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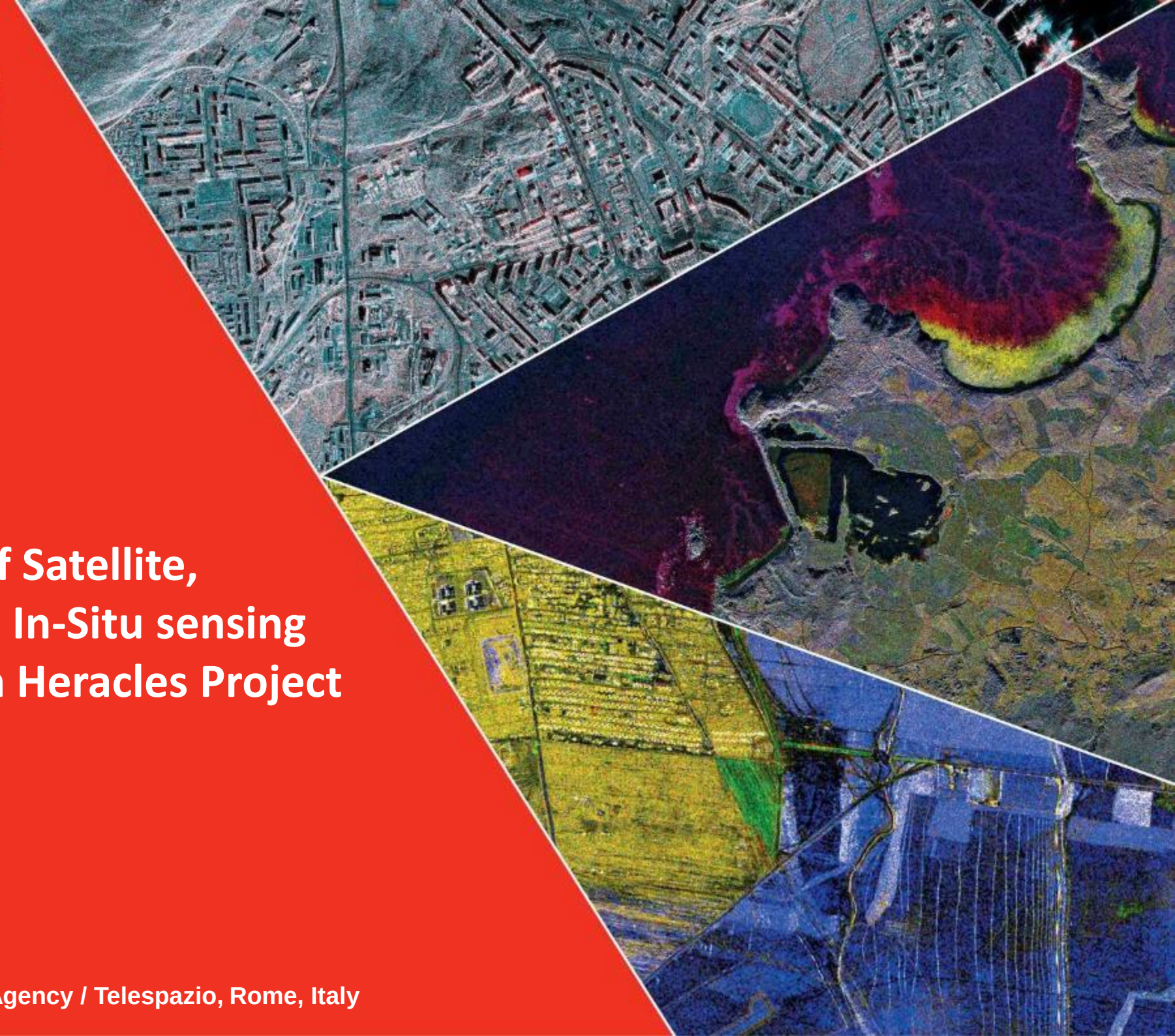


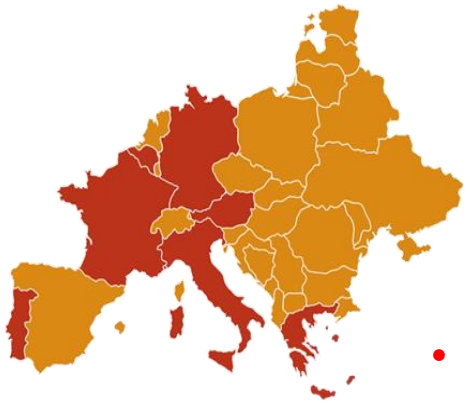
Integration of Satellite, Airborne and In-Situ sensing techniques in Heracles Project

Gabriele Murchio

e-GEOS -ItalianSpace Agency / Telespazio, Rome, Italy

HERACLES PROJECT OVERVIEW

The HERACLES Consortium is made of 16 entities from 7 countries



- **The Project received funding from the *European Union's Horizon 2020 research and innovation program* under Grant Agreement No 700395**
- **Funding:** *6.564.kEuro*

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STUDY AREA

- Two test sites in Southern Europe with the focus on two Cultural Heritage monuments each
  - Gubbio (Central Italy): City wall and Consoli Palace

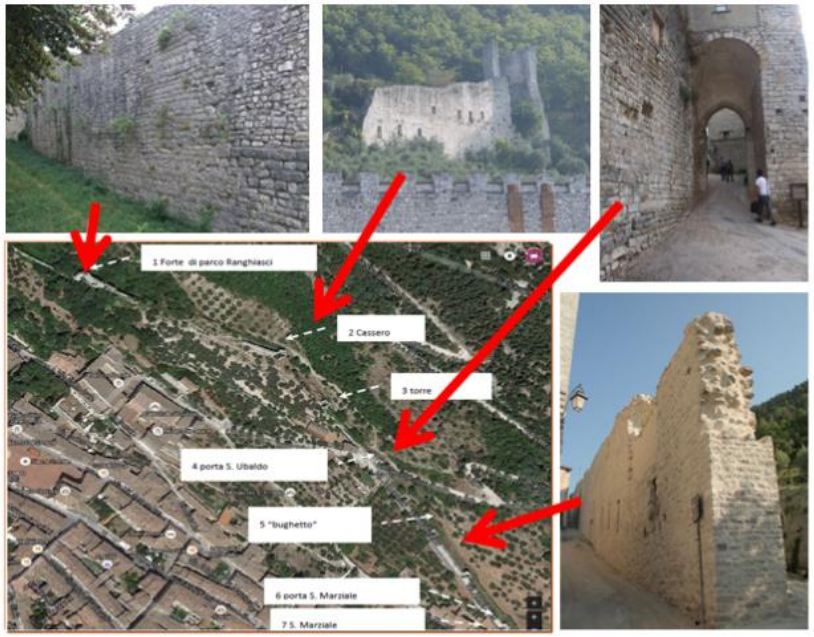
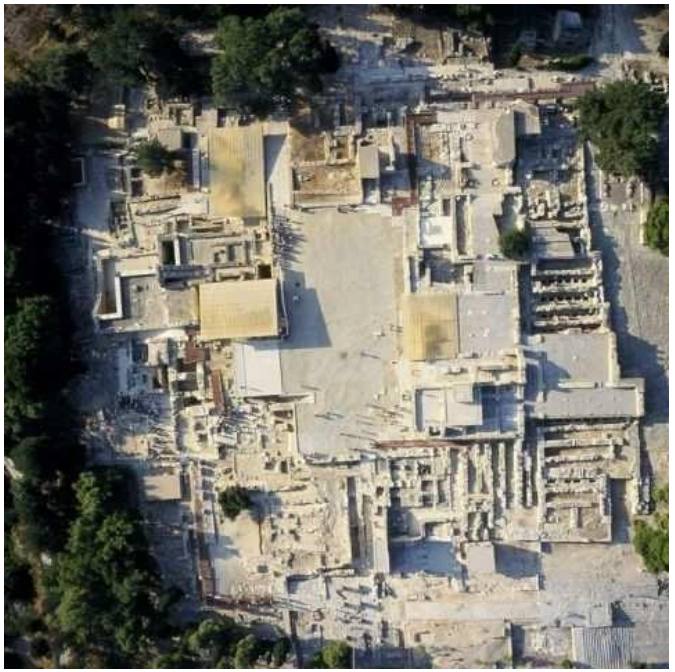


