



Incontro formativo e di addestramento sulle tecniche di elaborazione di dati geografici e di Earth Observation nell'ambito dei Servizi Core «Land» e «Marine» di Copernicus e di altri servizi downstream



https://youtu.be/uzF_ftCeZ5Y

...Copernicus in breve...

Bernardo De Bernardinis e Maria Vittoria Castellani

Genova, 11 febbraio 2020



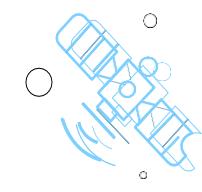
COPERNICUS IN BREVE



Nº1 al mondo nel monitoraggio ambientale e degli ecosistemi terrestri

Contribuisce al soft power dell'UE a livello globale

È uno strumento per lo sviluppo economico, chiave per l'economia digitale



Accesso ai dati libero, totale e gratuito



3º più grande fornitore di dati



+300,000 utenti registrati



**Componente
DATI IN SITU
nazionali**

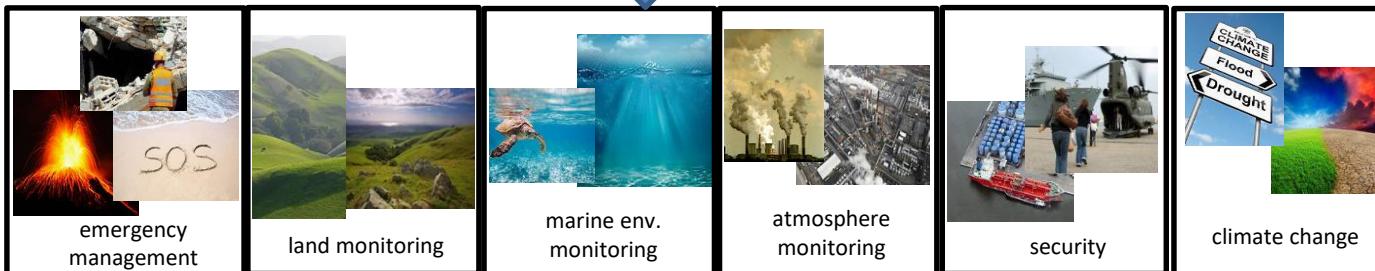
**Componente
SERVIZI**



**Componente
SPAZIO**



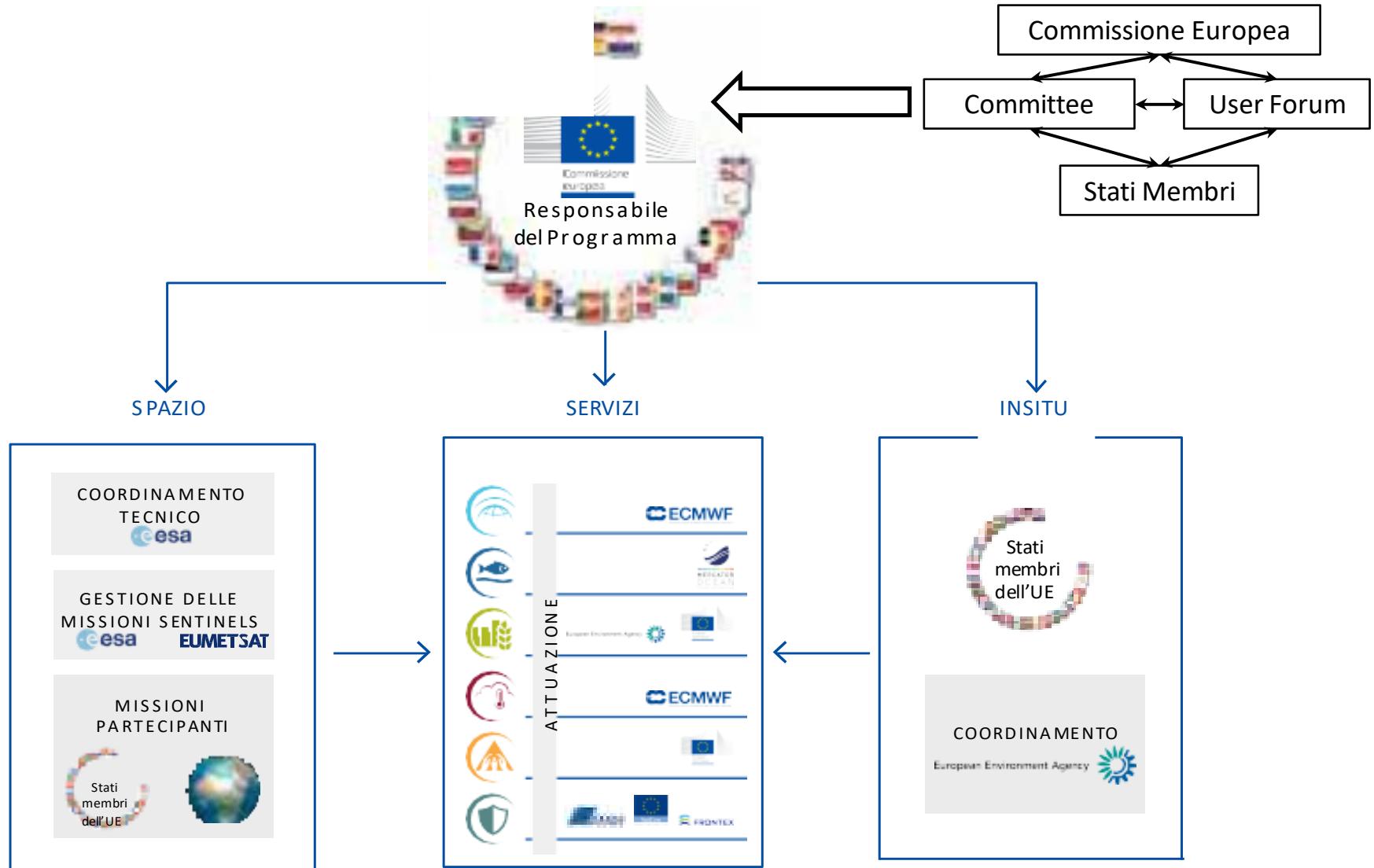
... i Servizi operativi europei di OT: i "Core Services" di Copernicus ...

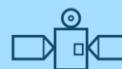
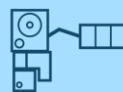
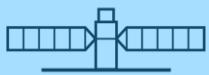


Italia

... i Servizi operativi nazionali di OT:
i "Downstream Services"

“... L’obiettivo di Copernicus è quello di fornire informazioni precise ed attendibili relative all’ambiente e alla sicurezza, adeguate alle esigenze degli utenti e a sostegno di altre politiche dell’Unione, riguardanti in particolare il mercato interno, i trasporti, l’ambiente, l’energia, la protezione civile e la sicurezza civile, la cooperazione con i paesi terzi e gli aiuti umanitari ...”





