

Earth Observation, a game changer for the 2030 Agenda on Sustainable Development

UN/Germany HLF: Space 2030, the way forward after UNISPACE+50
13-16 November 2018, Bonn

Session II: Furthering Sustainable Development and strengthening international cooperation on global health and low-emission and resilient societies

Marc Paganini

European Space Agency (ESA), Directorate of Earth Observation Programmes

EO serving the Global Agendas

Climate Action

Paris Agreement



Monitoring Climate Change & Understanding

Sustainable Development

2030 Agenda



Managing progress on sustainable development in all its facets

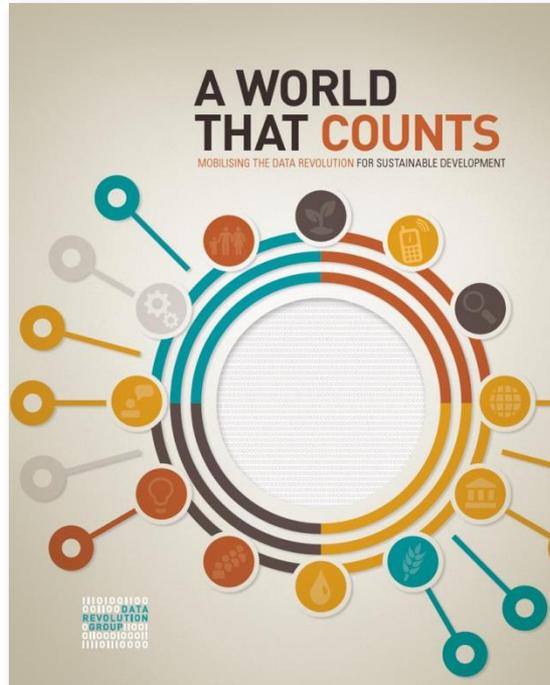
Disaster Risk Reduction

Sendai Framework



Supporting Disaster Resilient Societies

Mobilizing the Data Revolution for Sustainable Development



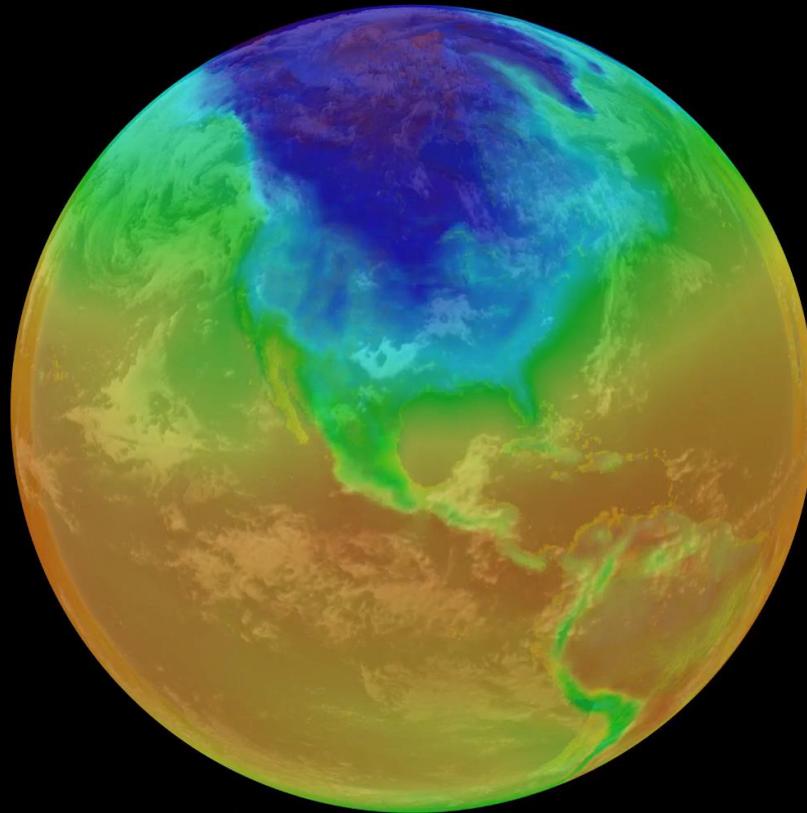
*“ **Data and evidence** are the foundation of development policies and effective program implementation. ”*

Mahmoud Mohieldin, SVP, World Bank

UN SG Independent Expert Advisory Group, 11/2014



Satellite Observations,
an essential source of information to study climate change



Commonly stated obstacles to the scaling-up and operational use of EO in the global sustainable development agendas

Restrictive data access policies (including cost)

Not enough “fit for purpose” products

Frequency of observations insufficient to track changes at appropriate scales

Needs for continuity of observations and long-term EO programs

Lack of standardisation of EO data processing methodologies

Lack of analysis ready data

Lack of clear and solid user-oriented methods and guidelines

Capacity building and training

Difficulties to discover and access EO data

Insufficient solid track records of successful case studies



The European Copernicus Program

S-1



Radar

A

3 Apr. 2014

B

25 Apr. 2016

C

2022/23

D

> 2022/23

S-2



High Res.
Optical

A

23 Jun. 2015

B

6 Mar. 2017

C

2022/23

D

> 2022/23

S-3



Medium Res.
Optical &
Altimetry

A

16 Feb. 2016

B

25 Apr. 2018

C

2023

D

> 2023

S-4



Atmospheric
Chemistry
(GEO)

A

2022

B

2027

S-5P



Atmospheric
Chemistry
(LEO)

A

13 Oct. 2017

S-5



Atmospheric
Chemistry
(LEO)

