Space for Sustainable Development

ESA's contribution to the **Where**, **What**, and **How** of Data

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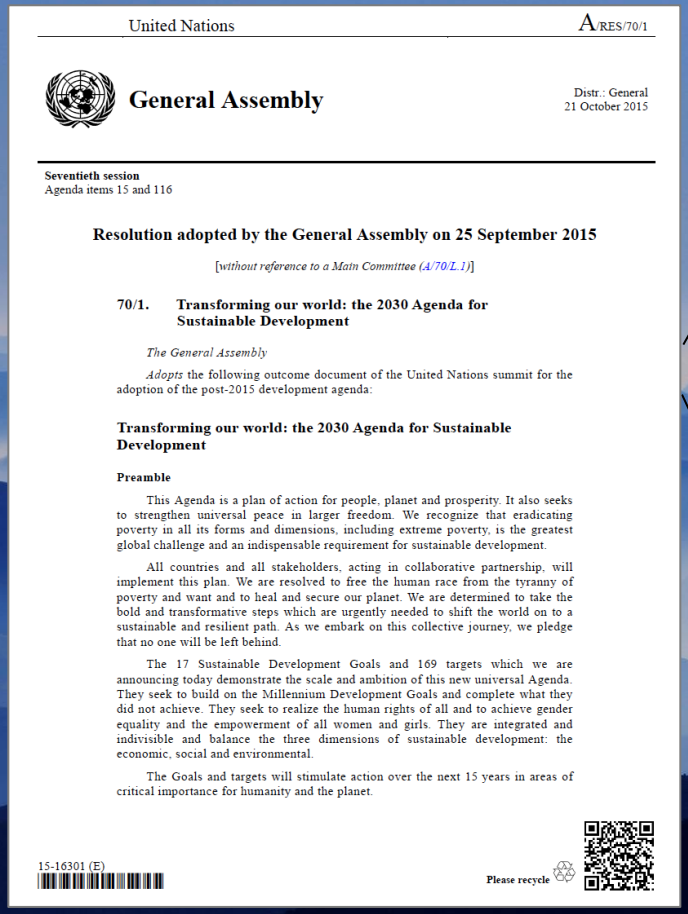
UN-GGIM 7th Session | New York, NY, 1 August 2017

UN-GGIM Forum on the 2030 Agenda for SD "Where is the Data?"

Global Sustainable Development
Role of Earth Observation information



United Nations A/RES/70/1

General Assembly

Distr.: General
21 October 2015

Seventieth session
Agenda items 15 and 116

Resolution adopted by the General Assembly on 25 September 2015

[*without reference to a Main Committee (A/70/L.1)*]

70/1. Transforming our world: the 2030 Agenda for Sustainable Development

The General Assembly

Adopts the following outcome document of the United Nations summit for the adoption of the post-2015 development agenda:

Transforming our world: the 2030 Agenda for Sustainable Development

Preamble

This Agenda is a plan of action for people, planet and prosperity. It also seeks to strengthen universal peace in larger freedom. We recognize that eradicating poverty in all its forms and dimensions, including extreme poverty, is the greatest global challenge and an indispensable requirement for sustainable development.

All countries and all stakeholders, acting in collaborative partnership, will implement this plan. We are resolved to free the human race from the tyranny of poverty and want and to heal and secure our planet. We are determined to take the bold and transformative steps which are urgently needed to shift the world on to a sustainable and resilient path. As we embark on this collective journey, we pledge that no one will be left behind.

The 17 Sustainable Development Goals and 169 targets which we are announcing today demonstrate the scale and ambition of this new universal Agenda. They seek to build on the Millennium Development Goals and complete what they did not achieve. They seek to realize the human rights of all and to achieve gender equality and the empowerment of all women and girls. They are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental.

The Goals and targets will stimulate action over the next 15 years in areas of critical importance for humanity and the planet.

15-16301 (E)

Please recycle

Transforming our World: The 2030 Plan for Global Action

Article 76:

… We will promote transparent and accountable scaling-up of appropriate public-private cooperation to exploit the contribution to be made by a wide range of data, **including Earth observation and geo-spatial information**, while ensuring national ownership in supporting and tracking progress.

17 GOALS

EO importance for the SDGs

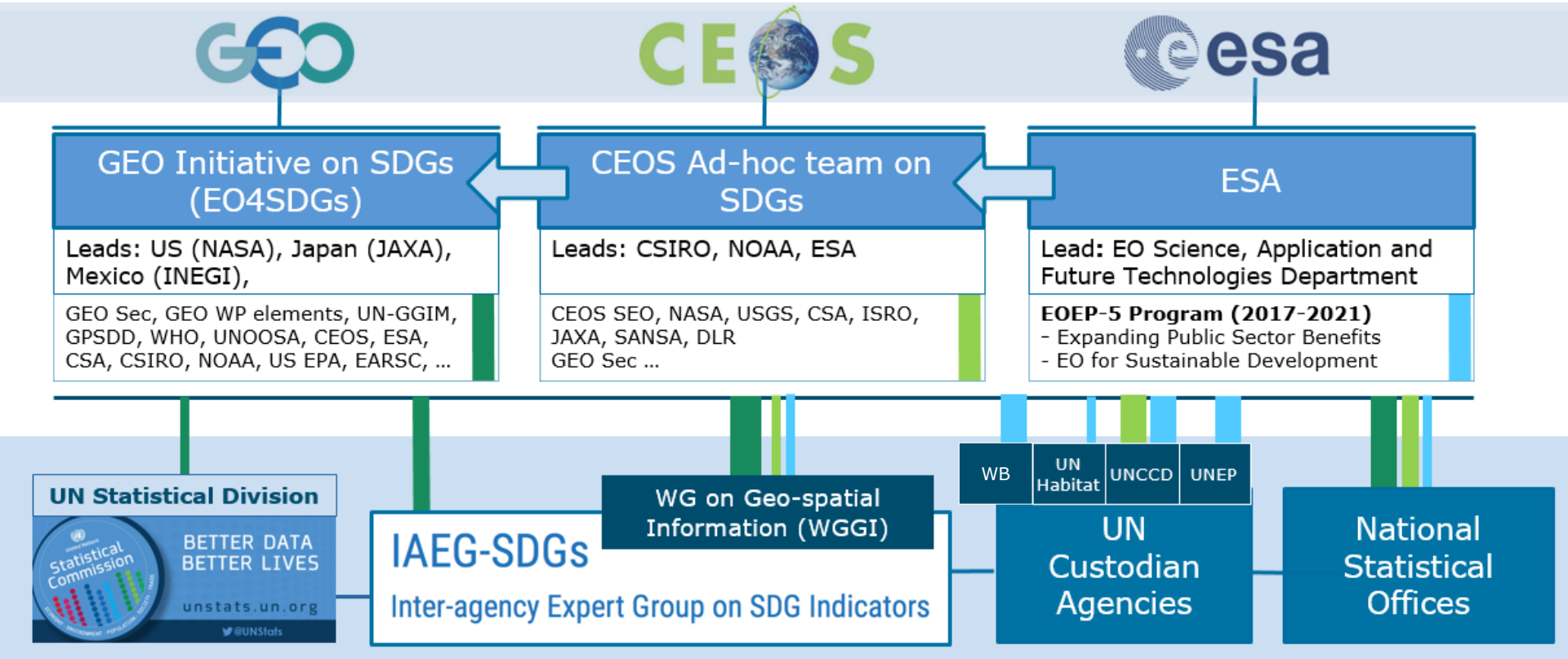
Earth Observation's potential contribution to the SDG Targets and Indicators

SDGs with most opportunities for EO data

Target — *Contribute to progress on the Target yet not the Indicator per se*								*Goal*	*Indicator* — *Direct measure or indirect support*				
						1.4	1.5	1	1.4.2				
					2.3	2.4	2.c	2	2.4.1				
				3.3	3.4	3.9	3.d	3	3.9.1				
								4					
							5.a	5	5.a.1				
	6.1	6.3	6.4	6.5	6.6	6.a	6.b	6	6.3.1	6.3.2	6.4.2	6.5.1	6.6.1
				7.2	7.3	7.a	7.b	7	7.1.1				
							8.4	8					
				9.1	9.4	9.5	9.a	9	9.1.1	9.4.1			
					10.6	10.7	10.a	10					
	11.1	11.3	11.4	11.5	11.6	11.7	11.b	11.c	11	11.1.1	11.2.1	11.3.1	11.6.2	11.7.1
			12.2	12.4	12.8	12.a	12.b	12	12.a.1				
				13.1	13.2	13.3	13.b	13	13.1.1				
	14.1	14.2	14.3	14.4	14.6	14.7	14.a	14	14.3.1	14.4.1	14.5.1		
15.1	15.2	15.3	15.4	15.5	15.7	15.8	15.9	15	15.1.1	15.2.1	15.3.1	15.4.1	15.4.2
							16.8	16					
17.2	17.3	17.6	17.7	17.8	17.9	17.16	17.17	17.18	17	17.6.1	17.18.1			

Analysis performed by the GEO EO4SDGs initiative

GEO-CEOS-ESA SDG engagement



CEOS Ad-Hoc Team on SDGs

In the complex and evolving SDG environment,

the new **CEOS AHT SDG** will

- **take stock of the UN processes** in place for the SDG implementation and of the existing participants and stakeholders,
- focus its activities around the **unique role that CEOS** should play **as coordination body of the Space community efforts** to support the integration of satellite EO in support to the full realisation of the SDG's.