SENTINEL-1

Radar - Permette di osservare la Terra in tutte le condizioni climatiche sia di notte che di giorno

- sorveglianza dei ghiacci
- analisi in mare
- identificazione di imbarcazioni
- rilevamento di movimenti della superficie terrestre
- mappatura di aree forestali
- gestione di crisi umanitarie ...

SENTINEL-2

Ottico – 13 bande spettrali per monitorare

- attività agricole e tipo di vegetazione
- copertura del suolo
- gestire le risorse forestali
- sorvegliare i confini
- identificare attività illecite in mare
- supportare in caso di emergenze (inondazioni, incendi)...

SENTINEL-3

Diversi strumenti permettono di monitorare oceani, terra, superfici ghiacciate e atmosfera della Terra per comprendere le dinamiche globali su larga scala.

- altezza della superficie marina
- Colore della superficie
- Flussi carbonici
- Livello di fiumi e laghi

SENTINEL-4

Monitoraggio continuo della composizione atmosferica focalizzato su

- qualità dell'aria
- monitoraggio di Ozono (O₃), diossido di azoto (NO₂), anidride solforosa(SO₂), Formaldeide (HCHO) ecc

SENTINEL-5

Monitoraggio quotidiano globale di gas inquinanti (CH₄ and O₂ NO₂ CO₂ HCHO, SO₂) e gas a effetto serra (CH₄ and tropospheric O₃)

SENTINEL-5P

Osservazione quotidiana **clima, qualità dell'aria e superficie Ozono**

SENTINEL-6

Previsioni marine, **topografia oceanica in real time** : altezza onde, superficie oceanica, velocità del vento

... già in orbita ...

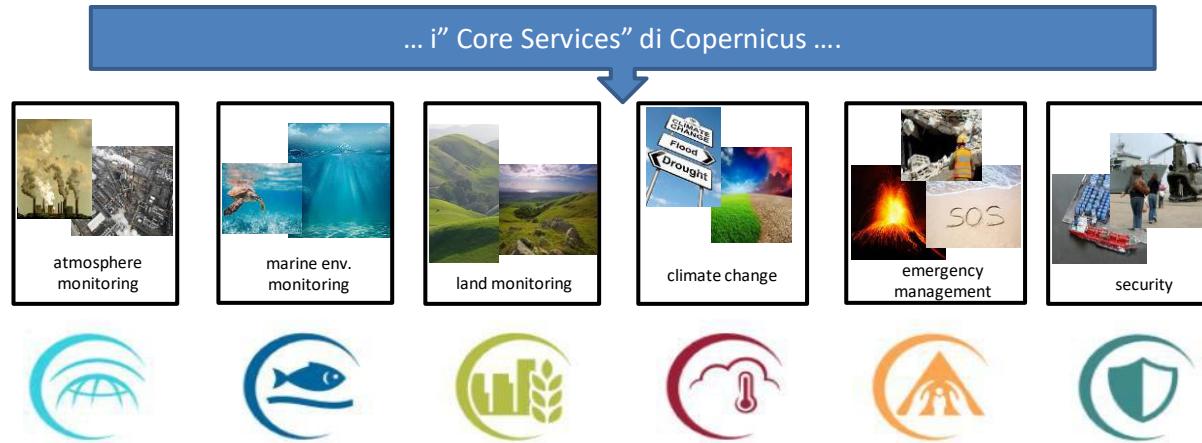


Contributing Missions

... ma l'obiettivo primario di Copernicus sono Servizi "Core" ...

"Copernicus dovrebbe fornire **informazioni sullo stato dell'atmosfera**, anche a livello locale, nazionale, europeo e mondiale; **informazioni sullo stato degli oceani**, anche mediante l'istituzione di un raggruppamento europeo specifico per il monitoraggio marino; **informazioni per il monitoraggio del territorio a sostegno dell'attuazione di politiche locali, nazionali ed europee**; **informazioni a sostegno delle politiche di adattamento e mitigazione dei cambiamenti climatici**; **informazioni geospaziali a sostegno della gestione delle emergenze**, anche attraverso attività di prevenzione, e della sicurezza civile compreso il sostegno all'azione esterna dell'Unione."

(REGOLAMENTO (UE) N.377/2014)



I Servizi "Core" di Copernicus **trasformano i dati**, raccolti da satelliti ed in situ, **in informazioni** a valore aggiunto: analizzandoli ed elaborandoli, integrando gli stessi con altre fonti e infine convalidando i risultati ottenuti. Le serie di dati acquisiti nel corso di anni e decenni, sono indicizzate e rese comparabili garantendo così il monitoraggio dei cambiamenti; i modelli strutturali sono esaminati e utilizzati per aumentare la capacità di previsione, ad esempio, nell'analisi degli oceani e dell'atmosfera.

Dai dati satellitari, associati ed integrati con altri dati sono create mappe, identificate caratteristiche ed anomalie degli eventi e dei processi in atto ed elaborate informazioni, anche statistiche.

... i Core Services sono prioritariamente destinati all'attuazione delle diverse e molteplici Direttive europee e sono trasversali a più domini applicativi che, per larghissima parte, rispondono ad interessi di specifiche ed ampie Comunità di Utenti finali, il cui riferimento ufficiale (Focal Point) è generalmente una Istituzione, ma i cui partecipanti sono soggetti di diversa natura giuridica, anche privata ...

European Directive	Copernicus Application Domains							
	Agriculture, Forestry & Fisheries	Biodiversity & Environmental Protection	Climate & Energy	Civil Protection & Humanitarian Aid	Public Health	Tourism	Transport & Safety	Urban & Regional Planning
Agriculture/Food security								
Nitrates European Directive (91/676/EEC)	■	■			■			
Common Agricultural Policy	■	■						
Habitats Directive (92/43/EEC)	■	■						
Birds Directive (2009/147/EC)	■	■					■	
Animal By-products Regulation (1069/2009/EU)	■	■		■				
Ecosystem structure/composition							■	■
Habitats Directive (92/43/EEC)								
Birds Directive (2009/147/EC)								
Animal By-products Regulation (1069/2009/EU)								
Inland/coastal water and environment								
Marine Strategy Framework Directive (2008/56/EC)		■						
Water Framework Directive (2000/60/EC)		■						
Bathing Water Directive (2006/7/EC)		■						
Maritime Spatial Planning Directive (2014/89/EU)		■						
Strategic Environmental Assessment Directive (2001/42/EC)		■						
Floods Directive (2007/60/EC)		■						
Directive urban waste water treatment (91/271/EEC)		■						
Air quality								
Ambient air quality and cleaner air Directive (2004/107/EC & 2008/50/EC)			■					
Cultural Heritage								
The General Conference of the United Nations Educational, Scientific and Cultural Organization meeting in Paris from 17 October to 21 November 1972								
Raw materials								
Raw Materials Initiative (COM 2008/699)	■	■						
Natural and man-made hazards								
Restrictions on the marketing and use of certain dangerous substances and preparations (asbestos) [1999/77/CE]	■	■						
Thematic strategy for soil protection" [COM(2006) 231]	■	■						
Water Framework Directive (2000/60/EC)	■	■						
Floods Directive (2007/60/EC)	■	■						
Waste Directive (2008/98/EC)	■	■						
Ice and snow								
No specific reference								
Urban Area Management								
Enhancing Europe's Natural Capital COM/2013/0249 final	■	■						
Decision n. 1386/2013/EU	■	■						