Figure 2 - Old town walls - test bed sites location

STUDY AREA

- Two test sites in Southern Europe with focus on two Cultural Heritage monuments each
  - Crete (largest Greek island): Koules fortress in Heracleon and Knossos archeological area



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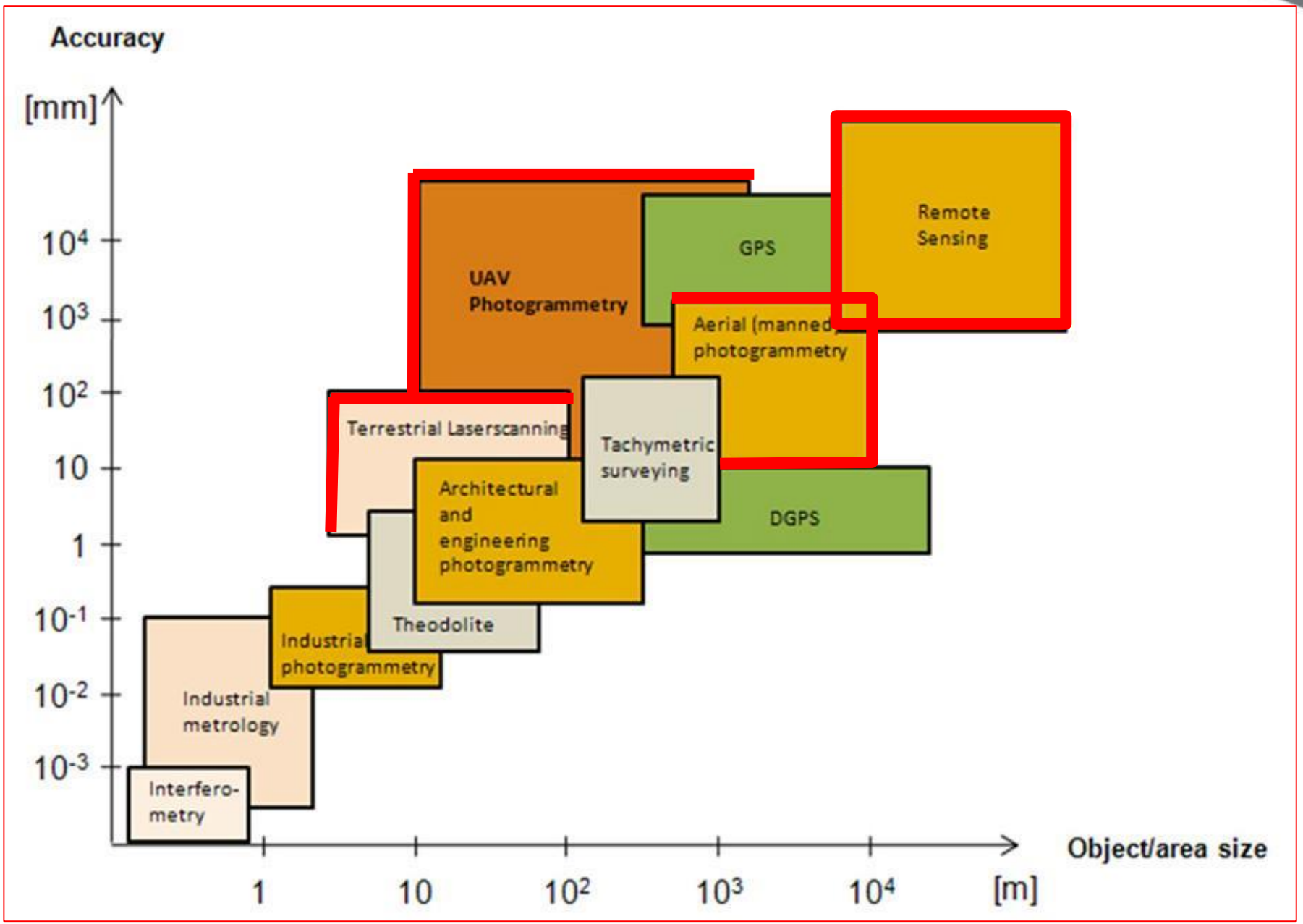

Relationship between object area size and accuracy Henri Eisenbeiß (2009)

SATELLITE ,AIRBORNE AND CLOSE RANGE PHOTOGRAMMETRY
HERACLES Project

SENSORS	PARTNER	SENSED QUALITY	SPATIAL RESOLUTION	NEW SURVEY	ARCHIVES	NOTE	GEOSPATIAL LAYER/DELIVERABLES
Spaceborne optical/VNIR	e-GEOS	mapping and cartography	30-60 cm		X	Stereo or Tri-stereo acquisition	DTM/ORTHOPHOTO/ LOD 1/LAND COVER
Airborne optical/VNIR	e-GEOS	mapping and cartography	20 cm		X	NATIONAL MAPPING SURVEY (between May-June 2017)	ORTHOPHOTO/DTM/ LOD1/LAND COVER
UAV optical	e-GEOS	mapping and 3D modelling	0,5-1 cm	X		Walls in Gubbio/Venetian Fortress in Heraklion	3D DIGITAL MODEL OF SITE/POINT CLOUD RGB 3D
Terrestrial laser scanner /UAV lidar	e-Geos/IOSB	mapping and 3D modelling	0,5-1 cm	X		Knosos Palace in Heraklion	3D DIGITAL MODEL OF SITE/POINT CLOUD RGB 3D
Terrestrial laser scanner /UAV optical	e-GEOS/IOSB	mapping and 3D modelling	0,5-1 cm	X		Palazzo de' consoli in Gubbio	3D DIGITAL MODEL OF SITE/POINT CLOUD RGB 3D

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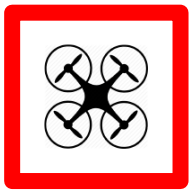
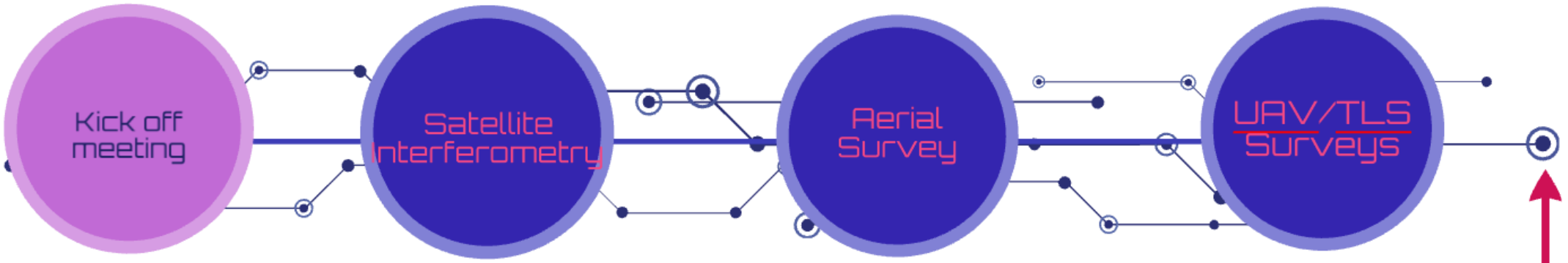
ACQUISITIONS TIMELINE





September 2016

From September 2015 to august 2017

APRIL 2014
HRAKLIO
JUNE 2017
GUBBIO

July 2017
GUBBIO
October 2017
HRAKLIO

(WP3 END MAY 2019)

