



Copernicus

General Overview



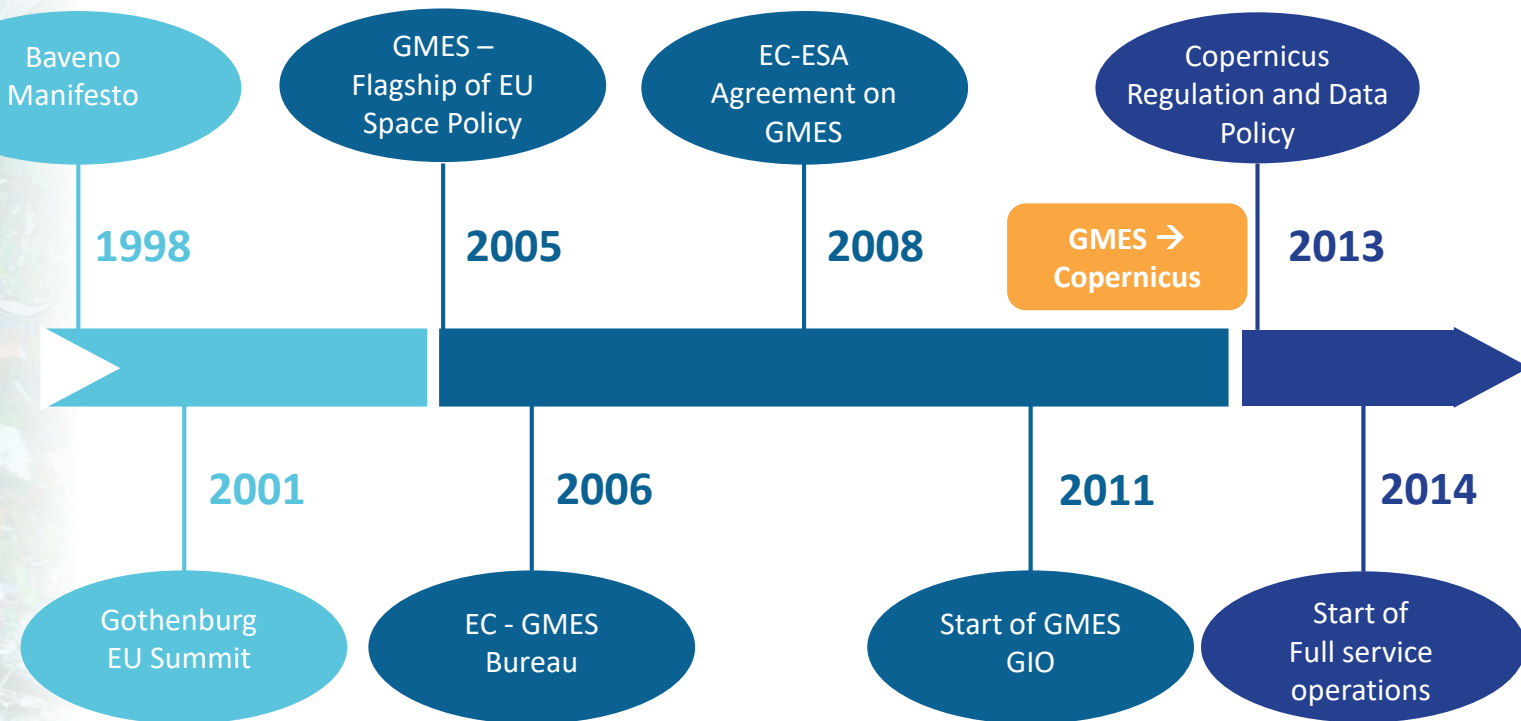
C O P E R N I C U S I N B R I E F

- **Copernicus is a flagship programme** of the European Union:
 - Monitors **the Earth**, its environment and ecosystems
 - Prepares for **crises, security risks** and **natural or man-made disasters**
 - Contributes to the **EU's role as a global soft power**
- a **full, free and open data policy**
- Is a tool for **economic development** and a driver for the **digital economy**



