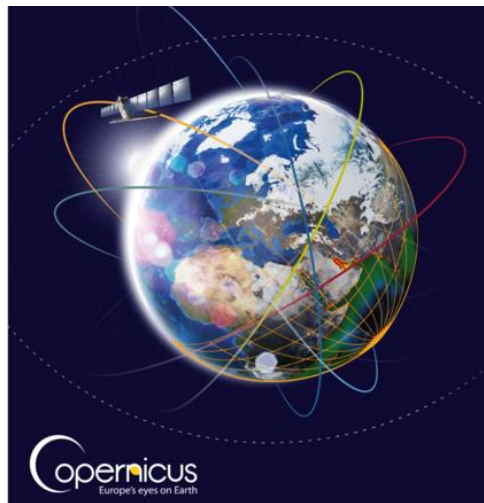




Improving urban resilience with open data and services from the European Copernicus Program



Ehrlich Daniele and Thomas Kemper
Disaster Risk Management Unit
Joint Research Centre
European Commission





Copernicus

COPERNICUS SERVICES

Full, free and open data policy

Monitoring the State of the Earth System Environment ...



Land Monitoring



Marine Environment Monitoring



Climate Change



Atmosphere Monitoring



Emergency Management



Security

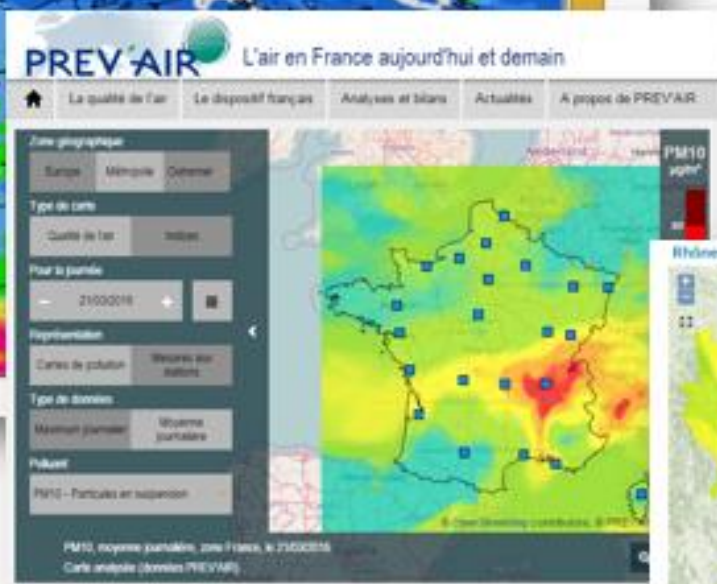
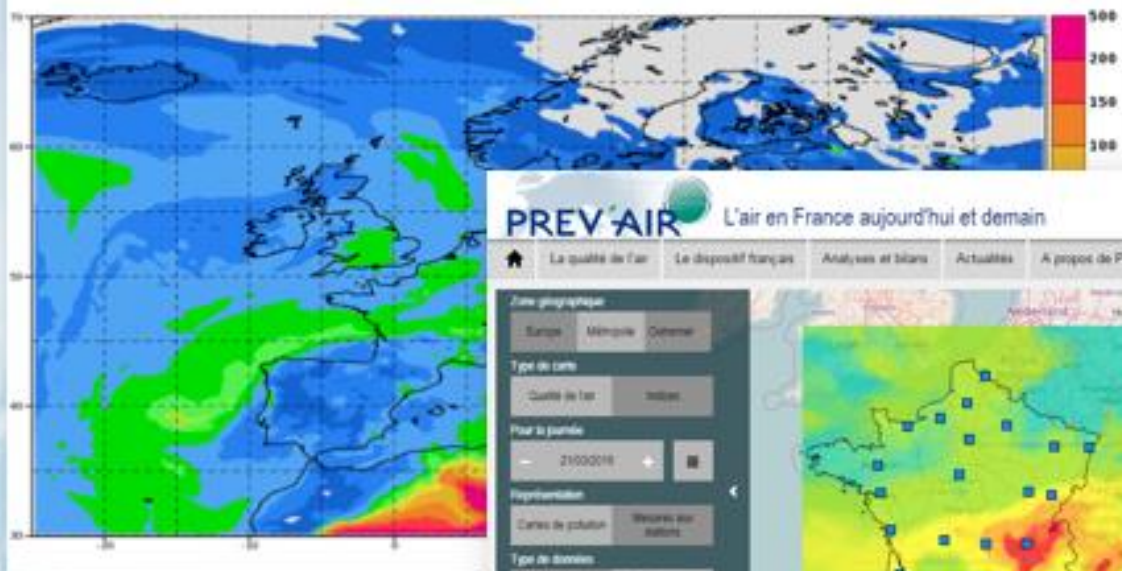
... Six cross-cutting Thematic Services

<https://copernicus.eu>



EXAMPLE: CAMS DATA FEEDING INTO MS' WORKFLOWS

Monday 21 March 2016 00UTC MACC-RAQ Forecast t+000 VT: Monday 21 March 2016 00UTC
Model: ENSEMBLE Height level: Surface Parameter: PM10 Aerosol [$\mu\text{g}/\text{m}^3$]

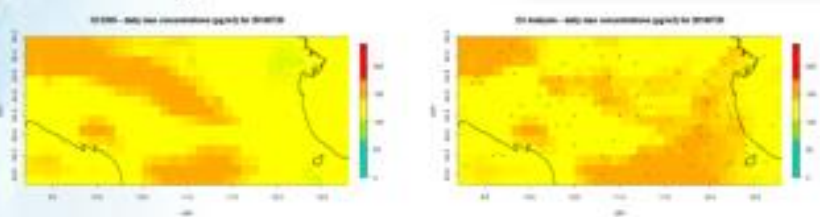


Objective: generalise operational integrated modelling chains to monitor and forecast air quality in a fully consistent way from the global scale to the city scale.



