WEkEO integration in the CURE project to support urban resilience

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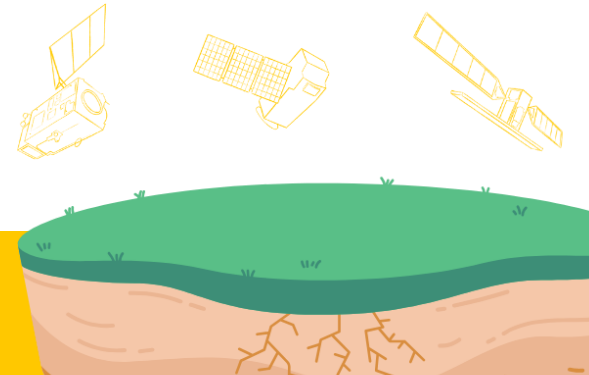
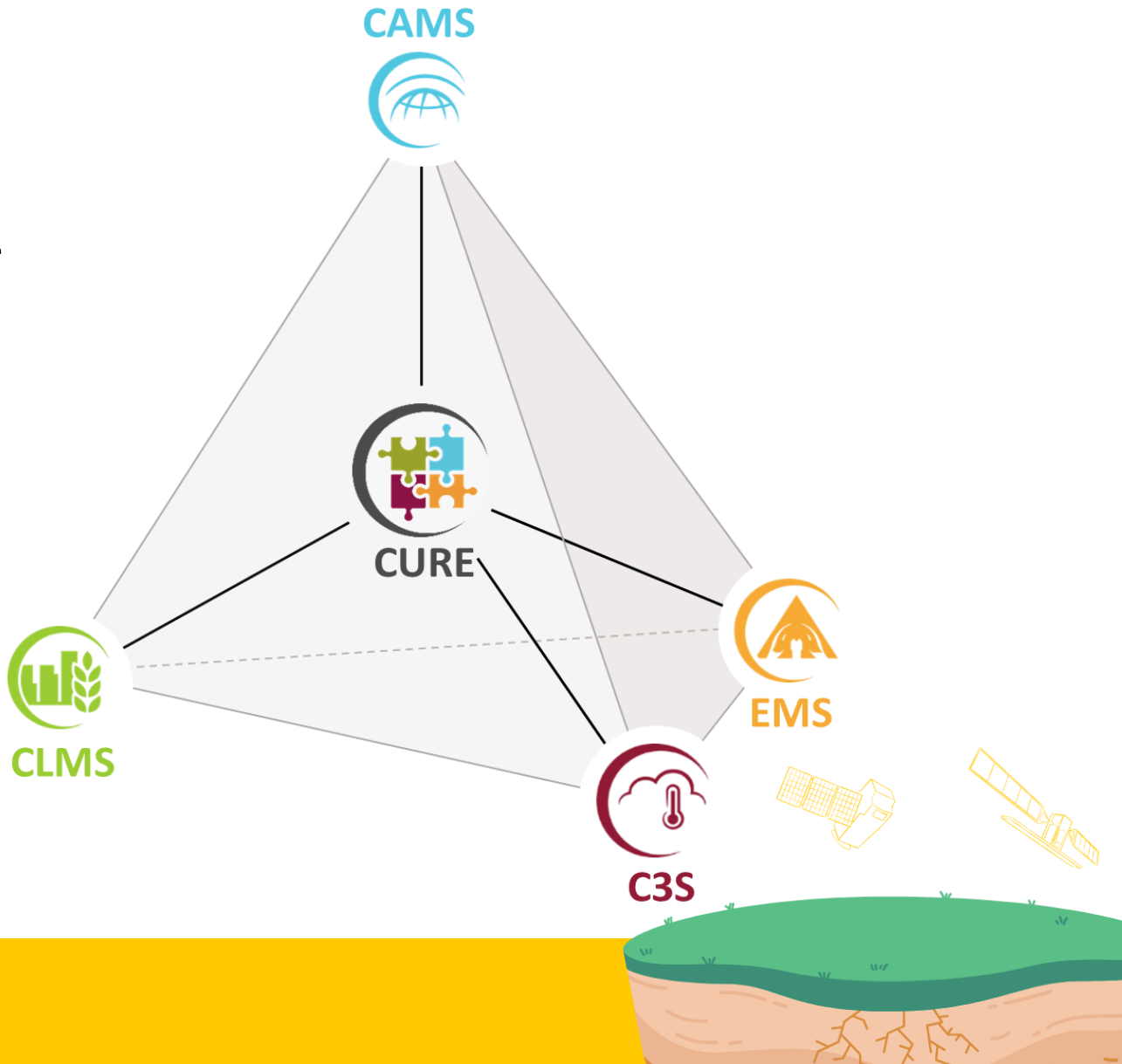
WEkEO webinar

