PROGRAMME OF THE EUROPEAN UNION

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SPACE-DRIVEN GEOSPATIAL ANALYTICS FOR PAN EUROPEAN HUMAN SETTLEMENTS FIXED ASSET VALUATION

ENHANCING EXPOSURE MODELLING FOR CLIMATE ADAPTATION POLICY

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Context and Motivation

What:

- Information available to understand the impacts of natural hazards has improved but remains incomplete: mapping ✅ … but …
- Need for high-resolution, long-term exposure data to characterise the exposure of human settlements to natural hazards; open and recent data ⟶ Leverage of Earth Observation for climate adaptation
- Importance of fixed asset valuation (FAV) for economic exposure assessment in human settlements
- Relevance to climate adaptation, disaster risk management, and economic policy frameworks (e.g., EU climate adaptation strategies, EU Cities Mission, Sendai Framework)

How:

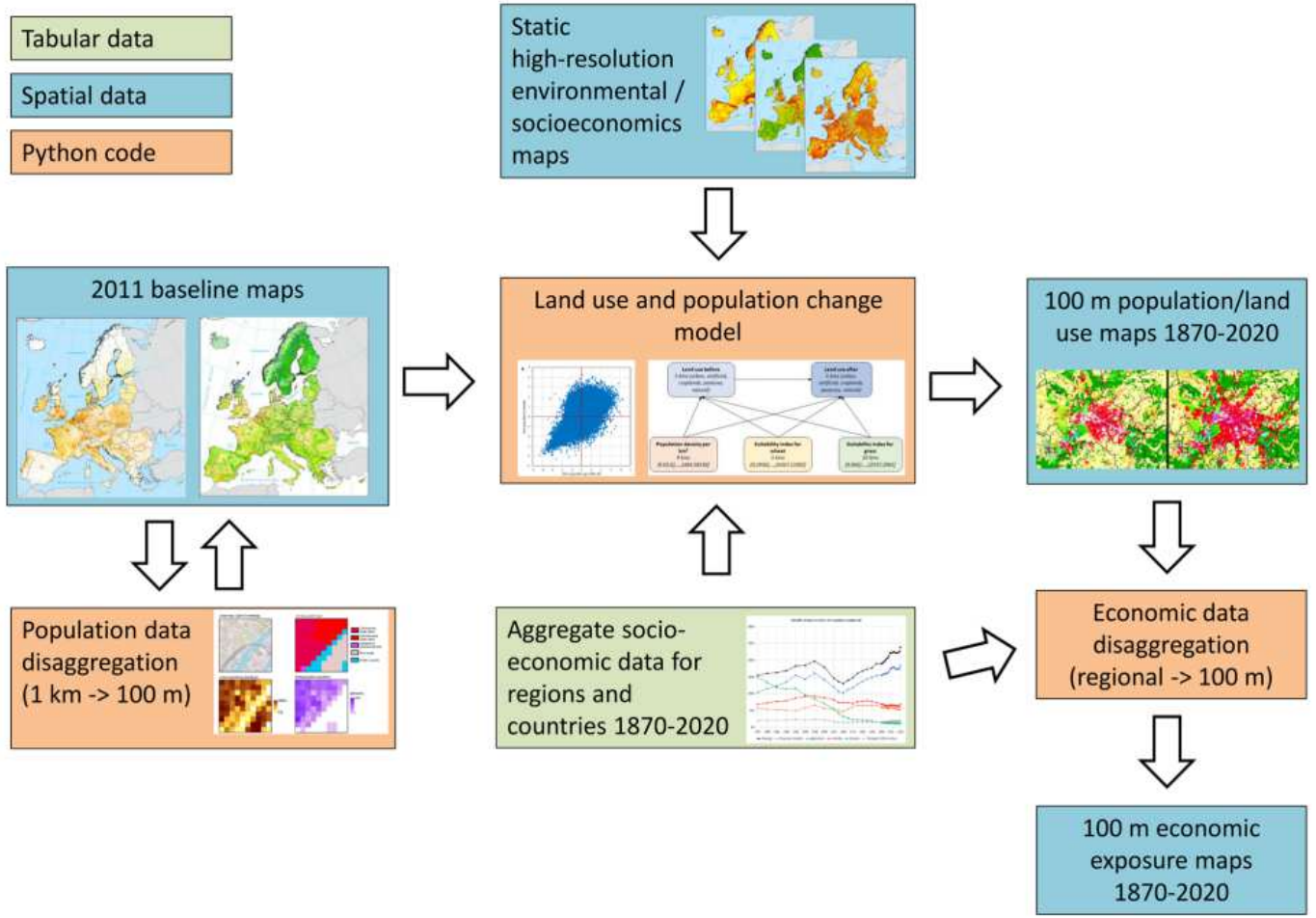
- Geospatial data integration: Human Settlements data and Fixed Asset Value (€)
- Measures tangible assets at regional level and disaggregated into a grid: housing, consumer durables, sectoral capital, infrastructure.
- Input for quantifying exposure and impact of hazards
- Piloting method and applying it to flood hazard 100yRP in North Italy

Research Objectives

- To include available asset value data into existing disaster risk management information systems and analyses
- To integrate of high-resolution fixed asset value data for human settlements though a scalable geospatial workflow
  - by addressing the need for risk-informed urban planning
- To support evidence-based economic and climate adaptation policy.
- Contribute to the evolution of the DRMKC Risk Data Hub

HANZE *(Historical Analysis of Natural HaZards)*

- HANZE v2.0 (HistoricalAnalysis of Natural HaZards in Europe) 2000-2020
- NUTS3 database of fixed asset values at 100m resolution (constant 2020€)
- Fixed Asset Value is the estimated economic value of tangible, long-term assets:
  - buildings,
  - infrastructure,
  - Housing contents,
  - Excluding livestocks, machinery and crops
- Disaggregation from regional socioeconomic statistics to grid cells employs a two-step dasymetric approach, combining population density (60%) and land use/soil sealing (40%) as predictors
- Compute fixed asset stock per sector by multiplying sectoral GDP by country-specific wealth-to-GDP ratios



Paprotny, D., & Mengel, M. (2023). Population, land use and economic exposure estimates for Europe at 100 m resolution from 1870 to 2020. *Scientific Data*, *10*(1), 372.

