Copernicus

Mauro FACCHINI

European Commission

DG DEFIS (Defense Industry and Space)

Earth Observation Unit

Space

Copernicus EU

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www.copernicus.eu

Copernicus
Europe's eyes on Earth

COPERNICUS ARCHITECTURE

Copernicus

FULL, FREE AND OPEN

Sentinels

6 services use Earth Observation data to deliver…

…added-value products

Contributing missions

In Situ

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Europe's eyes on Earth

European Commission

Copernicus : Europe´s Eyes on Earth

COPERNICUS is EU Earth Observation and Monitoring programme, looking at our planet and its environment for the benefit of all European citizens

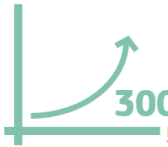
6 COPERNICUS SERVICES

PROVIDING TOOLS FOR ACTION OVER **1092 INFORMATION PRODUCTS**

7 COPERNICUS SENTINELS IN ORBIT

ACTIONNABLE INFORMATION

MONITORING THE PULSE OF OUR PLANET



300,000

USERS OF COPERNICUS DATA AND SERVICES PRODUCTS

16 TB

FULL, FREE AND OPEN EARTH OBSERVATION **DATA EVERY DAY**

COPERNICUS SERVICES

Copernicus

Monitoring the State of the Earth System Environment …

… Six cross-cutting Thematic Services

Copernicus Europe's eyes on Earth

European Commission

Land Monitoring

Benefit areas and products examples

- Ecosystems
- Biodiversity
- Agriculture
- Forestry
- Energy
- Natural Resources
- Water
- Urban planning

Global

Pan-European

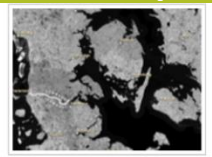


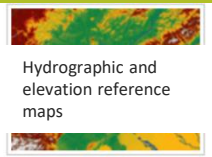
Image Mosaics


EU Land Cover

CORINE Land Cover


Specific land cover info

High Resolution Layers


Hydrographic and elevation reference maps

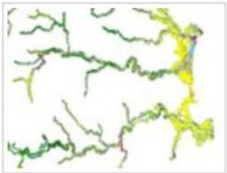
Reference Data


% of built-up area

Related Pan-European products

Local


Urban Atlas


Riparian Zones


Natura 2000 (N2K)

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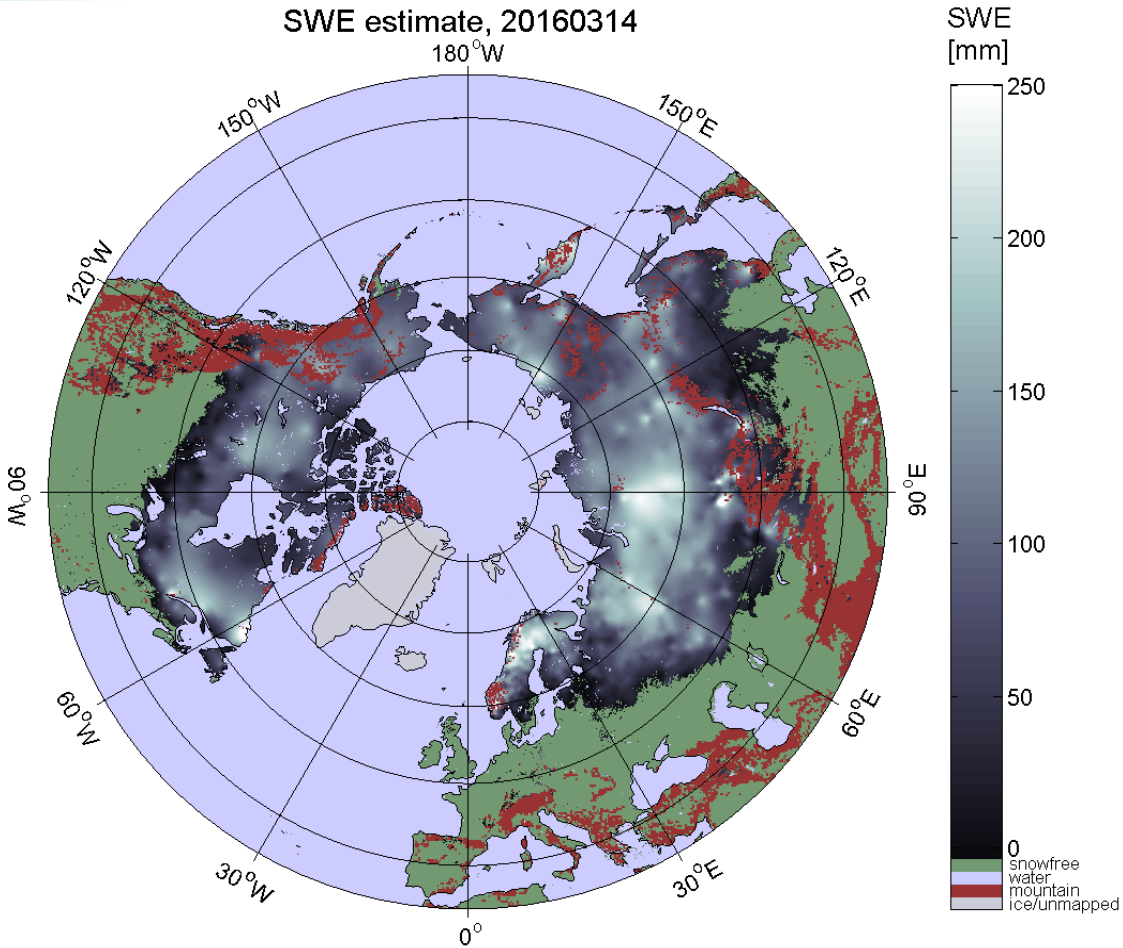
Land Monitoring