1 February 2024

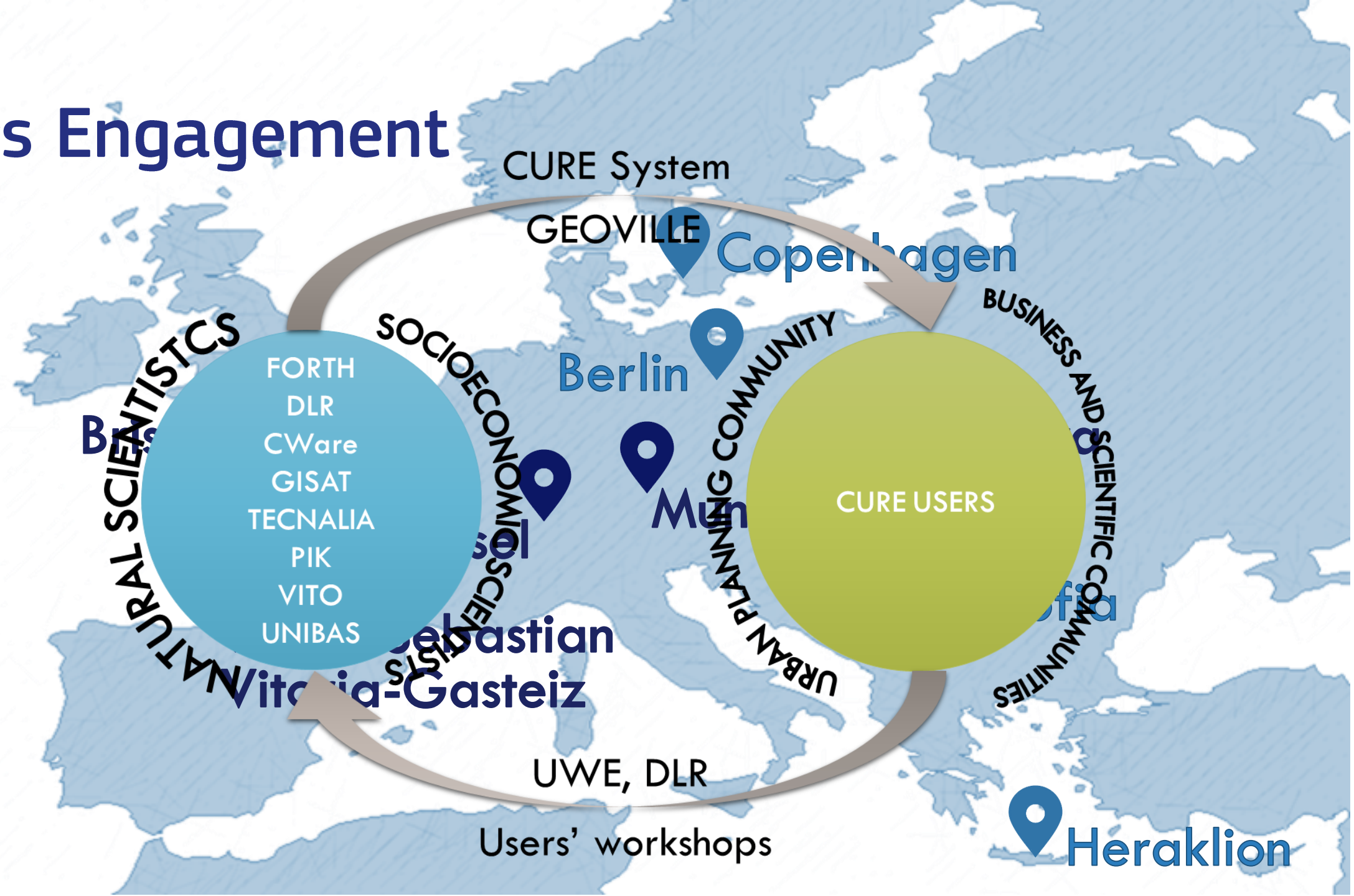


The CURE Concept

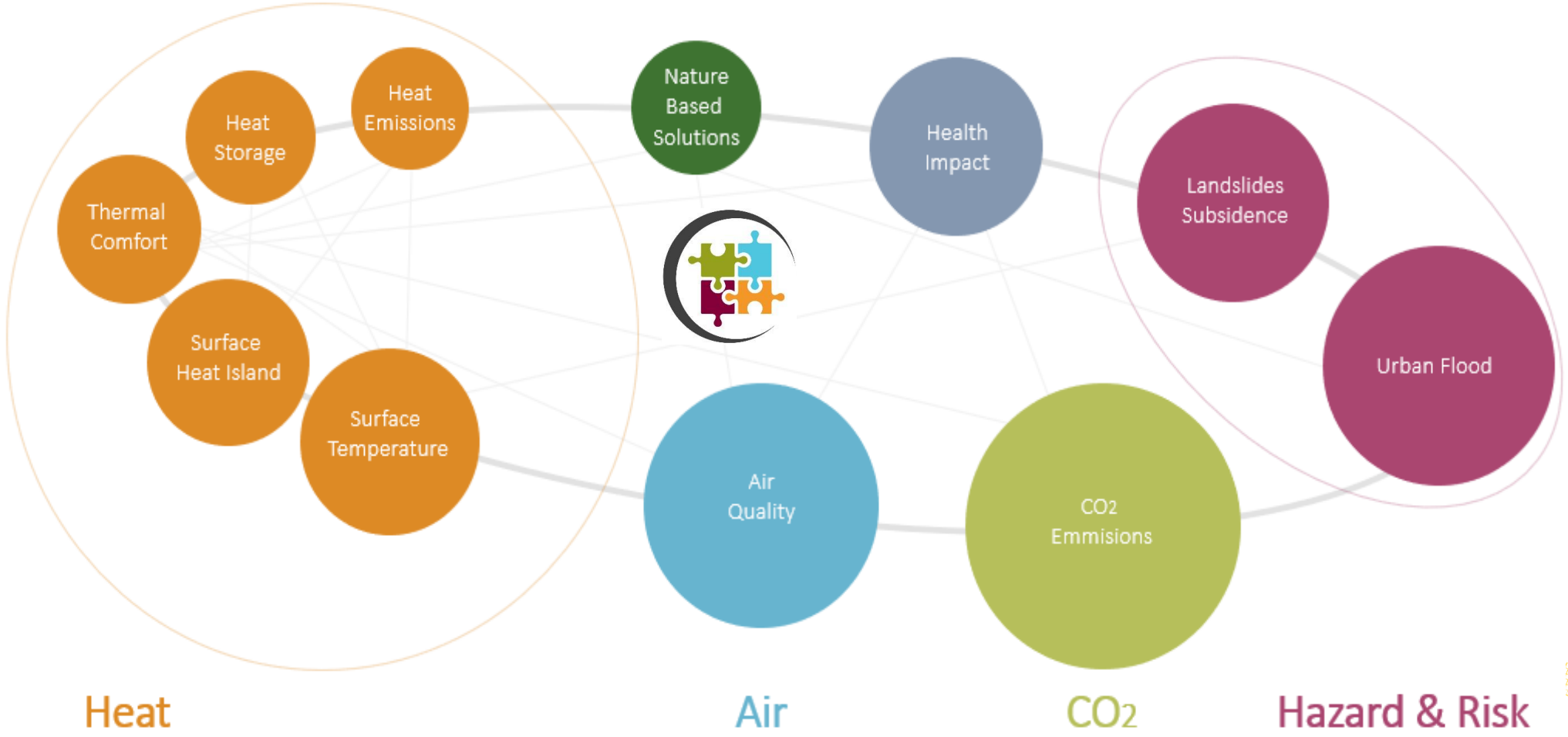
- H2020 Space 2020 2023
- Provides the means to cope with the EO data under exploitation in the domain of **sustainable and resilient urbanization**, by combining products from from CAMS, CLMS, C3S and EMS.
- Introduces novel ideas on how to **develop applications** across Copernicus Core Services in the domains:
  - **climate change adaptation & mitigation**
  - **healthy cities and social environments**
  - **energy and economy**