CEOS AHT will **align its engagement with the UN SDG agenda** in the context of **GEO** (GEO Programme Board, GEO Engagement Strategy, GEO initiative EO4SDGs) and **build on established relationships** the CEOS Agencies have with the **custodian agencies** and **individual countries**.

→ THE ESA EARTH OBSERVATION PROGRAMME

The Sentinel Family

- S1A/B
- S2A/B
- S3A/B
- S4A/B
- S5P
- S5A/B/C
- S6 J-CS A/B

1980 1990 2000 2020

meteosat family
ers-1
ers-2
proba-1
envisat
goce
smos
cryosat
meteosat second generation
metop family
mtg-i
mtg-s
metop-sg
sentinel-1a
sentinel-2a
sentinel-3a
sentinel-1b
sentinel-2b
sentinel-3b
sentinel-5p
sentinel-4
sentinel-5
swarm
adm-aeolus
earthcare
biomass
Third Party Missions

Meteorological Missions driven mainly by Weather forecasting and Climate monitoring needs. These missions developed in partnership with EUMETSAT include the Meteorological Operational satellite programme (MetOp), forming the space segment of EUMETSAT's Polar System (EPS), and the new generation of Geostationary Meteosat satellites (MSG & MTG satellites).

Copernicus Sentinel Missions driven by Users needs to contribute to the European **Global Monitoring of Environment & Security** (GMES) initiative. These satellite missions developed in partnership with the EU include C-band imaging radar (Sentinel-1), high-resolution optical (Sentinel-2), optical and infrared radiometer (Sentinel-3) and atmospheric composition monitoring capability (Sentinel-4 & Sentinel-5 on board Met missions MTG and EPS-SG respectively).

Earth Explorer Missions driven by Scientific needs to advance our understanding of how the ocean, atmosphere, hydrosphere, cryosphere and Earth's interior operate and interact as part of an interconnected system. These **Research** missions, exploiting Europe's excellence in technological innovation, pave the way towards new development of future EO applications.

Missions With Partners

EUP Operated Missions

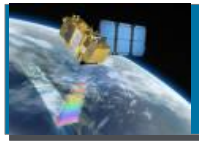
Long-term (decadal) continuous, consistent data

A new era: The space r/evolution

The European Copernicus Initiative

Securing satellite data access on the long term

Sentinel 1 – SAR imaging
All weather, day/night applications, interferometry
2014 / 2016

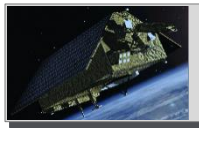


Sentinel 2 – Multi-spectral imaging
Land applications: urban, forest, agriculture,…
Continuity of Landsat, SPOT
2015 / 2017

Sentinel 3 – Ocean and global land monitoring
Wide-swath ocean color, vegetation, sea/land surface temperature, altimetry
2017 / 2018

Sentinel 4 – GEO Atmospheric Chemistry
Atmospheric composition monitoring, trans-boundary pollution
2019

Sentinel 5 & Precursor – LEO Atmospheric Chemistry
Atmospheric composition monitoring
(S5 Precursor launch in 2016)
2017 / 2019



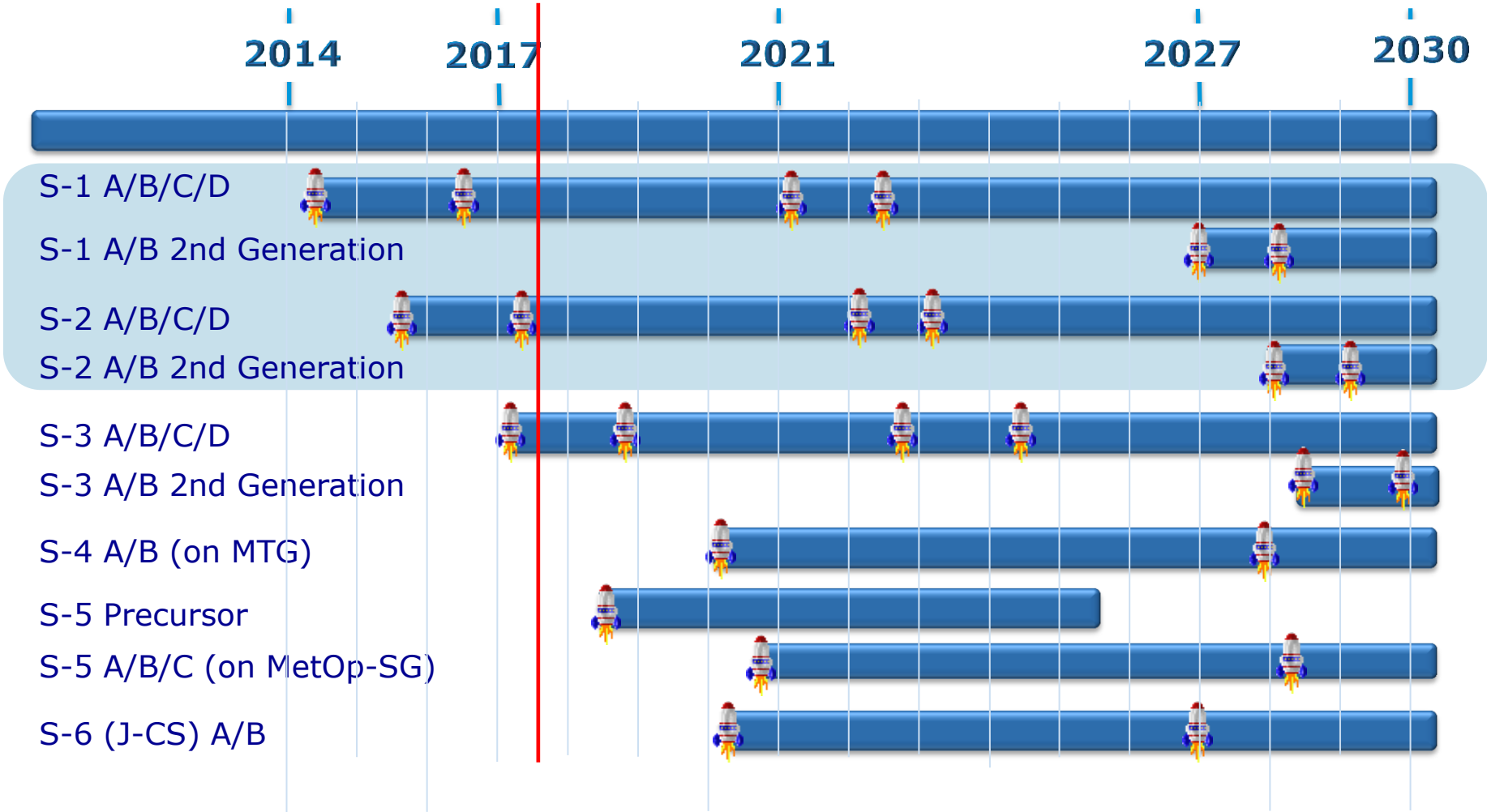
Sentinel 6 Jason-CS – Altimetry Mission
High precision measurements of global sea-level
(continuation of Jason ocean topography missions)
2020

Long term EO data to better monitor our Planet

* Joint EU/ESA Data Policy Principles adopted by ESA Council and by EU Parliament and Council (Nov 2013)