Copernicus

COPERNICUS HISTORY



GIO = GMES Initial Operation



Copernicus

COPERNICUS FUNDING

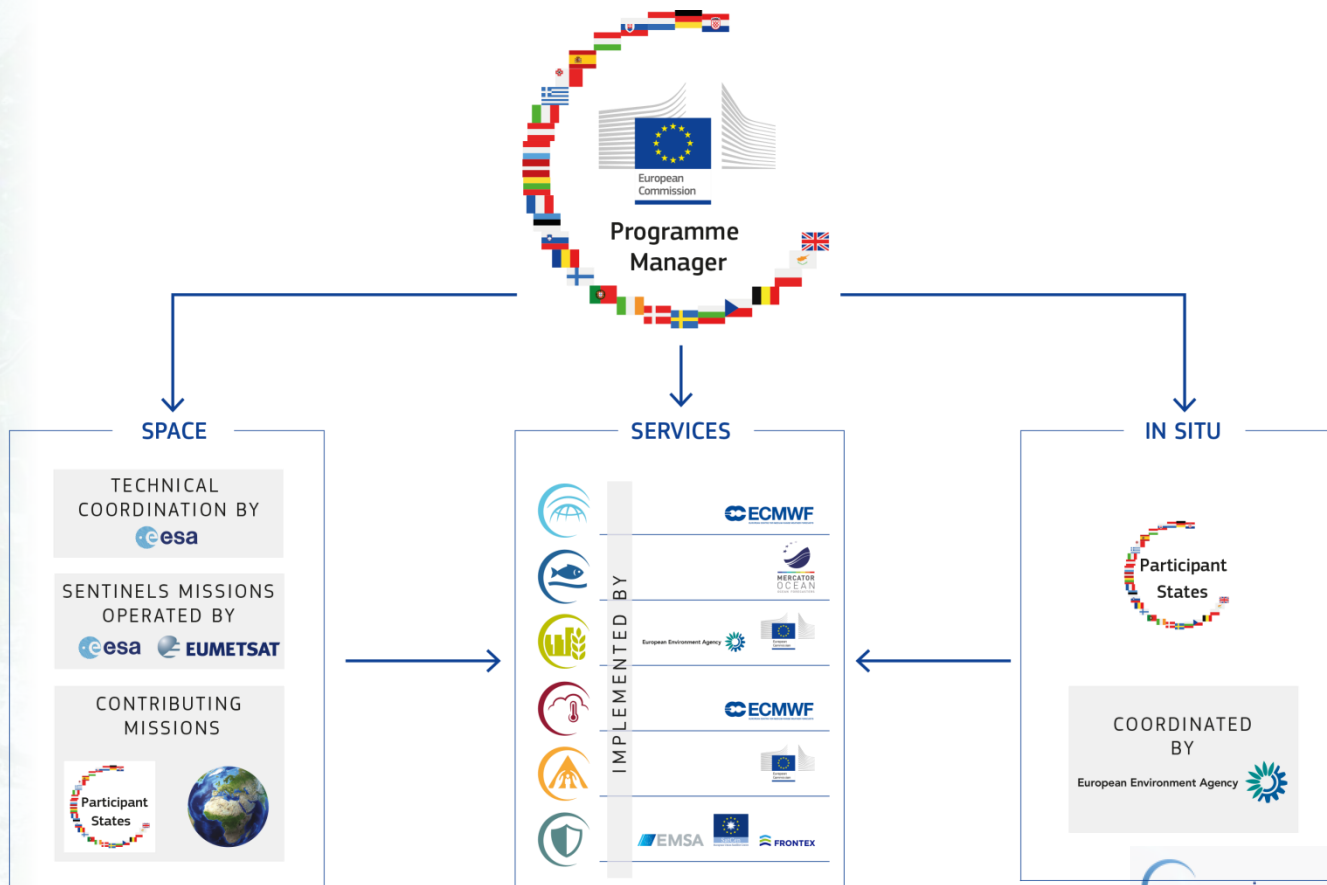
From research to operations





Copernicus

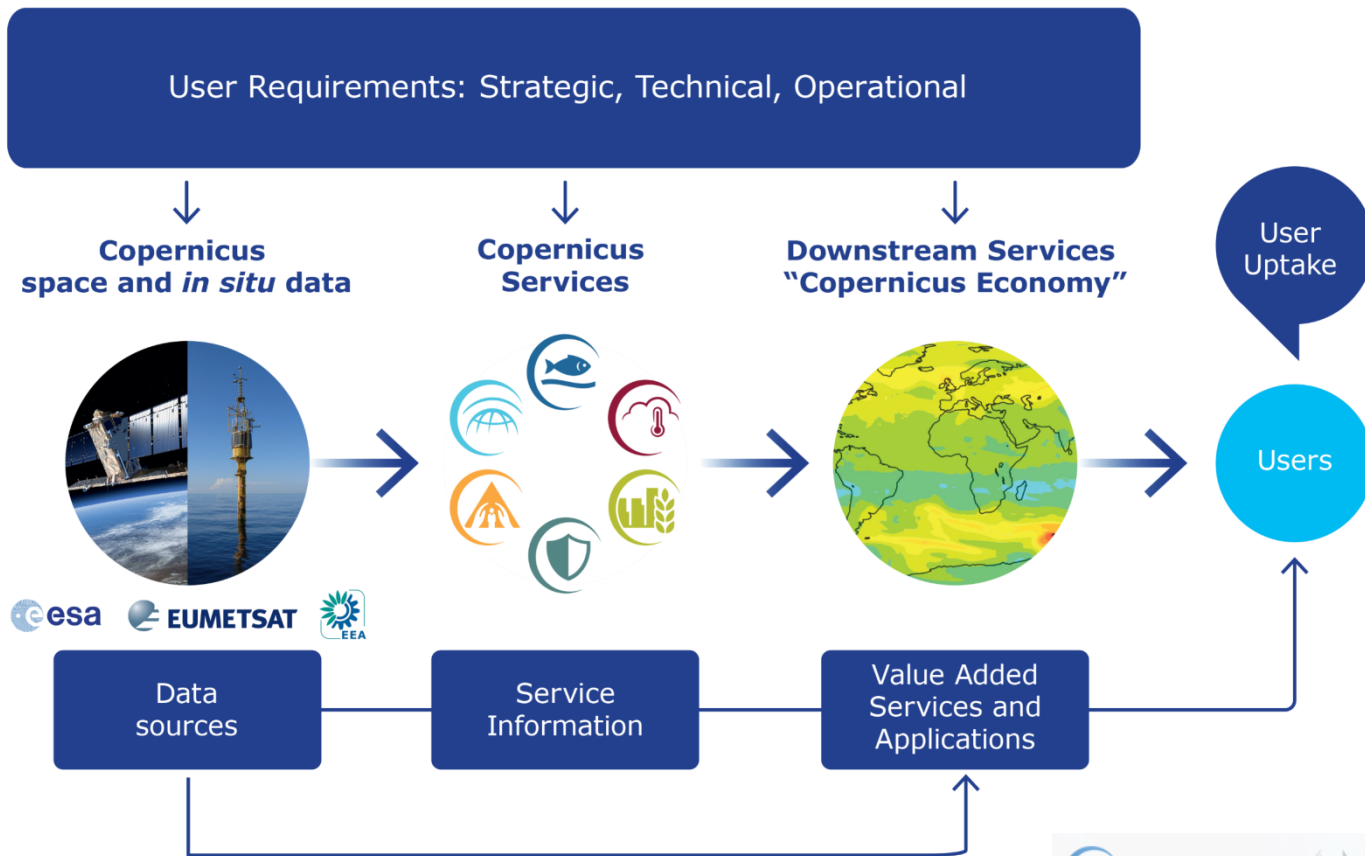
COPERNICUS GOVERNANCE





Copernicus

COPERNICUS IS DRIVEN BY THE USERS


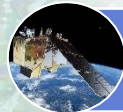









Copernicus

THE SENTINELS

Key Features

	SENTINEL-1: 4-40m resolution, 3 day revisit at equator	S1A and 1B in orbit	► Polar-orbiting, all-weather, day-and-night radar imaging
	SENTINEL-2: 10-60m resolution, 5 days revisit time	S2A and 2B in orbit	► Polar-orbiting, multispectral optical, high-resolution imaging
	SENTINEL-3: 300-1200m resolution, <2 days revisit	S3A in orbit S3B Spring 2018	► Optical and altimeter mission monitoring sea and land parameters
	SENTINEL-4: 8km resolution, 60 min revisit time	1st Launch 2020	► Payload for atmosphere chemistry monitoring on MTG-S
	SENTINEL-5p: 7-68km resolution, 1 day revisit	S5P launched 13/10/2017	► Mission to reduce data gaps between Envisat, and Sentinel 5
	SENTINEL-5: 7.5-50km resolution, 1 day revisit	1st Launch 2021	► Payload for atmosphere chemistry monitoring on MetOp 2 nd Gen
	SENTINEL-6: 10 day revisit time	1st Launch 2020	► Radar altimeter to measure sea- surface height globally



Space
Component

SENTINEL - 1



Key Features:

- SAR sensor - All-weather, day-and-night
