The Copernicus offer for Fisheries & Aquaculture

The potential of EO - ESA perspective

Espen Volden

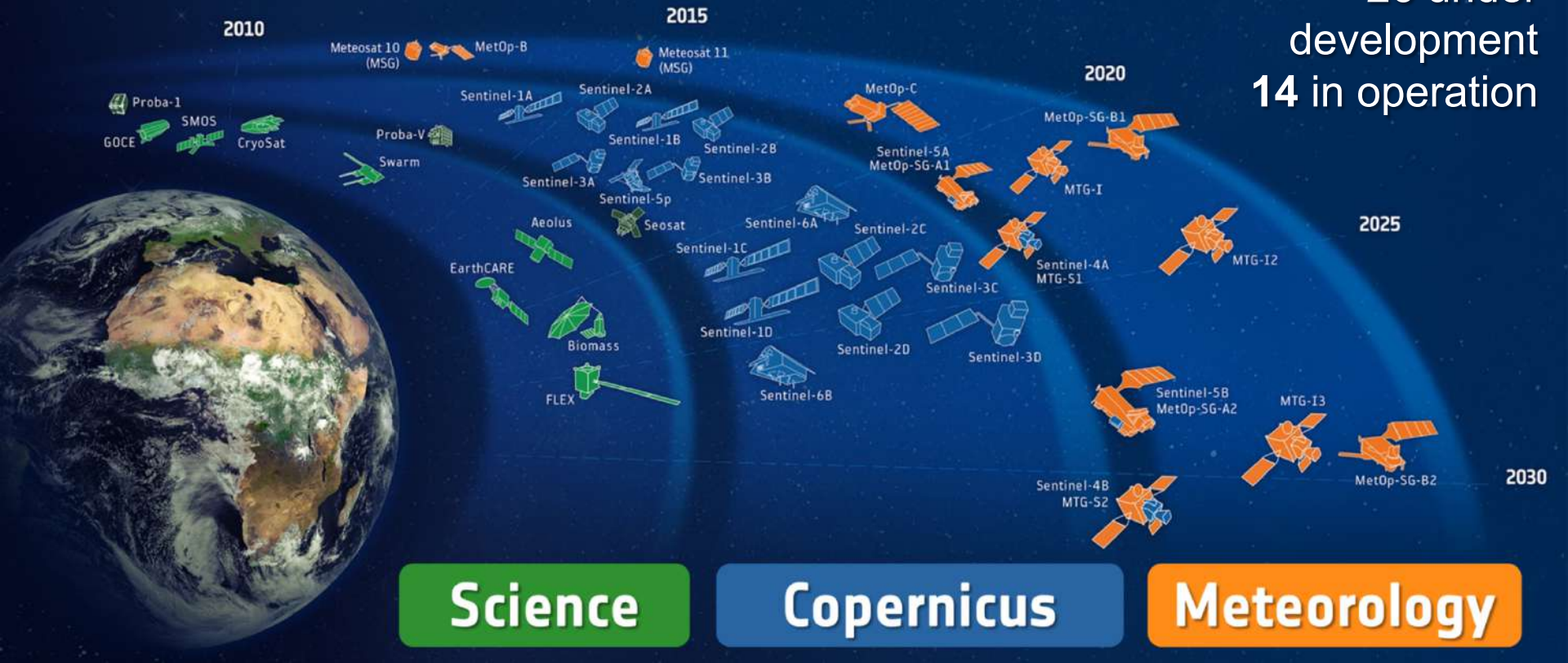
Thanks to:

ESA colleagues: Gordon Campbell, Olivier Arino, Craig Donlon

Project results by: ACRI, Hatfield, BRGM, …

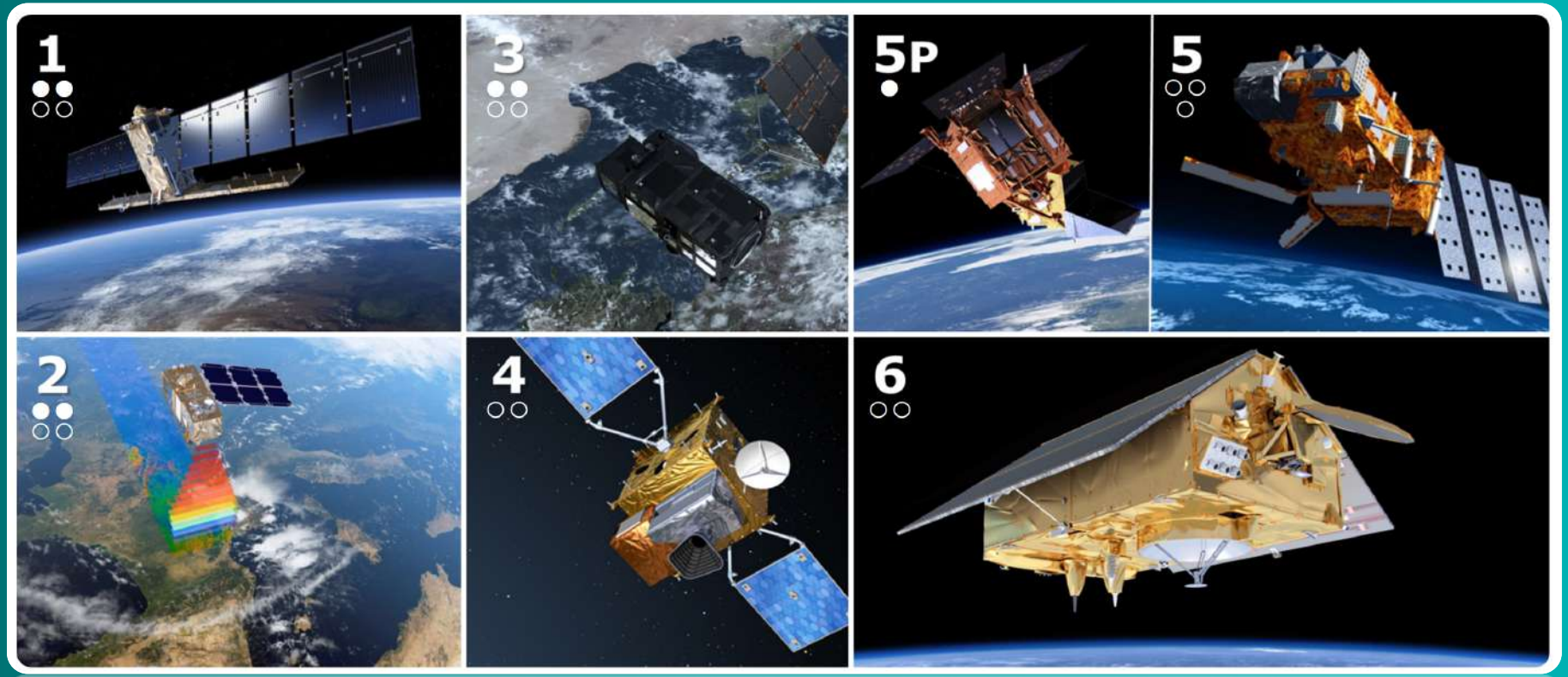
ESA-DEVELOPED EARTH OBSERVATION MISSIONS

Satellites
26 under development
14 in operation



The Big Data Revolution

Copernicus is the largest producer of EO data in the world



The Big Data Revolution

Copernicus is the largest producer of EO data in the world

Daily Data Production Sentinels	15 TB
Daily Data Dissemination Sentinels	150 TB

The Big Data Revolution

Copernicus is the largest producer of EO data in the world

All this data is available:

Freely and openly worldwide

With long-term continuity well beyond 2030

Sentinel access through

- EU/ESA Copernicus Open Access Hub
- DIAS
- 6 Copernicus services
- 18 ESA MS hubs
- NASA, NOAA, USGS, Geoscience Australia
- TEPs
- Other commercial hubs & platforms