Please note colour scales are different.

CAMS regional



CAMS regional + local observations

[Slide prepared by Laurence Rouil, INERIS (FR) and EMEP chairperson]



Emergency Management

Copernicus Emergency Management Service – **CEMS**

Exposure mapping

The Copernicus EMS exposure mapping component provides highly accurate and continuously updated information on the presence of human settlements and population with the Global Human Settlement Layer (GHSL).

Population grids

Population grids are effective datasets to assess the amount of resident population at fine spatial resolution. Population counts per grid cell quantify the amount of people exposed to hazards.

Built-up surface

Built-up surface grids are essential information to map human settlements and their characteristics (like land use and density). The amount of built-up surface per grid cell is useful to estimate settlement typologies and is used as covariate for population disaggregation.

GHSL | Population grids | GHSL | Built-up surface



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





Overview of CEMS



- CEMS is operational since **2012**
- Supports all actors involved in the management of natural or manmade disasters
- Addresses all phases of the disaster management cycle from preparedness, response to recovery and prevention
 - Preparedness: forecasts
 - Response: rapid maps and monitoring of events
 - Recovery & prevention: risk assessment for specific hazards and post-disaster recovery maps

Complementary to national efforts

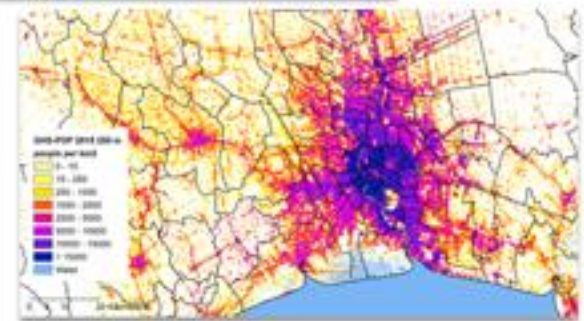
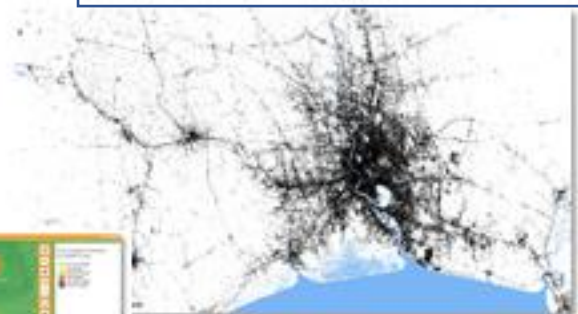
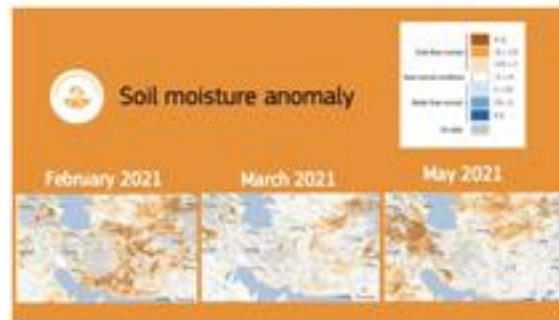
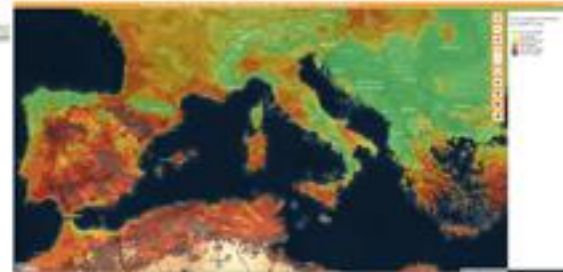
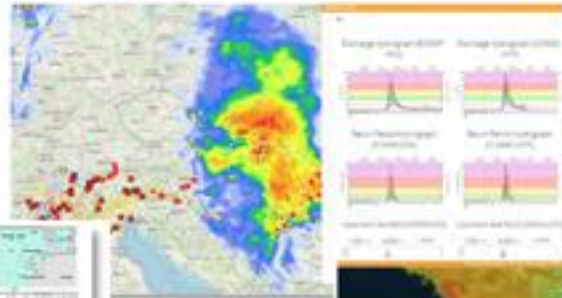
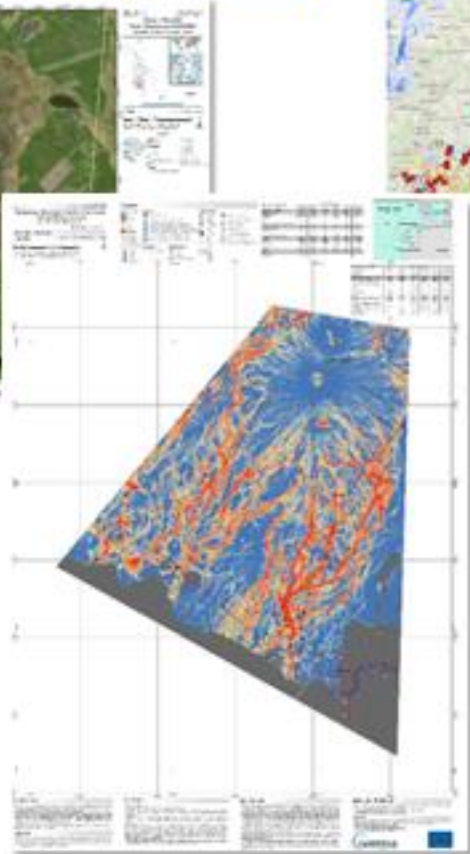
Supporting the EU's **Emergency Response & Coordination Centre (ERCC)** in Brussels