A

2021

B

2027

C

> 2027

S-6



Altimetry

A

2020

B

2025



Long term data continuity for sustained monitoring

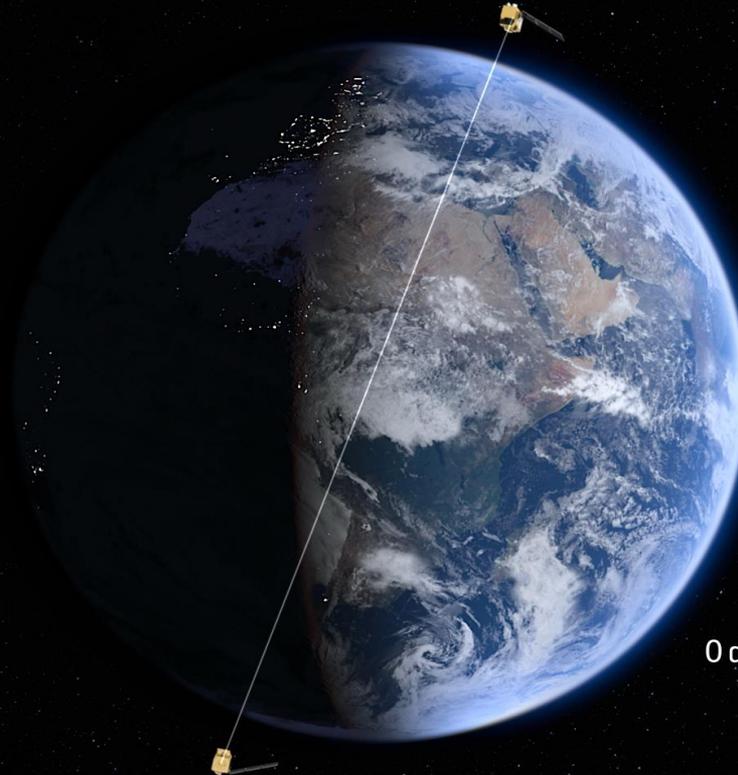
Promoting universal access to satellite data

Sentinel 2 Observation Scenario



Systematically

- **All land surfaces** between 56° South latitude and 84 North latitude
- **Major islands and coral reefs** (greater than 100 km² size),
- EU islands and all other small islands located at less than **20 km from the coastline**
- **The whole Mediterranean Sea** as well as all inland water bodies and closed seas
- S2A launch on 23 June 2015
S2B launch on 7 March 2017



10m/20m/60m
13 spectral bands
290km swath
5 days revisiting

0 days 00 hours 00 minutes
Sentinel-2 constellation:
summer solstice

Sentinels Fleet

Advent of steady satellite data streams

Big Data Era



>15 TB per day



Mobilise the data
revolution
for the benefits of
all
leaving no one
behind

Building on ICT advances

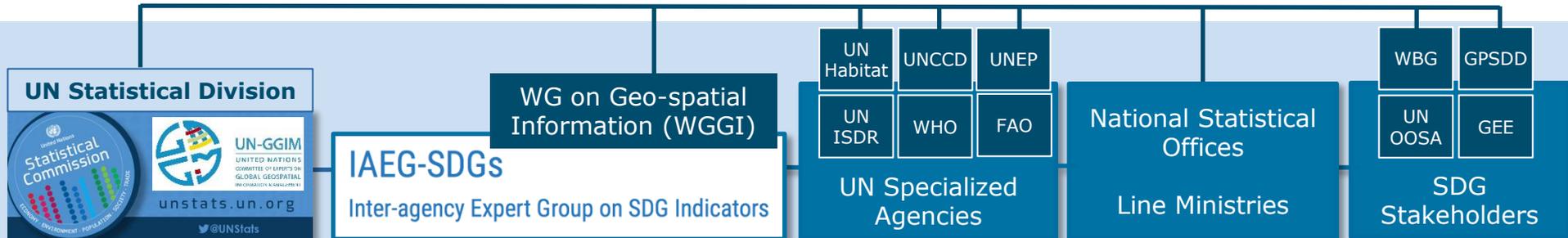
**High Performance
Computing Infrastructures**



International collaboration to scale up EO innovation for the full achievements of the 2030 Agenda on Sustainable Development?

GEO Initiative on SDGs
(EO4SDG)

CEOS Ad-hoc team on
SDGs (AHT SDGs)



Global Datasets

EO Good Practices Guidance

mainstream EO in national processes

EO Capacity Building

EO Toolboxes & Exploitation Platforms

EO Knowledge Sharing Hub

How is the EO community organised to scale up EO innovation for the full achievements of the SDGs?



