

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

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,...)

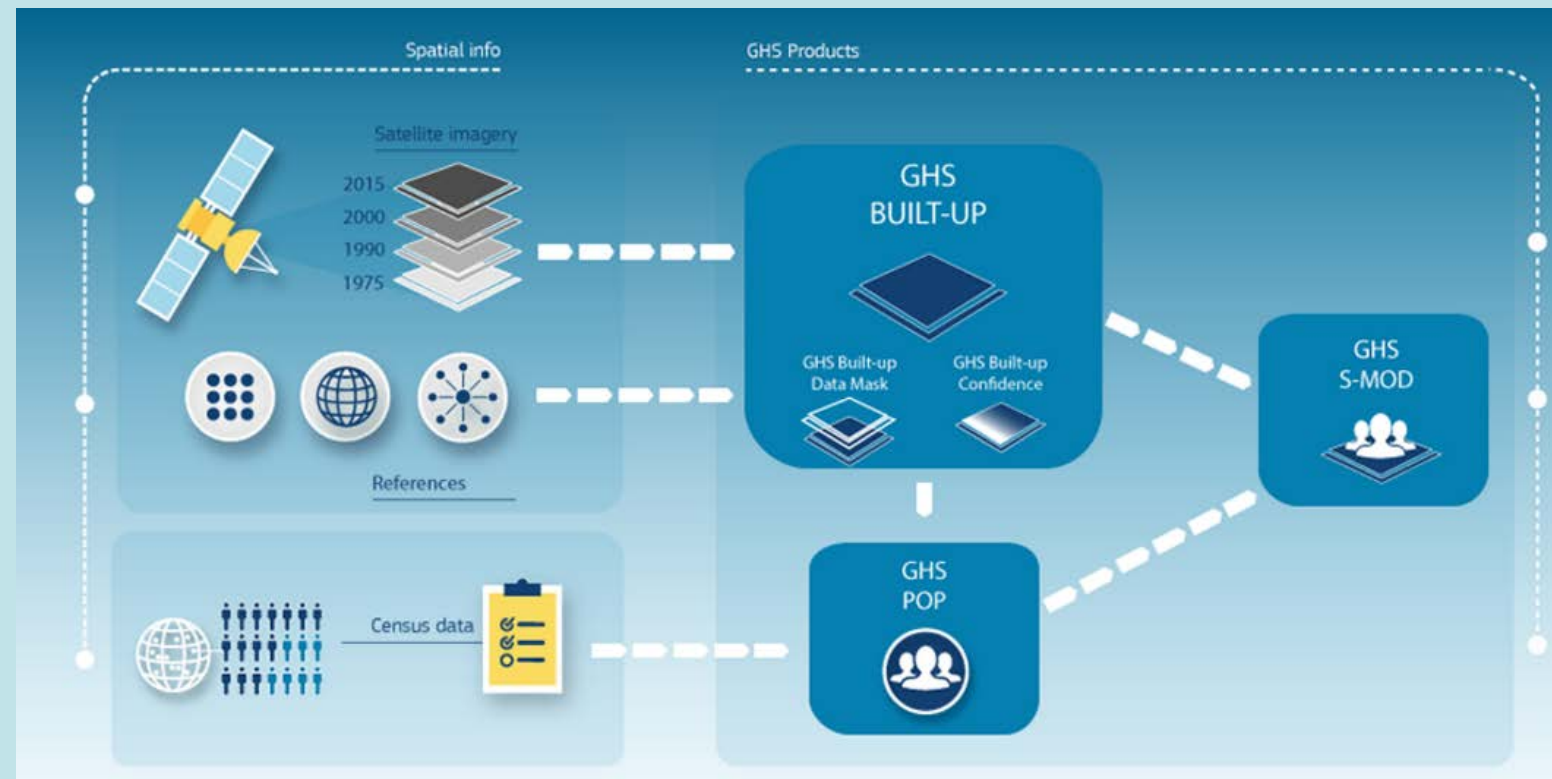
Geo-information on human settlements

- Producing indicators and monitoring targets, global scope:
- **Up-to-date**
- **Detailed**
- **Consistent** (comparable)
- **Sustainable** (repeatable, cost-effective)
- **Transparent** (clear methods)
- **Open & free**