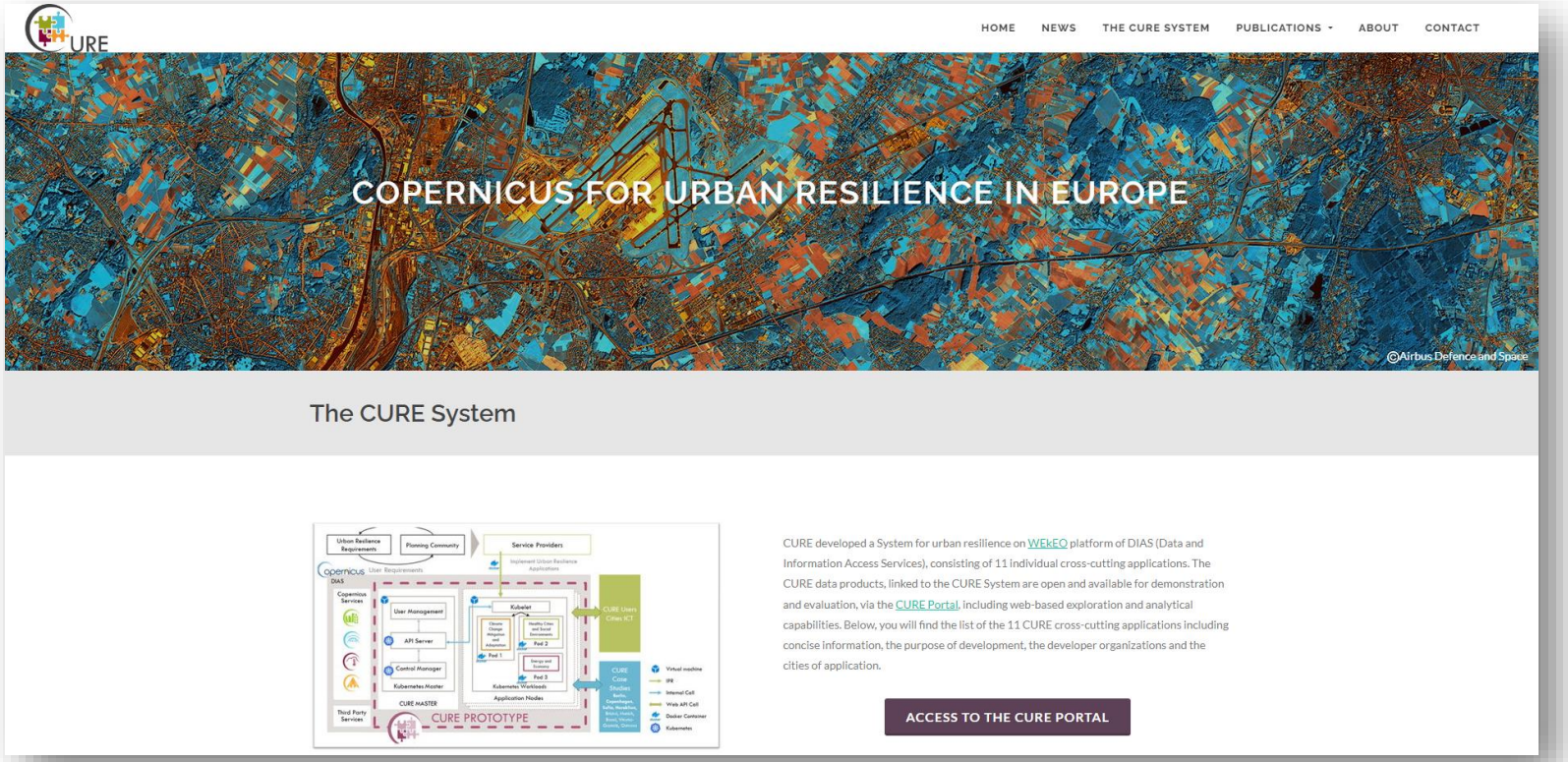
Users Engagement



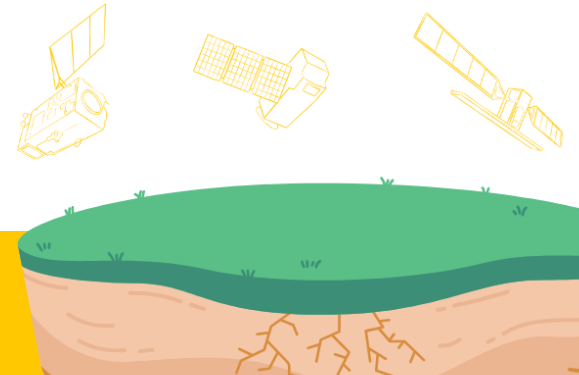
CURE applications constellation



The CURE Website



https://cure-copernicus.eu



Service Rationale

The surface temperature is one of the most important parameters in the physical processes of urban surface energy, water balance and the land-atmosphere exchanges. Thence, it constitutes a valuable information source for the understanding of the natural and human components of the Earth system. In this context, the service provides frequent local scale surface temperature estimations, which are essential data for other CURE services too, i.e. the Surface Urban Heat Island (UHI) Assessment Service, the Urban Heat Emissions Monitoring Service and the Urban Heat Storage Monitoring Service.

Detailed Land Surface Temperature (LST)

This CURE service generates daily land surface temperature maps for urban areas exploiting the Copernicus Sentinel-3 thermal acquisitions and detailed dynamic information on the land surface from Sentinel-2 and land cover / land use information from the CLMS and the atmosphere information from C3S. Similar maps available from Copernicus are coarse, with a pixel corresponding to more than 1 km on the ground, which makes it difficult to assess the intra-urban variations of surface temperature. The CURE urban LST compensates the spatial-temporal resolution trade-off of the satellite LST products, providing dense time series of 100 m spatial resolution LST. See example and compare the CURE LST product in 100m resolution (left) with original Copernicus service in 1km resolution (right).

Service Rationale

Partitioning of CO_2 emission sources/sinks

Urban CO_2 emissions have a spatial dimension due to the heterogeneous nature of urban land use/land cover and urbanization. In this CURE application, the CO_2 emissions are partitioned into an anthropogenic (traffic, heating/cooling) and a biogenic component (urban green space):

