



EARTH OBSERVATIONS TO BUILD SUSTAINABLE
AND CLIMATE RESILIENT CITIES AND COMMUNITIES

SPACE FOR CITIES: EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT

16 February 2022, Online event

MAIN MESSAGES FROM THE WORKSHOP

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THE EURISY “SPACE FOR CITIES” INITIATIVE



The Eurisy “[Space for Cities](#)” initiative aims at fostering the use of satellite-based services where most people live, i.e. in urban areas. The initiative aims at exploring current and potential uses of satellite applications to make our cities healthier, cleaner, safer, and more efficient, and at promoting the development of increasingly efficient and user-friendly satellite-based services.

Within the Space for Cities initiative, Eurisy has identified and analysed several cases of cities using satellite-based services operationally. In partnership with local and regional authorities, the association has organised events in which these examples were showcased and discussed and has published several short articles that are accessible on the Eurisy website.

At the same time, Eurisy has also been in contact with a number of research institutes and private companies working with cities to co-develop software, methodologies and tools relying on satellite data to support decision-making at the local level. These entities work closely with local authorities to propose satellite-based solutions increasingly efficient, user-friendly and economically viable.

Finally, Eurisy collaborates with other NGOs and international organisations working to bring the benefits of space to society. To introduce the “Space for Cities” initiative to a larger audience, Eurisy also leads the [Geospatial Cities](#) initiative within the Smart Cities Marketplace, to promote the use of spatial data from different sources to improve city management and foster a sustainable urban development.

EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT: BUILDING SUSTAINABLE AND CLIMATE-RESILIENT CITIES AND COMMUNITIES

[Sustainable Development Goal 11](#), i.e. the urban SDG, aims to make cities and human settlements inclusive, safe, resilient and sustainable. At the same time, the UN-Habitat's [New Urban Agenda](#) (NUA) recognises the increasing role that cities hold in the implementation and localisation of the SDGs, in an integrated manner.



City administrations, urban planners and even national/regional governments increasingly strive to balance development needs with the objectives of the aforementioned policies, as well as local prioritisations, both in everyday operational activities and in long-term planning.

THE NEW PARADIGM OFFERED BY THE EARTH OBSERVATION (EO) DOMAIN BRINGS OPEN, RELIABLE, TIMELY AND CONTINUOUS/SUSTAINABLE SOURCES OF INFORMATION FOR SUPPORTING AND ULTIMATELY ACHIEVING GOAL 11 AND RELATED URBAN ISSUES.

Many existing examples from local and regional authorities showcase the usefulness of integrating EO data into decision making to plan, implement and monitor policies. These development focus on SDG monitoring and on the use of EO to respond to specific urban needs.

To tap the full potential of Earth observations, the stakeholders involved, including public administrations, GIS offices, international organisations, NGOs, academia, and commercial companies, must be made aware of the tools/data enabled by EO.

They must be informed of how to access and utilise them operationally, and of the unique advantages EO brings, such as the geographic disaggregation of information or the identification of hot-spots, exemplified through urban implementations spanning the globe, while allowing for local particularities.

This online workshop has been organised to bring together representatives of local administrations, SMEs, research centres, NGOs, international, and space organisations to discuss the potential uses of EO to achieve and monitor the Sustainable Development Goals in cities.

Organised on the advice of the National Observatory of Athens, that also hosts the Greek GEO Office, and as a contribution to the EC Smart Cities Marketplace, the workshop aimed at introducing the audience to the newly released [Earth Observations Toolkit for Sustainable Cities and Human Settlements](#).

THE EO TOOLKIT WAS CREATED TO ESTABLISH A REFERENCE/STARTING POINT FOR THE STAKEHOLDERS INTERESTED IN UTILISING EO FOR THEIR URBAN NEEDS, PROVIDING A ROBUST COMPILATION OF EO DATA, TOOLS, AND THE DETAILED GUIDELINES TO USE THESE.

The workshop aimed at communicating about the Toolkit to public administrations (cities and regions in particular), to research centres, and to stakeholders working with cities.

However, among the 106 participants to the workshop, only 19% worked for public administrations, either at local, regional and national levels, while the vast majority of participants represented NGOs, international organisations and private companies supporting cities in their innovation policies.

This underlines yet again the difficulty of engaging public administrations into scientific discourses through online events.

The workshop included keynote speeches from representative's from Eurisy, the UN Office for Outer Space Affairs, and the GEO EO4SDG Initiative.

The "User Session" showcased two examples of use of EO to monitor SDG 11 in Warsaw (Poland) and Thessaloniki (Greece), which are part of the EO Toolkit. Furthermore, participants were made aware of two portals to access EO data and information at the city level: the Copernicus Land Monitoring Service and the Global Human Settlement Layer.

The full programme of the event, along with all the presentations, can be accessed [here](#).



Earth Observations Toolkit for **SUSTAINABLE CITIES AND HUMAN SETTLEMENTS**

MAIN MESSAGES FROM THE WORKSHOP

SPACE-BASE DATA SUPPORT THE ACHIEVEMENT AND MONITORING OF OUR SUSTAINABLE DEVELOPMENT GOALS, AND IN PARTICULAR OF SDG 11.

***“The hardware orbiting our planet changes lives on Earth”,
Simonetta Di Pippo, UNOOSA Director***

Earth observation and geolocation data are crucial to monitor the achievement of 65 out of the 169 targets set up within the 17 Sustainable Development Goals.

Furthermore, more than half of the Essential Climate Variables can only be measured from space.

Data from satellites can be used by decision-makers to take well-informed, evidence-based decisions to improve human and environmental well-being, both globally and locally.

Space as an Agent of Change

- 65 of the 169 SDG targets (almost 40%) are **reliant** on geolocation and Earth observation.
- More than half of **Essential Climate Variables** can only be **measured from space**



© ESA, Reindeer Island in Lake Winnipeg



© NASA/William Anders, Earthrise



SPACE4SDGS

- Make **decision-making** processes as well-informed as possible
- Applicable to many **industries**, human **activities** and improving the **well-being**

4



Some of the applications of satellite data in cities.
Slides from the presentation of Ms Simonetta Di Pippo, UNOOSA Director.

WHILE THE USE OF SATELLITE NAVIGATION AND COMMUNICATIONS IS TODAY A COMMON PRACTICE, SATELLITE EARTH OBSERVATION IS STILL UNDEREXPLOITED, SINCE IT REQUIRES TECHNICAL SKILLS TO EXTRACT INFORMATION FROM THE RAW DATA.

Nevertheless, Earth observations, including satellite remote sensing, carry an important potential to improve life in cities and achieve and monitor the Sustainable Development Goals.

The SDGs to which Earth Observations can contribute the most are SGD 6 “Clean Water and Sanitation”, SGD 14 “Life Below Water”, SGD 15 “Life on Land” and SGD 11 “Sustainable Cities and Communities”.

Alignment of Earth Observations to the Sustainable Development Goals, Targets, and Indicators

Target	Goal	Indicator
1.1	1 No poverty	1.4.2
2.1	2 Zero hunger	2.4.1
3.1	3 Good health and well-being	3.6.1
4.1	4 Quality education	
5.1	5 Gender equality	5.4.1
6.1	6 Clean water and sanitation	6.3.1 6.3.2 6.4.2 6.5.1 6.6.1
7.1	7 Affordable and clean energy	7.1.1
8.1	8 Decent work and economic growth	8.4
9.1	9 Industry, innovation and infrastructure	9.1.1 9.4.1
10.1	10 Reduced inequalities	
11.1	11 Sustainable cities and communities	11.1.1 11.2.1 11.3.1 11.4.2 11.5.1
12.1	12 Responsible consumption and production	12.4.1
13.1	13 Climate action	13.1.1
14.1	14 Life below water	14.1.1 14.4.1 14.5.1
15.1	15 Life on land	15.1.1 15.2.1 15.3.1 15.4.1 15.4.2
16.1	16 Peace, justice and strong institutions	16.8
17.1	17 Partnerships for the goals	17.6.1 17.8.1

<https://eo4sdg.org>

SDGs with most opportunities for EO contributions



GEO GROUP ON
EARTH OBSERVATIONS



CEOS
The Committee on Earth Observation Satellites

Illustration of the main contributions of EO to the SDGs. Slide from the presentation of Ms Argyro Kawada, GEO EO4SDG Initiative.

AT THE CITY LEVEL, EO CAN SUPPORT DECISION-MAKERS IN SEVERAL SECTORS.

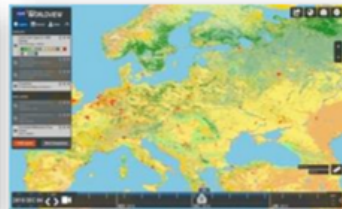
FOR EXAMPLE, IT CAN ENHANCE OUR UNDERSTANDING OF CITY GROWTH DYNAMICS AND SUPPORT ACTIONS TO MONITOR AIR QUALITY AND THE CARBON FOOTPRINT OF CITIES.

