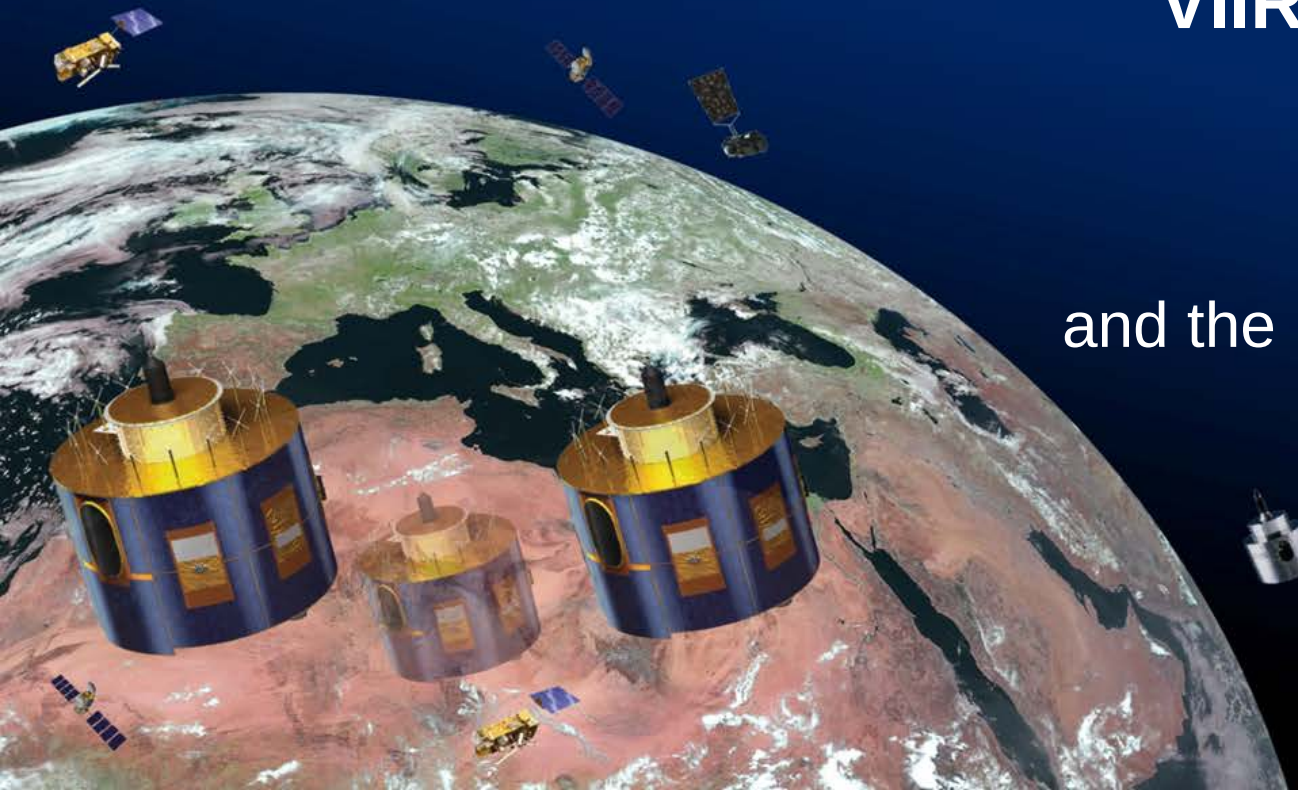
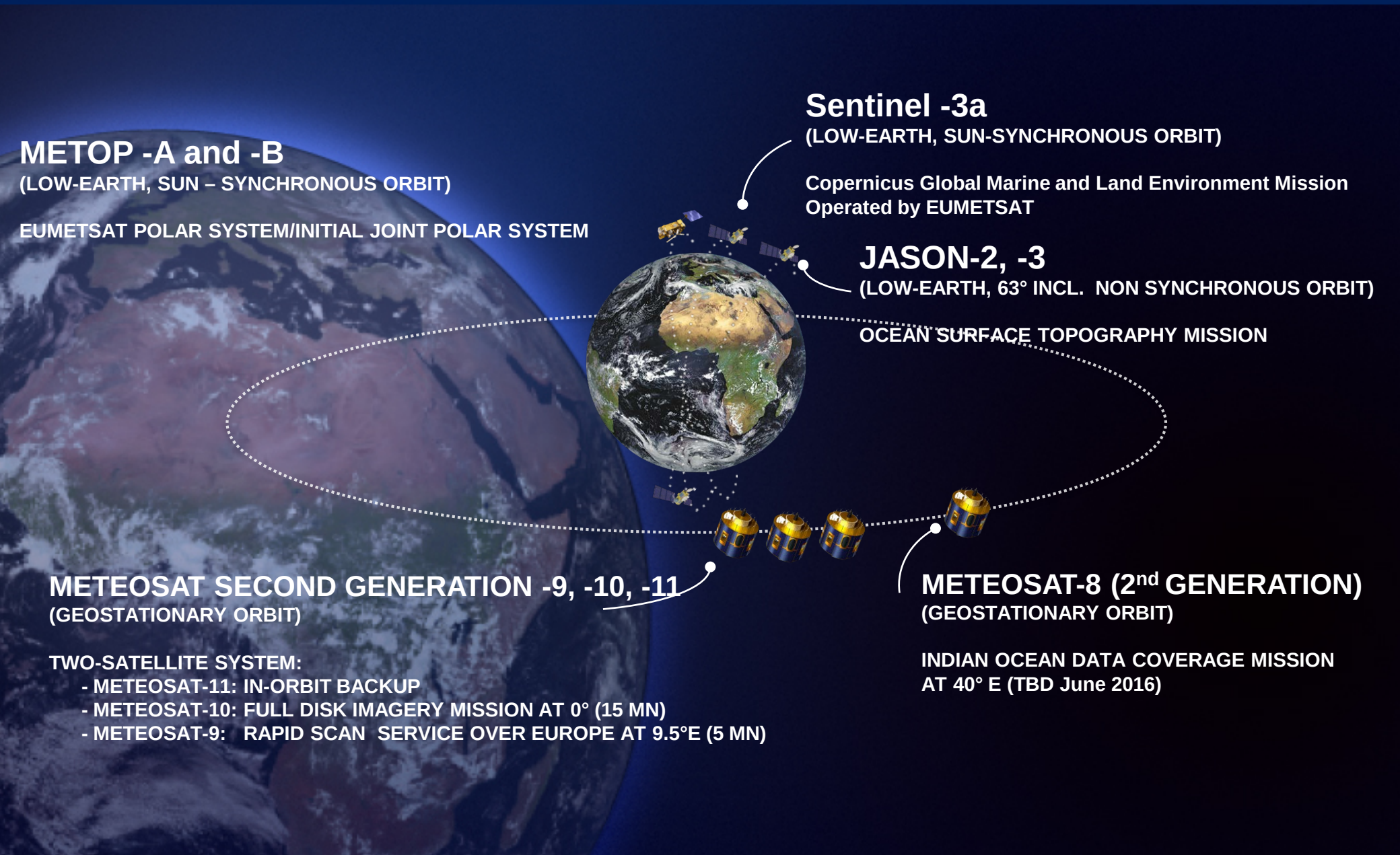
VIIRS/OLCI Cooperation