Jointly coordinated by three Commission DGs:

- **DG DEFIS**: overall governance, budget implementation
- **DG JRC**: operational implementation, technical coordination, contractual management, monitoring & quality assurance of deliverables
- **DG ECHO**: operational coordination including interface with the users & authorisation of activations



THE COPERNICUS EMERGENCY MANAGEMENT SERVICE





THE COPERNICUS EMERGENCY MANAGEMENT SERVICE



Disaster Risk

=



Hazard



Exposure

*

Vulnerability



Exposure Mapping

The Copernicus GHSL exposure mapping products

- **Global built-up fraction data** at 10 m spatial resolution based on Sentinel data
- **Global built-up change** from historical Landsat data (1975-2018)
- **Bi-annual updates** of spatial grids
- Planned starting date of built-up surface production 2023
- Products are already used by all CMES services

1975



2015



2023

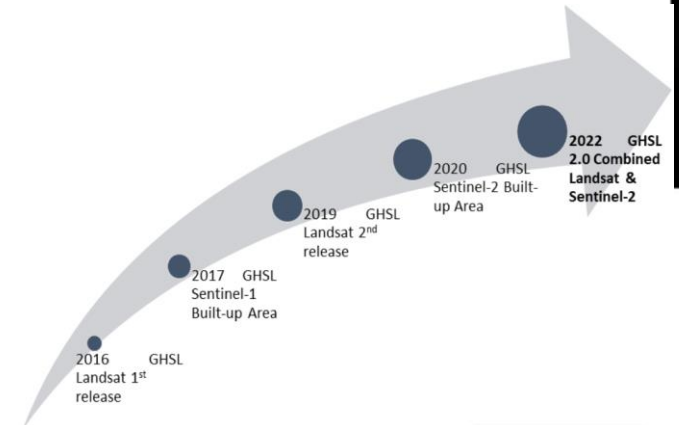


Global Human Settlement Layer – What is it?

Data processing designed to map human presence on planet Earth:
built-up areas, population, and settlements

for understanding and monitoring:

- human and physical **exposure** to natural and man-made disasters
- **impact** of human activities on ecosystems
- human **access** to resources



