GaiaVision

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Data Pathways to Healthy Cities and Human Settlements

Using NASA Earth Observation Data for Smarter Urban Planning

NASA INTERNATIONAL SPACE APPS CHALLENGE

Piraeus, Greece
04-05.10.2025

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Data Pathways to Healthy Cities and Human Settlements

Using NASA Earth Observation Data for Smarter Urban Planning

What the Challenge Asks

1. Ensure **wellbeing of society** (health, safety, quality of life)
2. Protect the **urban environment** (resources, ecosystems, infrastructure)
3. Show **how urban planners** can use **NASA Earth observation data**
4. Develop **smart strategies for city growth** that balance people + environment

How We Solve It

1. Build a **digital twin of the city** combining NASA satellite data + ESA satellite data + city data.
2. Data:
    1. Copernicus Earth Observation Data
    2. ICEYE High-Resolution SAR Data
    3. CORINE Land Cover (CLC)
    4. High-Resolution Topographic
3. Apply **machine learning + predictive analytics** to detect risks & trends.
4. Provide **interactive maps and dashboards** for urban planners.
5. Simulate **“what-if” scenarios** (e.g., planting trees, green roofs, flood defences).
6. Enable **smarter** and **sustainable growth decisions,** that improve **human wellbeing** and **protect ecosystems**.

Our Vision

A digital platform that combines NASA-ESA Earth data with city information to create a “digital twin” of urban areas. It shows how heat, water, air, land use and ecosystems are changing, giving planners a clear view of city health.

How This Helps

GaiaVision empowers urban planners and engineers to make informed, proactive decisions by transforming complex satellite and environmental data into clear, actionable insights. Its simulation capabilities reduce risk and waste by predicting the real-world impact of interventions before any resources are spent.

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Log In

Sign Up

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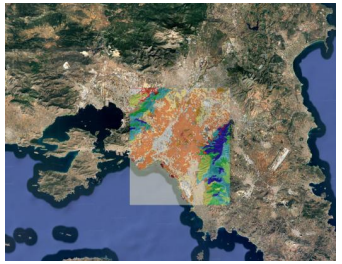
Menu Projects Maps

Search a city…

Local Climate Zones (LCZ) Map



CLC_LCZ_WRF v2 Map

Building Height Map

H/W (Height-to-Width ratio) Map

Heat Trap Index (HTI) Map

Flood Risk Map

Pollution Risk Map

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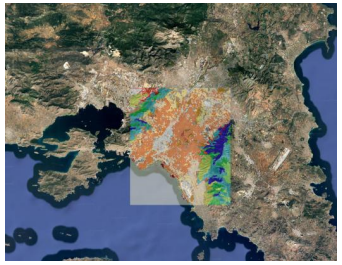

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An LCZ map helps urban planners and researchers understand the city's physical structure and its influence on local climate patterns. By categorizing areas based on land cover and built environment characteristics, it guides targeted strategies for climate adaptation and urban design.

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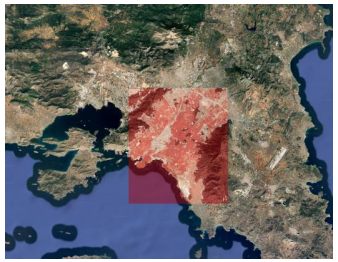

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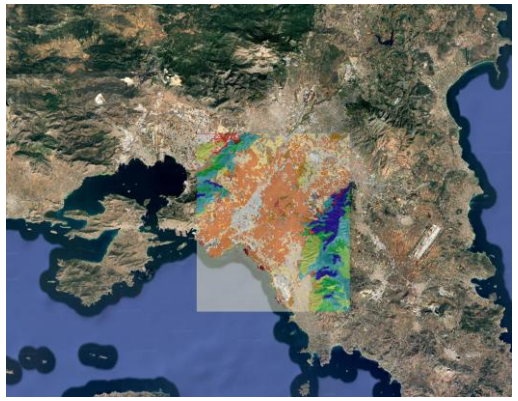

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The CLC_LCZ WRF v2 map shows the city's land cover and urban structure, combining CORINE Land Cover for natural areas with Local Climate Zones for urban areas. It distinguishes built-up surfaces, vegetation and water and provides a 100 m resolution WRF-ready dataset for urban climate and meteorological modelling.

