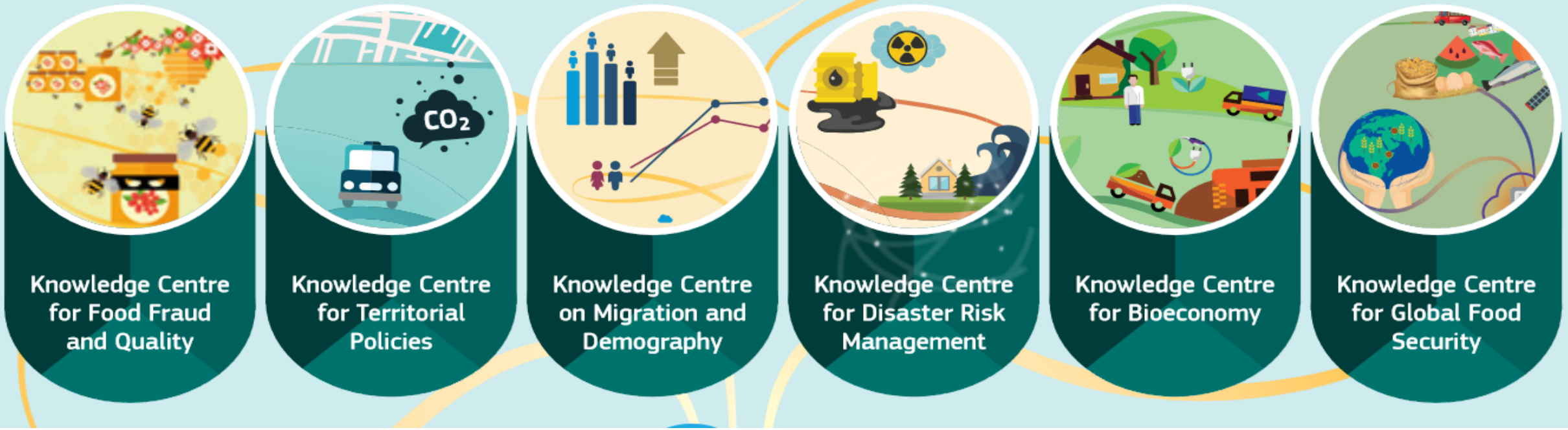
The European Commission's science and knowledge service

Joint Research Centre



AI for Earth Observation in Policy Support

Christina Corbane
European Commission, Joint Research Centre

Applied Machine Learning Days, Lausanne, 27 Jan. 2020

European Commission

AI for Earth Observation (EO)

- Growing amount of EO data and sensors
- EO recognized as tool monitoring international frameworks when combined with other data sources: surveys, citizen science, etc.
- AI is enabling scalable exploration of big data (faster & on larger scales)

Artificial Intelligence in the Commission

A Union that strives for more – My agenda for Europe

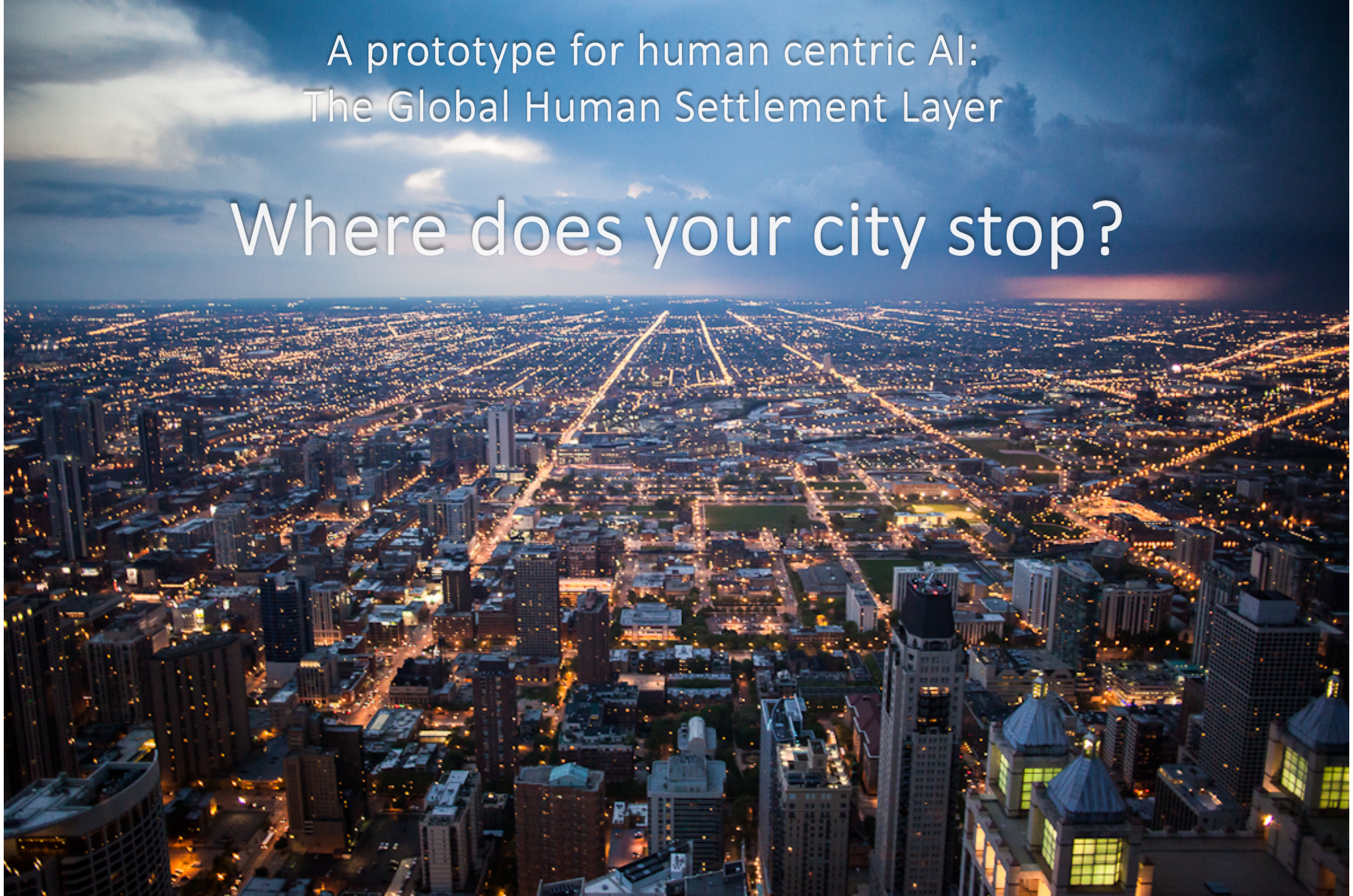
by President of the European Commission, U. Von Der Leyen:

"In my first 100 days in office, I will put forward legislation for a coordinated European approach on the human and ethical implications of Artificial Intelligence."

European Commission

A prototype for human centric AI:
The Global Human Settlement Layer

Where does your city stop?



