

# The European Commission's science and knowledge service

Joint Research Centre



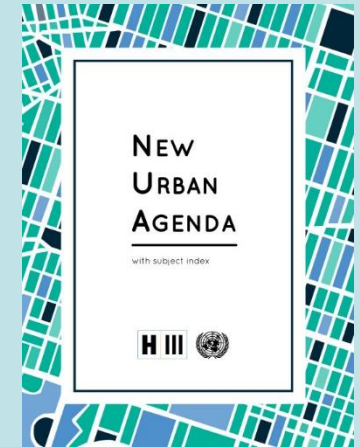
# **Towards a Copernicus Human Settlement Product**

**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

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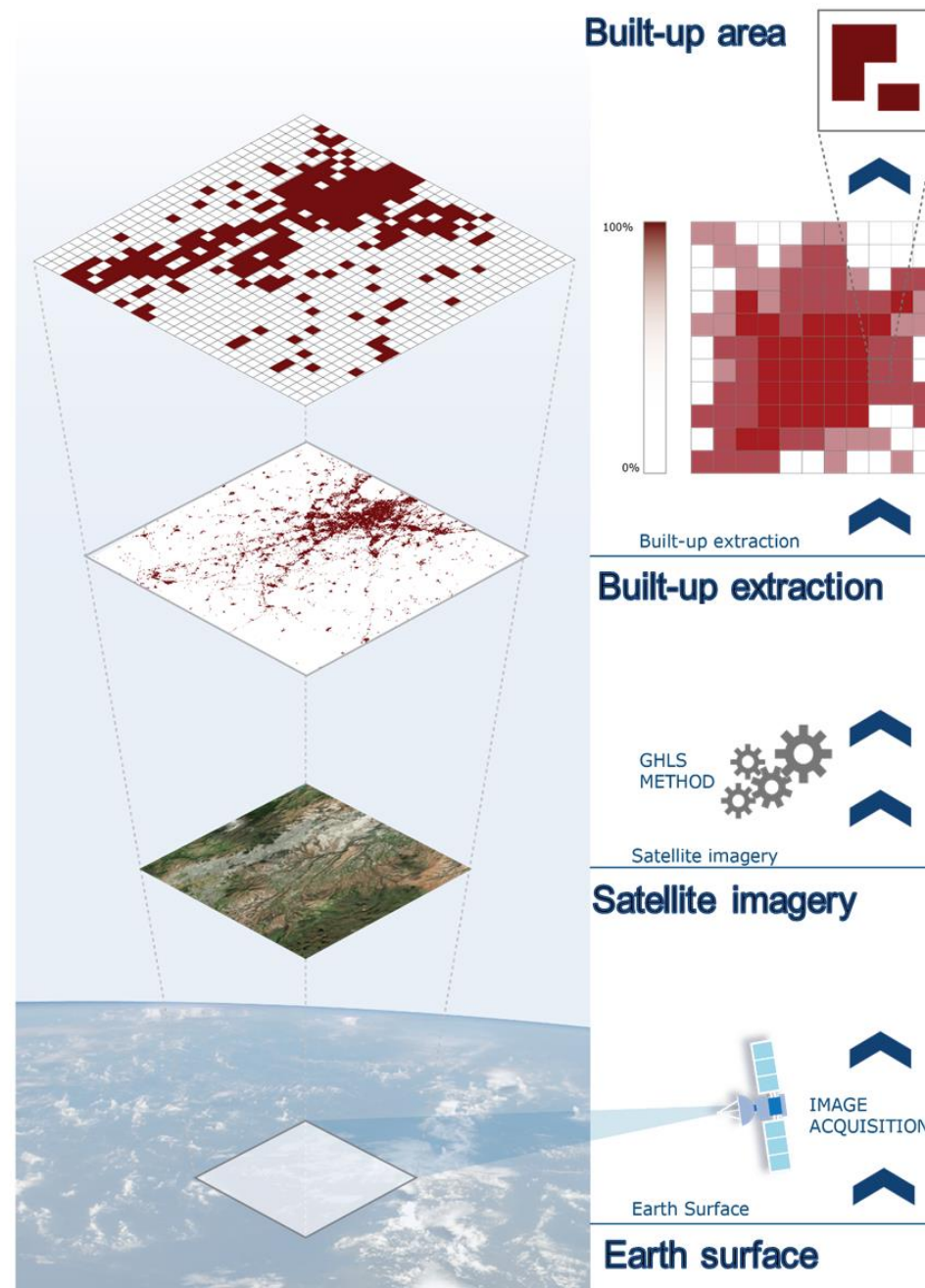
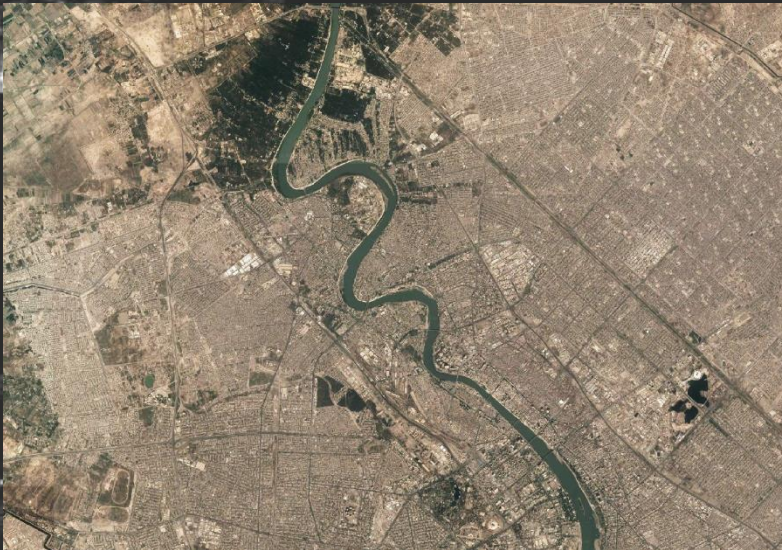
## Sustainable Development Goals