The GHSL project

- GHSL – Global Human Settlement Layer

- Models
- Tools
- Geospatial data
- Capacity building



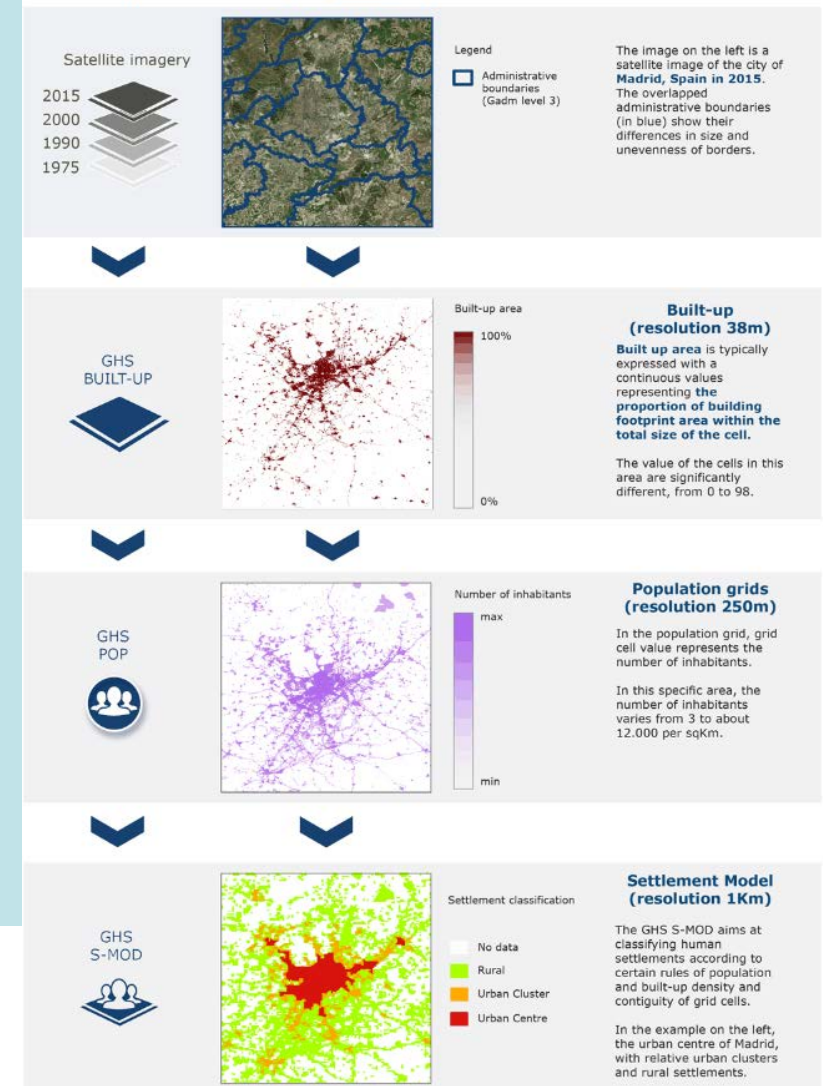
The GHSL project

- 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



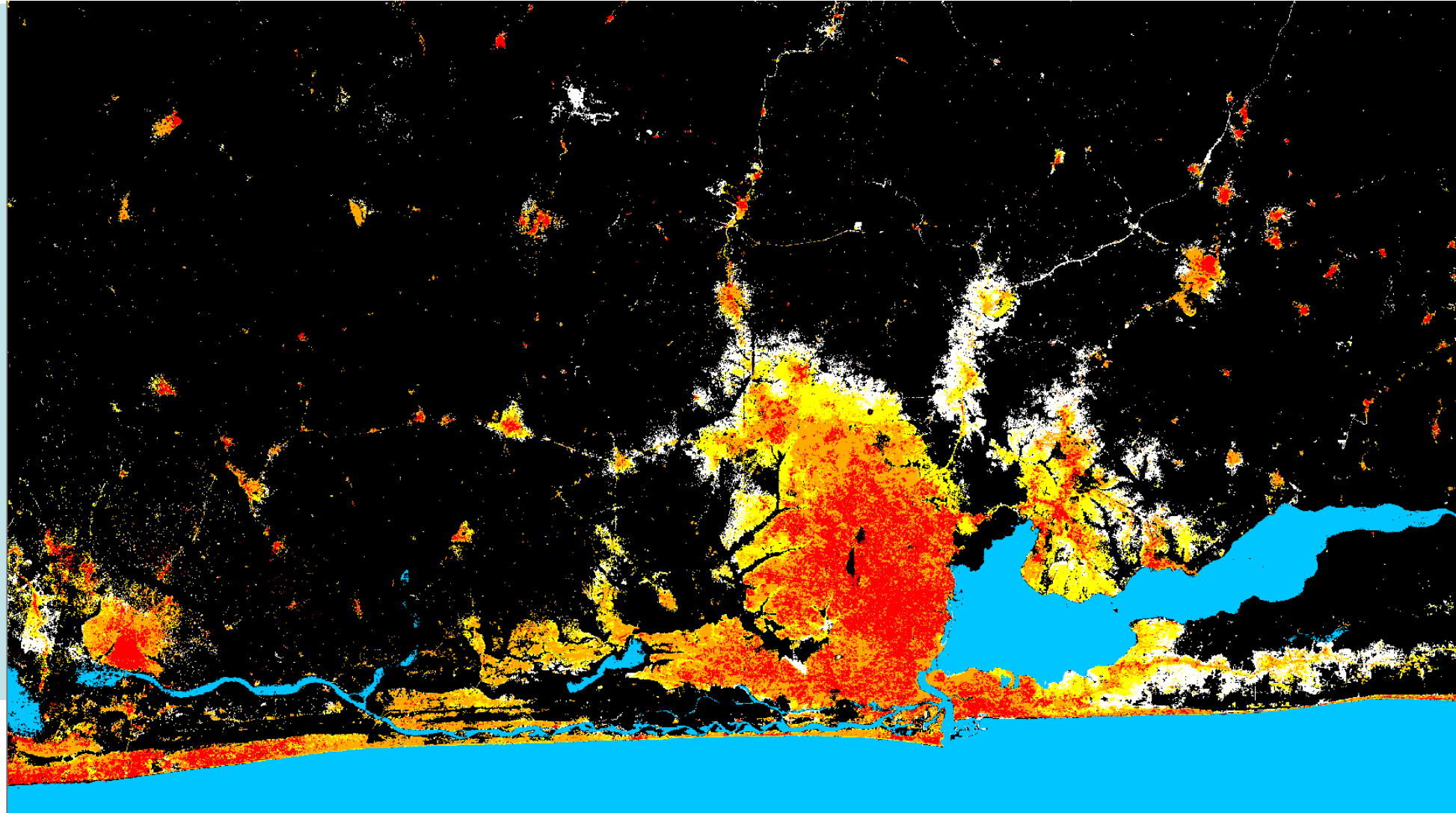
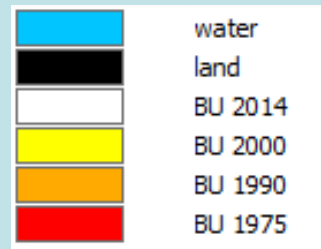
The evolving GHSL

- 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+** through max K mechanism
- **Enhanced detection of built-up** areas

The evolving GHSL

GHSL-MT (2015)

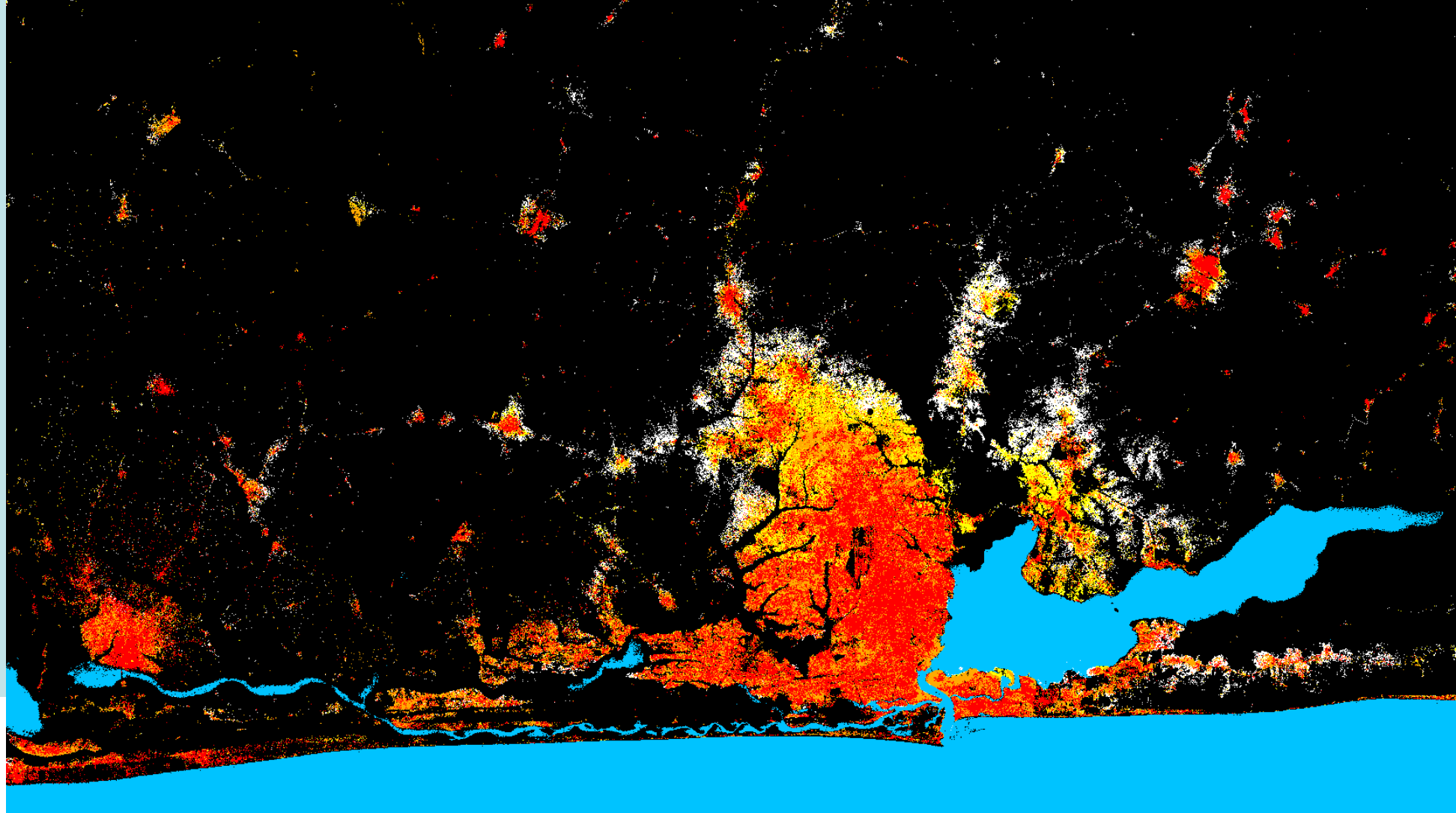
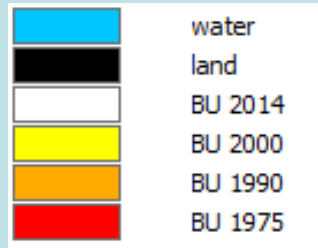
- Lagos (NIGERIA)









