Earth Observation (EO) for Smart Cities:
The SMURBS/ERA-PLANET EU Project and the contribution of EO to the SDGs frame

Smart Statistics 4 Smart Cities

Dr. Evangelos Gerasopoulos

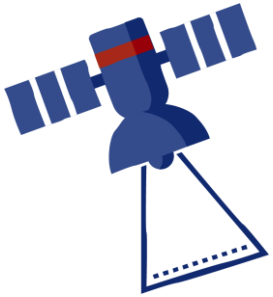
(Research Director, NOA)

Director of the Greek GEO Office

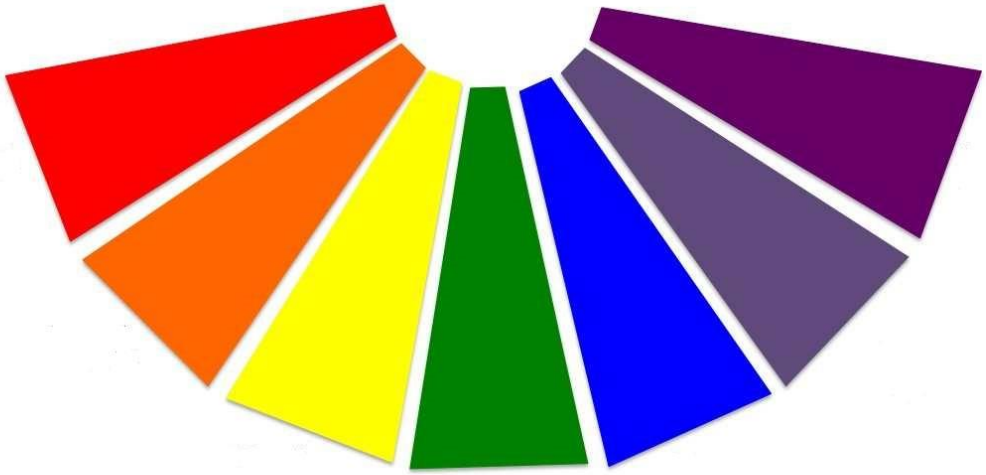
SMURBS

ERA-PLANET

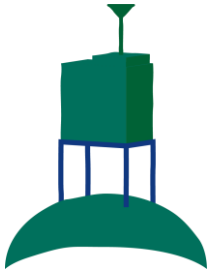
What does Earth Observation refer to?



Satellites

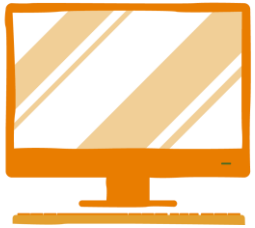


Citizen science



In situ

UAVs, smart sensors



Models

What is a Smart City?

A smart city is an urban area that uses different types of electronic data collection sensors to supply information which is used to manage assets and resources efficiently.

The smart city concept integrates information and communication technology (ICT), and various physical devices connected to the network (the Internet of things or IoT) to optimize the efficiency of city operations and services and connect to citizens.

wikipedia

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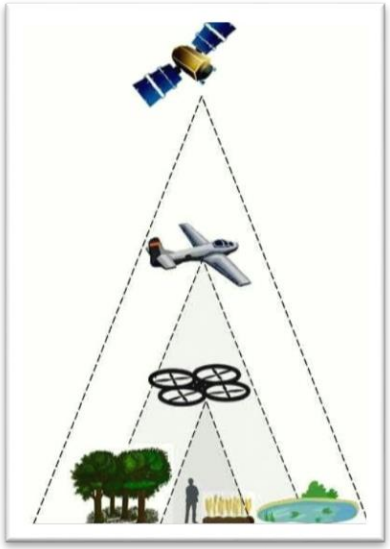

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We aim at linking these two huge, distinct yet interconnected worlds, and deliver our own interpretation or definition of smart cities

SMURBS project

HORIZON 2020

GEOSS
Global Earth Observation System of Systems

opernicus
Europe's eyes on Earth

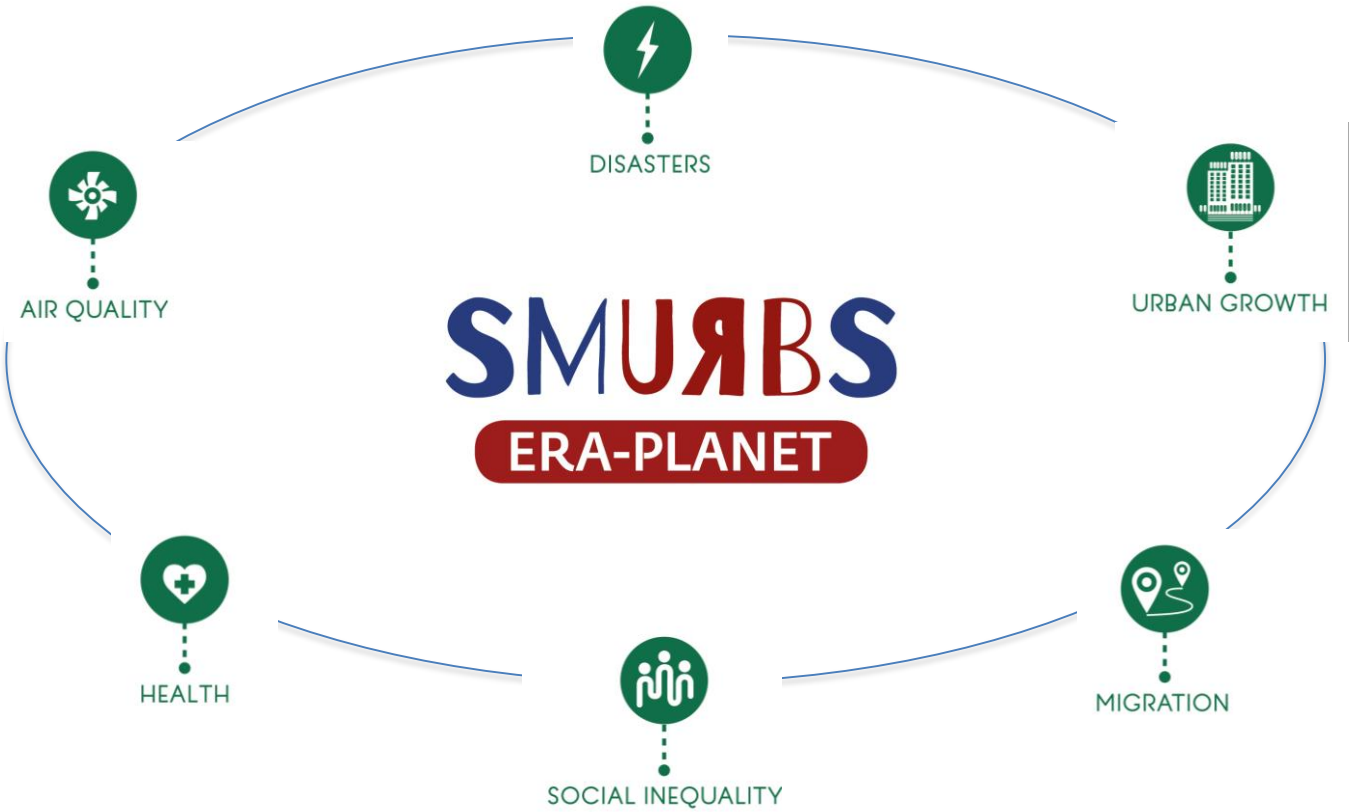
ERA-PLANET
The European network for observing our changing planet

