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The Future of Earth Observation

Technology, trends and applications in agriculture

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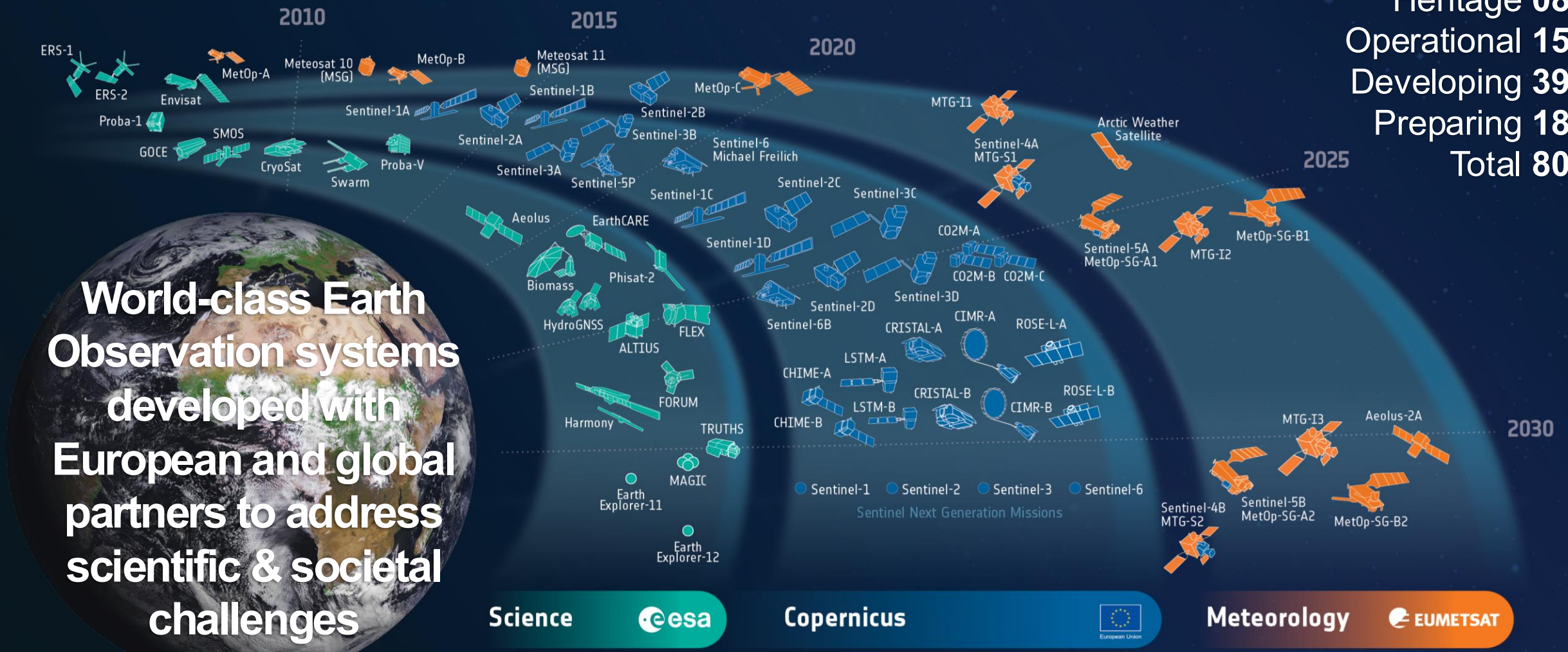
TAKING THE PULSE OF THE PLANET

ESA's Earth Observation Missions

Satellites

Heritage **08**
Operational **15**
Developing **39**
Preparing **18**
Total **80**