Big Earth Data 4 Policy: the Global Human Settlement Layer

Objective of GHSL

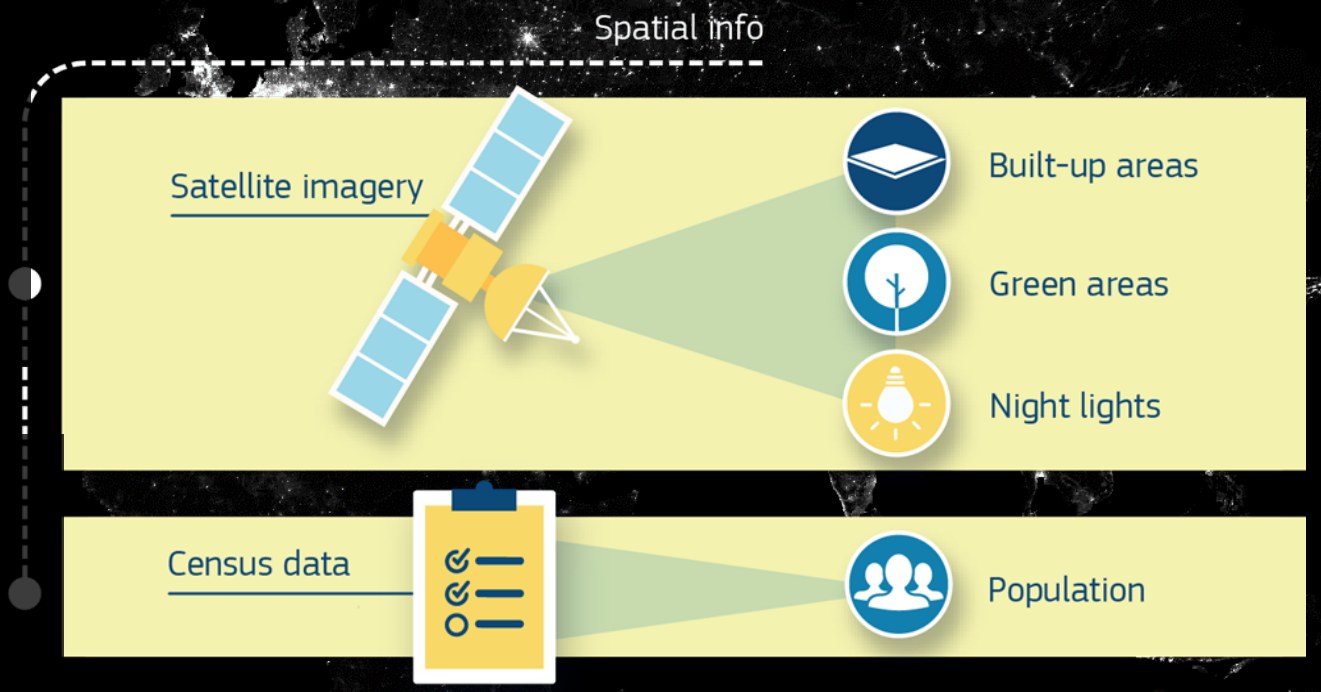
Produce new evidence for decision making:

- 2030 Agenda for Sustainable Development (SDGs)
- Sendai Framework for Disaster Risk Reduction
- New Urban Agenda

Key requirements for policy support

- Reproducible, scientifically sound, synoptic
- Sustainable information production
- Free and open access

➢ Facilitate information sharing and collective knowledge building



http://ghsl.jrc.ec.europa.eu

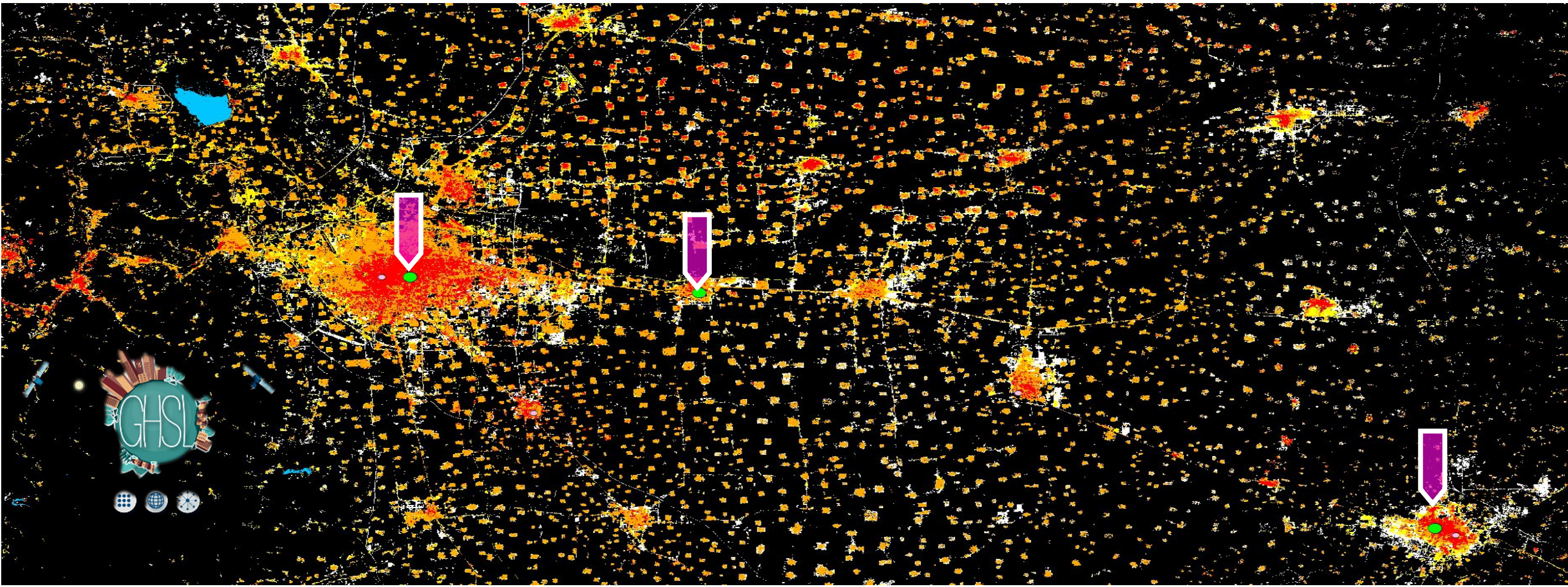
GHSL

GEO Human Planet Initiative

GEO GROUP ON EARTH OBSERVATIONS

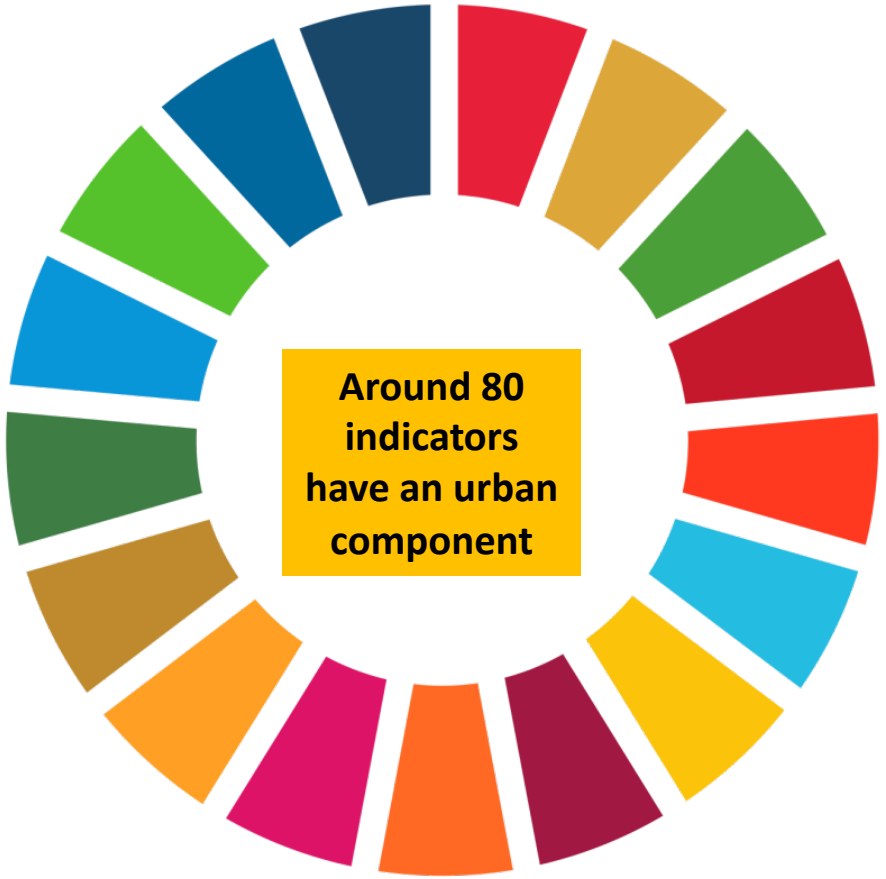
11 SUSTAINABLE CITIES AND COMMUNITIES

Do we know enough about our built-up world ?



