The European Commission’s science and knowledge service

Joint Research Centre

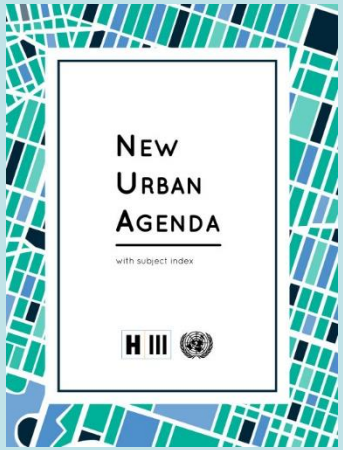
Towards a Copernicus Human Settlement Product

Experiences from the Global Human Settlement Layer

Thomas Kemper & GHSL team

Copernicus for Future Cities Workshop, Brussels, 9 November 2018

2030 Agenda for Sustainable Development



- All recent international frameworks rely on a set of indicators for monitoring their progress
- EO and geospatial data are explicitly mentioned as new data sources for reporting progress in achieving the targets

SUSTAINABLE DEVELOPMENT GOALS

	Population distribution	Cities and infrastructure mapping	Elevation and topography	Land cover and use mapping	Oceanographic observations	Hydrological and water quality observations	Atmospheric and air quality monitoring	Biodiversity and ecosystem observations	Agricultural monitoring	Hazards, disasters and environmental impact monitoring
1 No poverty	■	■			■					■	
2 Zero hunger	■	■	■	■	■	■	■	■	■	■
3 Good health and well-being	■	■		■		■	■		■	■
4 Quality education	■	■								
5 Gender equality	■	■								
6 Clean water and sanitation	■	■	■	■	■	■	■	■	■	■
7 Affordable and clean energy	■	■	■	■	■	■	■	■		■
8 Decent work and economic growth	■	■	■	■					■	
9 Industry, innovation and infrastructure	■	■	■	■			■			■
10 Reduced inequalities	■	■								
11 Sustainable cities and communities	■	■	■	■			■	■	■	■
12 Responsible consumption and production	■	■	■	■				■		■
13 Climate action	■	■	■	■	■	■	■	■	■	■
14 Life below water	■	■	■	■	■	■	■	■	■	■
15 Life on land	■	■	■	■		■	■	■	■	■
16 Peace, justice and strong institutions	■	■		■						
17 Partnerships for the goals	■	■	■	■	■	■	■	■	■	■

GEO GROUP ON EARTH OBSERVATIONS

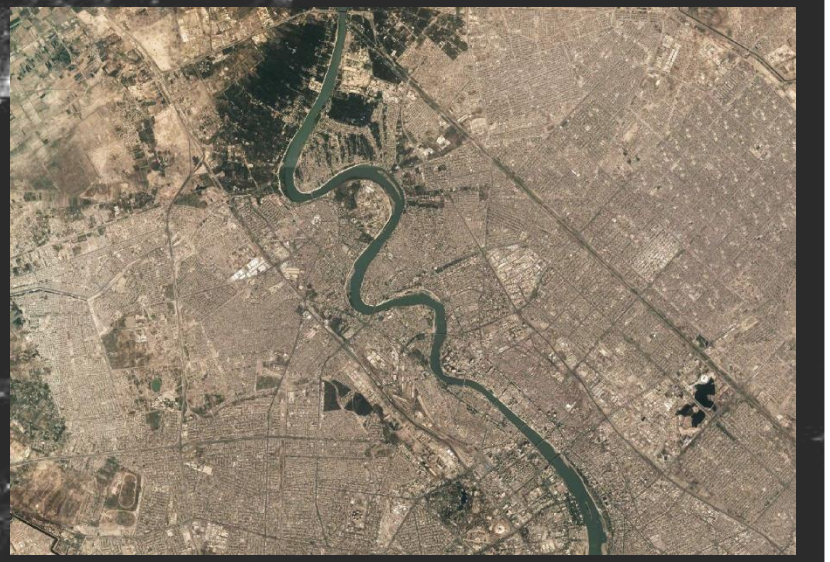
Sustainable Development Goals

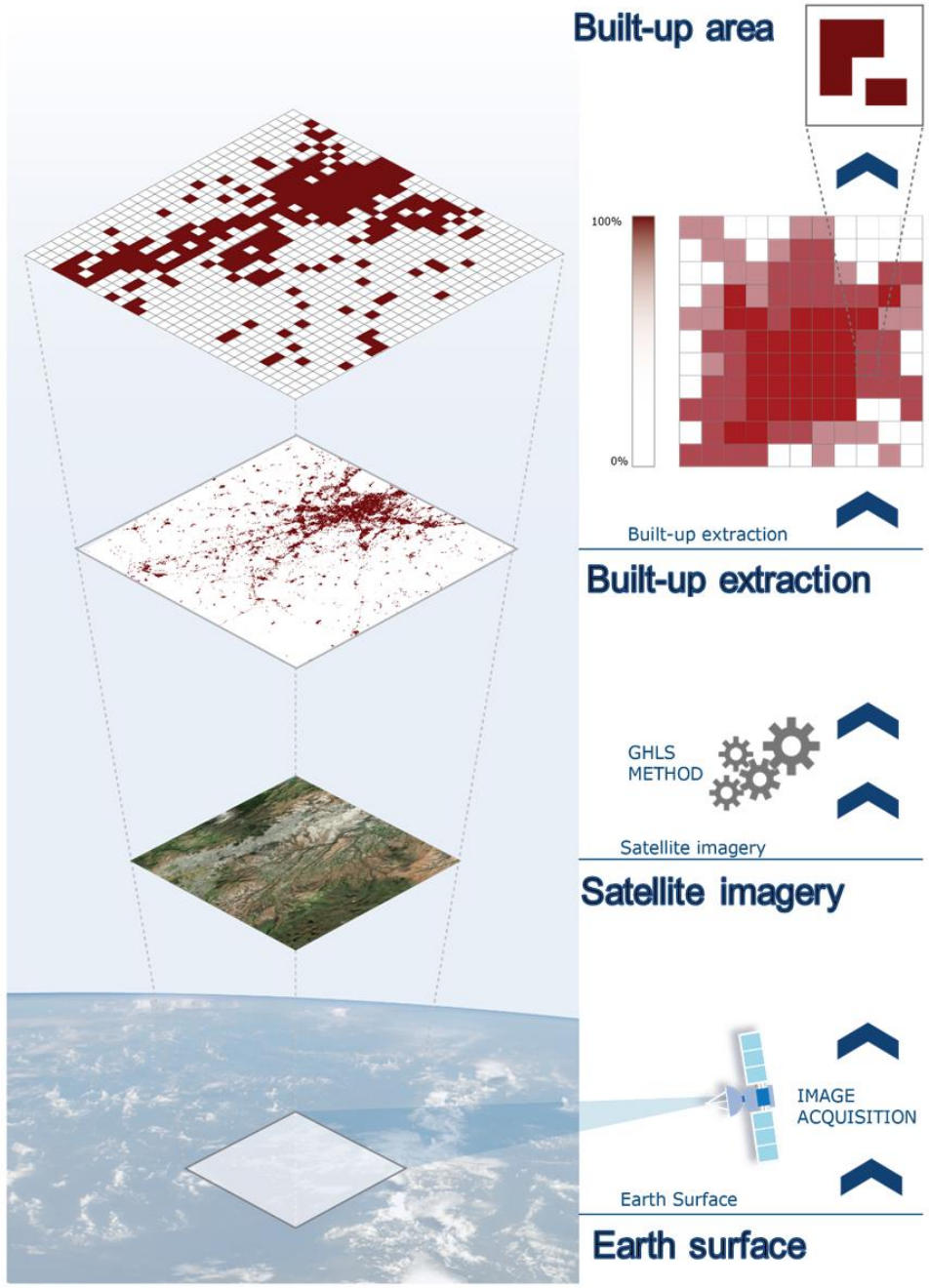
Earth Observations in Service of the *Agenda 2030*