Global
Datasets

EO Good
Practices
Guidance

mainstream
EO
in national
processes

EO Capacity
Building

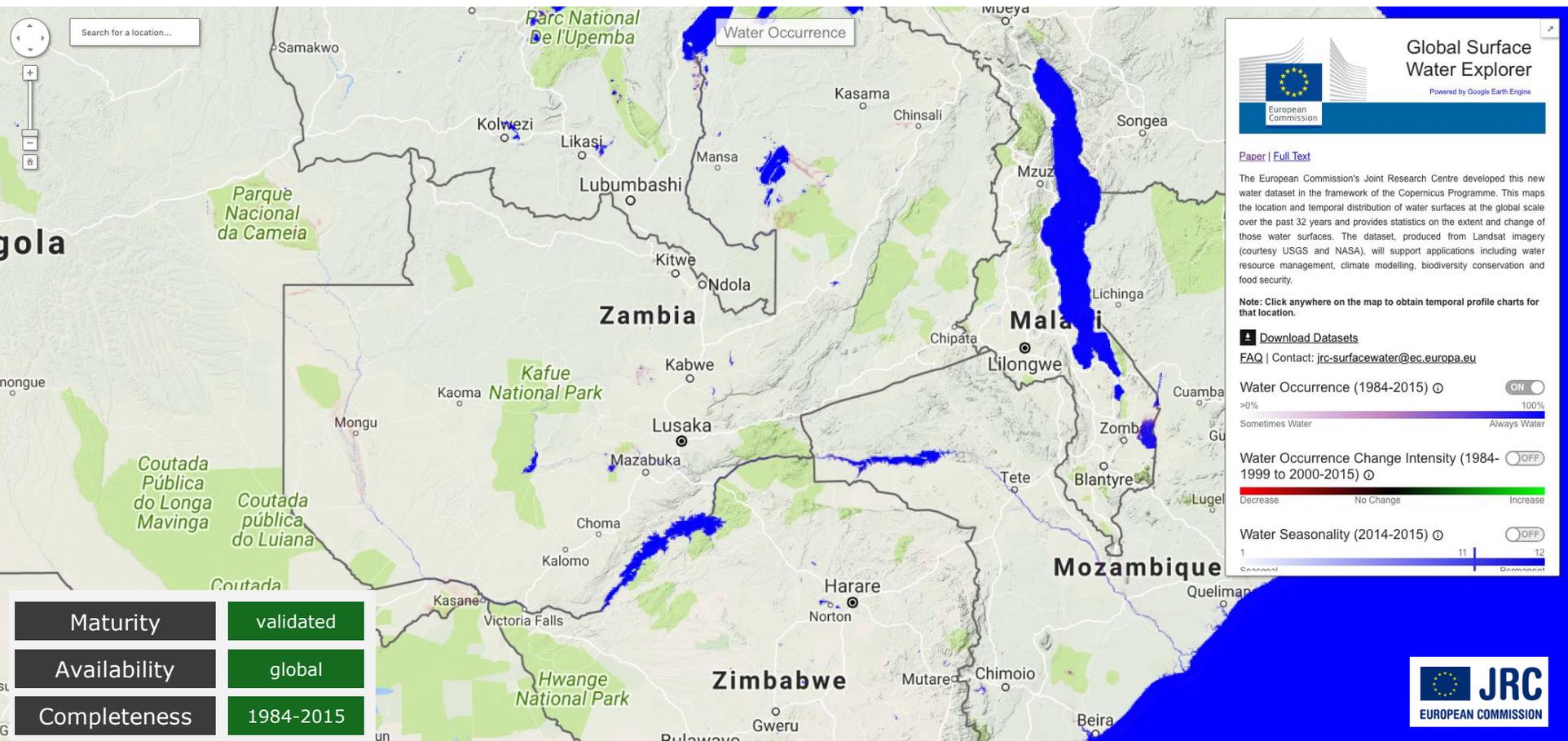
EO
Toolboxes
&
Exploitation
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EO
Knowledge
Sharing Hub



Global EO products in support of SDG indicators

Global Surface Water Extent for SDG 6.6.1 (water-related ecosystems)



Global EO products in support of SDG indicators

Global Mangrove Watch for SDG 6.6.1 (water-related ecosystems)



GLOBAL
FOREST
WATCH

FOREST CHANGE LAND COVER LAND USE CONSERVATION PEOPLE STORIES COUNTRY DATA

LAND COVER
Mangrove forests

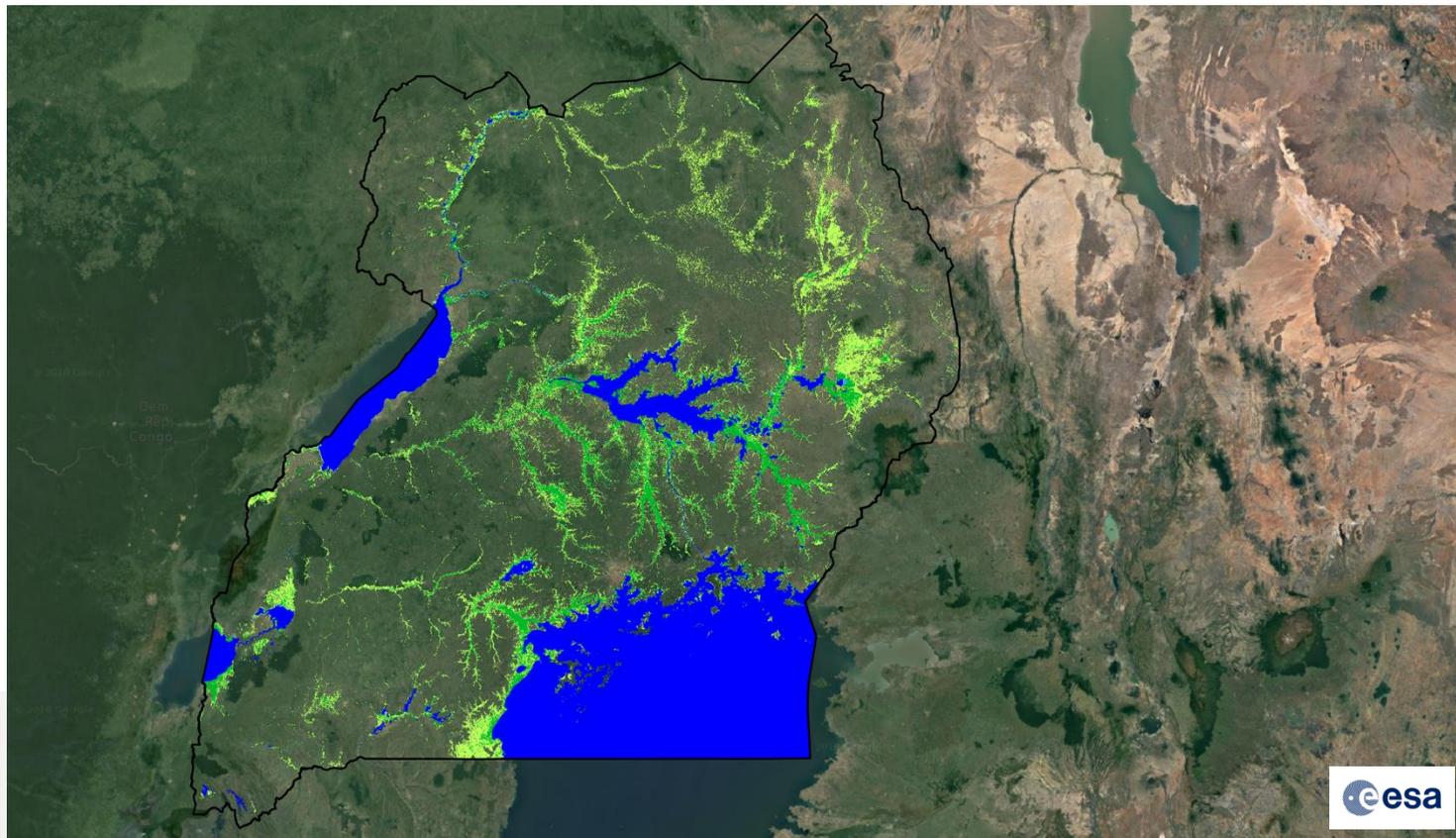
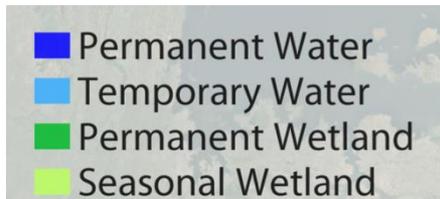


