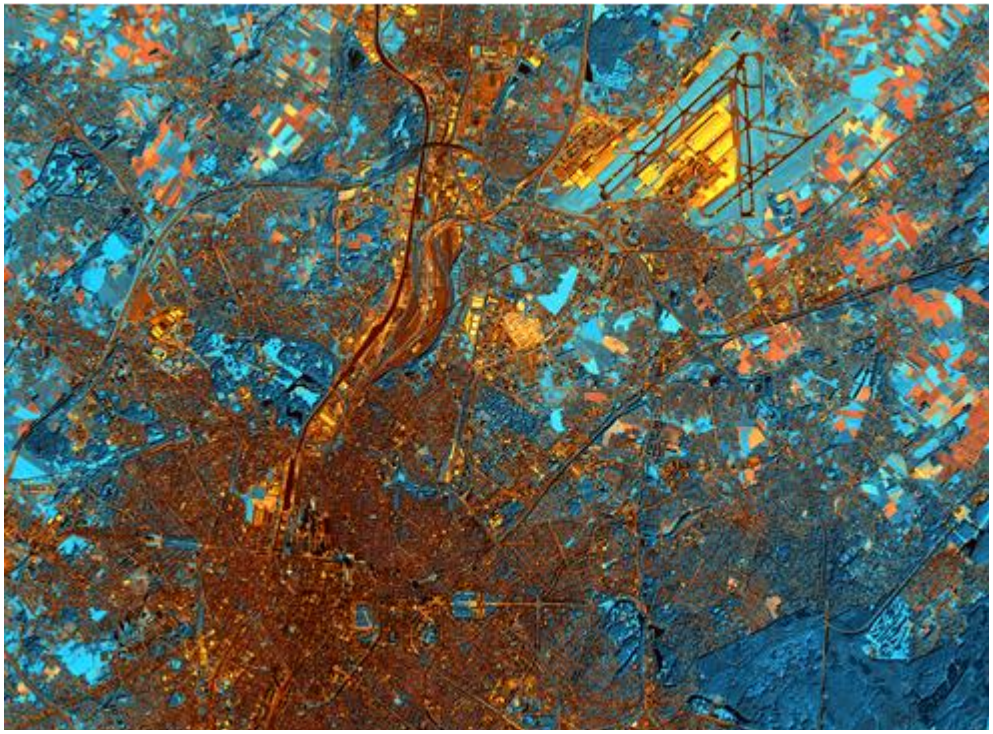


April 2023

COPERNICUS FOR URBAN RESILIENCE IN EUROPE

IN THIS ISSUE

Editorial

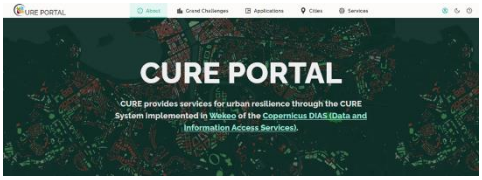
by Nektarios Chrysoulakis

CURE (Copernicus for Urban Resilience in Europe) is one of the three projects that were funded from the Horizon 2020 Space call on Copernicus evolution (LC-SPACE-04-EO-2019-2020). It is a joint effort of 10 partners that synergistically exploit Copernicus Core Services to develop an umbrella application for urban resilience (CURE System) based on DIAS (Data and Information Access Services). This System consists of 11 Cross-cutting Applications, evaluated at several European cities, for climate change adaptation/mitigation, energy and economy, as well as healthy cities and social environments.

The CURE project attempts to innovatively deploy information from Copernicus Core Services concerning atmosphere, land, climate change and emergency; in order to address the multidimensionality of urban resilience. In parallel, it exploits spatially disaggregated environmental Earth Observation (EO) data and products, which are not directly available from the Copernicus Core Services, such as data from contemporary satellite missions and in-situ observations. All the above are combined with third-party EO modelling towards coping with the required local scale.

The main project's milestone during the last 10 months was the organization of the CURE 2nd Demonstration Workshops. These Workshops comprised two meetings, which were held in October involving in-person and remote attendees. Each meeting concerned different CURE target groups, but both meetings aimed at showcasing the CURE Portal and its Applications as well as their potential to inform and support urban resilience stakeholders. Moreover, the CURE Applications and their integration into the CURE System/Portal were finalized, as well as activities related to management, communication, dissemination and exploitation were concluded or scheduled for the forthcoming period.

