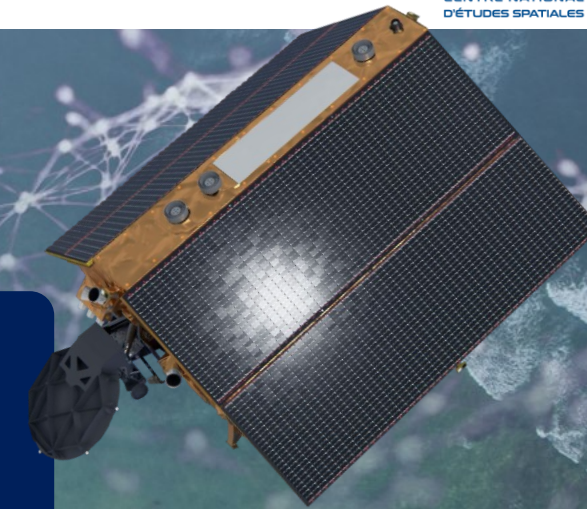


Presentation

NASA/CNES/NOAA/EUMETSAT/ESA program status

Nadya Vinogradova Shiffer (NASA , USA)
Yannice Faugere (CNES, France)
Estelle Obligis (EUMETSAT, Germany)
Eric Leuliette, Ellen Ramirez (NOAA , USA)
Jerome Bouffard (ESA, Italy)



IN PARTNERSHIP WITH



JPL





National Aeronautics and
Space Administration

NASA Ocean Physics 2025-2026

Nadya Vinogradova Shiffer

NASA Science Mission Directorate, Earth Science

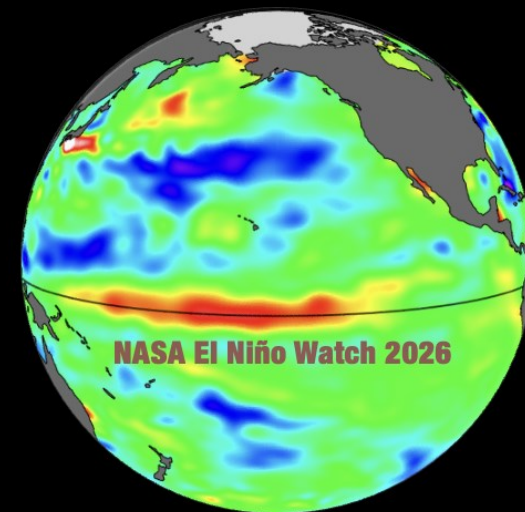
OSTST · June 22-26, 2026 · Wiesbaden, Germany





Sentinel-6B

Type	Orbiter
Target	Earth
Status	Current
Launch	Nov 16, 2026



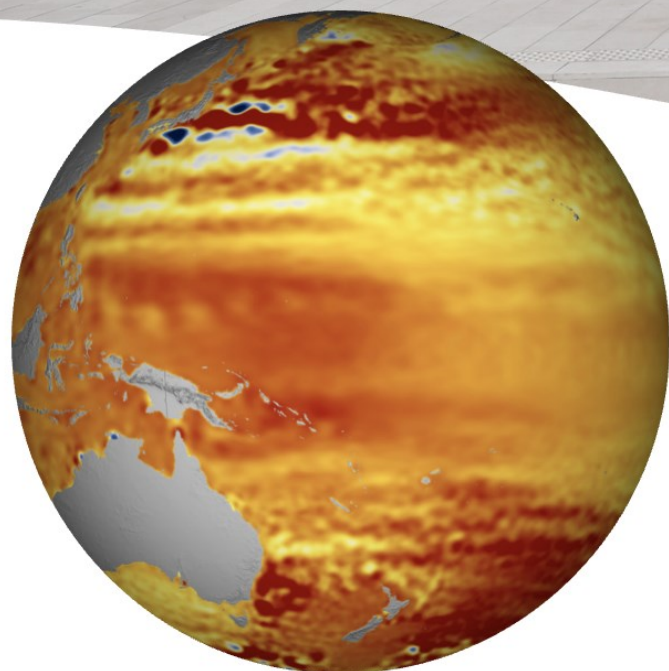
10 cm

5 cm

1995

2010

2025



NASA-NOAA OSTST 2025-2028:

70+ members · 20+ projects · \$12M



Welcome New Team!



National Aeronautics and
Space Administration

Opportunities

EARTH VENTURE ORBITAL-1
SENTINEL-6 SERIES
SWOT MISSION EXTENSION
CRISTAL

OCEAN PHYSICS
SWOT SCIENCE
ARCTIC FRESH

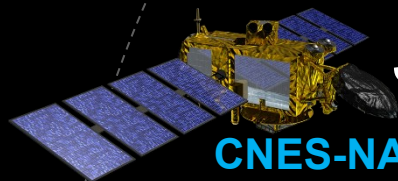




OCEAN PROGRAM

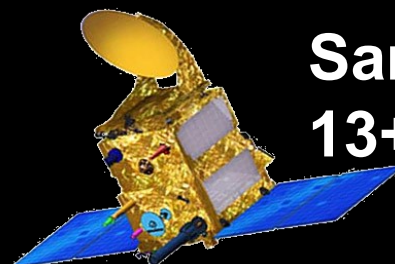
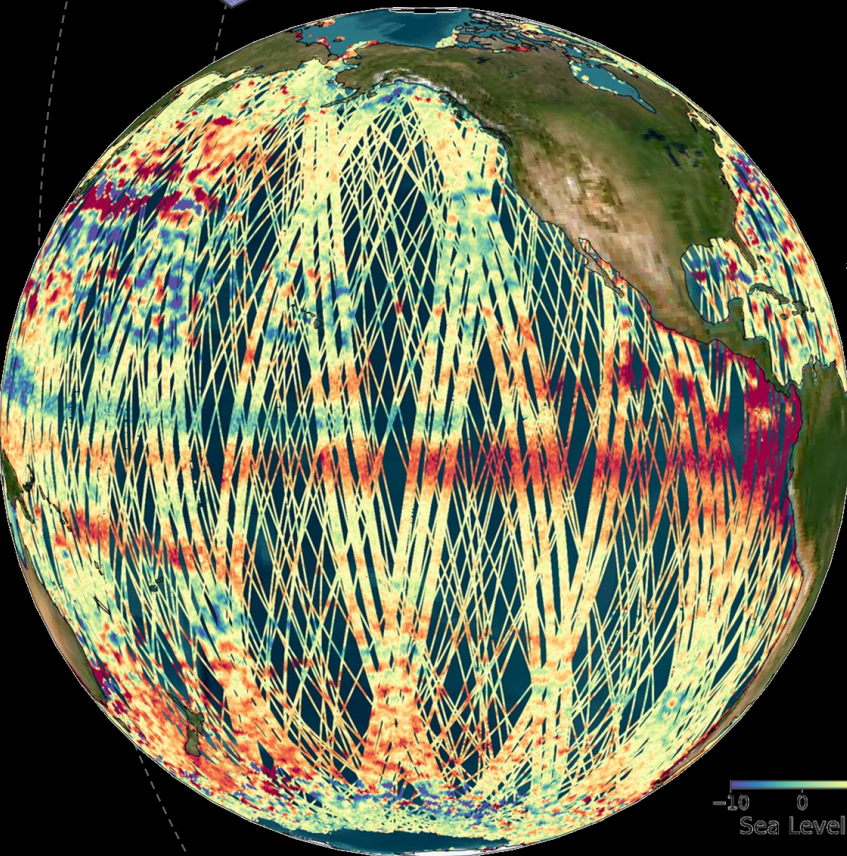
YANNICE FAUGERE

