The European Commission's science and knowledge service

Joint Research Centre

European Commission

Global updated and historical baseline data on population and built-up areas

S. Freire and GHSL team

Human Planet Forum – Enschede, 13-15 Sept., 2017

European Commission

Geo-information on human settlements

- Required for **modeling**, **analysis**, **policy-making**
(i.e. producing indicators and monitoring targets):

  - Sendai Framework for DRR 2015-2030 (adopted Mar. 2015)
  - 2030 Agenda for Sustainable Development (SDGs, Sept. 2015)
  - COP 21 Paris Agreement on Climate Change (Nov. 2016)
  - UN New Urban Agenda (Dec. 2016)

  - **Exposure** (to hazards, pollutants,...)
  - **Access** (to resources, services,...)
  - **Impacts** (from natural disasters, environmental change,...)

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Geo-information on human settlements

- Producing indicators and monitoring targets, global scope:

  - **Up-to-date**

  - **Detailed**

  - **Consistent** (comparable)

  - **Sustainable** (repeatable, cost-effective)

  - **Transparent** (clear methods)

  - **Open & free**

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The GHSL project

- GHSL – Global Human Settlement Layer
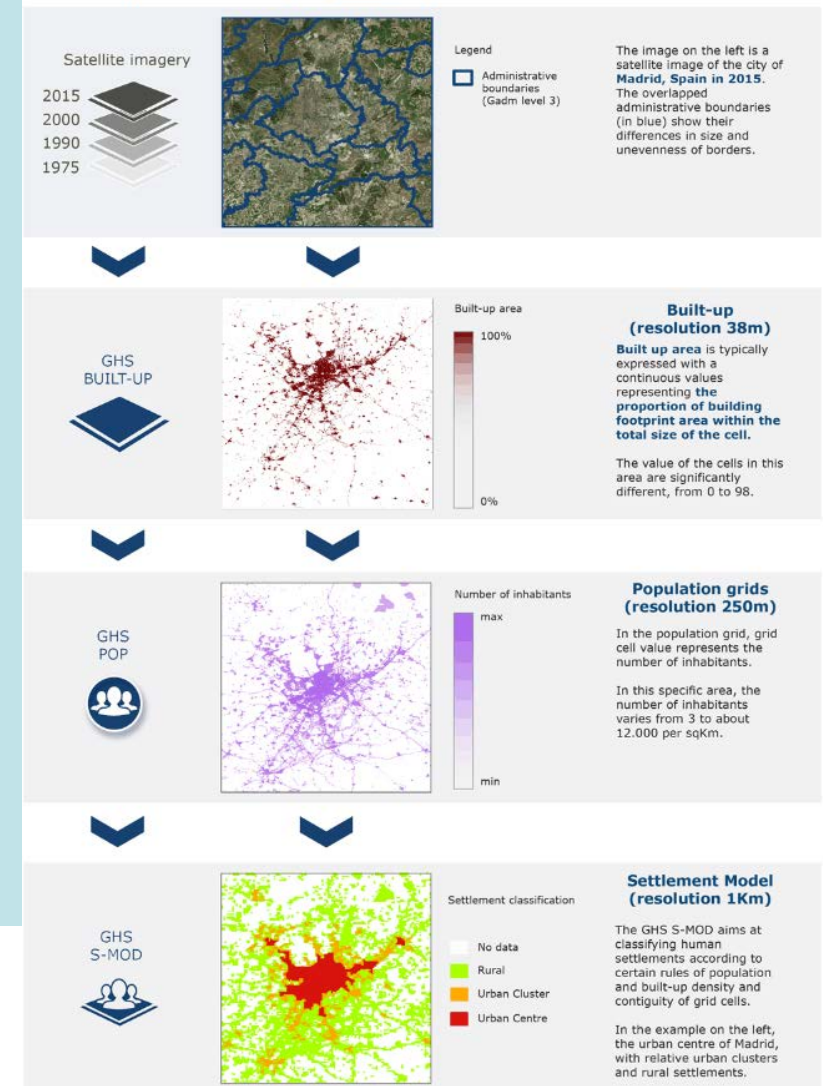
- Models

- Tools

- Geospatial data

- Capacity building
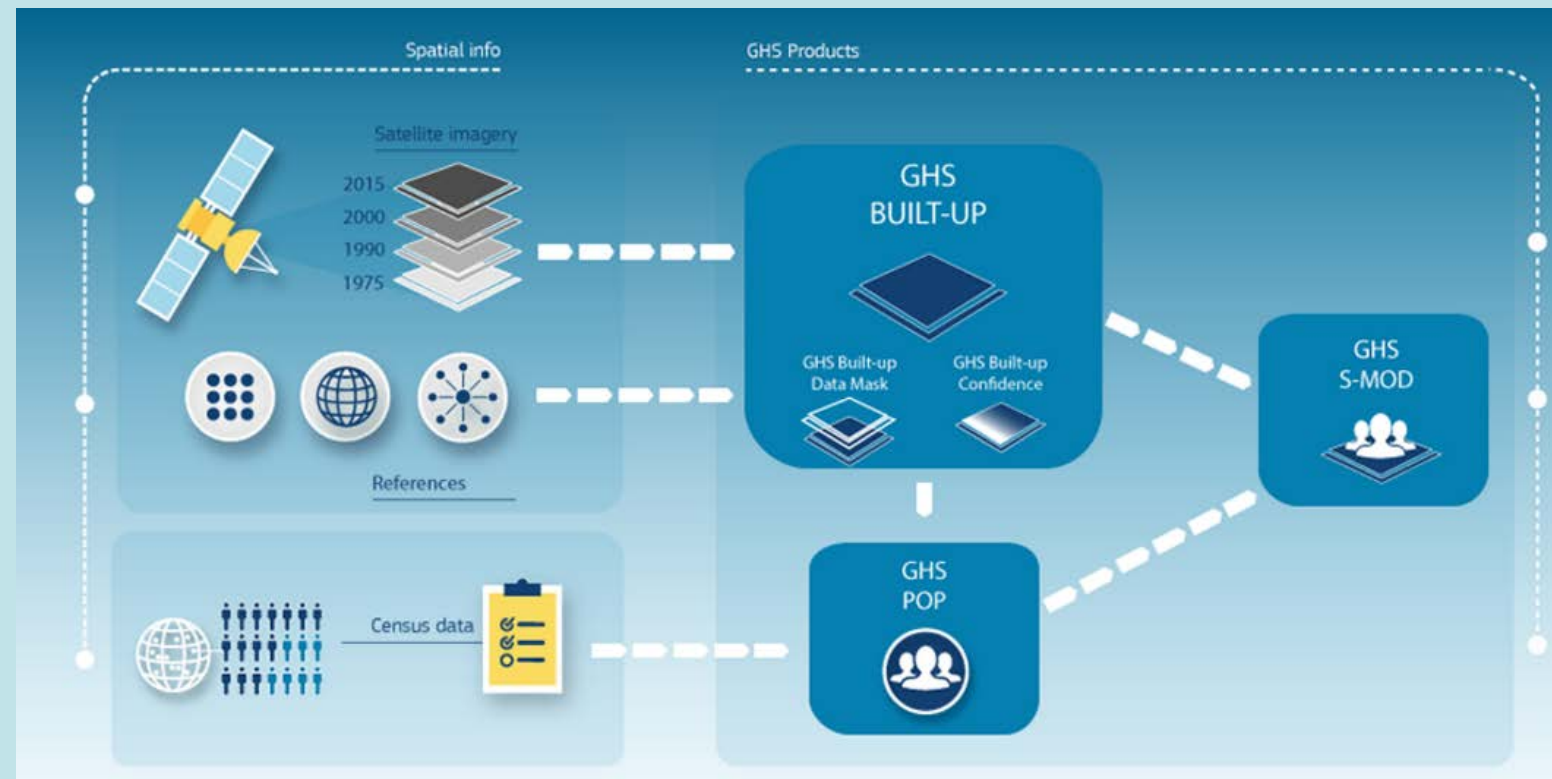
The GHSL project

- GHSL – the process

- Maps & characterizes human settlements (large and small)

- Based on satellite imagery

- Using approaches developed in-house

- Data → Analysis → Information

  (→ *Decision-making* → *Action*)

Level of abstraction:

An example from the city of Madrid, Spain

The evolving GHSL

- GHSL built-up grids P2018 (internal release 2017)

- **Better coverage** 2014 with L8: 100+ additional scenes

- **Reduction of *No Data*** instances

- **Improved training set** including a) GlobeLand30 and b) JRC Sentinel-1 GHSL experiment (Dec. 2016)

