LandScan Population Research Program

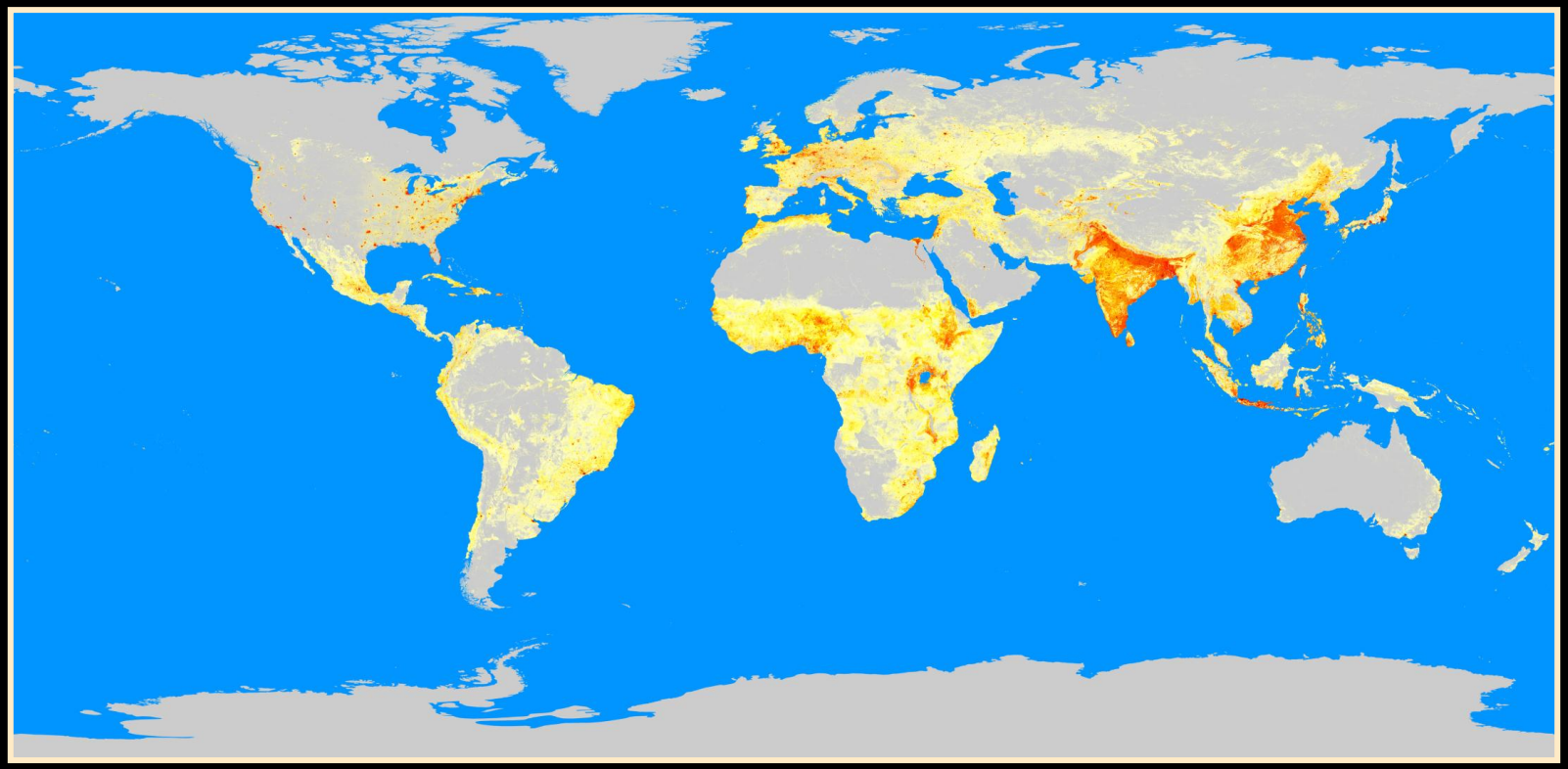
Presented by

Budhendra Bhaduri

Geographic Information Science and Technology
Computational Sciences and Engineering

What is LandScan?

Population distribution model, database, and tool developed from census and other spatial data using a uniform regular grid



Improving knowledge of where people are located

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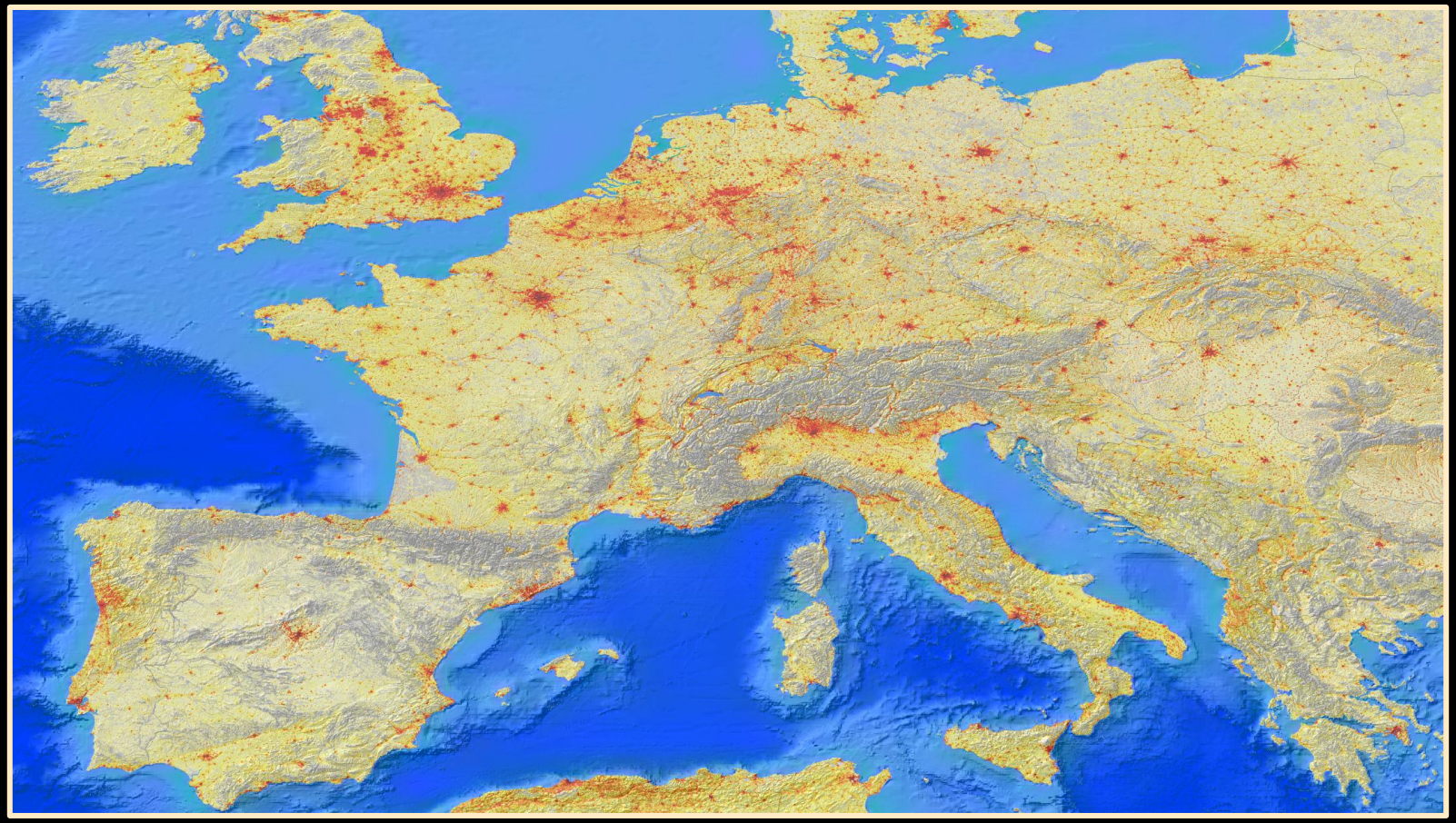

Improving knowledge of where people are located

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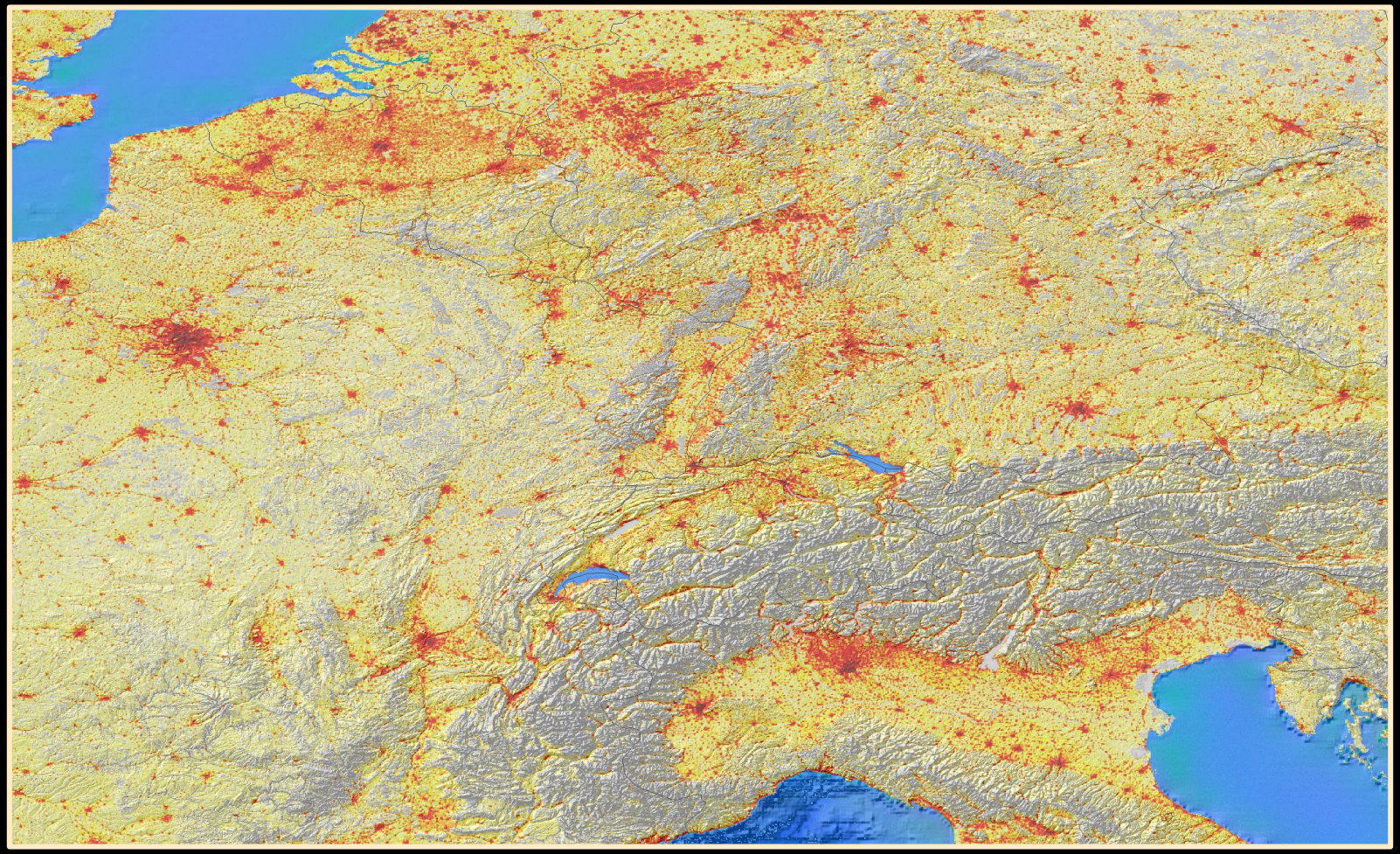
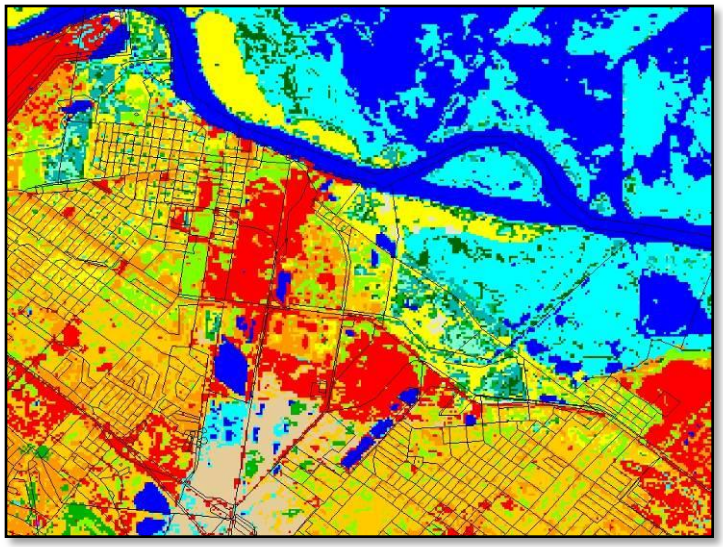


Improving knowledge of where people are located

How is LandScan developed?