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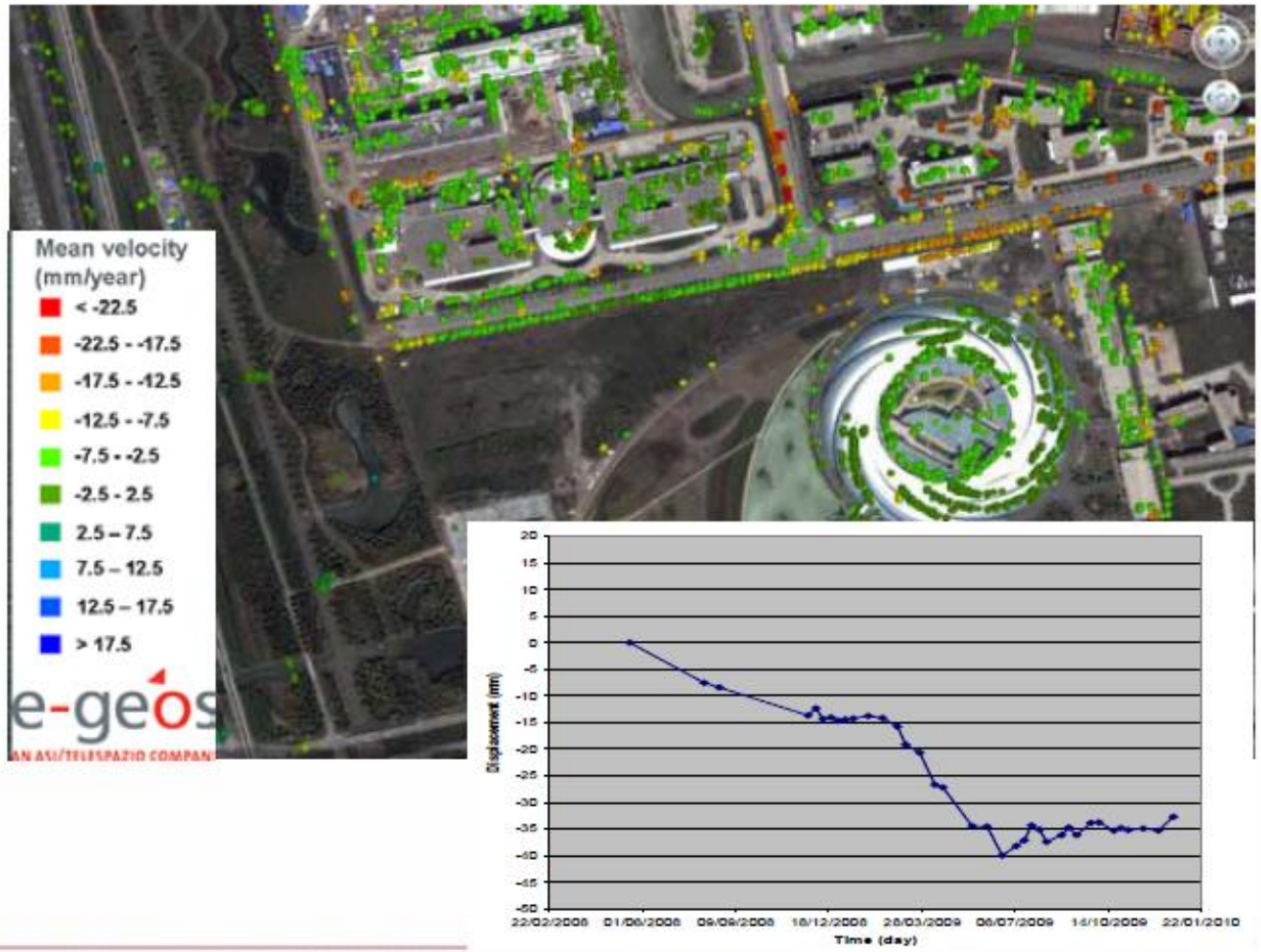
PSP SAR INTERFEROMETRY PRODUCT

PSP measurements are obtained corresponding to so-called persistent scatterers (PS), intented in the general sense of scatterers that exhibit interferometric coherence for the time period and baseline span of the acquisitions, including both point-like and distributed scatterers. The provided product includes:

1. **PS position**:
   3D position (cartographic or geographic coordinates and heights, with metric precision) of each identified PS
2. **PS mean velocity**:
   mean velocity of each PS between the first and the last SAR acquisition
3. **PS temporal evolution**:
   PS displacement (with millimetric precision) at each acquisition date