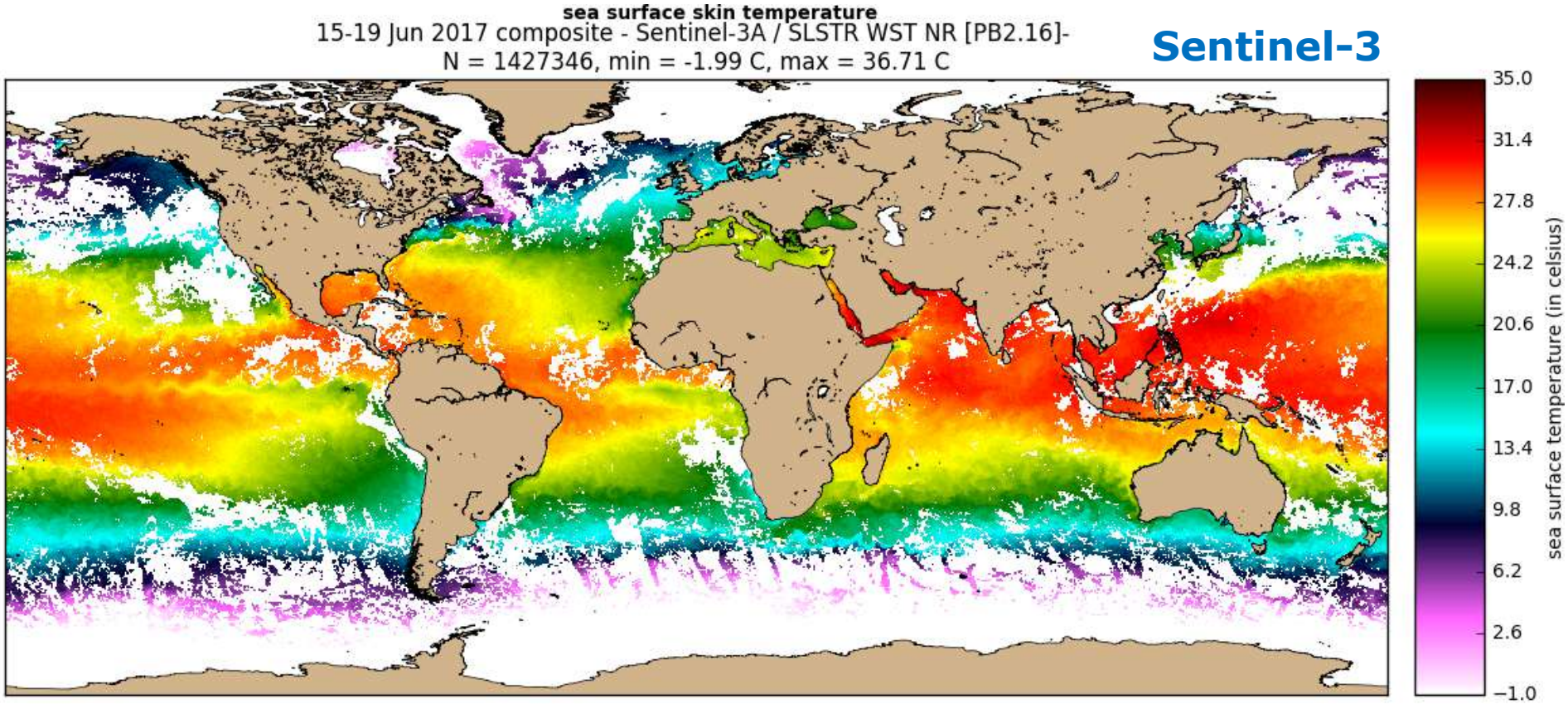
Marine Life

Fiji – South Pacific

Sentinel-2B

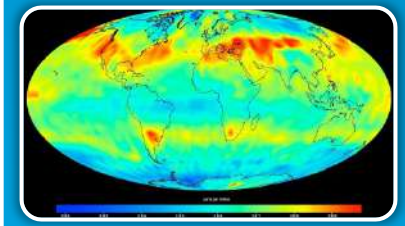
28 Sept. 2017

Sea Surface Temperature



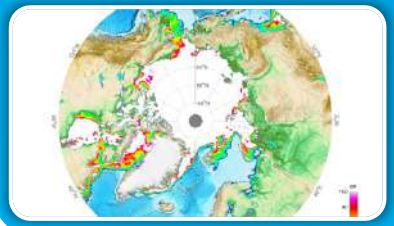
Copernicus 2.0

6 High Priority Candidate Missions

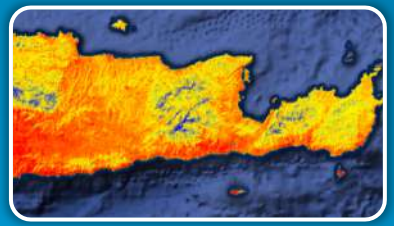


Monitor causes of Climate Change (CO_2 emissions)

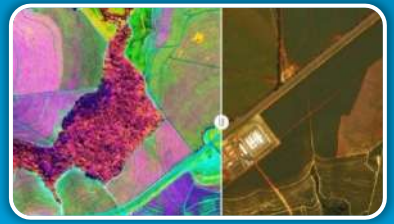
Monitor effects of Climate Change (Arctic/Polar ice volume)



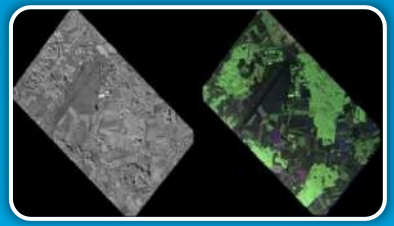
Sea Ice Conc. & SST (Arctic situational awareness)



Agriculture & Water Productivity



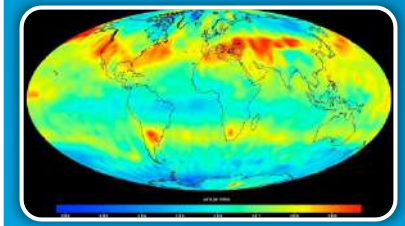
Food Security, Soil & Minerals, Forestry, Biodiversity



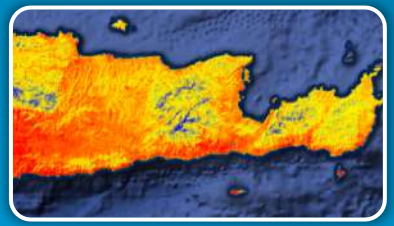
Soil Moisture, Vegetation & Ground Motion

Copernicus 2.0

6 High Priority Candidate Missions

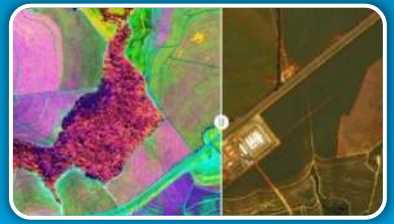


Anthropogenic CO_2 Imaging Spectrometer

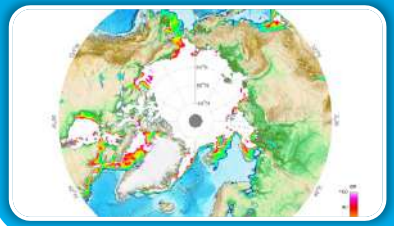


High Resolution Surface Temp.