ALTIMETRY



Jason-3 10+ years in orbit

CNES-NASA-NOAA-EUM

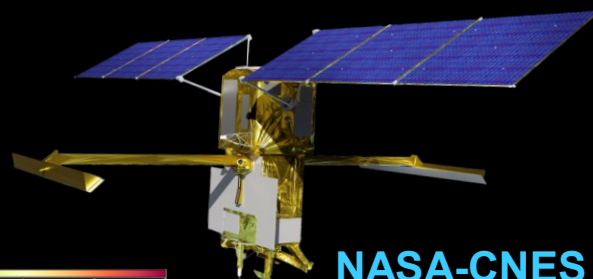


SARAL Altika
13+ years

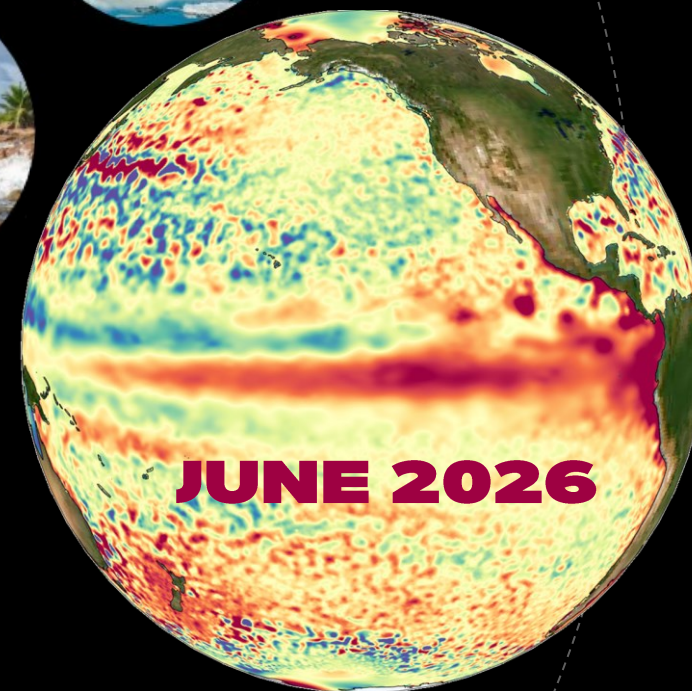
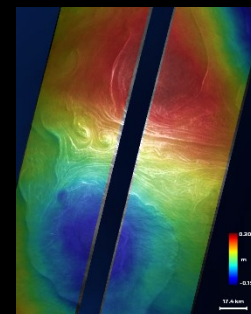
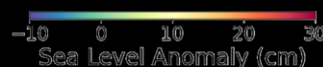
CNES-ISRO



SWOT : 3 years



NASA-CNES
UK-CSA



JUNE 2026

Check on El Nino
2026 development



TRANSITION TO HR ALTIMETRY: THE SWOT REVOLUTION

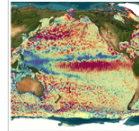
nature

WATER DATA
IN HIGH
DEFINITION

Wide-swath satellite altimetry unveils global submesoscale ocean dynamics

[Matthew Archer](#), [Jinbo Wang](#), [Patrice Klein](#), [Gerald Dibarboure](#) & [Lee-Lueng Fu](#)

Blending 2D topography images from the Surface Water and Ocean Topography (SWOT) mission into the altimeter constellation with the Level-3 multi-mission Data Unification and Altimeter Combination System (DUACS)



Ocean Science

Science

Abyssal marine tectonics from the SWOT mission

[YAO YU](#), [DAVID T. SANDWELL](#), AND [GERALD DIBARBOURE](#) [Authors Info & Affiliations](#)

Sizing the largest ocean waves using the SWOT mission

[Fabrice Ardhuin](#)^{a,1}, [Taina Postec](#)^a, [Mickael Accensi](#)^a, [Jean-François Piolle](#)^a, [Guillaume Dodet](#)^a, [Marcello Passaro](#)^b, [Romain Husson](#)^c, [Gilles Guitton](#)^d, and [Fabrice Collard](#)^d

PNAS

Wide-swath altimetry maps bank shapes and storage changes in global rivers

[A. Cerbelaud](#), [J. Wade](#), [C. H. David](#), [M. Durand](#), [R. P. M. Frasson](#), [T. Pavelsky](#) & [H. Oubanas](#)

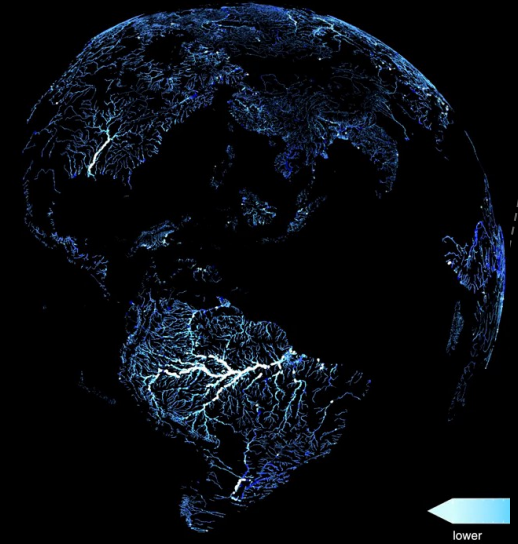
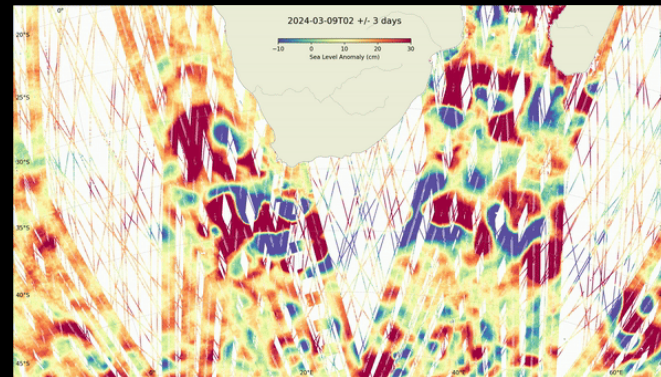
n

Fine-scale observations reveal distinct frontal phytoplankton communities

[Laurina Oms](#), [Andrea Doglioli](#), [Monique Messié](#), [Francesco d'Ovidio](#), [Xavier Capet](#), [Louise Rousselet](#),

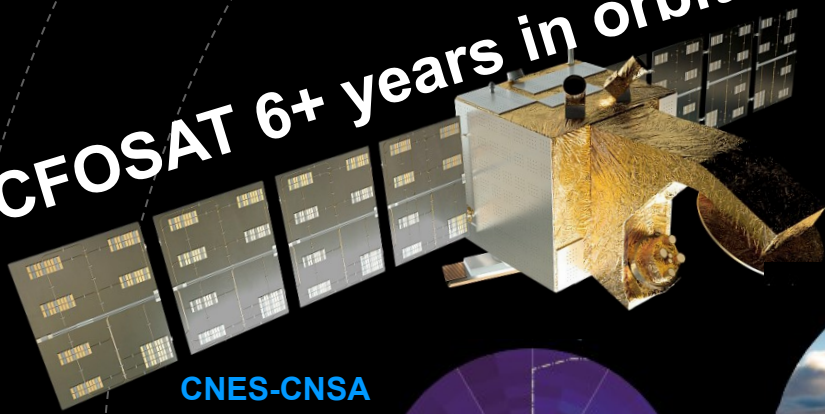


- ✓ 3 years in orbit
- ✓ Working beyond expectation
- ✓ Scientific excellence
- ✓ Application demonstration
- ✓ Still enormous unexploited potential
- ✓ Extension for 3 next years authorized by CNES

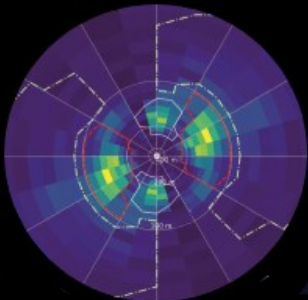
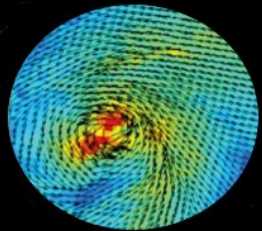


SEA STATE - WAVE, CURRENT

CFOSAT 6+ years in orbit



CNES-CNSA



- ✓ Waves: risk of observation gap on wave after 2027
- ✓ Ocean current is today one of the major gaps in ocean observation from space (JPL/CNES Odysea mission NOT selected)
- ✓ Gaps addressed in the altimetry CEOS reference document "Towards 2050"



- ✓ SWIM instrument is working perfectly
- ✓ Many science results (eg Bedossa 2026)
- ✓ Assimilation in operational wave forecasting models, products distributed in Copernicus services (Marine et Climat)