SATELLITE EARTH OBSERVATION HAS ALSO PROVED ITS ADDED VALUE TO REDUCE AND MANAGE NATURAL DISASTERS AND GEO-HAZARDS IN CITIES.

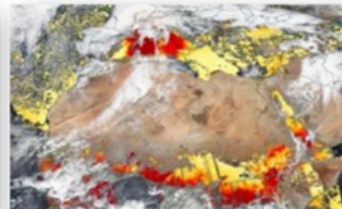
Examples of SDG 11-Related Earth Observation Data & Products



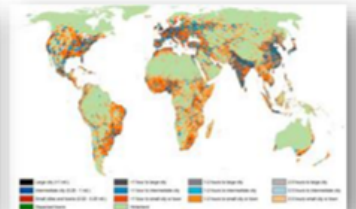
Land Surface Reflectance



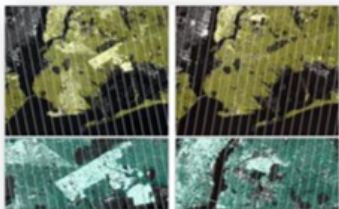
Land Cover/Land Use



Air Quality



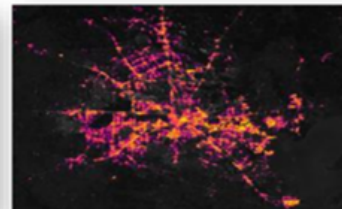
Urban-Rural Continuum



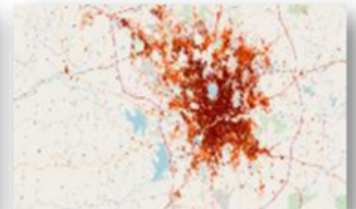
Synthetic Aperture Radar (SAR)
Data Products



Vegetation
Greenness/Phenology



Nighttime Imagery



Impervious Surface

Slide from the presentation of Ms Argyro Kavada, GEO EO4SDG Initiative.

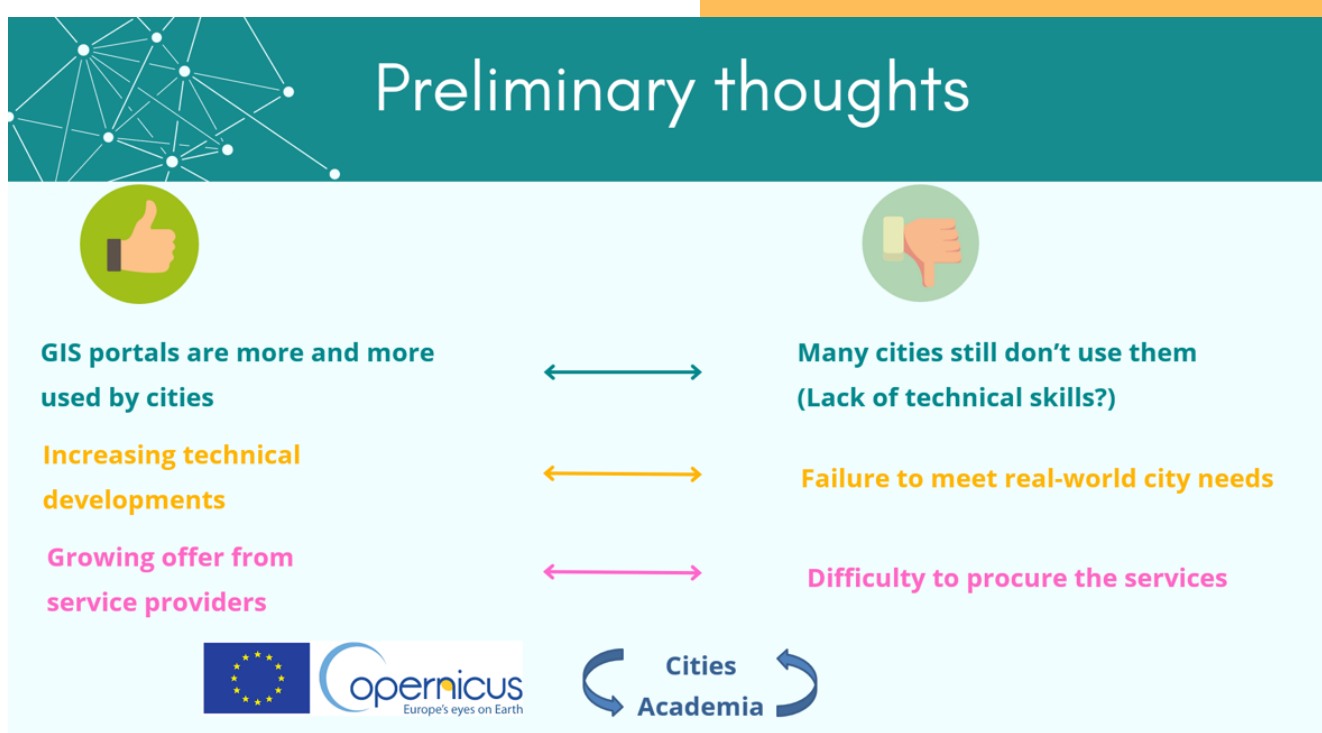
GIS PORTALS ALLOW CITIES TO INTEGRATE EO DATA INTO THEIR MANAGEMENT TOOLS. GIS ARE MORE AND MORE USED BY BIG CITIES. NEVERTHELESS, MANY SMALL CITIES AND TOWNS STILL DON'T HAVE SUCH CAPACITIES.

Geographic Information Systems are crucial to operationally use Earth observation data to improve public services at the city level, such as cadastral, environmental, and infrastructure management.

While large cities are today generally equipped with GIS, small and medium cities often don't. This is partially due to the lack of technical skills and to the insufficient information delivered to mayors about the availability of EO data, their potential uses, and the added value they can bring to everyday and long-term operations.

“Mayors often don’t know where to look for the right EO data and for software to exploit them”.

***Dominique Tilmans,
Eurisy president.***



Slide from the presentation of Ms Dominique Tilmans, Eurisy President

EO4SDG IS A COLLECTIVE INTERGOVERNMENTAL EFFORT OF THE GROUP ON EARTH OBSERVATIONS, WHICH AIMS TO PUT EO TO GOOD USE TO ACHIEVE AND MONITOR THE SDGS.

Earth Observations for Sustainable Development Goals

Countries, stakeholders, and the global community desire additional Earth observations and geospatial information to continue progress on improved social, economic, and environmental sustainability.




Contributors




<https://eo4sdg.org>

EO4SDG Initiative Purpose:

Extend uses of Earth observations and geospatial information to advance the 2030 Agenda and enable societal benefits through achievement of the SDGs.

Co-Chairs: U.S., Japan, Mexico   

Exec. Dir.: U.S. 

Key Emphasis:

Working with national statistical offices, line ministries, national mapping agencies, local governments, UN Agencies. Demonstrating benefits, building skills, and sharing knowledge on EO uses for SDGs.



Slide from the presentation of Ms Argyro Kawada, GEO EO4SDG Initiative.

The Group works with national statistical offices, ministries, national mapping entities, local governments, and UN agencies.

Since 2016, the [EO4SDG](https://eo4sdg.org) initiative has performed studies to assess how EO can support the achievement and monitoring of SDGs, demonstrating benefits, building skills, and sharing knowledge.

THE SDG11 “MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE” INCLUDES 10 TARGETS AND 14 INDICATORS.

In addition to SDG11, the New Urban Agenda provides an extension of the 2030 Agenda for Sustainable Development, by localising efforts and focusing on interventions to ensure that cities and human settlements are planned, developed and managed in sustainable ways.

SDG 11: Make cities and human settlements inclusive, safe, resilient, and sustainable



Slide Credit: Dennis Mwaniki, UN Habitat

Slide from the presentation of Ms Argyro Kawada, GEO EO4SDG Initiative.

ALIGNING WITH THE TARGETS OF SDG11 AND OF THE NEW URBAN AGENDA, EO4SDG HAS PRODUCED THE EO TOOLKIT FOR SUSTAINABLE CITIES AND HUMAN SETTLEMENTS.

Earth Observations Toolkit for Sustainable Cities and Human Settlements



Free and open, ready-to-use EO data sets.

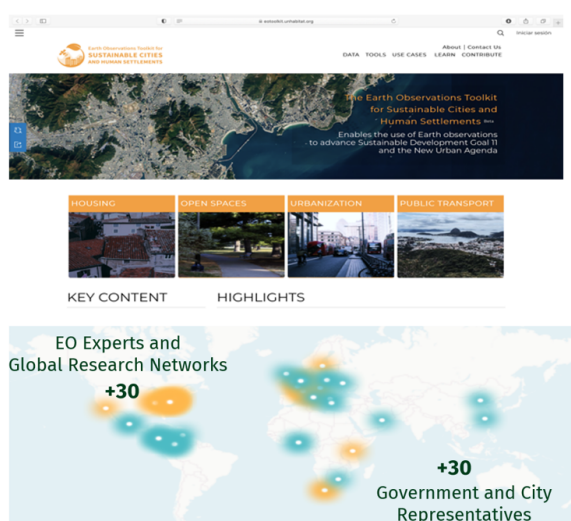


Tools to produce SDG 11 indicators and enable visualization and access to available data.



