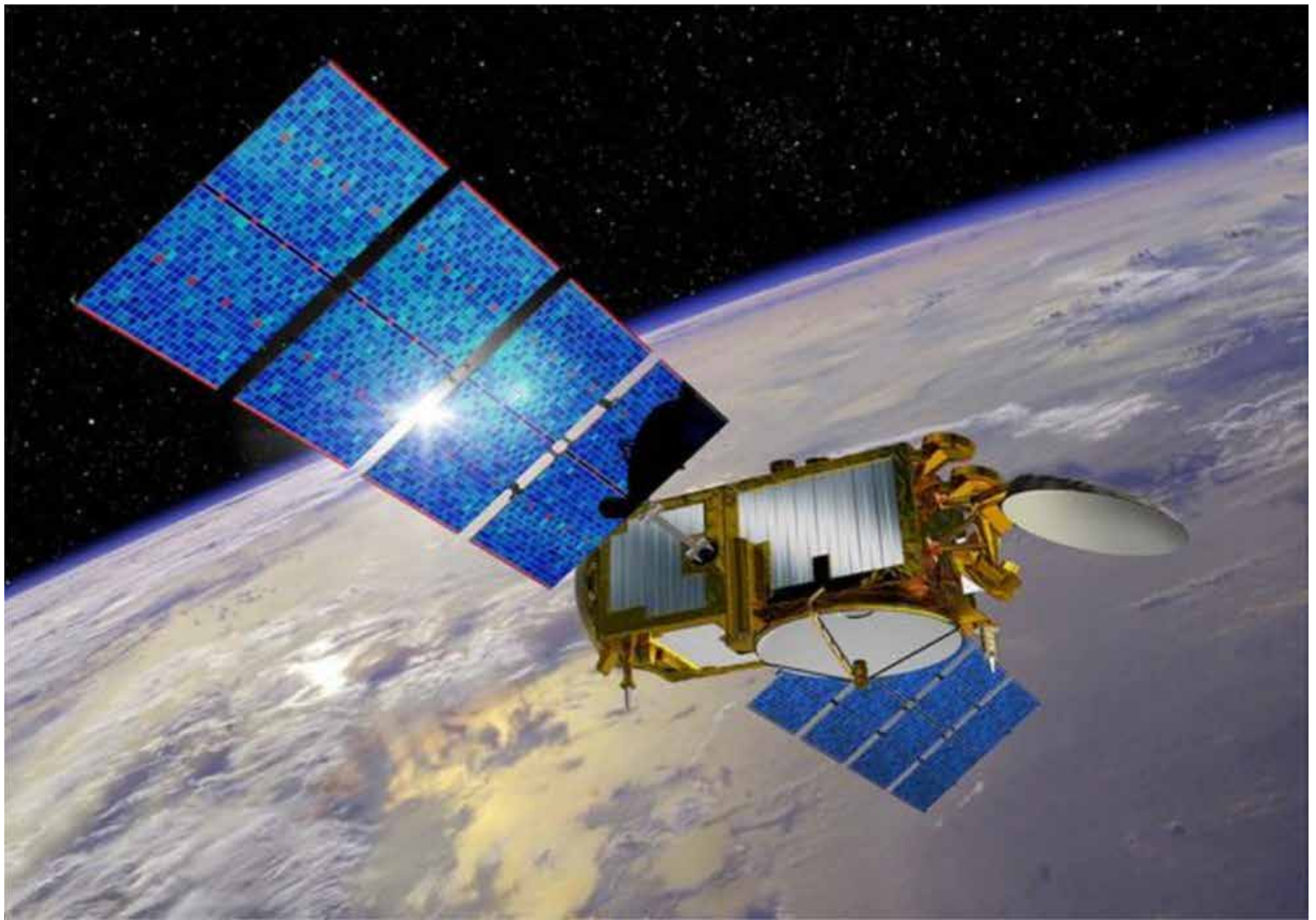
- < 2 hours time offset between aircraft survey and S3A overpass
- Only ~ 200 km of S3A orbit flown
- Fog conditions at the northern end of the flight line – placed a limit DMS imagery, but data from snow radar, and ATM lidar reported to be OK.



CoastWatch/OceanWatch/PolarWatch

NOAA CoastWatch/OceanWatch is a NOAA-wide program. Our mission is to process satellite data and provide oceanographic satellite products to federal, state and local stakeholders such as marine scientists, coastal resource managers, and the general public.

PolarWatch launched Fall 2016



Ocean Surface Topography Science Team • 23–27 October 2017

Ocean Surface Topography Science Team Meeting (OSTST)

October 23-27, 2017

“The 25th Anniversary of TOPEX/Poseidon”



ESA Programmes Status

Jérôme Benveniste



Mission: 5' to cover...

- Envisat and ERS Reprocessing
- CryoSat Mission Status
- GOCE and Swarm Activities
- SMOS Mission Status
- Sentinel-3 Mission (Craig Donlon's talk @11:00)
- Jason-CS/Sentinel-6 (Pierrik Vuilleumier's talk @11:30)
- R&D, Training and Outreach
Contributions from Pierre Féménias, Tommaso Parinello, Jérôme Bouffard, Rune Floberghagen, Susanne Mecklenburg

