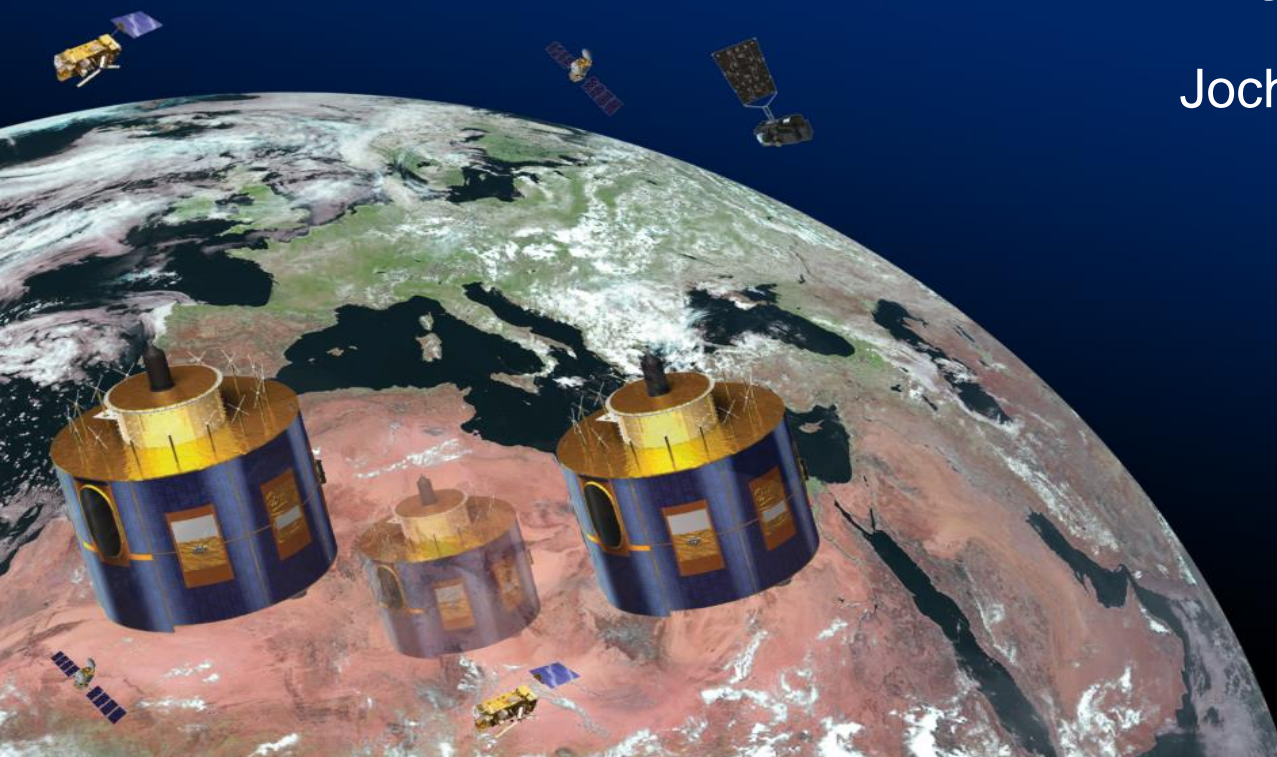


Overview of EUMETSAT's satellite products in support of water management

Jochen Grandell, Bojan Bojkov and

Lothar Schüller

EUMETSAT



Topics

- EUMETSAT Programme Overview
- EUMETSAT Product Development
 - Satellite Application Facilities (SAF)
- Product Examples
- Future Programmes
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Current EUMETSAT satellites

METOP-A & -B (98.7° incl.)

LOW EARTH, SUN-SYNCHRONOUS ORBIT

EUMETSAT POLAR SYSTEM (EPS) /
INITIAL JOINT POLAR SYSTEM

JASON-2 & -3 (63° incl.)

LOW EARTH, NON-SYNCHRONOUS ORBIT

OCEAN SURFACE TOPOGRAPHY MISSION,
SHARED WITH CNES/NOAA/EU

SENTINEL-3

LOW EARTH, SUN-SYNCHRONOUS ORBIT

OCEAN MISSION, SHARED WITH ESA/EU



METEOSAT-9, -10, -11

GEOSTATIONARY ORBIT

METEOSAT 2ND GENERATION

TWO-SATELLITE SYSTEM

FULL DISC IMAGERY MISSION (15 MINS) (METEOSAT-10 (0°))
RAPID SCAN SERVICE OVER EUROPE (5 MINS) (METEOSAT-9 (9.5° E))

METEOSAT-11 STORED IN ORBIT (UNTIL MID-2018)

METEOSAT-8 (41.5° E)

GEOSTATIONARY ORBIT

METEOSAT 2ND
GENERATION PROVIDING
IODC FROM FEBRUARY
2017 – MID-2020

Deploying the MSG and Metop satellites

**MSG-1
(Meteosat-8) launch**
28 August 2002



**MSG-2
(Meteosat-9) launch**
21 December 2005



**MSG-3
(Meteosat-10) launch**
5 July 2012



**MSG-4
(Meteosat-11) launch**
15 July 2015



METEOSAT SECOND GENERATION

METEOSAT-8

METEOSAT-9

METEOSAT-10

METEOSAT-11

YEAR... 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

EUMETSAT POLAR SYSTEM (EPS)

METOP-A

METOP-B

METOP-C

Metop-A launch
19 October 2006



Metop-B launch
17 September 2012

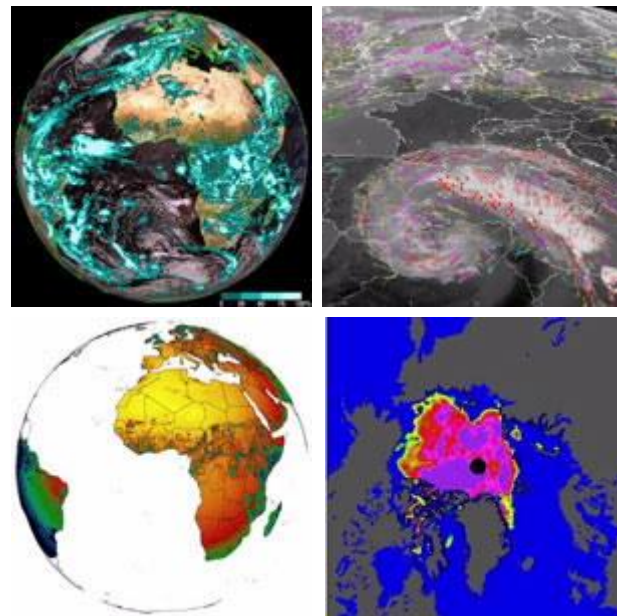


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EUMETSAT Data, Products and Services

- The EUMETSAT Data, Products & Services primarily support the application needs for Nowcasting and Numerical Weather Prediction (NWP) of our Member States.
- Product categories include:
 - Level 1 Data
 - Atmosphere
 - Marine
 - Land
 - Climate related data products
 - Software
 - Third Party Products
- In addition, to exploit the full potential of our satellite data in a broad range of meteorological and environmental applications, our ground segment also includes a network of eight **Satellite Application Facilities (SAFs)** that each specialize in the delivery of products in one application area.