The European Copernicus Initiative

Securing satellite data access on the long term



Towards efficient data access

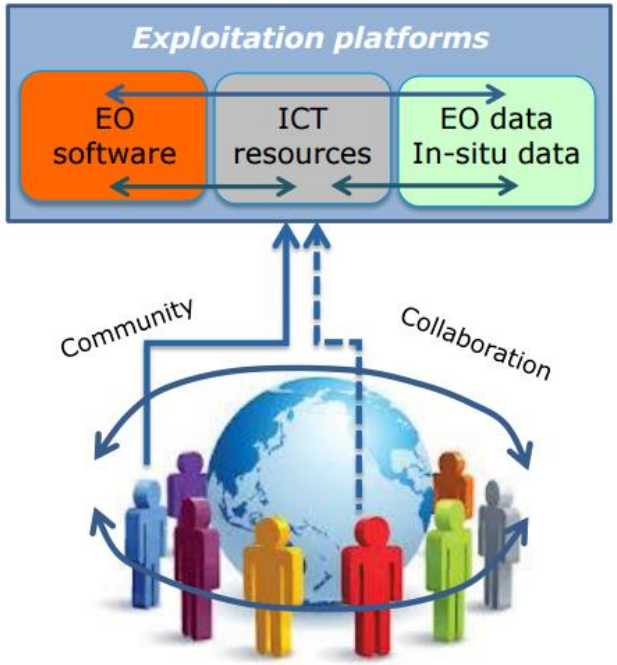
Towards efficient data exploitation

tep
thematic exploitation platform

hydrology tep
urban tep
coastal tep
polar tep
geohazards tep
forestry tep
food security tep

"Bringing the people to the data"

- Simplify the extraction of information from EO data
- Enable large scale exploitation of EO data
- Stimulate innovation with EO data
- Maximize impact of European EO assets



ESA approach to SDG implementation

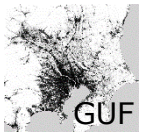
Global Datasets	Methodological Guidelines	Country Support	Capacity Building	Software Toolboxes	Knowledge Hub & Platforms

Custodian Agencies

- Access to global / regional datasets
- in the absence of or to complement and enhance, national data sources
- countries which face major difficulties in collecting national data

land cover cci

Global Surface Waters, JRC



- Support custodian agencies to develop methodological guidelines to countries
- EO Best Practices
- Scientifically sound algorithmic approaches
- Product validation
- Show cases

sentinel-2 + AGRICULTURE

innovators sponge

innovators eoforurban

GLOBWETLAND AFRICA

National Statistical Offices Governments / Agencies

- Targeted activities to support NSOs and governmental ministries to report on SDG indicators
- Support country level efforts to apply EO to track, monitor and achieve SDGs

eo4sd earth observation for sustainable development

- Build capacity to exploit EO
- Training courses
- Training material on EO best practices
- Mainly in developing and emerging economies
- Critical mass of technical centers

TIGER AFRICA

Key Stakeholders

- Free of charge
- Open source
- Easy to use
- EO Processing Toolboxes (SNAP)
- Thematic Toolboxes (WOIS, GWA, S2Agri)

WOIS

GLOBWETLAND AFRICA Toolbox

sentinel-2 + AGRICULTURE

- Facilitate access to Sentinel data
- Access to global / regional datasets
- EO Best Practices/ show cases
- Method. guidelines
- Visualization and Analysis
- On-line processing
- Toolboxes
- Knowledge sharing

tep thematic exploitation platform

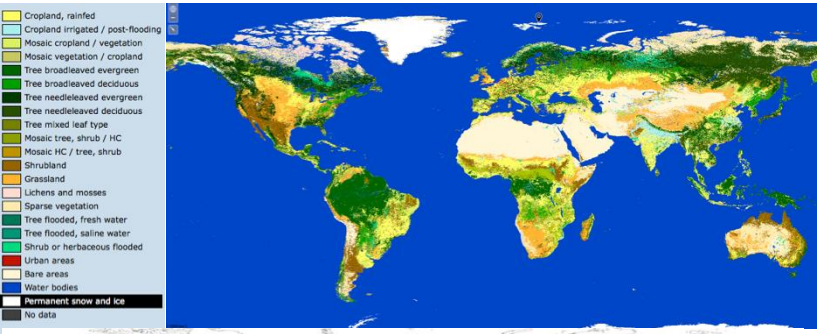
BIG DATA

Global products in support of SDGs

SDG 15.3 Land Degradation Neutrality (LDN)

Target 15.3 By 2030, combat desertification, restore degraded land & soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.

Indicator 15.3.1 "Percentage of land that is degraded over total land area"



Land Cover

GLOBAL LAND COVER MAP, EPOCH 2010

ENVISAT MERIS FRS, 300m

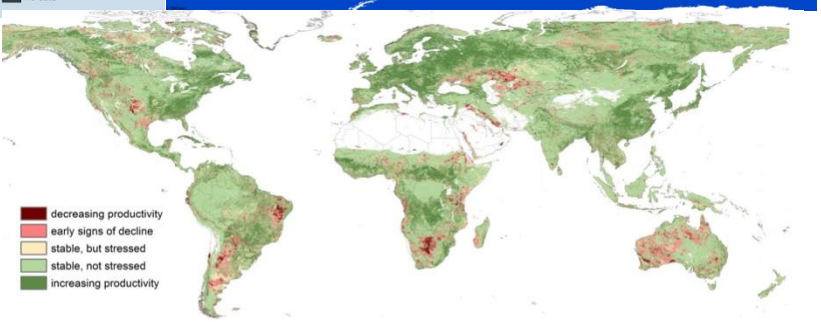
ESA Land Cover CCI

Custodian Agency:

- UNCCD (secretariat and Global Mechanism)

Other Involved Agencies

- FAO, UNEP/WCMC, CBD, UNFCCC



Land Productivity Dynamics

LPD derived from 1999-2013 NDVI phenological analyses

SPOT VEGETATION, 1km

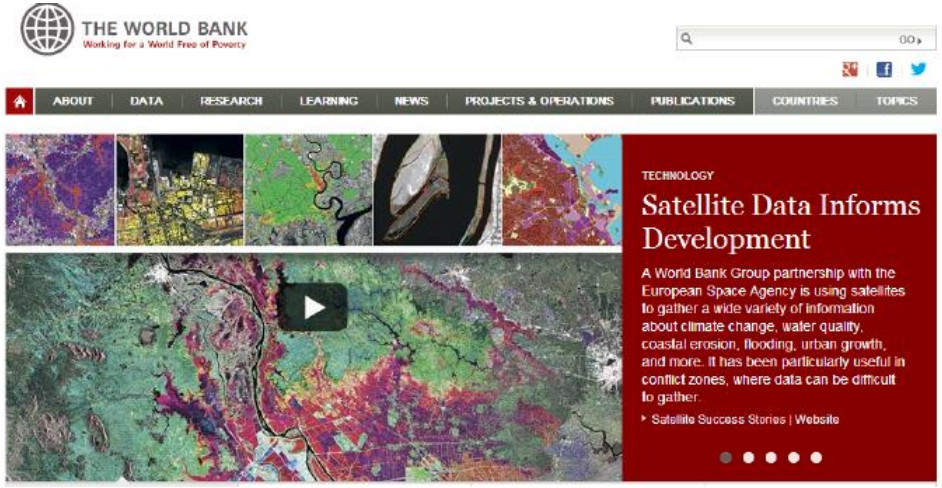
EC Joint Research Center (JRC)

