



# Copernicus the EU's Earth Observation Programme

**Astrid-Christina Koch**  
**Space Data for Societal Challenges and  
Growth**

**European Commission**  
**DG GROWTH**

*APSDEU – NAEDEX Meeting,  
9 October 2015*

Follow us on:



Space



- Copernicus – an introduction
- Space Component
- Service provision
- Data management

# Objectives



## "The Union Earth observation and monitoring programme"

Monitor the environment



Protect people and assets



Increase general knowledge on the state of the Planet



Improve environmental policy effectiveness



Facilitate adaptation to climate change

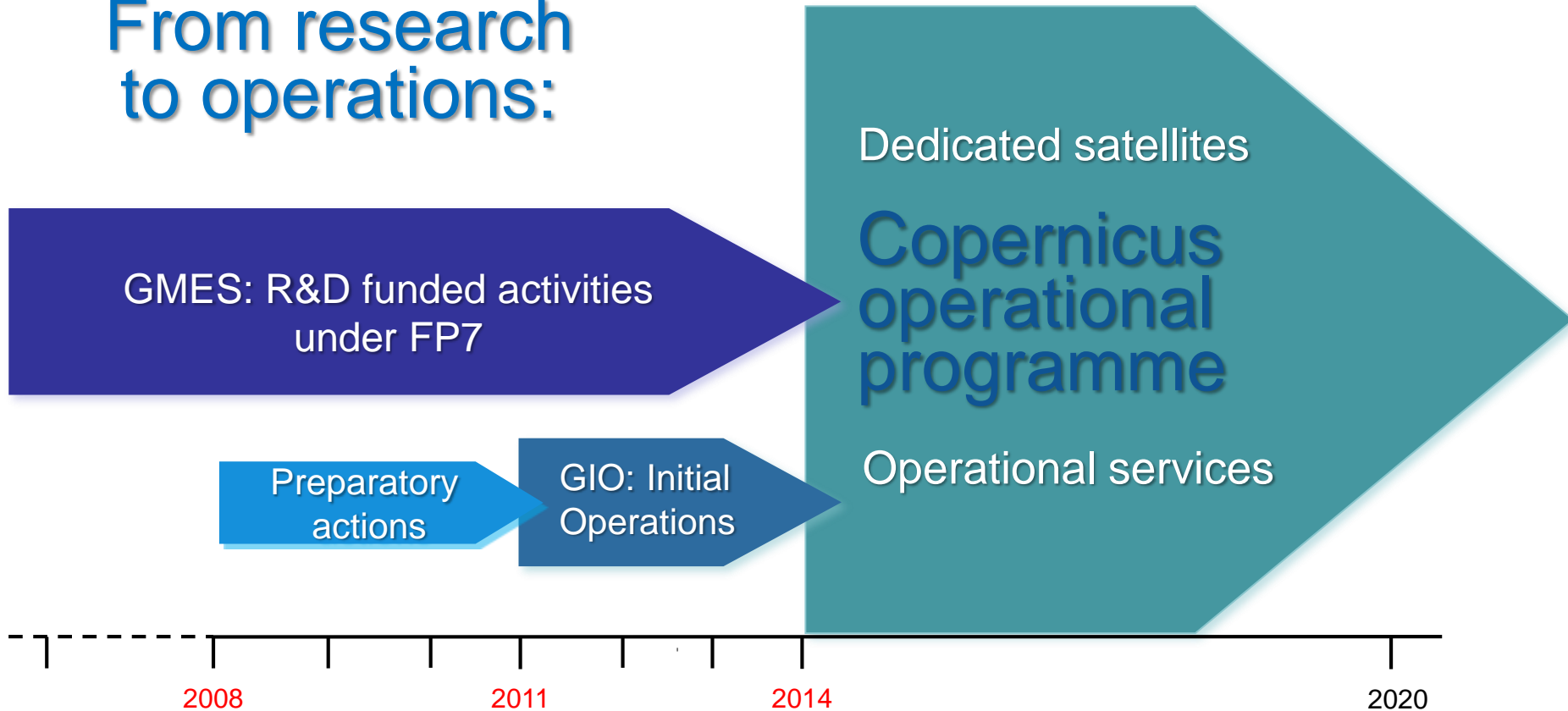
Foster downstream applications in a number of fields