China, EO data vs. Cities accounted in the UN World Urbanization Prospect 2016

Collaboration in Research and Methodology for Official Statistics



11.6.2 Annual mean levels of fine particulate matter in cities
11.7.1 Average share of the built-up area of cities that is open space for public use for all

European Commission

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

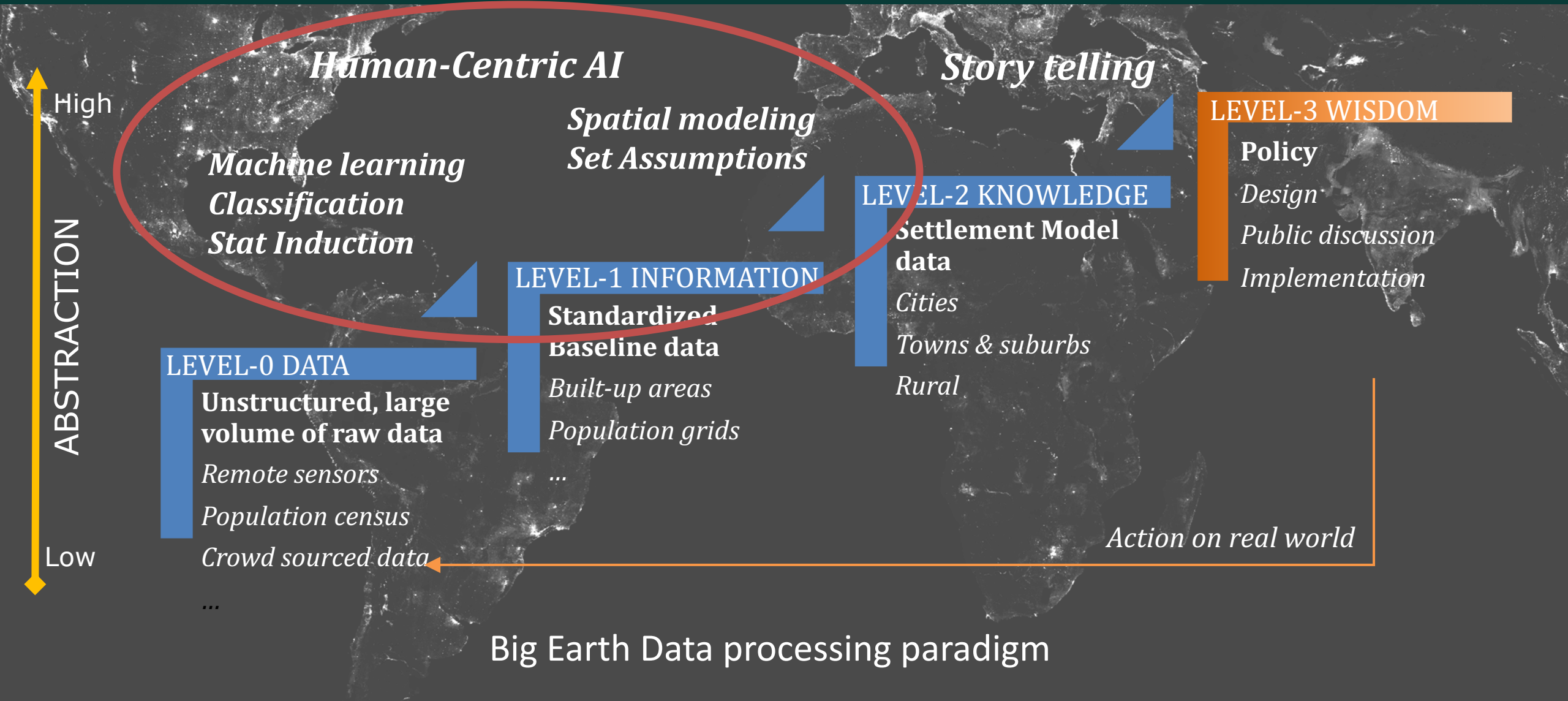
ILO

OECD

UN HABITAT
FOR A BETTER URBAN FUTURE

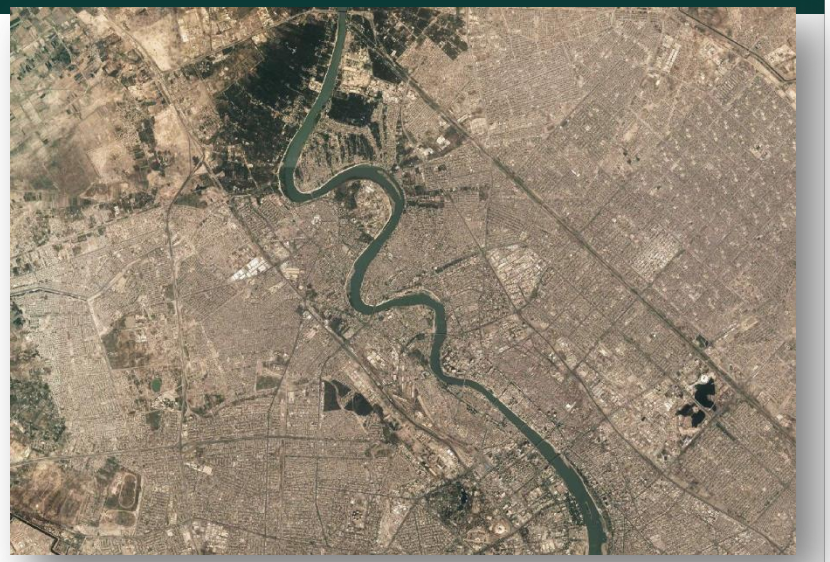