- Dasymetric spatial modeling
- Distribute best available census counts to LandScan cells based on a likelihood coefficient calculated by spatial models
- Model structure is the same everywhere, but weights for each variable are tailored to each country
- Similar operations performed for each data layer, and outputs are mathematically combined
- Population is allocated to each cell

H	H	H	L	L	F
H	H	H	L	F	W
H	L	L	L	F	W
H	L	F	W	W	W
L	L	F	W	W	W
L	F	F	W	W	W

H: High-density residential
L: Low-density residential
F: Evergreen forest
W: Water

150	**150**	**150**	**90**	**90**	**4**
150	**150**	**150**	**90**	**4**	**0**
150	**90**	**90**	**90**	**4**	**0**
150	**90**	**4**	**0**	**0**	**0**
90	**90**	**4**	**0**	**0**	**0**
90	**4**	**4**	**0**	**0**	**0**

$$W_{Cell\ i,j} = LC_{i,j} \times PR_{i,j} \times S_{i,j} \times LM_{i,j}$$

Aggregated to coefficient cell size

	1230			**372**	
	526			**0**	

3250	630
1120	0

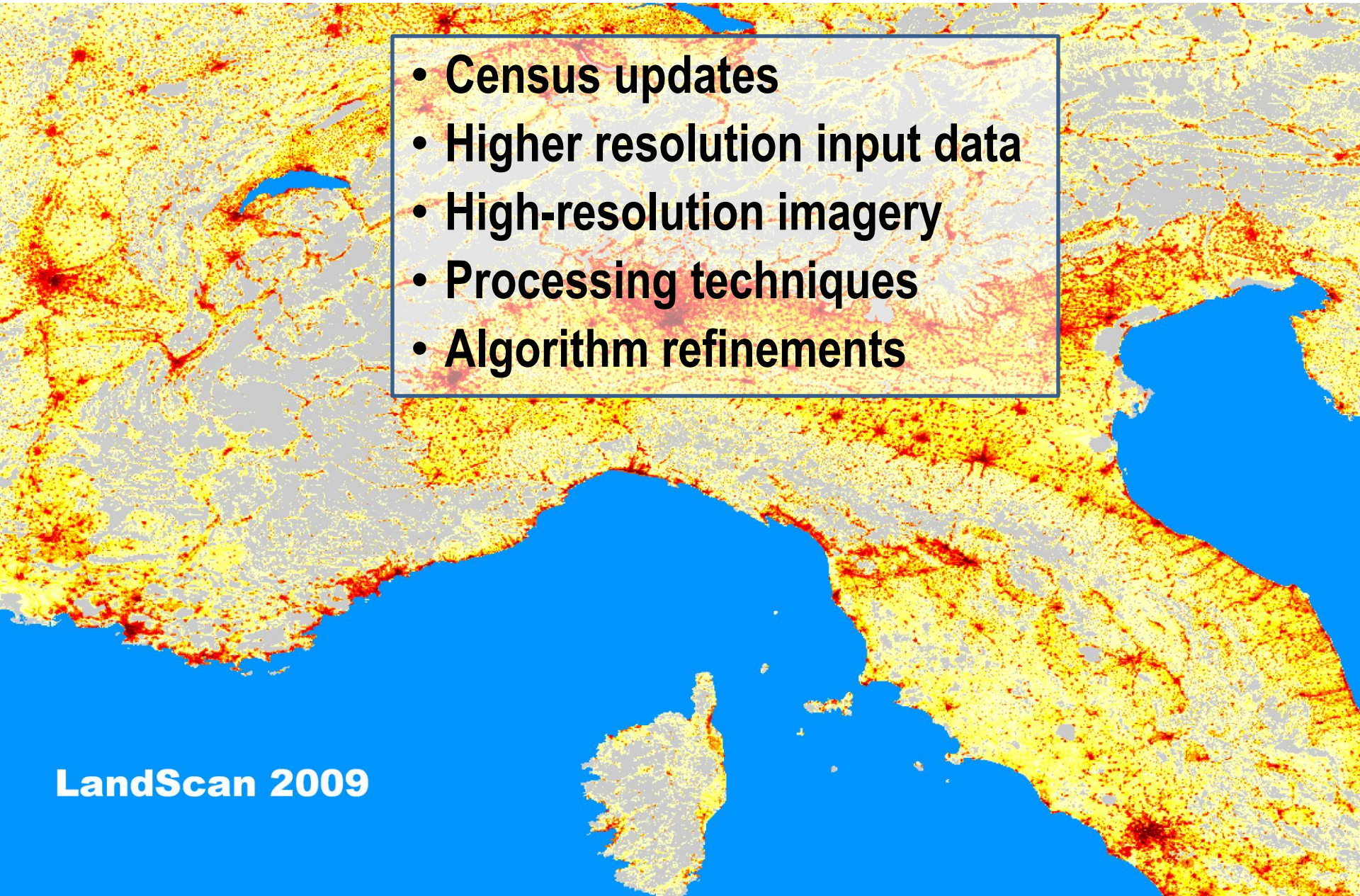
Product of additional data types (e.g. distance from roads, slope)

325	63
112	0

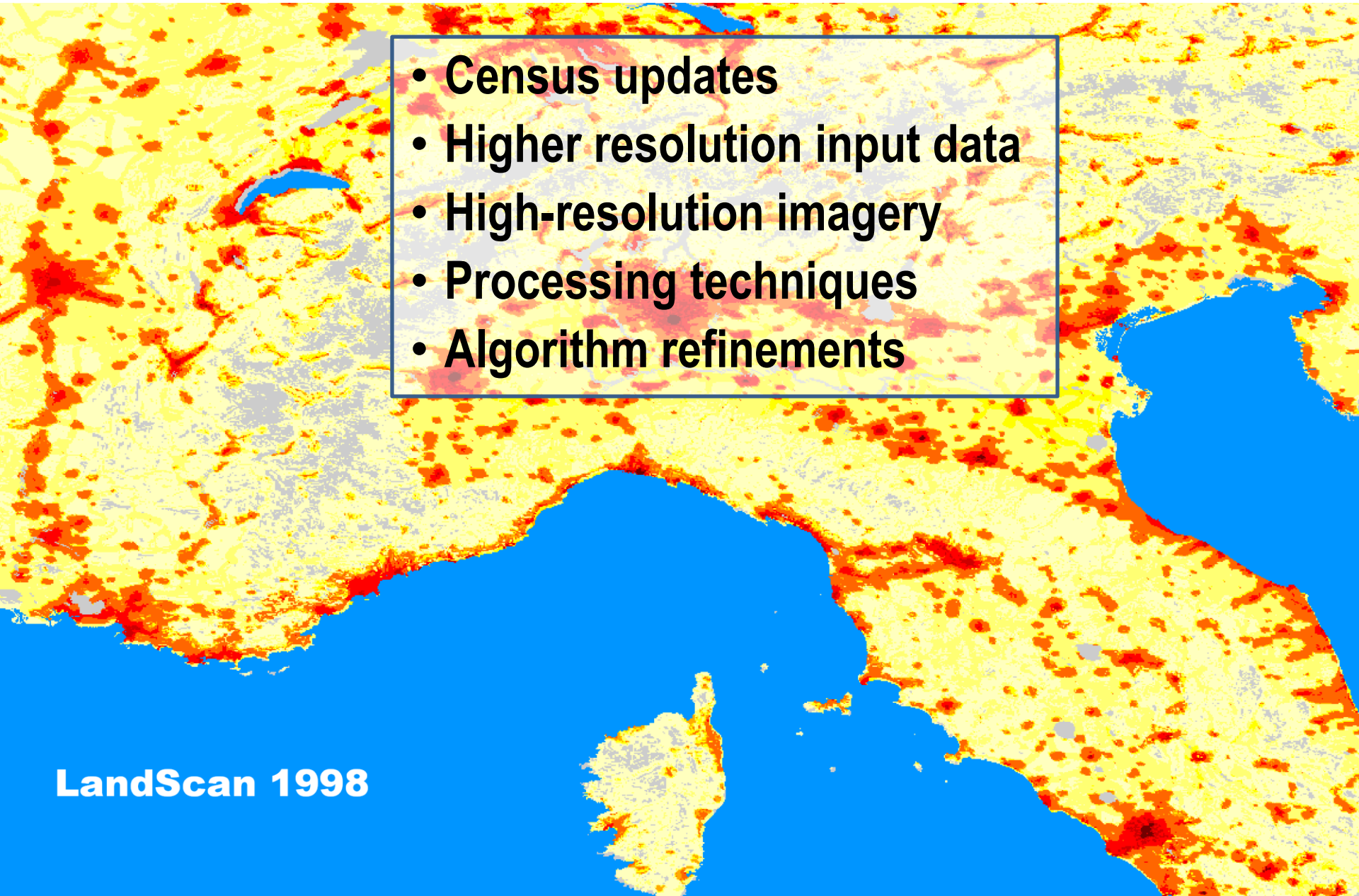
$$Population_{Cell\ i,j} = PC_{Block} \times W_{cell\ i,j}$$