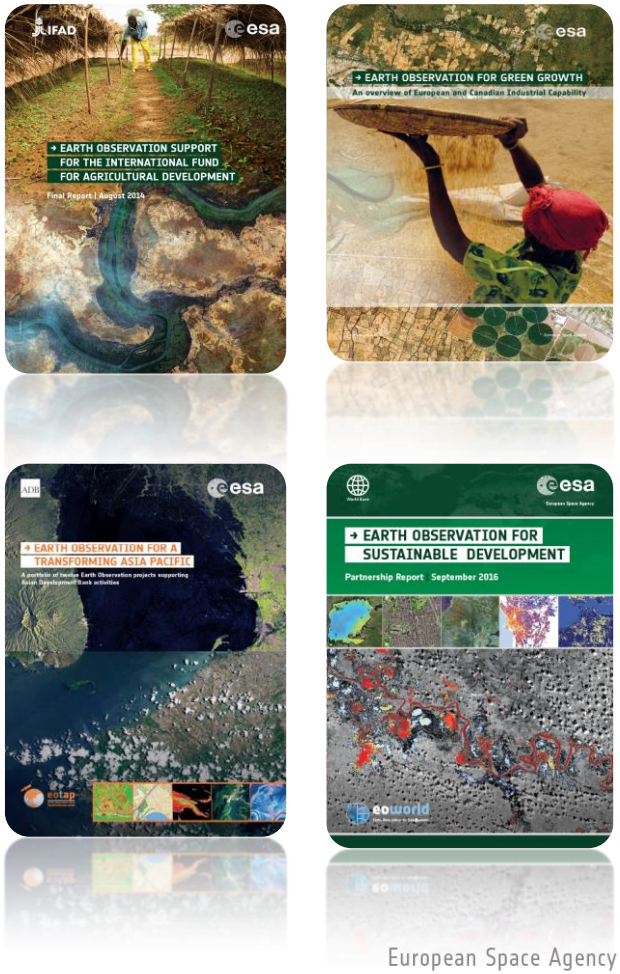
TIER III

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**

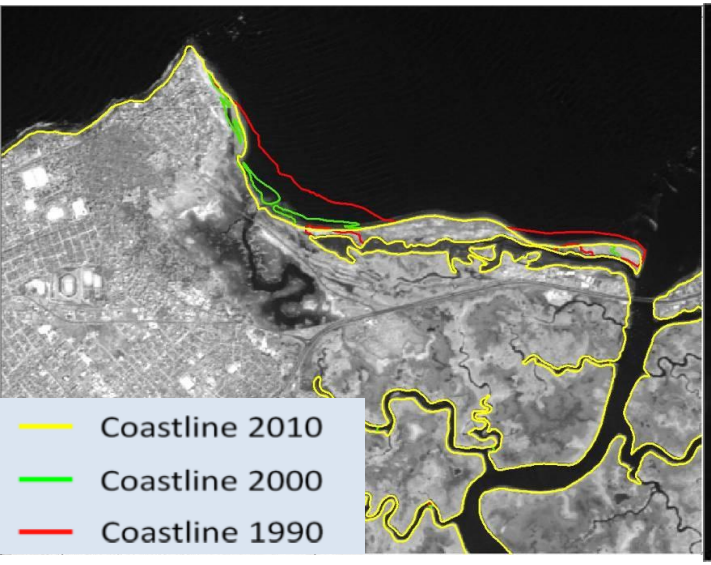
Promoting geo-data literacy and use in international development

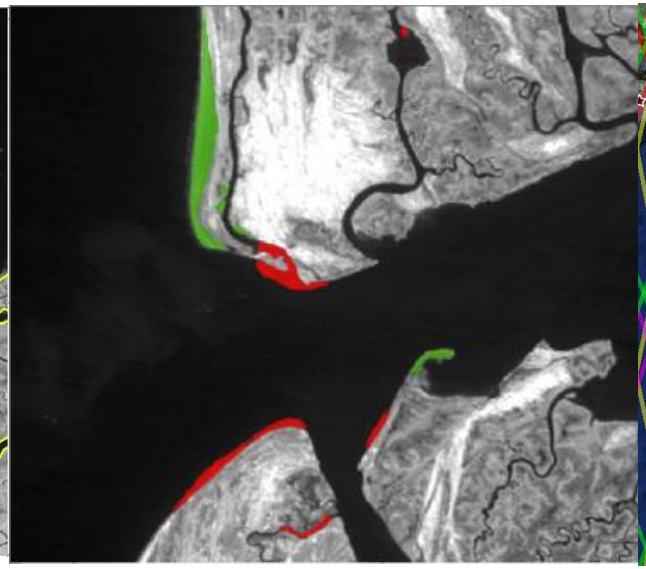
- **65 small-scale demonstrations** of EO services in support of IFI projects since 2008

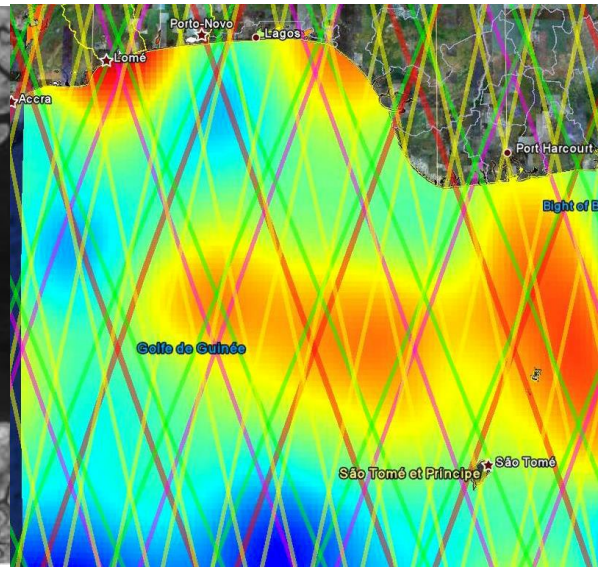




ESA-WB partnership:
West African Coastal Erosion



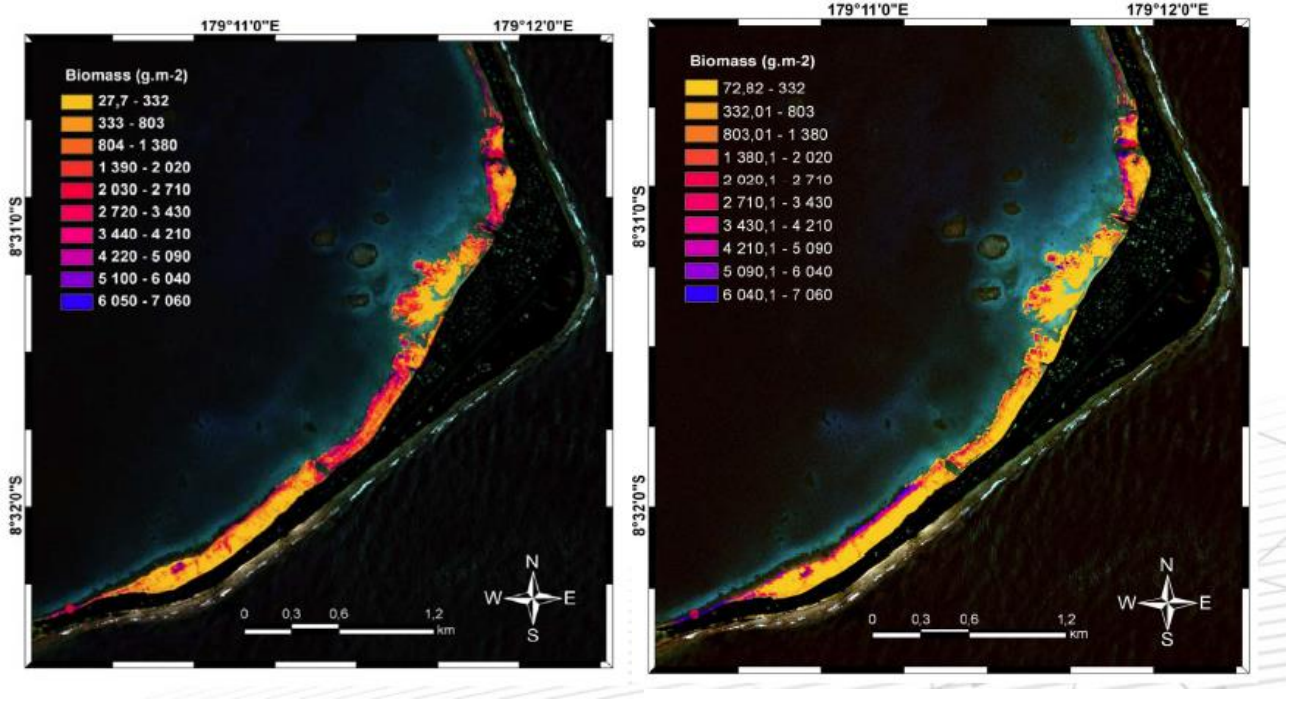


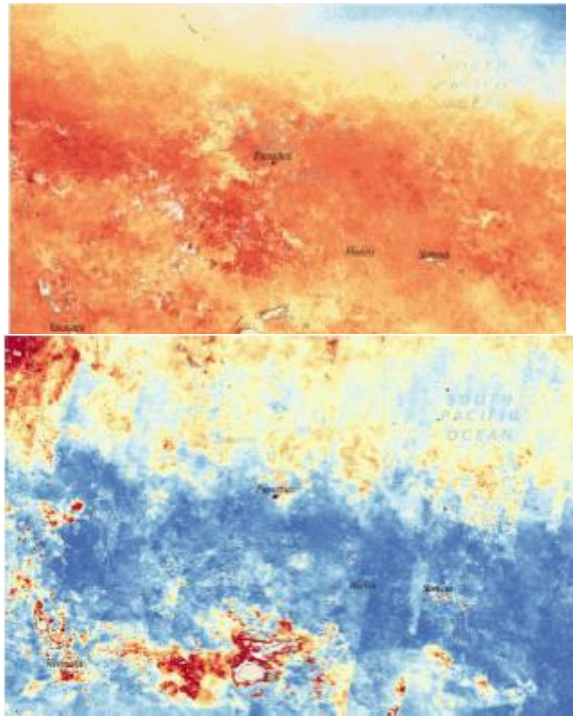


Project objective: Conduct systematic assessment of status and rate of change of coastal erosion in West Africa to support climate resilience planning

