



URBIS24 Report

16–18th September 2024, ESRIN

<https://urbis24.esa.int/>

Background & Objectives

URBan Insights from Space (URBIS24) builds on ESA's decade-long experience in supporting the development of innovative Earth Observation integrated methods and products for urban applications. As a natural progression from the previous events—MUAS (Mapping Urban Areas from Space) in 2015 and 2018—URBIS24 emphasizes a very strong engagement with end users. This has been done both by widely stimulating users to attend and be exposed to the technical session describing latest technical achievements of relevance, and by actively involving users as key contributors to the organization and structure of the event, ensuring their needs shape its direction.

The main objectives of URBIS24 have been to:

- **Gather participants from different sectors**, including urban experts, policy makers, remote sensing experts, academia and NGOs, in sharing knowledge, expertise and opportunities of using EO in addressing urban challenges, hence fostering new collaborations among participants;
- **Identify challenges and priorities** of urban experts and decision-makers in the context of urban planning, urban adaptation, increasing livability, which can strongly benefit from using up-to-date EO-integrated solutions;
- **Explore state-of-the-art results** from Remote Sensing scientists and experts and delineate new applications and R&D activities.

URBIS24 in numbers

211 in person attendees from 39 different countries;

70 technical presentations;

60 posters;

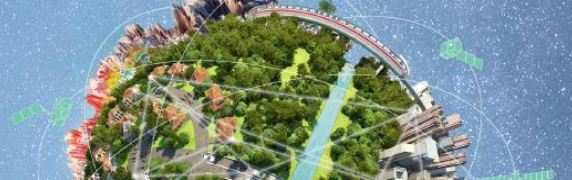
10 users' perspectives talks;

5 keynotes presentations;

32 Scientific Committee members.

Full Material

- Video recordings of URBIS24 3 days are available on the workshop website <https://urbis24.esa.int/re-watch/>.
- All presentations and posters made available by presenters can be found on the workshop website within the programme <https://www.conftool.pro/urbis24/sessions.php>
- Sessions' summary and recommendations will be made available on the workshop website <https://urbis24.esa.int/>.



Programme Committee

The Programme Committee has seen the involvement of:

Covenant of Mayors – Europe

Petya Pishmisheva, Coordinator

ICLEI

Pourya Salehi, *Head of the Urban Research, Innovation, and Development Team*

David Corbett, *Research, Innovation, and Development Officer*

UN-Habitat

Dennis Mwaniki, *Geospatial Data Expert*

Robert Ndugwa, *Head of Data and Analytics Unit*

OECD

Claudia Baranzelli, *Head of Laboratory for Geospatial Analysis*

DG JRC

Thomas Kemper, *Team Leader GHSL*

Together with:

ESA

with Francesca Elisa Leonelli, Marc Paganini, Zoltan Bartalis, Stefanie Lumnitz, Beatrice Barresi, Federica Marando

Serco c/o ESA

with Irene Renis, Sabrina Lodadio

The main role of the Programme Committee has been to support the organisation of the Programme of the workshop and to promote the event, but also to chair specific sessions, to propose keynote speakers, to propose members of the Scientific Committee.

Networks of city practitioners and users played a crucial role in shaping the event, fostering a highly dynamic and participatory approach.

Scientific Committee

The Scientific Committee was composed of 32 members, listed hereafter, chosen and invited among the main experts in Europe and worldwide of remote sensing for urban applications. The Scientific Committee has had the role to support the review process and to promote the event.

	Name	Entity	Country
1	Daniel Arribas-Bel	The Alan Turing Institute	UK
2	Yifang Ban	KTH	Sweden
3	Alexandre Banquet	OECD	France
4	Benjamin Bechtel	Ruhr-University Bochum	Germany
5	Ingunn Burud	NMBU Norwegian University of Life Sciences	Norway
6	Constantinos Cartalis	National and Kapodistrian University of Athens	Greece
7	Tzu-Hsin Karen Chen	University of Washington	US
8	Nektarios Chrysoulakis	FORTH	Greece



9	Fabio Del Frate	University Tor Vergata	Italy
10	Sébastien Delbour	CLS	France
11	Tahia Devisscher	University of British Columbia	Canada
12	Thomas Esch	DLR	Germany
13	Martin Fleischman	Prague University	Czech Republic
14	Dilek Fraisl	IIASA & CSGP	Austria
15	Paolo Gamba	University of Pavia	Italy
16	Iphigenia Keramitsoglou	National Observatory of Athens	Greece
17	Monika Kuffer	University of Twente	The Netherlands
18	Nicholas Longepe	ESA	Italy
19	Mattia Marconcini	DLR	Germany
20	Paolo Mazzanti	NHAZCA, Sapienza University of Rome	Italy
21	Annekatriin Metz-Marconcini	DLR	Germany
22	Zina Mitraka	FORTH	Greece
23	Ana Oliveira	CoLAB +ATLANTIC	Portugal
24	Mattias Roth	National University of Singapore	
25	Christophe Sannier	GAF	France
26	Katja Schechtner	Urbanistin die u.a. für MIT / OECD arbeitet	Austria
27	Tomáš Soukup	GISAT	Czech Republic
28	Iacopo Testi	<i>Expert</i>	Italy/USA
29	Matilda van den Bosch	ISGlobal, Spain / EFI Biocities	Italy
30	Jasper van Vliet	VU University Amsterdam	The Netherlands
31	Qihao Weng	Hong Kong Polytechnic University	Hong Kong
32	Maria Zaretskaya	ESA	The Netherlands



Programme Summary at a glance

The programme was organised in:

