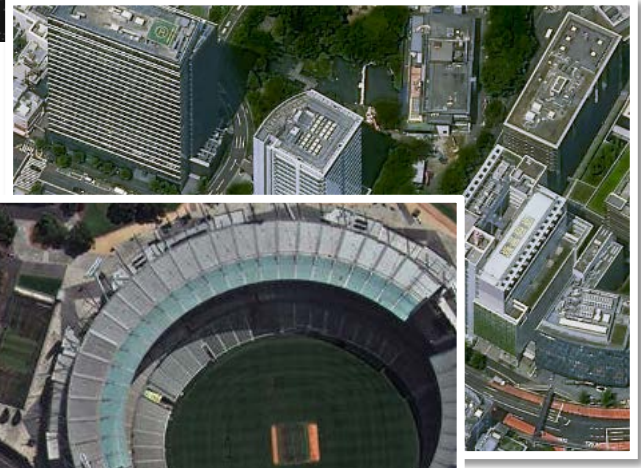
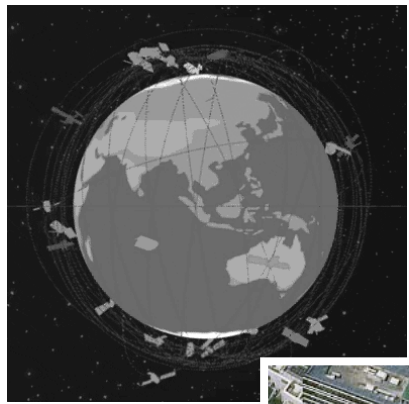


# Reconstruction of 3D Environments from Satellite Imagery by Artificial Intelligence and Computational Geometry for Exploitation in Mixed Reality

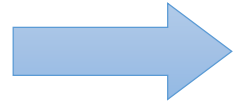
Yuliya Tarabalka  
Research Director, [ytarabalka@luxcarta.com](mailto:ytarabalka@luxcarta.com)