SAR INTERFEROMETRY APPLICATIONS

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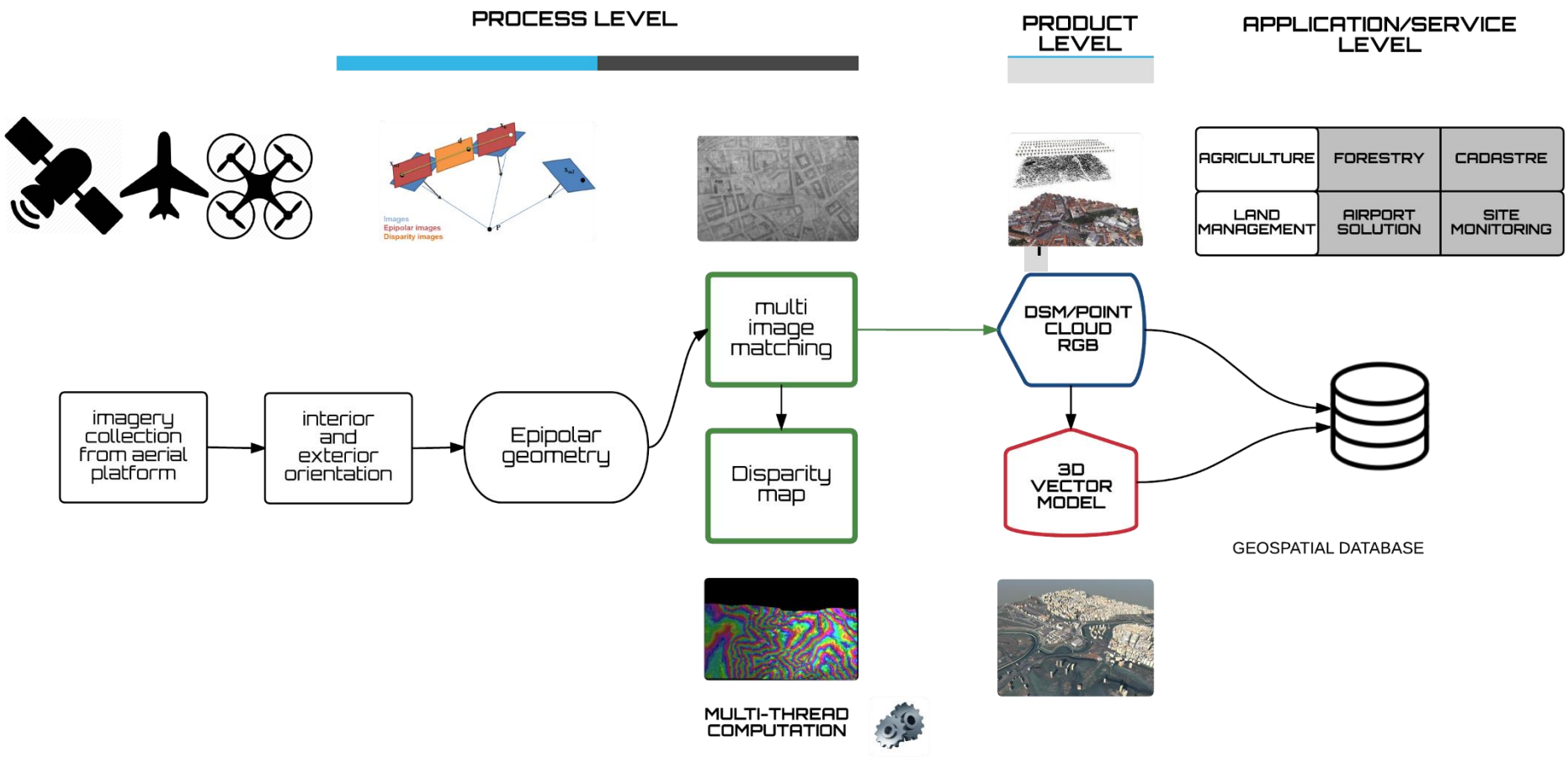
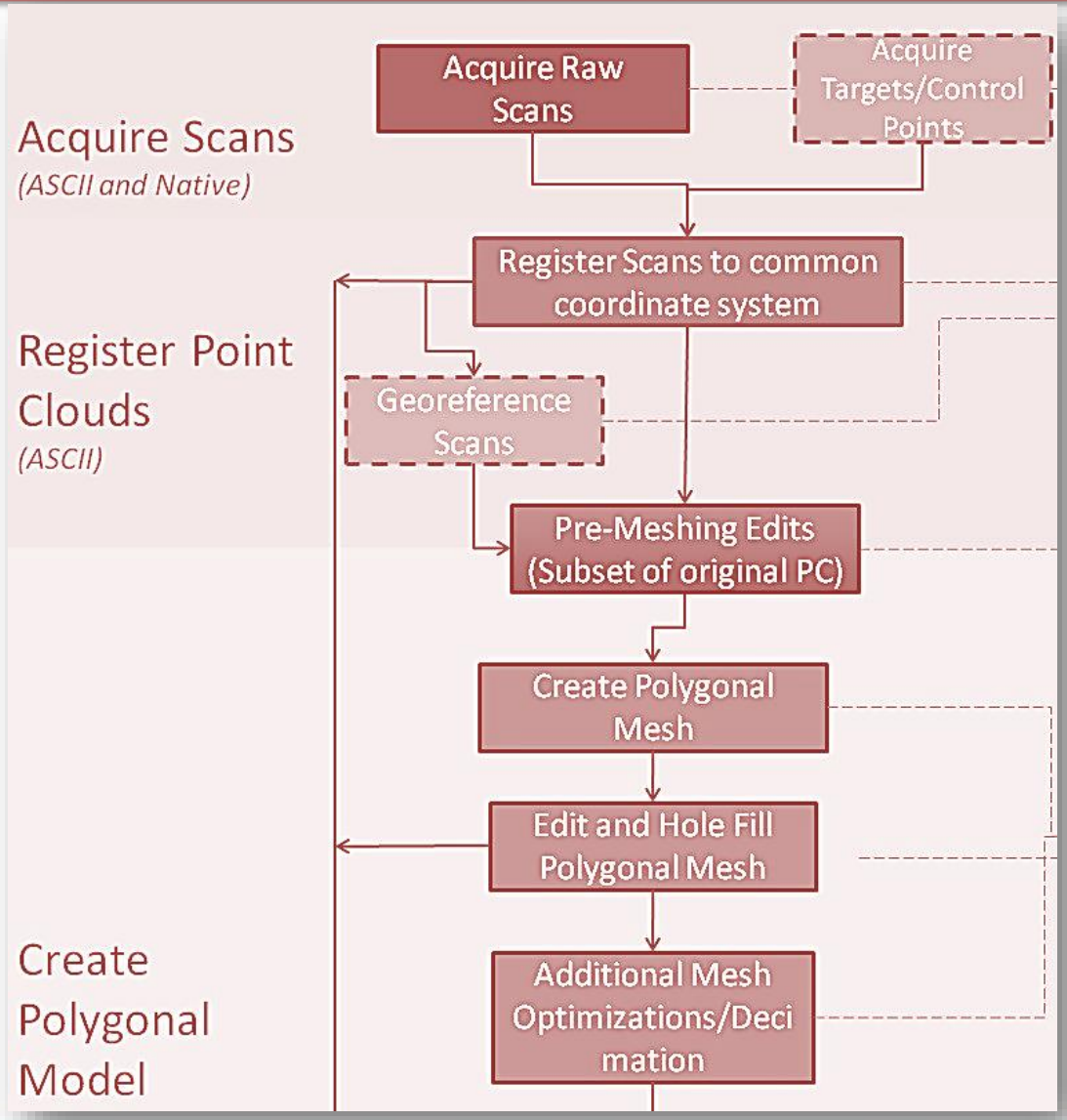
PHOTOGRAMMETRIC WORKFLOW



TERRESTRIAL LASER SCANNER WORKFLOW



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Level of Detail

- 5 Levels of Detail
  - **LoD0**: 2D (multi)polygons, as in “classical” GIS
  - **LoD1**: Single (or set of) prismatic geometries
  - **LoD2**: 3D models (only exteriors)
  - **LoD3**: 3D models (with interiors)
    - Some elements can be (simplified) reality-based models
  - **LoD4**: 3D high-resolution models or architectonic details (reality-based)