Help managing emergency and security related situations



## From research to operations:



€ 1.3 Bn → € 4.3 Bn

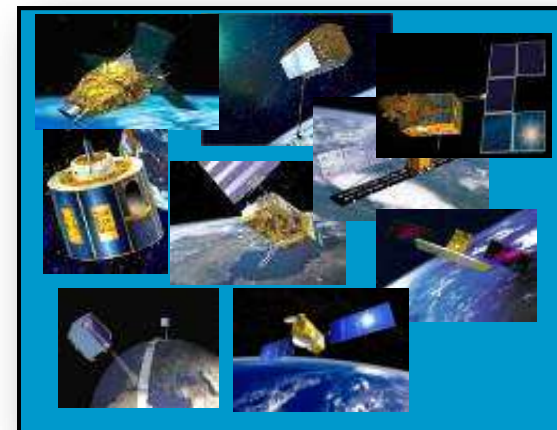
## Eight Milestones reached:

- **Budget of € 4.3 Bn for 2014-2020**
- **Full, free and open access to data**
- **Successful launch of Sentinel 1A & 2A**
- **Programme Regulation adopted**
- **First images presented**
- **Funds delegated to ESA/EUMETSAT**
- **Four services are operational delivering 24h/7d**

# Copernicus architecture

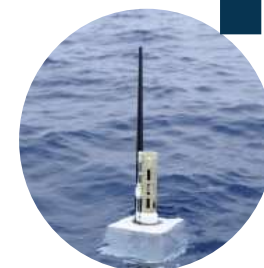
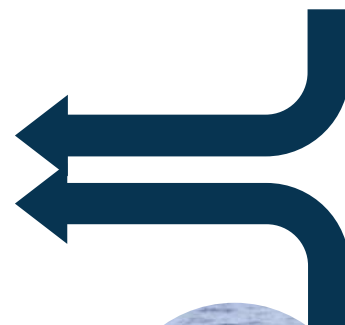


6 services use Earth Observation data to deliver ...



Sentinels

Contributing missions



...added-value products

in-situ

Each Sentinel is technically different to meet the needs of the 6 services



**Sentinel 1** – radar imaging  
All weather, day/night applications



**Sentinel 2** – Optical imaging  
Land applications: urban, forest, agriculture,..



**Sentinel 3+6** – Ocean and global land monitoring, high precision ocean altimetry



**Sentinel 4+5** – Atmosphere composition monitoring, from a geostationary (-4) and a polar orbit (-5)

# 6 operational Services



Monitoring the State of the Earth System Environment ...



... cross-cutting Thematic Services

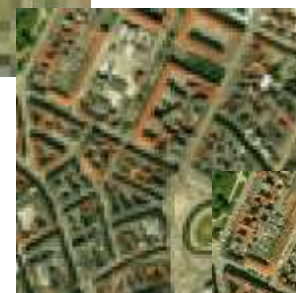
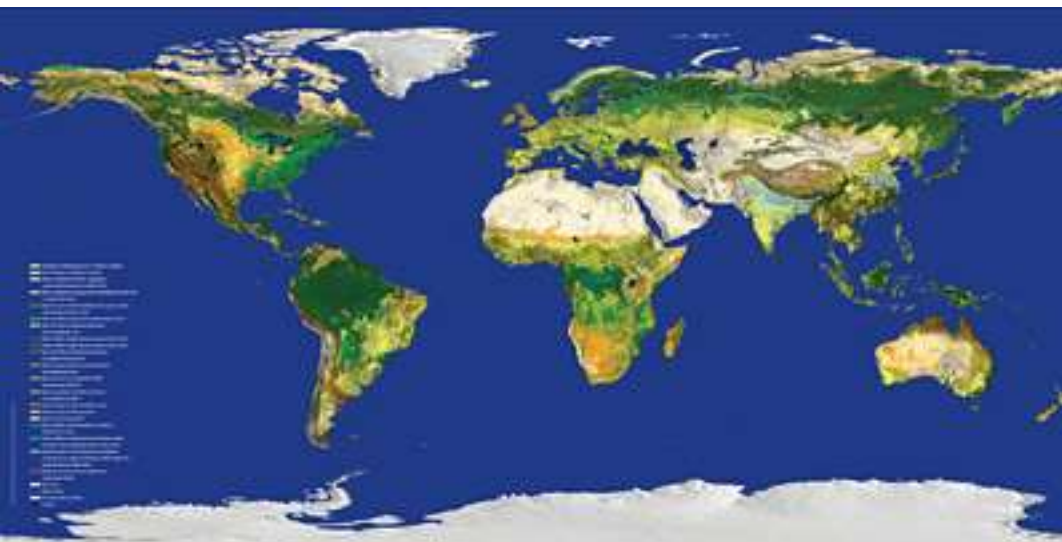