The evolving GHSL

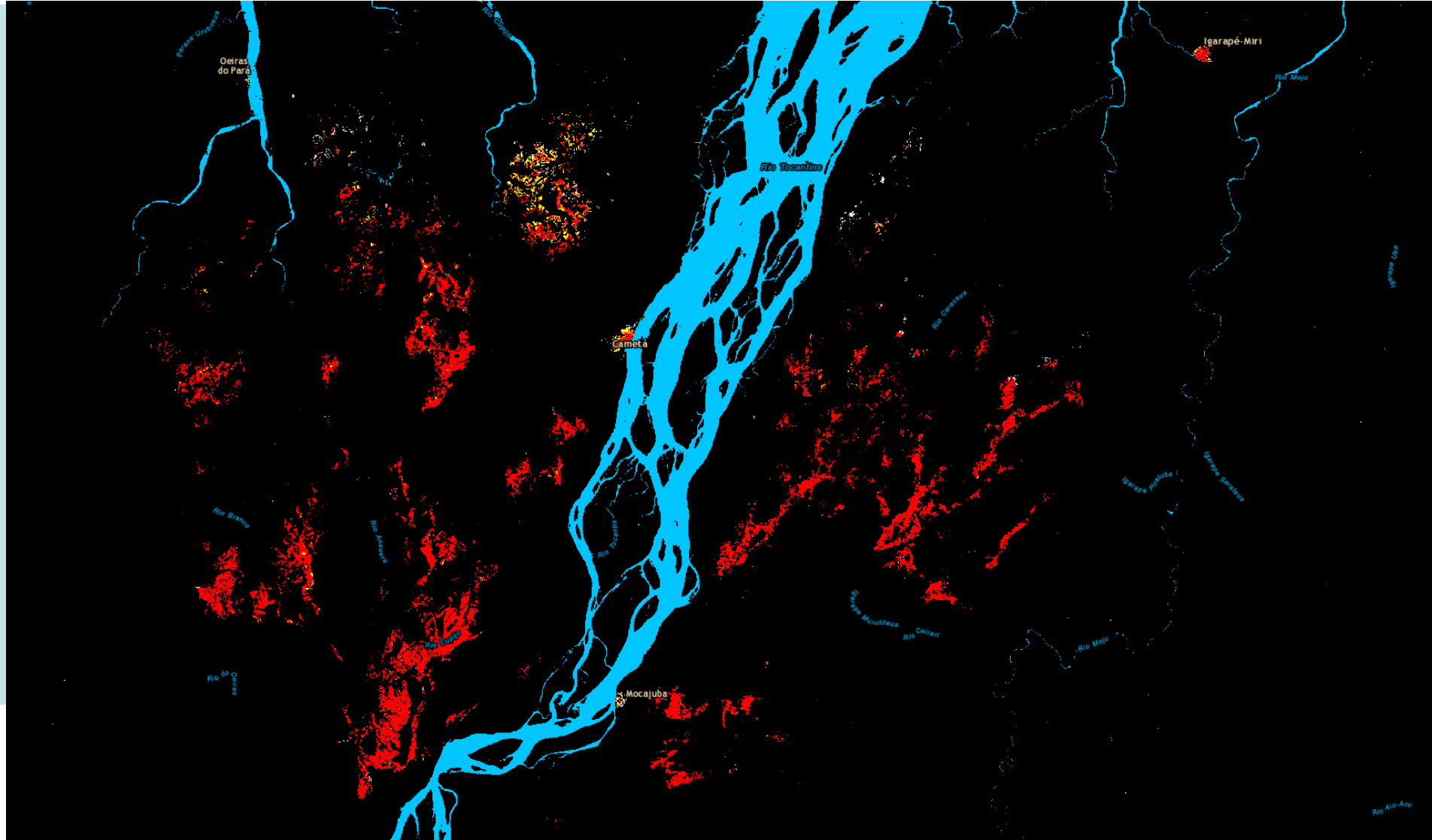
GHSL-MT (2017)

- Lagos (NIGERIA)









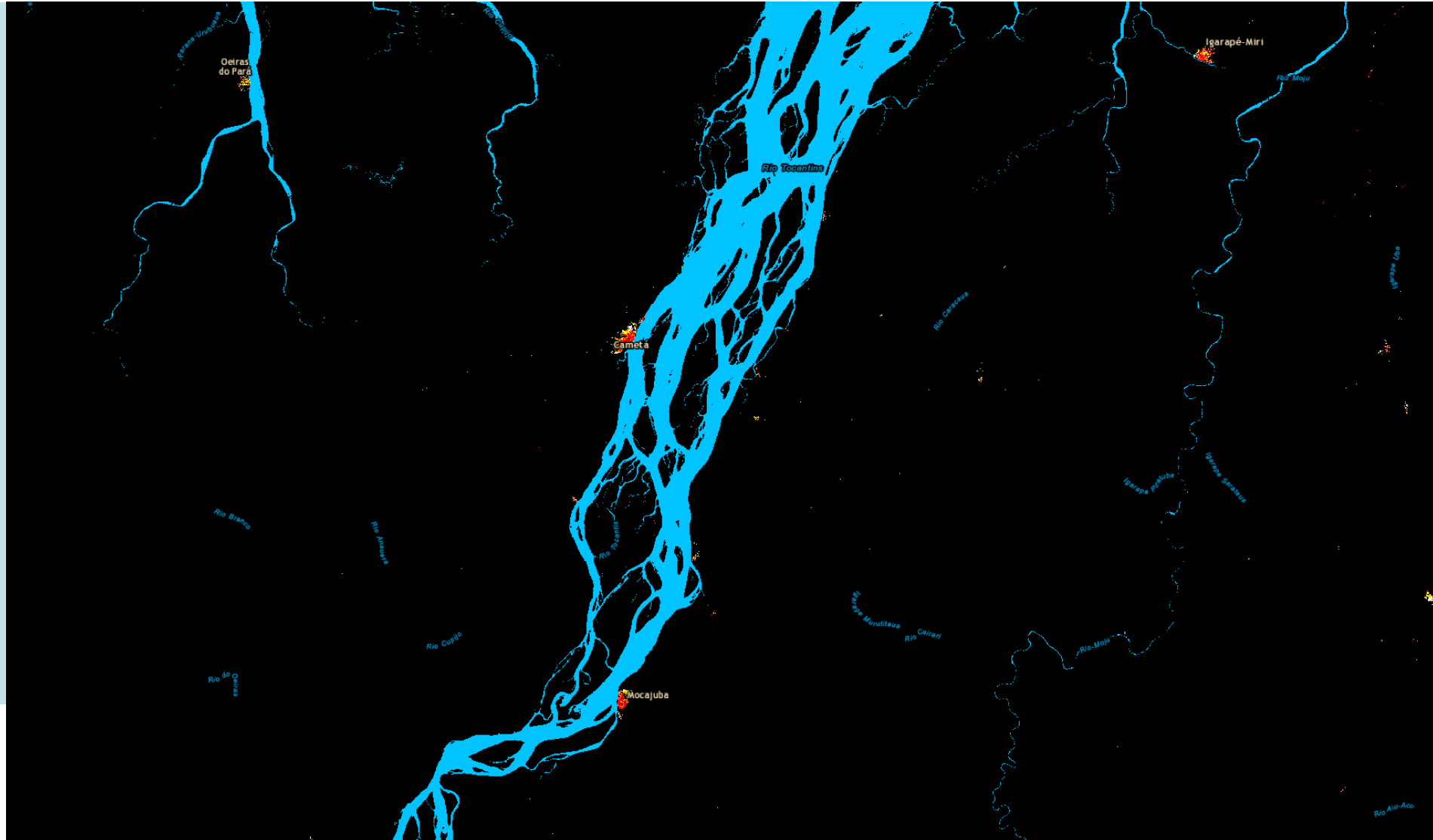
GHSL-MT (2015)

- | | |
|---|---------|
|  | water |
|  | land |
|  | BU 2014 |
|  | BU 2000 |
|  | BU 1990 |
|  | BU 1975 |



GHSL-MT (2017)