C. Zanka, N. Girard, S. Tripodi, C. Larrosa, F. Lavignotte,  
J.-P. Bauchet, G. Fonteix, V. Madelain, G. Smialek

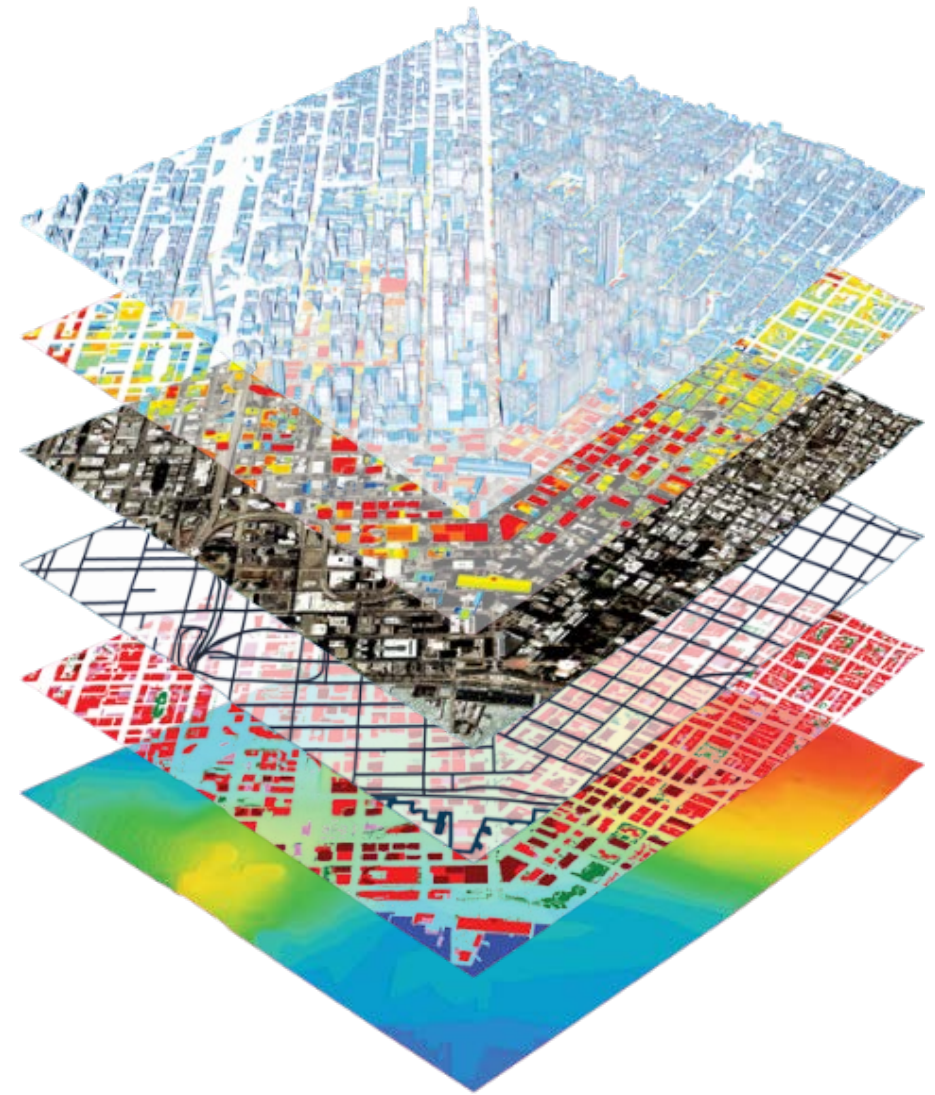
## Mapping **your** world in 3D



MAXAR  
WorldView  
images



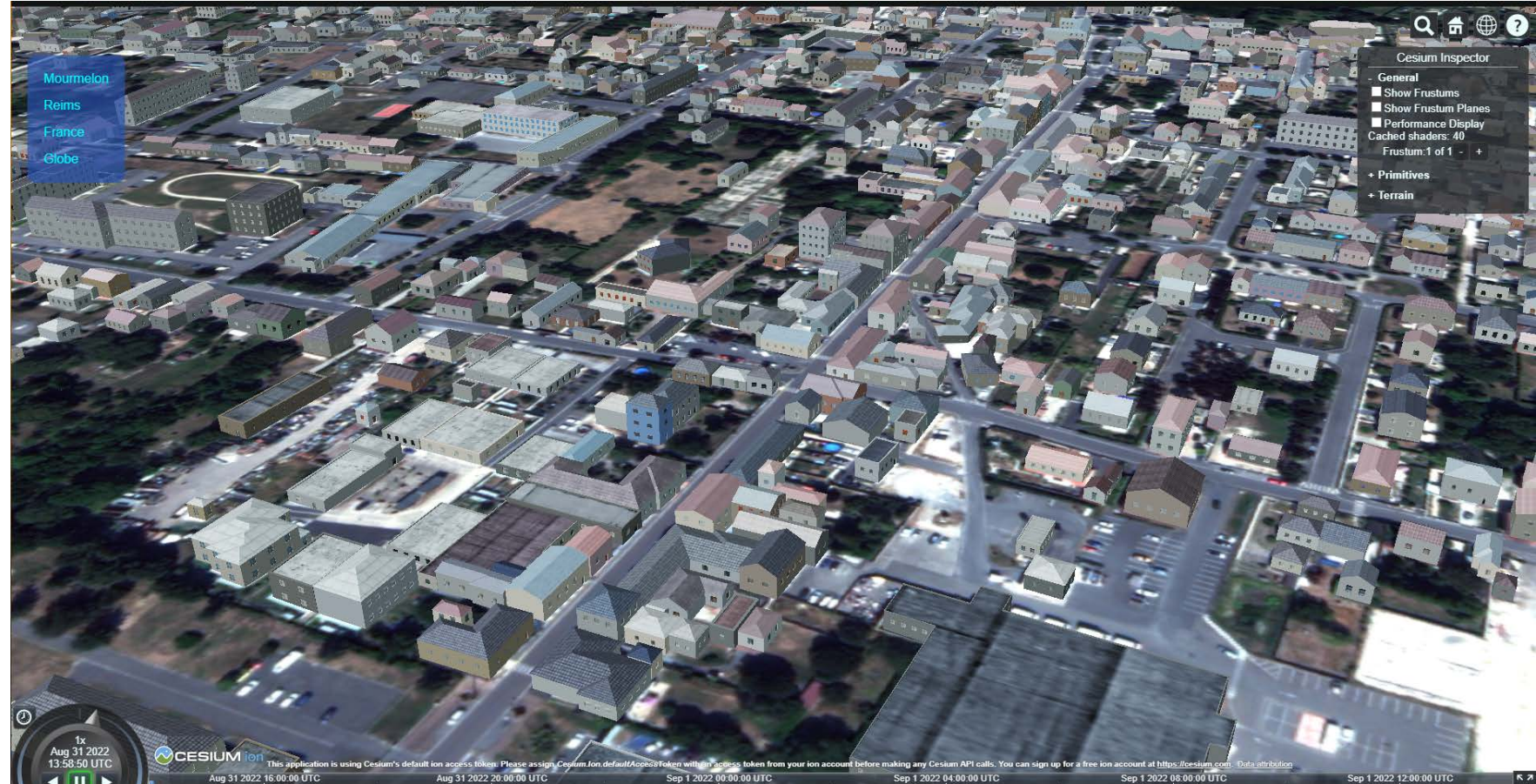
- Geodata producer + 3D viewer software & services
- **Automatic generation of 3D cartographic environments** from satellite images
- Applications: telecom, simulation & training, smart cities, navigation, ...