EO contribution: Unique opportunity to combine oceanographic trends with land use change and coastline change information to understand pressures and dynamics of coastal erosion

ESA-WB partnership:
Analyzing coral degradation in Tuvalu

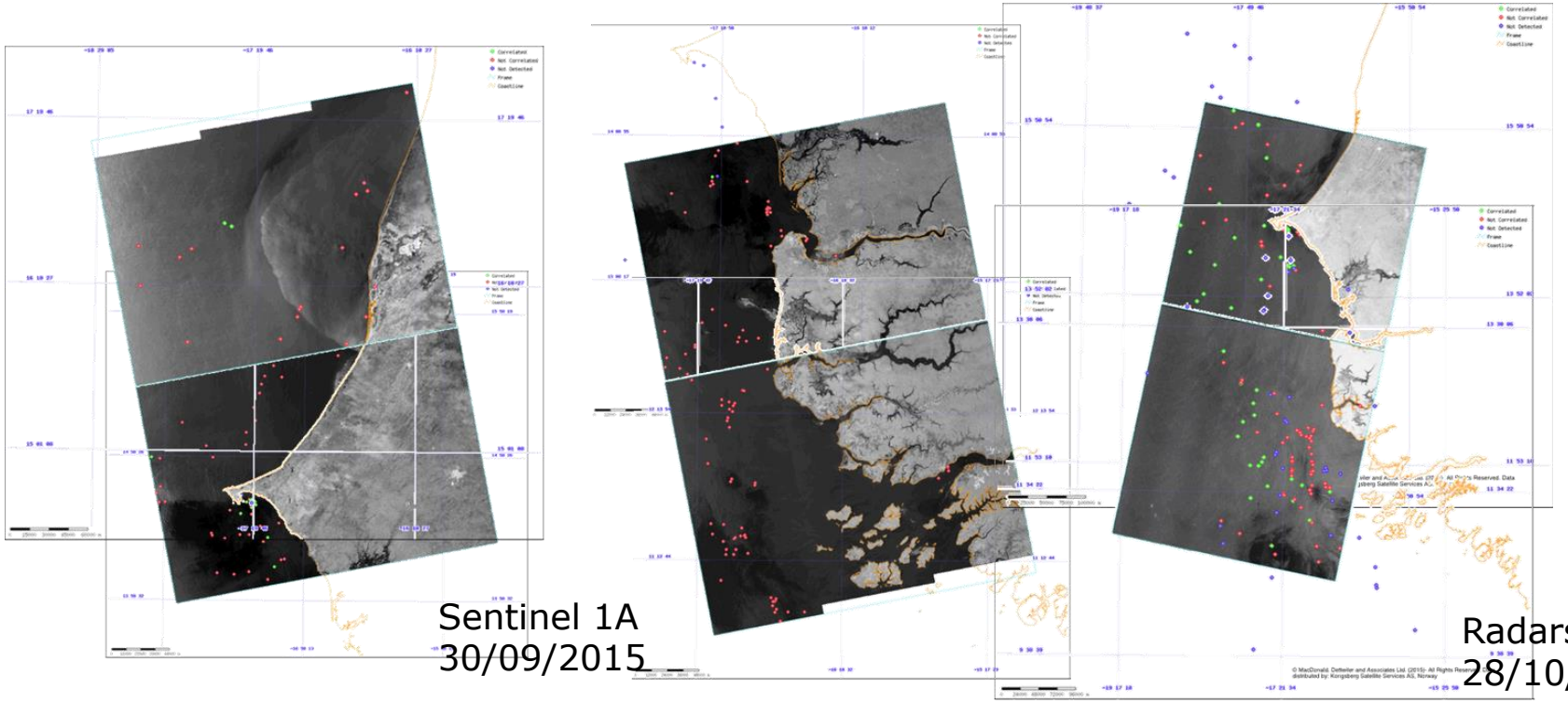




Project objective: Support Tuvalu in assessing pressures and drivers on coral reef degradation

EO contribution: Unique capability to combine oceanographic and land cover data to understand dynamics of coral degradation

ESA-WB partnership:
West Africa Regional Fisheries Program



Sentinel 1A
30/09/2015

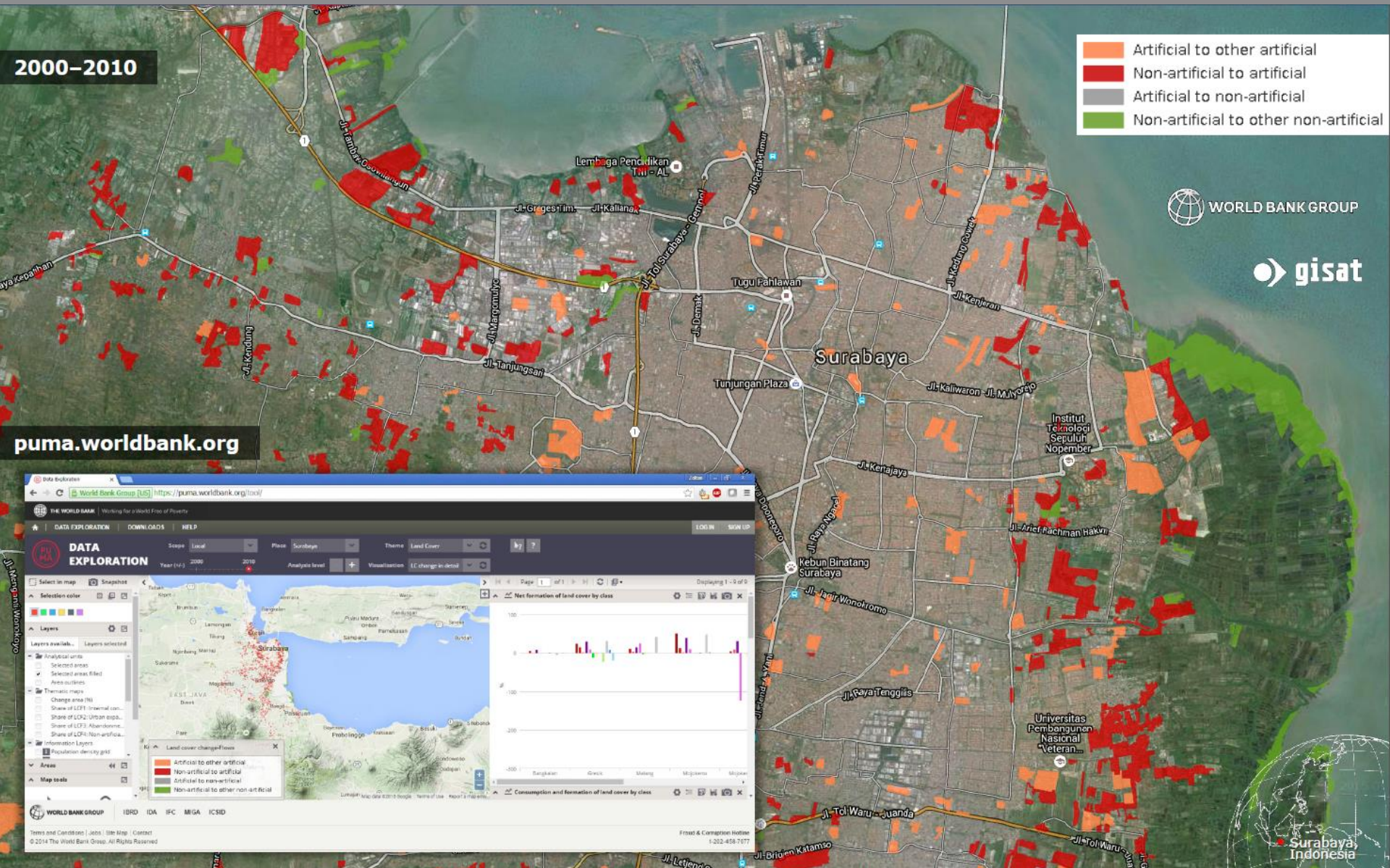
Radarsat 2
28/10/2015

Project objective: Improve management of West African EEZs and reduce levels of IUU fishing

EO contribution: Cost effective surveillance tool to detect vessels engaged in fishing and integrate with transponder and license data; additional capability to detect pollution highly appreciated

ESA-WB partnership:

LULC dynamics | platform development



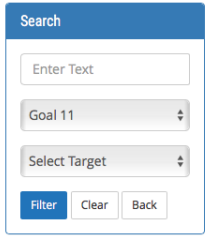
EO in support of *Sustainable Urban Development*

EO for SDG 11 on sustainable cities and communities

Tier 1: established methodology and data available

Tier 2: established methodology but data not regularly produced by countries

Tier 3: no established methodology and standards or being developed/tested.

