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Communication of open data quality with map–centric dashboards

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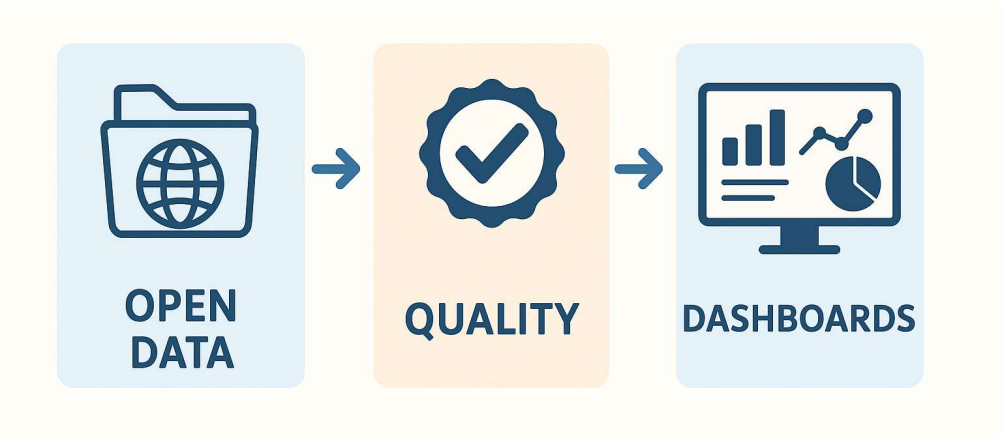
Open Data & Quality

- **Open Data**
- **Quality**
- **Geo-visual analytics**
- **Dashboard**
- **Map – centric dashboard**



Open Data

- **Road Network**
  - VGI
- **Buildings**
  - VGI
  - AI-generated
  - Authoritative data

OSM Roads

- Road network: worldwide and multi-scale
- Maximum zoom level (value 19): approximately a 1:1000 scale map.
- Data: lines in geographic coordinates (WGS84)
- Accuracy influenced by users and data collection methods (e.g. GPS, heads-up digitization, aerial and satellite images, georectification etc)
- Corresponding to objects tagged with the highway key (https://wiki.openstreetmap.org/wiki/Key:highway) downloaded from Bbbike (https://extract.bbbike.org)

Διαδρομή: Πέτρου Ράλλη (307311266)

Έκδοση #14

Updates @ Attica

Επεξεργάστηκε πάνω από 2 χρόνια πριν από Map-Finder

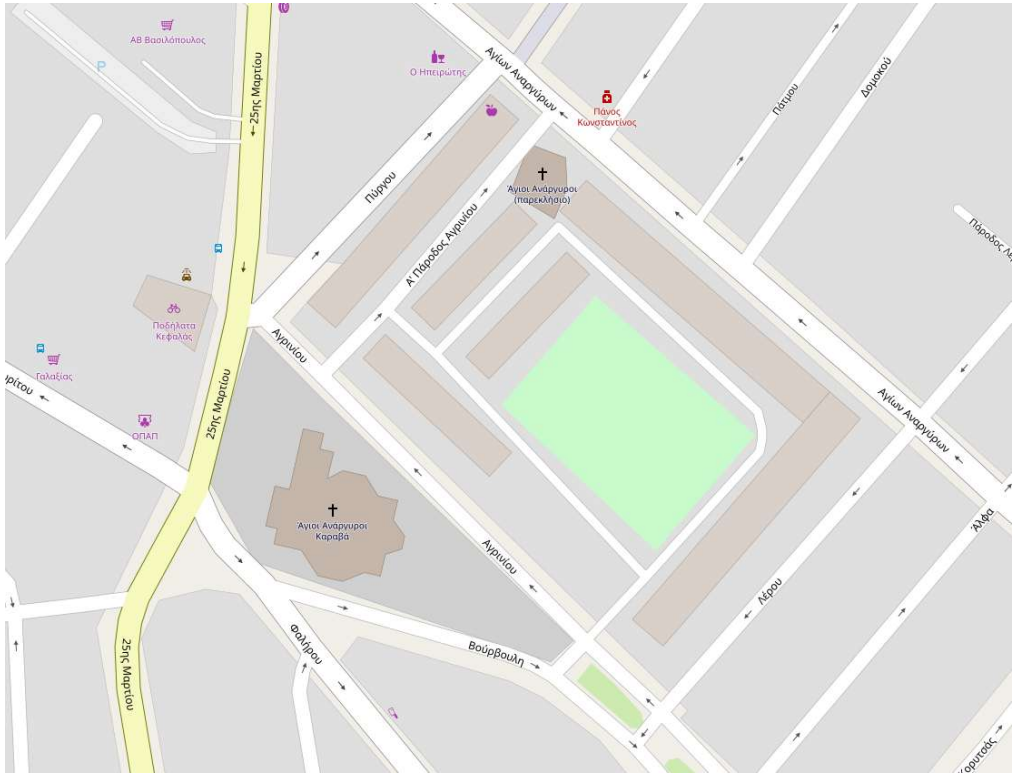
Ομάδα αλλαγών #103344970

Ετικέτες

highway	primary
int_name	Petrou Ralli
lanes	2
lit	yes
name	Πέτρου Ράλλη
oneway	yes
reg_ref	ΕΠ14
sidewalk	right
source:reg_ref	ΦΕΚ 47 Α/8.2.1956
surface	asphalt