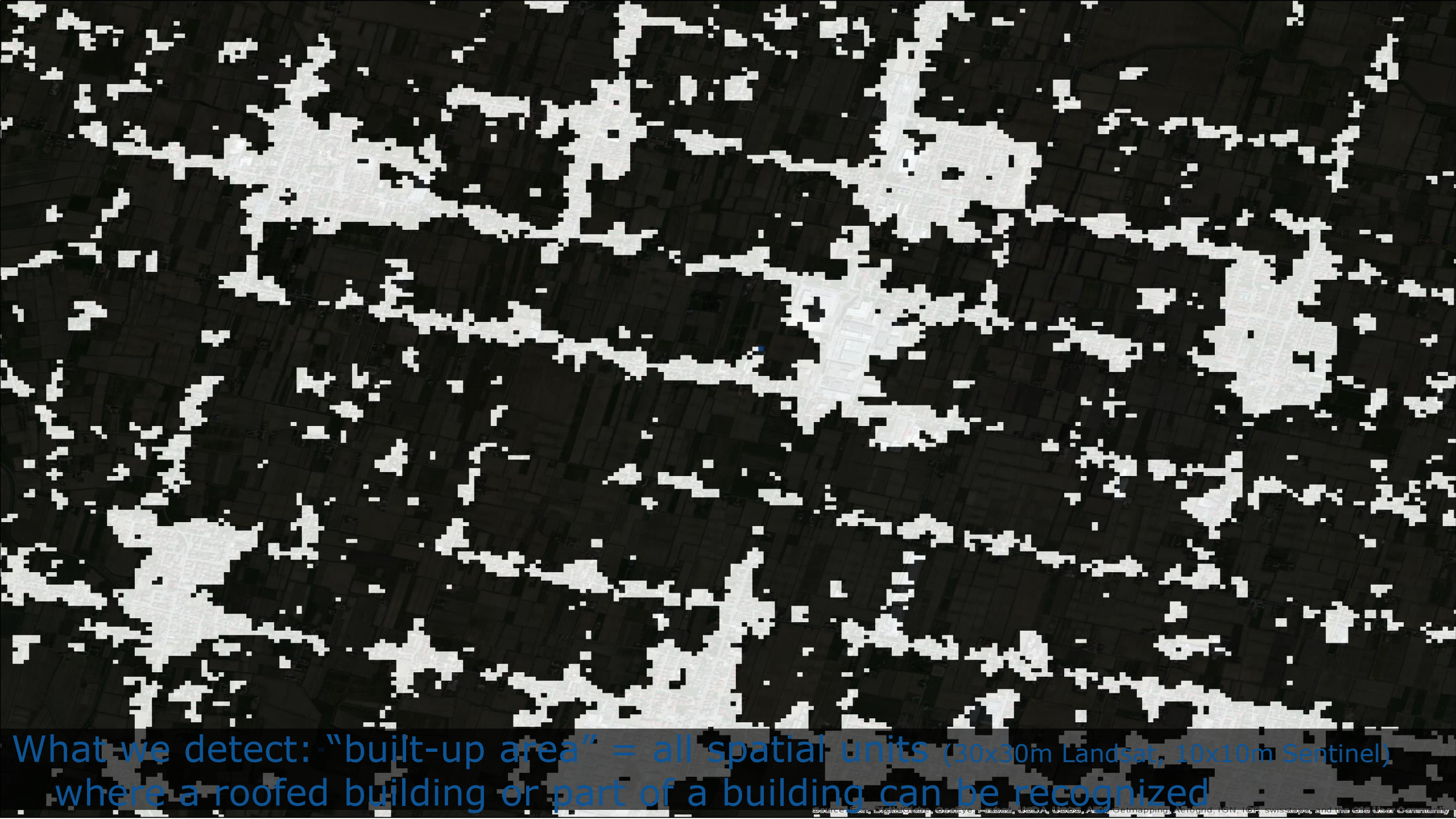
THE GLOBAL GOALS

Target (Contribute to progress on the Target yet not the Indicator per se)									Goal	Indicator (Direct measure or indirect support)				
							1.4	1.5	1	1.4.2				
						2.3	2.4	2.c	2	2.4.1				
					3.3	3.4	3.9	3.d	3	3.9.1				
									4					
								5.a	5	5.a.1				
		6.1	6.3	6.4	6.5	6.6	6.a	6.b	6	6.3.1	6.3.2	6.4.2	6.5.1	6.6.1
					7.2	7.3	7.a	7.b	7	7.1.1				
								8.4	8					
					9.1	9.4	9.5	9.a	9	9.1.1	9.4.1			
									10					
	11.1	11.3	11.4	11.5	11.6	11.7	11.b	11.c	11	11.1.1	11.2.1	11.3.1	11.6.2	11.7.1
									12					
					13.1	13.2	13.3	13.b	13	13.1.1				
		14.1	14.2	14.3	14.4	14.6	14.7	14.a	14	14.3.1	14.4.1	14.5.1		
	15.1	15.2	15.3	15.4	15.5	15.7	15.8	15.9	15	15.1.1	15.2.1	15.3.1	15.4.1	15.4.2
								16.8	16					
17.2	17.3	17.6	17.7	17.8	17.9	17.16	17.17	17.18	17	17.6.1	17.18.1			

