



City and Land Information Modeling

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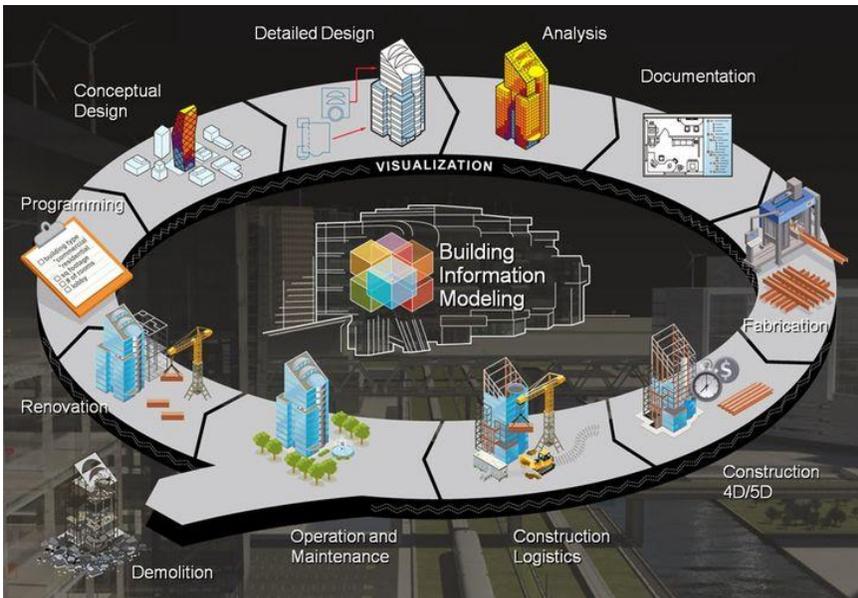


PARTNER

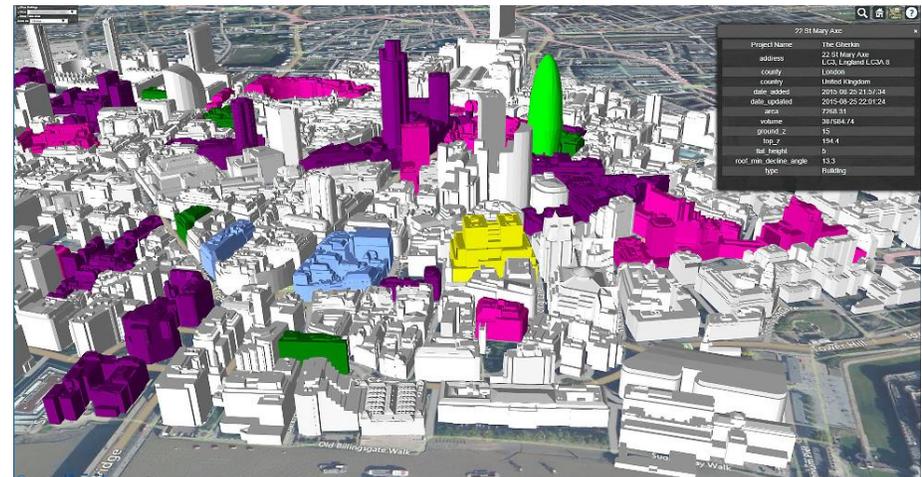


Building Information Modeling → City Information Modeling

ISO 19650:2019 defines BIM as: *Use of a shared digital representation of a built asset to facilitate design, construction and operation processes to form a reliable basis for decisions.*



Use of a shared 3D digital representation of a city asset to facilitate design, assessment and management processes and form a reliable basis for decision-making.



*The information base of the CIM is the 3D GIS, in which the **information concerns all 3D surfaces.** The three-dimensional elements representing constructions (buildings, infrastructures, etc.) are **connected to their BIM parameterisation.***

In the transition from BIM to CIM it is important that **BIM information is geo-referenced.**

*The CIM is first a **knowledge tool of the city**, but the research experience of the University of L'Aquila is directing CIM also to these 3 uses:*

City Information Modeling uses

City **DESIGN**

Urban Design, Cost Evaluation, Design Management, etc.