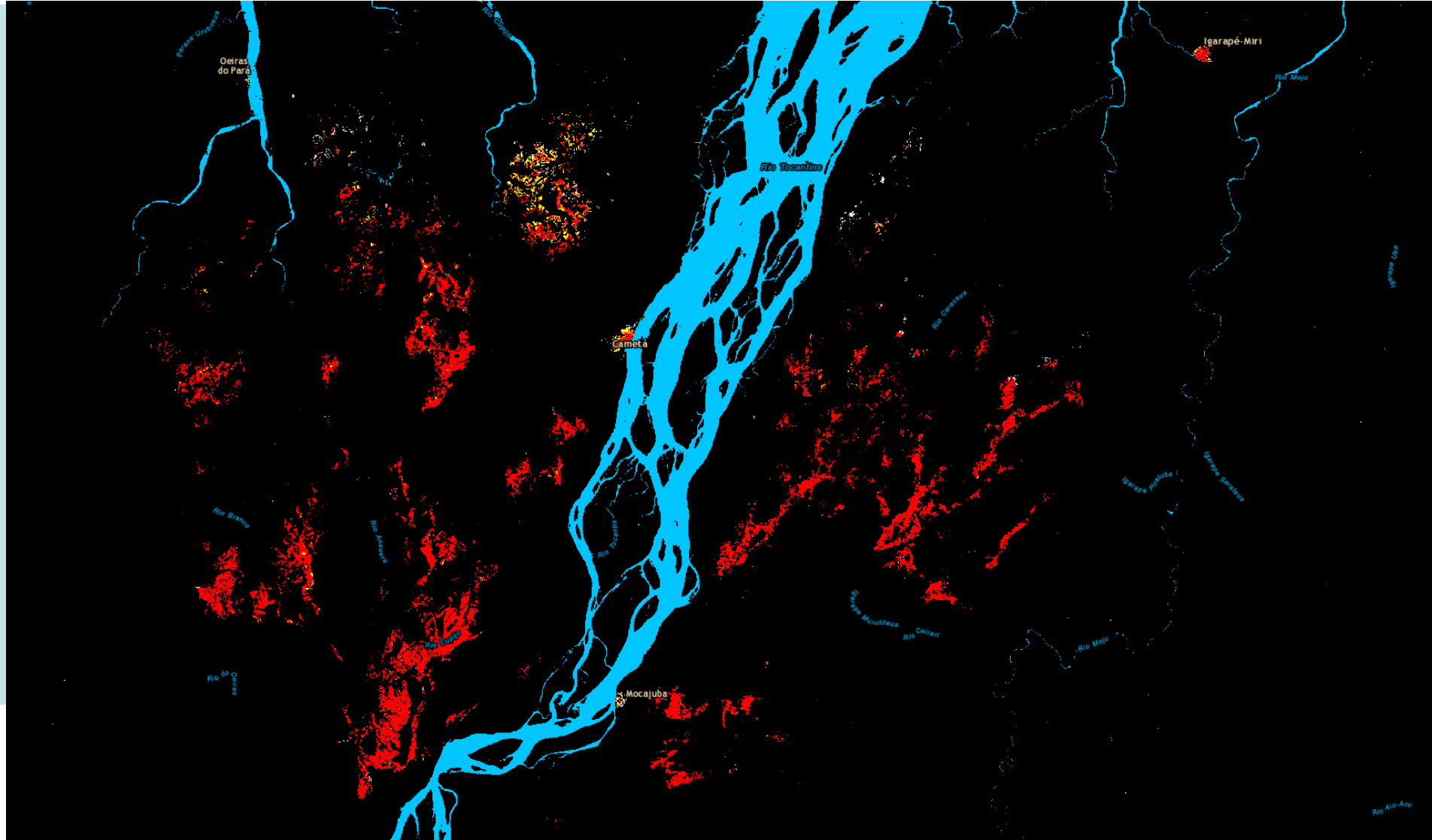- Maximization of **output agreement with GUF+** trough max K mechanism

- **Enhanced detection of built-up** areas

The evolving GHSL

GHSL-MT (2015)

- Lagos (NIGERIA)

water	water
land	land
BU 2014	BU 2014
BU 2000	BU 2000
BU 1990	BU 1990
BU 1975	BU 1975
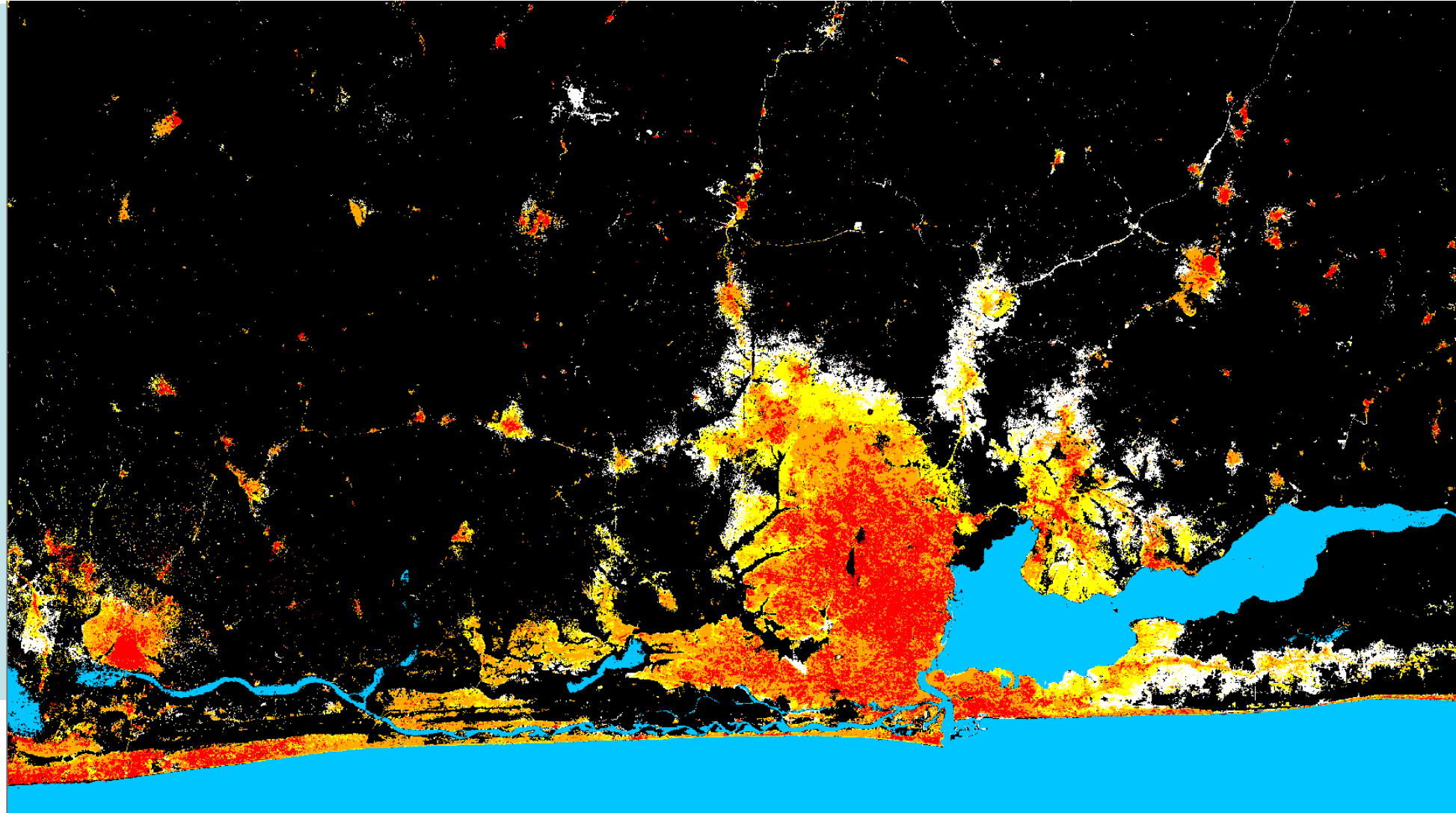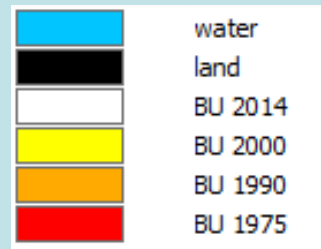
The evolving GHSL