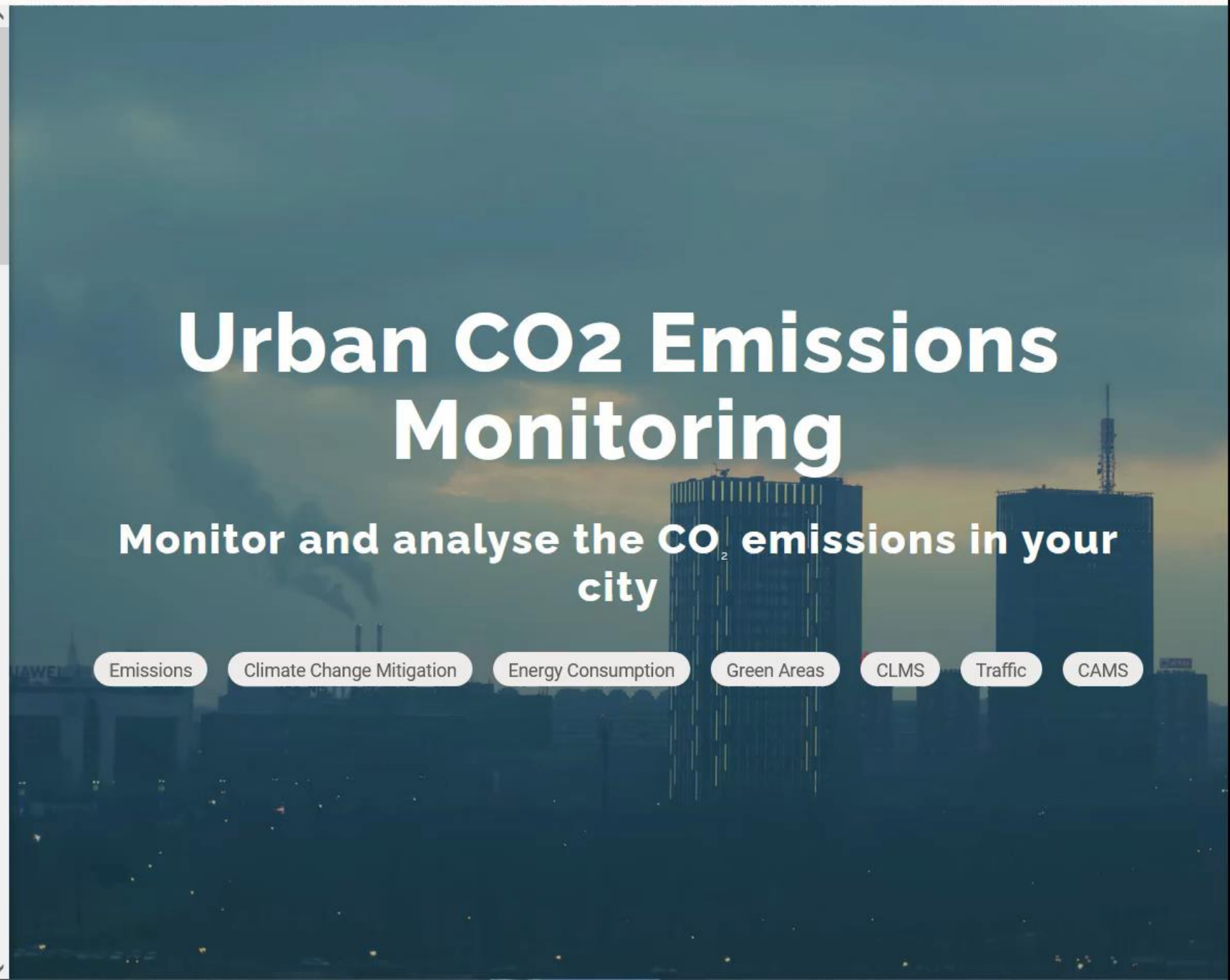
- Anthropogenic source from fossil fuel combustion by cars
- Anthropogenic source from fossil fuel combustion through heating/cooling
- Biogenic source from human respiration
- Biogenic source/sink from plant/soil respiration and photosynthesis

Eddy Covariance measurements

A very fast and simultaneous measurement of vertical wind and CO_2 concentration provides the base for calculating the vertical exchange of CO_2 (CO_2 flux).

Intra-urban CO_2 emission dynamics

Interactive maps help the user to assess, analyse and compare the CO_2 emissions from different sources/sinks for the area of investigation. Choose a map for the respective city, year, season and week days (working days/weekend). Hoover on the map to show the values for total CO_2 emissions as well the respective values for the individual contributions.



Service Rationale

Ambient air pollution is one of the key environmental problems in Europe. The European Environmental Agency (EEA) estimates that currently more than 95% of the European population is exposed to air pollution levels above the guidelines of the World Health Organization. Exposure to these high levels of air pollution is associated with a significant premature mortality: in 2019, more than 350.000 premature deaths in the EU-27 are related to exposure to air pollution. Because of the severe health impacts, air pollution also has considerable economic impacts, increasing medical costs and reducing productivity through reduced activity days across various economic sectors.

The CURE urban air quality application uses the ATMO-Street air quality model chain to compose street-level air pollution maps and data, thereby providing information on pollution hotspots in the city centre and the most important local sources for the air pollution.

Detection of hotspots and compliance checking

The pollution maps identify the pollution hotspots in the urban area. For nitrogen dioxide (NO_2), the highest concentrations are observed near the most important roads, whereas for particulate matter (PM), the highest concentrations are observed in the neighbourhoods with an abundance of coal and wood burning heaters.