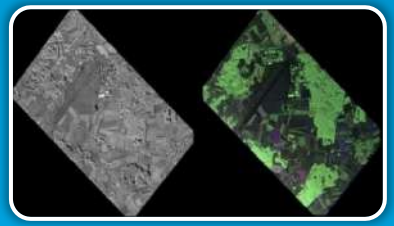
Polar Ice & Snow Topography



Hyperspectral Imaging



Passive Microwave Imaging



L-band SAR

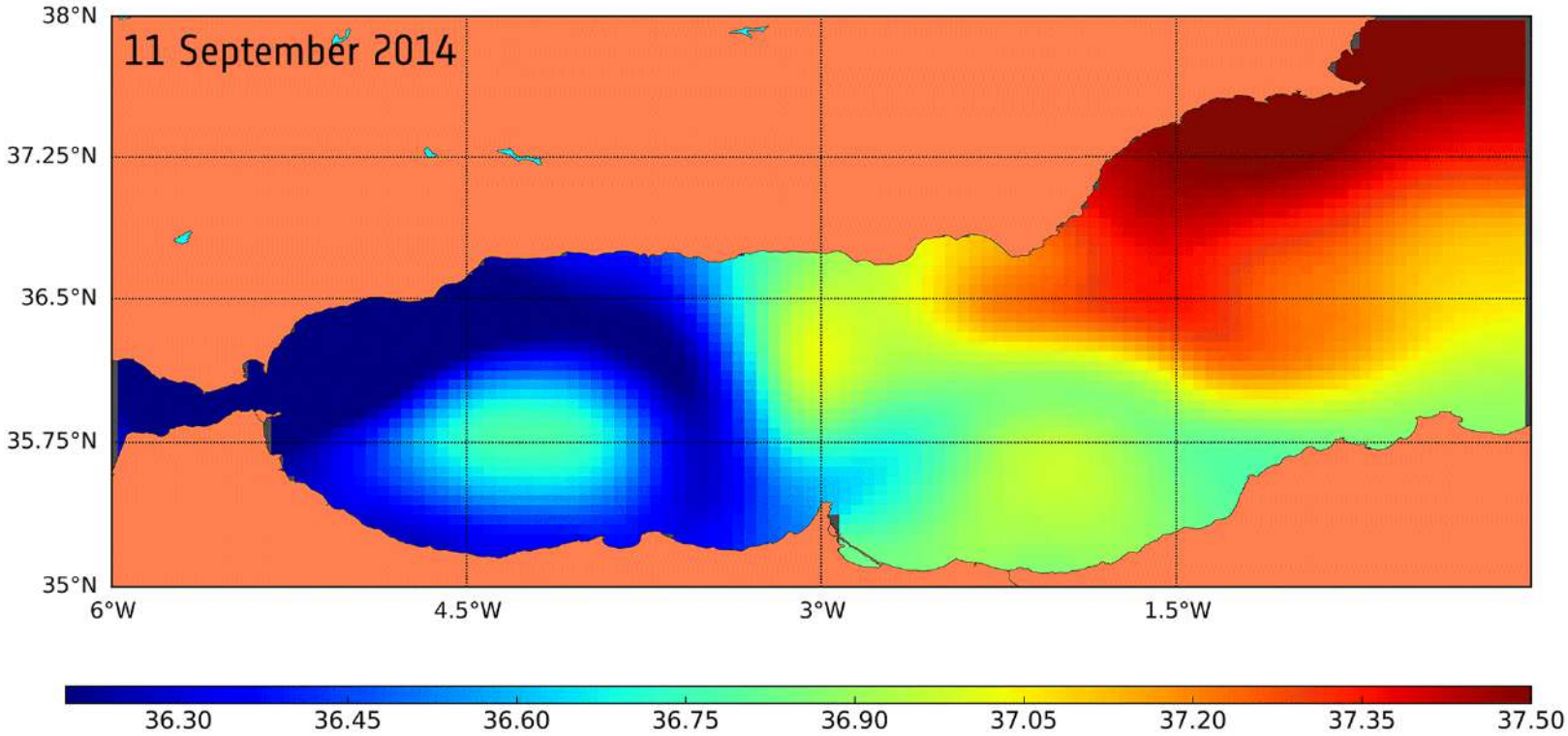
SMOS

Second Earth Explorer
Launched 2 Nov. 2009

Two variables

- Soil Moisture
- Ocean Salinity

SMOS: Alboran Sea Salinity Changes

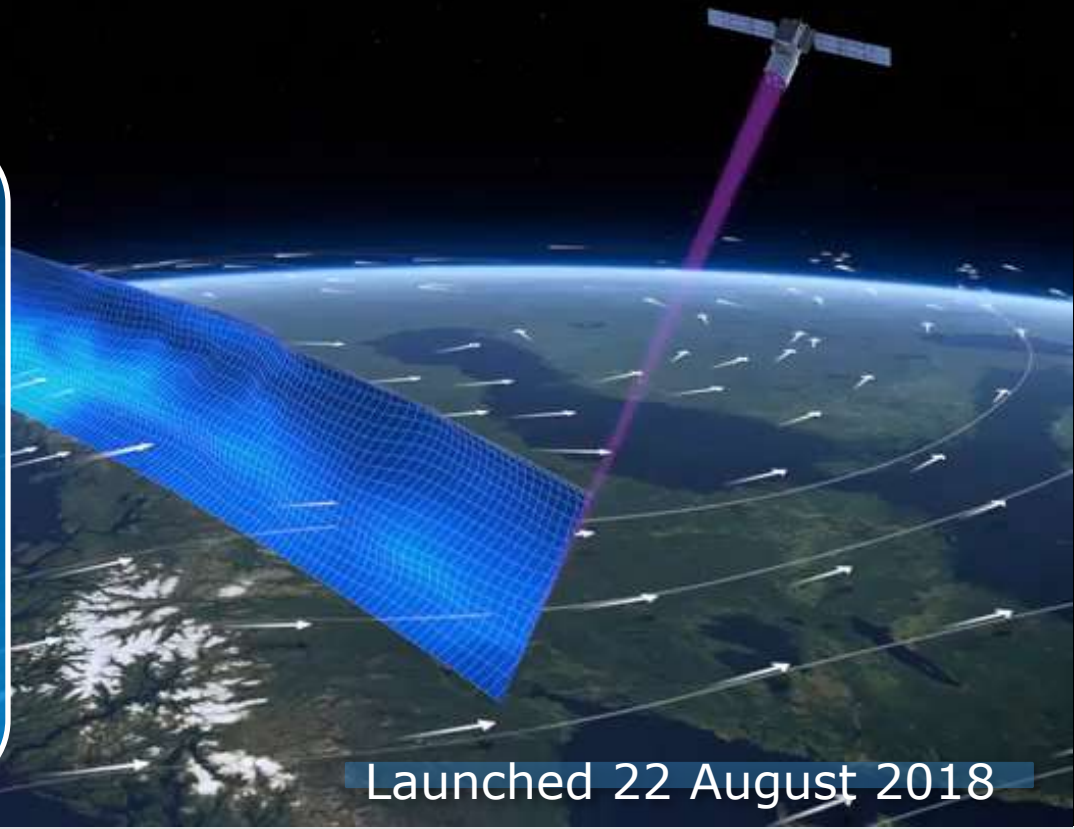


© Barcelona Expert Centre

Aeolus addresses our ‘Blind Spot’

Wind

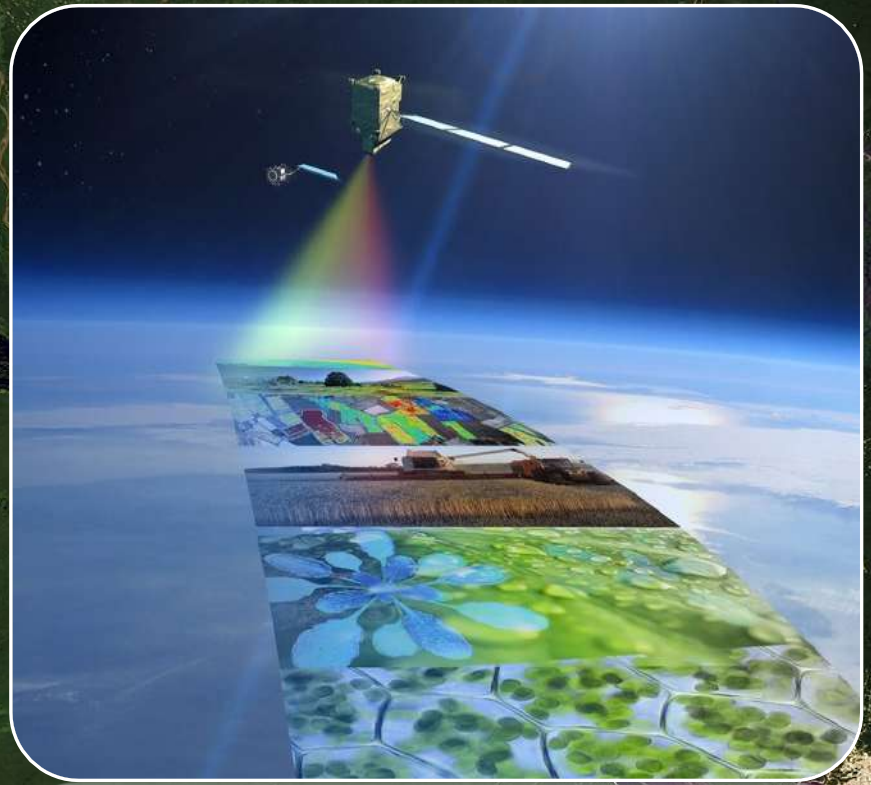
- Improving NWP Models’ forecast accuracy
- Deepening Understanding of Climate Science
- Spurring insight into the atmospheric energy, water, aerosol and chemistry cycles