Bojan R. Bojkov

and the Marine Applications team



The Current EUMETSAT satellite fleet



METOP -A and -B
(LOW-EARTH, SUN – SYNCHRONOUS ORBIT)

EUMETSAT POLAR SYSTEM/INITIAL JOINT POLAR SYSTEM

Sentinel -3a
(LOW-EARTH, SUN-SYNCHRONOUS ORBIT)

Copernicus Global Marine and Land Environment Mission
Operated by EUMETSAT

JASON-2, -3
(LOW-EARTH, 63° INCL. NON SYNCHRONOUS ORBIT)

OCEAN SURFACE TOPOGRAPHY MISSION

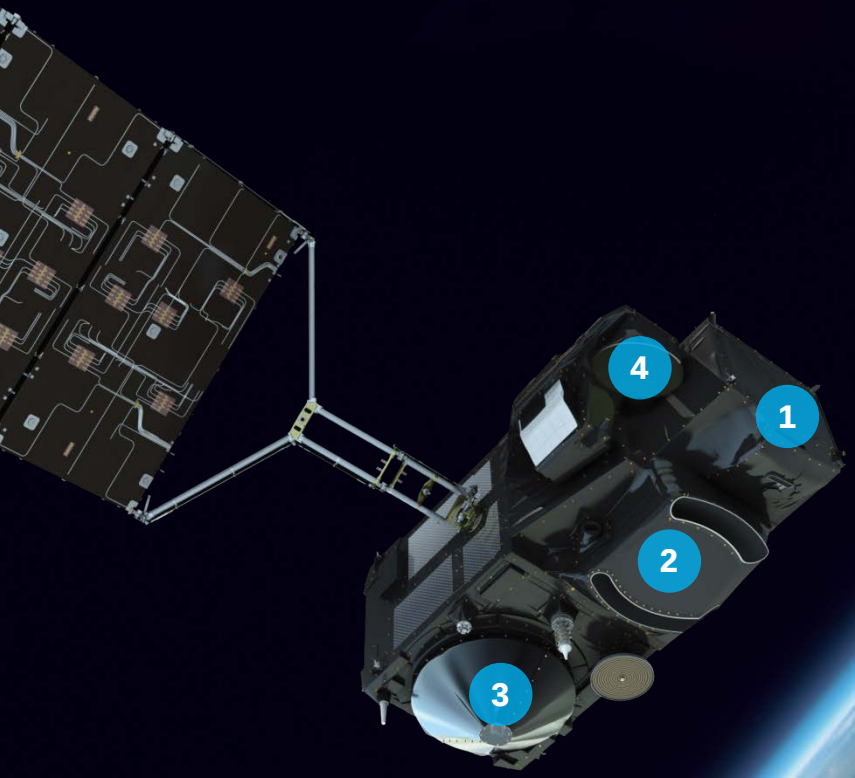
METEOSAT SECOND GENERATION -9, -10, -11
(GEOSTATIONARY ORBIT)

TWO-SATELLITE SYSTEM:
- METEOSAT-11: IN-ORBIT BACKUP
- METEOSAT-10: FULL DISK IMAGERY MISSION AT 0° (15 MN)
- METEOSAT-9: RAPID SCAN SERVICE OVER EUROPE AT 9.5°E (5 MN)