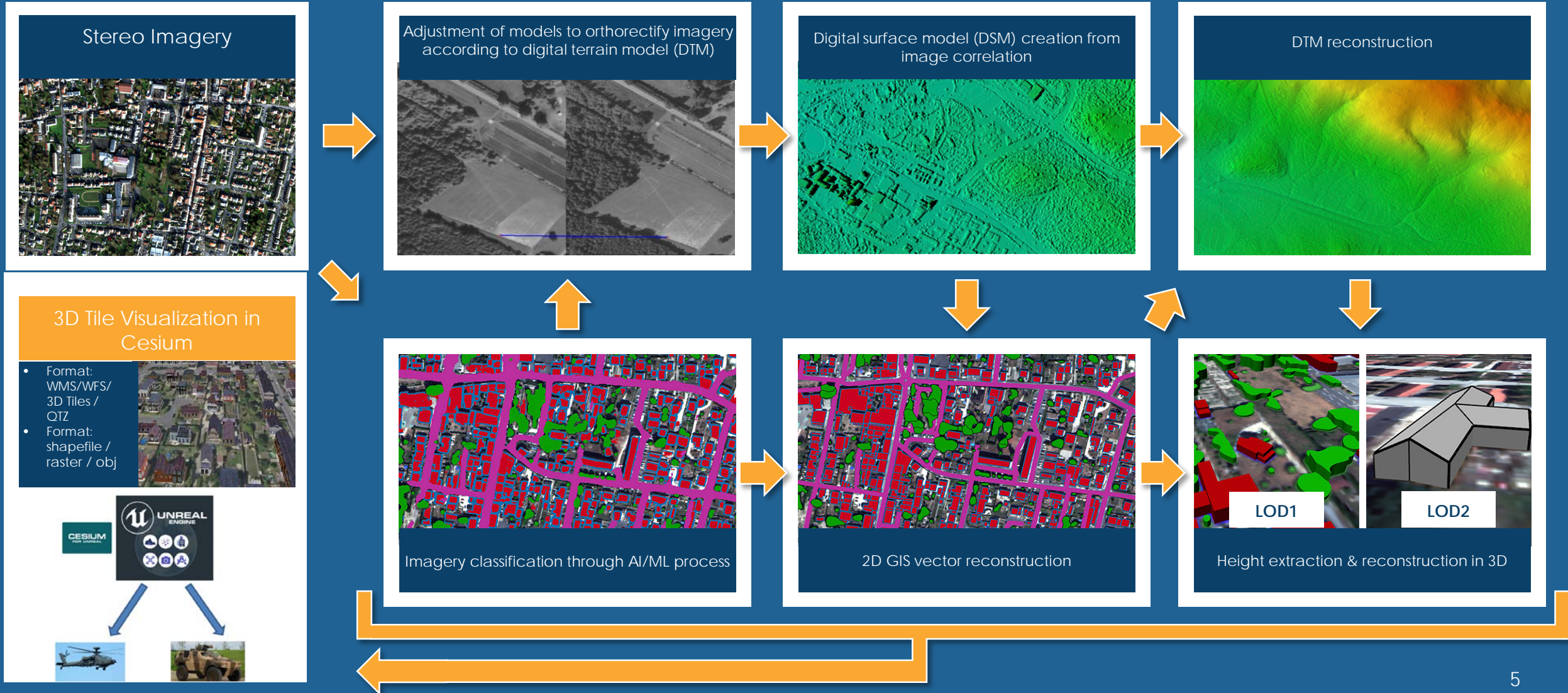


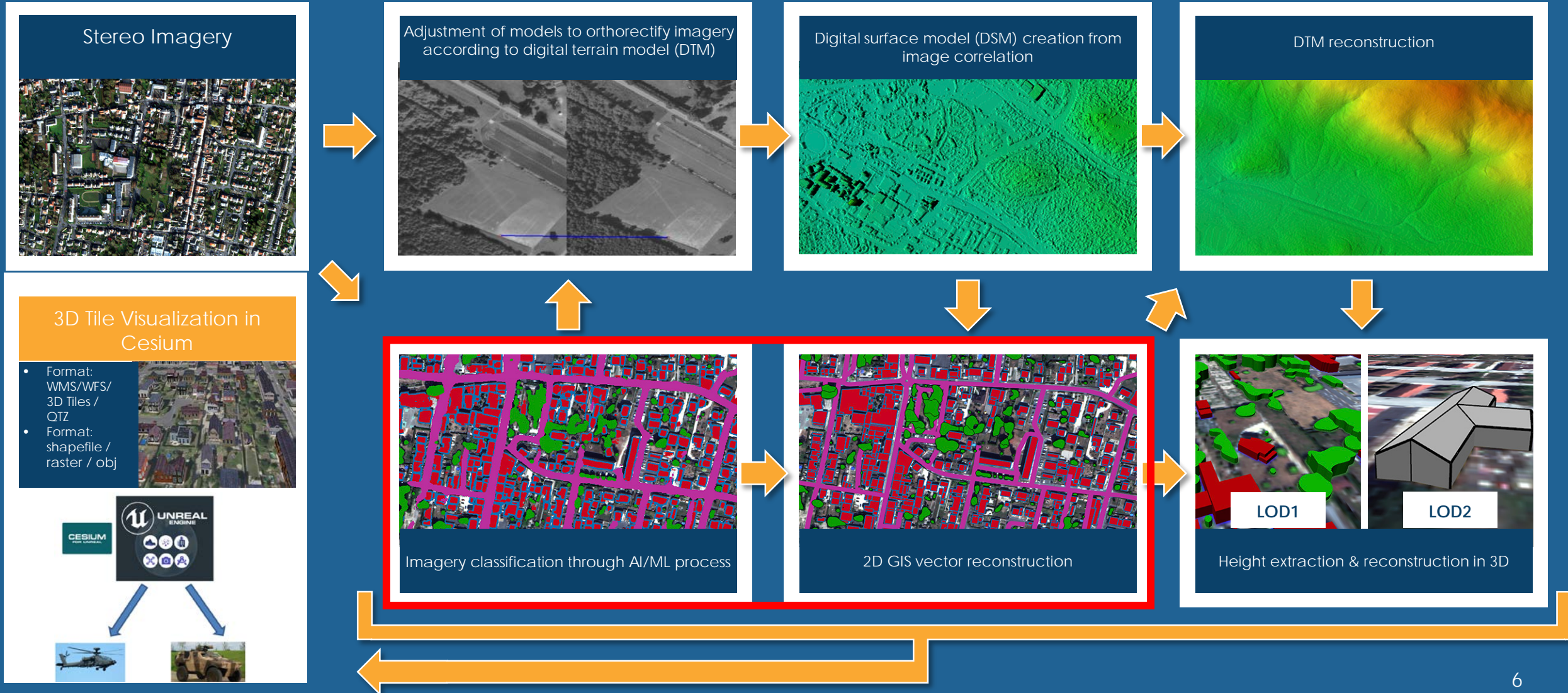


# Objective

- **Automatic reconstruction of faithful to the reality 3D environments**
  - Large Earth surfaces within a short time lapse
  - Satellite imagery enables frequent update of the scene
- **Data provision: centralized & streaming**
  - Optimized way for large-scene management









- 2D: millions of km<sup>2</sup> per year
- 3D: 50 à 100 000 km<sup>2</sup> per year
- Continuous update



