AI4EO

Special Topics in Applications (AIL861)
Artificial Intelligence for Earth Observation
Lecture 17

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Copernicus

- ✔ European Union's Earth Observation Program.
- ✔ It offers information services based on satellite Earth Observation and in situ (non-space) data.
- ✔ Free access to Data.

Copernicus

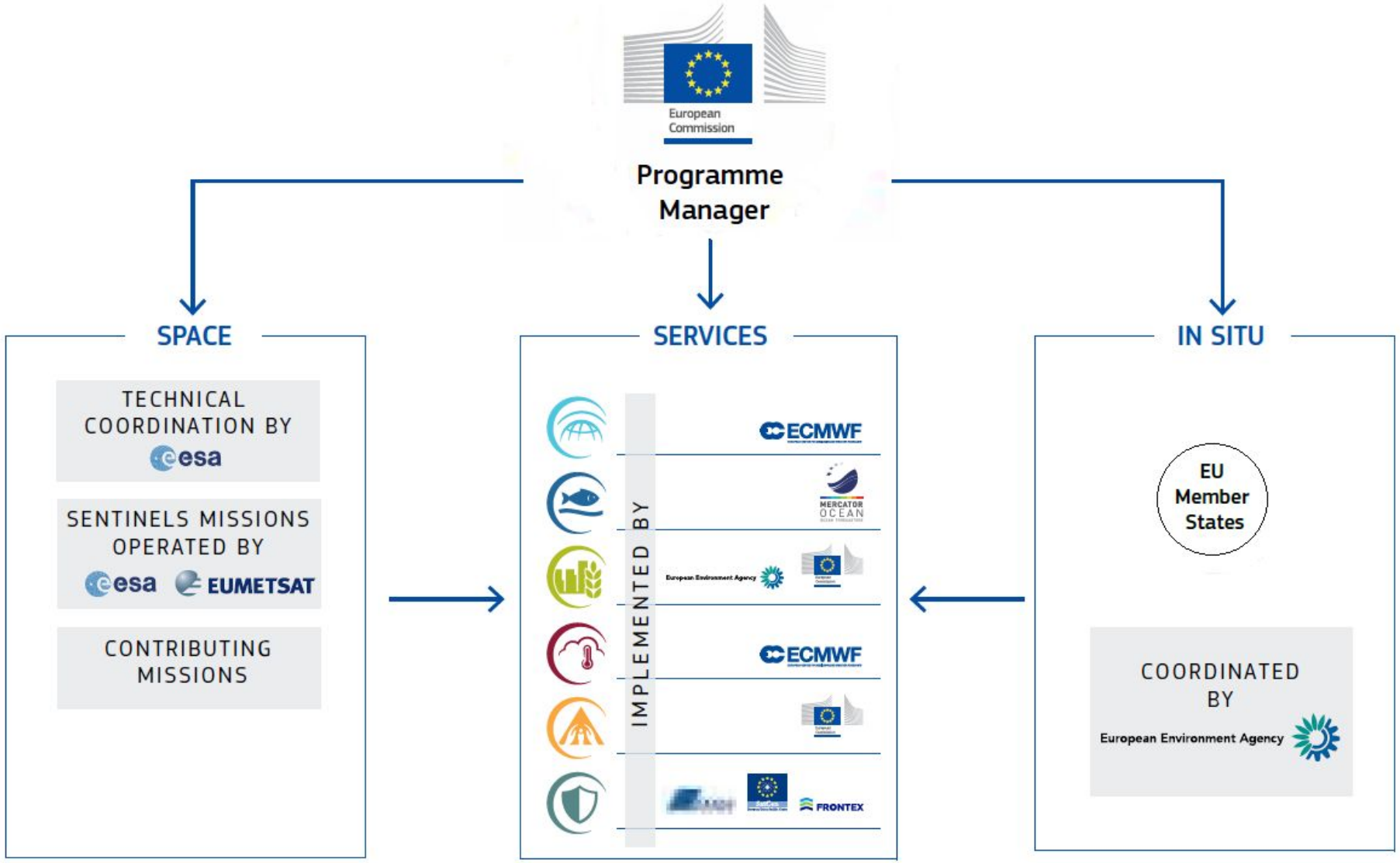
Tasks:

- ✔ Timely accessible information to improve the environment management-
- ✔ Prepares for crises, disasters, and security risks.
- ✔ Understand and mitigate the effects of climate change.