METEOSAT-8 (2nd GENERATION)
(GEOSTATIONARY ORBIT)

INDIAN OCEAN DATA COVERAGE MISSION
AT 40° E (TBD June 2016)

Copernicus Sentinel-3



Launched: 16 February 2016

10:00 local, desc. orbit (98.6º)

Instruments:

1. **OLCI**
   Ocean and Land Colour Instrument
2. **SLSTR**
   Sea and Land Surface Temperature Radiometer
3. **SRAL**
   SAR Radar Altimeter
4. **MWR**
   Microwave Radiometer

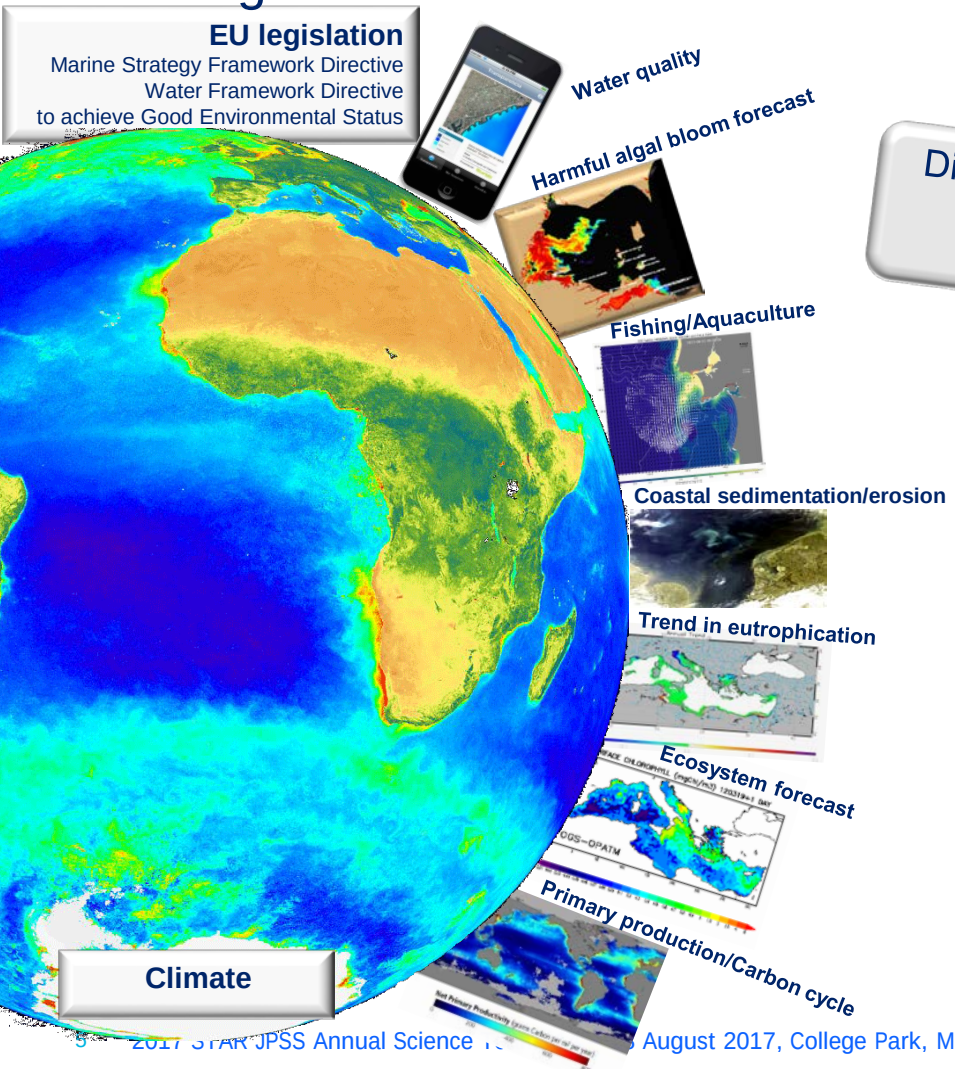
Ocean Colour Radiometry @ EUMETSAT

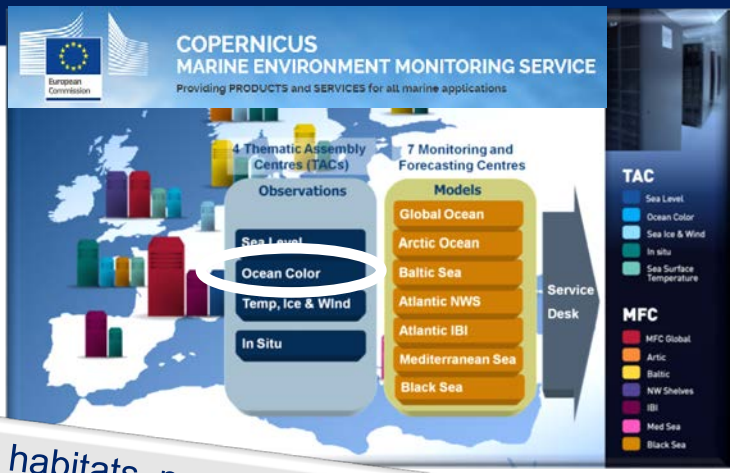
- **Context**
  - Ocean Colour is a new user community for EUMETSAT
  - EUMETSAT delegation for Copernicus S3 marine data services by the European Commission (EC)
  - The main customer is the Copernicus Marine Environment Monitoring Services (CMEMS)