Documented use cases from cities and countries.

Visit: eotoolkit.unhabitat.org



Slide from the presentation of Ms Argyro Kawada, GEO EO4SDG Initiative.

Relying on a partnership of over 40 international organisations and experts, EO4SDG and UN Habitat recently released the [EO Toolkit for Sustainable Cities and Human Settlements](http://eotoolkit.unhabitat.org).

The rationale behind the Toolkit was the recognition that the vast amount of Earth observation data and tools that exist are spread across multitude of locations, which can be confusing for local stakeholders.

THE TOOLKIT INCLUDES DOCUMENTED USE CASES, FREE AND OPEN EO DATA SETS AND TOOLS TO PRODUCE SDG 11 INDICATORS OR OTHER URBAN METRICS.

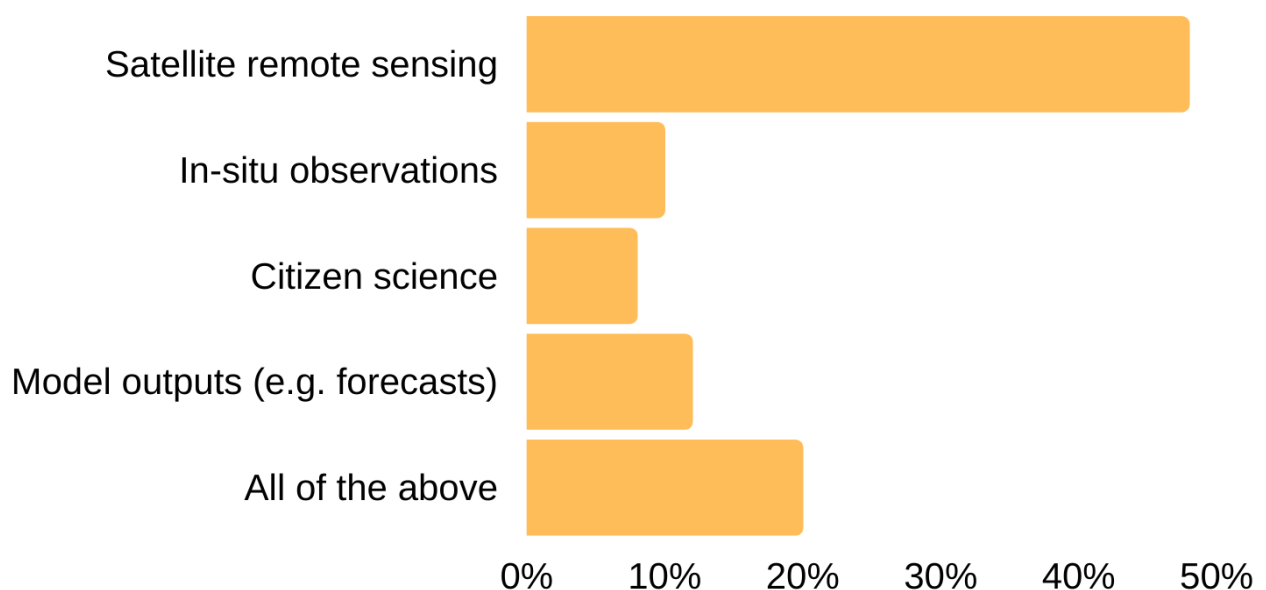
It enables visualisation and access to available EO data on housing, open spaces, urbanisation, and public transport in cities.

Users can filter the contents by topic of interest, data source and characteristics, tool coding environment, and SDG11 indicators.

Furthermore, the Toolkit includes trainings on the use of such data and tools. A [3-level training](#) (ARSET/NASA) was recently released in English and Spanish.

AS THE WORK ON THE TOOLKIT CONTINUES, INCREASED EFFORT IS PUT INTO EXPLORING THE POTENTIAL OF EO TO CONTRIBUTE NOT ONLY TO MONITORING AND ACHIEVING SDG11, BUT ON ENABLING MULTI-THEMATIC APPLICATIONS, AND INTO PROMOTING PUBLIC-PRIVATE COLLABORATIONS TO USE EO TO IMPROVE LIFE IN CITIES.

What comes into your mind when thinking about Earth observations?



While our workshop mainly focused on satellite Earth observations, the Toolkit includes use cases, data and tools that use the all array of Earth observations, including in-situ observations, citizen-science observations, model outputs, aerial images, and drone-based observations, among others.

THE EO TOOLKIT FOR SUSTAINABLE CITIES AND HUMAN SETTLEMENTS SHOWCASES CONCRETE USES OF EO TO MONITOR THE ACHIEVEMENT OF SDG 11.

The Toolkit showcases [examples](#) of use of EO data to monitor the achievement of SDG 11 in cities worldwide.

During our workshop, a session chaired by Orestis Speyer from the National Observatory of Athens, included the presentation of two such examples, that were described in detail by the public administrations that have integrated EO data to enhance evidence-based decision-making.

Anna Markowska, from the **Polish Institute of Geodesy and Cartography**, talked about how they use EO data, spatial analyses, and cartography within the **Urban Polish Observatory**.

While the Polish National Statistics Office has information useful to monitor the targets of SDG11 based on terrestrial monitoring, these data are not continuous nor harmonised.

“The use of EO can provide up-to-date, continuous and harmonised information for producing statistics related to the 7th target of SDG11, which is to provide access to safe and inclusive urban spaces”,
Anna Markowska, Polish Institute of Geodesy and Cartography

Such information is of paramount importance for public administrations at the local, regional and national levels, as well as for citizens.





Polish institutions collaborate in two out of the four working groups implementing the EO Toolkit: Group 1, which aims at increasing the impact of Earth Observation tools and data in policy and decision-making processes related to SDG11, and Group 3, aimed at transferring knowledge.

The **Polish Urban Observatory** is implemented by Statistics Poland (the country's national statistical agency), the Urban Policy Observatory of the Institute of Urban and Regional Development – IRMIR, the Office of the Marshal of the Mazowieckie Voivodeship, the University of Warsaw, and the Polish Institute of Geodesy and Cartography.

The consortium's breadth of stakeholders is one of its strongest assets.

The Observatory aims at elaborating, testing and publishing operational methodologies to produce new dasymetric indicators, based on EO and in-situ data, concerning:

- SDG 11.3: urbanisation, urban density, dynamics of urbanised areas, abandoned areas, and erosion-prone zones;
- SDG 11.6: waste management, air pollution, and aeration deficit in urban areas;
- SDG 11.7: safe, inclusive and accessible green and public spaces.

 SDG 11.3, 11.6, 11.7 Indicators			
	SDG 11.3 	SDG 11.6 	SDG 11.7 
AREA - pilot	<ul style="list-style-type: none"> • <u>Warsaw metropolitan area</u> • Cracow metropolitan area 	<ul style="list-style-type: none"> • <u>Warsaw metropolitan area</u> • Cracow metropolitan area • Poznań metropolitan area • Upper Silesia Coal Region 	<ul style="list-style-type: none"> • <u>Warsaw metropolitan area</u> • Cracow metropolitan area • Poznań metropolitan area • Upper Silesia Coal Region
- 1 stage	Mazowieckie Voivodeship	Mazowieckie Voivodeship	Mazowieckie Voivodeship
- 2 stage	area of Poland	area of Poland	area of Poland
SOURCE MATERIALS	<ul style="list-style-type: none"> • Statistical data; • EO satellite data: <ul style="list-style-type: none"> - Sentinel-2 - WorldView-3, -4 • Urban Atlas; • Orthophotomaps; • CORINE land Cover – 3, • BDOT10k – topographic database; • EGIB – Lands and building records databases; • Other <i>in-situ</i> data. 	<ul style="list-style-type: none"> • Statistical data; • EO satellite data: <ul style="list-style-type: none"> - Sentinel-2, - Sentinel-5P - WorldView-3, -4 • Urban Atlas; • Orthophotomaps; • CORINE land Cover – 3, • BDOT10k, EGIB; • Noise maps; • Maps of urban transport; • Urban transport timetables; • Aggregated medical data (Statistics Poland); • Other <i>in-situ</i> data. 	<ul style="list-style-type: none"> • Statistical data; • EO satellite data: <ul style="list-style-type: none"> - Sentinel-2, Sentinel -1 - Sentinel-5P - WorldView-3,-4, TerraSAR-X • Urban Atlas; • Orthophotomaps; • CORINE land Cover – 3, • BDOT10k, EGIB; • Noise maps; • Maps of urban transport; • Urban transport timetables; • Aggregated medical data (Statistics Poland); • Data on accidents; • Data on crimes & offences • Other <i>in-situ</i> data.