OSM Roads Quality Assessment

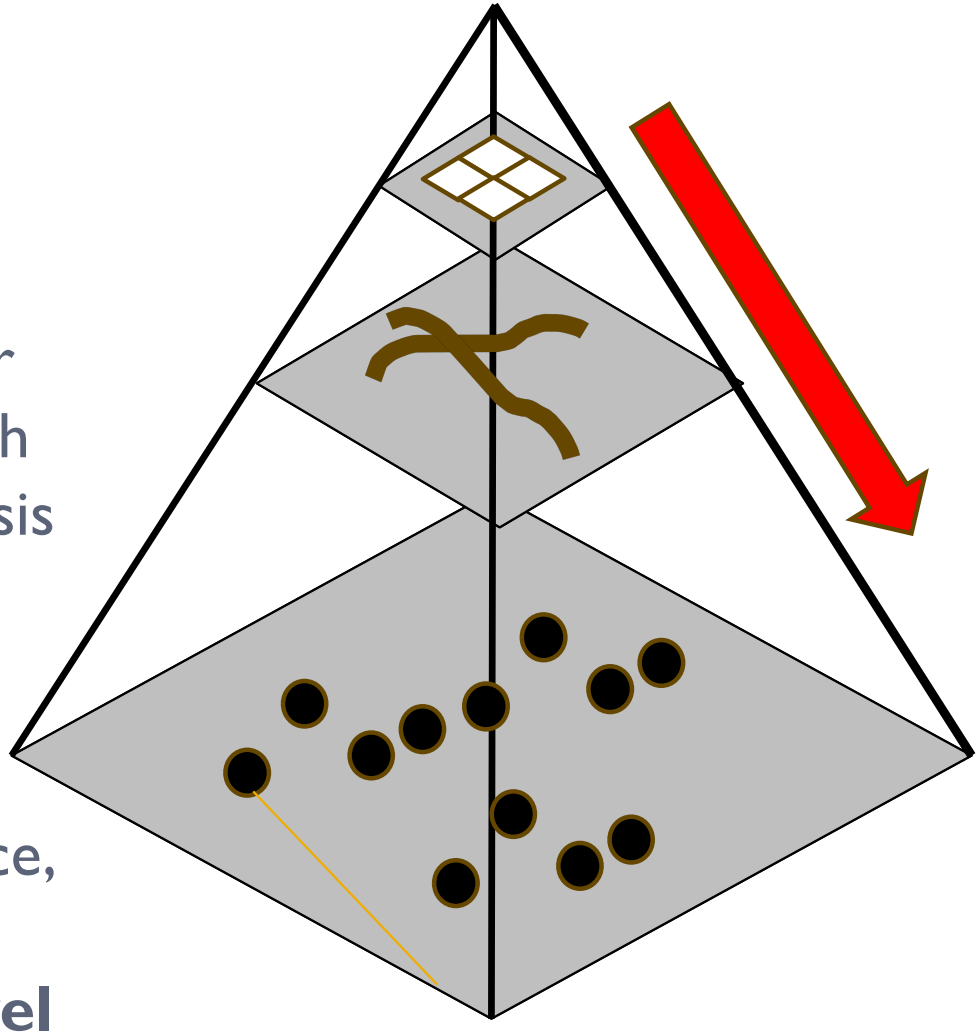
- External quality assessment – Positional Accuracy
- Comparison of VGI to an Authoritative Dataset
- OSM road network



- Hellenic Cadastre (HC)

User Needs - different scales/level of detail

- **OSM as a base map** in map composition: quality **at the grid cell level**
- OSM **as a road network source** for routing analysis or in combination with other thematic layers for spatial analysis or urban planning **at the line level**
- OSM **for large-scale uses**, e.g. network construction and maintenance, maps for autonomous driving, error distribution study **at the vertex level**



Positional Accuracy at different level of detail

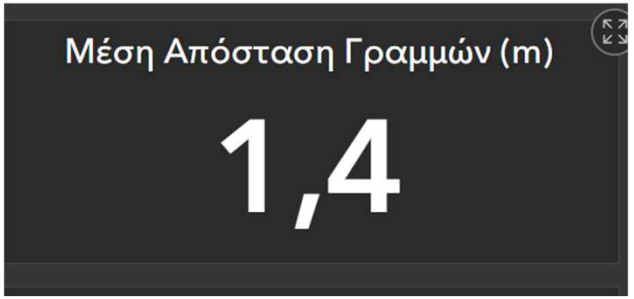
- At Feature level:
  - At the **vertex level**: **distance** of OSM **vertex** to the reference road network
  - At the **line level**: **average distance** for each **road line** based on vertices distances.

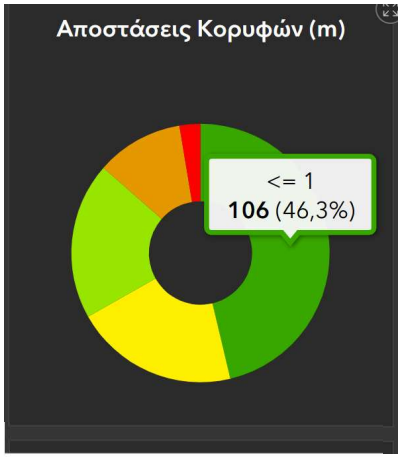
- At Grid level (cell 1km):
  - For each cell:
    - Average line distance
    - Percentage of OSM road length in reference data buffer zones, i.e. 1m, 2m, 3m