Maturity	validated
Availability	global
Completeness	2010



Global EO products in support of SDG indicators

Vegetated Wetlands Inventories for SDG 6.6.1 (water-related ecosystems)



Maturity	Under validation
Availability	national cases
Completeness	2017/18

Global EO products in support of SDG indicators

Water Quality for SDG 6.3.2 and 6.6.1



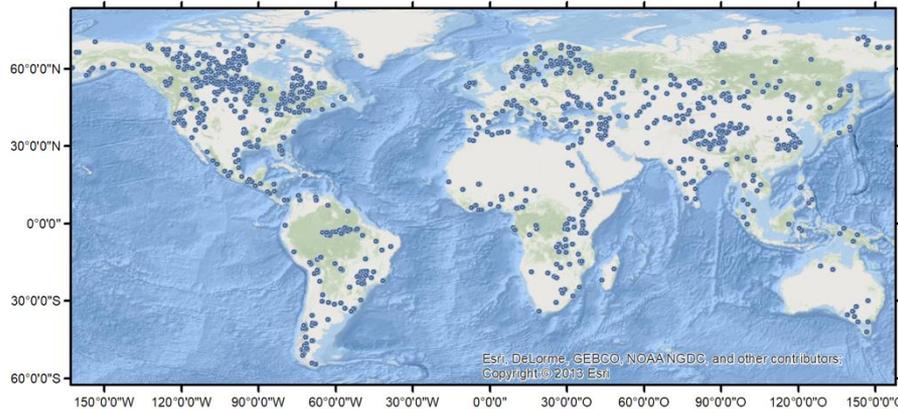
Water Bodies
Lake and river water level
Lake surface water temperature
Lake surface reflectance
Lake turbidity
Lake trophic state
Water Level

Parameters

- Lake Surface Reflectance (all bands)
- Lake turbidity
- Trophic state (based on CHL concentration)
- Lake Water Temperature

Spatial resolution

- 300m, 1km
- 100m (in evolution)



Coverage

- 1,000 selected lakes

Temporal

- 10days averages
- 2002 – 2012; 2016 - ongoing

Evolution

- Evolution towards a seamless global product covering all water bodies in 100m resolution

Maturity	needs tailoring
Availability	1,000 lakes
Completeness	2002-2012

Global EO products in support of SDG indicators

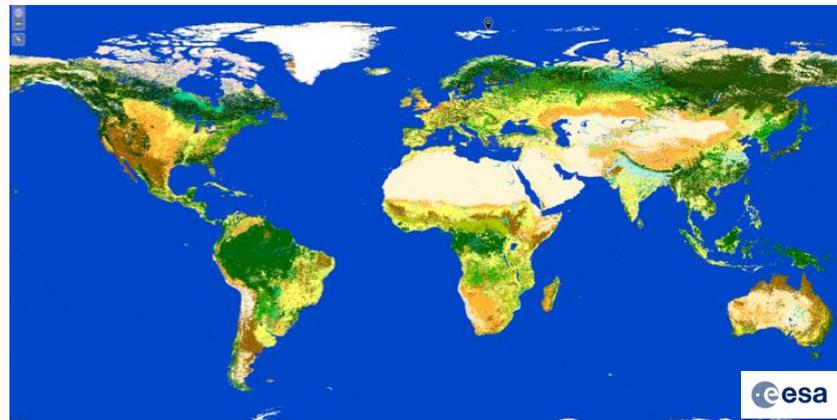
Global land cover and land productivity dynamics for SDG 15.3.1 (LDN)

Land Cover

Global Land Cover Maps, 1992-2015, Annual maps

AVHRR, SPOT VGT, ENVISAT MERIS, MODIS, PROBA-V, Sentinel 3, 300m

ESA Land Cover CCI

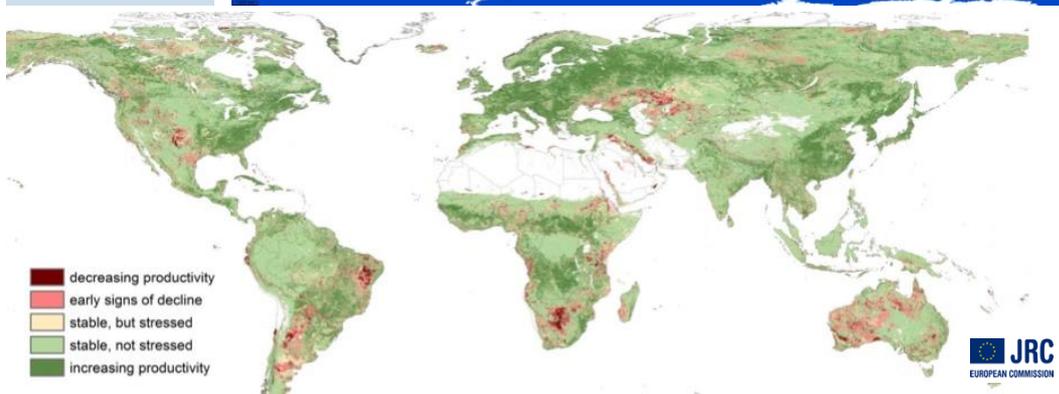


Land Productivity Dynamics

LPD derived from 1999-2013 NDVI phenological analyses

SPOT VEGETATION, 1km

EC Joint Research Center (JRC)