THE WORLD BANK

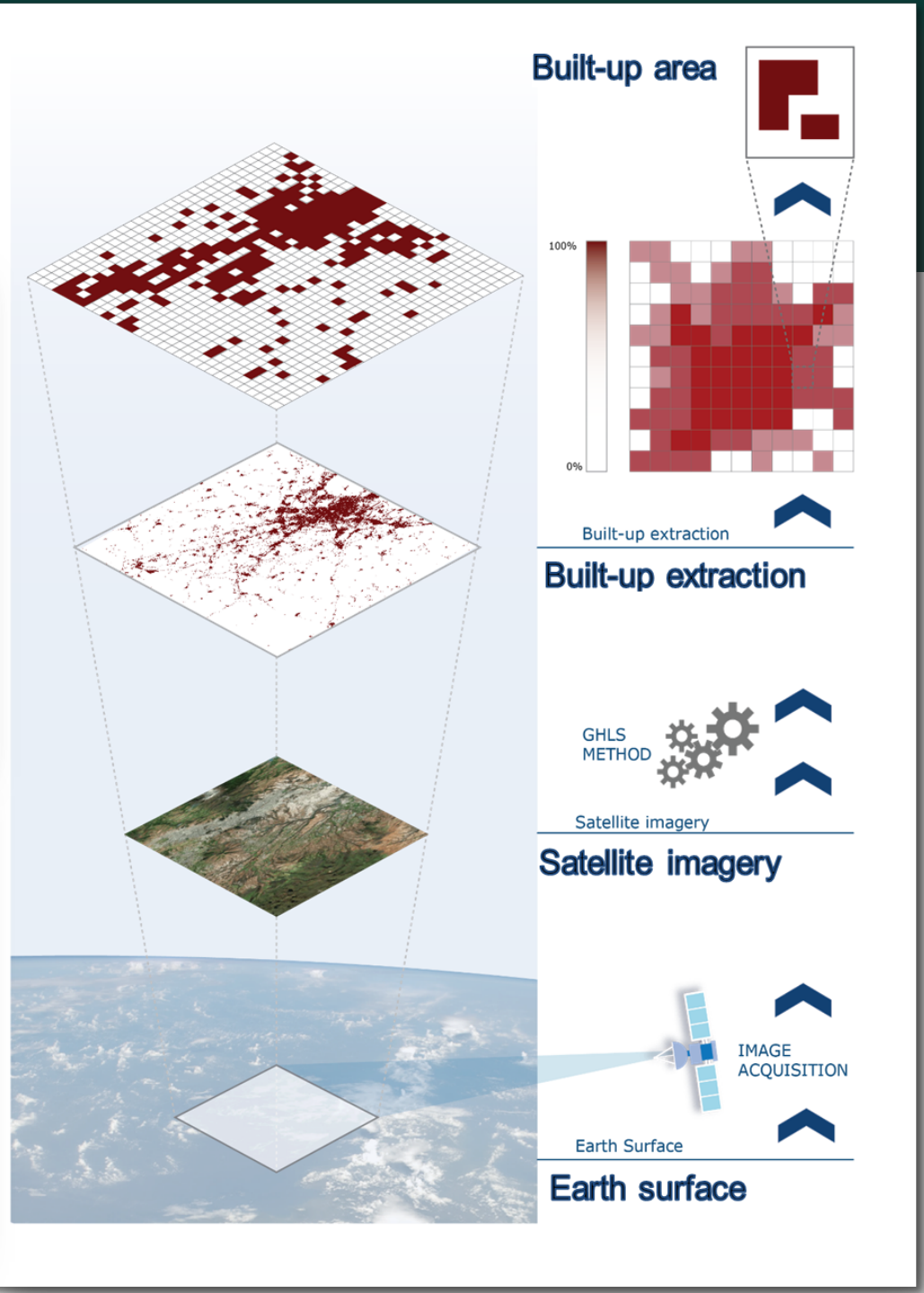
From data to wisdom: the GHSL example



Big Earth Data processing paradigm

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

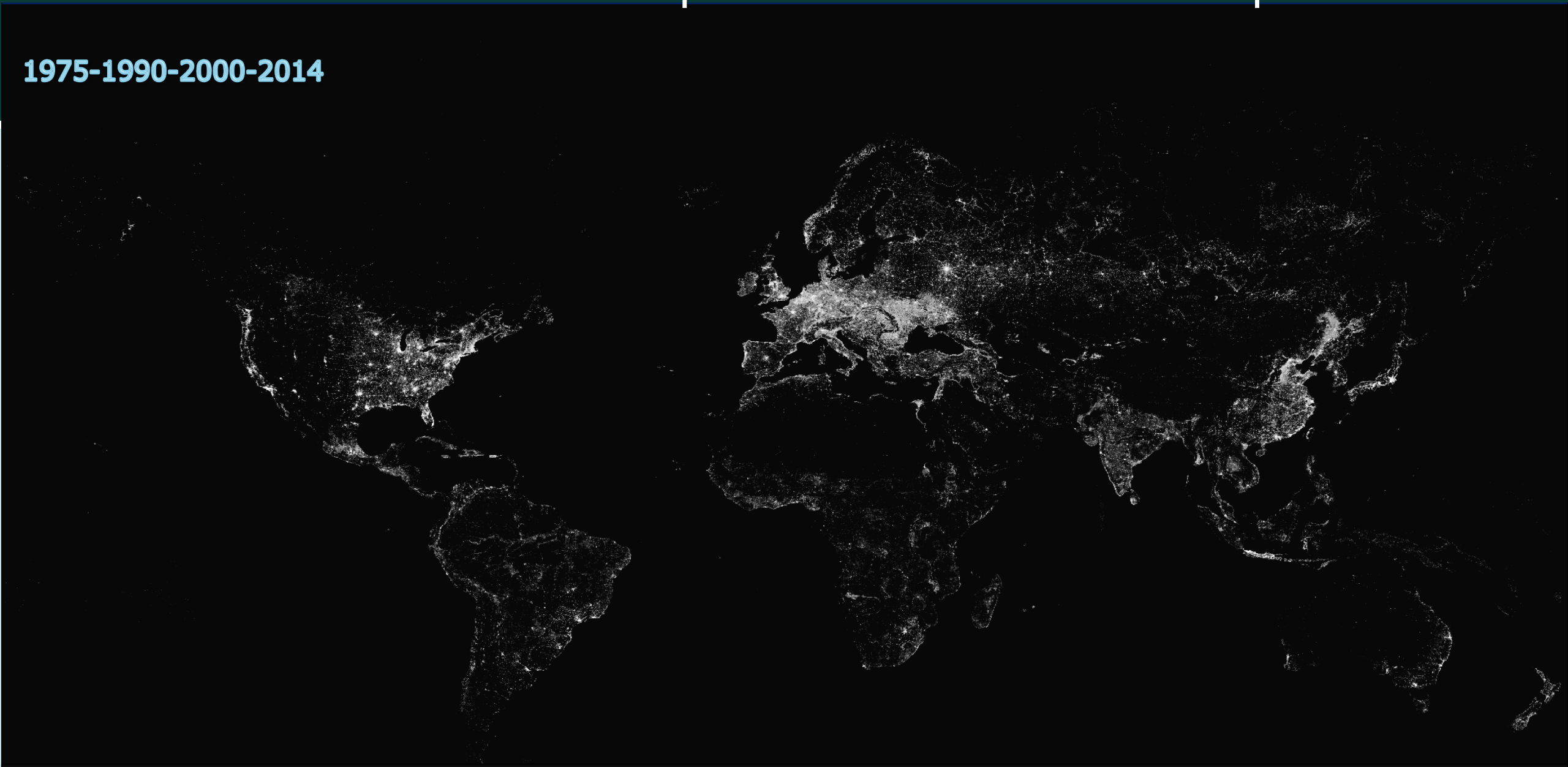




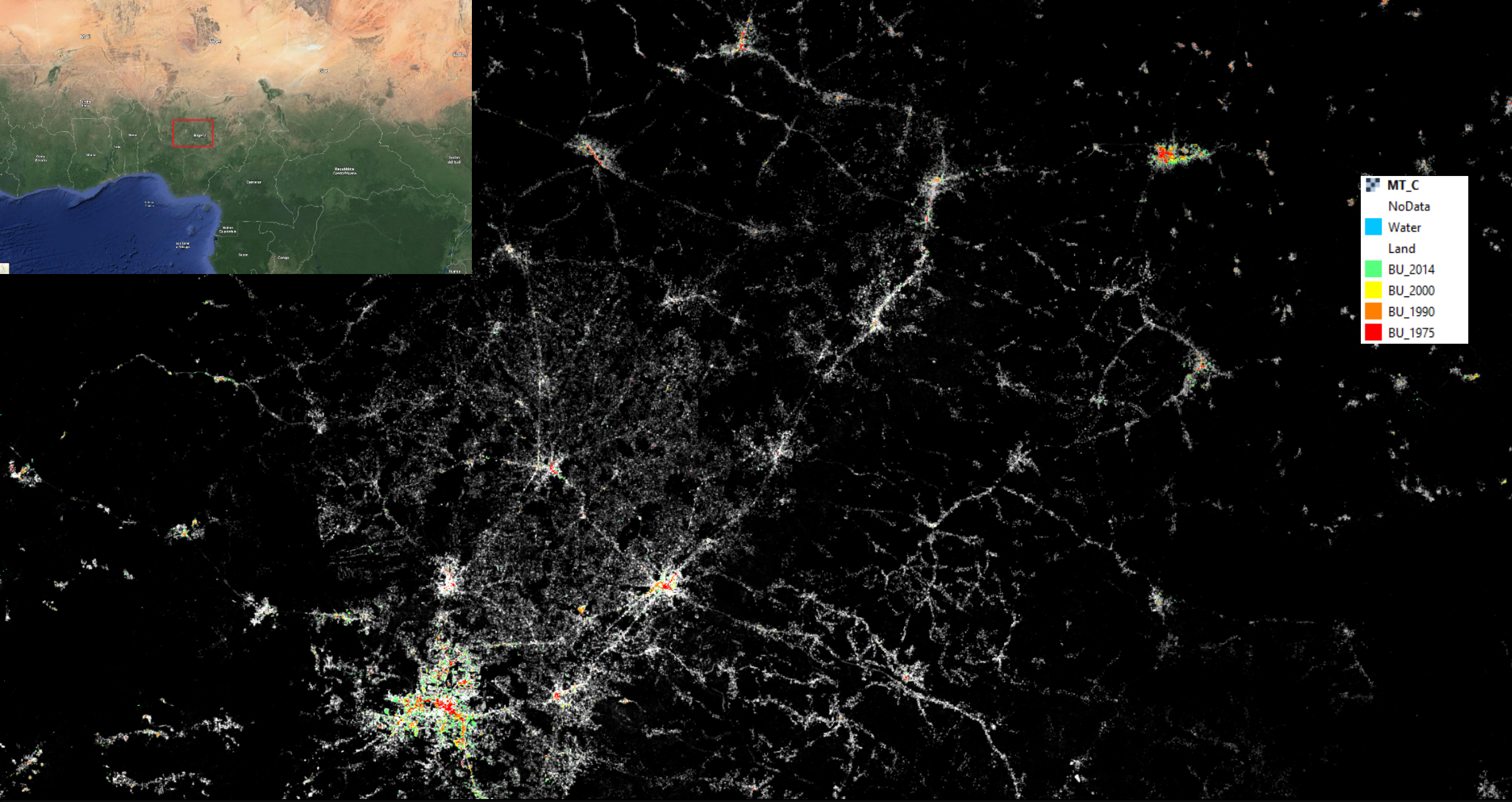
GHS-BUILT

GHSL Landsat: multi-temporal information on built-up areas

1975-1990-2000-2014



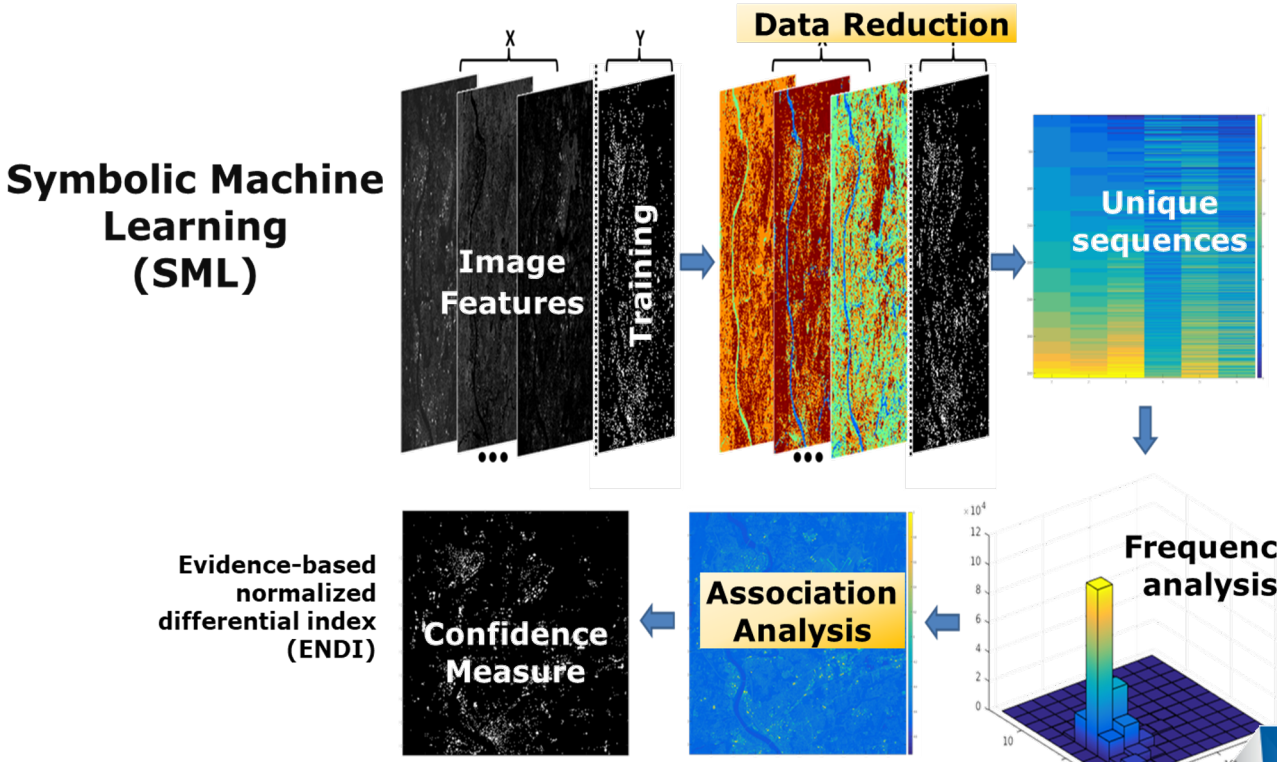
First available multi-temporal assessment of human settlements



Recent developments – CNN applied to Copernicus Sentinel- 2 data