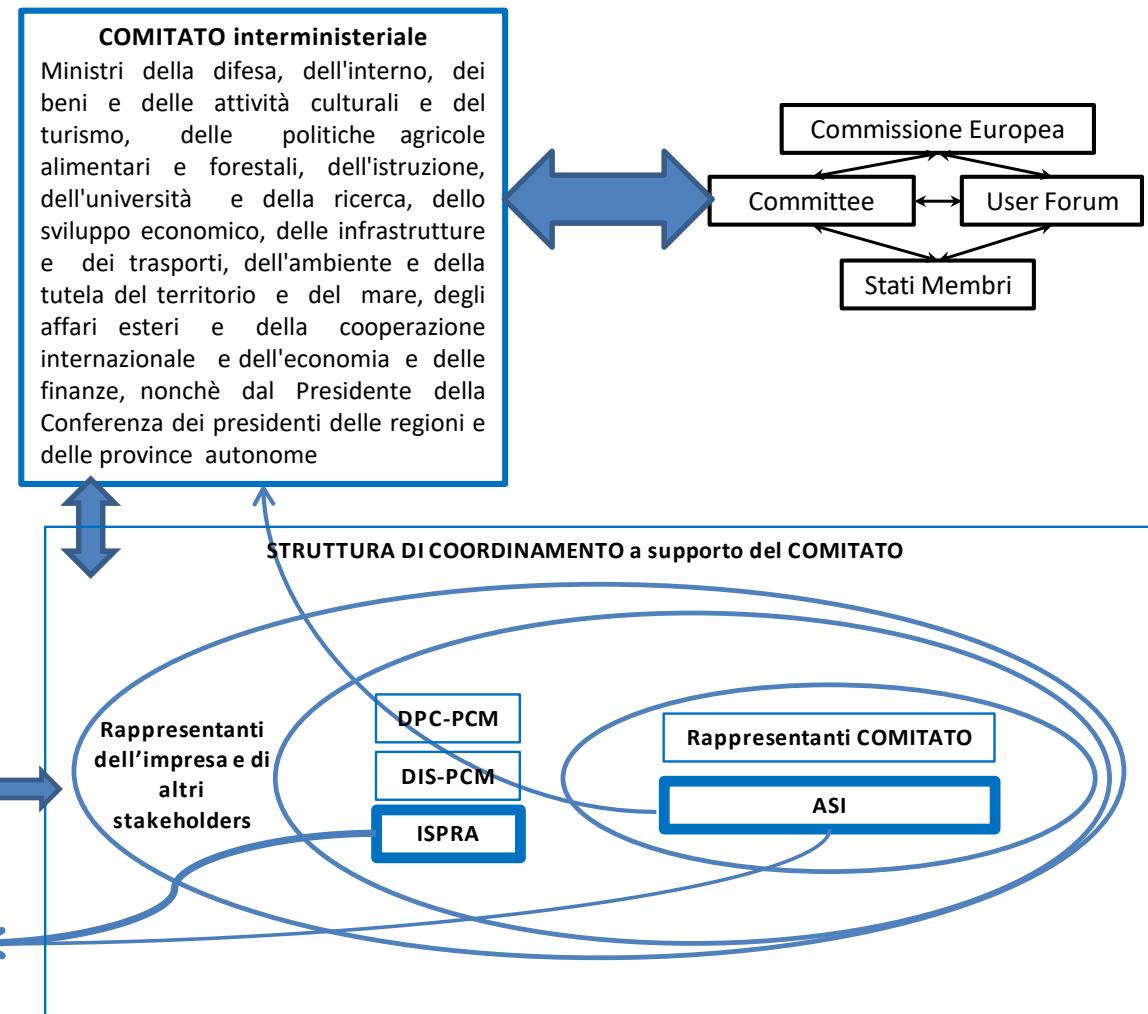
Copernicus Application Domain	Related Copernicus Service(s)	Link
Agriculture, Forestry and Fisheries		http://www.copernicus.eu/main/agriculture-forestry-and-fisheries
Biodiversity and Environmental Protection		http://www.copernicus.eu/main/biodiversity-and-environmental-protection
Climate and Energy		http://www.copernicus.eu/main/climate-and-energy
Civil Protection and Humanitarian Aid		http://www.copernicus.eu/main/civil-protection-and-humanitarian-aid
Public Health		http://www.copernicus.eu/main/public-health
Tourism		http://www.copernicus.eu/main/tourism
Transport and Safety		http://www.copernicus.eu/main/transport-and-safety
Urban and Regional Planning		http://www.copernicus.eu/main/urban-and-regional-planning

Legend

- Copernicus Marine Environment Monitoring Service (CMEMS)
- Copernicus Land Monitoring Service (CLMS)
- Copernicus Climate Change Service (C3S)
- Copernicus Emergency Management Service (CEMS)
- Copernicus Security Service (CSS)
- Copernicus Atmosphere Monitoring Service (CAMS)

Copernicus è un programma guidato dagli Utenti finali che, organizzati in Comunità nazionali, e rappresentati dalle Delegazioni nazionali nell'ambito del Comitato (Committee) e del Forum degli Utenti (User Forum), sono quindi coinvolti al fianco della Commissione nel governo e nell'attuazione del programma.

