

The Portal Component, Strategic Perspectives and Review of Tactical plans to implement the IAUC Initiative, WUDAPT ; a worldwide urban database for climate and environmental modeling

Jason Ching

Institute for the Environment at UNC, Chapel Hill, NC, USA



Collaborators

Gerald Mills, University College, Dublin

Linda See, IIASA

Benjamin Bechtel, U of Hamburg

Johannes Feddema, U of Kansas

Adel Hanna, UNC-IE

Grega Milcinski, Sinergise

Alberto Martilli, CIEMAT

Oscar Brousse, U of Strasbourg

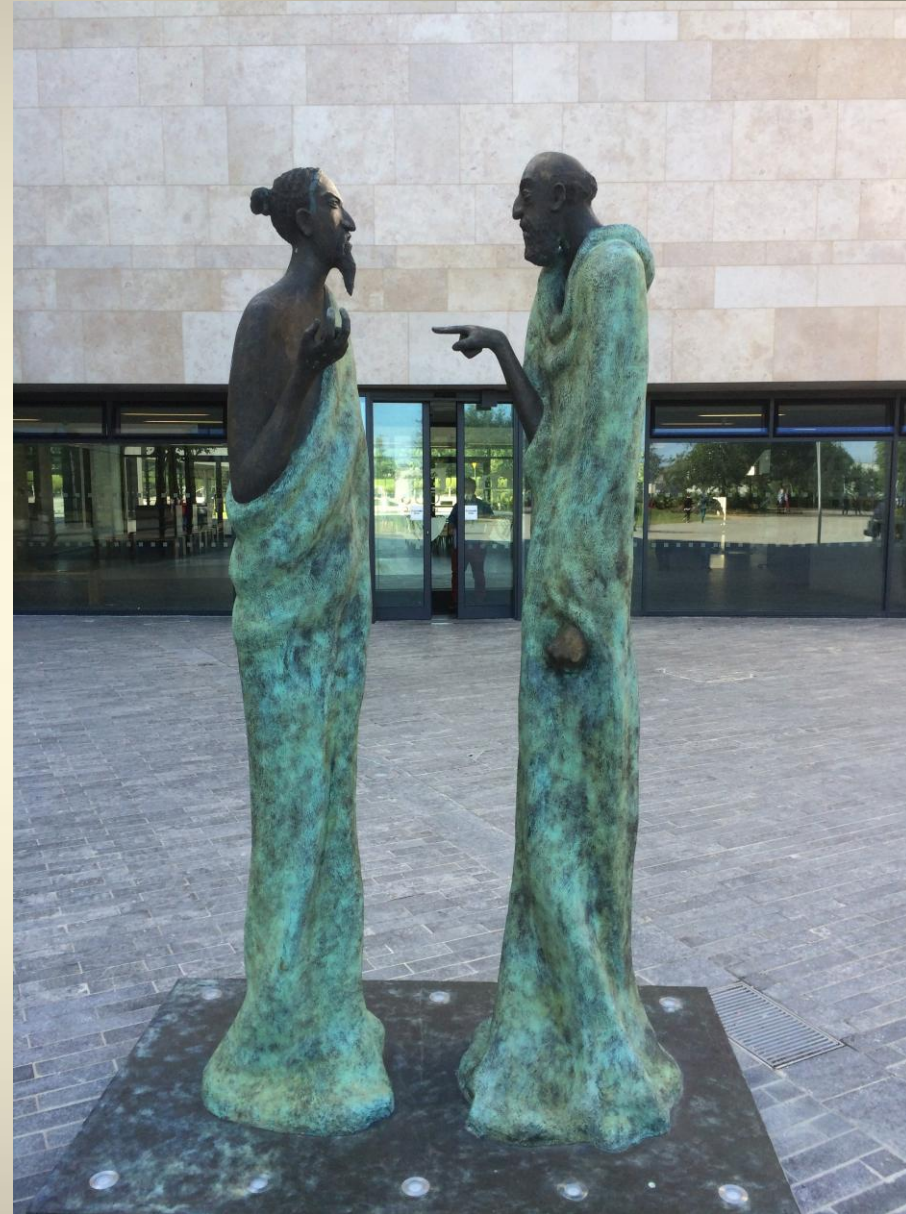
Fei Chen, UCAR/RAL

Sue Grimmond, U of Reading

Ian Stewart, U of Toronto

Xuemei Wang, Sun Yet Sen U

Chandana, Mitra (Auburn, U)



WUDAPT's critical elements

Prototype Census of Cities and Collaborative Partnerships

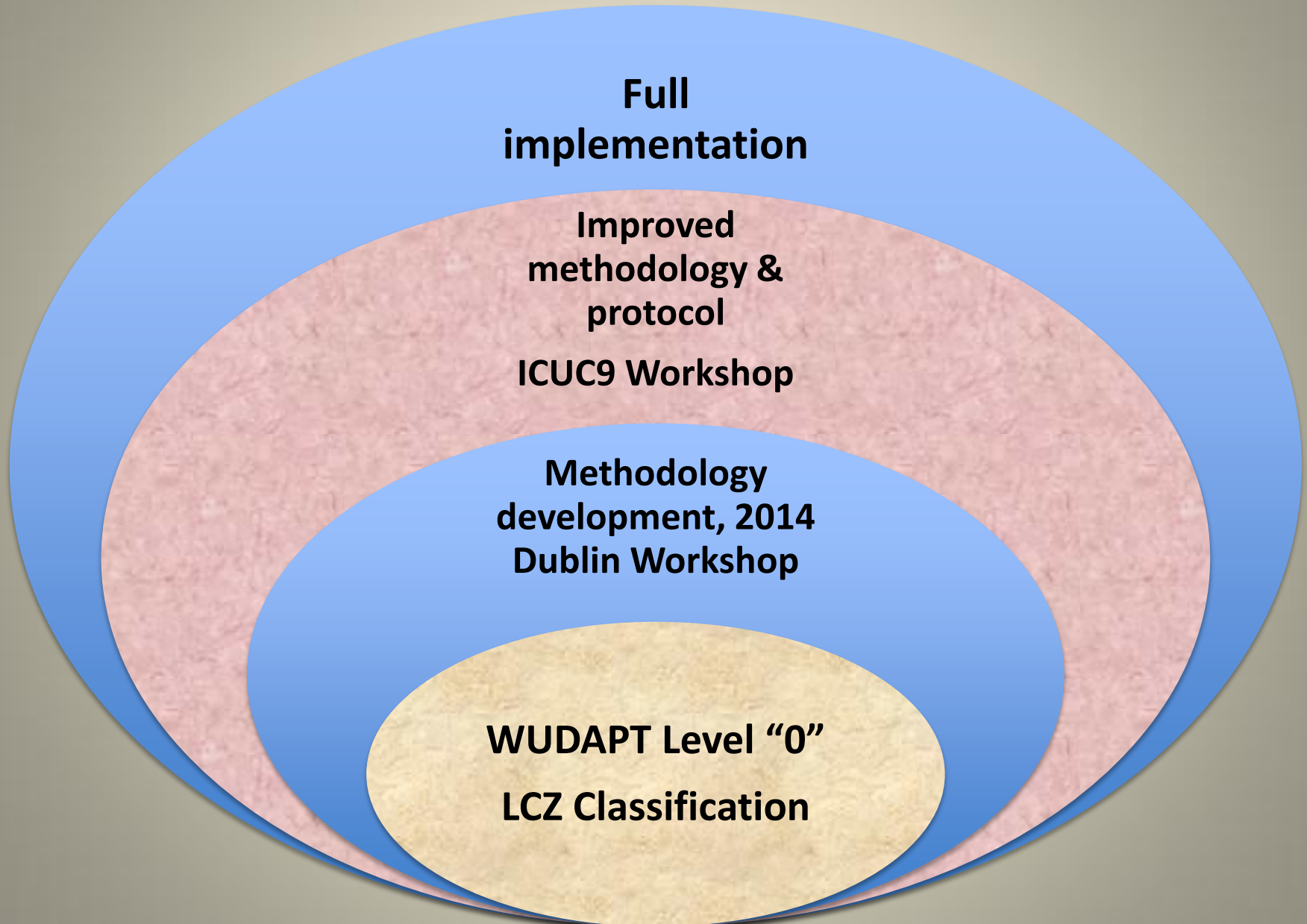
**Prototype Census of Cities:
Remote sensing
automation methodology
generates Level "0" LCZs**

**Expert system incorporates
urban- GeoWIKI to produce
Level "1 & 2" UCPs and
MMDs**

**Full implementation by
collaborative partnerships
between IAUC and engaged
technical and geopolitical
communities**

**Create and establish
customized Portals**

Progressive Staging of WUDAPT Level “0”



16 cities WUDAPT Level "0" generated at 2014 Workshop in Dublin Ireland

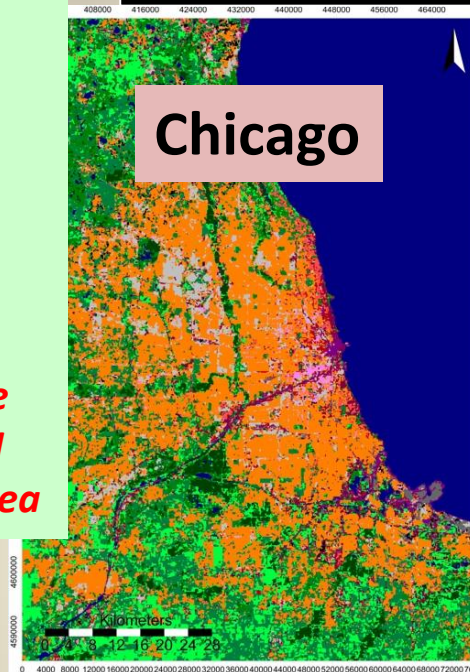
Rich diversity and complex distributions of climate zones observed within each city

