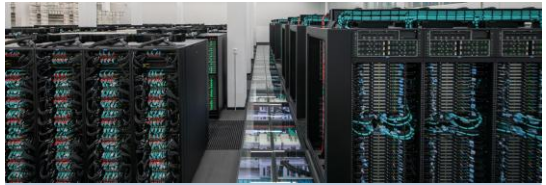
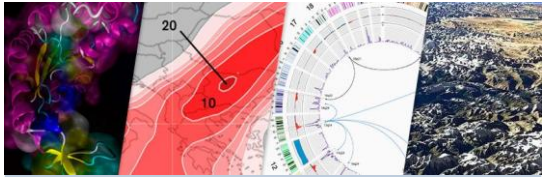
vCity: human-centric digital twins

Barcelona Supercomputing Center
Centro Nacional de Supercomputación



Supercomputing services for researchers in Europe



R&D in Computer Science, Life Sciences, Earth Sciences and Engineering

PhD programmes, Tech transfer

MARENOSTRUM 5

A EUROPEAN PRE-EXASCALE SUPERCOMPUTER
Total investment: **~350 M€**

314 Petaflops peak performance (314×10^{15})
Will facilitate world-changing scientific breakthroughs like the creation of digital twins and the advancement of precision medicine.

HOSTING CONSORTIUM:

Spain Portugal Turkey

The acquisition and operation of the EuroHPC supercomputer is funded jointly by the EuroHPC Joint Undertaking, through the European Union's Connecting Europe Facility and the Horizon 2020 research and innovation programme, as well as the Participating States Spain, Portugal, and Turkey

Euro HPC: Towards European HPC Technologies

EuroHPC-Ju members

Austria, Belgium,
Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece,
Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and Turkey.

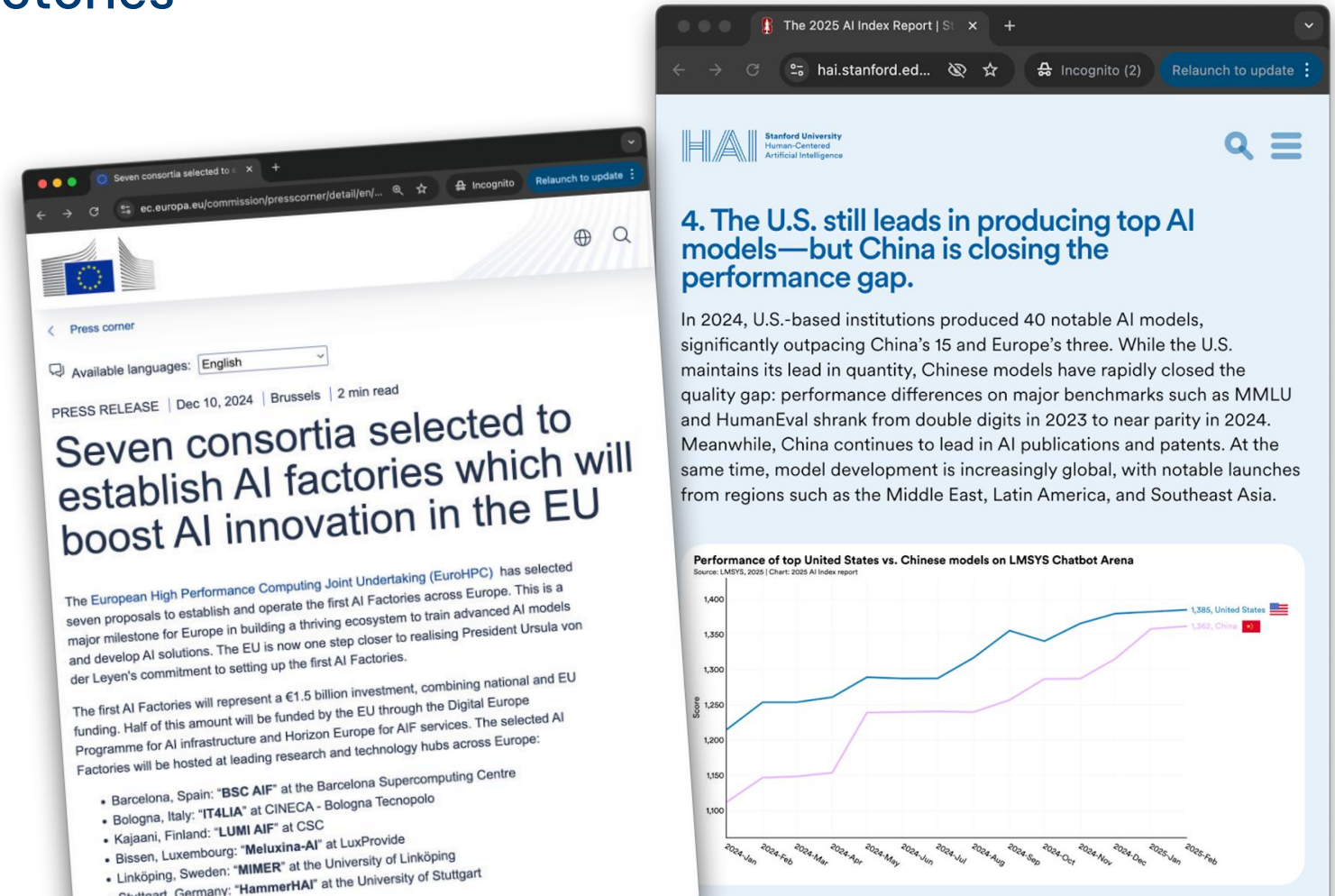
ETP 4 HPC BDV UIC

EuroHPC Joint Undertaking

"A new legal and funding structure – the EuroHPC Joint Undertaking – shall acquire, build and deploy across Europe a world-class High-Performance Computing (HPC) infrastructure.

It will also support a research and innovation programme to develop the technologies and machines (hardware) as well as the applications (software) that would run on these supercomputers."