**City Planner 3D**  
(0.5-2m resolution)

Covering 1,800 areas representing  
320,000 km<sup>2</sup>



**Urban Planner 2.5D**  
(2-10m resolution)

Covering 123 areas representing  
36,000 km<sup>2</sup>



**Urban Planner 2D**  
(5-10m resolution)

For over 2454 areas covering over  
5.5 million km<sup>2</sup>



**Region Planner 2D**  
(10-20m resolution)

635 areas covering 250 million km<sup>2</sup>



Our deep learning virtuous circle =  
continuous improvement



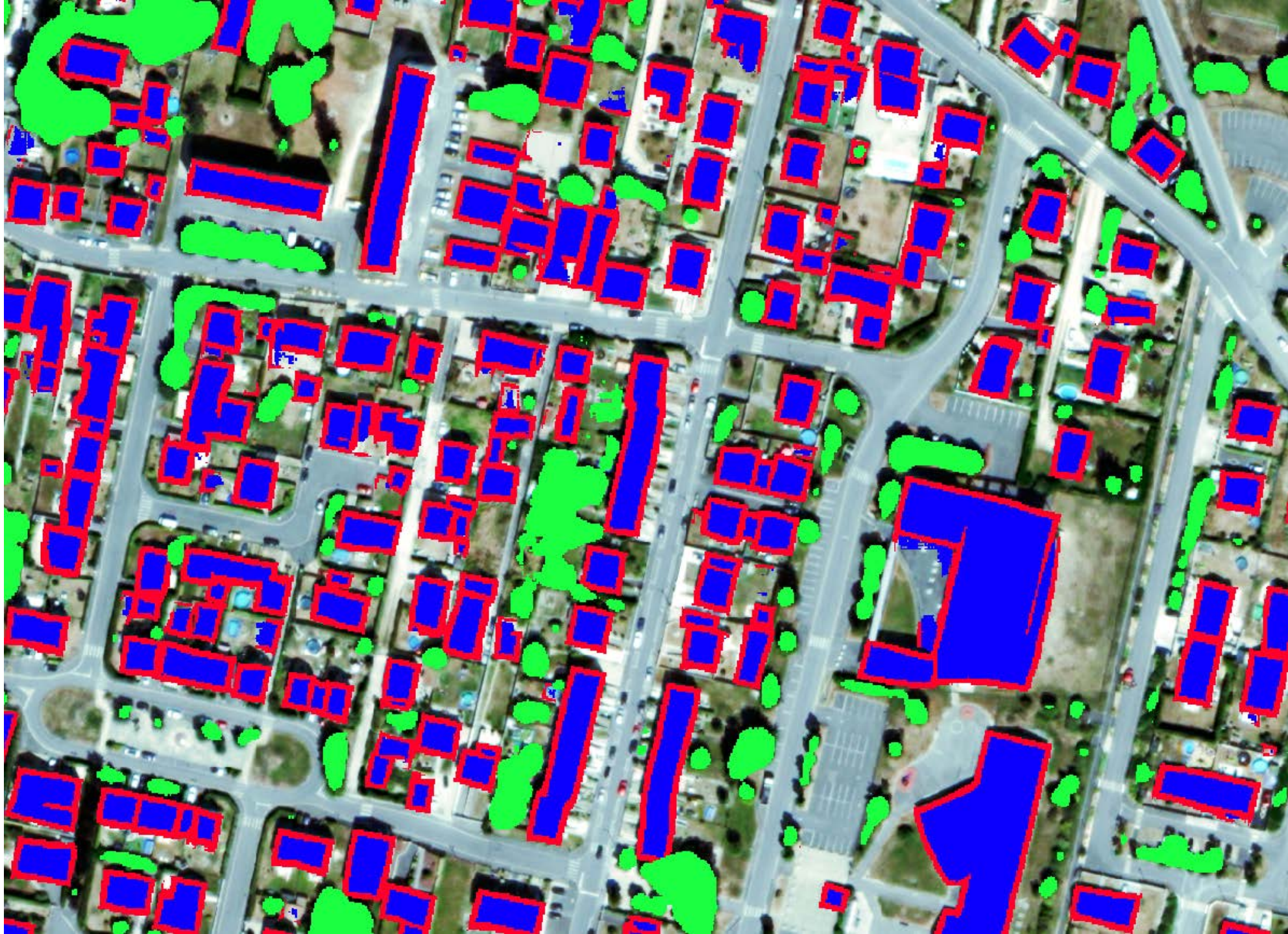
# AI-powered semantics



# AI-powered semantics

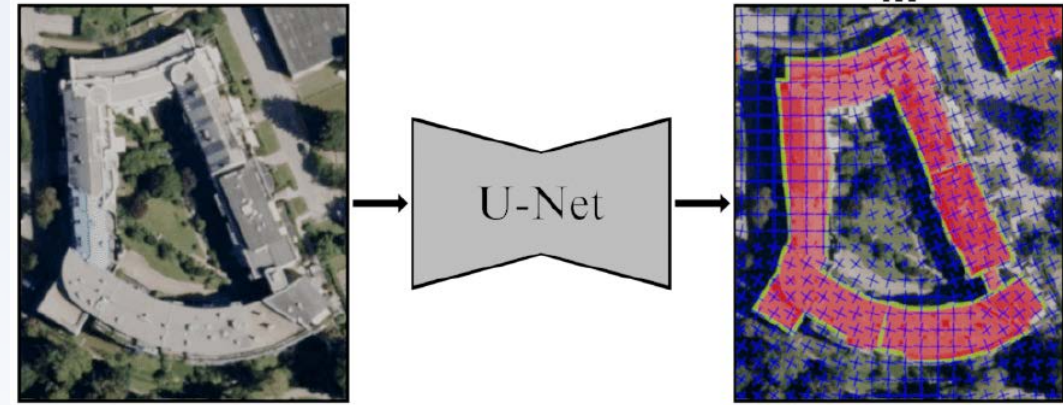
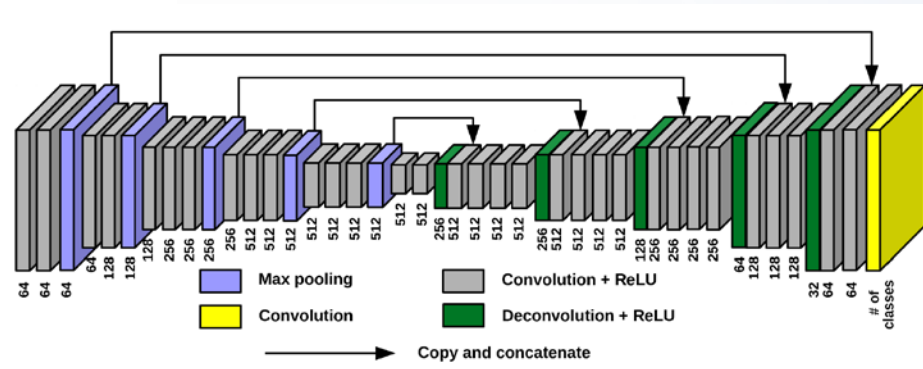