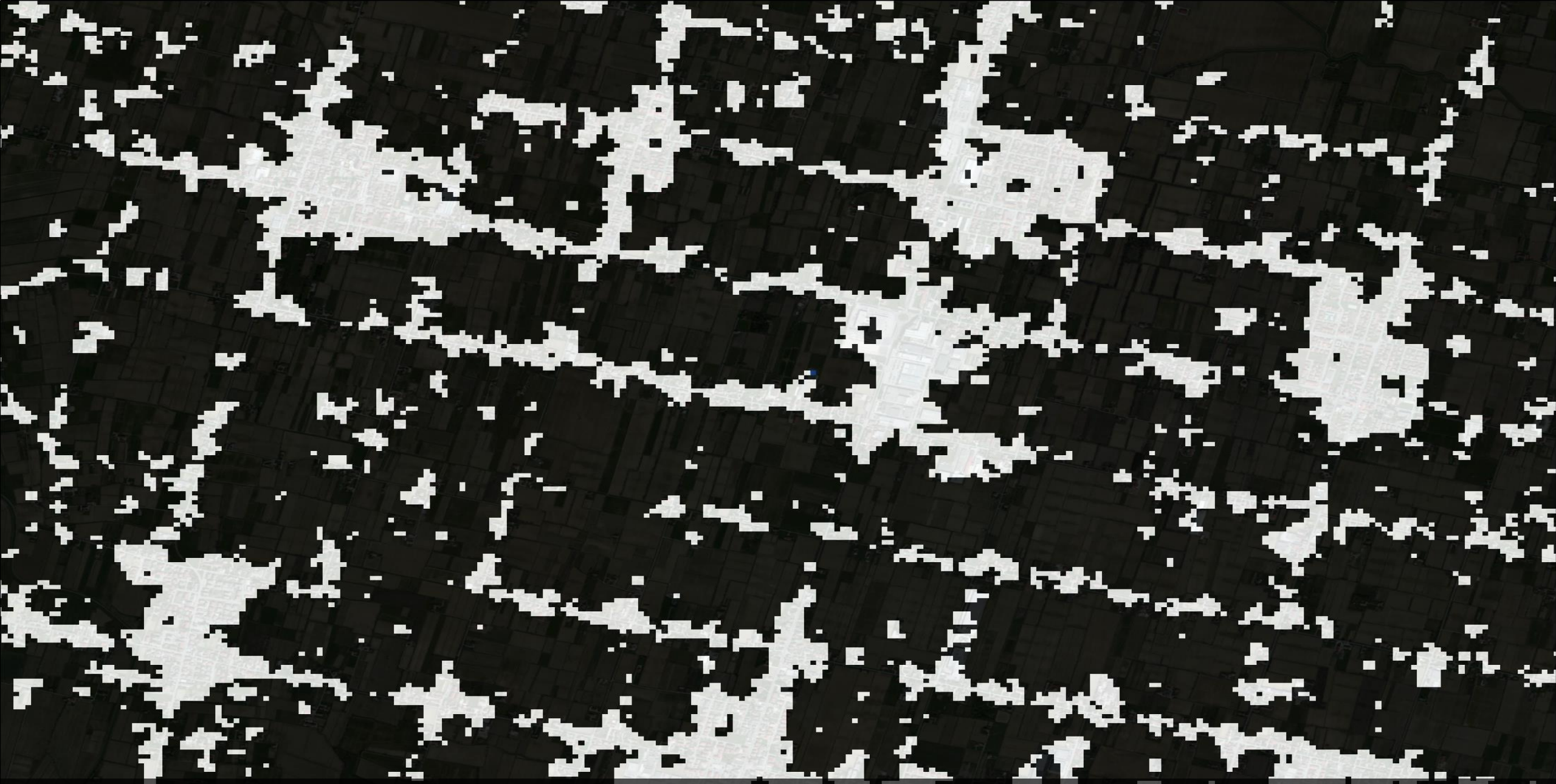


## Earth Observations in Service of the *Agenda 2030*

Target									Goal	Indicator				
Contribute to progress on the Target yet not the Indicator per se										Direct measure or indirect support				
							1.4	1.5	1 NO POVERTY	1.4.2				
						2.3	2.4	2.c	2 ZERO HUNGER	2.4.1				
					3.3	3.4	3.9	3.d	3 GOOD HEALTH AND WELL-BEING	3.9.1				
									4 QUALITY EDUCATION					
								5.a	5 GENDER EQUALITY	5.a.1				
		6.1	6.3	6.4	6.5	6.6	6.a	6.b	6 CLEAN WATER AND SANITATION	6.3.1	6.3.2	6.4.2	6.5.1	6.6.1
					7.2	7.3	7.a	7.b	7 AFFORDABLE AND CLEAN ENERGY	7.1.1				
								8.4	8 INDUSTRIALIZATION AND INNOVATION					
					9.1	9.4	9.5	9.a	9 DECENT WORK AND ECONOMIC GROWTH	9.1.1	9.4.1			
									10 REDUCED INEQUALITIES					