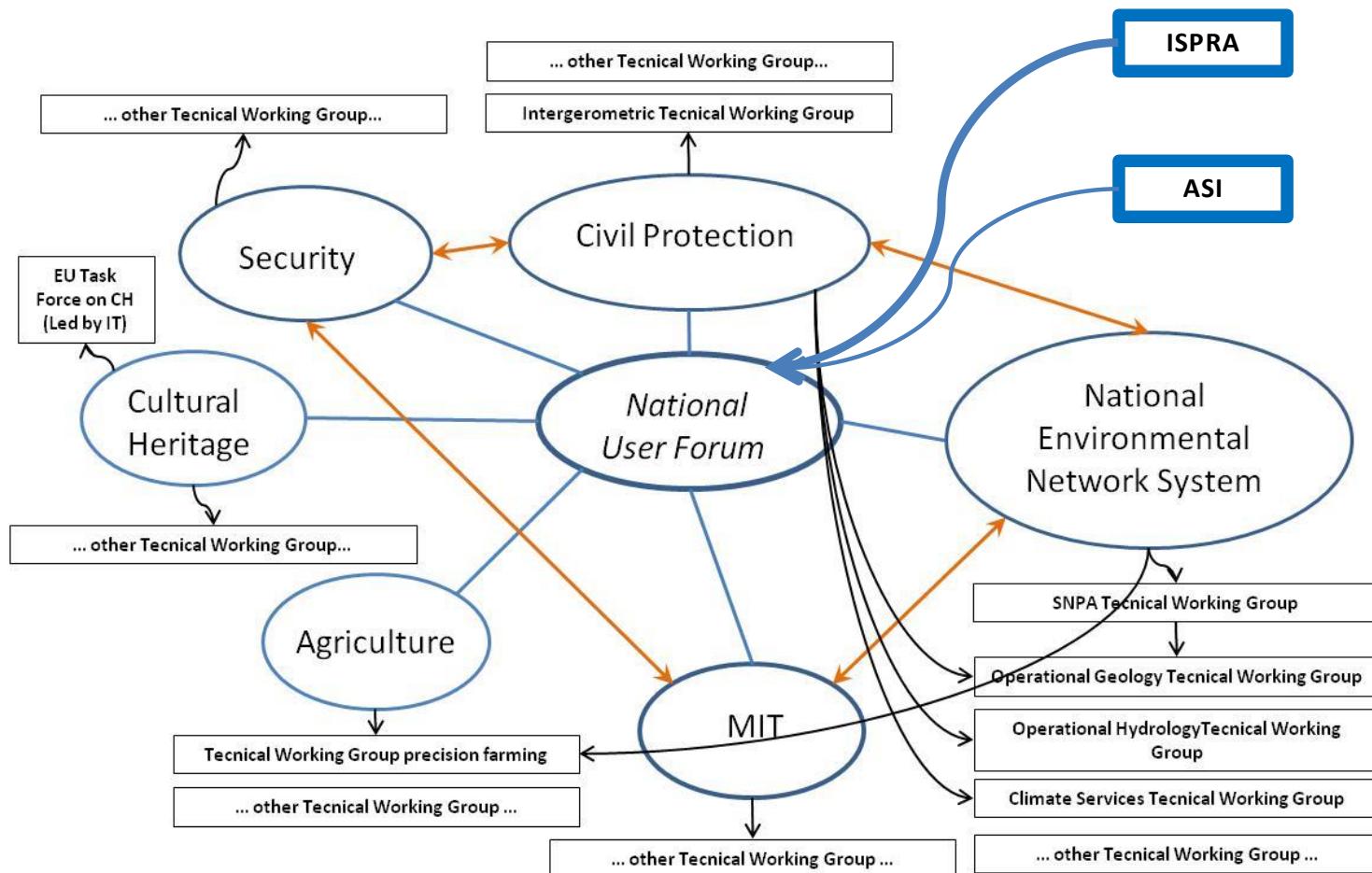
A livello nazionale di Copernicus ricade nell'ambito della **Legge n.7/2018** in materia di spazio, aerospazio ed osservazione della terra istituendo sempre presso la Presidenza del Consiglio dei Ministri un **Comitato Interministeriale** (COMIT) ed attraverso i successivi DPCM attuativi una **Struttura di Coordinamento** (SdC) a supporto delle attività del Comitato stesso e collegata allo **User Forum Nazionale di Copernicus** (UFN)



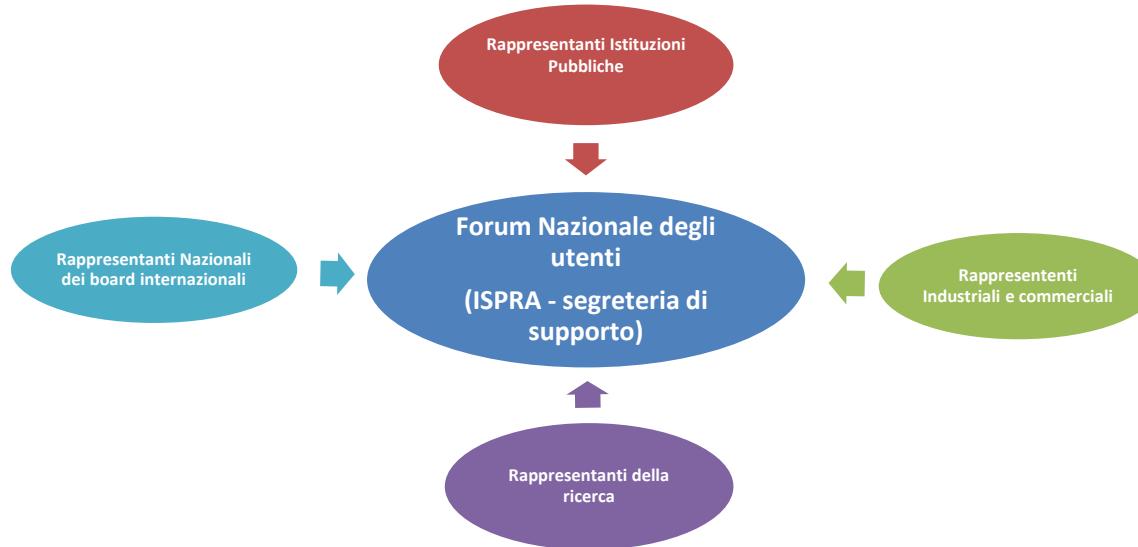
Copernicus National User Forum

Per garantire l'attuazione delle decisioni del Comitato è istituita con DPCM del 19 dicembre 2018 presso la Presidenza del Consiglio – Ufficio del Consigliere militare (PCM-UCM) la *Struttura di coordinamento per le politiche relative allo spazio, all'aerospazio e ai correlati servizi applicativi*. Tale Struttura si avvale del supporto, del Dipartimento di Protezione civile, del Dipartimento delle politiche di Coesione (PCM), del Dipartimento degli Affari regionali e le autonomie (PCM), gli Organi di informazione e sicurezza e dell'**ISPRA**, quale raccordo fra le **comunità di utenti** nazionali nel settore dell'osservazione della terra, già organizzate nel Forum Nazionale degli Utenti Copernicus.

COMMUNITÀ DI UTENTI



Copernicus National User Forum



Tavolo Controlli Ambientali (SNPA)

Tavolo Trasporti (MIT)

Tavolo Beni Culturali (MiBACT)

Tavolo Industria (ASAS, AIAD, APAS)

Tavolo Sicurezza (MD – MININT – MIT/CG-CP)

Tavolo Agricoltura (MIPAAF)

Coordinamento Copernicus Relay (User Forum Naz.)