GHSL-MT (2017)

- Lagos (NIGERIA)
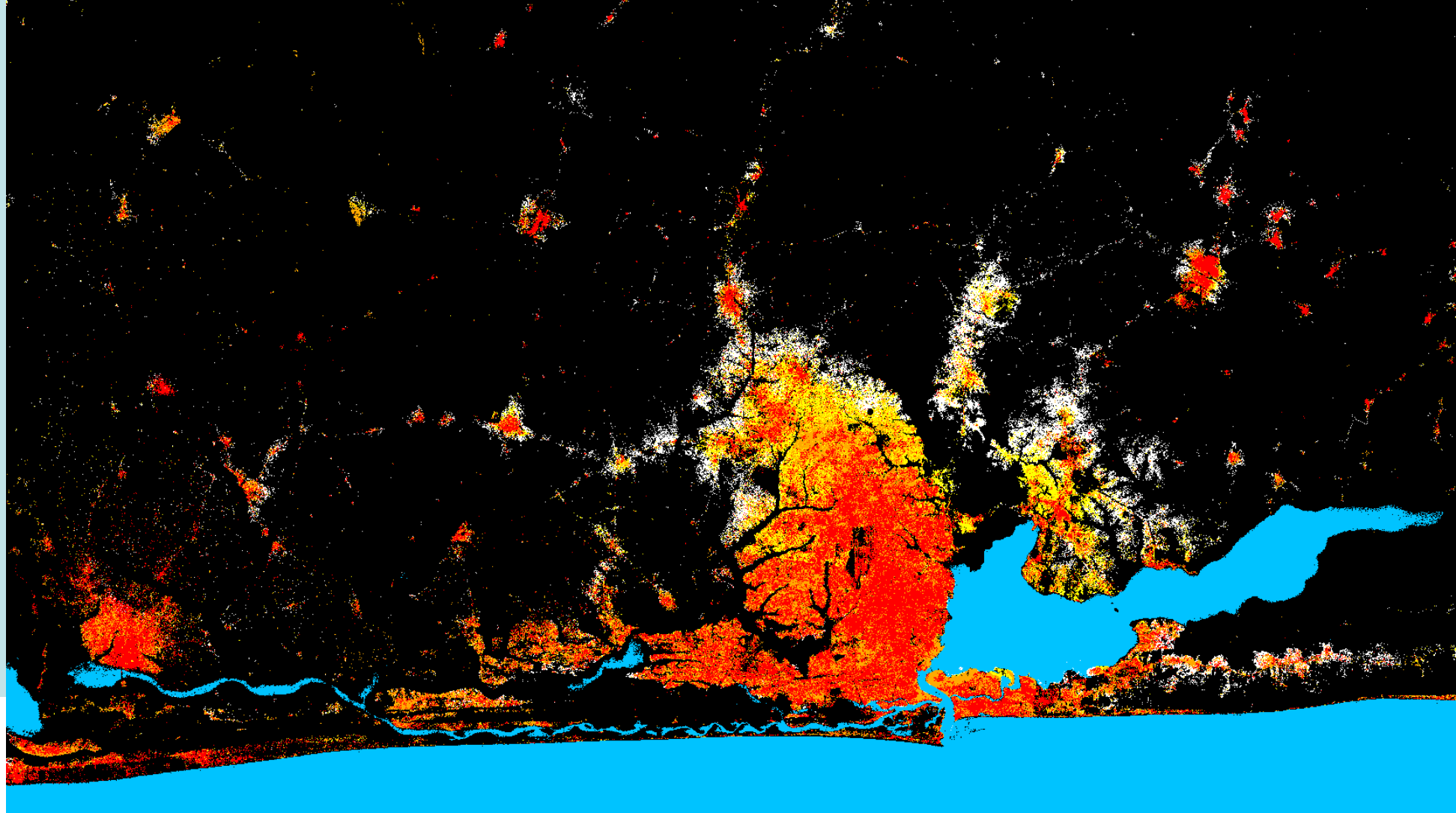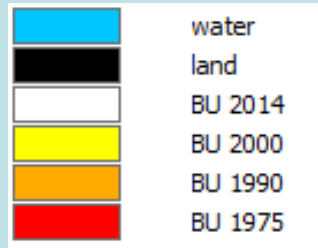
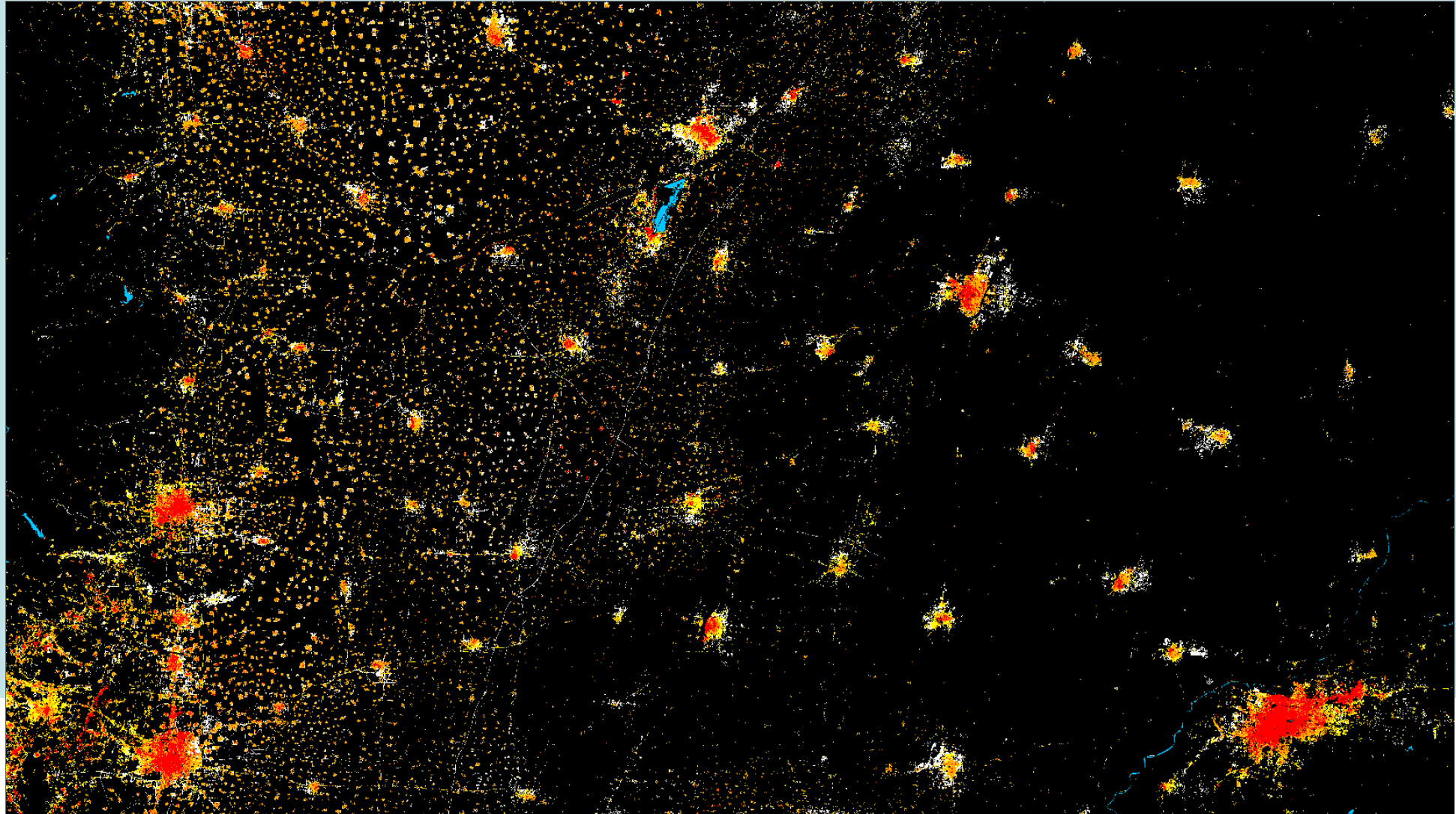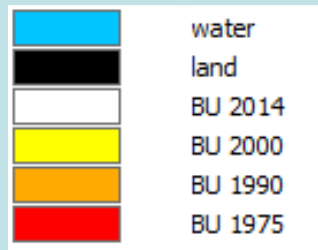|	
water	
land	
BU 2014	
BU 2000	
BU 1990	
BU 1975	