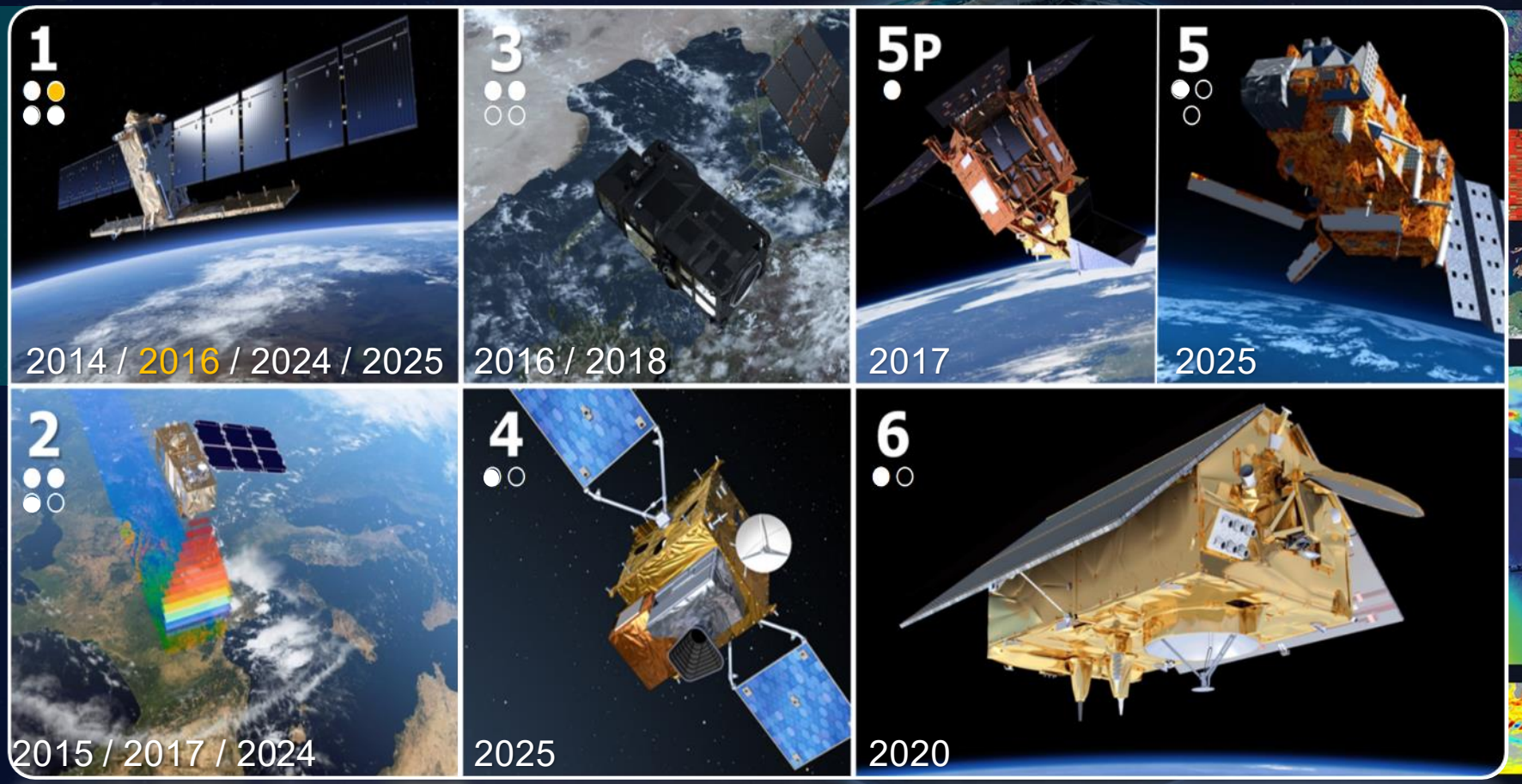
World-class Earth Observation systems developed with European and global partners to address scientific & societal challenges

The Copernicus Space Component – Sentinels

PROGRAMME OF THE EUROPEAN UNION

esa

Copernicus is the largest producer of EO data in the world



sentinel-1
→ RADAR VISION

sentinel-2
→ COLOUR VISION

sentinel-3
→ A BIGGER PICTURE

sentinel-4
→ EUROPEAN AIR MONITORING

sentinel-5p | sentinel-5
→ GLOBAL AIR MONITORING

sentinel-6
→ SURFING THE SEAS

* ESA Sentinel Data Policy (Sep 2013) and
EU Delegated Act on Copernicus Data and Information Policy (Dec 2013)

The Copernicus Space Component – Evolution

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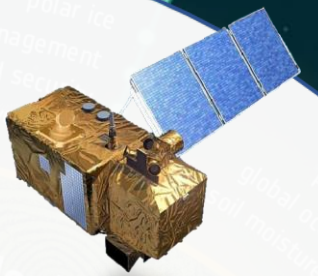
CHIME
Copernicus Hyperspectral Imaging Mission for the Environment

ROSE-L
L-band Radar Observing System

LSTM
Land Surface Temperature Monitoring

Sentinel-1 NG



Sentinel-2 NG

CIMR
Copernicus Imaging Microwave Radiometer

+ Next Generation Sentinels for data continuation and enhanced observations

Sentinel-3 TOPO/OPT NG

CO2M
Copernicus Anthropogenic Carbon Dioxide Monitoring

CRISTAL
Copernicus Polar Ice and Snow Topography Altimeter

The Technological Trio:

Turning raw data into policy and business-grade insights

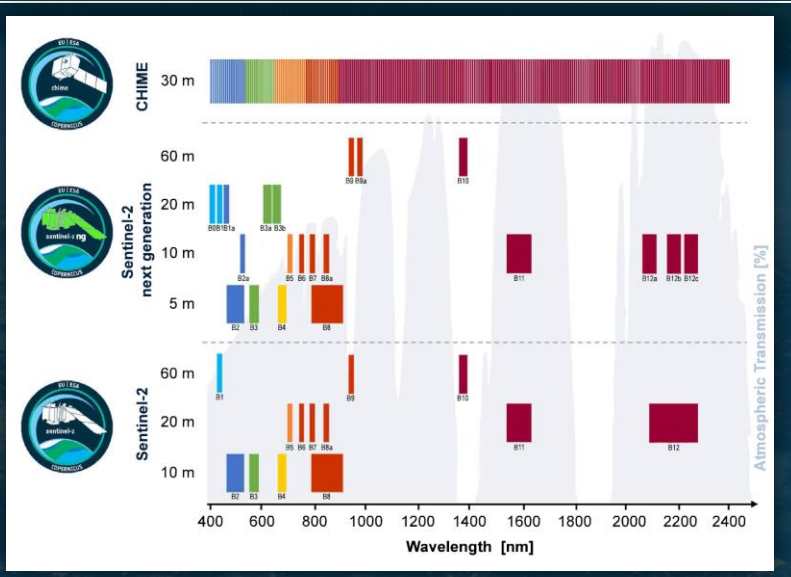
- **Why EO?**
  Provides up to **parcel-specific, objective** truth from space, slashing basis risk.
  - global, independent, consistent
- **Why AI?**
  To automatically detect crops, assess health, and quantify
  - pattern recognition, automation, forecasting.
- **Why the Cloud?**
  To process continental-scale data in hours, not months. A pay-as-you-go model that **eliminates massive IT investment.**
  - scalable, API-ready delivery

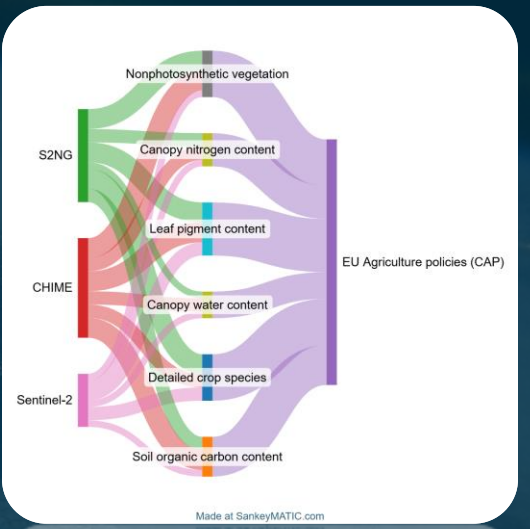
4
missions

30 TB
Daily data production

350 TB
Satellite data distributed per day

Earth Observation: Powering Sustainable Agriculture and Food Security





Global Insight: Provides harmonized, timely data on crops and land use worldwide.

Informs Policy: Monitors sustainability compliance and reduces need for physical inspections.

Manages Risk: Enables early warning for drought and yield loss to protect food security.

Bridges the Gap: Turns satellite data into actionable intelligence for policymakers.

Figures credits: FAO, Berger et al.

WorldCereal

Phase I
Scientific and technical feasibility study

Phase II
Operational and flexible crop mapping service

WorldCereal

- ✓ **User-friendly cloud-based** processing system
  (powered by OpenEO and Copernicus Data Space Ecosystem)
- ✓ New set of global products for **11 crop types**
  (maize, winter cereals, spring cereals, sunflower, rapeseed, millet, sorghum, wheat, barley, rye, soybean)
- ✓ **Customizable** crop type model training and application
- ✓ Addition of crop **yield** module to the system
- ✓ Focus on **capacity building** → towards increased adoption of the system

Comparative Study on Early Warning Systems

Different operational Early Warning Systems available

Confusing for potential users

Methods? Performance? Best suited for my area?

Global versus national approach?

Single system vs. Ensemble?

How to improve drought Early Warning?

High resolution crop masks?

Crop calendars?

NRT → forecasting?