Second Fine-Scale Air–Sea–Wave Interactions in Toulouse

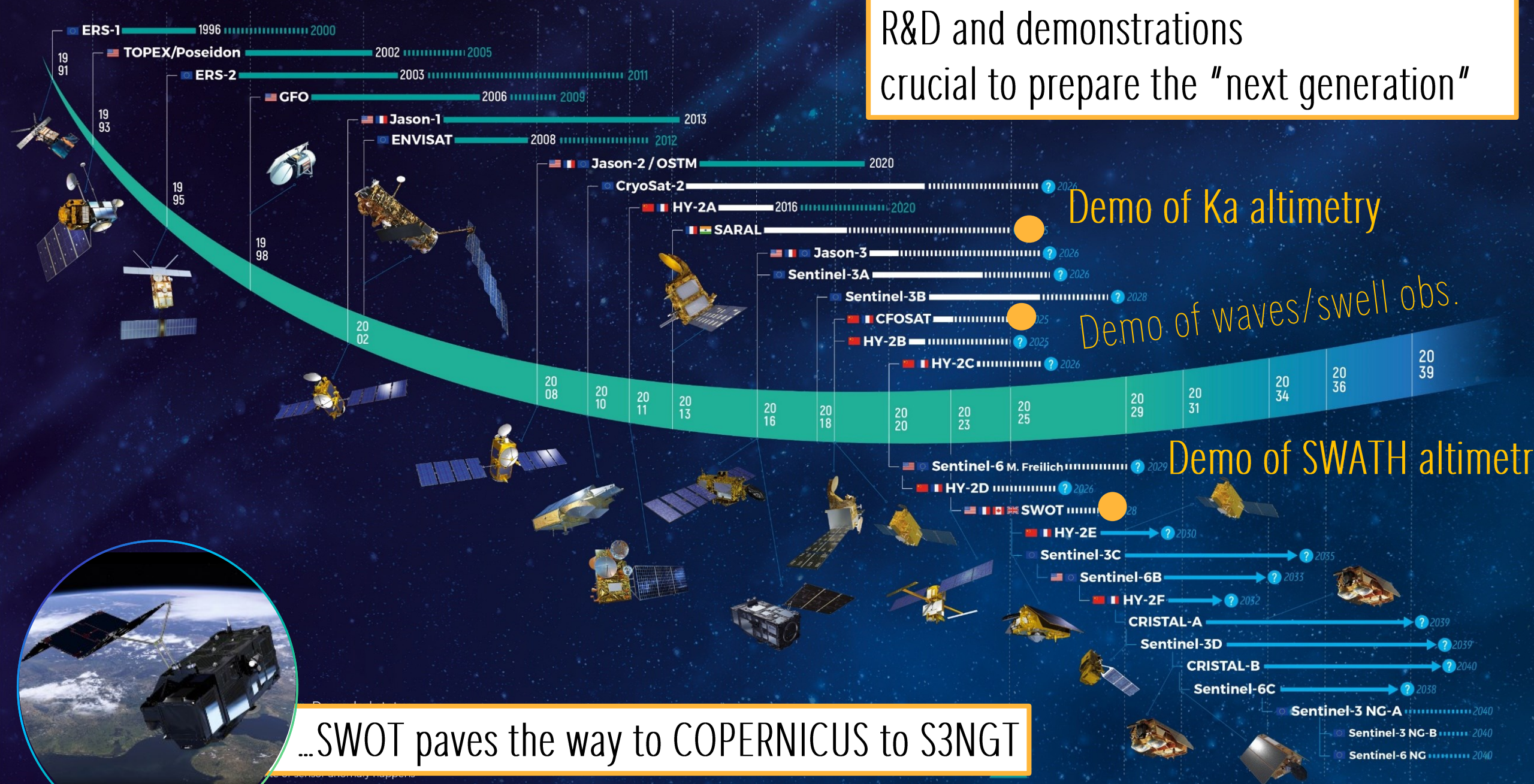
Observations, Modelling, Parameterizations

28 September 2026 | 29 September 2026

6th CFOSAT INTERNATIONAL SCIENCE TEAM MEETING

18-20 November 2026
Zhanjiang - CHINA

R&D and demonstrations
crucial to prepare the "next generation"

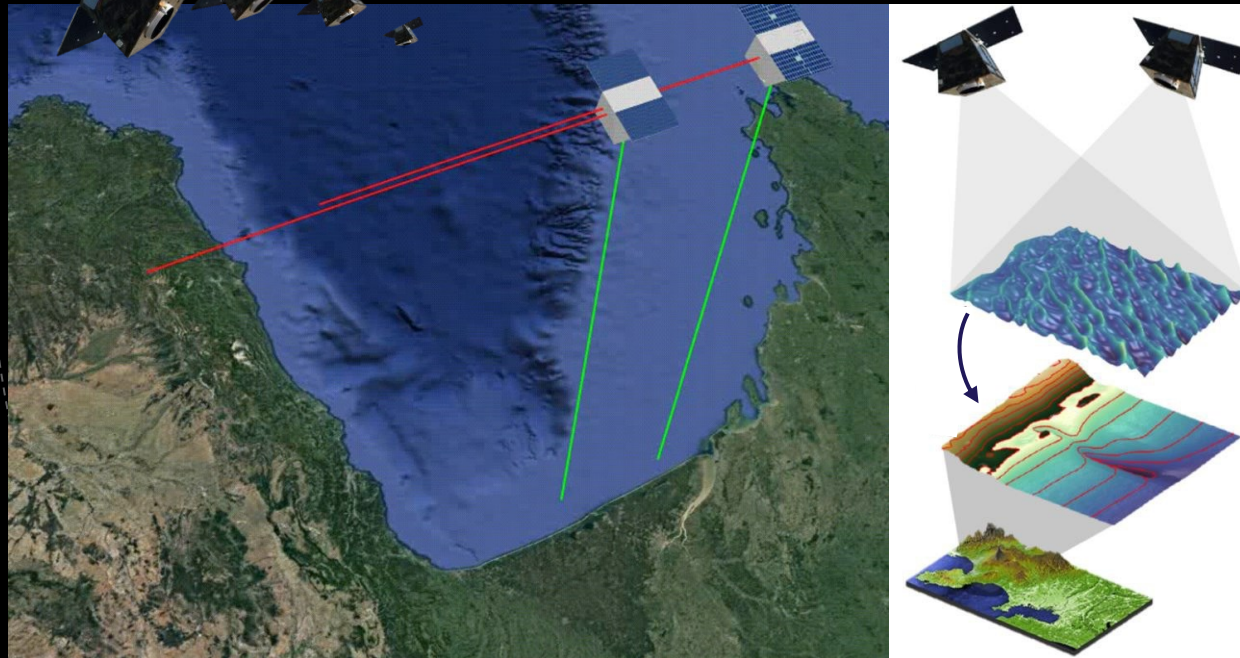


MULTISENSOR SYNERGY WITH FOR COASTAL OCEANOGRAPHY



CO3D

Launched in 2025 → opportunity for bathymetry, sea state observation



4 optical satellites, 50 cm resolution



CNES-ISRO

Expected end 2027 → One objective is High Resolution Coastal SST and Ocean Colour



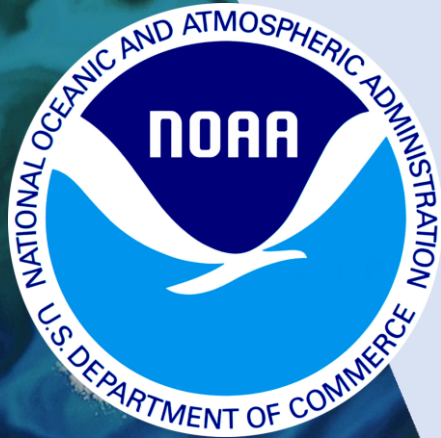
Thermal infrared and visible VNIR-SWIR – LWIR

Ocean Surface Topography Science Team renewal

- **Renewal for 2025-2028, 2 calls NASA-Roses and CNES-TOSCA/Eumetsat**
- **26 teams / 42 PI selected by CNES/Eumetsat Call**
- **Strong link with other altimetry ST (SWOT, ...)**



The altimetry community represents far more than 500 scientists!