- **Priority Objectives**
  - Deliver fully characterized operational products from the OLCI-A-B (and C-D in the future) constellation
  - Evolution of S3 OLCI operational products
  - Establishment of a European Vicarious Calibration infrastructure
  - Development of an Ocean Colour Products Portfolio

Ocean Colour – applications and user requirements

- CMEMS – primary user in the Copernicus framework
- Large and diverse user base





Diversity of regional water habitats, processes and constituents =
High variability of optical water properties =
Broad range of applications and users

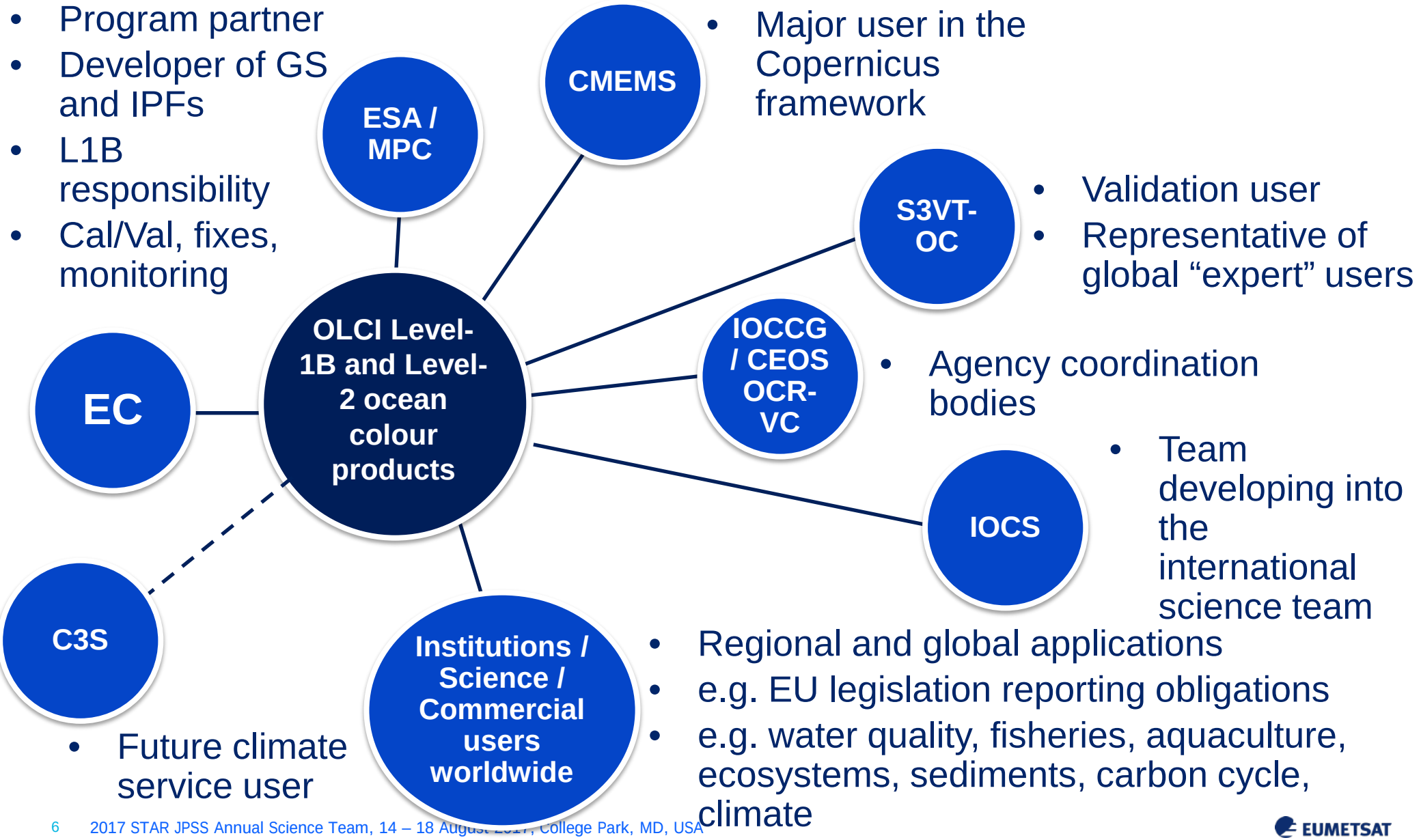
Users request ❶

- relevant products of known high quality
- harmonization, consistency and stability across missions
- focus on coastal and inland waters (in addition to open sea)
- new products

❶ CMEMS, S3VT-OC, IOCS, S3 MAG, GMES-PURE, Copernicus Marine Expert Exchange, Sentinel-3 Mission Documentation (S3 Mission Requirements Traceability Document, S3 Calibration and Validation Plan)

Institutions and community interfaces

Ocean Colour is global and very regional → diverse community



- Program partner
- Developer of GS and IPFs
- L1B responsibility
- Cal/Val, fixes, monitoring