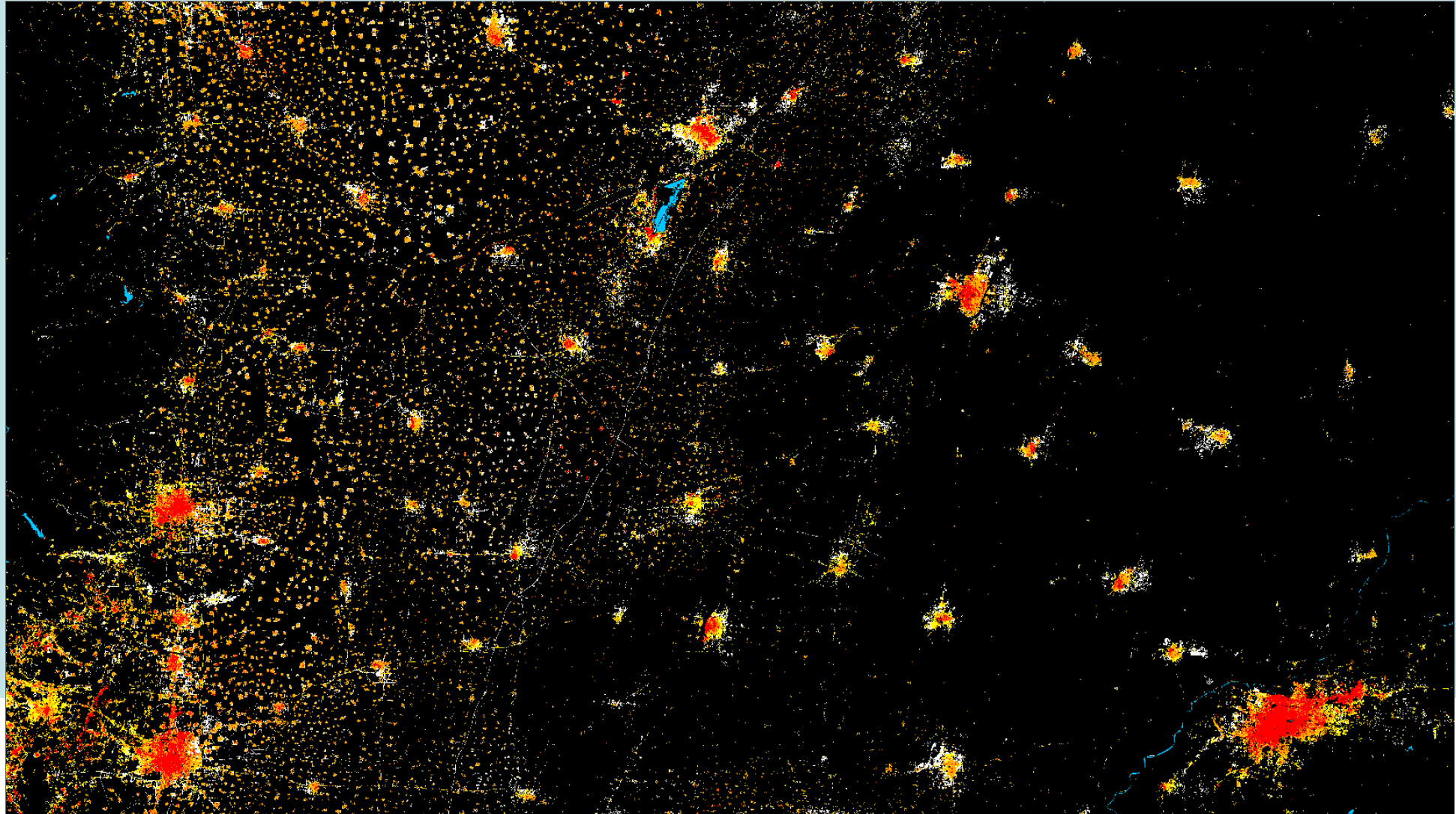
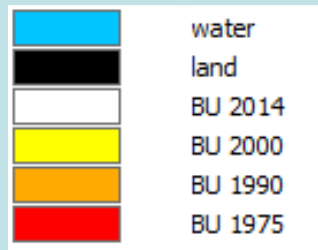
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The evolving GHSL

GHSL-MT (2015)

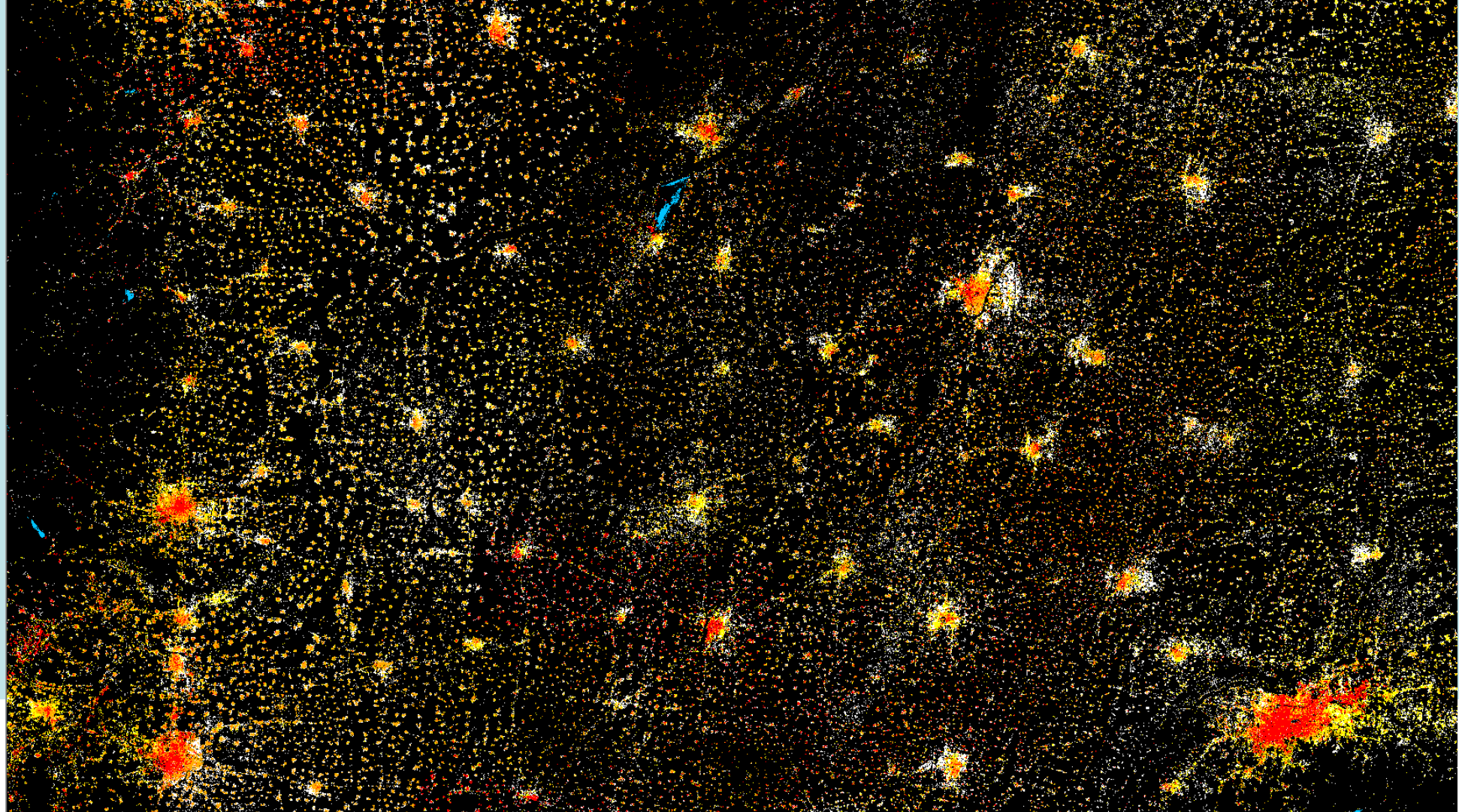
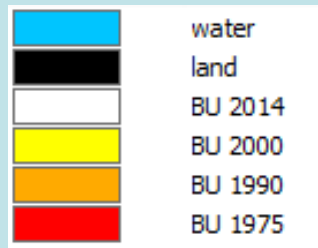
- Hengshi (CHINA)



The evolving GHSL

GHSL-MT (2017)

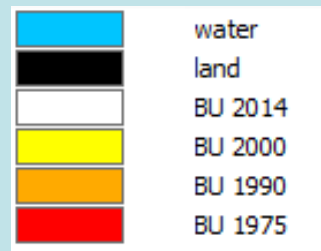
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The evolving GHSL

GHSL-MT (2015)