GEO Human Planet Initiative

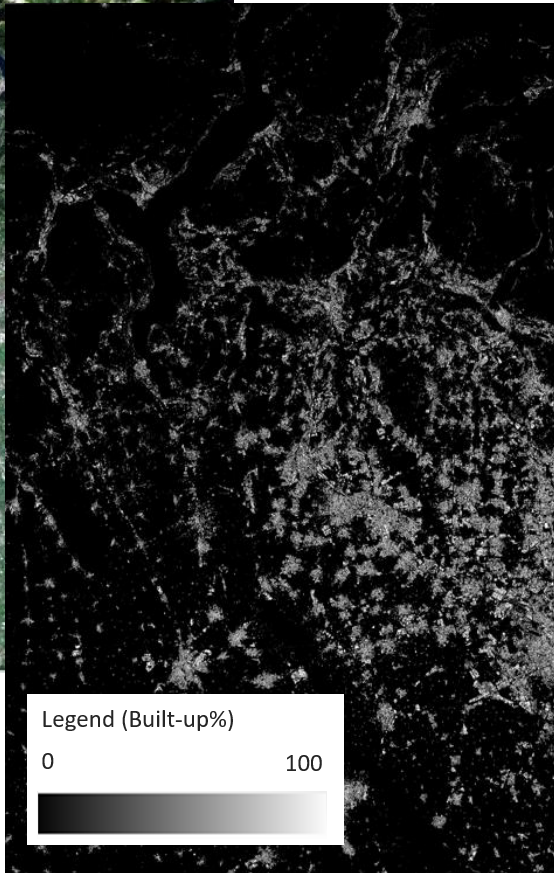




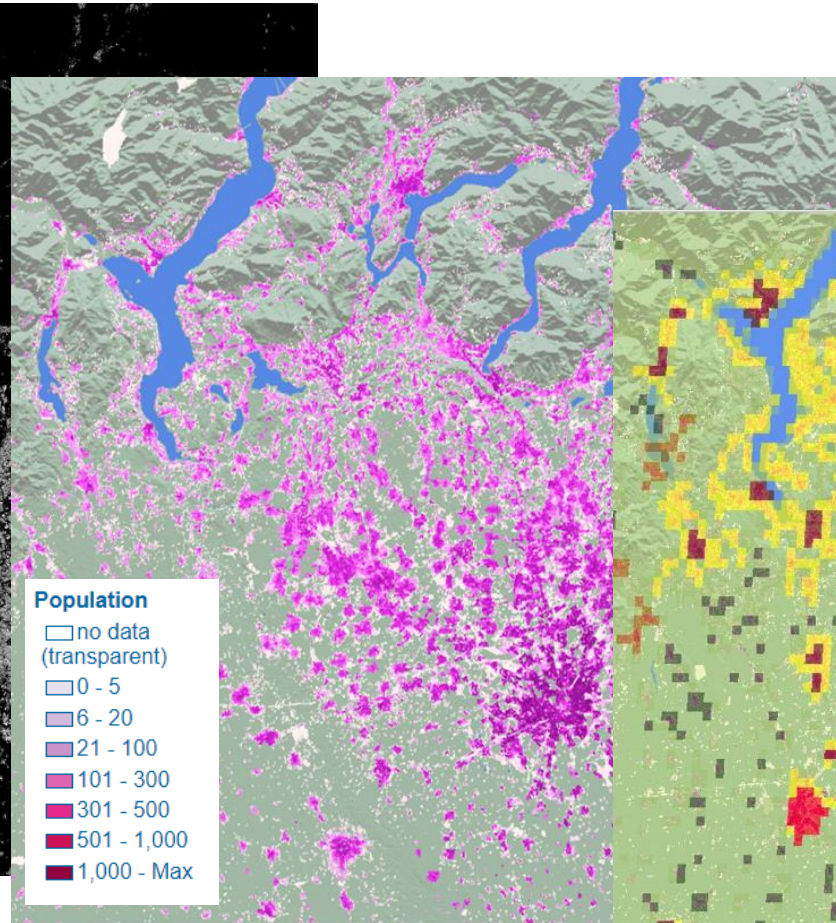
GLOBAL HUMAN SETTLEMENT (GHS) - LAYERS



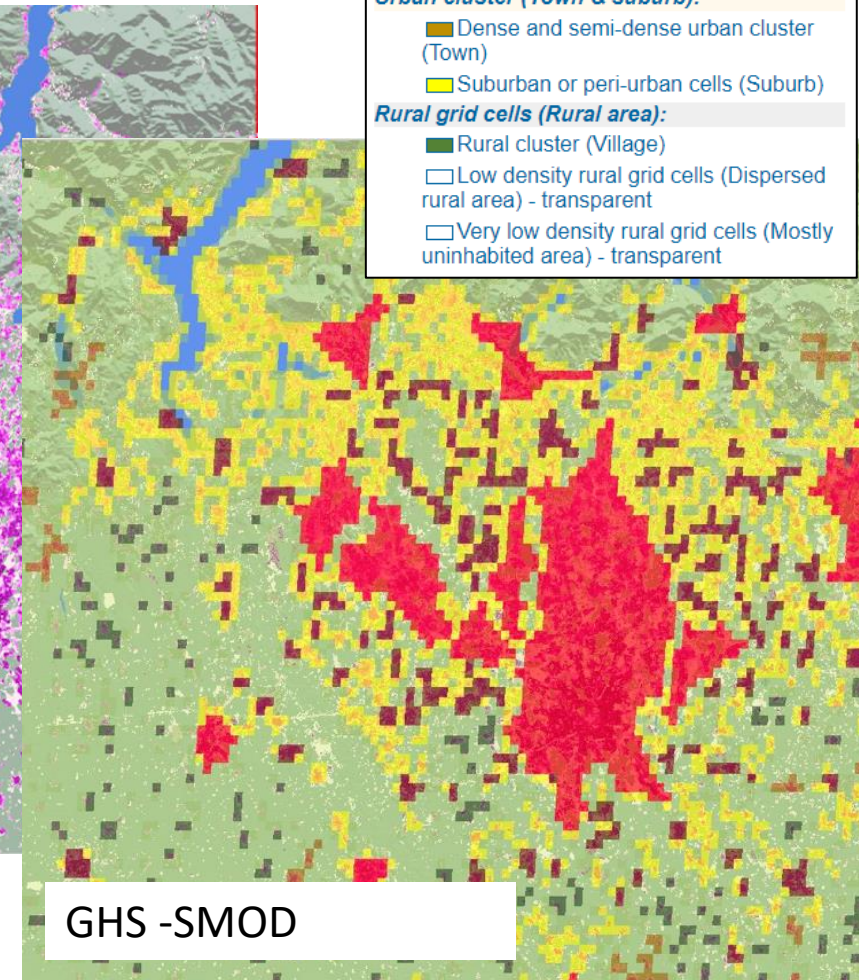
Copernicus Sentinel 2 –
Global Mosaic



GHS -BUILT



GHS -POP



GHS -SMOD

Degree of Urbanisation

Urban centre (City):

- Urban centre (City)

Urban cluster (Town & suburb):

- Dense and semi-dense urban cluster (Town)
- Suburban or peri-urban cells (Suburb)

Rural grid cells (Rural area):