LCZ signature palate different and unique to each city

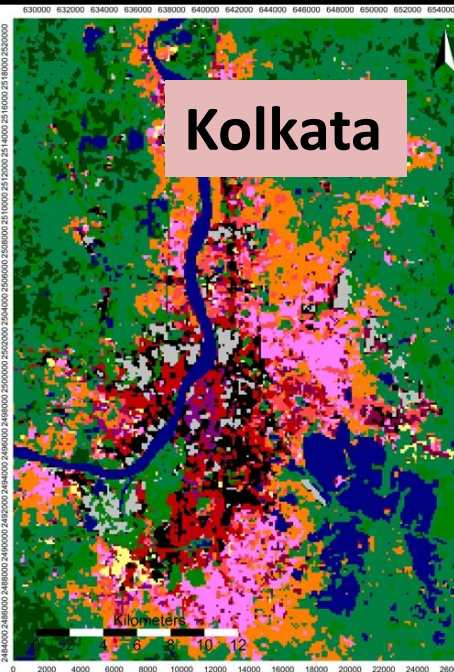
Distributions of "Form and Function" modeling parameters produce unique climate and meteorological responses to each urban area

LCZ Classes- Each urban area is unique

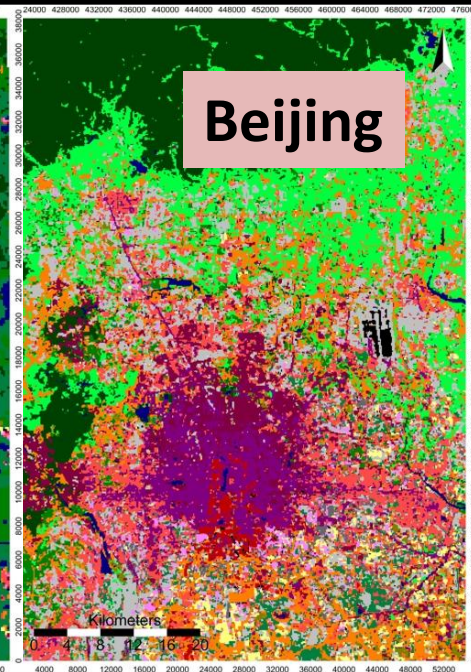
Chicago



Kolkata



Beijing

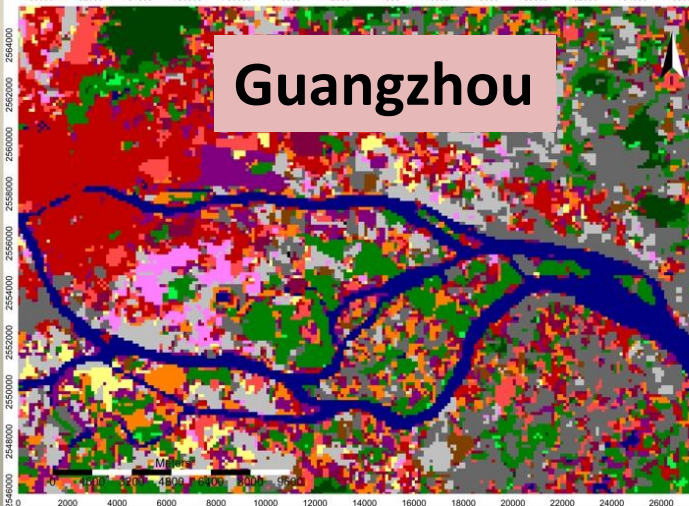


LCZ Classes

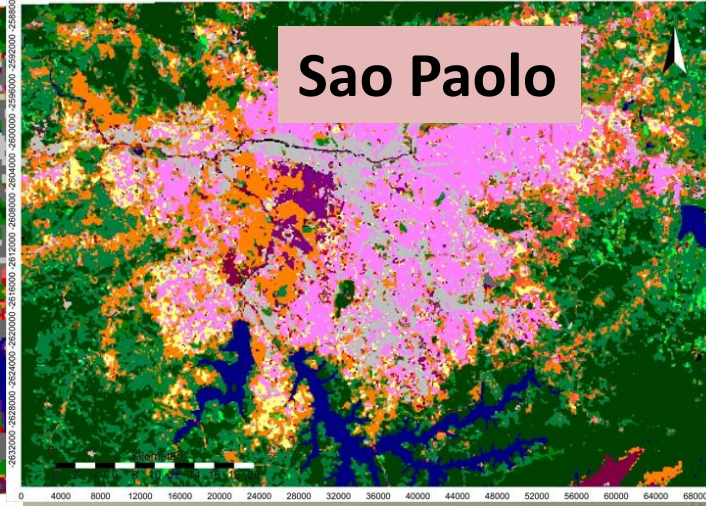
Legend



Guangzhou



Sao Paulo



Comprehensive Implementation Stages

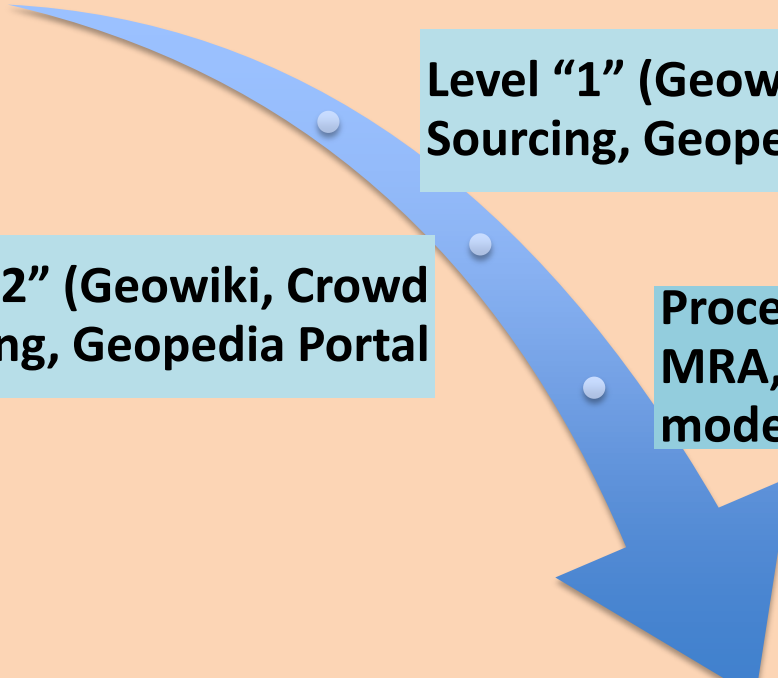
**Level “0”, Data Portal, Website,
Initial model testing**

**Level “1” (Geowiki, Crowd
Sourcing, Geopedia Portal**

**Level “2” (Geowiki, Crowd
Sourcing, Geopedia Portal**

**Processing Tools,
MRA, Growth
models**

**Portal Developments,
Applications, Refinements**



WUD---APT

World Urban Database

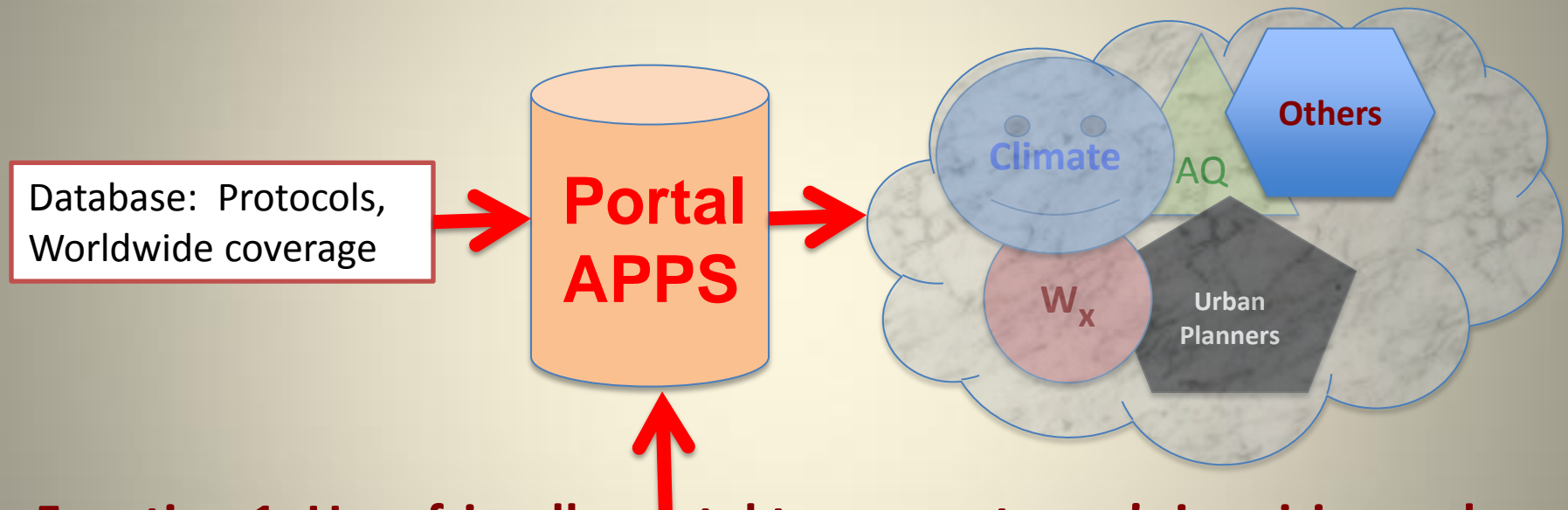
- Level “0”
 - Census of Cities as Local Climate Zone LCZ atlases
 - All world’s major urban areas
- Level “1” Form and function data “FIT FOR PURPOSE”
Multi-scale “fine to meso”
- Community-based and accessible
- Evolutionary and dynamic

Access Portal Tools

- Database Functionalities:
 - Collection,
 - Processing,
 - Validation,
 - Storage and Retrievals
- APPS Functionalities
 - Generic and rudimentary
 - WPS/WRF Interface
 - Scale dependent analyses
 - Modeling apps
 - Base and projections