- 9-40m resolution, 6 days revisit time at equator
- 2 launched on 3/4/2014 and 25/4/2016, 2 ordered

Contributes to:



Copernicus Land Monitoring Service



Copernicus Marine Environment Service



Copernicus Emergency Management Service



Copernicus Climate Change Service



Copernicus Security Service



Space
Component

SENTINEL - 2



Key Features:

- Multispectral optical sensor
- 10-60m resolution, 5 days revisit time
- First unit launched on 22/6/2015
- Second launched on 7/03/2017
- 2 more units are ordered

Contributes to:



Copernicus Land Monitoring Service



Copernicus Emergency Management Service



Copernicus Climate Change Service



Copernicus Security Service



Space
Component

SENTINEL - 3



Key Features:

- Medium resolution imaging and altimetry
- 300-1200m resolution, <2 days revisit time
- Monitors Sea and Land Surface Parameters
- First unit launched on 16/2/2016
- Second unit to be launched in Spring 2018
- 2 more units ordered

Contributes to:



Copernicus Land Monitoring Service



Copernicus Marine Environment Service

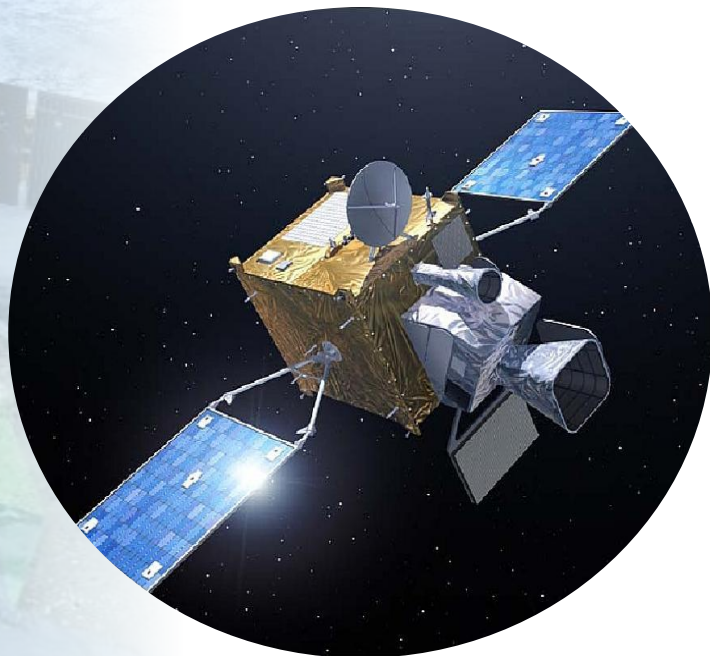


Copernicus Climate Change Service



Space
Component

SENTINEL - 4



Key Features:

- Onboard MTG-S
- Atmospheric Chemistry Mission
- 8km resolution, 60 min revisit time
- To be launched in 2022

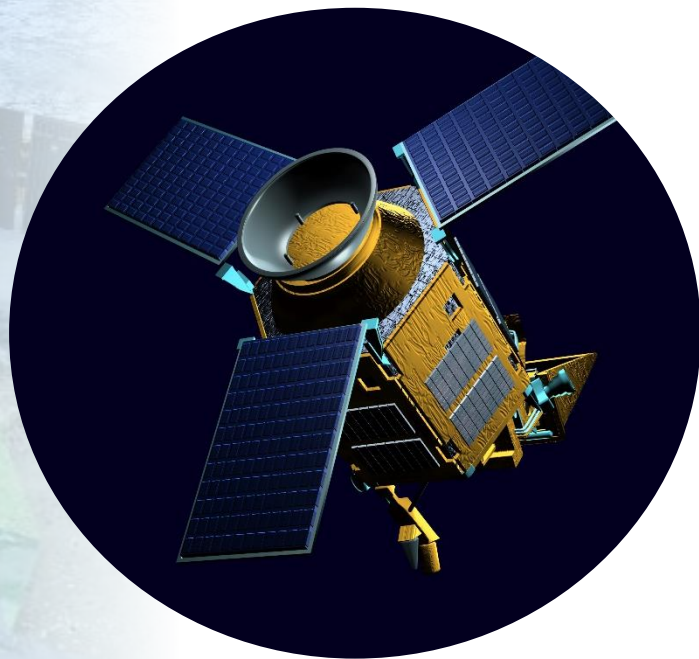
Contributes to:



Copernicus Atmosphere Service



Copernicus Climate Change Service



Key Features:

- Precursor of Sentinel-5
- Atmospheric Chemistry Mission
- 7-68km resolution, 1 day revisit time
- Launched on 13 October 2017

Contributes to:



Copernicus Atmosphere Service



Copernicus Climate Change Service



Space
Component

SENTINEL - 5



Key Features:

- Onboard MetOp 2nd Gen
- Atmospheric Chemistry Mission
- 7-50km resolution, 1 day revisit time
- To be launched in 2021

Contributes to:



Copernicus Atmosphere Service



Copernicus Climate Change Service



Space
Component

SENTINEL - 6



Key Features:

- Radar Altimeter
- Measures sea-surface height
- 10 days revisit time
- To be launched in 2020

Contributes to:



Copernicus Marine Environment Service



Copernicus Atmosphere Service

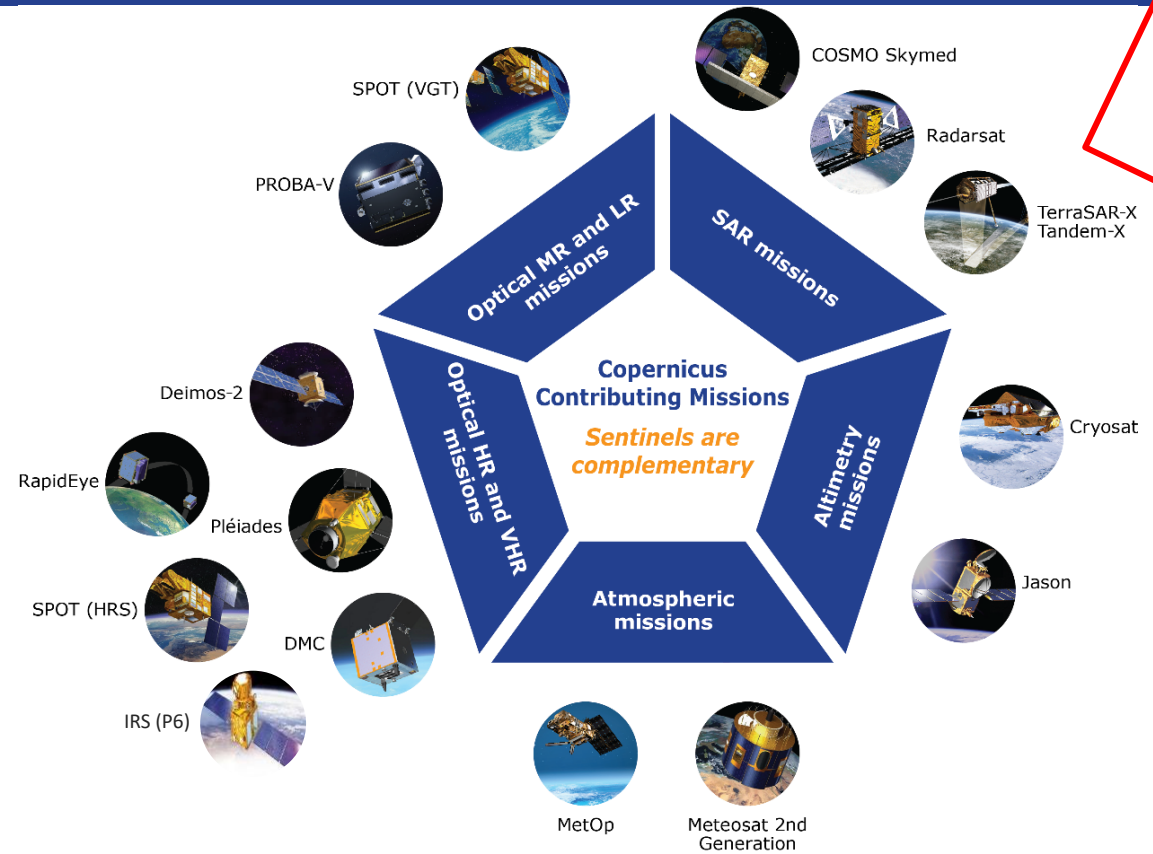


Copernicus Climate Change Service



Space
Component

THE CONTRIBUTING MISSIONS



Subject to Data
Owner's Data
Policy



In situ

IN - SITU : OVERVIEW

- *In situ* data = observation data from ground-, sea-, or air-borne sensors, reference and ancillary data licensed for use in Copernicus
- Use of *In situ* data:
 - Validate & calibrate Copernicus products
 - Reliable information services
- Implementation in two tiers:
 - Tailored *in situ* data for each Copernicus service level
 - Cross-cutting coordination across services by the EEA