Maturity	coarse resolution
Availability	global
Completeness	2000-2015

Monitoring 15.3.1. on the status & trends in land degradation is based on sub-indicators:
 (1) **Land Cover and Land Cover Changes** (2) **Land Productivity** (3) **Soil Organic Carbon**

Global EO products in support of SDG indicators

World Settlement Footprint (WSF) for SDG 15.3.1 (sustainable urbanization)



Marc.Paganini WSF GUF GUF+ TimeScan HAPS Regional LU - LC Geotagged Tweets Ground Surface Movement External Data



Maturity	validated
Availability	global
Completeness	2015



2010-12-31 2010-12-31

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**Data
gravity**

**Digital
Entrepreneurs**

**Massive
Geospatial-
temporal
data**

**New
Space**



**Transformative
technologies**

**Artificial
Intelligence**

**Deep
Learning**

→ THE ESA EARTH OBSERVATION Φ -WEEK

EO Open Science and FutureEO

12–16 November 2018 | ESA-ESRIN | Frascati (Rome), Italy

**Big Data
Analytics**

Harnessing the power of satellite data

TEPs, collaborative "big data" Thematic Exploitation Platforms

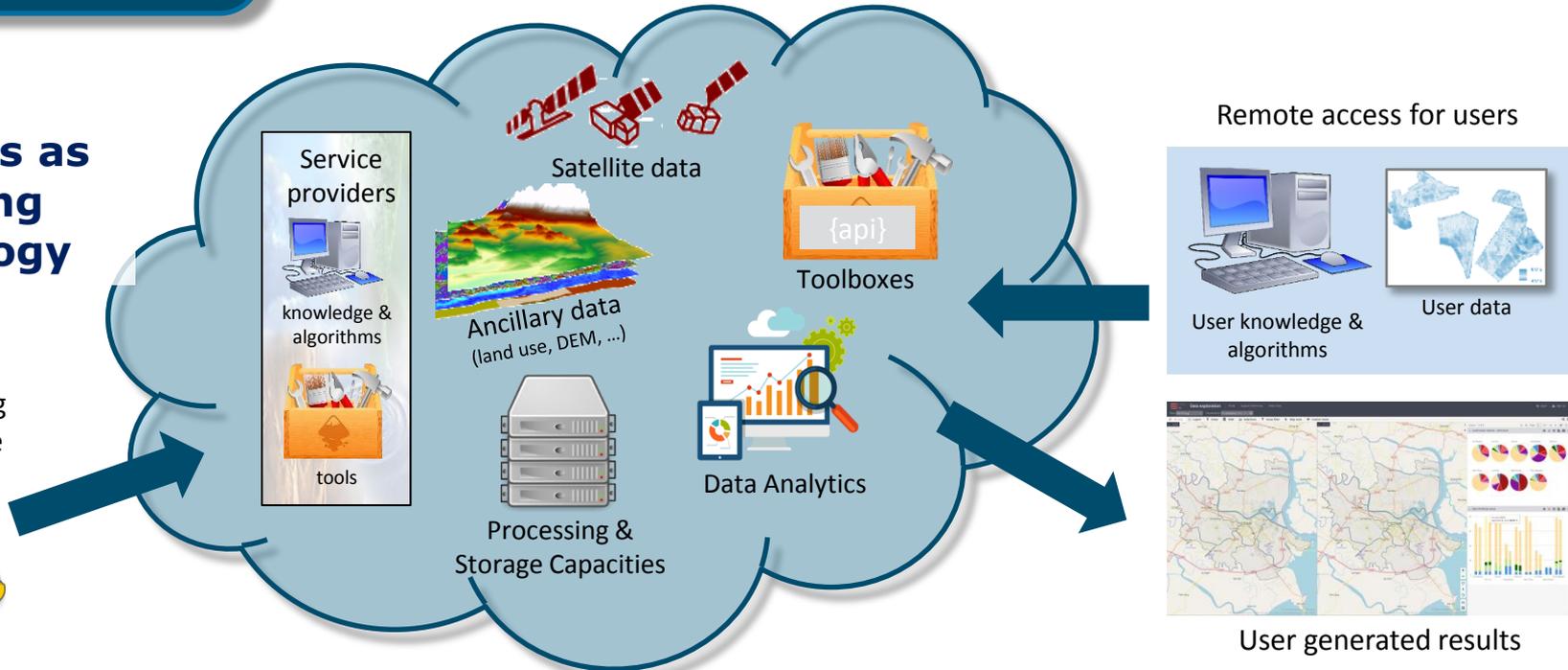
The power of the
Cloud
The power of
Partnerships

"Bringing the users to the data"

Simplify the extraction of information from EO data
Enable large scale exploitation of EO data
Stimulate innovation with EO data

**Platforms as
enabling
technology**

Mobile data
Crowdsourcing
citizen science





Global Urban Footprint (GUF) layer now available

Discover DLR's new Global Urban Footprint (GUF) data at the Urban TEP platform and inspect the urban and rural human settlements pattern in a so far unique precision and consistency

[Browse GUF](#)



**Geobrowser &
Catalogue**



**Visualization and
Analytics**



**Developer
Environment**



User Forum

Three **processing clusters** with standardised interfaces (OGC, WPS, WMS)