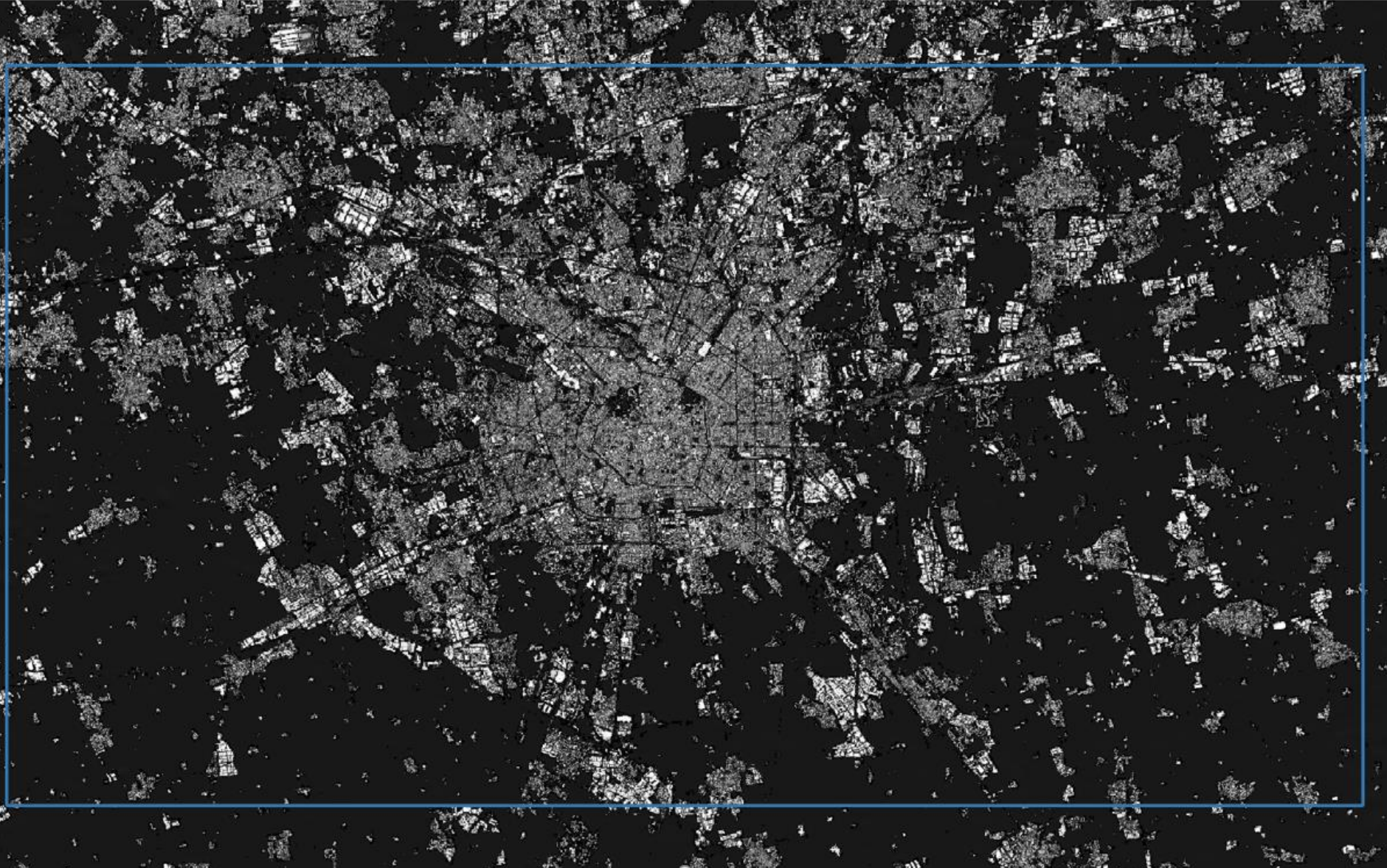
- Rural cluster (Village)
- Low density rural grid cells (Dispersed rural area) - transparent
- Very low density rural grid cells (Mostly uninhabited area) - transparent

Population

- no data (transparent)
- 0 - 5
- 6 - 20
- 21 - 100
- 101 - 300
- 301 - 500
- 501 - 1,000
- 1,000 - Max

Legend (Built-up%)

0 100



GHSL-BUILT-S

Built-up Surface

Grids:

10x10m

100x100m

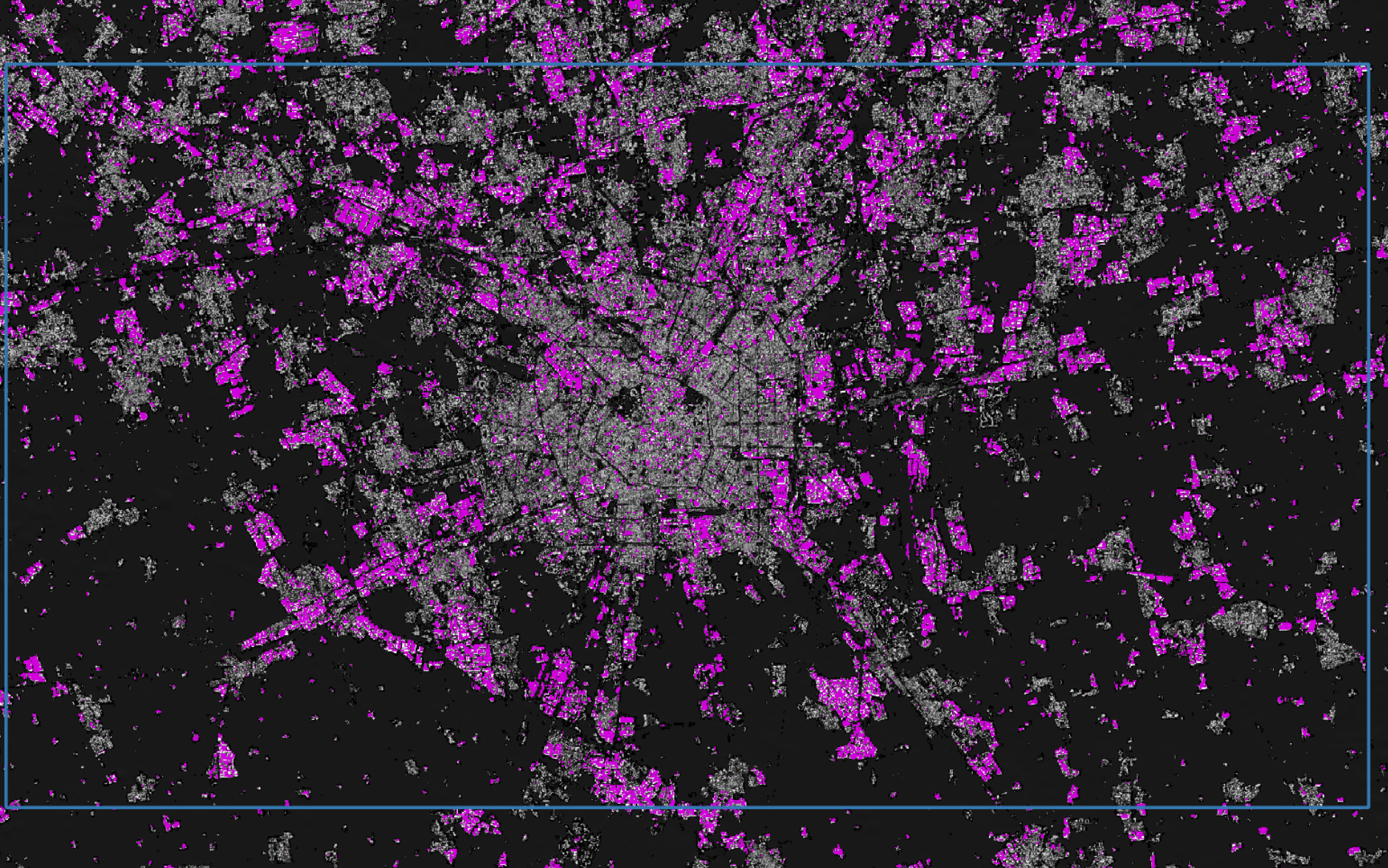
1000x100m

Legend (Built-up%)