Snow Water Equivalent



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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

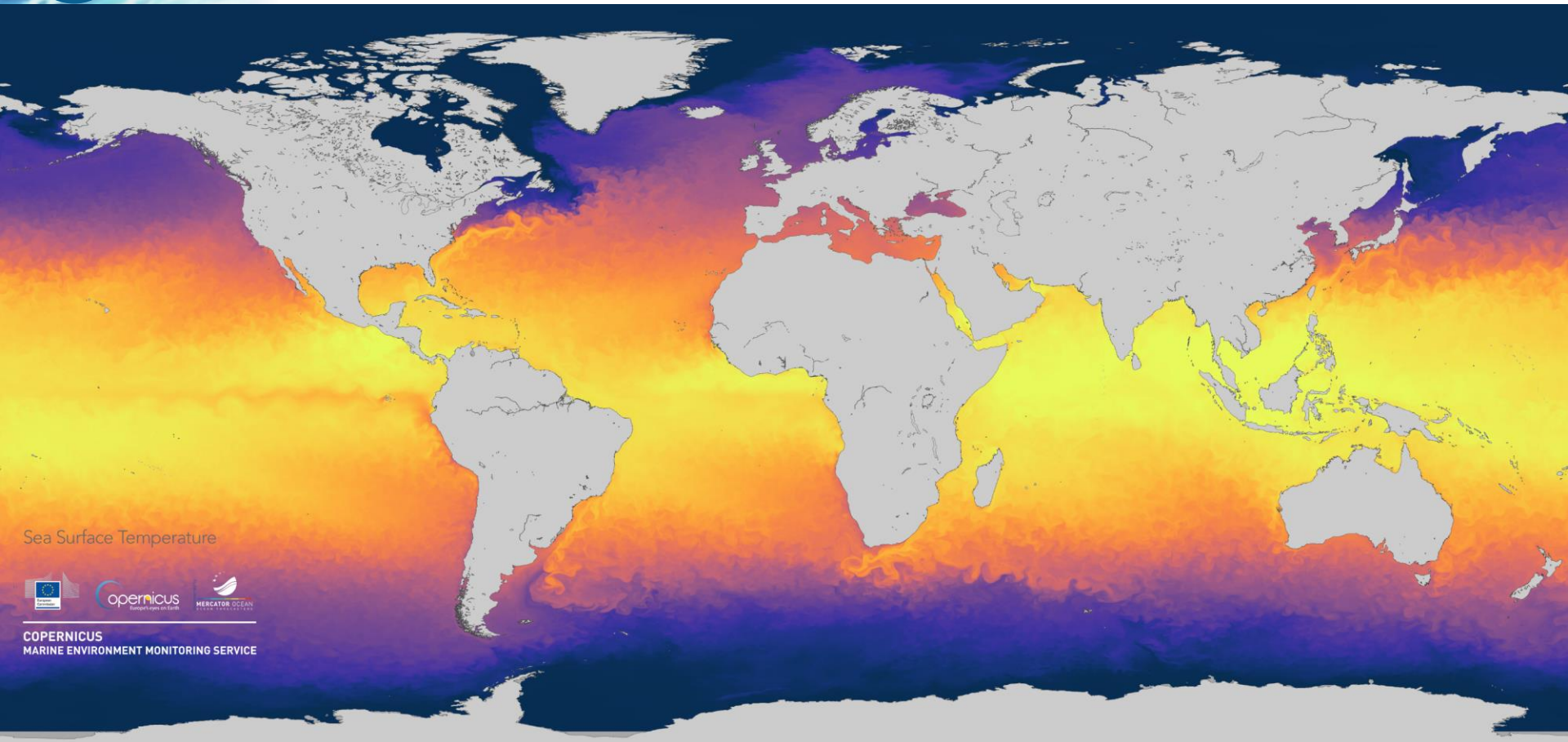
Sea Ice

Wind

Ocean Currents

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

Sea surface temperature



Atmosphere Monitoring

Benefit areas and products examples

- Health
- Environment
- Pollution
- Climate
- Renewable Energy

Air Quality and Atmospheric Composition

Climate forcing

Ozone layer & UV

Solar radiation

Emissions and surface fluxes

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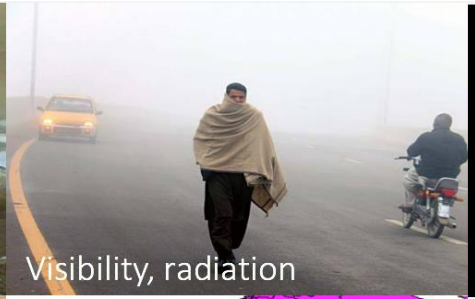
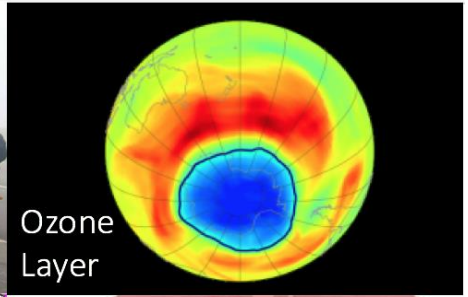
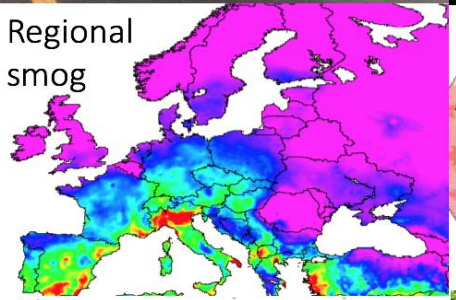
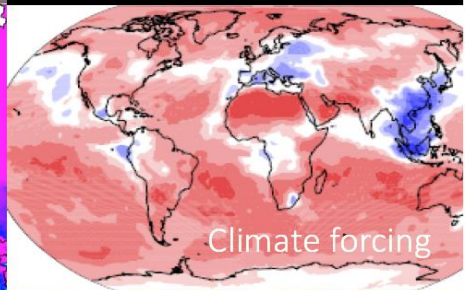
Atmosphere Monitoring