$$PC_{Block} = \frac{Total\ Population_{Block}}{\sum_{1}^{n} W_{Cell\ i,j}}$$

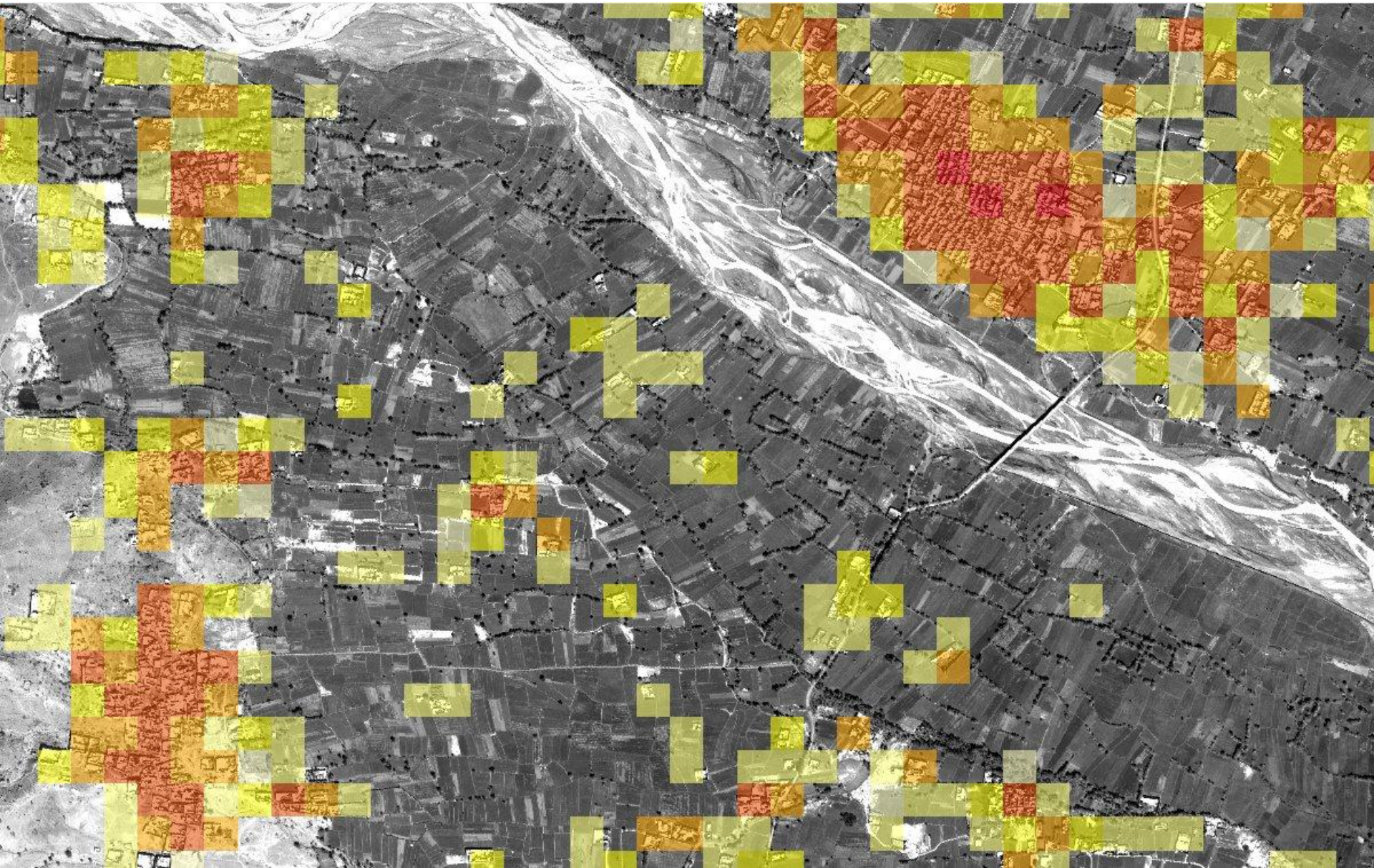
Annual improvements



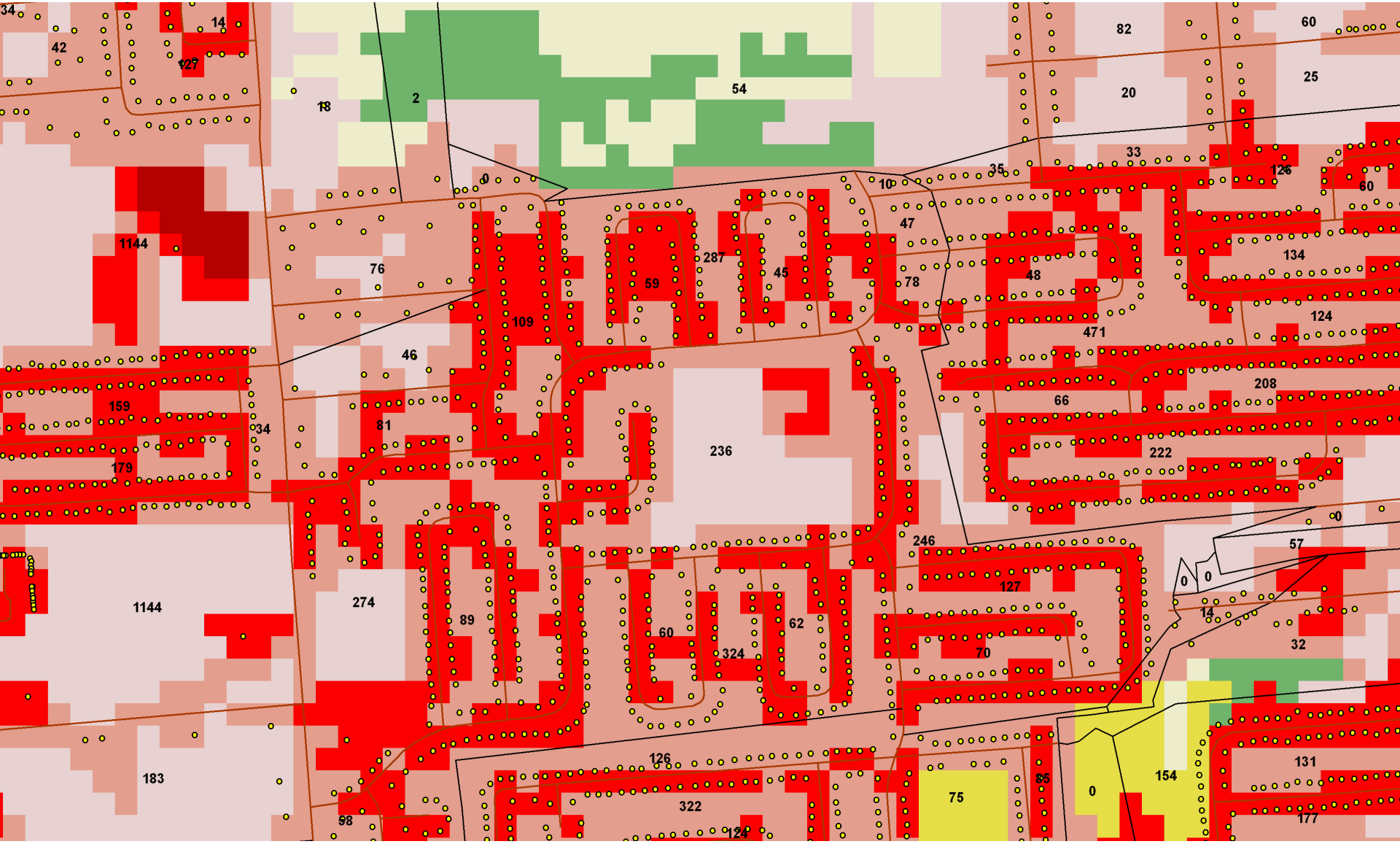
Annual improvements



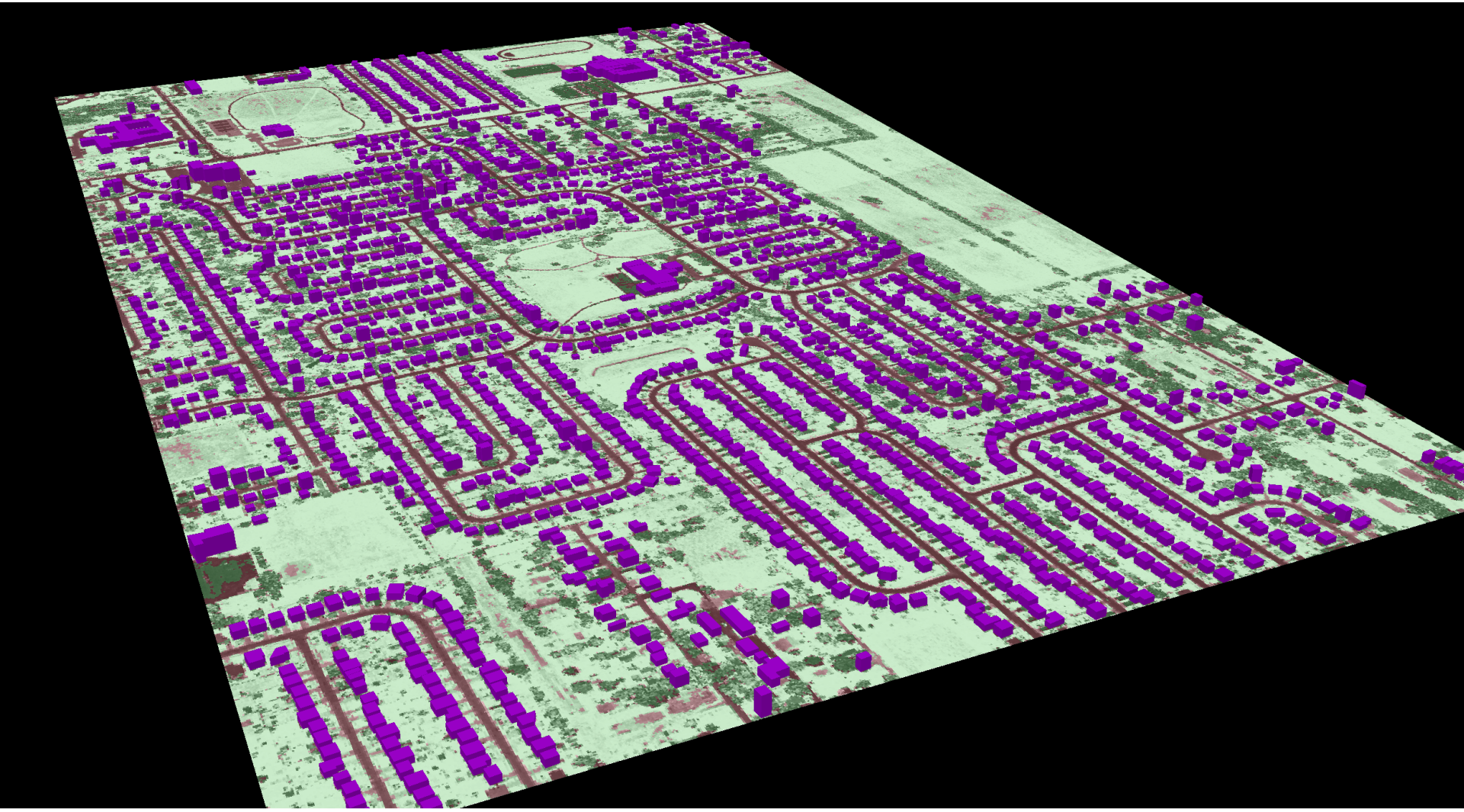