- Major user in the Copernicus framework

- Validation user
- Representative of global “expert” users

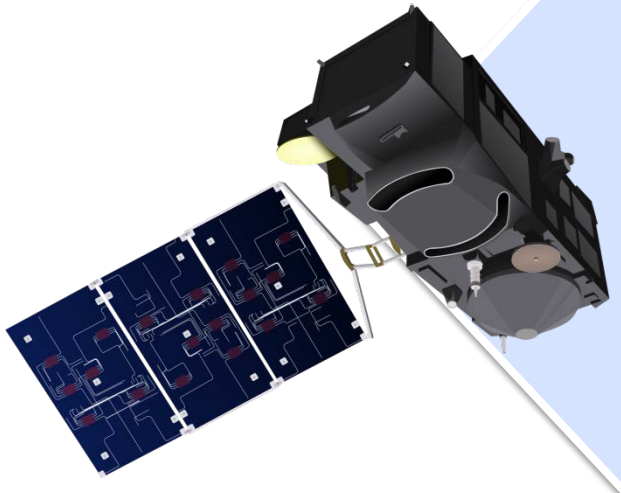
- Agency coordination bodies

- Team developing into the international science team

- Future climate service user

- Regional and global applications
- e.g. EU legislation reporting obligations
- e.g. water quality, fisheries, aquaculture, ecosystems, sediments, carbon cycle, climate

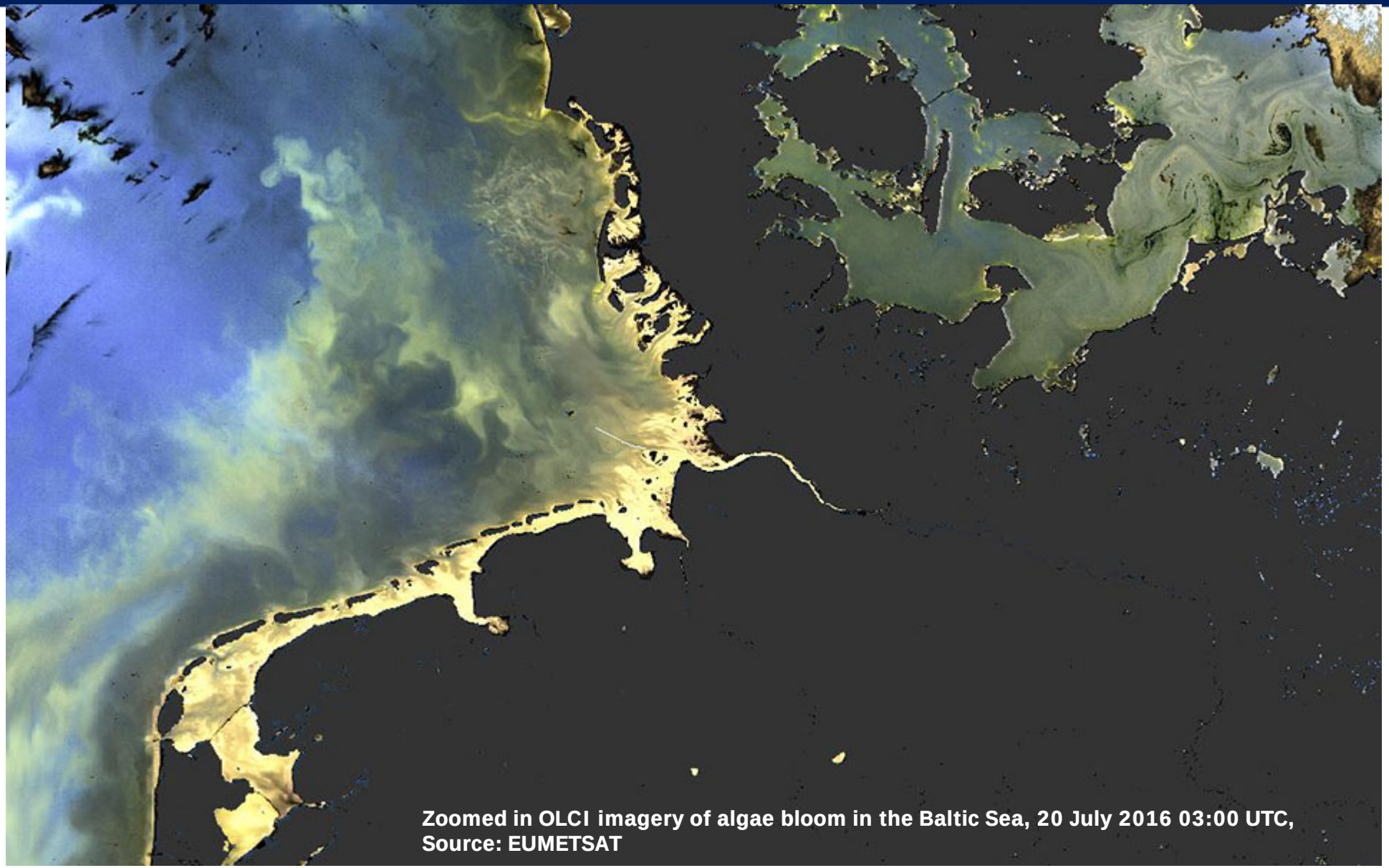
Ongoing tasks at EUMETSAT



Sentinel-3 {A,B,C, D} / OLCI:

- **Cal/Val tasks** based on Joint ESA/EUM S3 Cal/Val Plan
  - Solar diffuser in-flight characterization, completed for S3A
  - Operational scheduling of radiometric calibrations
  - Radiometric stability validations at L3
  - Geometric validation at ground control points
  - Ad hoc in situ FRM validations (MOBY)
  - Validations with L3 (multi-mission/climatology)
  - Product quality verifications (flags, artifacts)
- **Product maintenance** to achieve useable products
  - Fixes for major issues (biases, flags, old MERIS to OLCI,..)
  - REF product validations for new PB releases
  - Test reprocessings/product validations to define new PBs
- **System Vicarious Calibration** (SVC) – development of Copernicus FRM capability required for ocean colour missions to meet user product quality requirements
  - Study 1: Requirements for Copernicus SVC capability

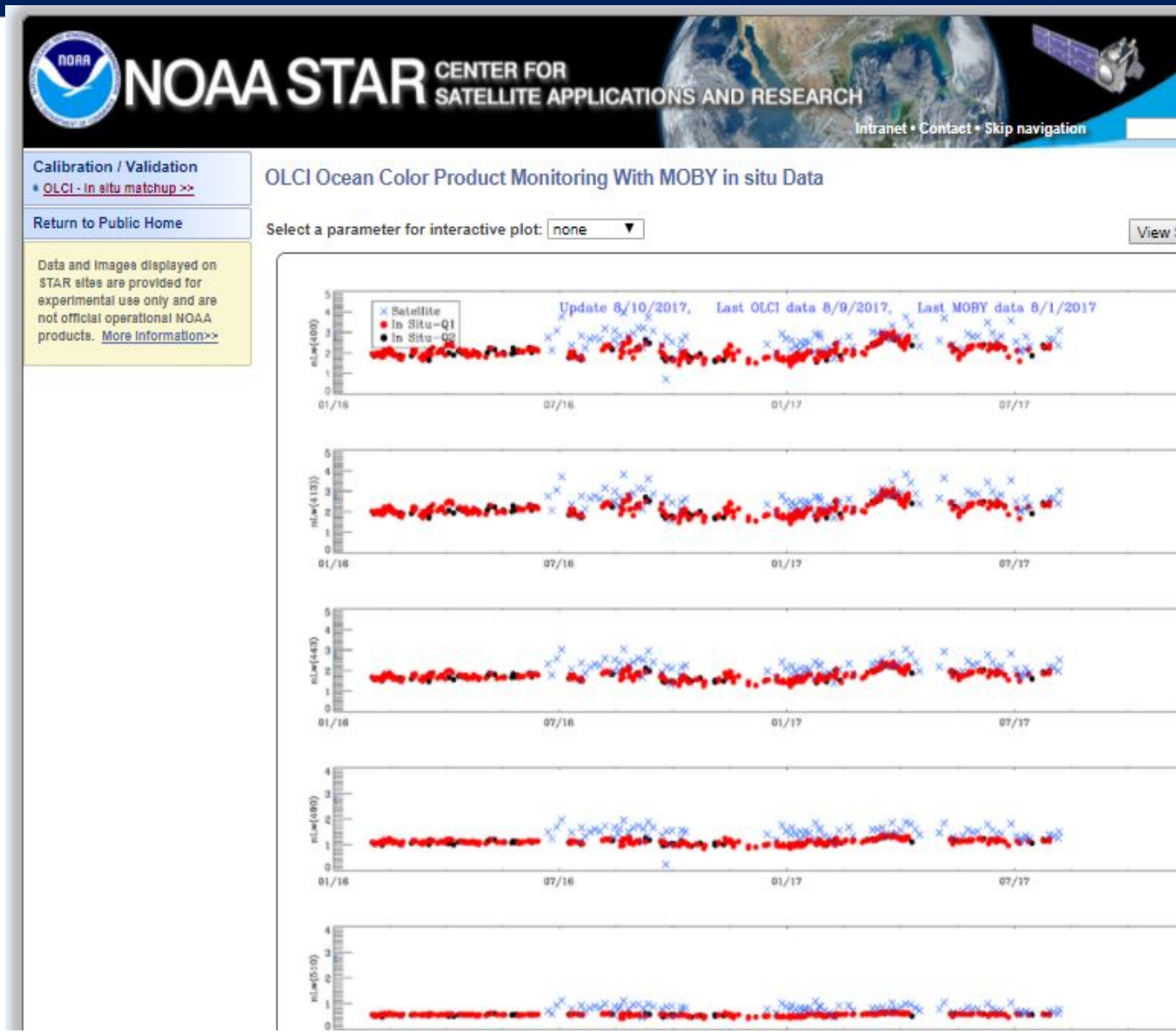
Sentinel-3: OLCI Level 2 products operational



Zoomed in OLCI imagery of algae bloom in the Baltic Sea, 20 July 2016 03:00 UTC, Source: EUMETSAT

Use of VIIRS NOAA OC data/tools for intercomparisons

- NOAA VIIRS products used extensively to ‘debug’ the initial versions of the L1 and L2 processors and “system” gains provided by ESA
- Tremendous help from the NOAA OC team
- Integration of OLCI into NOAA OC Cal/Val pages – *a very special thanks to Menghua Wang*