From Earth's Surface…
to Pixels…
to Built-up areas

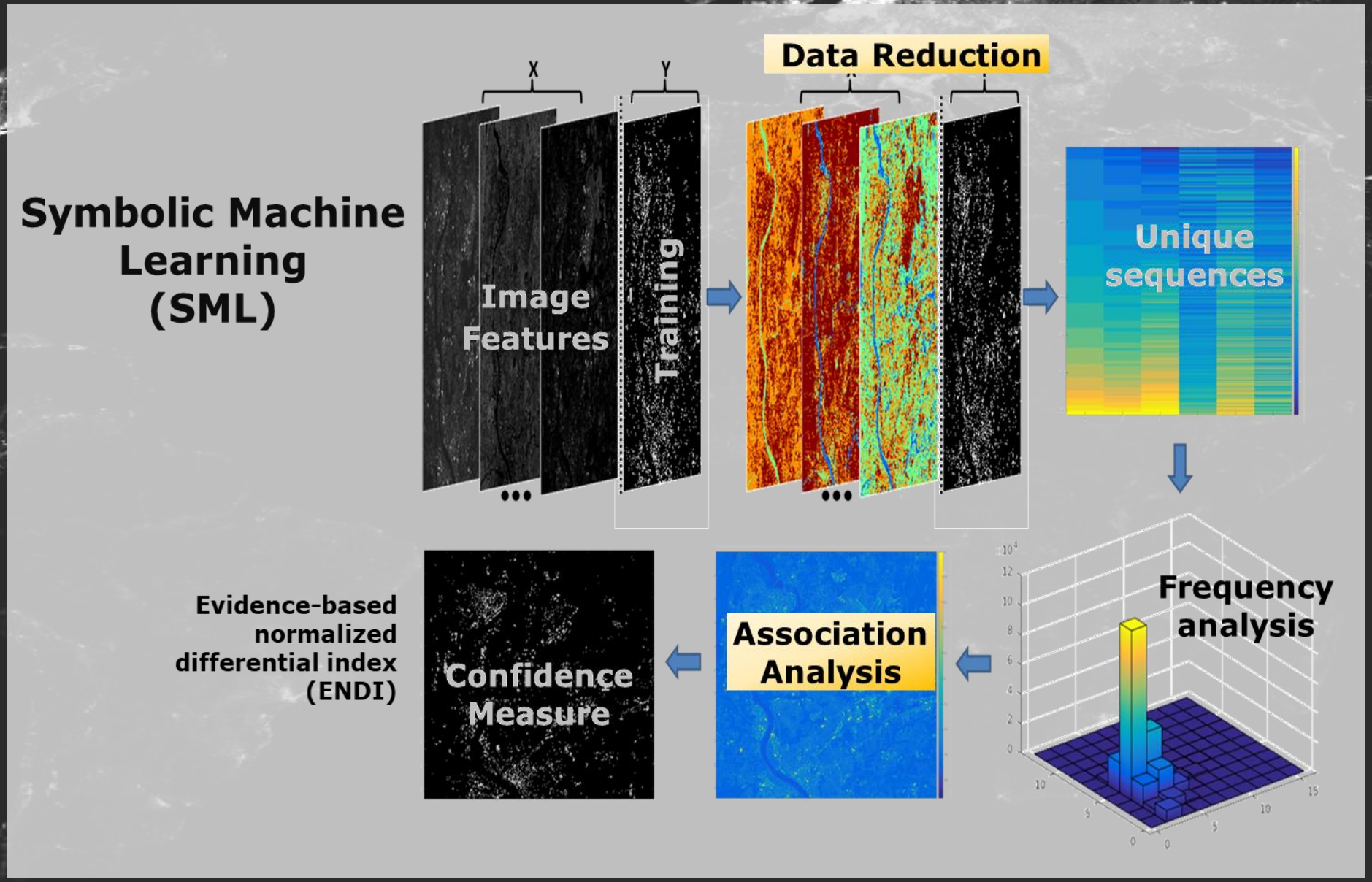




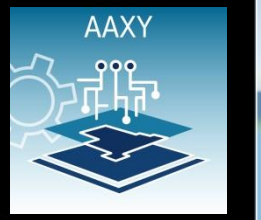


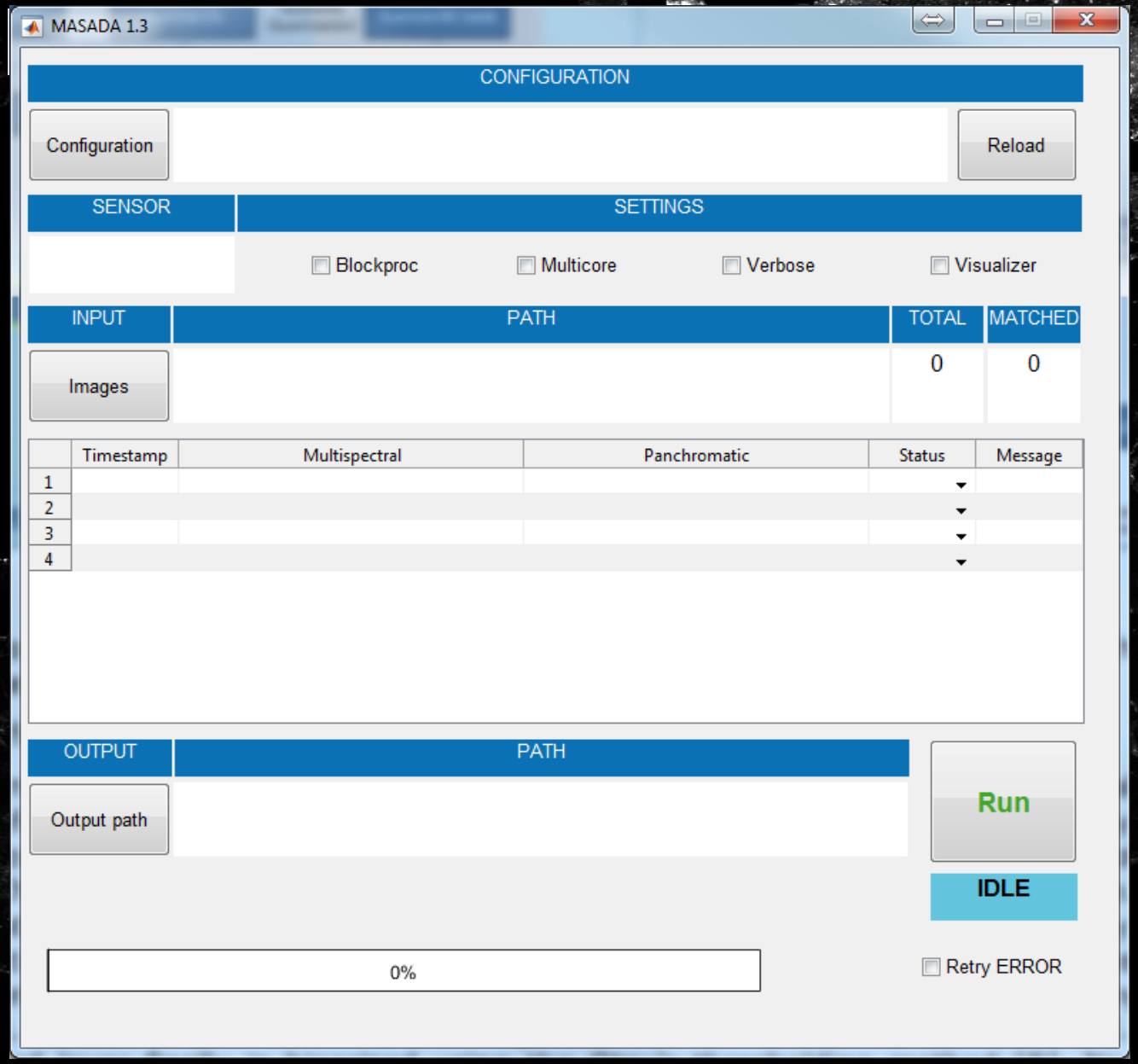
What we detect: “built-up area” = all spatial units (30x30m Landsat, 10x10m Sentinel) where a roofed building or part of a building can be recognized