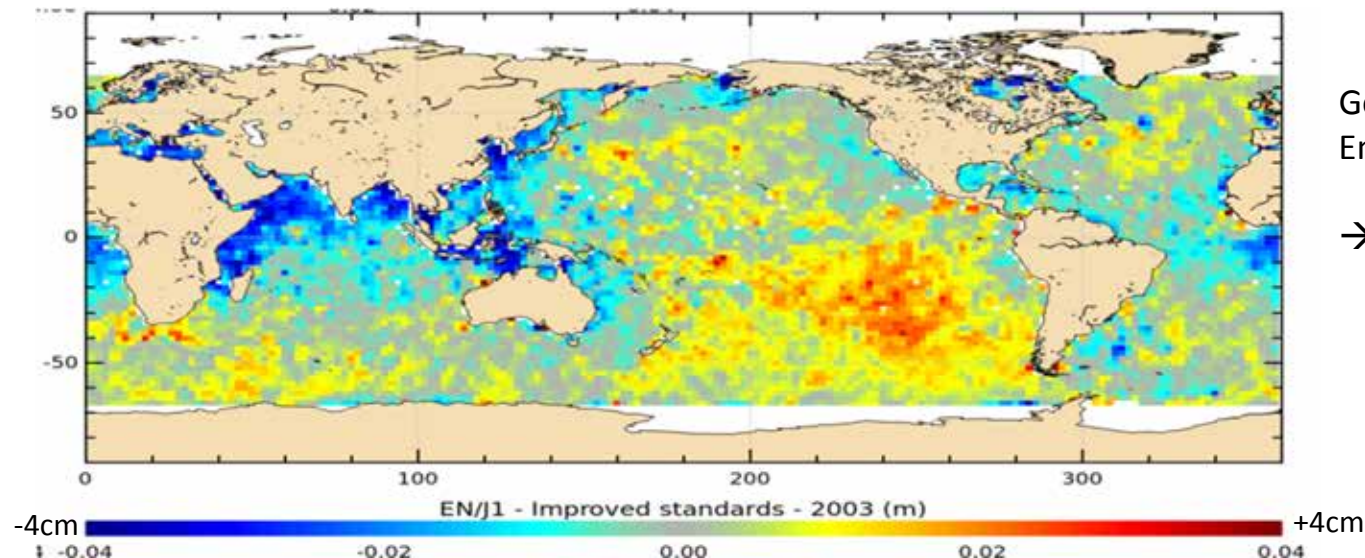
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ERS/Envisat Altimetry Data Quality Status



- **Envisat RA-2 & MWR**
 - ✓ Altimetry V3.0 Algorithm Reprocessing Baseline definition complete
 - ✓ **Envisat Altimetry V3.0** data set delivery intended in **Q4 2017**
 - ✓ RA-2 Individual Echoes included
 - ✓ New NetCDF format for the user products (GDR & S-GDR)
 - ✓ Numerous L1B & L2 algorithm improvements included
 - ✓ **Improvement of the Envisat Altimetry data quality expected at Mesoscale and Climate scale (Global MSL)**



Good homogeneity between
Envisat V2.1 and Jason-1

→ Will improve with V3.0!

•ERS RA & MWR

- ✓ REAPER data set currently aligned to the Envisat RA-2 V2.1
- ✓ Harmonization with the Envisat V3.0 data set intended

Mission: 5' to cover...

- Envisat and ERS Reprocessing
- **CryoSat Mission Status**
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CryoSat Mission Status

