URBAN EUROPE

ERA-NET Cofund Urban Accessibility and Connectivity Sino-European call

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Integrated systems and analysis of urban Mobility for climate-neutral, environmental friendly and susTainable Cities in Europe and China (IMTECC)

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Pan-Eurasian Experiment PEEX

PEEX Workshop, INAR
1, 9, 14 April 2026

UNIVERSITY OF COPENHAGEN

ZHEJIANG UNIVERSITY 1897

UPEC Connaissance - Action | UNIVERSITÉ PARIS-EST CRÉTEIL VAL DE MARNE

lisa

AARHUS UNIVERSITY

Hebei Agricultural University 1902

KØBENHAVNS KOMMUNE

Demonstration cities in focus:

Copenhagen, Denmark | **Paris, France** | **Hangzhou, China**

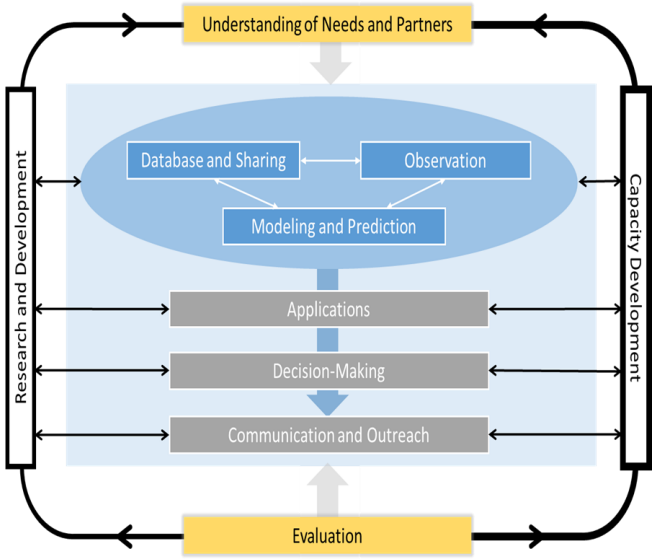
- **IMTEC project aims to provide tools and case studies for optimizing multimodal traffic management, improving urban mobility, reducing traffic emissions, and finding new solutions towards greener mobility practices, climate-neutral and smart cities.**
- **Based on big data, smart traffic management technologies, and integrated interdisciplinary methods, this project optimises multimodal traffic within the methodology of Integrated Urban System (IUS) and key performance indicators (KPIs) for environment- and climate-smart and sustainable cities.**

Methodology: Integrated Urban Hydro-Meteorological, Climate and Environmental Systems and Services (IUS) for smart & sustainable cities

World Meteorological Organization
Weather • Climate • Water

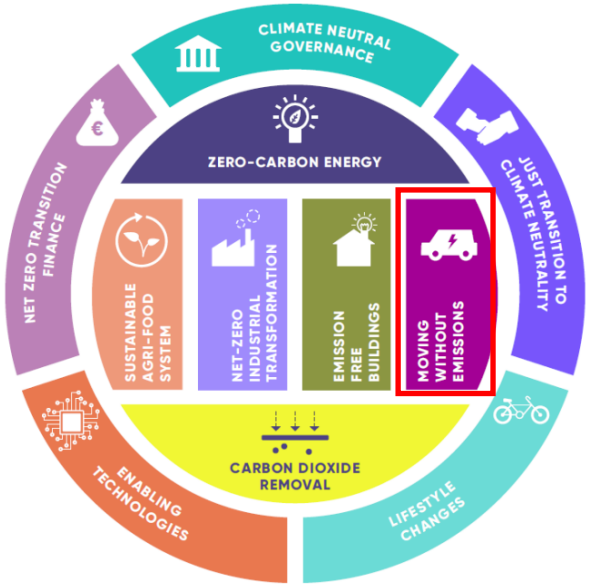
IUS Guidance Vol. I: Concept and Methodology