Conceptual Design Functionalities of WUDAPT

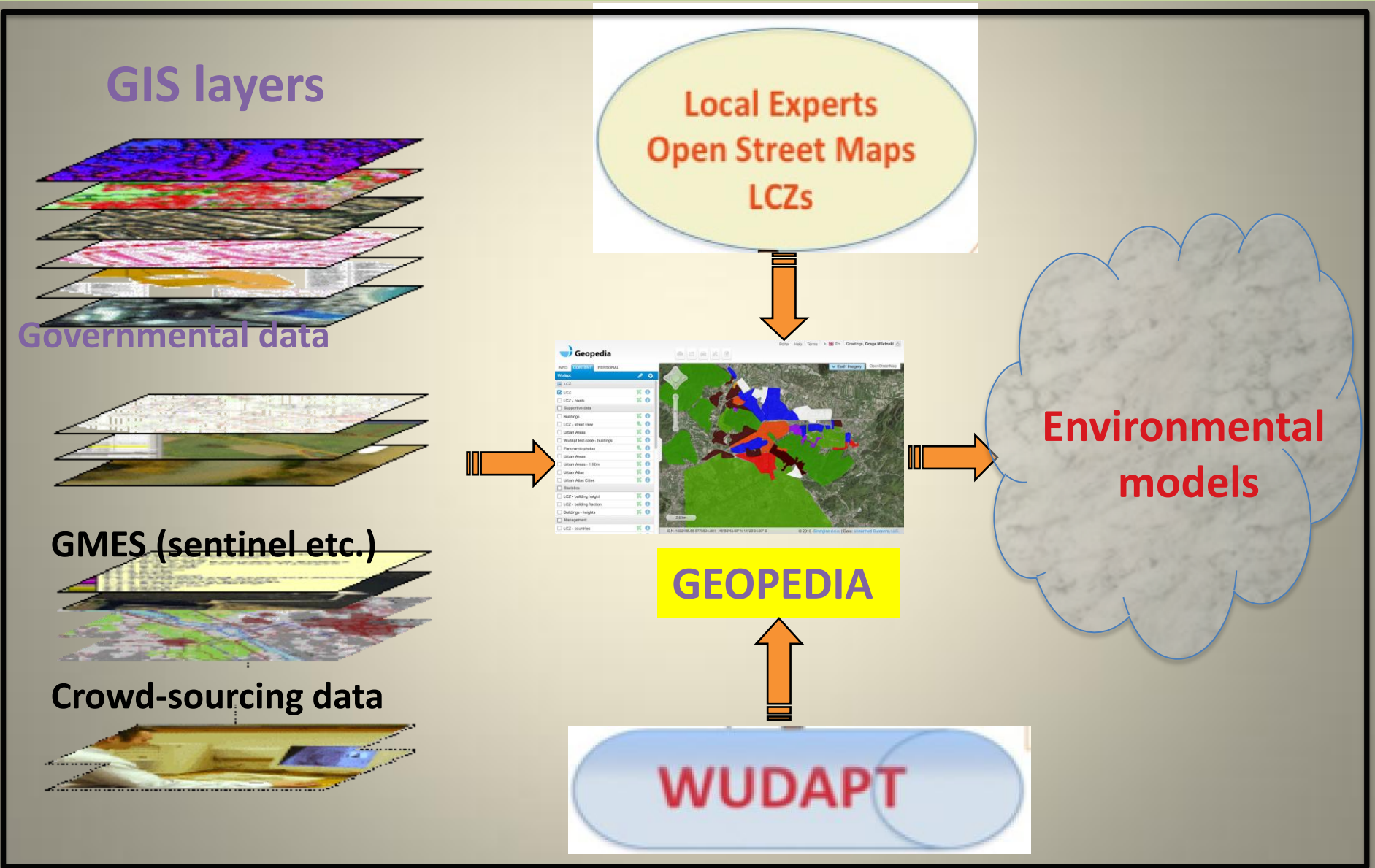
- **Open source** community framework
- **Worldwide coverage** of urban areas, all climate zones



- **Function 1:** User friendly portal to support user's inquiries and search inclusive of structured and unstructured information and supporting metadata- Ingestible to variety of user communities
- **Function 2:** Custom applications keyed to addressing variety of community needs

The diagram illustrates the data integration workflow for Geopedia. On the left, four data sources are shown as stacked layers: **GIS layers** (top, with various colored maps), **Governmental data** (second layer, showing a city map), **GMES (sentinel etc.)** (third layer, showing satellite imagery), and **Crowd-sourcing data** (bottom, showing a 3D model of a building). Arrows from these layers point towards the center. In the center, a screenshot of the **Geopedia** web interface is shown, displaying a map with various data layers and a sidebar with a list of layers. Above the Geopedia interface is a yellow oval containing the text **Local Experts**, **Open Street Maps**, and **LCZs**. Below the Geopedia interface is a blue rounded rectangle containing the text **WUDAPT**. Arrows point from the yellow oval and the WUDAPT rectangle towards the Geopedia interface. To the right of the Geopedia interface is a large, light blue cloud shape containing the text **Environmental models**. An arrow points from the Geopedia interface towards the cloud.

The diagram illustrates the data integration workflow for Geopedia. On the left, a vertical stack of five layers represents different data sources: 'GIS layers' (top, purple), 'Governmental data' (second, blue), 'GMES (sentinel etc.)' (third, green), 'Crowd-sourcing data' (fourth, yellow), and 'WUDAPT' (bottom, blue). Arrows from these layers point towards the center. In the center, a screenshot of the Geopedia web interface shows a map with various colored overlays and a sidebar with a list of data layers. Above the Geopedia interface is a yellow oval containing the text 'Local Experts', 'Open Street Maps', and 'LCZs'. Below the Geopedia interface is a blue rounded rectangle containing the text 'WUDAPT'. Arrows from these two sources point towards the Geopedia interface. To the right of the Geopedia interface is a large, light blue cloud shape containing the text 'Environmental models'. An arrow points from the Geopedia interface towards this cloud.



The diagram illustrates the WUDAPT (World Urban Database and Populations Projection Tool) framework, which integrates various data sources to create urban data layers for modeling.

Data Sources (Left Side):

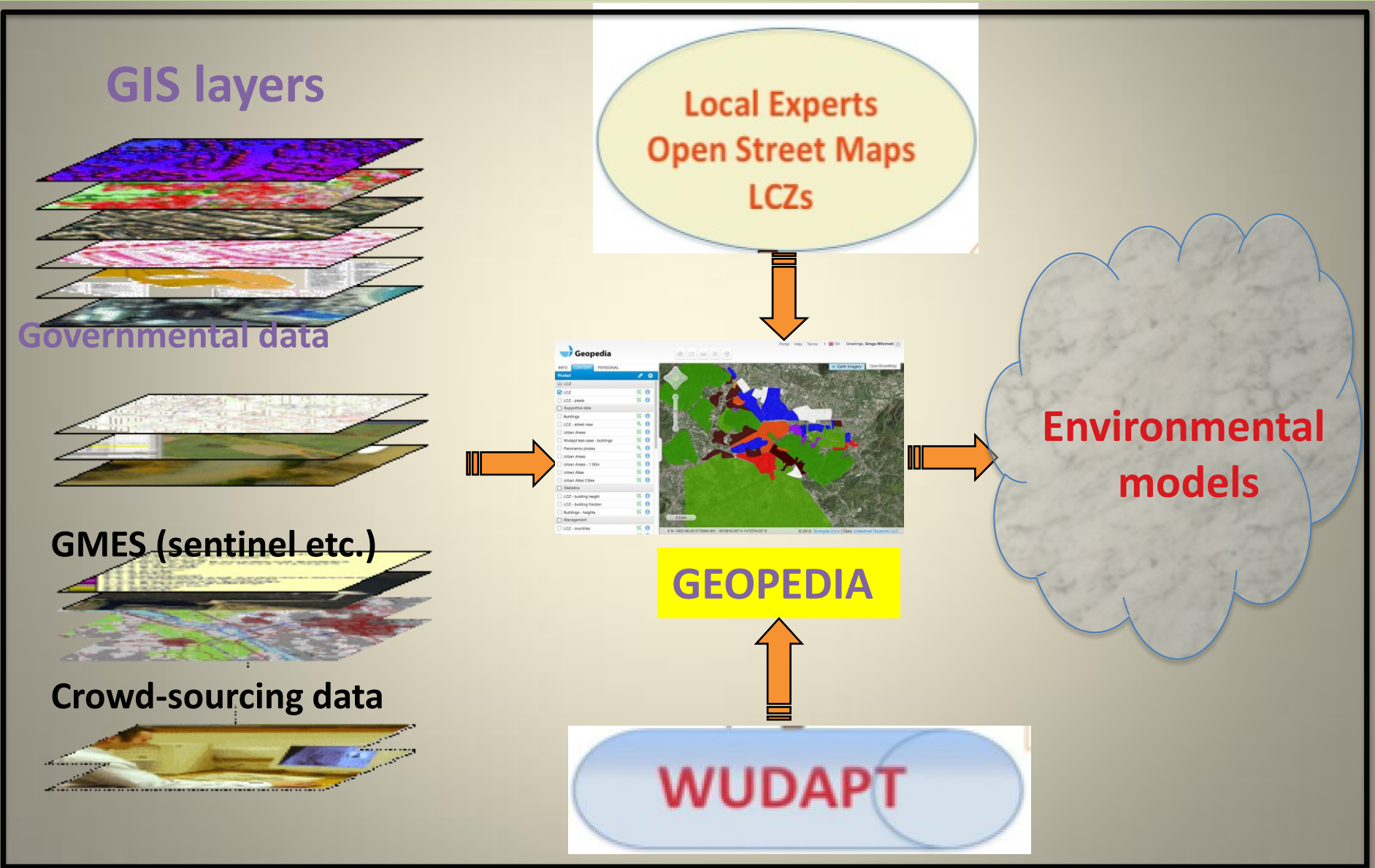
- GIS layers:** Represented by a stack of four colored layers (blue, green, yellow, red).
- Governmental data:** Represented by a stack of three layers (blue, green, yellow).
- GMES (sentinel etc.):** Represented by a stack of three layers (blue, green, yellow).
- Crowd-sourcing data:** Represented by a single layer (blue).

Data Integration (Center):

- Local Experts, Open Street Maps, LCZs:** These data sources feed into the **Geopedia** platform.
- Geopedia:** A central platform that integrates data from various sources, including **WUDAPT** (World Urban Database and Populations Projection Tool) and **Local Experts**.
- WUDAPT:** A platform that provides data to **Geopedia**.

Output (Right Side):

- Environmental models:** The final output of the framework, represented by a cloud shape.