The maps can also be used for compliance checking. The EU Ambient Air Quality Directive sets a threshold of 40 $\mu g/m^3$

Service Rationale

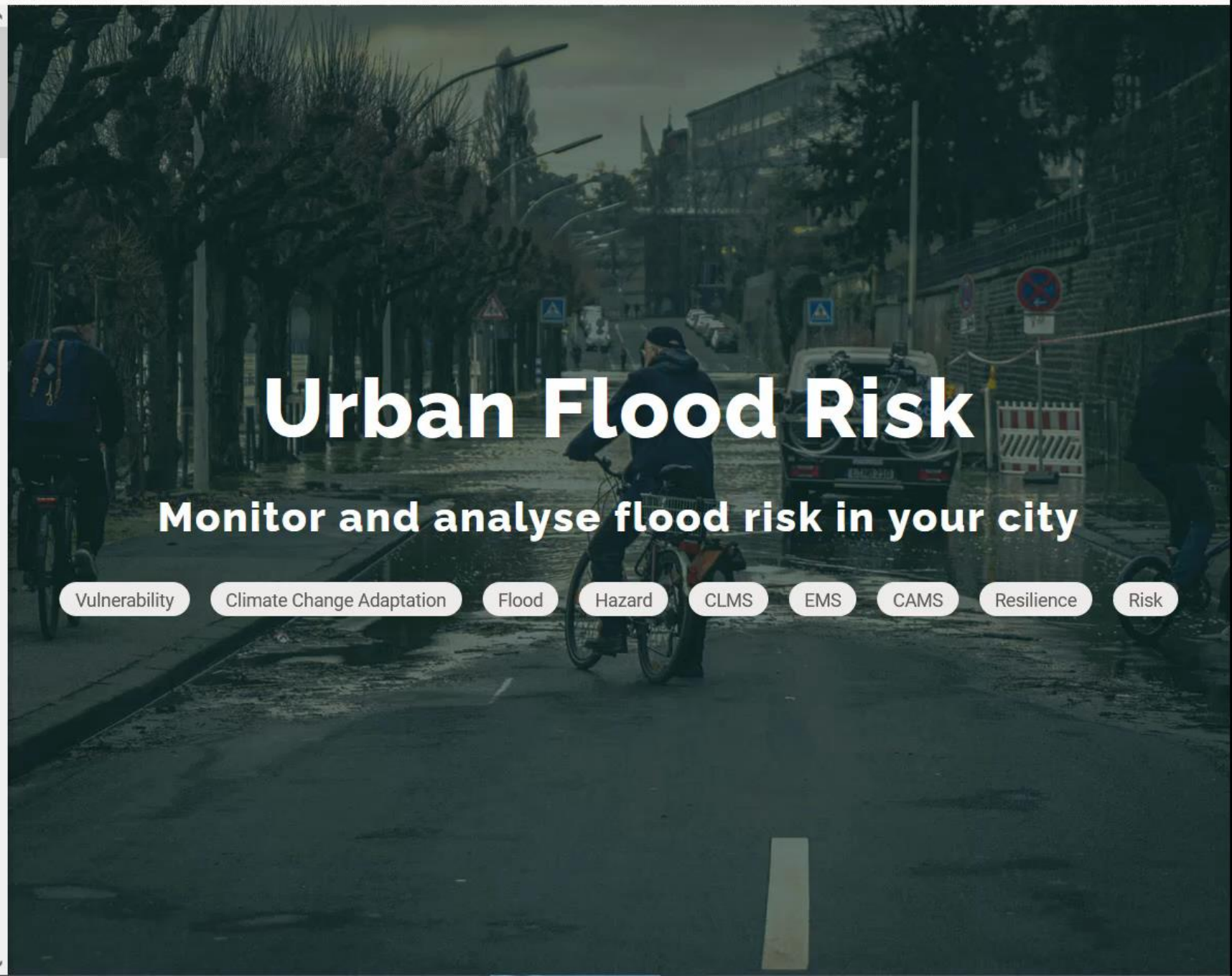
While water is a resource before being a threat, risks related to urban floods are critical for the security and resilience of the cities as especially as these are gradually amplified by climate change.

Floods are the natural hazard with the highest frequency and the widest geographical distribution worldwide. Various climatic and non-climatic processes can result in different types of floods e.g. river floods, coastal flood and flash floods, often defining their intensity, speed and severity.

Floods have several direct and indirect impacts on cities and citizens. Beside the direct threat to human life, they destroy houses, business sites and infrastructure, contributing to loss of jobs and other sources of income. Floods can also result in lack of quality of public service provisioning as they can cut off people and businesses from vital services such as energy, transport and clean water.

The overall magnitude of damaging flood events in the last decade clearly shows the need for comprehensive and innovative flood risk management. It is absolutely necessary to implement controlling mechanisms for the protection of population, land use areas, infrastructure and the natural space in endangered areas. Therefore flood monitoring tools and appropriate simulation procedures are indispensable. They have to provide necessary information for flood risk evaluation, successful risk management and communication.