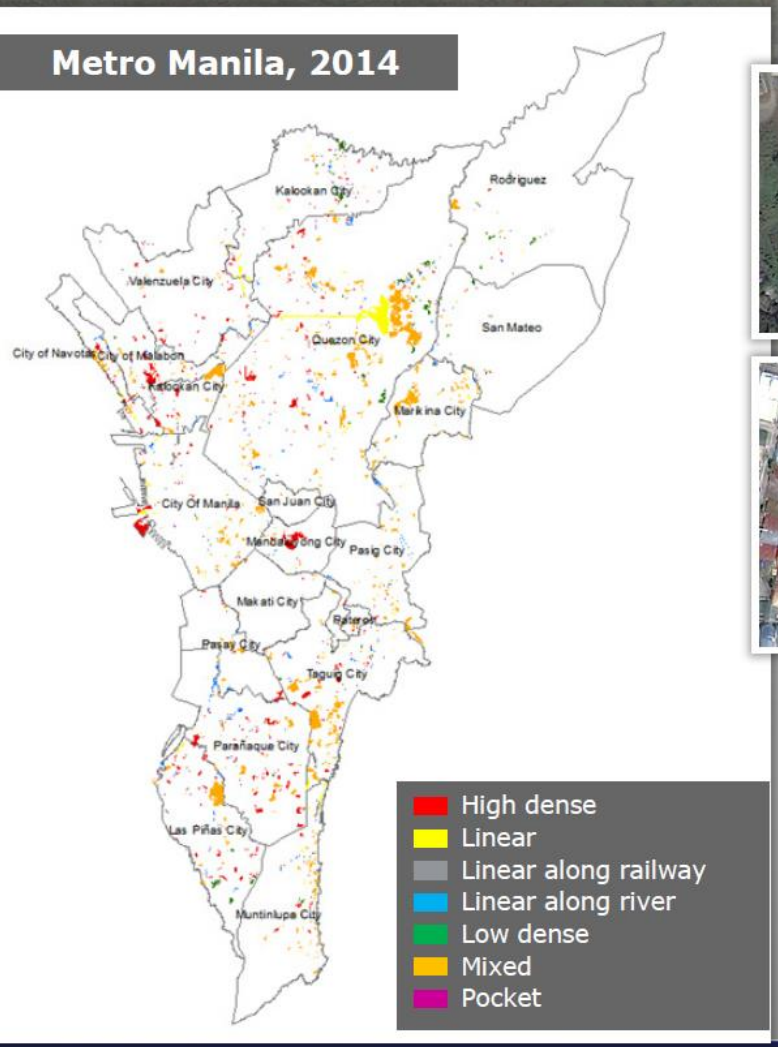


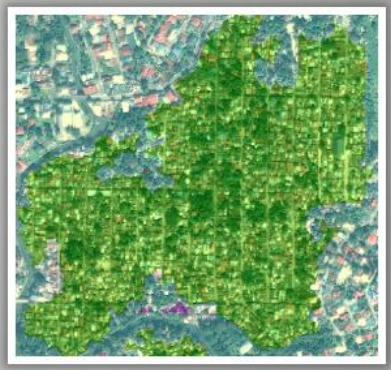
https://unstats.un.org/sdgs/metadata/

SDG #	Urban Indicators	Custodians	Tier
11.1.1	Slums and informal settlements	UN-Habitat	I
11.2.1	Access to public transport	UN-Habitat	II
11.3.1	Sustainable urbanisation	UN-Habitat	II
11.6.2	Urban air pollution	WHO	I
11.7.1	Urban green public areas	UN-Habitat	II

Target 11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums

Indicator 11.1.1 ***"Proportion of urban population living in slums, informal settlements or inadequate housing"***





Extracted from very high resolution imagery. Often using advanced semi-automated Object-Based Image Analysis (OBIA) techniques.

The Minimum Mapping Unit usually adjusted to remove very small artifacts but retain most of the informal settlements.

Analysis and classification based on attributes reveals typology.

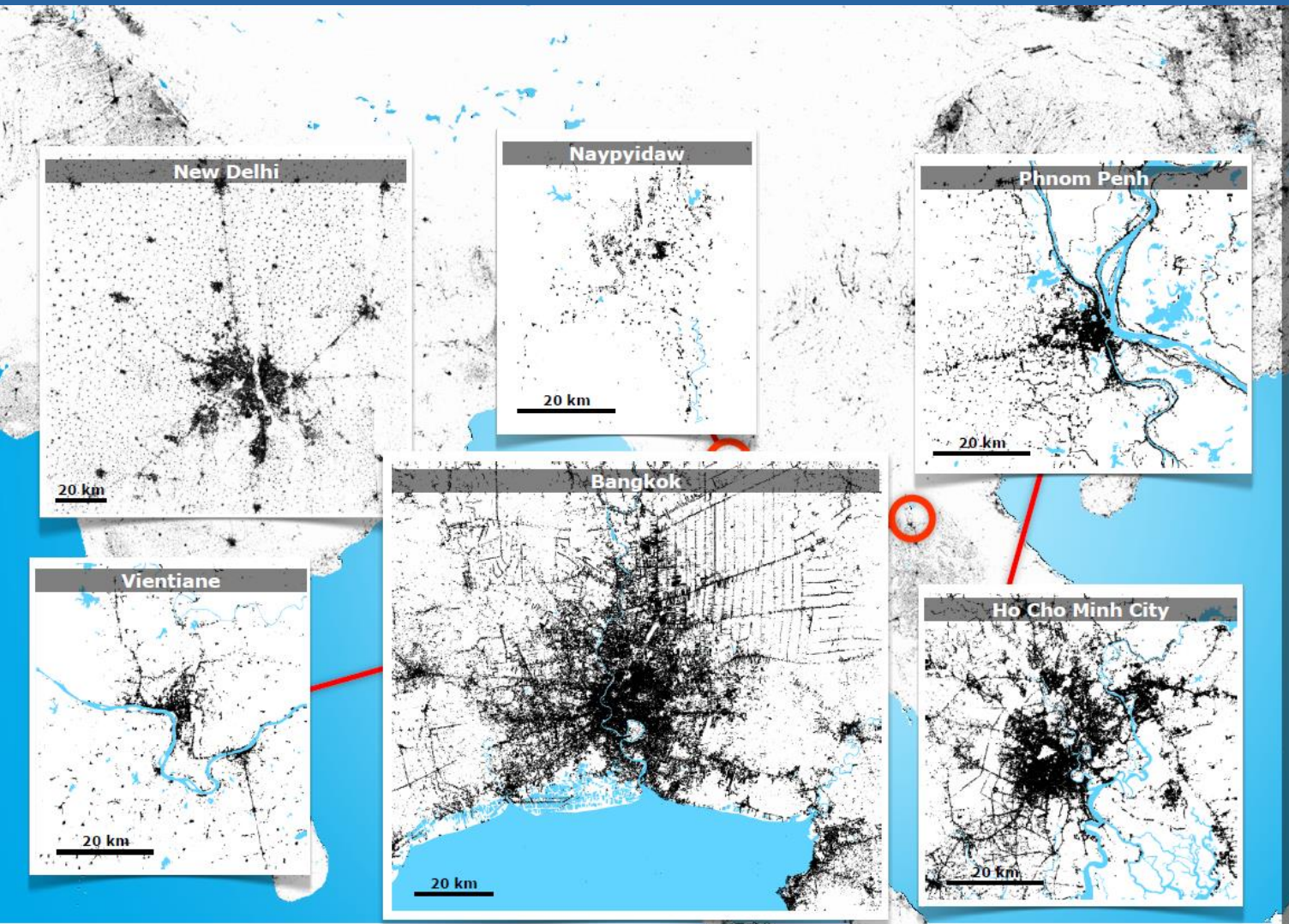
WORLD BANK GROUP

gim

Data: Pléiades 1A.
Processing: GIM.