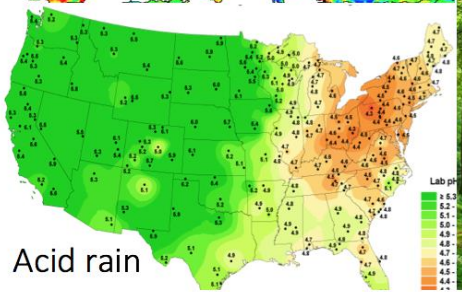
REASONS TO CARE ABOUT ATMOSPHERIC COMPOSITION

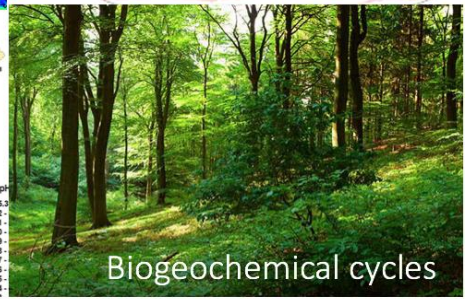












Local < 100km

Regional 100-1000km

Global > 1000km

D. Jacob

Benefit areas and products examples

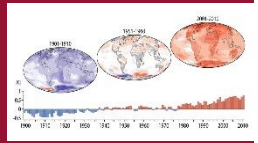
Climate Change

- 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

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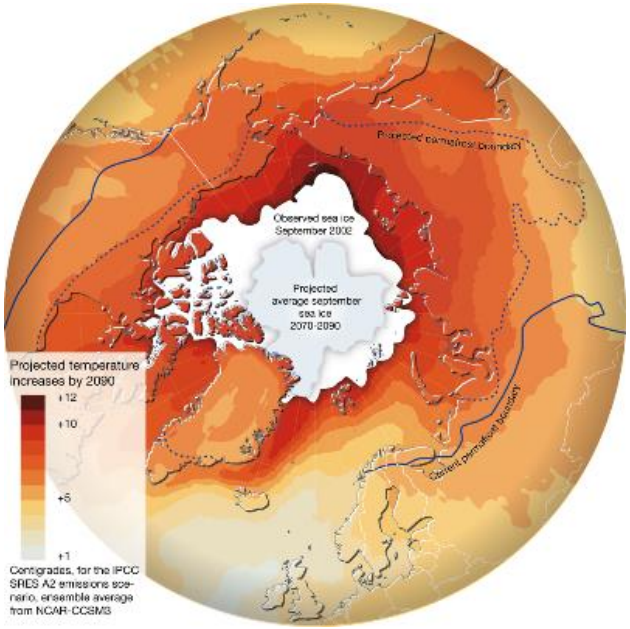
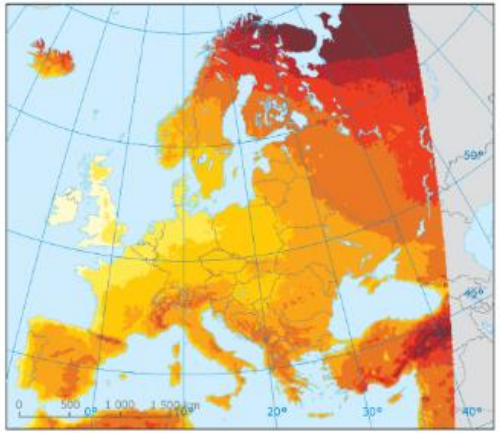
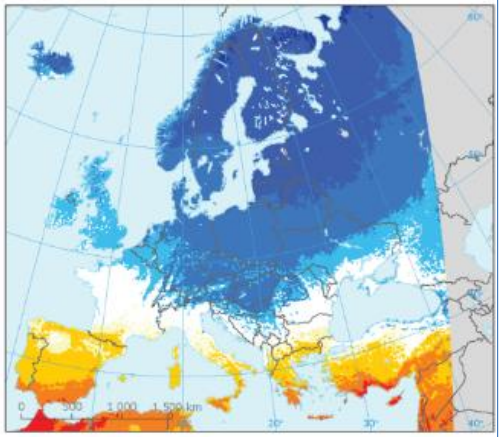
Climate Change

Access to past, present and future climate information







Projected changes in annual mean temperature (left) and annual precipitation (right)

°C: < 3 | 3 - 3.5 | 3.5 - 4 | 4 - 4.5 | 4.5 - 5 | 5 - 5.5 | 5.5 - 6 | > 6 | Outside coverage

%: < -40 | -40 to -30 | -30 to -20 | -20 to -10 | -10 to -5 | -5 to 5 | 5 to 10 | 10 to 20 | 10 to 30 | > 30

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Emergency Management

Emergency: Benefit areas and products examples

Natural & Man-made Disasters

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 & Monitoring:

- Floods: EFAS/GloFAS
- Forest Fires: EFFIS/GWIS
- Drought: EDO/GDO

*EFAS = **European Flood** Awareness System; GloFAS = **Global Flood** Awareness System*
*EFFIS = **European Forest Fire** Information System; GWIS = **Global Wildfire** Information System*
*EDO = **European Drought** Observatory; GDO = **Global Drought** Observatory*

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Copernicus Emergency Service