The evolving GHSL

GHSL-MT (2015)

- Cametà (BRAZIL)
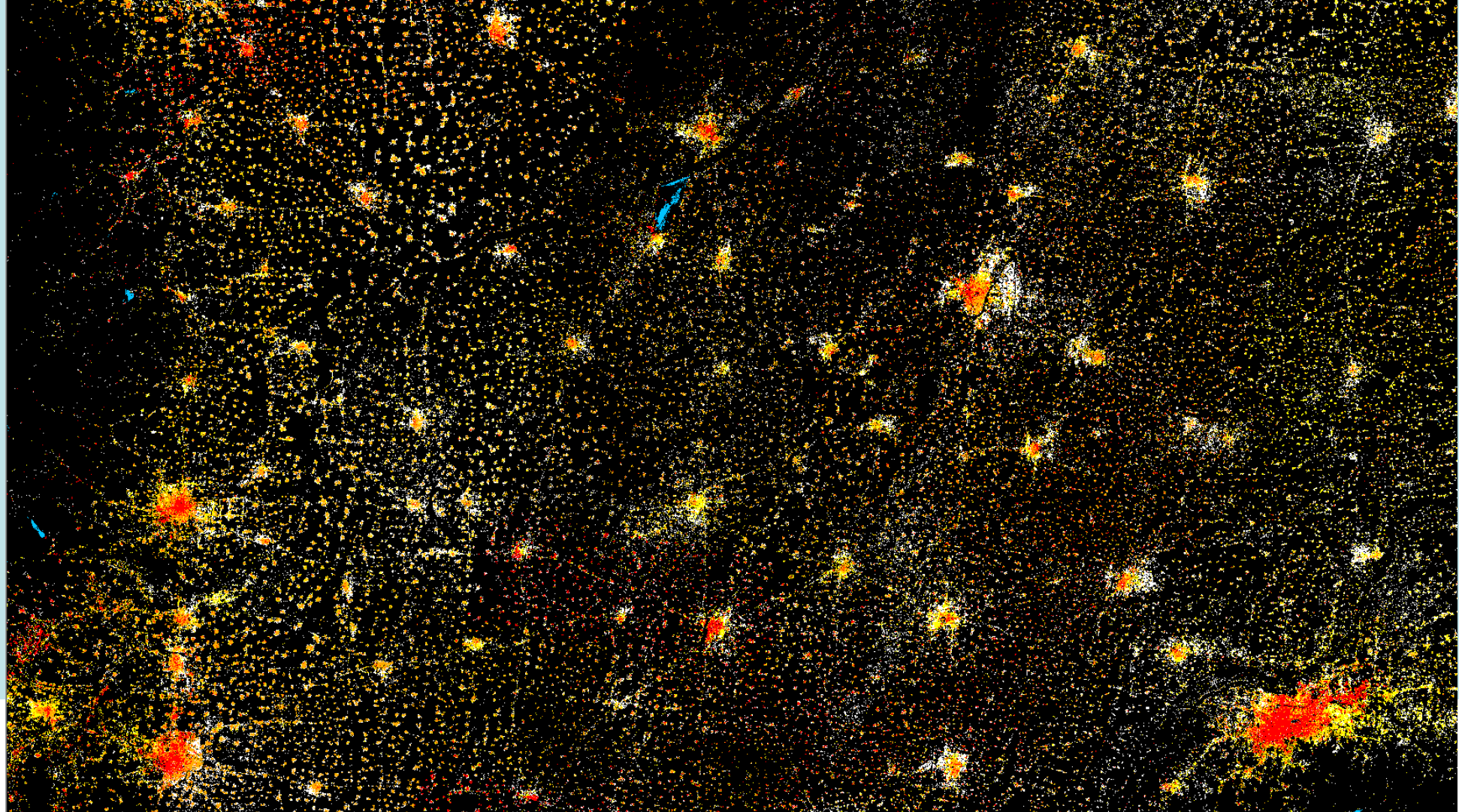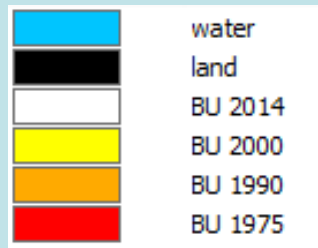
The evolving GHSL

GHSL-MT (2017)

- Cametà (BRAZIL)

(blue)	water
(black)	land
(white)	BU 2014
(yellow)	BU 2000
(orange)	BU 1990
(red)	BU 1975
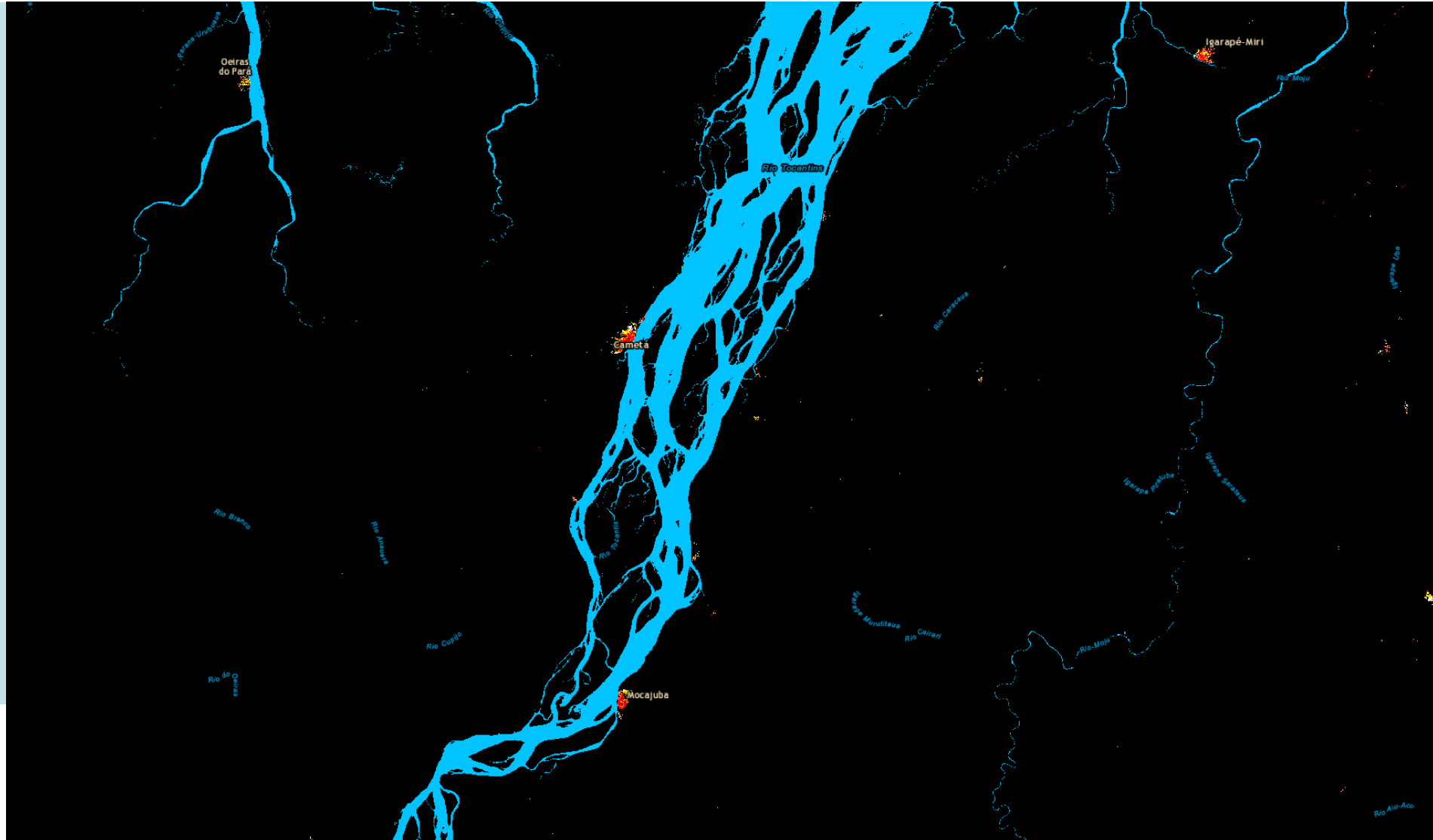
The evolving GHSL

GHSL-MT (2015)

- Hengshi (CHINA)

🟦	water
⬛	land
⬜	BU 2014
🟨	BU 2000
🟧	BU 1990
🟥	BU 1975

The evolving GHSL

GHSL-MT (2017)