Strand 1
"Smart Cities and Resilient Societies"

the fellowship of SMURBS

- 19 partners, 12 countries
- 2.75 m€, 9.15 m€ total

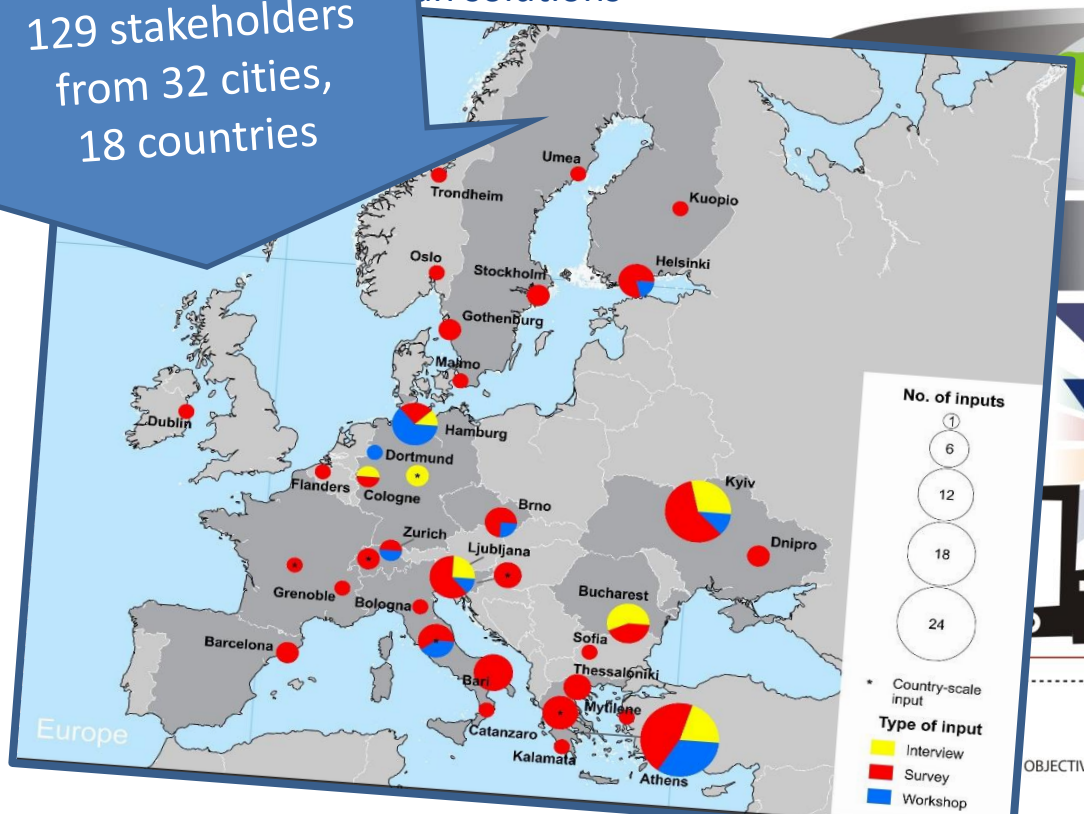
Our themes

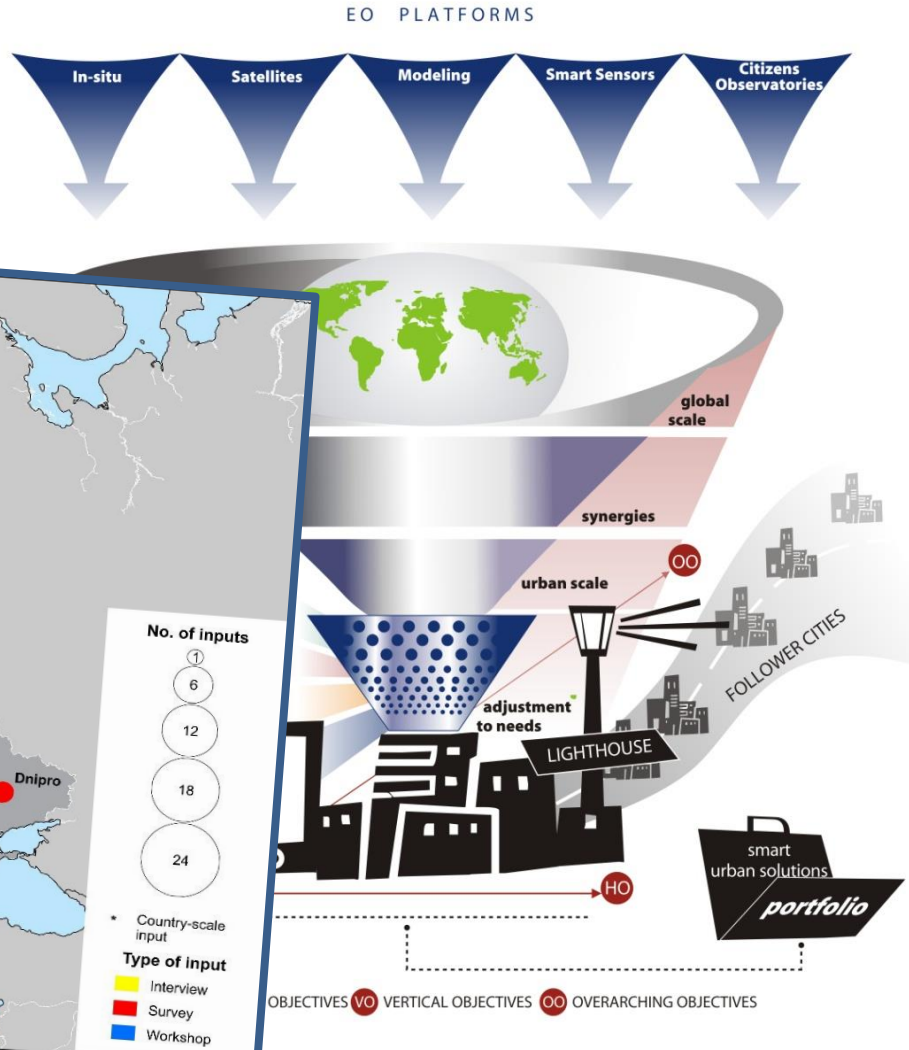

DISASTERS
AIR QUALITY
URBAN GROWTH
SMURBS
ERA-PLANET
HEALTH
MIGRATION
SOCIAL INEQUALITY

the concept

- develop synergies between EO platforms
- converge under the “smart city” banner
- take user needs on board
- tailor [illegible] areas
- deliv [illegible] an solutions
- test [illegible]
- let th [illegible]

Up to now:
129 stakeholders
from 32 cities,
18 countries





More info at: http://smurbs.eu/

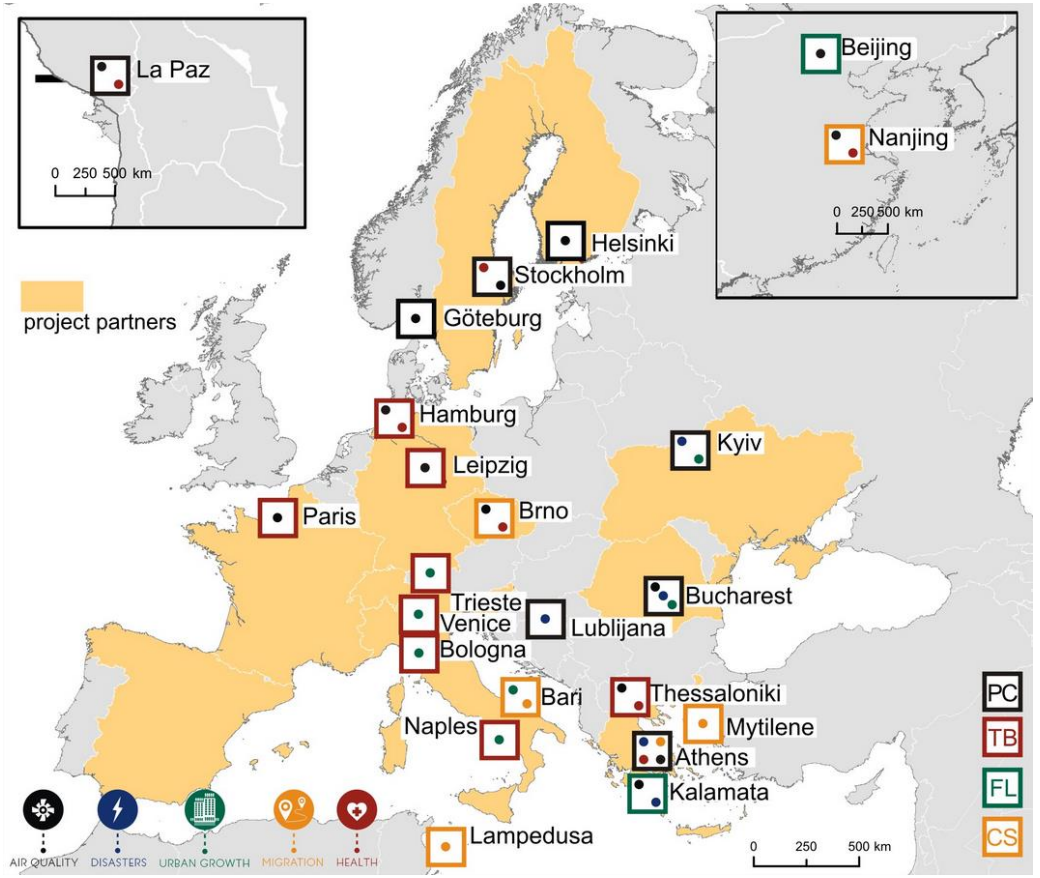
the network

Partnership:

• The **SMURBS consortium** consists of **19 ERA-PLANET partners** from **12 European countries**, including research institutes, space agencies and universities, EO experts of different disciplines and scientific background, in several thematic areas.

Smart-city network:

• A group of **23 cities (3 overseas)** of varying sizes, geographies, environmental pressures and levels of progress in terms of 'smartness' are selected with a multi-criteria analysis, to employ solutions from the **portfolio** and help establish the urban component of GEOSS in Europe.



More info at: http://smurbs.eu/

… act local

«Καφέ της Επιστήμης»

συζητήσεις για την Επιστήμη και την Τεχνολογία

με μία κούπα καφέ ή ένα ποτήρι κρασί.