Machine Learning tools

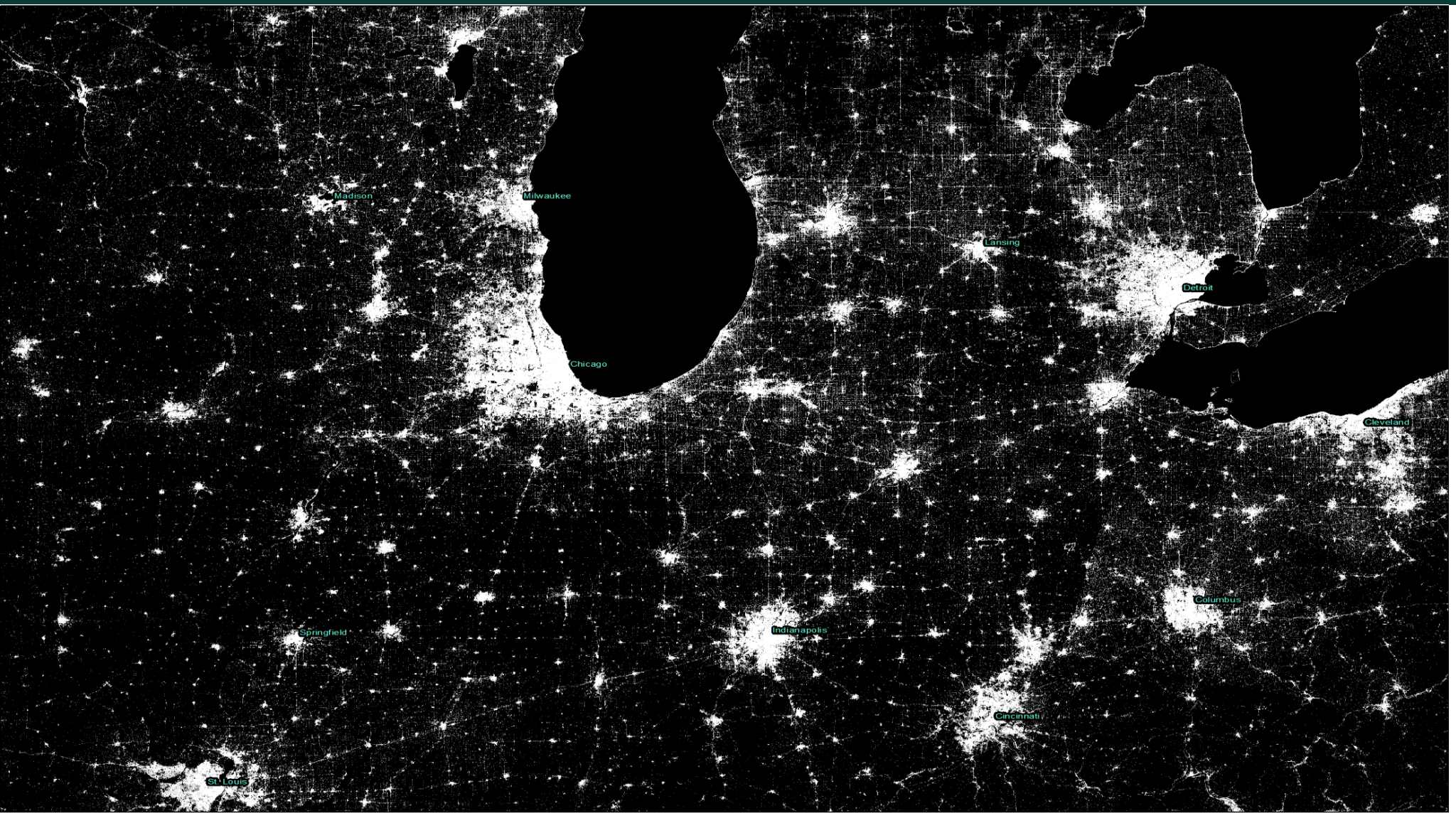


GHSL tools suite
http://ghsl.jrc.ec.europa.eu/tools.php





Enhancing the perception of the reality



Chicago, US

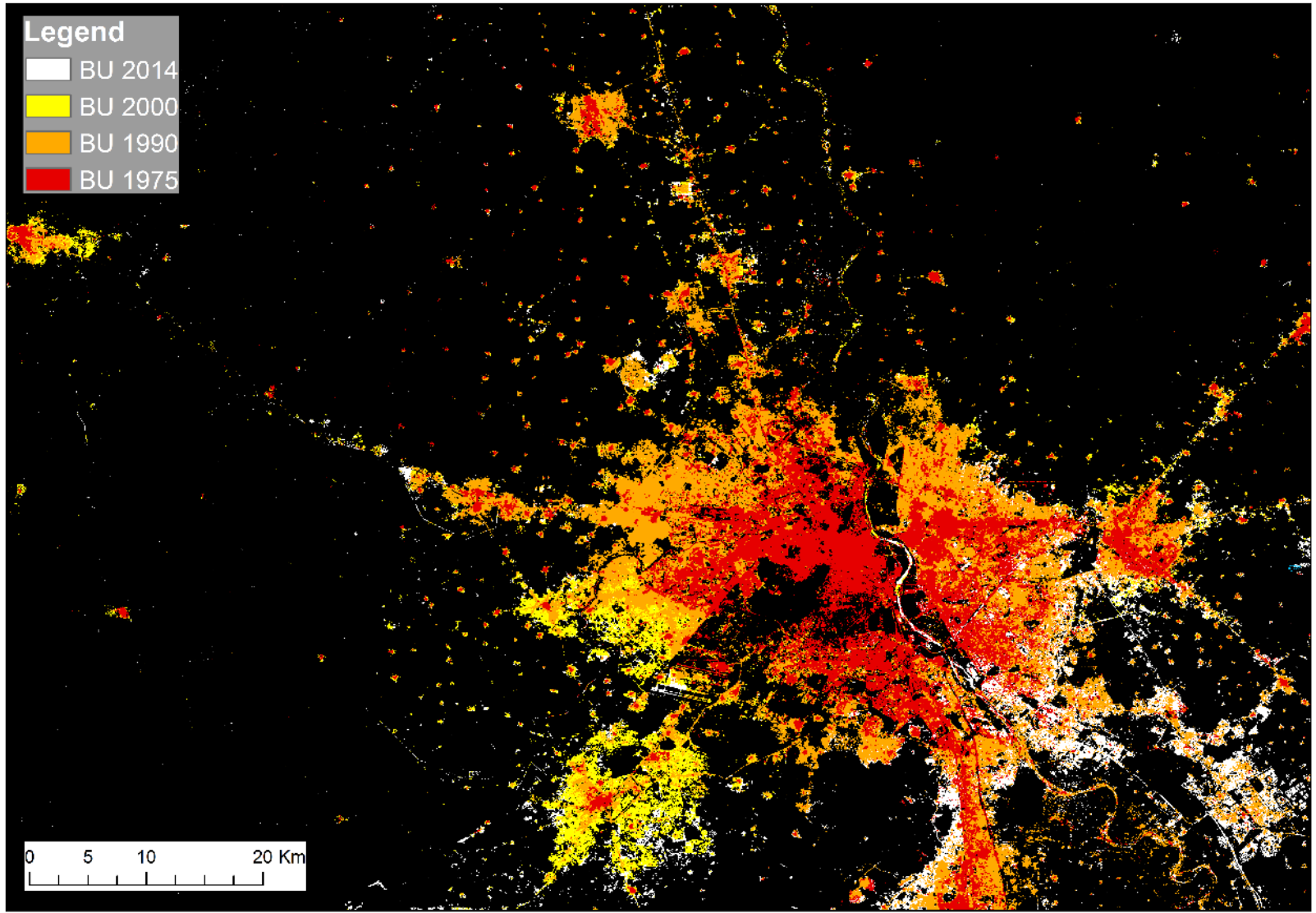
MERIS GLOBCOVER
(300m resolution)
“urban areas”

Landsat GHSL
(30m resolution)
“built-up areas”