Target 11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management…

Indicator 11.3.1 ***"Ratio of land consumption rate to population growth rate"***



"Global Urban Footprint": Worldwide mapping of settlements with unprecedented spatial resolution of approx. 12 m, based on imaging radar data.

Binary (black and white) map for urban/non-urban, available for 2014.

Allows for the analysis of urban structures, and hence the proportion of settled areas, the regional population distribution and the arrangement of rural and urban areas.

DLR

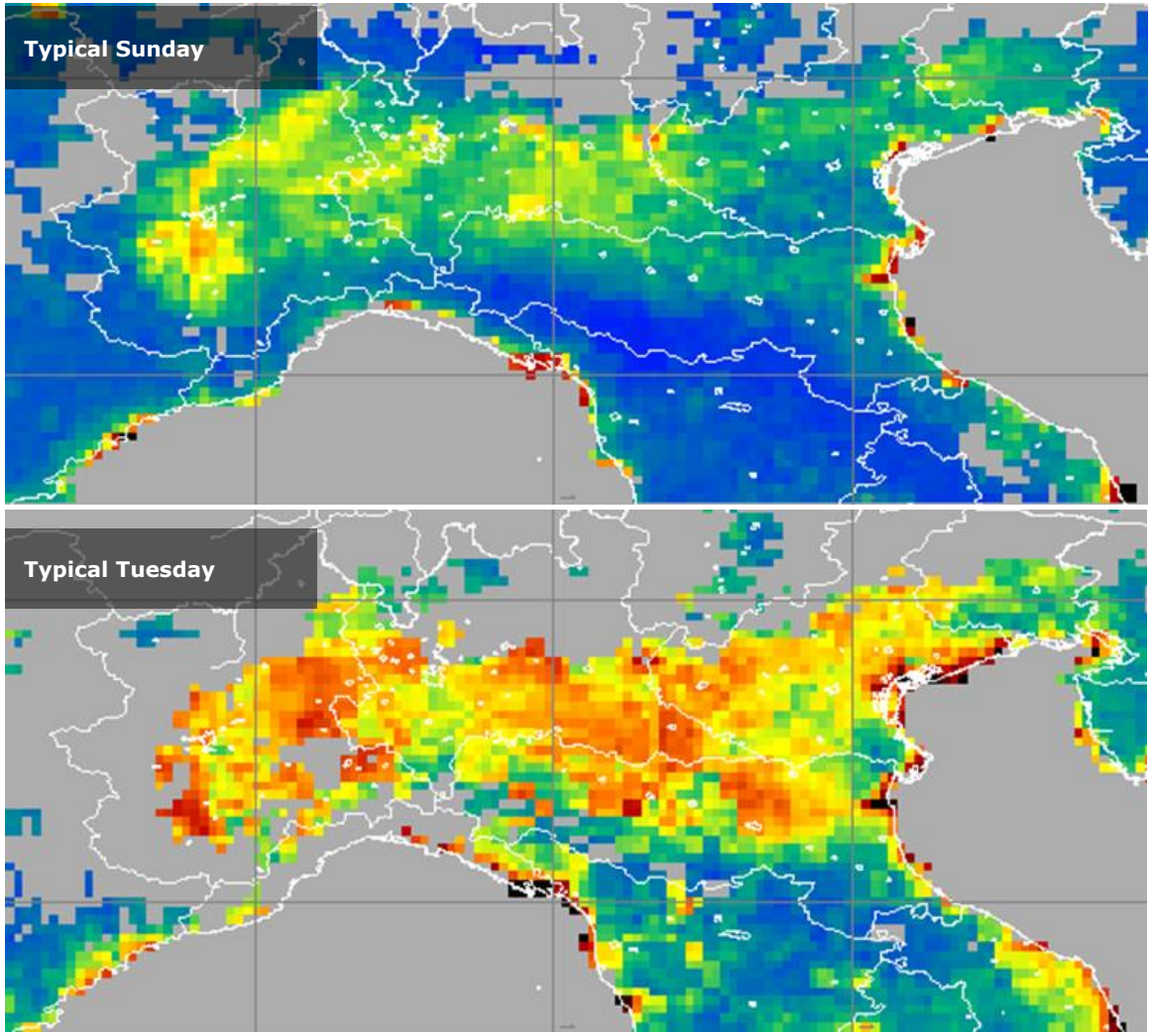
Data: TerraSAR-X, TanDEM-X.
Processing: DLR Global Urban Footprint.

Target 11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management

Indicator 11.6.2 ***"Annual mean levels of fine particulate matter (e.g. PM2.5 and PM 10) in cities (population weighted)"***

EO-derived parameters

- Annual mean levels of coarse particulate matter (PM10)
- Annual mean levels of fine particulate matter (PM2.5)



Aerosol thickness, e.g. optical depth of PM10 and PM2.5 (an indicator of the overall pollution).

Typical spatial resolutions: 1–10 km on a daily basis, with local improvements down to street level when adequate in-situ information and/or modelling is available

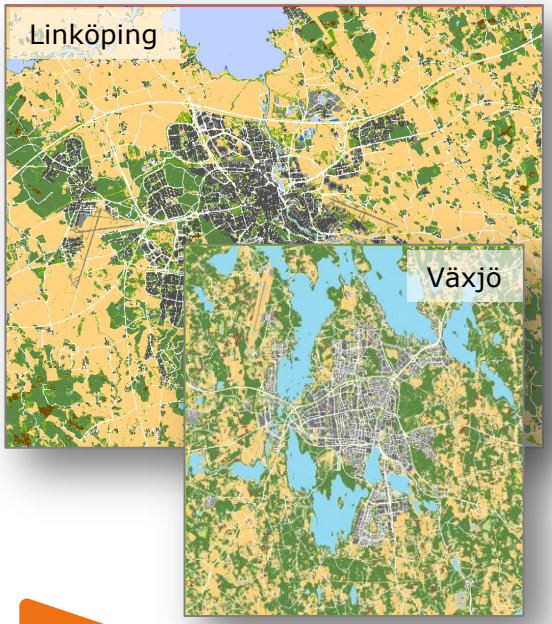
Data: MODIS/Aqua. Processing: Carlo Gavazzi Space / ISAC-CNR.

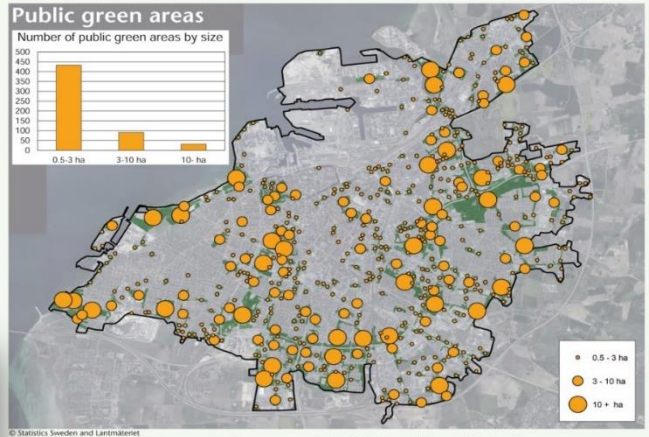
Fine particulate matter concentrations (2.5 and 10) over cities are estimated through numerical modelling, integrating satellite data (LEO/GEO through AOT assimilation) and in-situ data

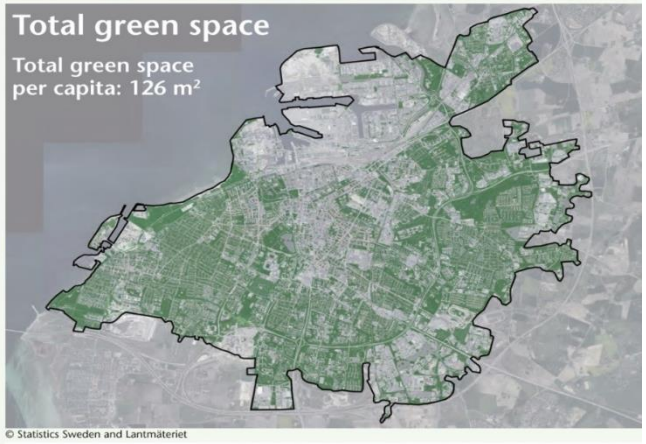
Target 11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities

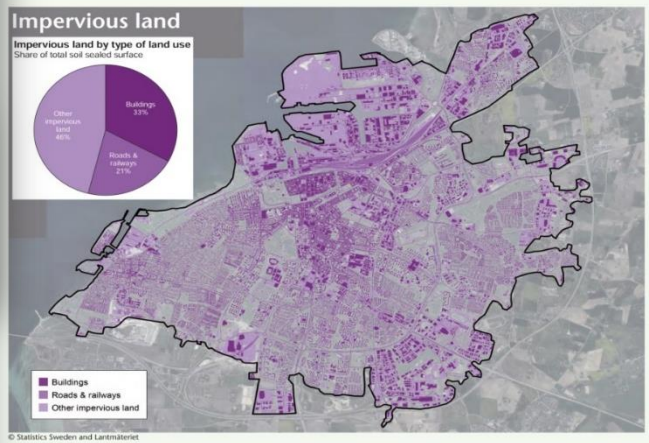
Indicator 11.7.1 ***"The average share of the built-up area of cities that is open space in public use for all disaggregated by sex, age and persons with disabilities"***

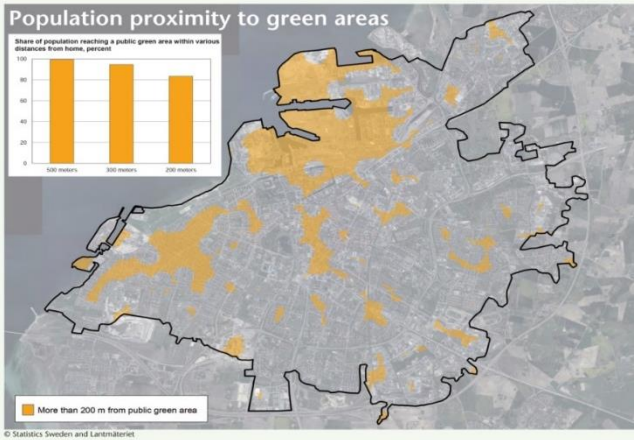
- Population Distribution and Density
- Transport Infrastructure
- **Urban Green Areas**
- **Urban Built-up Extent**
- **Urban and Peri-Urban Land Cover/Use**











For questions and further information, please contact:
Jerker Moström at Statistics Sweden, jerker.mostrom@scb.se

Accessibility to green areas | Swedish pilot study, Statistics Sweden and Landmäteriet

Access to public green areas based on mapping of urban green areas areas and controlled disaggregation of national census data

Promoting geo-data literacy and use in international development

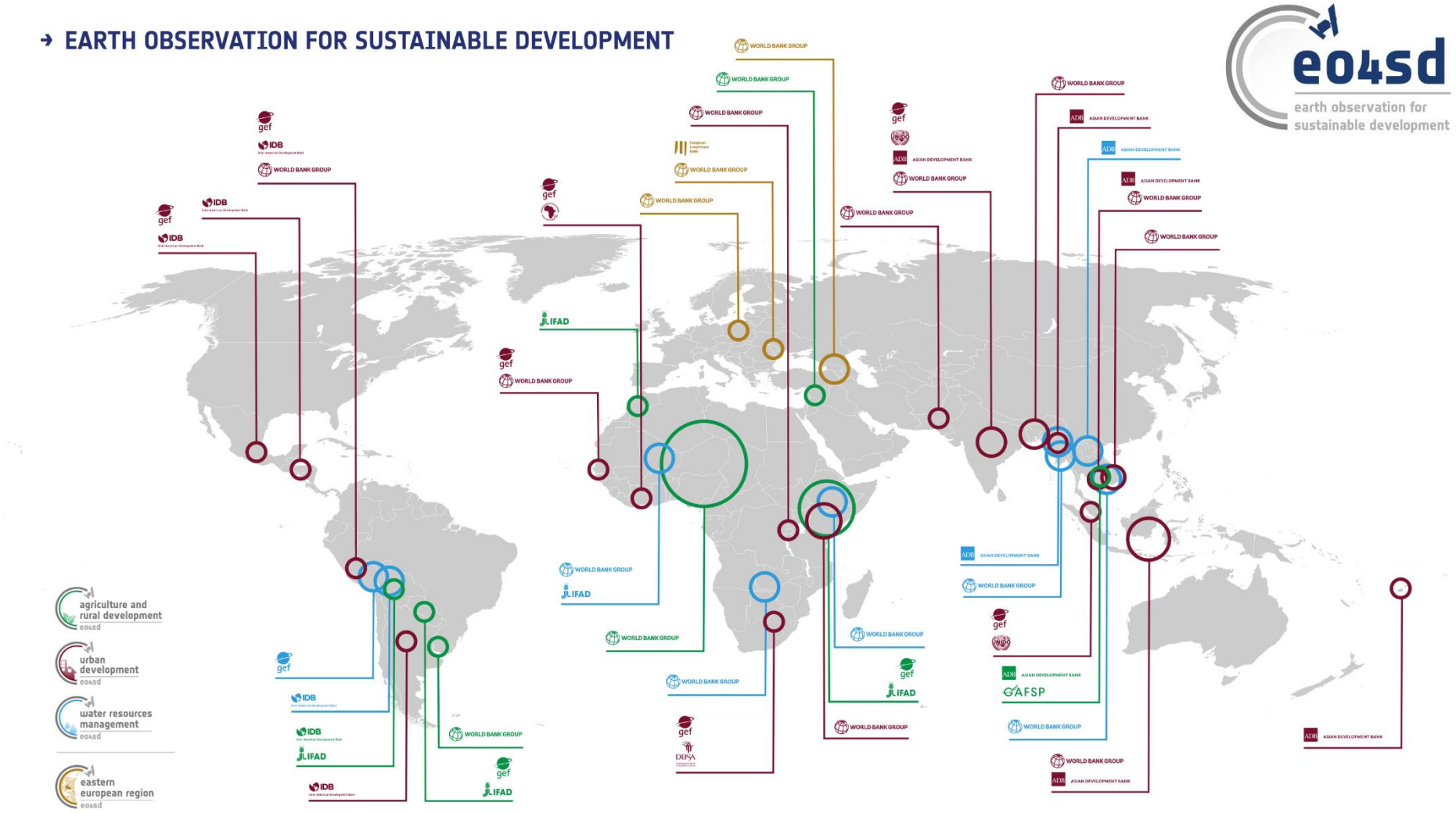
- **Mainstream & transfer EO** into operational working processes of international development – in countries & Multi-lateral Development Banks
- **EO as 'best-practice' source of environmental information** in Environmental Impact Assessment (EIA), Monitoring & Evaluation (M&E) methodologies
- **10 thematic priority areas:** Urban, Agriculture, Water, Disaster Risk Reduction, Fragile States, Climate Resilience & Proofing, Marine, Forest, Ecosystems, Energy

urban development eo4sd

agriculture and rural development eo4sd

water resources management eo4sd

Promoting geo-data literacy and use in international development



New ESA project on "EO for SDGs"

Support GEO, CEOS, ESA/EC and their Member States
and the EO community to play a leading role
in the full realization of Earth Observations in the 2030 agenda for SD

- Analyze in depth the **Metadata Repository** of all SDG indicators (169 targets, 230 indicators) and assess the **current and potential contribution of EO/Copernicus** to the SDG Global Indicator Framework.
- Review the **Tier 2 and 3 monitoring/reporting guidelines** produced by the custodian agencies for a number of key SDG indicators and propose areas of EO improvements.
- Perform **a country demonstration**, by partnering with the NSO and the relevant national governmental authorities (for the indicators selected) to support implementation of a number of SDG indicators (**at least two**)
- Study how the **GEO/CEOS/EC/ESA/MSs developed EO collaborative platforms and big data initiatives (data cube)** can serve the EO data and information needs of the large community of SDG stakeholders (UN-GGIM, Custodian Agencies, National Statistical Offices, etc.).

EOEP-5, 400 KEUR, 18 months, ITT in 2017 Q3

Earth Observation: A Necessity

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