City Design **ASSESSMENT**

Urban Performance Assessment, Urban Environmental Assessment, Urban Risk Assessment, etc.

City **MANAGEMENT**

Evacuation planning and management, emergency management, safety, mobility, etc.

Information from **BIM** models also contributes to these uses.

City Information Modeling

data sources

3D base MAP (3d GIS at the City Scale)

BIM Model (replaces the GIS volume of the constructions)

SCIENTIFIC ANALYSIS (specific scientific research on the city)

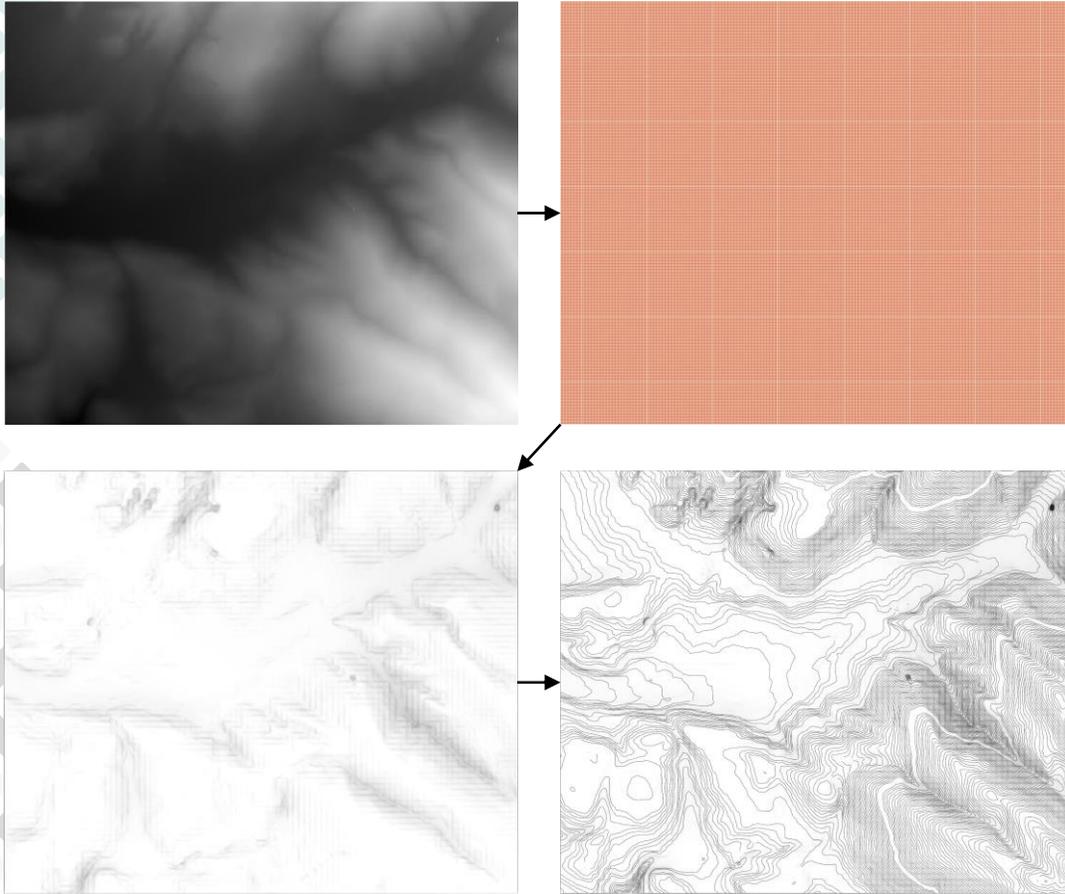
SOCIO-ECONOMIC DATA (e.g. linked to individual constructions)