The 6th issue of the CURE Newsletter introduces the CURE Portal and its components/capabilities as an online tool supporting urban resilience stakeholders; the objectives, content and outputs of the 2nd CURE Demonstration Workshop; as well as the future perspectives presenting the CURE potential beyond the end of the project. Also, the main CURE project news during this period are described in this issue (Page 8).



CURE Portal

The CURE Portal has been developed via an interactive web presentation, including descriptions, data visualization and analytics features.

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CURE Demonstration Workshops

The CURE Demonstration Workshops aimed to demonstrate the CURE Portal/Applications and their specific added value towards urban resilience.

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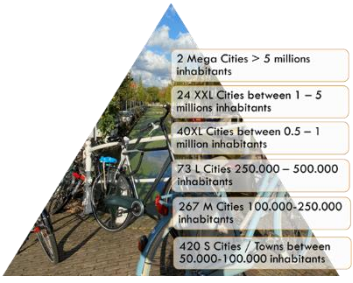

CURE Future Perspective

CURE has developed Copernicus-based services that can be used by all European cities and towns for facing climate and other resilience challenges.

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CURE Portal

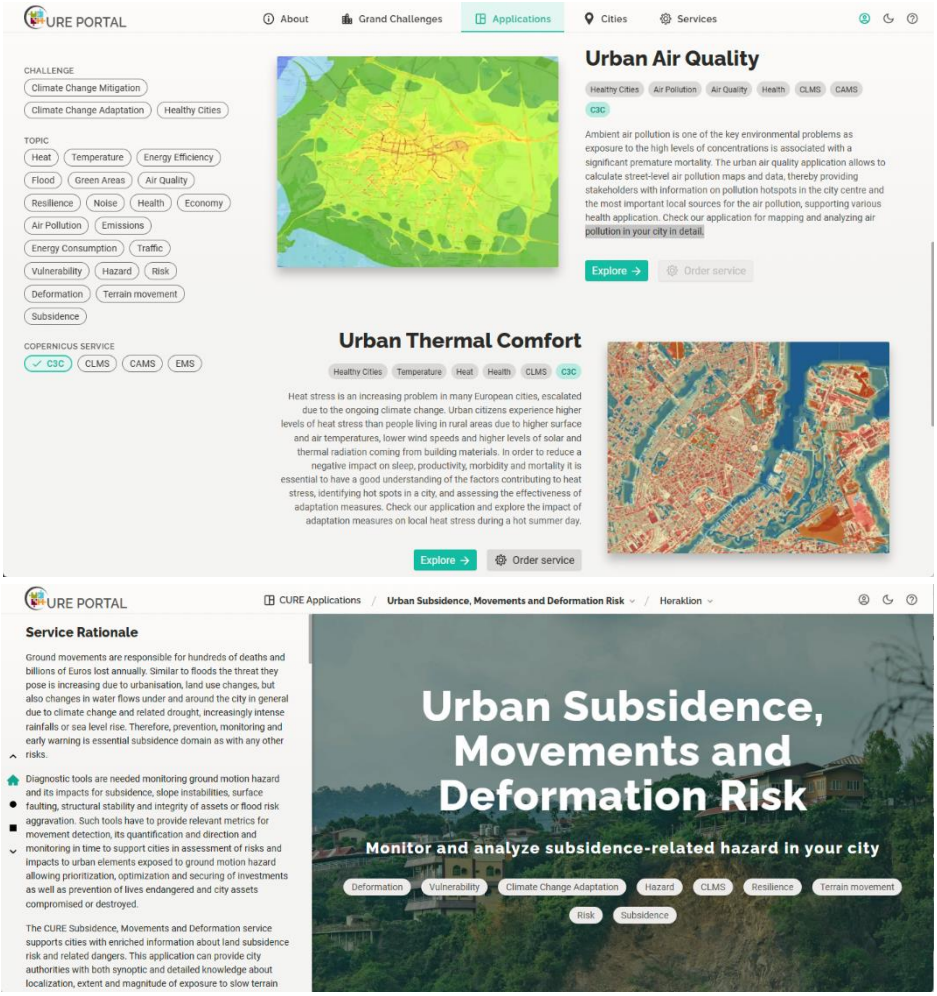
by Tomas Soukup and Katerina Jupova

One of the most important outputs of the CURE project is the CURE Portal, developed via an interactive web presentation, including descriptions, data visualization and analytics features. This web Portal has been designed and implemented to demonstrate (i) the potential and (ii) the pre-operational capacity of the CURE Applications and their services. Also, the CURE Portal is implemented in responsive design to detect the visitor's screen size and orientation and change the layout accordingly, so the same or similar user experience is achieved through multiple users' platforms (additional optimization can be done if needed). The overall concept and implementation framework is flexible enough and expendable, so the Portal content and functionalities might be further enhanced or evolved either during the project duration or beyond based on further CURE evolution and integration into Copernicus information streams.