Copernicus

COPERNICUS SERVICES

*Monitoring the State of the
Earth System Environment ...*

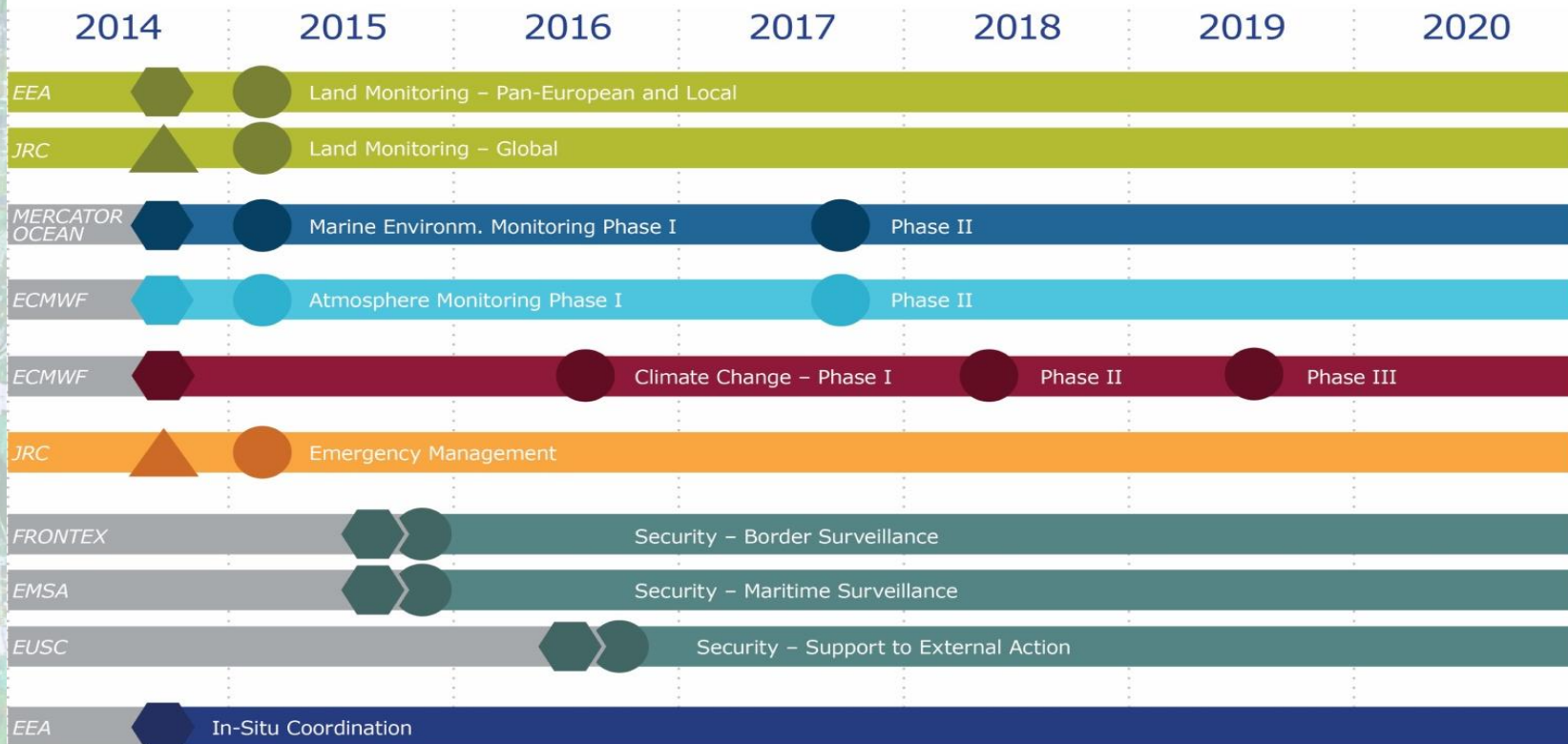


*... Six cross-cutting
Thematic Services*



Copernicus

SERVICES IMPLEMENTATION SCHEDULE



Legend: Delegation agreement Direct Management Operational phase



Land
Monitoring

Benefit areas and products examples

Ecosystems

Biodiversity

Agriculture

Forestry

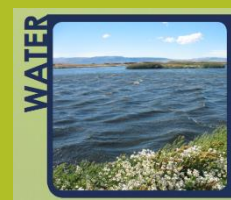
Energy

Natural Resources

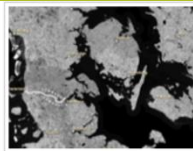
Water

Urban planning

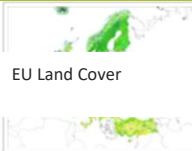
Global



Pan-European



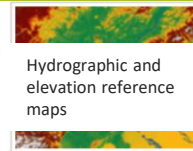
[Image Mosaics](#)



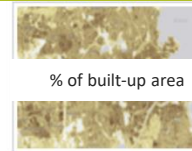
[CORINE Land Cover](#)



[High Resolution Layers](#)



[Reference Data](#)

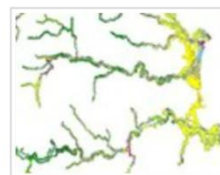


[Related Pan-European products](#)

Local



[Urban Atlas](#)



[Riparian Zones](#)



[Natura 2000 \(N2K\)](#)



Marine
Monitoring

Benefit areas and products examples

Marine safety

Marine resources

**Coastal and marine
environment**

**Climate and
meteorological
forecasting**

**Other: Transport,
Tourism,
Environment,
Pollution, Energy, etc.**



Sea Level

Ocean Salinity

Ocean Temperature

Sea Ice

Wind

Ocean Currents

Ocean Colour / Biogeochemistry
(e.g. optics, chlorophyll, biology, chemistry)



Atmosphere
Monitoring

Benefit areas and products examples

Health

Air Quality and Atmospheric Composition



Environment

Climate forcing



Pollution

Ozone layer & UV



Climate

Solar radiation



Renewable Energy

Emissions and surface fluxes





Climate
Change

Benefit areas and products examples

Climate change

**Mitigation and
adaptation**

Weather forecast

Pollution

Environment

Health

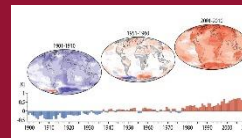
**Consistent Estimates of the
Essential Climate Variables (ECVs)**



**Support to Mitigation and
Adaptation Strategies**



**Global and Regional
Reanalyses**



**Seasonal Forecasts
And Climate Projections**





Benefit areas and products examples

**Disaster
Emergency
Situations**

**Humanitarian
Crises**



Risk & Recovery Mapping:

- Reference Maps
- Pre-disaster Situation Maps
- Post-disaster Situation Maps

Rapid Mapping:

- Reference Maps
- Delineation Maps
- Grading Maps

Early Warning:

- Floods: EFAS
- Forest Fires: EFFIS

EFAS = European Flood Awareness System;
EFFIS=European Forest Fire Information System