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Global Human Settlement Layer

Main Data products

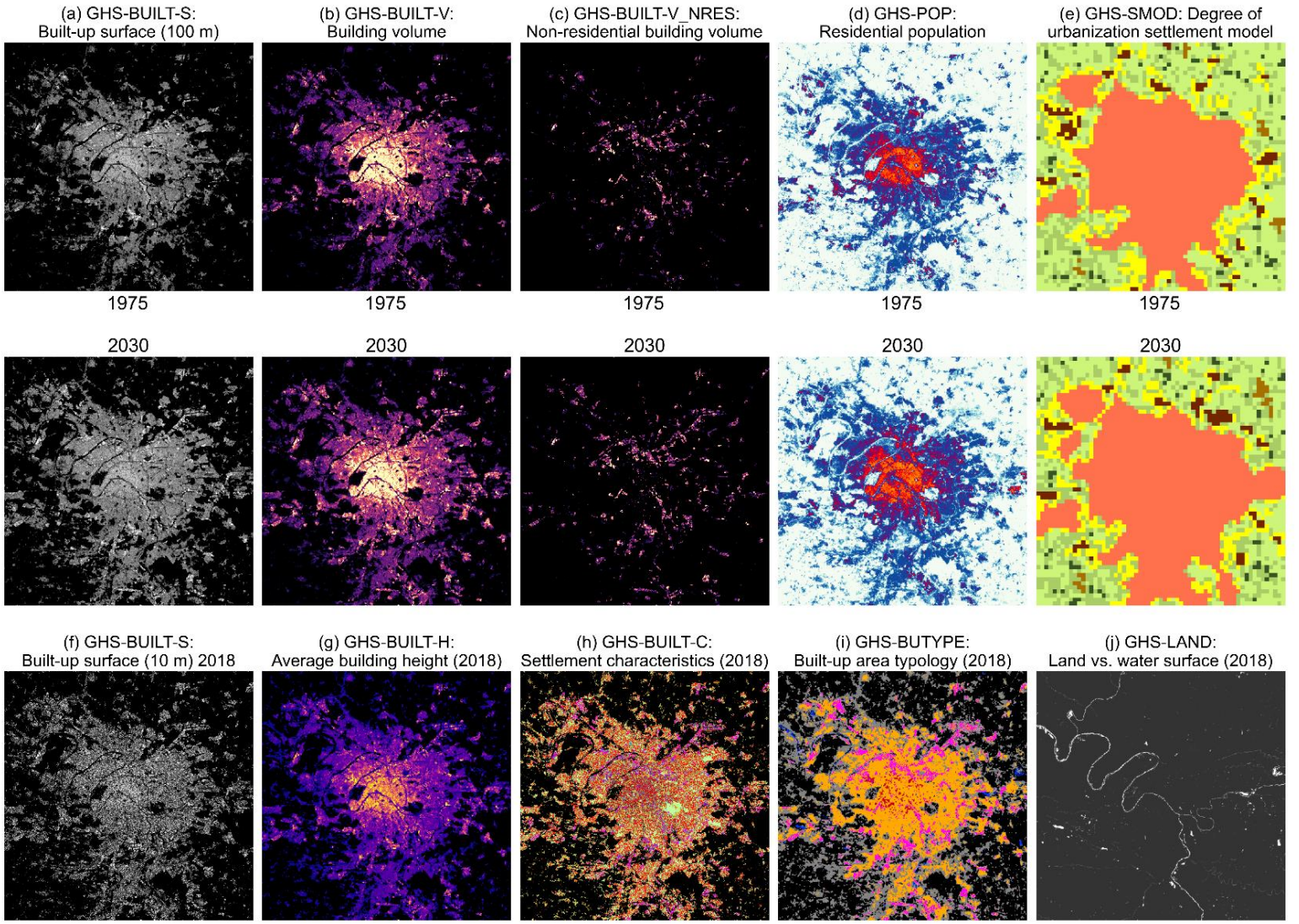
- Built-up surface [m²]
- Building height [m] & volume [m³]
- Residential/non-residential classes
- Residential population
- Degree of Urbanisation
- Settlement characteristics

