

**Emergency Management** 

The Global Human Settlement Layer (GHSL): concepts, methods, and applications





## The GHSL project

## **GHSL - Global Human Settlement Layer**

Open and free data and tools for assessing the human presence on the planet

Home

Data and tools v Visual analytics v

Degree of urbanisation ~

Knowledge v Partnerships v News



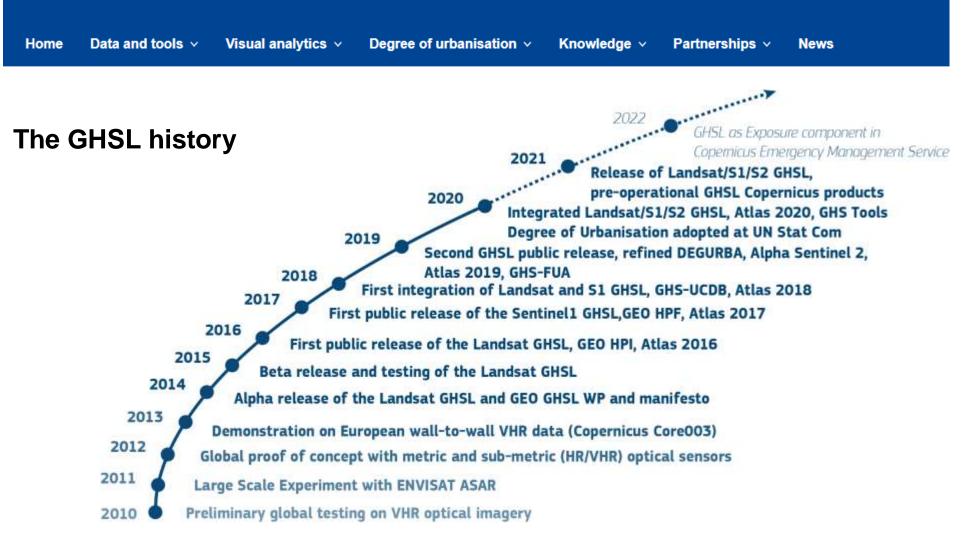


### The GHSL project: milestones



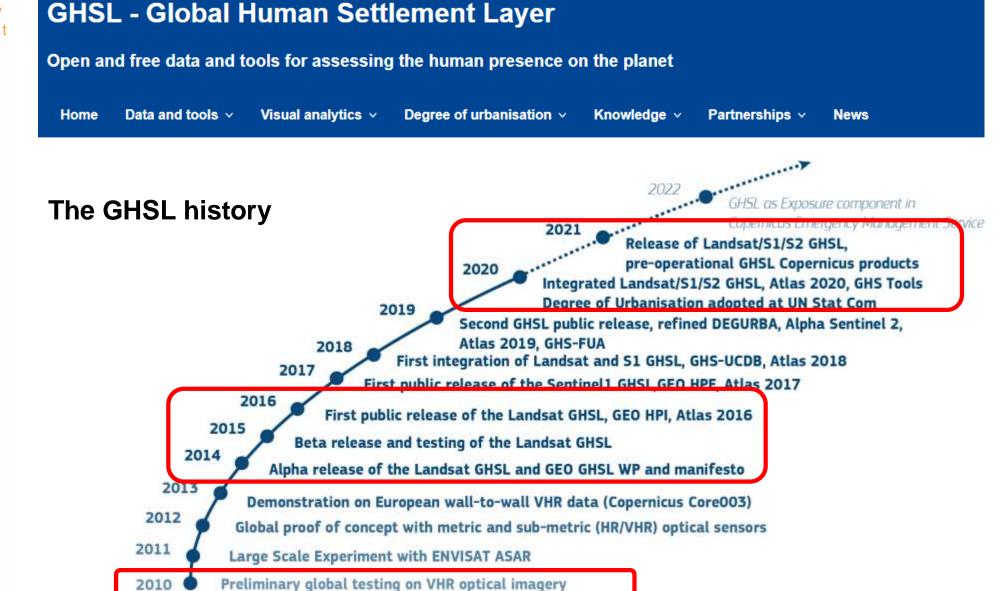
## **GHSL - Global Human Settlement Layer**

Open and free data and tools for assessing the human presence on the planet





### The GHSL project: milestones





## GHSL: big data for policy

## **Objectives of GHSL**

- Produce new evidence for decision making, e.g.:
- Sendai Framework for Disaster Risk Reduction
- 2030 Agenda for Sustainable Development (SDGs)
- Paris Climate Agreement, New Urban Agenda