# Copernicus Land Monitoring Service





**From global...**

**e.g. Vegetation dynamics,  
Bio-physical parameters,  
energy balance**

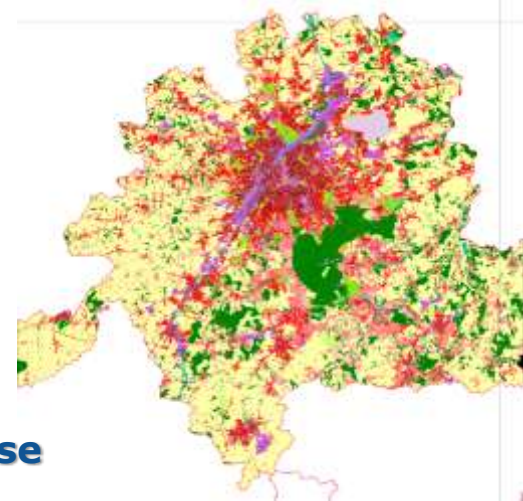
**...to pan-European...**

**e.g. bio-diversity, water  
bodies, land-use, land change**



**...to local**

**e.g. urban land-use**



## 9 groups of products (vegetation-energy-water) providing a picture of the world every ten days

<i>Variable</i>	<i>Temporal Coverage</i>	<i>Temporal resolution</i>	<i>Spatial coverage</i>	<i>Spatial resolution</i>	<i>Sensor</i>
<b>LAI/FAPAR/FCover</b>	<b>1999 – present</b>	<b>10 days</b>	<b>Global</b>	<b>1km</b>	<b>SPOT/PROBA V</b>
<b>NDVI/VCI/VPI</b>	<b>1999 – present</b>	<b>10 days</b>	<b>Global</b>	<b>1km</b>	<b>SPOT/PROBA V</b>
<b>Dry Matter Productivity</b>	<b>2009 – present</b>	<b>10 days</b>	<b>Global</b>	<b>1km</b>	<b>SPOT/PROBA V</b>
<b>Burnt Area</b>	<b>1998 – present</b>	<b>1 day</b>	<b>Global</b>	<b>1km</b>	<b>SPOT/PROBA V</b>
<b>TOC Reflectance</b>	<b>2013 – present</b>	<b>10 days</b>	<b>Global</b>	<b>1km</b>	<b>SPOT/PROBA V</b>
<b>Surface Albedo</b>	<b>1999 – present</b>	<b>10 days</b>	<b>Global</b>	<b>1km</b>	<b>SPOT/PROBA V</b>
<b>Land Surface Temperature</b>	<b>2009 – present</b>	<b>1 hour</b>	<b>Global</b>	<b>0.05 °</b>	<b>Σ Geo</b>
<b>Soil Water Index</b>	<b>2007 – present</b>	<b>1 day</b>	<b>Global</b>	<b>0.1 °</b>	<b>Metop / ASCAT</b>
<b>Water bodies</b>	<b>1999 – present</b>	<b>10 days</b>	<b>Global*</b>	<b>1km</b>	<b>SPOT/PROBA V</b>

Current service evolution : move from 1 km resolution to 300 m (EU)