CURE potential

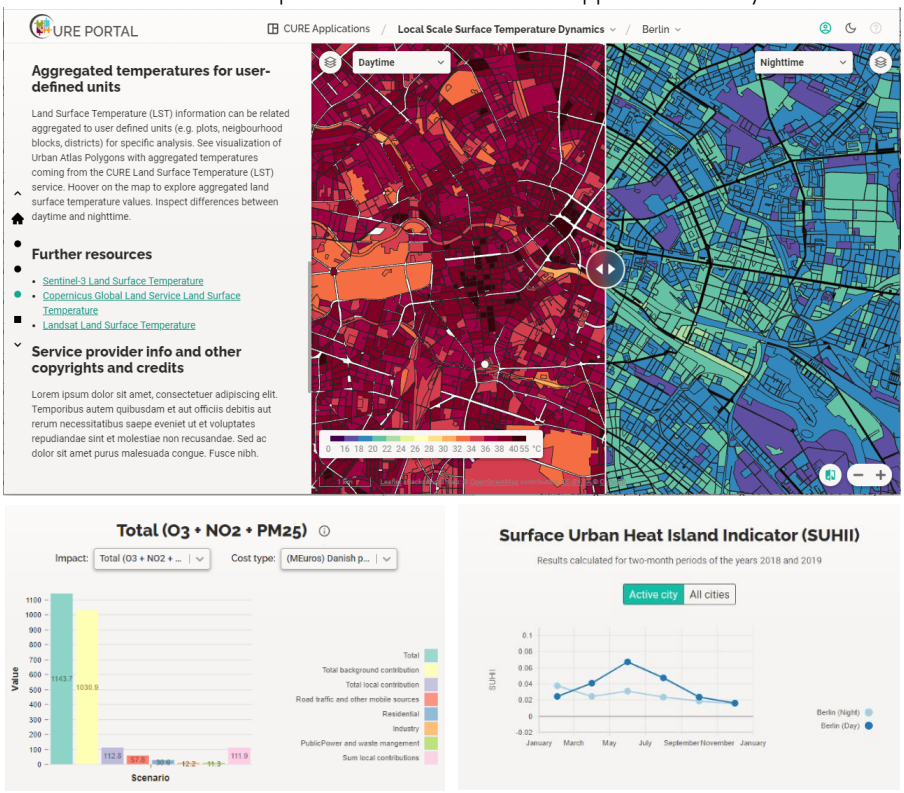
The CURE Portal demonstrates the potential and associated added value of all CURE Applications based on examples of mapping results and analytics developed for the cities involved in the CURE project. The aim of this demonstration of the CURE Portal is to support potential users and stakeholders in (i) understanding the CURE Applications rationale describing use cases, (ii) exploring information product examples generated by CURE their services, and (iii) realizing their added value deploying Copernicus resources for their needs. As part of CURE Applications potential demonstration, the CURE integration feature is also addressed and highlighted for users; including integration of several Copernicus Core Services inputs (cross-cutting services), Copernicus data with city data (global/local scales) and individual Application service results or chaining (integrated assessment). This aspect of the CURE Portal is designed and implemented by means of interlinked interactive storylines for each Application. In the CURE Applications overview page, each Application is shortly introduced providing the main entry point to its individual storyline. In addition, users can filter individual Applications using several pre-defined filters focused on challenges response (in line with city grand challenges described in the relevant tab), topics and Copernicus Core Services used for Applications implementation. Filters or filter groups are extendable and can be amended according to users' requirements.