NOAA
National Satellite, **Data**, and
Information Service

OSTST • 22 June 2026

NOAA Program Status

Eric Leuliette
NOAA Jason/Sentinel-6 Program Scientist

NOAA Support of the OSTST

Four projects funded for the 2025-2028 Team (~\$800K/year)

- Focussed on algorithm and application development for operations, particular for the weather enterprise
- In Fiscal Years 2025 and 2026 the NOAA Office of Ocean Exploration and Research have provided partial matching funding through the National Oceanographic Partnership Program (NOPP)

Investigator	Institution	Title
Christopher Buchhaupt	University of Maryland	Towards the Unification of Radar Altimetry Processing Approaches for Different Surface Types
James Carton	University of Maryland	Mapping coastal currents in midlatitudes and the Arctic
Sinead Farrell	University of Maryland	Assessing Decadal-Scale Variability and Trends in Arctic Ocean Surface Topography with High Latitude Altimetry
Paige Lavin (Trossman)	University of Maryland	From the Shelves to the Deep: Satellite-Derived Profiles for Operational Ocean Heat Content Applications in the North Atlantic and Pacific Oceans

<https://www.star.nesdis.noaa.gov/socd/lsa/OSTST.php>



NOAA Deputy Project Scientist/Sentinel-6

Dr. Heather Roman-Stork has worked at the NOAA/NESDIS Center for Satellite Applications and Research (STAR) since 2020. She has worked with the CoastWatch Applications Team at STAR.

Earlier this year, she was awarded the 2026 winner of NOAA's prestigious David S. Johnson Award for her work developing multi-sensor eddy tracking tools and applications.

Science III: Mesoscale and sub-mesoscale oceanography splinter co-chair

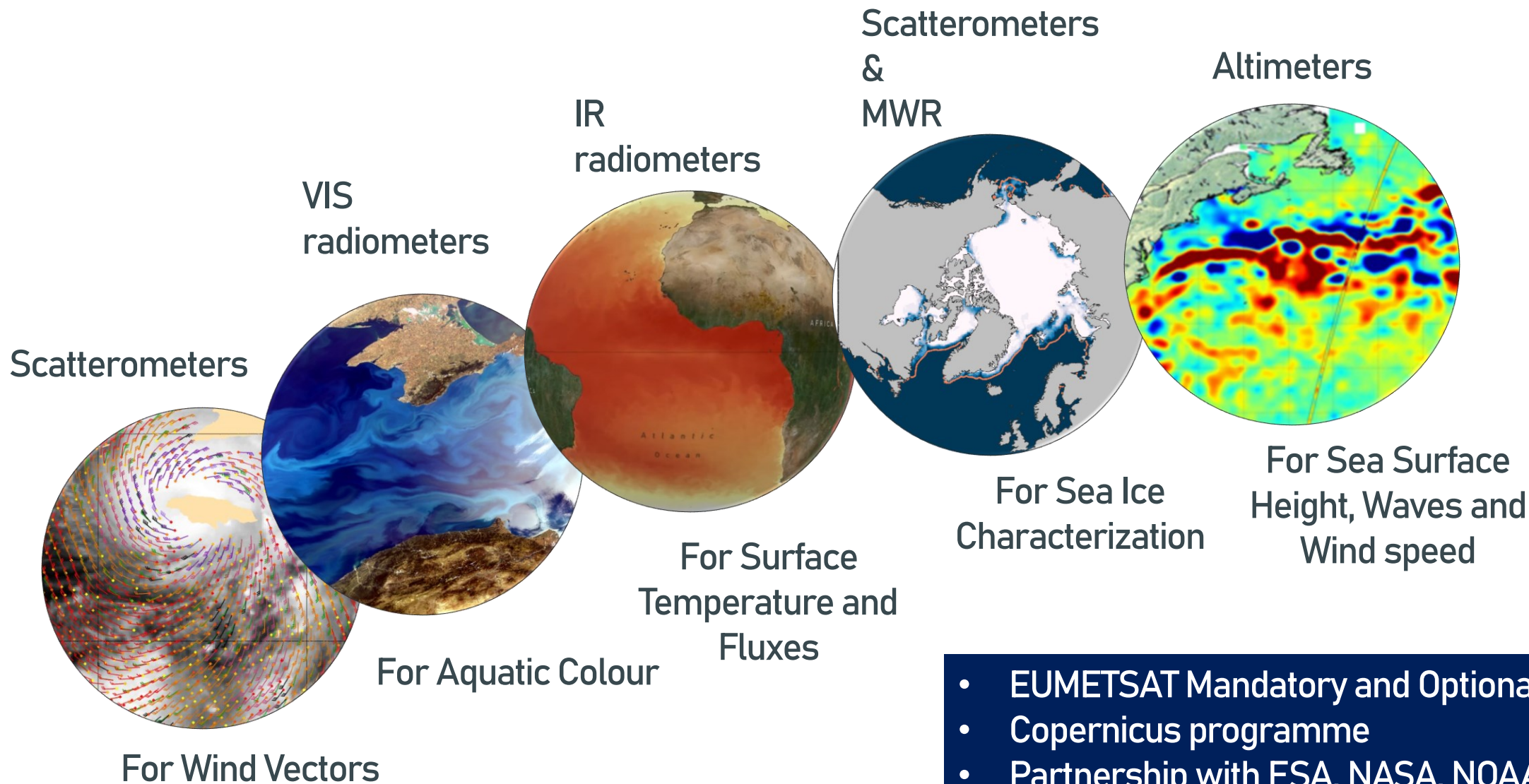


EUMETSAT Ocean Programme Status

Estelle Obligis & EUMETSAT colleagues

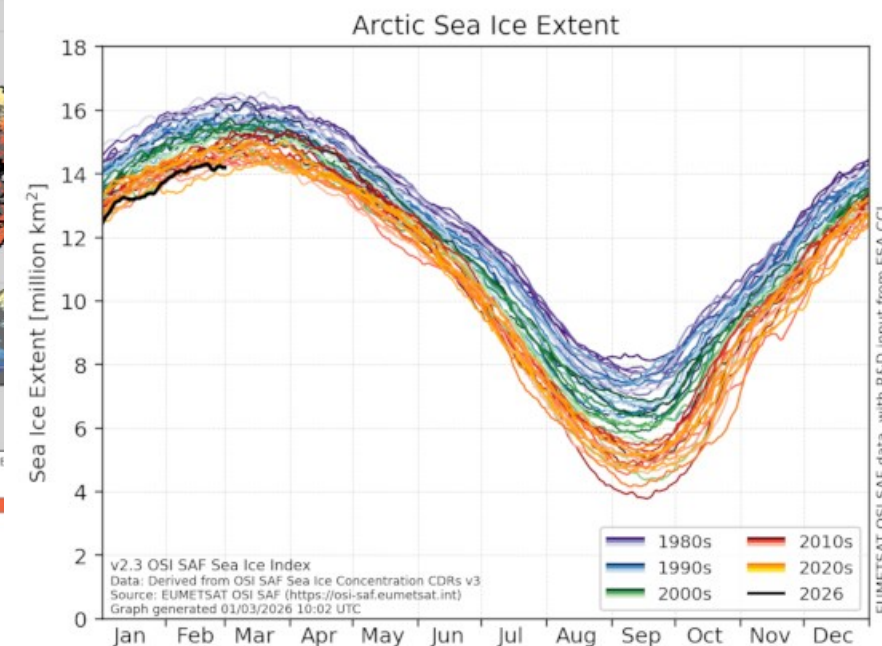
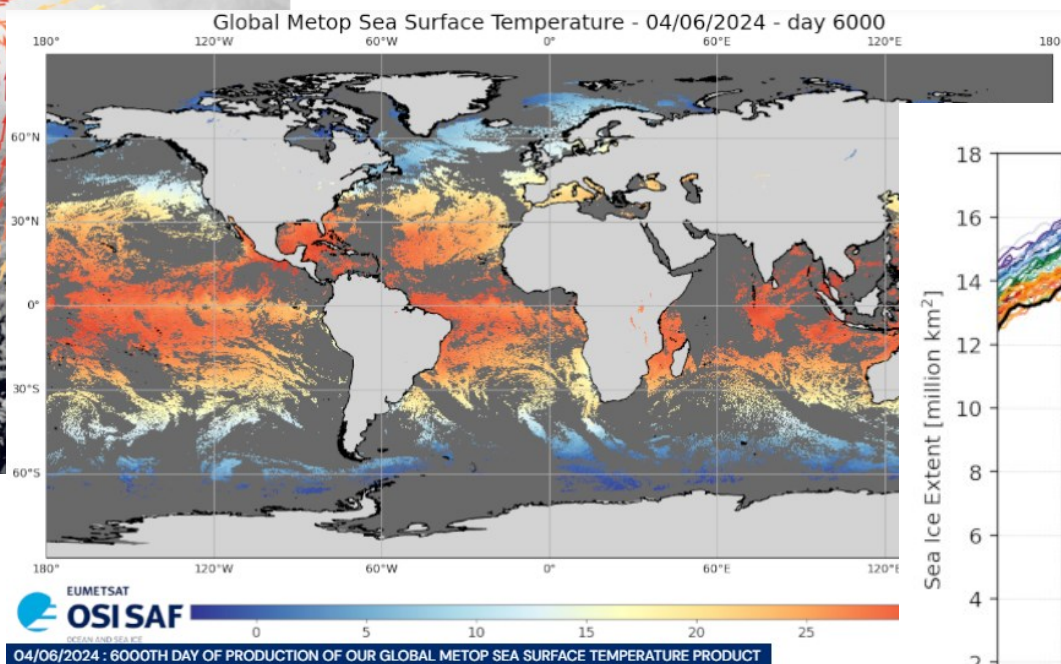
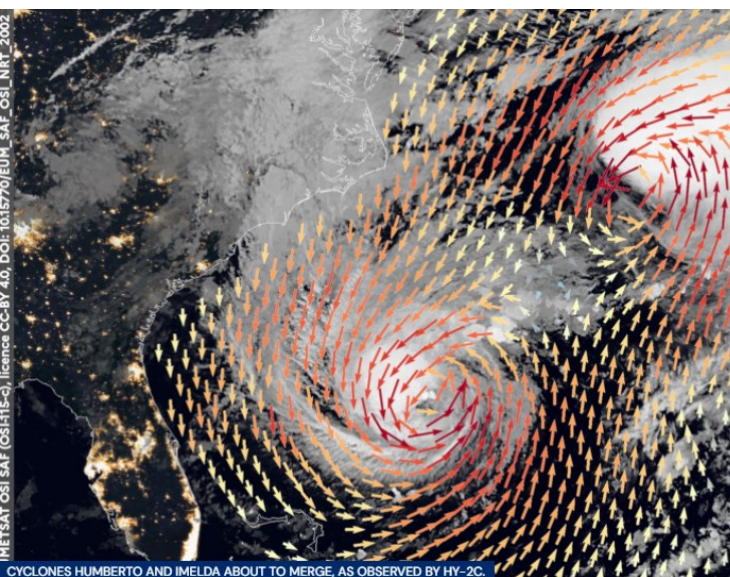
OSTST 2026 – 22 June 2026