Tsunami

Industrial accidents

Floods

Volcano eruptions

Fires

Other urgent events

Emergency Mapping Services

Geoinformation on demand

Earthquakes

Landslides

Hurricanes

Conflicts

EMERGENCY ACTIVATION

Emergency Management

Copernicus
Europe's eyes on Earth

Security

Benefit areas and products examples

Border Surveillance

- Coastal monitoring
- Pre-frontier monitoring
- Reference mapping

Maritime Surveillance

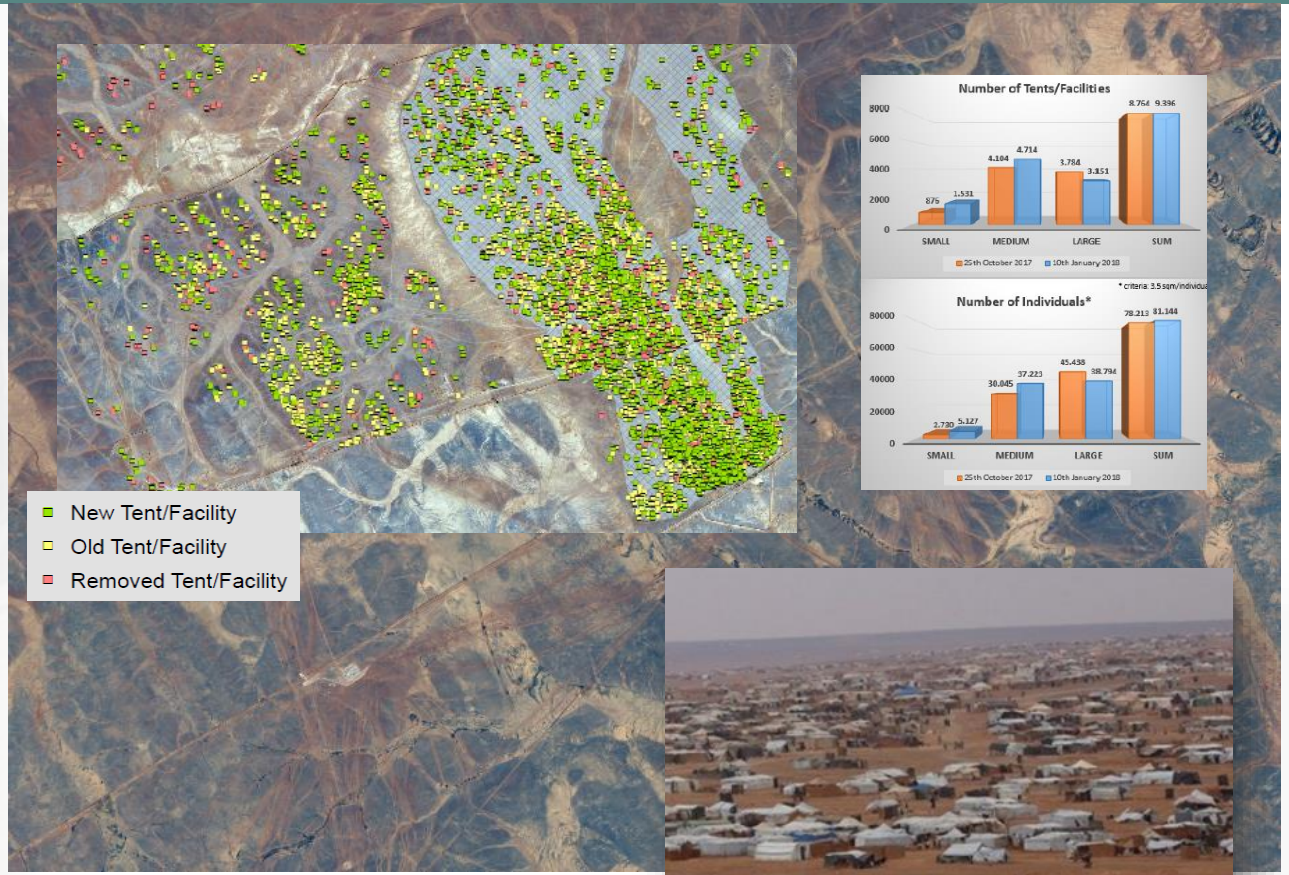
- Maritime surveillance of an area of interest
- Vessel detection
- Vessel tracking and reporting
- Vessel anomaly detection

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

Security

Copernicus SEA Operations



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COPERNICUS and SDGs

Copernicus & SDGs

- **Copernicus can already provide support to the monitoring of the progress of the following SDGs:**
- **the Biosphere**: SDG nrs 6 (clean water and sanitation), 13 (climate action), 14 (Life below water), 15 (Life on Land);
- **Society:** SDG nrs 2 (zero hunger), 3 (good health and well-being) 7 (affordable and clean energy), 11 (sustainable cities and communities);

Land Monitoring Service

15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements

Land Monitoring Service

2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality

Marine Environment Monitoring Service

Security Service

14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics

Atmosphere Monitoring Service

3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks

Land Monitoring Service

6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

Climate Change Service

13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

Emergency Management Service

11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage

Climate Change Service

Atmosphere Monitoring Service

7.3 By 2030, double the global rate of improvement in energy efficiency

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Copernicus in support of the UN Sustainable Development Goals
https://www.copernicus.eu/sites/default/files/2018-10/Copernicus_SDG_Report_July2018pdf.pdf

EUSpace supporting the Sustainable Development Goals
http://www.unoosa.org/documents/pdf/psa/activities/2018/EGNSSCopernicusEbook/SDGs_EGNSSCopernicus_eBook.pdf