	11.1	11.3	11.4	11.5	11.6	11.7	11.b	11.c	11 SUSTAINABLE CITIES AND COMMUNITIES	11.1.1	11.2.1	11.3.1	11.6.2	11.7.1
				12.2	12.4	12.8	12.9	12.b	12 RESILIENT INFRASTRUCTURE	12.2.1				
					13.1	13.2	13.3	13.b	13 CLIMATE ACTION	13.1.1				
		14.1	14.2	14.3	14.4	14.6	14.7	14.a	14 LIFE BELOW WATER	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 LIFE ON LAND	15.1.1	15.2.1	15.3.1	15.4.1	15.4.2
								16.8	16 PEACE, JUSTICE AND STRONG INSTITUTIONS					
17.2	17.3	17.6	17.7	17.8	17.9	17.16	17.17	17.18	17 PARTNERSHIPS FOR THE GOALS	17.6.1	17.18.1			

# From Earth's Surface... to Pixels... to Built-up areas





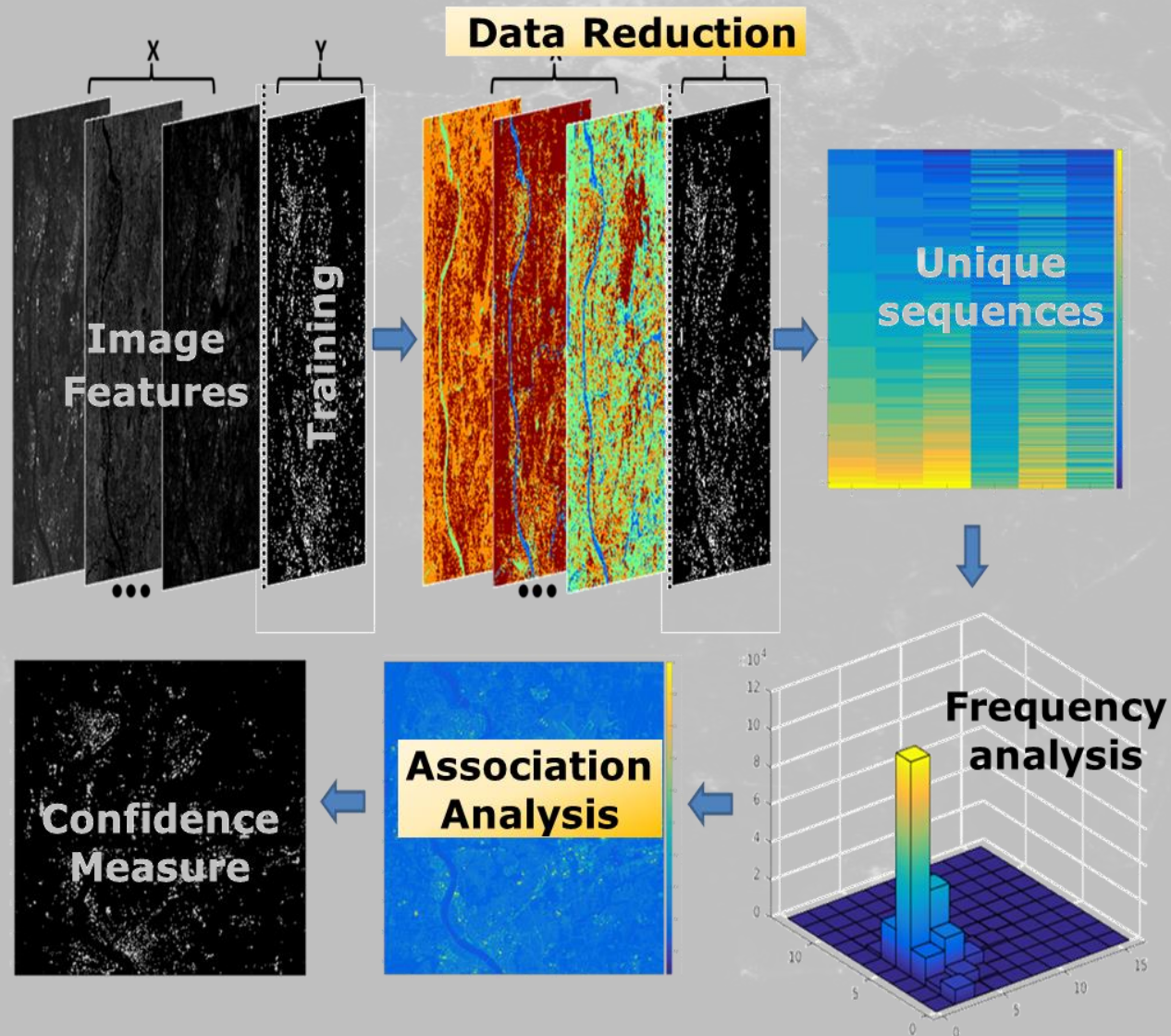
What we detect: “built-up area” = all spatial units (30x30m Landsat, 10x10m Sentinel)  
where a roofed building or part of a building can be recognized