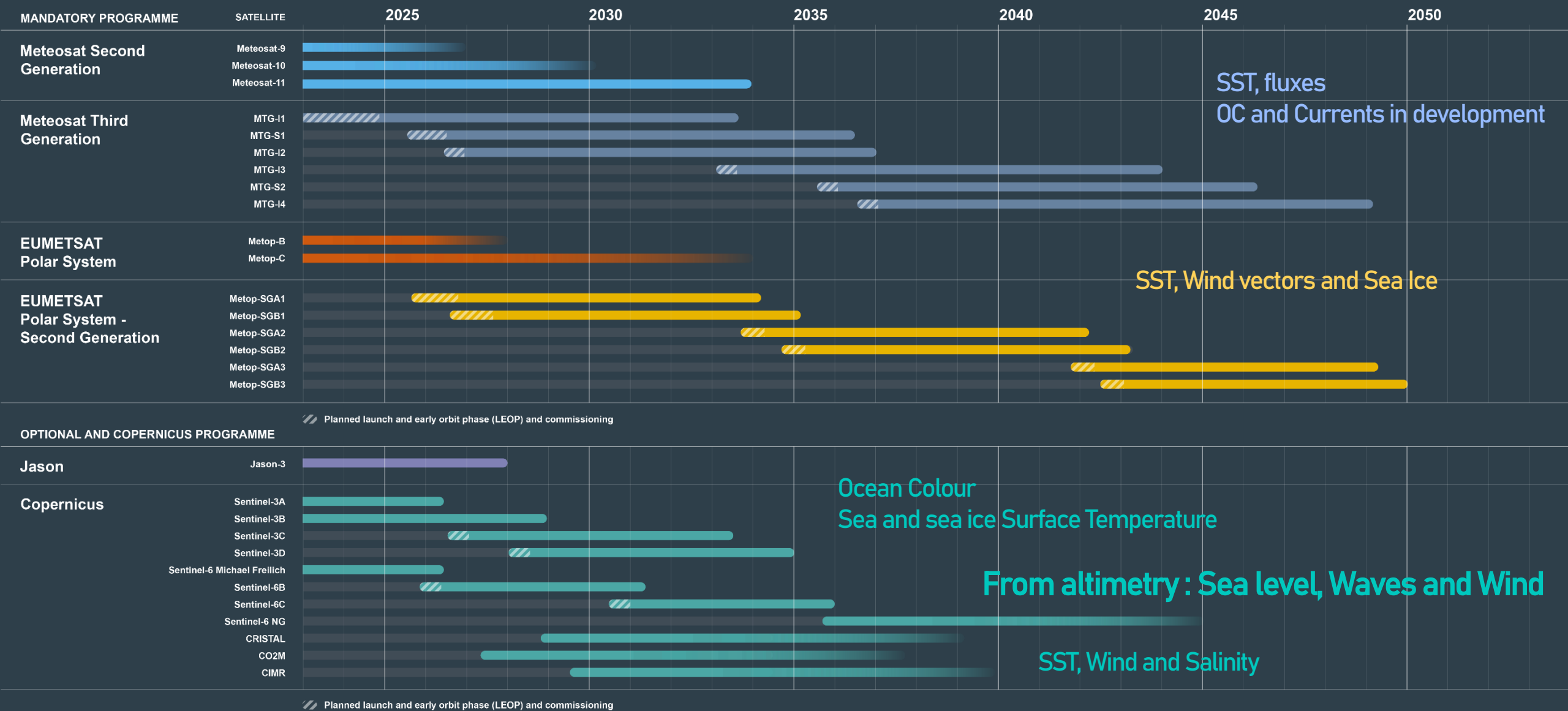
- EUMETSAT Mandatory and Optional programmes
- Copernicus programme
- Partnership with ESA, NASA, NOAA, CNES, CMA, NSOAS, JAXA, KMA, ISRO,...
- Key contribution from OSI SAF

OSI SAF is operated by a consortium of five members with Météo France as the leading entity providing operational services related to wind vectors, sea ice parameters, sea surface temperature and fluxes.





EUMETSAT mission planning



- Satellite observations of the ocean are essential for improving numerical weather prediction, ocean forecasting, and climate monitoring;
- EUMETSAT (with OSI SAF) has proven world-leading expertise and long-standing experience in the generation of **reference operational** products for the scientific and operational communities;
- These activities are supported by **sustainable** programmes (EPS-SG, MTG, and Copernicus), ensuring stability and continuity of services over the next 20 years;
- **Synergies** between programmes/missions/parameters are key for us to leverage the potential of individual missions.

- Altimetry helps us better understand our **Earth System** and has made its way to operational use in meteorological, oceanographic and climate models, with a clear contribution to science and people's lives;
- The success of satellite altimetry is one of **international cooperation**, addressing technical and scientific challenges as a community and building up a solid heritage
- We will continue the development and operations of altimetry missions for Copernicus by exploiting **synergies** in operations, scientific and technical heritage;
- EUMETSAT is preparing a **Mandatory Altimetry Programme** (start in 2028).