0

100



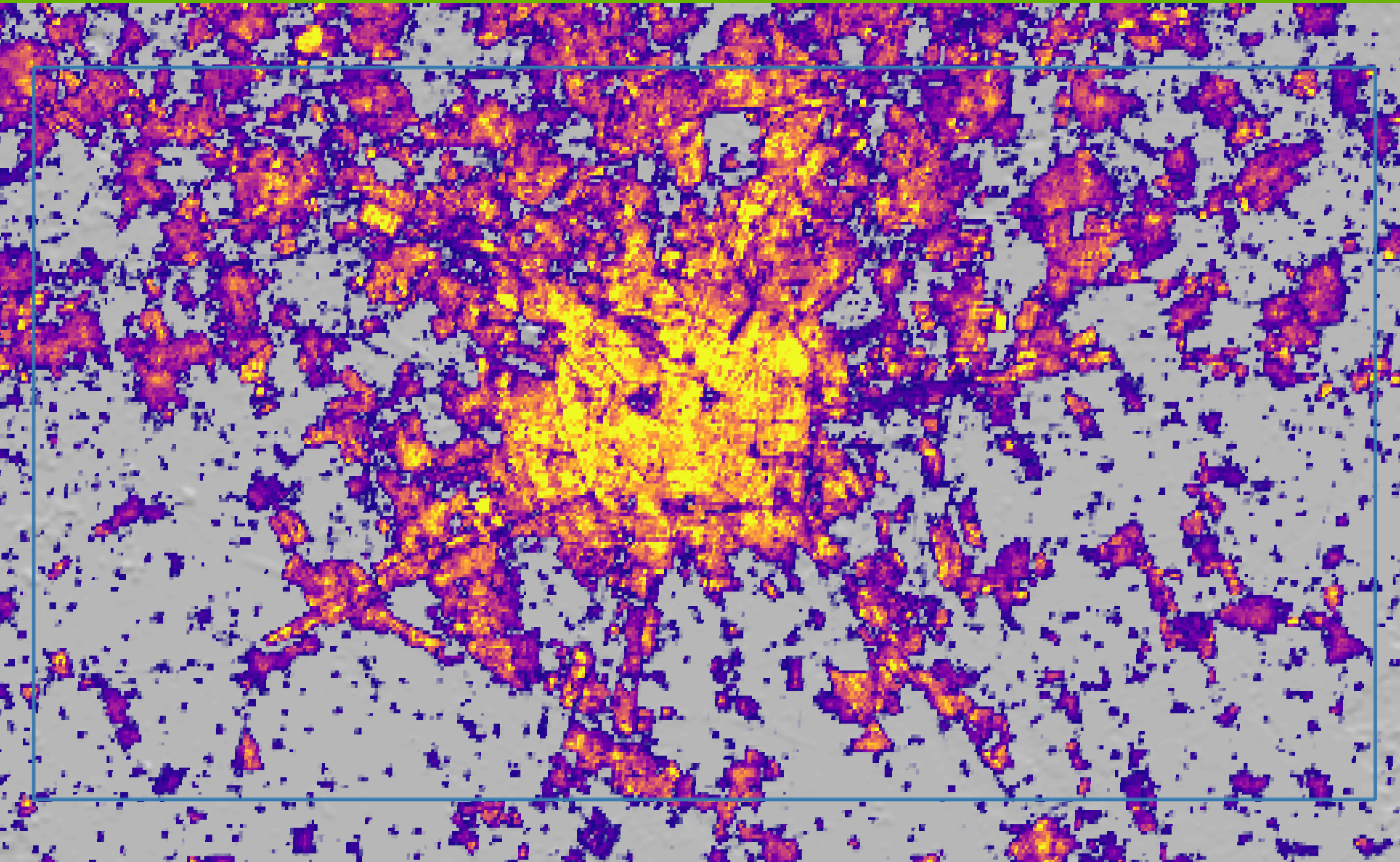
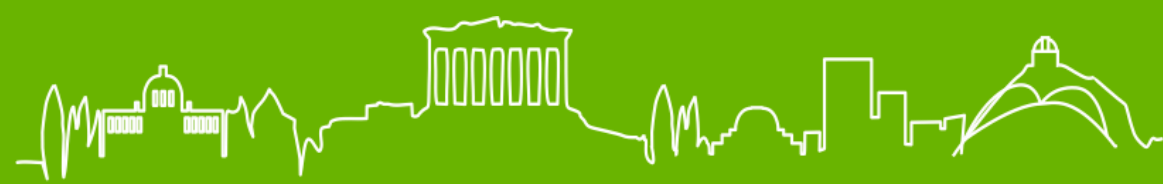