## INTERNET dissemination

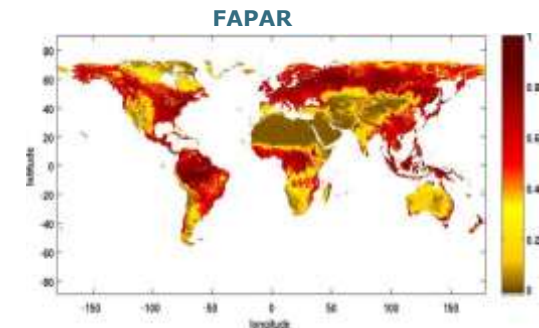
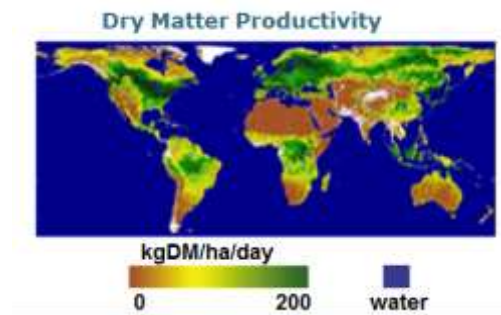
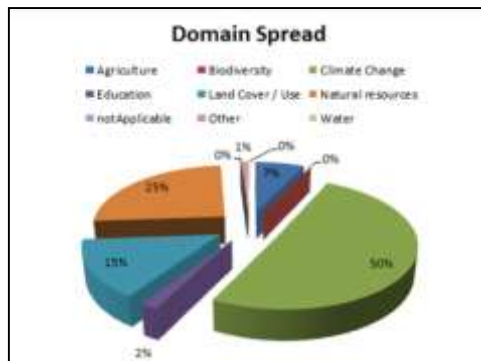
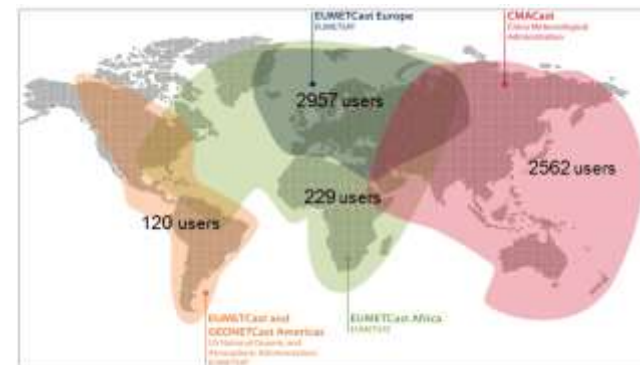
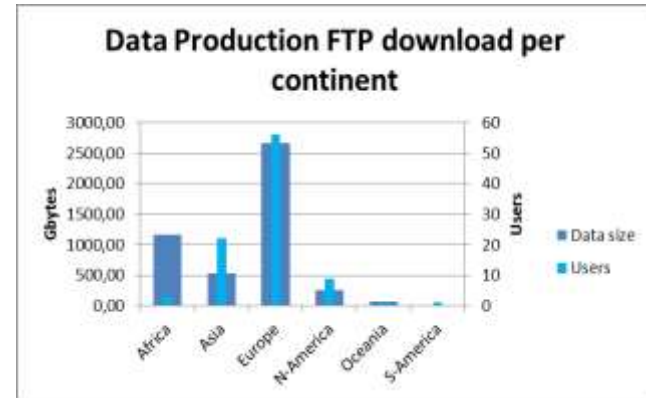
- Around 900 Gb delivered each month
- 158 countries accessed the WEB site
- Around 700 regular FTP users

## Top ten user countries:

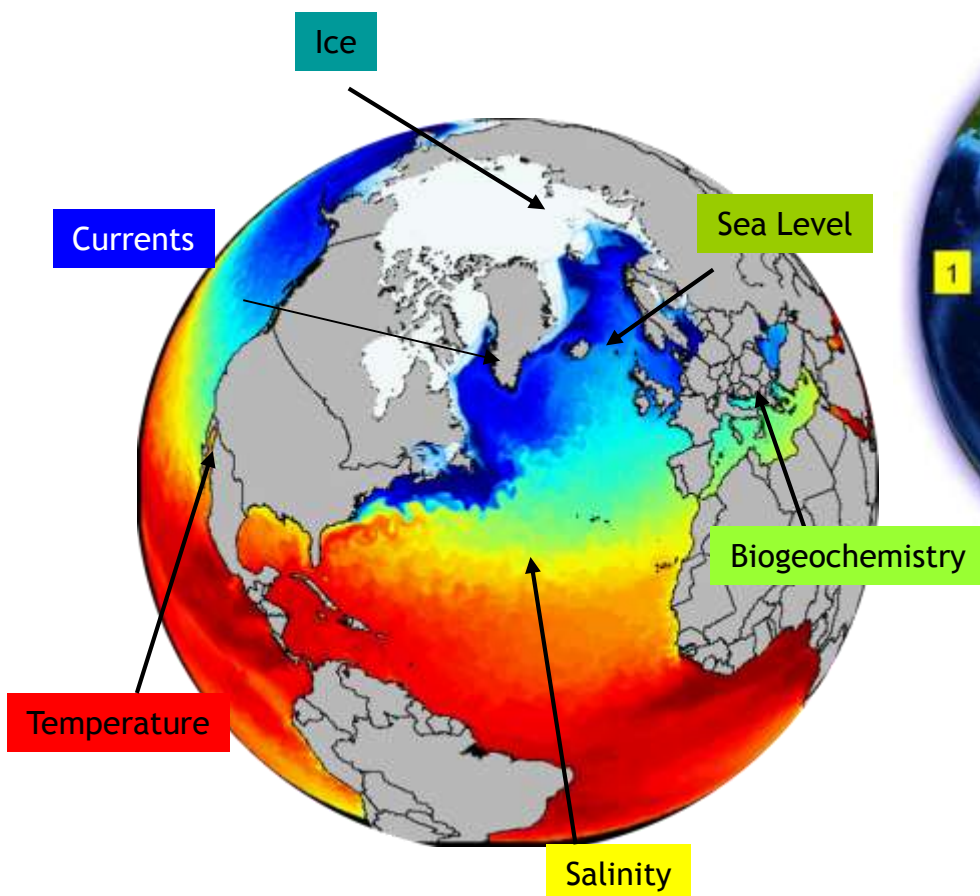
Italy, Spain, France, **China**, Germany, Netherlands, US, Poland, Austria, Belgium