# AI-powered semantics



# AI-powered semantics

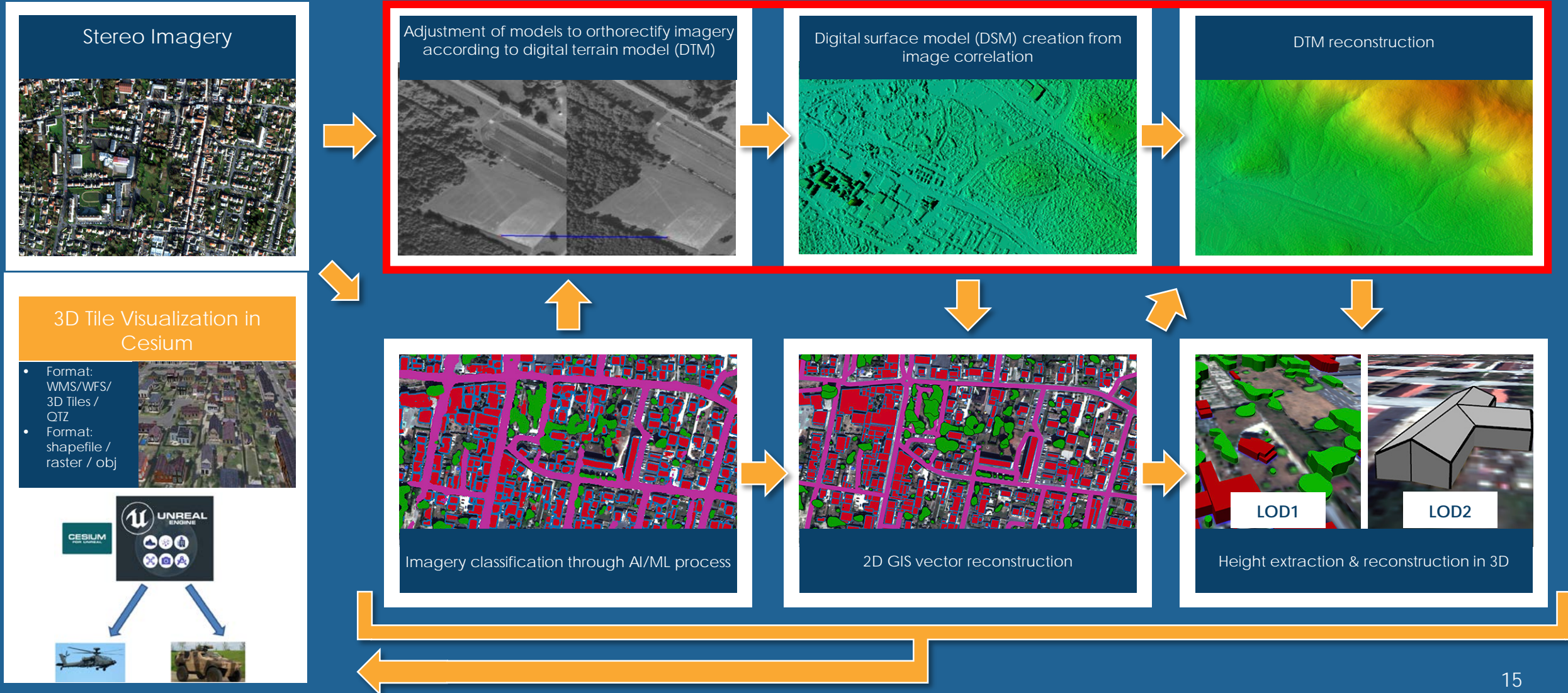




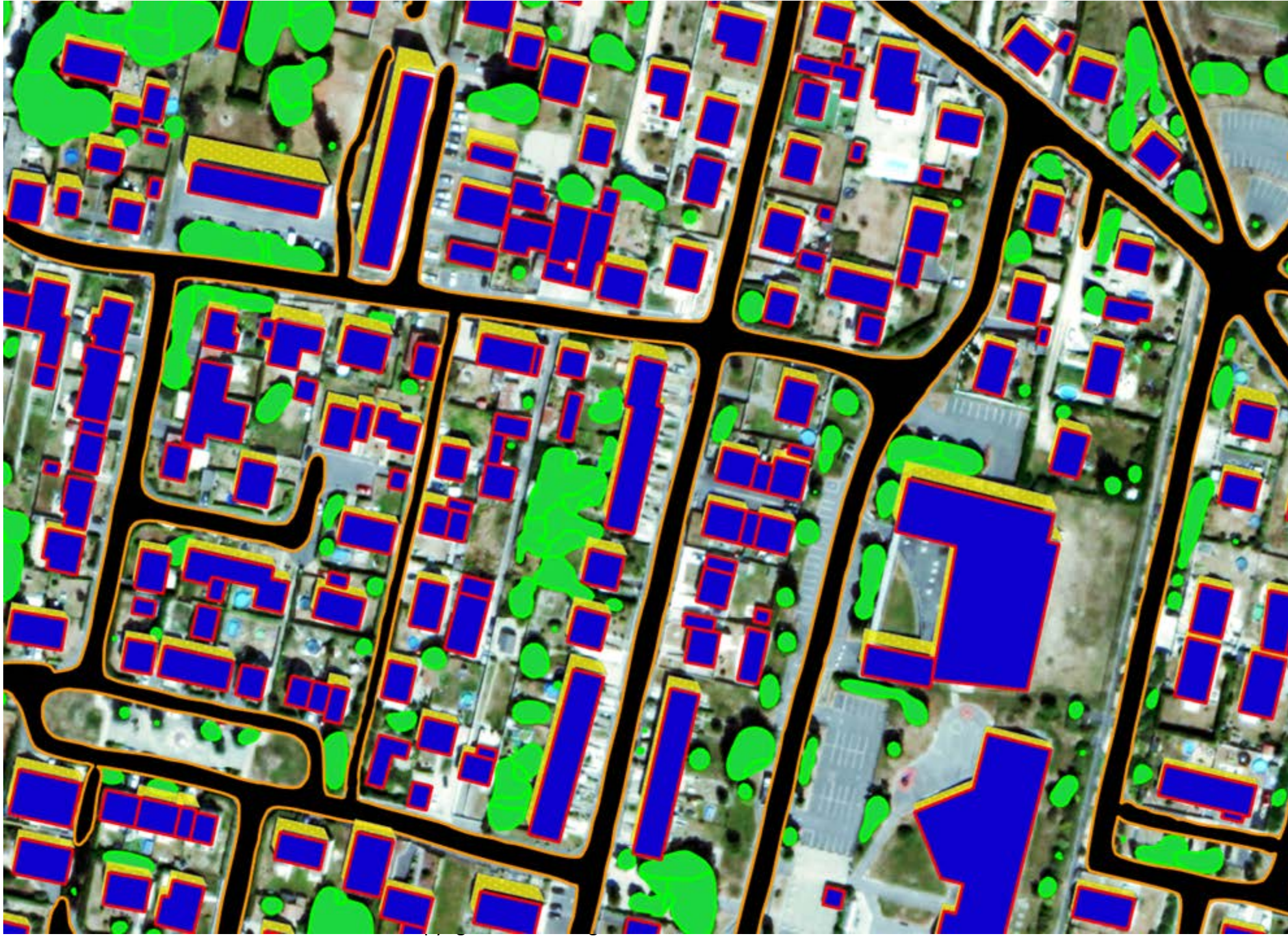
Girard et al, CVPR 2021, Bauchet et al, IGARSS 2022