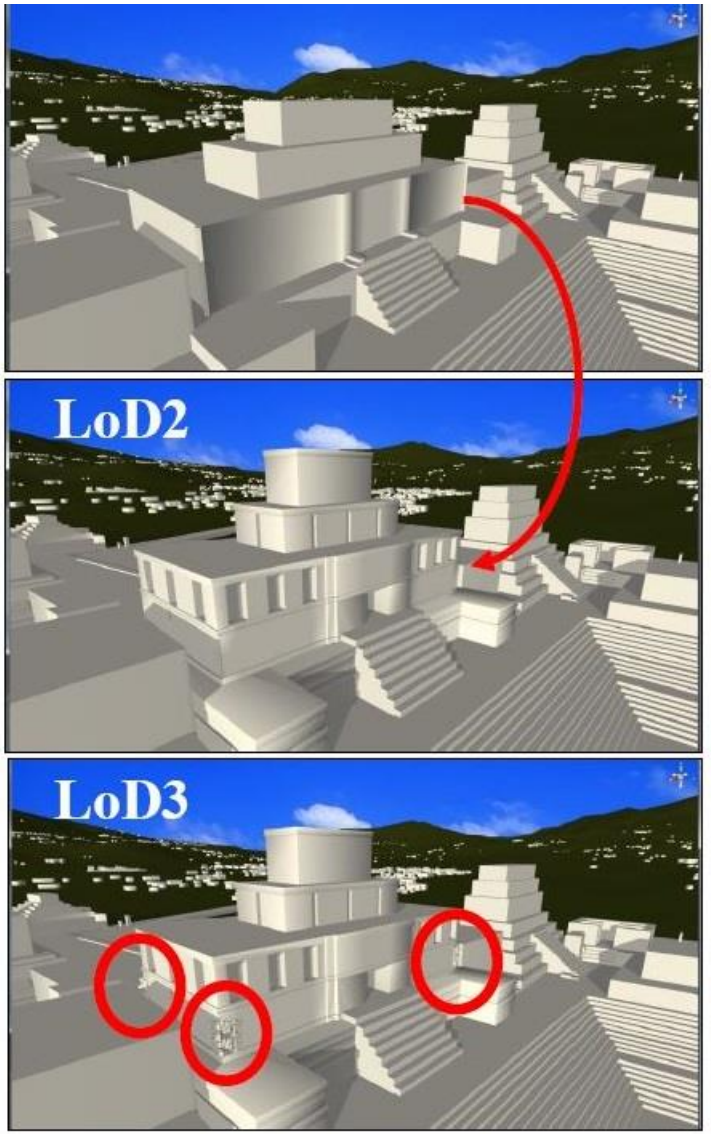

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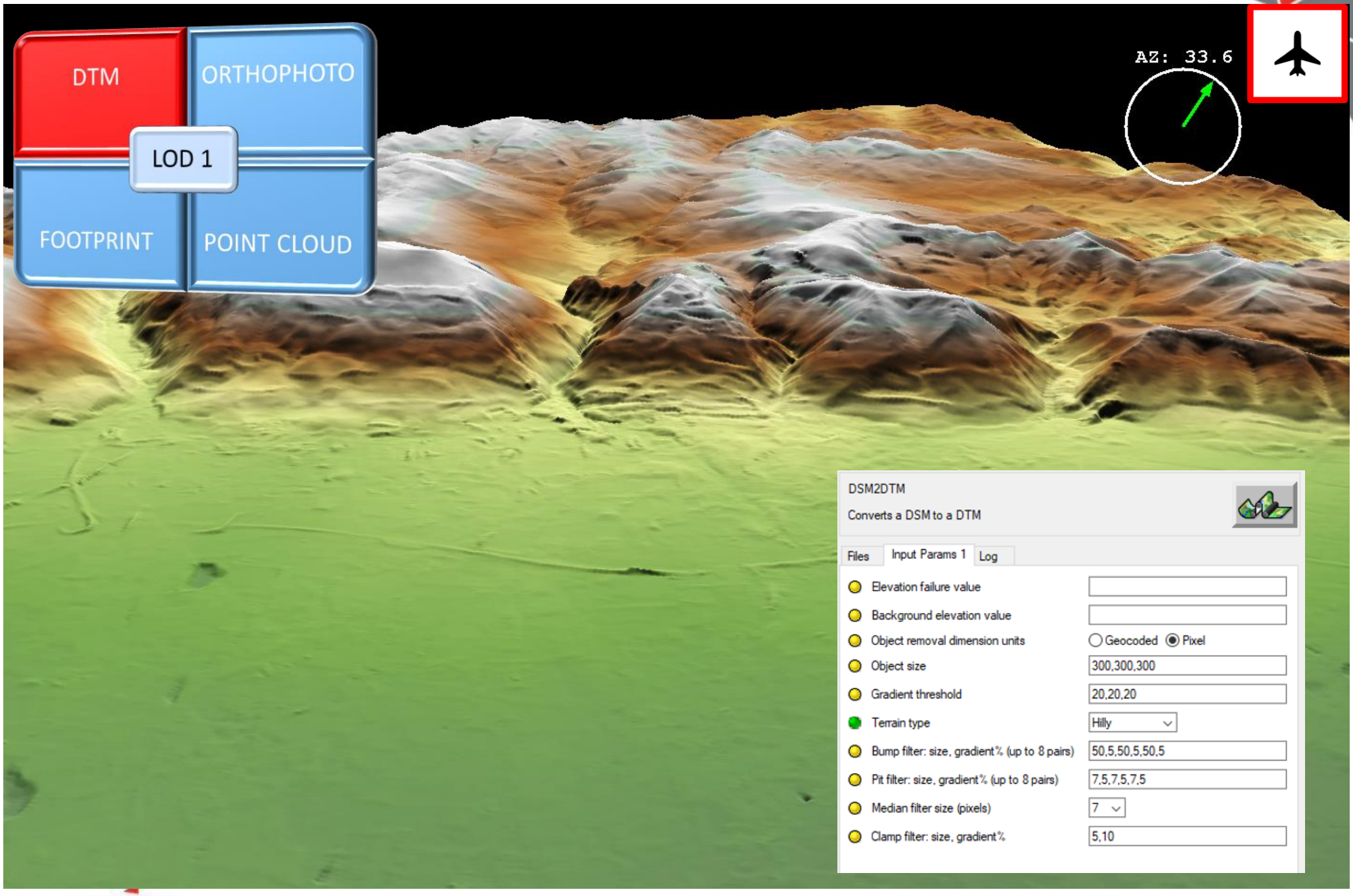
Image Source : *A Web-Based Interactive Tool for Multi-Resolution 3D Models of a Maya Archaeological Site* · G.Agugiaro; F. Remondino; G.Girardi; R.De amicis



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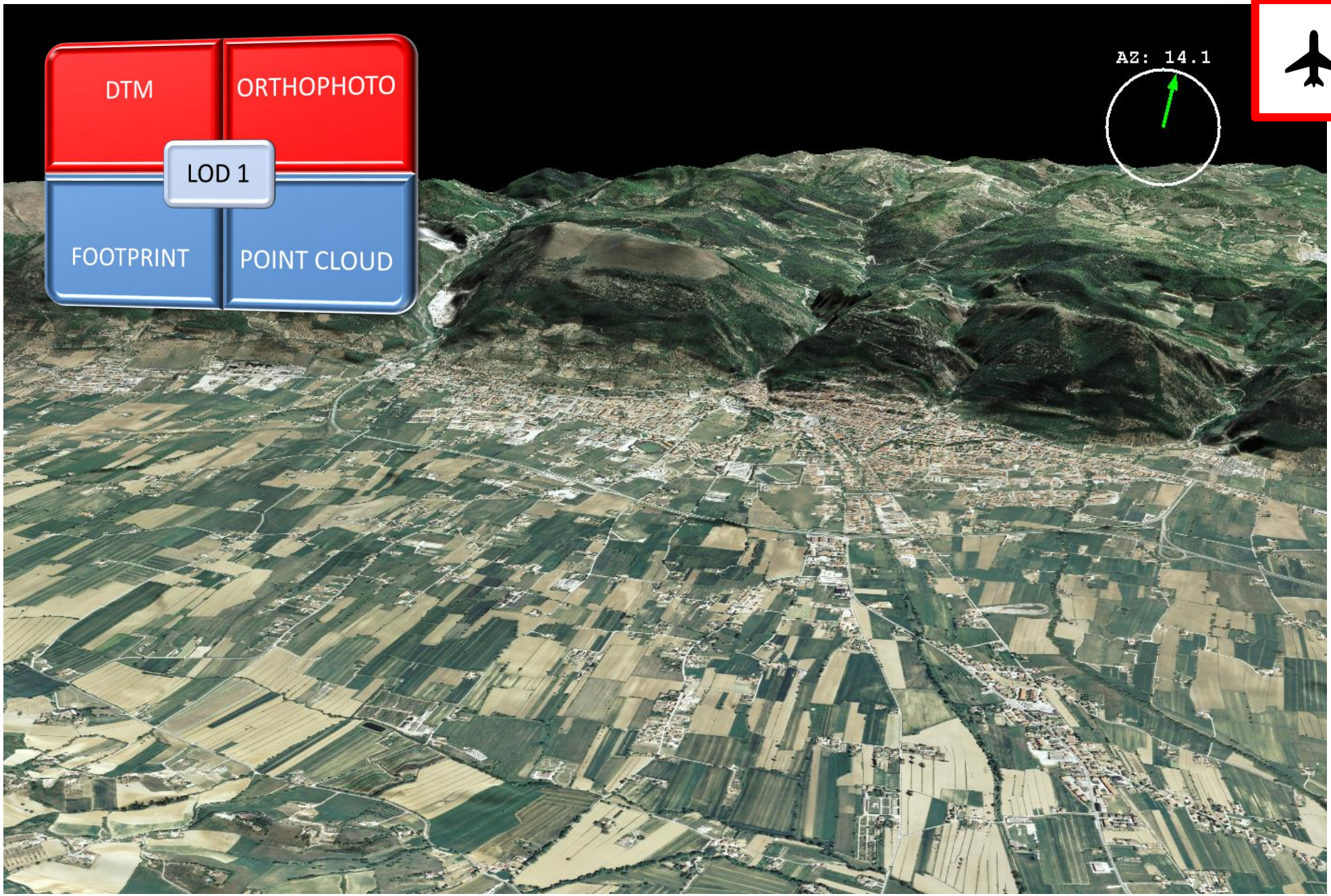