Το «***café-NEO***» του Απριλίου θα έχει θέμα:

«ΚΑΛΑΜΑΤΑ Έξυπνη Πόλη –

Προς τη δημιουργία έξυπνων και ανθεκτικών πόλεων με χρήση νέων τεχνολογιών»

Προσκεκλημένος ομιλητής θα είναι ο ***Δρ. Ευάγγελος Γερασόπουλος***, Διευθυντής Ερευνών του Ινστιτούτου Ερευνών Περιβάλλοντος και Βιώσιμης Ανάπτυξης του Εθνικού Αστεροσκοπείου Αθηνών

Baba Yaga (Χρήστου Κουμάντου 5, Καλαμάτα)

Δευτέρα 16 Απριλίου, στις 7:30 μμ

Το «café-NEO», είναι ένας κύκλος δωρεάν και ανοιχτών προς το κοινό συναντήσεων, με σκοπό την ενημέρωση σε σύγχρονα επιστημονικά θέματα, με έμφαση σε καίρια, τρέχοντα περιβαλλοντικά ζητήματα που οργανώνεται από το **Navarino Environmental Observatory (NEO), www.navarinoneo.gr**

SMURBS organized its 1st citizen workshop hosted by Navarino Environmental Observatory in the city of Kalamata, during April's scientific café. More than 40 citizens participated in the event, sharing their needs and smart ideas, over a hot cup of coffee!

The discussion reaffirmed many of the user needs findings, especially with respect to Air Quality requirement for real time, online information and the potential role of citizen observatory activities, along this direction, where highlighted with great zest.

GEO main priority and SMURBS objective

SUSTAINABLE DEVELOPMENT GOALS

SMURBS ERA-PLANET

talking GLOBAL

GROUP ON EARTH OBSERVATIONS

SUSTAINABLE DEVELOPMENT GOALS

Target (Contribute to progress on the Target yet not the Indicator per se)								Goal	Indicator (Direct measure or indirect support)				
							1.5	1 No poverty					
					2.3	2.4	2.c	2 Zero hunger	2.4.1				
				3.3	3.4	3.9	3.d	3 Good health and well-being	3.9.1				
								4 Quality education					
								5 Gender equality	5.9.1				
		6.3	6.4	6.5	6.6	6.a	6.b	6 Clean water and sanitation	6.3.2	6.4.2	6.5.1	6.6.1	
				7.2	7.3	7.a	7.b	7 Affordable and clean energy	7.1.1				
							8.4	8 Decent work and economic growth					
				9.1	9.4	9.5	9.a	9 Industry, innovation and infrastructure	9.1.1				
								10 Reduced inequalities					
	11.3	11.4	11.5	11.6	11.7	11.b	11.c	11 Sustainable cities and communities	11.3.1	11.6.2	11.7.1		
					12.2	12.a	12.b	12 Responsible consumption and production					
					13.1	13.3	13.b	13 Climate action	13.1.1				
	14.1	14.2	14.3	14.4	14.6	14.7	14.a	14 Life below water	14.3.1				
15.1	15.2	15.3	15.4	15.5	15.7	15.8	15.9	15 Life on land	15.1.1	15.2.1	15.3.1	15.4.1	15.4.2
								16 Peace, justice and strong institutions					
			17.6	17.7	17.9	17.16	17.17	17 Partnerships for the goals					

UN HABITAT
UNITED NATIONS HUMAN SETTLEMENTS PROGRAMME

GLOBAL PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT DATA

UN-GGIM
UNITED NATIONS INITIATIVE ON GLOBAL GEOSPATIAL INFORMATION MANAGEMENT

Smart Statistics 4 Smart Cities

talking EUROPEAN

talking GREEK

SUSTAINABLE DEVELOPMENT GOALS

Target (Contribute to progress on the Target yet not the Indicator per se)	Goal	Indicator (Direct measure or Indirect support)
1.5	1 No poverty	
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3.3 3.4 3.9 3.d	3 Good health and well-being	3.9.1
	4 Quality education	
	5 Gender equality	5.9.1
6.3 6.4 6.5 6.6 6.a 6.b	6 Clean water and sanitation	6.3.2 6.4.2 6.5.1 6.6.1
7.2 7.3 7.a 7.b	7 Affordable and clean energy	7.1.1
8.4	8 Decent work and economic growth	
9.1 9.4 9.5 9.a	9 Industry, innovation and infrastructure	9.1.1
	10 Reduced inequalities	
11.3 11.4 11.5 11.6 11.7 11.b 11.c	11 Sustainable cities and communities	11.3.1 11.6.2 11.7.1
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14.1 14.2 14.3 14.4 14.6 14.7 14.a	14 Life below water	14.3.1
15.1 15.2 15.3 15.4 15.5 15.7 15.8 15.9	15 Life on land	15.1.1 15.2.1 15.3.1 15.4.1 15.4.2
	16 Peace, justice and strong institutions	
17.6 17.7 17.9 17.16 17.17	17 Partnerships for the goals	

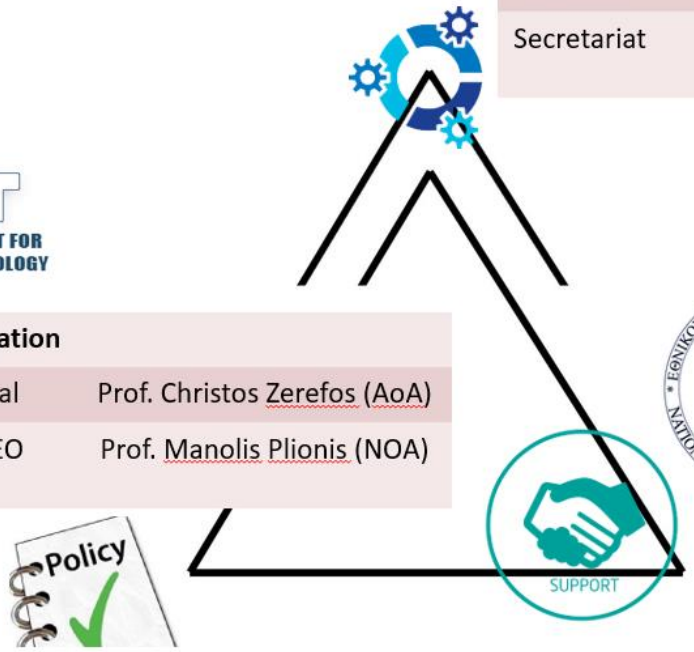
Mandate

The Greek GEO Office (GGO) operation focuses on the effective participation of Greece in the national, regional, and global activities, under the framework of GEO and GEOSS … as the focal point of GEO activities in Greece, it addresses the need for a permanent coordination mechanism of GEOSS activities at the national level, at the same time building interfaces with GEO and the Greek State