Copernicus

- ✔ Climate change
- ✔ Marine monitoring
- ✔ Atmosphere monitoring
- ✔ Land monitoring
- ✔ Security
- ✔ Emergency management

Copernicus


European Commission
Programme Manager
SPACE
TECHNICAL COORDINATION BY
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SERVICES
IMPLEMENTED BY
ECMWF
MERCATOR OCEAN
European Environment Agency
ECMWF
FRONTEX
IN SITU
EU Member States
COORDINATED BY
European Environment Agency

Sentinel-1

Key Features:

- SAR sensor – All weather, day and night
- 6 days revisit time at equator, data available in resolutions as explained in https://sentinels.copernicus.eu/web/sentinel/user-guides/sentinel-1-sar/resolutions/level-1-ground-range-detected
- 2 launched on 3/4/2014 and 25/4/2016

Sentinel-2

Key Features:

- High resolution, multispectral optical sensor
- 10-60m resolution, 5 days revisit time
- First unit launched on 23/6/2015
- Second unit launched on 7/3/2017

Sentinel-3

Key Features:

- Medium resolution imaging and altimetry
- 300-1200m resolution, <2 days revisit time
- Monitors Sea and Land Surface Parameters
- First unit (3A) launched on 16/2/2016
- Last (3D) launched in 2021

Sentinel-4

Key Features:

- Onboard MTG-S
- Atmospheric Chemistry Mission
- Main objective: To monitor air quality trace gases and aerosols
- 8 km resolution, 60 min revisit time
- Not launched

Sentinel-5P

Key Features:

- Precursor of Sentinel-5
- Atmospheric Chemistry Mission
- 7- 68 resolution, 1 day revisit time
- Launched on 13/10/2017

Sentinel-5P Application Example

APPLICATIONS

Methane emissions detected from Madrid landfill on 20 August 2021

10/11/2021 1619 VIEWS 13 LIKES 461178 ID

Source: esa.int

Sentinel-6

Key Features:

- Radar altimeter
- Measures sea-surface height
- 10 days revisit time
- Launched in 2020

Copernicus Data Access

Atmospheric Monitoring

- ✔ Copernicus Atmosphere Monitoring Service (CAMS) provides continuous data on atmospheric composition.
- ✔ The service describes the current situation, forecasts the situation a few days ahead, and analyses consistently retrospective data records for recent years
- ✔ Atmosphere-related data: http://atmosphere.copernicus.eu

Marine Monitoring

- ✔ Copernicus Marine Environment Monitoring Service (CMEMS) provides regular information on the dynamics of the ocean and marine ecosystems.
- ✔ The observations and forecasts produced by the service support all marine applications, including:
  - ❑ Marine safety;
  - ❑ Marine resources;
  - ❑ Coastal and marine environment;
  - ❑ Weather, seasonal forecasting and climate.
- ✔ Marine-related data: http://marine.copernicus.eu

Ocean Parameters

- ✔ Sea level
- ✔ Ocean salinity
- ✔ Ocean temperature
- ✔ Sea ice
- ✔ Wind
- ✔ Ocean currents

Temperature

- ✔ Sea surface temperature (SST) is the temperature of the ocean near the surface. Knowing the temperature of this part of the ocean is absolutely essential for many reasons.

- ✔ How is it measured ?
  - ❑ Infrared radiometers
  - ❑ Microwave radiometers

Salinity

- ✔ Sea Surface Salinity is a key parameter to estimate the influence of oceans on climate. Along with temperature, salinity is a key factor that determines the density of ocean water and thus determines the convection and re-emergence of water masses.

- ✔ It is measure using microwave radiometers.

Sea Ice

- ✔ Changing climate – crucial to measure polar sea ice.

- ✔ Measured using microwave radiometers, microwave scatterometers, infrared sensors, SAR sensors, and Altimeters.

Land Monitoring

- ✔ Copernicus Land Monitoring Service (CLMS) provides geographical information on land-cover.
- ✔ Land-related data: http://land.copernicus.eu

AI4EO

AI for Climate

- Monitoring impacts of climate change
- Identifying the regions where immediate attention is required
- Filling the gap in weather/climate data
- Enriching physics-based climate models
- AI to promote eco-friendly energy production
- AI to promote sustainable green future
- Creating awareness about climate change