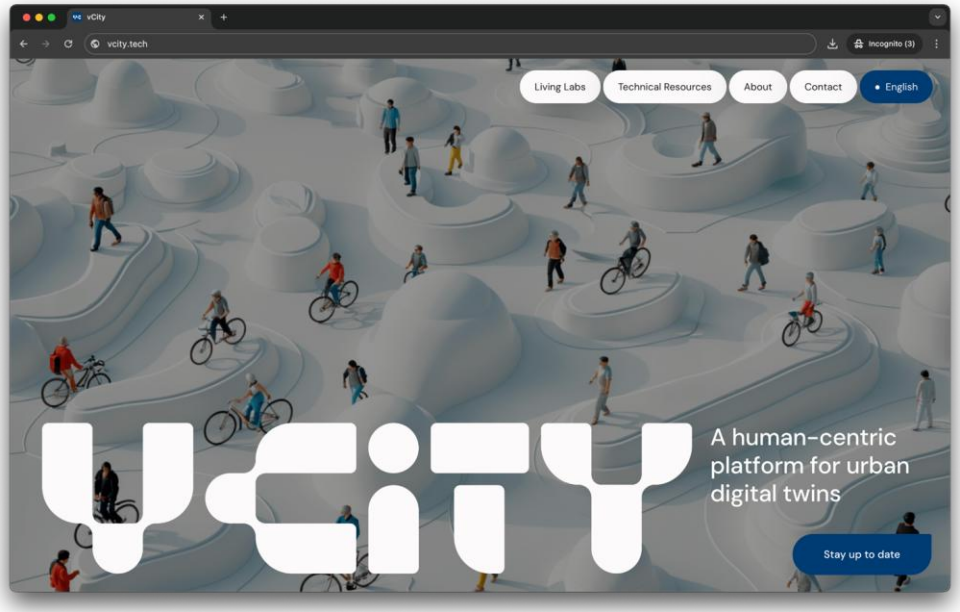
AI Factories



vCity

vCity
Planning an urban future that puts citizens first.

- vCity: evidence-based platform to help assess the impact of new interventions on all aspects of city life.
- human-centric, modular, adaptable
- 20+ multidisciplinary team
- 30+ subcontractors



Funded by the European Union NextGenerationEU
UNICO I+D Cloud

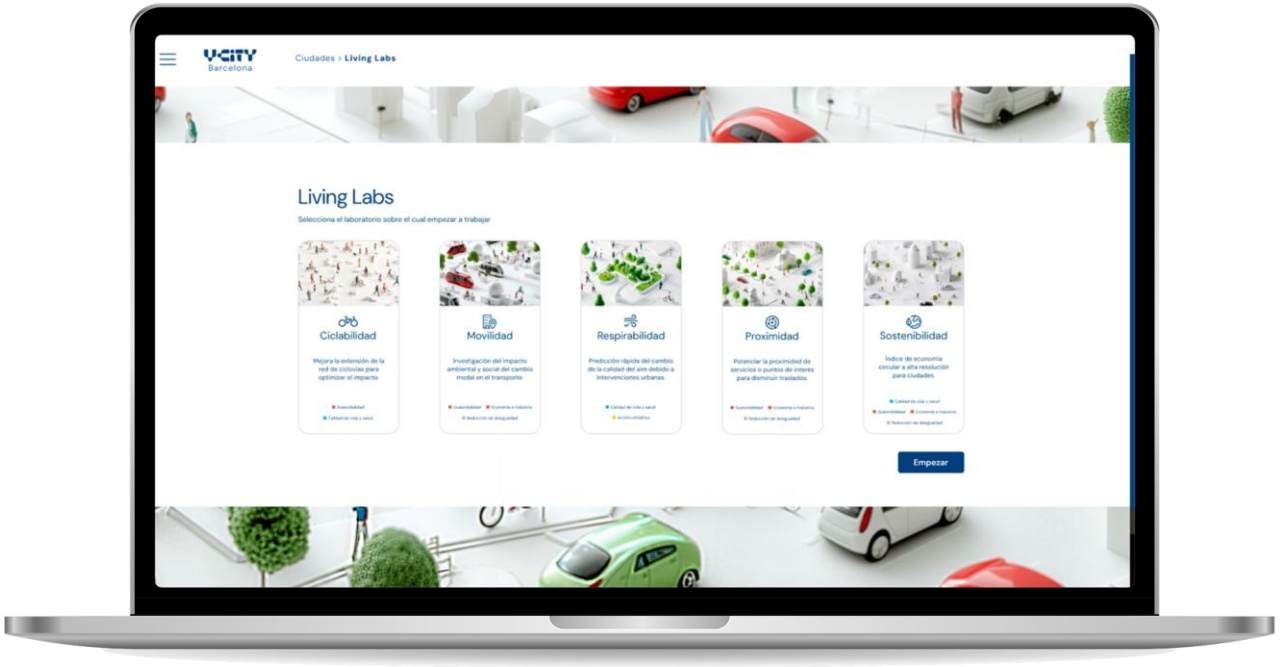
Platform + Use cases + studies

Co-creation process

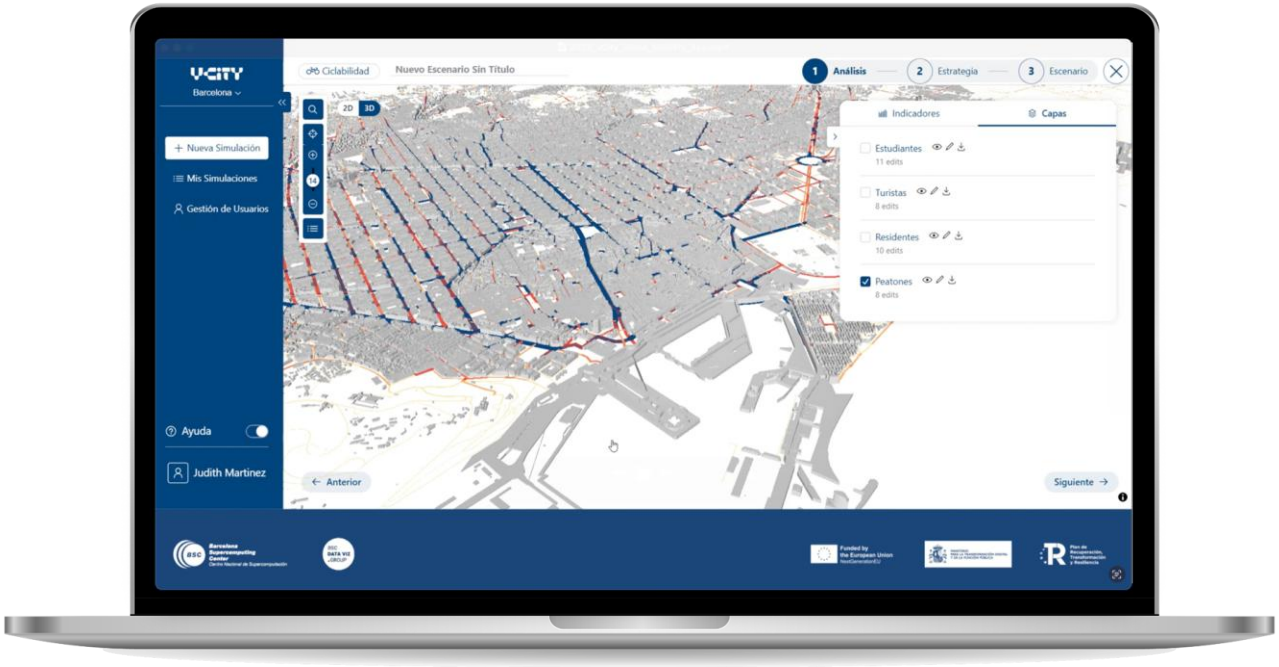
- With the cities involved
  - Barcelona, Spain
  - Viladecans, Spain
  - Kobe, Japan
- Use cases
  - scenarios
  - indicators
- UI/UX