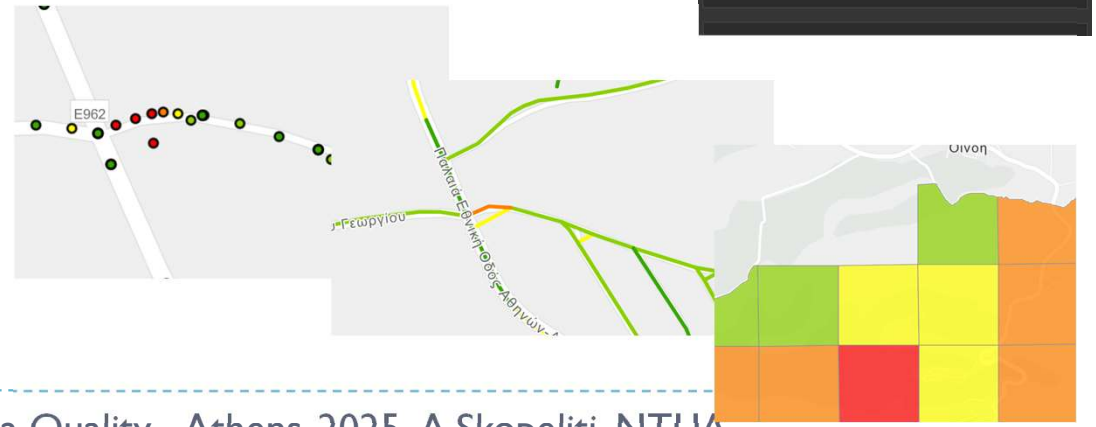
Quality Information in the Dashboard

For each municipality

- Text
  - Average **vertex** distance
  - Average **line** distance
  - Average **cell** distance
- Graphs
  - Pie Chart: Distribution of **vertex** distance
  - Pie Chart: Distribution of average **line** distance
  - Pie Chart: Distribution of average **cell** distance
- Maps
  - **Vertex** distance
  - Average **line** distance
  - Average **cell** distance

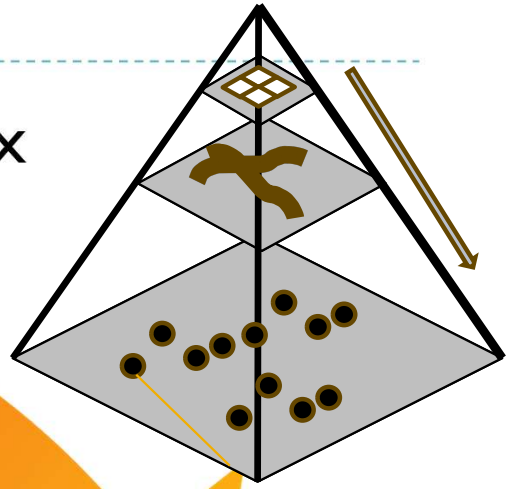






Visualization at different scales/level of detail

Detail Increases:
Grid < Line < Vertex



Scale Increases
Zoom Increases
Granularity Increases

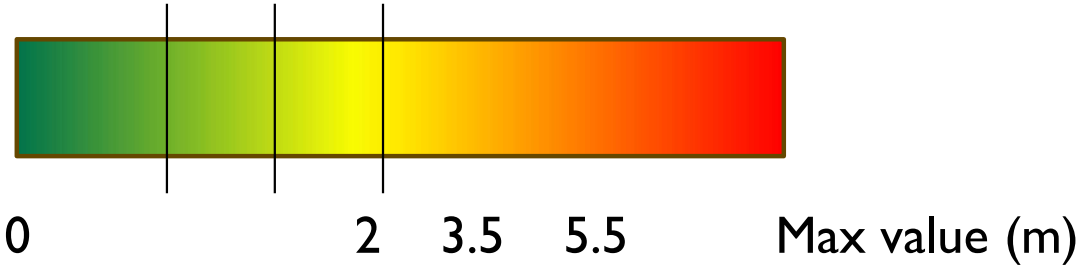
Symbols & Visualization I

- Positional Accuracy visualization is implemented by overlaying symbols on the map,
- Simultaneous display of OSM data and quality
- Point, line, and polygon symbols in relation to scale
- Visual variables:
  - Colour:
  - A diverging color scheme from green to red is used for point, line, and polygon symbols.

  - Transparency:
  - Positional accuracy at the grid cell level is portrayed with transparency