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Land Monitoring

Possible future SDG indicators based on CLMS

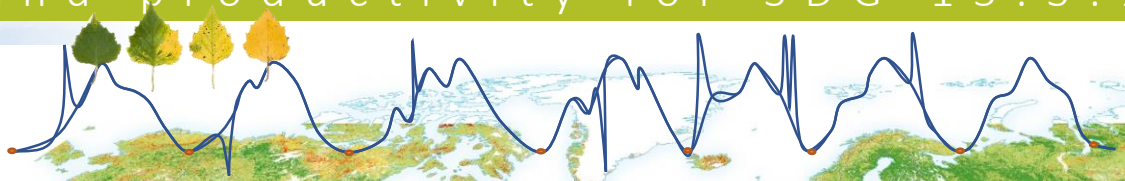
- **Tree cover change**, based on the HRL tree cover density and dominant leaf type change products for the 2012-2015-2018, documenting changes in tree covered area
- **Grassland change indicator** starting from the 2015-2018, documenting pattern and dynamics of grassland dynamics
- **Change in small woody features** once the 2015-2018 change product is published
- CLC based **“land take” indicator**
- **Landscape fragmentation** pressure from urban and transport infrastructure expansion
- **Changes in vegetation productivity and phenology** across Europe capturing the effects of climate change, and droughts/flooding
- **Land recycling and densification** documenting change in the urban environment