Security

Benefit areas and products examples

Border Surveillance

- Coastal monitoring
- Pre-frontier monitoring
- Reference mapping



Maritime Surveillance

- Maritime surveillance of an area of interest
- Vessel detection
- Vessel tracking and reporting
- Vessel anomaly detection



Support to EU External Action

- Road network status assessment
- Conflict damage assessment
- Critical infrastructure analysis
- Reference map
- Support to evacuation plans
- Crisis situation map
- Border map
- Camp analysis

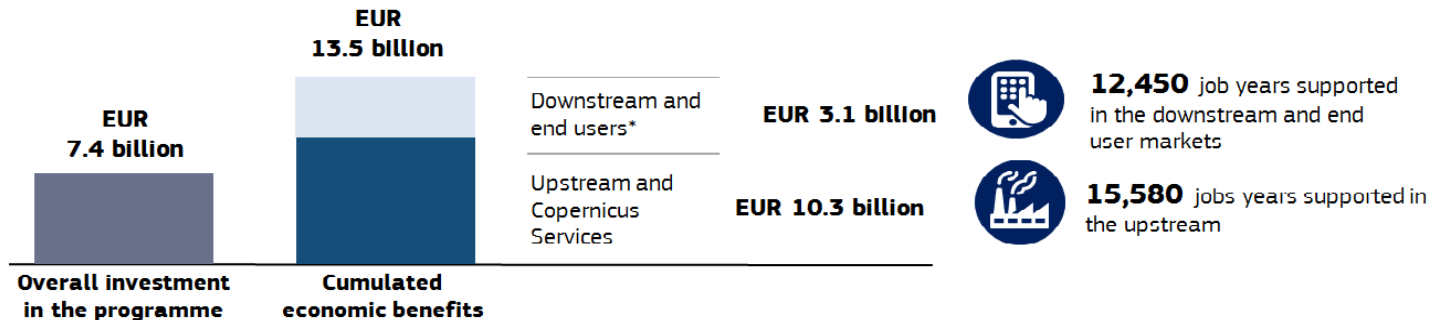




Copernicus

COPERNICUS MONETARY BENEFITS

Estimated direct monetary benefits between 2008 and 2020



Examples of existing Copernicus benefits

70% Cost reduction of a precision farming service in Austria, thanks to Copernicus



€ 60k Yearly savings for each construction company using a work progress monitoring app



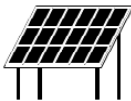
60% Higher accuracy for analysis of the impact of trans-boundaries pollutants on air quality



5% Productivity gain for fish farmers, by monitoring toxic algal blooms



50% Copernicus-based forecasts generate 50% more benefits to solar energy producers than traditional forecasts



€ 186M Benefits of Copernicus on the insurance market in 2015



* The Downstream and end user analysis includes only 8 value chains: Agriculture, Forestry, Urban Monitoring, Insurance, Ocean Monitoring, Oil & Gas, Renewable Energies and Air Quality. Estimates for end users were only calculated for Insurance, Oil&Gas and Urban Monitoring. The estimates of downstream and end user benefits should be seen as extremely conservative because they were calculated a year after the launch of the first Sentinel satellite. Benefits are likely to increase significantly as more Sentinels become operational.



Copernicus

COPERNICUS BROADER BENEFITS

Climate change & Environment



Development & Cooperation

Security & Defence



Tourism

Health



Insurance & Disaster management

Blue economy



Urban planning...

Energy & Natural resources



Forestry...



EXAMPLE OF COPERNICUS BENEFITS



Pipeline Infrastructure
Monitoring in the
Netherlands

Benefits for the
Netherlands:
€15 to €18 M/year



Forest Management in
Sweden

Benefits for Sweden:
€16 to €22 M/year



Winter Navigation in the
Baltic

Benefits for Sweden
and Finland:
€24 to €106 M/year



User
Uptake



Agriculture sector: Examples of benefits

*More affordable applications based on **Free Sentinels 1 and 2 Data and the Land Service Products***

- **Precision farming** applications such as yield mapping, input management, farm management recording, etc.
- **Seasonal mappings** of cultivated areas
- **Field scale and crop dynamics** mapping
- **Irrigation management** and drought monitoring
- **Food security** monitoring
- **Agriculture development** in Africa



Sources: PwC-Strategy& analysis & European Commission



€78M

More efficient use of
agricultural inputs



Better quality food production



More efficient and
appropriate use of fertilizers



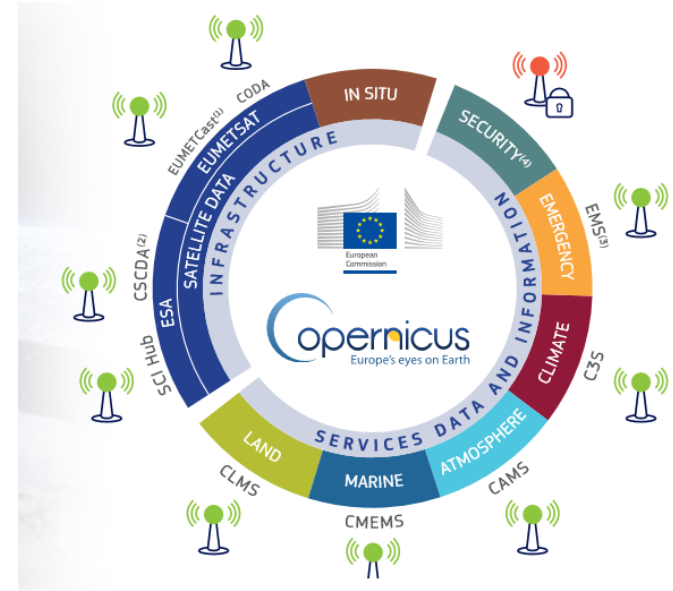
Expected Copernicus enabled revenues



User Uptake

Copernicus Data Access Overview

- Satellite Data distribution Hubs
 - Sentinels
 - Contributing missions
 - Access to images in NRT
 - Access to archives
- Services Information portals for
 - Added value products, indicators
 - Models
 - Archives, Near Real Time and Forecasts products



Note: Copernicus in situ component provides in situ data access, serving the Copernicus services. It is not delivering in-situ data to the end-users.