## EUMETCAST delivery

- 550 users registered
- More than 250 receiving stations and 300 regular users in Africa
- 56 organizations registered in South America



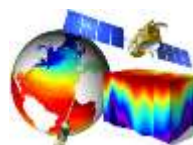
# Copernicus Marine Environment Monitoring Service



- 1. Global
- 2. Arctic
- 3. Baltic
- 4. NWS
- 5. IBI
- 6. Med Sea
- 7. Black Sea

- **Global and Regional**
- **Real time and Reanalyses**
- **Satellite & In Situ obs. and Models**

A 3D and consistent  
estimation of the ocean



## Service portfolio: 11 product groups with ~120 data products covering Ocean state

Product groups	
Analysis and Forecast	Global Ocean
	Arctic Ocean
	Baltic Sea
	Atlantic-European North West Shelf Ocean
	Atlantic-Iberian Biscay Irish Ocean
	Mediterranean Sea
	Black Sea
Observation	Sea Level
	Ocean Colour
	Sea Surface Temperature, Sea Ice, Wind
	In-situ (Temperature, Salinity, Bio)

- ❑ Details in: *MyOcean catalogue of PRODUCTS, Mercator Ocean / November 2014*
- ❑ Future: *Product Portfolio = Baseline document of operational service*

# Copernicus Atmosphere Monitoring Service



# Atmosphere Monitoring service



Monitoring atmospheric composition & climate

macc Monitoring atmospheric composition & climate

HOME NEWS ABOUT THE PROJECT SERVICES DATA PRODUCTS DOCUMENTS EVENTS CONTACT US

Home

macc Monitoring Atmospheric Composition and Climate is the current pre-operational atmospheric service of the European GMES programme. MACC provides data records on atmospheric composition for recent years, data for monitoring present conditions and forecasts of the distribution of key constituents for a few days ahead. MACC combines state-of-the-art atmospheric modelling with Earth observation data to provide information services covering European Air Quality, Global Atmospheric Composition, Climate, and UV and Solar Energy.

Services by theme

- European Air Quality
- Global Atmospheric Composition
- Climate
- UV, Solar Energy, Stratospheric Ozone

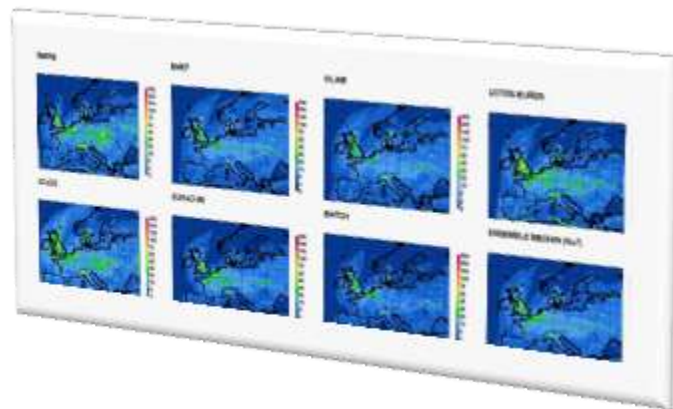
Services by user

- Health
- Environment
- Science Community
- Citizen
- Meteorology

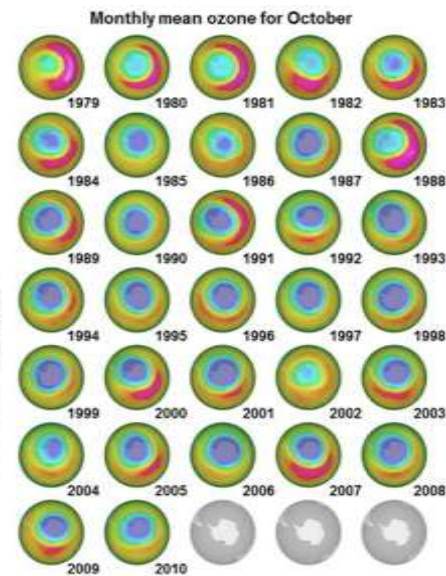
Potential users of MACC are invited to complete the questionnaire at this link

MACC is a Collaborative Project (2009-2012) funded by the European Union under the 7th Framework Programme. It is coordinated by the European Centre for Medium-Range Weather Forecasts and operated by a 43-member consortium.