PROGRAM STATUS – ESA

S3, S3NG-T, S6 and CRISTAL in other talks

Jérôme Bouffard* & ESA colleagues

*ESA - Sentinel-3 and CRISTAL Missions Manager



3 families of EO missions including altimetry and Passive MRW sensors



Prepare Develop
Operate

World-class EO systems with
European and global partners
to address scientific & societal
challenges

Science



Copernicus



Meteorology



Importance of R&D and Cal/Val to improve past / current missions and prepare future ones

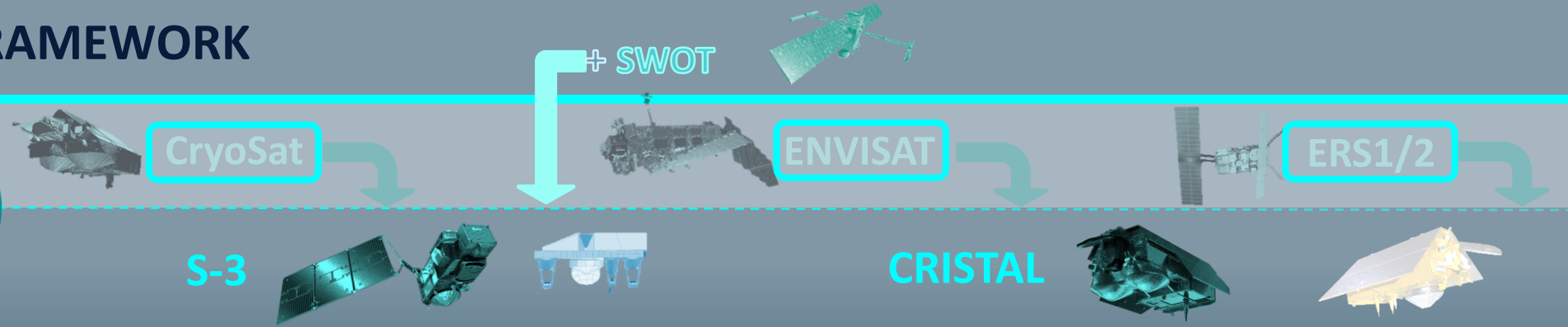
CONTEXT

A MULTI-MISSION FRAMEWORK

ESA R&D

Algo innovation

- = Product evolutions
- = Mission preparation



ESA Multi-Mission

Tailored IPF & Cal/Val

- = Product consistency
- = Product continuity
- = Product quality



ESA involvement across EO programs & mission phases

Altimetry MPC/ESL

Altimetry FRM

DEMO PRODUCTS

End-users & Copernicus Services & ESA Partners



FULL MISSION REPROCESSING (FDR4ALT-FO)



- Based on **state-of-the-art** algorithms & corrections (e.g. GDR-F ERS orbits, ...)
- Generated innovative Earth system data records: 2 **FDR's** and 6 **TDP's**
- **Synergies** with past, current & future ESA projects and missions (e.g. **CryoSat-2**)

Fundamental Data Records

L1B products containing all ancillary and instrumental data used for calibrations

Thematic Data Products

Level-2P, easy to use, validated products with uncertainties included serving different communities involved in long term data exploitation



Ocean & Coastal Topography



Inland waters



Land Ice
Greenland +
Antarctic



Sea Ice



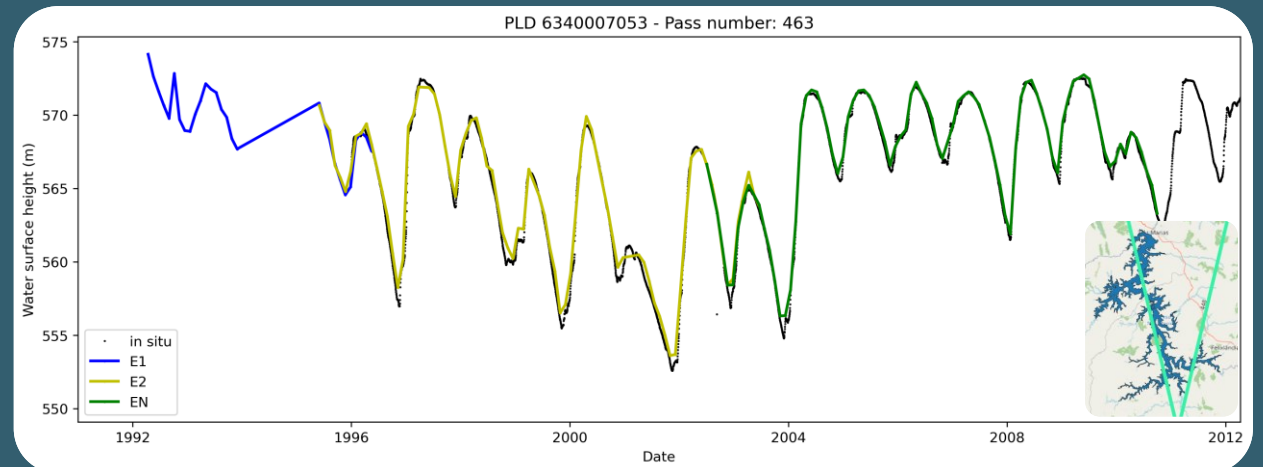
Atmosphere



Ocean Waves

See poster ODS2026_002 in Terrassensaal A+B and many others..

Continuity ERS-1, ERS-2, ENVISAT / Validation with in-situ



SPACE SEGMENT STATUS

1



- Platform remains stable and performing well.
- SIRAL Continues to deliver high-quality SAR/SARIN altimetry
- Orbits and attitude performance remain compatible with Mission Re.
- Fuel and battery outlook can support operations into **late 2020s**

GROUND SEGMENT / DATA STATUS

2



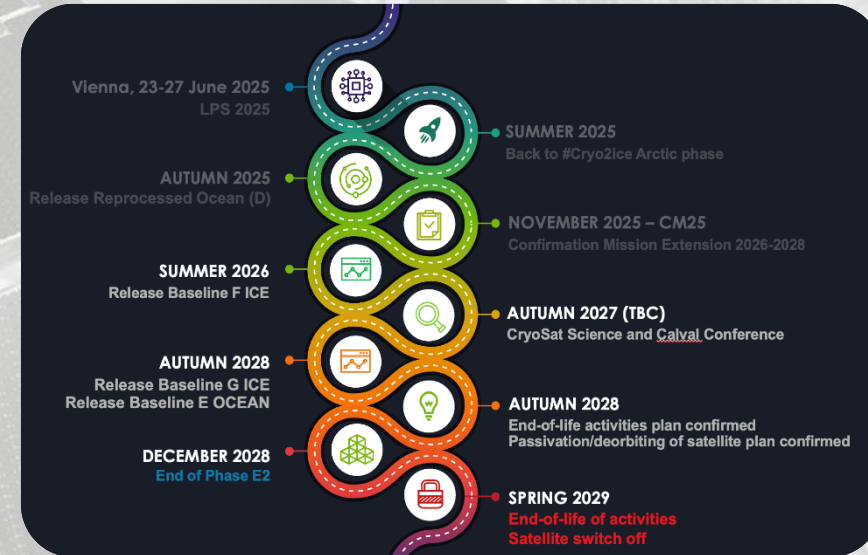
- Routine operations and data productions **remain stable**
- Long-term data record continues to be maintained and improved
- Ongoing processor maintenance and evolution to ensure data quality and usability (L1, L2 Ice and Ocean, CryoTEMPO)

MISSION RELEVANCE

3



- Reference mission** for cryospheric altimetry
- Unique long-term CDR for Earth's ice fields, polar oceans, coastal and inland
- Direct heritage for CRISTAL (strategic overlap opportunity)
- Strong synergy with other mission and sensors (e.g. **SMOS**)



Space Segment

Stable
SIRAL performing



Ground Segment

Operational
Products maintained



Science / Users

High demand
Long-term climate record



STATUS & HIGHLIGHTS

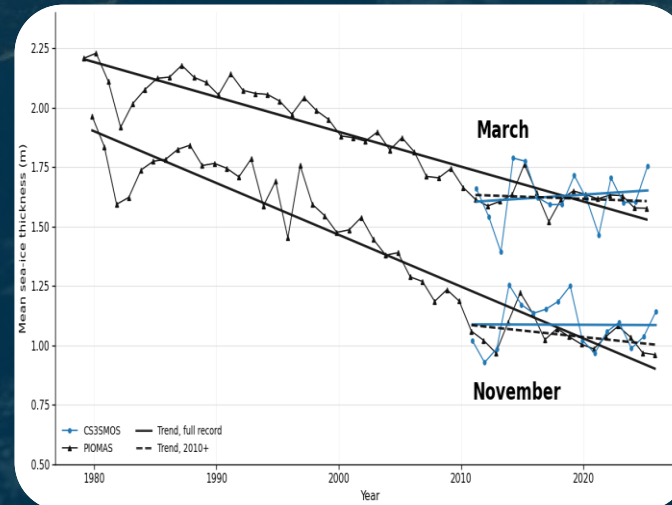
- Platform and payload in **excellent** condition. Today 17 years of high quality data, operation extended until December **2028**.
- Update of SIT product :
 - Product extended to Antarctic.
 - S3 added to the CS2/SMOS synergy product (resolution improvement from 25 to 12.5 km).
 - Evaluation of ECMWF ocean-ice reanalysis ORAS6 for inversion and uncertainty assessment.
- Also promising in preparation of **CRISTAL** and **CIMR**