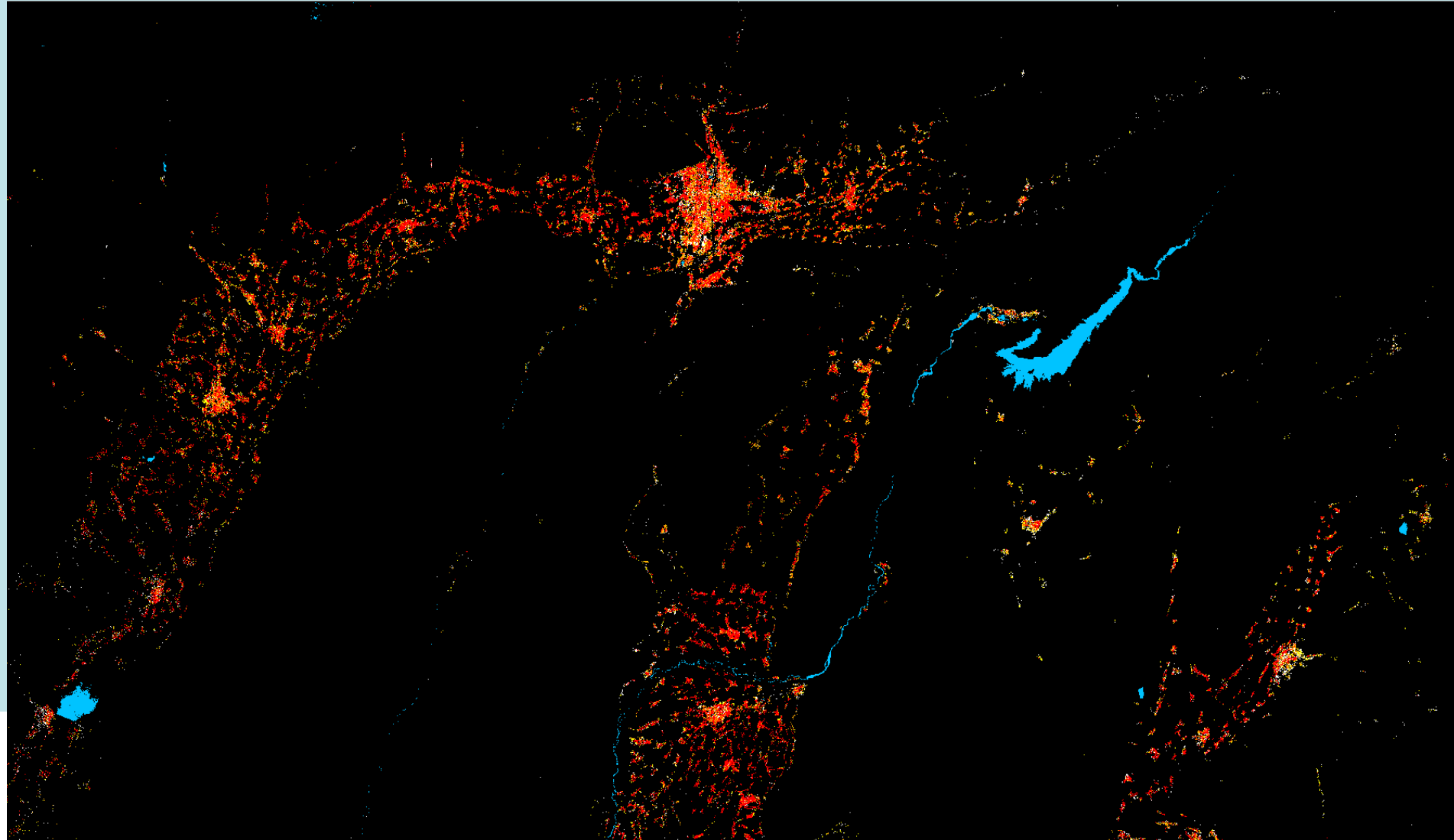
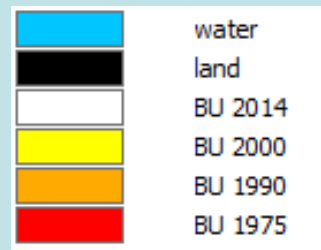
- Dushanbe
(TAJIKISTAN)



The evolving GHSL

GHSL-MT (2017)

- Dushanbe
(TAJIKISTAN)