Spatial refinement of LandScan Global



Address point locations



LIDAR data with building elevations



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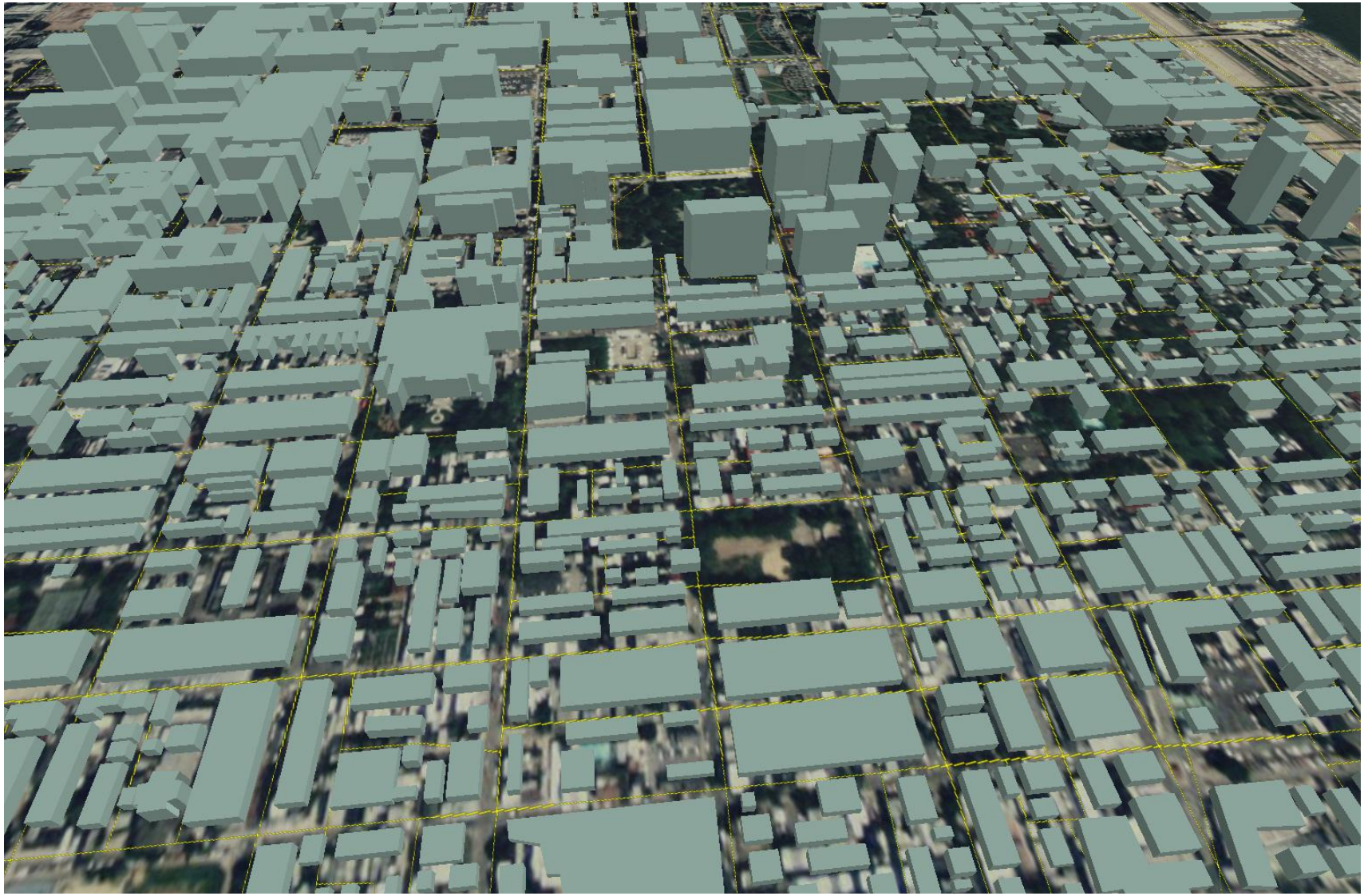
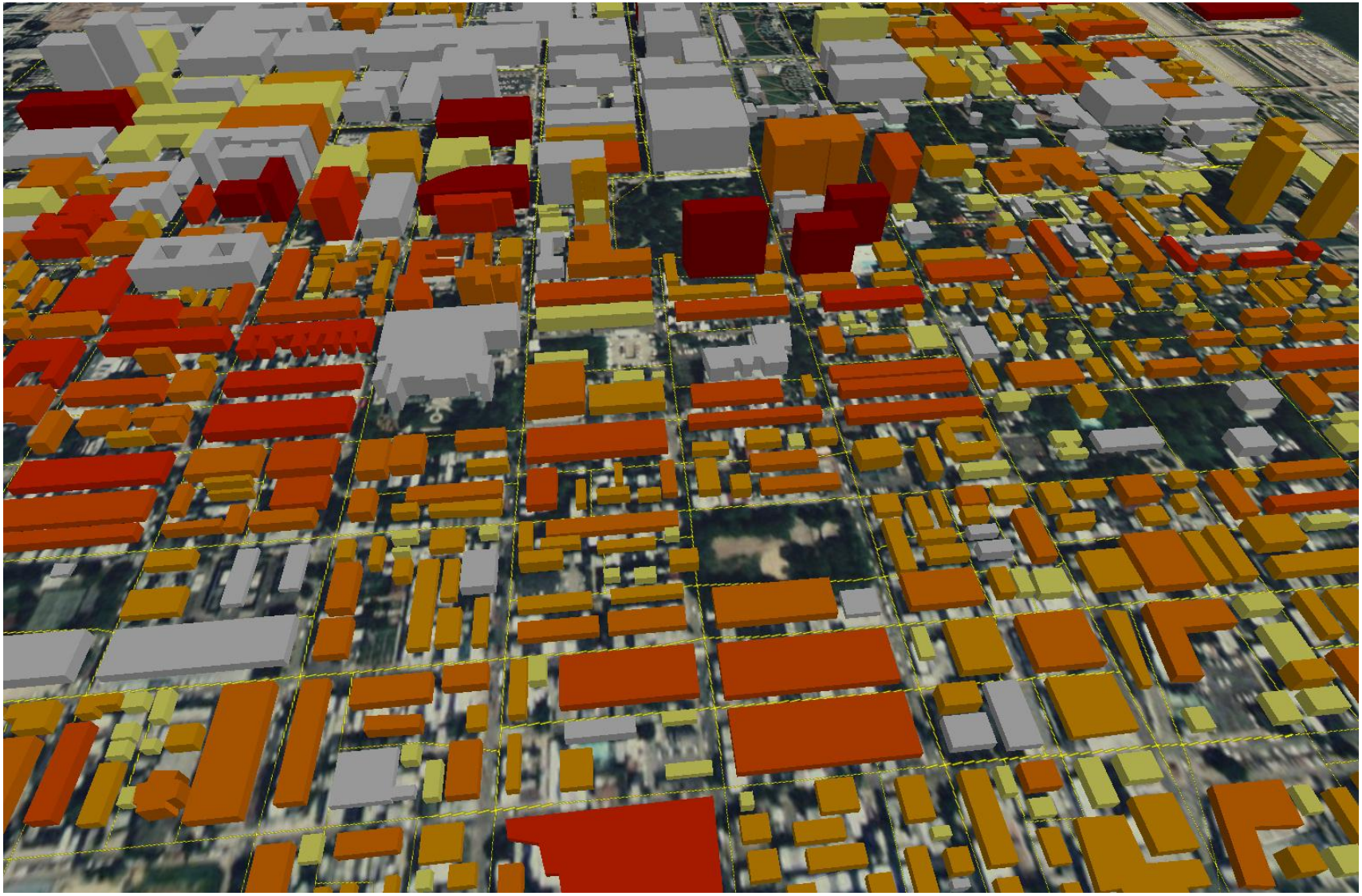
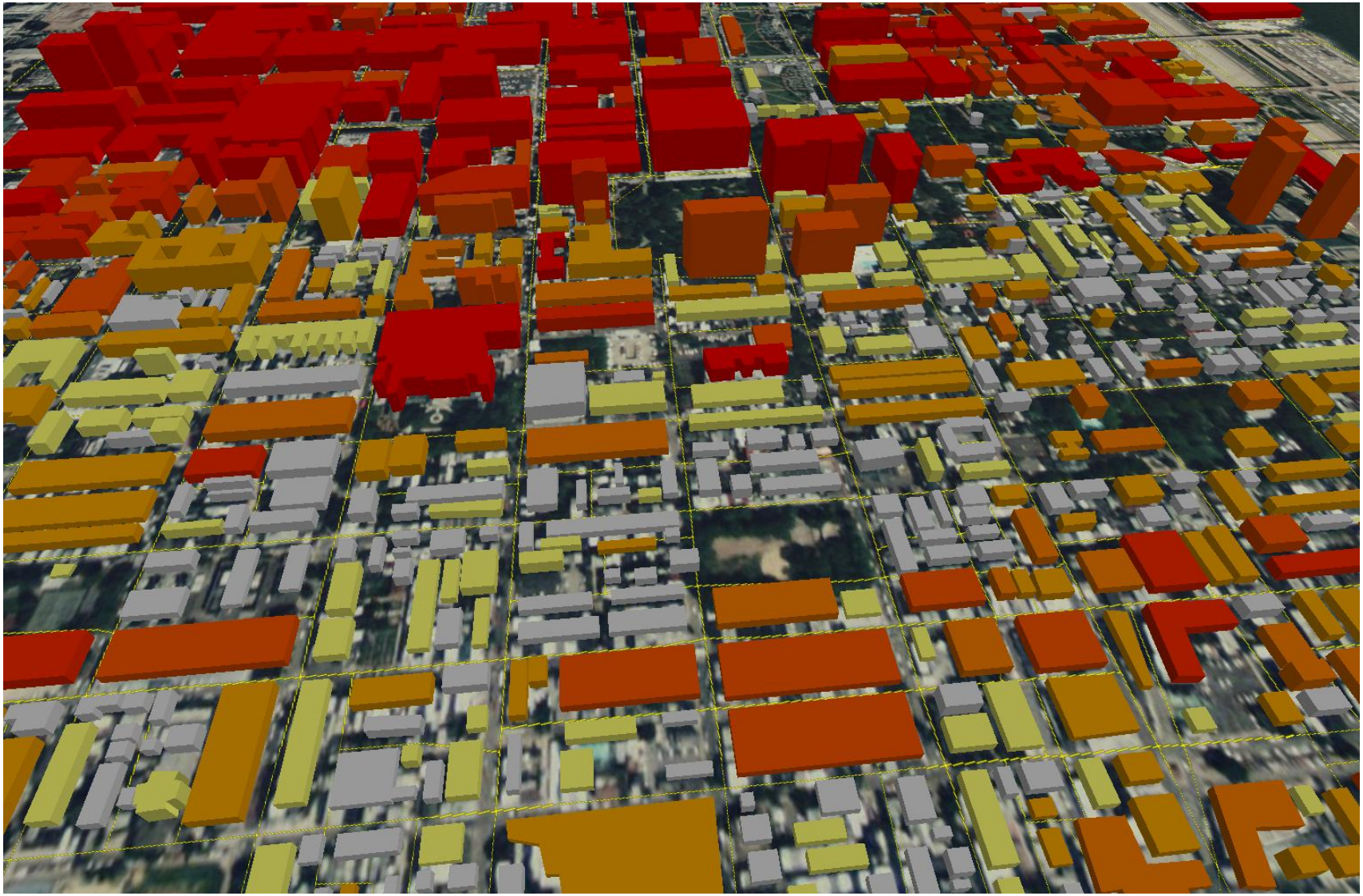


