

Working towards scalable, **plot-level** building height detection **over time**

High-Resolution Tracking of Urban Densification Dynamics

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Dataset

Motivation:

- In places without administrative height data: Impossible to closely monitor urbanization dynamics
- LiDAR imagery precise but less cost-efficient + no temporal dimension to reconstruct height evolution

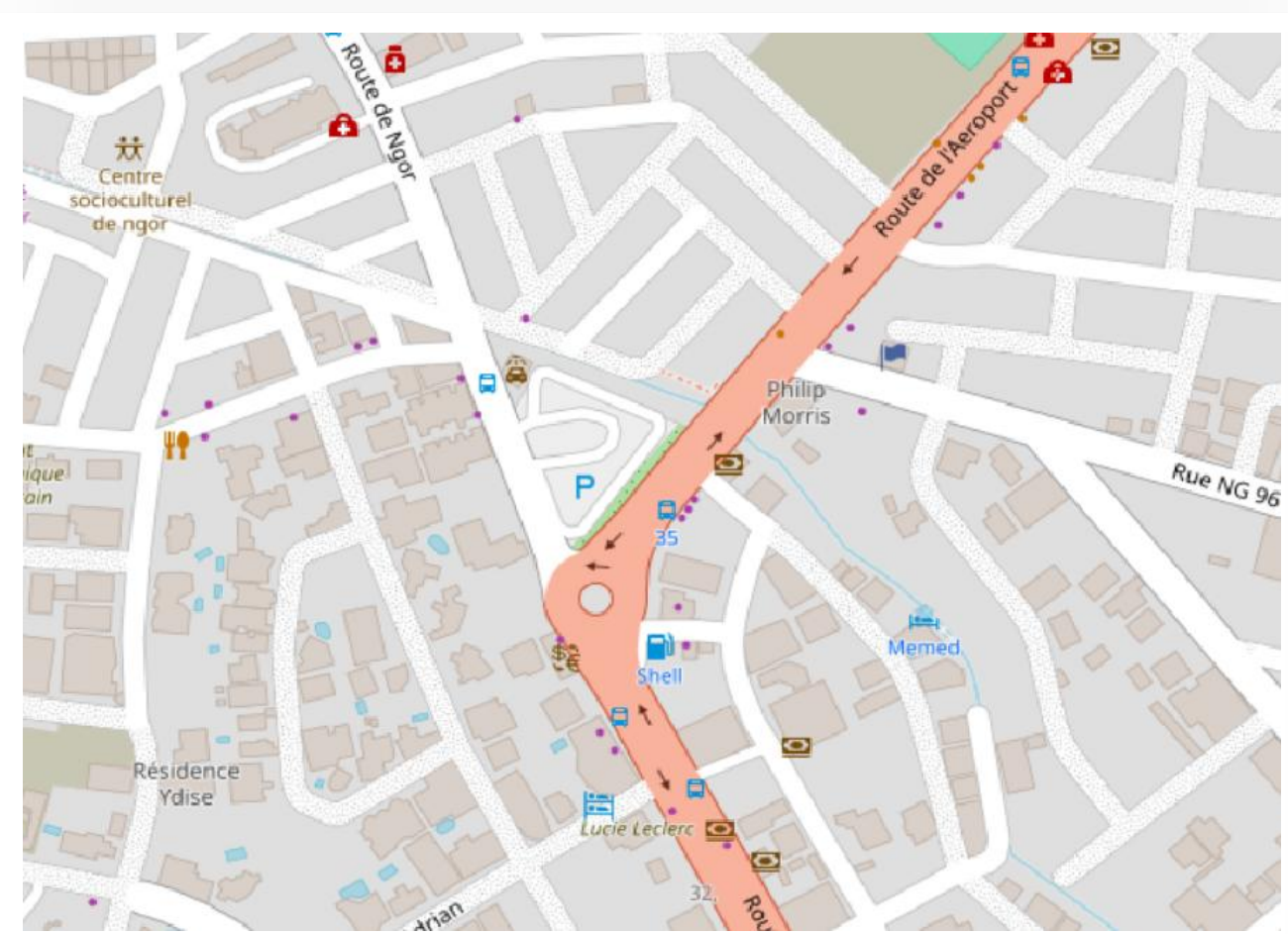


Figure: Almadies, Dakar (OpenStreetMap)