Spatial Resolution

- 10 (2018), 100, 1000 m

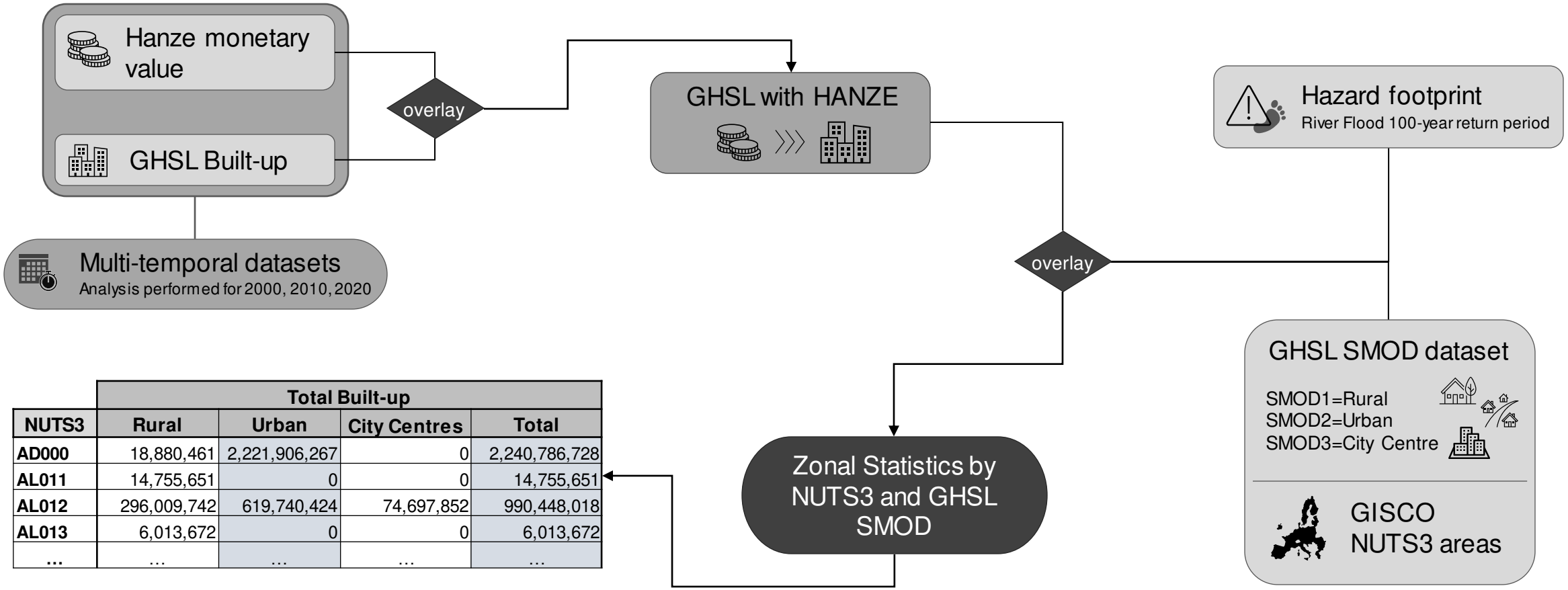
Landsat-Sentinel-2 timeseries

- 1975-2030 in 5 years interval



Pesaresi, Martino, et al. "Advances on the global human settlement layer by joint assessment of earth observation and population survey data." *International Journal of Digital Earth* 17.1 (2024): 2390454.