User
Uptake

COPERNICUS DATA ACCESS: KEY LINKS

Access to Satellite data

FULL, FREE AND OPEN




sentinel data hub

Scientific and Other Access

<https://scihub.copernicus.eu/>

esa



CSC data access

*Copernicus Space Component
Data Access Portal**
CSC-DA

<https://spacedata.copernicus.eu/>

FULL, FREE AND OPEN

EUMETSAT

- Copernicus Online Data Access (CODA)
- EUMETCast:
www.eumetcast.com
Needs to get a station and pay a yearly fee

Access to Copernicus Services Data

- Land-related data: <http://land.copernicus.eu>
- Atmosphere-related data: <http://atmosphere.copernicus.eu>
- Marine-related data: <http://marine.copernicus.eu>
- Emergency-related data: <http://emergency.copernicus.eu>
- Climate change-related data: <http://climate.copernicus.eu> (Beta version)

FULL, FREE AND OPEN

(*) Includes instructions on how to access Contributing Missions data



User
Uptake

THE BIG DATA CHALLENGE

- **Massive amounts of data**
- **Full, open and free-of-charge**



**Over 10 Petabyte/year
of new data**

with just Sentinels-1, -2
and -3 fully operational
(data are downloaded
many time over)

- Different types of **dissemination** infrastructures
- **New technology** developments
- ICT and EO **cross-fertilisation**
- **Interoperability** with non-EO datasets
- Global EO **competition**
- Growth and jobs in **downstream** sector



User
Uptake

C O P E R N I C U S B I G D A T A A P P R O A C H

Dual approach:

- Strong Copernicus Distribution Services for download
- Imminent launch of several **Data Access and Information Services (DIAS)**
 - Access to all Copernicus data and information collocated with computing resources
 - Big Data analytics without the need to download the data and information
 - Data fusion with non-EO data and information

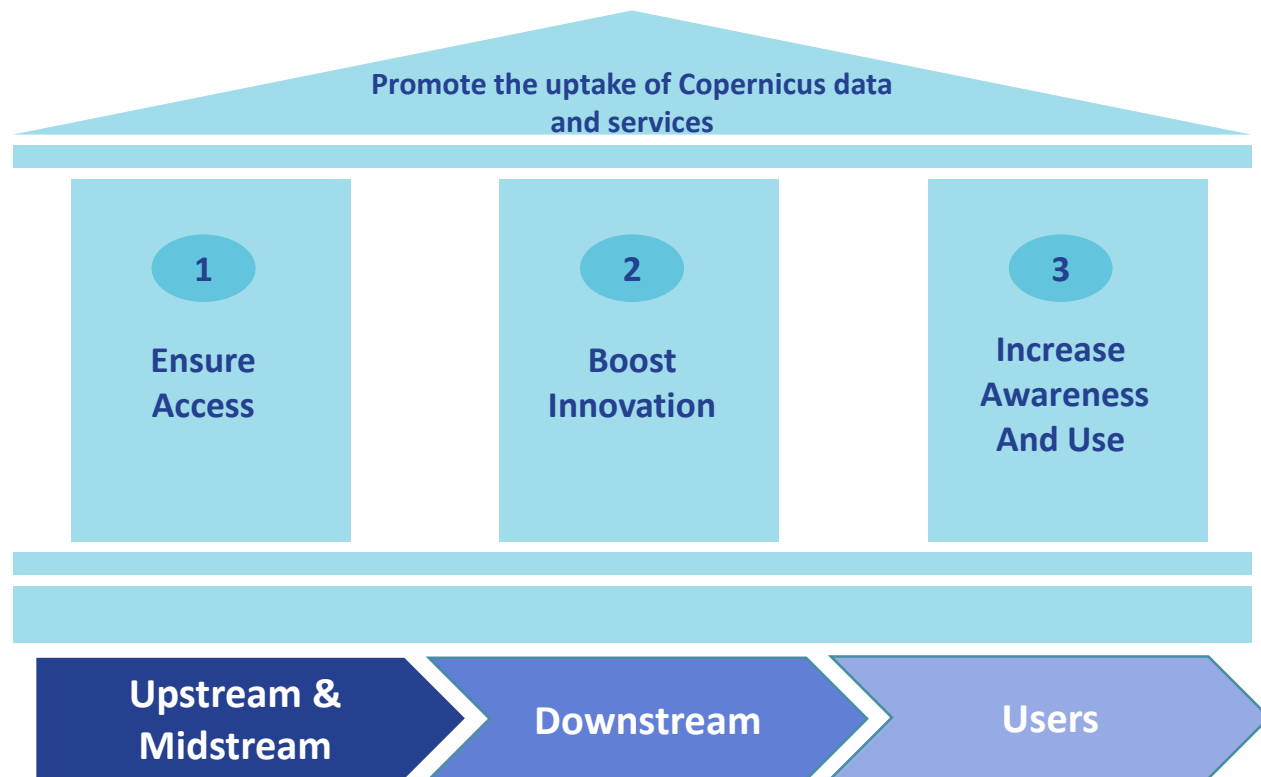
Overall **ensuring that Copernicus data is easily accessible and used!**