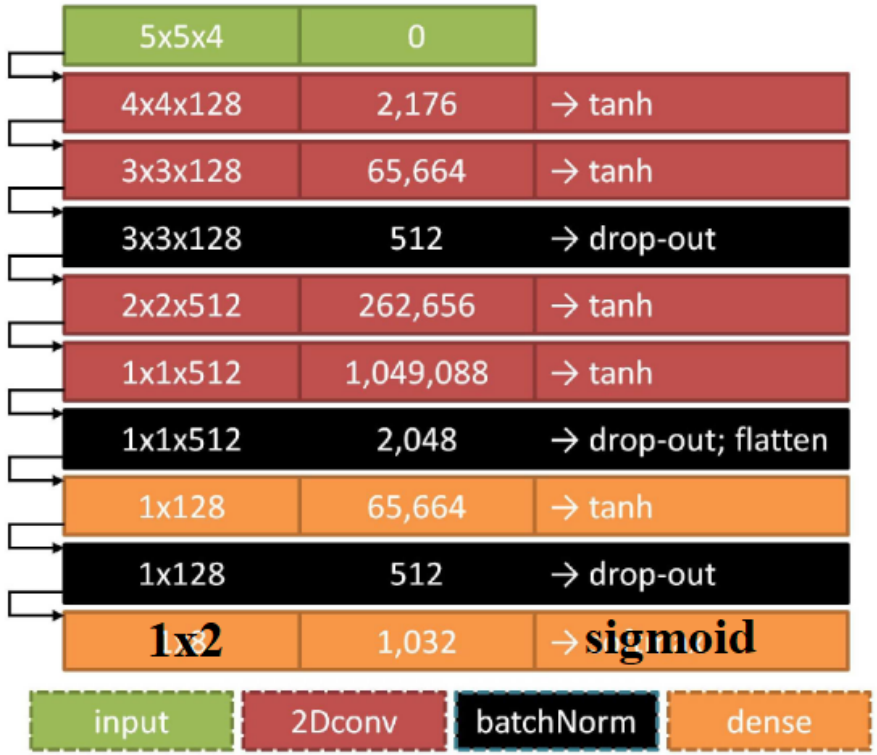
AI tools & Big Data Infrastructure

JRC Symbolic Machine Learning



Pesaresi M., Julea A.M. and V. Syrris ; A New Method for Earth Observation Data Analytics Based on Symbolic Machine Learning., Remote Sens. 8(5):399, 2016.

CNN 5*5 model

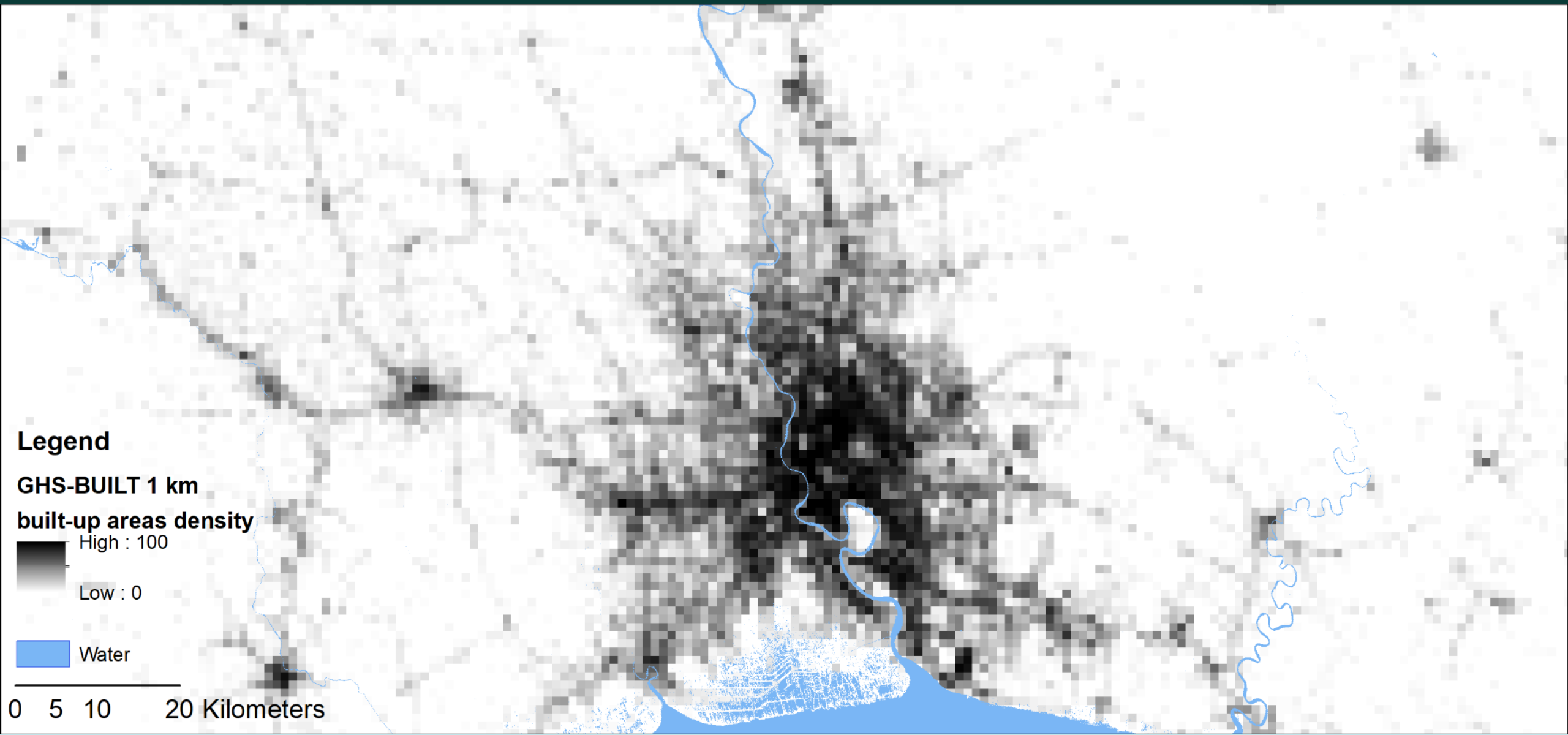


Syrris, V.; et al. 2019 Evaluation of the Potential of Convolution al Neural Networks and Random Forests for Multi-Class Segmentation of Sentinel-2 Imagery. Remote Sens. 11, 907.