GEO GROUP ON EARTH OBSERVATIONS

European Commission

Enhancing the perception of the reality



Evolutionary, self-learning artificial intelligence data cubes

New Delhi, India

Landsat GHSL (release 2015)
“built-up areas” 1975-2015

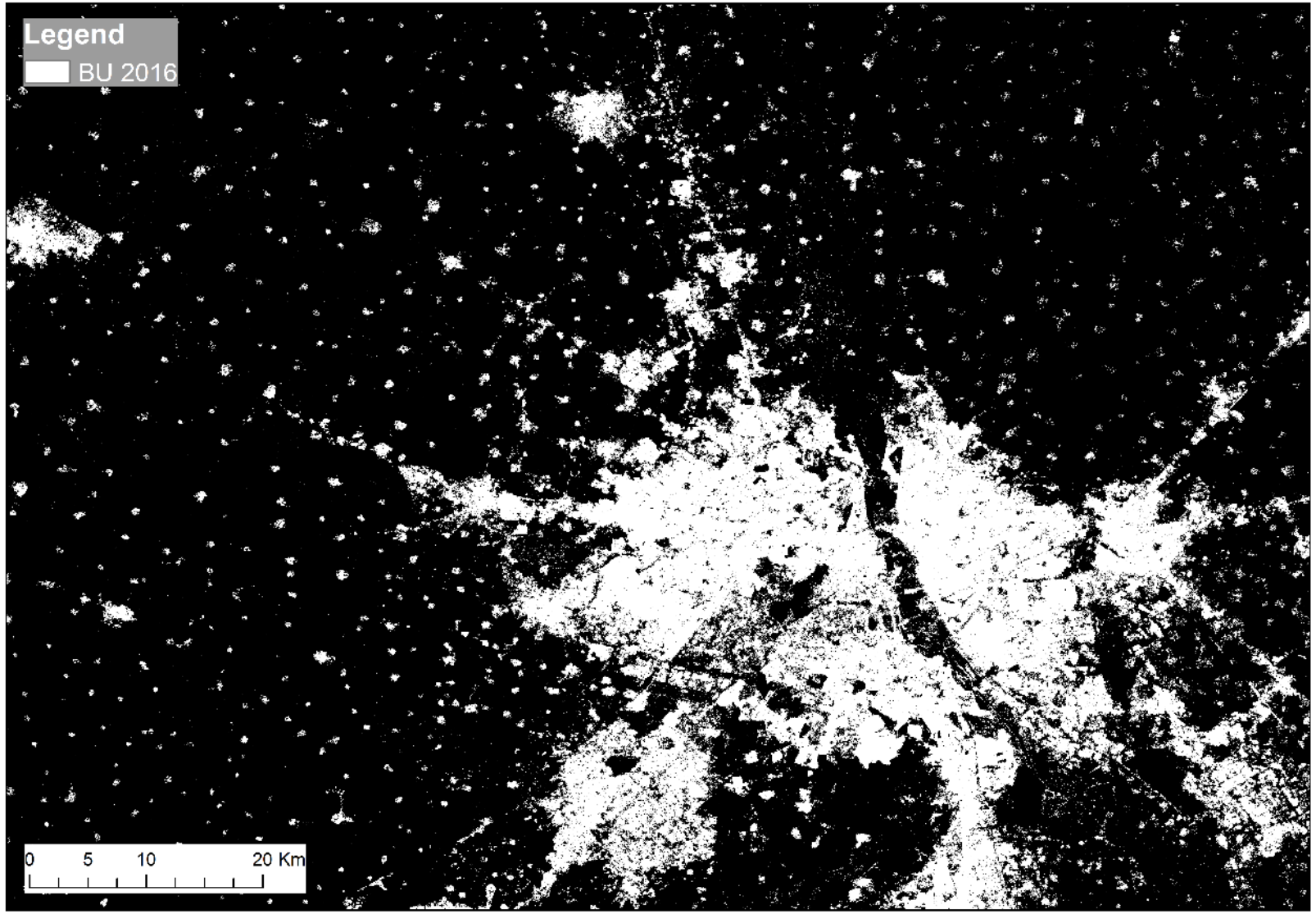
Sentinel1 GHSL (release 2016)
“built-up areas” 2016

Landsat GHSL
(release 2017 reloaded)