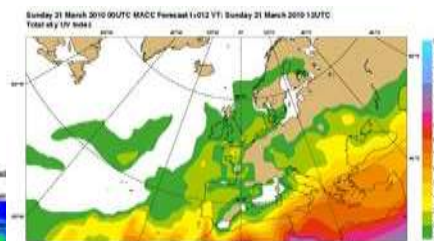
Air Quality forecast  
and  
(Re-)Analysis



Stratospheric Ozone

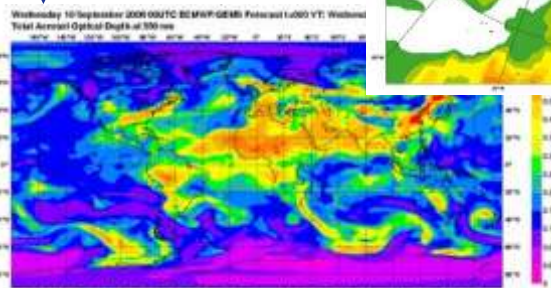
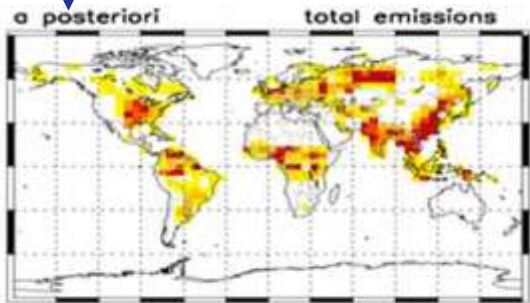


UV Information



Emissions

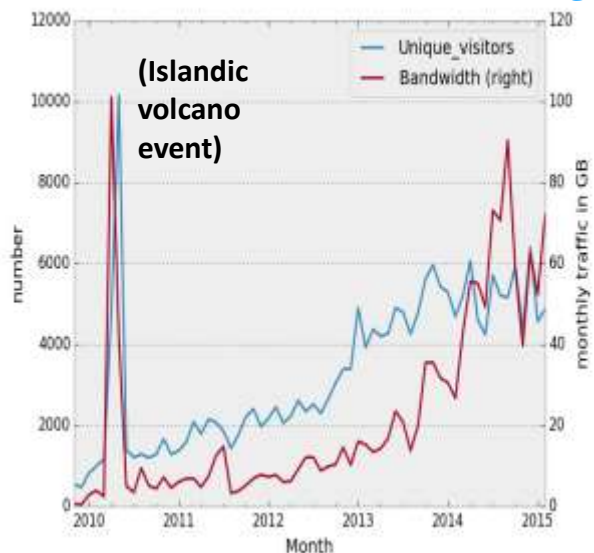
Global Forecasts



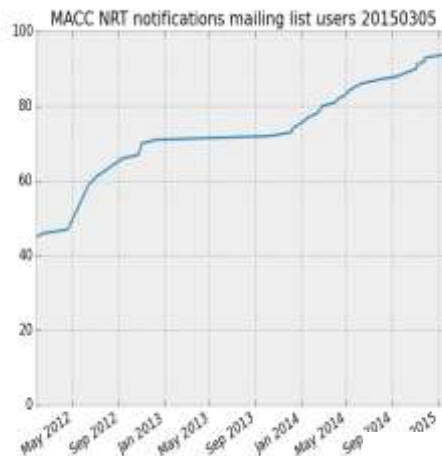
Product groups	
Regional products	European AQ NRT analysis and forecast
	European AQ reanalysis
Global products	Atmospheric composition NRT analysis and forecast (troposphere and stratosphere)
	Atmospheric composition reanalysis (troposphere and stratosphere)
Supplementary products	Policy support
	Solar radiation
	Greenhouse gas fluxes
	Climate forcing
Emissions products	Anthropogenic emissions
	Fire emissions

**Current details:**  
***MACC - Product and Service Specifications Document V2, ECMWF / July 2014***  
 **Future:**  
***Product Portfolio = Baseline document of operational service***