What is a SAF?



- SAF = **Satellite Application Facility**
- part of the EUMETSAT application ground segment
- providing operational products and services to users
- specialised on topics and themes
- complement production of standard meteorological products at EUMETSAT Secretariat
- located at Weather Services in EUMETSAT Member and Co-operating States
- developed and operated by consortium of partners



EUMETSAT Network of Satellite Applications Facilities



Support to Operational Hydrology and Water Management
Led by Italian Meteorological Institute



Radio Occultation Meteorology
Led by Danish Meteorological Institute



Ozone and Atmospheric Chemistry Monitoring
Led by Finnish Meteorological Institute



Land Surface Analysis
Led by Portuguese Meteorological Institute



Support to Nowcasting and Very Short
Range Forecasting
Led by Agencia Estatal de Meteorología,
Spain



Ocean and Sea Ice
Led by Météo France



Climate Monitoring
Led by Deutscher Wetterdienst, Germany



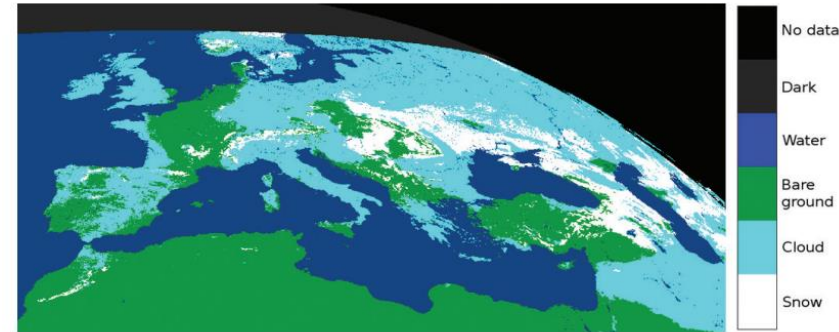
Numerical Weather Prediction
Led by Met Office (UK)

A circular diagram representing the EUMETSAT Network of Satellite Applications Facilities. The center is a white circle with the text 'EUMETSAT NETWORK OF SATELLITE APPLICATION FACILITIES'. Surrounding this is a ring divided into eight colored segments, each corresponding to one of the SAFs. The background of the entire diagram is a circular collage of various satellite imagery, including maps, weather patterns, and land surface data.

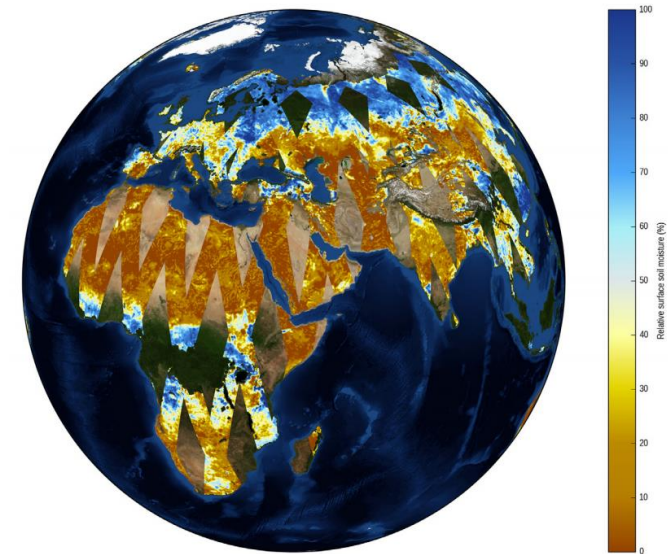
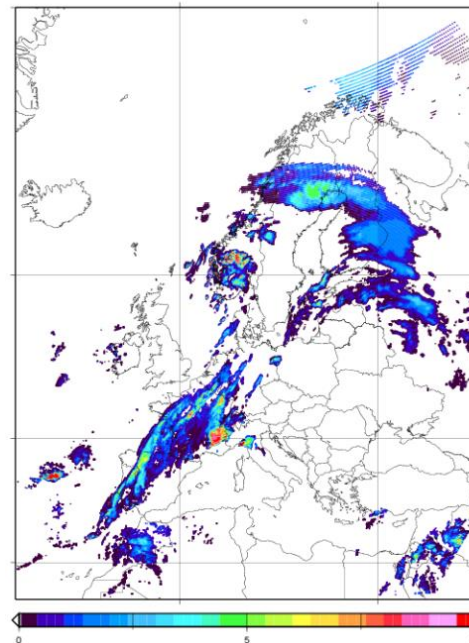
EUMETSAT NETWORK
OF SATELLITE
APPLICATION
FACILITIES



- SAF on Support to Operational Hydrology and Water Management
- Leading Entity: Italian Meteorological Service (ITAF Met Service)

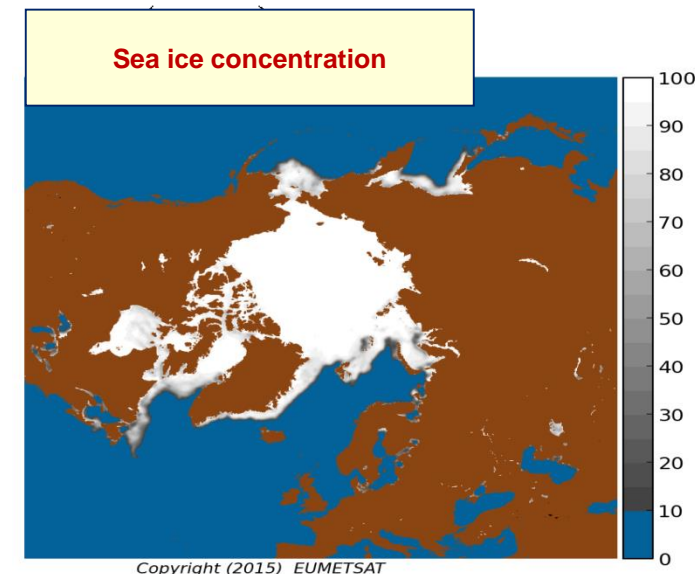
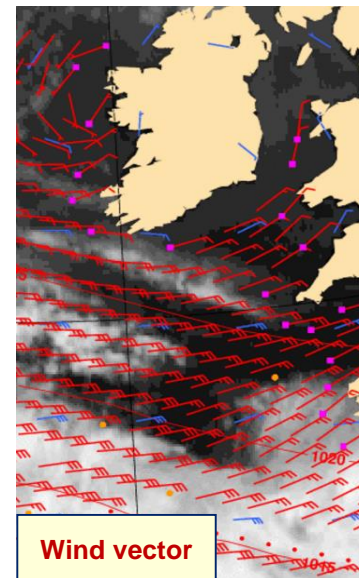
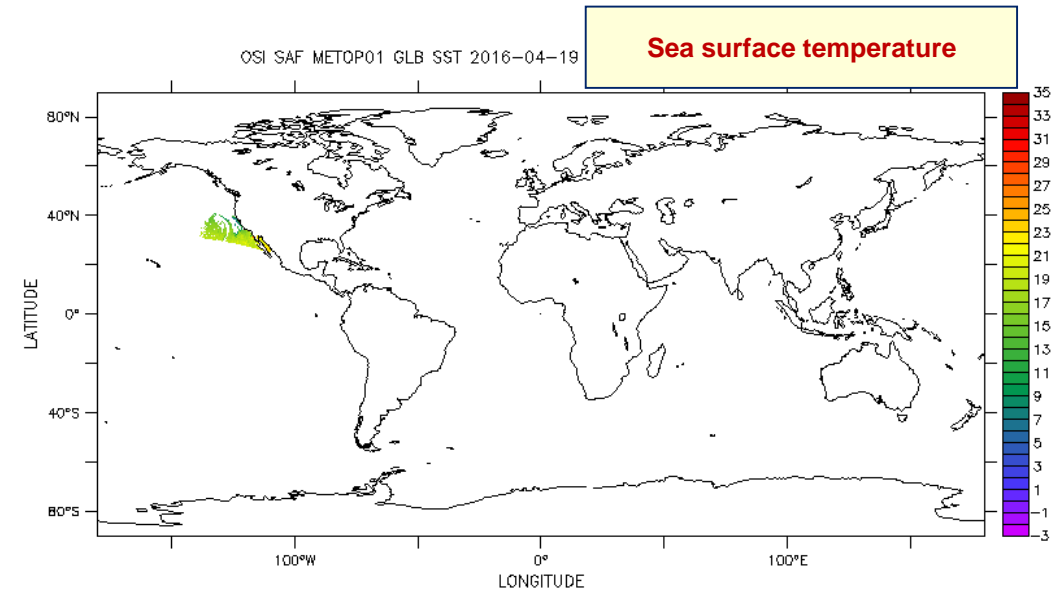