SATELLITE DATA

SENSORS - REAL TIME DATA

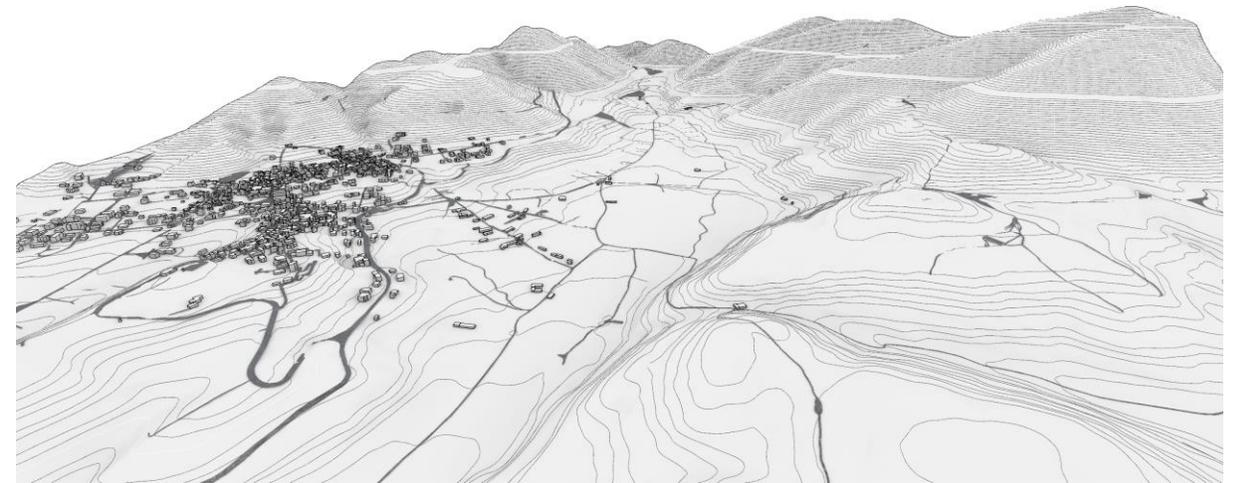
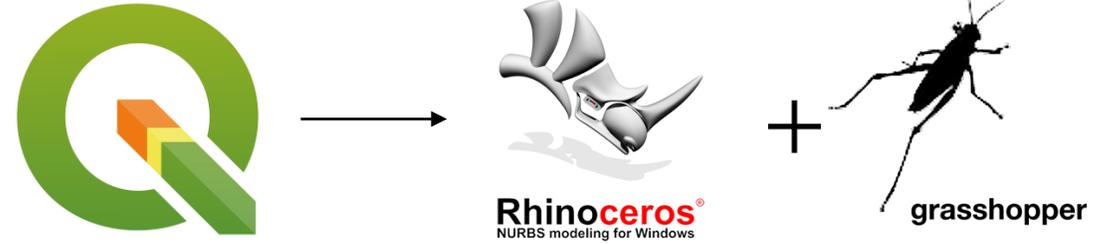
URBAN DESIGN and **URBAN PLANNING** (design data)