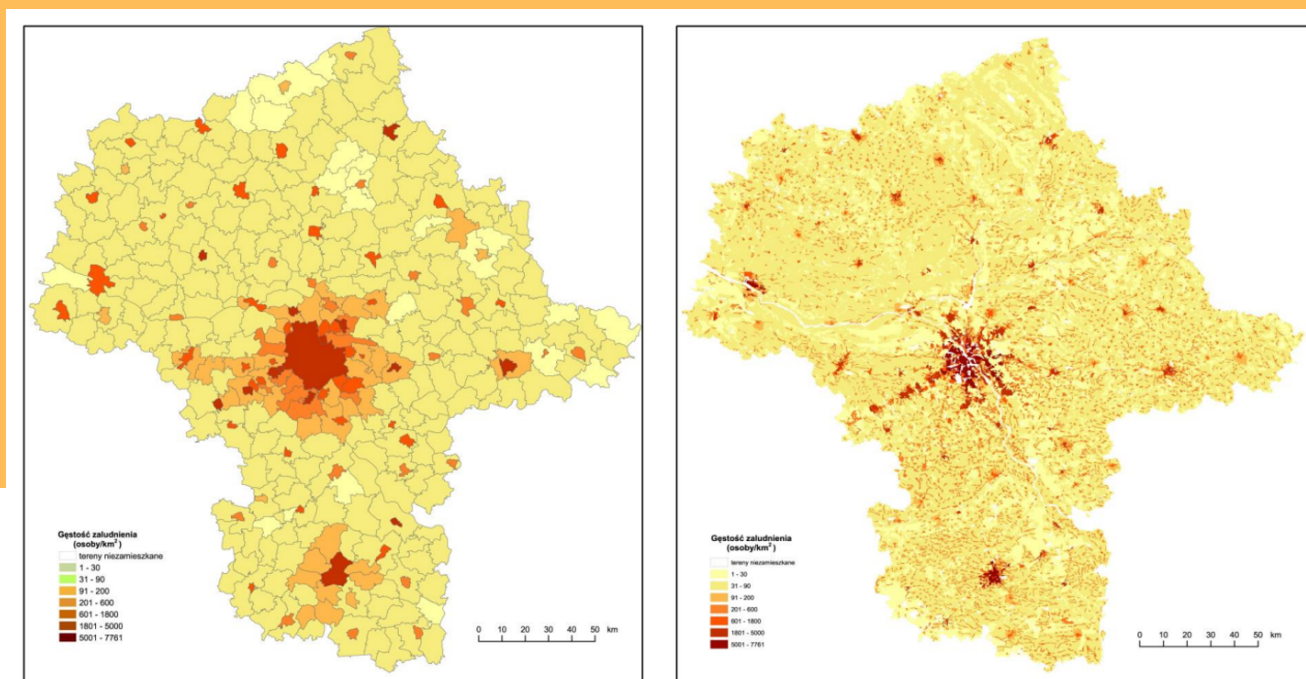
Slide from the presentation of Ms Anna Markowska, from the Polish Institute of Geodesy and Cartography

The methodologies developed by the Observatory to monitor the aforementioned targets are currently being tested in the capital city of Warsaw, in Cracow and in Poznan.

Such methodologies are based on freely available data, including data from the [Copernicus programme](#) (Sentinel-1 and Sentinel-2 satellites) and [CORINE land cover data](#).

To facilitate the use of the methodology, the members of the Observatory developed training tools intended for urban stakeholders.

THE OBSERVATORY PRODUCES MAPS ALLOWING CITIES TO VISUALISE THE PROGRESS TOWARDS THE SDG11 TARGETS.



➡ <https://eo-toolkit-guo-un-habitat.opendata.arcgis.com/pages/poland-use-case>

Slide from the presentation of Ms Anna Markowska, from the Polish Institute of Geodesy and Cartography, showing the distribution of the population in the Mazowieckie Voivodeship. The map on the left has been realised using traditional statistical methods, while the map on the right is a dyasimetric map showing the distribution of the population in relation to geographical features and produced using EO data.

THESE TOOLS WILL HELP STRENGTHENING THE MONITORING CAPACITIES OF PUBLIC ADMINISTRATIONS, BY MAKING AVAILABLE DATA AND TRAINING MODULES TO FILL THE COMPETENCY GAP ON HOW TO PROCESS SATELLITE DATA AND IMPLEMENT SPATIAL ANALYSES.

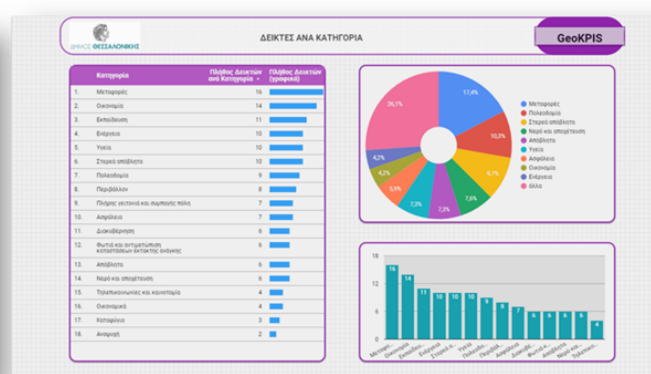
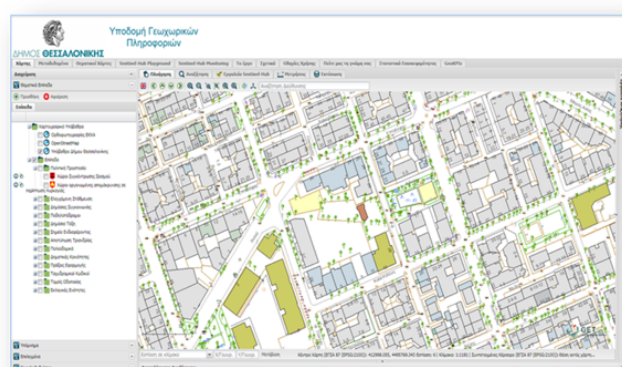
IF NATIONAL POLICIES CAN HELP CITIES ACCESSING AND USING EO INFORMATION, CITIES ARE ALSO MAKING EFFORTS TO DEVELOP THEIR OWN TOOLS AND CAPACITIES.

In Thessaloniki, in Greece, the Department of Operational Planning & Development Programs Monitoring has an office dedicated to urban resilience.

The **Resilient Thessaloniki Office** deals with the challenges faced by the city of Thessaloniki that are related to achievement of SDG11: lack of sufficient green and open space due to high population density, ageing infrastructure, exposure to natural hazards, such as earthquakes, and to climate change, causing heatwaves and floods, and a decrease in economic activities.

However, the city's Social Progress Index (SPI) is higher than in other Greek regions.

To face such challenges, in the last 10 years Thessaloniki has put in place a **Geographic Information System**, established a Copernicus-Open Data Platform/ GeoHUB, a Risk Data Portal which is updated almost in real time, and in 2019 it created an Urban Resilience Observatory to monitor the implementation of the SDGs in the city.



FUNDED WITH EU STRUCTURAL FUNDS, THE OBSERVATORY COLLECTS DATA AND MEASURES INDICATORS UNDER THE THREE PILLARS OF SUSTAINABLE DEVELOPMENT: ENVIRONMENT, ECONOMY AND SOCIETY.

Ms Stella Psarropoulou provided examples of how EO can contribute facing some of the challenges threatening the city of Thessaloniki, e.g. by allowing city authorities to map and forecast urban heat islands, or to promptly manage fires in the city's outskirts.

*“Through our GIS we aim at promoting data-driven decision-making and policies in our city”,
Stella Psarropoulou, Municipality of Thessaloniki*

Earth Observations Toolkit for Sustainable Cities and Communities

The MoT has developed a **new project** (Observatory) which uses the Copernicus Space Program, a unique environmental monitoring program which is coordinated and managed by the European Commission.

Purpose of this study,

- upgrade the existing SDI of the Municipality of Thessaloniki

Nowadays,

- we integrate a new satellite data set from Sentinel 5P, which gives information about air pollution.


A part of the data viewer Portal of Copernicus of the GIS of the Municipality (<https://gis.thessaloniki.gr/sdi/>),

- presents collective data on the distribution of urban green spaces
- categorization of the buildings of the Municipality.
- very recent Pleiades data (0.5 m PAN, 2 m MS) of very high resolution are displayed for the years 2019 and 2020.
- various multispectral compositions are displayed for the entire set of satellite data (e.g. Sentinel-2 TrueColor L2A, NDVI & Green City, False Color IR and Pleiades NDVI PAN, True Color PAN, False Color, NDVI)

The **observatory** also

- serves the needs of a repository of other environmental data related to the green spaces of the Municipality
- displays dynamic data from the urban thermal island forecasting system of the project <https://app/lifeasti.eu/>.
- All data (except the Pleiades satellite data) are available through WMS web viewing services.

www.thessaloniki.gr
www.gis.thessaloniki.gr

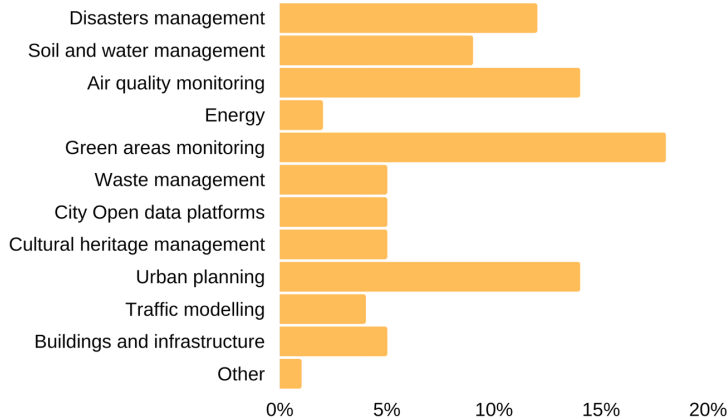


Slide from the presentation of Stella Psarropoulou from the Municipality of Thessaloniki.