- **The opening session** set the scene for the workshop by presenting perspectives from users. Initially, Programme Committee outlined the mandates of their respective organizations, as well as their interests and expectations for the workshop: **Petya Pishmisheva** emphasised the role and potential of EO data in supporting cities' climate commitments and the development of effective adaptation strategies with evidence-based information, with a specific focus on small and medium sized cities, as prominent in Europe. Key city needs expressed by cities include identifying sources of emissions, renewable energy potential and optimal site selection, mobility and transportation management, as well as improvements in air quality, carbon sinks, soil-sealing rations and management of heat islands. **Pourya Salehi** discussed ICLEI's role in bridging the gap between urban practitioners and scientific communities. He underscored the necessity of translating complex EO data into actionable insights for local governments, advocating for capacity-building initiatives that empower cities to utilize EO technologies effectively in their climate action plans. **Dennis Mwaniki** emphasised the role of geospatial data in urban monitoring and policymaking, explaining that EO data can track urbanization trends, evaluate public service access, and identify vulnerable areas. He highlighted the importance of EO in ensuring consistent and comparable data across various urban contexts, supporting policy monitoring, such as tracking SDG targets and indicators. Dennis also underscored the need to clearly communicate the capabilities and limitations of available products and services to build trust, along with enhancing capacity for data comprehension and effective use. **Claudia Baranzelli** discussed OECD's commitment to leveraging geospatial analysis to inform regional development strategies, focusing on creating indicators that guide decisions related to urban growth, infrastructure, and environmental sustainability. Claudia highlighted the importance of international collaboration in developing geospatial tools to address global urban challenges, underscoring the need for standardized methodologies to ensure data consistency and comparability across different urban contexts.

Then, **Benjamin Caspar** (Coordinator of Urban Nature and Biodiversity Policy, EC DG ENV) gave a policy overview explaining how the Nature Restoration Law directly affects cities with the specific urban restoration targets, and how cities in Europe, covering 22% of the continent, will need to have an increasing trends in green spaces and tree canopy cover after 2030, acting as a catalyst for increasing the interest in monitoring biodiversity and green areas in cities. This will translate in the need of increasing frequency, resolution and accessibility of data in support of cities monitoring and reporting necessities. Benjamin also emphasised the importance of modelling and if scenarios developments, providing decision support for next actions.

Last, city representatives **Sabrina Alfonsi** (Councillor of Agriculture, Environment, and Waste Cycle, City of Rome) and **Markus Annilo** (Digital Twin Technology manager, City of Tallinn) shared on-going initiatives and highlighted main challenges they daily face in city management, setting the very practical context that the EO community can focus on.



- The **Navigating Urban Futures with Earth Observation session**, where **Karen Seto**'s highlighted the growing focus given by the IPCC to cities with dedicated chapters, and how EO has contributed to these chapters emphasising the potential of analysing global trends consistently, with a particular emphasis to the forthcoming Special Report on Climate Change and Cities. **Inge Jonckheere** then went through the main state-of-the-art urban applications while looking forward to the relevant upcoming Earth Explorers missions.

The following panel discussion highlighted challenges and opportunities in integrating Earth Observation (EO) into urban planning to address practical needs and issues, by involving perspectives from representatives of all sectors: **Petya Pishmisheva** (Coordinator, EU Covenant of Mayors for Climate and Energy), **Karen Seto** (Yale University and Coordinating Lead Author of IPCC 5th and 6th ARs), **Iacopo Testi**, (ex-MIT Senseable Cities Lab, ENEL X, Urban AI), **Klemens Himpele** (CIO, City of Vienna), **Thomas Kemper** (Team Leader GHSL, JRC).

From mapping to meaning

Key issues faced by governments include managing emissions, mitigating risks, and translating global strategies into actionable local plans. While the interest in EO has expanded beyond technical experts to attract a wider range of users and disciplines, there is a crucial need to integrate public and commercial data sources to transition from basic mapping—answering questions like "where is what"—to understanding the reasons behind urban developments, the implications of policy actions, and projecting future scenarios with questions like "how, why, and what if." For instance, instead of merely identifying where trees are, urban planners need to know where to plant them to maximize cooling effects. This approach is vital for providing municipalities and governments with actionable information and decision-making support. With the advent of tools such as Sentinel-2, which offers 10m spatial resolution, combined with investments from major internet players, there has been significant progress in developing urban products and achieving global coverage for human footprint mapping. This is especially valuable for data-scarce regions like the Global South. While identifying the location of houses has been largely solved, understanding deeper contextual factors such as population vulnerability and living conditions still requires interdisciplinary collaboration that goes beyond EO alone.

Building relationships and capacity

Bridging the knowledge gap in cities demands targeted initiatives that enhance their understanding of how to use data effectively, focusing not just on data access but on awareness of data availability, tools, and capacity-building efforts that equip municipalities with tailored insights. However, the connection between industry expertise and the practical needs of cities remains weak, underscoring the importance of fostering partnerships and co-development approaches. This collaborative model, rather than a one-way provider-user dynamic, strengthens the effectiveness of EO applications. Supporting entities like regional and national energy agencies, who play a crucial role in reaching more cities, is essential, as it is impractical to engage each city individually. Many municipalities also lack the capacity to process complex data independently, emphasizing the need for researchers to understand broader urban challenges beyond EO-focused questions.

Economic sustainability and support

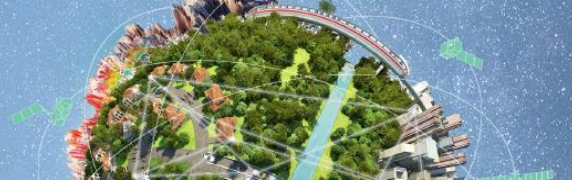
When resources are limited, which is the case e.g. for the many small-medium public administrations around Europe, economic sustainability is essential for the practical adoption of EO solutions. Open-source data and models help overcome financial constraints and enable service providers to develop cost-effective solutions viable for



municipal use.

Currently, there is a lack of comprehensive information on the impacts of climate action funding, which makes it difficult to demonstrate returns on investment and secure additional financial support. EO and high-resolution data, can help generate the insights needed to quantify the costs and benefits of urban interventions, but only when combined with effective partnerships involving economists and health experts.