vCity
Planning an urban future that puts citizens first.

vCity
Planning an urban future that puts citizens first.



vCity
Planning an urban future that puts citizens first.



vCity
Planning an urban future that puts citizens first.

Platform + Use cases + studies

Cycling

Plan and implement an efficient network of cycle lanes.

Breathing

Rapid prediction of air quality changes due to urban interventions.

Mobility

Investigate the environmental and social impacts of different dimensions of multimodal transport.

Sustainability

Extend the circular economy index to high resolution for cities.

Proximity

Promote the proximity of services or points of interest to reduce transfers.

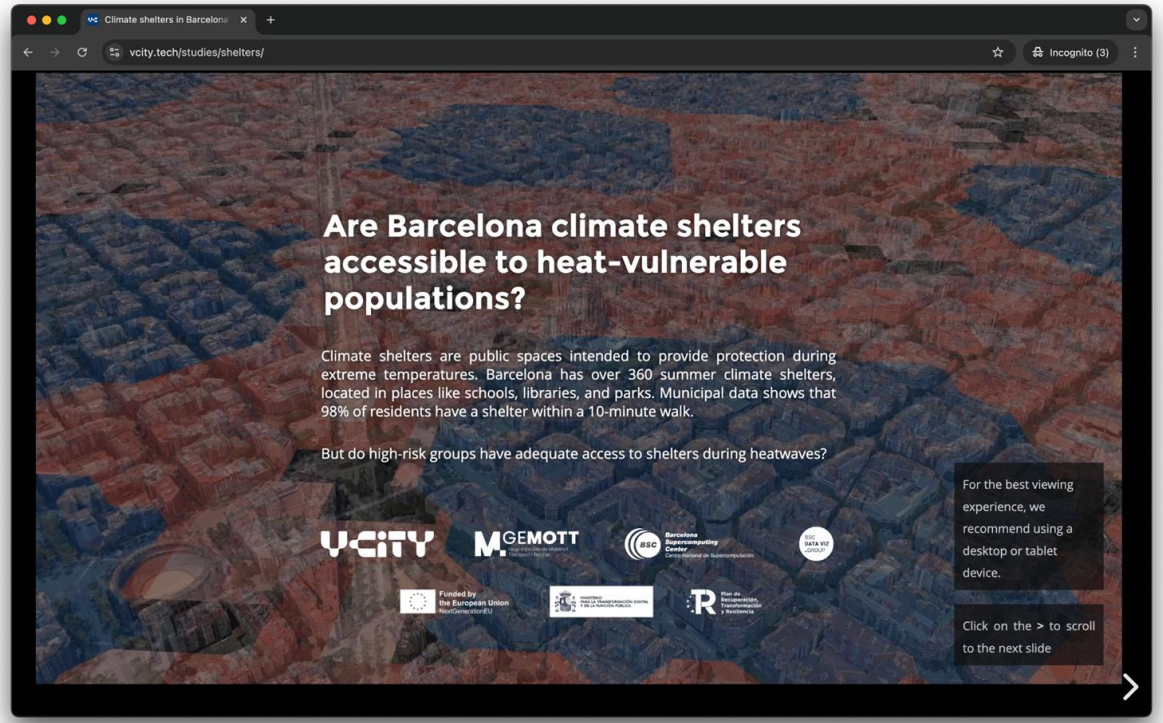
Quality of life and health | Industry and economy | Sustainability | Reduction of inequalities | Climate Action