7 years in operations



European Space Agency

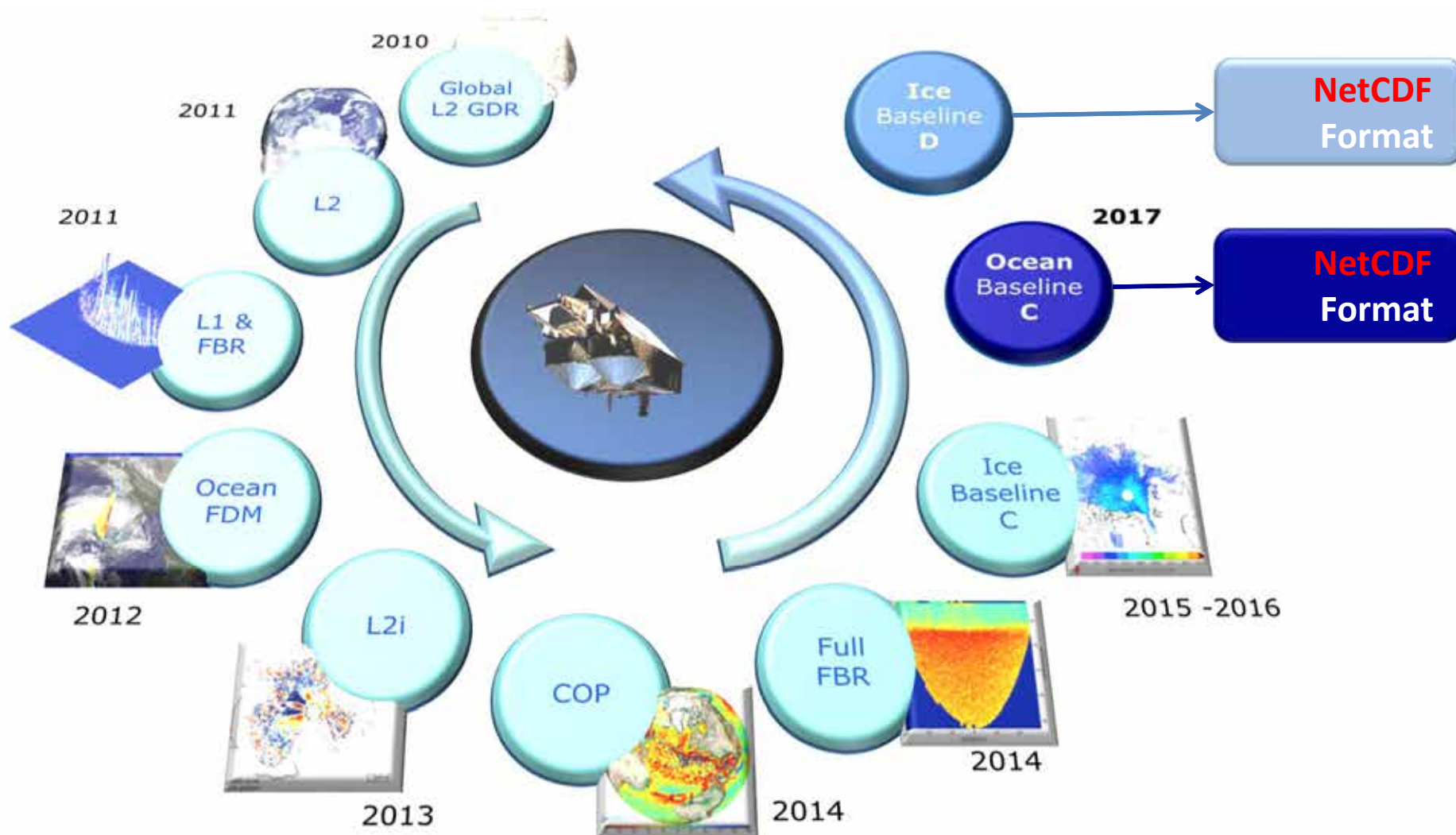
Primary Mission Objectives

- Determination of regional and basin-scale trends in perennial Arctic sea ice thickness and mass
- Determination of regional and total contributions to global sea-level of the Antarctic and Greenland ice sheets



	Sea Ice 10^5 Km^2	Ice Sheets Regional scale 10^4 Km^2		Ice Sheets $13.8 \cdot 10^6 \text{ Km}^2$
Mode	SAR	LRM	SARIn	SARIn/LRM
Mission Requirement	3.5 cm/yr	8.3 cm/yr		1.0 cm/yr (130 Gt/y)
Measured	< 3.0 cm/yr	< 4.8 cm/yr		< 0.2 cm/yr

CryoSat Product Evolutions



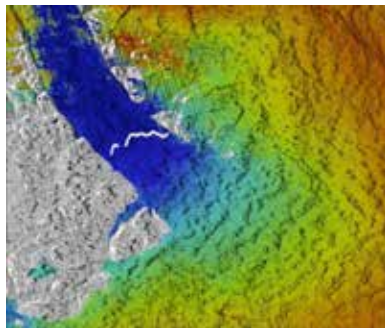
- Independent processing chain from ICE
- Includes six improved models (e.g. dry atmospheric correction, tides)
- New data fields compatible with Sentinel-3
- NetCDF v4 format
- Includes SAR e SARIN (unique) data
- 3 time deliveries: Near Real Time (3 hours), 2days, 30days
- Available (to all) from 30 October 2017
- Full reprocessed data [2010-2017] available from Jan 2018



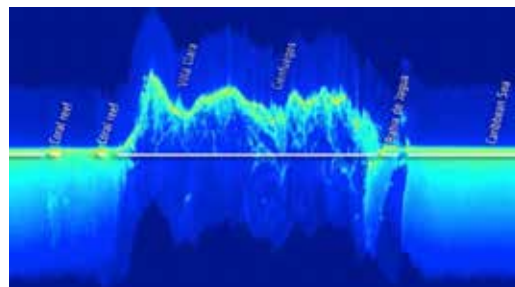
CryoSat is not only for ice



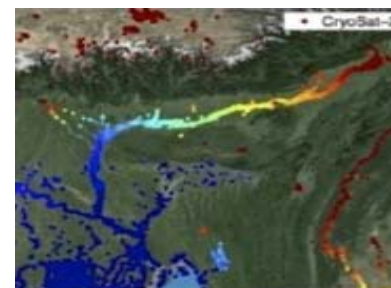
CryoSat is providing high quality data for Oceanography, Coastal Zones, Gravity, Hydrology with valuable contributions to key climate change indicators and operational services