- **1 keynote session** where **Dennis Pamlin** called for a shift from static use of data and tools for optimisation of existing problems to dynamically using EO to create innovative solutions, while **Martyn Clark** shared insights into GEO's urban resilience projects towards operational services through user co-development approach, and **Mark Nieuwenhuijsen** focused on the links between city types and health, including key point of how increasing 30% of tree cover in European cities could reduce temperatures of 1.3°C and prevent 1/3 premature heat-related deaths.
- **10 technical sessions** ranging through topics of urban heat in relation to soil sealing, air quality and safety management, urban hazards such as flood risk and subsidence, energy efficiency, green spaces monitoring, urban development, dynamics and informal settlements, but also emerging technologies in downscaling, AI, and 3D modelling, along with commercial EO products, were presented focusing on urban environments and related variables.
 - Among these, **4 technical sessions have been co-chaired by users and EO experts**, in order to maximise the interaction among sectors.
- **2 Demo Areas** sessions showcasing data platforms for urban applications.
- **Stakeholders Engagement Facility (SEF) stand** during coffee breaks, with the team showcasing urban applications to attendees, especially users, with products both from ESA funded projects, and from the EARSC community.
- **1 closing session** including the award ceremony of the **Hackaton MapYourCity AI4EO** with the presentation of the three winning projects; the award presented to the no-profit organisation **UniverCities**; summaries and recommendations provided by the chairs of each technical session and an overall workshop summary with the related key outcomes and recommendations presented by the organisers.



Key Recommendations

URBIS24 has highlighted **enthusiasm** from both participants and presenters for the multi-sector nature of the event. However, it also evidenced a **significant lack of similar crosscutting opportunities**, and a **clear need to bridge between demand and supply** in a more structured way, in order to stablish more effective and impactful collaborations between users and technical experts.

Four main outcomes emerged consistently throughout the workshop, potentially leading to specific actions that ESA, together with key partners, can take to address these needs and create new opportunities for collaboration and impact.

OUTCOMES/ RECCOMENDATIONS	POSSIBLE ACTIONS
<p>ADDRESSING GAPS</p> <p>Need to raise city practitioners' awareness and understanding of EO resources and capabilities, ranging from data, products, services and tools, but also key players in the field.</p> <p>Industry faces significant challenges in engaging with cities and urban practitioners, as direct outreach efforts often fail to establish connections and meaningful partnerships.</p>	<ul style="list-style-type: none"> ➤ Facilitate systematic interactions through intermediate bodies and networks, acting as multipliers. ➤ Host demonstration events (e.g. webinars) to showcase EO products and services in detail, potentially focusing on specific topics of interest. ➤ Establish multi-sector connections with a structured approach beyond events using targeted one-to-one matchmaking strategies, potentially focusing on specific topics of interest.
<p>KNOWLEDGE SHARING</p> <p>Need to consolidate information on EO resources into easy-to-navigate solutions, allowing users to efficiently explore available options and understand available capabilities and offerings.</p>	<ul style="list-style-type: none"> ➤ Develop product inventories that highlight cross-sector applications and enable leveraging of complementary solutions ➤ Map existing innovative methodologies and technological solutions with key priorities, also identifying areas for further developments
<p>USER-FRIENDLY</p> <p>Need for ready-to-use data and tools that minimise processing requirements, as municipalities, especially of small-medium size, often lack in-house capacity for data handling.</p>	<ul style="list-style-type: none"> ➤ Align products with decision-making processes and multi-level governance needs via requirements gathering and multiple rounds of refinements ➤ Expand capacity building focus, not limited to municipalities but also among technical city practitioners who can serve as multipliers offering guidance and support across various urban sectors
<p>BUILDING TRUST</p> <p>Trust in EO products is essential for users' adoption and uptake.</p> <p>Technical experts require consistent access to reference data to validate solutions and refine the products developed.</p>	<ul style="list-style-type: none"> ➤ Emphasize transparency by clearly communicating the reliability, limitations and uncertainties of products ➤ Co-develop applications with users, ensuring solutions meet needs and expectations. ➤ Encourage city practitioners to share their local data, which can support the customization and improvement of solutions.



Summary, Highlights & Recommendations from each session

The following have been provided by the chairs of each session.

Session 1 - Urban heat dynamics and soil sealing assessments for resilient planning

Programme

1. **Opening**
Efrén Feliu Torres
2. **Coupling dynamic cities and climate: the urbisphere project**
Nektarios Chrysoulakis, Jörn Birkmann, Andreas Christen, Sue Grimmond
3. **Surface albedo and emissivity for Belgian cities (SuaBe)**
Jonathan León-Tavares, Zhijun Zhen, Nicolas Lauret, Jean Philippe Gastellu-Etchegorry
4. **Large scale exploitation of satellite data for the assessment of urban surface temperatures: the EO4UTEMP project**
Zina Mitraka, Giannis Lantzanakis, Maria Gkolemi, Nektarios Chrysoulakis
5. **From Space to lives saved: A Digital Twin for heat-related mortality risk assessment in urban areas**
Iphigenia Keramitsoglou, Klea Katsouyanni, Evangelia Samoli, Alexandra Tragaki, Eleni Toli, Panagiota Koltsida, Nefta Votsi, Evangelos Gerasopoulos, Christos Zerefos, Stavros Solomos, Christos Spyrou, Sorin Cheval, Chris T. Kiranoudis
6. **Harmonized Pan European time series for monitoring soil sealing**
Christophe Sannier, Gergely Maucha, Eva Ivits³, Joachim Maes, Lewis Dijkstra
7. **The ESA Ulysses project and the exploitation in the Mediterranean area of Soil Sealing products and indicators**
Daniela Iasillo, Vito De Pasquale, Paola Di Lauro, Luca Congedo, Michele Munafo, Loic Faucqueur, Konrad Rolland, Olivier Arino, Walter De Simone

Full Session 1 Programme: [link](#)

Summary

The overall aim should be generating **transferable-scalable workflows and applications** which could allow combining different data sources (EU-local), with different resolution-qualities and complementary information (spatial, socioeconomic, perception, vulnerability, etc.), for complex “**sophisticated**” **informed decision making** (dynamic, scenarios, effectiveness, AI, etc.).

- *In situ* sensors-instrumental (calibration), Lidar, real-time, downscaling, modelling, AI, data-cubes, dockers, DIAS etc.
- Form vs functions, indoor-outdoor, sky-view factor, etc. / Mixed domains & co-benefits.
- EWS & operational decisions vs long-term planning / ex-ante (scenarios) and ex-post effectiveness.