# AI-powered reconstruction





# AI-powered height extraction

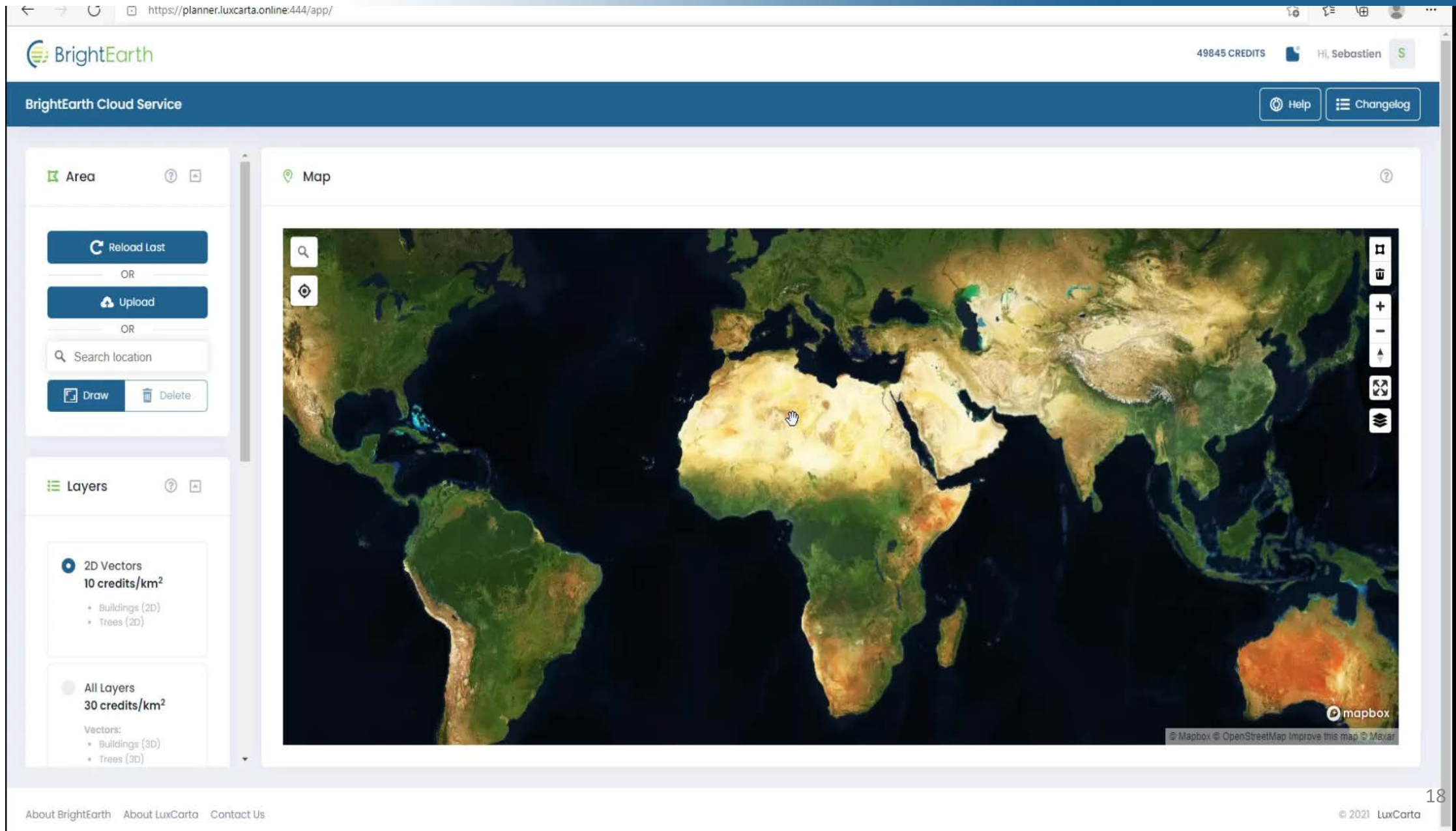




- **Smart data aggregation**
  - Additional images & open-source data
  - Boosting quality & confidence estimation



# AI-powered Automatic Mapping Platform

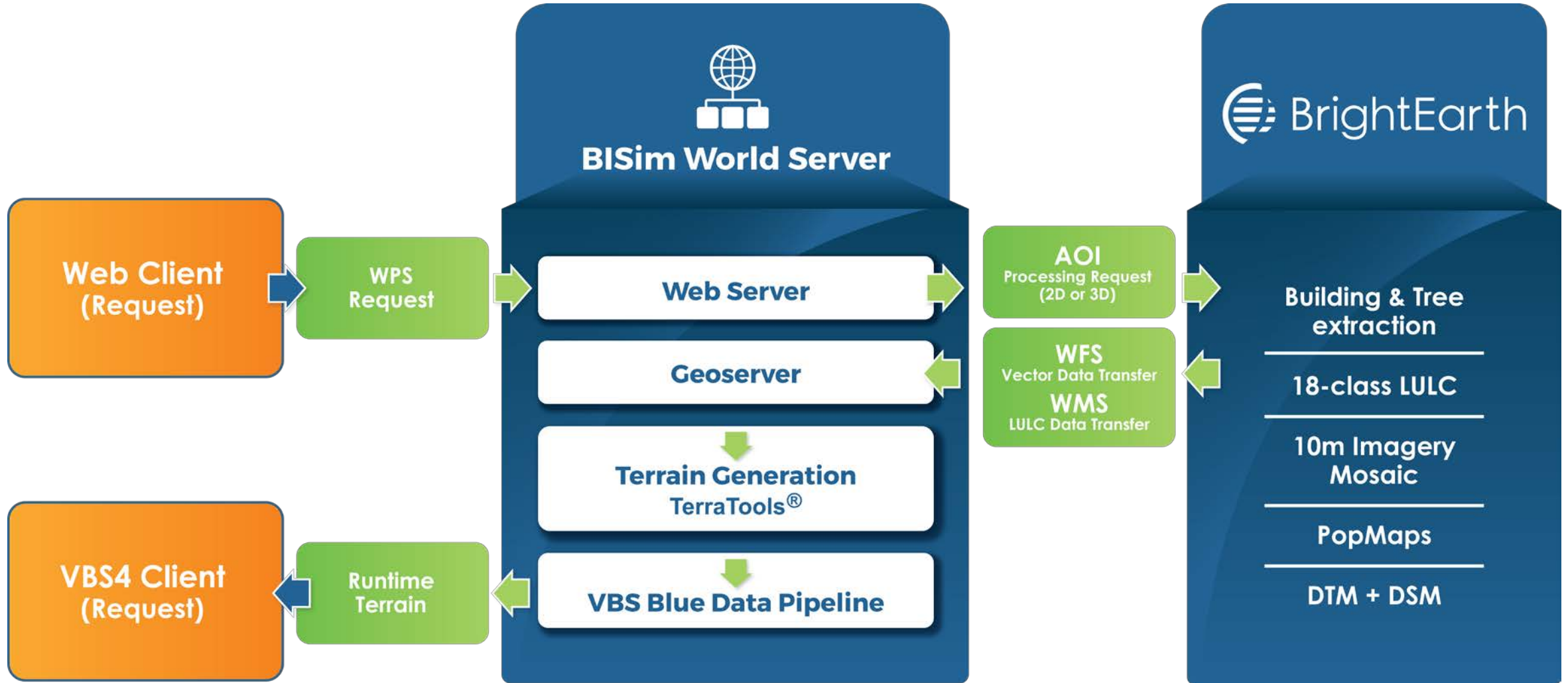


The screenshot displays the BrightEarth Cloud Service web interface. At the top, the browser address bar shows the URL <https://planner.luxcarta.online:444/app/>. The page header includes the BrightEarth logo, the text "BrightEarth Cloud Service", and user information: "49845 CREDITS", "Hi, Sebastien", and a profile icon. Navigation buttons for "Help" and "Changelog" are also present.