City Information Modeling

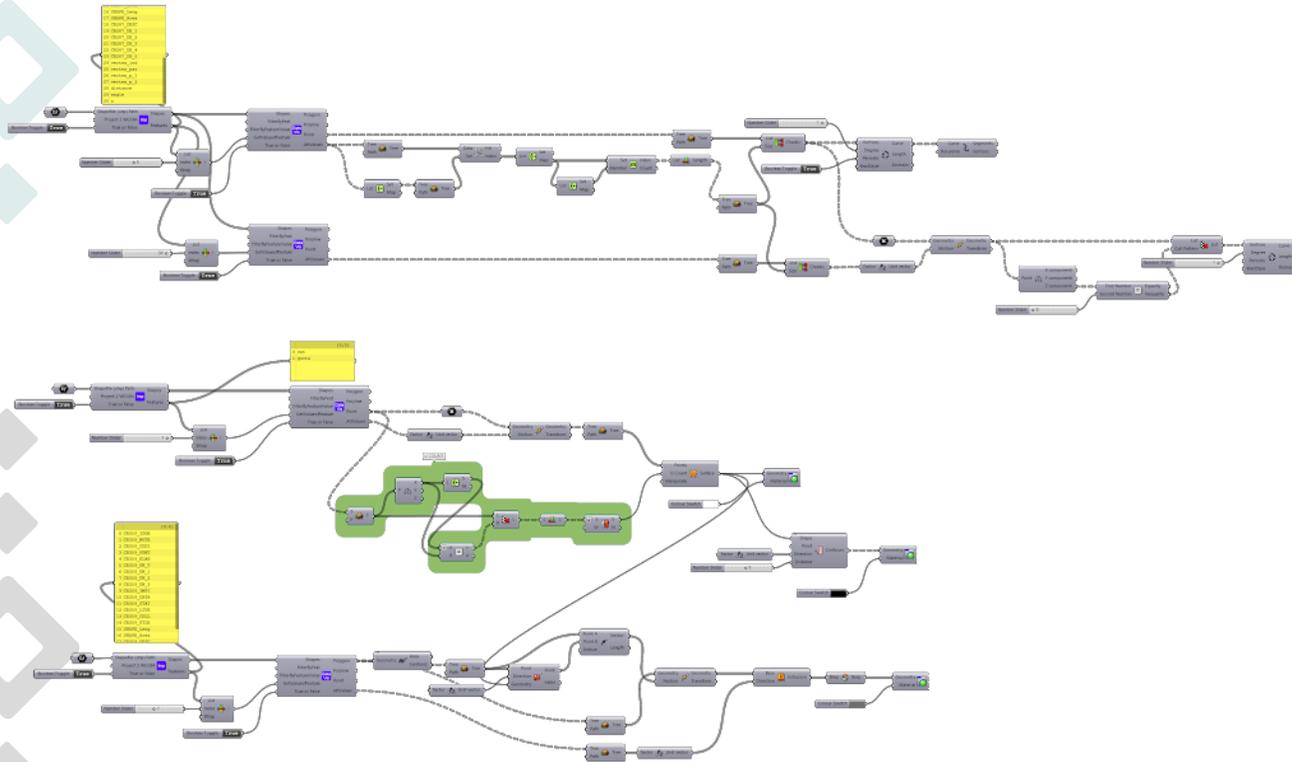


From Digital Terrain Model (DTM) to 3D model

Workflow: from Geographic data (QGIS) to NURBS Surfaces (Rhino + Grasshopper)

