

# SMURBS

ERA-PLANET



Earth Observations meet Smart Cities

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## THE CHALLENGE

Urbanization is a high priority in the UN 2030 Agenda for SDGs (G11) and GEO's Societal Benefit Area for Sustainable Urban Resilience.

## THE SOLUTION

SMURBS sets the stage for integration of the still fragmented EO, into information and decision making tools for individuals and local governments, in a network of smart cities.



[www.smurbs.eu](http://www.smurbs.eu)

# An Earth Observation approach on smart cities

**M**ore than half of the global population lives in urban areas, according to the United Nations' statistics. The heightened demand from growing populations will consequently amplify urban pressures. Urbanization is projected to elevate urban populations by 2.5 billion by 2050, and the challenge of sustainable development in cities will continue to increase. The use of cutting-edge technologies to monitor these pressures and implement efficient solutions will be essential for sustainable development and creating smarter cities.

## Earth Observation and Smart Cities

SMart URBan Solutions for air quality, disasters and city growth (SMURBS) is a project which integrates Earth Observation (EO) expertise to promote the 'smart city' concept and enhance urban resilience. SMURBS, as one of the four ERA-PLANET's joint, transnational projects, is funded by the EU's Horizon 2020 Research and Innovation Programme. Its focus areas include air quality, the management of disasters, urban growth (including migration aspects), and the health implications of urban pressures.

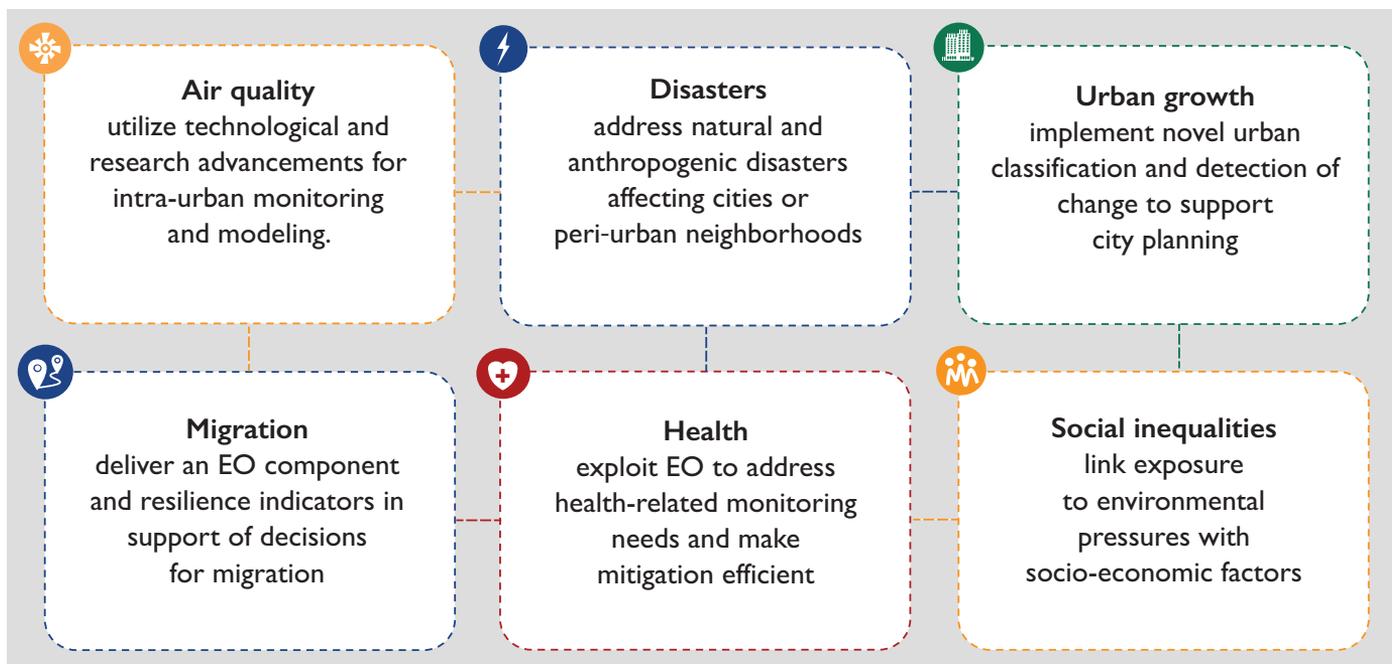
The main activities of the SMURBS project are:

- Gathering user needs from local and regional authorities, city level stakeholders, and citizen communities to facilitate fact-based decision making

by providing access to the information they need when they need it, and in an accessible format;

- Utilizing a variety of EO platforms such as satellites (e.g. Sentinel family), in situ air quality instrumentation, atmospheric modelling and Copernicus EO data;
- Incorporating EO data from innovative platforms such as Citizen Observatories and smart sensors;
- Expanding cross-validated EO information and creating synergies across these platforms to scale up for city applications;
- Creating a pragmatic portfolio of Smart Urban Solutions, predicated on the full use of EO capacities and of established smart city methods, towards targeting urban pressures; and
- Establishing the SMURBS smart city network by extensively testing and improving these solutions across a range of candidate cities.

SMURBS is led by the project co-ordinator Dr Evangelos Gerasopoulos, a research director of the National Observatory of Athens (Greece). The consortium encompasses 19 ERA-PLANET partners from 12 European countries, including research institutes, space agencies and universities, and EO experts of varying disciplines and backgrounds.



## Urban resilience: A Group on Earth Observations engagement priority

The Group on Earth Observations (GEO) is an intergovernmental partnership that improves the availability, access and use of Earth observations for a sustainable planet. GEO promotes open, coordinated and sustained data sharing and infrastructure for better research, policy making, decisions and action across many disciplines.

As part of GEO's work, focus is given to several areas where Earth observations (EO) can support the development of public policy, decision making and subsequent action on the ground. For the last two years GEO has focused on the role of EO in support of the Paris Agreement, the Sendai Framework and the United Nations 2030 Agenda. Over the coming years our focus areas will expand to include applications to various components of the New Urban Agenda and the relevant Sustainable Development Goals (SDGs), such as SDG 11.

During the World Urban Forum (WUF9) in Malaysia in February 2018, Mr Robert Ndugwa, Head of the Statistics and Data Unit at UN-Habitat, spoke about pilot activities using open EO data to support the definition of a city (i.e. the distinction between urban, sub-urban and rural areas), tracking the stock and evolution of open public spaces, urban expansion mapping and to better understand urbanization trends such as historical growth and where growth is happening. Additionally, EO data is supporting the estimation and validation of data on slum populations, complementing traditional data collection methods that rely on non-EO data. The open data used in these pilots included Landsat and Sentinel, as well as data from Google Earth. Another global database which is being piloted is the Global Human Settlement Layer (GHSL) from the Joint Research Centre of the European Commission.

The GEO Secretariat participated in a series of related meetings in 2018, including WUF9 and Resilient Cities 2018 in Bonn, Germany. In addition to looking at data collection methods and the value of EO, these meetings highlighted the reasons to integrate EO in monitoring of the SDGs and the New Urban Agenda. In particular, the events looked at the low investment required by cities and countries to acquire and scale the required data and demonstrated the reliability and high degree of accuracy of freely available EO data. However, the need for greater public private partnerships was recognized as an important next step, as the private sector is the provider of high resolution imagery that offers fine details of the structure and mature of the city fabric, for example at the building footprint level.