- SAF products focuses on
 - ▶ precipitation
 - ▶ soil moisture
 - ▶ snow parameters
 - ▶ utilisation of these parameters in hydrological models and NWP





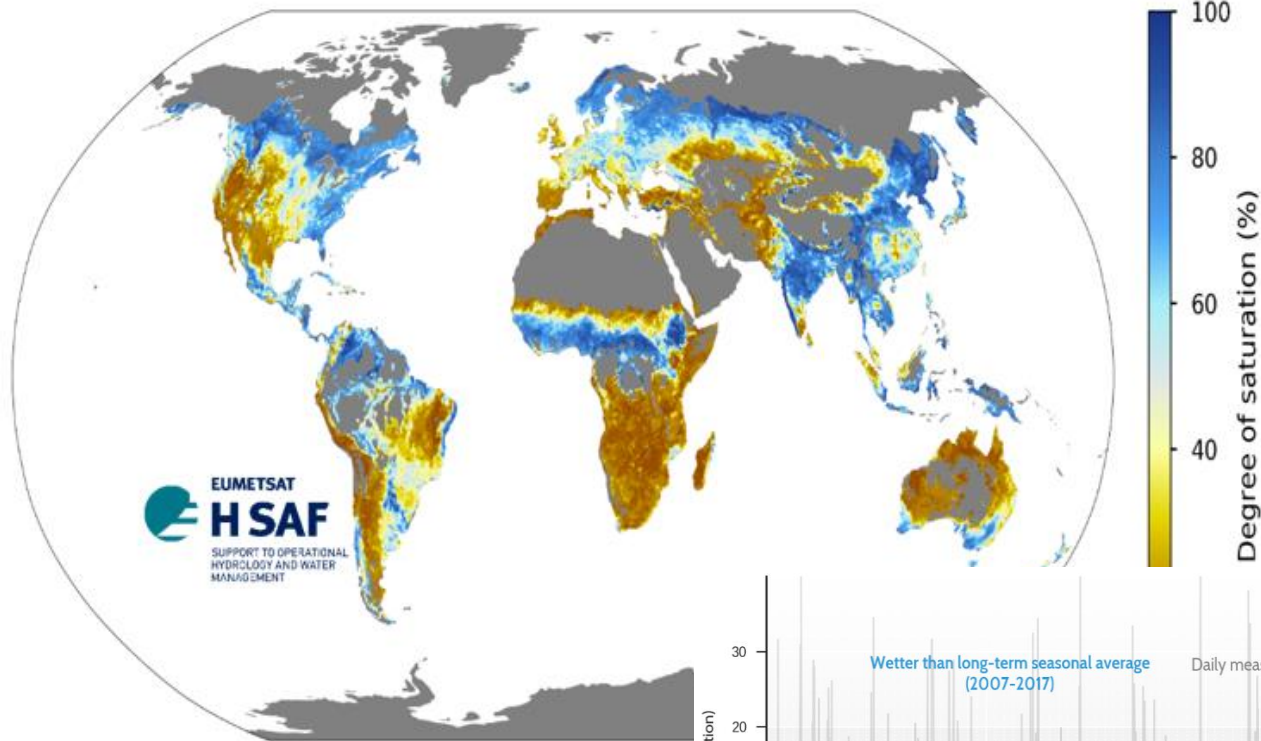
- **Ocean and Sea Ice (OSI) SAF** routinely produces and disseminates products characterising the ocean surface:
 - Sea Surface Temperature and the energy fluxes
 - Information on the sea ice characteristics (extend, concentration, ...)
 - Wind speed from Scatterometry
- Leading Entity is Météo-France in Lannion
- OSI SAF distributes near real-time products based on data NOAA, MSG, Metop, DMSP, GOES and other satellites



Topics

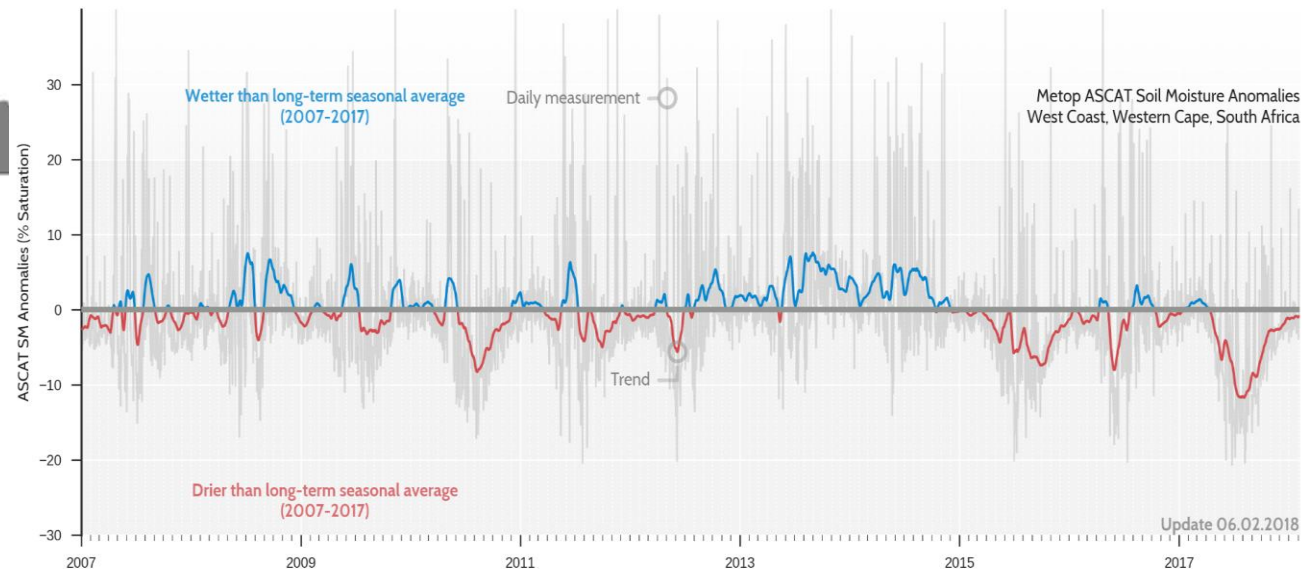
- EUMETSAT Programme Overview
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10-year ASCAT soil moisture record at 12.5 km resolution (2007-2017)