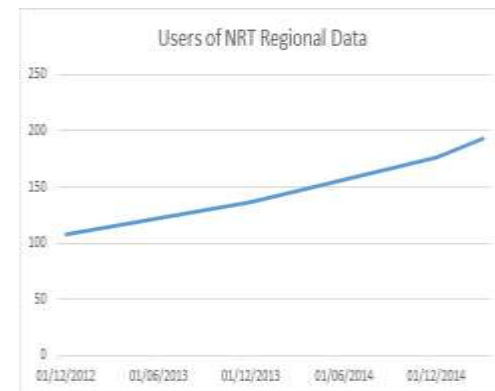
## atmosphere.copernicus.eu web



## Daily time-critical users of Global Services

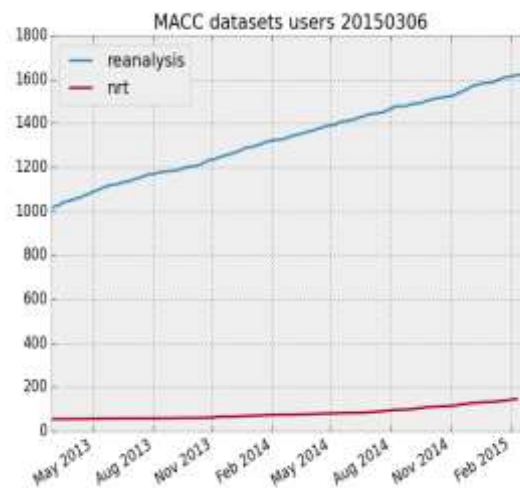


## Daily time-critical users of Regional Services



Service	Number of Users/ Requests for data
Global NRT Analyses & Forecasts	~225 users
Regional NRT Analyses & Forecasts	155 users
Global Reanalysis	1600 users
GHG flux inversions	40 users
Solar Radiation	~1000 requests/year
Global ftp	~ 40 users
Emissions, fire	1773 users (716 institutes)

## Users of the global re-analysis



# Copernicus Climate Change Service





## ★ Objectives:

- ★ **Monitor the climate system**
- ★ **Detect climate change behaviours to allow projections**
- ★ **Assess impacts of, and support adaptation to climate variability & change**

Space & in-situ  
Observations

Climate data & re-  
analyses

Climate model  
projections

★ **Consistent Climate Data Store**

★ **Sectoral Information System**

Agriculture and forestry

Health

Energy

Infrastructure

Insurance

Coastal areas

Water management

Tourism





# Copernicus Emergency Management Service

*Mapping Component*

*Early Warning  
Component*





## Flood and forest fire risk forecasts



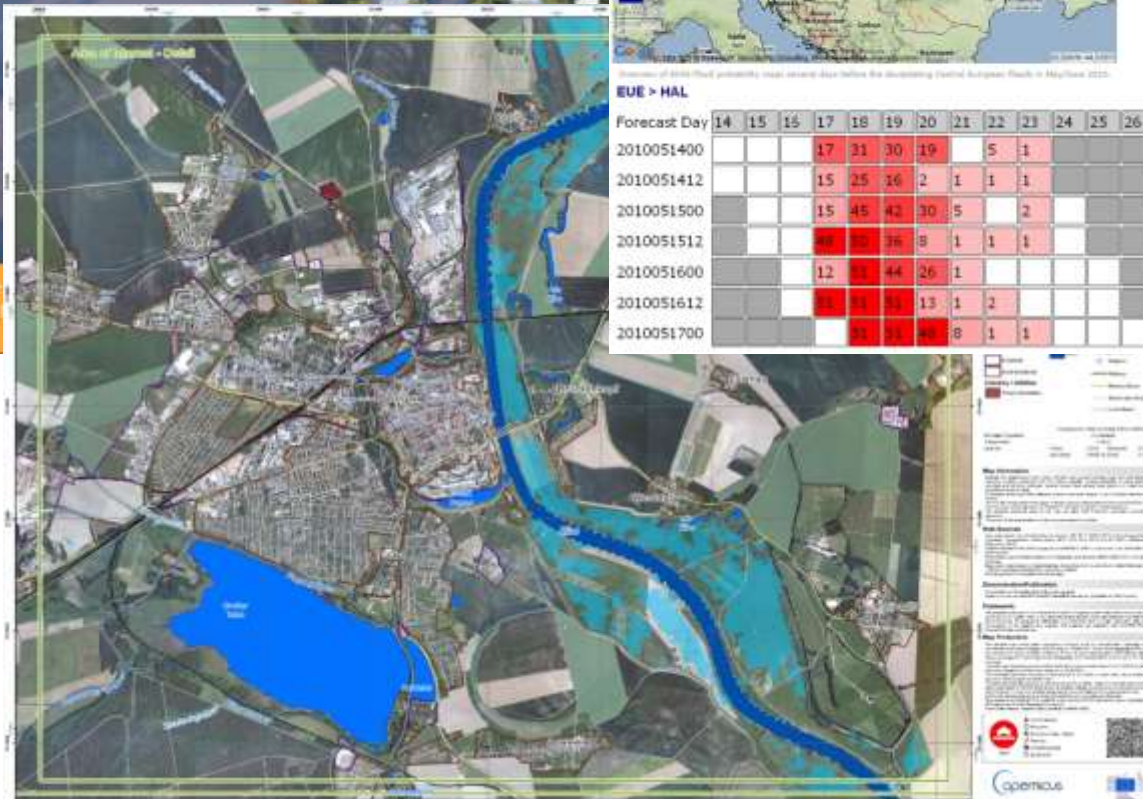
Figure 1: 2010 flood probability map overlaid with the forecasting control European Grid in May/June 2020.