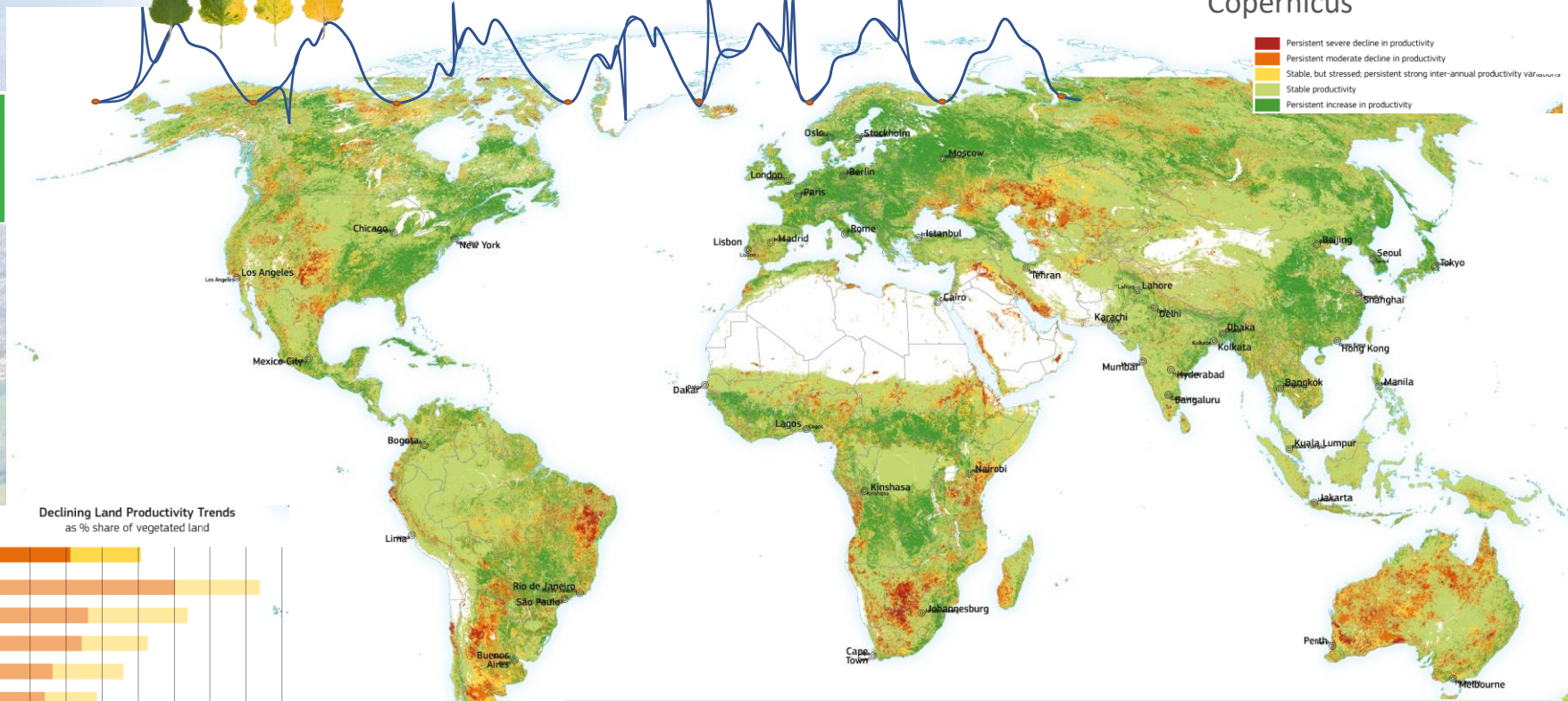
Land productivity for SDG 15.3.1

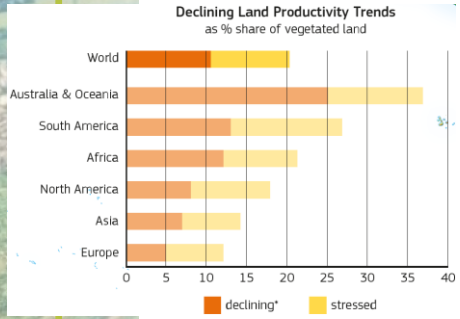
Prototyping for Copernicus

Land Monitoring

15 LIFE ON LAND







Land Productivity Dynamics (1999-2013) - 3 and 5 yearly for past period

12% of vegetated land shows declining productivity

21% of vegetated land shows declining and stressed productivity

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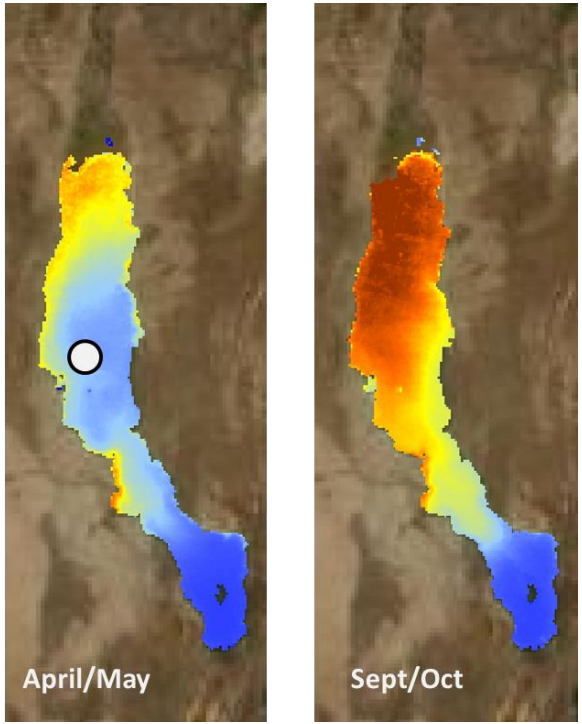
Lake Turkana monitoring

Land Monitoring

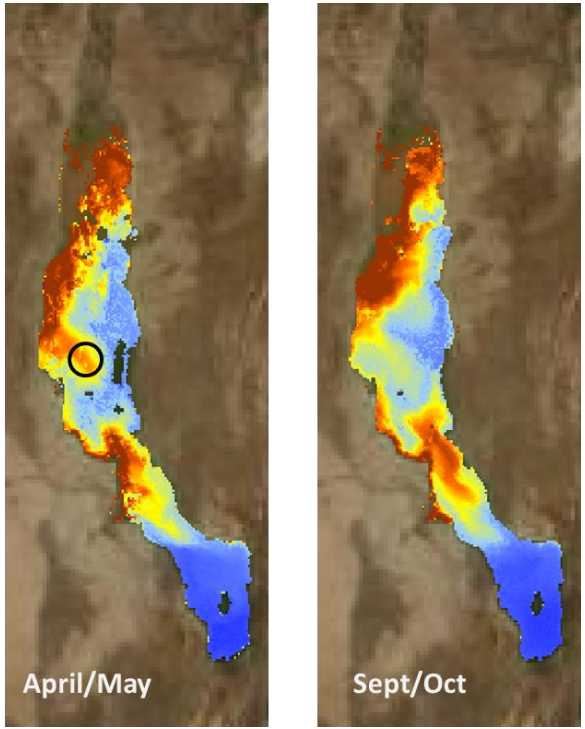
6 CLEAN WATER AND SANITATION

Water Quality product: +-4500 lakes at 300m (turbidity, trophic state, reflectance)

Turbidity data over 10 years
seasonal trends



NRT Turbidity data - 2018



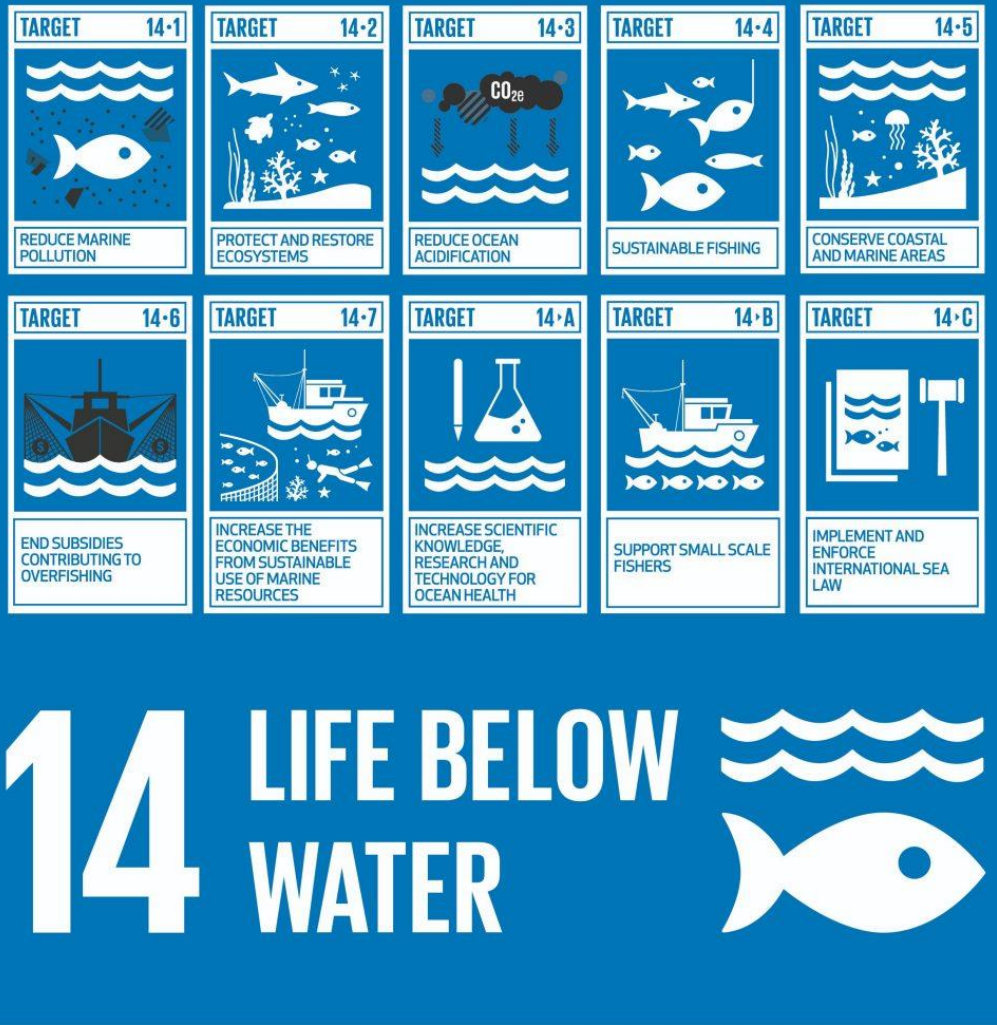
C3S and UNFCCC Sustainable Development Goals