“built-up areas” 1975-2015

GEO GROUP ON EARTH OBSERVATIONS

European Commission

Enhancing the perception of the reality



Evolutionary, self-learning artificial intelligence data cubes

New Delhi, India

Landsat GHSL (release 2015)
“built-up areas” 1975-2015

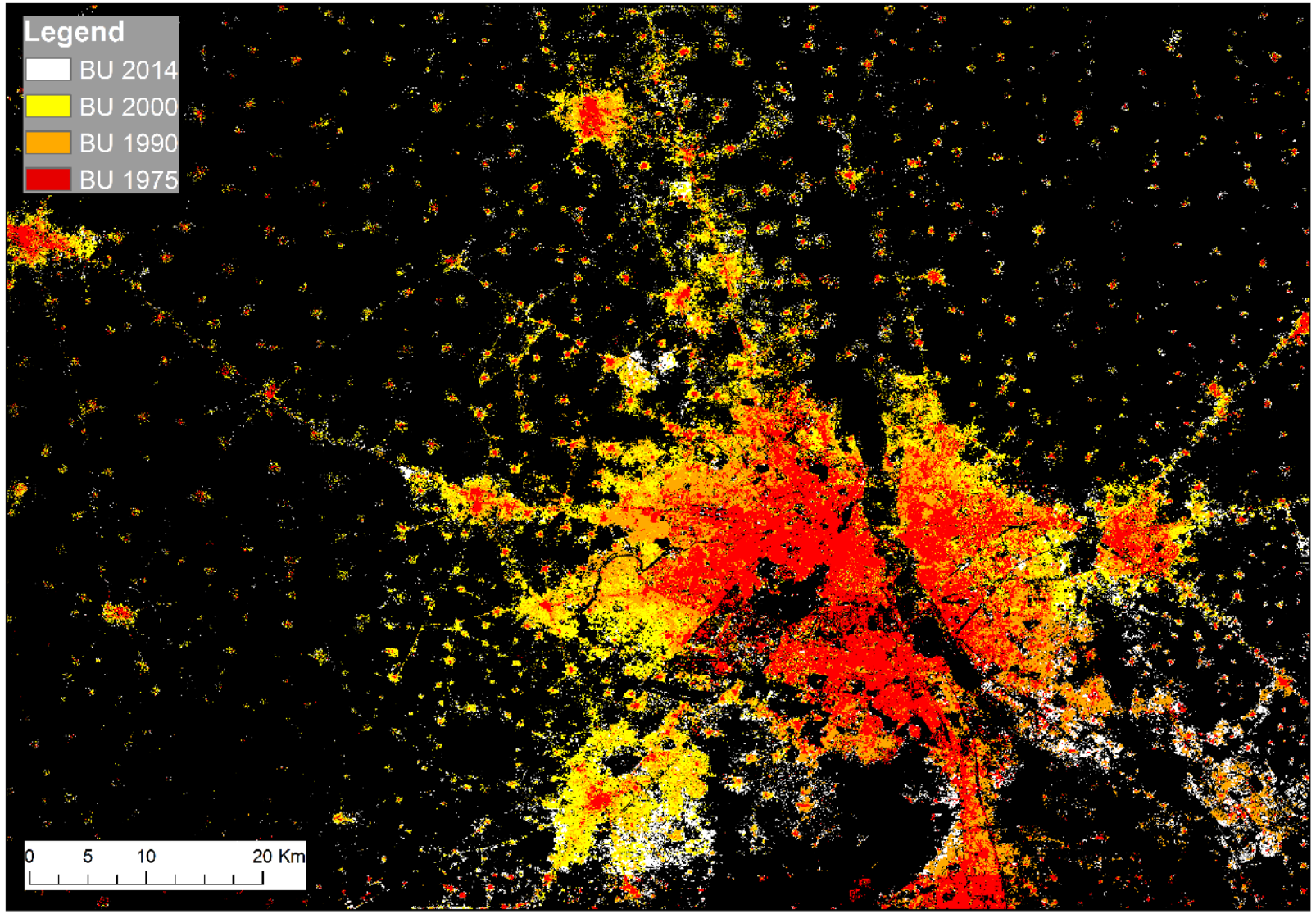
Sentinel1 GHSL (release 2016)
“built-up areas” 2016