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Menu Projects Maps

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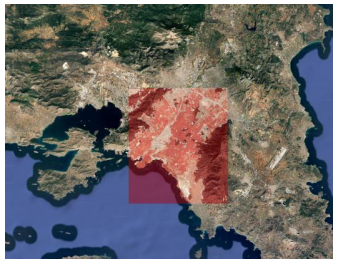

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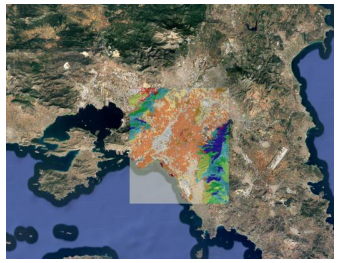

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Building Height Map

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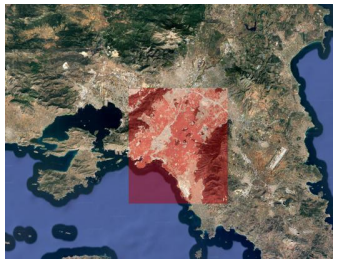
A building height map visually displays the vertical dimensions of structures across a city, showing variations in height and density. Such maps help planners and engineers analyze shading, airflow and urban microclimate effects for better design and climate adaptation strategies.

Search a city…



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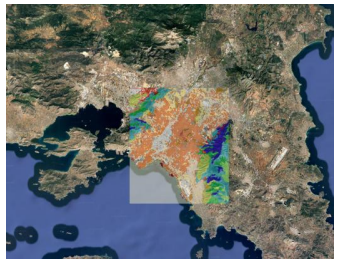

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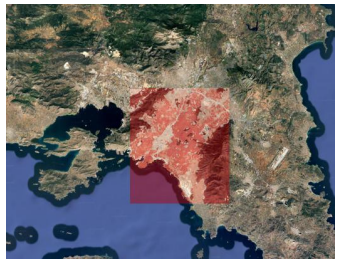
An H/W (Height-to-Width) map illustrates the ratio of building height to the width of streets or open spaces around them. This visualization helps urban planners understand urban canyon effects, airflow patterns, sunlight penetration and how the built environment influences local microclimates.

Search a city…



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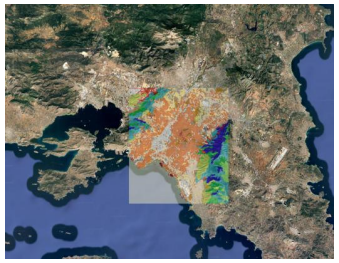

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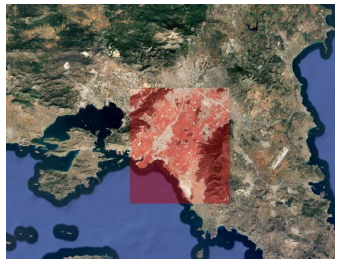
Pollution Risk Map

A Heat Trap Index (HTI) map visualizes areas in a city where heat tends to accumulate due to urban materials, building density and limited ventilation. It helps planners identify hotspots, assess the Urban Heat Island effect and target interventions like greening, reflective surfaces or improved airflow to reduce local temperatures.

Search a city…



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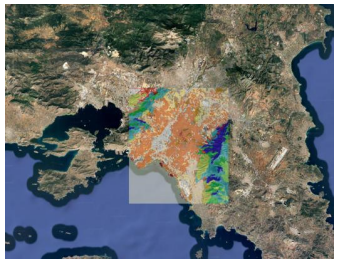

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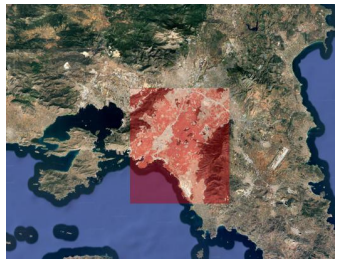
A Flood Risk Map highlights areas within a city that are susceptible to flooding due to rainfall, river overflow, drainage limitations or sea-level rise. It guides urban planners and engineers in designing resilient infrastructure, emergency response strategies and land-use planning to minimize flood damage and protect communities.