Crop Monitor EARLY WARNING

European Commission

ASAP - Anomaly Hotspots of Agricultural Production

HARVEST

GLOBAL AGRICULTURE MONITORING SYSTEM

GIEWS - Global Information and Early Warning System on Food and Agriculture

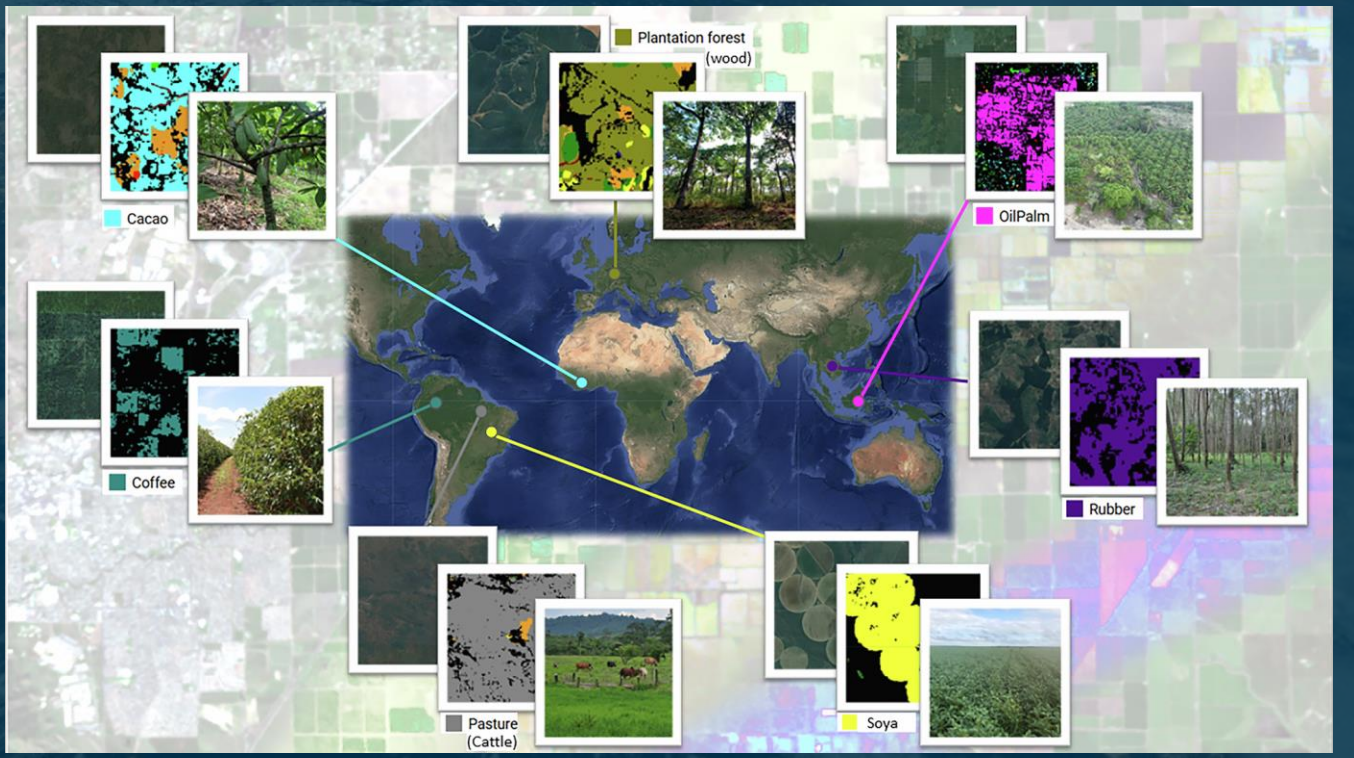
CropWatch

World AgroCommodities

- **Development of a pre-operational monitoring system to support the implementation of the EUDR by EU Member States**

WorldAgroCommodities

- a free and open system will align with the requirements and needs of the **Competent National Authorities (CNAs)** responsible for monitoring the compliance of **operators** and traders
- on 31 May 2023, the European Parliament and the Council of the European Union adopted the regulation **(EU) 2023/1115** on the making available on the Union market and the export from the Union of certain commodities and products *associated with deforestation and forest degradation*.



Take Home Message

- **Long term data availability is secured** for the next decades by national and international programmes like the European Copernicus, the US Landsat, …
- Data policies with **full, free and open-access** satellite data are spreading and enable **transparency** of information;
- **On ground reference data** are essential to unplug the wealth from synergy with satellite data and models;
- We are in a **data rich period**, a good basis for high quality products and services, with clear **uncertainty** levels and **consistency** over time;
- IT capabilities like **cloud computing** and **AI** enable **dense time series analysis** and **analytics** at large scale, and **bridge the digital divide;**
- Let’s do the next step in **agricultural monitoring!**

Thanks for your attention!

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