## Key requirements for policy support

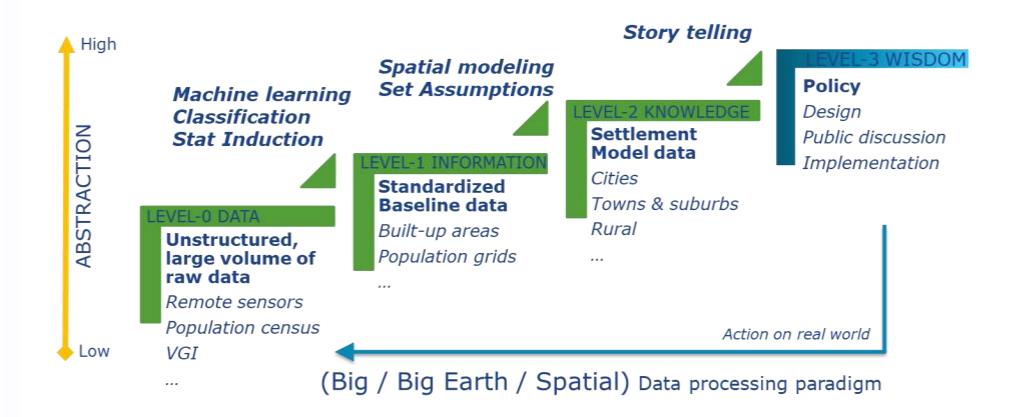
- Reproducible, scientifically sound, synoptic
- Sustainable information production
- Free and open framework
- FAIR data principles (Findable, Accessible, Interoperable, Reusable)





### GHSL: from data to policy

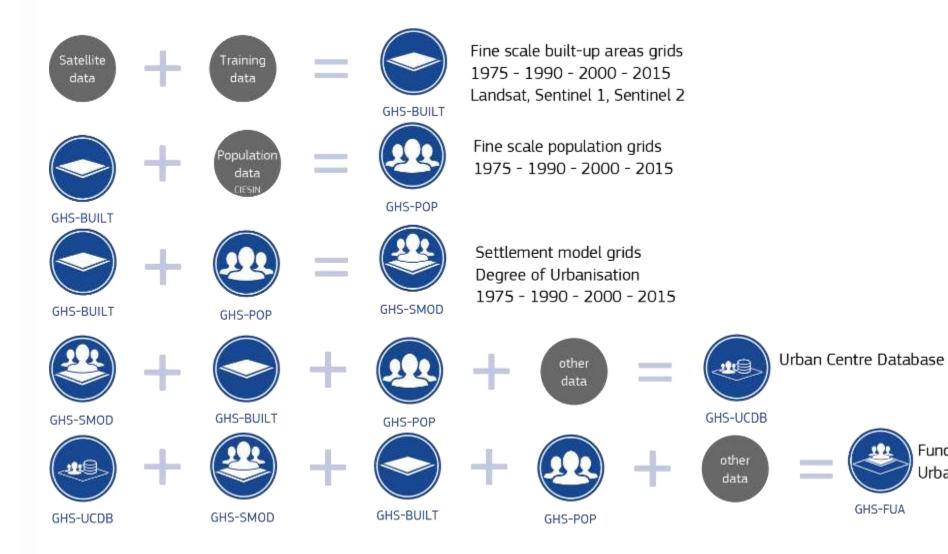
## The GHSL data hierarchy



## GHSL data anatomy

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GHSL – an integrated **global** geospatial product suite:



Functional

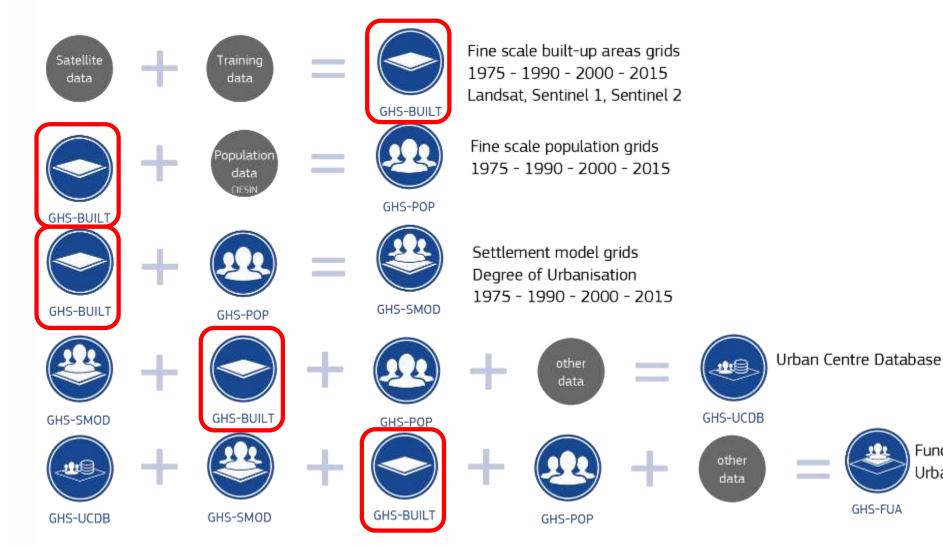
GHS-FUA

Urban Area

### GHSL data anatomy

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GHSL – an integrated **global** geospatial product suite:



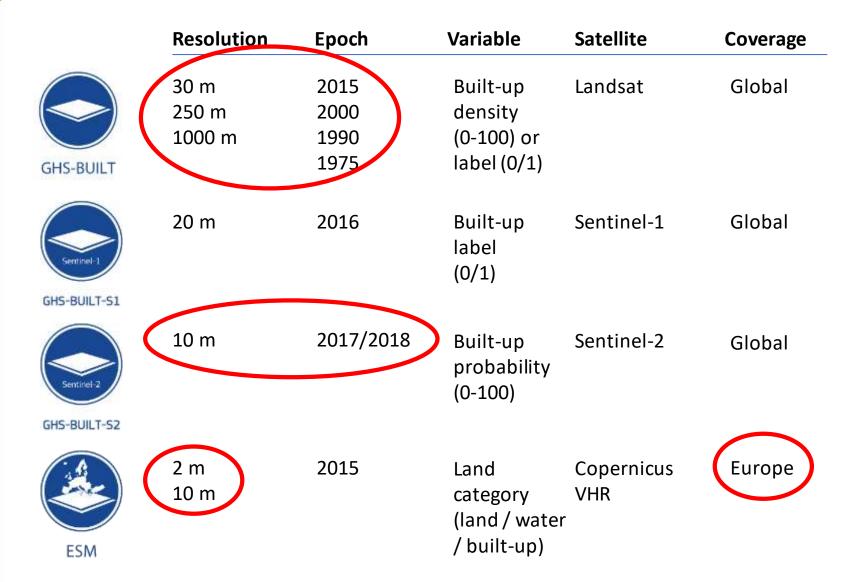
Functional

Urban Area

**GHSL** data

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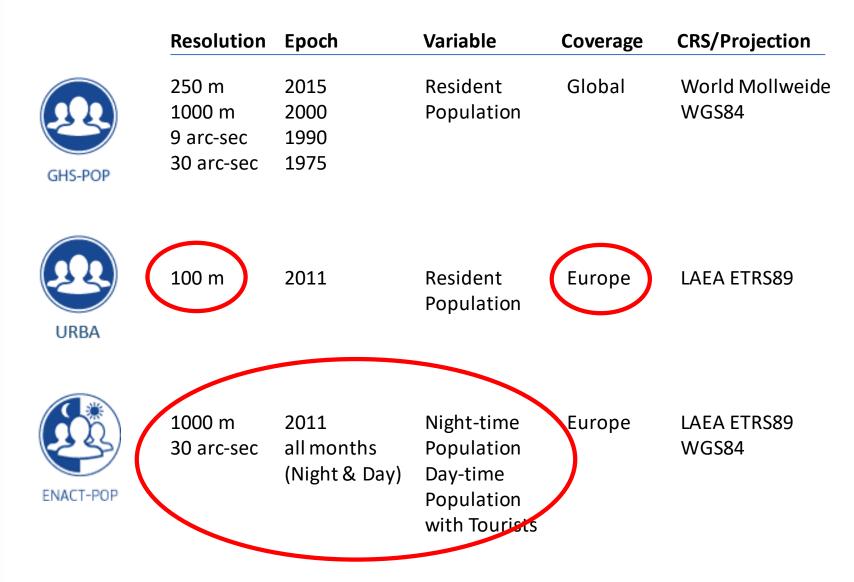
## Types of GHSL built-up data



**GHSL** data

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## Types of GHSL population data