GEO Office	
Director	Dr. Evangelos Gerasopoulos
Secretariat	Mrs. Eleni Christia Mrs. Georgia Diakogianni

GSRT
GENERAL SECRETARIAT FOR RESEARCH AND TECHNOLOGY

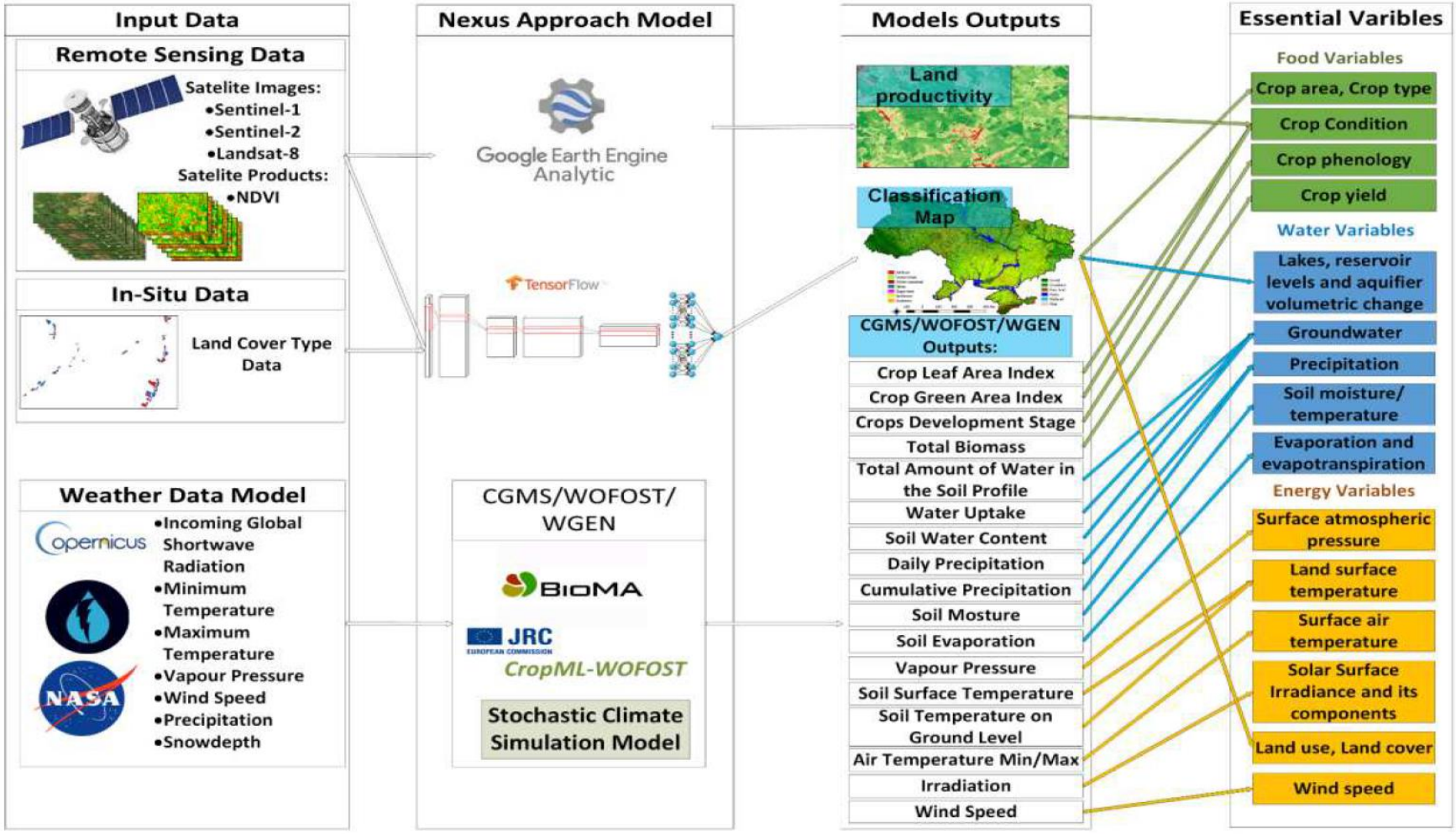
National Delegation	
GEO Principal	Prof. Christos Zerefos (AoA)
Alternate GEO Principal	Prof. Manolis Plionis (NOA)