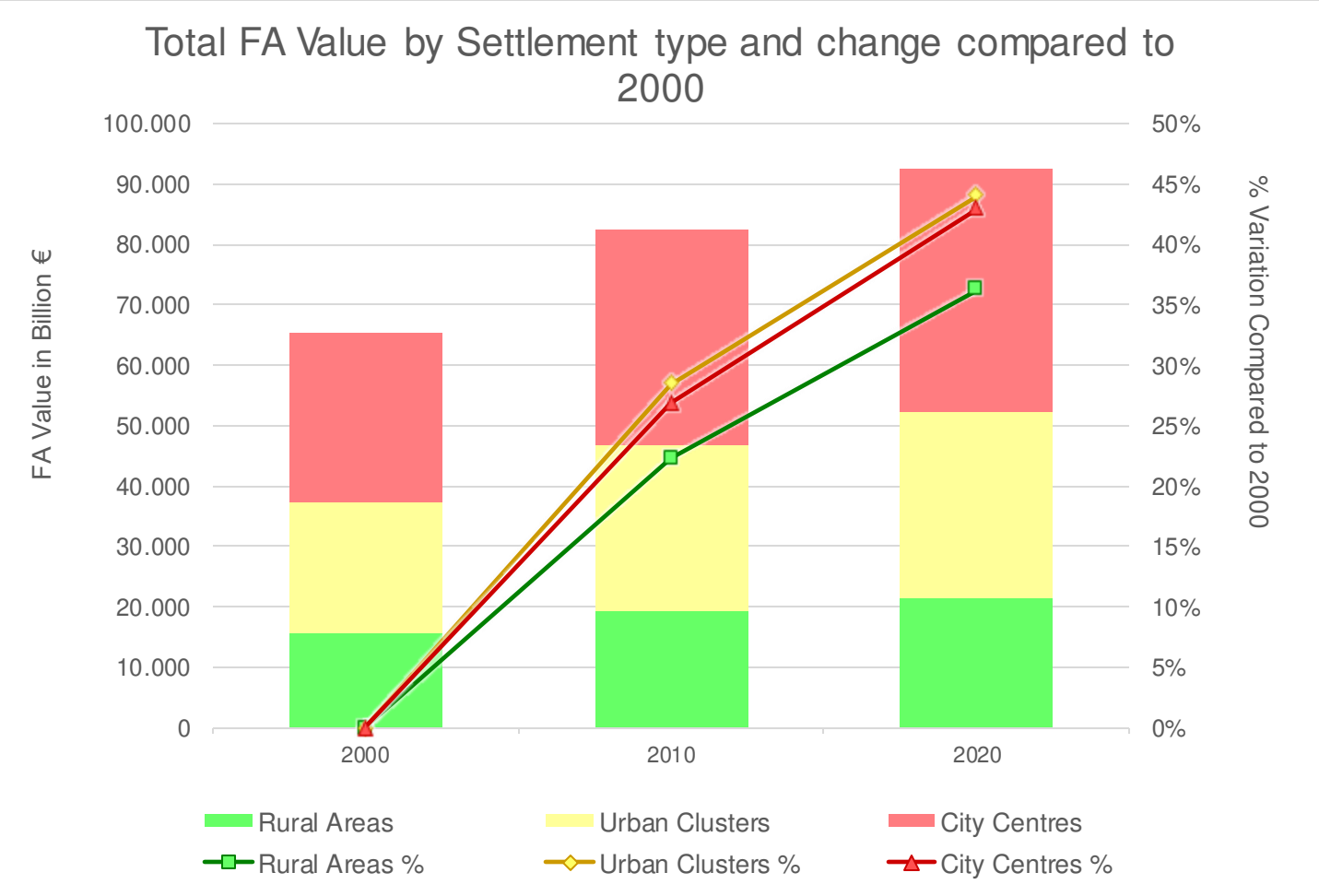
Method – geospatial data integration



	Total Built-up			
NUTS3	Rural	Urban	City Centres	Total
AD000	18,880,461	2,221,906,267	0	2,240,786,728
AL011	14,755,651	0	0	14,755,651
AL012	296,009,742	619,740,424	74,697,852	990,448,018
AL013	6,013,672	0	0	6,013,672
…	…	…	…	…

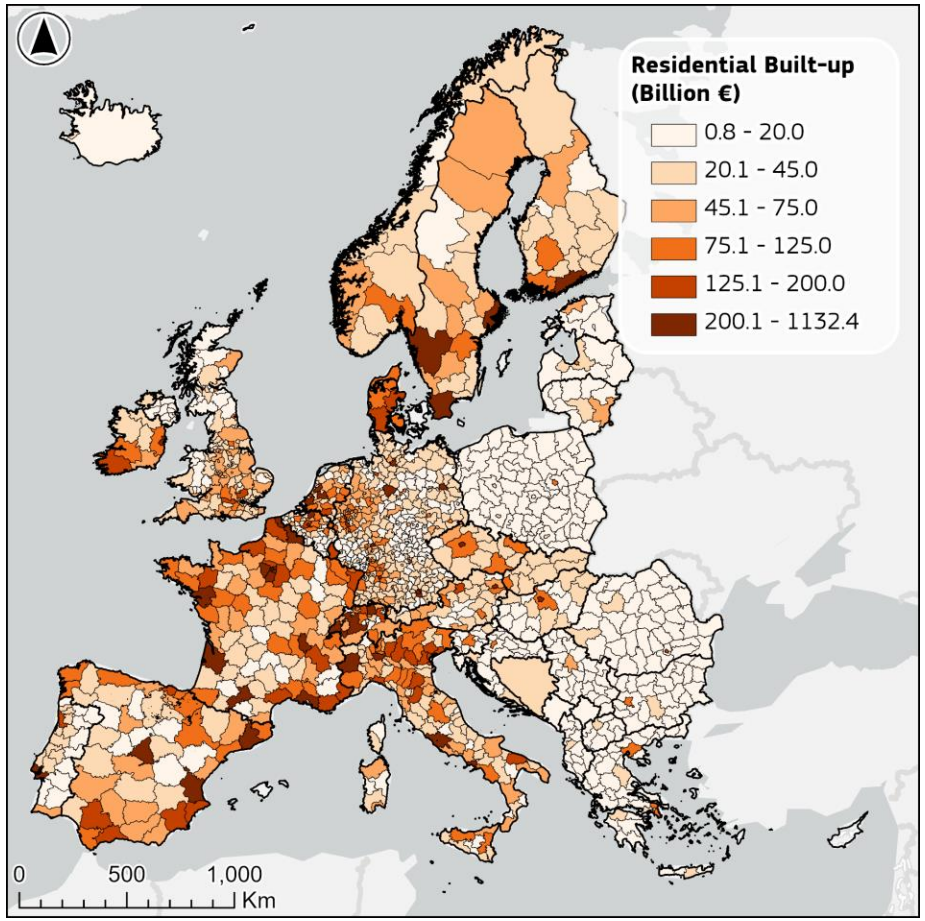
Zonal statistics FAV(€), FAV per km^2, FAV per sector (built-up RES, NRES, contents), by settlement type