Landsat GHSL
(release 2017 reloaded)
“built-up areas” 1975-2015

GEO GROUP ON EARTH OBSERVATIONS

European Commission

Enhancing the perception of the reality



Evolutionary, self-learning artificial intelligence data cubes

New Delhi, India

Landsat GHSL (release 2015)
“built-up areas” 1975-2015

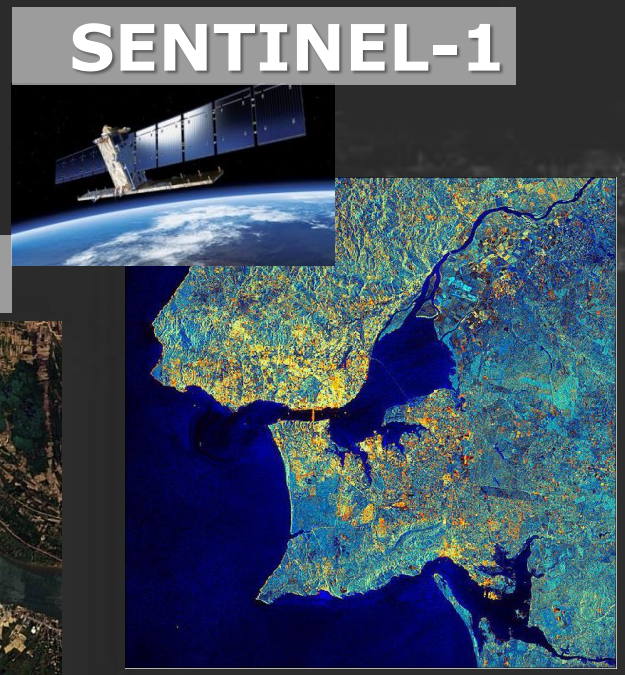
Sentinel1 GHSL (release 2016)
“built-up areas” 2016

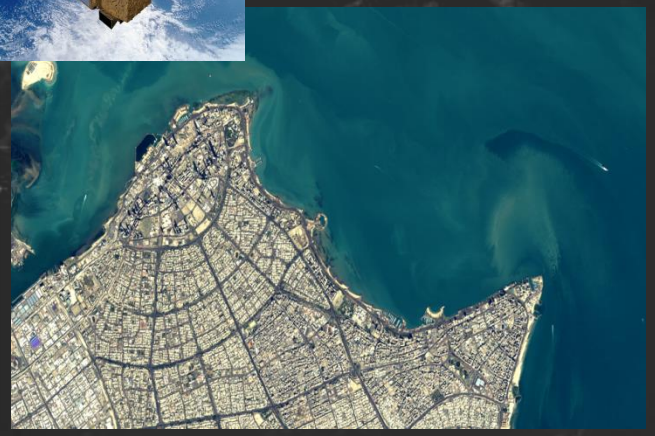
Landsat GHSL
(release 2017 reloaded)
“built-up areas” 1975-2015