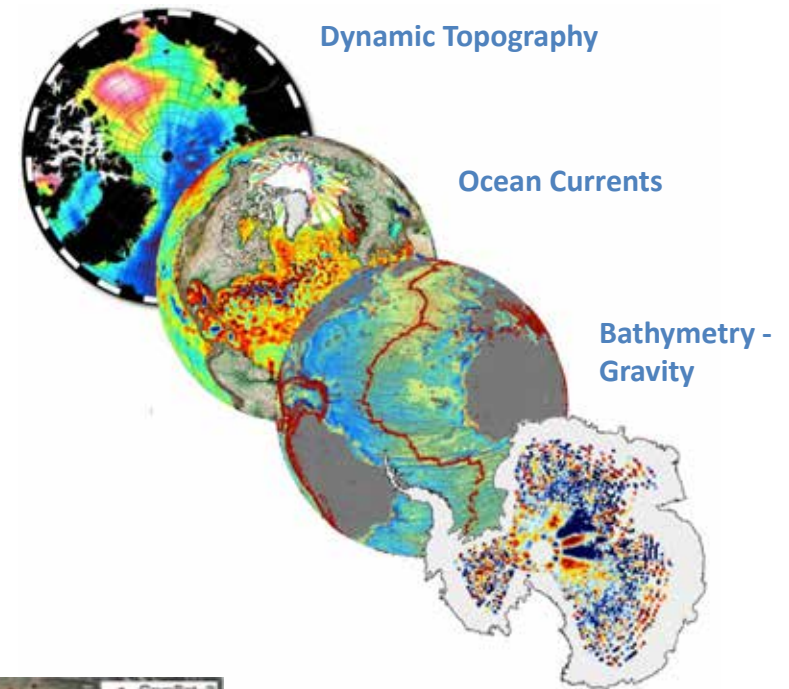
Glacier Topography



Coastal Zones



River & Lakes

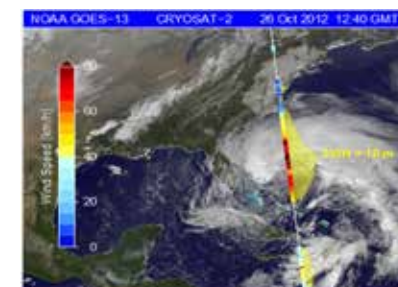


Dynamic Topography

Ocean Currents

Bathymetry - Gravity

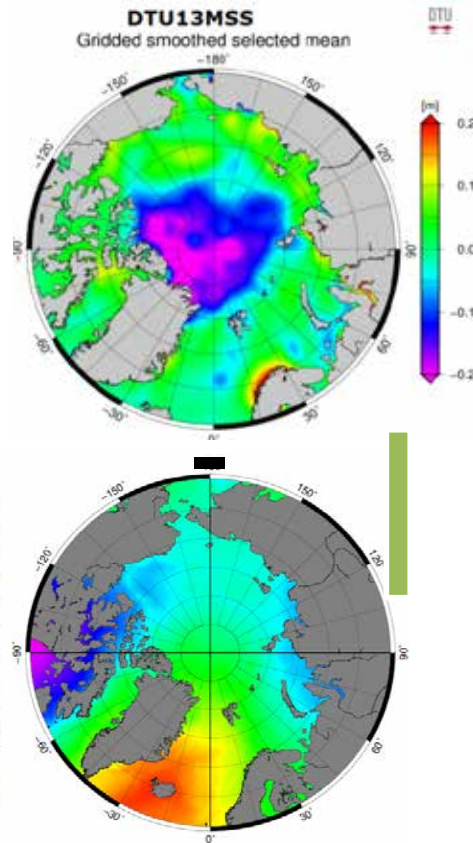
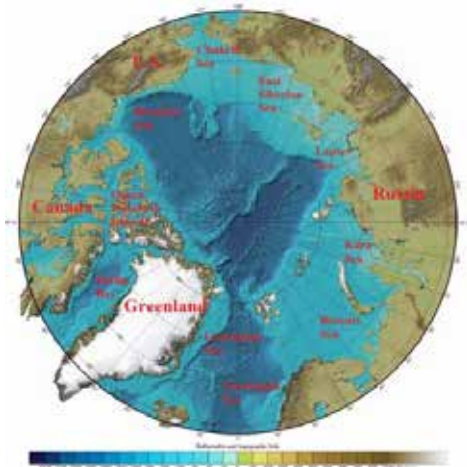
Surface EM interaction



Wind Speed Maps

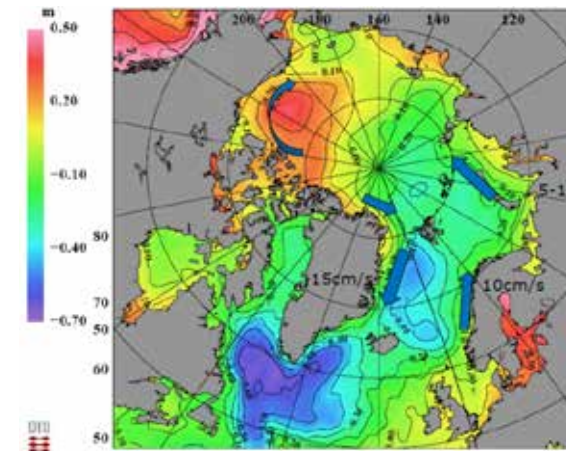


Arctic Mean Dynamic
Topography (MDT)
Satellite Altimetry
and Gravity derived



GOCE Geoid
(e.g. GOCO2S)

Mean Dynamic Topography (MDT)