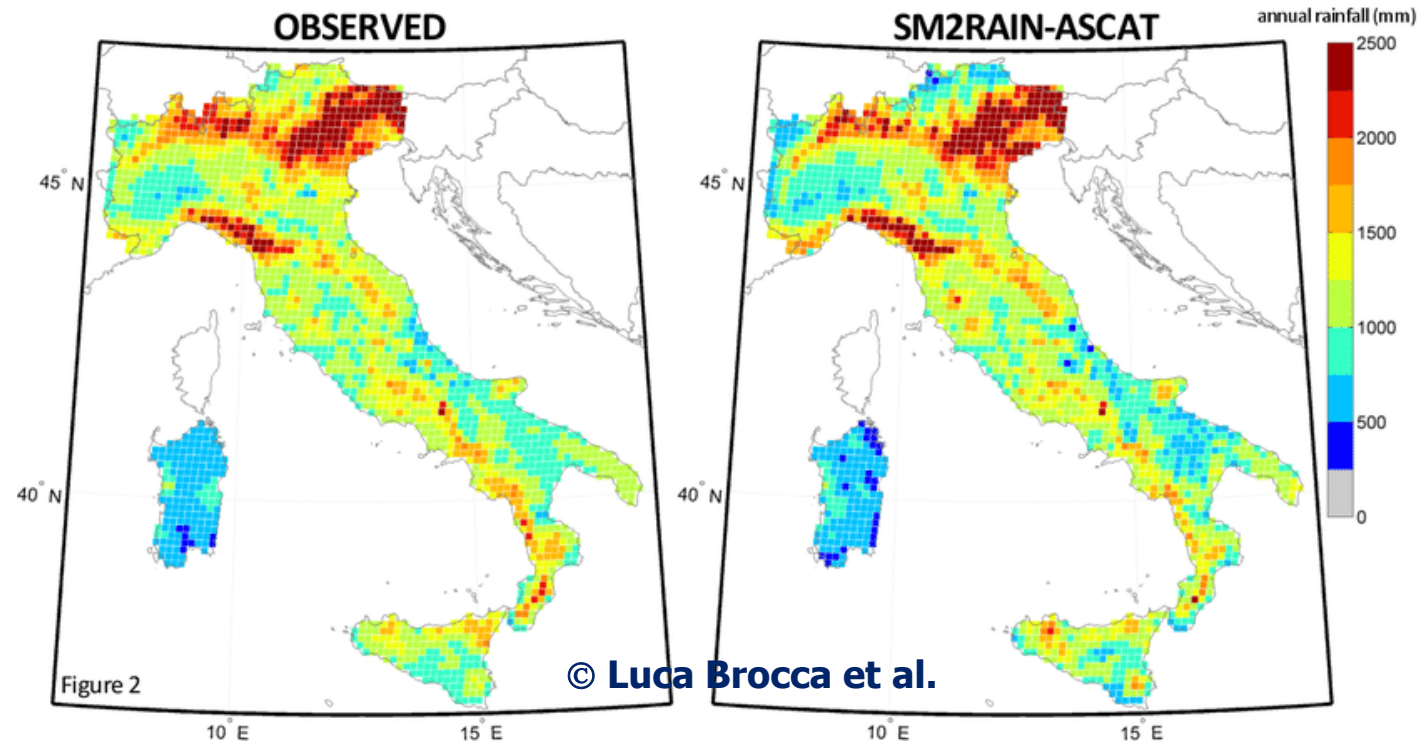
Interim Climate record
monitors water crisis in Cape Town

Monthly mean of ASCAT soil moisture
relative to saturation in July 2013

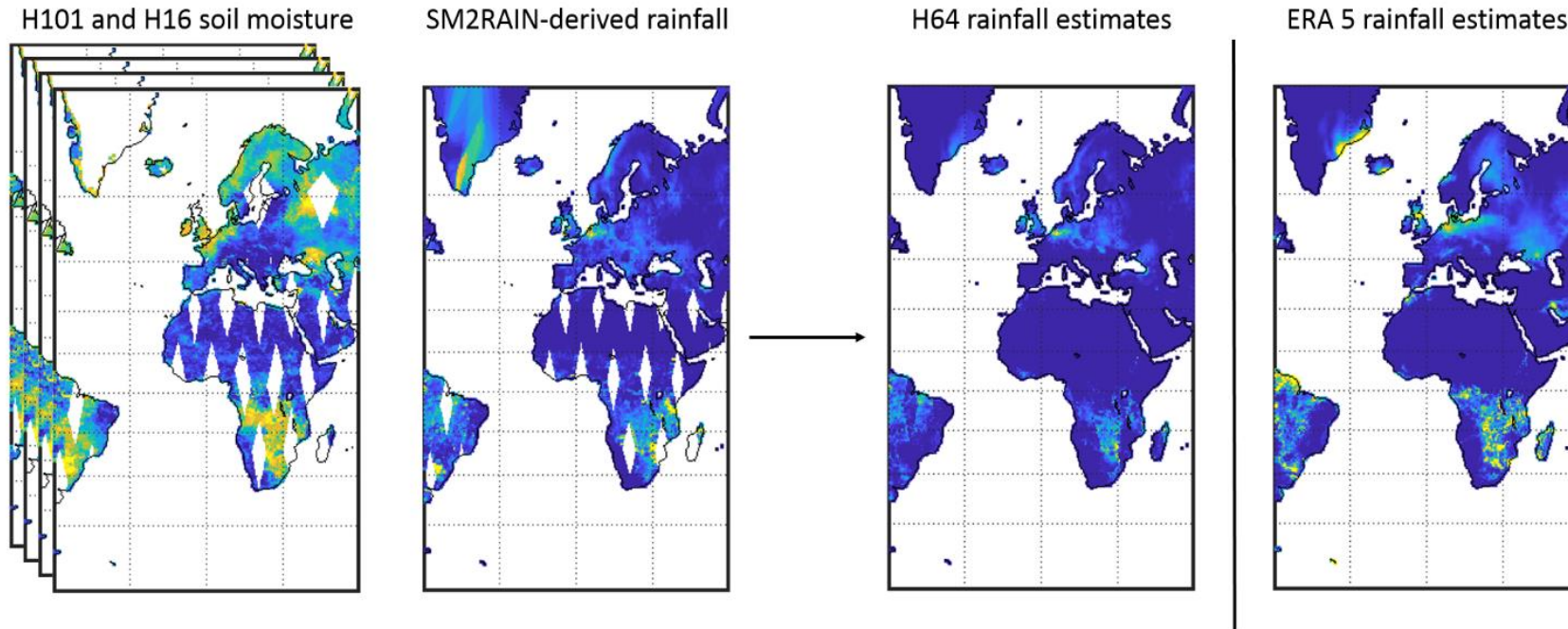


SM2RAIN: Global precipitation dataset from ASCAT soil moisture data

- Obtained by applying the SM2RAIN algorithm (Brocca et al., 2013, 2014) to ASCAT SM data
- Based on the inversion of the soil water balance equation, i.e. it estimates the rainfall by using the change in time of the amount of water stored into to the soil, thus considering it “as a natural rain gauge”.
- Calibration carried out by the latest reanalysis of ECMWF forecasts (ERA5 dataset)