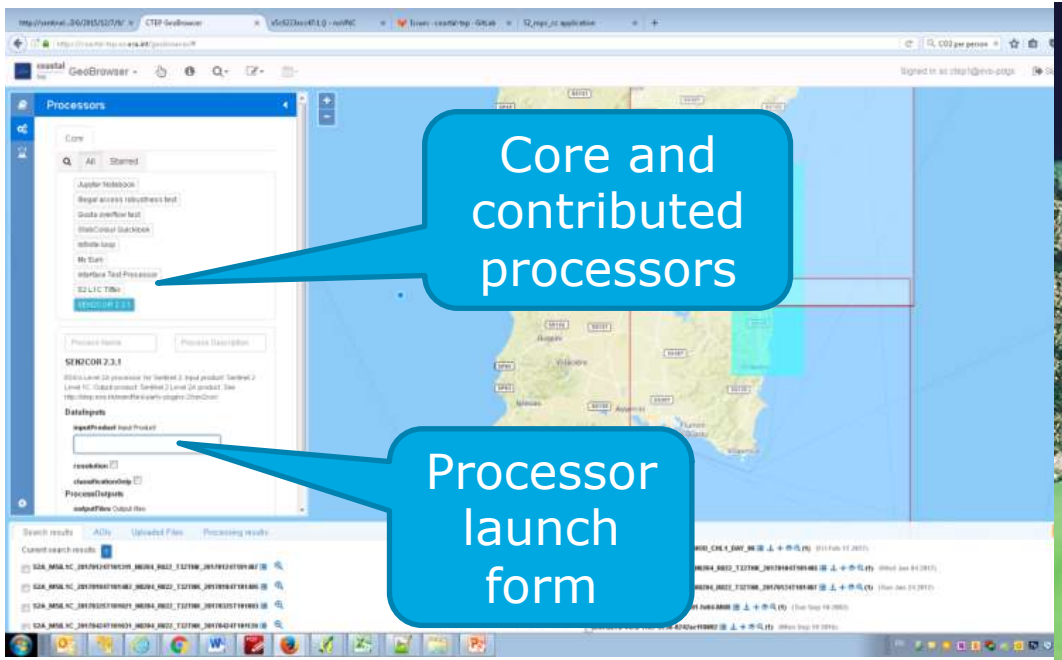
Launched 22 August 2018

FLEX

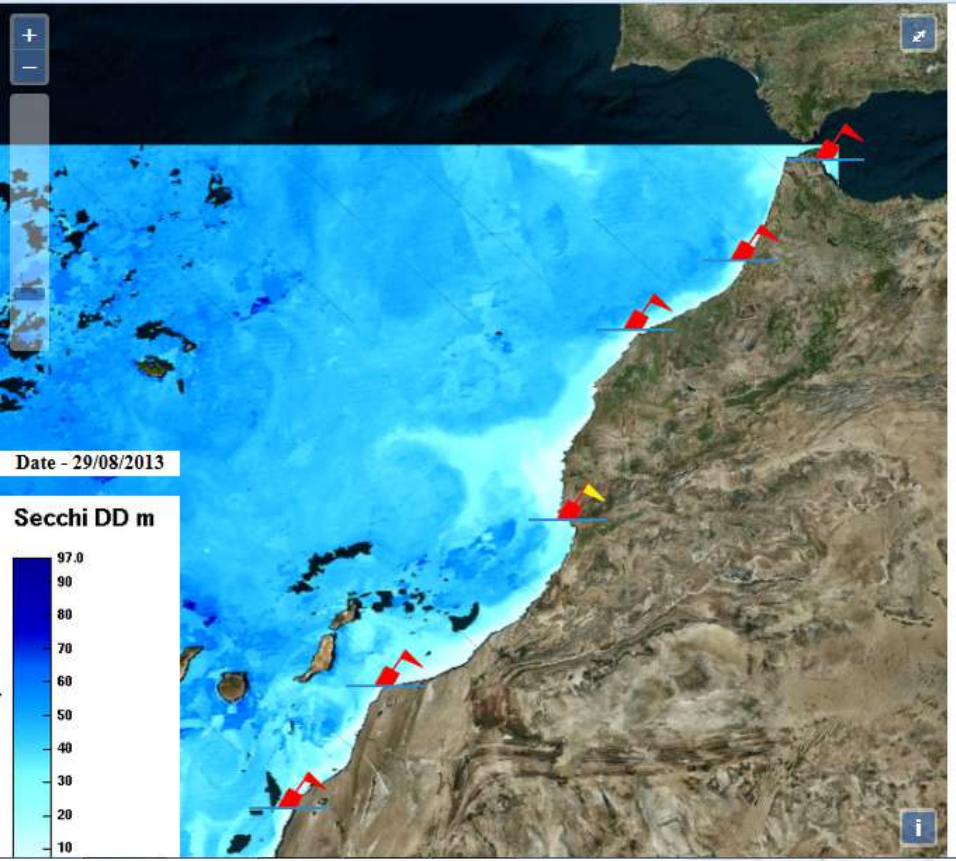
Mission	Study & monitoring of fluorescence signal linked to photosynthetic activity; pixel 300m.
Swath	150 km
Payload	FLORIS, 2 channels spectrometers (O_2 lines)
Orbit	SSO, alt: 814 km; LTDN: 10h00
Satellite	470 Kg
Consortium	Prime: TAS Instrument: Leonardo
Launch date	end 2022
Lifetime	3.5 years