The diagram illustrates the WUDAPT (World Urban Dynamics Analysis Platform Tool) framework, which integrates various data sources to create environmental models for urban planning.

Data Sources (Left Side):

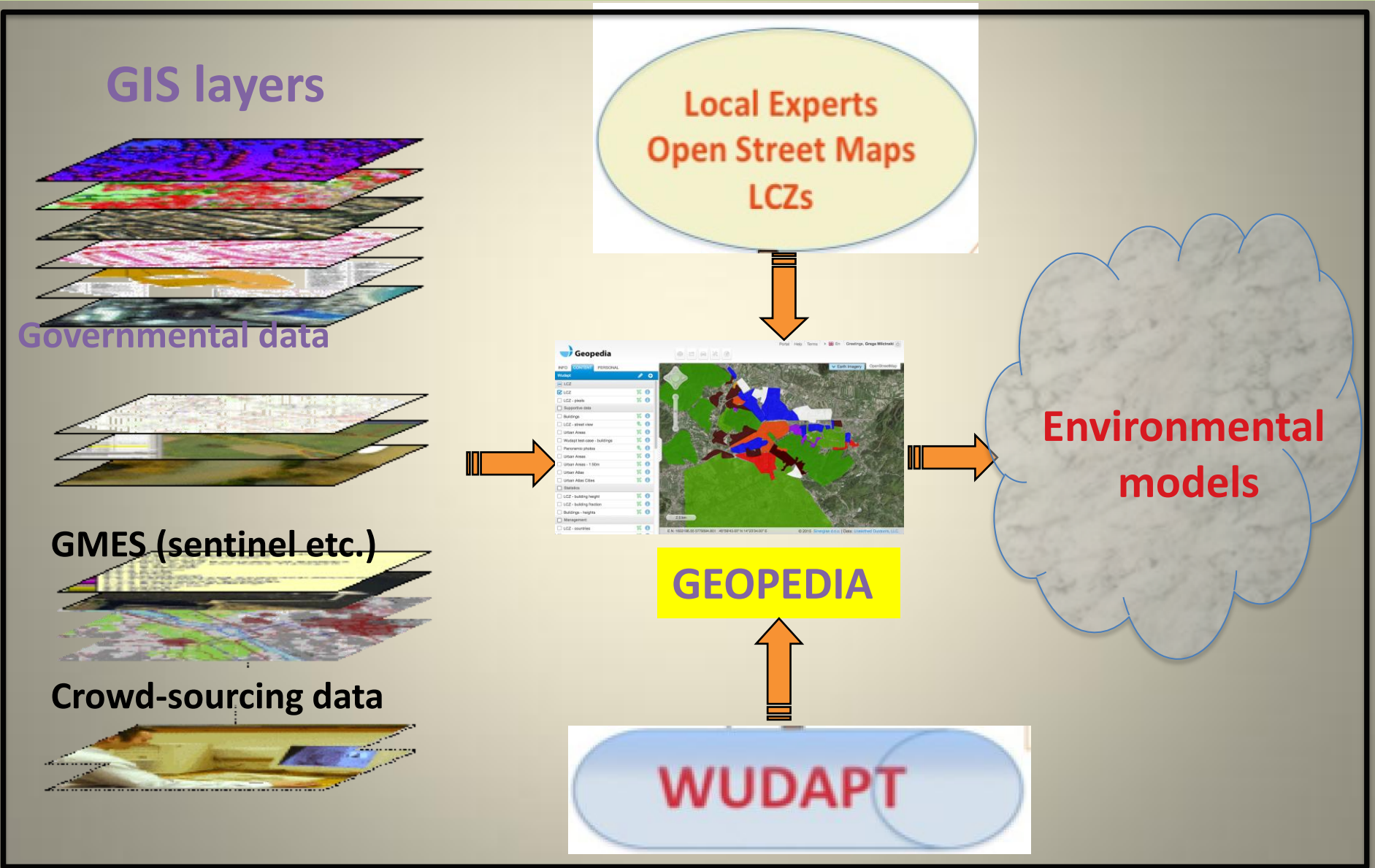
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Output (Right Side):

- Environmental models:** The final output of the framework, represented by a cloud-like shape.



The diagram illustrates the WUDAPT (Web-based Urban Dynamics Analysis Platform Tool) framework. It shows a central 'Geopedia' interface receiving input from various data sources and outputting to 'Environmental models'.

Data Sources (Left):

- GIS layers:** Represented by a stack of four colored layers (blue, green, red, yellow).
- Governmental data:** Represented by a stack of three layers (white, green, brown).
- GMES (sentinel etc.):** Represented by a stack of three layers (yellow, green, brown).
- Crowd-sourcing data:** Represented by a single layer (yellow).

Data Sources (Top):

- Local Experts**
- Open Street Maps**
- LCZs**

Central Interface:

- Geopedia:** A screenshot of the Geopedia web interface showing a map with various layers and a sidebar with a list of layers (e.g., LCZ, buildings, roads, etc.).
- GEOPEDIA:** A yellow box with the word 'GEOPEDIA' in blue text, positioned below the screenshot.

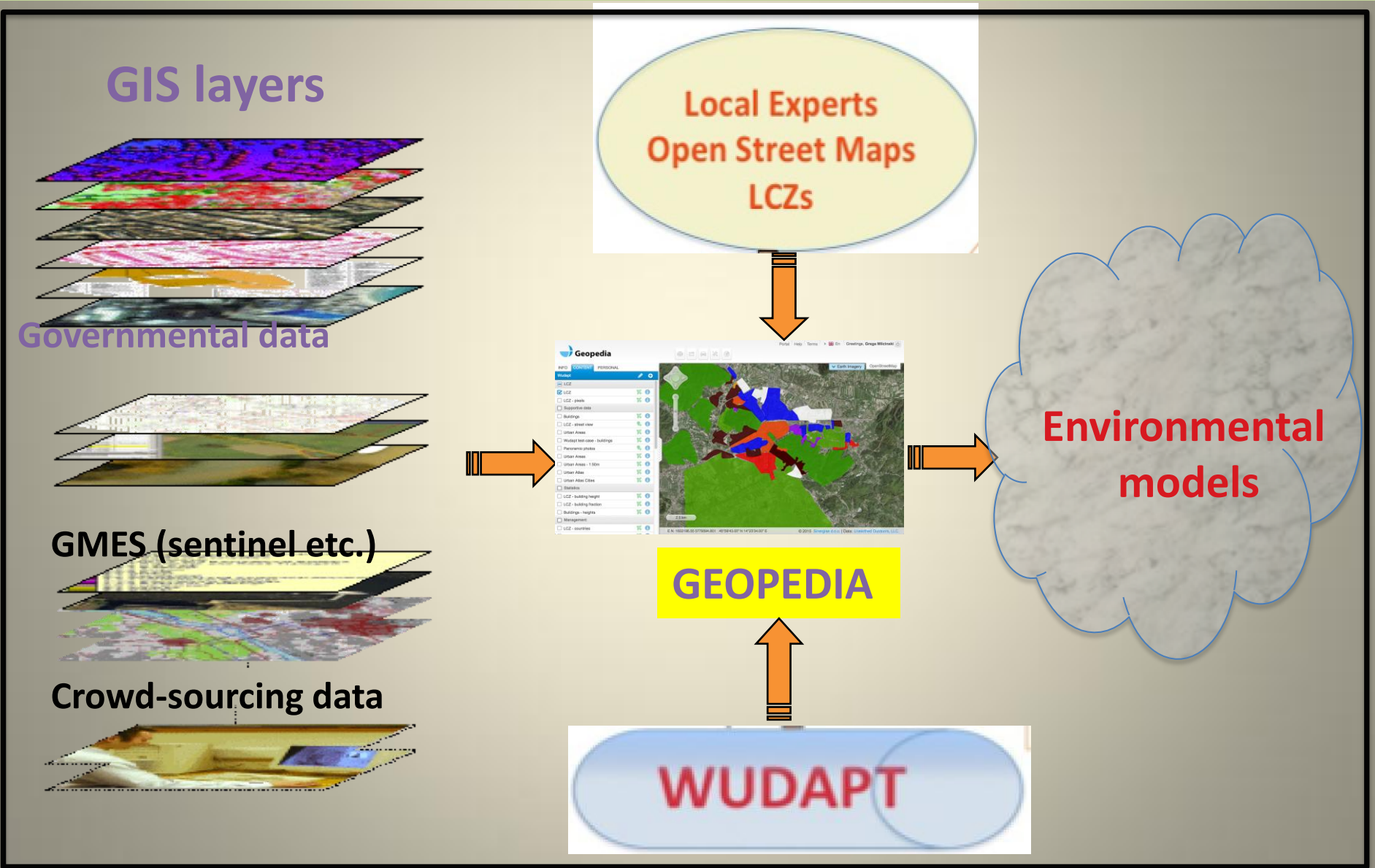
Data Source (Bottom):

- WUDAPT:** A blue box with the word 'WUDAPT' in red text, positioned at the bottom of the diagram.

Output:

- Environmental models:** A cloud-like shape on the right containing the text 'Environmental models' in red.

Flow: Arrows indicate the flow of data from the sources into the Geopedia interface, and from the Geopedia interface into the Environmental models.



The diagram illustrates the WUDAPT (Web-based Urban Dynamics Analysis Platform Tool) framework. It shows a central 'Geopedia' interface receiving input from various data sources and outputting to 'Environmental models'.