Source: [Epi](#), [DigitGlobe](#), [GeoEye](#), [Landsat](#), [USDA](#), [USGS](#), [AESA](#), [Getmapping](#), [Aerogrid](#), [IGN](#), [IGF](#), [Swissstopo](#), and the [GIS User Community](#)

# Machine Learning tools

**Symbolic Machine Learning (SML)**

**Evidence-based  
normalized  
differential index  
(ENDI)**



# GHSL tools suite

<http://ghsl.jrc.ec.europa.eu/tools.php>



MASADA 1.3

**CONFIGURATION**

Configuration Reload

**SENSOR** **SETTINGS**

☐ Blockproc ☐ Multicore ☐ Verbose ☐ Visualizer

**INPUT** **PATH** **TOTAL** **MATCHED**

Images 0 0

	Timestamp	Multispectral	Panchromatic	Status	Message
1				▼	
2				▼	
3				▼	
4				▼	

**OUTPUT** **PATH**

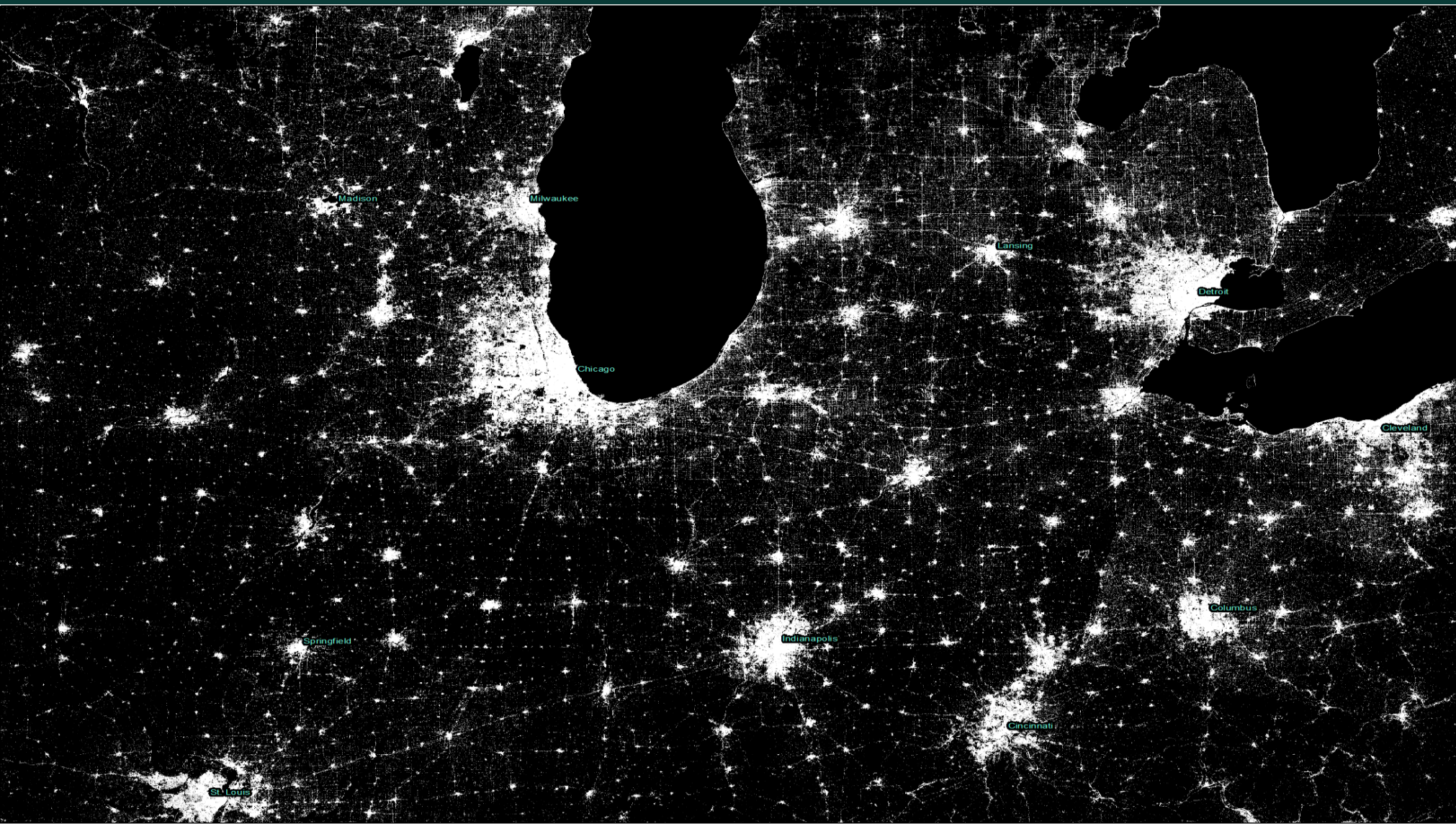
Output path Run

**IDLE**

☐ Retry ERROR

0%

# Enhancing the perception of the reality



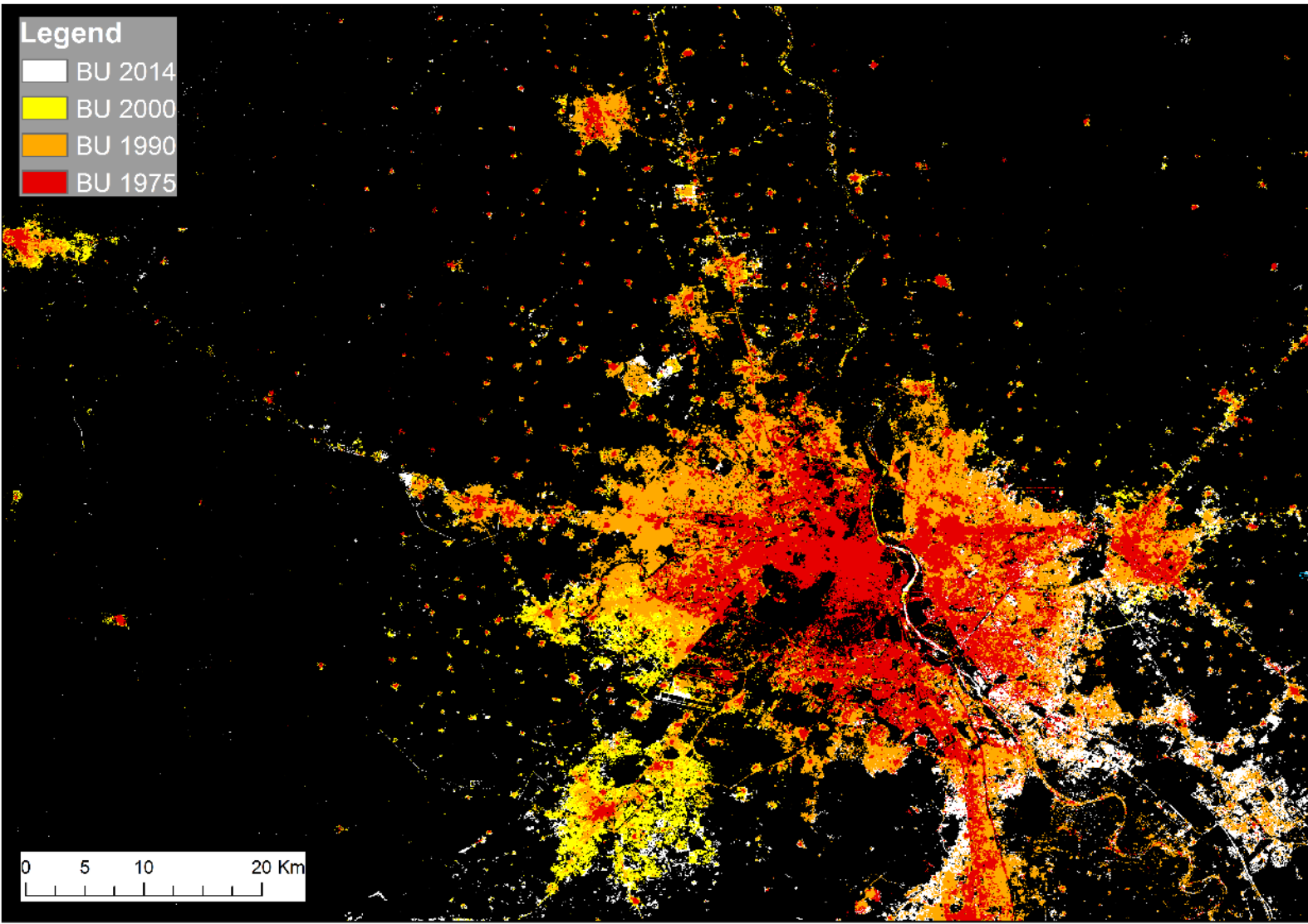
Chicago, US

MERIS GLOBCOVER  
(300m resolution)  
"urban areas"

Landsat GHSL  
(30m resolution)  
"built-up areas"