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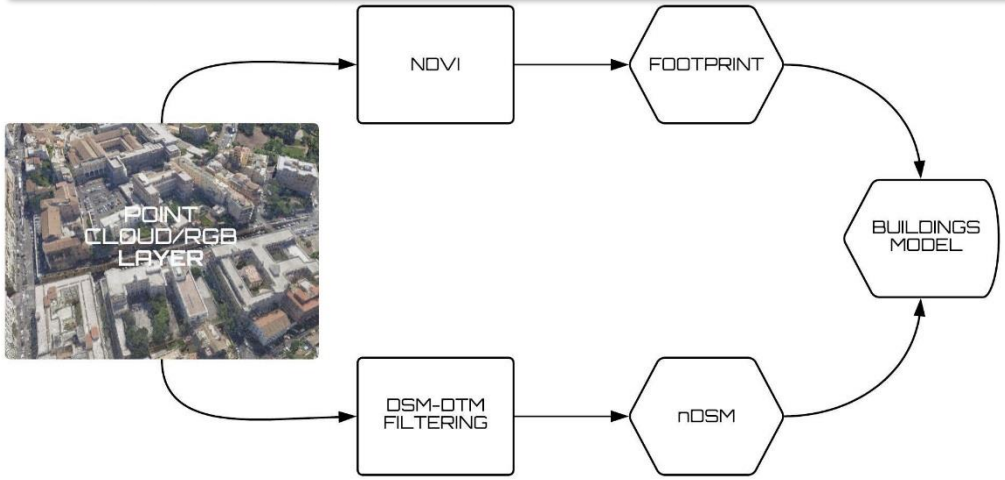
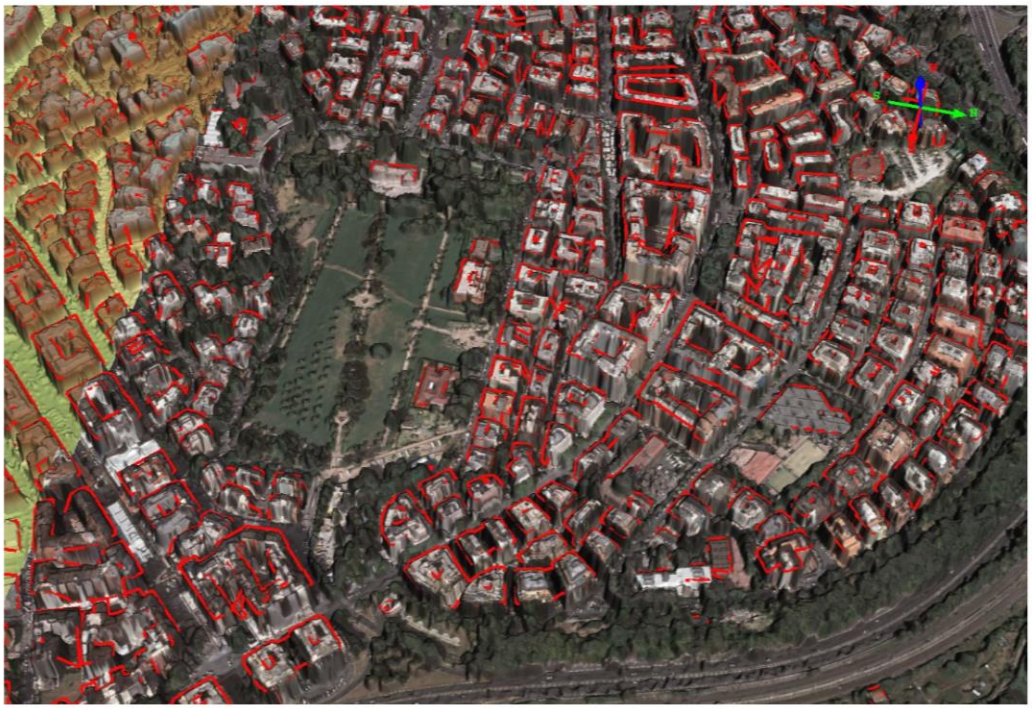
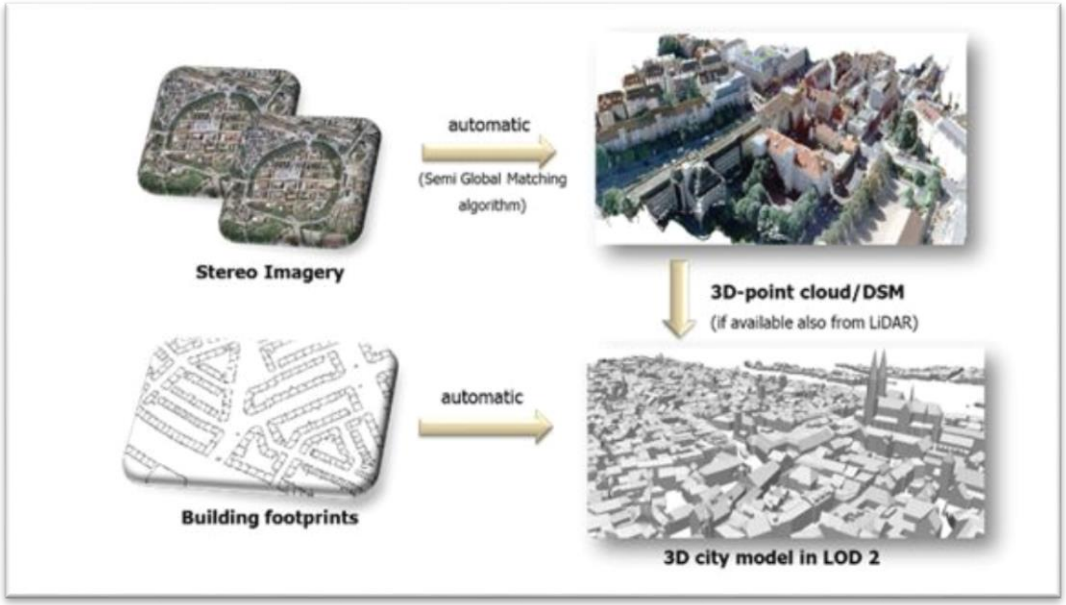
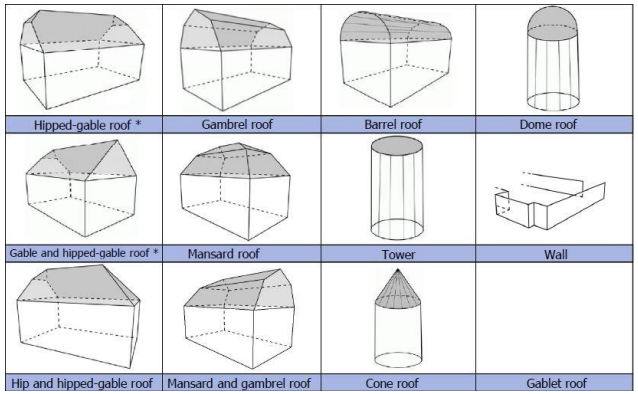
DENSE IMAGE MATCHING FOR PARAMETRIC RECONSTRUCTION OF BUILDINGS