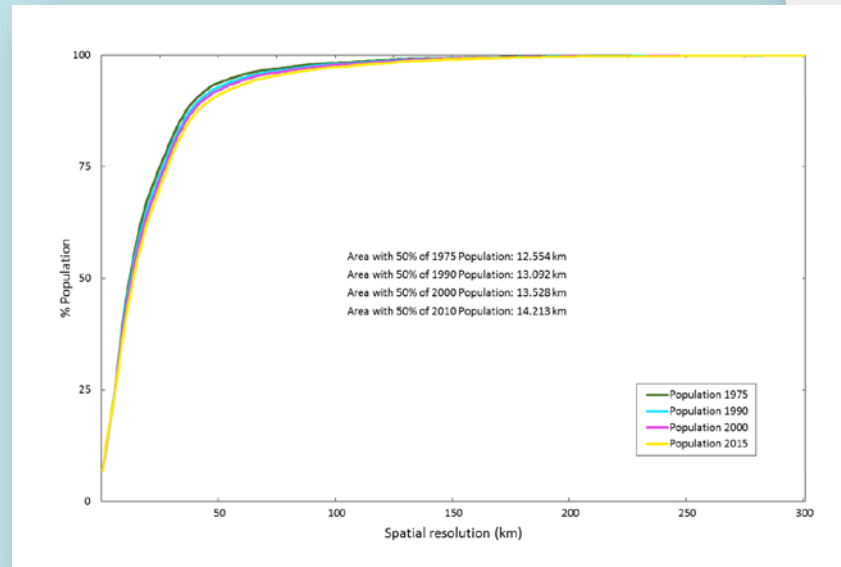


The evolving GHSL

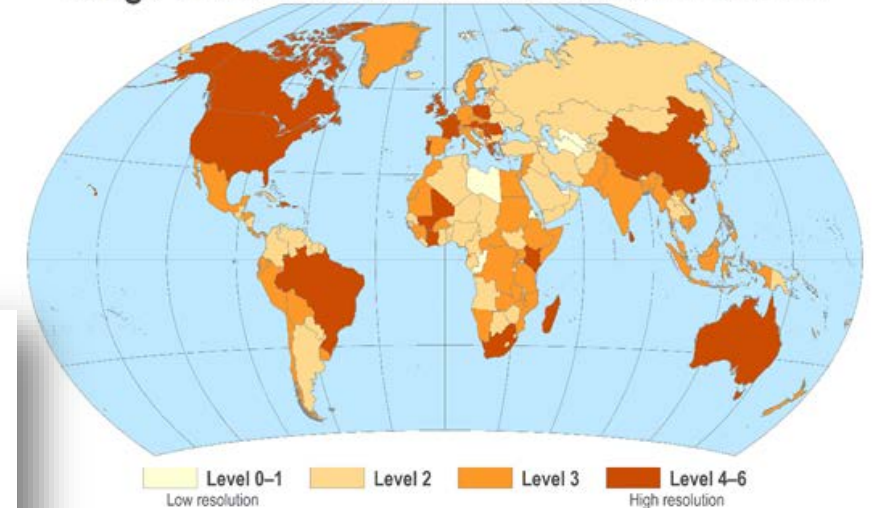
- GHSL – Population

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

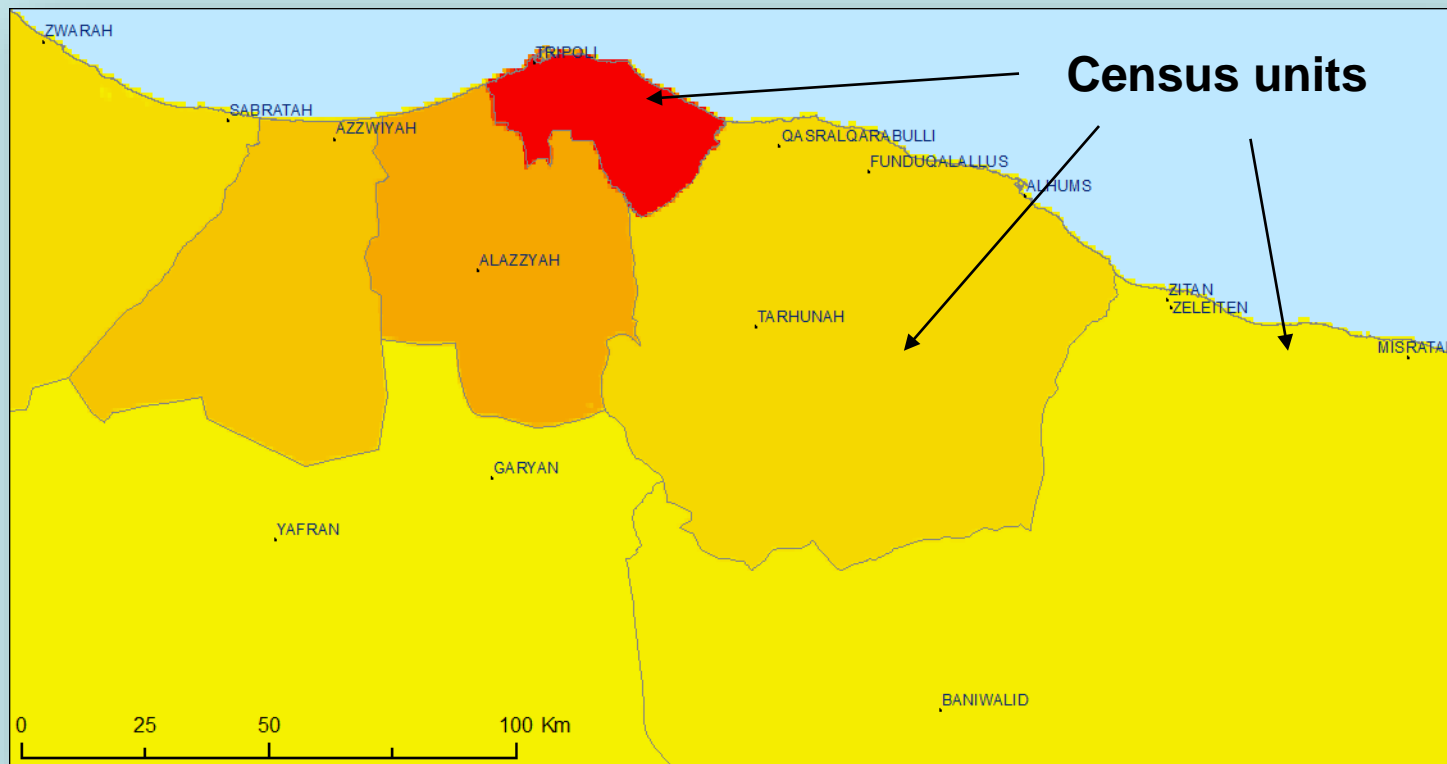
50% of global pop. in units > 200 km²

The evolving GHSL

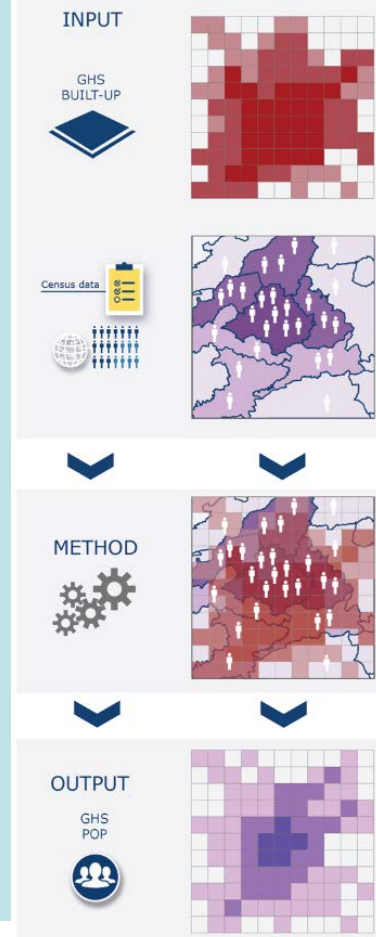
- $\text{GHS-POP} = f(\text{GHS-BUILT}, \text{GPW census data})$

GPWv4,
2015 Pop.
Counts
Cell size: 30"