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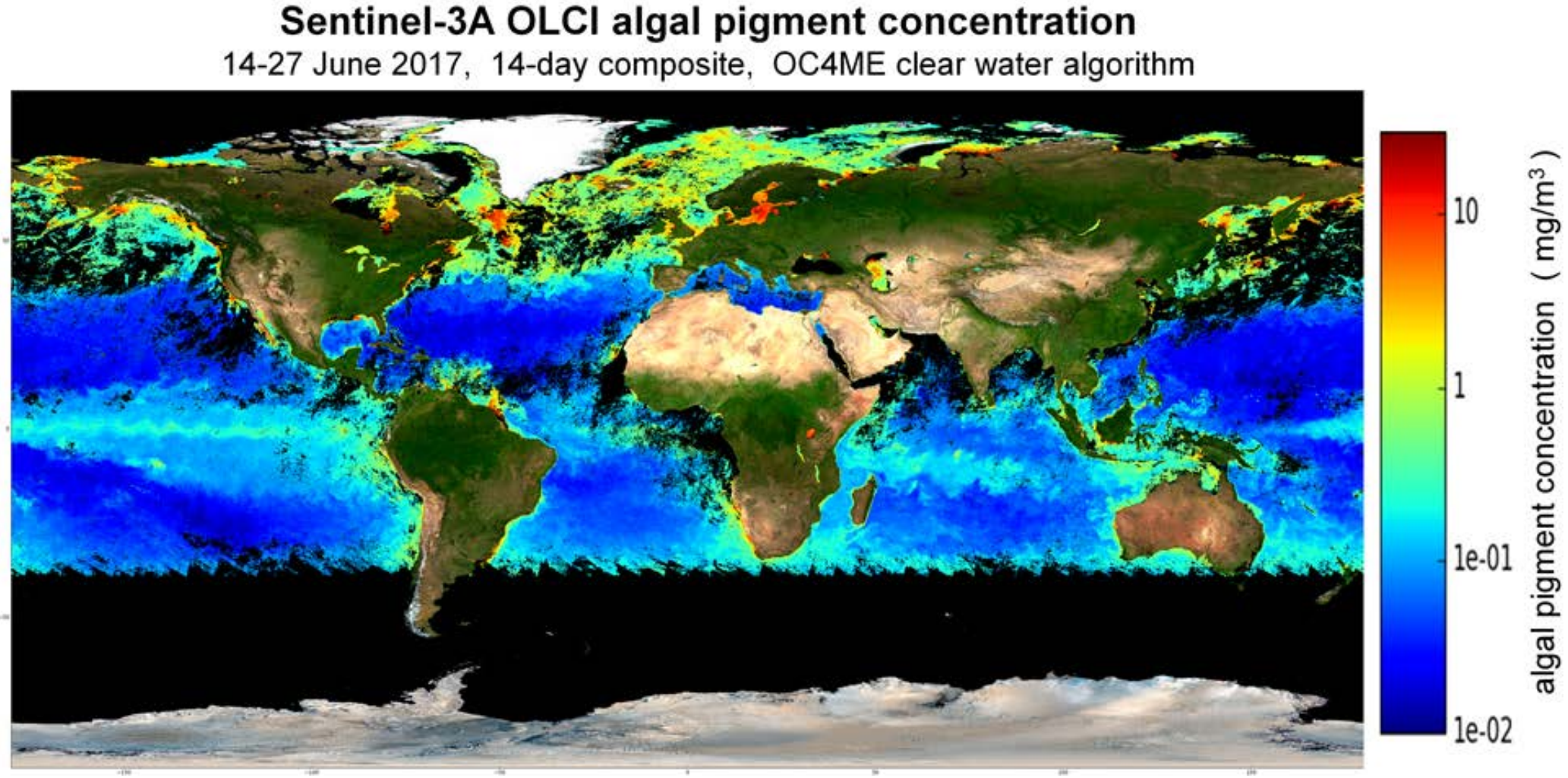
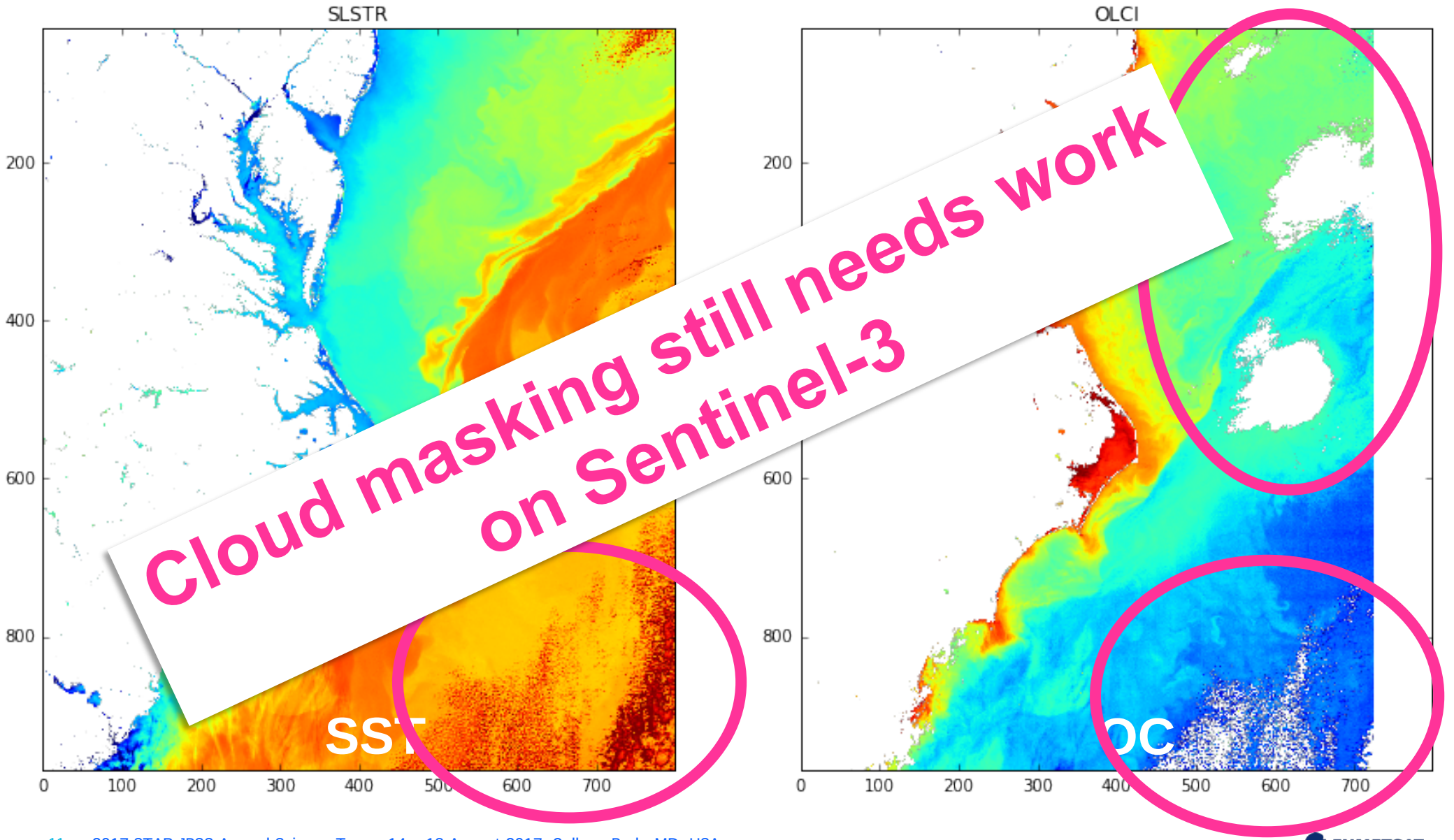
Sentinel-3A OLCI Level-2 products operational