Platform + Use cases + **studies**

vCity studies: circular city index

https://www.vcity.tech/studies/circular

vCity studies: climate shelters



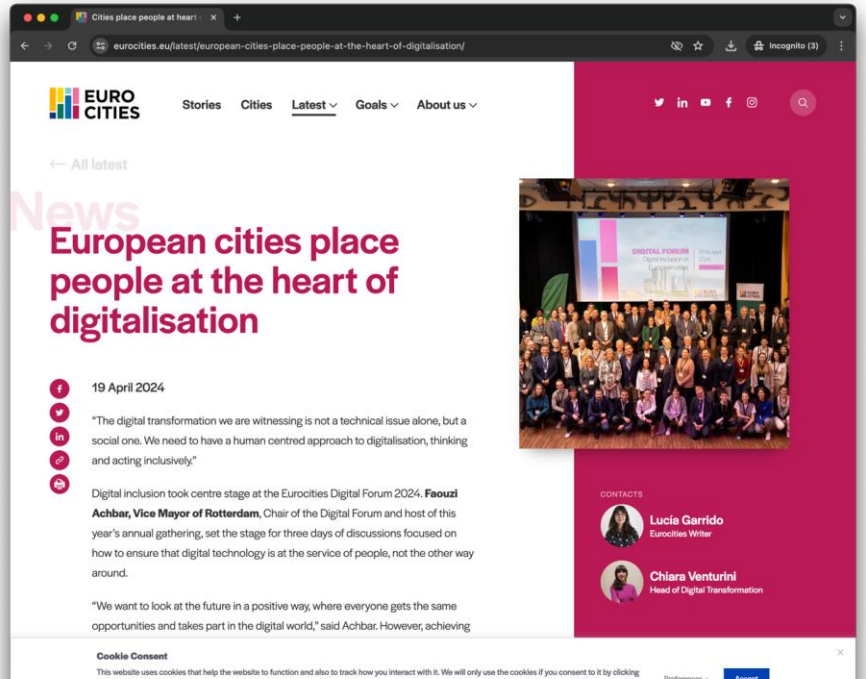
https://www.vcity.tech/studies/shelters

04

People-centred solutions

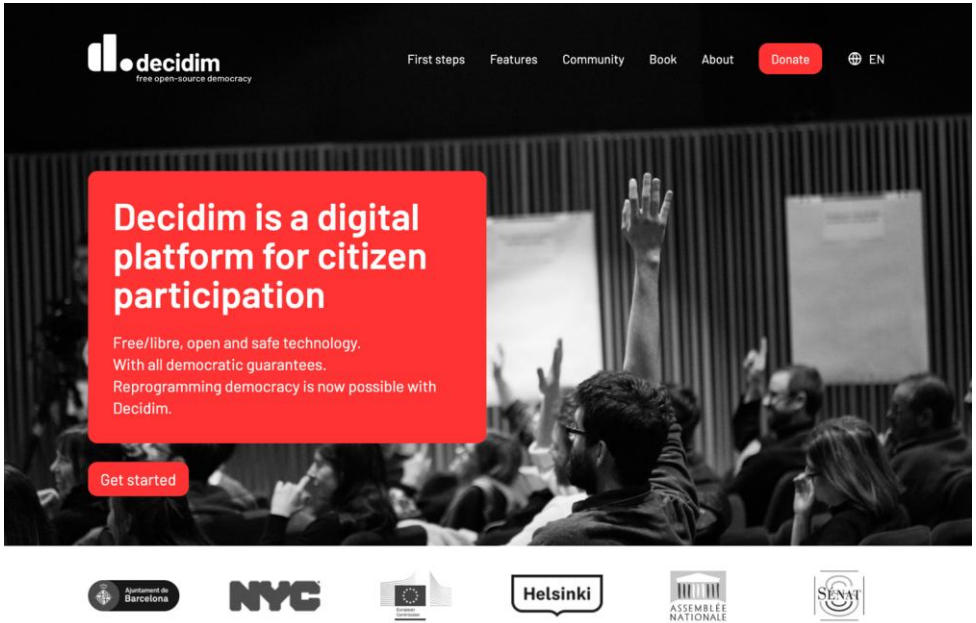
Eurocities Digital Forum 2024

- *"Digitalisation should be **people-centred**"*
- *"The **smartest** cities are the most **sustainable**"*
- Digital **inclusion**



Participatory democracy

- What do **citizens want** for their **city**?
- How citizens **feel** about their **city**?



05

Multidisciplinary effort

Data Analytics & Visualization Group


Fernando Cucchietti


Patricio Reyes


Carlos García


Laura Roldán


Guillermo Marín


Sol Bucalo


David García


Jerónimo Calderón


Marzieh Karimi


Marta Esteban


Paula Fernández


Marc Heras


Raquel Barrachina


Adria Espinoza

BSC
DATA VIZ
.GROUP


Roger González


Alex Gil


Luca Liebscht


Tomás Andrade


M´riam Herrero


Paula Méndez

vCity advisors

Ana Freire
Doctorado en Ciencias Informáticas

Diseño de metodología de transparencia en uso de GD

Andy Kirk
Experto en Visualización de Datos

Diseño de dashboards

Federica Bordelot
Directora de Política e Impacto

Diseño de metodología de reducción en el sesgo en GD

Federico J. Fernández
Investigador en Ciencias de la Computación

Ciencia de datos computacional

Francesca Bria
Profesora de Innovación

Diseño de políticas y estrategias de implementación de GD en ciudades

Francisco Rowe
Laboratorio de Ciencia de Datos Geográficos

Diseño de aplicaciones e interfaces para ciudadanía

Michael Szell
Profesor asociado

Diseño de aplicaciones e interfaces para ciudadanía

Thais Ruiz de Alda
Experta en tecnología y digital

Perspectiva de género en Tecnología

Rossano Schifanella
Profesor asociado e investigador

Diseño de arquitectura de Casos de Uso

Tania Marcos
Responsable de Calidad y Ciudades Inteligentes y Sostenibles

Diseño políticas de detección de sesgos

Vicente Guallart
Arquitecto

Estudio de aplicabilidad

Visitors

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Universitat Autònoma de Barcelona, Grupo GEMOTT, España

Yohsuke Murase
Riken, Japón

Carmen Cabrera
University of Liverpool, Reino Unido

Fabián Hernández
TEC Monterrey, México

Alex Capilla
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Roger González
Universitat de Barcelona, España

Miguel Carrasco
University of Los Andes, Chile

Tomás Andrade
Universitat de Barcelona, España

Paula Benito
Universitat Politècnica de Catalunya (UPC), España

Giovanni Mauro
ISTI-CNR, IMT Alti Studi Lucca, Italia

Luca Liebscht
Universitat Politècnica de Catalunya (UPC), España

Pablo Villar
NIC Chile Research Lab, Chile

Collaborators

300.000 Km/s	ARUP	CARTO	CETAQUA	DECIDIM	DigitalFems	Domestic Data Streamers
Eurocities	Festival Cruilla	Festival Sonar	GeoSolutions	Guadaltel	Guallart Architects	IAAC
Idealista	INTRA	iThinkUPC	LIS Data	Logicalis	MCrit	Memorandum
MongoDB	Taller Estampa	TC-Street	TomTom	Universidad Autónoma de Barcelona	University of Bologna	University of Liverpool
Universitat Oberta de Catalunya	Universidad Pompeu Fabra	University of Torino	Urbanly	Wizzie	Yonder	

Barcelona

Viladecans

Kobe

Your city

The UNICO-GDU-HPC project, part of the UNICO I+D Cloud programme, has the Ministry for Digital Transformation and of Civil Service and the EU-Next Generation EU as financing entities, within the framework of the PRTR and the MRR.

Thanks!