 **GROUP ON  
EARTH OBSERVATIONS**

# Enhancing the perception of the reality



Evolutionary, self-learning  
artificial intelligence data cubes

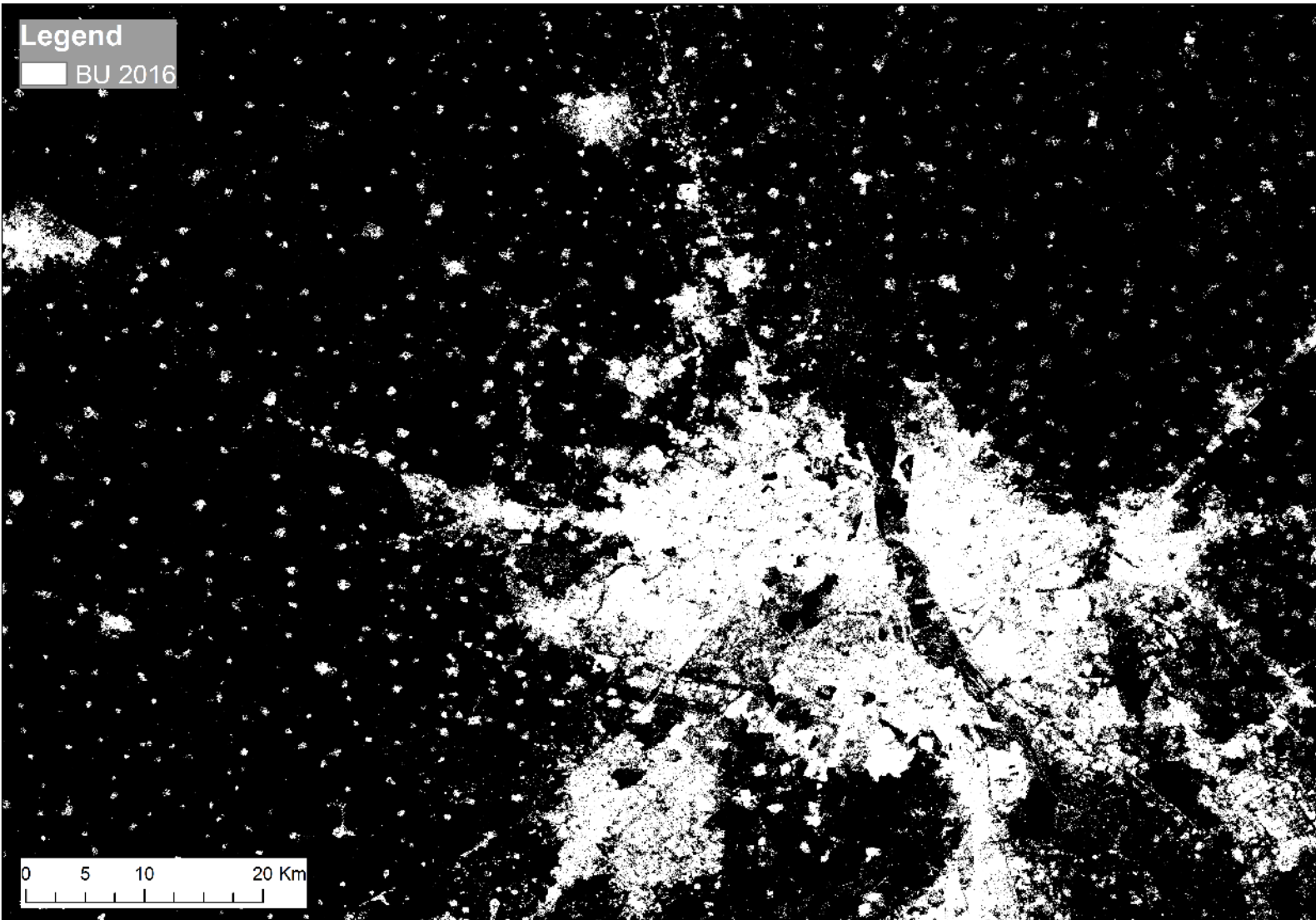
New Delhi, India

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