Entering the individual storylines, a web presentation for each CURE Application is divided into two main parts. The left part includes all text explanation describing various aspects of each Application and service, plus the navigation through the storyline. The content of the textual part is standardized including the following sections: Service Rationale, Added Value Discussion, Further Resources, Service Provider Info and Other Copyrights and Credits. The right part includes all interactive elements (maps and analytics) illustrating and exemplifying described Application and service features in selected visualisation(s) based on real and live data. Users can interact with data and develop their own views and insights. Functionality of interactive part is mostly harmonised among the CURE Applications, but some specific Application needs resulted in adapted storylines. In addition, the upper part allows users to quickly switch between cities (if data and products for additional cities are available) or switch between different Applications without needing to go back to the CURE Applications overview page.

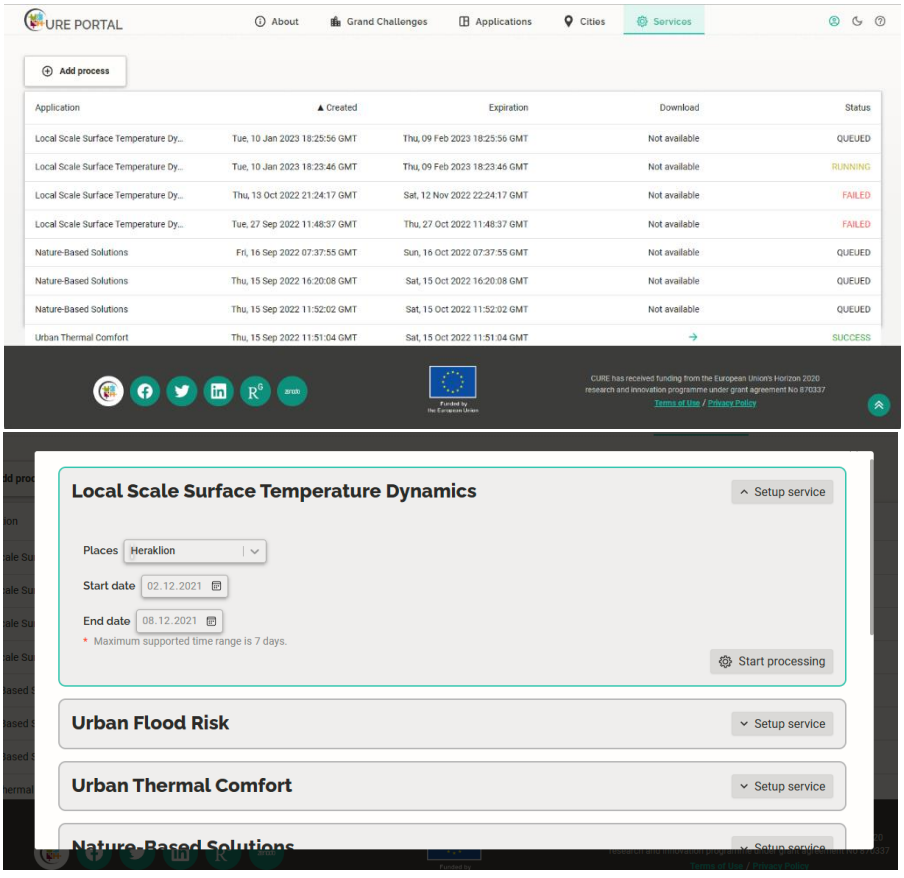


CURE Applications overview (upper image) and home (lower image) pages.

For each storyline, specific CURE Application service showcases have been defined focusing on the most interesting features of the demonstrated service from the users' point of view. These showcases are accompanied with interactive elements to exemplify these features. At least one (mostly multiple) showcase is currently demonstrated for each Application. Storyline structure is extendable and additional showcases can be included. For example, Application showcase at the top of the page informs, how CURE Local Scale Surface Temperature Dynamics Application might support users' decision-making at certain spatial scale (e.g. district, neighbourhood, block). Detailed pixel-based results from Land Surface Temperature (LST) service can be aggregated for such specific analysis. Here, interactive visualisation presents CURE LST results at the Copernicus Urban Atlas block level. A user can use slider and hoover on the map to explore aggregated LST values per block, inspect differences between daytime and nighttime temperatures and correlate service outputs with actual land uses. Interactive elements are not restricted to mapping ones. Various analytics in form of graphs or tables are included, tailored for the storyline needs of each CURE Application.



Descriptive and interactive parts (upper image) and non-map features (lower images).



Web-based production dashboard (upper image) and new processing task selection and specification (lower image).