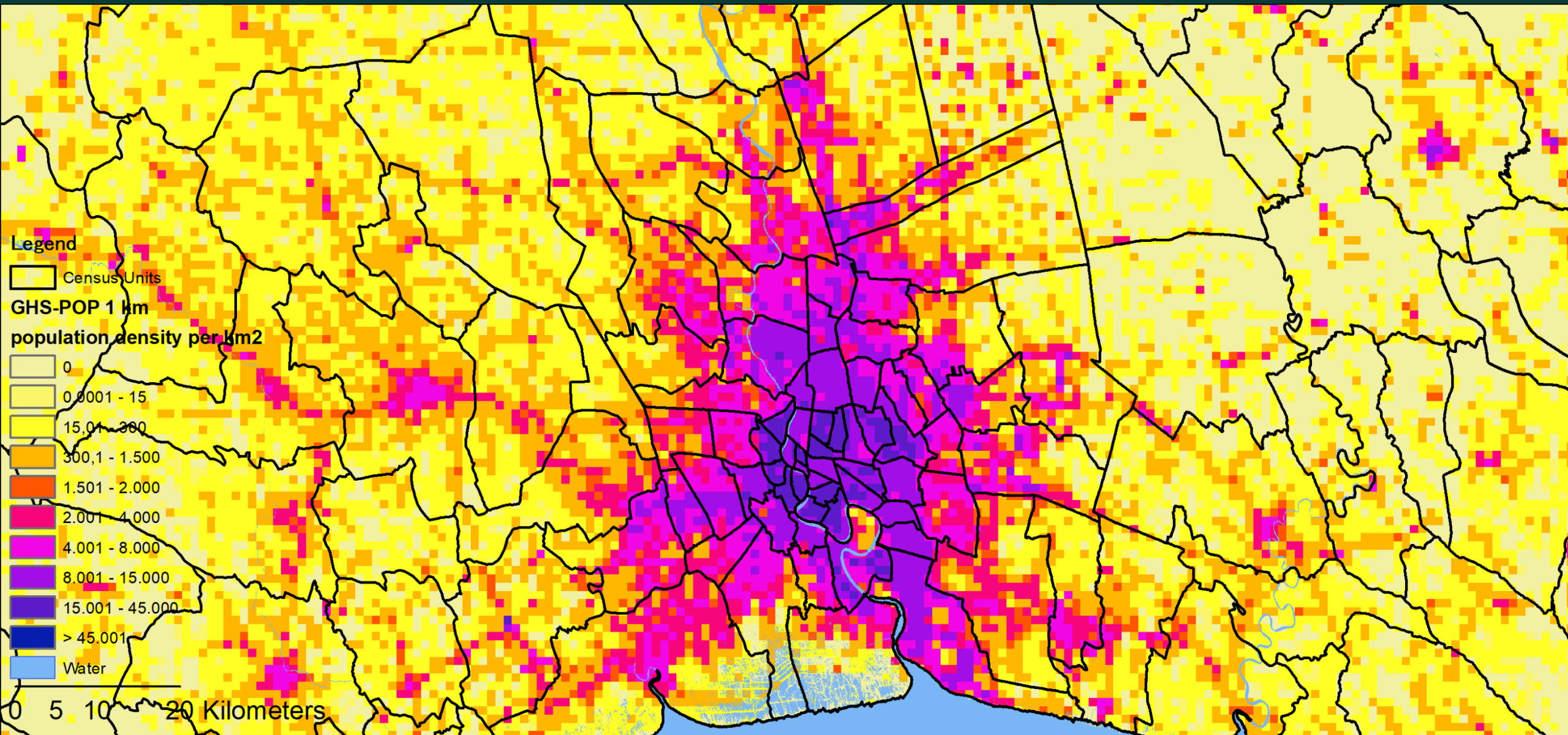
P. Soille, A. et al. 2018, A versatile data-intensive computing platform for information retrieval from big geospatial data, Future Generation Computer Systems