Flood hazard in the city area



Service Rationale

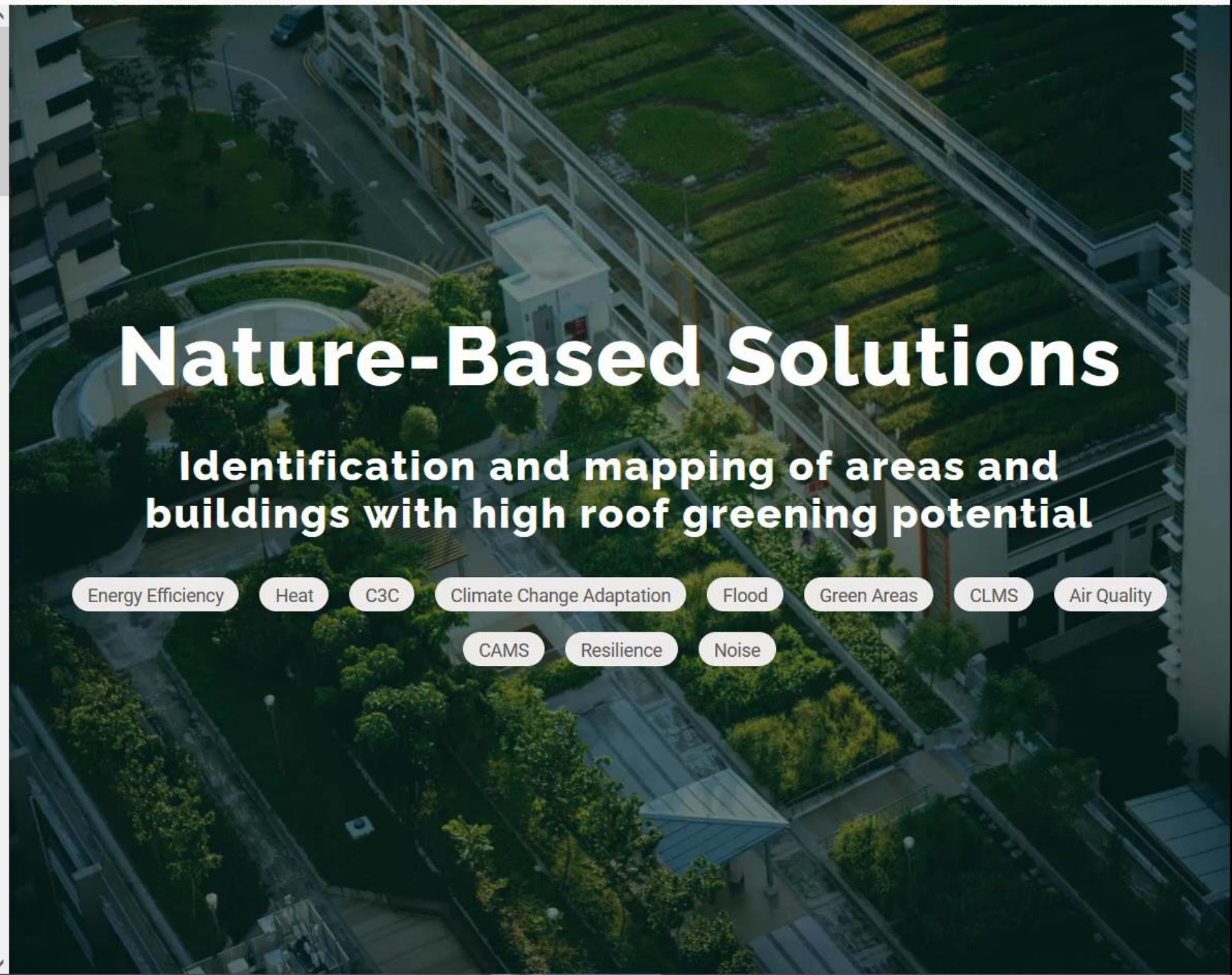
Nature-based solutions (NBS) are actions inspired by nature which use the features and complex system processes of nature, such as its ability to store carbon and regulate water flows, in order to help societies address a variety of environmental, social and economic challenges in sustainable ways. Nature-based solutions examples are green roofs, green walls, urban farms, etc.

In urban areas, green roofs provide multiple benefits as reducing the risk of flooding by collecting rainwater, reduce the ambient temperature, improve energy efficiency in buildings and offer many social benefits associated with urban agriculture, well-being, noise reduction, healing, environmental and air quality and representing a valid alternative to increase the green areas, especially where available land for greening is limited.