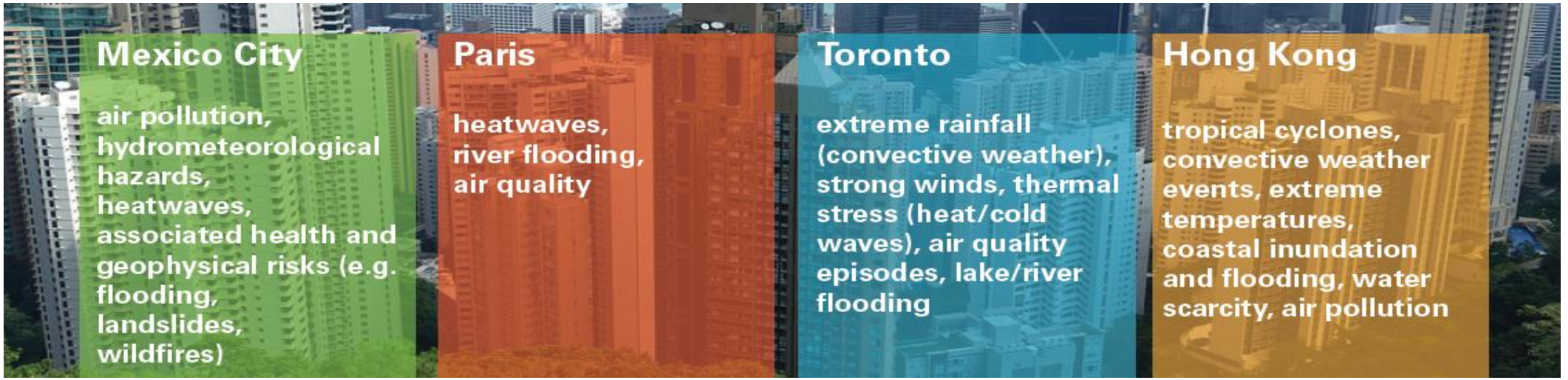
IUS Guidance Volume II: Demonstration cities
30 cities considered



Benefits: Useful, Usable, Used

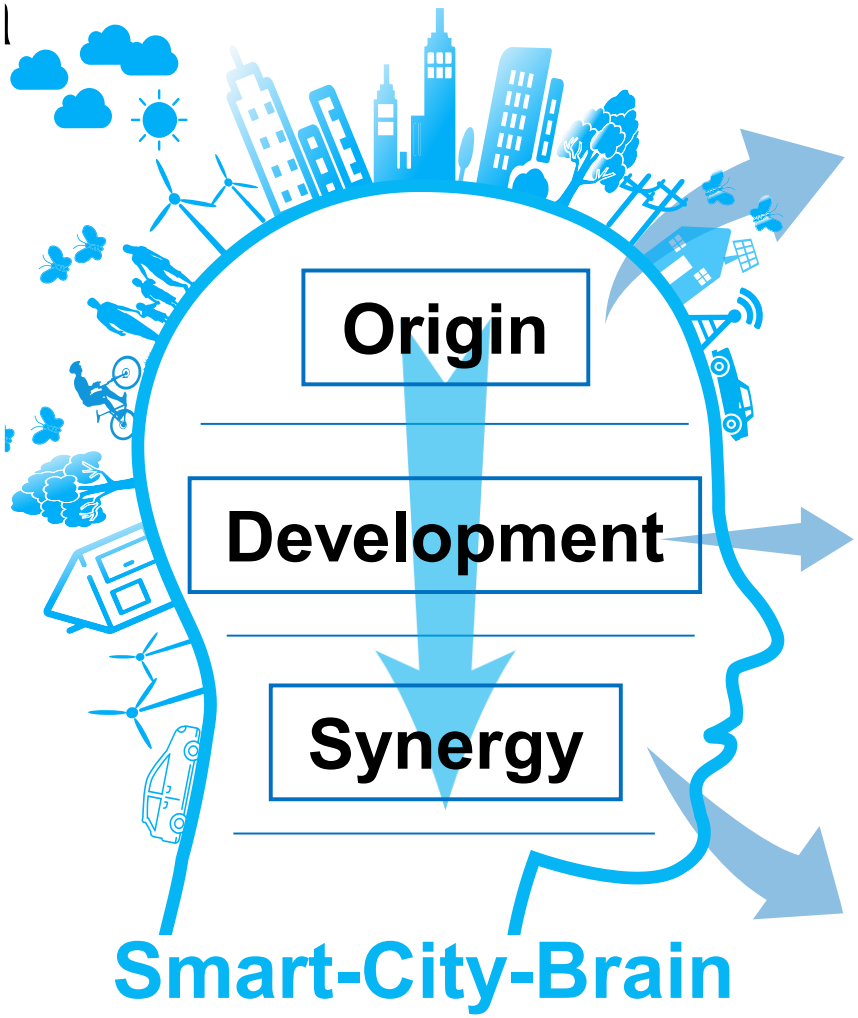
1. Resiliency through Multi-Hazard Early Warning Systems
2. Sustainability through urban long-term planning
3. Capability and capacity through cross-cutting services
4. Efficiency through infrastructure cross-cutting services
5. Consistency (hence, effective, efficient) through integration
6. Effective service through Partnerships / Risk Communication