It should also be noted that there are elements (indicators) of other SDGs that are relevant for urban resilience, such as SDG 3 (health), SDG 6 (water), SDG 7 (energy) and SDG 13 (climate). EO can be used to support air quality and precipitation monitoring, disaster risk reduction and land use and environmental



**The GEO Work Programme is a key aspect of the global work of the Group on Earth Observations, and the EO4SDG initiative has already started to consider the role of Earth observations in support of SDG11: safe and resilient cities. As we develop our focus further on urban resilience and related topics, other activities in the Work Programme, such as GEO Wetlands, GEO Human Planet and GEOGLOWS, will all have relevance for cities and decision making. The SMURBS/ERA-PLANET project can support the on-the-ground, interdisciplinary approach that is needed for action.**



*Steven Ramage, Head of External Relations, GEO Secretariat & SASNet Fellow, Urban Big Data Centre, University of Glasgow*

monitoring, and there are a wide range of sensors available to support these tasks.

## The EO4SDG Initiative and the untapped potential of EO in the SDG framework

EO4SDG is a Group on Earth Observation (GEO) Initiative that organizes and realizes the potential of Earth observations and geospatial information to advance the United Nations 2030 Agenda and enable societal benefits through achievement of the Sustainable Development Goals (SDGs).

The SDG framework captures the interlinked, multifaceted and ambitious aspirations for the continued development of nations and societies. Effective reporting of progress toward the Targets and Indicators of these Goals requires the use of multiple types of data, traditional, such as national accounts, household surveys and routine administrative data, as well as new sources of data, namely, geospatial information, citizen science, Big Data and lastly, Earth Observation (EO).

The potential of EO in supporting the SDG framework is both vast and, for the time being, only partly exploited. Since EO and disaggregated geospatial information are often continuous in their spatial and temporal resolutions, they help capture the sustainability of development. Further, they can significantly expand monitoring capabilities at different geographical levels and across sectors, while they can also reduce the cost of monitoring and make reporting manageable and sustainable within the limited resources available to national governments. The EO potential, which also entails modeling and capacity for scenario-based approaches, goes beyond the direct monitoring of indicators, as it can also offer indirect support or contribute to the actual targets, as is



Target Contribute to progress on the Target, not necessarily the Indicator									Goal	Indicator Direct measure or indirect support to the Indicator				
							1.4	1.5	1 No poverty	1.4.2				
							2.3	2.4	2 Zero hunger	2.4.1				
							3.3	3.4	3 Good health and well-being	3.9.1				
									4 Quality education					
								5.a	5 Gender equality	5.a.1				
		6.1	6.3	6.4	6.5	6.6	6.a	6.b	6 Clean water and sanitation	6.3.1	6.3.2	6.4.2	6.5.1	6.6.1
								7.2	7 Affordable and clean energy	7.1.1				
								7.3	7 Affordable and clean energy					
								7.a	7 Affordable and clean energy					
								7.b	7 Affordable and clean energy					
								8.4	8 Decent work and economic growth					
								9.1	9 Industry, innovation and infrastructure	9.1.1	9.4.1			
								9.4	9 Industry, innovation and infrastructure					
								9.5	9 Industry, innovation and infrastructure					
								9.a	9 Industry, innovation and infrastructure					
								10.6	10 Reduced inequalities					
								10.7	10 Reduced inequalities					
								10.a	10 Reduced inequalities					
	11.1	11.3	11.4	11.5	11.6	11.7	11.b	11.c	11 Sustainable cities and communities	11.1.1	11.2.1	11.3.1	11.6.2	11.7.1
								12.2	12 Responsible consumption and production	12.a.1				
								12.4	12 Responsible consumption and production					
								12.8	12 Responsible consumption and production					
								12.a	12 Responsible consumption and production					
								12.b	12 Responsible consumption and production					
								13.1	13 Climate action	13.1.1				
								13.2	13 Climate action					
								13.3	13 Climate action					
								13.b	13 Climate action					
		14.1	14.2	14.3	14.4	14.6	14.7	14.a	14 Life below water	14.1.1	14.3.1	14.4.1	14.5.1	
									14 Life below water					
									14 Life below water					
									14 Life below water					
	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
									15 Life on land					
									15 Life on land					
									15 Life on land					
								16.8	16 Peace, justice and strong institutions					
									16 Peace, justice and strong institutions					
									16 Peace, justice and strong institutions					
17.2	17.3	17.6	17.7	17.8	17.9	17.16	17.17	17.18	17 Partnerships for the goals	17.6.1	17.18.1			

Figure 1: The Targets and Indicators of the Sustainable Development Goals (SDGs), which can be benefited from Earth Observation (EO) and geo-spatial information.

illustrated in Figure 1, and can also inform planning, and projecting impacts of policies and decision-making.