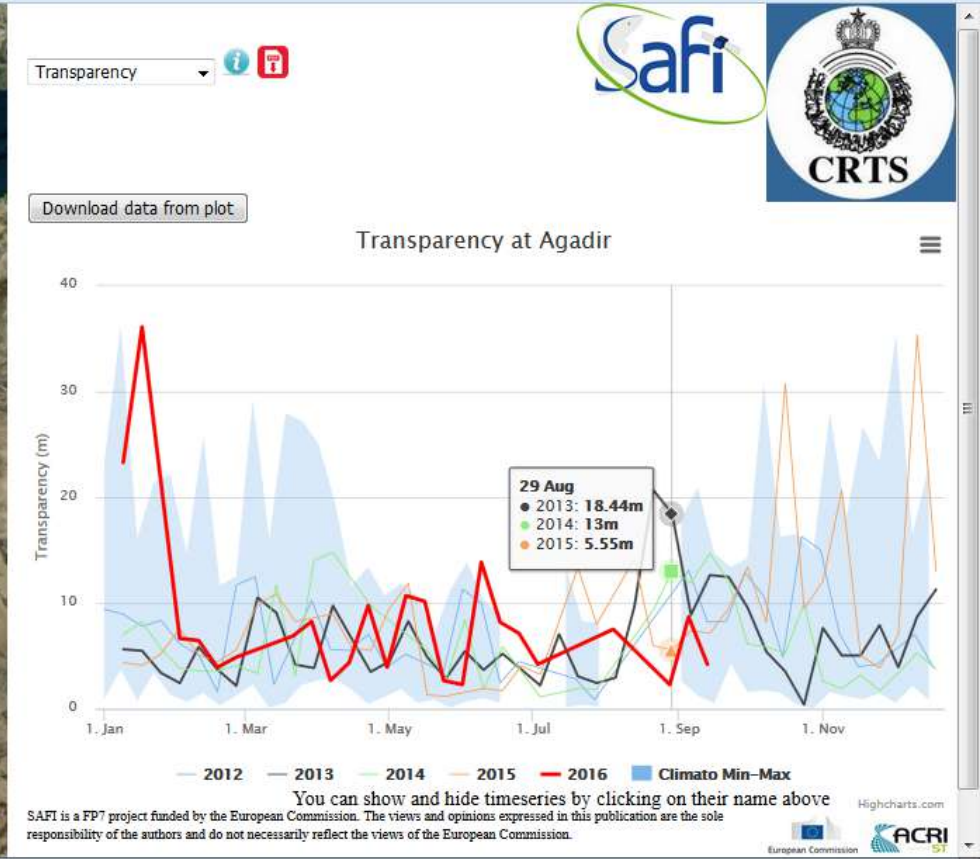


Coastal Platform (TEP) - Basic Image Analysis

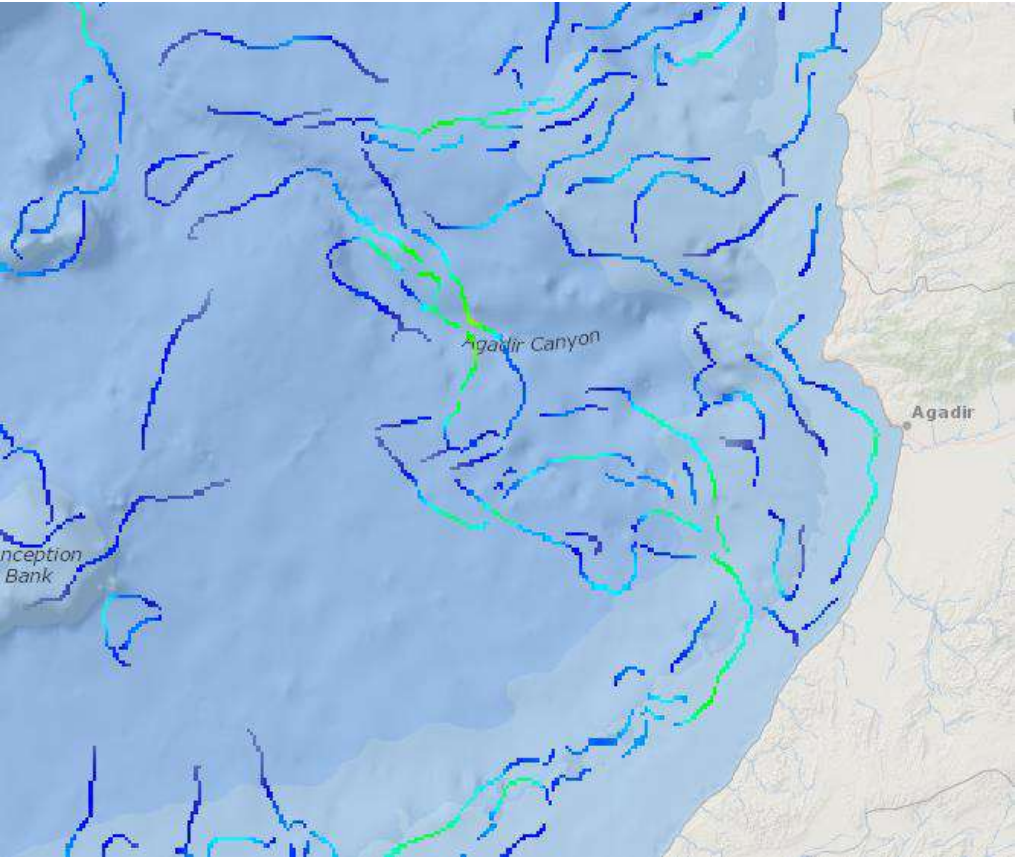


Processing services–environmental conditions for aquaculture



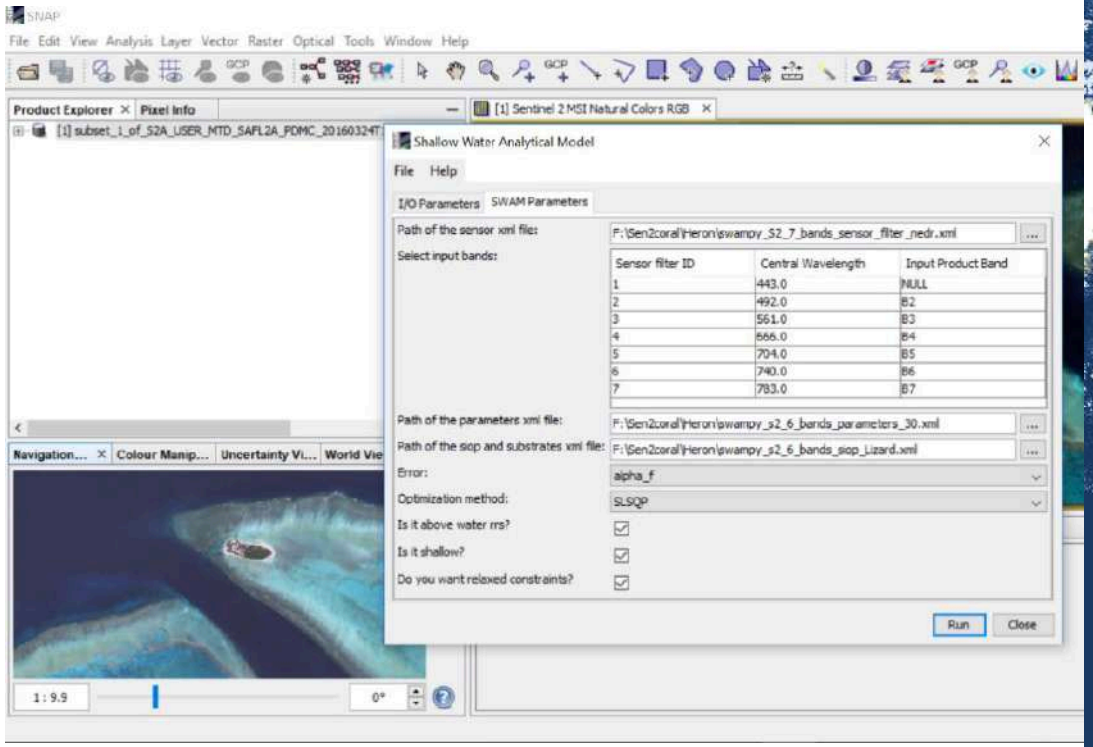


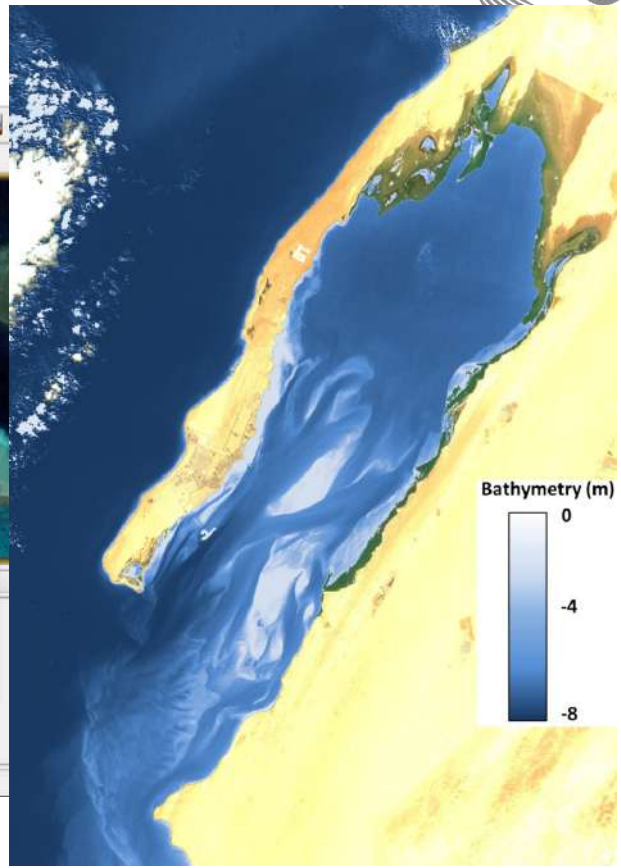
Frontal structures



SAFI-SST FRONTS (COLOURS INDICATE FRONT STRENGTH IN °C/KM)
PICTURED: MONTHLY SST FRONTS NEAR
AGADIR, MOROCCO, SEPTEMBER 2015