CURE pre-operational capacity

The pre-operational capacity aspect highlights all the effort done for the overall automation of the CURE Applications and their services. These activities included (i) generic access to Copernicus resources via the Copernicus Core Services Interface (CCSI), (ii) streamlining and dockerization of the individual Applications and services, as well as (iii) set-up of the dedicated cloud processing infrastructure and incorporating individual Applications and services into the CURE System. In the CURE Portal, this aspect is demonstrated through supporting user interaction with a production system and new service task activation ability. A simple web-based production dashboard / task scheduler has been implemented for such communication with the production system via standard Application Programming Interfaces (APIs), as developed on the processing platform (CURE System) based on a Microservice architecture. Status of new tasks can be monitored, harvesting actual status of each processing task, again via the CURE APIs. This aspect of the CURE Portal is considered as proof-of-concept demonstrator for selected CURE Applications, but ready for further upscaling or deployment for a full-fledged interactive operational production tool in future.

CURE Demonstration Workshops

by David Ludlow

Workshops' objective and content

CURE 2nd Demonstration Workshops were held on Friday 14th and Monday 17th October 2022 hosted by CEMR (Council of European Municipalities and Regions) in Brussels, Belgium and virtually. Both meetings aimed to demonstrate how the CURE Portal (System) and Cross-cutting Applications can be operationalized for urban planning, identify their specific added value, and consider how they can be transferable to cities more widely. These Workshops were a continuation of the previous one (1st Demonstration Workshop) focused on demonstrating the range of capabilities of the CURE Applications in relation to city challenges and laying emphasis on the views of CURE stakeholders regarding the effectiveness of these Applications.

The Friday workshop engaging mainly with representatives from cities (including cities involved in the CURE project, such as Berlin, Heraklion, Copenhagen and Sofia) was a full day event with morning session demonstrating the CURE Portal and Applications together with their capabilities, structured around the three urban planning requirements of Climate Change Mitigation (the Heat and CO_2 Applications), Climate Change Adaptation (the Nature-Based Solutions and Flood/Subsidence Applications) and Healthy Cities (the Health, Thermal Comfort and Air Quality Applications). This was supported by three case study presentations for the CURE project cities of Berlin, San Sebastian, and Copenhagen. The afternoon session was promoted as a Dialogue Café, fostering engagement with city representatives regarding the specific urban challenges addressed by the CURE Portal and Applications, and the priorities for the further development of their functionalities. The Monday workshop, engaging mainly with representatives from pan-European entities involved in urban resilience (European Commission (EC), Climate-KIC, Copernicus Entrusted Entities, etc.), included a morning session demonstrating the capabilities of the CURE Portal and Applications, as with the Friday workshop.

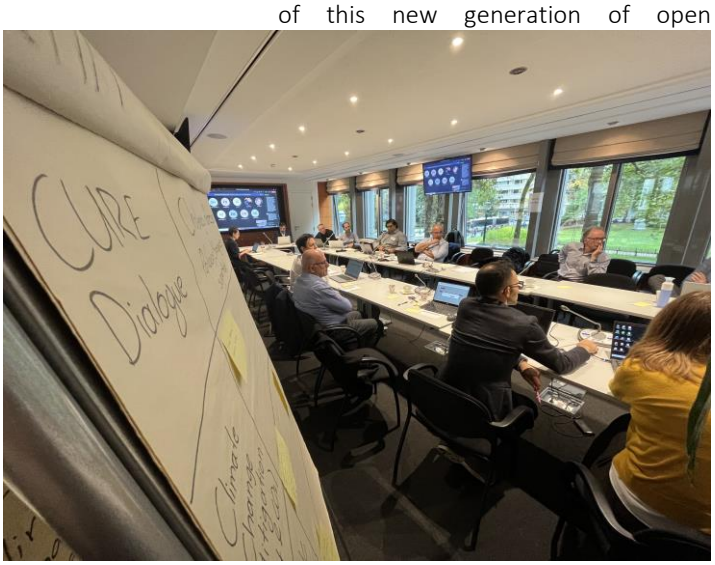
CURE user-based assessment

The question of the added value of the CURE Portal and Applications, addressed by the CURE Demonstration Workshops, concerns effectiveness in relation to specific urban planning end-user information and intelligence requirements that support the complex decision-making process of urban planning. The basis for this CURE added value assessment is the urban governance model developed by the Smarticipate Horizon 2020 project and applied in the CURE project, incorporating three interlinked governance principles:

- Open – governance process and decisions that foster citizens' engagement improving the quality of decision-making for public institutions;
- Integrated – assessment of urban complexity supporting enhanced decision-making in a framework of interconnected strategic policy objectives, where policy co-benefits and "win-win" solutions are sought;
- Interoperable – concerning the commonality of the drivers of change at global and pan-European levels that impact cities, supporting the requirement for generic modular systems of urban governance, in which smart city governance solutions are applied universally to the cities of Europe.