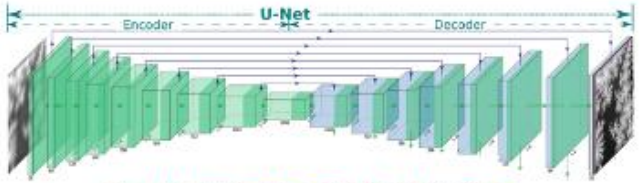
www.vcity.tech
hello@vcity.tech

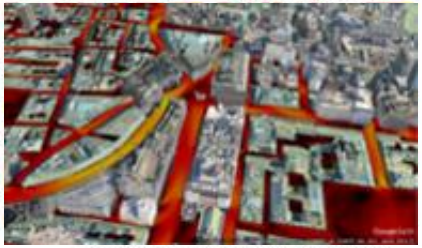
Patricio Reyes
Head of Urban Data Science
Data Analytics and Visualization Group
BSC

Fast prediction of air quality change due to urban interventions

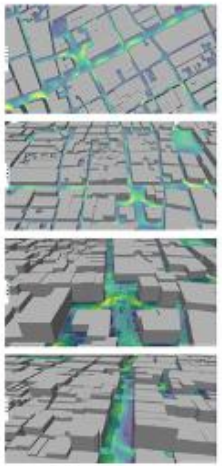
AI prediction of wind speed
Mobility provided emission map
Simplified contaminant advection
Demographics data/models (w/mobility)

Input: Geometry





CFD-based training dataset

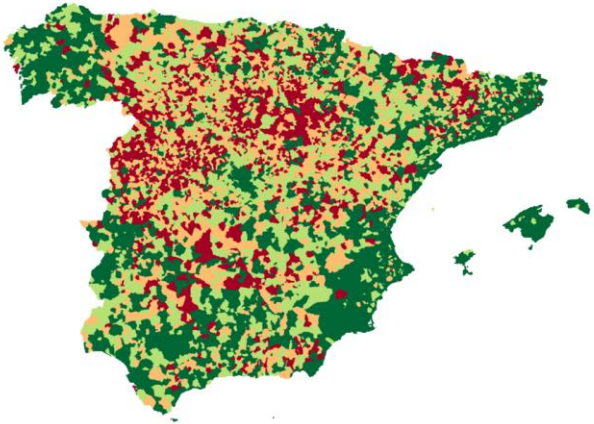


Output: Wind Field

Breathing

Compute scenarios of the circular city index at sub-city resolution

Data on 15 categories to estimate index (Publicly available datasets homogeneous for 16K municipalities in Spain and Italy)
Demographics growth model for scenarios

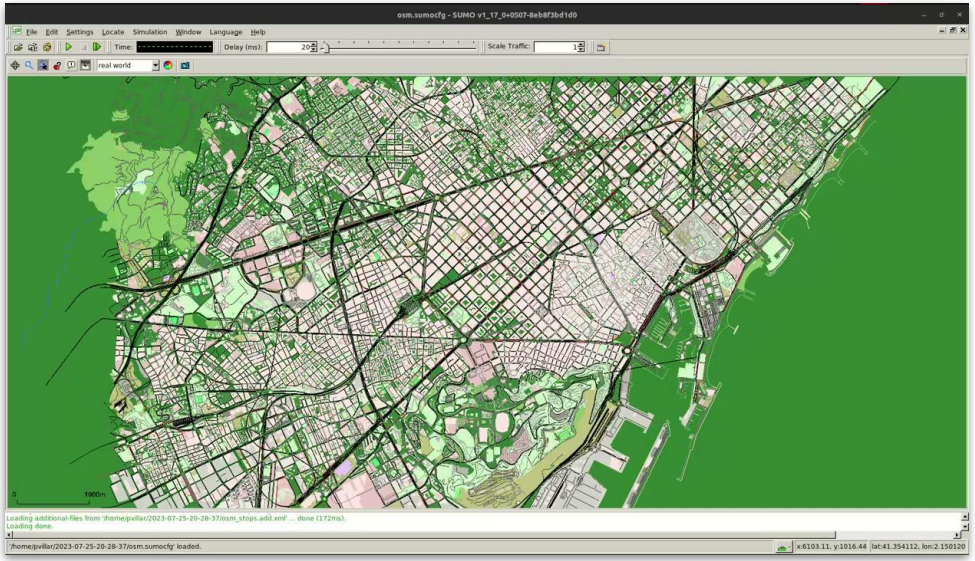


Circular City Index: An Open Data analysis to assess the urban circularity preparedness of cities to address the green transition -- A study on the Italian municipalities. Muscillo et al