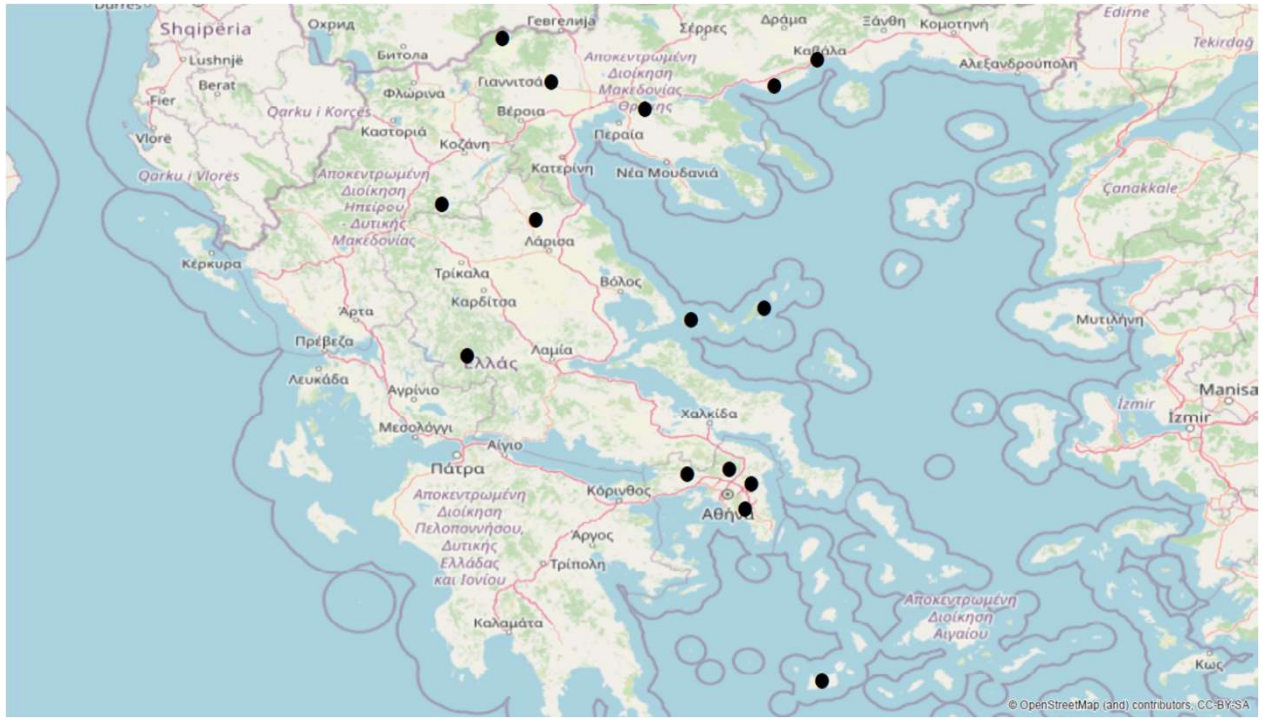
Symbols & Visualization II

- Data values classification for symbolization
- Focus on user needs in the city context
- Critical values - Thresholds
  - 2 m - the average sidewalk width
  - 3.5 m - the average street lane width
  - 5.5 m – addition of the sidewalk width and a single-lane street



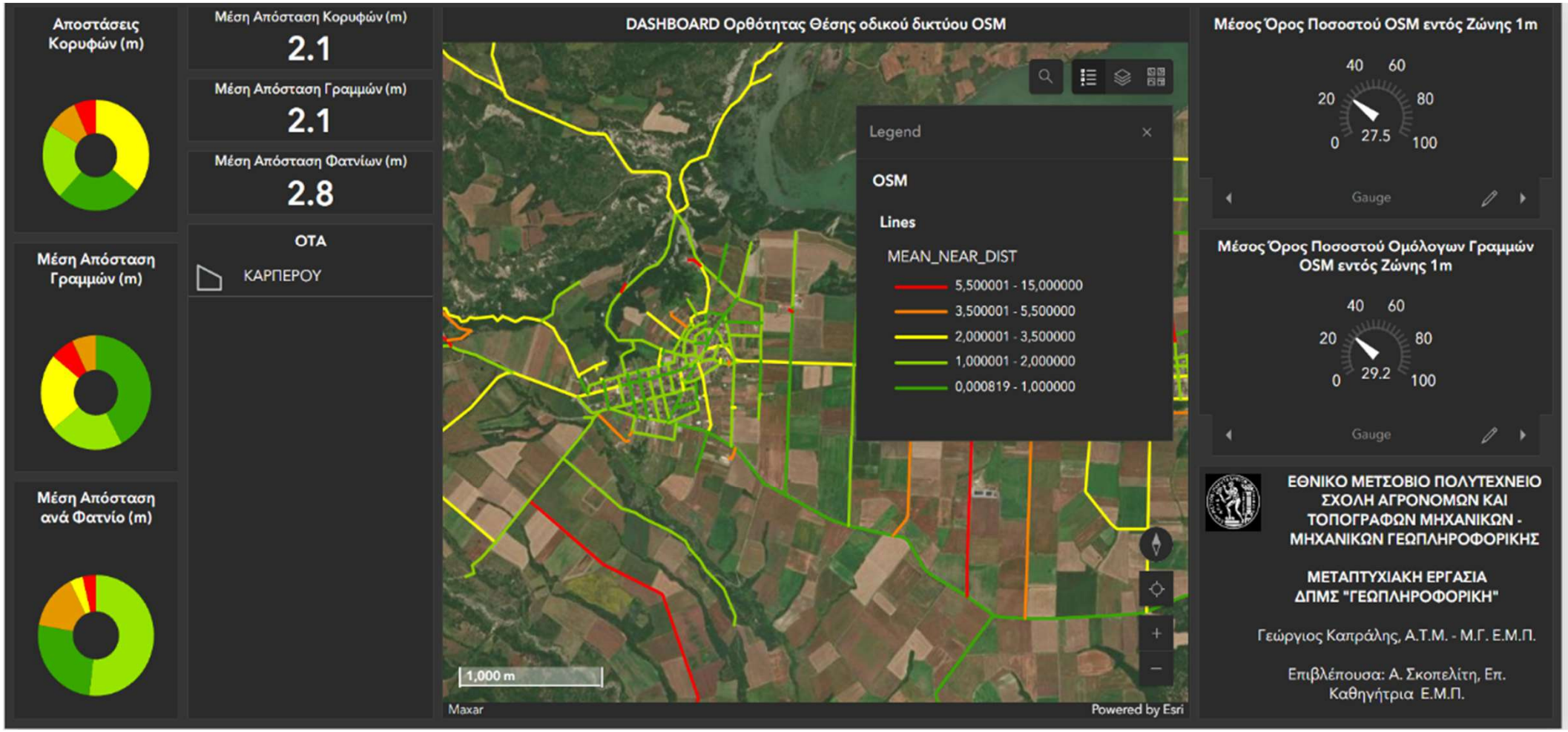
OSM Roads Case study

- The study area includes 15 municipalities in Greece with a total area of 1512.61 km ^{2}
- Criteria: Elevation, Slope, Population Density, Poverty level