The perspective of this governance model is a response to the reality that urban planning is moving from a centralised top-down application towards engagement with bottom-up solutions within top-down governance frameworks, to make governance process and decisions open, and to foster stakeholder engagement improving the quality of decision-making. Socio-economic and technological developments in combination are driving the emergence of this new generation of open

Introducing the CURE project and concept.



Discussing about the added value of the CURE Portal and Applications.

government services. Information Communication Technologies (ICT) are a key enabler in making this possible as open governance promotes the opening up of structures and public organisations supporting the development of transparency, accountability and trust, embodied in the interconnection of open data and open process delivering open governance services.

CURE added value

Specifically, CURE added value is identified from an open governance perspective in offering an enhanced visualisation, providing a powerful communication tool to aid decision making, with data visualizations simply representing and conveying complex ideas to both expert and lay audiences. More effective communication among urban planning communities and among urban planners, citizens and other stakeholders affects engagement, can lead to political support for planning transitions, and assists in mobilising behavioural change as complement to integrated planning (top-down and bottom-up combined). Integrated assessment of urban complexity supporting enhanced decision-making is central to the functionality of the CURE System and Applications, in relation to thematic integration and the cross-cutting assessment of city socio-economic, environmental and spatial ecosystems. Specifically, they address the need for data and enhanced intelligence in relation to multi-dimensional impact assessment in relation to socio-economic and environmental factors in the spatial context of the city-neighbourhood seeking policy co-benefits and "win-win" solutions. For example, air quality and health; green roof assessments supporting adaptation targets (heat impact, flood risk, etc.).

The CURE System and Applications also support temporal integration, providing comparable and frequent time-series of monitoring and evaluation data and products. Hence, they respond to the dynamics of rapid environmental and socio-economic transition of the city, particularly in the context of post-COVID new normal city living, and support urban planning to address transition to net-zero communities, e.g. 15-minute city. The CURE Portal and Applications clearly provide fundamental input in respect of interoperability of planning systems. In particular, they support city by city comparabilities, benchmarking with other cities and gaining from other cities experience using comparable data, e.g. Copernicus Urban Atlas. At the same time, they facilitate spatial integration developing scalable solutions that enhance cross-border integration setting city planning in a city-region context, and overcoming political and administrative barriers to assess simultaneously, and on comparable basis, city-neighbourhood, city-wide and city-region. In total, the CURE Portal and Applications drive decision-making innovation providing integrated data and intelligence supporting the development of the next generation of integrated planning and decision support tools, e.g. Digital Twin.

Indeed, the major challenges arising in planning and transition to "new-normal" and carbon neutral cities emphasise the limitations of existing urban governance models and the urgent need for new solutions in the "new- normal" context. This dynamic is prompting the redefinition of the design principles and operational rules for "new urban governance", including urban planning. These challenges also emphasise the urgent need to develop the next generation of decision support systems supported by ICT, and in particular Digital Twin solutions, which are gaining momentum in building sustainable future cities. Enabled by real time data capture allied to analysis and visualisation of multiple layers of information for collective intelligence and knowledge generation, Digital Twins are becoming an important tool for urban governance and decision making. For example, the Copernicus-based CURE System or even a set of CURE Applications provides a suitable example of the integrated functionality required to support Digital Twin enabled decision-making. The CURE Portal and Applications support integrated assessment and decision-making for urban resilience. Deploying Copernicus-enabled functionalities, they promote the implementation of climate change mitigation and adaptation as well as healthy cities solutions at the local level.

Presenting the multidimensional CURE Applications constellation.

Demonstrating the CURE Portal and its functionality.