### GHSL: data access & usability

Management

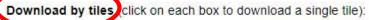


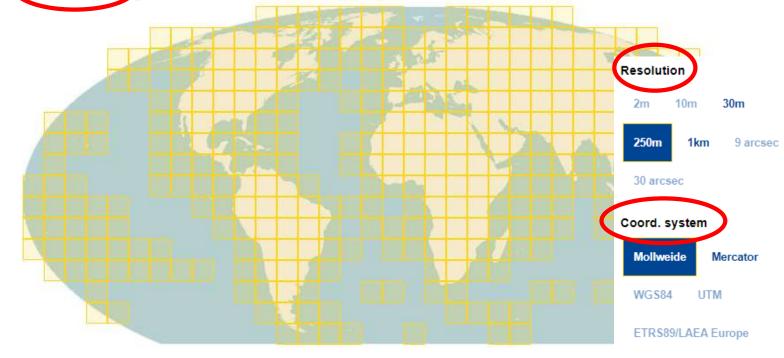
#### Current selection:

Product: GHS-BUILT, epoch: 2015, resolution: 250 m, coordinate system: Mollweide.

#### **Technical details**

⑦ To be noted that some variation might be available only for a certain product (e.g. the 30m resolution is only available for the GHS-BUILT multi-temporal classification)

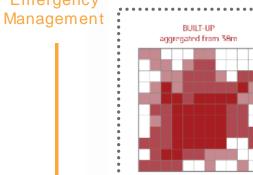


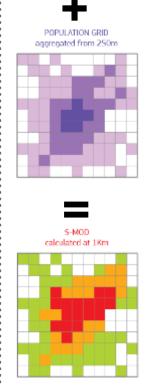


https://ghsl.jrc.ec.europa.eu/download.php



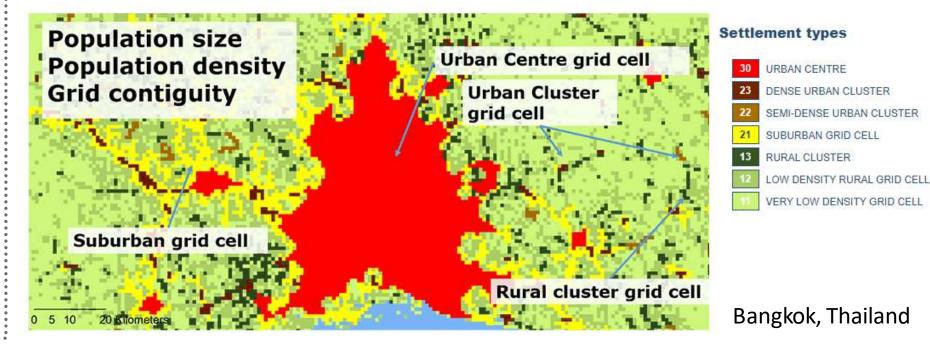
## GHS-SMOD & DEGURBA





## **Degree of Urbanisation: GHS-SMOD**

- A harmonized global definition of cities and settlements
- Combines BU and POP grids @ 1km
- Settlement map:

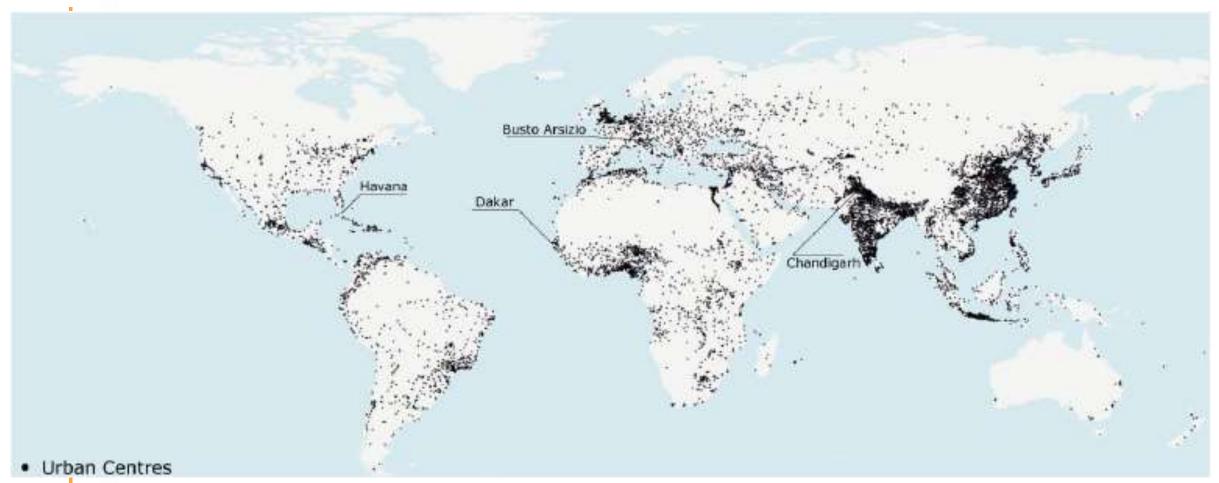






## GHS-UCDB

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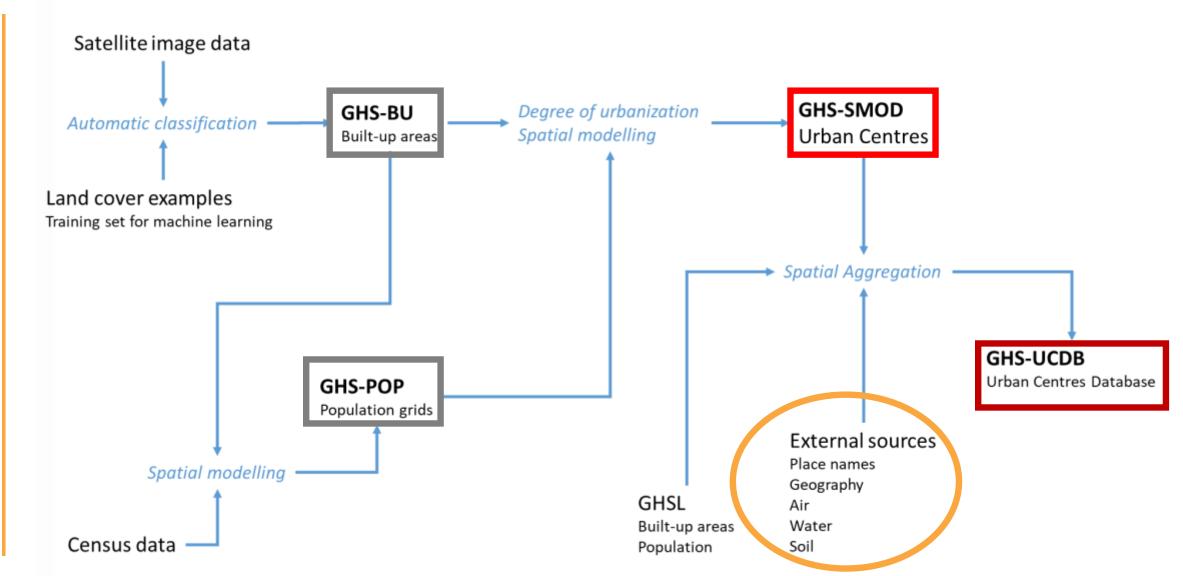


10,000+ Urban Centres in 2015 (>50k inhabitants)

**GHS-UCDB** 

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## **Urban Centre Database (UCDB) basics - Conceptual design**



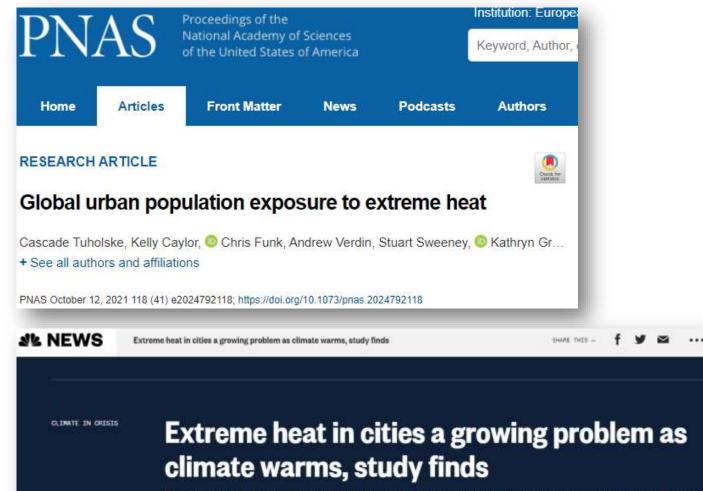
**GHSL** for DRM

#### **Emergency** Management UCDB – Global urban population exposure to extreme heat

PNAS, Oct. 2021:

- GHS-UCDB
- GHS-POP
- for 13,115 cities
- measure urban extreme heat exposure
- 1983 to 2016
- urban exposure increased nearly 200%
- 52% above population growth alone

https://www.pnas.org/content/118/41/e2024792118



People flocking to cities in rapidly urbanizing areas such as southern Asia and sub-Saharan Africa are increasingly vulnerable to soaring temperatures and high humidity. GHSL for DRM

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## Beyond DRM – other users of GHSL:

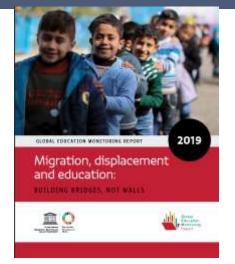


<u>OECD:</u> Green Growth Indicators <u>UN-Habitat/UN-Statistical division</u>: High Level Political Forum <u>UNESCO</u>: Global Education Monitoring Report <u>FAO</u>: Global Strategy for Improving Agricultural & Rural Statistics <u>UNEP</u>: Global Environmental Outlook

Green Growth Indicators 2017









GHSL for DRM

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In: Atlas of the Human Planet 2020

IRC SCIENCE FOR POLICY REPORT

Atlas of the Human Planet

• Applications of GHSL ranked by contribution to DRM phase:

Prevention Rehabilitation Preparedness Response (planning+mitigation) and Recovery **DRM** applications DRMKC Risk Data Hub 1 2 3 **INFORM** epidemic 2 1 SEDAC Global COVID-19 Viewer 1 2 3 4 ENACT project 1 Response Rehabilitation Mapping drought risk 1 2 **European Wildfire Risk Assessment** 2 1 Low Elevation Coastal Zone 1 GloFAS Rapid flood risk assessment 3 2 1 Flood Impact Using Social Media (FIUME) 2 1 GDACS automatic identification of Areas of Interest 2 1 Preparedness 2 3 Prevention Copernicus EMS mapping 2 1 After conflicts in Iraq 2 1



## European Settlement Map (ESM 2015)

- Input data: Copernicus VHR Europe (39 countries)
- Reference year: 2015
- Released in October 2019

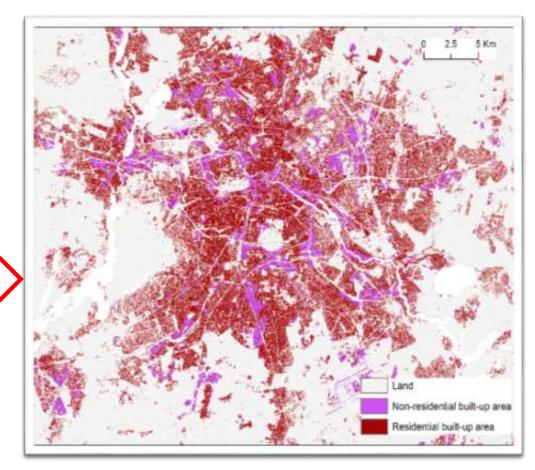
### Three main types of products:

- 2-m thematic classes
- 10-m typology of built-up: RES/NRES

Scientific uses (upon request):

10-m open spaces, distance to open spaces, green in open spaces

• Semi-operational product with 3-year updates



In: Sabo et al., 2019. Update and improvement of the European Settlement map. 2019 Joint Urban Remote Sensing Event (JURSE), 1–4.

https://ghsl.jrc.ec.europa.eu/download.php?ds=ESM

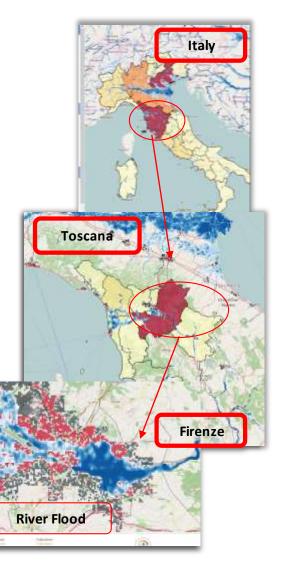


## European Settlement Map for DRM

## Used in DRMKC Risk Data Hub

- Exposure: BU RES/NRES
- Hazard: by extent and intensity
- Pan-European analysis @100 m
- Multi-scale analyses

https://drmkc.jrc.ec.europa.eu/risk-data-hub#/



River floods:

Region

• Province





## European Settlement Map – updates

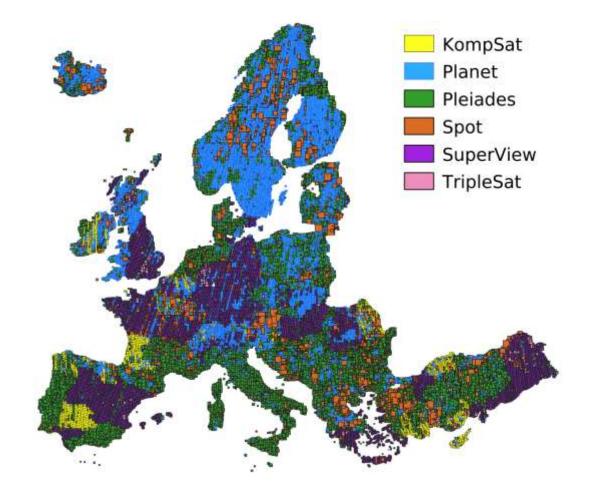
## **New ESM 2018**

IN:

- CORE 03 2012
- VHR\_IMAGE\_2018 (2 4m)
- Ancillary data

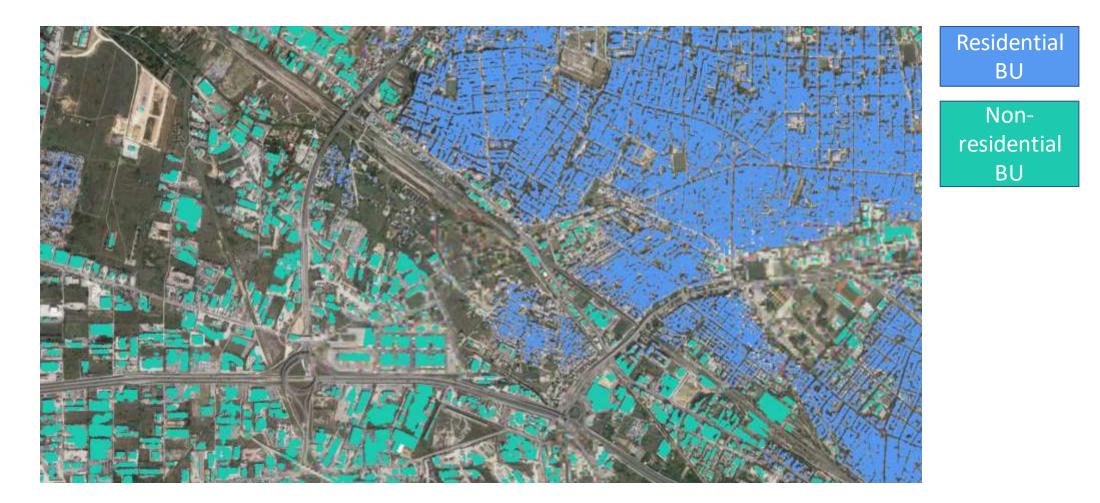
## OUT:

- BU map 2018
- BU changes 2012-2018
- BU RES/NRES
- @ 2m





## European Settlement Map 2018 – preliminary results

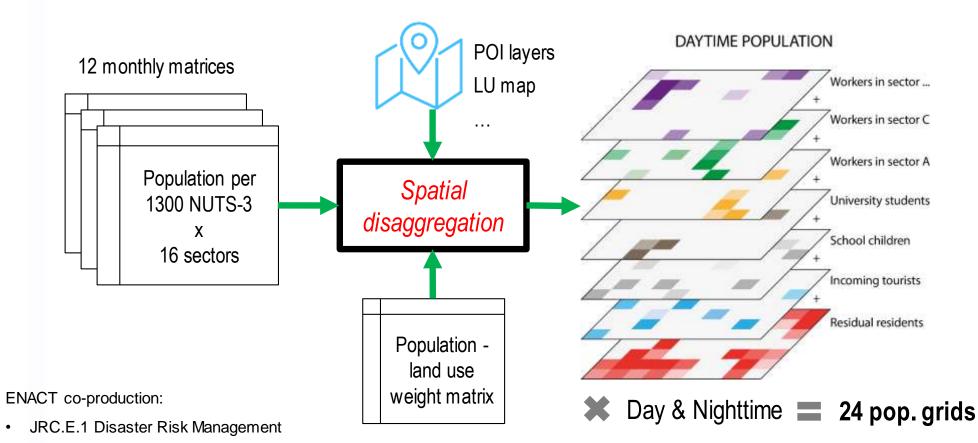


• Thessaloniki, GREECE



### Increasing temp resolution & map dynamics

## ENACT (ENhancing ACTivity and population mapping)



- JRC.B.3 Territorial Development ٠
- JRC.B.6 Digital Economy ٠

٠

https://ghsl.jrc.ec.europa.eu/enact.php

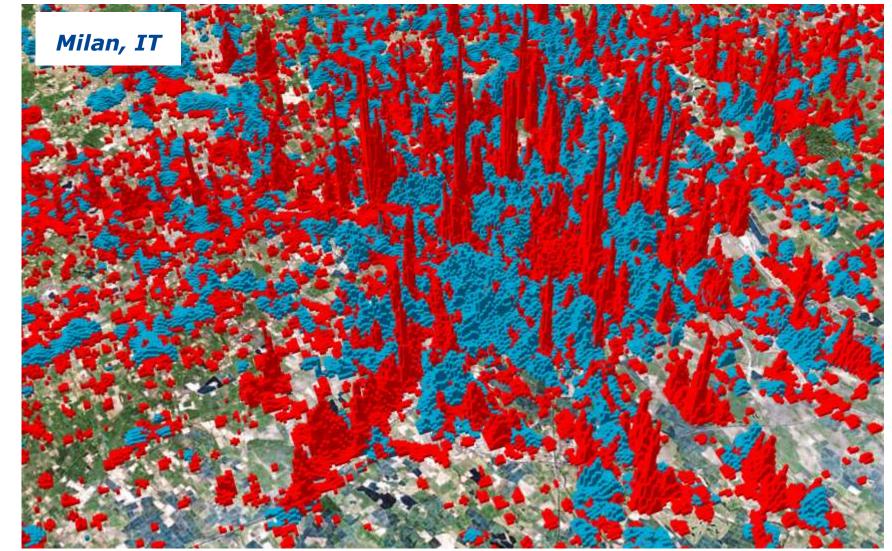


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## ENACT (ENhancing ACTivity and population mapping)

Total population distribution: Night vs Day,

x 12 months

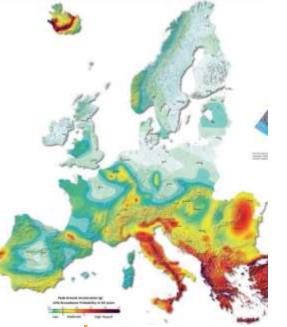


### Increasing temp resolution

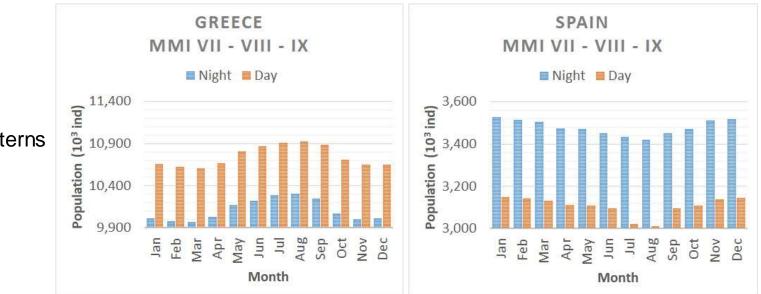
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## Potential population exposure to seismic hazard

• Temporal patterns – Greece vs Spain



- ✓ Mapping
- ✓ Quantifying
- ✓ Spatio-temporal patterns
- ✓ Hot spots
- 2013 SHARE map
- Spatial resolution: ~ 6.6 km (WGS84)
- PGA converted to MMI scale



In: Freire et al., 2018. Advancing exposure and risk assessment in the EU by modeling population distribution in daily and seasonal cycles. <u>https://ui.adsabs.harvard.edu/abs/2018EGUGA..2019691F/abstract</u>

• MMI > VI (Strong +)



## GHSL: more than data

## ent The GHSL tools

## • Degree of Urbanisation, population and settlement analysis



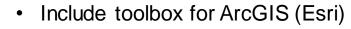
## Feature extraction from Earth Observation

Smart Dissolve



GIS Analysis





• Freely available at:

https://ghsl.jrc.ec.europa.eu/tools.php



### Conclusions and Outlook

## **Conclusions:**

- GHSL is constantly evolving
- Range of datasets with different technical specs
- From extracting BU areas to mapping Urban Centres & Metro areas
- Designed with DRM in mind: support to all phases

## Future from current developments:

- 15:45 'Everything you wanted to know about the new GHSL data release'
- Stay tuned for following sessions!



# Questions?

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