Recommendations

- Need of authoritative data sources, allowing **benchmarking** across Europe, while providing the required local analysis **granularity**.
- Main challenges related to **integration** of earth observation with local/private data and **interoperability** across Copernicus services.
- Necessary **orchestrating offer to end-users** (open and commercial, under diverse business models), with co-production and “Generous” coordination of research and harmonisation of validated approaches, managing offer and transition from basic



research to applied R&I to operational services (development vs operational), mapping and clarifying alternative data/products (city size, fit for purpose, best available technologies), providing capacity building to end-user and practitioners (generalised use vs specialised services).

Session 2 - Urban Air Quality, Mobility and Safety monitoring and management

Programme

- 1. Opening**
Olivier Sanchez
- 2. TRIPS: a solution for advanced urban safety management**
Simonetta Bodojra, Alberto Falletta, Fabio Limardo, Elena Deambrogio
- 3. Evaluating the costs and benefits of satellite imagery resolutions for assessing unpaved road condition**
Robin Workman
- 4. THE 'PRIMARY' PROJECT: URBAN AIR QUALITY MONITORING WITH PRISMA HYPERSPECTRAL DATA**
Davide De Santis, Marco Di Giacomo, Sarathchandrakumar T. Sasidharan, Gianmarco Bencivenni, Fabio Del Frate, Gabriele Curci, Ana Carolina Amarillo, Francesca Barnaba, Luca Di Liberto, Cristiana Bassani, Ferdinando Pasqualini, Alessandro Bracci, Silvia Scifoni, Stefano Casadio, Alessandra Cofano, Massimo Cardaci, Daniele Latini, Giorgio Licciardi
- 5. The CitySatAir Project: Monitoring urban air pollution with satellite data**
Bas Mijling, Philipp Schneider, Paul Hamer, Pau Moreno, Isadora Jimenez
- 6. Spatiotemporal imputation and bias correction of Sentinel-3 SYN for intraurban air quality assessment using Generative Adversarial Networks/Deep Learning**
Ester Pantaleo, Roberto Cilli, Nicola Amoroso, Alessandro Fania, Mariella Aquilino, Marica De Lucia, Sabino Maggi, Silvana Fuina, Cristina Tarantino, Francesco Carbone, Nicola Pirrone, Vincenzo Campanaro, Francesca Intini, Angela Morabito, Alessandra Nocioni, Ilenia Schipa, Annalisa Tanzarella, Maria Adamo, Alfonso Monaco, Roberto Bellotti
- 7. Earth observation for mental health: exploring the correlation of urbanization, green and blue spaces with UK Biobank cohort data**
Sören Hese, Paul Renner, Elli Polemiti, Kerstin Schepanski, environMENTAL Project Consortium

Full Session 2 Programme: [link](#)

Summary

In total 6 papers were presented covering three main topics: 2 Urban safety management, 3 Air quality and 1 Mental health related to air quality.

Application of satellite data included: maintenance of road network, use of HR satellite data for air quality monitoring with an objective to provide information on aerosol composition, monitoring urban NO₂ with TROPOMI data (Open source code), APEMAIA (Assessment of PM Exposure at the intra-urban scale in preparation for the MAIA mission) and correlation of urbanization, green and blue spaces with UK Biobank cohort data

Highlights

- There is an increase in data quality or validation process / uncertainties / integrated columns versus ground level concentrations
- Interoperability of data is improving but research and projects is still needed to improve and automate it
- The cost of the data for access and processing is an ongoing challenge
- The granularity of data for city level information derived from satellite data is been tackled currently using simulations.



- Temporal resolution (satellites dealing with pollutant concentrations from one or two satellite passes per day)
- There is a gap between research / EO to operational institutes dealing with information. Way it close this using skill transfer / expertise needs to be addressed in the projects (or other initiatives)

Recommendations

- Capacity building and skills development is important and necessary for data/information users and decision makers
- Data access from different sources and high resolution is still a challenge (ease of access & cost)
- Innovative dynamic data analysis/processing needs to evolve rather than static methods as the data resolution and quality are improving
- Co-creation of solutions and mixing domain expertises (satellite, modellers, and platform providers) is key for successful and collaborative outcome

Session 3 - Urban energy landscapes and efficiency mapping

Programme

1. **Opening**
Matthieu Denoux
2. **Pioneering Urban Energy Efficiency - the ESA BEE.AI project**
Alessandra Feliciotti, Mattia Marconcini, Francesco Asaro, Gianluca Murdaca, Emanuele Strano, Stefanie Lumnitz
3. **SOLAR-DE - Mapping Germany's Rooftop Solar Landscape**
Annekatri Metz-Marconcini, Mattia Marconcini, Julian Zeidler, Stefan Dech
4. **How space-based solutions can support urban energy decarbonisation**
Matteo Manieri
5. **Zoom in – benefits of a multiscale approach for solar potential analysis**
Elke Kraetzschmar, Kristin Fleischer, Peter Schauer
6. **Space for energy efficiency in smart cities**
Beatrice Barresi
7. **Mapping the Energy Transition: EO4Energy's Global Survey of Wind Turbines and Coal Power Plants**
Annekatri Metz-Marconcini, Mattia Marconcini, Cornelia Zygar, Zoltan Bartalis

Full Session 3 Programme: [link](#)

Summary

- New products and services were presented, including solutions for:
 - assessing energy efficiency and renovation needs of building stock using street-view, satellite and in-situ data,
 - PV analysis, and Solar potential analysis
 - Evaluating renewable energy potential in rural areas to meet urban energy demand.
- Urban EO solutions depend on the scale of the projects. Different scales require unique urban EO solutions, cost considerations, and partnerships – ranging from international collaborations to hyper-local initiatives.

Highlights

- Satellite data plays a key role in regional-level urban emission monitoring for decarbonization



- EO data has scaling potential in urban areas, both geographically and in terms of timely responses.
- Urban energy management is supported both by applications and analysis inside large cities as well as outside in rural areas by, i.e. identifying and managing renewable energy sources.