Search a city…



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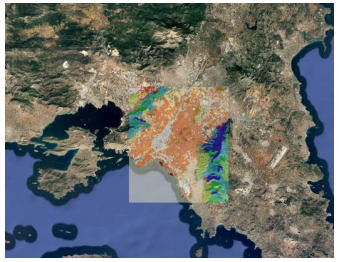

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Building Height Map

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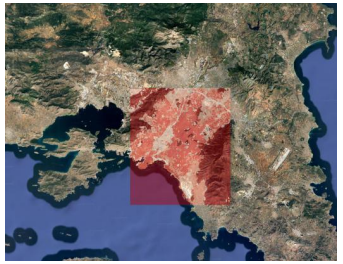
Heat Trap Index (HTI) Map

Flood Risk Map

Pollution Risk Map

A Pollution Risk Map shows areas of a city exposed to high levels of air, water or soil pollutants. It helps urban planners and public health officials identify hotspots, prioritize mitigation measures and design strategies to reduce environmental and health risks.

Search a city…



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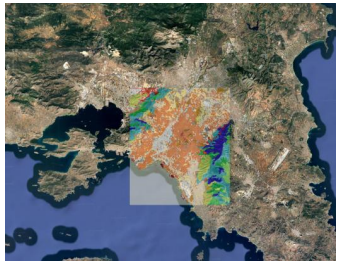

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Menu Projects Maps

Omonia, Athens, Greece

Local Climate Zones (LCZ) Map

CLC_LCZ_WRF v2 Map

Building Height Map

H/W (Height-to-Width ratio) Map

Heat Trap Index (HTI) Map

Flood Risk Map

Pollution Risk Map

Example: GaiaVision interface showing *seven* urban analysis maps for Omonia, Athens, including:

- LCZ
- Building Height
- H/W Ratio
- Heat Trap Index
- Flood Risk and
- Pollution Risk.

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Omonia, Athens, Greece

Menu Projects Maps

Pollution Risk Map

Insert country

Greece

Insert area

Omonia, Athens

Insert address

Here we see a close-up of Omonia, Athens, where the map highlights areas with *elevated* pollution risk.

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Omonia, Athens, Greece

Menu Projects Maps

Pollution Risk Map

Insert country

Greece

Insert area

Omonia, Athens

Insert address

Agiou Konstantinou 16-18

The urban planner enters a specific address (e.g., Agiou Konstantinou 16-18). The interactive maps then zoom in to this location, allowing a detailed view of relevant metrics such as pollution risk, building height, heat traps and flood zones.

Agiou Konstantinou 16-18

Insert country

Greece

Insert area

Omonia, Athens

Insert address

Agiou Konstantinou 16-18

Statistics of the area

- Current $PM_{2.5}$: *5.7 μg/m³*
- Ideal $PM_{2.5}$: *≤5.0 μg/m³*

What-If scenario

Current class of building...

After entering the address, GaiaVision provides **detailed statistics** for the area, such as current $PM_{2.5}$ levels (5.7 μg/m³) compared to the ideal (≤5.0 μg/m³). Users can also explore '**What-If**' scenarios, including the current building class and potential improvements.

Agiou Konstantinou 16-18

Insert country

Greece

Insert area

Omonia, Athens

Insert address

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Statistics of the area

- Current $PM_{2.5}$: *5.7 μg/m³*
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What-If scenario

Current class of building...

A+/A
B
C/D
E/F
G

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What-If scenario

E/F ▶

Target class of building... ▶

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What-If scenario

E/F

Target class of building...

A+/A
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C/D
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Omonia, Athens, Greece

Menu Projects Maps

Result if the whole block acts similarly

Insert country

Greece

Insert area

Omonia, Athens

Insert address

Agiou Konstantinou 16-18

Statistics of the area

- Current $PM_{2.5}$: *5.7 μg/m³*
- Ideal $PM_{2.5}$: *≤5.0 μg/m³*

What-If scenario

E/F ▶

B ▶

Results

- **20–35% reduction** in the building's *operational* energy use and associated emissions
- **CO_2: ~20–33%** range
- local air-pollutant (NO_2 / PM) emissions: **~10–30%**

GaiaVision simulates the **impact of upgrading a building** from class E/F to B. The map dynamically shows how pollution risk **decreases** and operational energy use, CO_2 and local air pollutants are **reduced**.

FUTURE PLANS

Advanced AI Integration for Proactive Forecasting

Shift to proactive, forward-looking insights for long-term planning

IoT & Citizen Science Integration

Create a high-resolution, ground-truthed data network

Economic Analysis & Policy Module

Empower decision-makers with a clear understanding of the financial implications

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Make urban planning and client presentations more intuitive

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THANK YOU