CURE Future Perspective

by Birgitte Holt Andersen

Urban hazards and need for spatial data

Given the enormous challenges cities are facing now and over the next decades to invest in adequate measures to protect cities against a changing climate, the need to provide cities and decision-makers with the best possible data and products, to make the most cost-effective decisions and to avoid mal-investments, is evident.

In assessing the value of CURE, a bottom-up approach has been applied and 'what's at stake' in terms of urban resilience investment, required over the coming 15 years, is assessed. Focusing on climate change, hazards facing cities are heat, heavy precipitation, flooding, and drought. The assessment of the CURE economic feasibility (CURE Deliverable D6.2) shows that an amount of 7B EUR is likely to be invested in greening cities on a yearly basis across European cities over the next 15 years. Likewise, an amount of 4B EUR will be required to invest in measures to build resilience against heavy precipitation and cloud bursts. While measures to adapt to higher risk of river and coastal flooding will amount to 15B EUR on a yearly basis over the next 15 years.

Mal-investments are likely to happen, it can be assumed that 10% of the investment are mal-investments for different reasons, and that availability of CURE services can reduce the risk of mal-investments by 10%. On the other hand, the CURE Cross-cutting Applications can be provided to a hundred European cities for around 2M EUR per year.

CURE Stakeholders

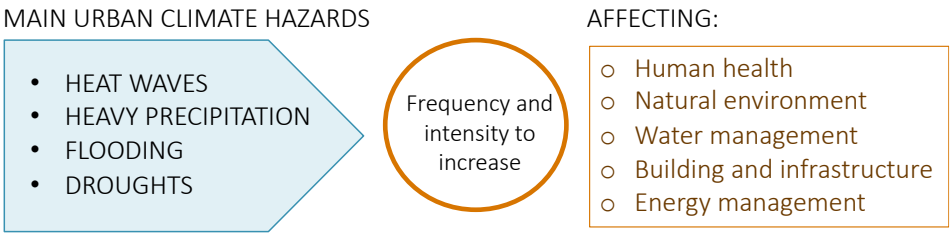
A clear demand for CURE has been identified from the cities involved in the CURE project, and from European stakeholders including various services of the EC; e.g. Directorate-General for Environment (DG ENV) and Directorate-General for Regional and Urban Policy (DG REGIO) in support of European Green Capital Award, implementation of Climate Actions within the Cohesion Policy and Social Climate Fund, as well as Directorate-General for Employment, Social Affairs and Inclusion (DG EMPL) due to the potential impact of urban heat on employment, health, human wellbeing, elderly homes, hospitals, schools, etc.

Consequently, there is a need for CURE, the business case is clear, but is CURE a public service or a commercial service? Does it belong to the Copernicus family, or could it be under the responsibility of the European Environment Agency (EEA) (e.g. case of Urban Atlas), or does it belong to DG REGIO to support optimal investments of Structural Funds?

CURE proposes a top-down service provision, where the CURE System offers a one-stop shop for Copernicus-based urban spatial data, which in turn can be used by downstream service developers to offer tailored and innovative services.

CURE Exploitation Roadmap

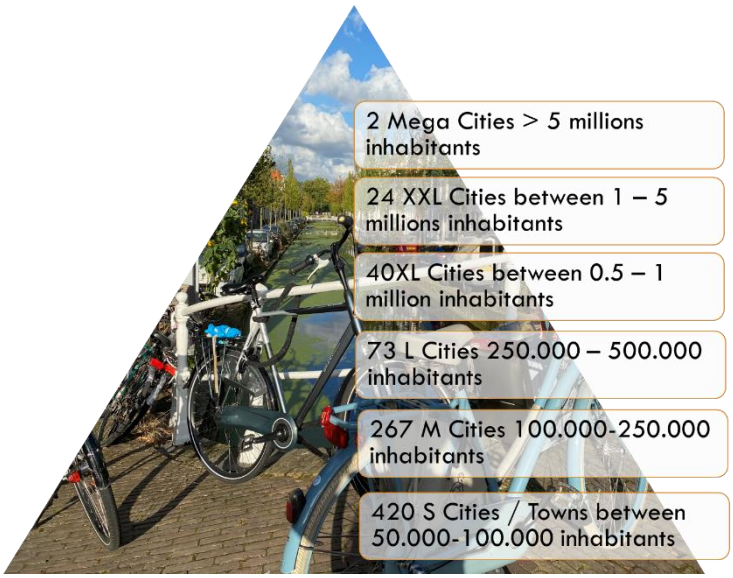
The aim of the CURE project is to provide an evidence-based toolkit for assisting current and future policy and decision making in the field of urban resilience. In the short term, specific CURE products can be integrated into the Copernicus Operational Service Portfolio. In the long term, a Copernicus Urban Service can be developed. Both short term and long term visions of the CURE project can be supported by European stakeholders, such as the above-mentioned EC services, EEA, and Climate-KIC as well as other urban resilience actors that have recognized the CURE added value. To this end, funding to further pilots and demonstrations with these stakeholders would have high priority.