MARIOLOPOULOS-KANAGINIS FOUNDATION FOR THE ENVIRONMENTAL SCIENCES

How can we do this in practice

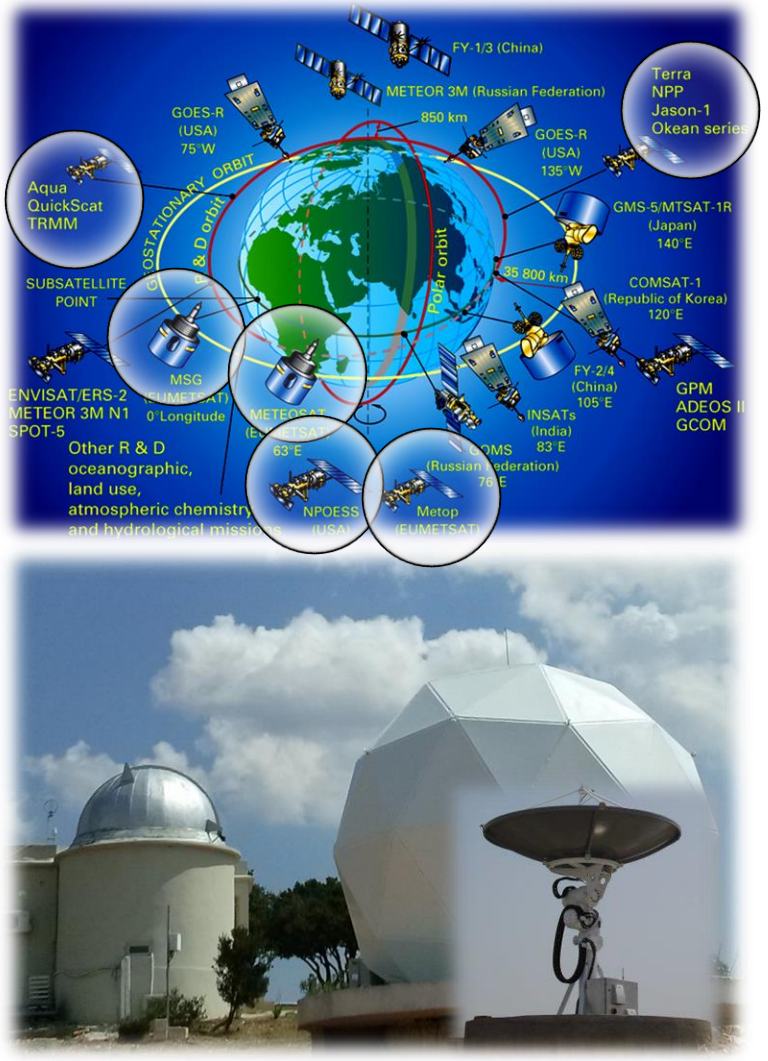
Create data flowcharts



Urban indicators that depend on EO data

- **11.1.1** Proportion of urban population living in slums, informal settlements or inadequate housing
- **11.2.1** Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities
- **11.3.1** Ratio of land consumption rate to population growth rate
- **11.6.2** Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities
- **11.7.1** Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities

Urban Essential Variables



Example – SDG 11.3.1

Ratio of land consumption rate to population growth rate (SDG Indicator 11.3.1):

- City population
- Built-up area

Stage 1: Estimate the **population growth rate**.

$$PGR=LN(Popt\_(t+n)/Popt\_t\ )/((y))$$

Where

Popt: Total population within the city in the past/initial year

Popt+n: Total population within the city in the current/final year

y: The number of years between the two measurement periods

Stage 2: Estimate the **land consumption rate**.

$$LCR=LN(Urb\_(t+n)/Urb\_t\ )/((y))$$

Where

Urb_t: Total areal extent of the urban agglomeration in km2 for past/initial year

Urb_(t+n): Total areal extent of the urban agglomeration in km2 for current year

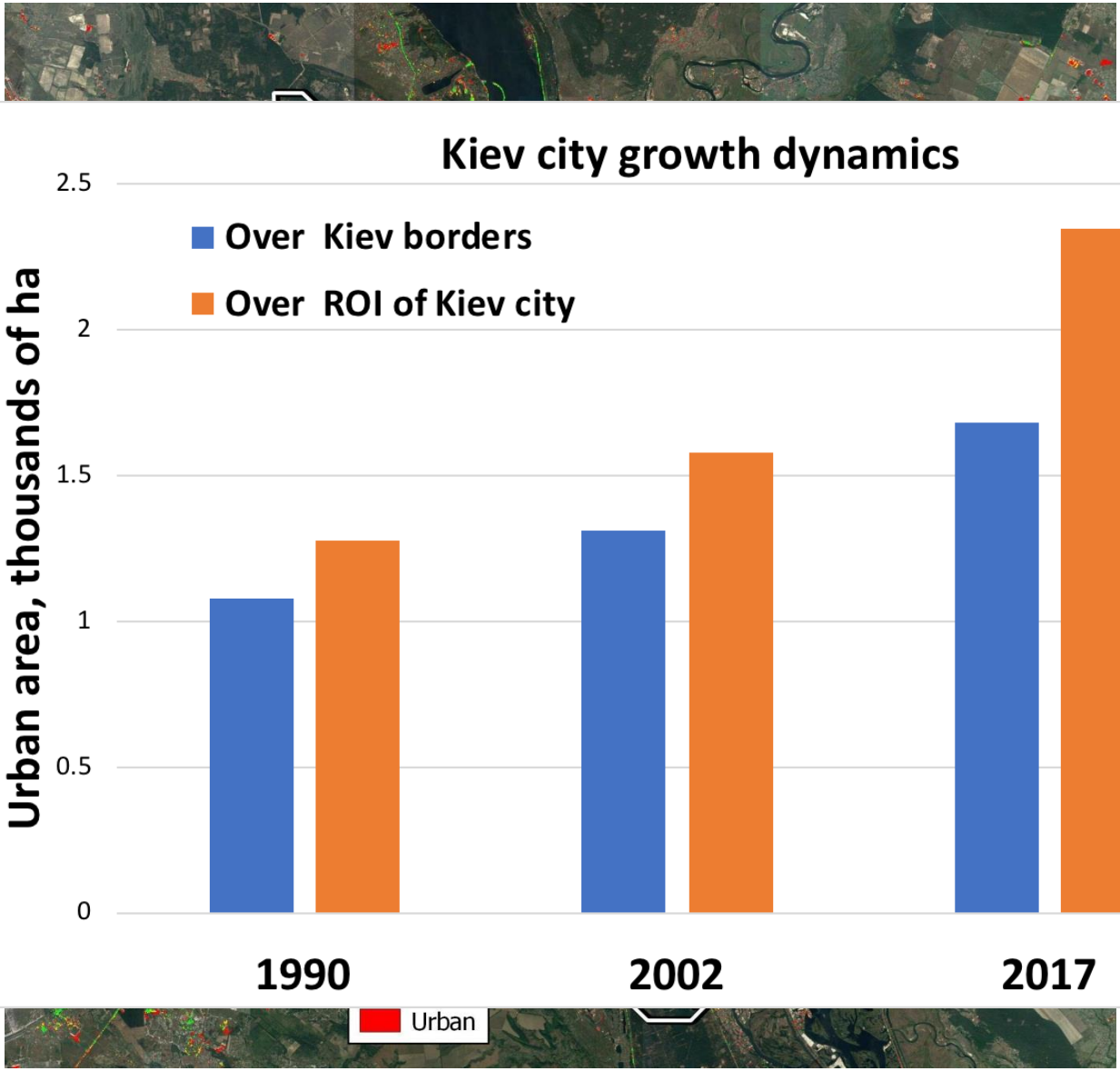
y: The number of years between the two measurement periods

$$LCRPGR = \left(\frac{Land\ Consumption\ rate}{Annual\ Population\ growth\ rate}\right)$$