Sentinel-3 SLSTR and OLCI L2 operational as of 5 July



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VIIRS/OLCI cooperation: Ocean Colour Processor

- User Needs
  - Ocean colour users need products with the same characteristics regardless of the scene observed. This applies to the water-leaving radiances as well as the optical and bio-geo-chemical properties;
  - The atmospheric correction process shall have open ocean, coastal and inland water competency, ensuring consistent correction above clear as well as turbid waters;
  - The in-water product shall be multi-water consistent across clear and turbid;
  - The L2 product shall include directly usable quality information and expression of parameter uncertainties.

- Approach
  - A new independent development, implementing the state of the art, IPR-free such as for example the ESA CCI legacy;
  - Open source and active involvement of the global expert community, via community code and independent peer reviews;
  - Flexible framework easing transition from prototype to operational processor, supporting expansion of products portfolio → *agile development*
  - Design with applicability to other missions e.g. geostationary

VIIRS/OLCI cooperation: OC FRM Infrastructure

OC Fiduceal Reference Measurement (FRM) = “European MOBY”

- For OC missions, the system vicarious adjustment is critical to meeting the mission accuracy requirements;
- Vicarious adjustment capability is critical for the long-term operational Copernicus and JPSS Programmes to provide quality Ocean Colour products and services;
- Sustained European infrastructure(s) are essential for the long term and complimentary to the NOAA MOBY activities.
- Key requirements include: high accuracies and SI-traceability of the optical radiometer system, minimal environmental uncertainties -marine and atmospheric- at the deployment site, and operational performance to support calibrated time-series over a few decades.

VIIRS/OLCI cooperation: OC FRM Infrastructure (ii)

Approach for the OC FRM:

Step 1: Community driven requirements/specifications

Has been implemented by a EUMETSAT-led Copernicus study establishing the highest level applicable scientific, technical and operational requirements that form the basis for the development of a Copernicus Infrastructure for Ocean Colour Vicarious adjustment. This study was run in liaison with the ESA study ”QA4EO FRM4SOC” focusing on the development of best practises for these FRMs for satellite ocean colour validation, and the international OC community (reviews)

Step 2: Preliminary design

Three studies will run in parallel in order to compare thoroughly the possible approaches/designs in the 2017-2018 time frame. Again, international review of the preliminary design will be undertaken.

Step 3: Final design and deployment

The concept selected at the conclusion of Phase 2 will be developed into a detailed technical design specification in the 2019 time frame, with a deployment in 2021 timeframe pending final budgetary approval by the European Commission.

Summary

- NOAA OC team critical to OLCI OC gaining operational status at EUMETSAT, through intercomparisons, Cal/Val, personnel exchanges, etc.

- Future EUMETSAT-NOAA cooperation on OC:
  - Continue on-going L1 and L2 activities
  - Start work together on the community OC processor (*and the related Cal/Val tools)*
  - Help define future European OC FRM infrastructure
  - To be formalised by year end