- Hengshi (CHINA)

water	
land	
BU 2014	
BU 2000	
BU 1990	
BU 1975	

The evolving GHSL

GHSL-MT (2015)

- Dushanbe (TAJIKISTAN)

(blue)	water
(black)	land
(white)	BU 2014
(yellow)	BU 2000
(orange)	BU 1990
(red)	BU 1975
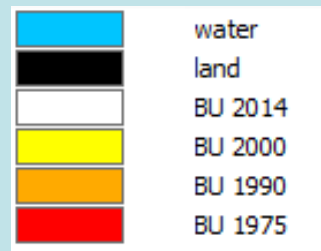
The evolving GHSL

GHSL-MT (2017)

- Dushanbe

  (TAJIKISTAN)

water	
land	
BU 2014	
BU 2000	
BU 1990	
BU 1975	
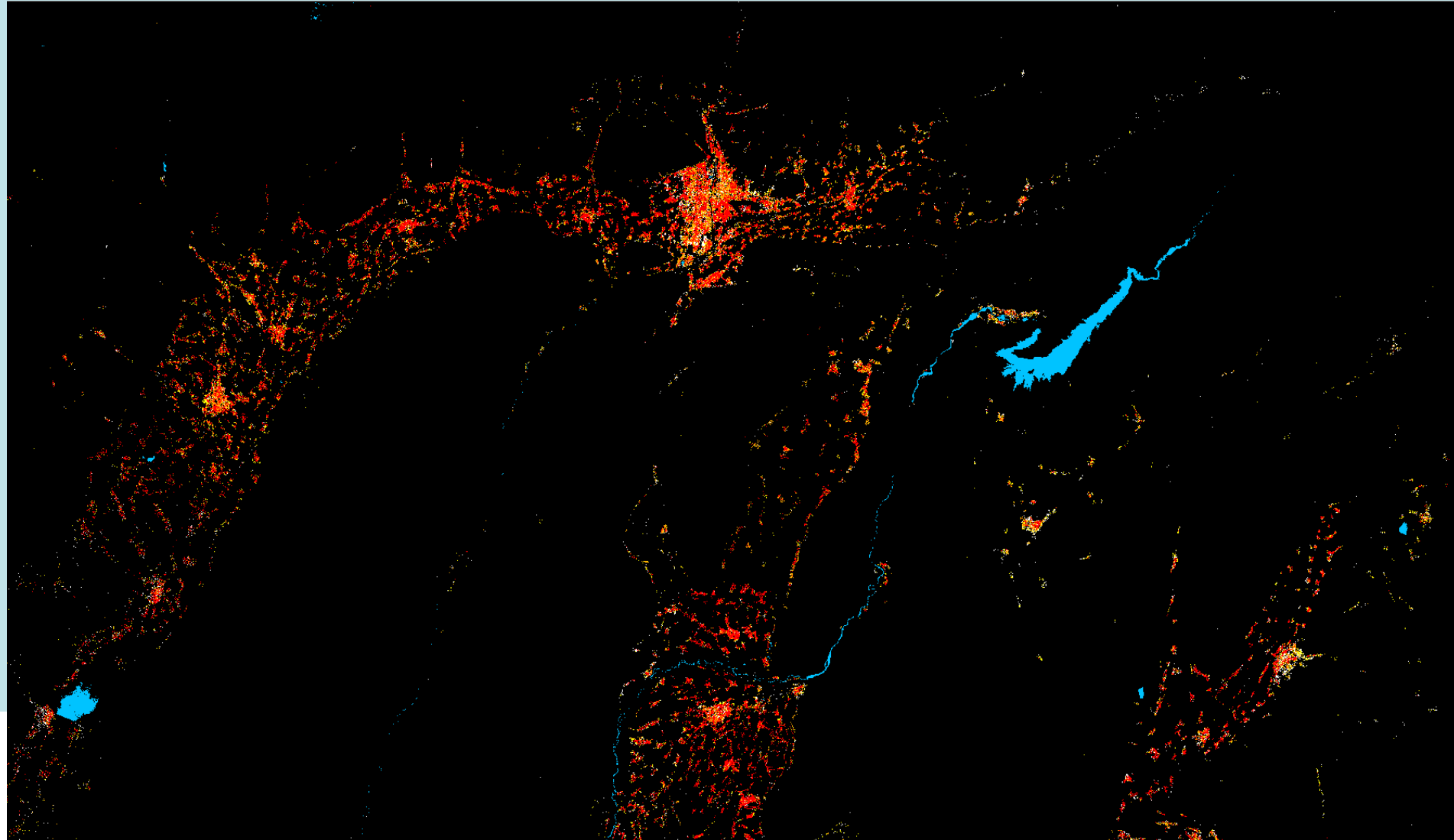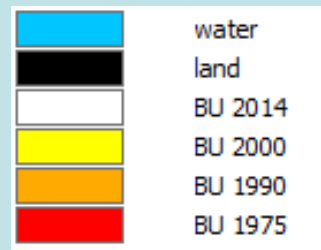
The evolving GHSL

- GHSL – Population

Globally, census data is quite heterogeneous:

- Quality

- Availability (access)