- Karperou
- Vorinos
- Karpenisi
- Pentelis
- Argyropoulos
- Skiathos
- Kropia
- Giannitsa
- Milos
- Mandra
- Kavala
- Alonissos
- Chortiatis
- Akropotamos
- Acharnes

OSM Road Positional Accuracy Dashboard



Open Buildings I

- **VGI:** OSM buildings corresponding to objects tagged with the building key (https://wiki.openstreetmap.org/wiki/Key:building) downloaded from Bbbike (https://extract.bbbike.org)
- **Machine Learning**: Microsoft's Global **ML Building** Footprints are generated by Deep Neural Networks (DNNs) on Bing Maps high-resolution satellite imagery acquired between 2014 and 2023 (https://github.com/microsoft/GlobalMLBuildingFootprints).
- **Authoritative dataset:** Digital Building Stock Model (**DBSM**) was released in 2023 by the Joint Research Centre (JRC) of the European Commission. It is a pan-European dataset produced from the hierarchical conflation of three input datasets: OSM, MS and the European Settlement Map
- The four open building datasets analyzed in this work (OSM, EUBUCCO, MS and DBSM) were downloaded in **October 2024**.

Open Buildings II

DATA	TYPE	COMPLETENCE	ACCURACY	UPDATED	
DBSM	Authoritative	MODERATE	HIGH	LOW	
OSM	VGI	LOW	MODERATE	MEDIUM	
ML Buildings	AI	HIGH	LOW	HIGH	

Measures I

At the building level

- Building outline
- Geometric quantities e.g. area

For an administrative division or area

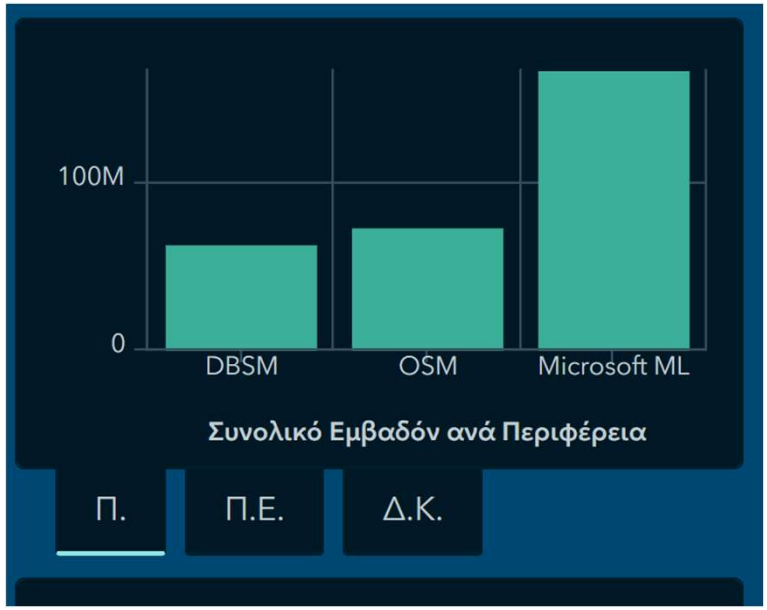
- Total area of buildings
- Average building area
- Percentage of area covered by buildings

User Needs - different scales/level of detail

- For the administrative divisions of Greece
  - Regions (13)
  - Regional units (51)
  - Municipalities (332)
- Additional spatial units based on hexagonal grids of 10 km^2, 5 km^2 and 1 km^2