N Libya



From built-up area to population grid

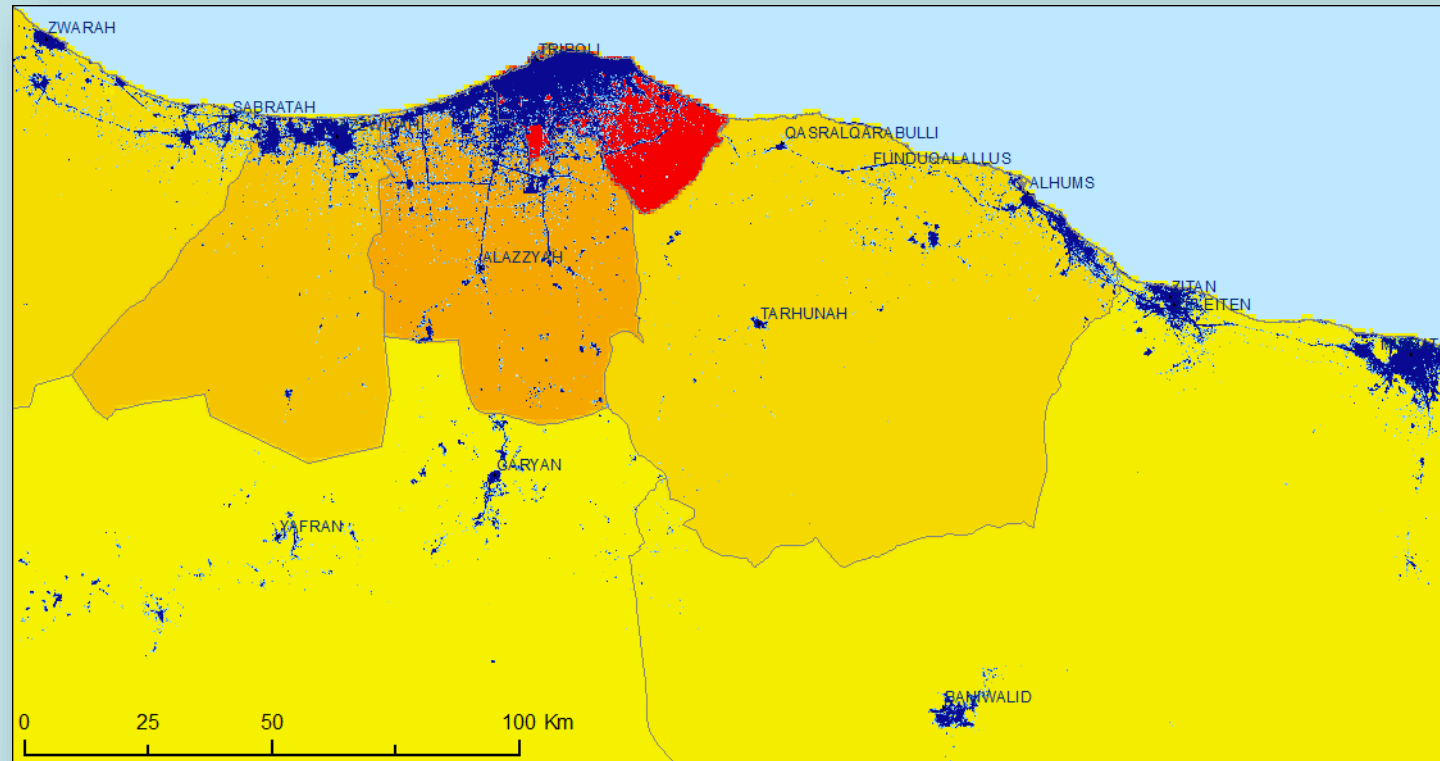


The evolving GHSL

- $\text{GHS-POP} = f(\text{GHS-BUILT}, \text{GPW census data})$

GHS-BUILT
2014
250 m

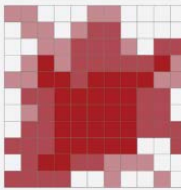
N Libya



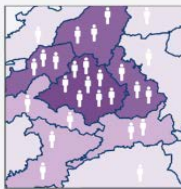
From built-up area to population grid

INPUT

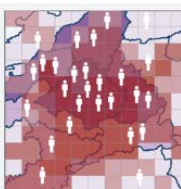
GHS
BUILT-UP



Census data

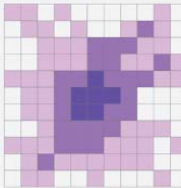


METHOD



OUTPUT

GHS
POP



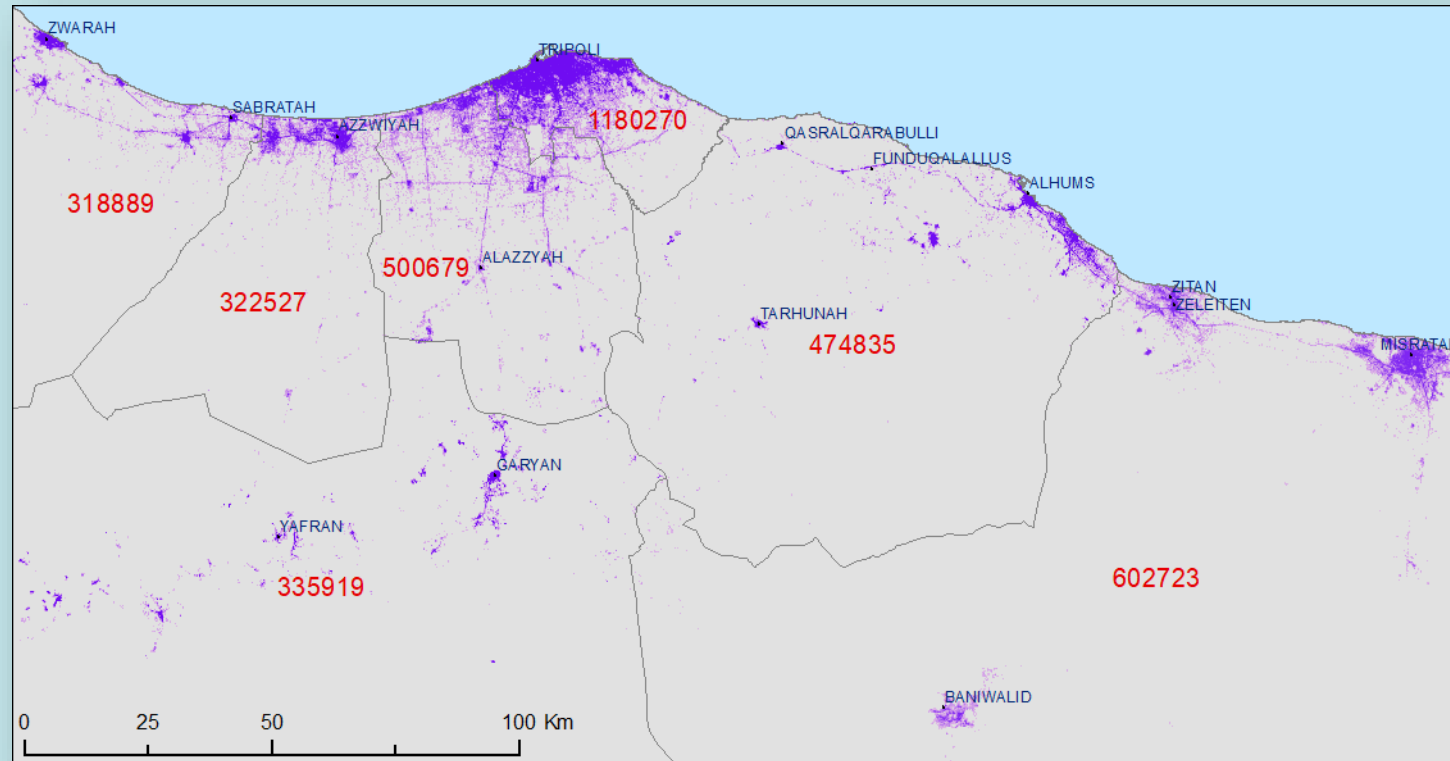
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- $\text{GHS-POP} = f(\text{GHS-BUILT}, \text{GPW census data})$

GHS-POP
2015
250 m

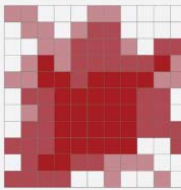
N Libya



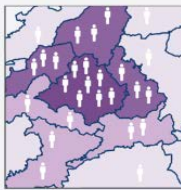
From built-up area to population grid

INPUT

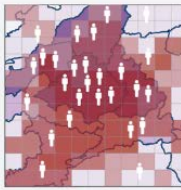
GHS
BUILT-UP



Census data

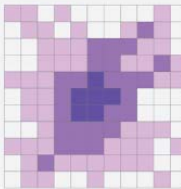


METHOD



OUTPUT

GHS
POP



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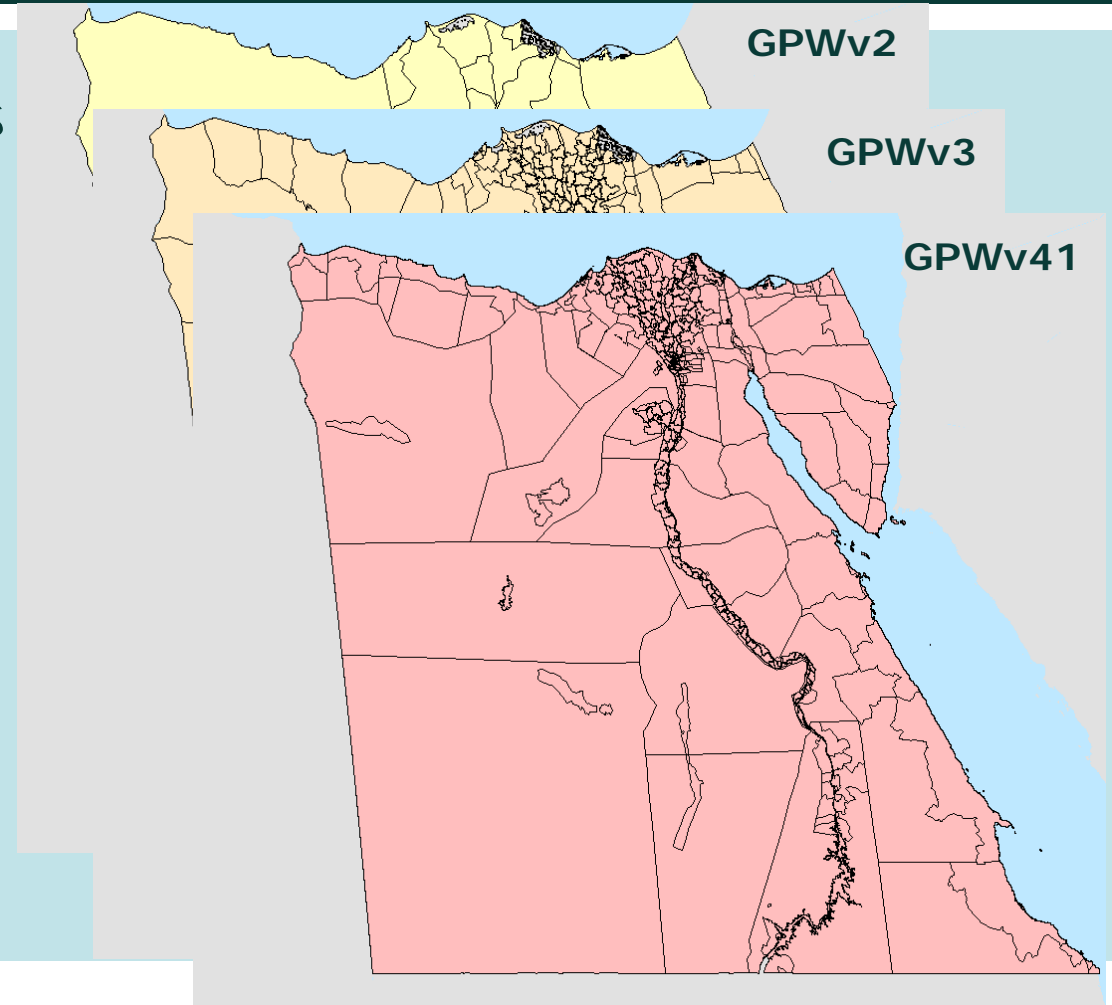
The evolving GHS-POP