The main interface is divided into several sections:

- Area Panel:** Contains buttons for "Reload Last", "Upload", "Search location", "Draw", and "Delete".
- Layers Panel:** Lists two layer options:
  - 2D Vectors (10 credits/km<sup>2</sup>):** Includes "Buildings (2D)" and "Trees (2D)".
  - All Layers (30 credits/km<sup>2</sup>):** Includes "Vectors" with "Buildings (3D)" and "Trees (3D)".
- Map Panel:** Displays a world map with a hand cursor over Africa. It includes a search icon, a location pin icon, and a vertical toolbar with zoom in (+), zoom out (-), home, and other map controls. The Mapbox logo is visible in the bottom right corner of the map area.

At the bottom of the page, there are links for "About BrightEarth", "About LuxCarta", and "Contact Us". The footer also includes the copyright notice "© 2021 LuxCarta".



Search for locations

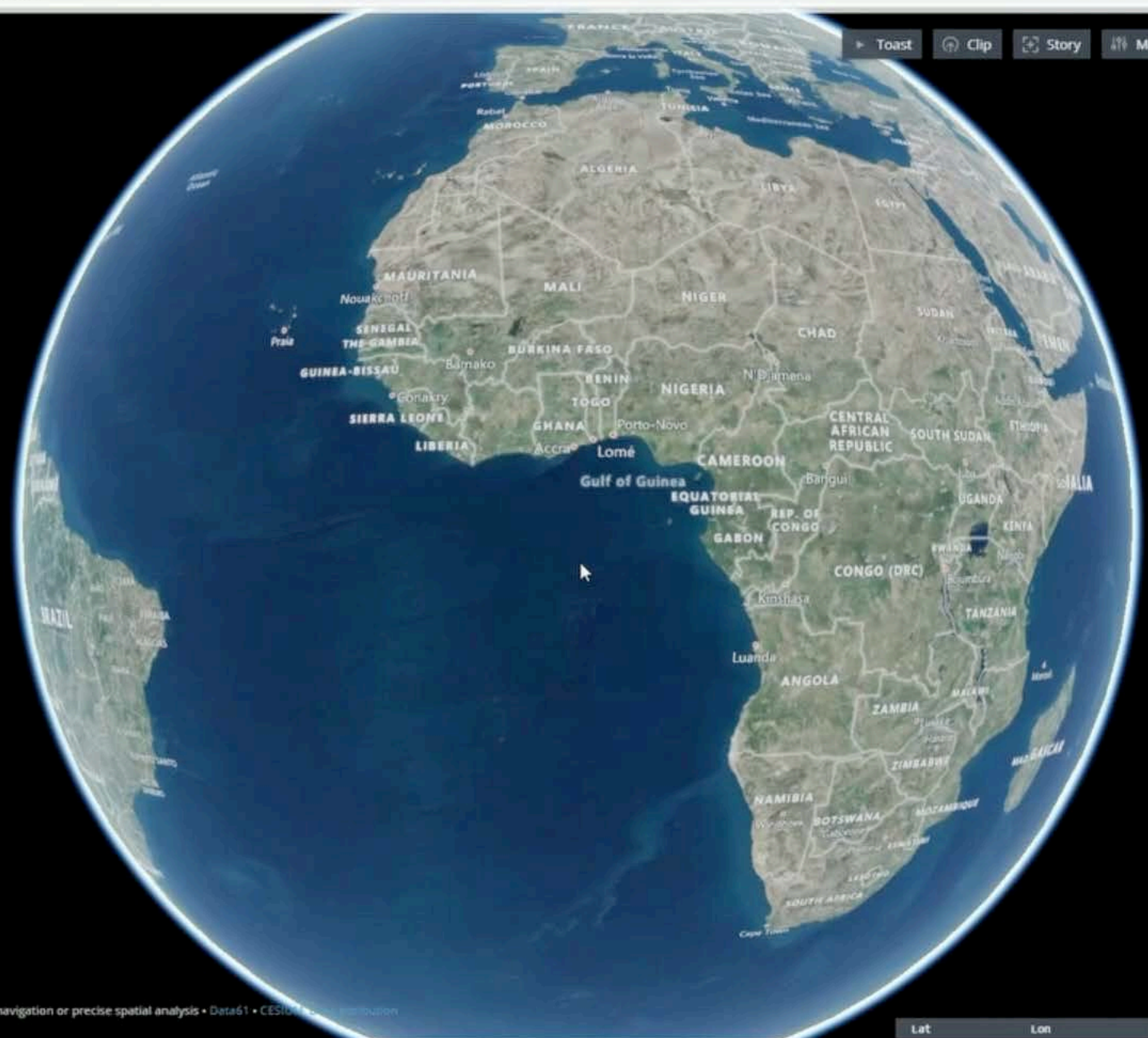
Add Data

Your workbench is empty

Click 'Add Data' above to

- Browse the Data Catalogue
- Load your own data onto the map

TIP: All your active data sets will be listed here

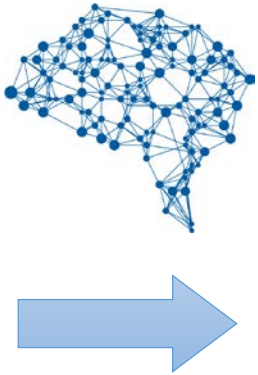


Toast | Clip | Story | Map | Share / Print | Help

Map navigation controls: Home, Zoom In, Zoom Out, Full Screen, and a circular refresh button.

# AI-assisted Texturing







# Calibration Height Adjustments

The image shows a blue calibration card held by a hand. At the top left, there is a compass icon and the text "Calibrate North". Below this is a vertical white slider with a teal knob. To the right of this is a horizontal white slider with a white knob. Below the sliders are directional controls: "Slower" with a horizontal line, "Faster" with a plus sign, "Move North" with an upward arrow, "Move South" with a downward arrow, "Move West" with a leftward arrow, and "Move East" with a rightward arrow.









Mapping **your** world in 3D