Tavolo Geologia Operativa (naz. ISPRA – Regioni - SNPA)

Tavolo Servizi Climatologia Operativa (naz. coord. ISPRA)

Tavolo Servizi Idrologia Operativa (naz. coord. ISPRA)

Tavolo GREEN-NET (naz. coord. ISPRA)

Tavolo della Fascia Costiera

Tavolo della valorizzazione

Tavolo della disseminazione

Coordinamento Copernicus Accademy Network

Struttura di Coordinamento a supporto del Comitato Interministeriale Spazio

c/o la Presidenza del consiglio dei Ministri

Outcomes

National and European space policy discussion – Copernicus National User requirement coordination

The Italian National User Forum Architecture

Responsible to the Presidency of The Council of the Ministers
National delegated to the Copernicus User Forum and Committee
Responsible for security aspects (Copernicus security board)

National members for the management of Copernicus Services

National representative in ESA, EUMETSAT, ECMWF, WMO, EEA, INSPIRE
National coordinating Boards representatives on the matter of Copernicus Service sectorial exploitation (even Downstream)

National User Forum Operational Boards:
Security, Infrastructure & Transports, Cultural Heritage, Agriculture, Environmental Controls,
Industry, Geology, Climate, Hydrology.

Users Community Representatives

National, regional or local institutions, bodies and authorities entrusted with the definition, implementation, enforcement or monitoring of a public service or policy:

- Ministries
- Environmental control system
- Civil Protection Service
- Italian Regions

Universities or any other research and education organisations

- Representative of Academia
- National representative of Research Bodies and Institutions

Industrial and commercial public and private enterprises

- Industrial Space and Aeronautic Associations
- Commercial EO Associations

charities, non-governmental organisations and international organisations

- National Convention for innovation policy and promotion

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Nello UFN il Sistema nazionale delle Università oltre che dal **MIUR** è rappresentata specificamente dalla **Presidenza della Conferenza dei Rettori** e dalla **Presidenza della Consulta degli EPR nazionali**

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**... IL SUCCESSO MONDIALE DI COPERNICUS ... MA
COPERNICUS HA PERSEGUITO COMPIUTAMENTE I PROPRI
OBIETTIVI ?...**

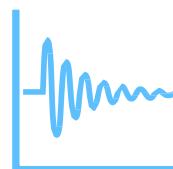
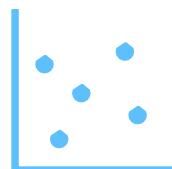
COPERNICUS DATA POLICY

972.343.516.863 TB

DIVERSI TIPI DI DATA POLICY:

- DATI SATELLITI SENTINELLE (ACCESSO LIBERO, TOTALE E GRATUITO)
- SERVIZI COPERNICUS (ACCESSO LIBERO, TOTALE E GRATUITO)
- MISSIONI CONTRIBUTRICI (ACCESSO SOTTOPOSTO ALLE DIVERSE POLICY)

L'ACCESSO AI PRODOTTI DEL SERVIZIO SICUREZZA È LIMITATO A UTENTI AUTORIZZATI PER PROTEGGERE GLI INTERESSI DELL'UE E DEGLI STATI MEMBRI



I BENEFICI DI COPERNICUS

Key Figures



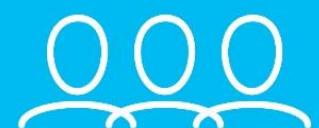
Cost per
EU citizen =
~€1.07/year



Every **€1** spent
generates
a return of
~€3.2



Min. financial
benefits on
EU GDP =
~€30bn by 2030

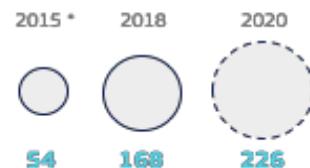


~50.000 jobs
maintained/
created in the
next 15 years

REVENUES

Copernicus impact for
intermediate users of
the 10 selected value
chains

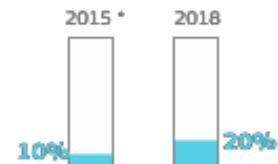
Enabled revenues for intermediate users in Europe (EUR million)



Expected average annual growth rate up to 2020



Average penetration of Copernicus data with regards to EO data



COPERNICUS UPTAKE (2017)