Recommendations

- Information services can be used as evidence to support evidence-based decision-making when communicating with citizens.
- The computational load for creating solar energy potential maps is a challenge. There is a need to transition workflows towards high-performance and optimized processes.
- There is a mismatch between the expectation of receiving information quickly and the willingness to pay for the processing of that information.
- The urban energy transition is not only happening in cities but is also part of a broader energy transition.
- Sustainability, cost-effectiveness, and guaranteed operation of data products are crucial for cities. Cities must be involved early in the process to secure investments, or intermediary actors (national institutes, regional or local agencies) should be engaged.

Session 4 - Urban green infrastructure: from vegetation characterisation to strategic resilience planning

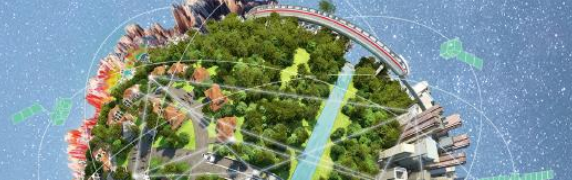
Programme

1. **Opening**
Markus Annilo
2. **Urban Vegetation characterization from Multispectral and Very High-Resolution Satellite Imagery**
Fatimatou Coulibaly, Pierre Sicard
3. **Navigating Urban Landscapes: Unveiling Green and Blue Infrastructure through Strategic Mapping**
Raquel Ubach, Jaume Fons-Esteve, Eva Ivits-Wasser, Mirko Gregor, Joachim Maes, Lewis Dijkstra
4. **Thermal behavior of large-scale urban parks in global megacities during compound heat and drought events**
Ilias Agathangelidis, Constantinos Cartalis, Kostas Philippopoulos
5. **Enhancing urban green spaces through Earth Observation: Integration of super-resolution in sustainable urban planning**
Mihaela Gheorghe, Teodora Selea, George Boldeanu
6. **Unveiling living urban co-habitats: looking at cities through a species agnostic classification**
Gabriele Oneto, Anne Mimet, Katia Perini, Maria Canepa, Wolfgang Weisser
7. **Species-specific air pollution removal by individual trees and shrubs at city scale**
Pierre SICARD, Fatimatou COULIBALY, Ilaria ZAPPITELLI

Full Session 4 Programme: [link](#)

Summary

The session explored the role of green infrastructure in urban environments, covering several key topics: techniques for detecting and classifying urban trees, analysis of how parks mitigate urban heat stress and drought by providing cooling effect, advanced data processing, such as super-resolution methods, for detailed assessments of green spaces, including vegetation health, development of multidisciplinary mapping tools bridging various fields within urban studies, evaluation of plant species most effective in removing air pollutants.



Highlights

- To detect and classify trees, high-resolution data is needed.
- Local data such as municipality inventory are essential for training and validation of models
- During daytime parks under different climates have a cooling effect of 1.5 degree on average, which is higher where the tree canopy is denser, and the cooling effect of parks grows logarithmically with the park's sizes
- Air pollution removal can be analysed at individual tree level, highlighting the species being the most effective for each pollutant

Recommendations

Mapping and identifying green areas is only the starting point: health of vegetation, accessibility to green areas, noise levels and other analytics are needed as additional information that can support decision making.

Scalability of methods is essential to step from the project-wise research perspective towards more operational solutions which make the best impact of EO data.

Numerous small to medium size parks can potentially have a higher impact in cooling the urban surrounding than a single big park.

Session 5 - Assessing and Mitigating Urban Hazards: Subsidence, Water Risks, and Flooding

Programme

1. **How can 13 billion measurements of the ground motion help manage natural hazards in urban areas?**
Lorenzo Solari
2. **Present-day and future urban subsidence risk in Italy based on multi-scale satellite InSAR workflows and advanced modelling**
Francesca Cigna, Roberta Boni, Pietro Teatini, Roberta Paranunzio, Claudia Zoccarato
3. **Visualizing the impact of water availability and extreme events - enhancing water risk mapping through future climate change and urbanization scenarios.**
Frederic Andreas Hebbeker, Chahinaz Ziani
4. **Modelling multi-geohazard risk at city scale through satellite InSAR and official open data**
Giandomenico Mastrantoni, Claudia Masciulli, Roberta Marini, Carlo Esposito, Gabriele Scarascia Mugnozza, Paolo Mazzanti
5. **Fast and generalized flood emulators for high-resolution urban pluvial flooding**
Dinesh Krishna Natarajan^{1,2}, Marco Stricker¹, Marlon Nuske¹, Andreas Dengel^{1,2}
6. **Subsidence risk assessment for enhancing urban infrastructure sustainability: A case study in Ravenna, Italy**
Hanieh Dadkhah, Divyeshkumar Rana, Giandomenico Mastrantoni, Ebrahim Ghaderpour, Paolo Mazzanti

Full Session 5 Programme: [link](#)

Summary

The session addressed the identification and mitigation of natural and manmade hazards in urban areas. Four of the six presentations focused on geo-hazards, more particularly ground motion caused, for example, by subsidence or sinkholes with three examples from Italy and a presentation of an operational Copernicus Service with European coverage. The flood related application analysed current and future flooding scenarios in three secondary cities in Asia and presented a machine learning based flash-flood model.



Highlights

- The Copernicus European Ground Motion Service (EGMS) provides comprehensive insights into ongoing ground deformation processes. The EGMS is a deferred-time, multi-purpose mapping, monitoring tool for active ground motion in urban areas for expert users
- A multi-scale methodology to assess present-day and future land subsidence risk in urban areas of Italy, from the national to the local scale, with a focus on direct impacts on metropolitan landscapes (development of ground depressions, earth fissures, structural damage, increased flood risk).
- A water risk mapping methodology that visualizes climate change impacts and evaluates blue-green adaptation measures for South-East Asian secondary cities in Laos, Cambodian and Indonesia
- A multi-risk model tailored for urban assets, integrating multi-frequency multi-temporal satellite InSAR data, multi-hazard mapping, and the physical attributes of the built environment.
- A deep learning-based flood emulator for fast, real-time estimation of rainfall-induced flood depths in urban areas that speeds up calculations compared to conventional methods of flood inundation modelling.
- A methodology to assess urban sustainability and resilience, with a specific focus on subsidence risk. Integrating subsidence risk and weighted socio-economic factors, this approach ranks municipalities and local administrative units based on their sustainability. It empowers informed decision-making, promoting the sustainability and resilience of the city's infrastructure.