- Currency

- **Spatial detail**
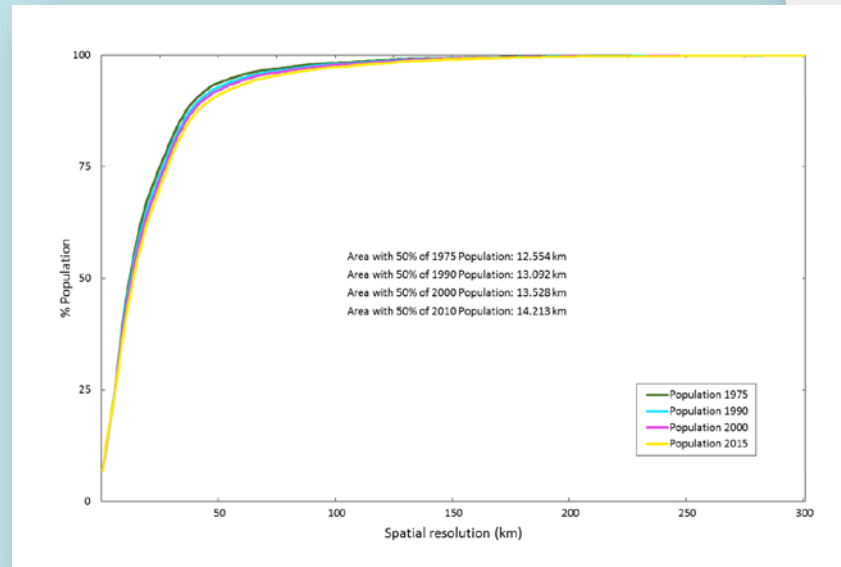
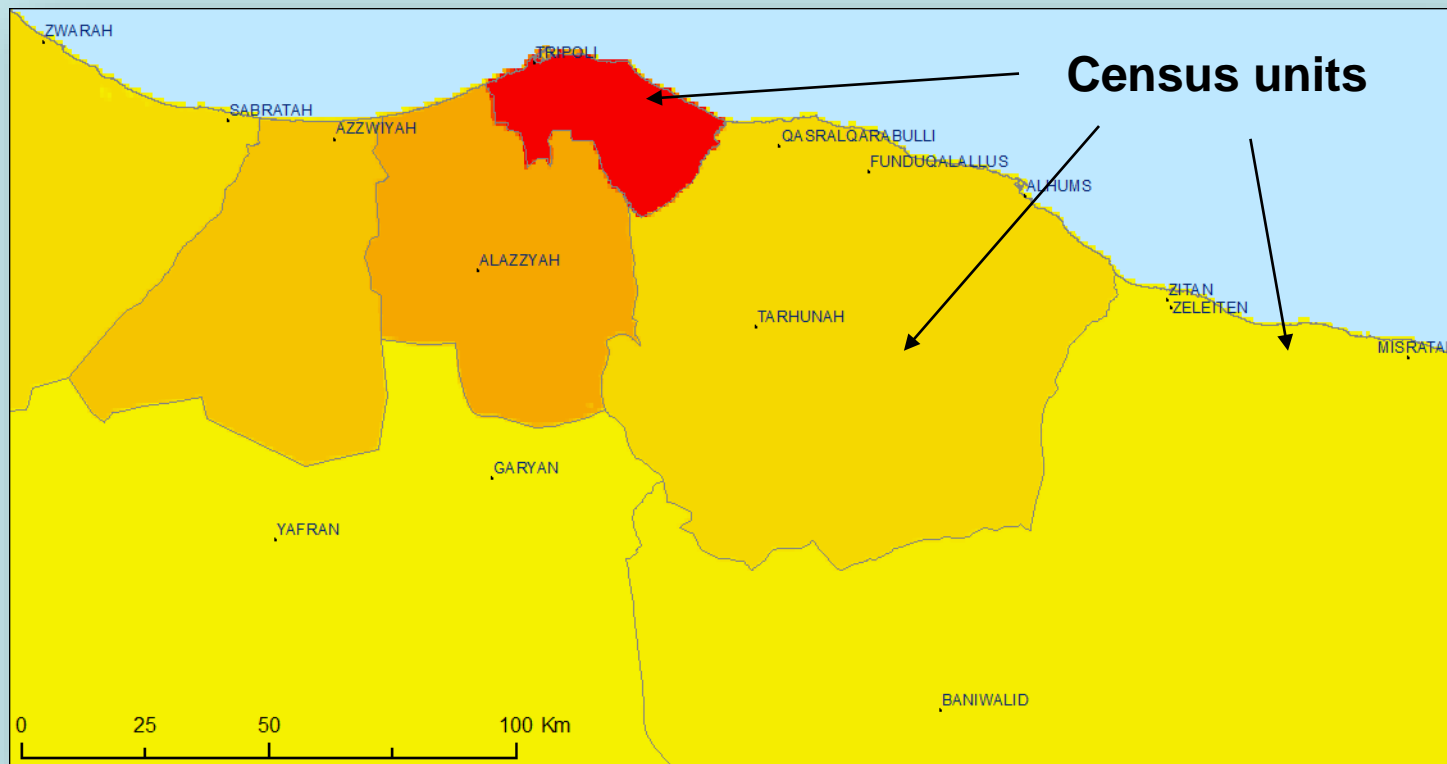Range of Administrative Levels Used in GPWv4
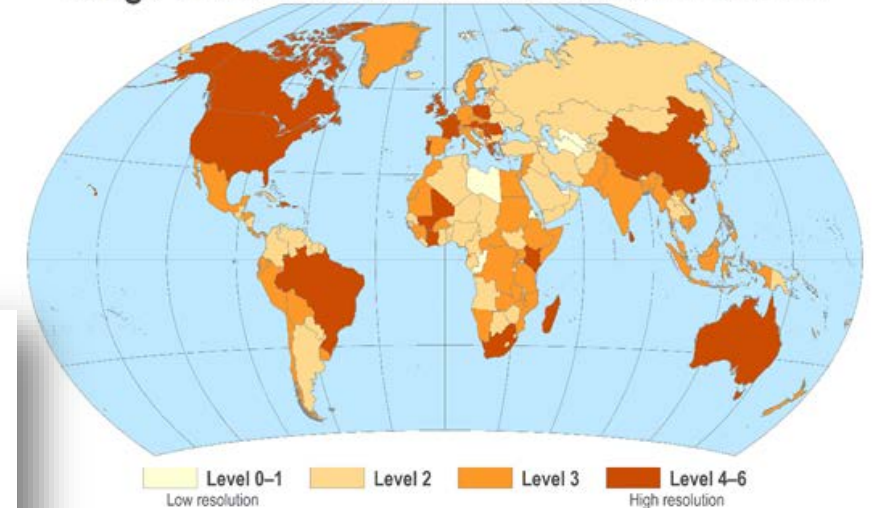
Census unit mean size: 15 km2
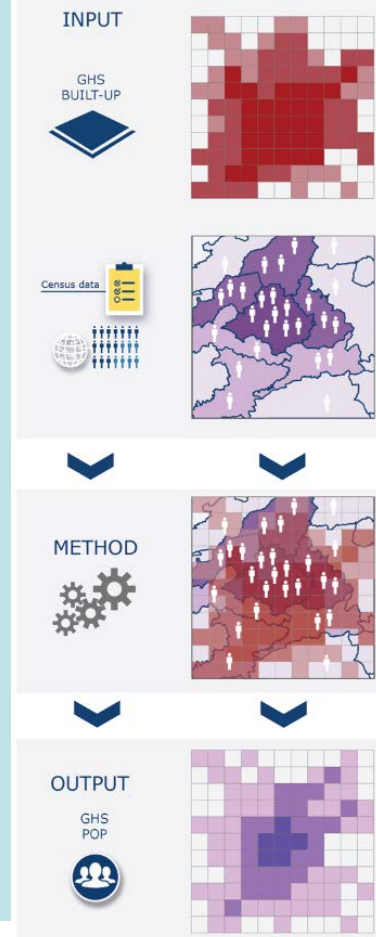
50% of global pop. in units > 200 km2

The evolving GHSL

• GHS-POP = f(GHS-BUILT, GPW census data)

Census units

GPWv4,

2015 Pop. Counts

Cell size: 30"

N Libya

The evolving GHSL

- GHS-POP = f(GHS-BUILT, GPW census data)

GHS-BUILT
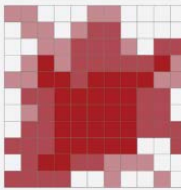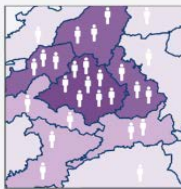
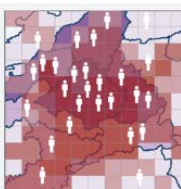**2014**