CityIPCC 4 cities case studies: Baklanov et al., 2020

Integrating the Smart-City-Brain framework for carbon neutrality, resilient and sustainable cities



The origin of Smart City is to solve various urban issues

Traffic + Energy + Climate + Health + Environment + More

The development of Smart City is integrating new technologies

Internet of Things + Big data analysis + Urban digital twin + Artificial intelligence decision-making + More

Data-driven	Technology empowerment	Collaborative governance	Carbon neutrality	Continuous optimization
• Multi-source data integration	• Big data processing • Artificial intelligence algorithm	• Intelligent decision-making • Instruction feedback	• Carbon neutrality priority algorithm • Encouraging carbon reduction	• Integrating equity and health • Sustainable development goals

Chen et al., JUM, 2026

The overall IMTECC working concept

Hangzhou

Paris

Copenhagen

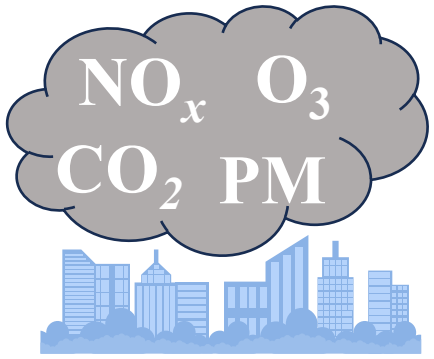
Establish a multimodal transportation solution

Policy orientation/Human choice

Climate Health

The impact of air pollutants on climate and health

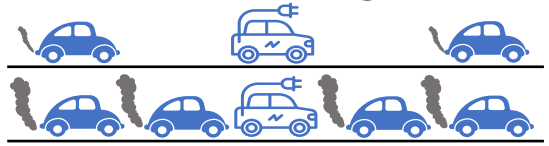
Air quality & GHG emission



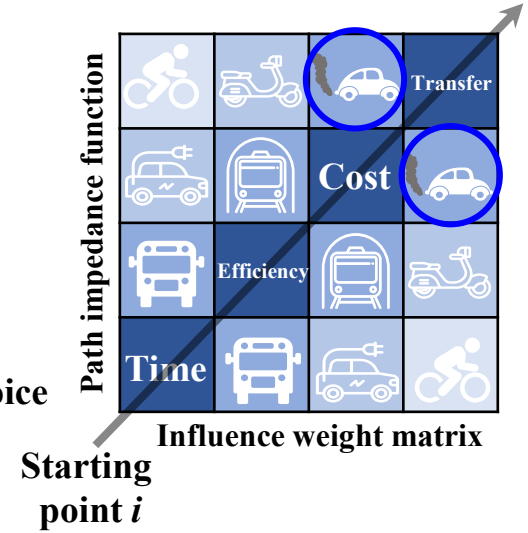
Update the emission inventory based on traffic emission results