Imagery

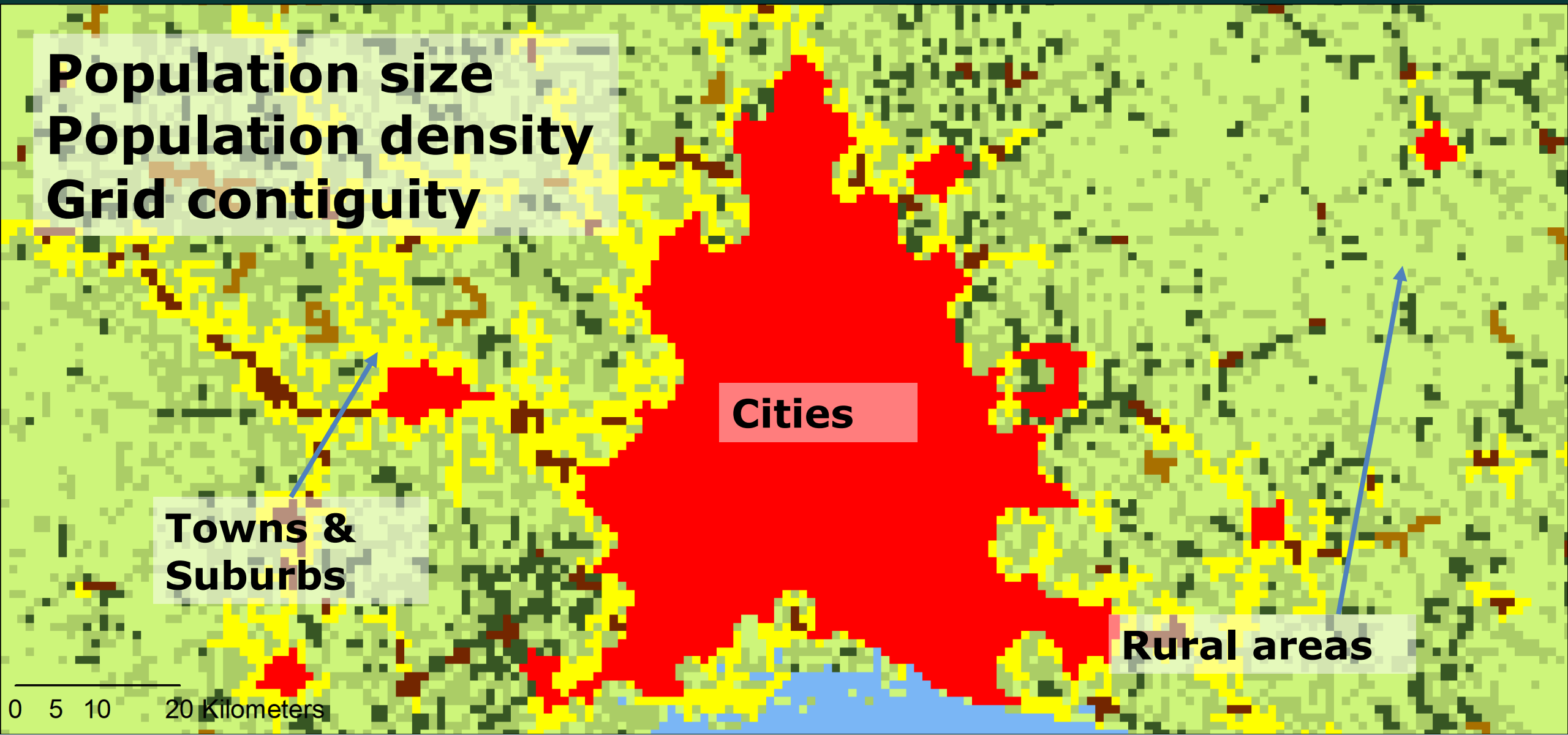
Built-up areas GHS-BUILT



Population GHS-POP



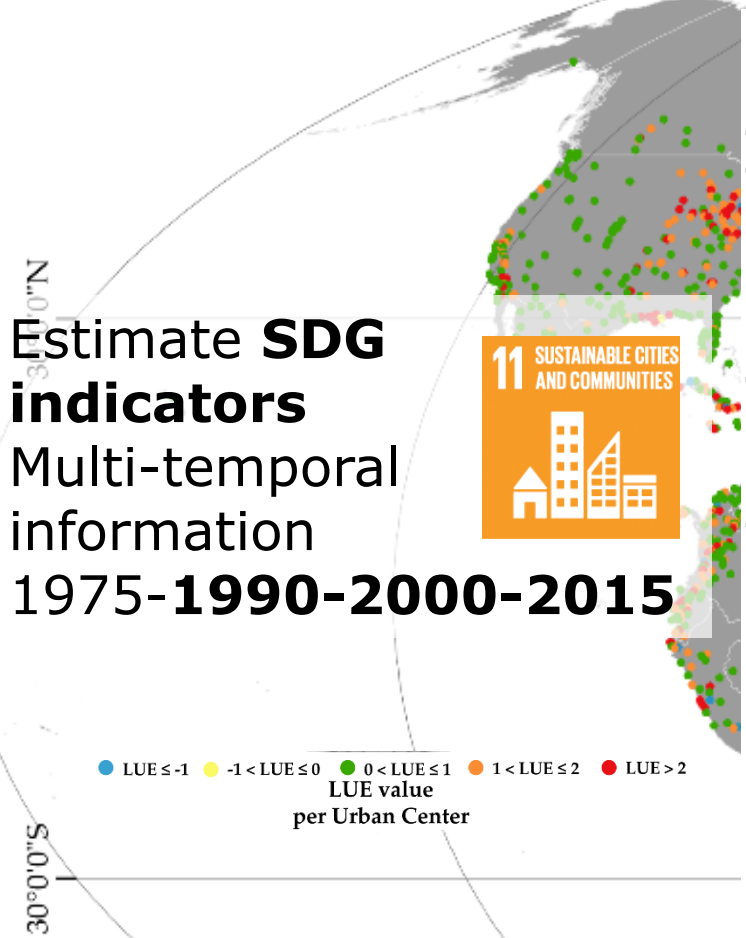
Settlement Model GHS-SMOD

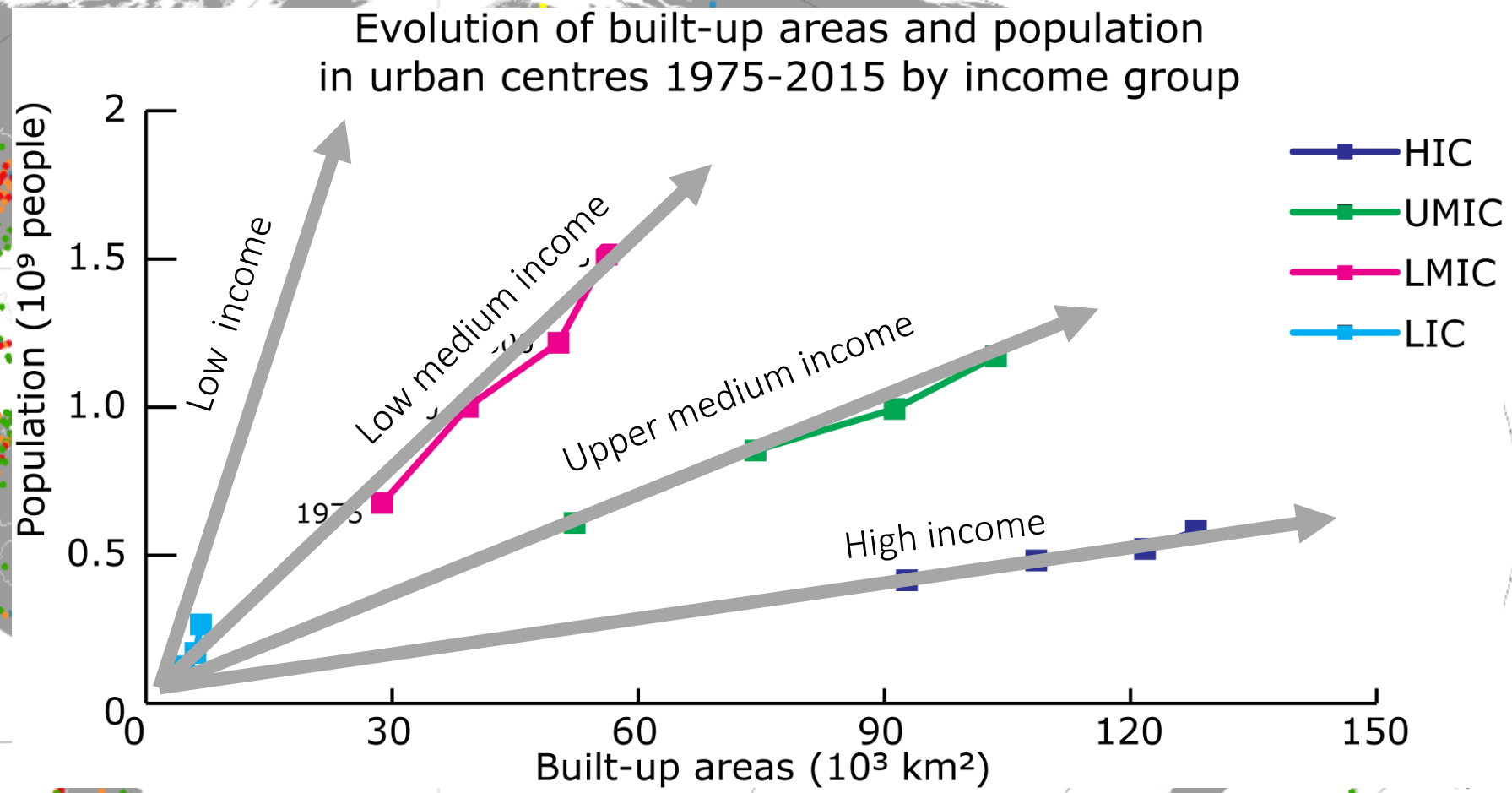


Assessing development trajectories (1975-2015)

GHS-UCDB

Estimate **SDG indicators**
Multi-temporal information
1975-**1990-2000-2015**





Melchiorri, M.; Pesaresi, M.; Florczyk, A.J.; Corbane, C.; Kemper, T. Principles and Applications of the Global Human Settlement Layer as Baseline for the Land Use Efficiency Indicator—SDG 11.3.1. *ISPRS Int. J. Geo-Inf.* **2019**, *8*, 96

Co-evolution of decision making & technical development

Decision Making process

Degree of Urbanisation applied in the European Statistical System

2012

2015

EU, OECD, World Bank Voluntary commitment

Habitat III

2016

Deg.Urba in EU Regulation 2017/2391

FAO

2017

UN-HABITAT

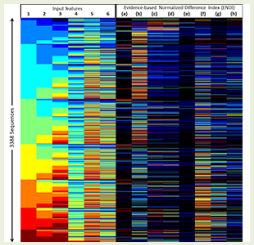
2018

EU-UN Habitat Regional Workshops with of 83 countries

2019

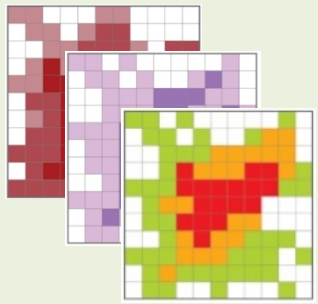
51st session of UN Statistical Commission