During the summer of 2021, the Thessaloniki GIS was hacked by a cyberattack, which highlights the need to secure web tools for cities to be able to stably rely on them.

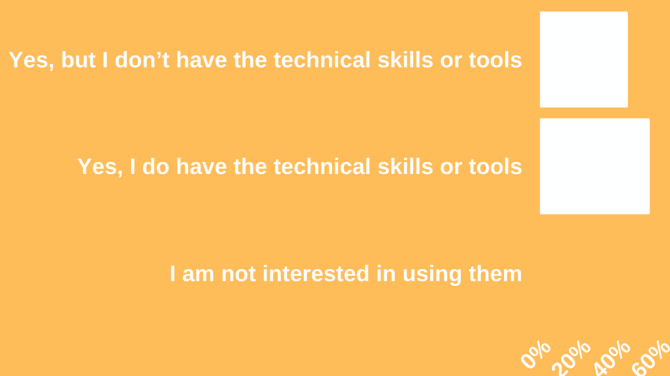
These examples show only a few of the possible uses of EO data in cities. Many more can be found and on the webpage of the [EO Toolkit for Sustainable Cities and Human Settlements](#) and on the [Eurisy website](#):

What applications of EO in cities do interest you?



Asked about the applications of EO in cities that interest them the most, workshop's participants indicated the fields of Green areas monitoring, Urban planning, Disasters management Air quality monitoring, and Soil and Water management.

Do you want to use EO?



Most interestingly (and bearing in mind that most of them were non-city stakeholders), most participants would be interested in using EO data. However, 44% of them declared that they do not have the technical tools or skills to do so.

According to Stella Psarropoulou, **cooperation between public and private institutions** can be the key to provide cities with the skills they need to build and operate their own GIS platforms.

Political engagement is also essential and can be achieved by showcasing the usefulness of such tools to enhance social, economic and environmental well-being. indeed, the Polish use case showed how political engagement can enable for the development of tools to effectively support cities.

EO DATA ARE ACHIEVING AN INCREASING SPATIAL RESOLUTION, ALLOWING FOR THE CREATION OF PLATFORMS ADAPTED TO THE SPECIFIC NEEDS OF CITIES AND HUMAN SETTLEMENTS.

In addition to use cases, the EO Toolkit also provides access to platforms and tools to access EO data for sustainable cities.

The second session of our workshop was dedicated to presenting two such platforms. The session was moderated by Marc Paganini, Technical Officer at the Directorate of Earth Observation Programmes of the European Space Agency (ESA).

Ensuring a continuous flow of data is essential to achieve the 2030 agenda, as well as the objectives set in other international instruments, such as the [Sendai Framework for Disaster Risk Reduction](#), the [New Urban Agenda](#), and the [European Green Deal](#).

The increasing amount of data produced by satellite, aerial, in-situ, and citizen-science observations, coupled with the advancements in software, data analytics (such as artificial intelligence), the Internet of Things, and computer infrastructure, offer great opportunities for countries and cities to monitor their urban development.

At the same time, this continuous flow of data makes it difficult for decision makers to efficiently deal with it.

“Data is at the hearth of the Sustainable Development Agenda. Scaling and mainstreaming their use are key to enable efficient urban policies”

Marc Paganini, European Space Agency

The EO community has been very active in the promotion of the use of EO for the development of urban strategies and policies. The EO Toolkit for Sustainable Cities and Human Settlements represents a collective effort to “package” all available data, best practices and trainings to enable cities integrating EO into their strategies.

“It is nice to have an urban strategy, but you also need the means to monitor their implementation”

Orestis Speyer, National Observatory of Athens.

THE COPERNICUS LAND MONITORING SERVICE, IMPLEMENTED BY THE EUROPEAN ENVIRONMENT AGENCY AND THE JOINT RESEARCH CENTRE OF THE EUROPEAN COMMISSION, CAN POTENTIALLY CONTRIBUTE TO EVERY CHAPTER OF THE EUROPEAN GREEN DEAL.

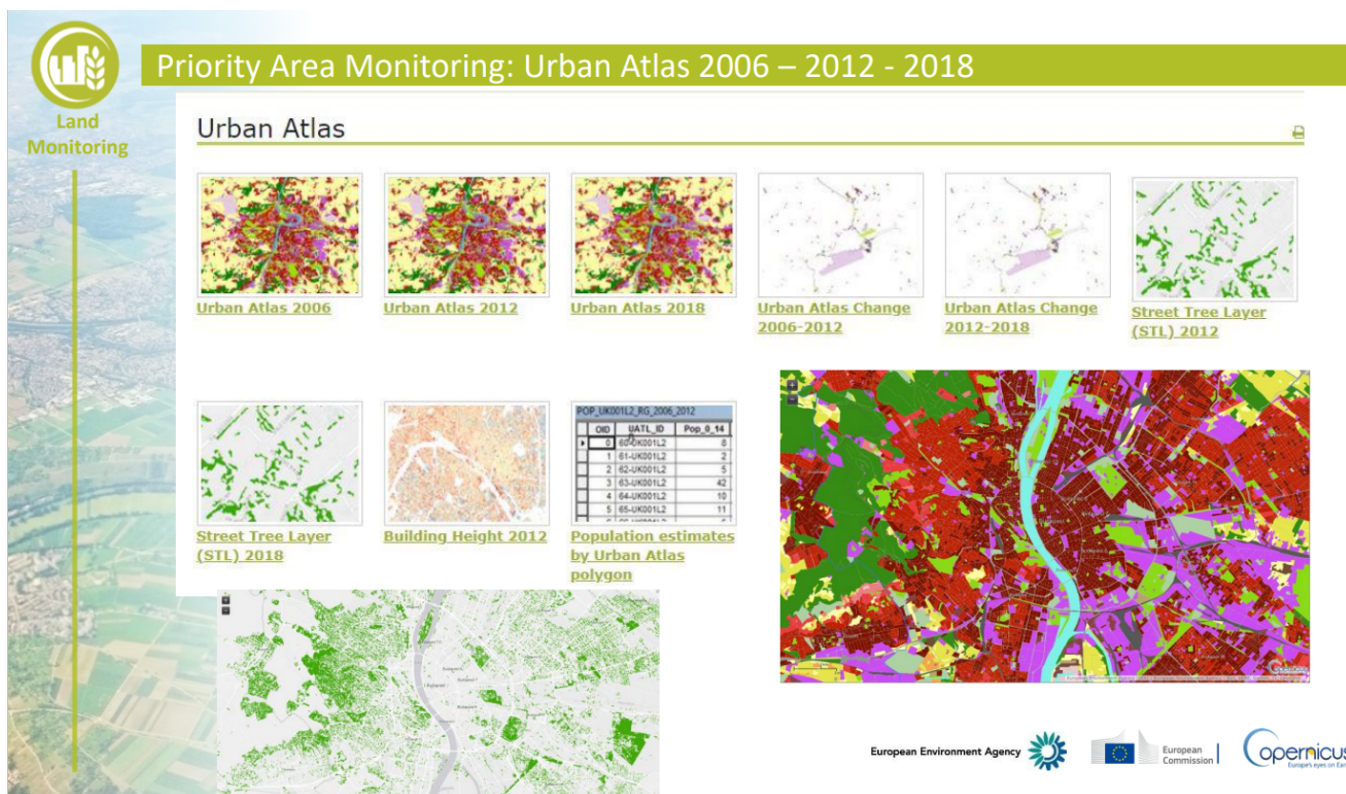
Set up in 2011, the [Copernicus Land Monitoring Service](#) (CLMS) aimed at mapping land cover and use in Europe.

Since 2014, the service extended its portfolio, including biophysical monitoring, and the [European Ground Motion service](#).

Also, considering the increasing space occupied by artificial surfaces, the Copernicus Land Monitoring Service included among its services one especially conceived for cities, the [Urban Atlas](#).

At first, the Urban Atlas only provided information on European cities of over 100.000 inhabitants. Afterwards, it started including cities with more than 50.000 inhabitants.