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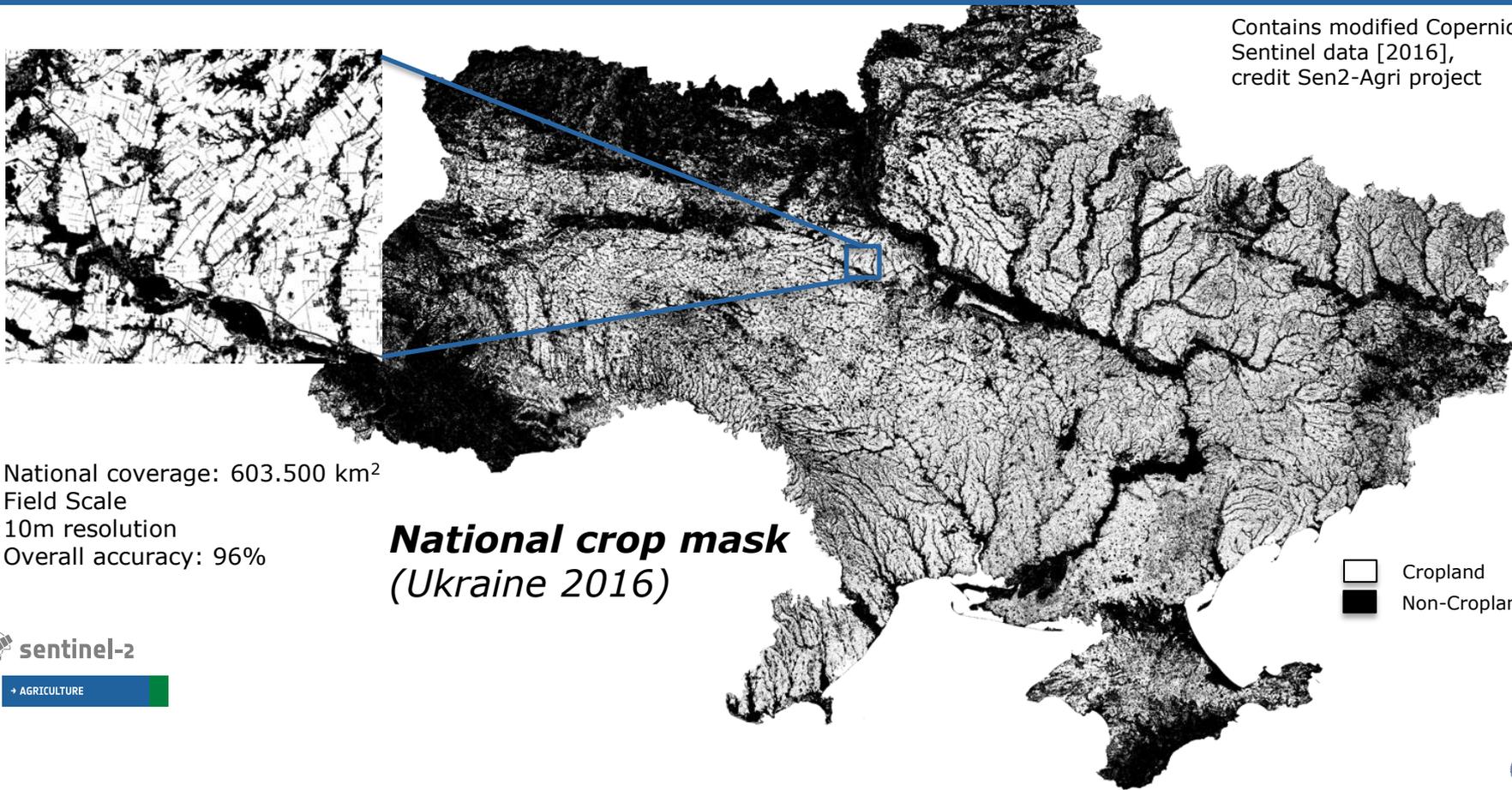


EO products in support of SDG indicators

Crop masks and crop types for SDG 2.4.1 (sustainable agriculture)