Proportion of EO companies
exploiting Copernicus data in
Europe



Proportion of EO companies
exploiting Copernicus
services in Europe

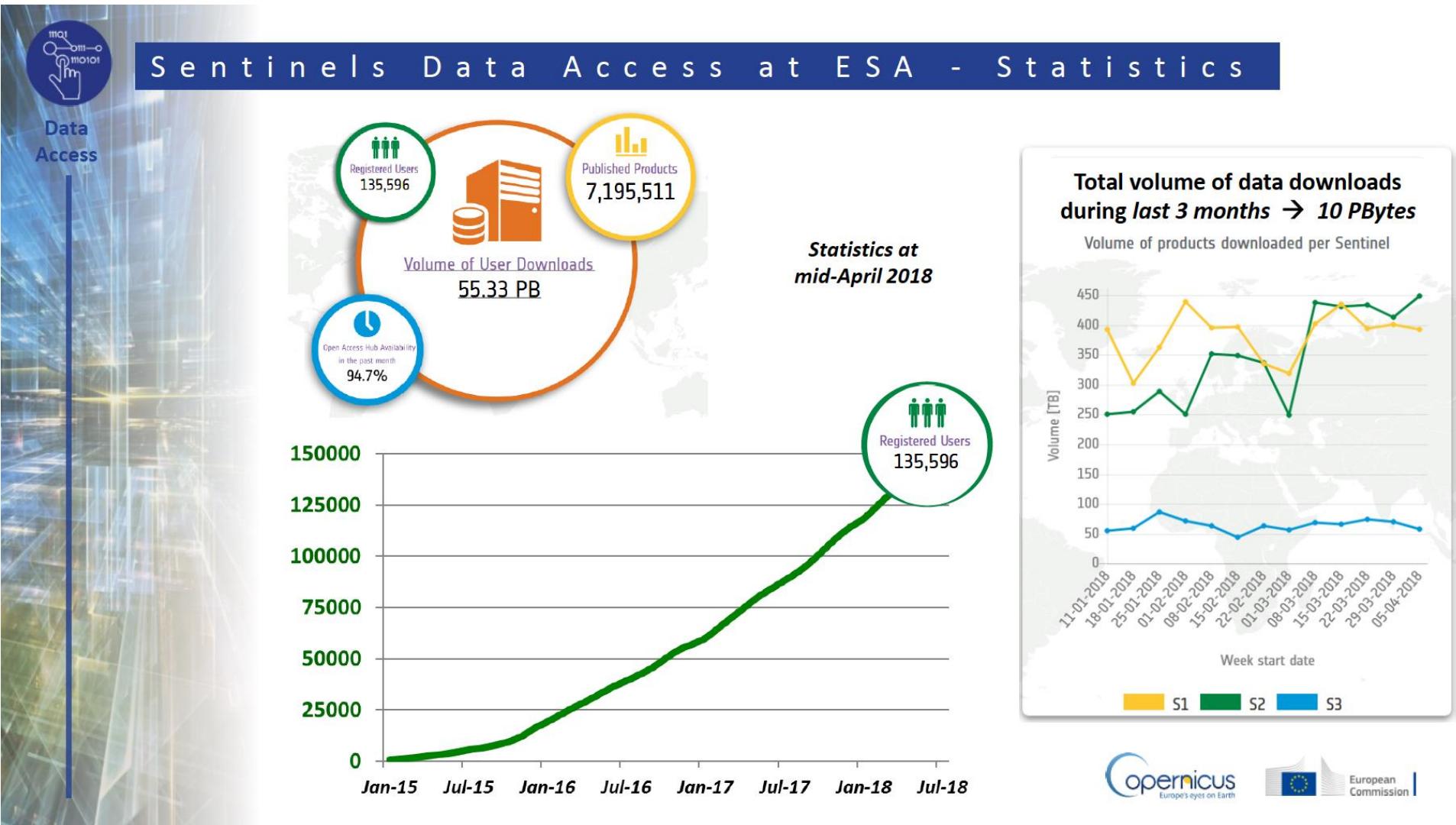


Volume of downloads
from the Data Access
Systems



overall registered users on the
different hubs (ESA, EUMETSAT,
ECMWF, EEA, Mercator and JRC)

... Copernicus Sentinels Data Access : Users & Downloads...



... Copernicus Sentinels Data Access: Users & Downloads...

Sentinels Data Access – Open Access Hub

Distribution of active users on ESA Open Access Hub
(i.e. downloading data) during *last 3 months*



Statistics at mid-April 2018

Statistics of ESA Open Access Hub do not include active users downloading Sentinel data through :

- Eumetsat (Sentinel-3)
- Partners within national collaborative ground segment (in Europe)
- Partners within international ground segment (e.g. US or Australia)

Statistics of ESA Open Access Hub do not include active users using Sentinel data (without downloading products) through image visualisation and handling tools:

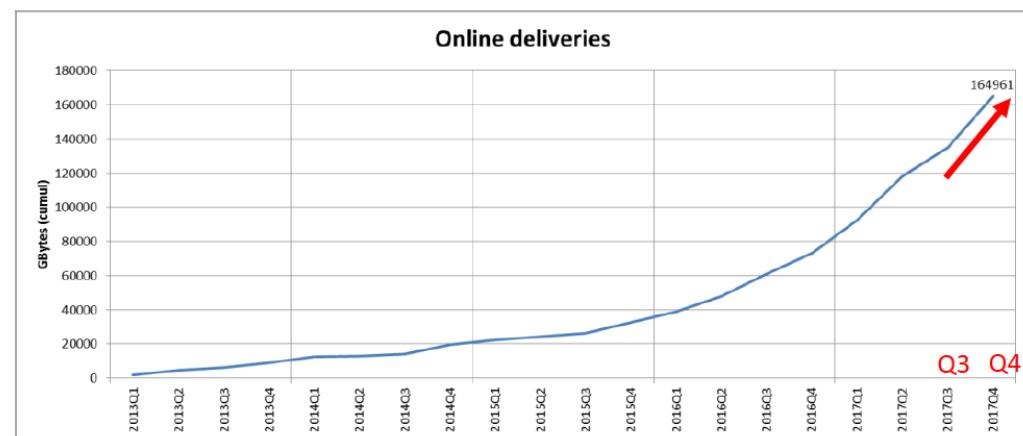
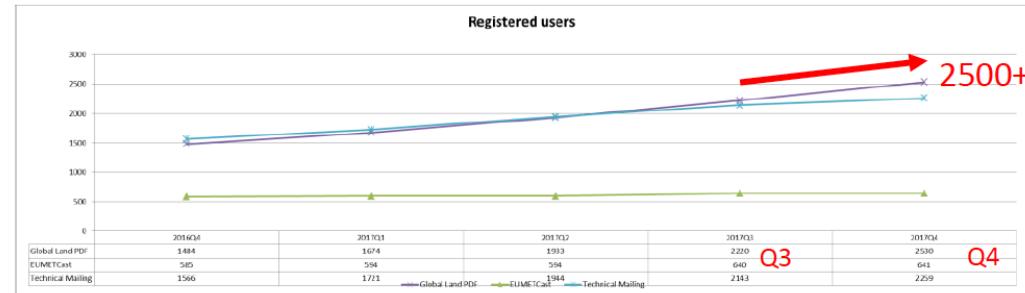
- “EO Browser” (see next slide)

... Copernicus Land Monitoring Core Services: Users & Downloads...



Users and Downloads

- More than 2500 users are registered,
- An additional interface for time aggregation for cryosphere products will allow users to request several products simultaneously, is being tested.
- Preparations are in the final stage for the uptake of the first lake products (Lake Surface Water Temperature and Lake Water Quality).
- Data has been brokered to the Copernicus Climate Change Service (C3S), following their reformatting to netCDF4.



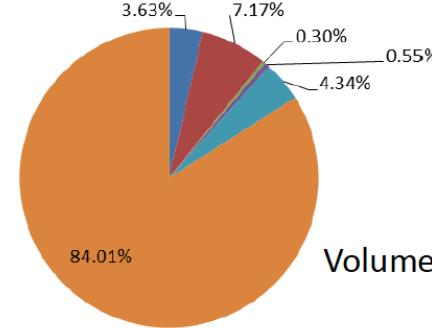
... Copernicus Land Monitoring Core Services: Users & Downloads...



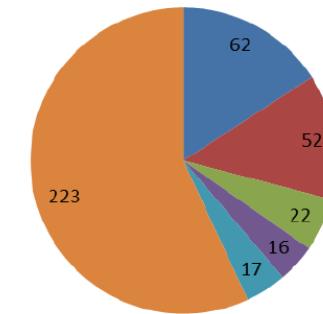
New Users Typology

- In terms of volumes, the UN/inter-governmental, Commercial company and Academic sectors show increases, with largest (relative) changes for UN/inter-governmental sector, which remains the smallest in absolute terms.
- In absolute figures, the Academic sector remains the largest.
- In terms of the number of users, comparison with the previous quarter shows increase for the academic sector (+24) and a slight decrease for national/regional Government

■ Commercial Company ■ Government
■ NGO / civil society / non-profit ■ Private person
■ United Nations / Intergovernmental ■ University / Research Institute



Volume downloaded



Number of users

... European Space Strategy to optimise the benefits from space and the actions to improve the Copernicus results; the User Uptake action ...