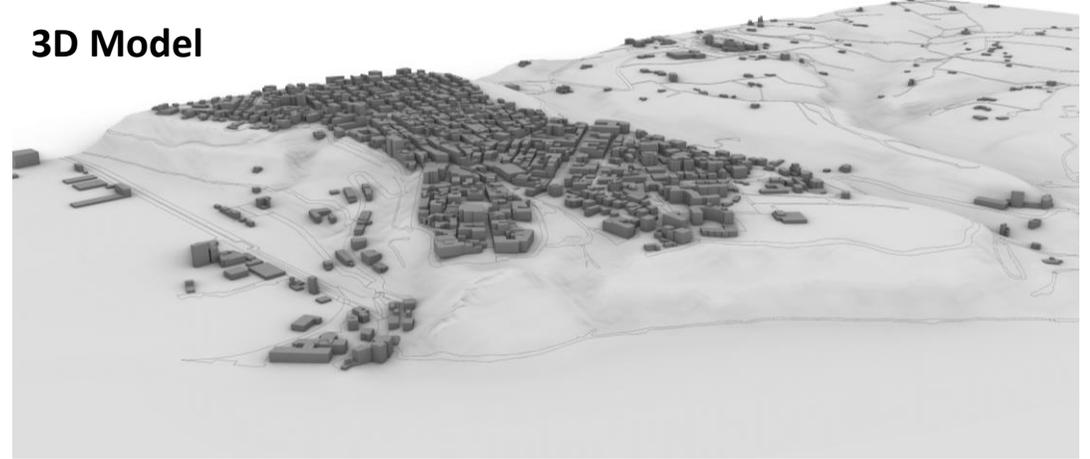


City Information Modeling



Visual scripting in Grasshopper towards automatic 3D modeling

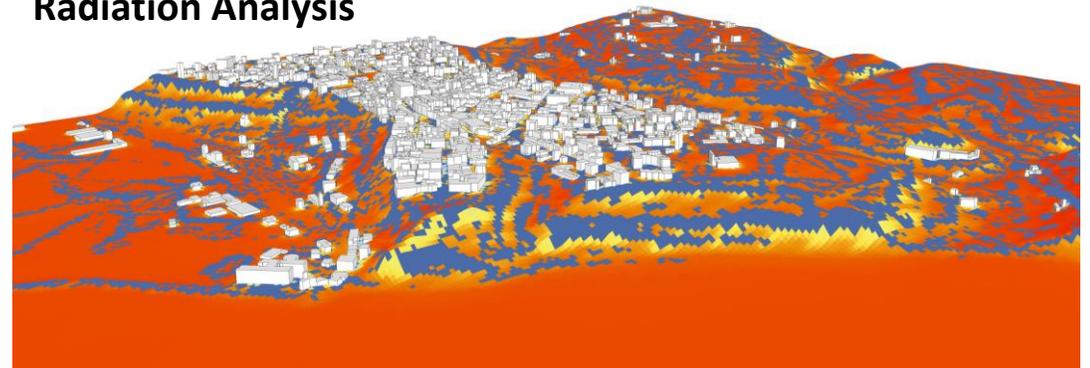
3D Model



Sunlight Analysis

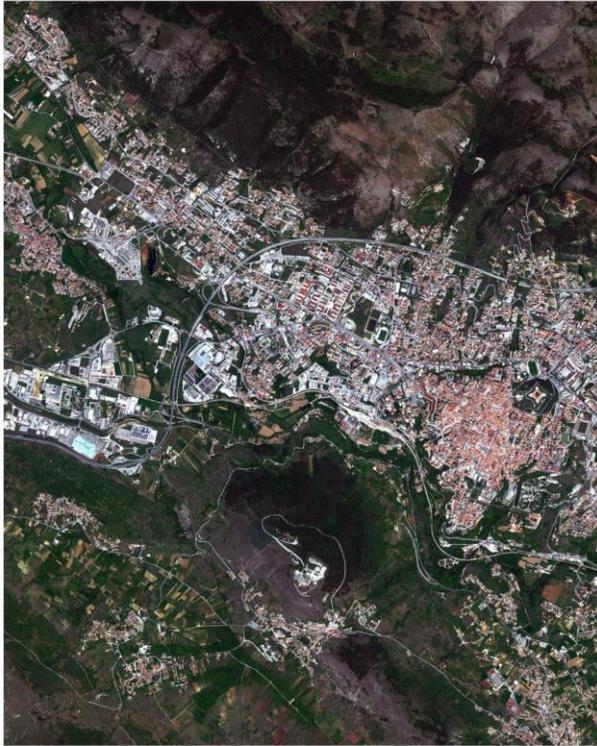


Radiation Analysis



L'Aquila City Information Modeling

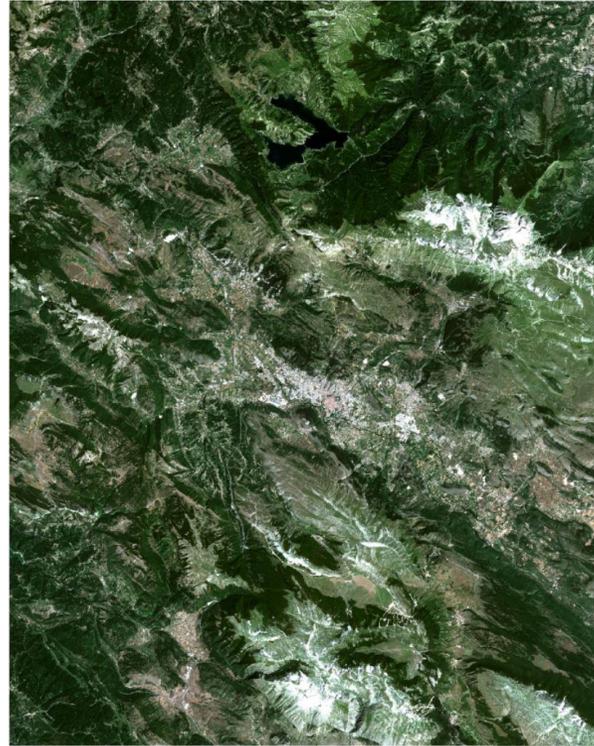
Worldview II



1. **COASTAL** Band (400-450 nm)
2. **BLUE** Band (450-510 nm)
3. **GREEN** Band (510-580 nm)