In development: Integrated rainfall product (H-SAF)

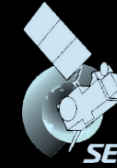


A new H SAF product under development will integrate microwave based precipitation (H05) information (best for instantaneous rain) with indirect rainfall estimation from Scatterometer Soil moisture observations (accumulated precipitation)

Demonstrational product: Sentinel-3A SLSTR Snow Extent

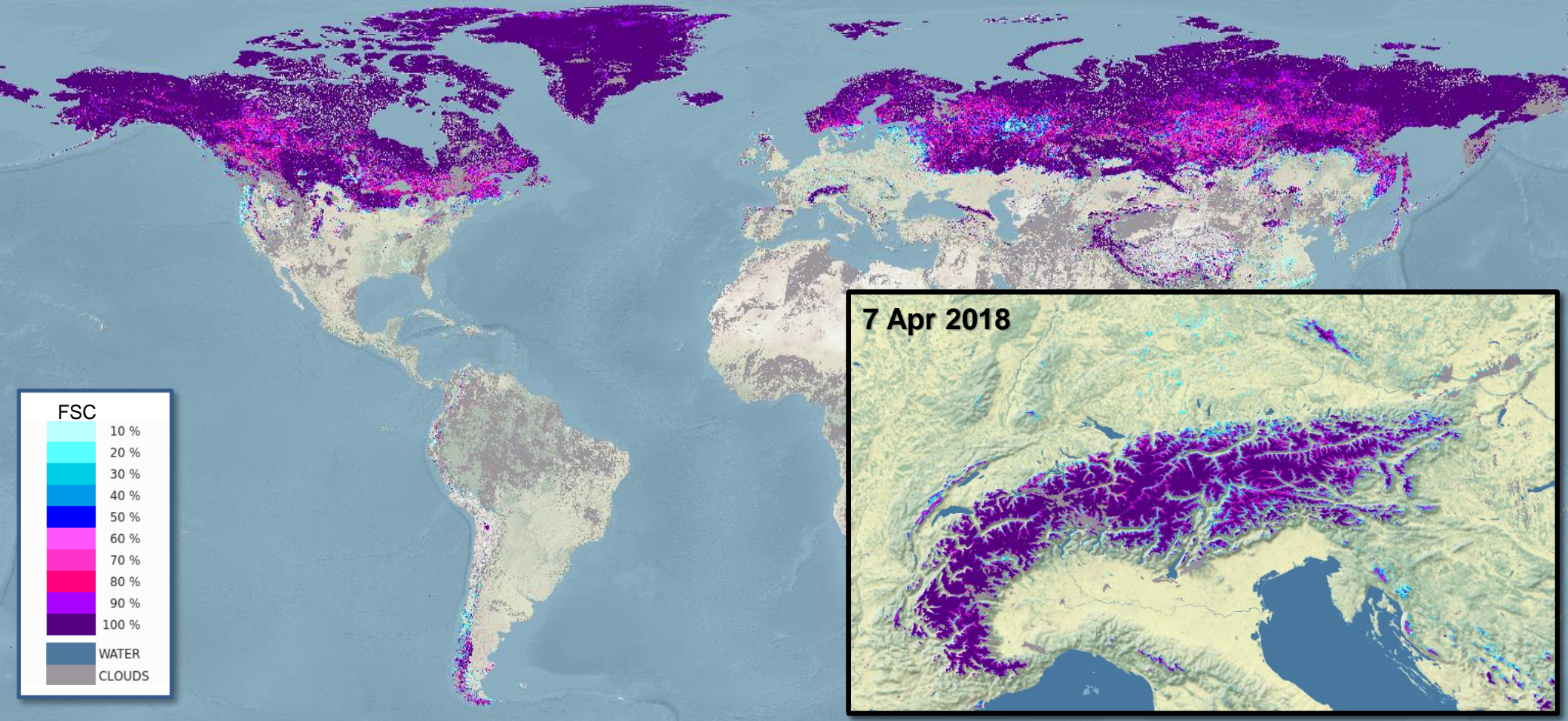
5 -10 April 2018

Courtesy of T. Nagler of Enveo



Copernicus

SENTINEL 3



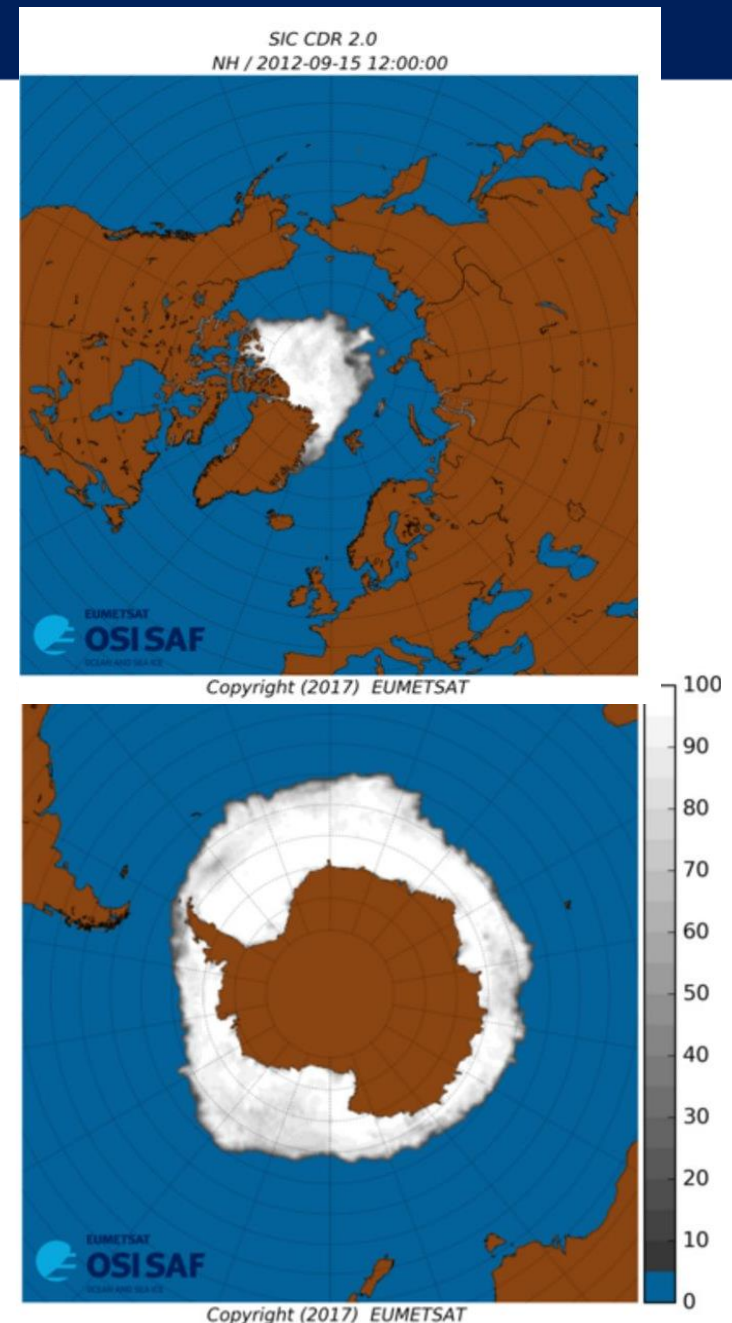
FSC

10 %
20 %
30 %
40 %
50 %
60 %
70 %
80 %
90 %
100 %

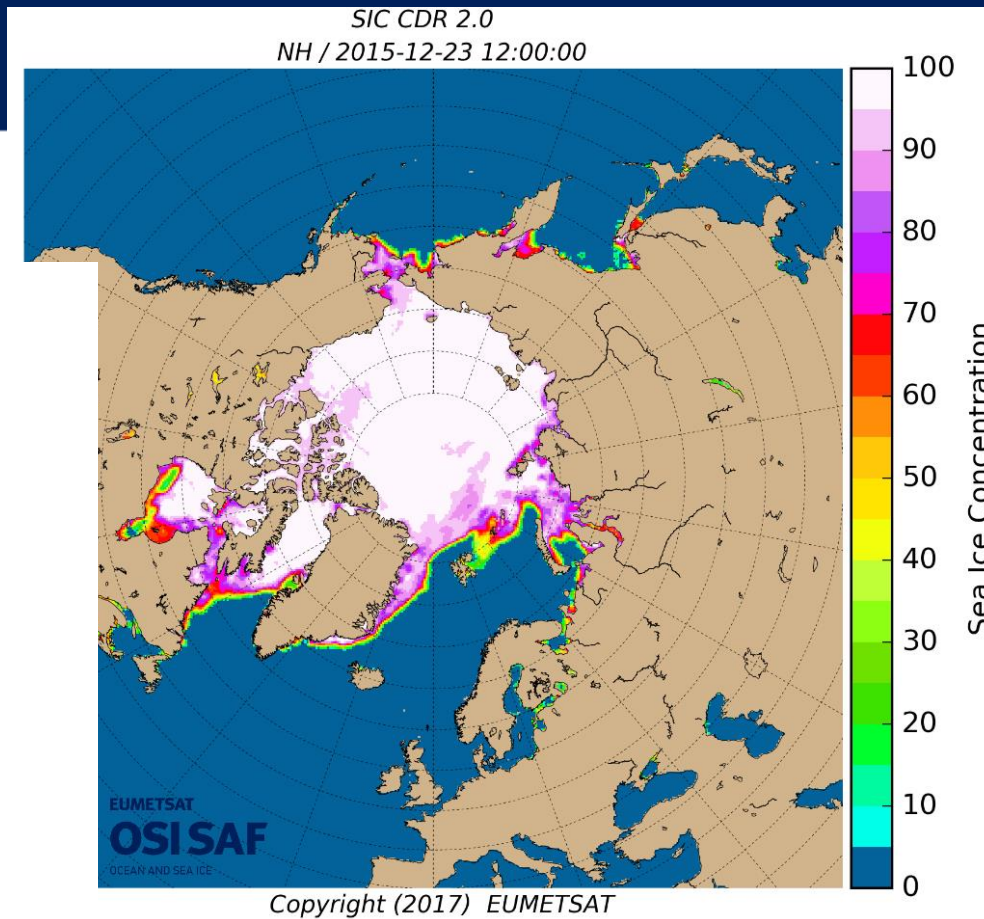
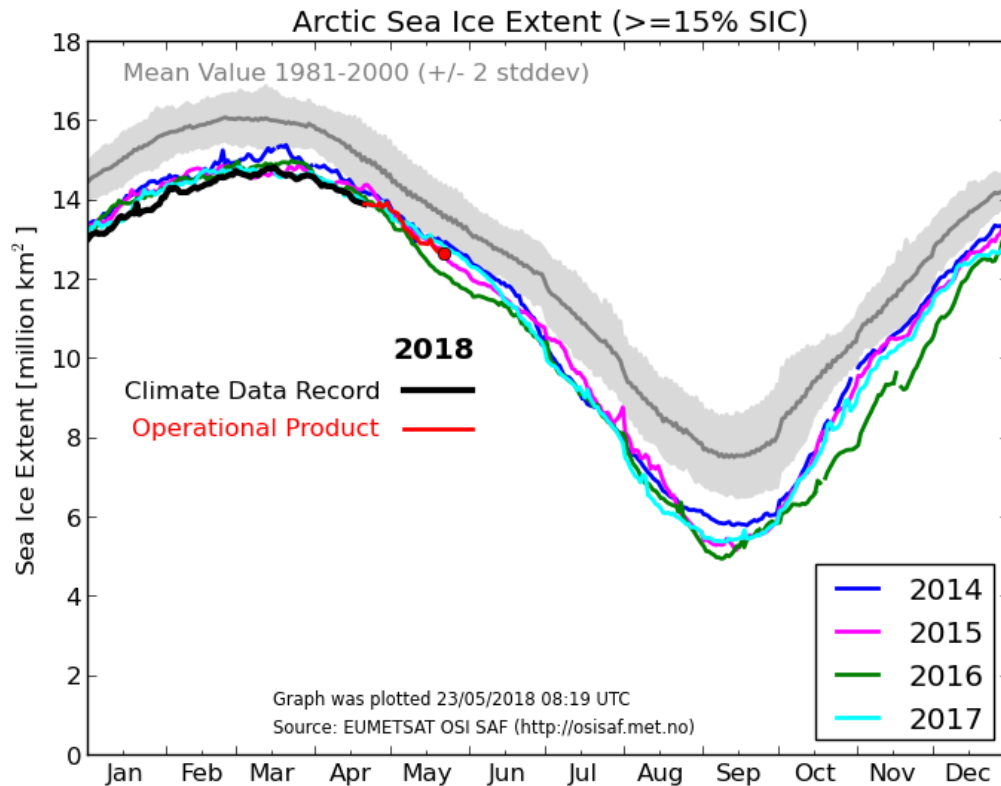
WATER
CLOUDS