Anomalies in monthly sea ice volume in Arctic Ocean sectors in 2025

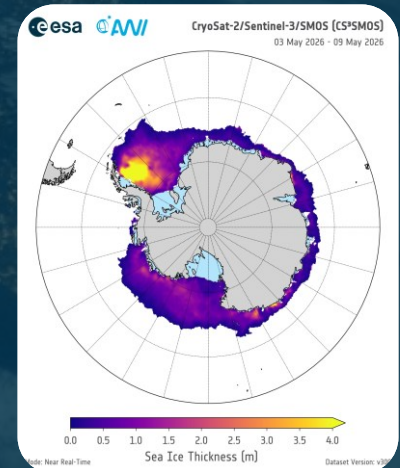
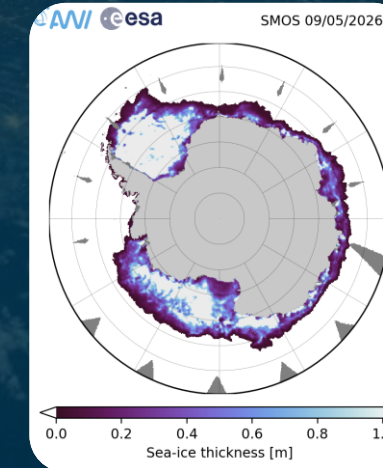
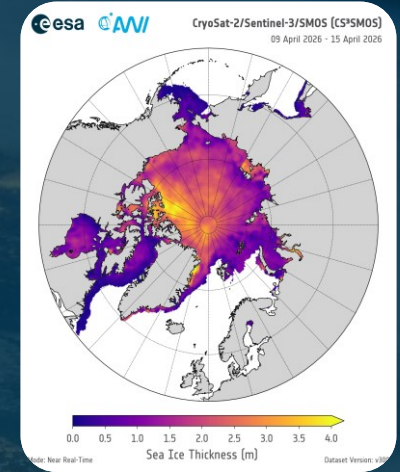
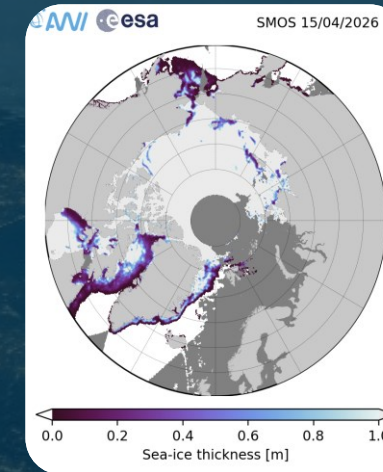


Sea Ice Volume Anomaly (%)	Jan 2025	Feb 2025	Mar 2025	Apr 2025	Oct 2025	Nov 2025	Dec 2025
Central Arctic (1)	1%	2%	3%	1%	-11%	-5%	-7%
Beaufort Sea (2)	1%	17%	1%	4%	-3%	-9%	-11%
Chukchi Sea (3)	7%	26%	14%	24%	247%	79%	7%
East Siberian Sea (4)	-6%	0%	3%	5%	24%	40%	6%
Laptev Sea (5)	0%	7%	11%	5%	88%	6%	-5%
Kara Sea (6)	14%	22%	25%	30%	-91%	-76%	-10%
Barents Sea (7)	8%	-5%	-5%	12%	-98%	-94%	-75%
East Greenland Sea (8)	4%	8%	23%	-1%	-36%	-9%	-9%
Baffin Bay & Labrador Sea (9)	2%	1%	4%	17%	4%	54%	42%
Hudson Bay (10)	-27%	-7%	-1%	-1%	-100%	-98%	-92%
Canadian Archipelago (11)	-6%	-1%	-1%	0%	-32%	-26%	-19%

Data: ESA Level-4 CryoSat-2/Sentinel-3/SMOS Sea Ice Thickness v.1.1 • Reference period: 2010–2021 • Credit: AWI/CS3/ECMWF.



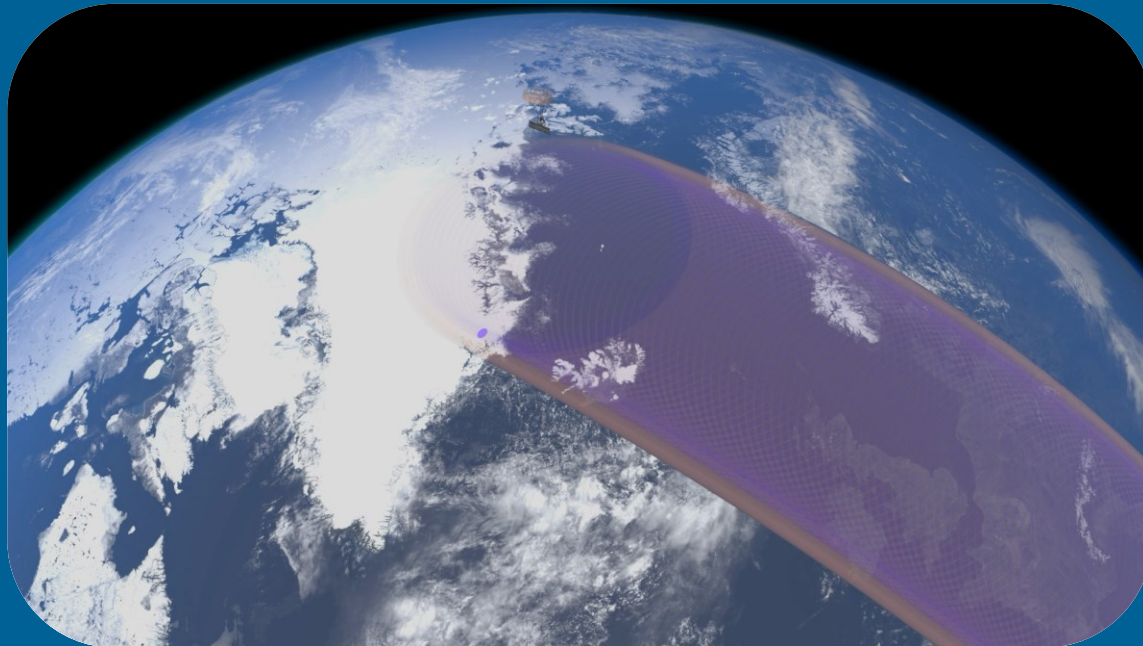
SMOS L3 & CS2/SMOS/S3 L4 SIT





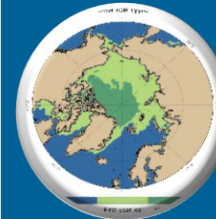
STATUS & HIGHLIGHTS

- Mission payload: Conically scanning imaging **radiometer**
- Primary objectives: Measure **SIC**, **SIE** and **SST** with **sub-daily** coverage of the Polar Regions, **no-hole at pole**, polar ocean products in **NRT1HR**
- Status: System CDR ongoing – final review in October 2026

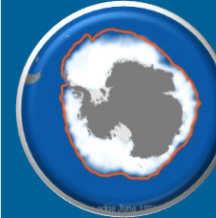


Synergies of CIMR with altimeters

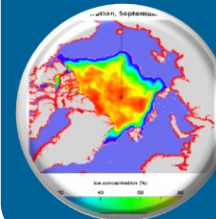
CIMR can provide **auxiliary inputs** to improve geophysical retrievals