2020

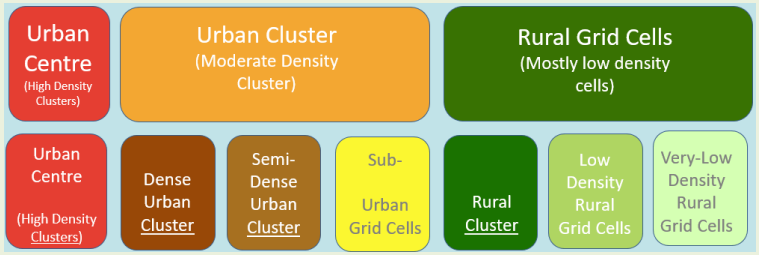


New Machine Learning Tools

JEODPP



1st Release of GHSL Data and Tools

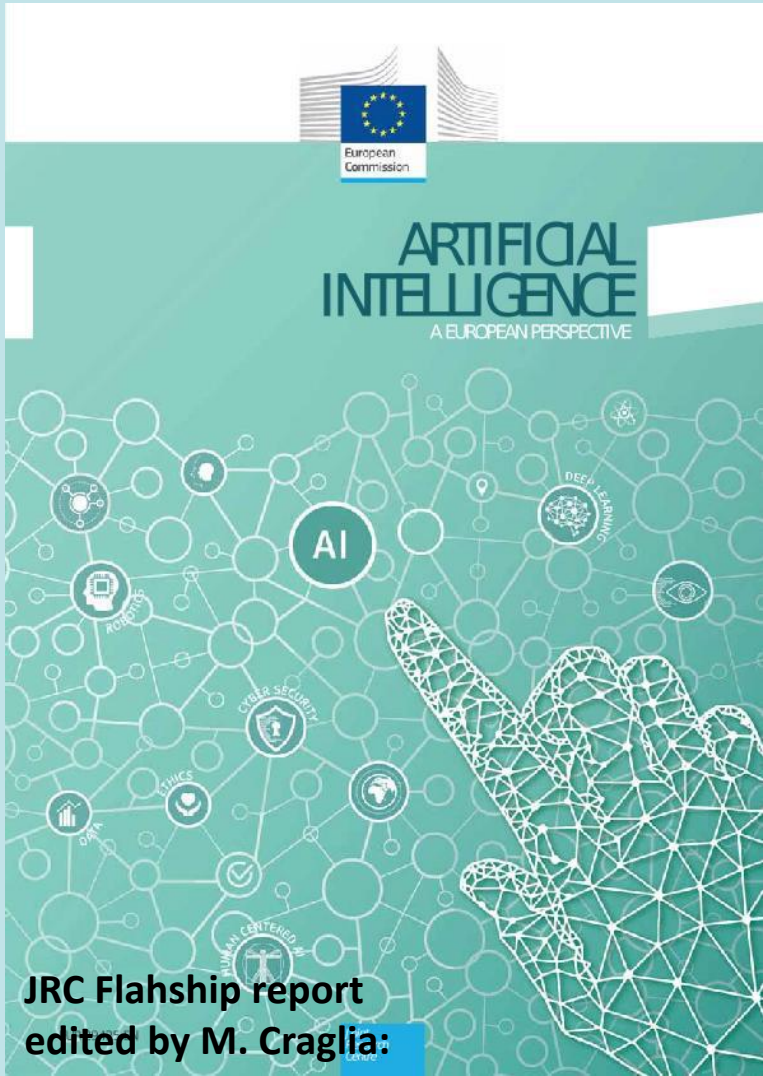


Testing and improving data and models based on dialogue with countries and stakeholders

Technical Development Process

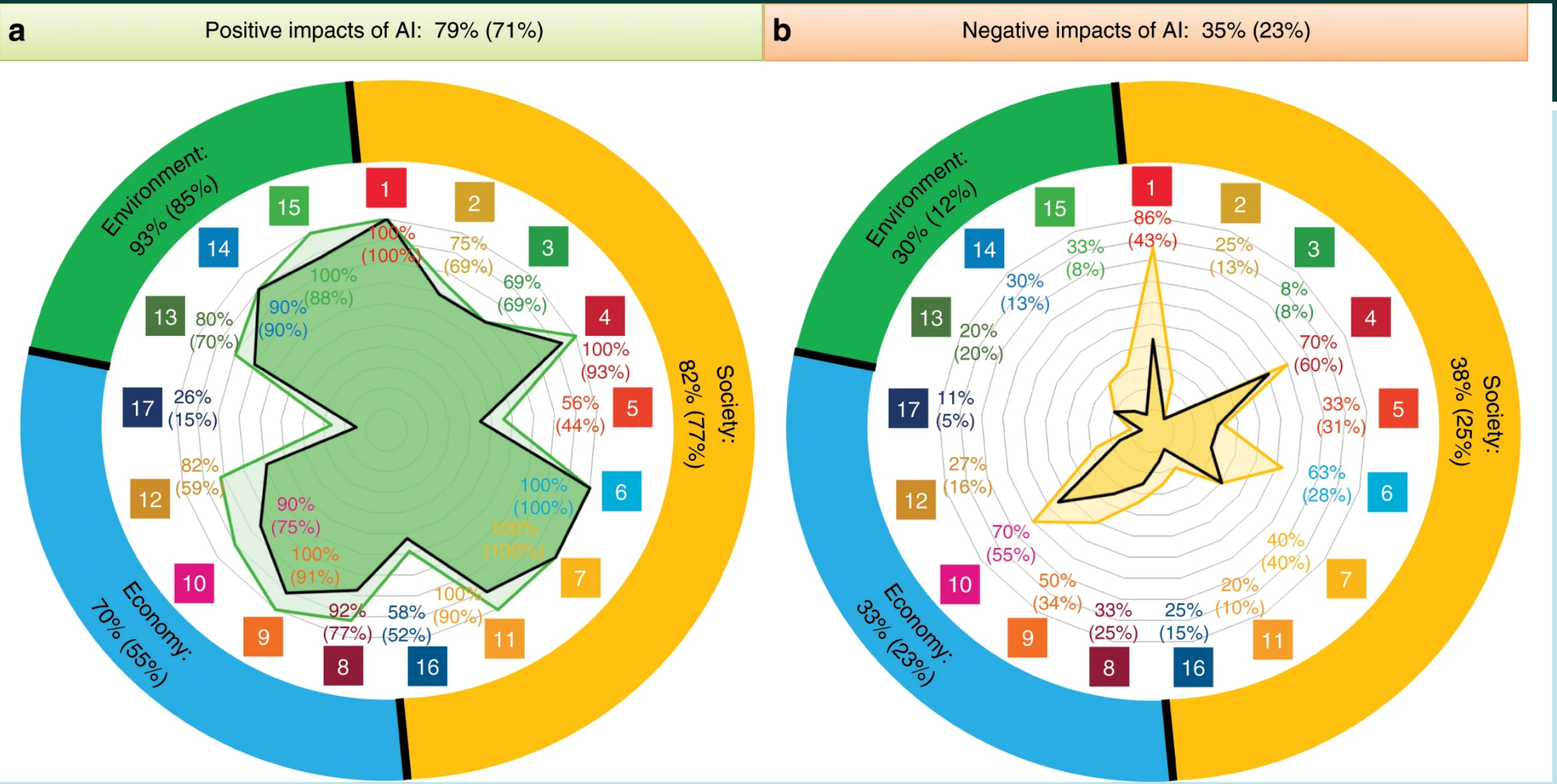
Recommendations for a research agenda

- Develop **human-interpretable solutions** by creating a bridge between EO and AI communities.
- AI applications supporting policy making in the EU have to be **transparent, comprehensible, monitorable and accountable**
- AI should be backed up by frameworks for **auditing** and evaluating with agreed **international standards**
- We should challenge the **shortcomings of AI** and work towards strong evaluation strategies, transparent and reliable systems, and good human-AI interactions.



JRC Flahship report edited by M. Craglia:

The role of artificial intelligence in achieving the SDGs



Vinuesa, R., Azizpour, H., Leite, I. *et al.* The role of artificial intelligence in achieving the Sustainable Development Goals. *Nat Commun* **11,** 233 (2020). https://doi.org/10.1038/s41467-019-14108-y

THANK YOU

http://ghsl.jrc.ec.europa.eu/

Christina Corbane, PhD

Christina.corban@ec.europa.eu

Tools

Global Human Settlement Layer (GHSL), Joint Research Centre (JRC):
http://ghsl.jrc.ec.europa.eu

GEO GROUP ON EARTH OBSERVATIONS

Special Issue Call for Paper

Big Earth Data Intelligence: the convergence between Big Earth Data and Artificial Intelligence

Guest Editors:

Christina Corbane, European Commission, Joint Research Centre, Christina.corban@ec.europa.eu

Martino Pesaresi, European Commission, Joint Research Centre, Martino.pesaresi@ec.europa.eu

Stefano Nativi, European Commission, Joint Research Centre, stefano.nativi@ec.europa.eu

Max Craglia, European Commission, Joint Research Centre, massimo.craglia@ec.europa.eu

Submission Deadline: 1 March, 2020