One of EO4SDG main goals is addressing the underutilized potential and tackling the real-world challenge of mainstreaming EO uses is support of SDG processes, i.e. the actual integration of EO into the various existing SDG indicators' workflows. It has delineated the way forward in discrete elements, including direct engagement with the UN Custodian Agencies to pursue incorporation of EO in recommended, global data methodologies, facilitation and encouragement for national government ministries and agencies to work together across traditional institutional lines to incorporate

EO and data collection techniques beyond traditional statistical practices, and following of a federated approach in the GEO community, bringing the EO solutions closer to the SDG framework.

The state-of-play, as was presented in the GEO WEEK 2018 in Kyoto, is that extensive activity towards the above has already taken place. Concrete and established examples of successful EO support of the SDGs exist in different countries, and there is a need for more good practice use cases to help drive impact among GEO member countries, the extended GEO, and international community. Moreover, one area of increasing maturity, and especially relevant to the urban

“The SMURBS/ERA-PLANET project can help address this issue of developing and scaling examples of EO integration in SDG monitoring and reporting, with a focus on promoting societal and environmental resilience to urban pressures. It can do so by providing a critical mass of partners and cities, seasoned communication channels, and local knowledge of relevant inter-agency relationships, serving, thus, as an ambassador for this common EO and SDGs pathway in support of urban-related, sustainable development issues.”

*Argyro Kavvada, Ph.D.*

*Lead for SDGs at NASA Earth Science/BAH. Focal Point for GEO's @EO4SDG*

resilience community, is GEO's ongoing work with UN-Habitat on SDG 11: Safe and Resilient Cities (target 11.3.1). The big question for the future, however, is: "What does it take to scale up and convince others"?

## **D**r Evangelos Gerasopoulos is a Research Director at the National Observatory of Athens, from where he coordinates the SMURBS project

Here, he discusses the challenges of EO use for smart cities, expands on the potential benefits of the SMURBS project for the European Smart Cities initiative, and outlines the future of SMURBS.

### **What are the challenges involved in coping with the still fragmented Earth Observation information for delivering smart city solutions, and how do you plan to overcome these challenges?**

The EO information involves too many platforms and formats for data storage and retrieval, as well as projects that often duplicate the same research efforts. One of the challenges is that the semantics in the field of EO for urban applications is an uncharted territory. SMURBS is tackling the challenge of fragmentation building an inclusive network which also involves other relevant or complementary European projects, local and regional institutions that undertake smart city initiatives. We develop a set of semantic resources to define the specific domain of the urban environment, to facilitate turning a large volume of data into findable, accessible and comprehensible knowledge for users.

No doubt, there is a lack of interest from stakeholders to use new solutions and incorporate new procedures into their decision-making mechanism. To combat this, SMURBS plans to invest in existing city and partners' assets, refine them for the needs of the smart city (in a co-design mode with stakeholders), deliver several showcases, and finally upscale its findings where possible.

SMURBS is keen to contribute to the long-term penetration of EO into smart city practices.

### **How does the SMURBS project serve GEOSS and Copernicus?**

Our work is in alignment with GEO's Societal Benefit Areas (SBA) of "Sustainable Urban Development" by exploiting EO for monitoring urban sprawl; that of "Public Health Surveillance" by monitoring air quality, by identifying new dangerous pollutants, as well as their sources, and by estimating the exposure to them, and lastly, that of "Disaster Resilience", by increasing the capacity to prepare for, mitigate, manage and recover from urban disasters.

In parallel, we focus on advancing GEOSS' practices in data management, sharing principles and on increasing interoperability of data and methodologies.