Contains modified Copernicus Sentinel data [2016], credit Sen2-Agri project



National coverage: 603.500 km²
Field Scale
10m resolution
Overall accuracy: 96%

***National crop mask
(Ukraine 2016)***

□ Cropland
■ Non-Cropland



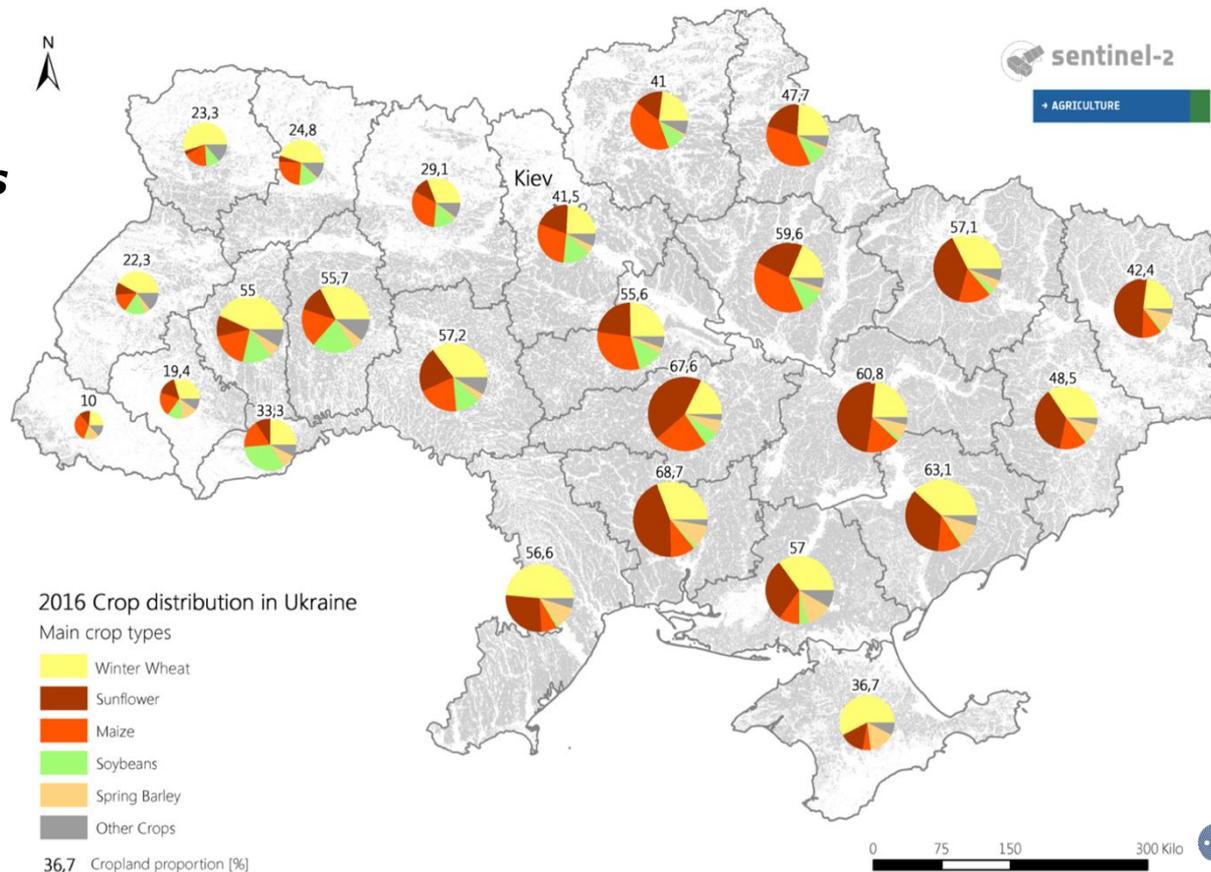
→ AGRICULTURE



EO products in support of SDG indicators

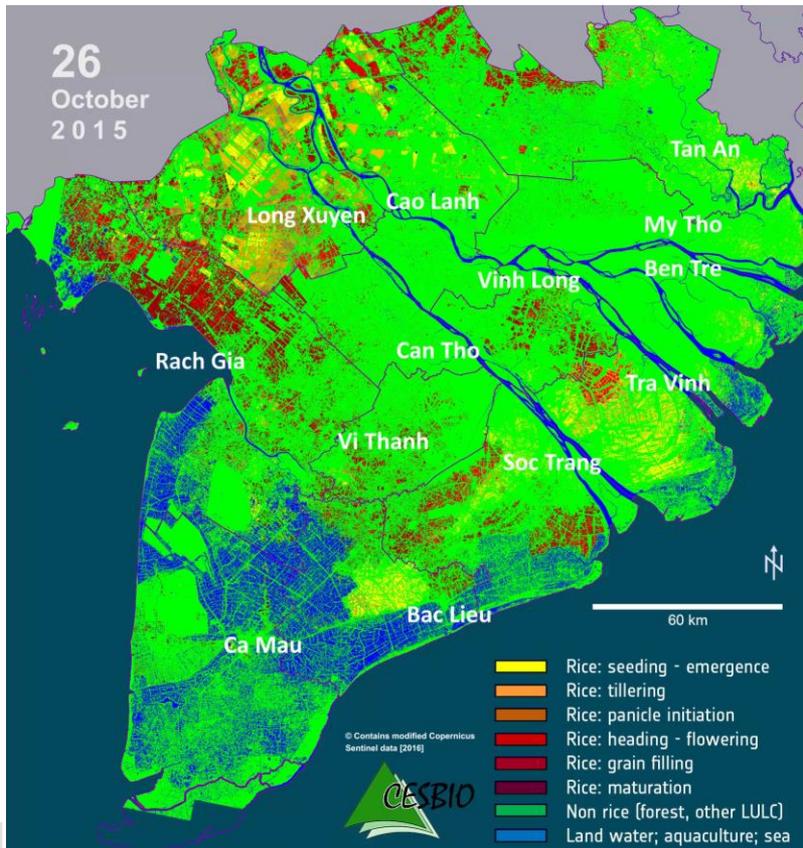
Crop masks and crop types for SDG 2.4.1 (sustainable agriculture)

National crop statistics by admin. units (Ukraine 2016)



EO products in support of SDG indicators

Rice Monitoring (areas and stage) for SDG 2.4.1 (sustainable agriculture)



Winter-Spring Rice 2015/16

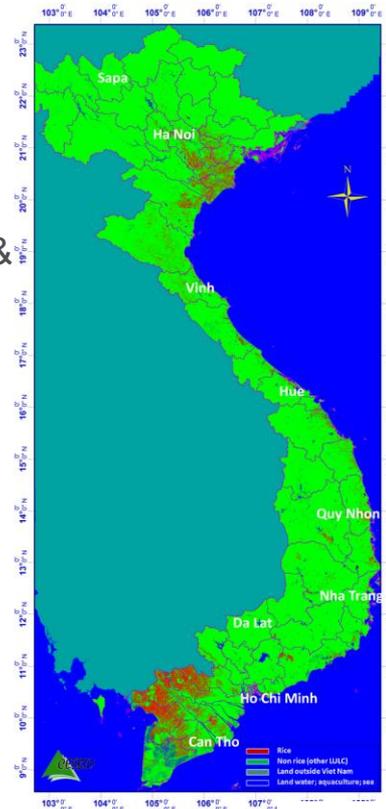
- March 2016: 1.4 Million ha rice
- March 2015: 1.7 Million ha rice