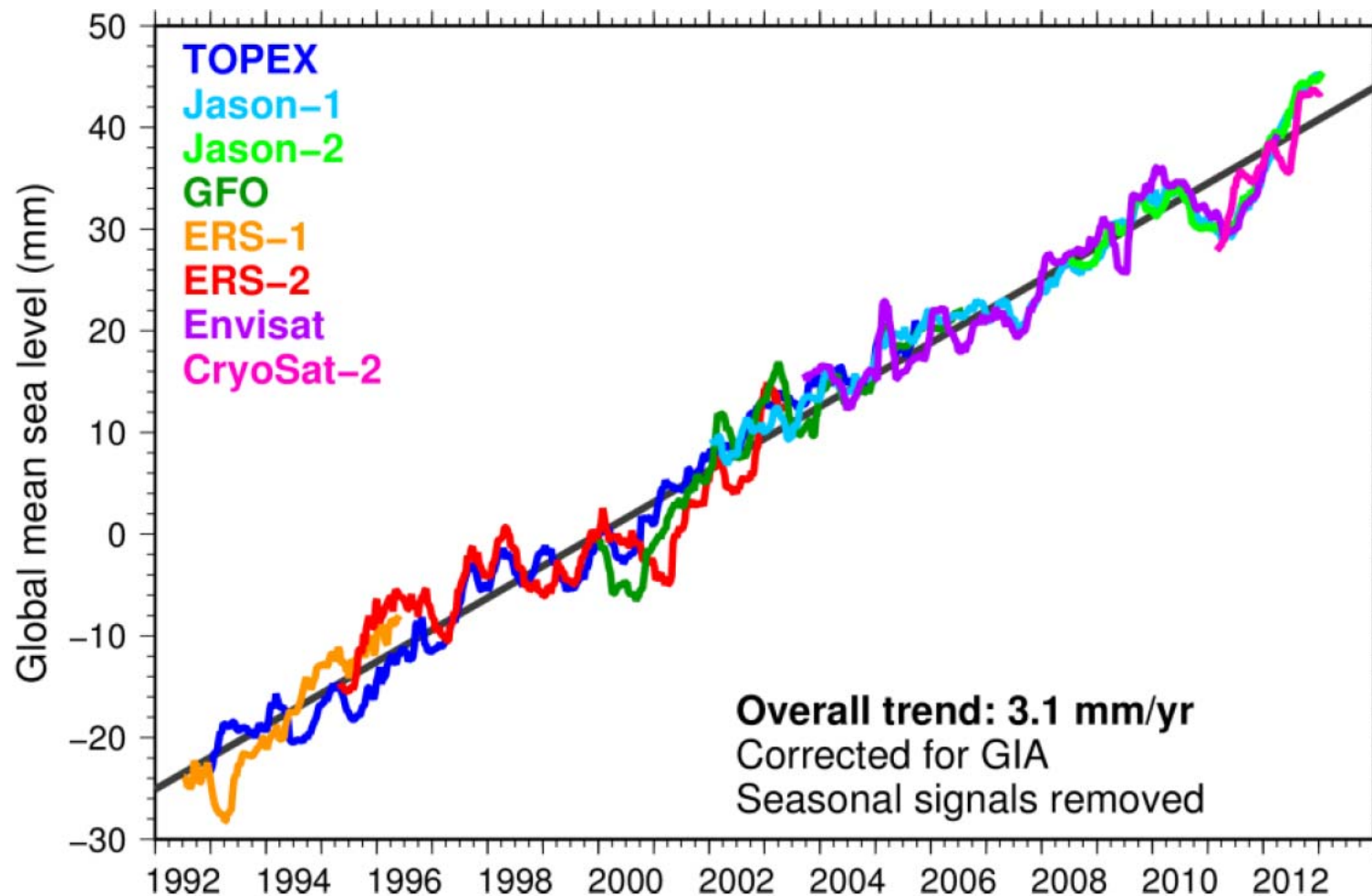


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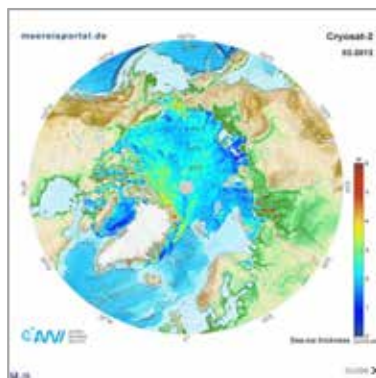
$$\text{MDT} = \text{Mean Sea Surface} - \text{Geoid}$$

Courtesy O. Andersen

Sea Level: CryoSat adds high latitude oceans



Courtesy
R. Scharoo,
EUMETSAT



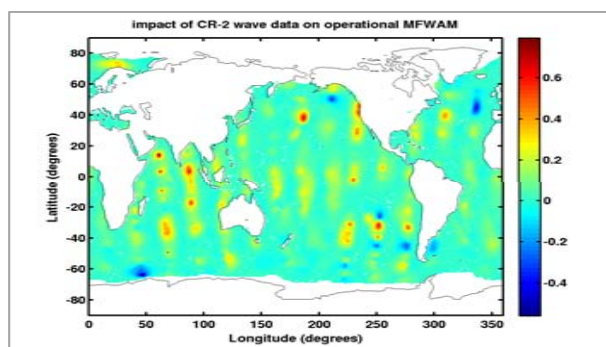
Sea ice thickness:

- NRT sea-ice thickness products available from different institutions (e.g. AWI, UCL, FMI, NASA) for operational use up to 88 degree latitude with unprecedented accuracy (e.g. forecasting, transport, rescue, etc.). Future products will focus on Antarctic sea-ice
- Merged SMOS-CryoSat sea-ice thickness provided by AWI and University of Hamburg

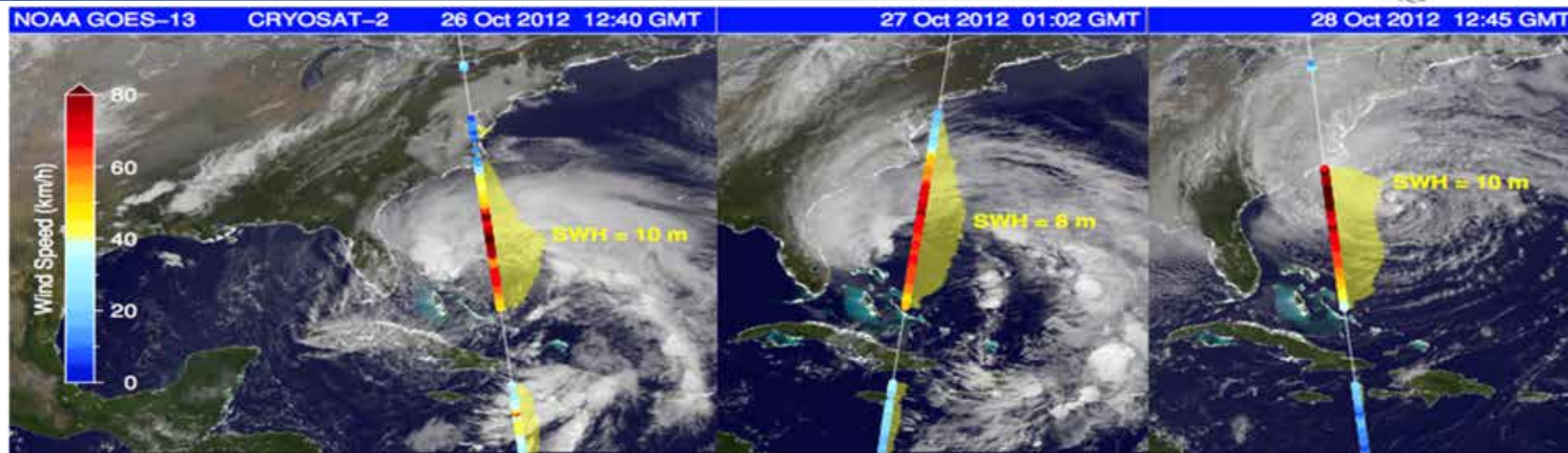


Meteo forecast.