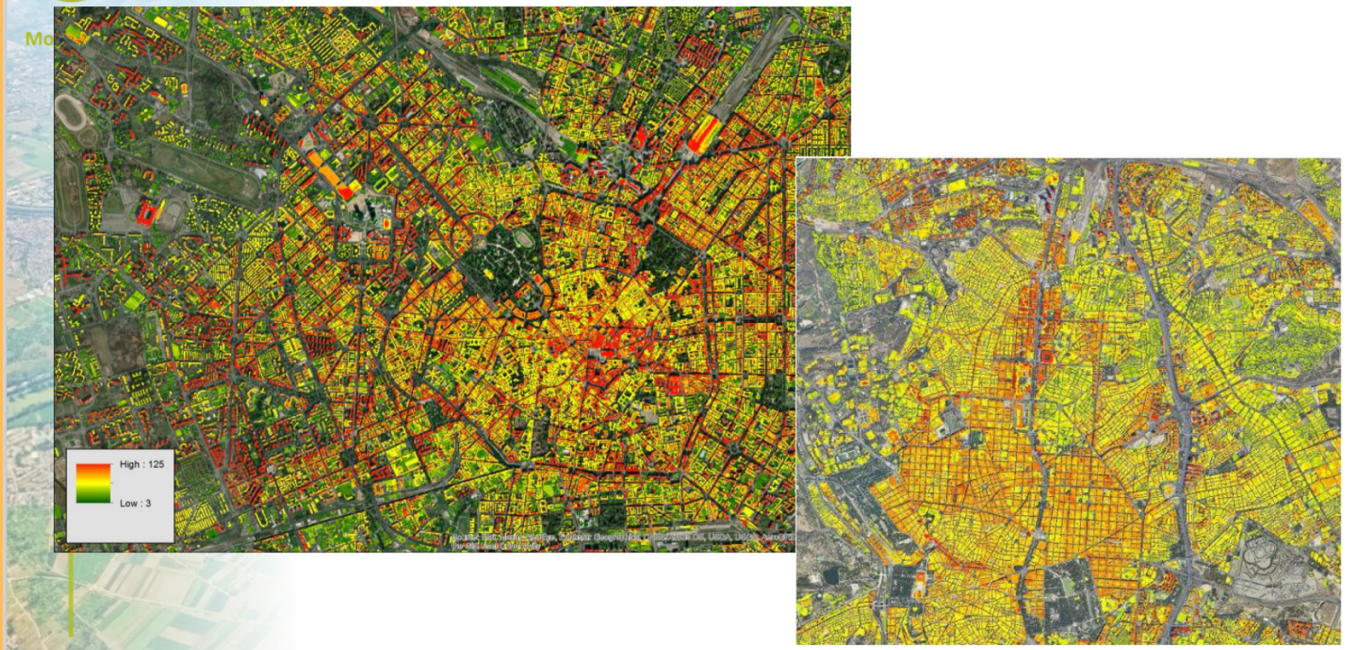
The Atlas shows changes in land cover and use in such cities, including information on riparian zones and imperviousness density, on the proximity of green urban areas and of Natura 2000 sites, on the frequency of different types of public transport, on urban trees and, most recently, on the height of building blocks in cities.



The Urban Atlas. Slide form the presentation of Hans Dufourmont, from the European Environment Agency (EEA).



UA: Building Block Height Milano & Madrid



Building blocks height in Milan and Madrid. Slide from the presentation of Hans Dufourmont, European Environment Agency (EEA).

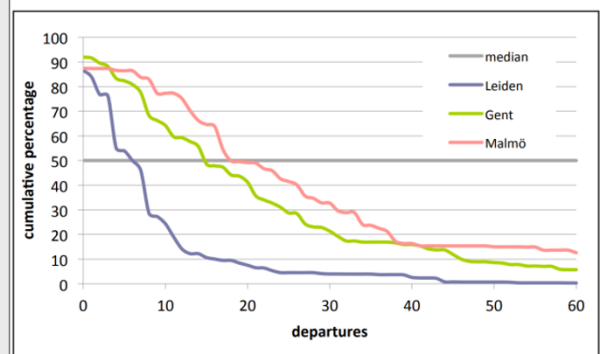
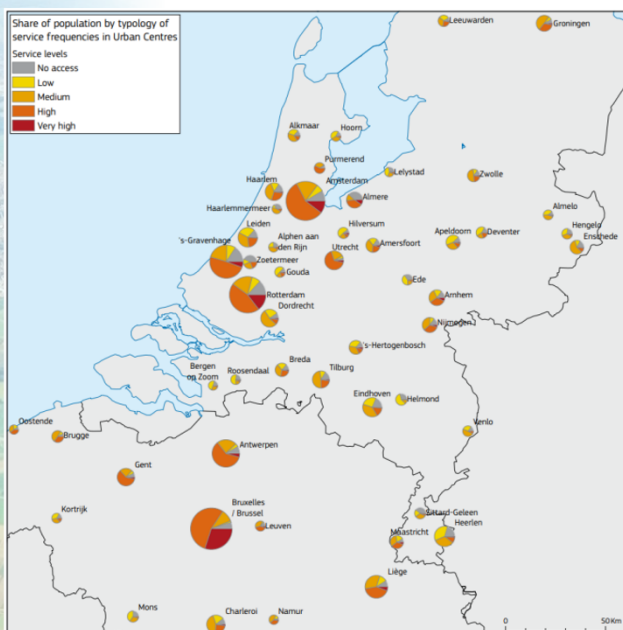
Such data has been collected since 2006 and is currently updated every three years, allowing city managers to effectively monitor changes over time.

IT IS ALSO USED BY THE EUROPEAN COMMISSION AND BY DG REGION TO BENCHMARK CITIES' NEEDS AND DISTRIBUTE REGIONAL FUNDS.



Land Monitoring

Access to Public Transport



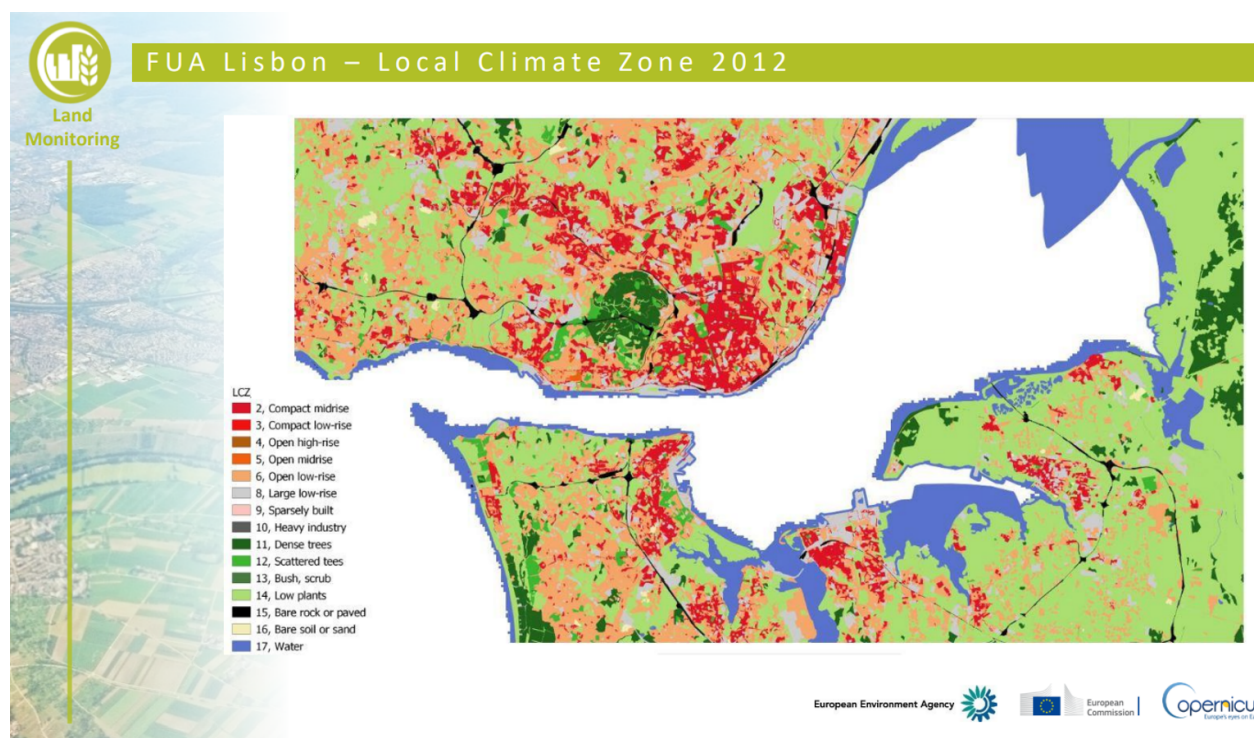
Access to public transport. Slide from the presentation of Hans Dufourmont, European Environment Agency (EEA).

The information provided by the Copernicus Land Monitoring Service can also be combined with cadastral information to map employment in urban areas or it can be used for LULUCF assessments (Land Use, Land Use Change and Forestry), which are used to report the CO₂ flows between different terrestrial reservoirs (biomass, soils, etc.) and the atmosphere that take place on the surfaces of a territory.