Bathymetry retrieval





Bathymetry with Sentinel 2 (16/09/2015)

Food Security Platform (TEP)
Framework for Aquaculture User Requirements

- Aquaculture Development
  - Strategic planning and zonation
  - Site suitability
- Aquaculture practice and management
  - Inventory and status
  - Monitoring of the environment
  - Monitoring at the farm level
- Aquaculture risk management
  - Disaster risk management (DRR, response, recovery)
  - Monitoring and assessment of DRM

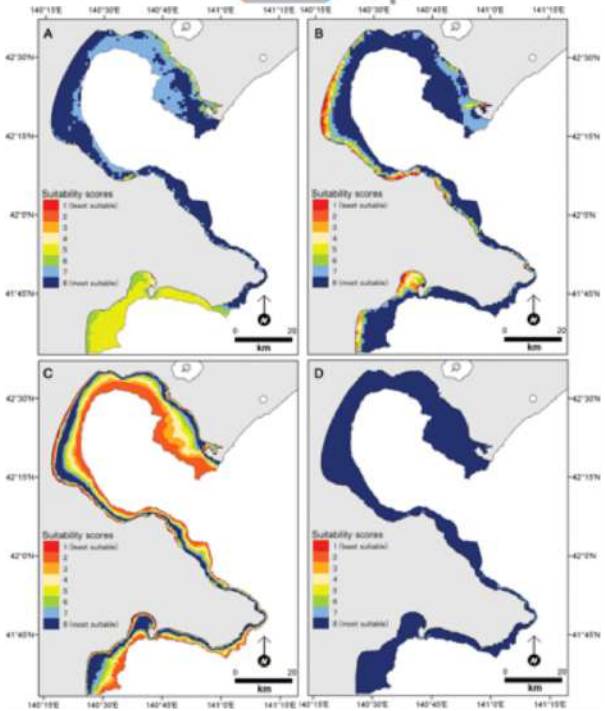
Photo source license: CC BY-SA

© Food Security TEP 2018

Required products, input parameters & ancillary data for Aquaculture Development part

food security tep

Parameters	▪ Chlorophyll-a concentration ▪ Primary Production ▪ Total suspended solids (TSS) ▪ Water temperature / SST / SST Front Detection ▪ Secchi Disk Depth ▪ Wave climate (SWH) ▪ Currents ▪ Bathymetry
Ancillary data	▪ Administrative boundaries, coastline, exclusive economic zone and marine zonation, Infrastructure (e.g. roads, ports)
Outputs (integration)	▪ Aquaculture potential zones ▪ Ecological carrying capacity estimates ▪ Production carrying capacity estimates



Aquaculture site selection for Japanese kelp (Laminaria japonica) - ICES J Mar Sci. 2010;68(4):773-780.

© Food Security TEP 2018

Trial Service Requirements [1]

food security tep

- Aquaculture Development
  - Site suitability – assess **strategic zonation risks and benefits** to future and current aquaculture developments, such as **moving seaweed production further offshore**

Members of the Zanzibar Seaweed Cluster Initiative. Photo source: Dr. Flower Msuya

Photo Source License: CC BY-SA

© Food Security TEP 2018

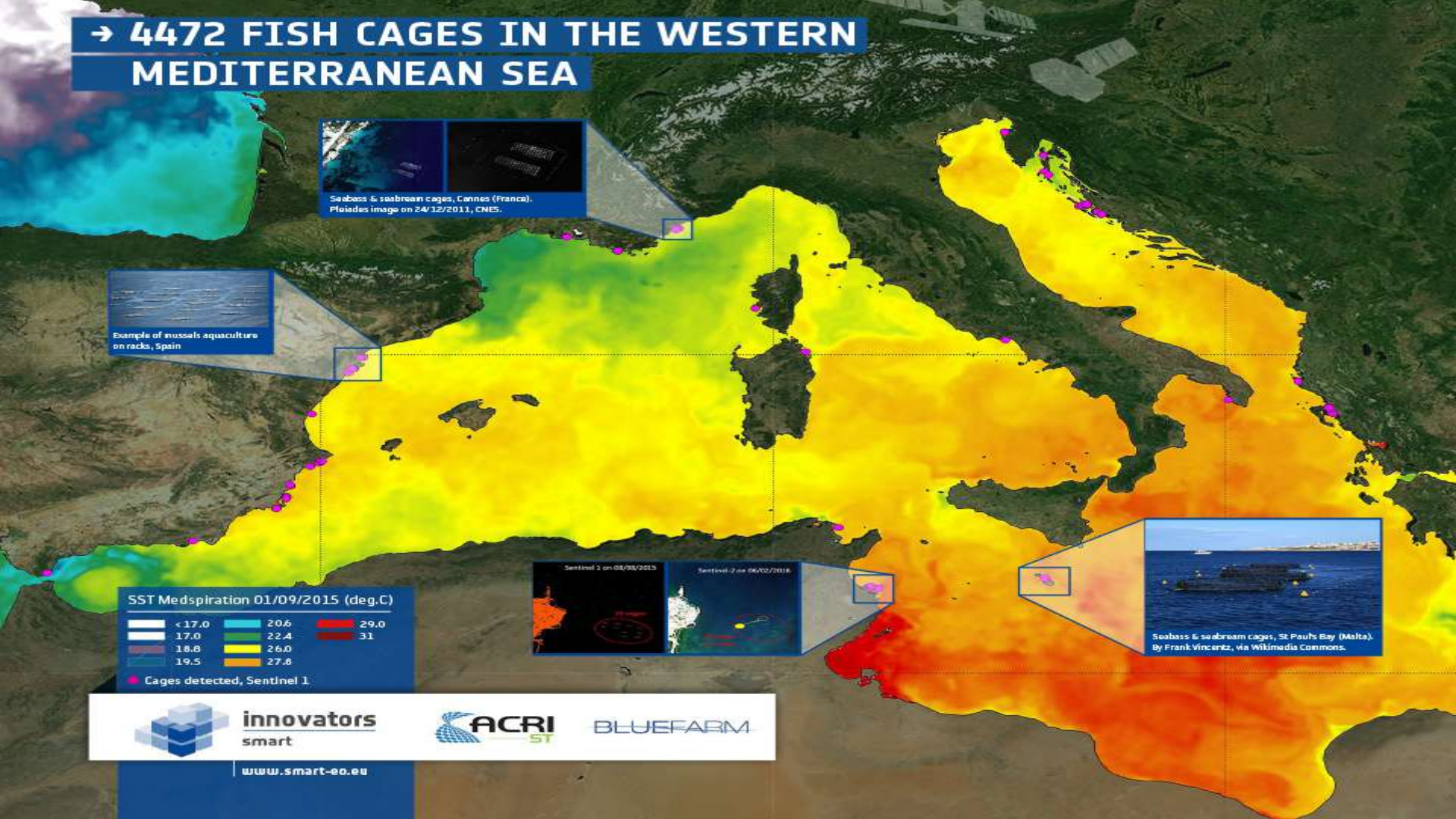
Trial Service Requirements [2]