New sea ice data record

- New sea ice data record (OSI-450)
- Released 12 May 2017
- Based on SSMR, SSM/I, SMISS
- Covering 35 years 1979-2015
- Succeeding OSI-409: implemented improvements and extension of period
- Benefits from methods developed by ESA CCI



Arctic Sea Ice Extent



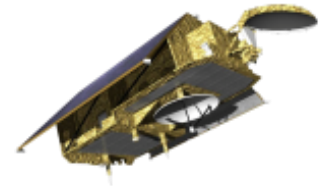
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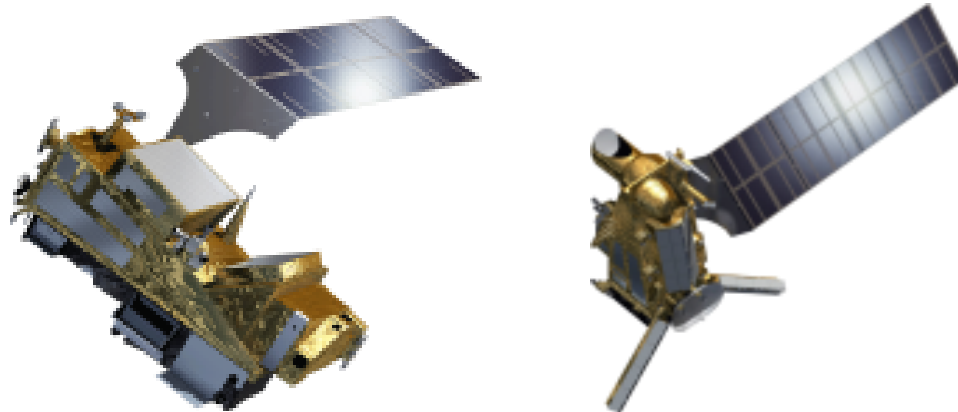
EUMETSAT future programmes



Third generation Meteosat in GEO: MTG
(approved since 2011)



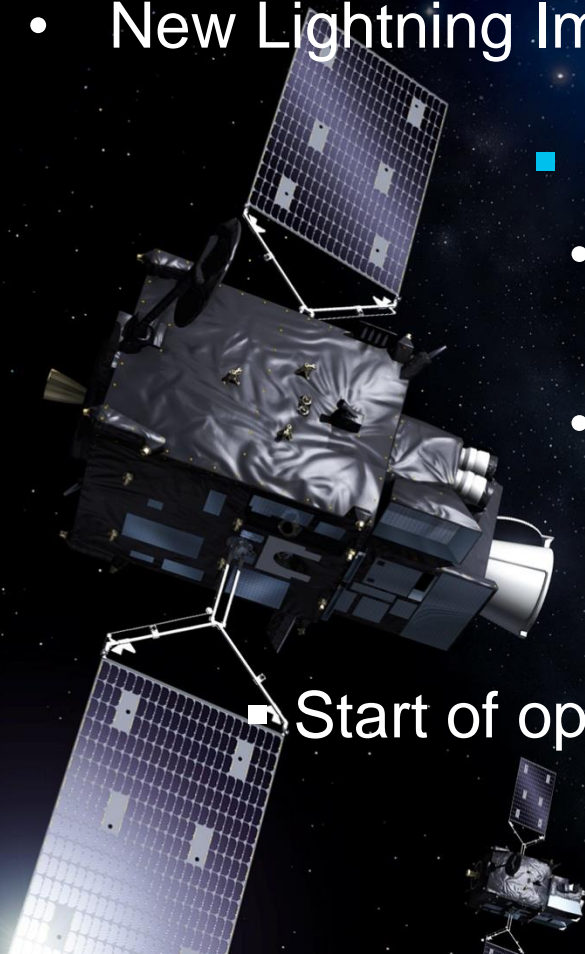
Jason-CS/Sentinel-6
(approved optional programme
since 2015)



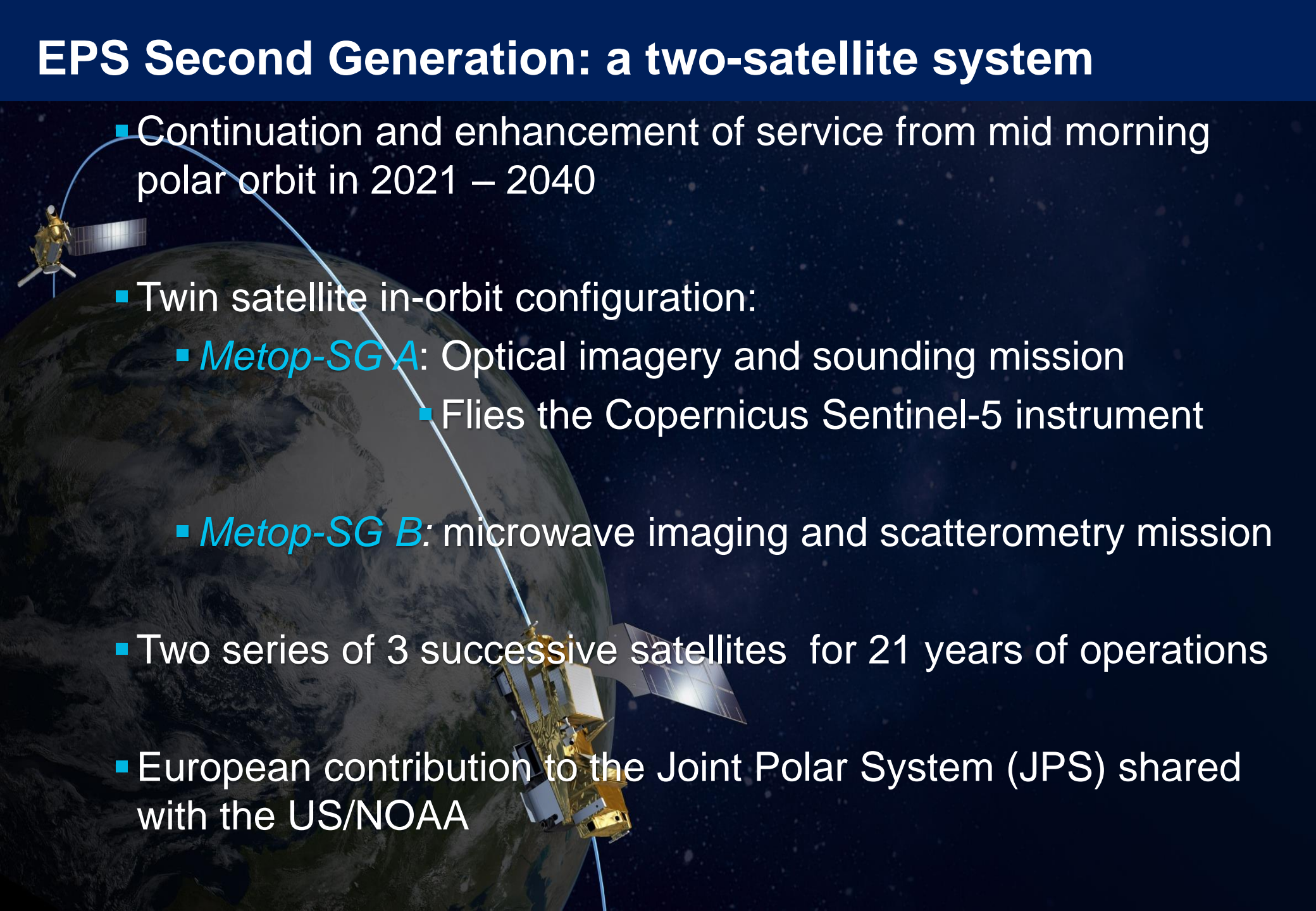
Second generation Metop in LEO: EPS-SG
(approved since 2015)