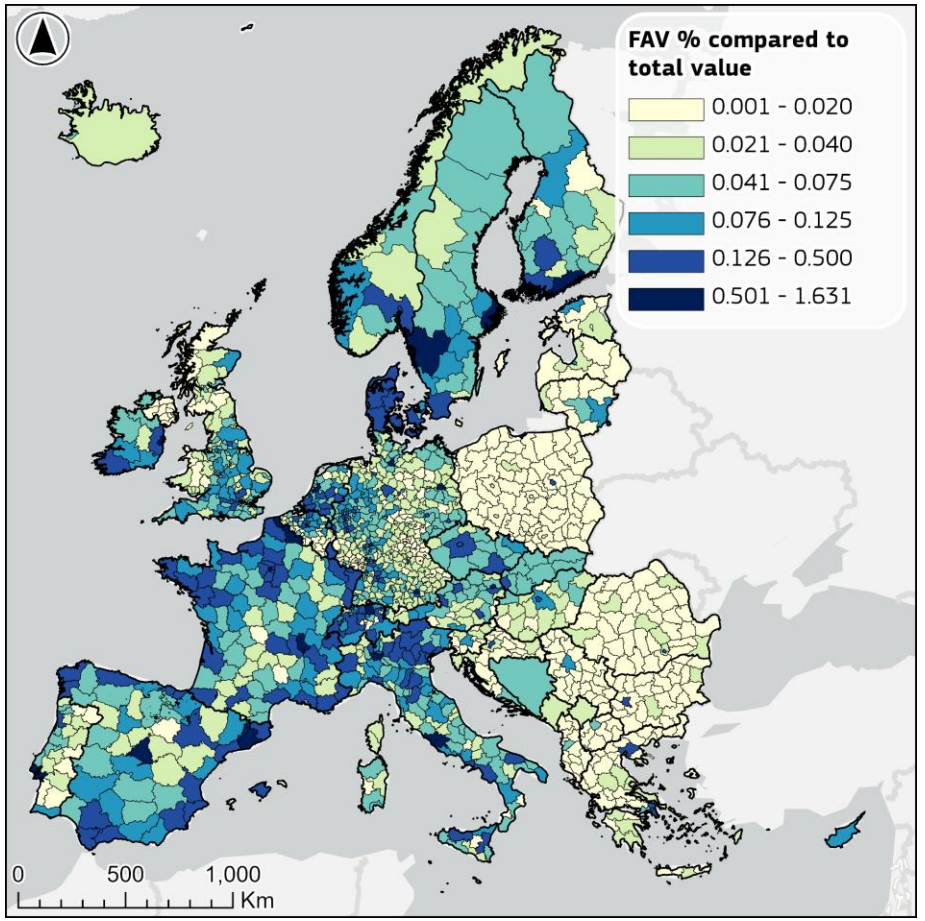
Fixed Assets in Pan-EU HS ~92 T€

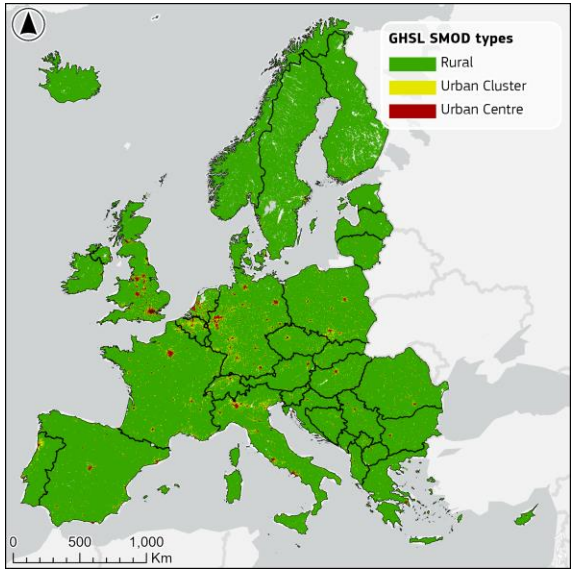


- Between 2000 and 2020 FAV increases by 43% in urban centres and 44% in urban clusters, compared to 35% in rural areas
- weight of cities and towns with ~75% of FA – proportion is constant over time