Data Sources (Left):

- GIS layers:** Represented by a stack of four colored layers (blue, green, red, yellow).
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Data Sources (Top):

- Local Experts**
- Open Street Maps**
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Central Interface:

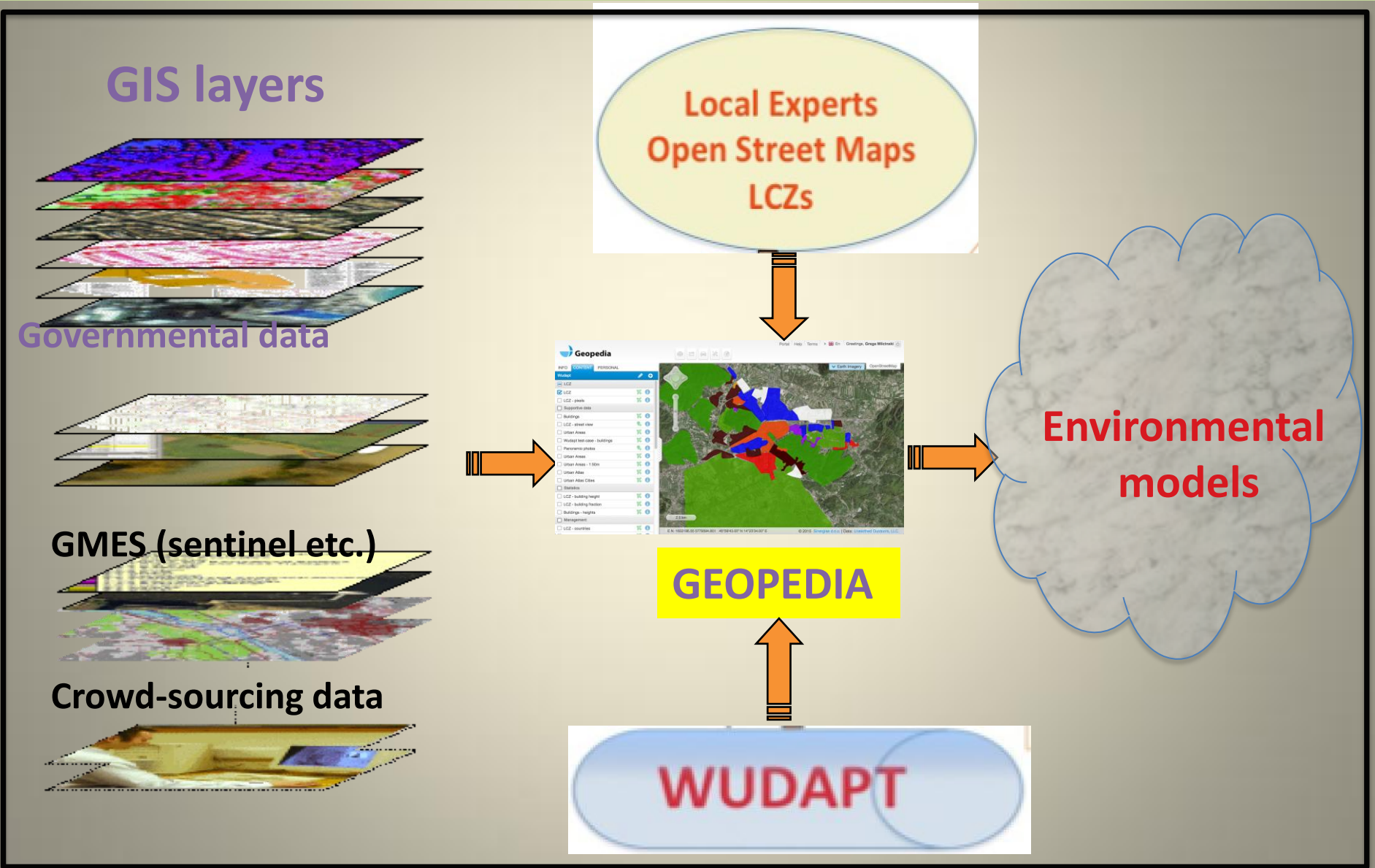
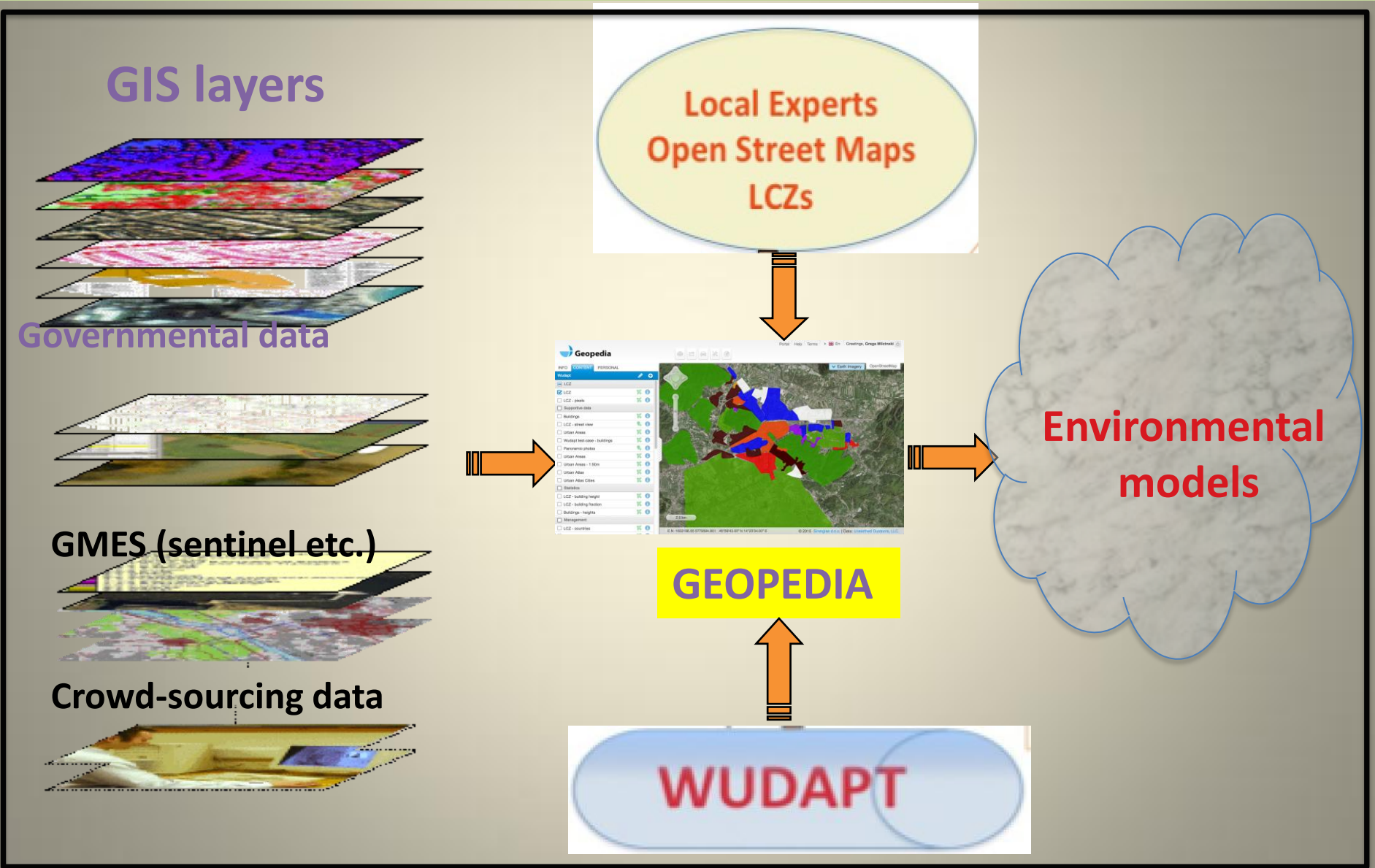
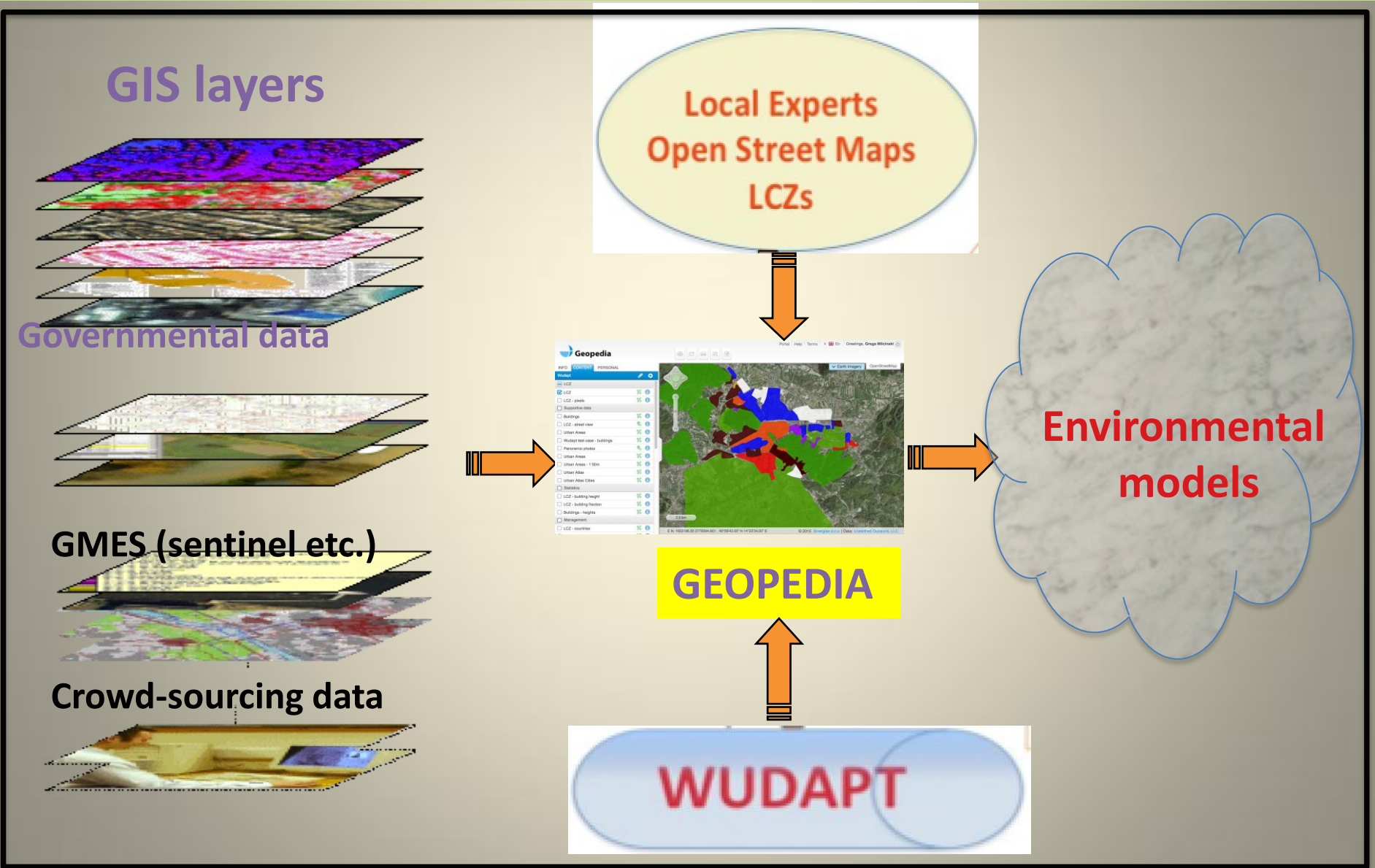
- Geopedia:** A screenshot of the Geopedia web interface showing a map with various layers and a sidebar with a list of layers (e.g., LCZ, Buildings, Urban Areas).