250 m

N Libya
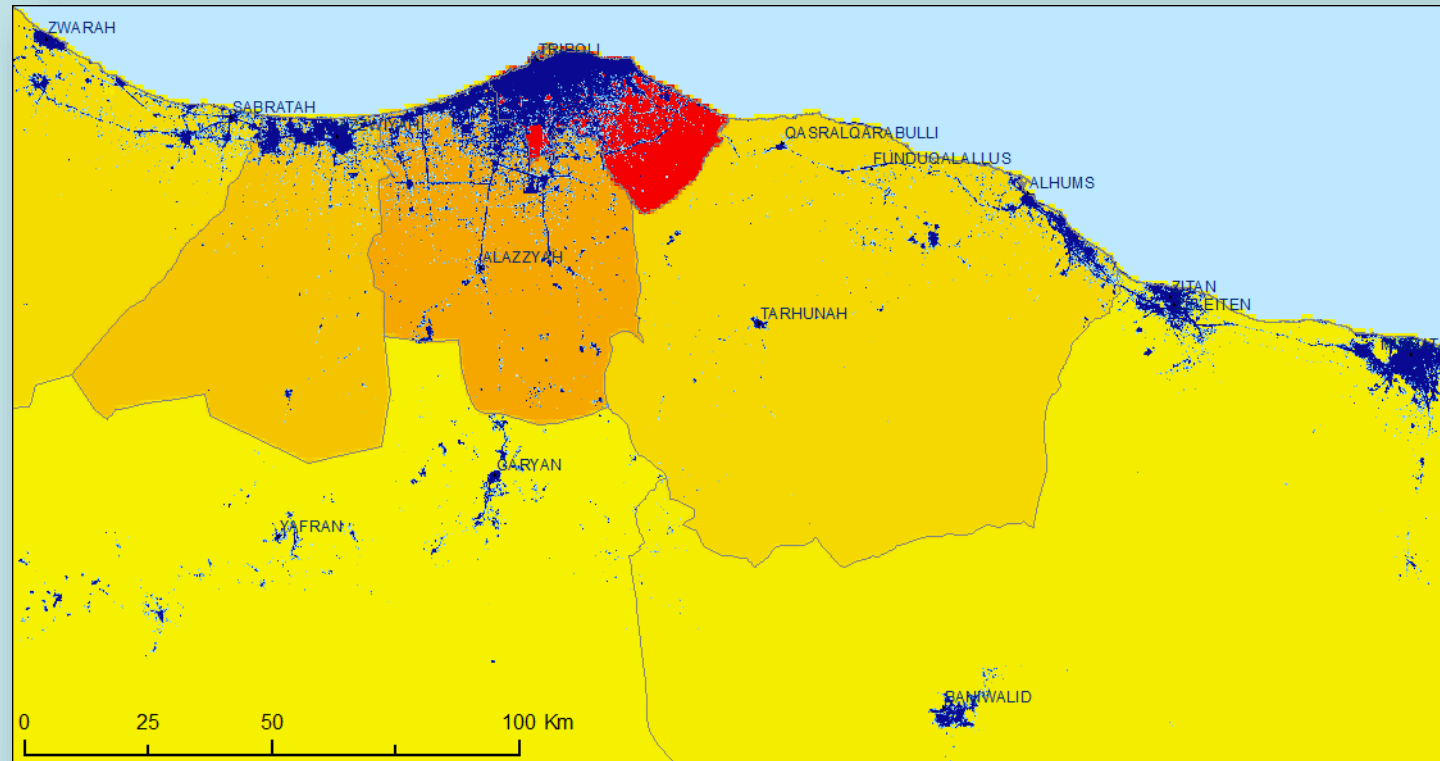
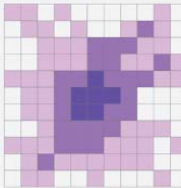From built-up area to population grid
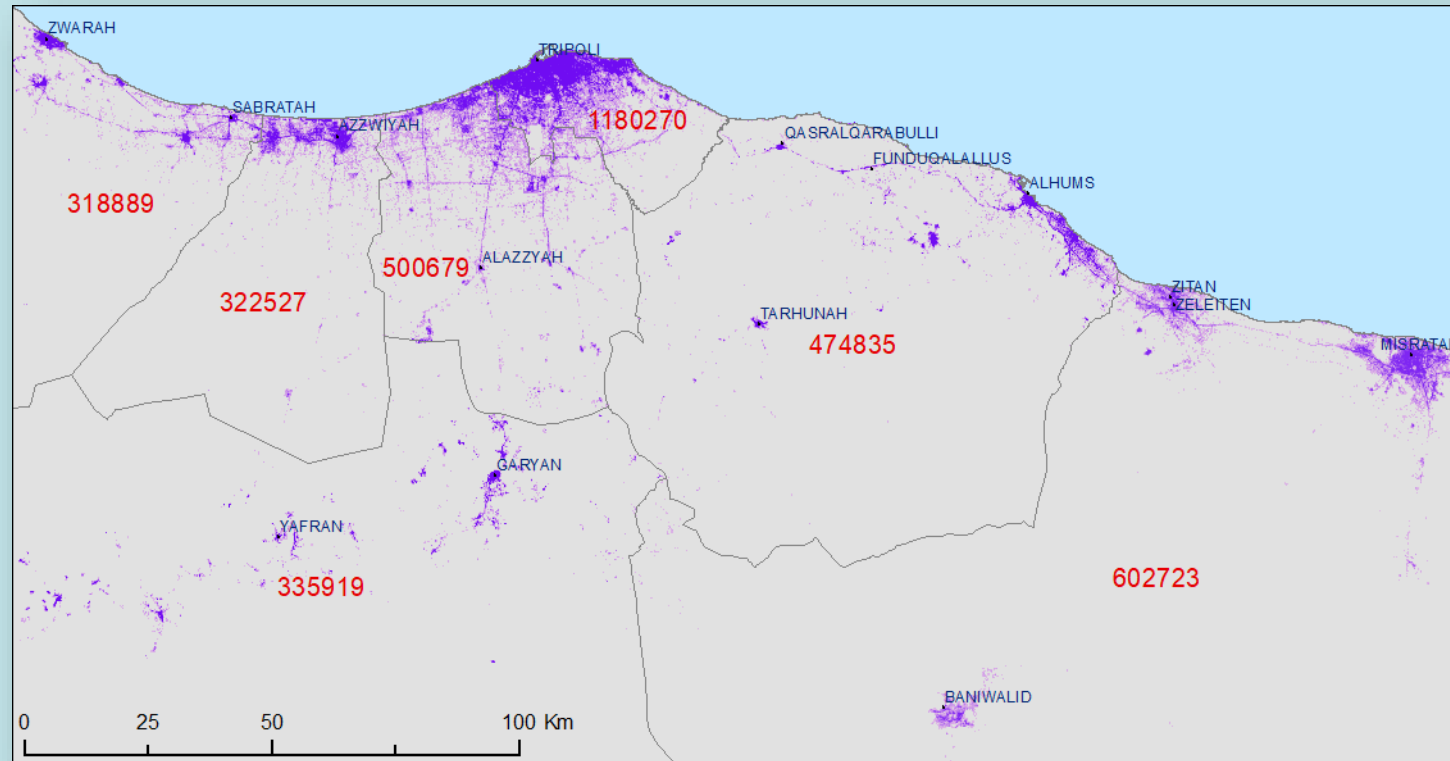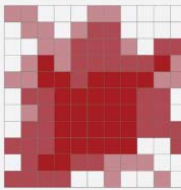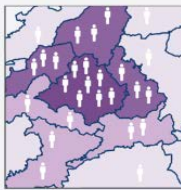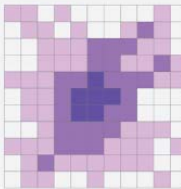
INPUT

GHS BUILT-UP

Census data

METHOD
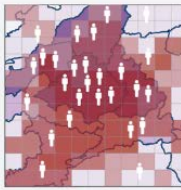
OUTPUT

GHS POP

European Commission

The evolving GHSL

- GHS-POP = f(GHS-BUILT, GPW census data)