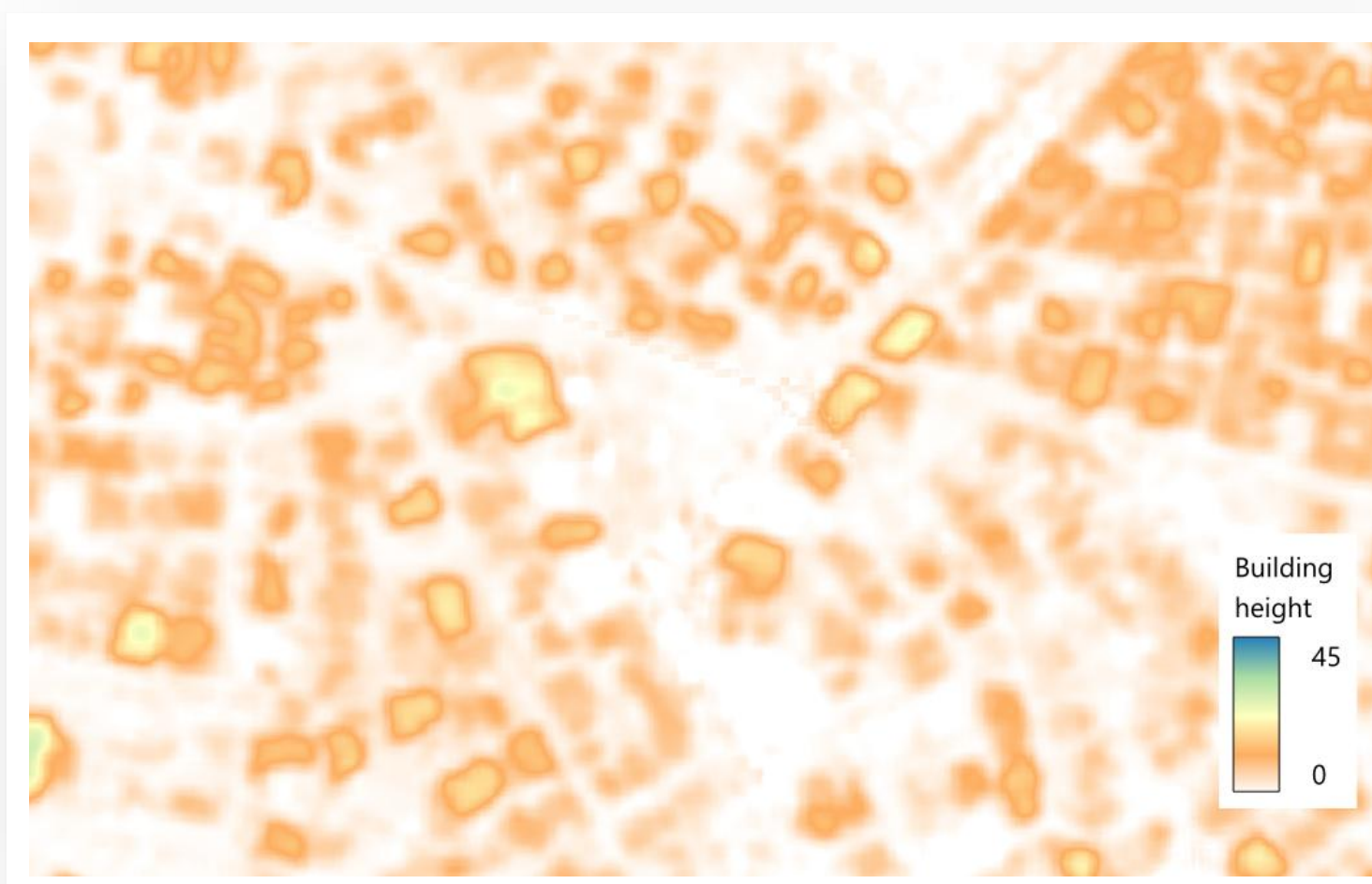


Figure: Building heights in Almadies, Dakar (2015)