Output:

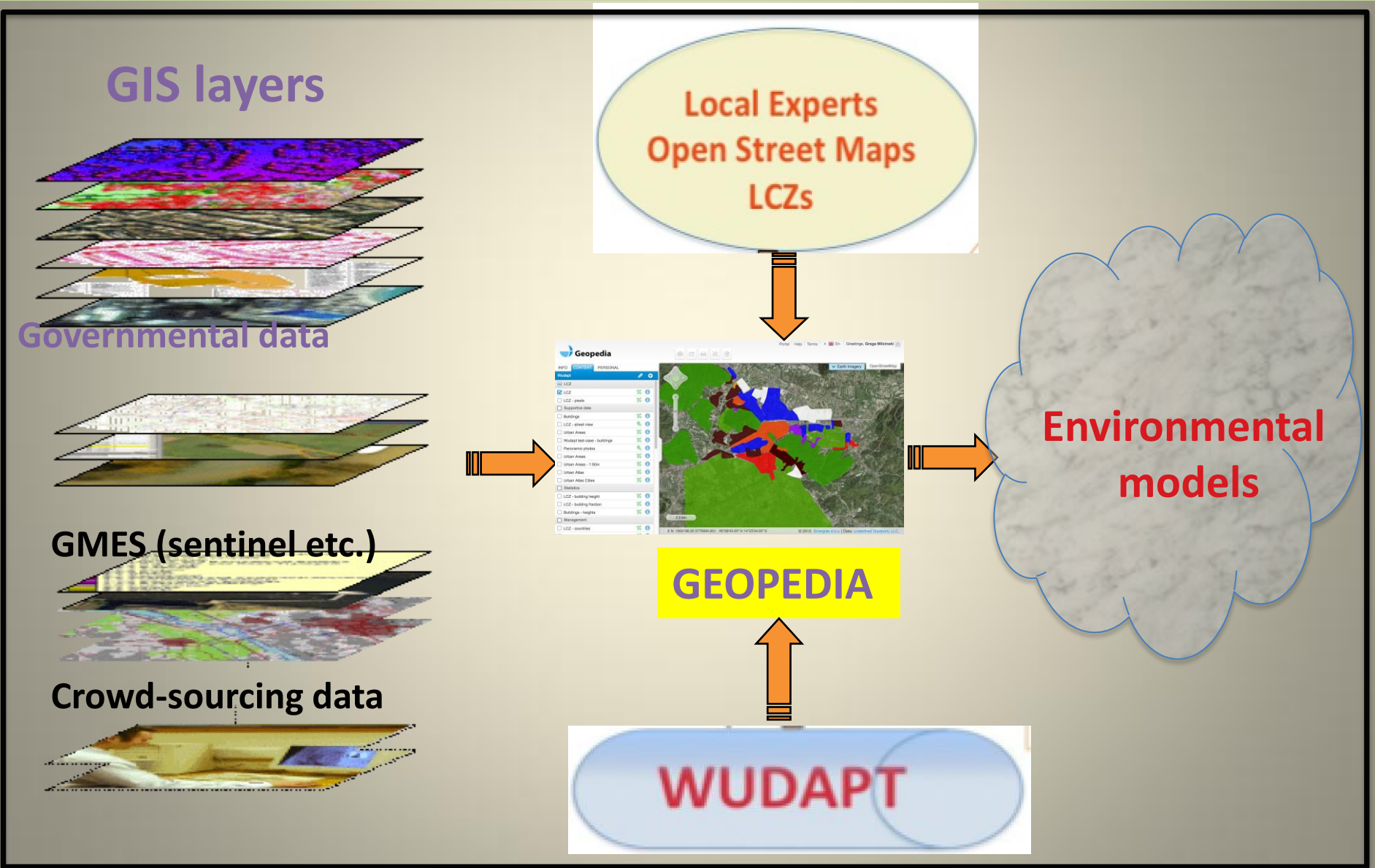
- Environmental models:** Represented by a cloud shape on the right.

Platform:

- WUDAPT:** A blue button at the bottom center.



The diagram illustrates the data integration workflow for Geopedia. On the left, five layers of data are shown as stacked maps: 'GIS layers' (purple), 'Governmental data' (purple), 'GMES (sentinel etc.)' (black), 'Crowd-sourcing data' (black), and 'WUDAPT' (blue). These layers feed into the central 'Geopedia' interface, which displays a map with various colored overlays. The 'Geopedia' interface is connected to 'Local Experts', 'Open Street Maps', and 'LCZs' (yellow oval) at the top, and 'WUDAPT' (blue oval) at the bottom. An arrow points from the 'Geopedia' interface to a cloud labeled 'Environmental models' on the right.

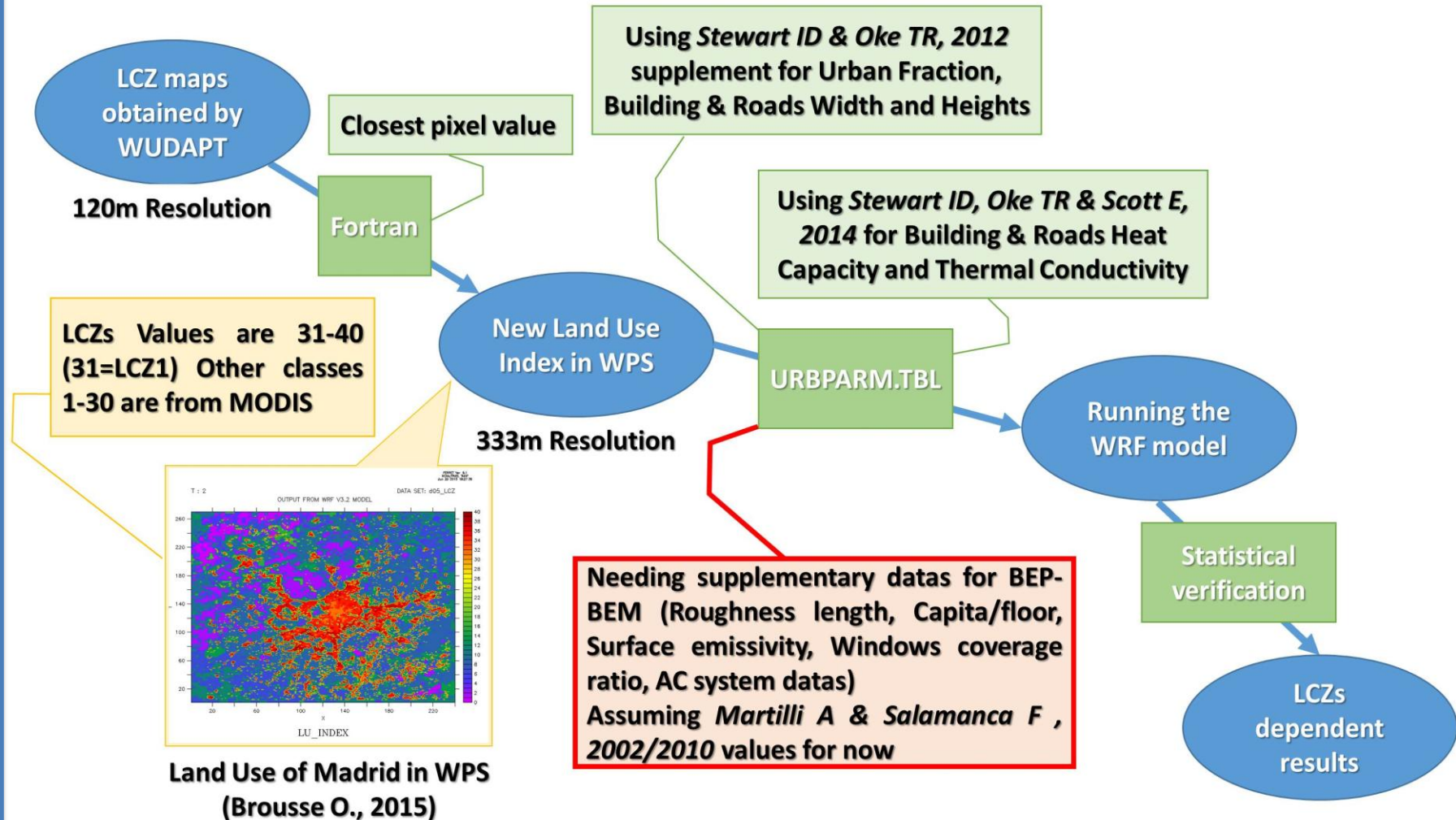


The diagram illustrates the data integration workflow for Geopedia. On the left, five layers of data are shown as stacked maps: 'GIS layers' (top, purple), 'Governmental data' (pink), 'GMES (sentinel etc.)' (yellow), 'Crowd-sourcing data' (blue), and 'WUDAPT' (bottom, blue). Arrows from these layers point towards the center. In the center, a screenshot of the Geopedia web interface is shown, displaying a map with various colored overlays and a sidebar with a list of data layers. Above the screenshot is a yellow oval containing the text 'Local Experts', 'Open Street Maps', and 'LCZs'. Below the screenshot is a yellow rectangle with the text 'GEOPEDIA'. To the right of the screenshot is a large, light blue cloud shape containing the text 'Environmental models'. An arrow points from the Geopedia interface towards this cloud.