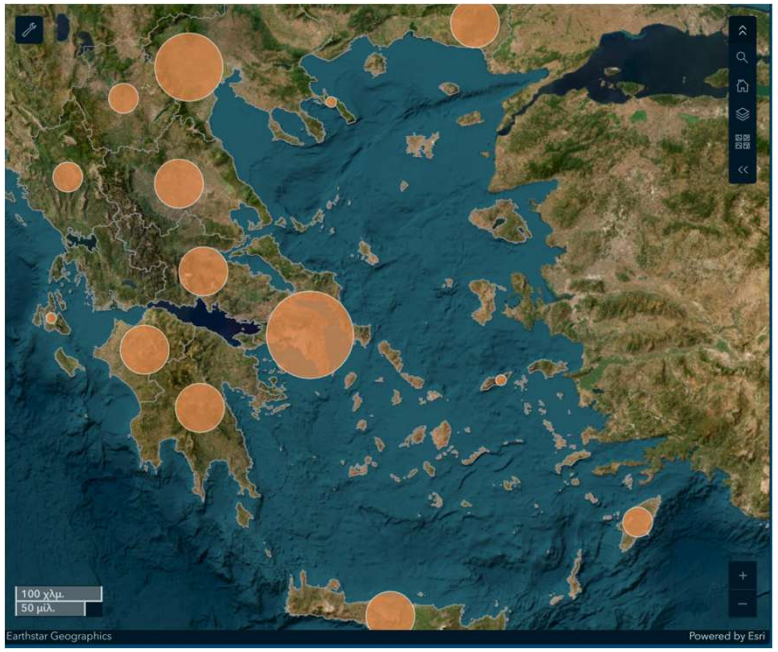
Quality Information in the Dashboard I

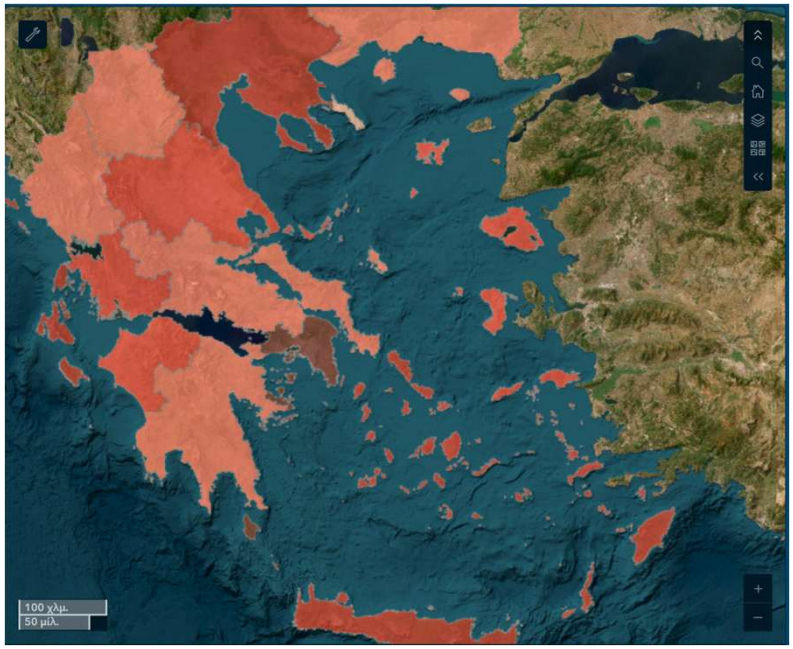
- Graphs - Bar Chart
  - For each Region / Regional Unit / Municipality
    - Total Building Area for the three datasets
    - Average Building Area for the three datasets
    - Percentage of area covered by buildings for the three datasets



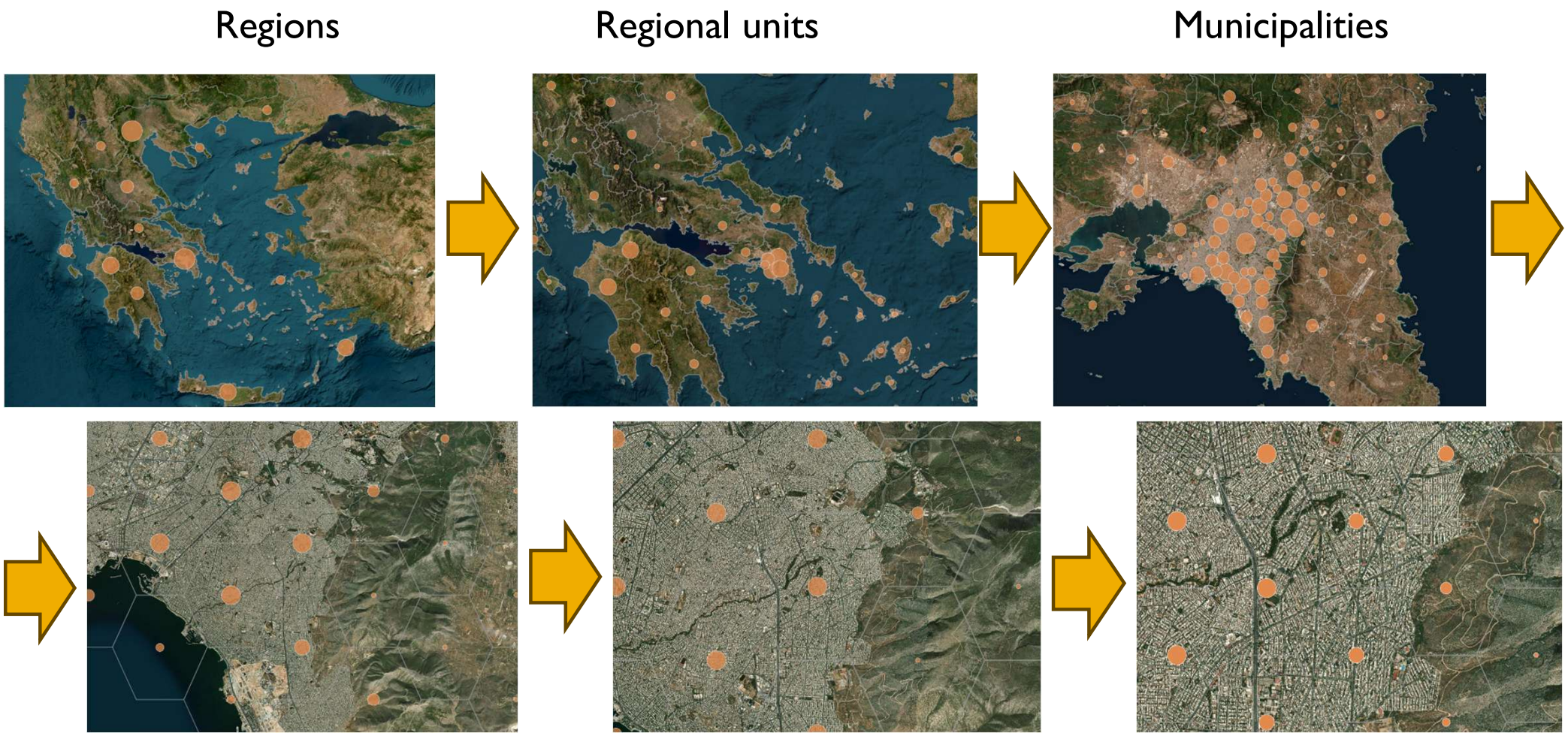
Quality Information in the Dashboard II

- Maps
  - For each Region / Regional Unit / Municipality/ Spatial Unit
    - Total Building Area
    - Average Building Area
    - Percentage of area covered by buildings