16.5% loss in rice area due to drought & salt water intrusion caused by El Nino

976,000 people affected

67 Mil.\$ estimated damage (UN estimates)

The Mekong Delta, Vietnam
300 km x 300 km
20 m resolution



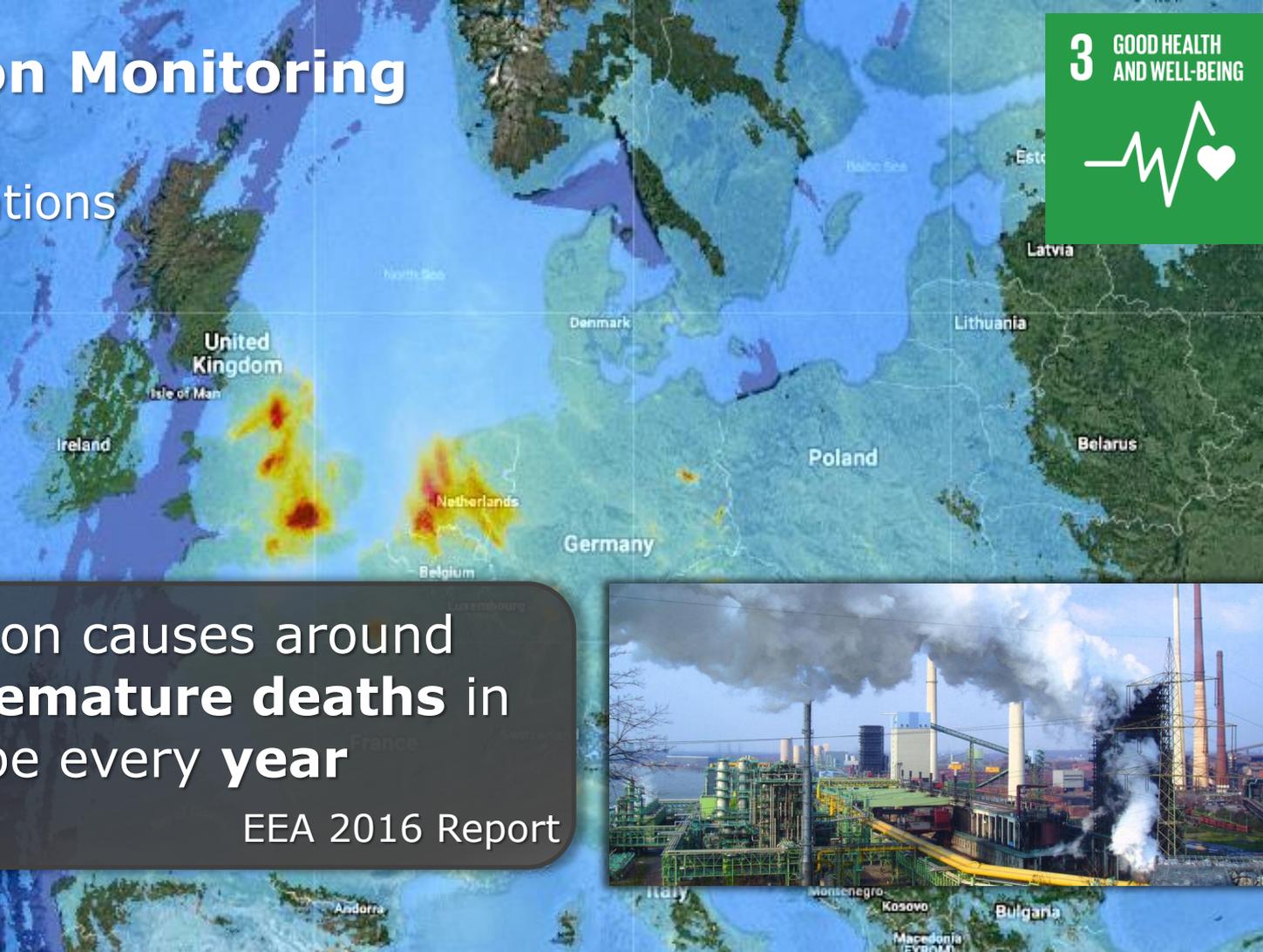
Air Pollution Monitoring Sentinel-5P

NO₂ Concentrations
Europe

19 April 2018

© KNMI / ESA

3 GOOD HEALTH
AND WELL-BEING



Air pollution causes around
467,000 **premature deaths** in
Europe every **year**

EEA 2016 Report



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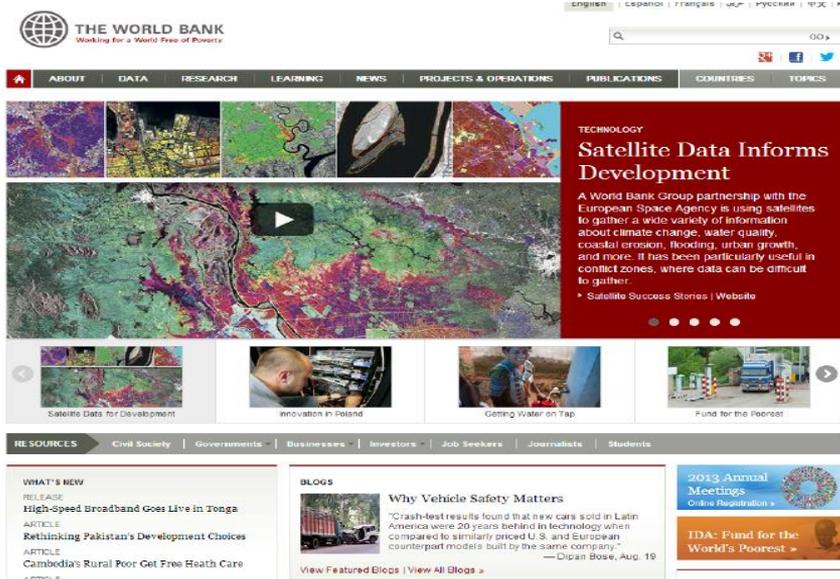
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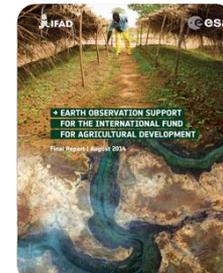
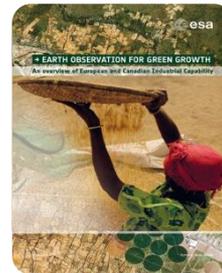


Earth Observation for Sustainable Development

In partnership with International Financing Institutions



From demonstrations to mainstreaming:
Transferring EO into operational working
processes & development financing as
'best-practice' source of geo-information



European Space Agency



*“The integration of statistics, geospatial information, **Earth observations**, and other sources of Big Data, **combined with new emerging technologies**, analytics and processes, are **becoming a fundamental requirement for countries** to measure and monitor local to global **sustainable development policies** and programs”*

UN-GGIM co-chairs

<http://eohandbook.com/sdg/>