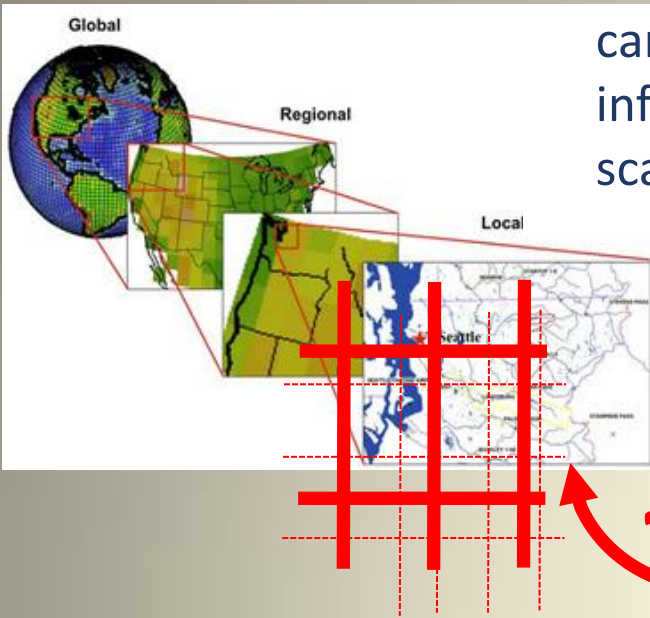
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Current modeling progress using WUDAPT.

Processing WUDAPT Level “0” data to run WRF –Urban: the case for Madrid, Spain, Brousse & Martilli 2015

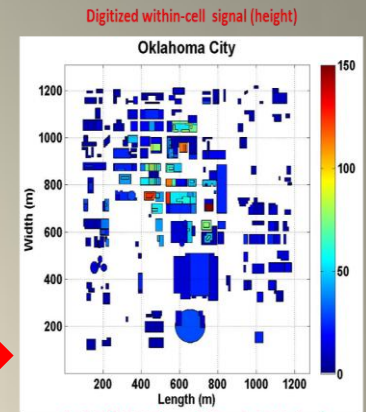


2. How do representation of urban canopies (resolved and sub-grid information) change with scale/model resolution?

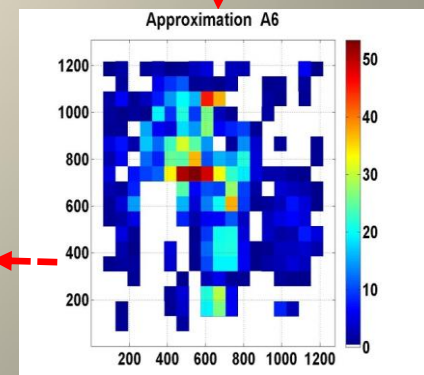
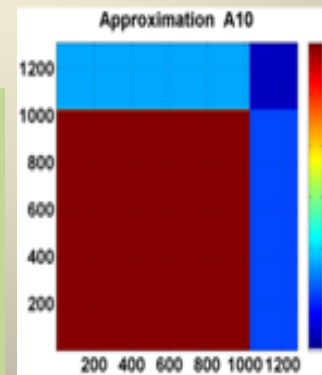
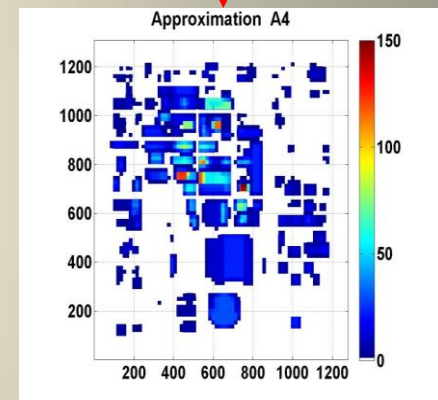


1. What is the macroscopic feedback of urban canopies into larger scale models and what is the sub-grid scale Information for parameterization?

Adding Multi-Resolution Analysis (MRA) into WUDAPT



Initial/Original resolution: 1 pixel = 1 m²

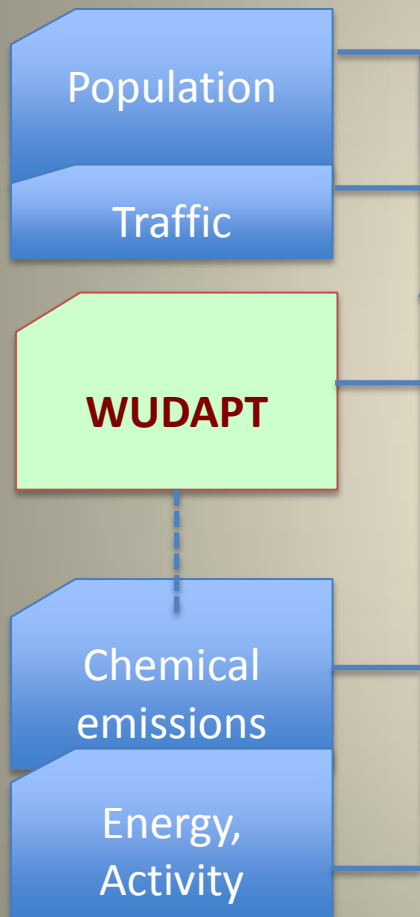


Consideration for Portal: Urban Planning-Growth Model APPS

- **SLEUTH** urban growth and land use change model, simulates four types of urban land use change:
 - spontaneous growth,
 - new spreading center growth,
 - edge growth, and
 - road-influenced growth.
- **SynCity** (Synthetic City) –Sub-models (Layout, Agent Activity & Resource Technology Network (RTN))
- **MARS (Metropolitan Activity Relocation Simulator)**
Strategic, dynamic, integrated urban land use and transport model

Conceptual hierarchical urban modeling systems incorporating WUDAPT

Model systems As Portlets



Portal System
**Data handling,
Query-Based
Toolkits**
-Urban Growth
models
-Scale dependent
analyses tools

**Level One
Application
Current Climate
Conditions**

**Level Two
Applications
Climate Change
Scenarios**

Broaden capabilities to performing
integrated modeling applications

Two Examples of emerging Portal Apps using WUDAPT

- Risk Assessments (Heat stress) current and climate projection modeling
- Systemic modeling approach

Example 1: APP/Portal for heat stress advisories for extreme heat wave situations in urban areas under current and future climates

(Hanna, Pinto and Ching, ICUC9 (2015))

Goals: Heat stress indices (WBGT, Tmrt, PETs) for:

- Enhanced mortality, morbidity risks
- Safe activity levels, comfort/discomfort advisories

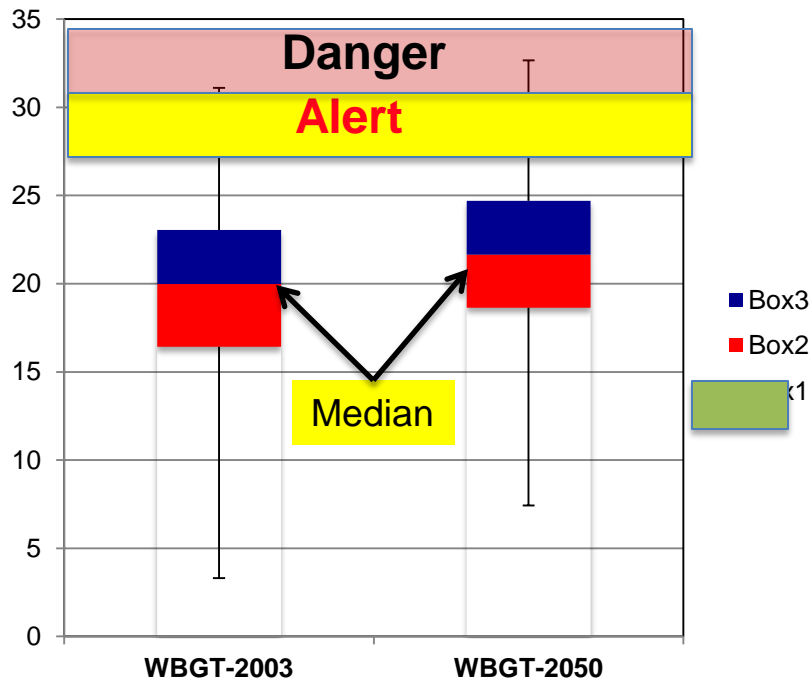
Method: Customized APPS (using portlets?) for:

- **Operational O(10km)** weather and climate model now and futurecasts outputs *with Intra-urban variation using Sky View Factor as weights based on Level “0” table lookups*
- **Fine grid customized and urbanized** Wx model outputs [O (1km)] utilizing *MRA portlet generates appropriate UCPs to mesoscale models*

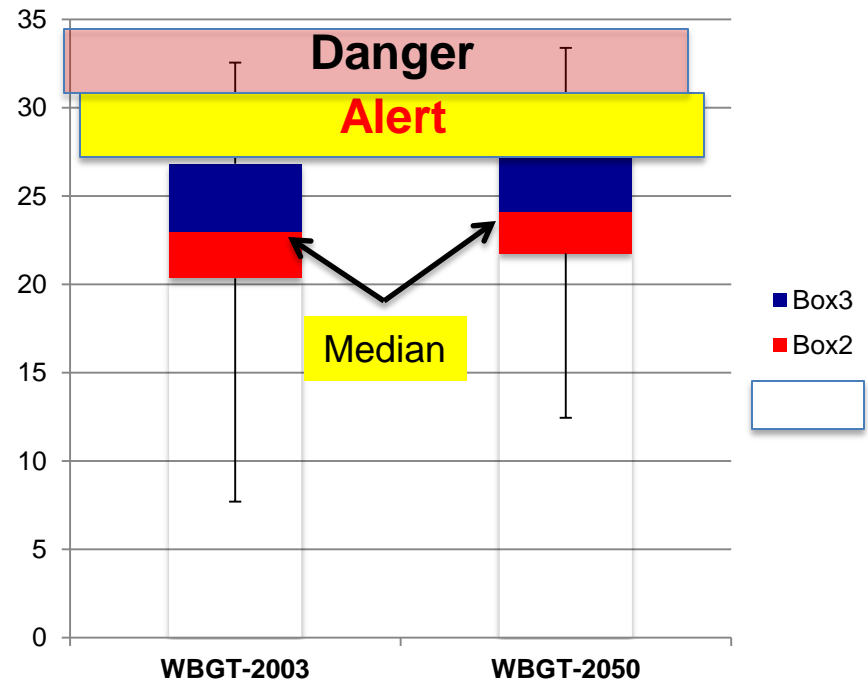
Summer Heat Stress (WBGT) Index for Atlanta and Chicago 2003, 2050