4. **YELLOW** Band (585-625 nm)
5. **RED** Band (630-690 nm)
6. **RED-EDGE** Band (705-745 nm)
7. **NIR1** Band (770-895 nm)
8. **NIR2** Band (860-1040 nm)

Dimensione Pixel:
 - Pancromatico 0,46 metri
 - Multispettrale 1,84 metri

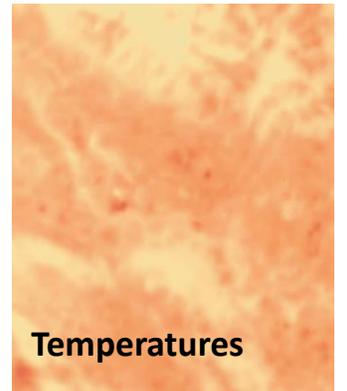
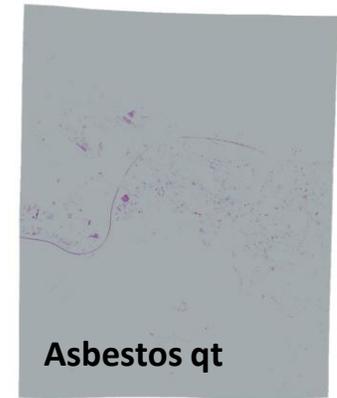
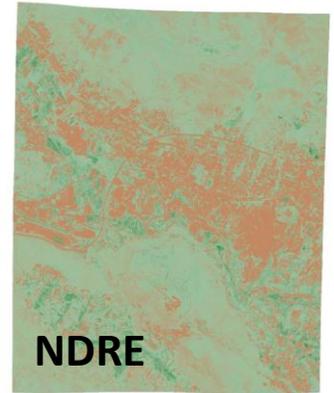
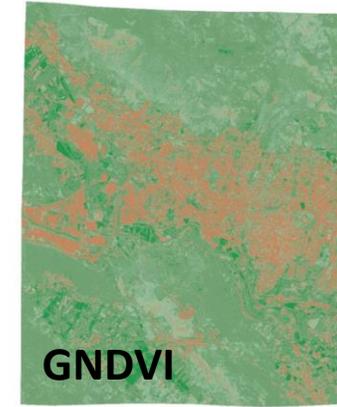
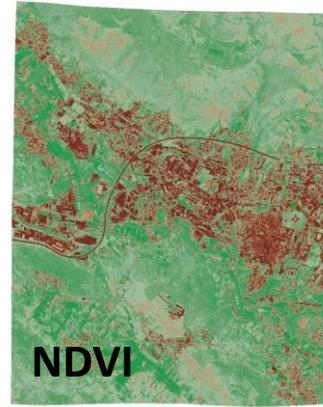
Landsat 8