Multiscale Assessment and Visualisation I

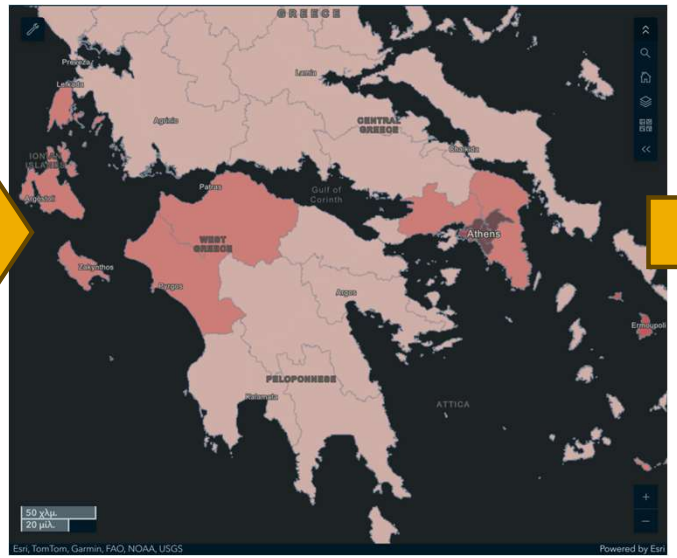


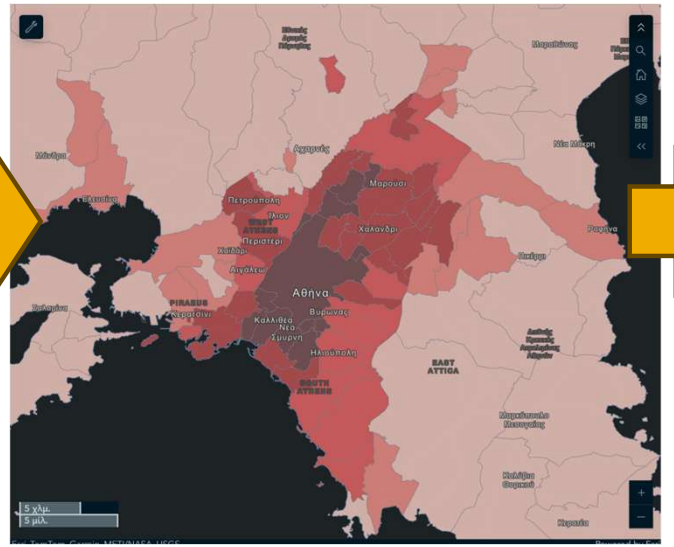
Multiscale Assessment and Visualisation II