**EUE > HAL**

Forecast Day	14	15	16	17	18	19	20	21	22	23	24	25	26
2010051400				17	31	30	19		5	1			
2010051412				15	25	16	2	1	1	1			
2010051500				15	45	42	30	5		2			
2010051512				48	32	36	8	1	1	1			
2010051600				12	31	44	26	1					
2010051612				14	34	37	13	1	2				
2010051700				33	33	48	8	1	1				

Providing support to emergency response services

Situation maps, reference information



## Service covers all the 3 phases of emergencies

### Non-rush mode products

- On demand
- Tailored on user needs
- Weeks-months

Reference maps

Pre-disaster situation maps

Reference maps

Post-disaster situation maps



### Rush mode products

- On demand
- Standardized
- Hours-days

Reference maps

Delineation maps

Grading maps

- ★ Service is provided on the basis of activation via Authorised Users
- ★ In case of non-EU states **via the EU Delegation**



Tacloban City - PHILIPPINES  
Typhoon HAIYAN - 08/11/2013  
Cracking VICE - October 2013

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**Legend**

Symbol	Description
[Red outline]	Cracked
[Orange outline]	Cracked (Minor)
[Yellow outline]	Cracked (Major)
[Blue outline]	Cracked (Severe)
[Green outline]	Cracked (Extreme)
[Red outline]	Cracked (Severe)
[Orange outline]	Cracked (Major)
[Yellow outline]	Cracked (Minor)
[Blue outline]	Cracked (Severe)
[Green outline]	Cracked (Extreme)



**Map Information**  
This map was created using the following data sources:  
- Aerial imagery from Google Earth  
- Cracking data collected by VICE team members  
- GIS software: ArcGIS 10.2

**Map Projections**  
This map uses the following projection:  
- UTM Zone 51N

**Scale**  
The scale of this map is 1:50,000.

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**vicemaps**





## Two complementary approaches:

- ★ ***Bringing the data to the user:***  
web portal, mirroring of the data – high bandwidth connection needed (e.g. Géant)
- ★ ***Bringing the user to the data:***  
cloud computing ('hosted computing') – upgrade of the Copernicus core ground segment needed

# Sentinel Data Access



Full, free  
and open  
Access for  
everybody



Copernicus Space Component  
Data Access Portal

[sentinels.copernicus.eu](https://sentinels.copernicus.eu)

Copernicus  
Services  
Access

Scientific / Other  
Access Hub

Collaborative  
Access Hub

International  
Agreements  
Access Hub

## Task Force on IGS & BD

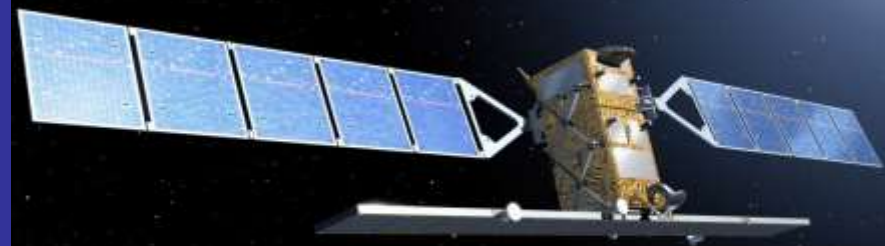
- ★ Copernicus Roadmap for Integrated Ground Segment and Big Data is currently being drafted and is due at the end of 2015.
- ★ The Task Force has been set up to finalise this roadmap (together with Copernicus participating countries and entrusted entities) and agrees on the importance to adopt an integrated approach involving all Copernicus dissemination platforms.
- ★ Interoperability features and common functionalities responding to Big Data challenges are also of practical interest to participating countries' own dissemination systems.

- ★ Commission needs to decide on scale, financial and legal set up of the initiative
  
- ★ Key Knowledge and expertise are shared among
  - ★ Copernicus partners
  - ★ Commission services and EU agencies
  - ★ Member States
  - ★ Industry (EO and ICT),
  - ★ International partners



# Thank you for your attention!

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CopernicusEU 

Space

 Copernicus  
Europe's eyes on Earth