Meteosat Third Generation: MTG-I and MTG-S missions

- *Imagery mission* implemented by two MTG-I satellites
 - Full disk imagery every 10 minutes in 16 bands
 - Fast imagery of Europe every 2.5 minutes
 - New Lightning Imager (LI)
- *MTG-S hyperspectral infrared sounding mission:*
 - Full disk 3D weather cube: temperature, water vapour, O₃ (every 30 minutes over Europe)
 - Air quality monitoring and atmospheric chemistry
(in synergy with the Sentinel-4 instrument)
- Start of operations in 2022 and 2024



EPS Second Generation: a two-satellite system

- 
- The background of the slide is a dark blue space scene with a view of the Earth's surface from space. Two satellites are shown in polar orbits. One satellite is in the upper left, and the other is in the lower right, both with their solar panels extended. A thin blue line represents the orbital path of the satellites around the Earth.
- Continuation and enhancement of service from mid morning polar orbit in 2021 – 2040
 - Twin satellite in-orbit configuration:
 - *Metop-SG A*: Optical imagery and sounding mission
 - Flies the Copernicus Sentinel-5 instrument
 - *Metop-SG B*: microwave imaging and scatterometry mission
 - Two series of 3 successive satellites for 21 years of operations
 - European contribution to the Joint Polar System (JPS) shared with the US/NOAA

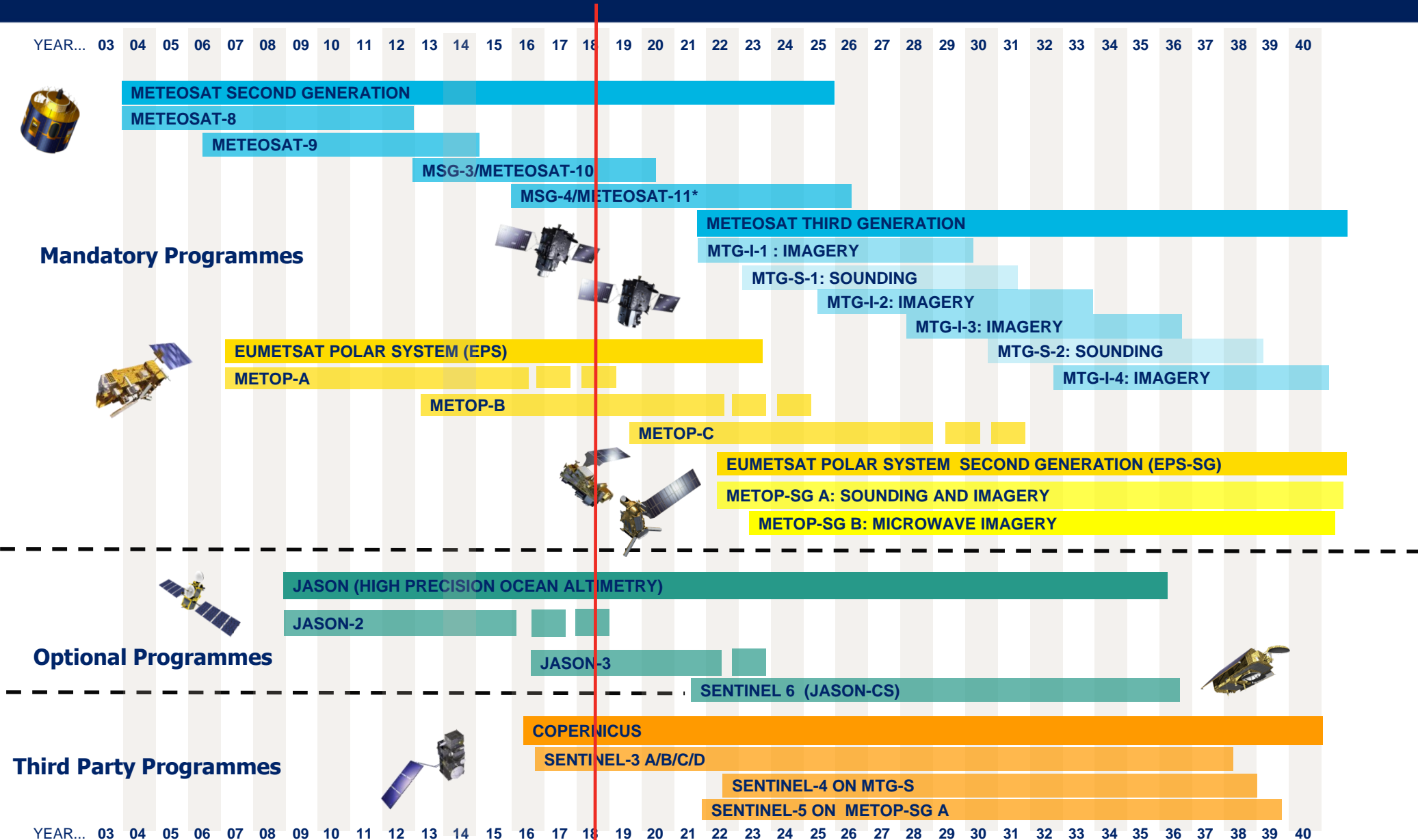
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Summary

- EUMETSAT is operating and developing a fleet of operational meteorological satellites
 - Products available from current EUMETSAT mandatory, optional and 3rd party programmes (Meteosat, EPS, Jason, Sentinel-3)
- ⇒ Providing data for a variety of applications concerning the water cycle
- Products developed for the EUMETSAT application ground segment at EUMETSAT HQ and at the SAFs
 - Future programmes MTG and EPS-SG providing data continuity and critical new missions from 2022 onwards

Operational services call for long term commitments...



Thank You for Your Attention



backup

EUMETSAT's Participation in the Copernicus Program

EUMETSAT participates in **COPERNICUS** with the following elements:

- In co-operation with ESA, EUMETSAT is operating the
 - **Sentinel-3** Ocean Mission
- In co-operation with CNES, NOAA and NASA, EUMETSAT is operating the High Precision Ocean Altimetry (HPOA) Mission of **Jason-3**
- In co-operation with ESA, EUMETSAT is preparing for the operations of the
 - **Sentinel-4** Atmospheric Chemistry Mission from GEO on MTG
 - **Sentinel-5** Atmospheric Chemistry Mission from LEO on EPS-SG
- In co-operation with ESA, NOAA and NASA, EUMETSAT is preparing for the operations of the High Precision Ocean Altimetry (HPOA) Mission of **Sentinel 6/Jason-CS** (Continuity of Service)

EUMETSAT ground segment overview