Sustainability

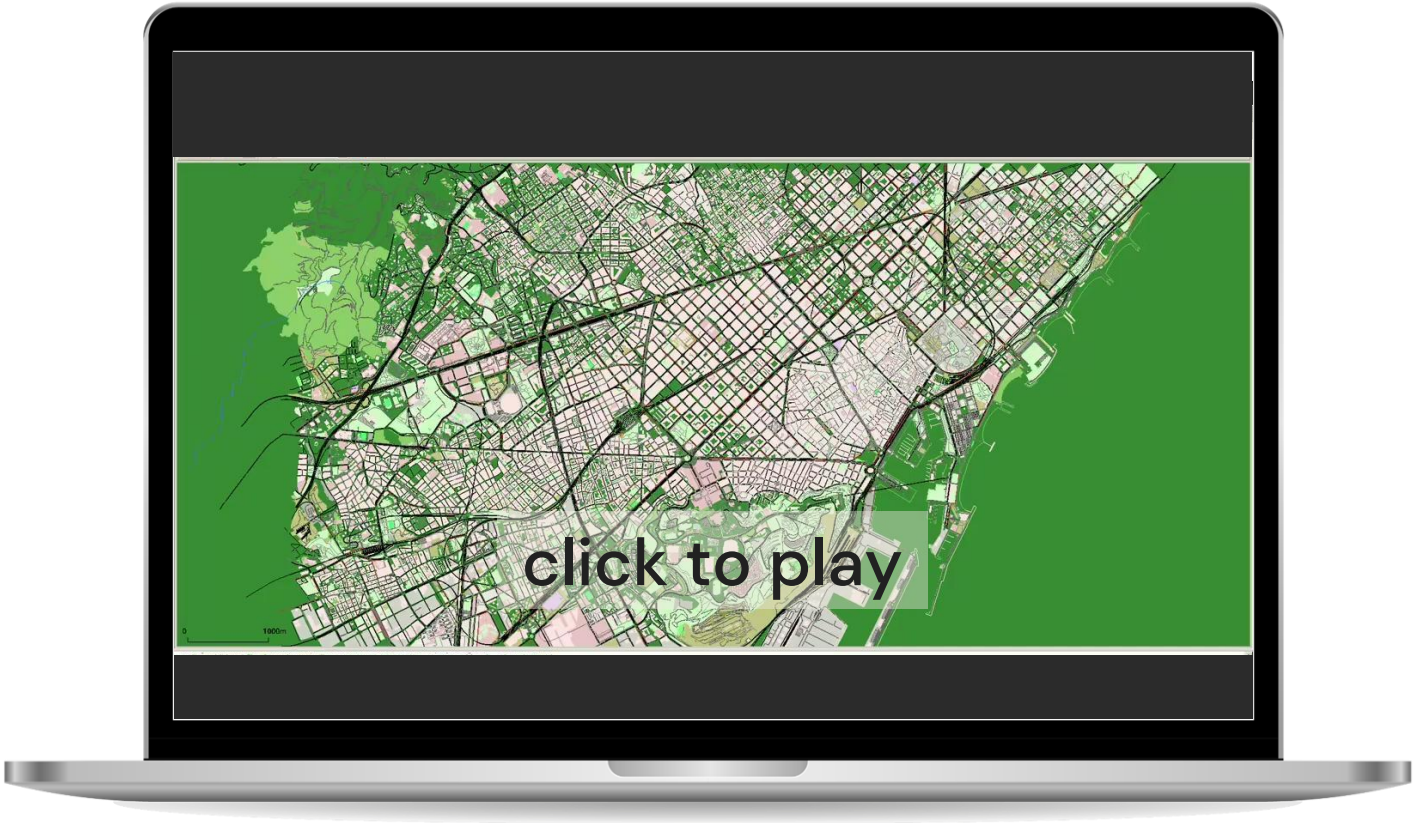
Pedestrian flow prediction

OD matrix prediction (from data and models)
Multi-modal mobility simulation (SUMO) from OD matrix



Mobility

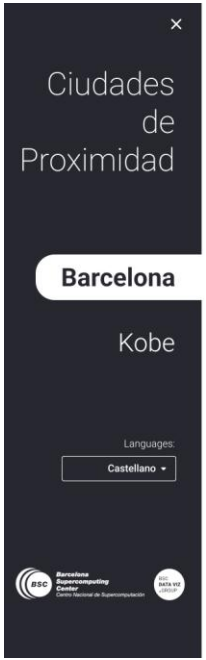
Urban mobility

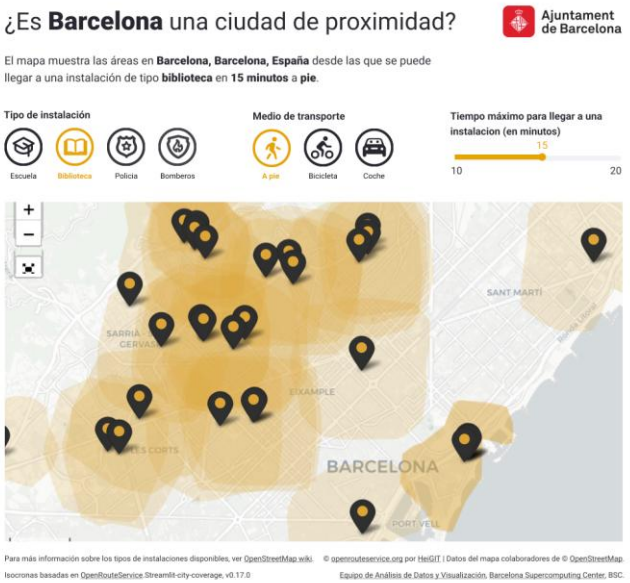


source:
vCity

Improve accessibility to daily needs.

Demographics models
Daily routines data
Mobility models
Proximity estimation
Relocation algorithm (in collaboration with Sony CSL)





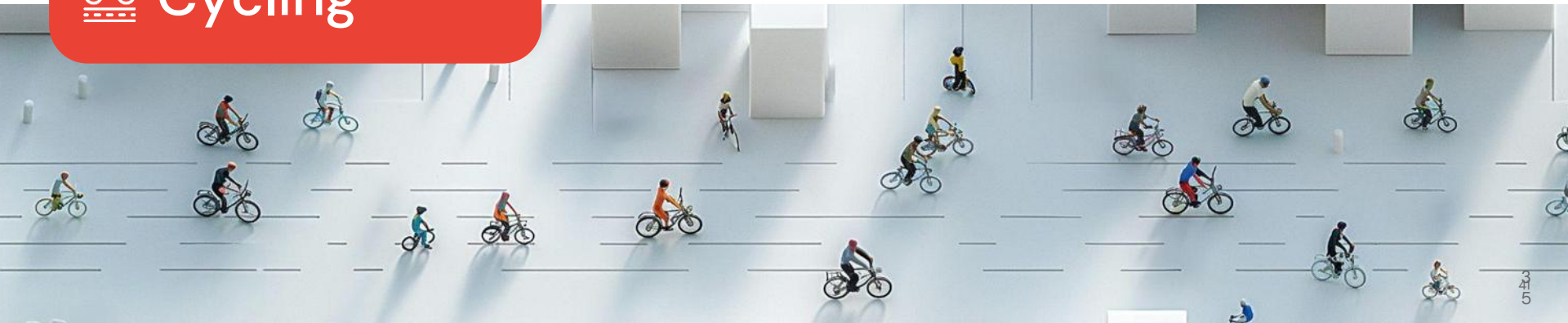
Proximity

Optimizing impact and ROI on bike network expansion

Based on data-driven graph-network optimization (M. Szell et al)

Incorporates socio-demographics and preference data to guide priorities in optimization.