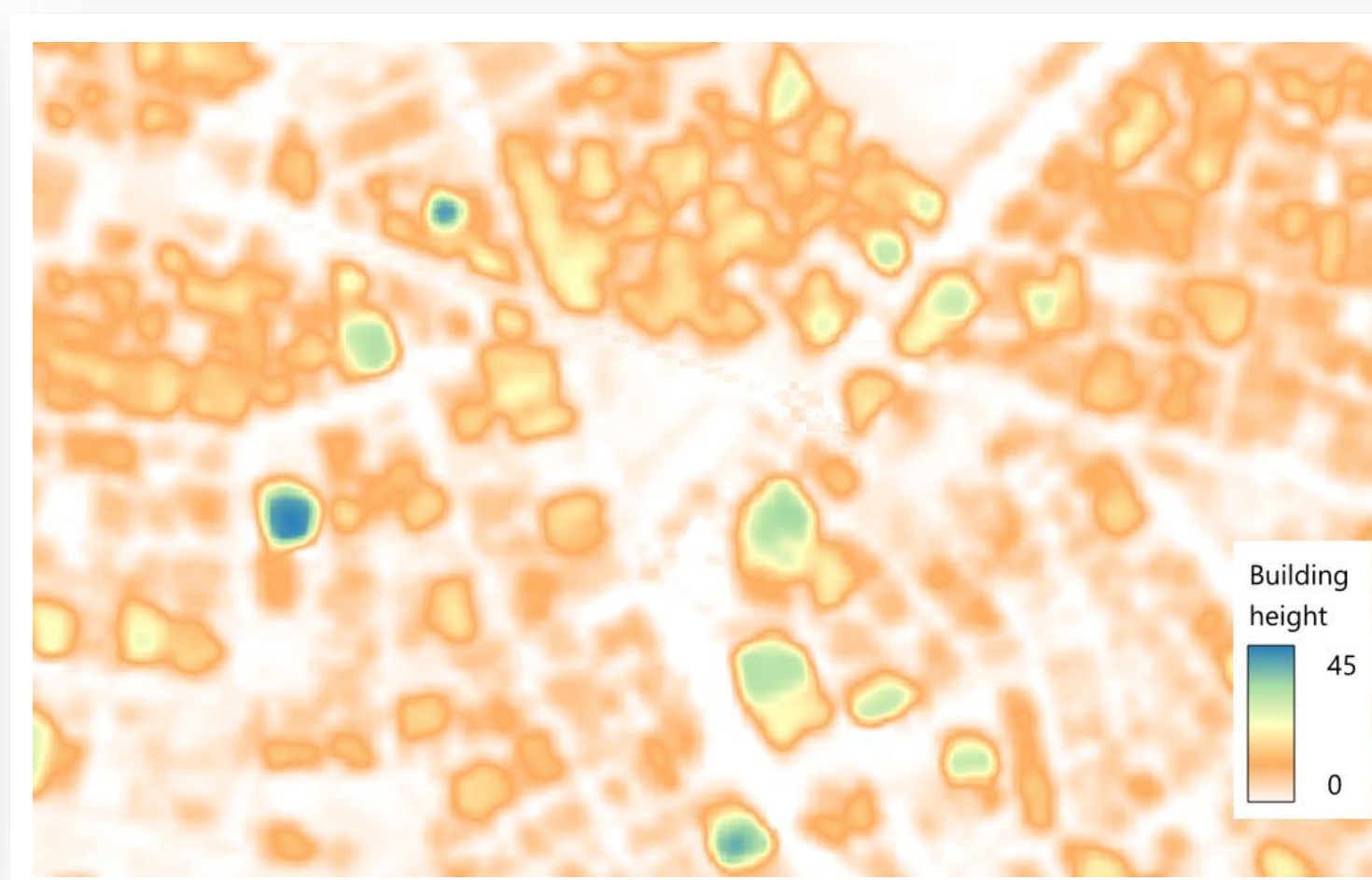


Figure: Building heights in Almadies, Dakar (2024)

Data product

- Spatial resolution: 1m x 1m raster data with a continuous measure of the highest point in meters
- Temporal dimension: From 2012 onwards depending on availability of imagery in Airbus catalogue
- Segmentation by type of densification: height additions, entire buildings, infills, greenfield, etc.