From Prof. Petros Patias, EuroGEOSS Workshop 2018

Kiev city growth 1990-2017

From Dr. Natalia Kussul (SRI), SMURBS stakeholders workshop, Hamburg



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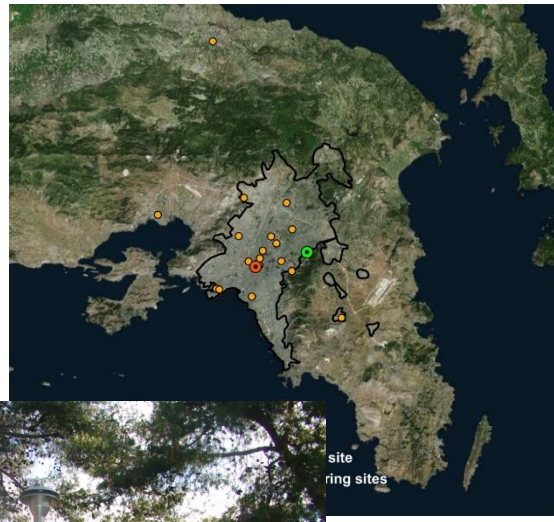
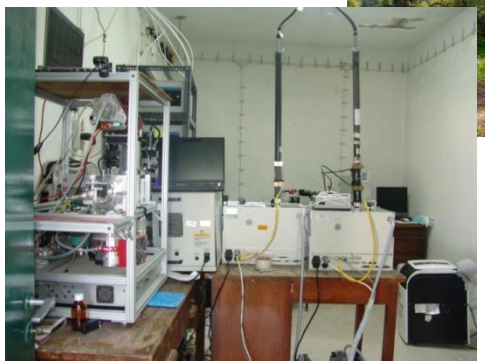
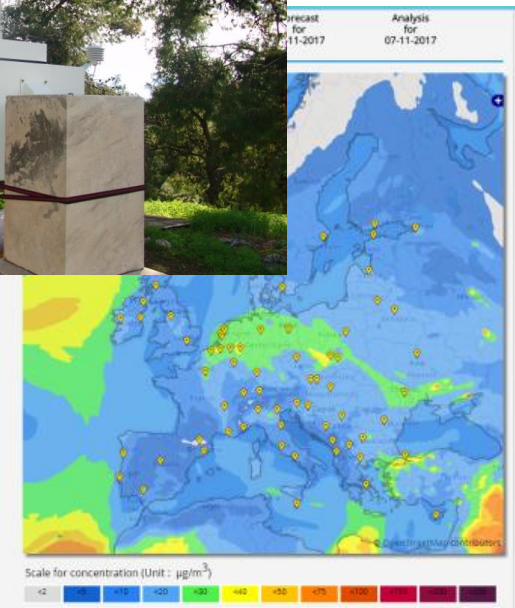






Land consumption refers to the conversion of open space or farmland to residential, commercial, or other developed land uses, including over-intensive exploitation of land.

SDG 11.3: By 2030 enhance inclusive and sustainable urbanization and capacities for participatory, integrated and sustainable human settlement planning and management in all countries

Supported by funding from NASA and the Global Environment Facility (GEF) with capacity building and tool development lead by Conservation International

Trends.Earth

A platform for global spatial analysis and assessments of SDGs

Trends.Earth brings together models developed with support from the GEF and NASA that leverages Google's Earth Engine platform to integrate earth observation data from multiple sources at user-defined scales and timeframes. The project increases access to earth observation data to improve assessment and reporting for the SDGs.

Team:
Conservation International: Alex Zvoleff, Mariano Gonzalez-Roglich, Monica Noon
NASA: Lahouari Bounoua, Eric Brown De Colstoun, Stephanie Uz

http://trends.earth

NASA

CONSERVATION INTERNATIONAL

TRENDS.EARTH tracking land change

Google Earth Engine

Development of tool to asses the ratio of land consumption rate to population growth rate

PI: Alex Zvoleff, Conservation International

CONSERVATION INTERNATIONAL

Background:

- *Promotes user driven assessments* -- Trends.Earth provides high-resolution spatial and temporal datasets for measuring land consumption rates in urban areas validated in 10 countries.
- Trends.Earth uses remotely sensed imagery to measure urban extent to map change over time and overlays gridded population to asses the land consumption rate. The tool is easy and free to use.

Impact:

- Trends.Earth has over 1,000 registered users globally; trainings have been held in nine different countries representing over 300 participants from 146 countries.