The proportion of electric vehicles/fuel vehicles

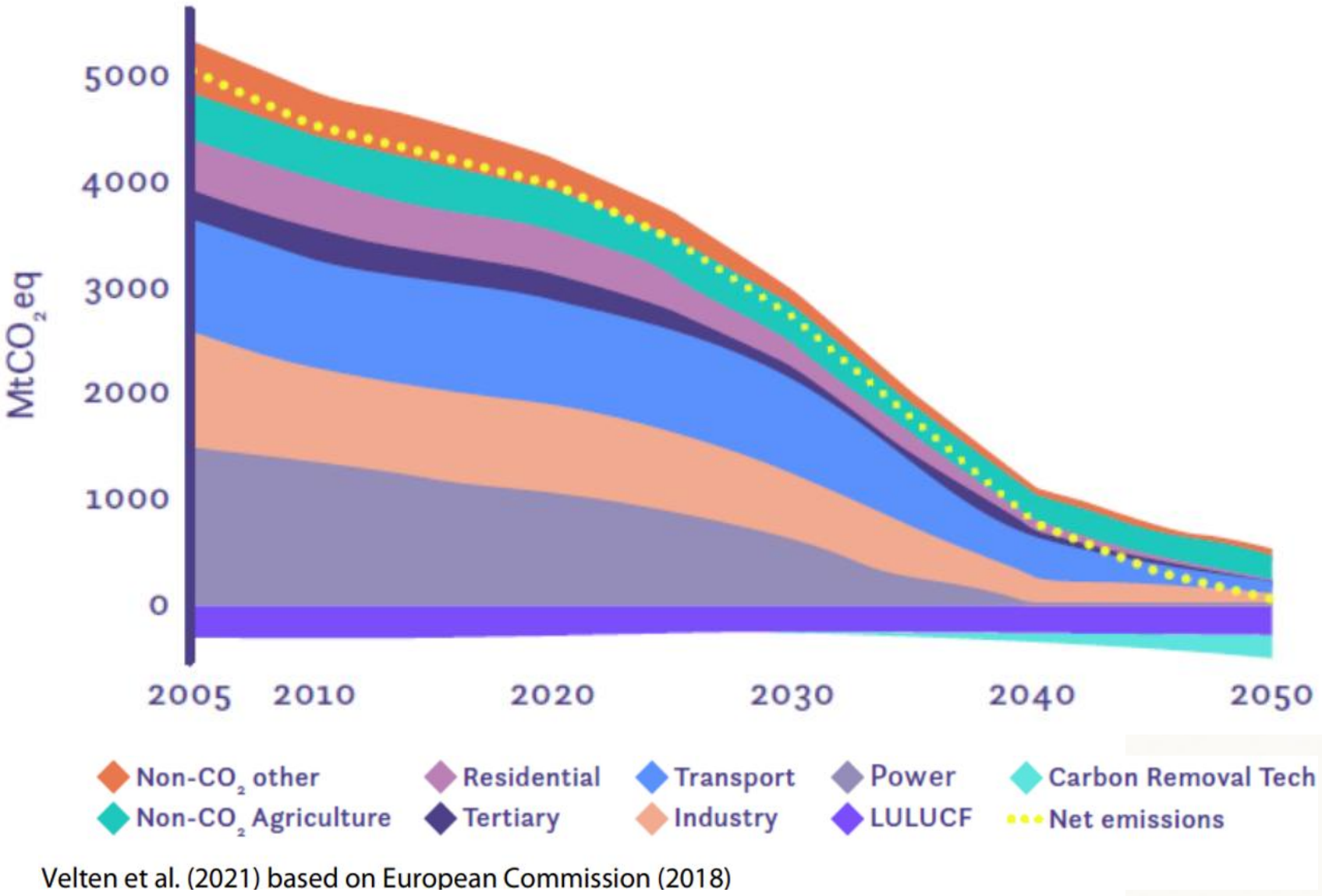
Different traffic congestion scenarios



Traffic emissions in different scenarios



Towards climate neutral systems & cities



Velten et al. (2021) based on European Commission (2018)

Building a Climate- & Environmental-Smart Transport System in Cities

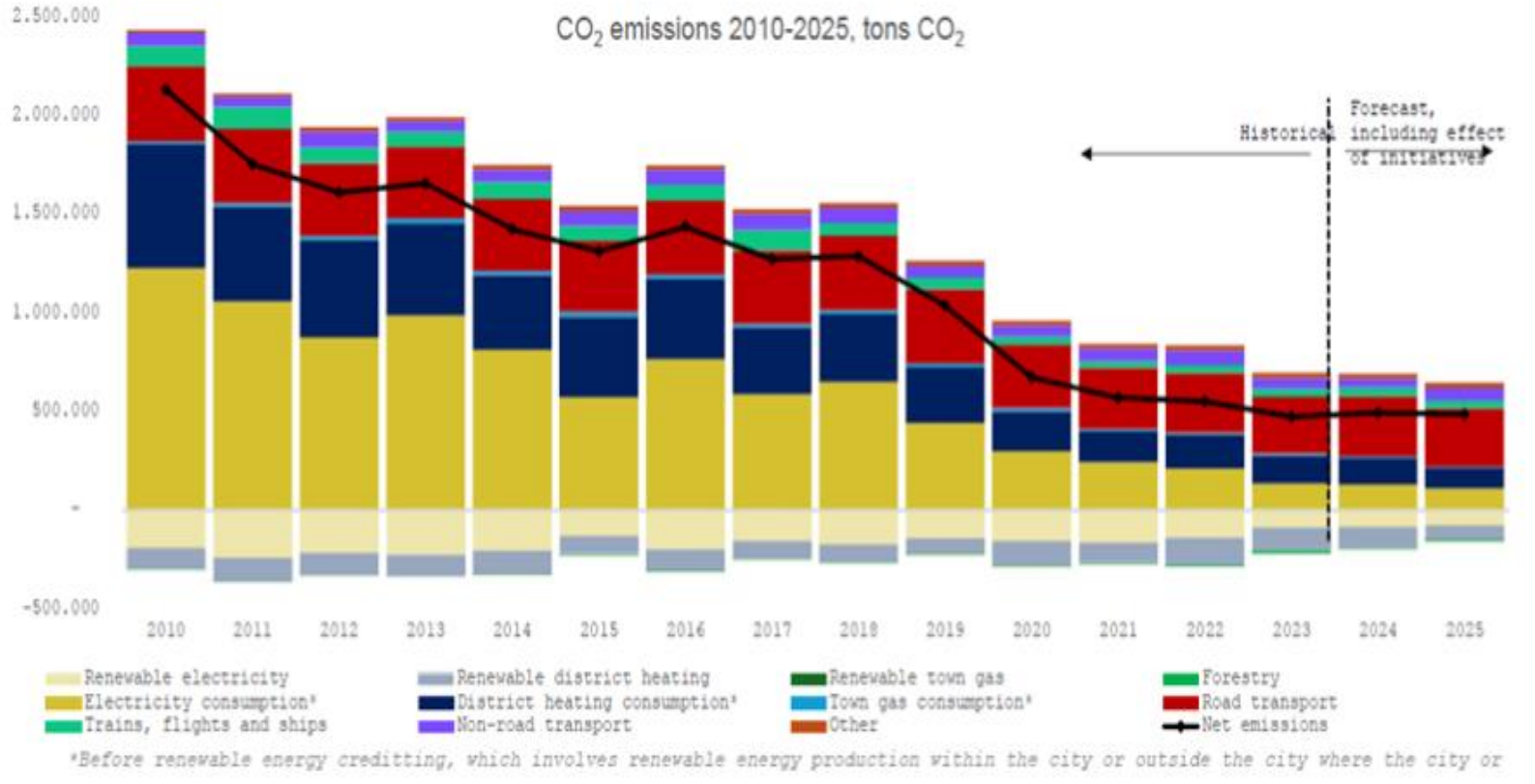
- Vision & Policy Framework
- Governance & Stakeholder Engagement
- Infrastructure Development
  - Public Transport
  - Non-Motorized Transport (NMT)
  - EV Charging & Shared Mobility
- Smart Mobility & Digital Integration
- Policy Instruments & Incentives
- Environmental Monitoring & Green Infrastructure
- Education & Public Awareness
- Monitoring, Evaluation