GHSL-BUILT-S

Built-up Surface

Grids:
10x10m

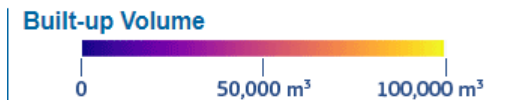
Residential 
Non Residential 

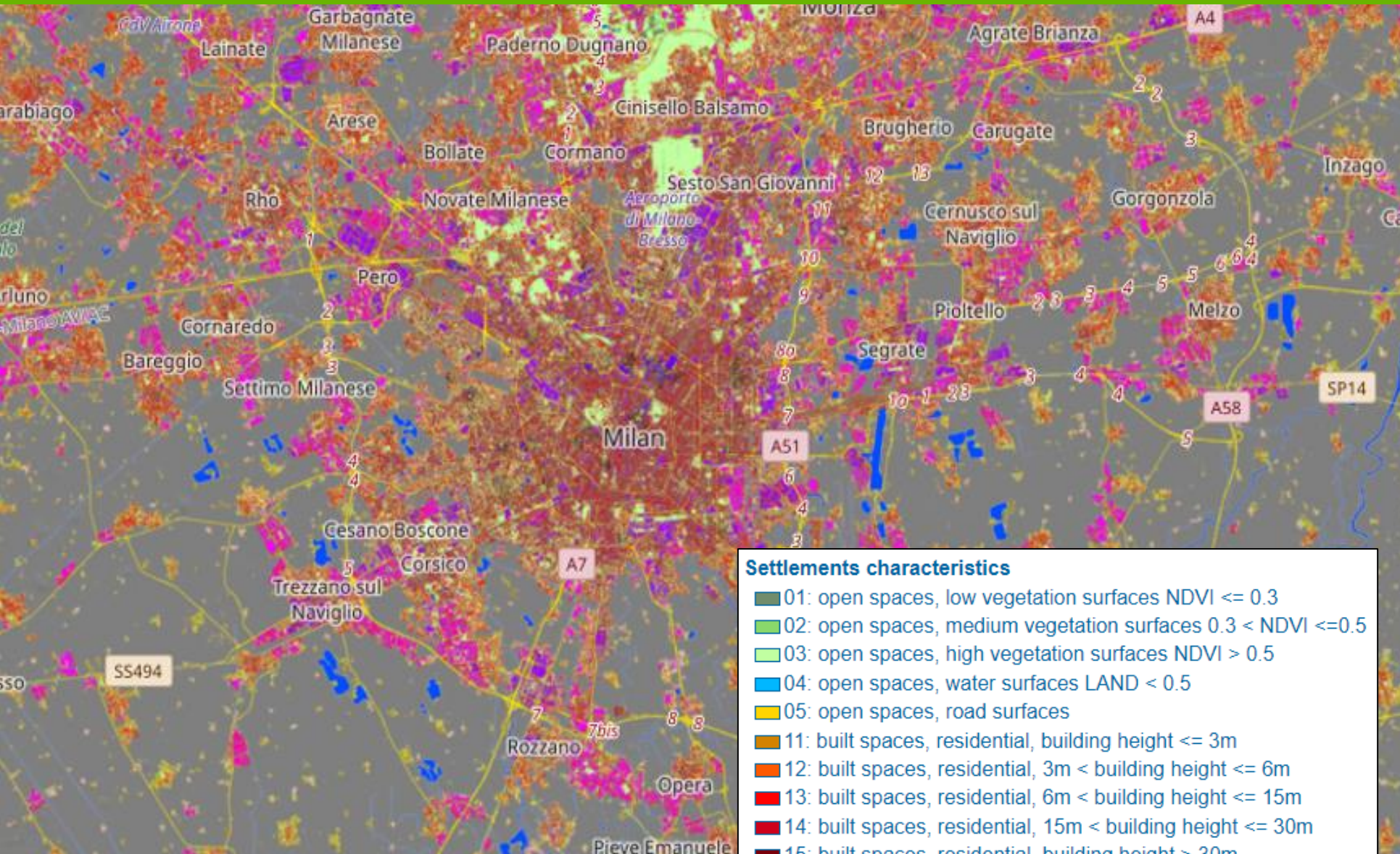
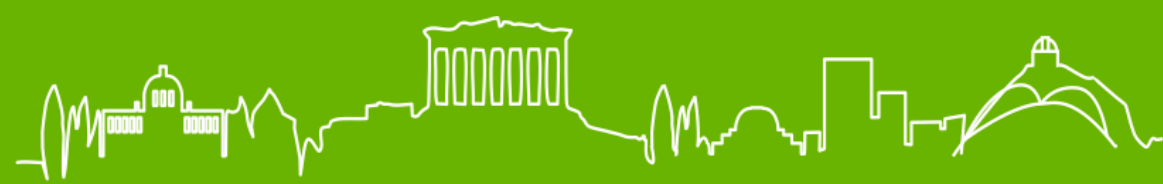


GHSL-BUILT-V

Built-up Volume

Grids:
100x100m





Settlements characteristics

01	open spaces, low vegetation surfaces NDVI ≤ 0.3
02	open spaces, medium vegetation surfaces $0.3 < \text{NDVI} \leq 0.5$
03	open spaces, high vegetation surfaces NDVI > 0.5
04	open spaces, water surfaces LAND < 0.5
05	open spaces, road surfaces
11	built spaces, residential, building height $\leq 3\text{m}$
12	built spaces, residential, $3\text{m} < \text{building height} \leq 6\text{m}$
13	built spaces, residential, $6\text{m} < \text{building height} \leq 15\text{m}$
14	built spaces, residential, $15\text{m} < \text{building height} \leq 30\text{m}$
15	built spaces, residential, building height $> 30\text{m}$