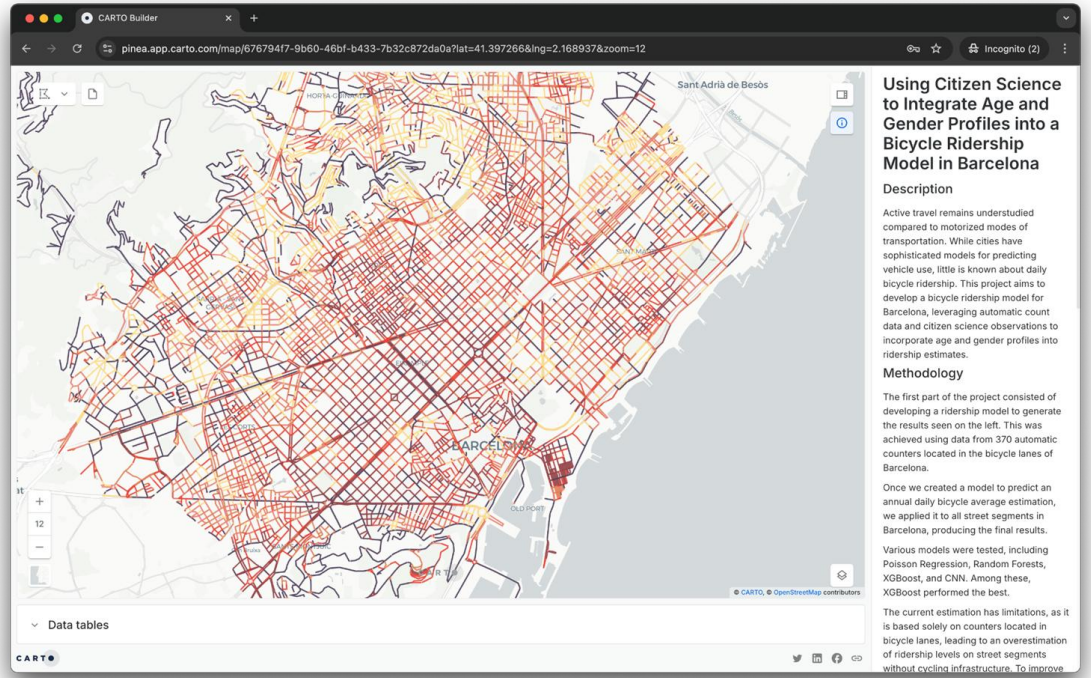
Cycling



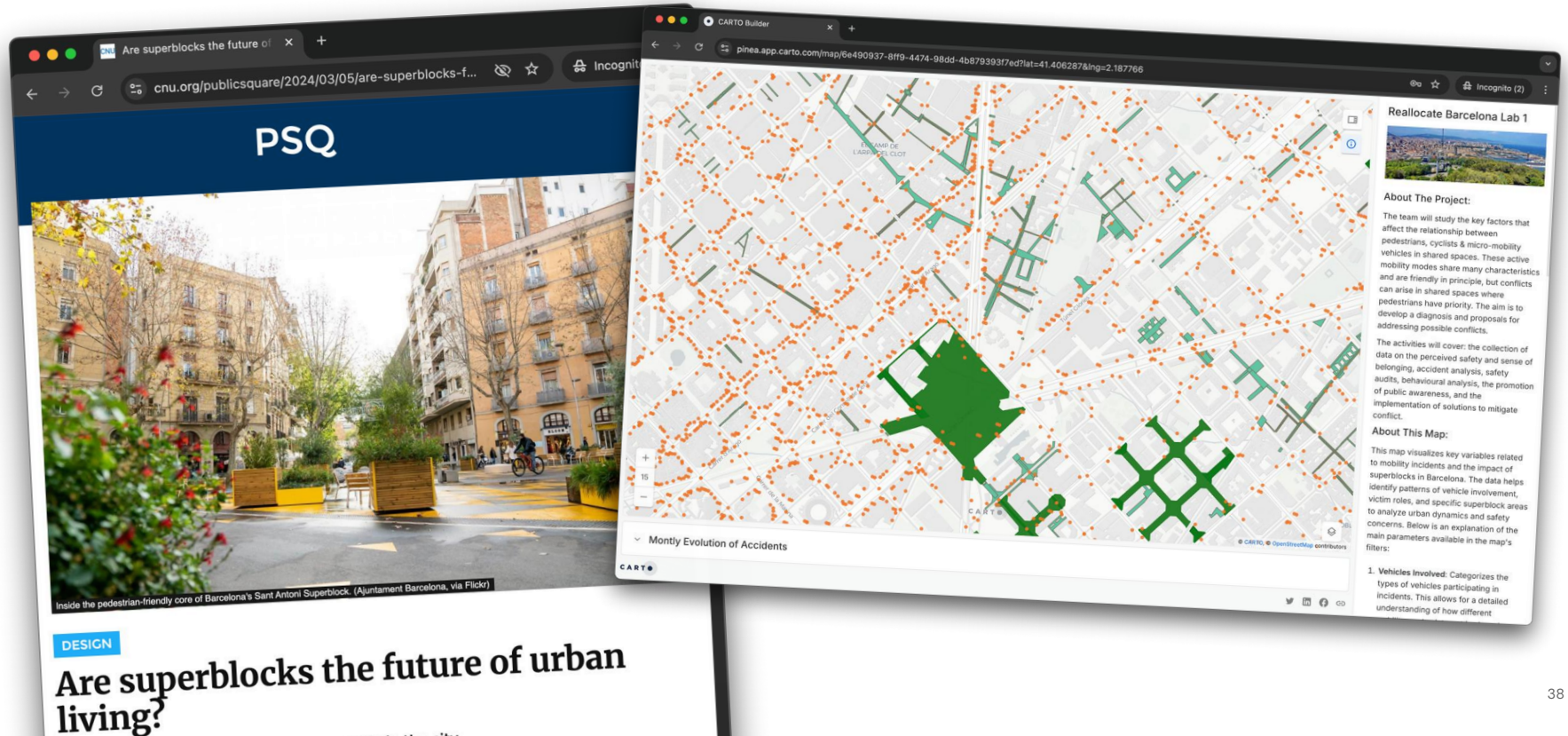
Projects related

Cyclepath traffic modeling

- Cyclepath categorization
- Data source:
  - Bike counters from city council
- External collaborators:
  - Jordi Honey-Roses (UAB)
  - Mintu Miah (SafeTREC, UC Berkeley)