Key climate-related CO2 metrics for Copenhagen, Paris, and Hangzhou:

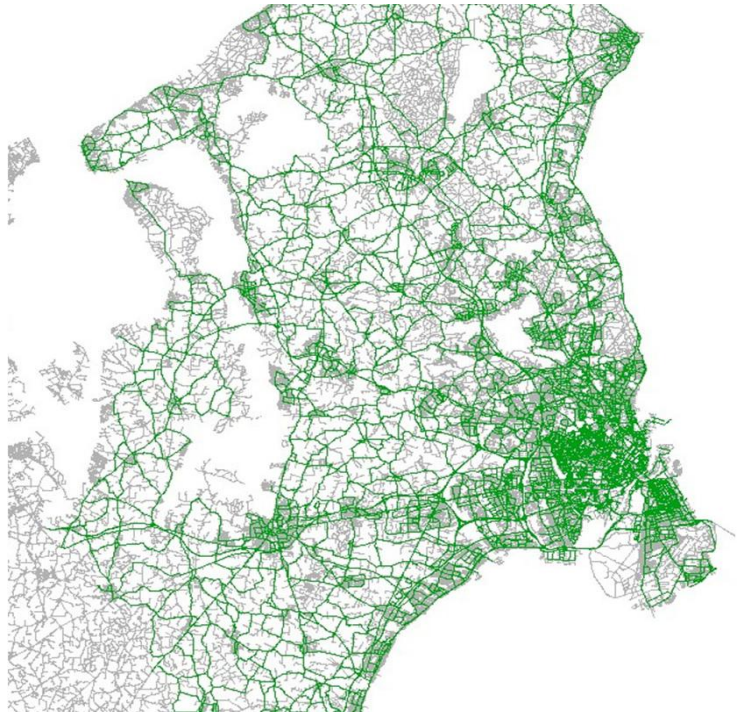
City	Current Carbon Footprint / Emissions	Carbon Neutrality Target	Transport Share of CO_2 Emissions
Copenhagen	~2.5 t CO_2 per capita – city emissions fell ~31–40 % since 1990/2005 and dropped 80 % between 2009–2022 (talkofthecities.iclei.org)	Net-zero by 2025 (though possibly shifting to 2026–28)	~22 % of city emissions from transport
Paris	Carbon footprint ↓ 20 % (2004–2018); GHG emissions ↓ 25 %	Net-zero by 2050 (100 % local emission reduction vs 2004; residual offsetting)	~30 % of total emissions from the transport sector
Hangzhou	Emissions reached ~16 million tC in 2015 (~59 $MtCO_2$)	Follows China's carbon-neutral pledge: 2060	Transport ≈10 % of total national CO_2; city-level likely similar

Copenhagen is a global leader in climate-smart transport

A **city-specific scheme for building a climate- and environmental-smart transport system in Copenhagen and 2 other cities**, based on its current strategies and new suggested scenarios, but structured for scalability and continued innovation.