Gross FAV per subnational division

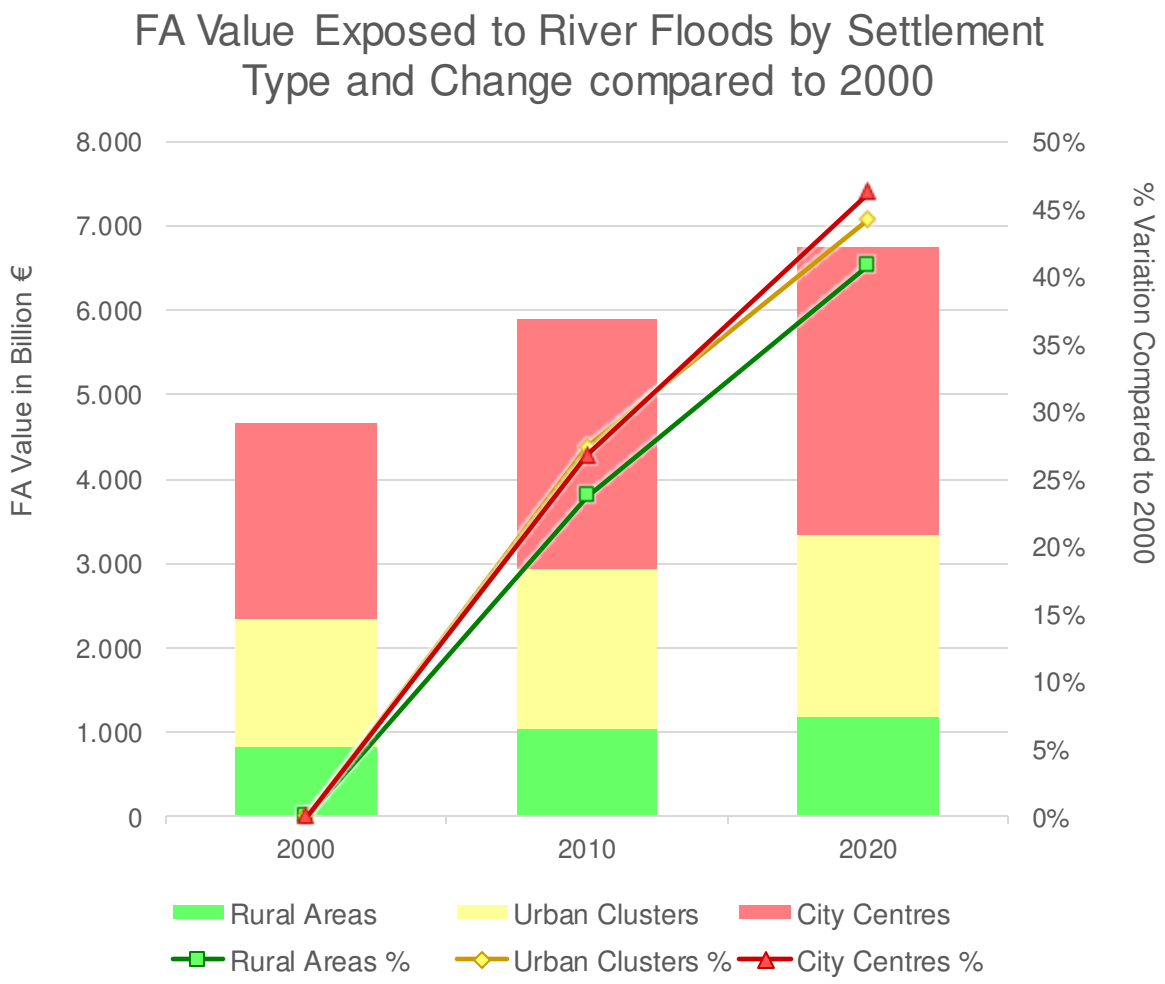


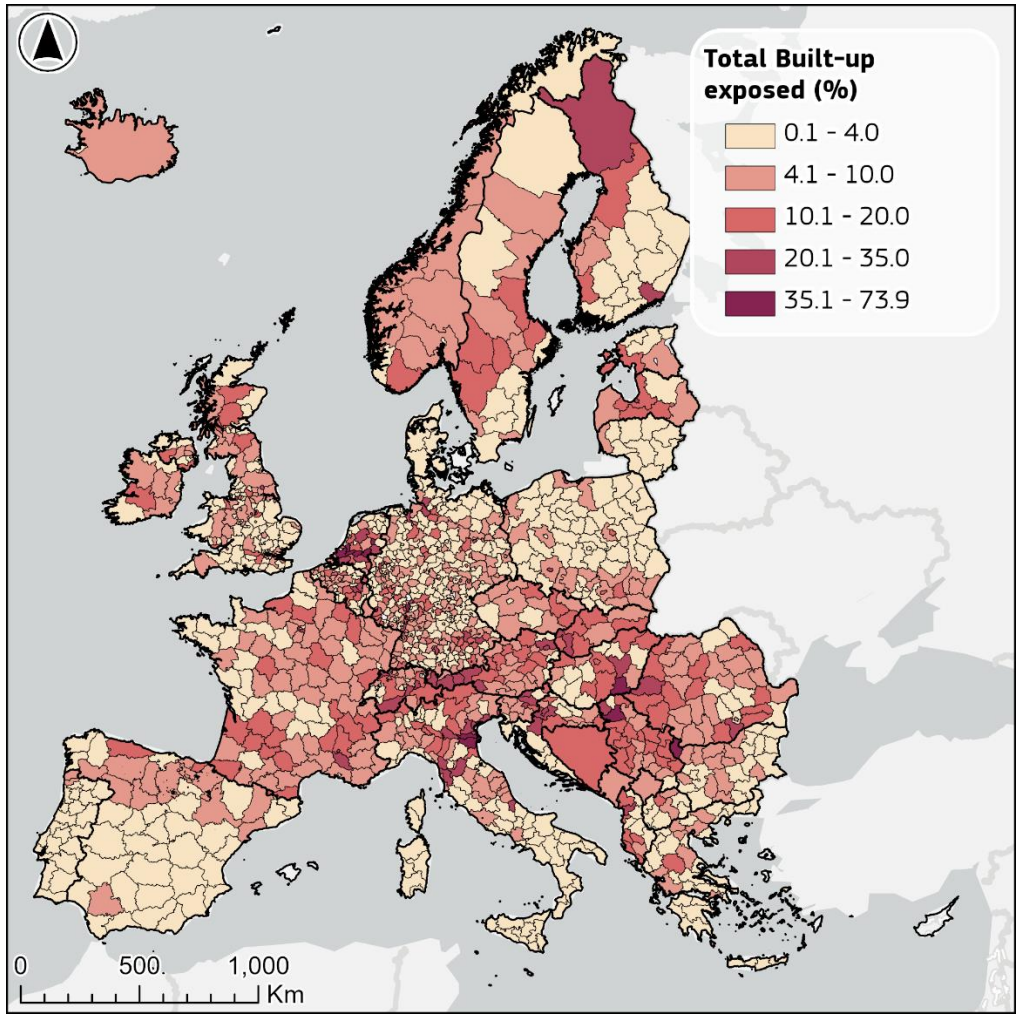




Year of reference of the maps: 2020

FAV exposure to floods over time by settlement type





Year of reference of the map: 2020

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Risk Data Hub

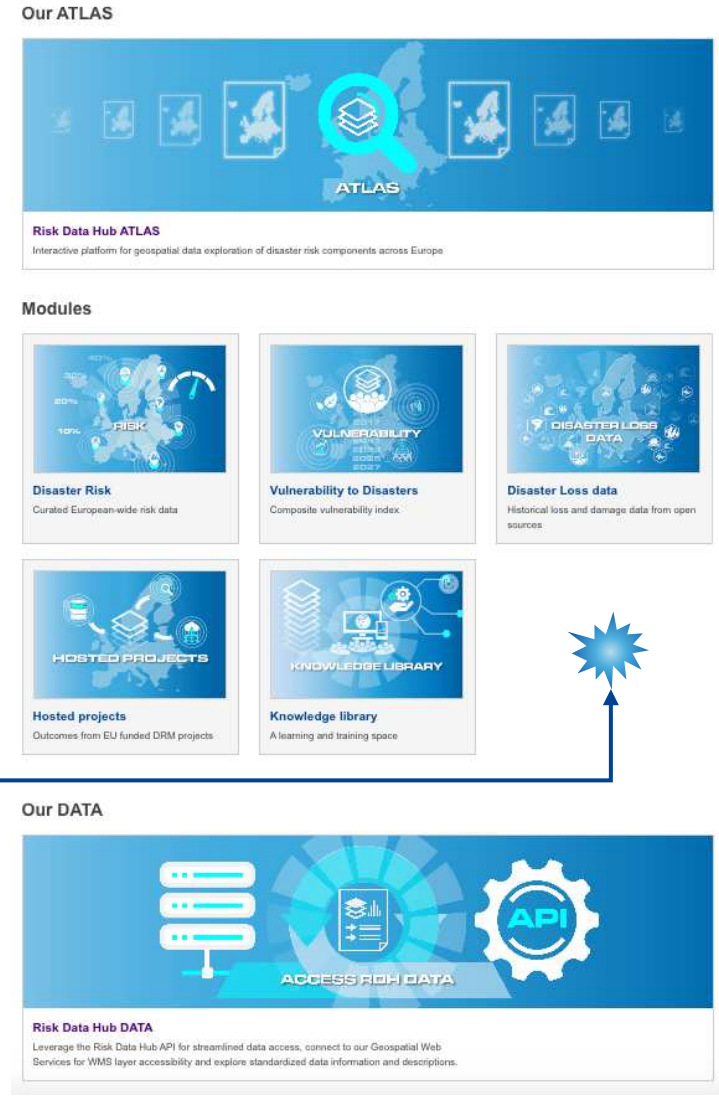
Next steps

Data visualization dashboard (desktop & mobile)

SCAN ME

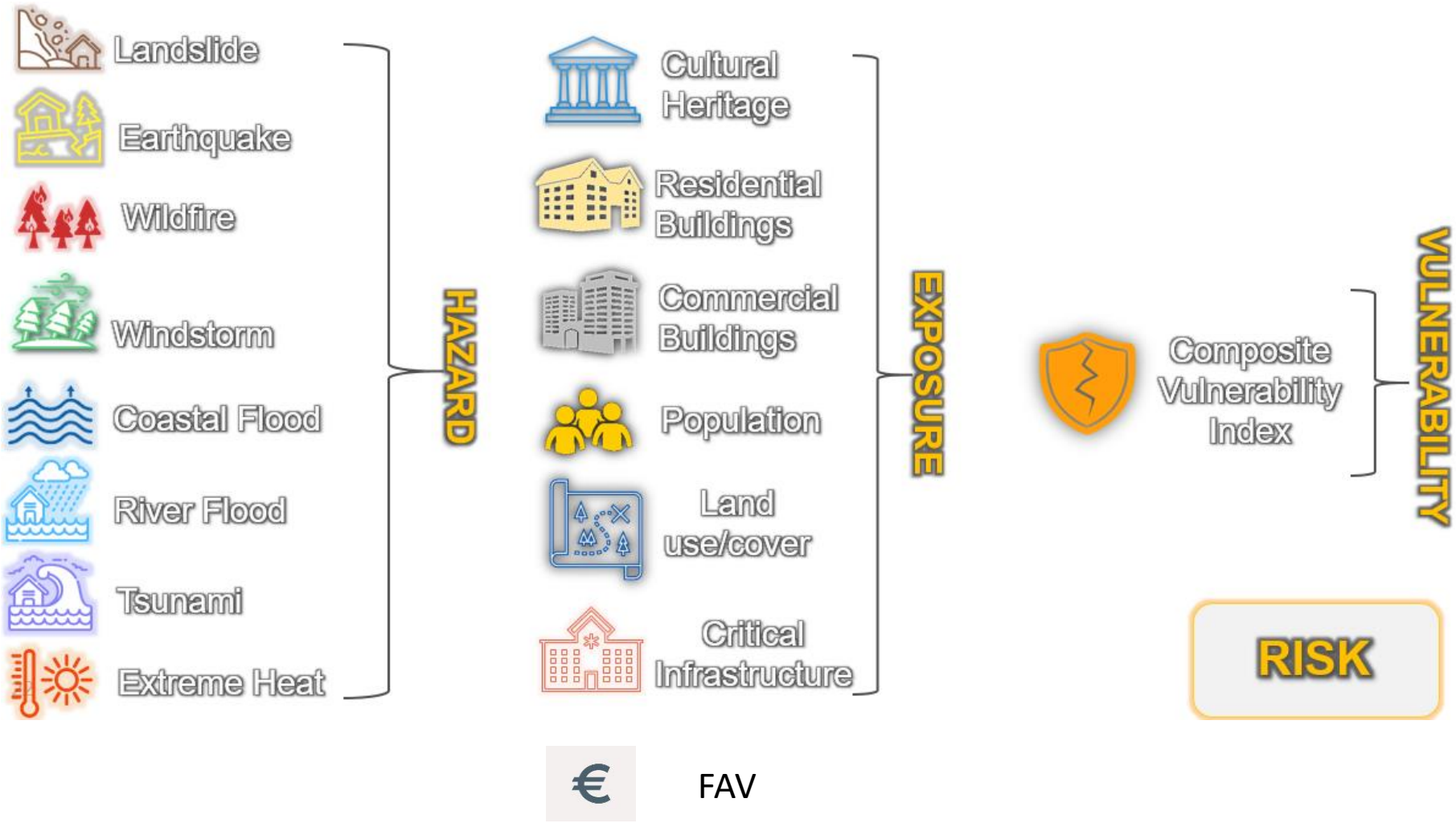
[Beta version](#) already available!

INTEGRATION



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

Next steps



- Extend the number of hazard
- Fully integrate the FAV indicator among the exposure ones in the RDH
- Pilot impact assessment from MYRIAD data (database of events with geospatial extent)

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

Risk Data Hub

Thank you

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OPEN ACCESS

Advances on the Global Human Settlement layer by joint assessment of earth observation and population survey data

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https://human-settlement.emergency.copernicus.eu/

FAV technical description

Regional GDP is split partially proportionally to population and partially according to land-use (with soil sealing where appropriate). In this way, both **labour** (part of the total population) and **capital** (connected to land-use) input to GDP is represented. Labour share of GDP in advanced countries is about 60% and has been relatively stable over time[54].