User Uptake

C O P E R N I C U S U S E R U P T A K E S T R A T E G Y





User
Uptake

COPERNICUS USER UPTAKE STRATEGY

Basis

=

**Full, free and open
data policy**

Objective: maximizing the socio-economic benefits of Copernicus

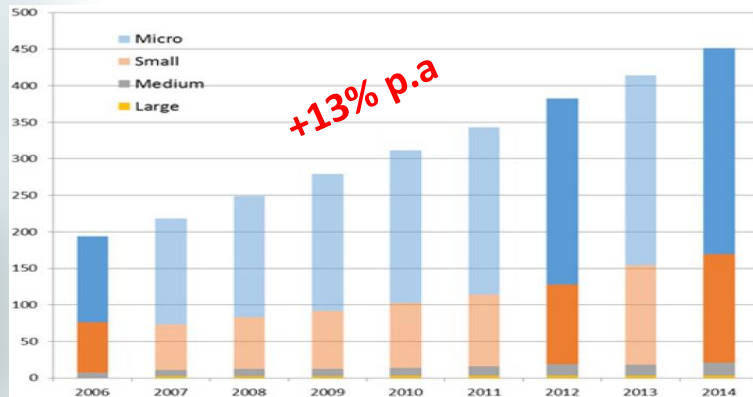
Challenge: geospatial data (including Copernicus) are difficult to use by non-experts

Strategy: support the emerging downstream ecosystem, which use Copernicus data and services to create products for non-experts



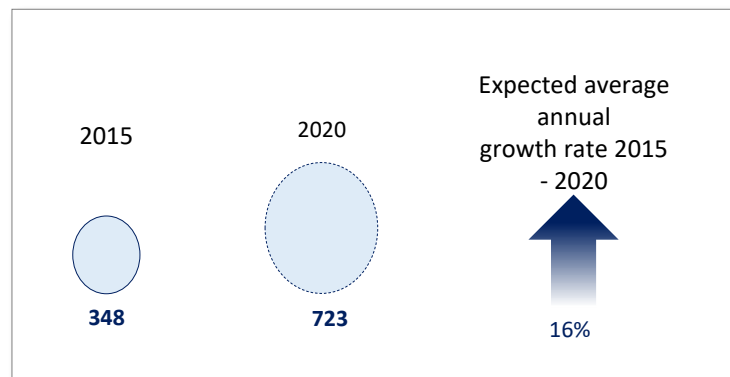
User
Uptake

A NEW DOWNSTREAM ECOSYSTEM



Commercial annual benefits
of Copernicus (in EUR million)

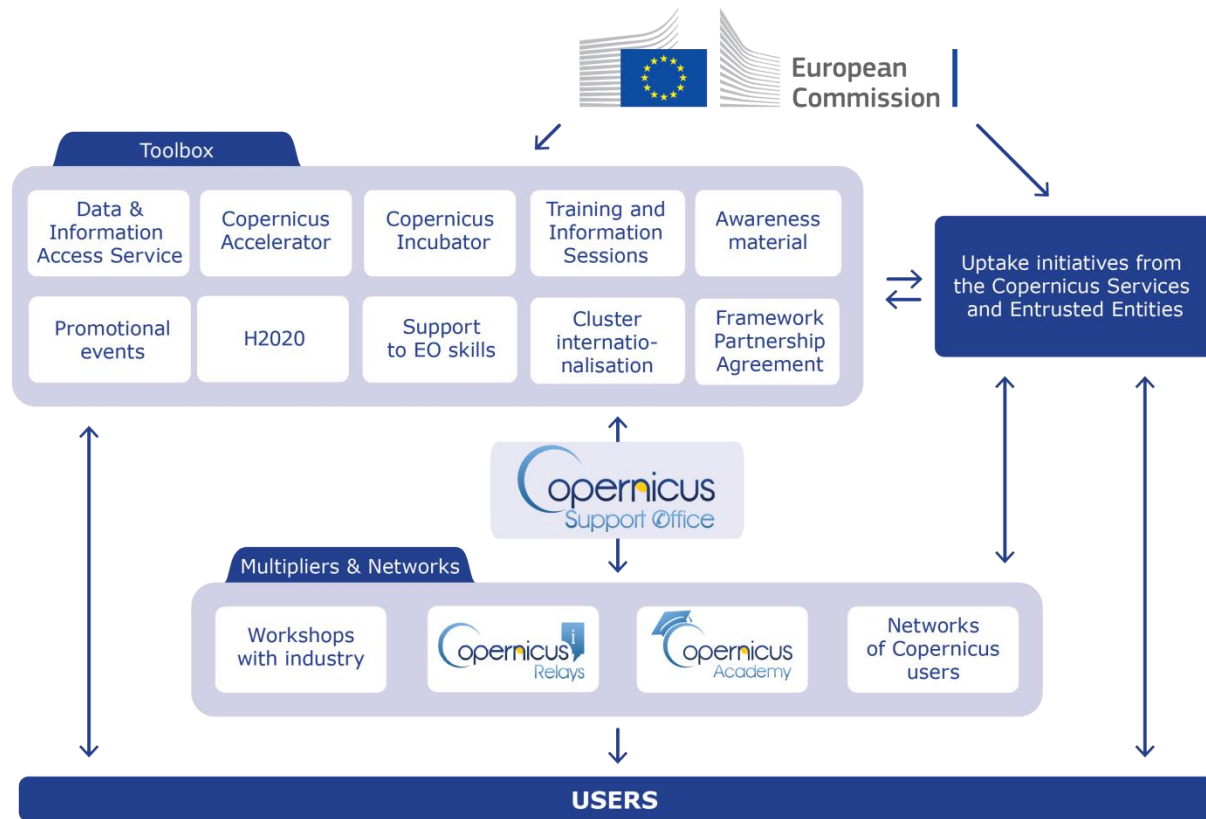
Number of Earth Observation companies
in Europe





User Uptake

COPERNICUS USER UPTAKE INITIATIVES





Copernicus

CONCLUSIONS

The Union **Earth Observation** and monitoring programme

Increase general knowledge
on the state of the Planet



Protect people
and assets



Improve environmental
policy effectiveness



Facilitate adaptation
to climate change



Monitor
the environment



Foster downstream
applications in
a number of fields



Help managing emergency
and security related situations