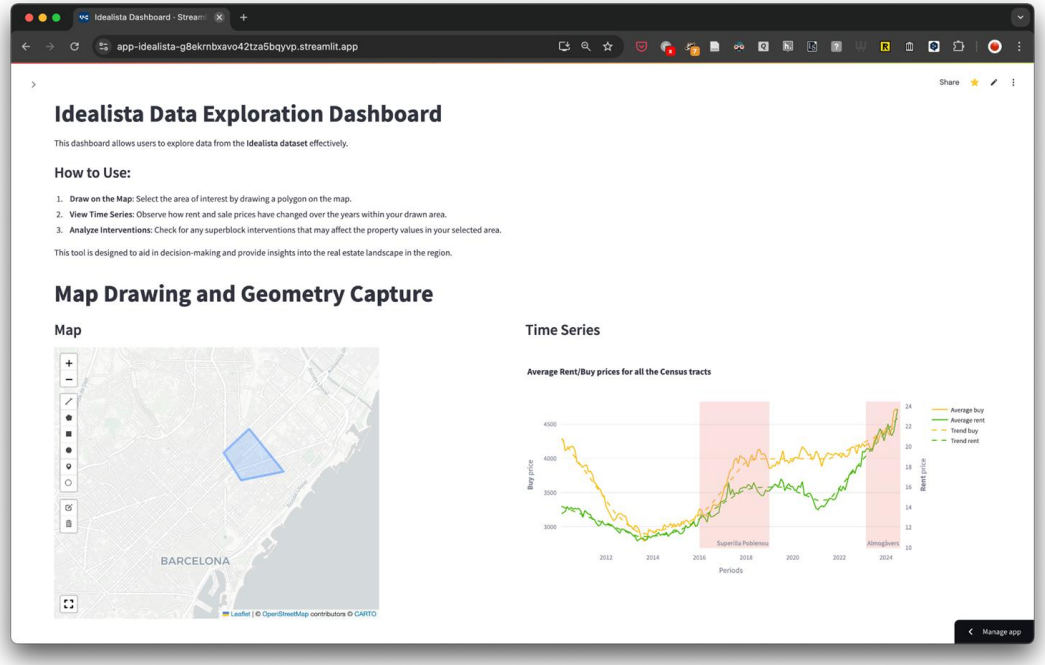


REALLOCATE: Urban interventions & accidents



Housing affordability

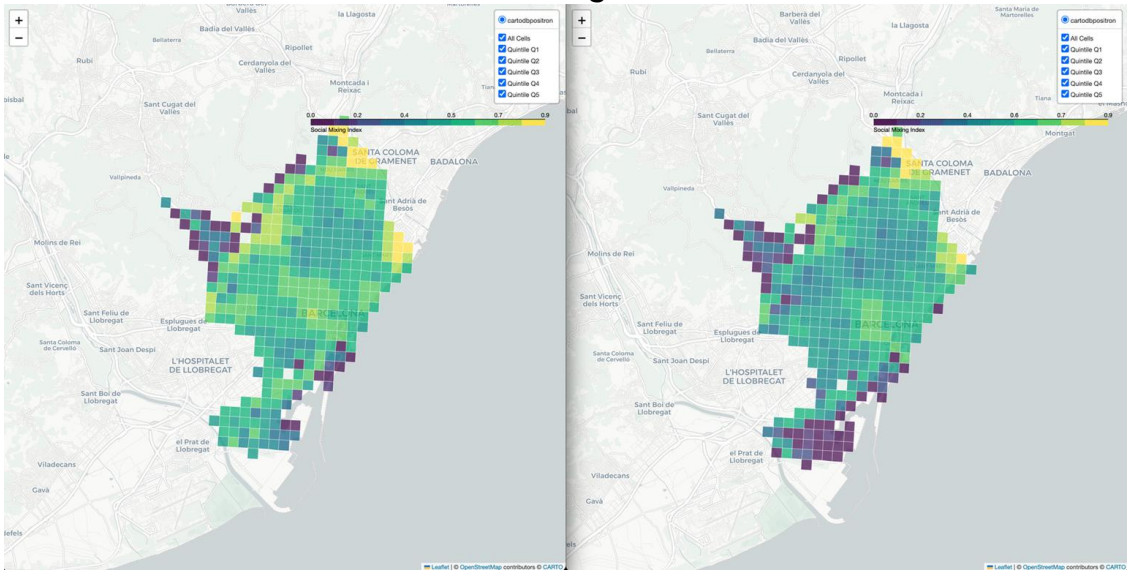
- Data: idealista.com
- buy/rent timeseries
  - 2010-2024
  - census-tracts (~1100)



Mobility justice & social-mixing

- Data: mobile phones
  - Spatio-temporal
    - 4h
    - 500m x 500m
  - home vs other activities

Social mixing indicator

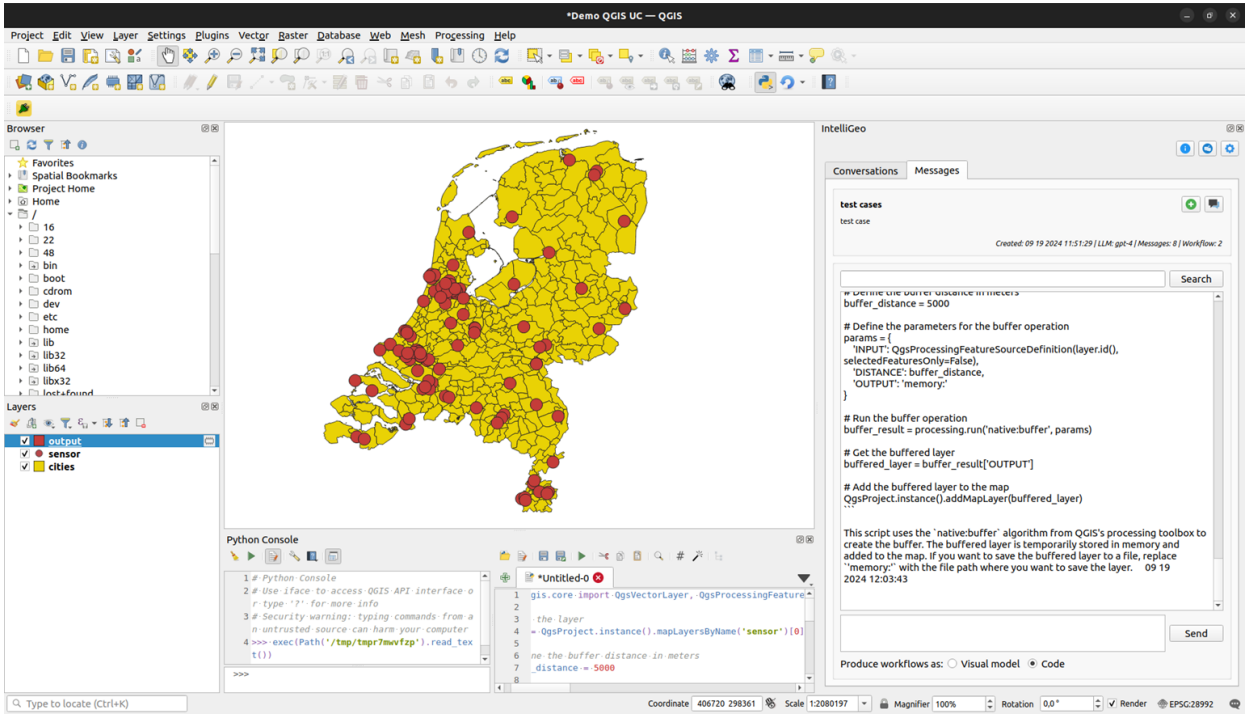


Monday to Friday

Saturday, Sunday

LLMs into GIS

- QGIS chatbot plugin
- www.intelligeo.org
- ITC, University of Twente



How to collaborate

- European research programme
- BSC AI-Factory
- 1-1 collaborations
    - Cities
    - Institutions