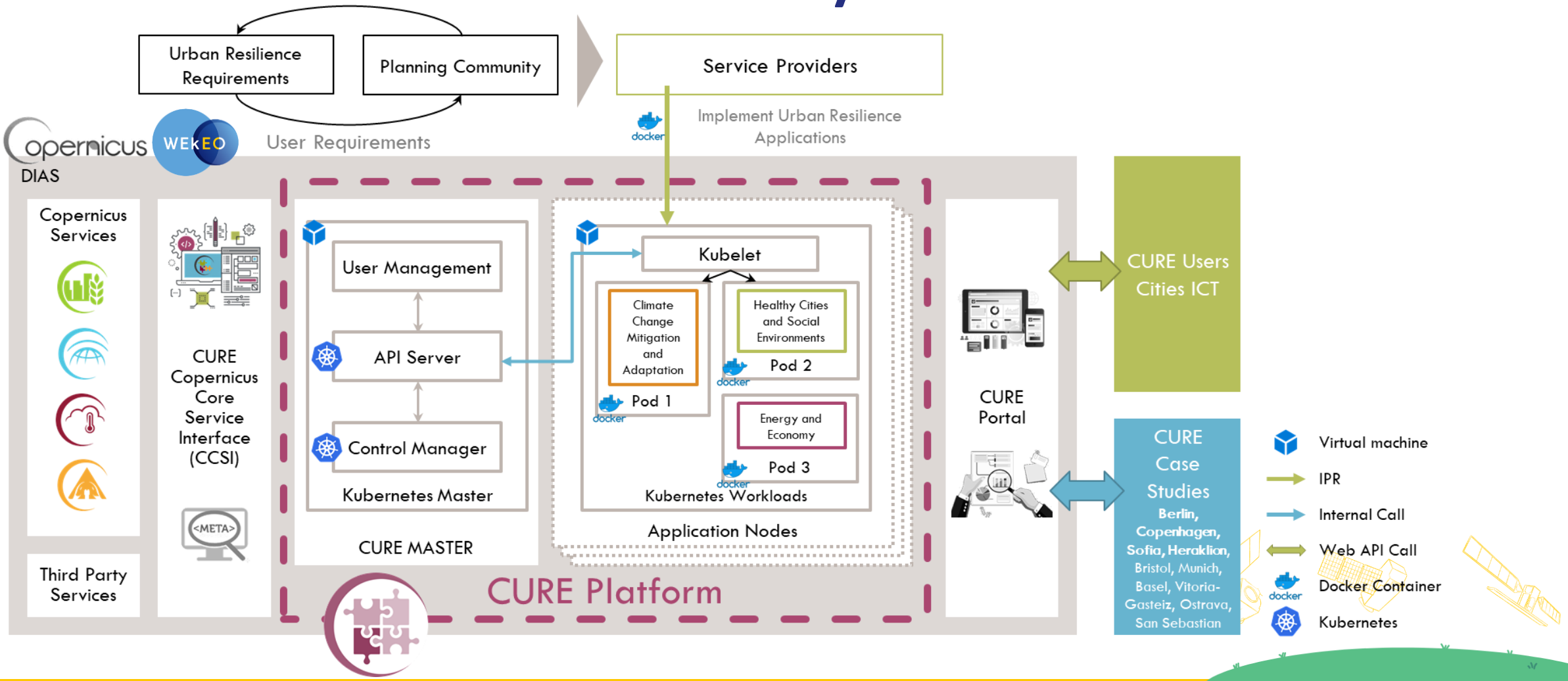
Knowing the capacity of a city to host these types of nature-based solutions allows defining which areas have the highest potential to accommodate these solutions and provides decision-makers with different scenarios on green roof potential deployment. In addition, buildings suitability for roof rehabilitation buildings is provided to support actions prioritization.

Estimation of the maximum green roof potential

The CURE Nature-Based Solutions allows to identify already existing green roofs as well as identifying areas with high roof retrofitting potential by quantifying potential green roof

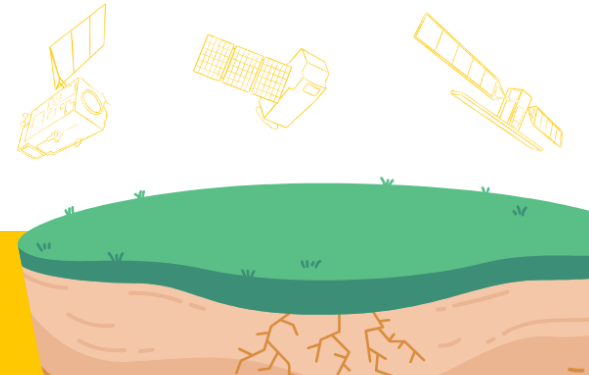


The CURE System



Main Outcomes

- **Online platform** for combining CCS to support urban resilience.
- **DIAS WEkEO** cloud infrastructure integration for **data access** and **computation power**
- **Uniform data** for large samples of urban areas across Europe
- **Consistent measurements** across European cities, including synergies between Copernicus core products and third party data
- **Different approaches and models** for better information on **urban form** and **function** at different spatial and temporal scales
- **Assimilation of users' knowledge** with technical data and benchmarking



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