In addition to the Pan-European services, the Copernicus Land Monitoring Service also has a global component. Such open and free data are submitted to a rigorous quality control and are continuously updated.

More information can be found here:

<https://land.copernicus.eu/>



Local Climate Zone in Lisbon in 2021. Slide from the presentation of Hans Dufourmont, European Environment Agency (EEA).

“Our economic and social well-being depend on the health of our environment”

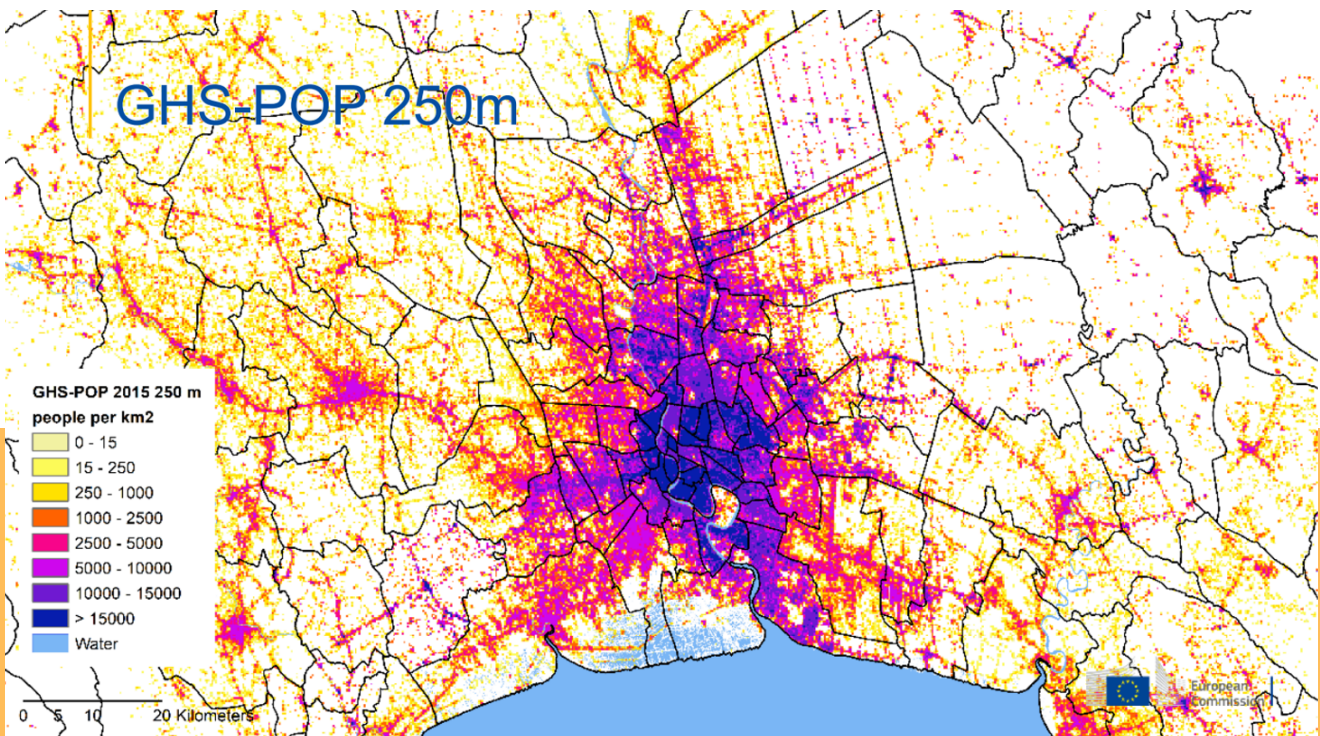
Hans Dufourmont, European Environment Agency.

THE GLOBAL HUMAN SETTLEMENT LAYER (GHSL) DELIVERS GLOBAL SPATIAL INFORMATION ABOUT THE HUMAN PRESENCE ON THE PLANET OVER TIME, IN THE FORM OF BUILT-UP MAPS, POPULATION DENSITY MAPS AND SETTLEMENT MAPS.

Developed by the Joint research Centre of the European Commission, the [GHSL](#) provides data embedded in the products of the [Copernicus Emergency Management Service](#).

THE SATELLITE EO DATA ARE COMBINED WITH DATA FROM CENSUS TO PRODUCE INFORMATION ON POPULATIONS AND BUILT-UP ENVIRONMENT.

Buildings are mapped through satellite remote sensing (currently at 30m spatial resolution). Such data is then combined with data from census to have a precise picture of the population density in a human settlement, which is crucial during crises or disasters.



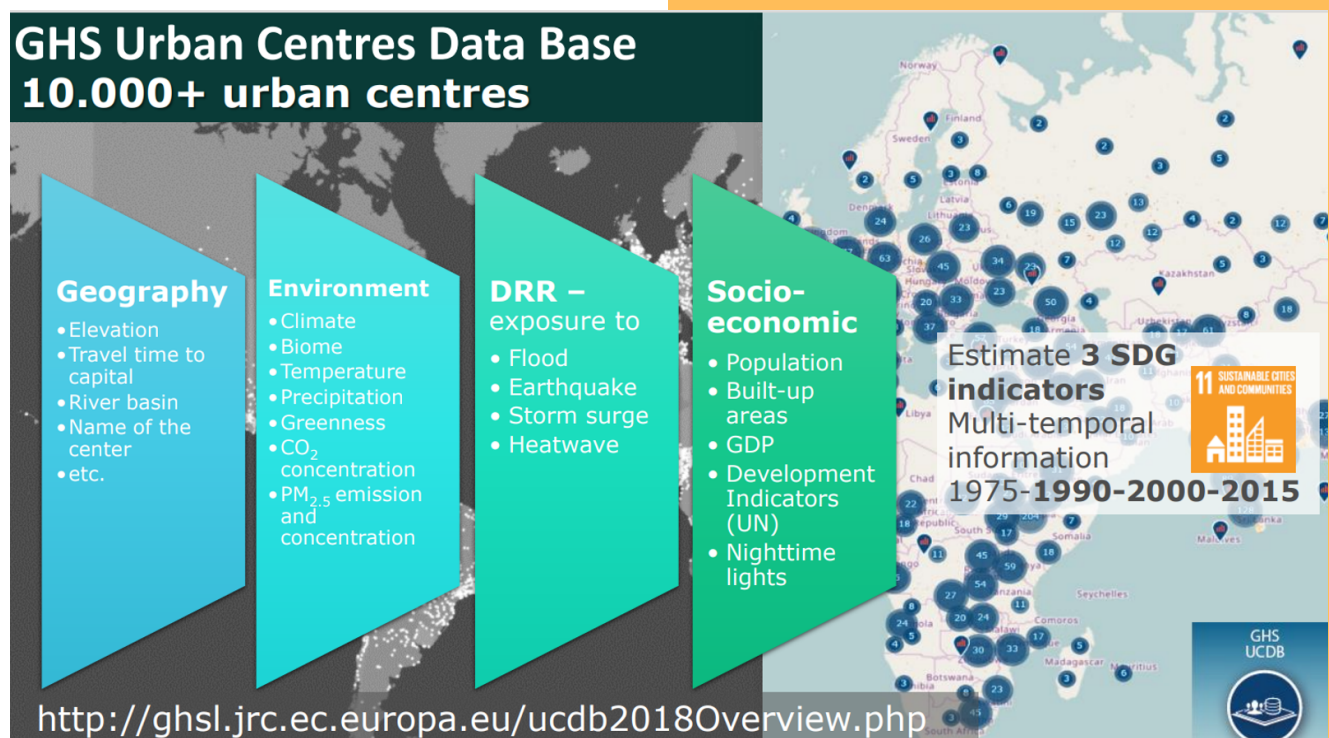
A slide from the presentation of Thomas Kemper, Scientific/Technical Officer and Project Lead at the Disaster Risk Management Unit of the Joint Research Centre of the European Commission

Such information can be used to characterise settlements in urban areas based on their degree of urbanisation, and assess the actual spread of cities, a challenging task in many big cities in low- and middle-income countries.

THE UN STATISTICS COMMISSION ENDORSED THE GHSL AS A REPORTING METHOD AGAINST SDGS FOR DIFFERENT COUNTRIES.

Indeed, since data collected on urban sprawl varies significantly across countries, the GHSL presents the significative advantage of allowing comparisons among countries and harmonise data collection.

The GHSL mapped over 10.000 cities with over 50.000 inhabitants across the globe. The information on population and built-up areas can be combined with other data to create different indicators related to geography, environment, disaster risk reduction, and socioeconomics which can be visualised at the city level and that can be freely accessed [online](#).



Slide from the presentation of Thomas Kemper, EC Joint Research Centre

ALL THESE TOOLS ARE AVAILABLE ON THE PORTAL OF THE EO TOOLKIT, TOGETHER WITH TRAINING EXERCISES.