GHSL-BUILT-C

Built-up Characteristics

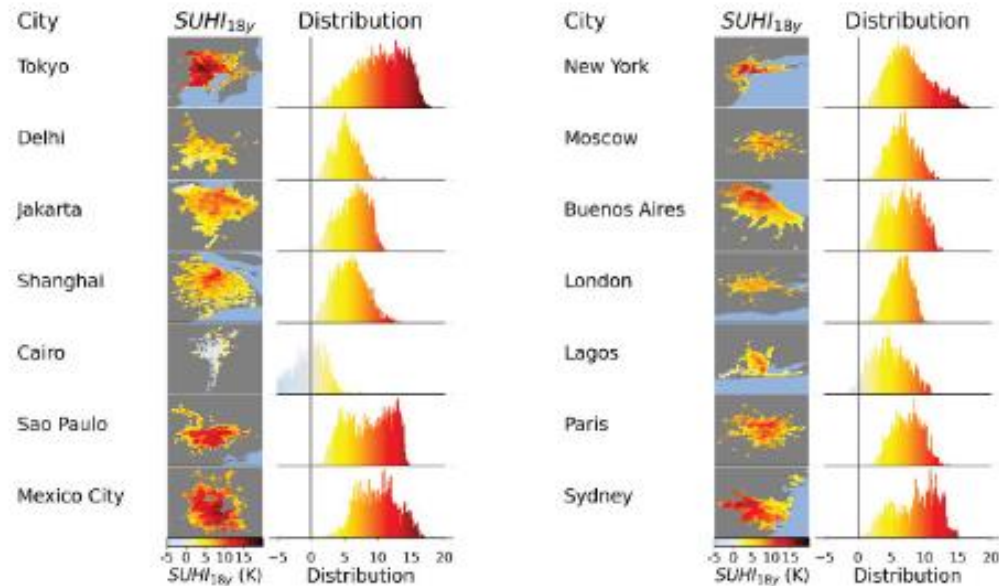
Grids:
10x10m

Morphology and
functional use



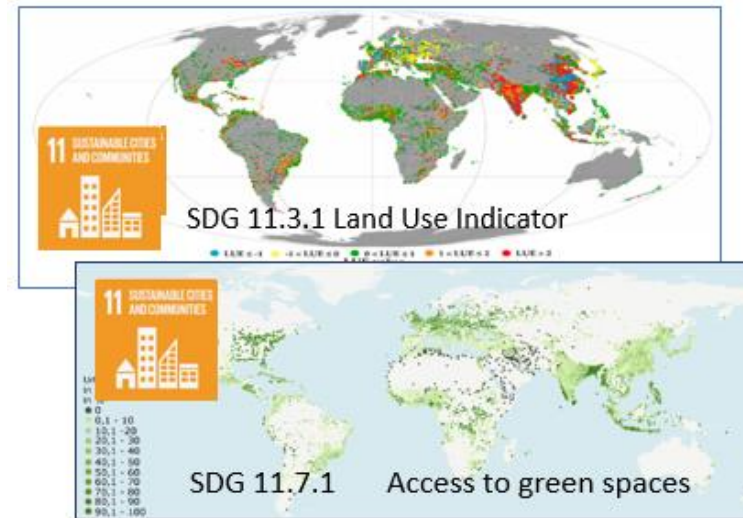
How are the data used?

Urban heat island extremes for worlds megacities

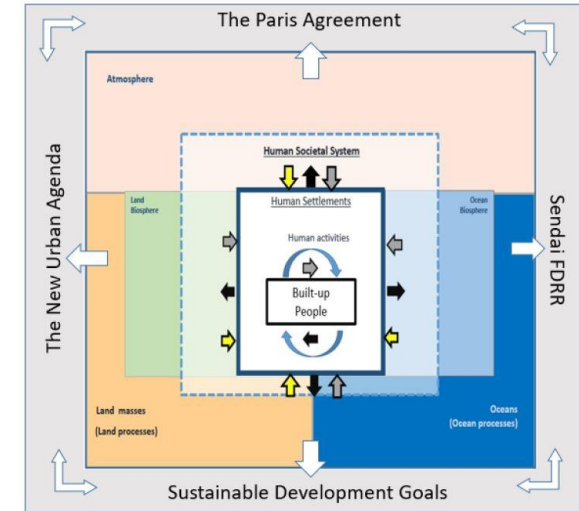


Mentaschi, L., Duveiller Bogdan, G.H.E., Zulian, G., Corban, C., Pesaresi, M., Maes, J., Stocchino, A. and Feyen, L., Global long-term mapping of surface temperature shows intensified intra-city urban heat island extremes, *GLOBAL ENVIRONMENTAL CHANGE-HUMAN AND POLICY DIMENSIONS*, ISSN 0959-3780 (online), 72, 2022, p. 102441, JRC123644.

SDG Toolkit



<https://eotoolkit.unhabitat.org/>



<https://doi.org/10.3390/su13147851>



JRC SCIENCE FOR POLICY REPORT
Atlas of the Human Planet 2017
Global Exposure to Natural Hazards



JRC SCIENCE FOR POLICY REPORT
Atlas of the Human Planet 2018
A WORLD OF CITIES



JRC SCIENCE FOR POLICY REPORT
Atlas of the Human Planet 2020





Thank you

Copernicus
Europe's eyes on Earth

Exposure Mapping

Population

Built-up areas

1975
↓
2022
↓
2023

Logos: European Commission, Food and Agriculture Organization of the United Nations, UN HABITAT FOR A BETTER URBAN FUTURE, OECD, WORLD BANK GROUP, eurostat

Applying the Degree of Urbanisation
A METHODOLOGICAL MANUAL TO DEFINE CITIES, TOWNS AND RURAL AREAS FOR INTERNATIONAL COMPARISONS
2021 edition

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HIGHLIGHTS
Cities in the World
A new perspective on urbanisation

OECD

UN HABITAT FOR A BETTER URBAN FUTURE
World Cities Report 2022
Envisaging the Future of Cities