GEO GROUP ON EARTH OBSERVATIONS

European Commission

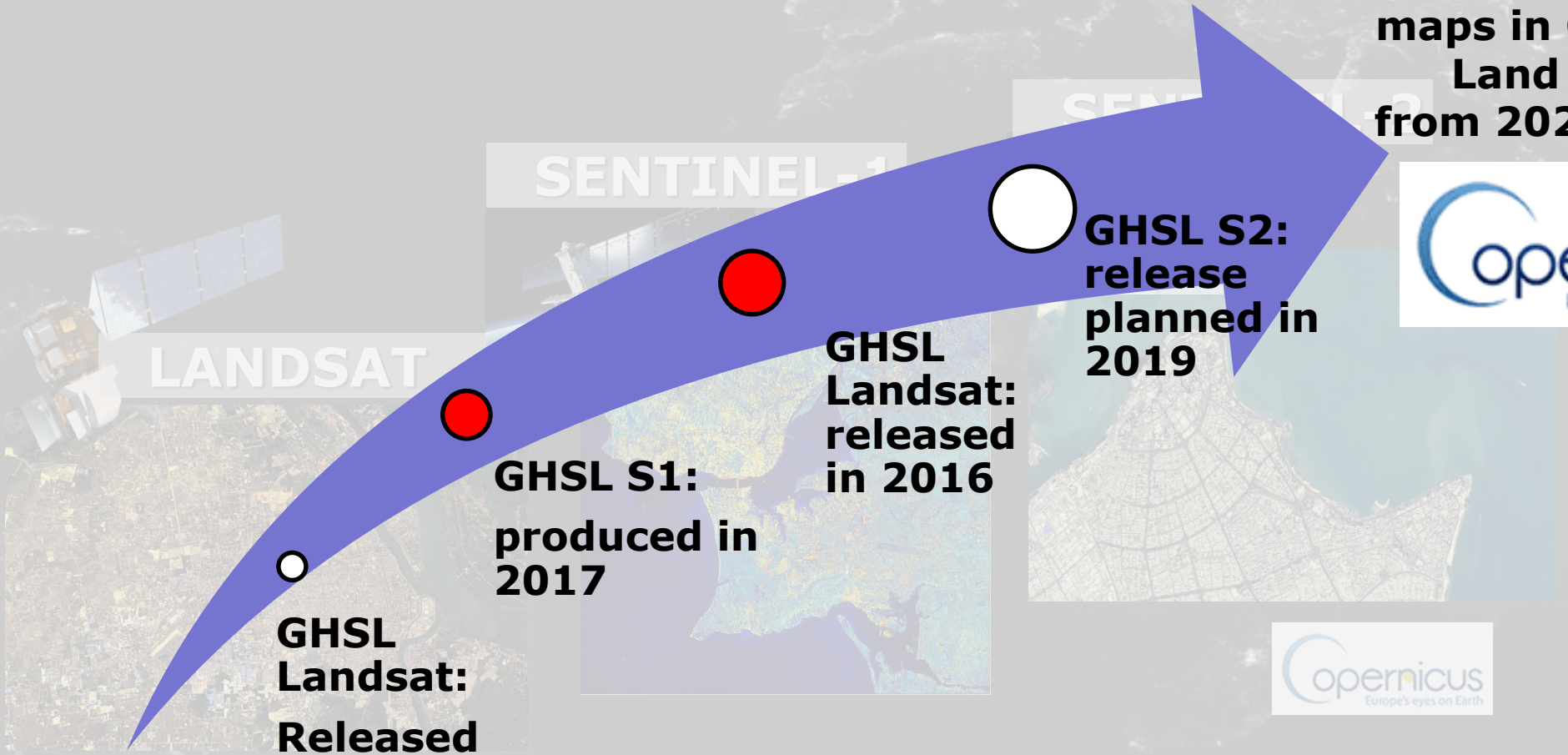
GHSL : built-up extraction from different sensors





Copernicus
Europe's eyes on Earth

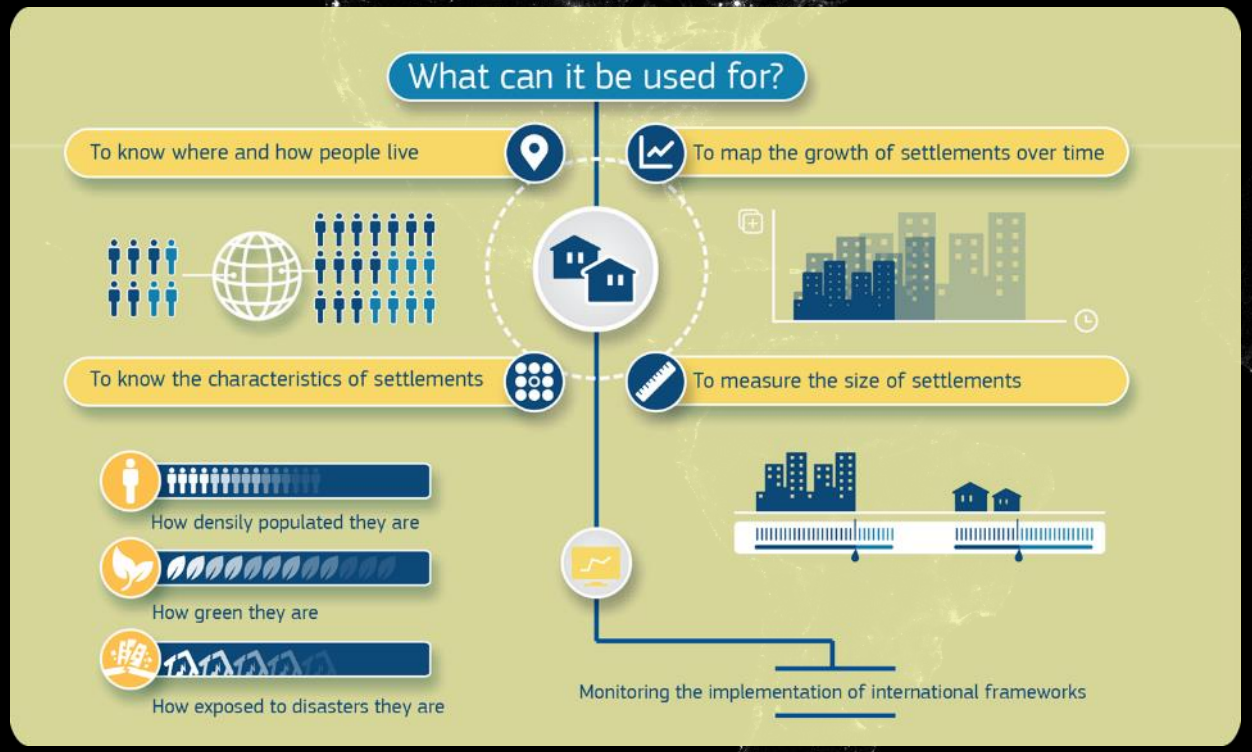
GHSL : built-up extraction from different sensors



Production of global built-up maps in Copernicus Land Service from 2020 onwards

Global Human Settlement Layer (GHSL)

The most complete, consistent, global, free and open data set on human settlements. from the village to the megacity, for the epochs 1975 – 1990 – 2000 – 2015



Full open free data and tools at
http://ghsl.jrc.ec.europa.eu
http:/www.geoportal.org/

GEO Human Planet Initiative

GEO GROUP ON EARTH OBSERVATIONS

European Commission