Urban Climate hazards.

CURE Stakeholders.

Second level exploitation activities are related to downstream service development, where CURE partners are already active and successful in the market of downstream services provided directly to European Cities. Besides European level stakeholders, the market for the urban downstream services is substantial. In Europe, more than 60 cities have population larger than half a million inhabitants and around 800 towns with more than 50.000 inhabitants. Many European cities and towns participate in the European Union (EU) Missions for "Climate-neutral and Smart Cities" and "Adaptation to Climate Change", including cities involved in the CURE project. Furthermore, all cities and towns are likely to be in the process of formulating and implementing climate change adaptation plans. Hence, investing in concrete climate change mitigation and adaptation measures will be substantial for these urban areas. Investments that would benefit from accurate and up-to-date spatial data and products to limit mal-investments.



Addressable market: Number of cities and towns in the EU.

Conclusion

Given the huge challenges European cities and towns are facing now and in the coming decades, where billions of Euros will be invested in urban resilience, it will be crucial for the decision makers to have access to up-to-date and accurate data and products. CURE has demonstrated that such services, based on Copernicus data and products, can be made available at very modest costs, if provided as a pan-European Urban Service hosted by the EU, such as the Copernicus Core Services.

Benefits of CURE SYSTEM

Assuming that the core services includes those required to develop the downstream services needed by the city

What are the added value to downstream service developers?

Economic/Environmental/Social

- One-stop shop for Copernicus-based urban data
- More developers attracted to use the CURE system
- Increased competition and innovation in downstream applications development

Quantification of added value

- Saved development costs
- Saved processing costs
- Better and more innovative services
- Based on CURE up-scaling estimates from 1 to 100 cities, service delivery costs could be reduced by a **factor 5-10**

Benefits of downstream Urban Climate services

Assuming that downstream services will be developed in accordance to local user requirements and needs to maximise the benefits of the services

What are the added value to cities and city stakeholders of evidence based data and products?

Economic/Environmental/Social

- Improved supply of better and more innovative Climate services
- More competition might result in relative cheaper services
- Improved quality of decision making related to investing in climate change mitigation and adaptation measures
- Raising awareness of unknown critical issues

Quantification of added value

- Cost avoidance due to mal-investments
- Difficult to quantify how much you can improve decision making towards optimal decision making
- '**What's at stake**' approach adopts the perspective that in case there are huge risks of mal-investments, then whatever you can do to minimise that risk has a value

CURE Valorisation.

Project news

5th Progress Meeting

The 5th Progress Meeting of the CURE project was successfully completed on 30 June and 1 July 2022 both in person (Bilbao, Spain) and virtually. During the Meeting, the CURE progress for the first 2022 semester was presented and discussed, as well as the CURE planning for the next six months was outlined. Also, during the second day of the Meeting, the local resilience policies of Vitoria and San Sebastian Municipalities as well as the CURE contribution to urban resilience focusing on both Municipalities were introduced and discussed.

Inclusion of CURE in WEkEO Use Cases

The CURE use case was added in the WEkEO website entitled "New tools for increasing Urban Resilience in Europe" presenting information about the CURE project, the key features of the CURE System and the benefits of deploying WEkEO.

CURE presentation in international scientific meetings

The CURE project was presented in the following meetings:

- SPIE Sensors/Imaging 2022 Conference, 5-7 September 2022
- 41st EARSeL Symposium 2022 / 6th EARSeL Workshop on Developing Countries, 13-16 September 2022
- EuroGEO Workshop 2022, 7-9 December 2022

Also, a special session related to the CURE project will be held in the JURSE 2023 (17-19 May 2023).

JURSE 2023 Heraklion - Crete

All news of the CURE project are available through the project's web-site: http://cure-copernicus.eu/news.html.

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