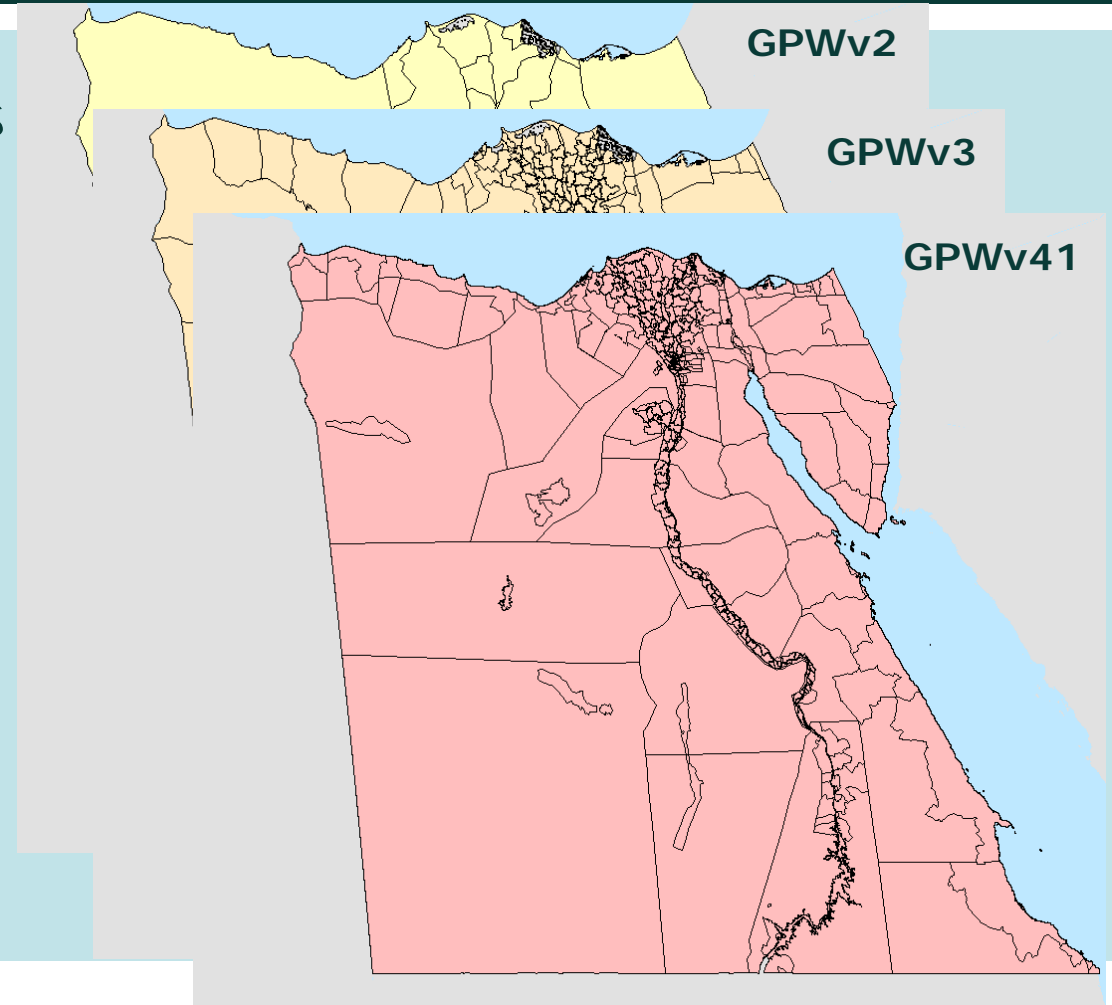**GHS-POP**

2015

250 m

N Libya

The evolving GHS-POP

- GHS-POP P2018: some additional improvements

- Better **matching of census sources with BU** data

- Harmonization of **coastline**

- Revising **unpopulated areas**

- A **JRC/GHSL and CIESIN/GPW collaboration** effort

European Commission

The evolving GHS-POP
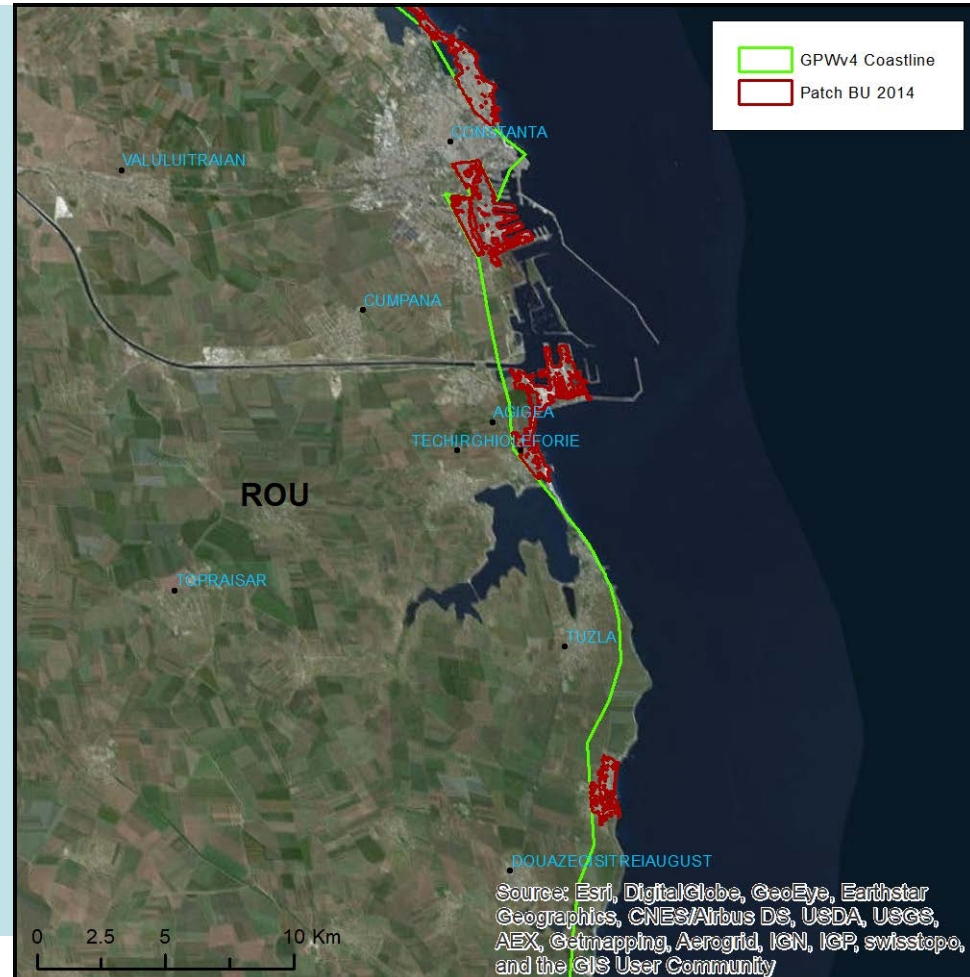
- **Better matching census sources for earlier epochs**

- Coarser units, but higher reliability of population estimates in 1975 and 1990

GPWv2

GPWv3

GPWv41

Egypt

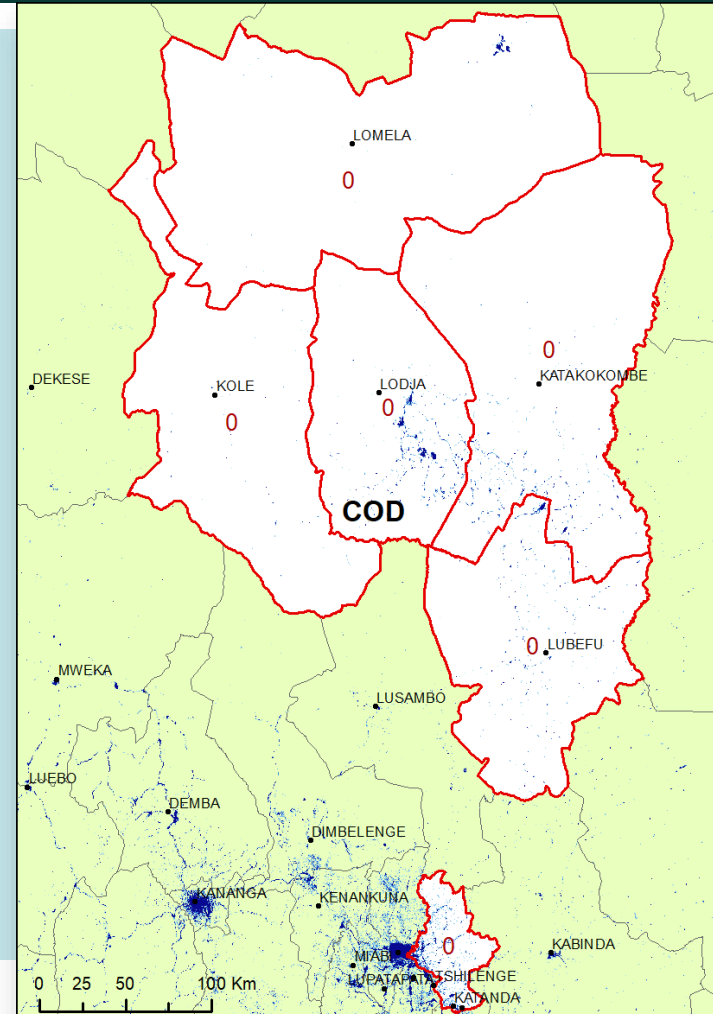European Commission

The evolving GHS-POP

- • Coastline harmonization

- Patches of BU 2014 > 1 km²

- Visually validated with VHR img

- BU surface beyond coastline: **591 km²**

Black Sea coast

The evolving GHS-POP

- Revising "unpopulated" areas

- Census units > 3 Km² AND BU > 10 ha

- Visually validated with VHR img

- **19 countries**

- Area of polygons with pop.: **297,000 km²**

- Area of BU: **624 km²**

- Estimated population: **6 million +**

COD - Democratic Republic of the Congo

The evolving GHSL

- Modeling & mapping population dynamics

  - **Nighttime**   **Daytime**

- ENACT

- JRC Exploratory
  Research project

- Activity mapping

- Day- vs nighttime
  pop for EU-28

- X 12 months

Naples, ITALY

European
Commission

The GHSL web platform

- Information (reports, articles, atlases)

- Visualization

- Download (data, tools)

- Feedback

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

Acknowledgements

- *GHSL is supported by **EC-JRC** and the **DG for Regional Development (DG REGIO)** of the European Commission, together with the international partnership **GEO Human Planet Initiative***
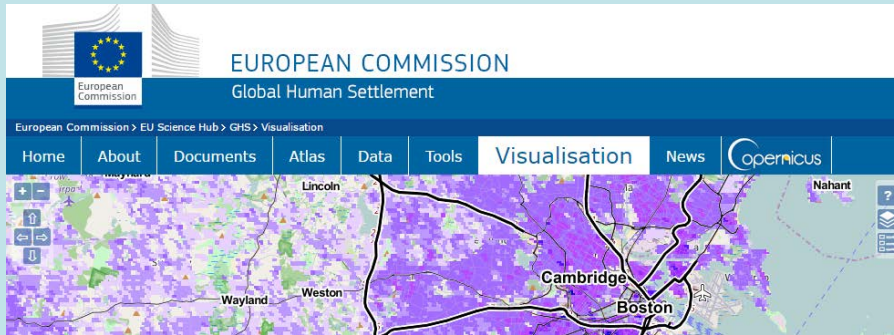

- CIESIN - SEDAC, Columbia University (USA)

- Gridded Population of the World (GPW)

- Kytt McManus et al.

Thanks

Any questions?

You can find me sergio.freire@ec.europa.eu

Joint Research Centre (JRC)
Directorate E. Space, Security & Migration
Disaster Risk Management Unit

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

European Commission