SMURBS works to increase the uptake of Copernicus data by actively utilizing its Land Monitoring, Atmospheric Monitoring and Emergency Management Services. We contribute to the broadening of Copernicus' user base through dissemination activities but also through our pilots' implementation, and we support the production and validation of Copernicus products with localized and specialized in situ datasets.

### **What are the potential benefits of the SMURBS project for the European Smart Cities?**

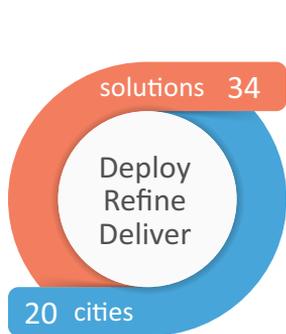
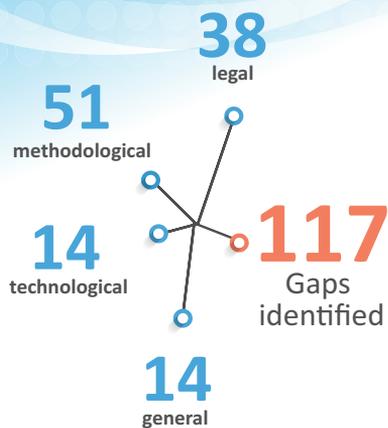
There is growing consensus of the benefits and the currently untapped potential of Earth Observation for smart cities. For example, the European Innovation Partnership on Smart Cities and Communities (EIP-SCC) recognizes the important role that Earth Observation technologies play in supporting better planning and operations. SMURBS links EO with smart cities and delivers its own interpretation for "smartness", talks with city stakeholders and actualizes its smart solutions in a network of smart cities. In this context, SMURBS activities and network could be integrated into existing or set the basis for e.g. the formulation of a new EIP-SCC Action Cluster or Initiative. In any case, our EO-based approach lays the groundwork for including Earth Observation language and concepts in the European Smart Cities.

### **What are your hopes for the future of the SMURBS project?**

We hope that the SMURBS network will become the point of reference for the urban component in GEO and EuroGEOSS, and we are solidifying day by day. The key word for the future of SMURBS is sustainability. This can be achieved by products which find their place in the market through the commercialization process, but we also strive to engage the local authorities to make use of our solutions.

EuroGEOSS, which is an initiative of the European Commission to support GEOSS at the regional level, offers a timely and great opportunity for SMURBS to evolve into a project with a more long-term perspective. We anticipate the continuation of many of our project activities.

# SMURBS' first year in numbers



# SMURBS

a smart-city project

## ERA-PLANET

Smart URBan Solutions for  
Air Quality, Disasters and City



Social inequalities



Migration



Urban growth



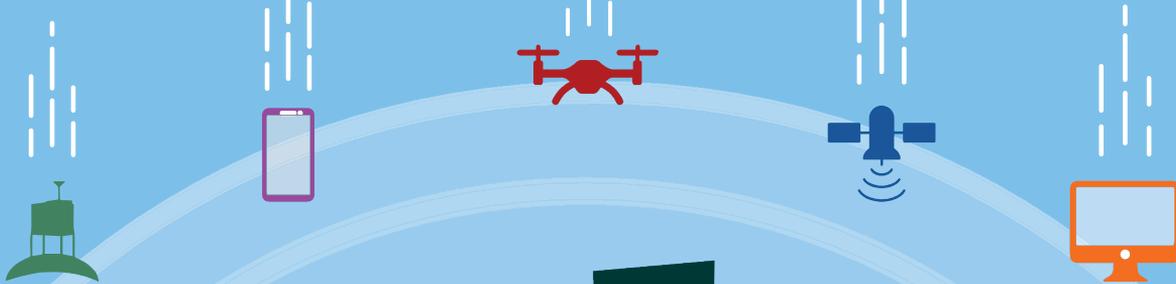
Disasters



Health



Air quality



## Urban Resilience through Earth Observation



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Duration: 36 months (01/09/2017 - 31/08/2020)  
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