Hence, 60% of GDP is disaggregated according to population and the remaining 40% using land use. Fixed assets in absolute terms per region are computed by **multiplying regional GDP, or a sector thereof, by the respective wealth-to-GDP ratio for each sector, as defined by variables "Fixed assets"** (Table 6).

Housing and consumer durables are distributed according to total population, as they are most closely related to population distribution. Other assets, related to economic activities, are distributed to appropriate land use classes, proportionally to the degree of soil sealing. Finally, **infrastructure is distributed to urban and industrial land** (CLC classes 111–121) **proportionally to the area covered by roads and streets, and to roads/railways, ports, and airports** (CLC classes 122–124) proportionally to the degree of soil sealing.

Paprotny, D., & Mengel, M. (2023). Population, land use and economic exposure estimates for Europe at 100 m resolution from 1870 to 2020. *Scientific Data*, *10*(1), 372.

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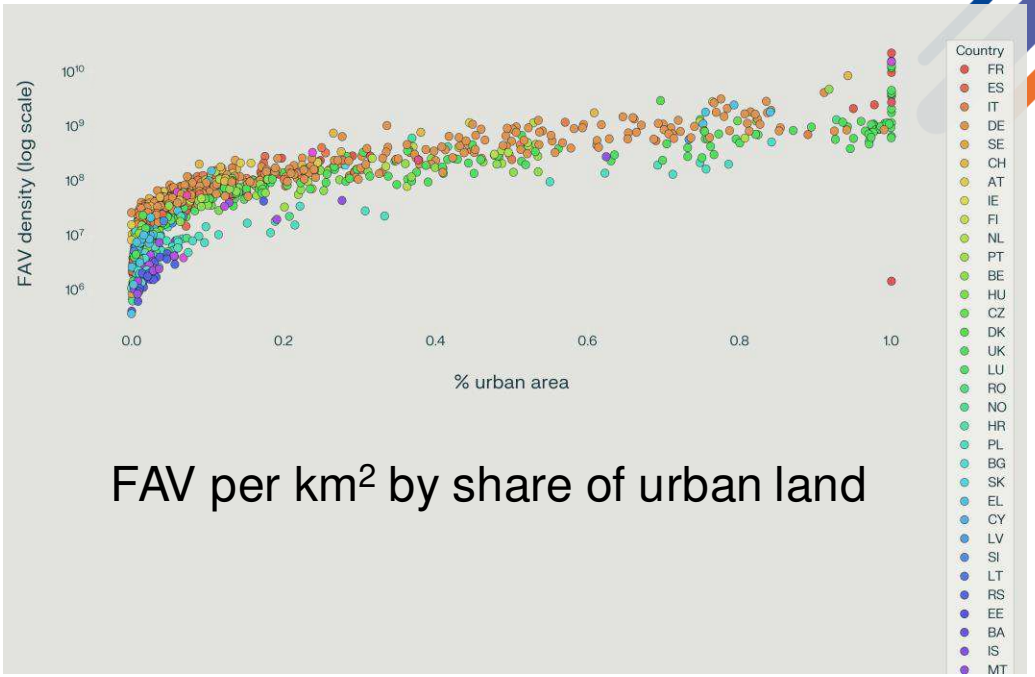
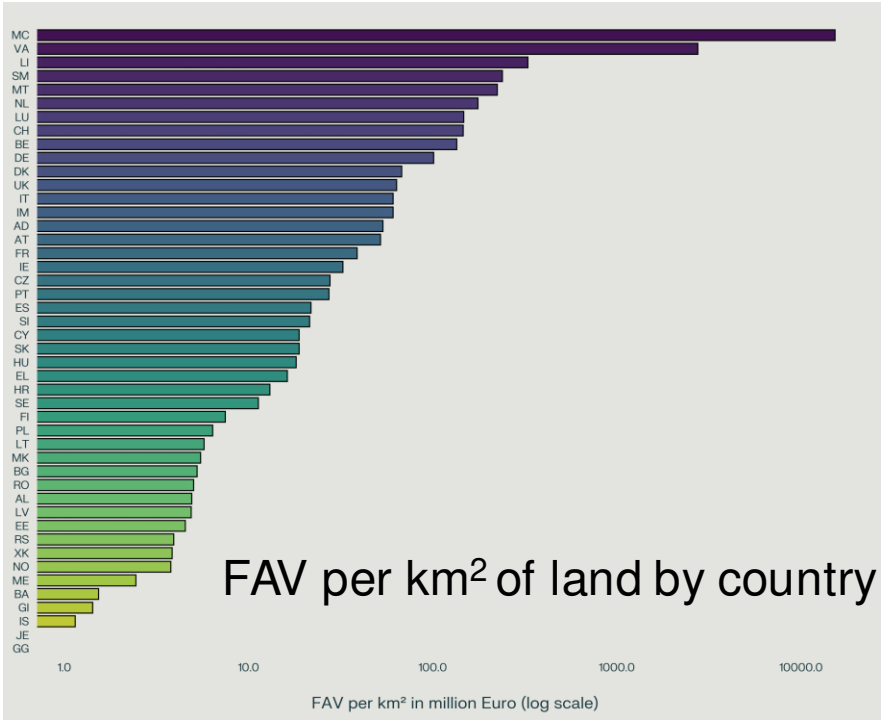
Some considerations II *next steps*

- Descriptive statistics
  - Rank NUTS by FAV
  - Rank-size distribution

- Indicators
  - Average FAV per km² by country (land),
    - And relative change over time
  - Average FAV per km² per settlement type
    - Exposure to various return periods
  - Share of exposed FAV per NUTS3



FAV per km² by share of urban land



FAV per km² of land by country