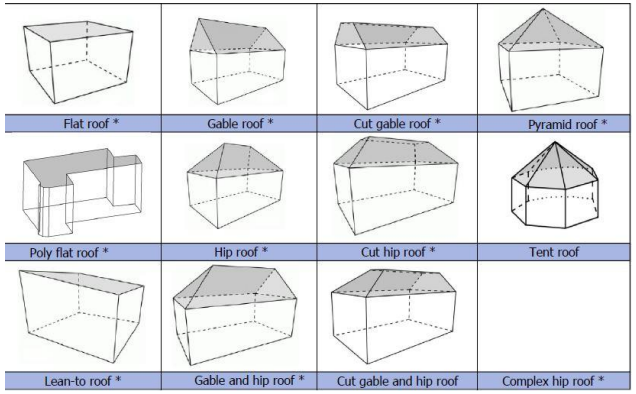




DENSE IMAGE MATCHING FOR PARAMETRIC RECONSTRUCTION OF BUILDINGS








```
Analyse height data ...
Finished analysing height data.

Analyse data sources ...
Finished analysing data sources.

Roof form detection

End of roof form recognition

Report --> :
        Lean-to roof                :455
        Gable roof                  :2898
        Hip roof                    :93
        Gable and hip roof          :589
        Cut hip roof                :27
        Cut gable roof              :315
        Hipped-gable roof           :0
        Gable and hipped-gable roof :8
        Pyramid roof                :4
        Tent roof                   :0
        Gambrel roof                :0
        Mansard roof                :0
        Mansard and gambrel roof    :0
        Tower                       :0
        Dome roof                   :0
        Barrel roof                 :0
        Gablet roof                 :0
        Gable and gablet roof       :0
        Freeform roof               :0
        Flat roof                   :2578
        Flat roof (LoD1)            :4038
        not found                   :0