1. **COASTAL AEROSOL** Band (435-451 nm)
2. **BLUE** Band (452-512 nm)
3. **GREEN** Band (533-590 nm)
4. **RED** Band (636-673 nm)
5. **NEAR INFRARED NIR** (851-879 nm)
6. **SWIR 1** (1566-1651 nm)
7. **SWIR 2** (2107-2294 nm)
8. **PANCHROMATIC** (503-676 nm)
9. **CIRRUS** (1363-1384 nm)
10. **THERMAL INFRARED (TIRS)1** (10600-11190 nm)
11. **THERMAL INFRARED (TIRS)2** (11500-12510 nm)

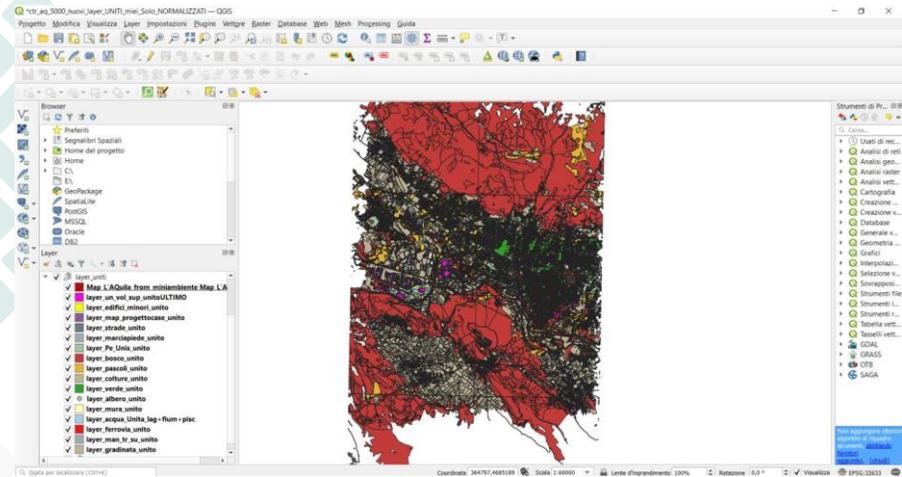
Dimensione Pixel:
 - Pancromatico 15 metri
 - Multispettrale 30 metri
 - Termico 100 metri