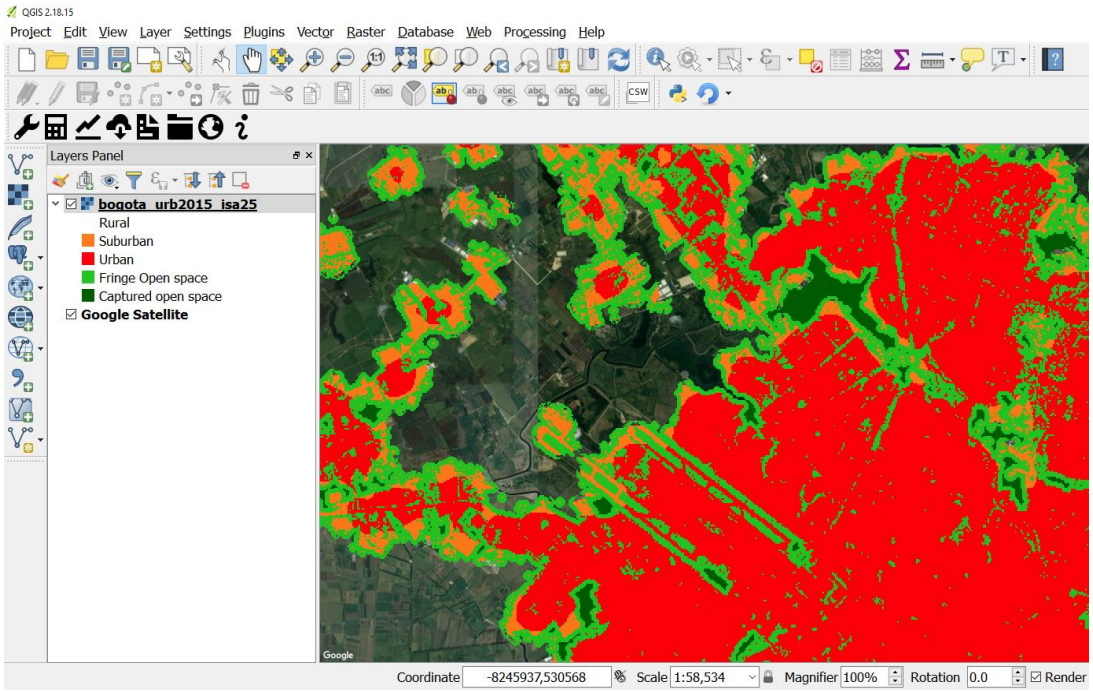
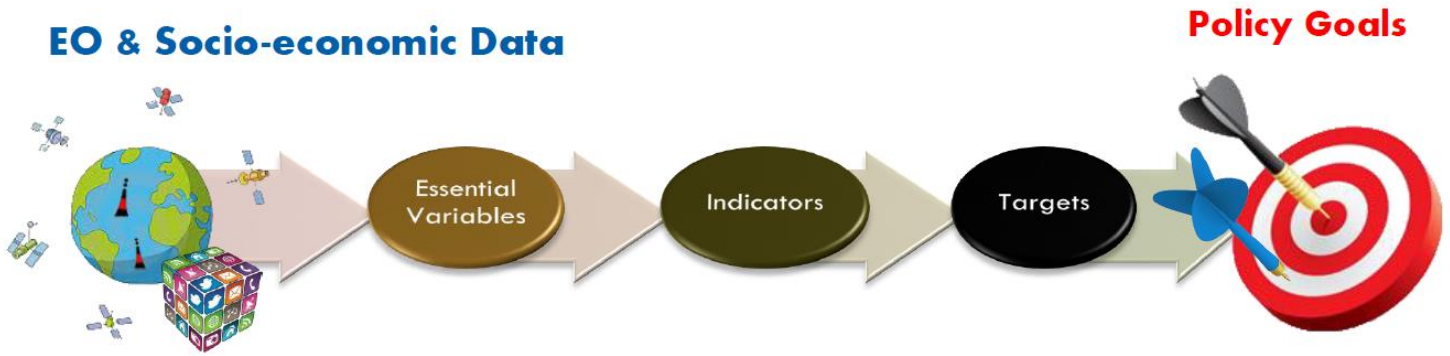


Figure 1. The output from the Trends.Earth tool reporting on Sustainable Development Goal (SDG) 11.3.1: Land consumption in Bogota, Colombia with Sub-urban (orange), Urban (red), Fringe open space (green), Captured open space (dark green) classes calculated using remotely sensed data.

From EO to knowledge



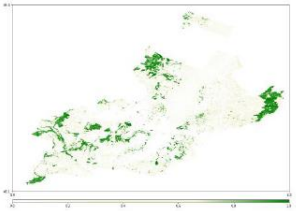
it is happening nationally …

Indicator 15.1.1 - Forest area as a percentage of total land area

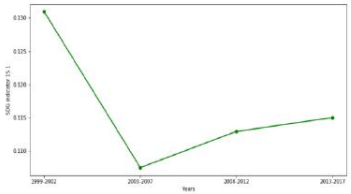
From

Swiss Data Cube

NDVI time series



Forest/non-forest time series



SDG 15.1.1

From Swiss GEO Office, EuroGEOSS 2018 Workshop

An established interaction in Germany

The BKG (Federal Agency of Cartography and Geodesy) has been working trustfully together with e.g. the Federal Statistical Office to implement national and international measures relating to the sustainability goals of UN.

The Presidents of the BKG and Destatis formalized this cooperation with a **Memorandum of Understanding** (MoU) in November 2016. It is part of the MoU to create an action plan that is annually updated and contains concrete cooperation plans.

BEST PRACTICE ?

Take home!

EO and SDG domains only marginally overlap

10-15% of SDG indicators can "be obtained or supplemented by EO procedures". Social and economic statistic data prevail

Take home!

All parties agree that EO has the *potential* to support national reporting and make SDG monitoring truly sustainable.

UN-GGIM (United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM)) says: "As the implementation of the 2030 Agenda gains momentum, Member States and the global community are now also beginning to understand the commensurate prospects for using Earth observations and geospatial information as fundamental inputs for realizing the 2030 Agenda."

Take home!

The Global indicator framework adopted by the General Assembly also states that " Sustainable Development Goal indicators should be disaggregated, where relevant, by income, sex, age, race, ethnicity, migratory status, disability and geographic location, or other characteristics, in accordance with the Fundamental Principles of Official Statistics."

EO is not only for monitoring but also supporting indirectly the SDGs e.g. providing geospatial data that can help disaggregate other statistics data and make them really SMART

Take home!

All parties agree that National Statistical Offices (NSO) and indicators' Custodian Agencies are key players in the actual integration of EO in the SDG chain

Smart Cities

Smart Statistics

4

Earth **Observations**

THANK YOU!