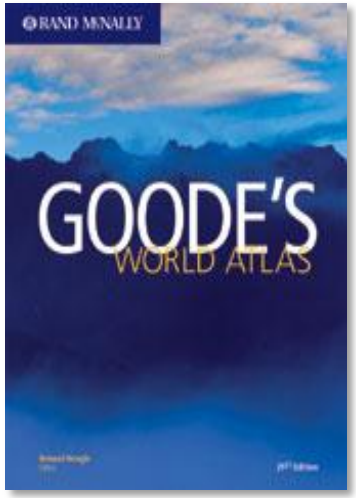
Residential population

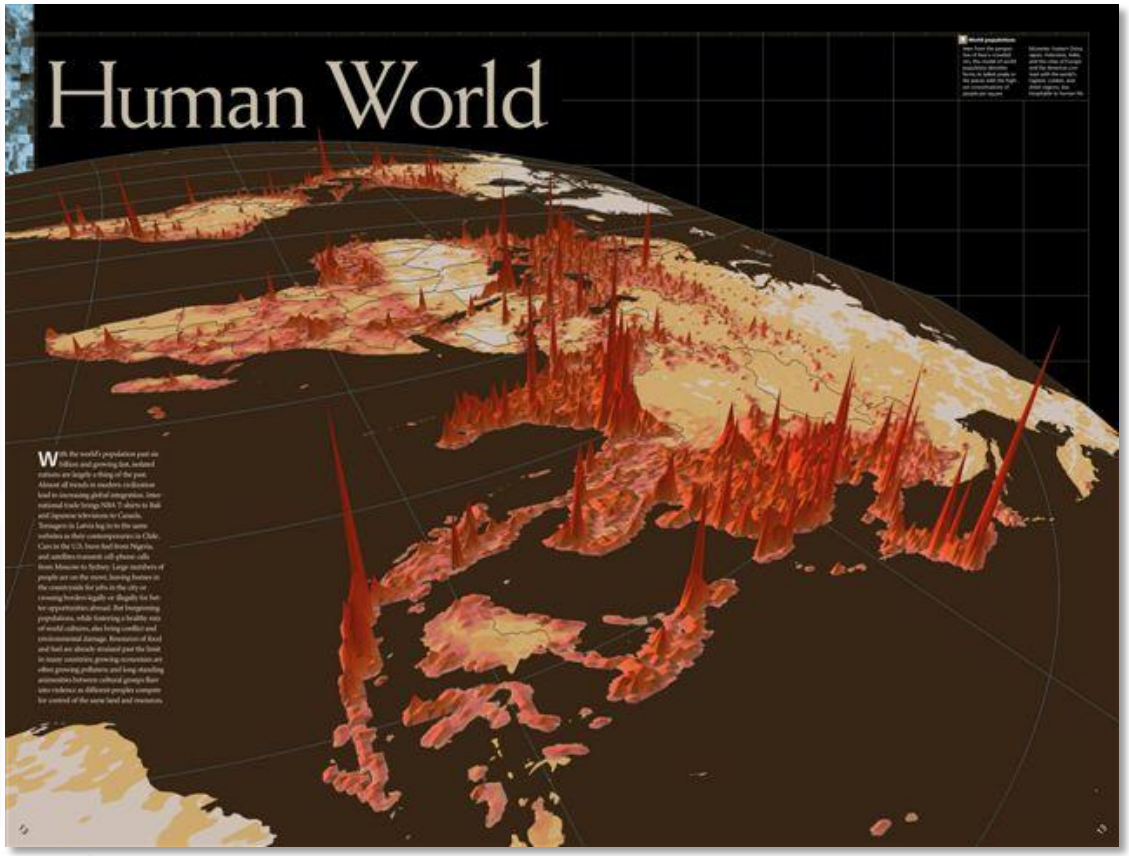


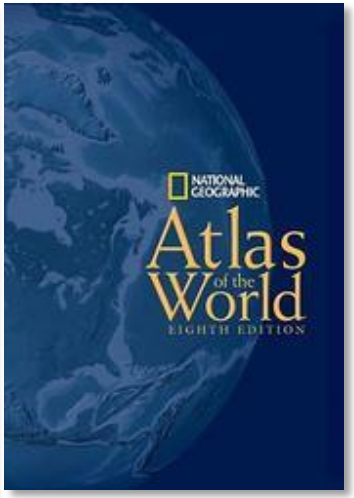
Workers population

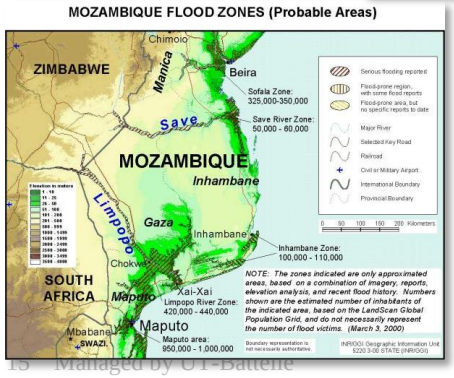


Community standard for population









R&D 100

isciences

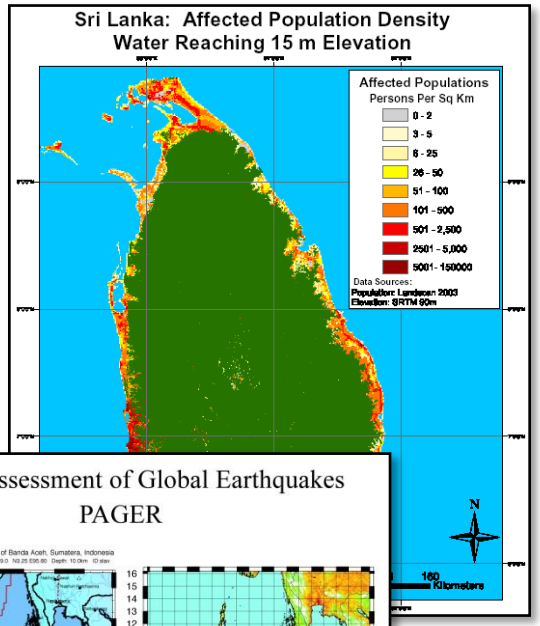
computa maps

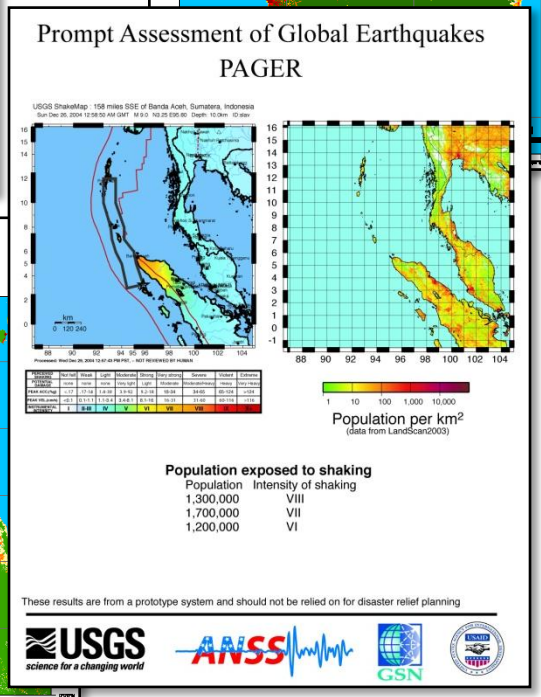
The New York Times ON THE WEB

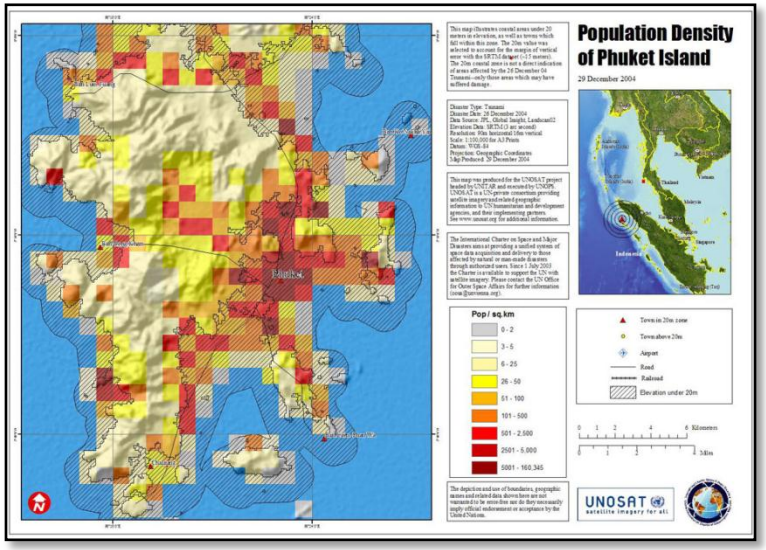
World Resources Institute

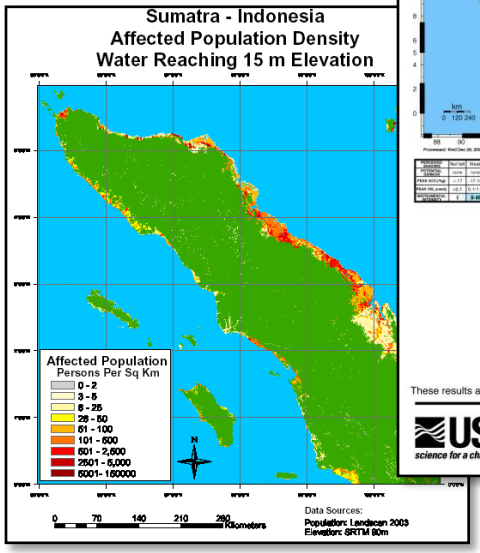
OAK RIDGE National Laboratory

LandScan application: Tsunami relief

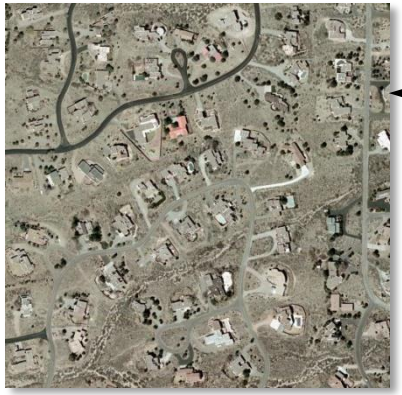


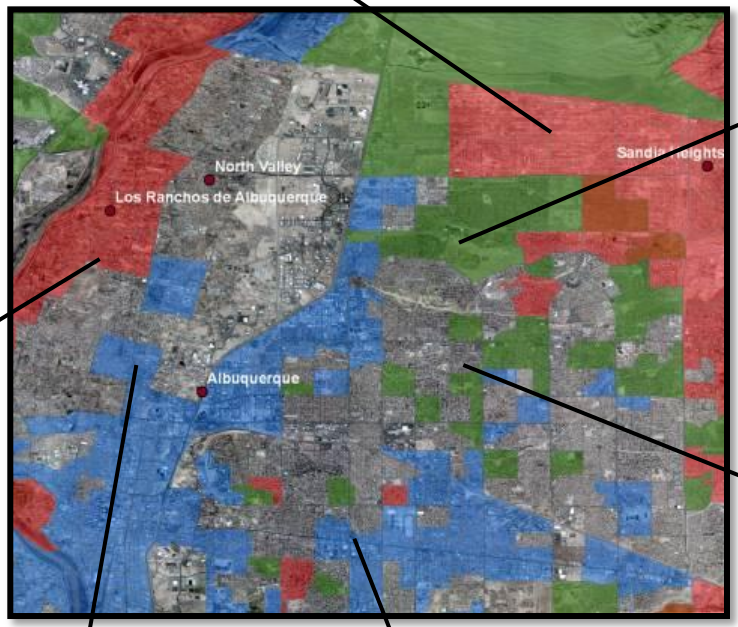






Patterns in overhead imagery