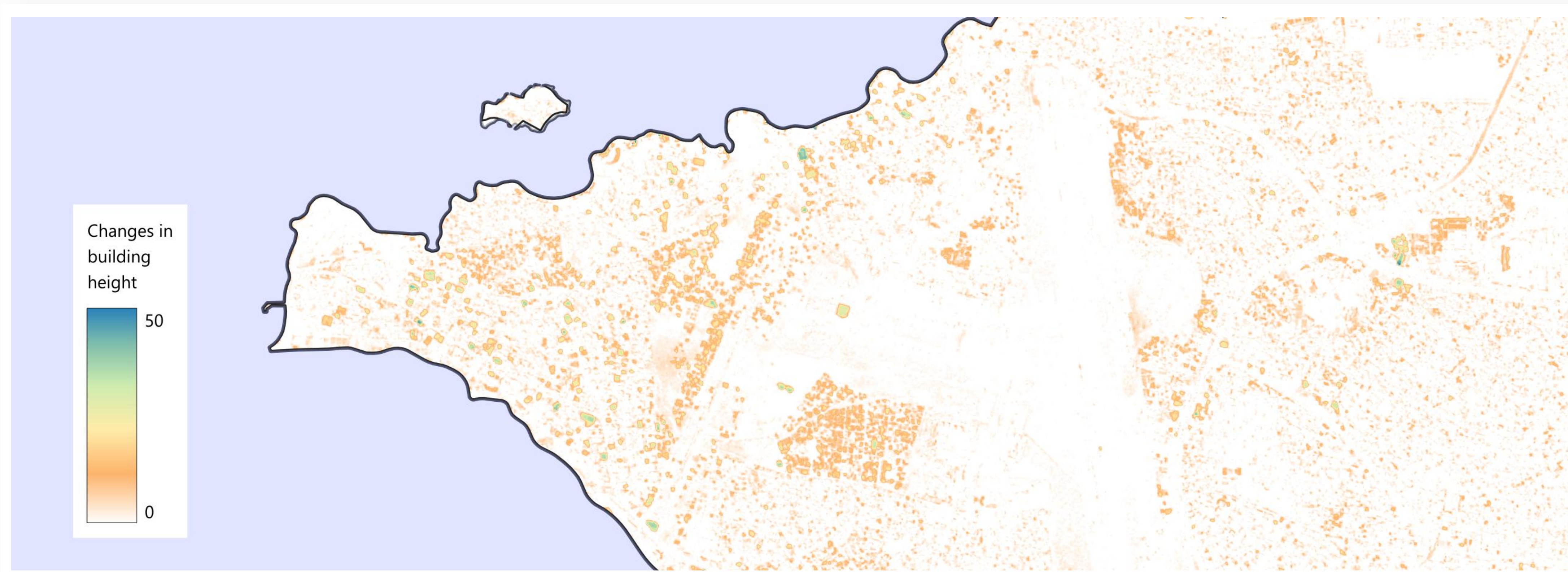


Figure: Building height changes in Western Dakar (2015-2024)

Research & Policy Potential

- Land titling programs
- Tax property collection programs
- Monitoring of urban development
- Enforcement of regulation

Next steps

- Validation with LiDAR imagery
- Validation of changes over time
- Application to plot-level intervention to assess impacts on housing investments

Technical

Approach

- Multi-view stereo Pleiades satellite imagery (satellite active since 2011/12)
- Computation of digital surface models and access to high-resolution satellite imagery via Data-Terra DINAMIS platform
- Drawing on MicMac algorithm for 3D reconstruction from multi-view images (Rupnik et al, 2018)

Validation

- Comparison to ground truth data on number of floors of approx. 2,000 properties in Dakar 2018 (Knebelmann et al, 2024)
- >90% of buildings' height within +/- one floor of predicted height