In its 2016 Communication on a European Space Strategy the Commission states that "*The Commission's aim is to optimise the benefits that space brings to society and the wider EU economy. Achieving this means boosting demand among public and private users, facilitating access to and use of space data, and stimulating the development and use of innovative downstream applications. It also means ensuring the continuity and user-driven development of EU space programmes.*"

Therefore, three basic actions have to be set up:

- the **simplification of the existing system of heterogeneous platforms** to facilitate the users access to Copernicus data and services
- the **improvement of user uptake** of Copernicus data, information and services
- the **promotion of the development and offer of downstream services** derived from Copernicus data and information

... European Space Strategy to optimise the benefits from space and the actions to improve the Copernicus results ...

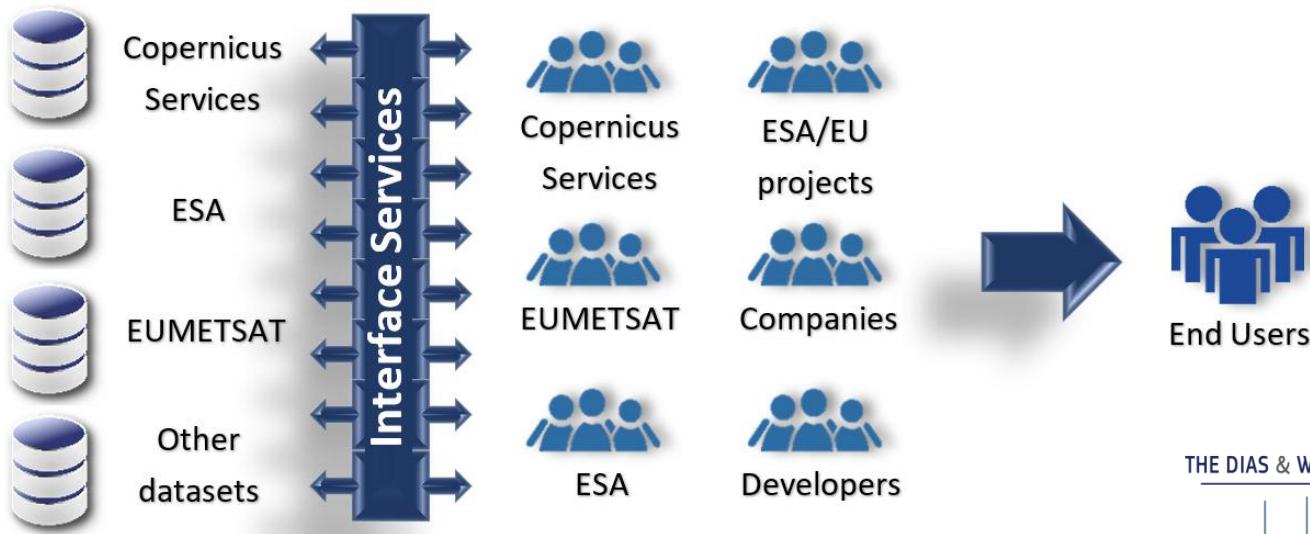
DIAS ... a game changer for accessing and processing Copernicus data and information

The mass sharing and use of Copernicus data and information started across a series of heterogeneous platforms while the user carried the burden of download, processing and storage. To facilitate and standardise access to this data, the European Commission is funding the deployment of five cloud-based platforms providing centralised access to Copernicus data and information, as well as to processing tools.

These platforms are known as the DIAS, or Data and Information Access Services.

The five DIAS online platforms allow users to discover, manipulate, process and download Copernicus data and information. Each platform provides access to the full set of Copernicus data and information, as well as the ability to process and combine it with data from other sources (space and non-space). Their cloud-based systems architecture performs the heavy lifting on the back end, so users get coherent and analysis-ready information on the front end. Because the DIAS platforms are providing mass storage and handling of data, users can begin using information from a single entry point.

DIAS ... a game changer for accessing and processing Copernicus data and information ...



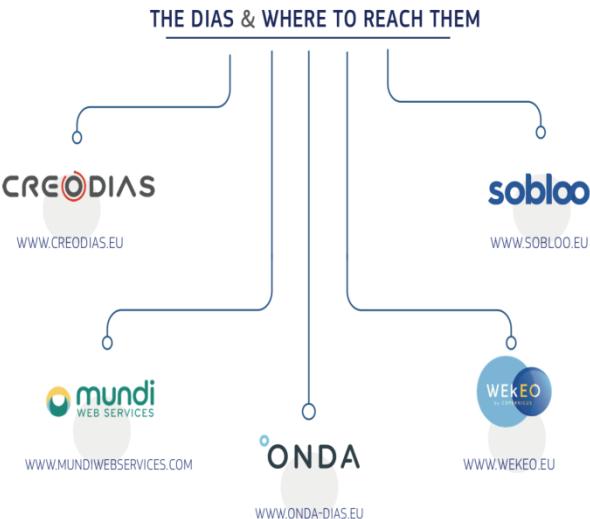
'Creodias – <http://www.creodias.eu>' : Createch (PL) with cloud provider CloudFerro (PL)

'ONDA – <http://www.onda-dias.eu>' : Serco (IT) with cloud provider OVH (FR)

'SOBLOO – <http://www.sobloo.eu>' : Airbus (FR) with cloud provider Orange (FR)

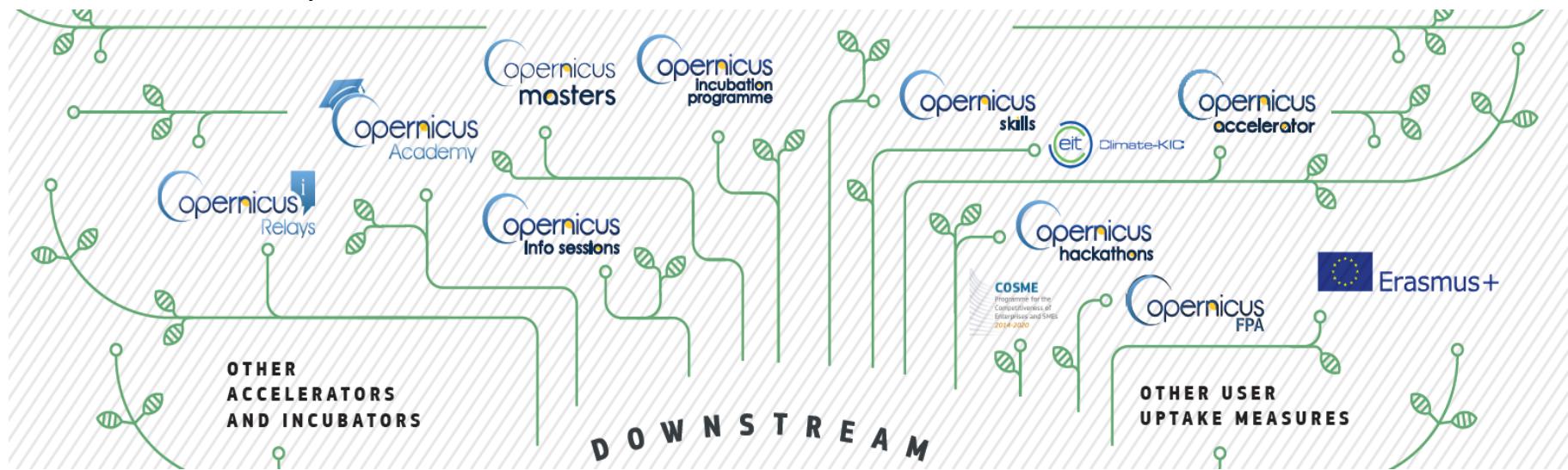
'Mundiwebservices – www.mundiwebservices.com' : ATOS (FR) with cloud provider T-Systems (DE)

'WeKEO – <http://wekeo.eu>' : EUMETSAT, with Mercator Ocean and ECMWF



... European Space Strategy to optimise the benefits from space and the actions to improve the Copernicus results ...