Satellite images



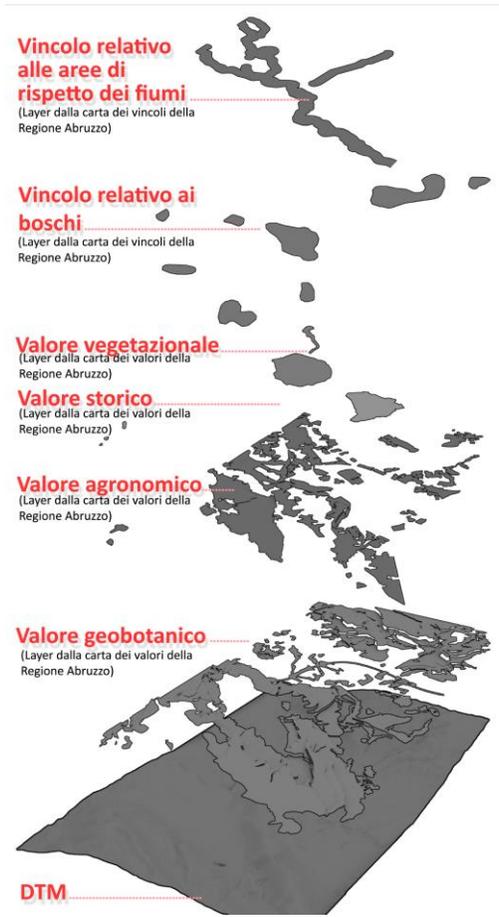
Satellite data

L'Aquila City Information Modeling

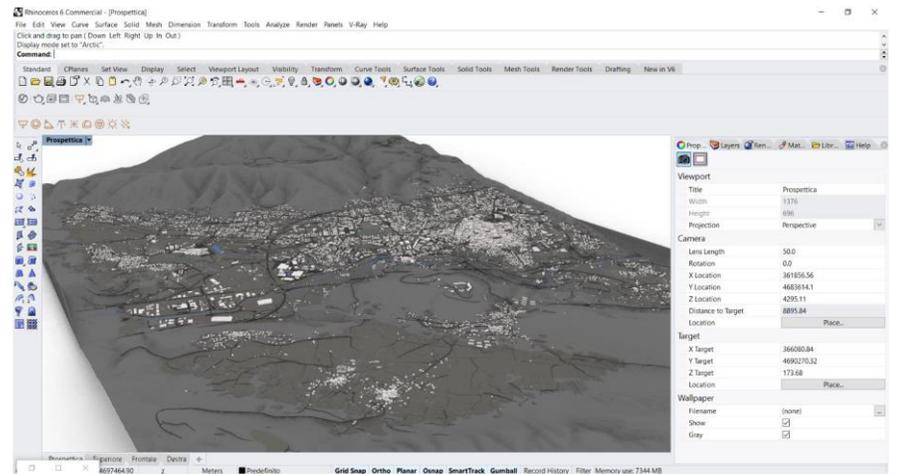
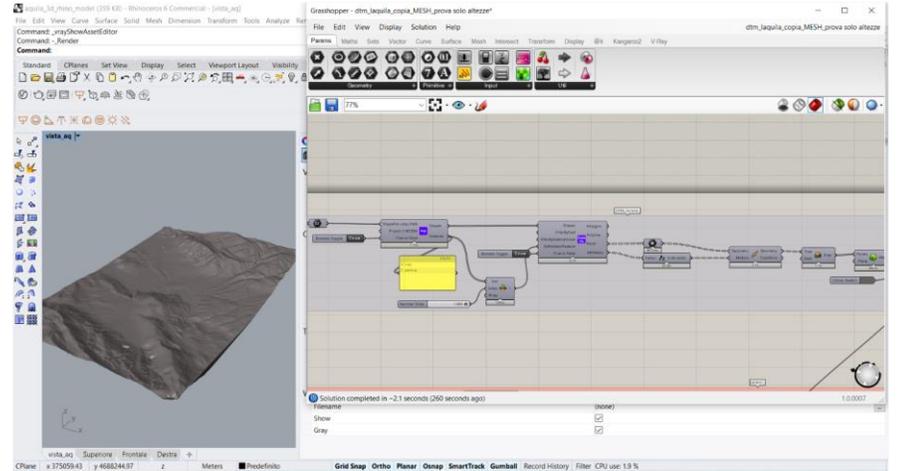


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1	YES	YES	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
2	YES	YES	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
3	YES	YES	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
4	YES	YES	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
5	YES	YES	YES	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
6	YES	NO	NO	NO	NO	YES	YES	NO							
7	YES	YES	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
8	YES	NO	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
9	YES	NO	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
10	YES	NO	NO	NO	NO	YES	YES	NO							
11	YES	NO	NO	NO	NO	YES	YES	NO							
12	YES	YES	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
13	YES	YES	YES	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
14	YES	YES	YES	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
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17	YES	NO	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
18	YES	NO	NO	NO	NO	YES	YES	NO							
19	YES	NO	NO	NO	NO	YES	YES	NO							
20	YES	YES	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
21	YES	NO	NO	NO	NO	YES	YES	NO							
22	YES	YES	YES	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
23	YES	YES	YES	YES	YES	NO	YES	YES	NO	NO	NO	NO	YES	YES	NO
24	YES	NO	NO	NO	NO	YES	YES	NO							

Geographic Information System



3D Model + Database



Next Step

As seen in the slides, *our research considered only a few uses of CIM and considered only a few data sources.* In the next steps **we will continue this experimentation in order to realize an integrated BIM/CIM environment.**

In another line of research we will also **extend the concept of CIM to the Land**, to constitute **Land Information Modeling.**

City Information Modeling & Land Information Modeling

In addition, we are currently investigating the **potential of Digital TWIN and Digital Spatial Knowledge Platforms.**

City Digital Twin & Land Digital Twin



Thank you!
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