Sea Ice Type



Sea Ice Edge

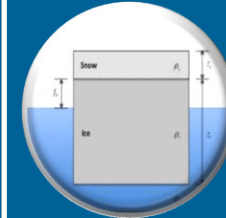


Sea Ice Concentration

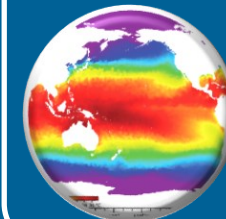
Can be **jointly exploited** to improve quality of geophysical retrievals & **cross cal/Val**



Snow depth



Sea Ice Thickness

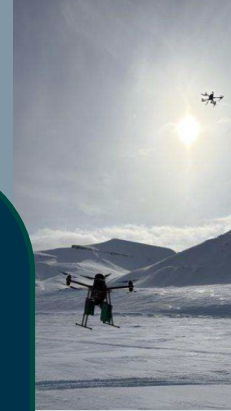


Global Surface Currents

CALVAL ACTIVITIES

FIDUCIAL REFERENCE MEASUREMENTS

- Develop protocols/procedures based on **metrology**, ensure the operational provision of FRM and derive +
- Special e (PROVA)



VOCALIS 2026

Validation of Operational Copernicus Altimetry
over Land water and Ice Surface

21-24 September 2026, UNIS, Longyerbyen, Svalbard

<https://vocalis2026-workshop.noveltis.fr>

S
(see also
val site



INTERCOMPARISONS EXERCISES

- **International & multi-agency** collaborations to develop joint protocols for the intercomparison of Altimetry + other EO products over the cryosphere.

→ Key for CCI/IPCC

OCEAN



Ocean Colour

Phytoplankton Biodiversity & Biomass

- **NEW project**

Sea State

Ocean Carbon

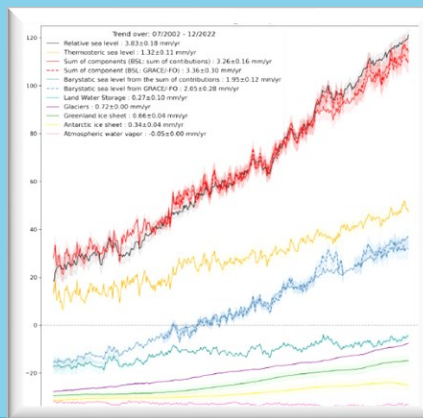
Salinity

Sea Surface Temperature

Ocean Surface Flux - **NEW project**

Sea Level & Sea Level Budget Closure

Meyssignac et al, in prep.

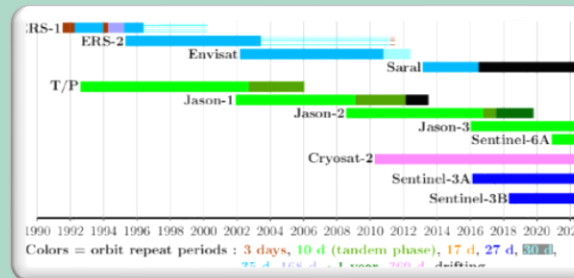


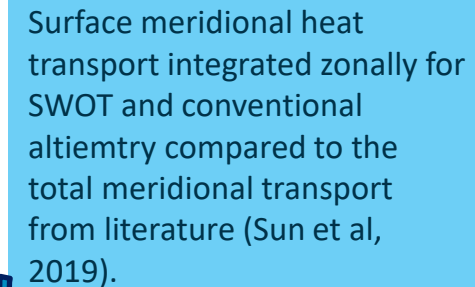
HYDROLOGY



River Discharge Precursor

Derive long term climate data records for some selected river using EO (**altimetry** and multispectral images) and ancillary data at 54 locations (within 18 river basins) over 1992-2023





- Eddy velocity times temperature anomaly calculated combining SST anomaly and eddy velocities from the trajectories, averaged over the SWOT period (July 2023 - May 2024).



EXAMPLE FROM AN ESA'S TPM

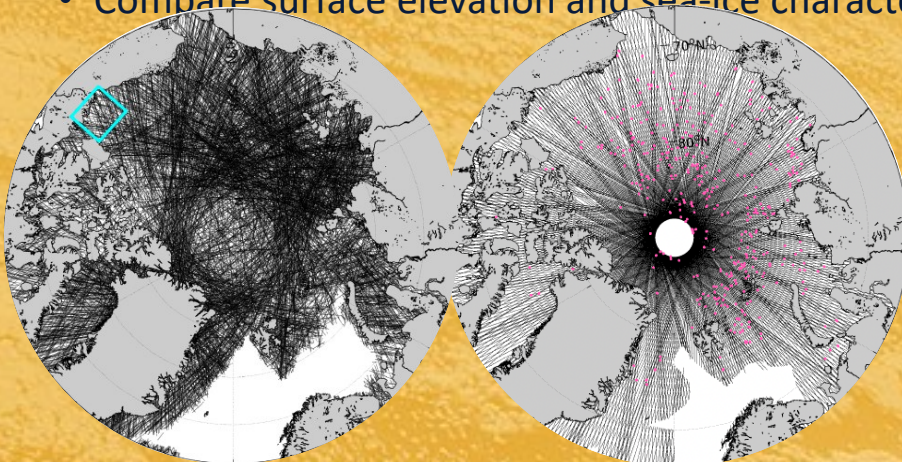
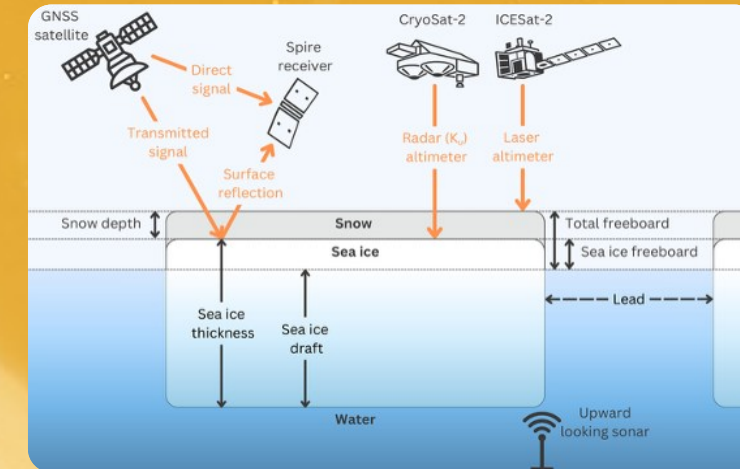


OBJECTIVE

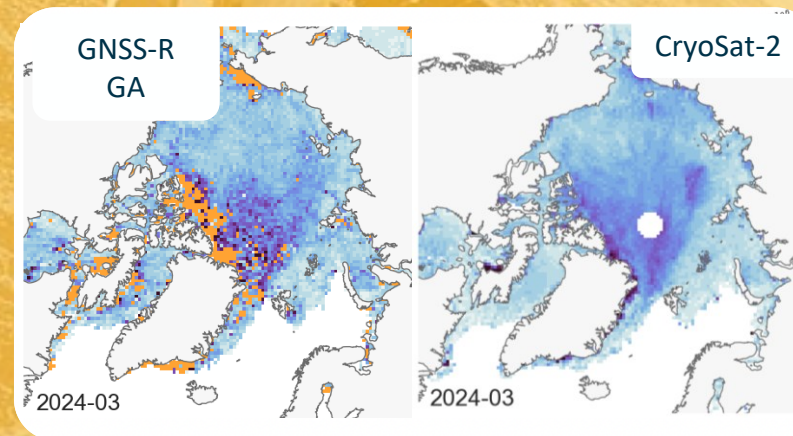
- Assess the capability of Grazing-Angle GNSS-R to support sea-ice monitoring
- Investigate its potential for sea surface height and freeboard retrieval

APPROACH

- Exploit SPIRE GNSS-R observations and benchmark against CryoSat-2, ICESat-2, and Sentinel-1
- Compare surface elevation and sea-ice characteristics over the Arctic



GA GNSS-R (left) and CryoSat-2 SAR/SIN (right) Arctic coverage. Pink markers indicate collocations; cyan box shows the S1 SAR image location.



Freeboard from GA GNSS-R (left) and CryoSat-2 (right) for March 2024. Orange pixels indicate no data.

NEXT STEPS

- Initial results show promising consistency with reference missions
- Remaining differences highlight the need for further refinement
- Next step: refine freeboard retrieval and improve sea-ice classification

Thank you!

Questions are welcome.



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