A principal element of achieving this aim is to enhance user uptake of Copernicus data and services. The Commission has defined a User Uptake Strategy (CUF-2016-73), identifying objectives, key principles and specific actions to implement user uptake measures in the framework of Copernicus.



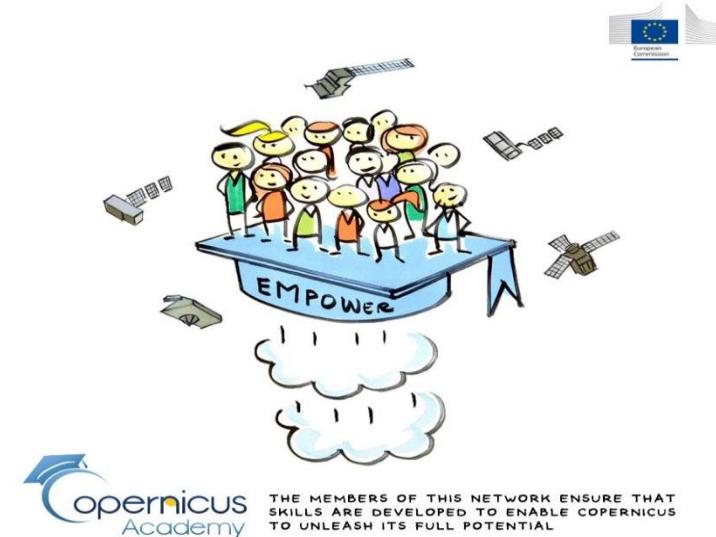
Some of the user uptake measures implemented in Italy through the Copernicus National User Forum (CNUF) are:

- **National thematic Workshops** at along with sectorial **Seminars**
- Relays and **Copernicus Academy** specific and coordinated activities.
- **GeoData and Satellite Facilities Open Schools**

... the Copernicus User Uptake through the National User Forum activities ...

National Copernicus Academy Coordinator

It is worth remembering that in Copernicus the **Operational Services** are the priority and this is the reason why **Copernicus** has deemed necessary to define and carry out an action which would pursue the **training** not only of new researchers, but **also of new teachers, public servants, professionals and entrepreneurs to get new skills for new professional profiles and new business areas**, systematizing the higher education capacities, already existing at the European and National level and concerning EO, GI and ICT matters, within the **Copernicus Academy**.



Therefore, at the beginning of the 2019, the CNUF has decided to appoint a **National Copernicus Academy Coordinator (NCAC)** to foster, support and coordinate the national members of the European Copernicus Academy Network to a collective participation in the CNUF itself, as well as to ensure relations, including operational ones, with **FabSpace** and **EO4GEO** Projects networking and activities.

... the Copernicus User Uptake through the National User Forum activities ...

National Copernicus Academy Network

Moreover, the **Italian National Delegation in Copernicus**, along with the CNUF has proposed and has been fostering the creation of a **National Copernicus Academy Network (NCAN)**, involving the main Italian Universities, or other academic bodies at least representative of the academic community at the regional level, as the focal joints of the network, in order to define, support and implement along with other public and private subjects, a three-years National Action Plan to develop its mission.

The institution, architecture and objectives, as well as the instruments, of the National Network have also been formalised with its reference authority in the CNUF, i.e. the MUR. This has certainly received a positive and enthusiastic response which, however, has never been the subject of a public formalisation, signed by the MUR political authority. However, the National Network, as promoted by the Coordinator in accordance with the Delegation and NFU's recommendation, has received an official administrative, having been the subject of the Action 2020-1-10 "User uptake action towards the Copernicus Academy National System", proposed by the MUR itself to the NFU, which has positively accepted it, for its candidacy at European level

The major planned and promoted specific activities under the NCAN coordination are aimed at:

- **Analyzing the existing curricula** offered by universities and high schools in the different areas where Earth Observation matters, along GI and ICT curricula, may have a positive impact and an educational added value and assess how Copernicus products and services can contribute to such existing curricula;
- **Fostering the development of interdisciplinary masters and educational classes, strengthening the skills and professional training programs and bridging the Universities sectorial trainings;**
- **Informing the academic and educational bodies and networks, authorities, enterprises and citizens, about Copernicus** and how its services, products, information and data can be used, through a wide offer of coordinated, focused and public **Academic Workshops**;
- **Promoting the connectivity with the Copernicus Relays** and the capacity building among and inside the SMEs, in particular, **through the national components of the European FabSpace network**;
- **Promoting the identification, approval and development of new and innovative skills** (also linked to new occupational profiles) in the –space geo-information and information and communication (IC) sectors, **through the national components of the European EO4GEO Project**;
- **Organizing GeoData and Satellite Facilities Open Schools** to address a generality of subjects, stretching from who must make decisions, to those who are simply curious.

The specific activity of involvement and first coordination of the national members of the European Copernicus Academy network, also with the aim of creating a homologous and closely connected national one, starts already in the **spring of 2018**. Meetings and seminars have been held at some of the main Universities in the Country and a specific collaborative relationship with DG GROW and the Copernicus Support Office established.

This happens in 2018, before the National Delegation and the National User Forum of Copernicus formalized the need of the Copernicus Academy activities coordination at the national level, appointed a National Coordinator and recognized the National Copernicus Academy Network as a structure of the CUFN.

Since then, the coordination activity has been intensively carried on. Formal meetings, seminars, open schools, national workshop have been fostered and realized at university campus and research centres, as well as at professional institutes. This has been also done by involving in it enterprises providing EO, Gi and ICT services and training and by systematically pursuing relationships with other "user uptake" activities, such as **Hackthon**, **Info Sessions**, **Skills** and those carried out by national members of the **European Network of Copernicus Relays**. Moreover, this overall action has seen the promotion and implementation of and the participation in numerous official events, including those at European level.

The following list highlights the most significant of them, like the active participation in fostering and preparing the national Copernicus Academy proposals for the FPCUP Action Plan 20020-2023.