Recommendations

- The various studies related to ground motion/subsidence and the availability of an operational Copernicus Service highlight the potential to decision makers at local and regional level. However, efforts are needed to translate the expert assessments into policy relevant information.
- Future sessions should focus also on other natural and man-made hazards in urban contexts

Session 6 - Global Urban development and dynamics

Programme

1. **Monitoring Urbanization's Pulse – the WSF tracker**
[Mattia Marconcini](#), Annkatrin Metz-Marconcini, Noel Gorelick
2. **The global human settlement layer as a complete framework for research and policy on urban development**
Michele Melchiorri, [Thomas Kemper](#), Martino Pesaresi
3. **Accurately mapping urban dynamics at global and continental scale based on high-resolution Sentinel-2 and Sentinel-1 imagery**
[Michael Riffler](#), Armin Leitner, Stefan Ralser, Loic Fauqueur, Alexandre Pennec, Maximilian Jakasovic, Yang Li, Mattia Marconcini, Thomas Esch, Eva Sukenikova, Usue Donezar, Manuel Mayr, Michele Melchiorri, Thomas Kemper, Christian Schleicher
4. **From Space to Place: Earth Observation for Global Urban Sustainability Made Easy**
[Tomas Soukup](#), Pavel Vlach, Vojtech Dubrovsky, Thomas Esch, Mattia Marconcini
5. **Nighttime Warming Trends in Cities Across Two Decades**
[Panagiotis Sismanidis](#), Benjamin Bechtel, Marzie Naserikia, Negin Nazarian, Melissa Hart, Iphigenia Keramitsoglou, Darren Ghent



6. Where does night light matter?

Monika Kuffer, Angela Abascal, Alejandro S. De Miguel, Christopher Kyba, Hector Linares, Franz Hölker, Tobias Degen

Full Session 6 Programme: [link](#)

Summary

- Global datasets are important to understand the global urbanisation processes (change patterns) and support countries and cities developing sustainable urban development strategies (especially in the Global South).
- Global data on urbanisation trends are already available (much more to come): availability of excellent and quality-controlled datasets (GHSL, WSF, new Copernicus Services on human settlements, and derived products).
- Spectral, temporal and spatial features (morphological features) of freely available data (Sentinel 1 and Sentinel 2) allow to monitor urban growth globally.
- Importance of dense time series of satellite observations for urban growth monitoring was emphasised.
- Many challenges to be addressed to go global (different environmental conditions, different urban fabrics, computing extensive) -> use of modern ML techniques including DL (U-Net).
- Methodology needs to be cost-effective and transferable (cloud providers agnostic)
- Use of nighttime data is also important (LST, ALAN)
- Multiple urban applications: DRR (exposure element), SDG and NUA indicators (SDG 11.3.1), city warming trends.
- Importance of night lights: economic growth, conflict, shielded street lights, seasonality (due to tourism), slums / informal settlements, energy transition.
- Make the datasets accessible in a seamless way to urban practitioners (Data visualisation and Analytics).
- Benefits for end-users : focus on the problems to be solved and not on technical obstacles
- Important also for the research community (to add value to these datasets)

Recommendations

- More collaboration between the dataset developers.
- Be clear on the strengths and limitations of the datasets and their use.
- Data is large and complex to use: important to have Analysis Ready Data (removing the burden of the data processing) and integrate this data in Data Analytics tools to simplify the access and use to the data.
- Important to collaborate with organisations that can act as multipliers (UN Habitat, World Bank, etc.)
- Access to reference data is key (e.g., Building footprint data extracted from OSM, Microsoft, Google)
- improved spectral and spatial resolution of night light observations.



Session 7 - Mapping and modelling urban growth: from informal settlements to SDG indicators monitoring

Programme

- Improved mapping and modelling of urban development for impact assessment**
[Jasper van Vliet](#)
- Machine learning urban segmentation using Sentinel-2 and its super resolved version**
[Maximilien Houël](#)
- Earth Observation Time Series for SDG11.3.1 Indicator Monitoring: Opportunities and Challenges**
[Yifang Ban](#), Dennis Mwaniki, Robert Ndugwa
- Complementary use of citizen science and EO data for addressing SDG data gaps**
[Dilek Fraisl](#), Linda See, Ian McCallum, Steffen Fritz
- User and data-centric artificial intelligence for mapping informal areas (IDEATLAS)**
Bedru Tareke, Paulo Silva Filho, Monika Kuffer, [Claudio Persello](#), Raian V. Mareto, Jon Wang, Angela Abascal, Priam Pillai, Binti Singh, Juan Manuel D'Attoli, Caroline Kabaria, Juilo Pedrassoli, Patricia Brito, Peter Elias, Elio Villaseñor Garcia, Andrea Ramírez Santiago
- Leveraging AI technologies for informal settlement mapping**
Sophie Naue, Michael Hathorn, [Anand Gajaria](#)

Full Session 7 Programme: [link](#)

Summary

The session highlighted many advanced approaches to urban growth monitoring, from historical trends analysis and future change modelling to slums and informal settlements mapping techniques and the value of citizen science in deepening our understanding of urbanization and making informed decisions.

Highlights

The key highlight from the session was that while technologies to analyse urbanization are advancing at a fast rate, and while interesting products are being developed at the scientific level, there still exists a big gap in how the results are being brought down to the cities/users who would benefit from them. Notable was a deep interest by all presenters to make products and resources available and accessible to all, despite some limitations such as requirements in models for very high-resolution imagery (often commercial), high processing power needed to achieve full transfer of technologies, and often complex urban setups that make replication of models difficult to achieve (such as slum mapping models transferability). With the increasing technological advancements, some of these challenges are likely to become less evident, such as the increasing relevance of super resolution imagery and technological opportunities presented by Google Earth Engine. Equally, the power of citizen science should not be undermined while developing the many products, but volunteered data and other similar processes should rather be leveraged to enhance the value of ongoing efforts.