food security tep

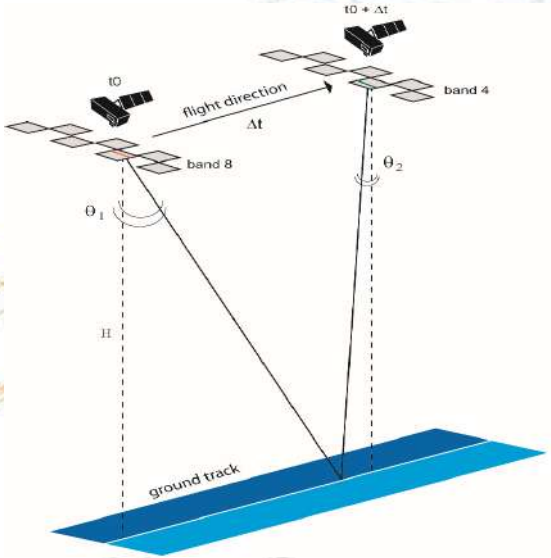
- Aquaculture practice and management:
  - Inventory and status of aquaculture – supporting the **mapping and attribution of previously developed and currently in-use coastal aquaculture sites**
  - Could also support **mapping of mangrove habitat**, which may be affected by clearance for fish, prawn and crab production

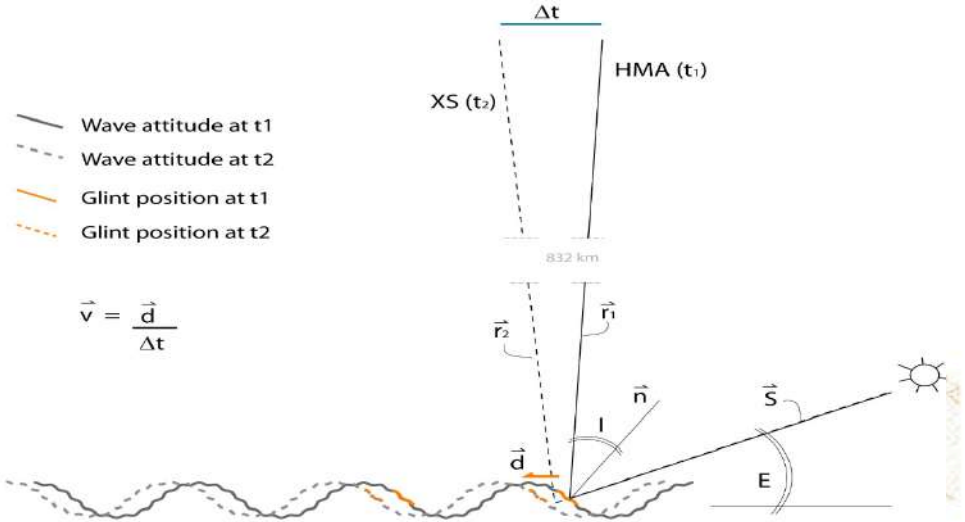
© Food Security TEP 2018

→ 4472 FISH CAGES IN THE WESTERN MEDITERRANEAN SEA



Knowledge of coastal bathymetry is essential for understanding marine ecosystems, on which fisheries depend





Bathysent concept:

- Time lag between multiple images acquisitions (bands) of « push-broom » sensors
- Used to measure ocean/sea waves celerity (de Michele et al., 2012)
- Celerities and wavelengths are related to water depth

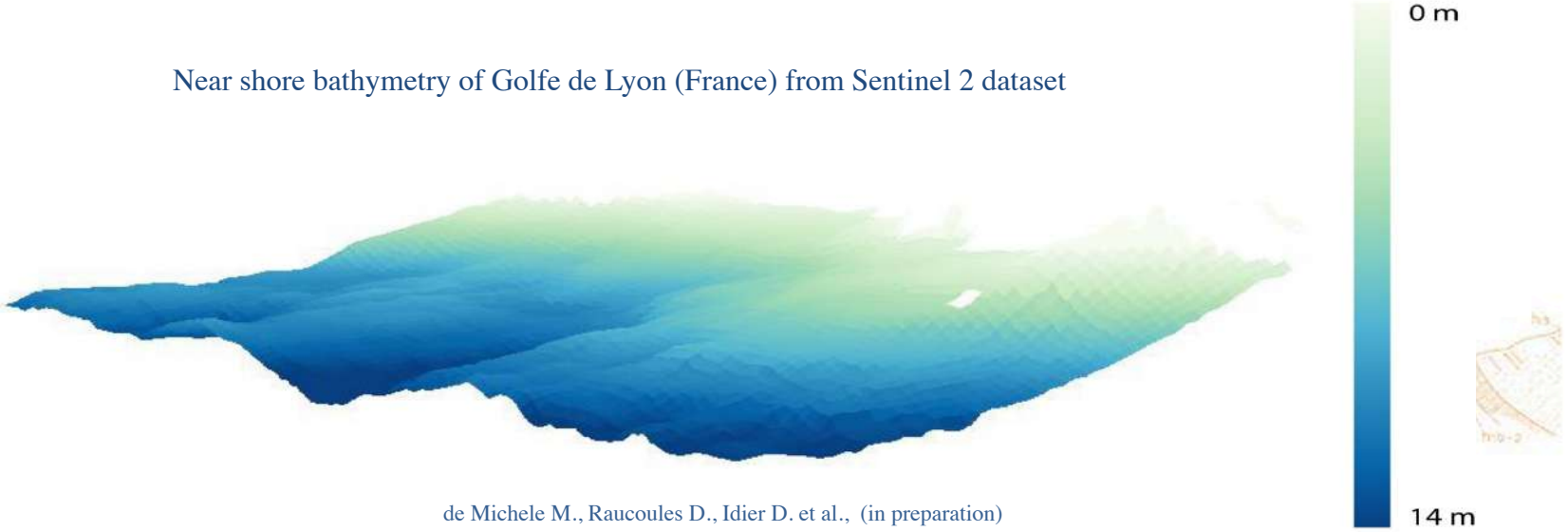
Example: Starting from a single Sentinel 2 dataset…

Sentinel 2 image of Golfe de Lyon (France)

de Michele M., Raucoules D., Idier D. et al., (in preparation)