        other                       :0
        ----------------------------------
        Sum                         :11005

Quality sure                        :1841
Quality unsure                      :3292
Quality not recognized              :1834
Quality not recognized Lod1         :4038

-------------------------------------------------------------------------------

Input                               :5804
After splitting                     :11005
Found                               :11005
Not found                           :0
After adjustment                    :11005

Calculation completed.
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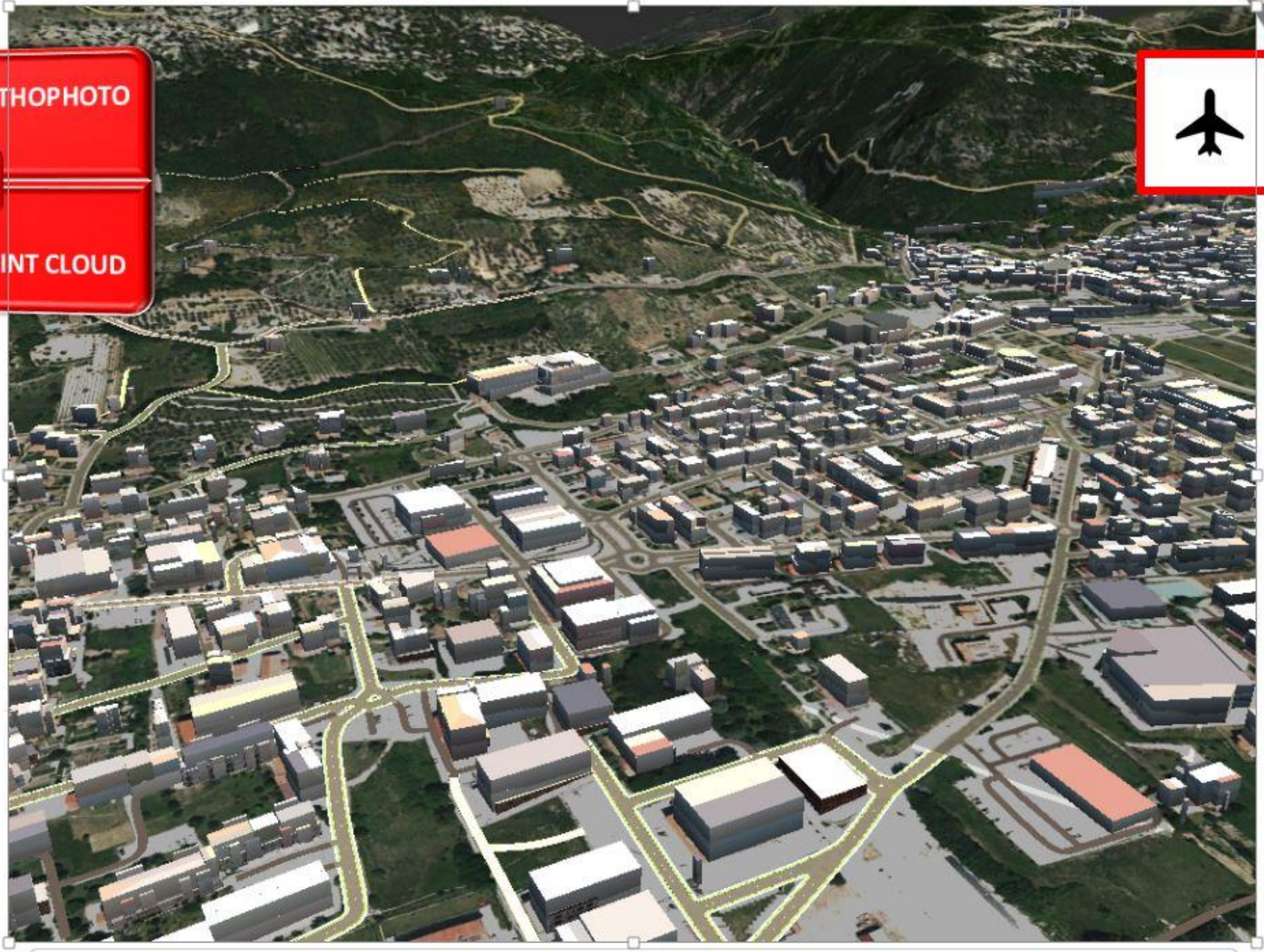

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01:02,90

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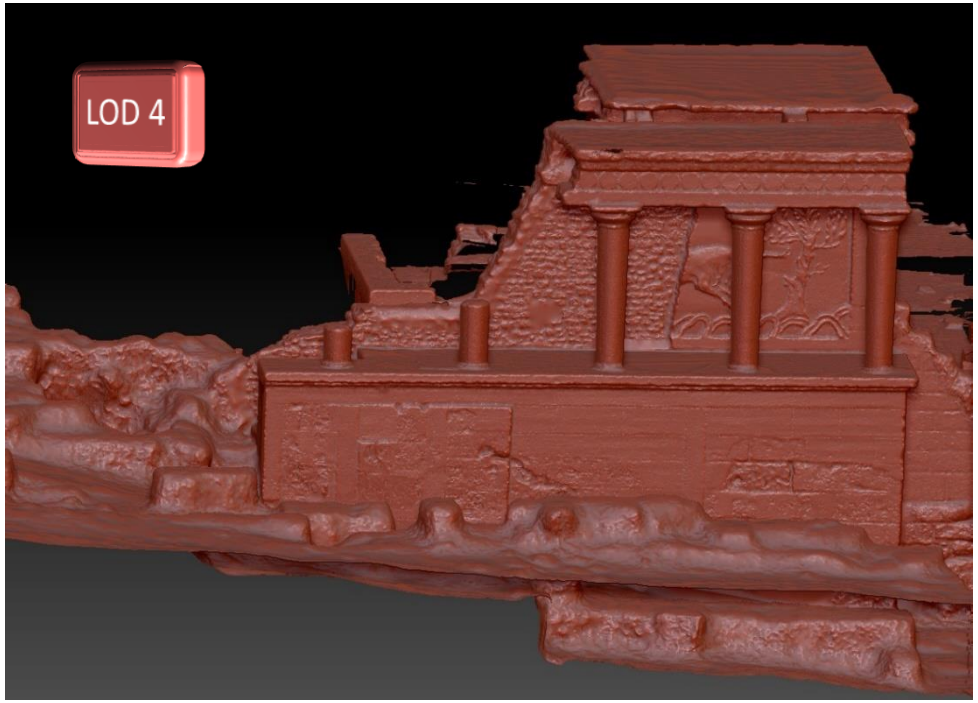

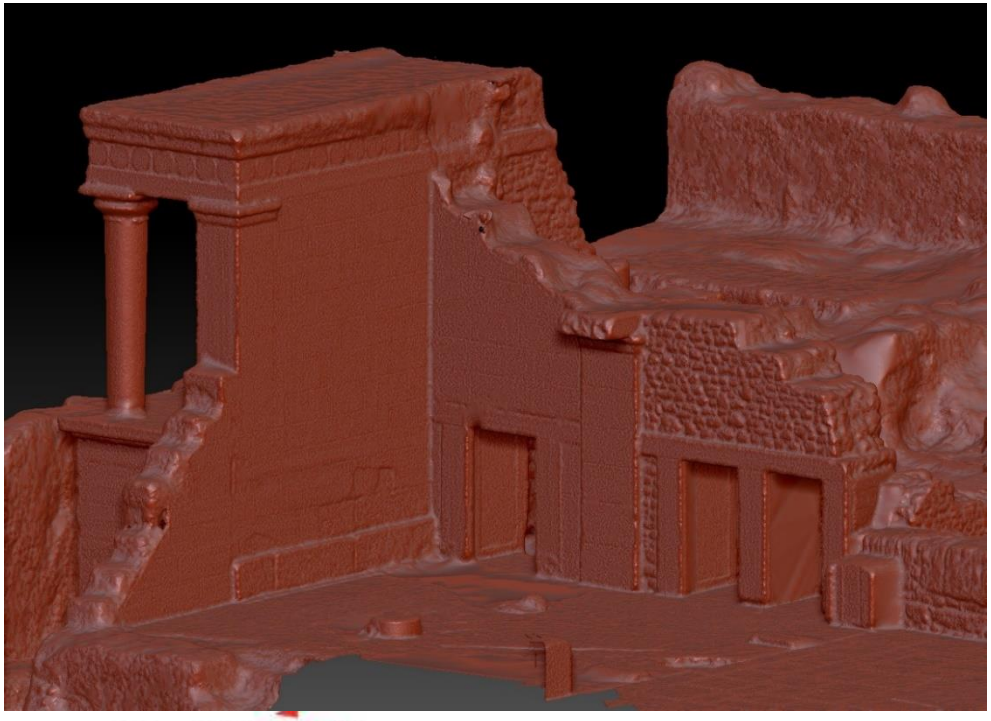

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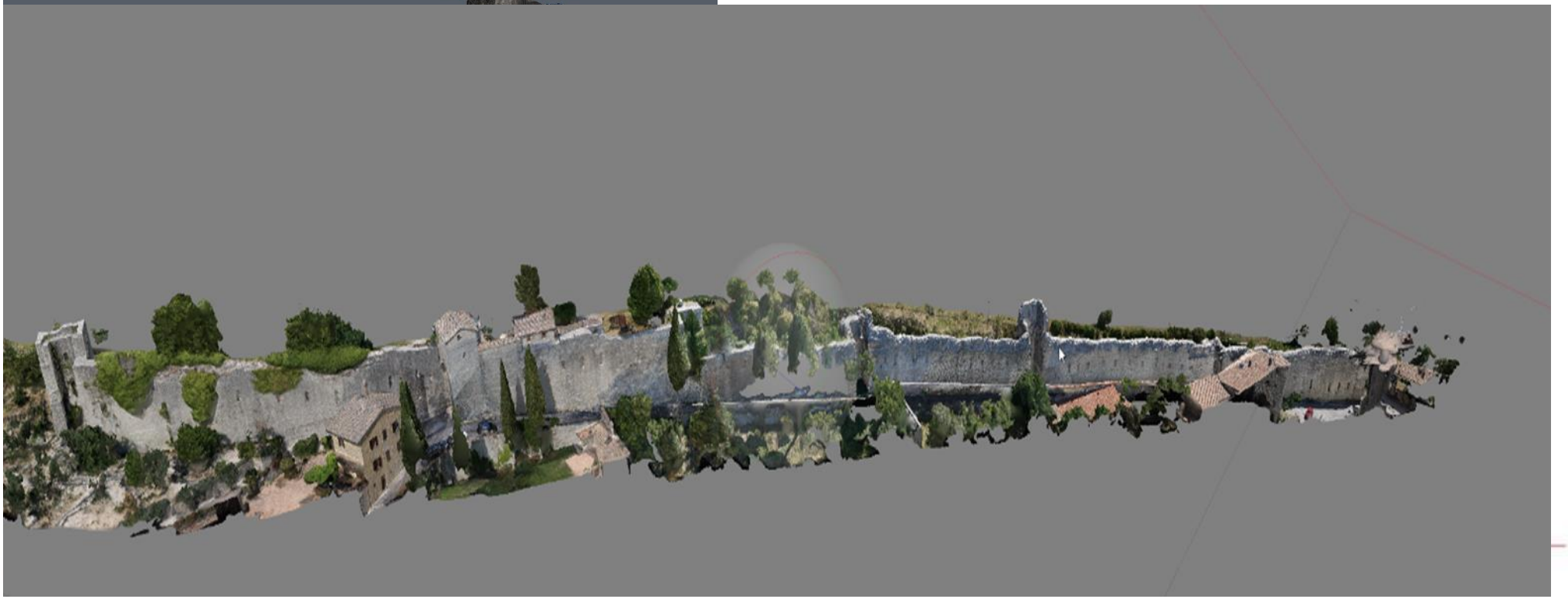
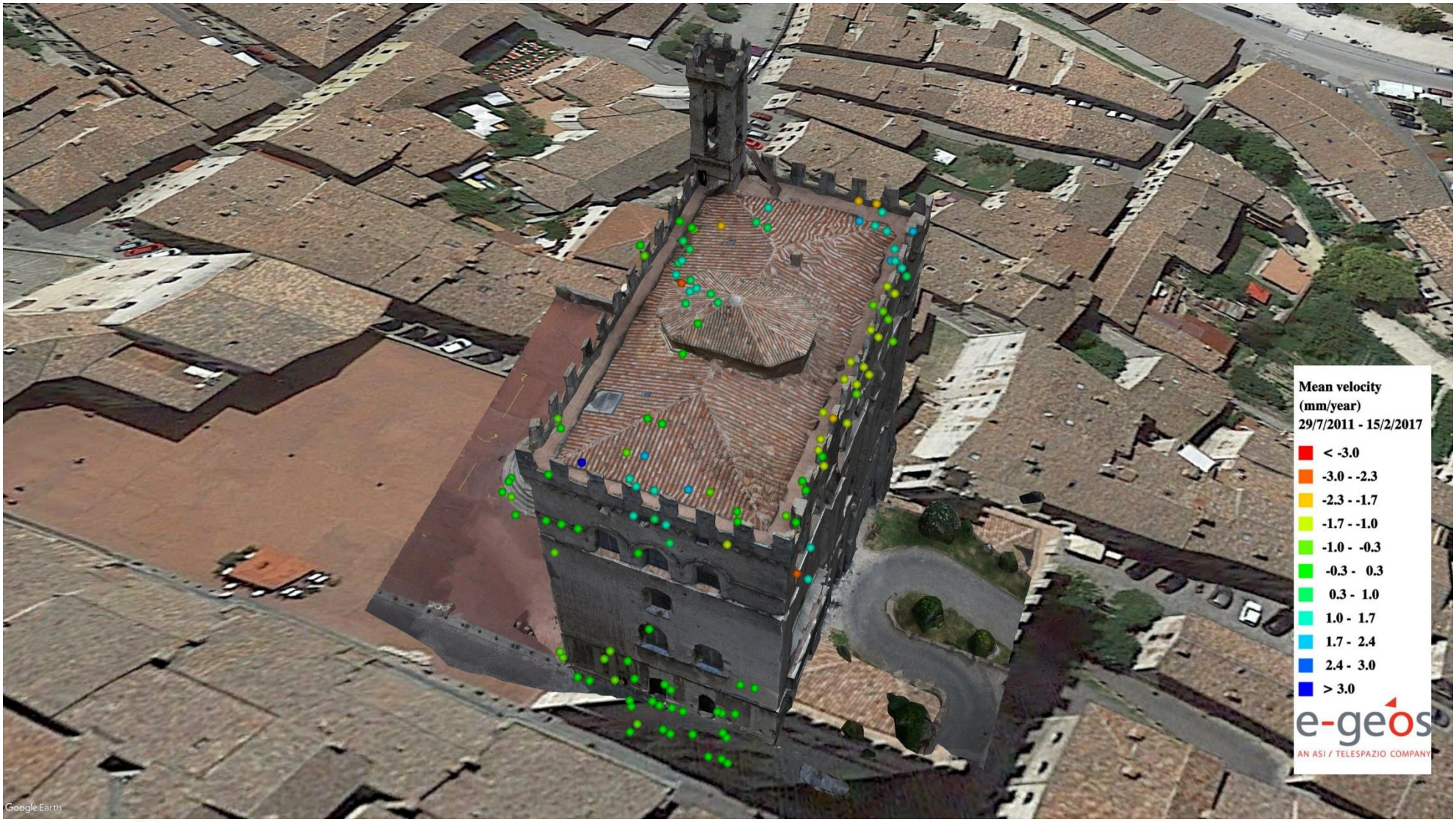
LOD 4





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Thank you

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