Recommendations

Despite these limitations, the ongoing work by different organisations (panellists) is very impactful and should be further disseminated through all available channels. A possible way move towards this direction could include deliberate efforts to convert the amazing data results into simplified information, whose dissemination may have more relevance at the "user" levels.



Session 8 - Commercial EO data and services for urban contexts

Programme

1. **ESA Earthnet Third Party Missions Programme - commercial data for science and R&D**
Peggy Fischer
2. **Innovative Solutions for Urban Heat Challenges: Insights from SatVu's HotSat-1 Thermal Data**
Natalia Kuniewicz
3. **constellr HiVE thermal infrared satellite constellation - High Resolution Land Surface Temperature for urban and infrastructure monitoring**
Tobias Leismann, Daniel Spengler
4. **The urban applications of 3D modelling & simulations based on high resolution satellite data**
Claire d'Oiron
5. **The COSMO-SkyMed system: unique capabilities for managing urban needs**
Axel Oddone, Simone Sampieri, Andrea Bucarelli
6. **Japetus constellation & Earth Observation Platform: How Prométhée Earth Intelligence is offering a new decision support capacity to protect cities against Natural Disasters**
Philippe Mateu, Bastien Cerri, Adrien Pordoy, Youssef Houali, Mehdi Irzan, Carole Belot, Olivier Maes, Pierre Pommies

Full Session 8 Programme: [link](#)

Summary

- ESA presentation (TPM and CCM) and 4 presentations from data provider industry (SatVu, ConstellR, e-Geos and Prométhée Earth Intelligence)
- Commercial companies provide both primary data and “simple ways of integrating products into decision making” (value added services)
- Commercial data highly relevant for Urban monitoring applications: Thermal Infrared (VHR Thermal and LST, a new emerging dataset with high potential for use in urban context), SAR (interferometric applications, change detection analysis), optical (high revisit and reactivity for mapping)
- Complementarity of established companies (with VHR data and large archive sitting on a wealth of information) and emerging suppliers (with innovative capabilities and new products)

Highlights

- Commercial companies are shaping the future of high-resolution data (spatial, temporal, spectral) with innovative approaches (e.g. AI on board processing, LST finer processing, innovative monitoring of buildings)
- Offer meets demand ◊ Additional opportunities for the companies to engage with customers in Europe emerged during the session and ESA team is very happy to see immediate impacts of the event
- Not enough large cities take advantage of the existing / working technology
- Many relevant questions from the audience showing engagement and interest

Recommendations

- Check TPM data – registration is easy and data free of charge
- Increase communication to non-specialised sectors (it is still not enough)
- Keep efforts to “dumb down” the complex EO data transformation for non-experts



Session 9 - Innovative downscaling and AI techniques

Programme

1. **Evaluating the performance of the urbisphere Urban Hyperspectral Library in multi-sensor satellite imagery classification**
Giannis Lantzanakis, Nektarios Chrysoulakis, Andreas Christen, Sue Grimmond, Joern Birkmann
2. **IRIX4US: Chaining AI models for a comprehensive change detection of building footprints from super-resolved Sentinel-2 images**
Ricardo Martínez Prentice, Alejandro Redondo García, Aaron Nebreda Trejo, Javier Becerra, Aurelio García Rochera
3. **Super-Resolution of Sentinel-2 and PlanetScope EO images: a comparative study**
Roberto Cilli, Ester Pantaleo, Nicola Amoroso, Gaetano Alessandro Vivaldi, Vincenzo Giannico, Giovanni Sanesi, Alfonso Monaco, Roberto Bellotti
4. **Human-in-the-loop: empowering urban environmental monitoring with flexible cloud-based satellite mapping workflows**
Nicklas Simonsen, Mads Christensen

Full Session 9 Programme: [link](#)

Summary

The session involved presentations of several works, where super-resolution or downscaling of satellite imagery plays a key role in understanding and processing of urban scenes, for applications such as material building material segmentation, building footprint change detection, tree inventory, roof segmentation, and urban dataset curation.

Highlights

- *Urbisphere* – a library of hyperspectral material measurements
- Change detection of building footprints from super-resolved Sentinel-2
- Single Image Super-Resolution of Sentinel-2 – limitations due to the cost of HR data acquisition
- Cloud-based satellite mapping workflows – a platform for building urban datasets with human-in-the-loop and a variety of sources

Recommendations

- Hyperspectral real measurements applied at scale can lead to powerful applications for urban material mapping
- Shadows for hyperspectral signatures challenging
- Generative artefacts need to be accounted for when employing SR methods – and cost of omission vs commission is an important aspect that depends on the exact use case
- Realistic estimation of the downsampling kernel and the influence of spectral characteristics over SR task are an important area of future study
- Human in the loop can be a powerful scheme for improving the quality and volume of urban datasets

Session 10 - Advancements in 3D Urban Modeling

Programme

1. **Deep Learning architecture for 2D/3D joint Change Detection in Urban Areas**
Babak Memar, Paolo Gamba, Luigi Russo, Silvia Liberata Ullo
2. **A global analysis of 3D settlement morphology and its relationship to economic and planning conditions**
Thomas Esch, Klaus Deininger, Remi Jedwab, Mattia Marconcini, Hogeun Park, Julian Zeidler



3. **Unveiling 3d insights of buildings from multi-modal sentinel-1/2 time series**
Ritu Yadav, Andrea Nascetti, Yifang Ban
4. **A Deep Learning system for automatic extraction of 3D building heights on large scale using very high-resolution COSMO-SkyMed data**
Luigi Russo, Paolo Gamba, Silvia Liberata Ullo
5. **Generating semantized 3D meshes with CARS, a scalable open-source Multiview Stereo framework.**
Yoann Steux, David Youssefi, Marian Rassat, Thomas Billaud, Loïc Dumas, Mathis Roux
6. **3D surface temperature modeling evaluation with in-situ thermal remote sensing: A study in Berlin**
Maria Gkolemi, Zina Mitraka, Nektarios Chrysoulakis, Will Morrison, Andreas Christen, Sue Grimmond, Jörn Birkmann