# Enhancing the perception of the reality



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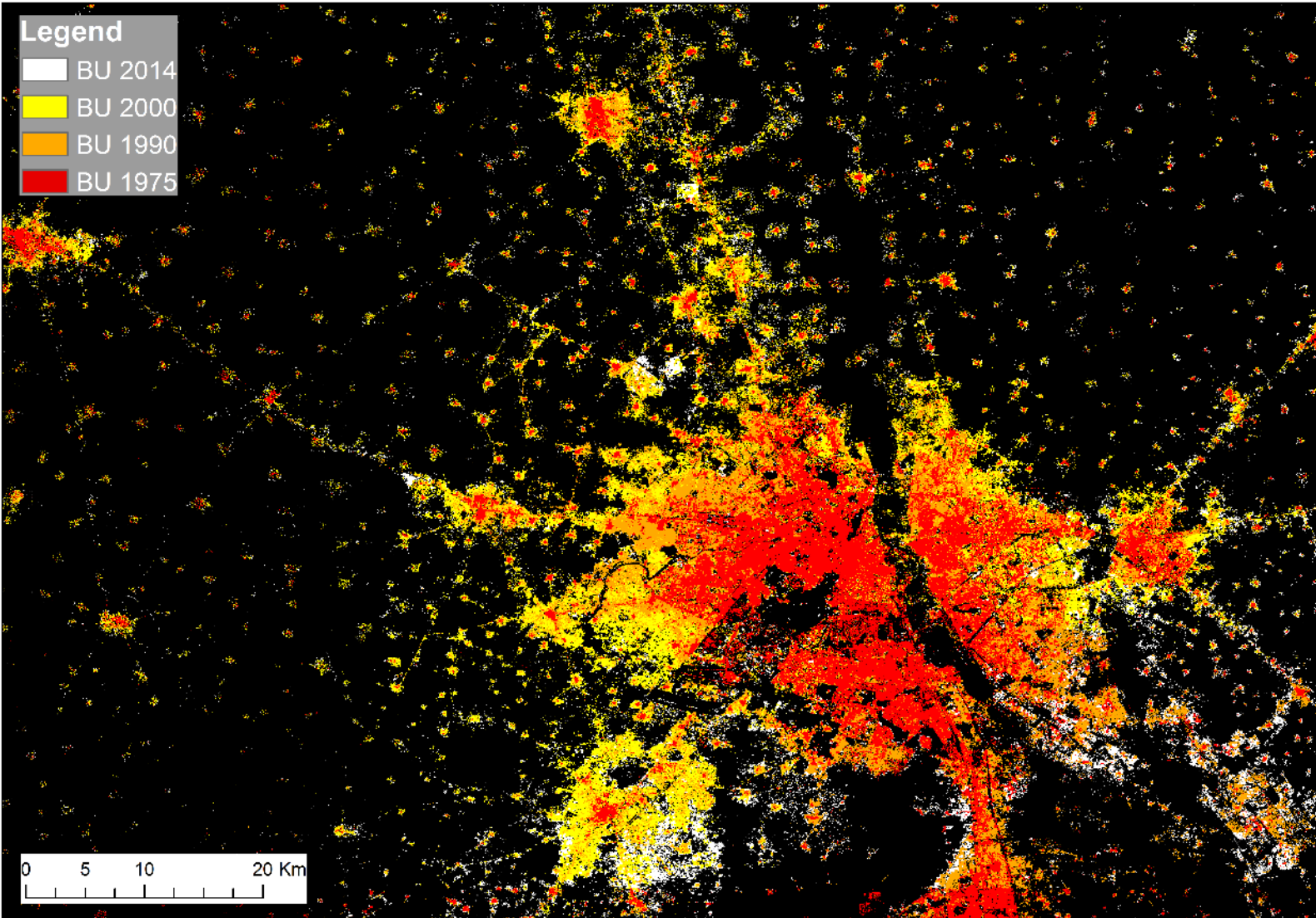
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# GHSL : built-up extraction from different sensors