Climate

	C3S contribution to SDGs
2 ZERO HUNGER	C3S SIS addresses agriculture, and some of the global services will focus on food security
3 GOOD HEALTH AND WELL-BEING	C3S SIS addresses health, providing relevant climate change indicators
6 CLEAN WATER AND SANITATION	Two Proof-of-concept SIS projects in C3S dedicated to water management. A urban PoC SIS is also addressing this SDG at city level. Migrated to Operations
7 AFFORDABLE AND CLEAN ENERGY	Two proof-of-concept SIS projects in C3S dedicated to the Energy Sector. Reanalyses (produced by C3S) are also highly relevant. Migrated to Operations
8 DECENT WORK AND ECONOMIC GROWTH	C3S activities contribute indirectly to this SDG insofar that the energy climate impact indicators (see goal 7) are relevant.
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	C3S is working closely with the standardisation community (via DG-CLIMA) on developing climate change information required for the writing of standards in infrastructure and transport.

	C3S contribution to SDGs
11 SUSTAINABLE CITIES AND COMMUNITIES	C3S SIS related to urban aspects of climate change, as well as health and infrastructure aspects, contribute indirectly to this SDG. Reanalysis products too.
12 RESPONSIBLE CONSUMPTION AND PRODUCTION	C3S SIS products and indicators on water management are directly relevant for this goal.
13 CLIMATE ACTION	ECV products, including from reanalysis, CDRs, seasonal forecasts and climate scenarios, directly relevant for adaptation. The SIS also delivers relevant indicators in support of adaptation. Cooperation: EEA Climate ADAPT
14 LIFE BELOW WATER	Some of the ECV products generated by C3S (including reanalysis ORAS5) are ocean relevant. This is done in coordination with CMEMS. SIS on shipping highly relevant
15 LIFE ON LAND	Biodiversity is a sectoral application of C3S. Relevant products contribute to this goal. ECV products on soil moisture, forestry, lakes, also contribute to this goal.

Marine Monitoring



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The European Earth Observation Programme

Marine Monitoring

CMEMS indicator for ocean acidity

A new indicator developed by the Copernicus Marine Service:

Global surface ocean pH from 2001 onwards

- Developed, produced and distributed by the Copernicus Marine Service; scientific expertise from Anna Conchon (Mercator Ocean International) and Marion Gehlen (IPSL), France
- Reported to and endorsed by the European Statistical Office **EUROSTAT**, and European Environmental Agency **EEA**

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Implemented by MERCATOR OCEAN INTERNATIONAL

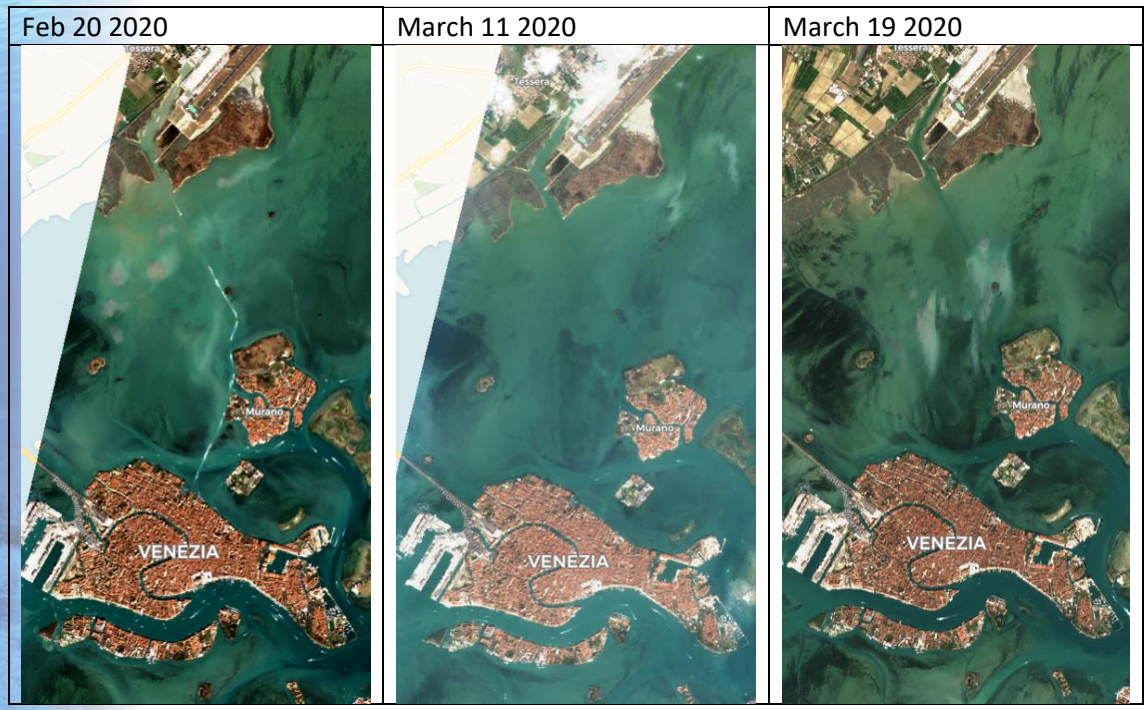
Copernicus

Some examples of the use of Copernicus during the COVID 19 Pandemics

Marine Monitoring

Lagoon of Venice - Water Transparency

While COVID-19 pandemic is striking Europe, and Italy is fighting to save lives, our environment is showing a different face with to the reduction of human activity. The famous Venice Lagoon, with reduced boat traffic, witnesses a clear change in its water transparency. The Copernicus Sentinel-2 satellite helps monitoring the evolution of the Venice Lagoon water transparency.