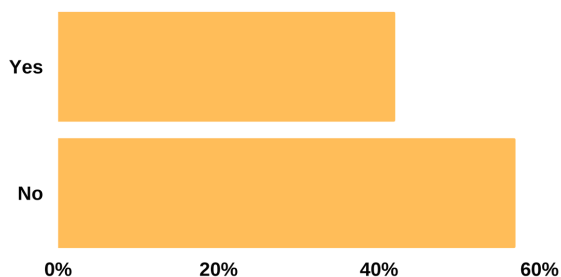
Soon, the GHSL will release new data, allowing to map residential and non-residential built-up areas, non-vegetated, densely, and sparsely vegetated surfaces, water, and roads.

The GHSL also has a product dedicated to Europe, the [European Settlement Map](#) based on Copernicus high resolution data (2m spatial resolution), showing changes in residential and non-residential buildings between 2012 and 2018.

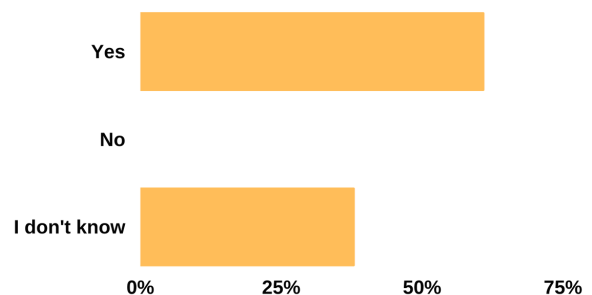
DIALOGUE WITH CITIES AND NETWORKS OF CITIES IS CRUCIAL TO PUT EO DATA TO USE TO SUPPORT SUSTAINABLE URBAN POLICIES AND STRATEGIES.

EVEN THOUGH EO DATA AND TOOLS PRESENTED ARE FREELY AVAILABLE, MOST OF THE PARTICIPANTS TO OUR WORKSHOP HAD NEVER HEARD ABOUT THEM, WHICH PINPOINTS TO THE IMPORTANCE OF COMMUNICATING ABOUT THEM IN AN ACCESSIBLE JARGON AND WITH A USER-DRIVEN APPROACH.

Did you know about these datasets and toolkits before?



Do they respond to local needs?



Local governments need affordable and easily accessible data to both implement and evaluate their climate adaptation strategies. As an example, to estimate energy consumption per square metre, cities need a precise understanding of how buildings are distributed and used. Also, information on buildings' height is needed to estimate the carbon footprint of heating and cooling.

To bring the discussion to those who should benefit from it, we invited to the panel concluding the workshop Mr Andreas Jäger from ICLEI – Local Governments for Sustainability, a global network of more than 2.500 local and regional governments committed to sustainable urban development.

“EO data can really contribute to filling the data gap we experience in some cities. Data on air quality, temperatures and soil sealing is fundamental to avoid urban heat island effects, to adapt urban materials to climate change and to increase the energy efficiency of our buildings”
Andreas Jäger, ICLEI

DATA FROM EARTH OBSERVATIONS, INCLUDING SATELLITES CAN PLAY AN IMPORTANT ROLE FOR CITIES.

INITIATIVES LIKE THE EO TOOLKIT ARE PRECISELY INTENDED TO BRING EO DATA TO CITY MANAGERS, TOGETHER WITH TOOLS AND TRAINING THAT WILL HELP THEM EXPLOITING THEM.

“Cities are ready to harness the data revolution but would need support and capacity building. Indeed, it is not just a matter of collecting data, but of interpreting them”, Stella Psarropoulou, Municipality of Thessaloniki

Such **training** is needed for politicians, for them to understand what you can do with EO data, and also for city managers, to turn the data into operable information.

Collaboration with **private entities** can help filling the capacity gap, as in the case of Thessaloniki, who was supported by a private company to build their GIS.

National institutions can also have a role to help cities accessing and exploiting geospatial information, like in the Polish case. The Observatory implemented a project on urban green areas in collaboration with regional units. They took care of delivering the information not as raw numbers but as classified information (indices) with an explanation on what these indices are. This is an example of how technical data can be communicated in a non-technical jargon.

Indeed, to adapt the **language** with which we communicate about available data to user communities is essential to foster technology transfer.

Presenting data in a visual and **intuitive** fashion also helps engaging politicians and empowering city managers.

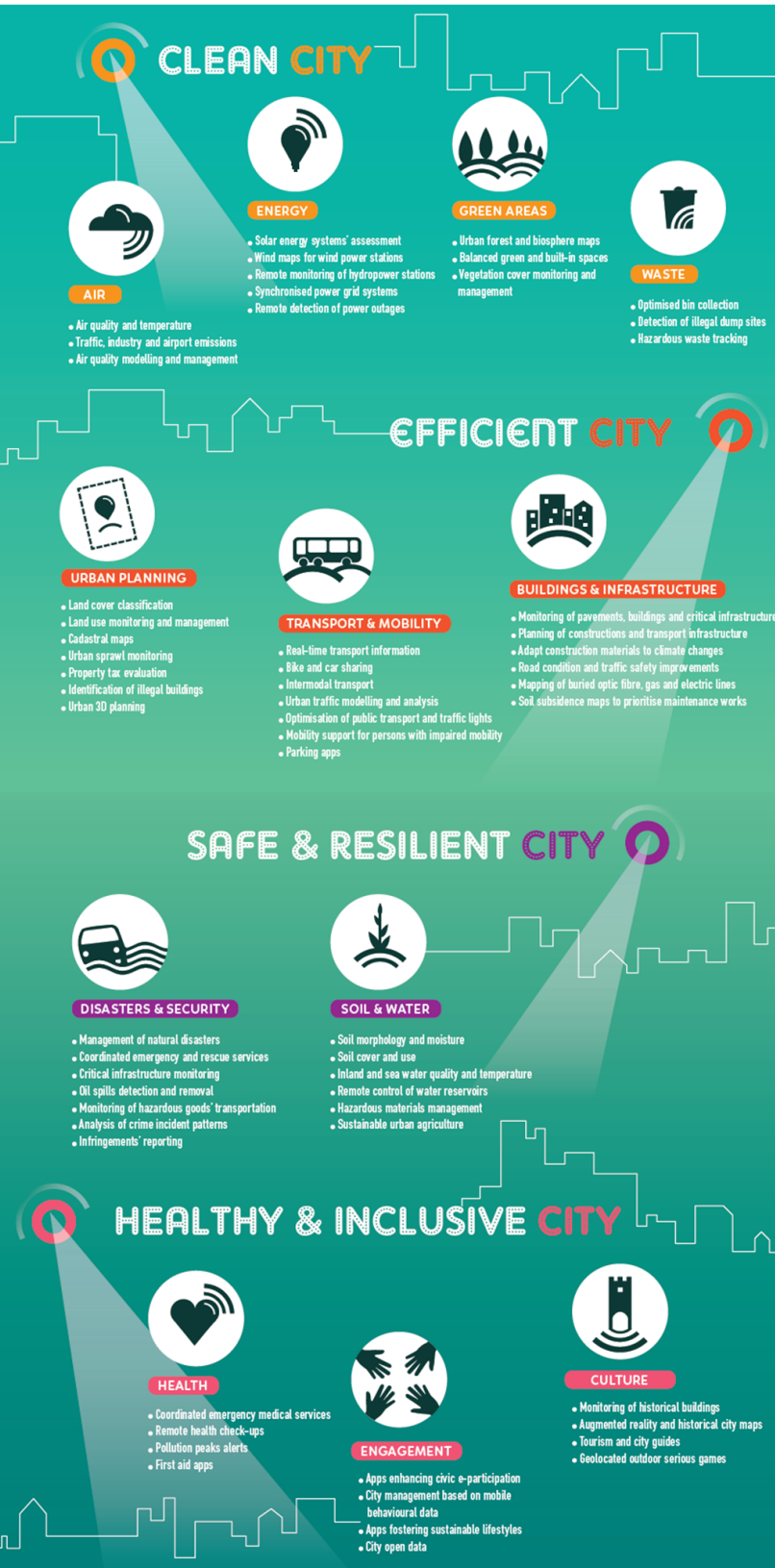
Dialogue among countries is also crucial. The Polish Institute of Geodesy and Cartography is for example collaborating with authorities in South Africa to assess how their experience with the Urban Observatory could be transferred to other contexts.

Finally, the promotion of **case studies** and the implementation of **peer-to-peer learning** (i.e. having city representatives talking with other city representatives) has also proved to be the most effective way to encourage cities adopting new technologies.

The EO Toolkit for Sustainable Cities and Human Settlements wants to fill existing knowledge and capacity gaps. The EO Toolkit team can help cities getting a first set of information on how to address their priorities with the support of EO data.

Cities, regional and national administrations, academia, NGOs and all interested entities are invited to [get in touch](#) with the EO Toolkit team to explore collaboration paths.

EURISY



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BRIDGE SPACE AND SOCIETY

Eurisy is a non-profit association of space agencies and government offices dealing with space affairs in Europe.

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52 Rue Jacques Hillairet
75012 Paris - France
+33 1 47 34 00 79
eurisy@eurisy.eu
www.eurisy.eu