Regions

Regional units

Municipalities



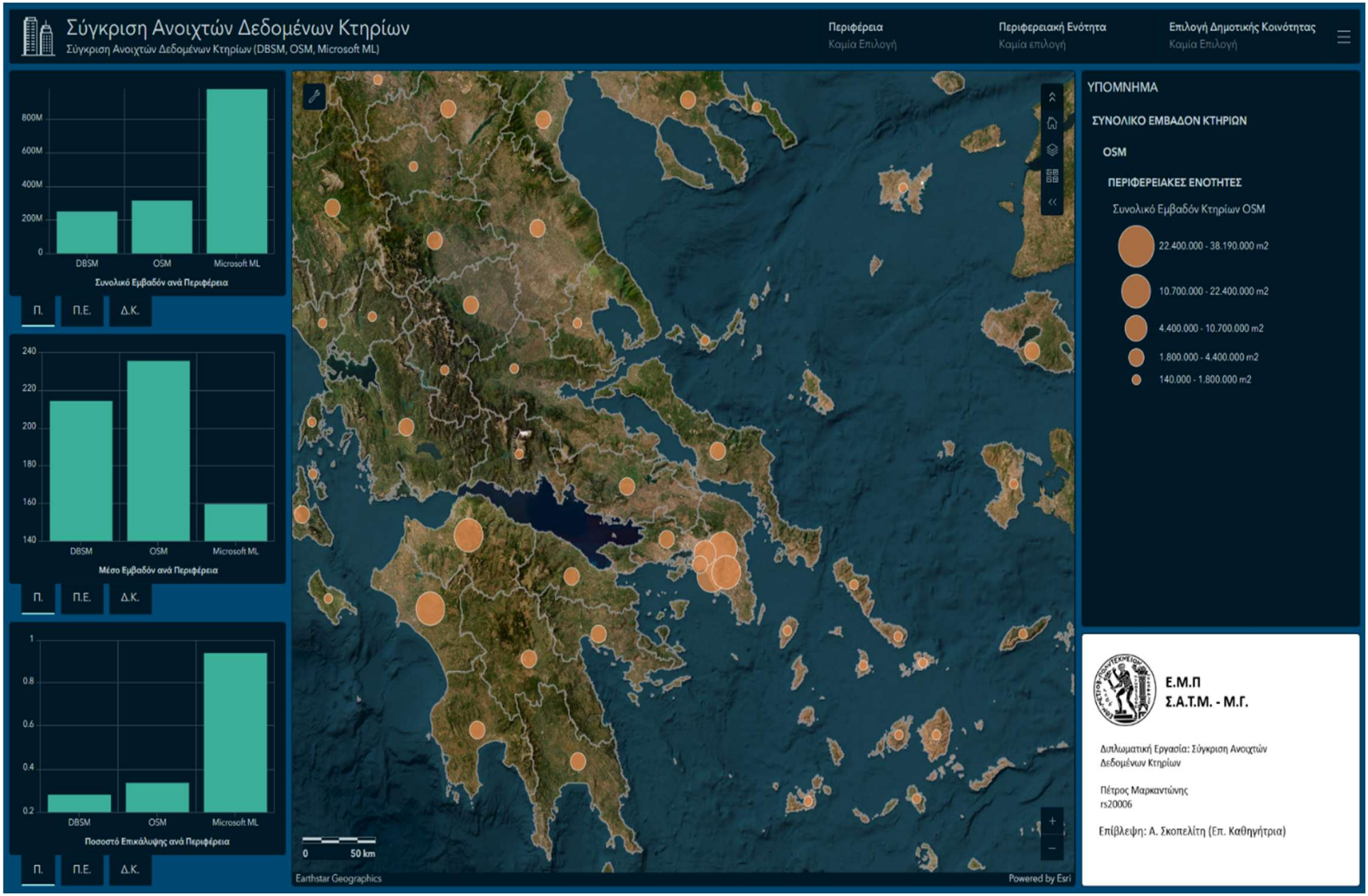


Grid 10 km^2

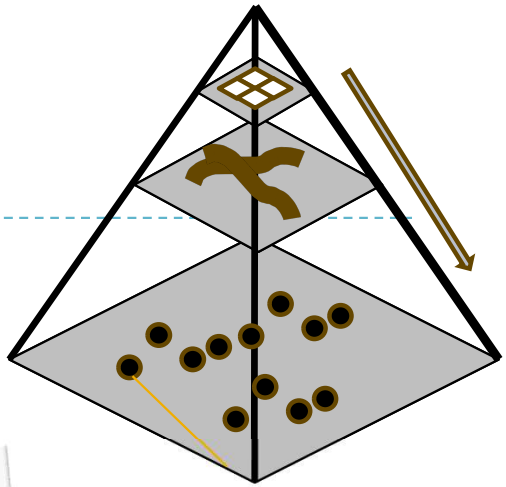
Grid 5 km^2

Grid 1 km^2

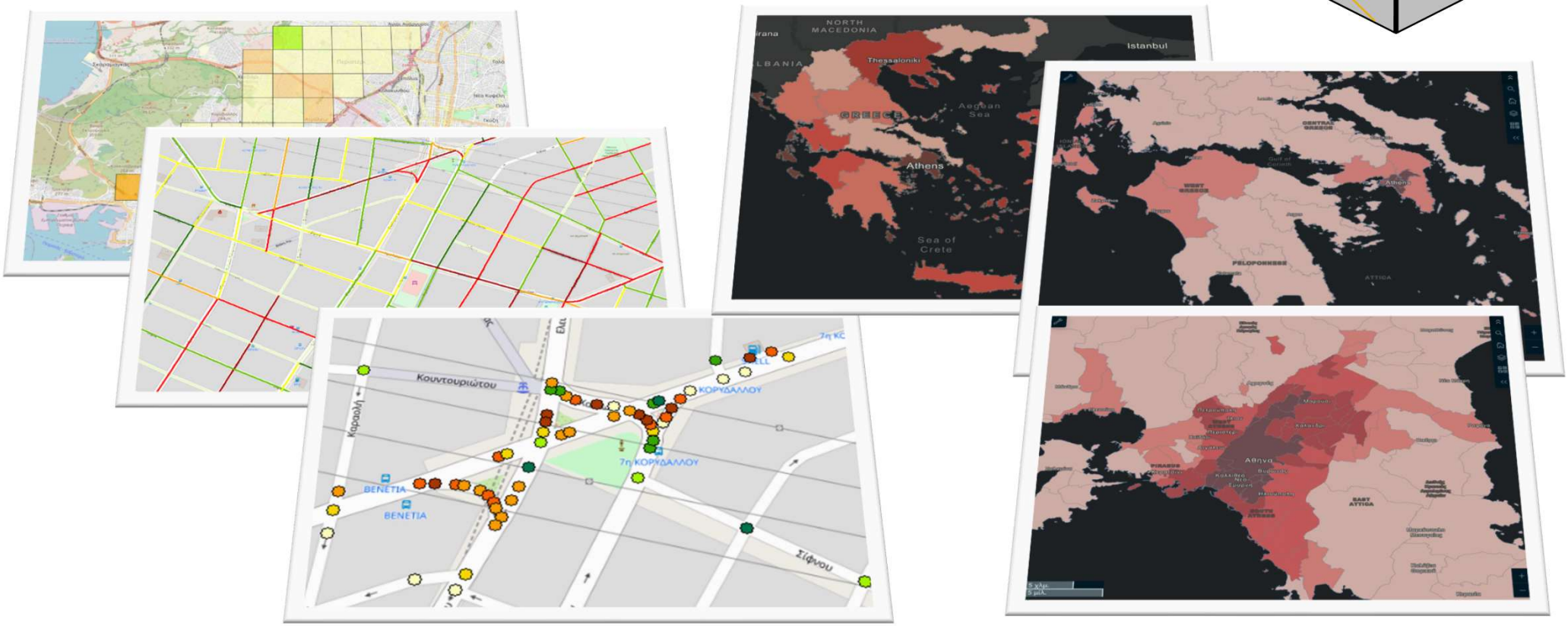
Open Buildings Quality Dashboard



Conclusions & Plans



- Multiscale quality assessment and visualization
- Address various user needs in terms of detail level



- Survey on users' ability to obtain information from the multiscale assessment and visualization