**LANDSAT**

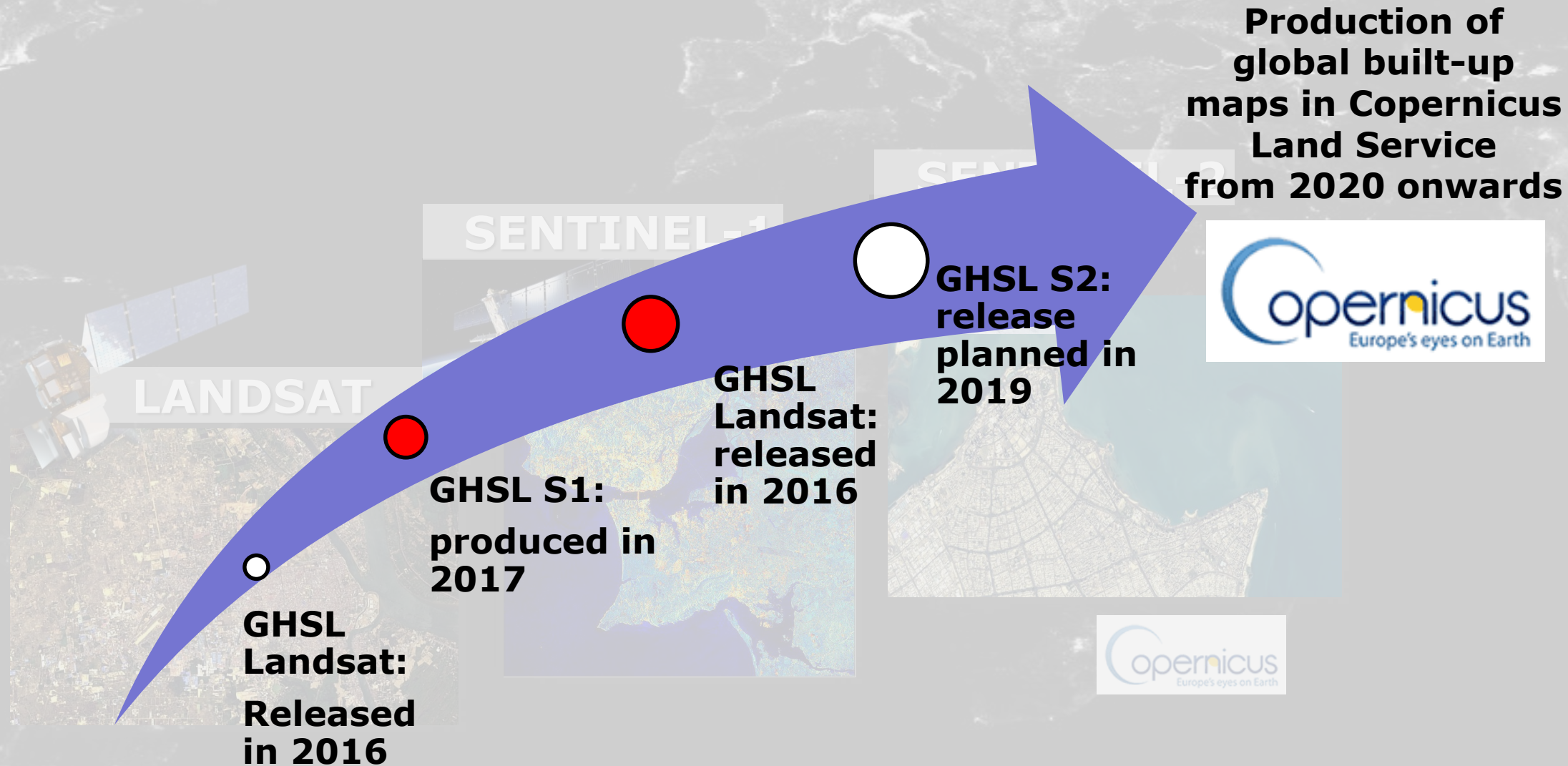


**SENTINEL-1**



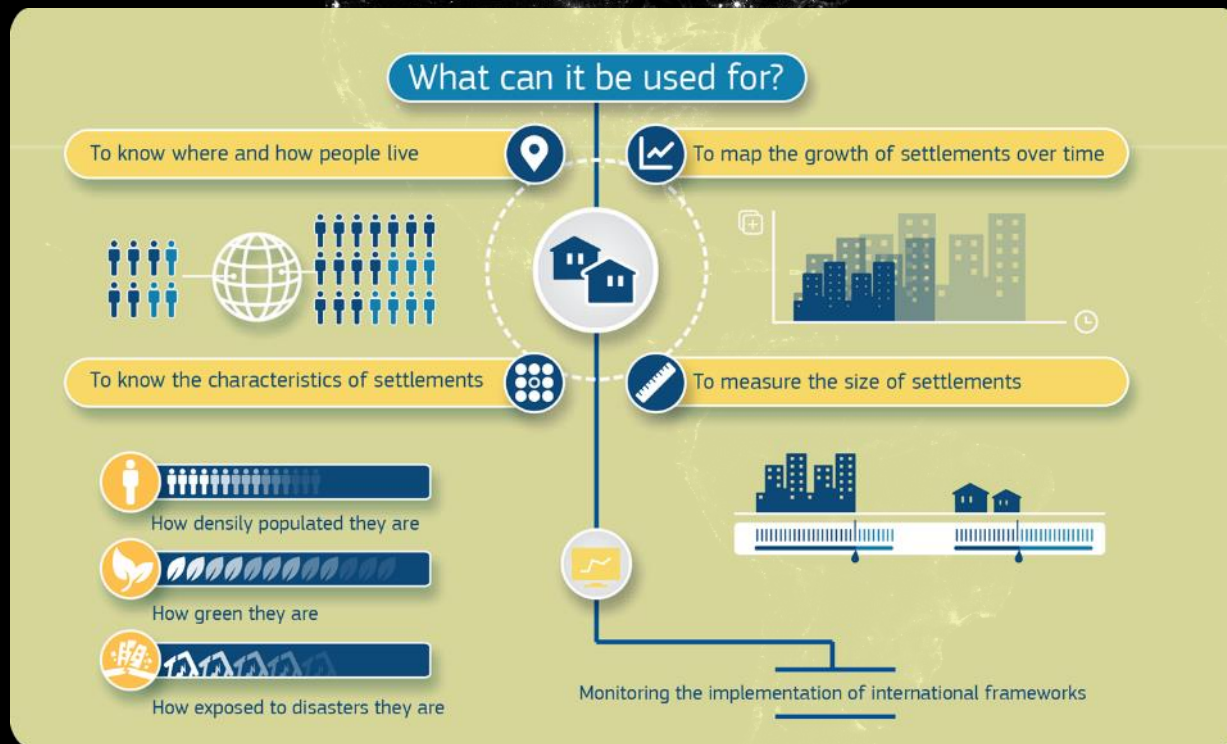
**SENTINEL-2**

# GHSL : built-up extraction from different sensors



# 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



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EUROPEAN COMMISSION  
Global Human Settlement

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**GHSL - Global Human Settlement Layer**  
**A new open and free tool for assessing the human presence on the planet**

- Produces new global spatial information, evidence-based analytics and knowledge describing the human presence on the planet
- Operates in an open and free data and methods access policy (open input, open method, open output)
- Supported by the Joint Research Centre (JRC) and the DG for Regional Development (DG REGIO) of the European Commission, together with the international partnership [GEO Human Planet Initiative](#)

**News** 11/09/2017 [Degree of urbanisation](#) - New page of our website, contains country fact sheets used to inform the discussion on the "global harmonized definition of cities and settlements"

2014

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

[Click here to find out about the technology behind this image](#)