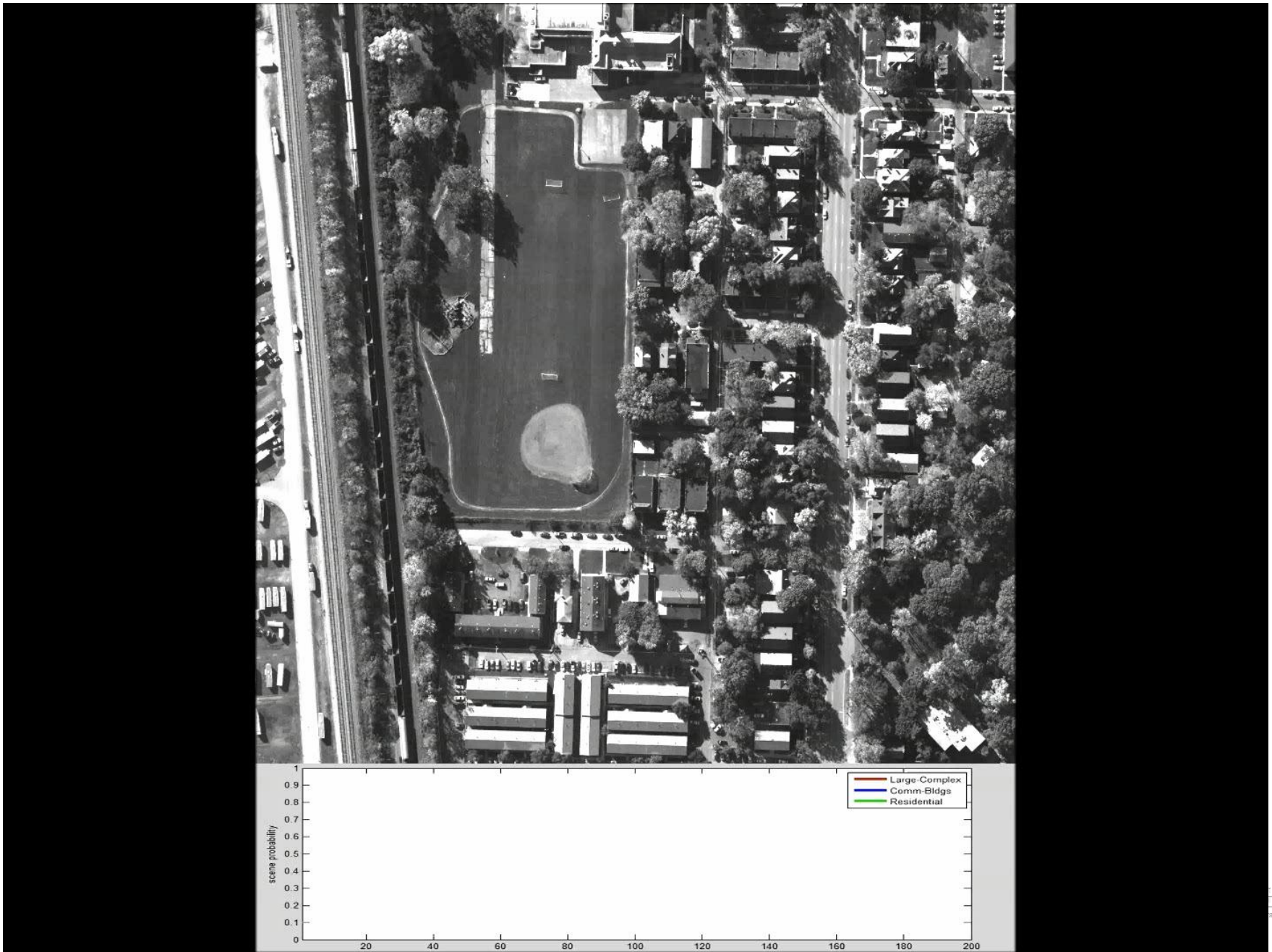


Higher Income

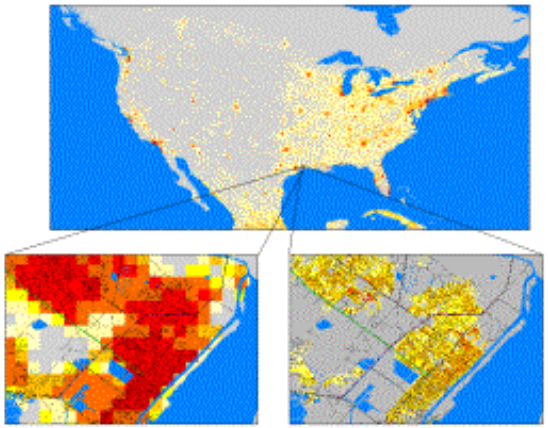
Middle Income

Lower Income

Urban Characterization from UAV Stream

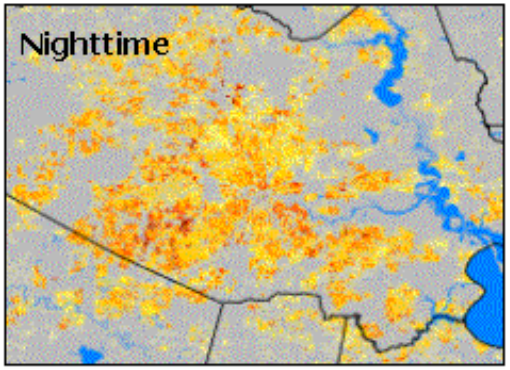


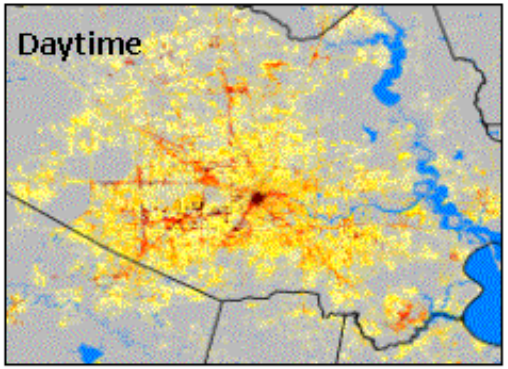
LandScan USA

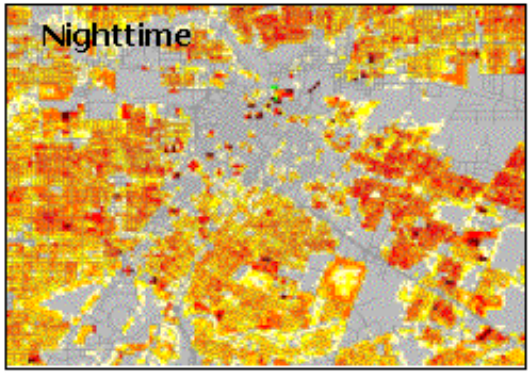


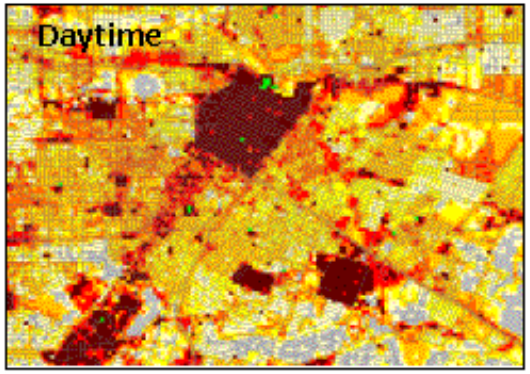
450m 90m

Harris County and the city of Houston

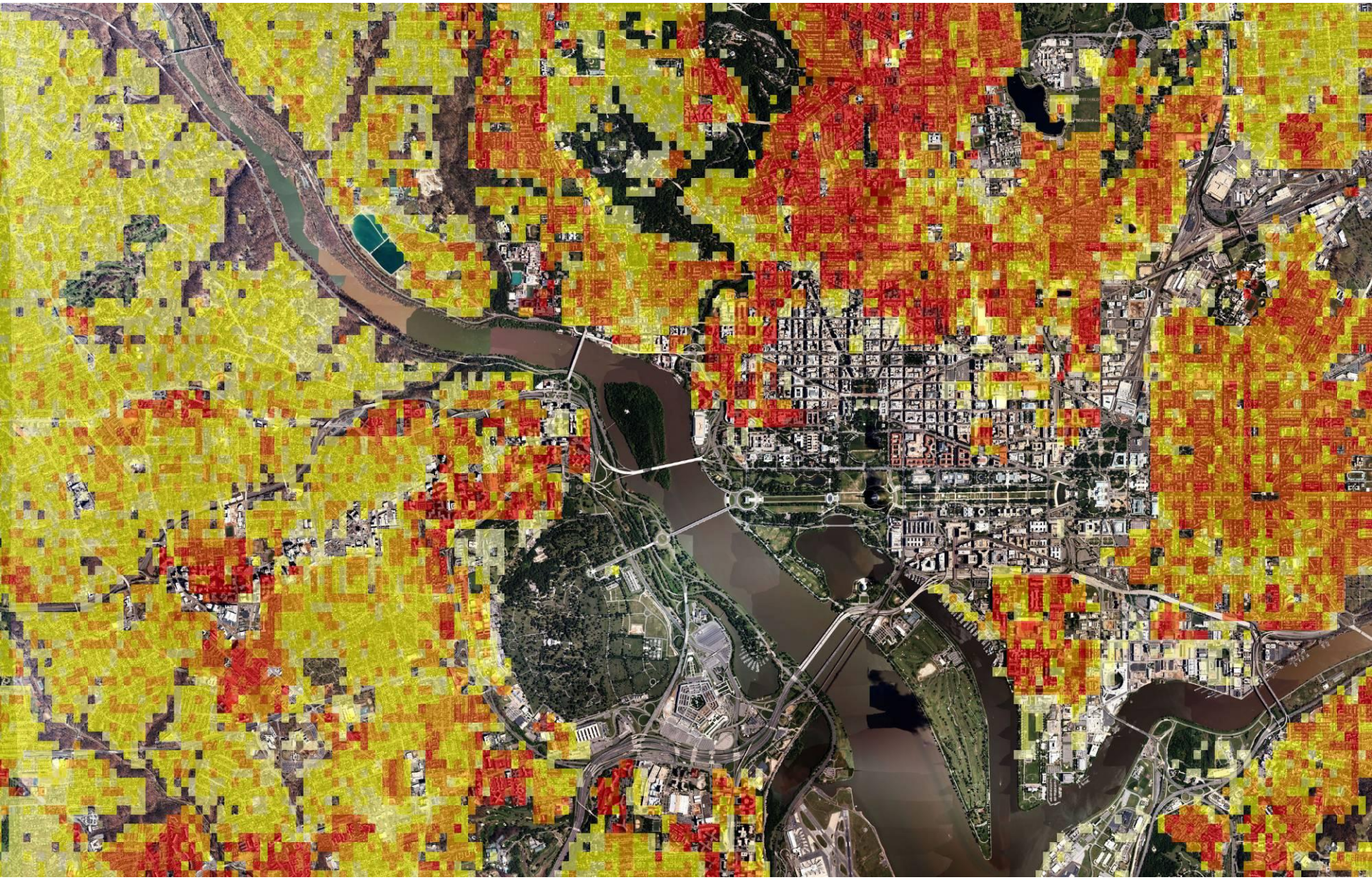




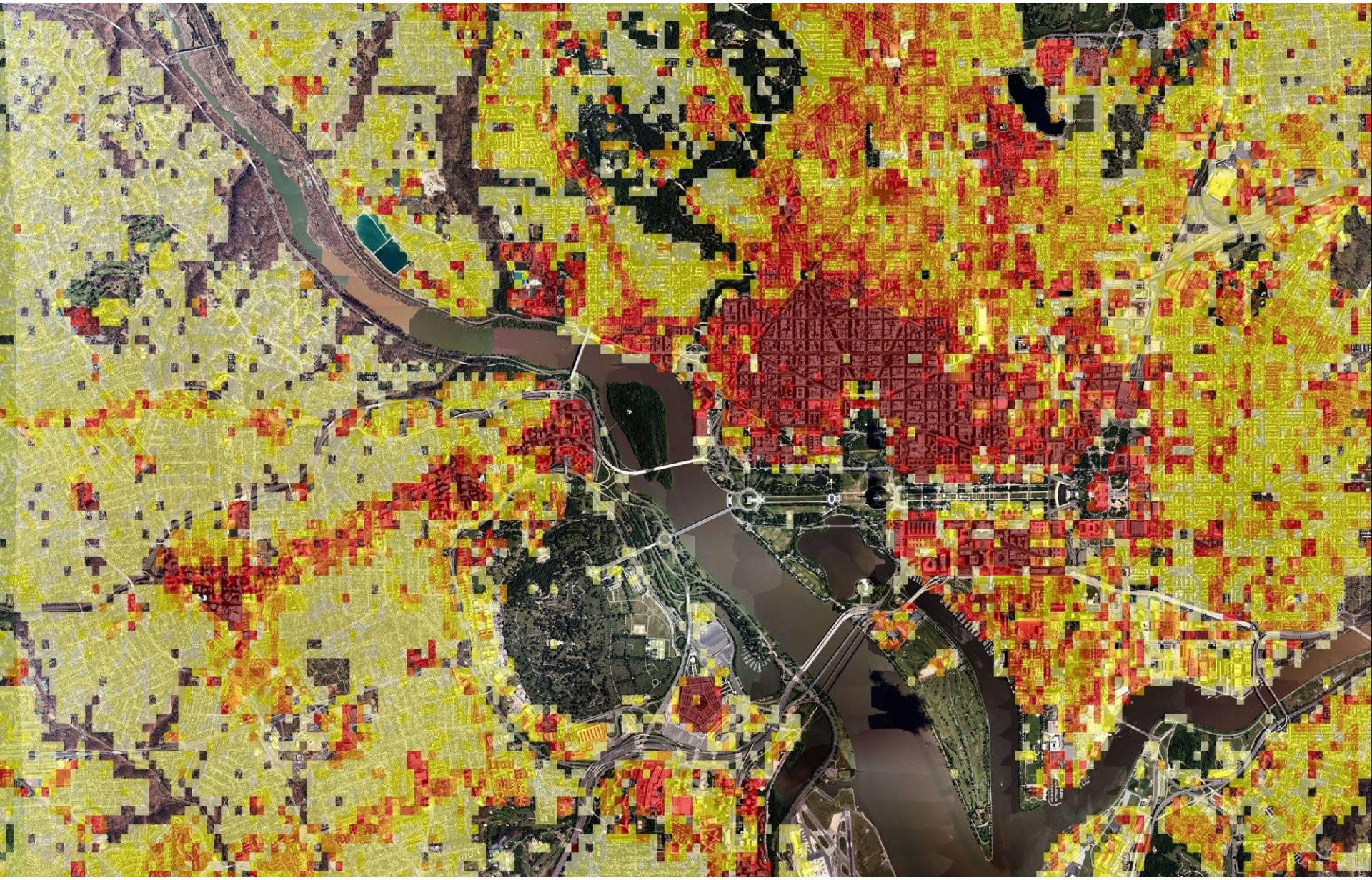




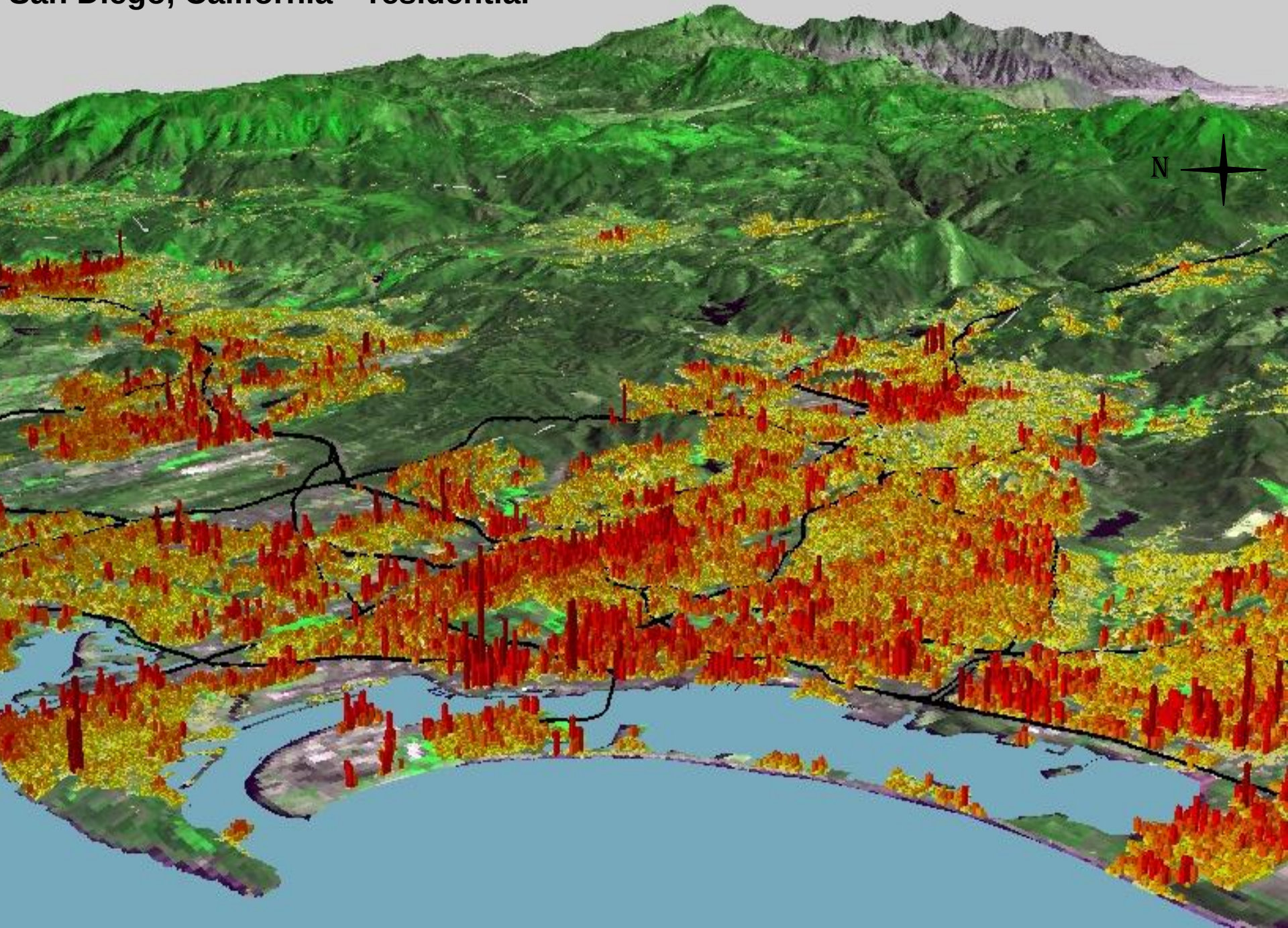
Very high spatial resolution	3 arc second resolution (about 90 m or 300 ft) or finer
Finer temporal resolution	Nighttime (residential) and daytime population distributions