Overall increase across the Distribution for both cities from 2003 to 2050

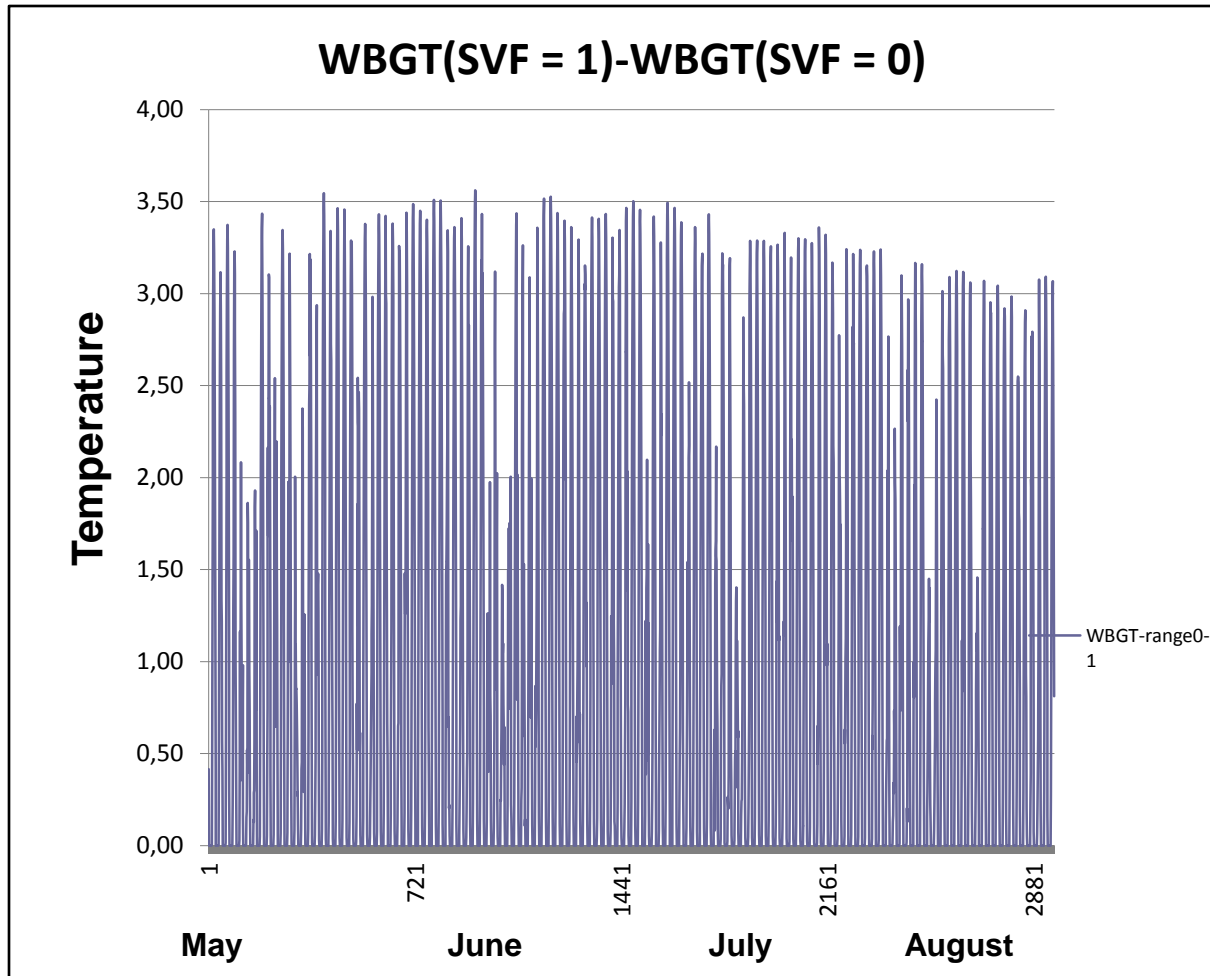
WBGT Chicago 2003 vs 2050



WBGT Atlanta 2003 vs 2050



Sensitivity of WBGT to Sky View Factor (SVF)



Differences of more than 3.0 are seen particularly during June and July

1/3 the range of concern of heat stress risk levels

Significant diurnal variability in WBGT

Portal APPS options

Context: Urban adaptation planning for Baseline and Climate Change impacts projections (Masson et al., 2014)

Impact (risks) and direct outcome modeling

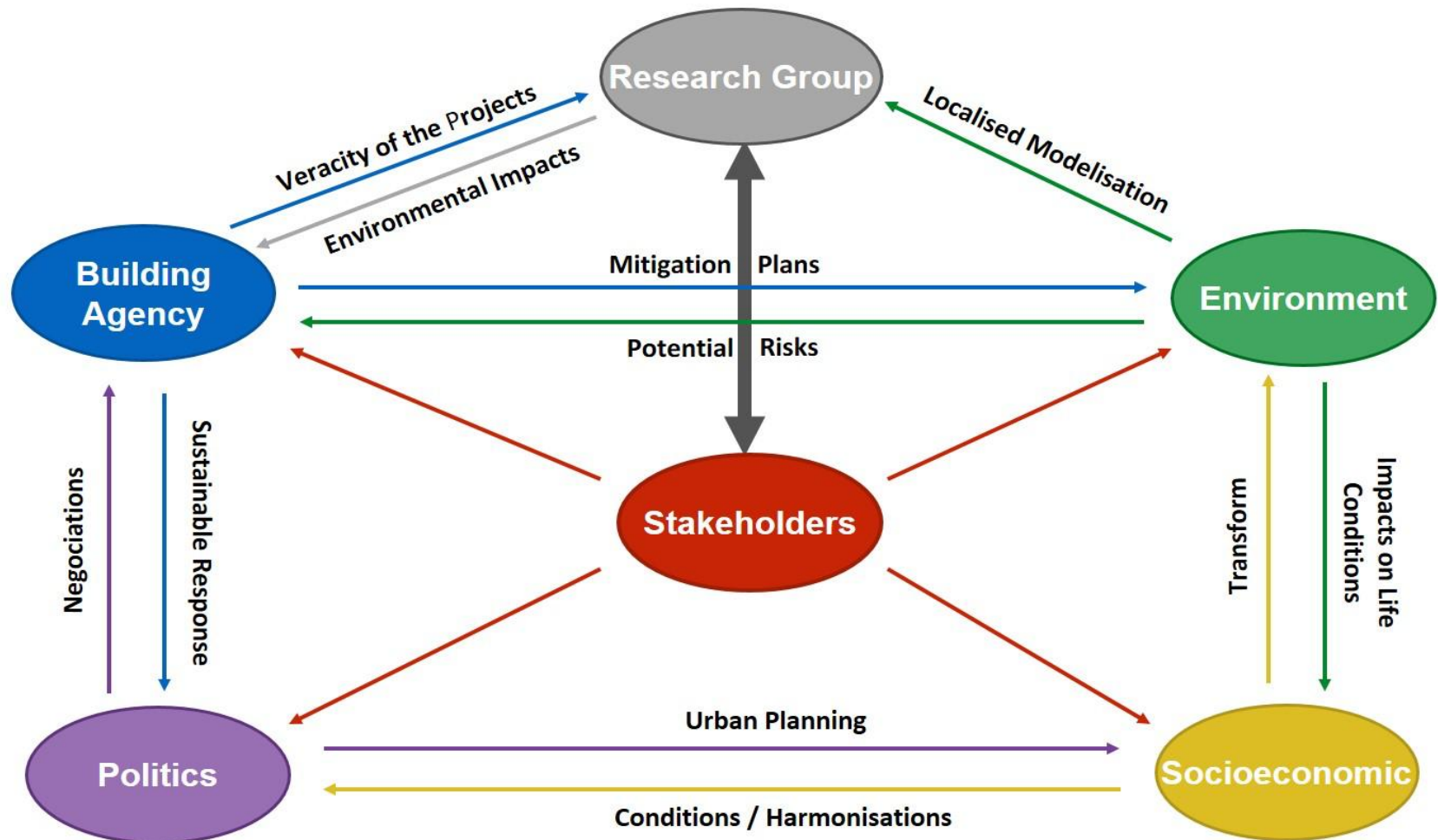
- Climate projection model tools
- Scale dependent weather prediction model tools
- Air quality and exposure modeling tools
- City long term planning modeling tools
- Off line Vulnerabilities, Adaptation and Risk assessment modeling tools

Systemic modeling (interdisciplinary)

- Baseline and climate change projections
- City models for adaptation strategies
- Physical modeling for impacts
- Indicators and outcomes

Example 2: Systemic-type modeling that incorporates WUDAPT into environmental models (e.g., WRF, TEB by Strasburg Research Group)

Customizing systemic planning approach for city growth



Countries with active WUDAPT collaborators: Produced 16 Level “0” (LCZ) cities @ 2014 Dublin workshop

HERCULES

INFO CONTENT PERSONAL

Wudapt

- ☐ LCZ
- ☒ LCZ
- ☐ LCZ - pixels
- ☐ Supportive data
- ☐ Buildings
- ☐ LCZ - street view
- ☐ Urban Areas
- ☐ Statistics
- ☐ LCZ - building height
- ☐ LCZ - building fraction
- ☐ Buildings - heights
- ☐ Management
- ☒ LCZ - countries
- ☐ Urban Areas
- ☐ WMS
- ☐ Google maps: hybrid
- ☐ Google maps: roadmap
- ☐ Google maps: satellite
- ☐ Google maps: terrain

Language Greetings, grega

TrueMarble

5000 km

©2013 Sinergise d.o.o. | Data: Unearthed Outdoors, LLC.

E N: -8883817.175 4181127.234 35°7'36.51" N 79°48'16.88" W

Ver. 2.1.14



Summary and Steps Forward



LCZ Classes

Legend



Beijing

Chicago

Kolkata

Guangzhou

Sao Paulo

**Villagers, Thanks & please
join, support WUDAPT
Exciting times are ahead!**