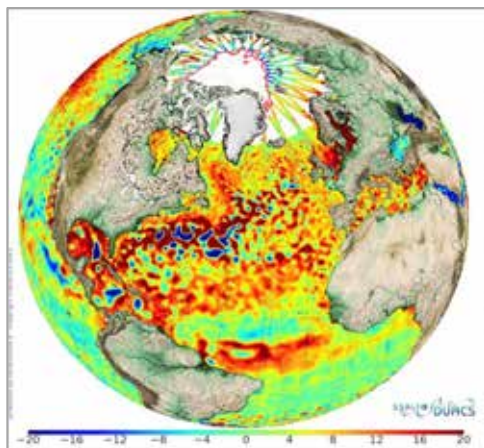
- Assimilation of CryoSat NRT FDM products of wind and wave products into ECMWF GTS systems to improve weather forecasting
- Assimilation of operational wave forecasting system of Météo France



Global Ocean forecast and modelling. Assimilation of Cryosat altimetry products to ensure good monitoring and forecasting of the mesoscale activities crucial for numerous applications (search & rescue, Oil & gas operations) – *GODAE/Mercator*



Hurricane tracking: Information on storm wind speeds, wave heights and tracks are of fundamental importance for Numerical Weather Prediction and operational oceanography and maritime safety. *NCEP - NOAA*



NRT monitoring of ocean status Serving near-real time the main operational oceanography and climate forecasting centers in Europe and worldwide for ocean status and maritime services: *DUACS/AVISO/SSALTO*



- ✧ Many presentations on Climate & Growing Operational Applications
- ✧ No technical restriction to maintain CS2 until 2022 ... what about after ?
- ✧ Strong demand for continuity of a similar polar mission in the next decade with focus on new observations requirements and capacity (Ku-Ka SAR interferometry) for ice and ocean climate and operational application

CryoSat: Special Issue on Advances Space Research



Advances in Space Research

CryoSat Special Issue

Many papers accepted and
some still under review

=> Early 2018



- CryoSat has met all of its scientific objectives
- Financed until end of 2019
- Mission continues to deliver high impact **science** on a variety of different earth Science including marine
- Growing use of data in wide range of **operational services**, including sea level, sea ice, numerical weather prediction, seasonal forecasting, and ocean meteorology
- New ocean processor available from end of October 2017. Full compatibility with Sentinel-3 data fields. NetCDF v4 format. Includes SAR and SARIN (**new**) processor
- Strong demand for **continuity** of a similar polar mission in the next decade with focus on new observations requirements and capacity (Ku-Ka SAR interferometry) for ice and ocean climate and operational application

(see recommendations on www.cryosat2017.org)

Prepare the future of Polar Altimetry

- ✧ Multi-mission synergy (snow: **Ka/Ku**, S-3, IC2, SMOS), **SAR Fully Focused** processing & **Operational applications** over sea-ice, land ice and Polar Oceans
- ✧ Stimulate new **SARin-based** applications, e.g. **Iceberg** detection, **Swath** processing

More and more multi-agencies collaborations on these subjects

Mission: 5' to cover...

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- **GOCE and Swarm Activities**
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GOCE - OGMOC

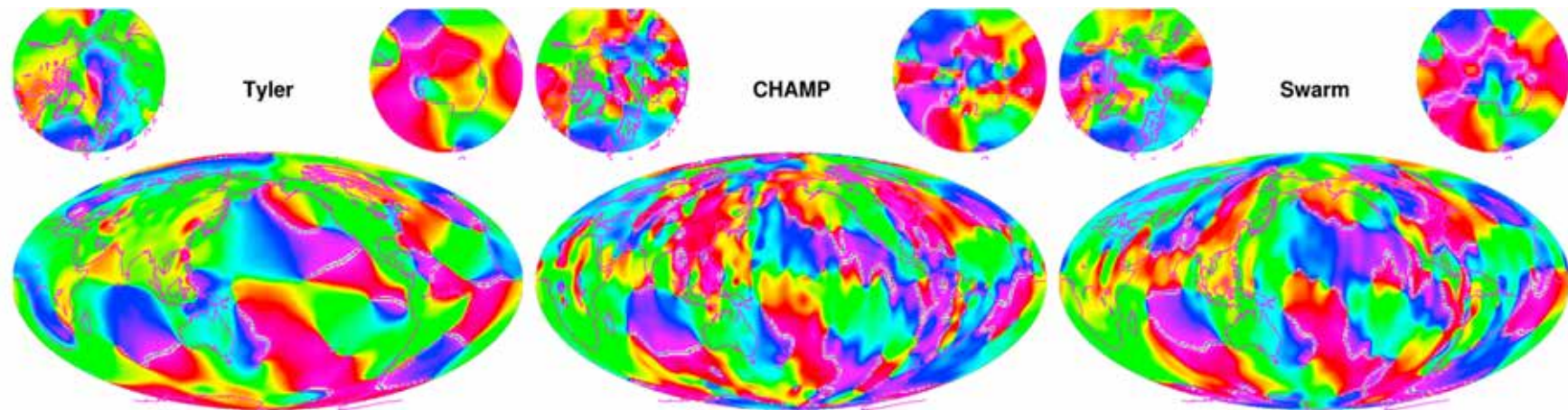


- Oceanographic user consultation was integral part of a study on the **impact of the GOCE-based geoid on ocean modelling** that has brought the ocean modelling community and the gravity field modellers closer.
- Updated satellite-only and combined models of the **ocean mean dynamic topography** have been produced and assessed in detail with the aim to quantify the role of the new geoids in ocean models.
- For the first time, the impact of the GOCE gravity field models on **volume and eddy heat transport** in the ocean has been quantitatively assessed using the test case of a cross-section of the North Atlantic at 26 degrees N.
- **Indication of higher transports** than those measured by RAPID.