High currency	Modeled from best available census block data
Value added	Demographic and socioeconomic characteristics for easy integration with risk and impact assessment models
Compared with census data	Better than census resolution for most city blocks

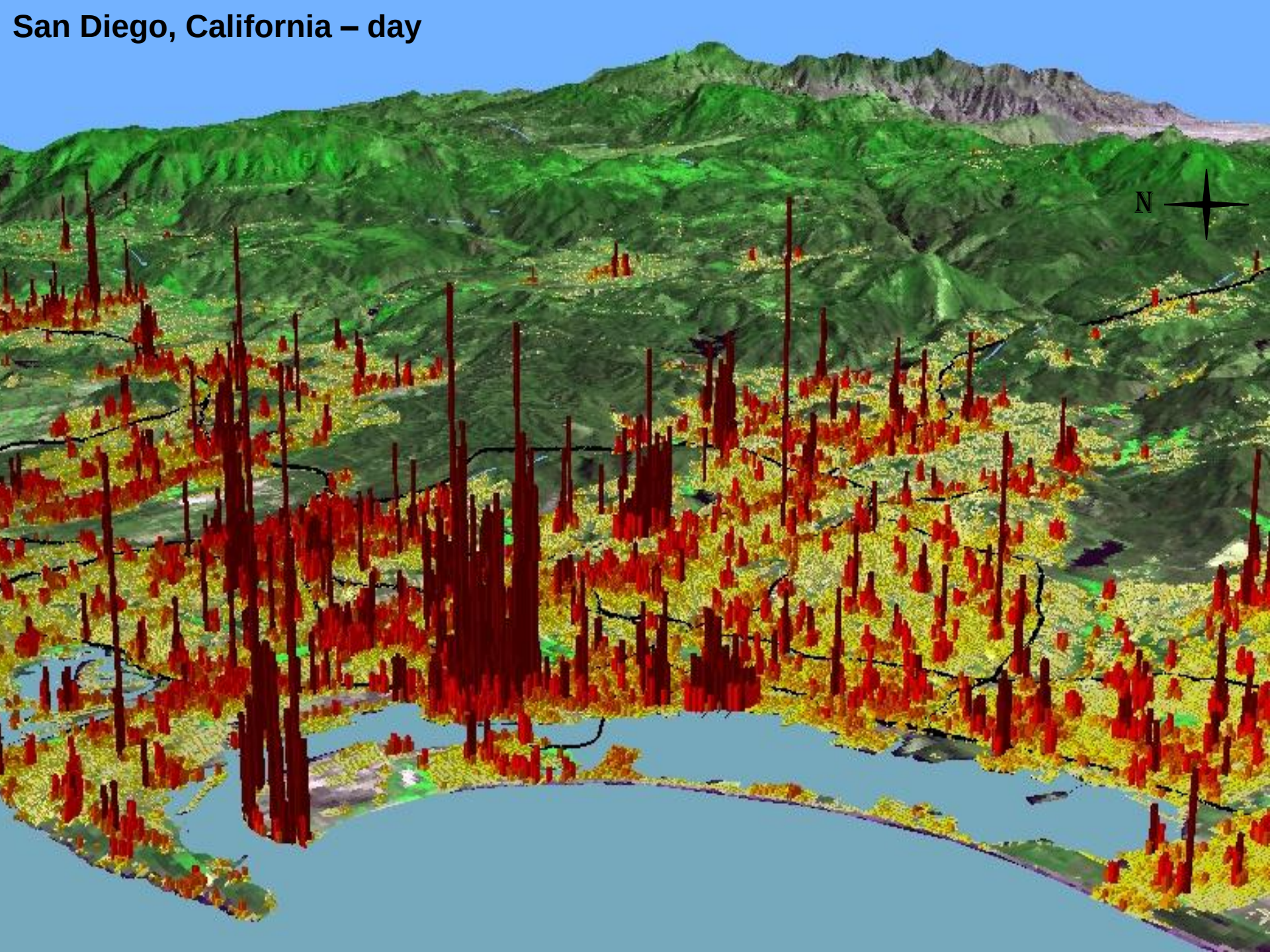


Daytime distribution

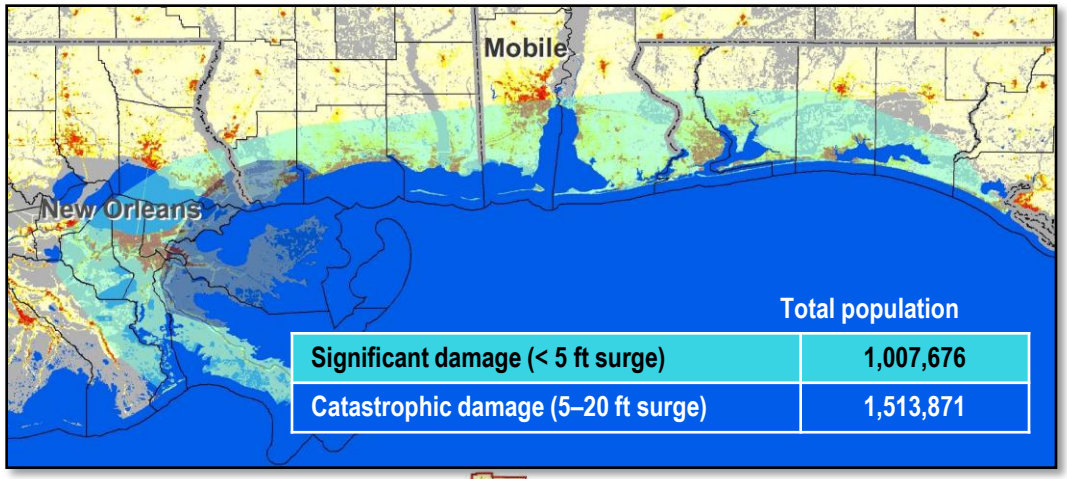


San Diego, California – residential

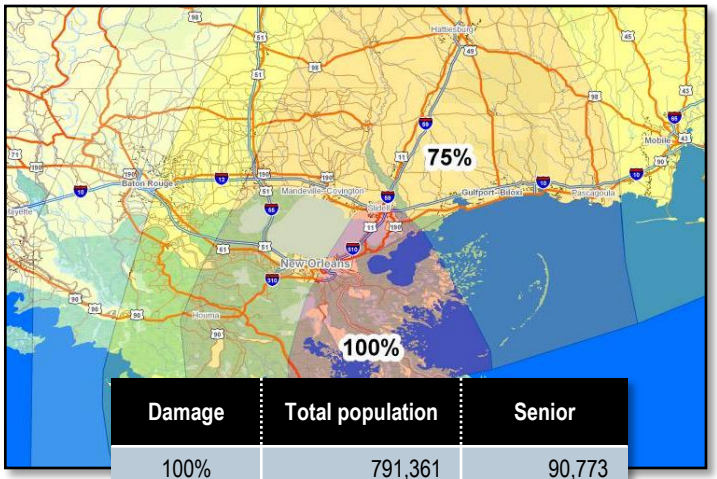



San Diego, California – day
N

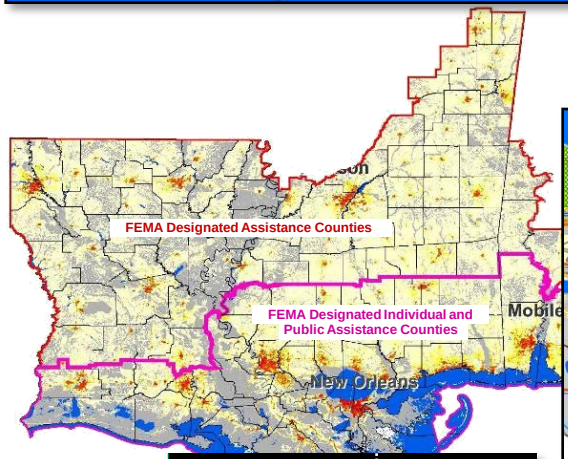
Hurricane preparedness and response



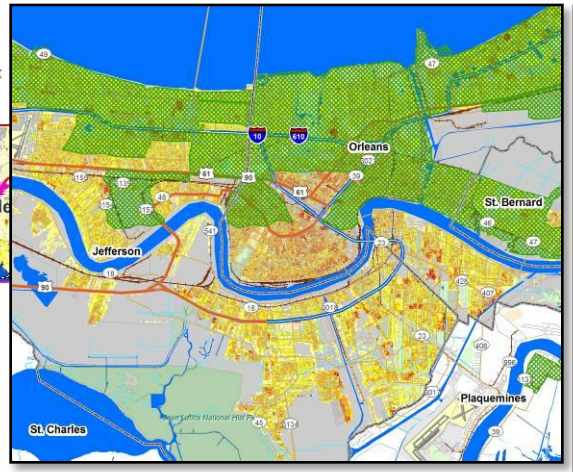
	Total population
Significant damage (< 5 ft surge)	1,007,676
Catastrophic damage (5–20 ft surge)	1,513,871