Full Session 10 Programme: [link](#)

Highlights

- 2D and 3D changes can be correctly detected with adequate DL architecture and VHR CSK and TSX dataset
- World Settlement Footprint 3D (WSF® 3D): First Worldwide 3D mapping of entire built environment
- understanding of the global megatrend of urbanization and help spatial development policies (extend spatial and/or vertical)
- Existing large-scale solutions provide height at coarse spatial resolution (500 m - 90 m), a better resolution can provide more comprehensive understanding of urban development -> exploit S-1 asc/desc acquisitions and S-2 shadow over seasons
- Open-source framework for multi view stereo using VHR imagery, versatile, with the concept of semantized meshes
- Combination of EO with in-situ infrared observations and modelling to achieve complete 3D surface temperature.

Recommendations

- 3D built up dataset like WSF depends on DEM so maybe AI-based can be helpful to have height information more frequently (derived by other products)
- Some good perspectives with VHR imagery but generalization of techniques at national/regional scale with sometimes costly SAR/VHR imagery, might need some improvements with low resolution imagery such as S-1 or S-2...

Demo Area - Data Platforms for Urban Applications - part 1

Programme

1. **The Earth Observations Toolkit for Sustainable Cities and Human Settlements**
[Dennis Mwaniki](#), Monika Kuffer
2. **RethinkAction platform: an example of co-creation of solutions leveraging digital technology for sustainable development**
[Pourya Salehi](#)
3. **Navigating the GHSL data, tools and knowledge space**
[Thomas Kemper](#)
4. **Urban TEP - Urban Information Hub for Sustainable Urban Development Support**
[Tomáš Soukup](#), Thomas Esch

Full Demo Session –part 1 Programme: [link](#)

Summary

The presenters demonstrated tools and platforms that highlight the effectiveness of EO data in addressing urban challenges, e.g. through human settlement monitoring and measuring



various (SDG 11) indicators. These solutions contribute to long-term sustainability by enabling risk assessments, informing land use adaptation and mitigation strategies, and supporting policymaking. The platforms and tools foster collaboration between local communities and decision-makers across Europe and highlight the need for multi-scale evaluation framework and dynamic models to meet diverse user needs and capture the complex socio-environmental processes on various scales.

Highlights

- Designed to bridge the gap in EO data use, the EO Toolkit equips cities and local governments with the tools needed to support SDG 11, enhancing sustainable urban development and resilience.
- The RethinkAction project empowers citizens and decision-makers to integrate climate action into land use planning, providing cross-sectoral solutions and fostering resilience across Europe in alignment with the EU Green Deal and Paris Agreement goals.
- The GHSL project, through its advanced data processing and global collaborations, provides comprehensive spatial data and analytics on human settlements, supporting global efforts in urban policy, disaster management, and sustainable development with open access tools and resources.
- Urban TEP leverages high-resolution satellite data, big data analytics, and expert knowledge to offer a range of services and datasets that promote sustainable urban development, policy planning, and community collaboration.

Demo Area - Data Platforms for Urban Applications - part 2

Programme

1. **Expanded Climate and Innovation Agenda**
[Pourya Salehi](#)
2. **Space for Smart and Green Cities Task Force**
[Kavitha Muthu](#), [Beatrice Barresi](#)
3. **CLMS for urban areas: focus on Urban Atlas**
[Lorenzo Solari](#), [Alice Lhernould](#)
4. **ESA Green Transition Information Factories (GTIF)**
[Patrick Griffith](#)

Full Demo Session –part 2 Programme: [link](#)

Summary

Presenting and showcasing initiatives and platforms in support of urban applications

Expanded Innovation Agenda for cities - Pourya (ICLEI):

- *integrated and dynamic approach to address global challenges, the evolving issues, priorities and needs at the centre and the need for evolving solutions*
- *Redesigning the vision and creating an ecosystem of innovation, reflecting on what is needed to change the narrative in a broader sense*

Space for smart and green cities Task Force: Kavitha and Beatrice (ESA)

- *Overview of the activities conducted since the launch of the Task force, showcasing use cases in support of cities using space assets*
- *Focus on priority topics: urban development, sustainable mobility, Energy, Well-being and inclusiveness => calls for proposals open, strong focus on the co-design and co-creation process*



Urban Atlas suite of products: Lorenzo and Alice (CLS):

- *Overview of the urban atlas product suit giving users access to detailed land cover/land use maps*
- *Demo (e.g for the city of Rome), political framework, technical evolutions and upcoming products*

ESA Green Transition Information Factories: Patrick (ESA)

- *Overview of the ESA GTIF initiatives (from the GTIF-AT demonstrator and consolidation to GTIF kick-starters, to upcoming Pathfinders on Adaptation)*
- *Showcasing some selected GTIF capabilities in the context of the sustainable cities and renewable energy domains as part of a live demonstration.*

ESA Task Force for Smart and Green Cities

- For cities: Get in touch with ESA Task Force for Smart and Green Cities to discuss your needs and priorities and to pilot operational solutions
- for companies: if you want to have information on the upcoming calls on smart cities

Recommendations

Discussed challenges, recommendations and call for collaboration/action:

The importance to report on use and impact

- The need to report on impact and use, e.g no clear insights on how many cities are actively using urban Atlas products => entities can provide feedback on their use of the product in a dedicated use-cases section on the website.

Need for scaling approaches

- GTIF: how to roll out different decision support systems for different stakeholders, working on an ecosystem of reusable services and leveraging digital innovation to streamline their reuse + involving companies and supporting them to generate revenue as service providers, invitation to coordinate with other initiatives (e.g EARSC best practices) and to showcase existing solutions with potential for scale in GTIF + invitation to get in touch if you are a city stakeholder with a specific need or EO-integrated solution provider for the Pathfinders activity