Swarm as an oceanographic mission



Swarm recovers the **magnetic signal of oceanic tides** much more efficiently than was possible with previous satellites



Sabaka et al.,
GRL, 2016

Prediction

Observed by CHAMP (10 years)

Observed by Swarm (2 years)

M2 tidal signals can be detected with only two years of Swarm data, thanks to the gradient concept (required 10 years of Champ data), providing information about depth integrated ocean salinity and temperature, as well as information about solid Earth conductivity

SWARM, GOCE and CryoSat Workshops @ Banff, AB, Canada 21-24 March 2017

- ❑ Geodetic Missions Workshop with strong focus on Future Missions
- ❑ Gravity, altimetry, mass transport, reference frames, height systems and absolute positioning using SAR are top-priority on the agenda
- ❑ Meeting engaged the community and the ESA EO leadership in a one-to-one discussion on future needs
- ❑ Fourth Swarm Science Meeting featured a dedicated session on extraction of oceanic (depth-integrated) oceanic signals

See the Gravity & geodesy – Banff resolution at

www.swarm2017.org



Mission: 5' to cover...

- Envisat and ERS Reprocessing
- CryoSat Mission Status
- GOCE and Swarm Activities
- **SMOS Mission Status**
- Sentinel-3 Mission (Craig Donlon's talk @11:00)
- Jason-CS/Sentinel-6 (Pierrik Vuilleumier's talk @11:30)
- R&D, Training and Outreach

SMOS: OBJECTIVES & SCIENCE REQUIREMENTS

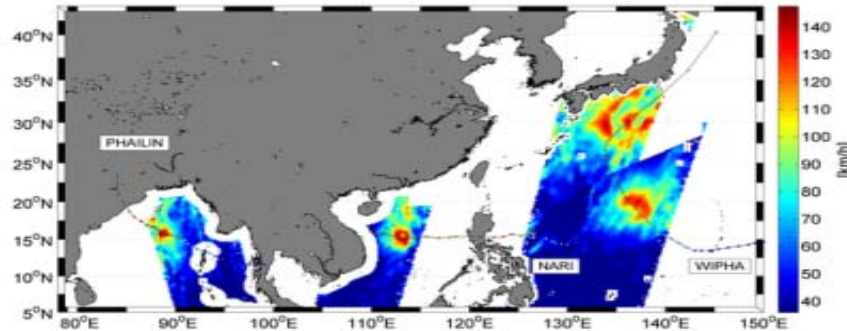


	Requirement	Status
Soil Moisture	4% volumetric soil moisture, spatial resolution 35-50 km, 1-3 days revisit time	Reached, based on an assessment of the data quality over representative validation sites.
Sea surface salinity	0.5-1.5 psu for single observation 0.1 psu for a 10-30 day average for a open ocean area of 200x200 km	Product accuracy over ocean is constantly improving and approaching targeted values, depending on regions.
Sea ice thickness	Daily sea ice thickness estimates based on MIRAS observations shall be provided for the Northern Hemisphere with a spatial resolution of 10.000 km ² up to maximum values of 50 cm.	Reached.
Water cycle processes	SMOS observations shall be analysed with respect to geophysical processes related to the water cycle occurring on time scales exceeding the nominal mission lifetime of 3 (5) years.	On-going scientific work.

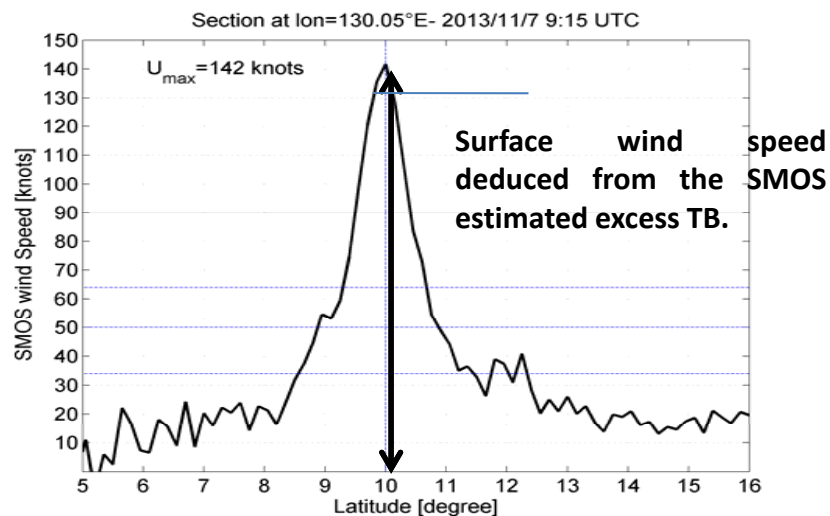


Measurement principle: MIRAS (Microwave Imaging Radiometer using Aperture Synthesis instrument): **passive** microwave 2-D interferometric radiometer measuring in L-Band (1.4GHz, 21cm)
Orbit: altitude of 758 km; inclination of 98.44°; low-Earth orbit, polar, sun-synchronous.

SMOS new product : Severe wind speed



SMOS captured wind speed up to 140 km/h for these three typhoons during 10–15 October 2013. Credit: ESA/IFREMER/CLS/CATDS/CNES.



- ✓ SMOS data used to track severe winds. Emissivity/TB from ocean in microwave increases with increased wind speed (and thus surface roughness/foam).
- ✓ **SMOS can measure winds up to 70-80 m/s with an accuracy of ~5 m/s**
- ✓ Scatterometer data saturate at extreme winds (Hurricane force)
- ✓ Promising for improving Tropical Cyclone intensity forecasts
- ✓ Storms catalogue available from www.smosstorm.org/
- ✓ **NRT product will be available operationally/systematically from Q2 2018 from IFREMER/ODL and ESA**

Mission: 5' to cover...