Damage	Total population	Senior
100%	791,361	90,773
75%	1,594,806	187,677
50%	1,505,196	184,372
25%	1,701,593	224,279
Total	5,592,956	687,101

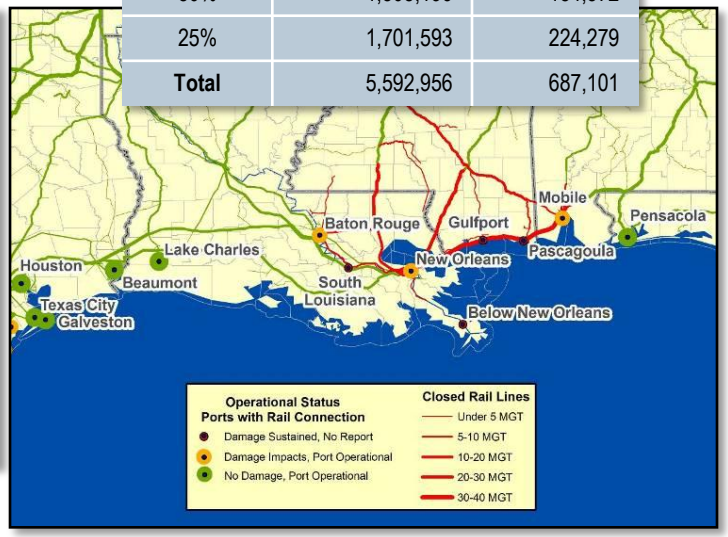


	Individual and public assistance	Public assistance
Alabama	575,133	56,801
Mississippi	707,506	1,391,233
Louisiana	3,153,293	1,362,477



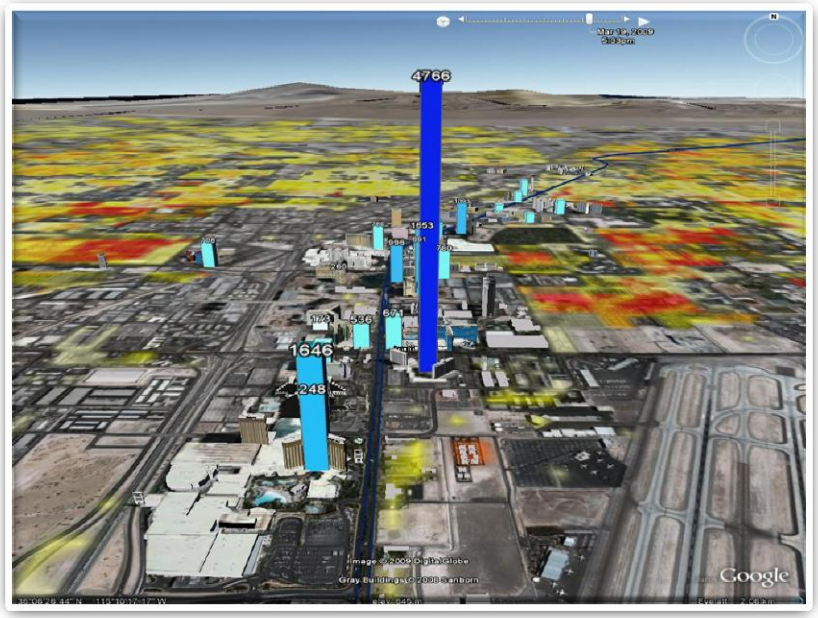
FEMA Impacted Areas

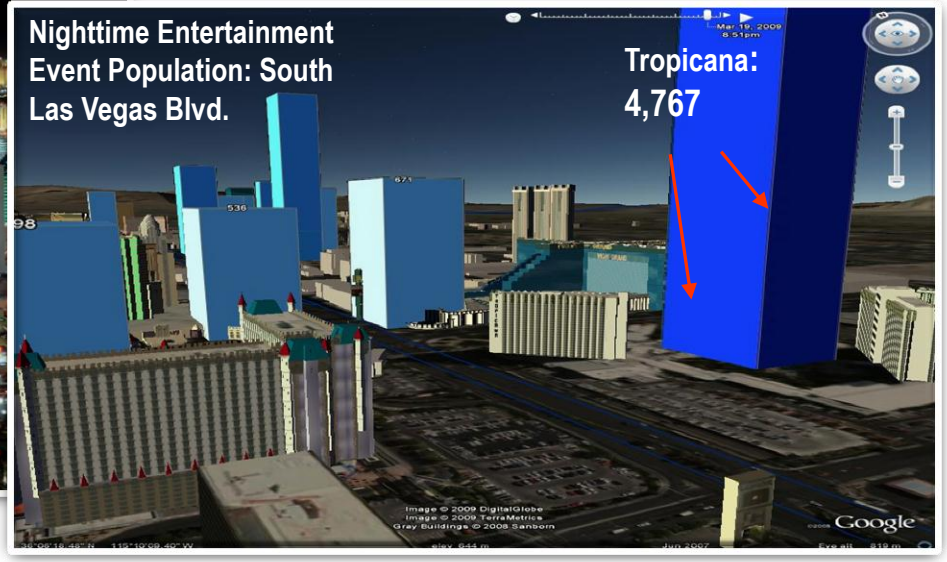
Source: FEMA Impacted Areas, August 31, 2005



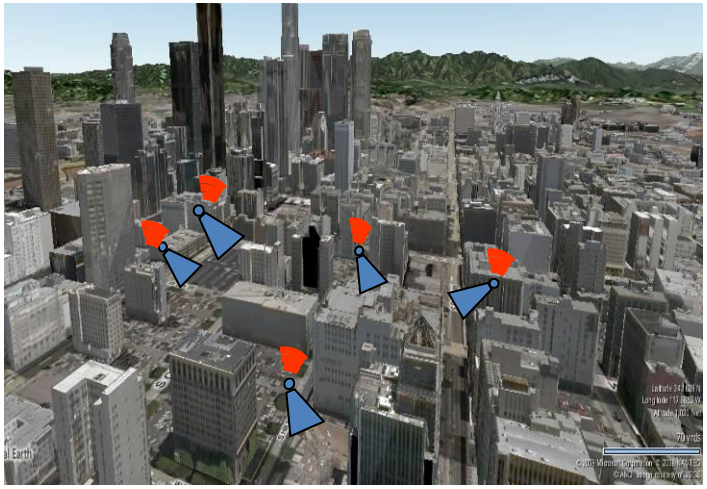
Transient populations

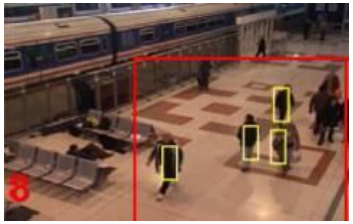
Distribution of nighttime entertainment event population





Automated crowd scene analysis





Problem statement

- **Dense crowd situations pose many challenges to automated tracking systems**
  - **Learning background models in crowded situations and ad-hoc camera views is hard**
  - **Inter- and intra-object occlusions are highly common. Objects usually occupy only a few pixels**
  - **Fitting shape and appearance models may be difficult**

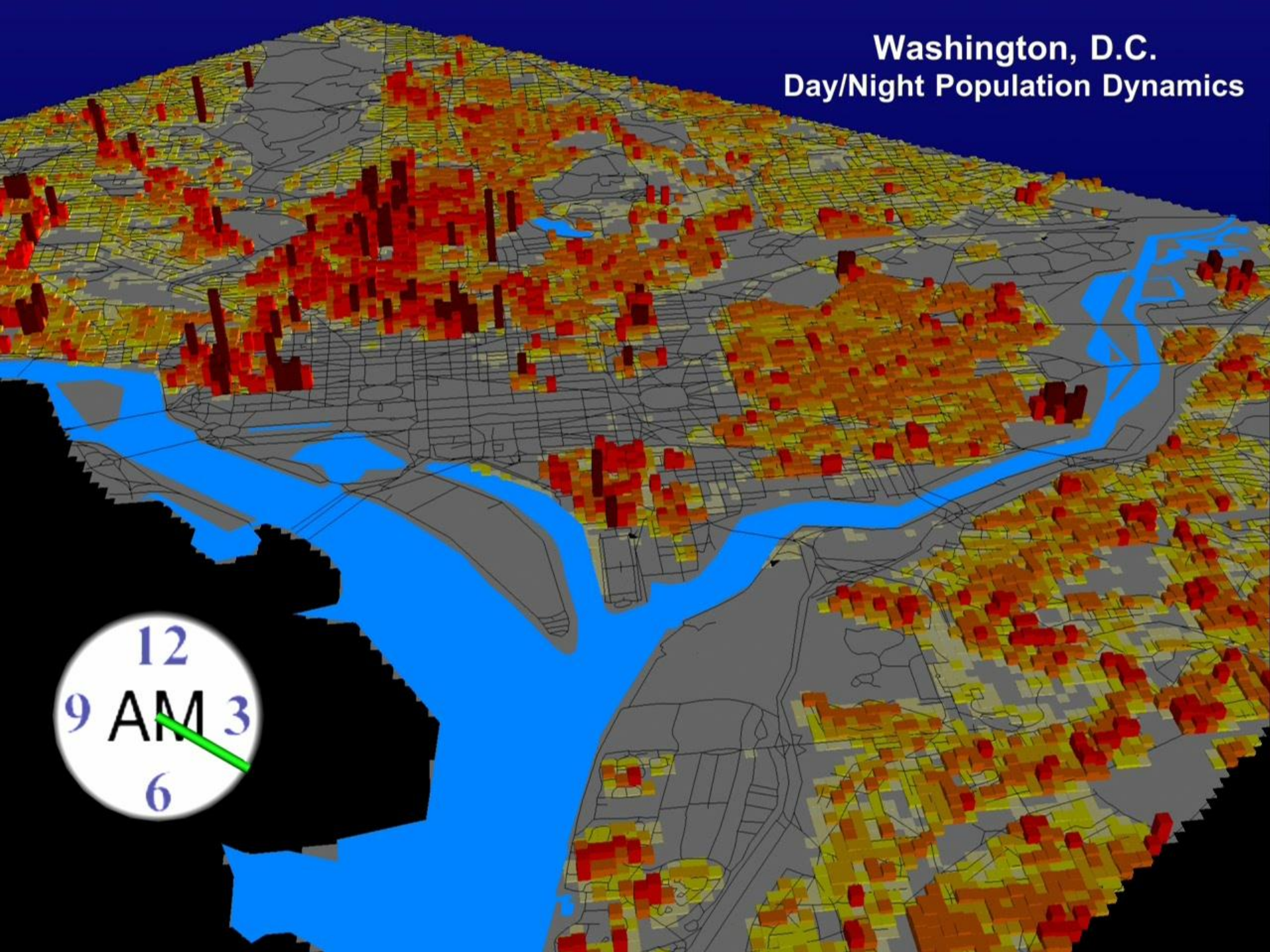
Technical approach

- **Identify dominant crowd motions in video where individual tracking is highly challenging. Our approach is based on clustering low-level feature tracks, which may be fragmented or noisy. The similarity between two point tracks is measured using a Longest Common Subsequence based algorithm. The matching cost is computed using dynamic programming**

Benefit

- **Computer vision system(s) can autonomously interpret crowded environments in a wide range of operating conditions for public safety systems and other persistence surveillance systems**

Computational Science and Engineering Division


Washington, D.C.
Day/Night Population Dynamics
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Contact

Budhendra Bhaduri

Geographic Information Science and Technology
Computational Sciences and Engineering
(865) 241-9272
bhaduribl@ornl.gov