Copernicus Sentinel-2 true colour images in the Lagoon of Venice on Feb 20 (the last cloud free day before any restrictive measure, left), March 11 (when lock-down was in place , middle) and March 19 (right)

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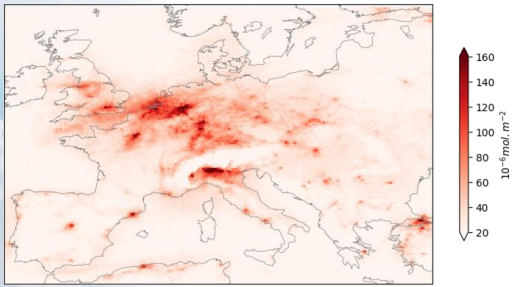
CAMS IN ACTION : SENTINEL-5P, AIR QUALITY FROM SPACE

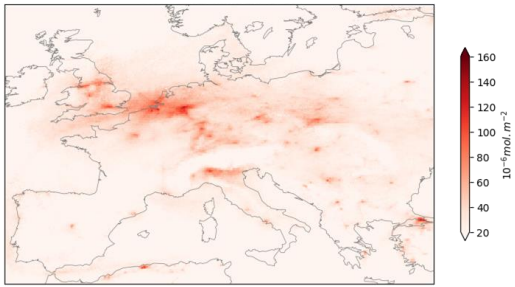
Atmosphere Monitoring

NO_2 Total Column

Mid-March to mid-April 2019



Mid-March to mid-April 2020



S-5P is the 1st satellite to provide credible measurements of air quality.

S-5P NO_2 total column provision: ESA, KNMI (NL)
S-5P NO_2 total column processing: ECMWF

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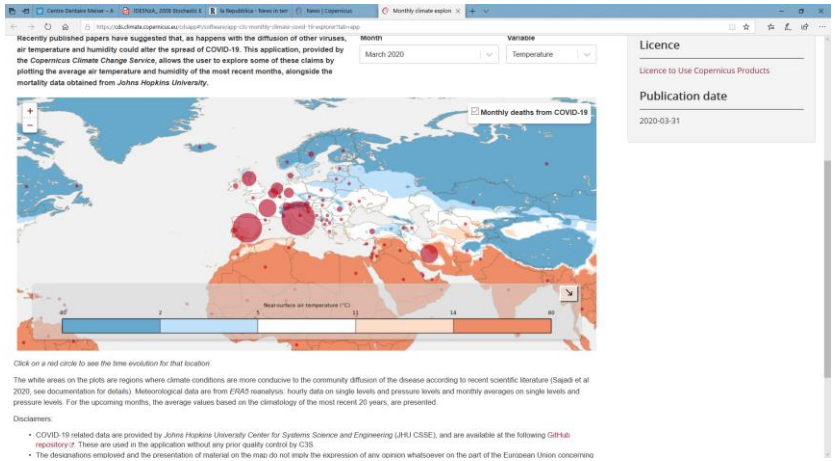
Climate Change

C3S helps health experts explore how temperature and humidity affect virus spread

https://climate.copernicus.eu/c3s-helps-health-experts-explore-how-temperature-and-humidity-affect-virus-spread

Recent research suggests that the spread of the new coronavirus (SARS-CoV-2) could be affected by temperature and humidity, so the C3S has worked with environmental software experts B-Open to develop an application that maps mortalities against temperature and humidity data. The application allows health authorities and epidemiology centres to explore the claims that temperature and humidity could affect the spread of coronavirus



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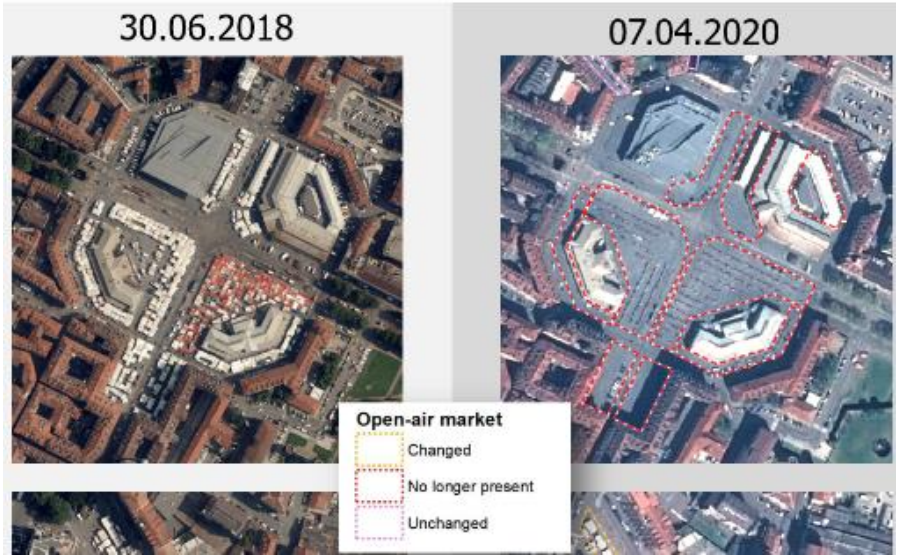
EMS - COVID-19 outbreak in taly

Emergency Management

- Copernicus EMS Rapid Mapping was activated by the Italian Civil Protection Department on the 5th of April for the city of Turin in northern Italy.
- The scope of this activation is to map and observe over time public gathering places such as street markets and parks, as well as temporary health facilities such as tents and triage facilities next to hospitals.
- The objective is, to provide the Civil Protection with evidence to support the decision-making process in relation to the COVID-19 emergency.
- Activation area: Piedmont Region – Alessandria, Cuneo and Turin



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Thank you

M. Facchini

HoU Earth Observation

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