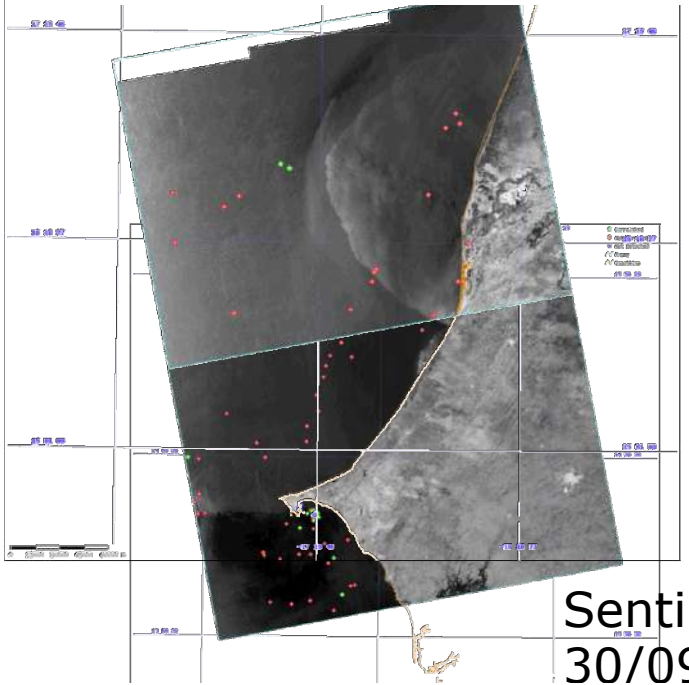
… producing a bathymetric maps

Near shore bathymetry of Golfe de Lyon (France) from Sentinel 2 dataset

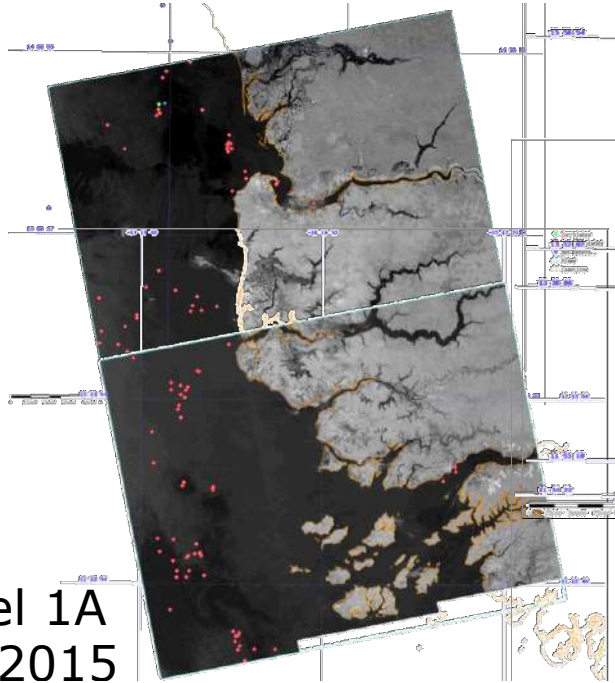


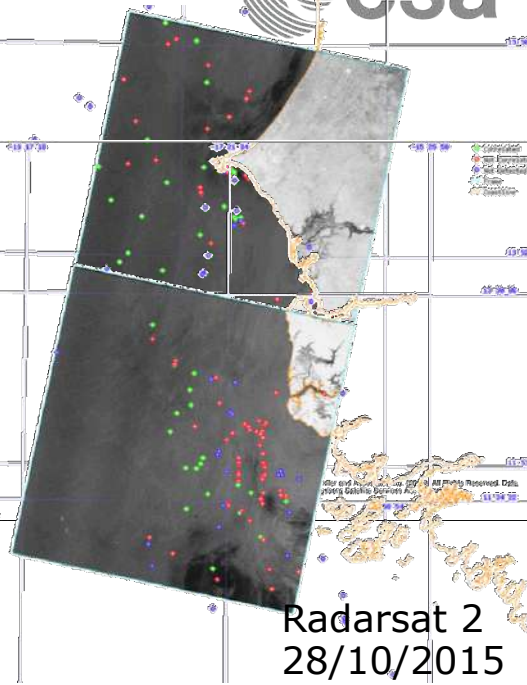
de Michele M., Raucoules D., Idier D. et al., (in preparation)

Example – West Africa Regional Fisheries Program



Sentinel 1A
30/09/2015





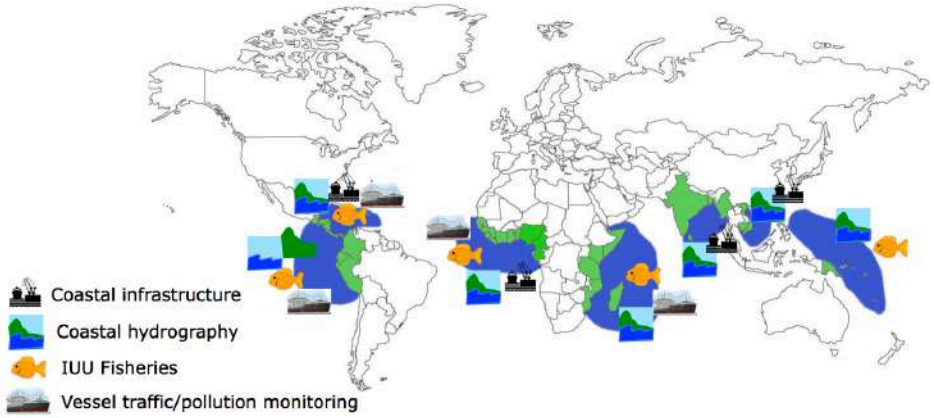
Radarsat 2
28/10/2015

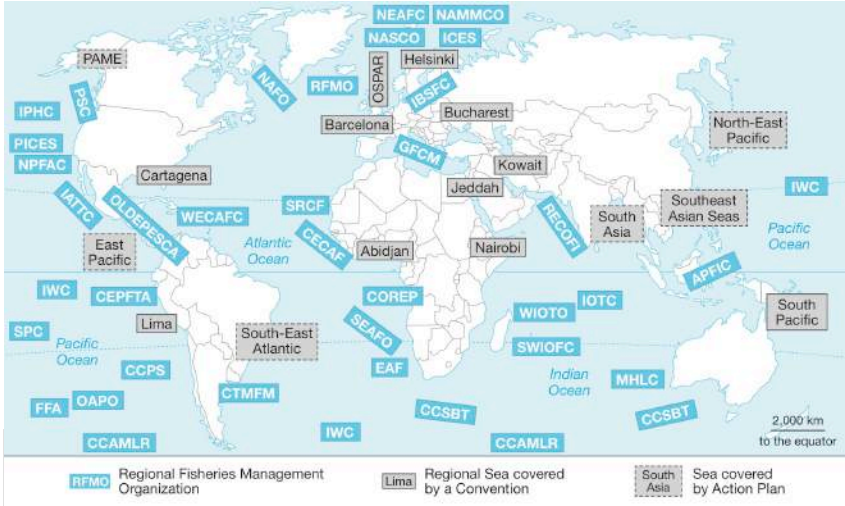
Project objective: Improve management of West African EEZs and reduce levels of IUU fishing

EO contribution: Cost effective surveillance tool to detect vessels engaged in fishing and integrate with transponder and license data
Additional capability to detect pollution highly appreciated

EO4SD - Marine and coastal service cluster

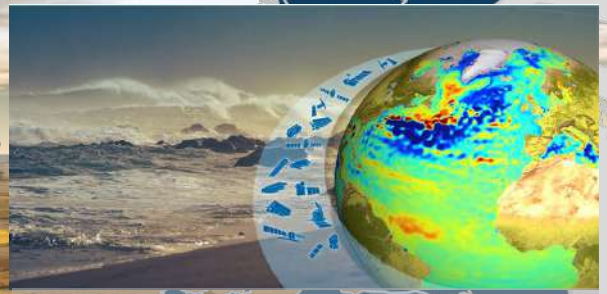
- Hydrographic information
  - Coastal bathymetric mapping
  - Coastline change mapping/sediment/deposition
  - Coastal LC/LCC
- Coastal Environment information
  - Benthic habitat extent & status
  - WQ monitoring & assessment
  - Coastal habitat status
  - MPA planning & management support
  - Invasive species monitoring & assessment
- Surveillance and Monitoring information
  - IUU fisheries surveillance
  - Marine pollution detection & polluter identification
  - Sand/gravel extraction/monitoring
  - Detection & monitoring of waste discharges
- Information to support Blue Economy
  - Aquaculture site selection and monitoring
  - Blue economy planning & monitoring support
  - Coastal environment impact assessment/monitoring





Regional Initiatives

- ESA has started a set of Regional initiatives
- Including science, applications and data infrastructure components (platforms)
- Focus on regional priorities with high interest for ESA Member States
- Target regions: Baltic, Black-Sea/Danube, Alpine, Atlantic and Mediterranean
- A key priority is to ensure connection with existing EC activities, e.g. EU Regional Strategies and projects
- Downscaling and adapting to regional conditions and needs



Atlantic from Space Workshop
23-25 January 2019, Southampton, UK

esa

living planet symposium

MILAN
13–17 May
2019

UNDERSTANDING THE EARTH SYSTEM

SPACE 4.0 AND EARTH OBSERVATION

BENEFITS FOR A RESILIENT SOCIETY

PUBLIC AND PRIVATE SECTOR INTERACTIONS

Deadlines

Session Proposals	Abstracts	Registration	
17 June 2018	11 November 2018	April 2019	lps19.esa.int