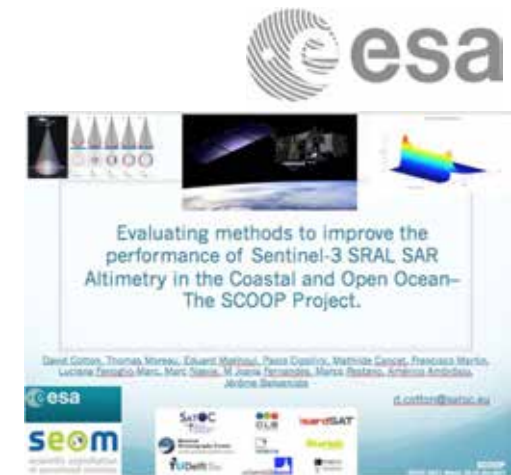
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Research & Development

- SCOOP – Ocean and Coastal (Oral Tue 9:15)
- SHAPE – Inland Water (SC4_002)
- SPICE – Ice sheets (SC4_015)
- DEDOP – Open Source SAR processor
- SARvatore, SARINvatore, S3SARvatore (OUT_002, OUT_006)
- BRAT (OUT_001)
- GUT (GEO_004)
- SL_cci, SLBC_cci (SC1_003)
- SAR Altimetry Training Course
- 10th Coastal Altimetry Workshop
- Banff Geodetic Missions Workshop
- ...and more...

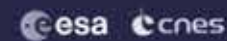
OPEN CALL is open!

Several ITTs coming Early 2018 on Exploitation of CryoSat SARin and Sentinel-3





RADAR ALTIMETRY



TUTORIAL & TOOLBOX



[Toolbox](#) [Code](#) [Data Access](#) [Links](#) [Altimetry Tutorial](#) [Use Cases](#) [Missions](#) [Helpdesk](#)



TOOLBOX



TUTORIAL



FORUM



HELPDESK



SENTINEL-3
SRAL



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NEWS & UPCOMING EVENTS

• OSTST 2016

We will have a poster at the Ocean Surface Topography Science Team (OSTST) meeting 01 - 04 November in La... more info... →

• Gravity, Geoid and Height Systems 2016

We will have a poster at the International Symposium on Gravity, Geoid and Height Systems 2016 in Thessaloniki, Greece on the 19-23 September... more info... →

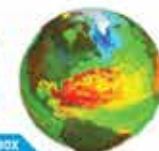
• EO Open Science 2016

We will have a poster at the Earth Observation Open Science 2016 Conference in ESRIN (Frascati, Italy) on 12-14 September... more info... →

• ESA Living Planet 2016

We will have a presentation at the ESA Living Planet Symposium (09:00-09:20 - 10 May 2016) presenting the official version of... more info... →

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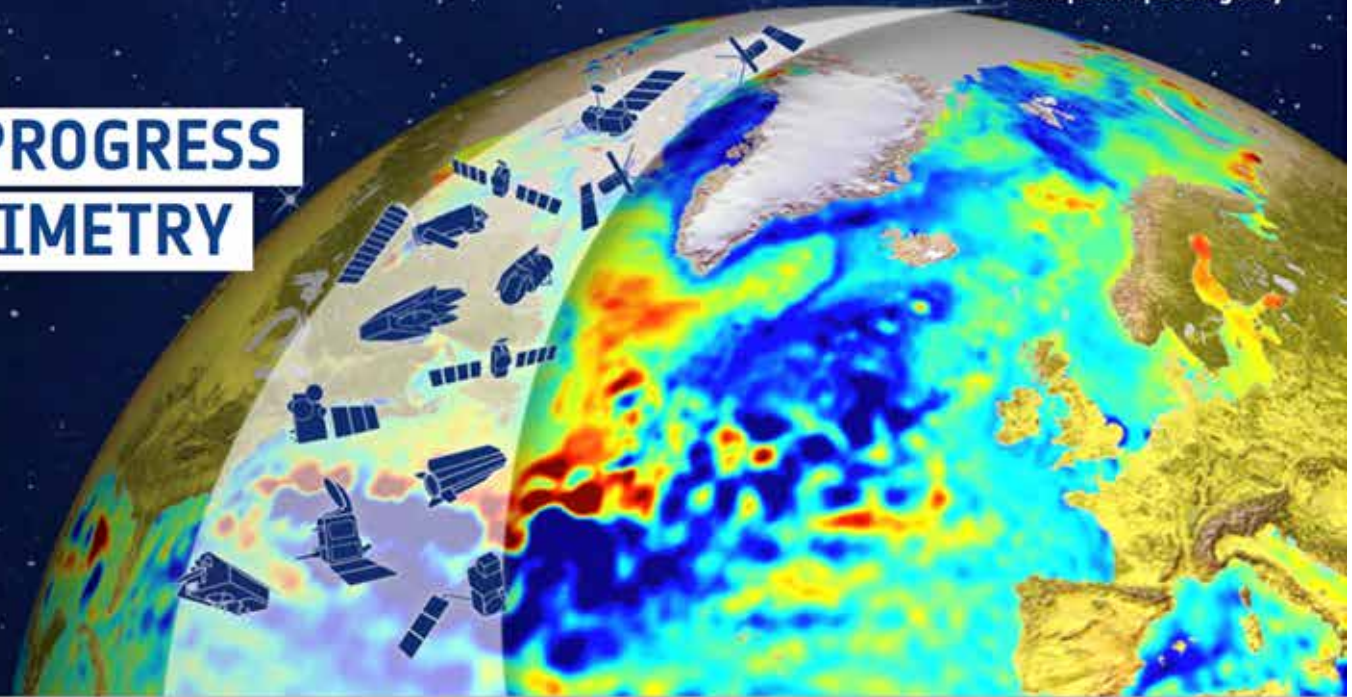


BROADVIEW RADAR ALTIMETRY TOOLBOX



→ 25 YEARS OF PROGRESS IN RADAR ALTIMETRY SYMPOSIUM

24–29 September 2018
Ponta Delgada, Azores



Includes OSTST'18 and IDS'18

www.altimetry2018.org



European Space Agency



Thank you for your attention!

Get the slides from the OSTST web site!!



European Space Agency