- 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

The evolving GHS-POP

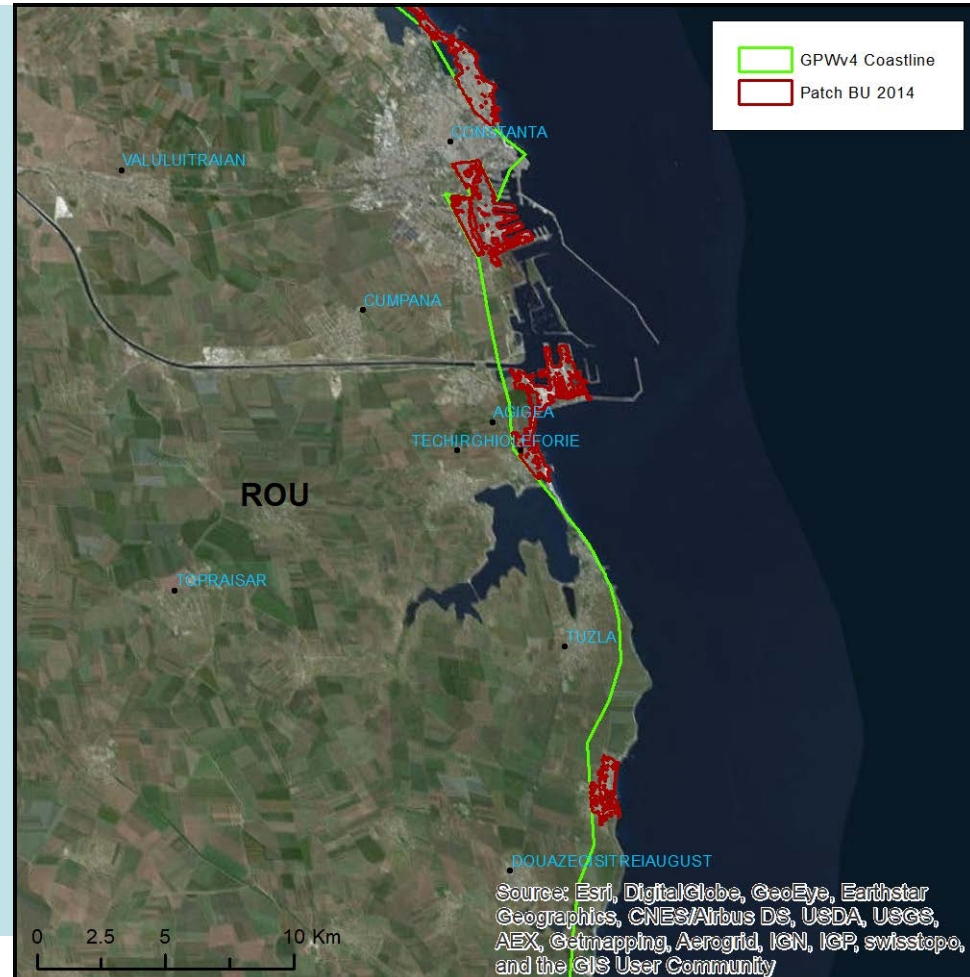
- Better matching census sources for earlier epochs
- Coarser units, but higher reliability of population estimates in 1975 and 1990

Egypt



The evolving GHS-POP

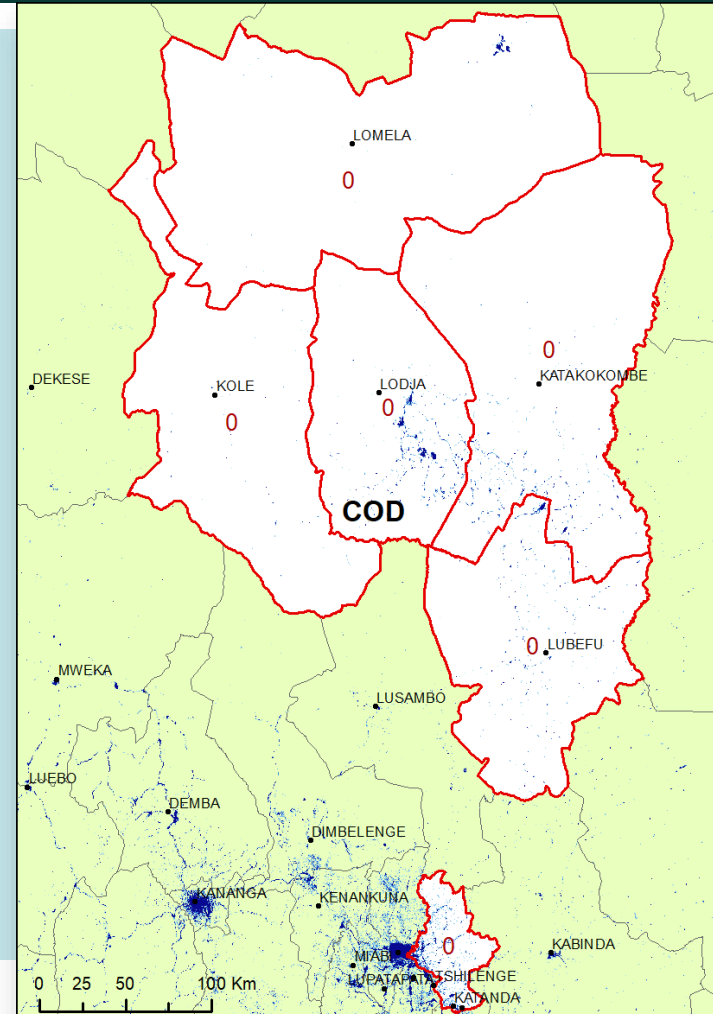
- Coastline harmonization
- Patches of BU 2014 > 1 km²
- Visually validated with VHR img
- BU surface beyond coastline: **591 km²**



Black Sea coast

The evolving GHS-POP

- Revising “unpopulated” areas
- Census units $> 3 \text{ Km}^2$ AND BU $> 10 \text{ ha}$
- 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



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The evolving GHSL

- Modeling & mapping population dynamics

▪ Nighttime

▪ Daytime



Naples, ITALY

- ENACT
- JRC Exploratory Research project
- Activity mapping
- Day- vs nighttime pop for EU-28
- X 12 months

The GHSL web platform

- Information (reports, articles, atlases)
- Visualization
- Download (data, tools)
- Feedback



The screenshot shows the homepage of the GHSL (Global Human Settlement Layer) web platform. At the top, there is a header with the European Commission logo and the text "EUROPEAN COMMISSION Global Human Settlement". Below this is a navigation bar with links: Home, About, Copernicus, Documents, Atlases, Global Definition, Data, Tools, Visualisation, and News. The main content area features the title "GHSL - Global Human Settlement Layer" and a subtitle "A new open and free tool for assessing the human presence on the planet". A list of bullet points describes the platform's capabilities and its support by the Joint Research Centre (JRC) and the DG for Regional Development (DG REGIO) of the European Commission, along with the international partnership GEO Human Planet Initiative. On the right side, there is a gold medal icon with the text "Geospatial World Excellence Award". At the bottom, there is a news section titled "News" with a date "07/09/2017" and a headline "Human Planet Forum 2017 - The 2017 Human Planet Forum will take place in Enschede, Netherlands, 13-15 September 2017. The forum is open to established and potential partners interested to engage with the GEO Human Planet Initiative."

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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](#)

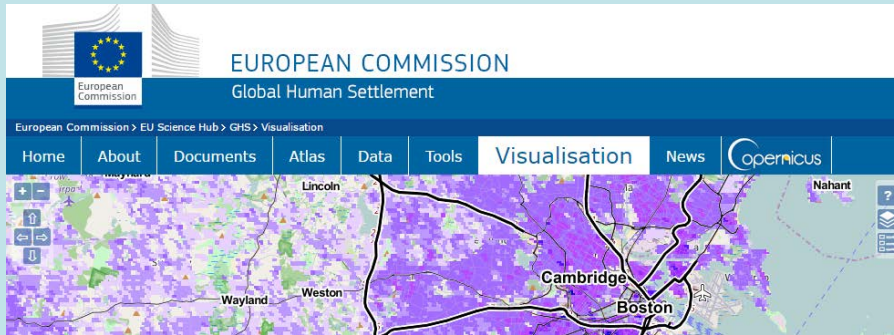
Geospatial World Excellence Award

News 07/09/2017 **Human Planet Forum 2017** - The 2017 Human Planet Forum will take place in Enschede, Netherlands, 13-15 September 2017. The forum is open to established and potential partners interested to engage with the GEO Human Planet Initiative.

<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>