Dynamics of CO2 emission by different source types for the city of Copenhagen for years 2010-2025, in tons CO2 (Source: City of Copenhagen, 2023, courtesy of Karsten Biering Nielsen)



Copenhagen Smart Transport Snapshot (2025 targets)

Metric	Target
Modal Share (bike + public)	>75%
Emission-free city buses	100% by 2030
EV share of new registrations	>50%
Daily cyclists in metro area	>300,000
CO_2 emissions from transport	-70% from 2005 base

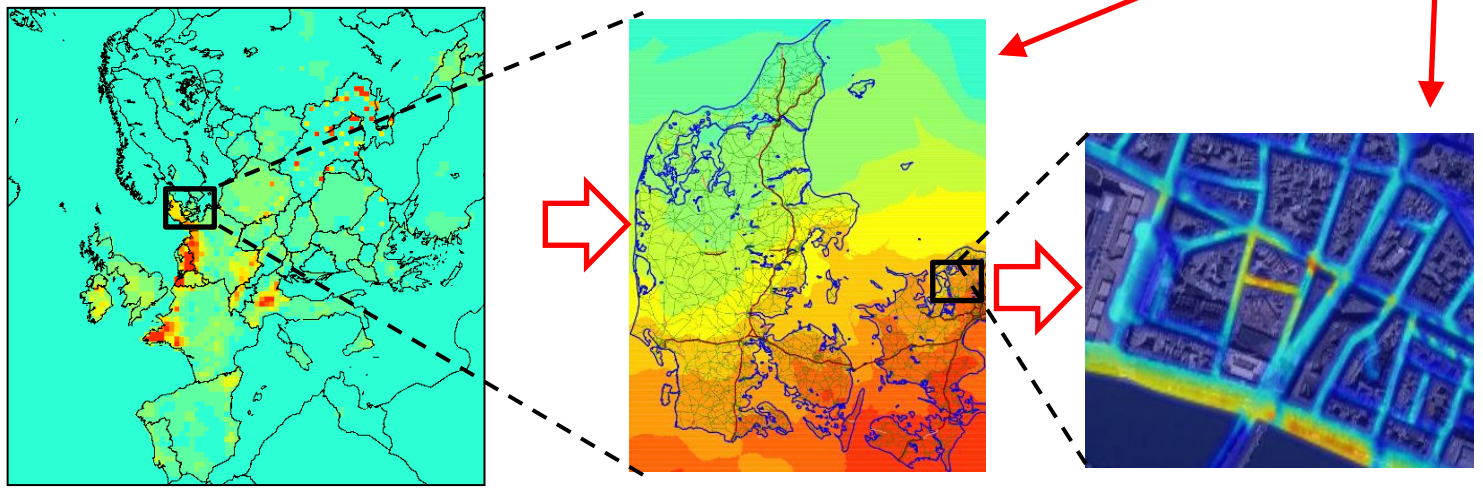
Multi-modeling platform for the city of Copenhagen

The Danish multi-scale modelling system DEHM-UBM-AirGIS is establishes for pilot city Copenhagen.

- **Urbanized multi-scale integrated meteo-model Enviro-HIRLAM**
- **3 coupled air pollution models**
- **COMPASS, activity-based traffic model**

Traffic input from
COMPASS - **Co**penhagen Greater Area
Model for **Pass**enger Transport
Urbanized meteorological fields

Danish Eulerian Hemispheric Model (DEHM)
for the Northern Hemisphere
150 km => 5.6 km



Operational Street Pollution Model (OSPM)
for urban street locations

High-resolution meteorological fields from urbanized NWP or CCMM model
(Enviro-HIRLAM, HARMONIE, etc)

Urban Background Model (UBM)
Denmark : 1 km resolution

Human exposure

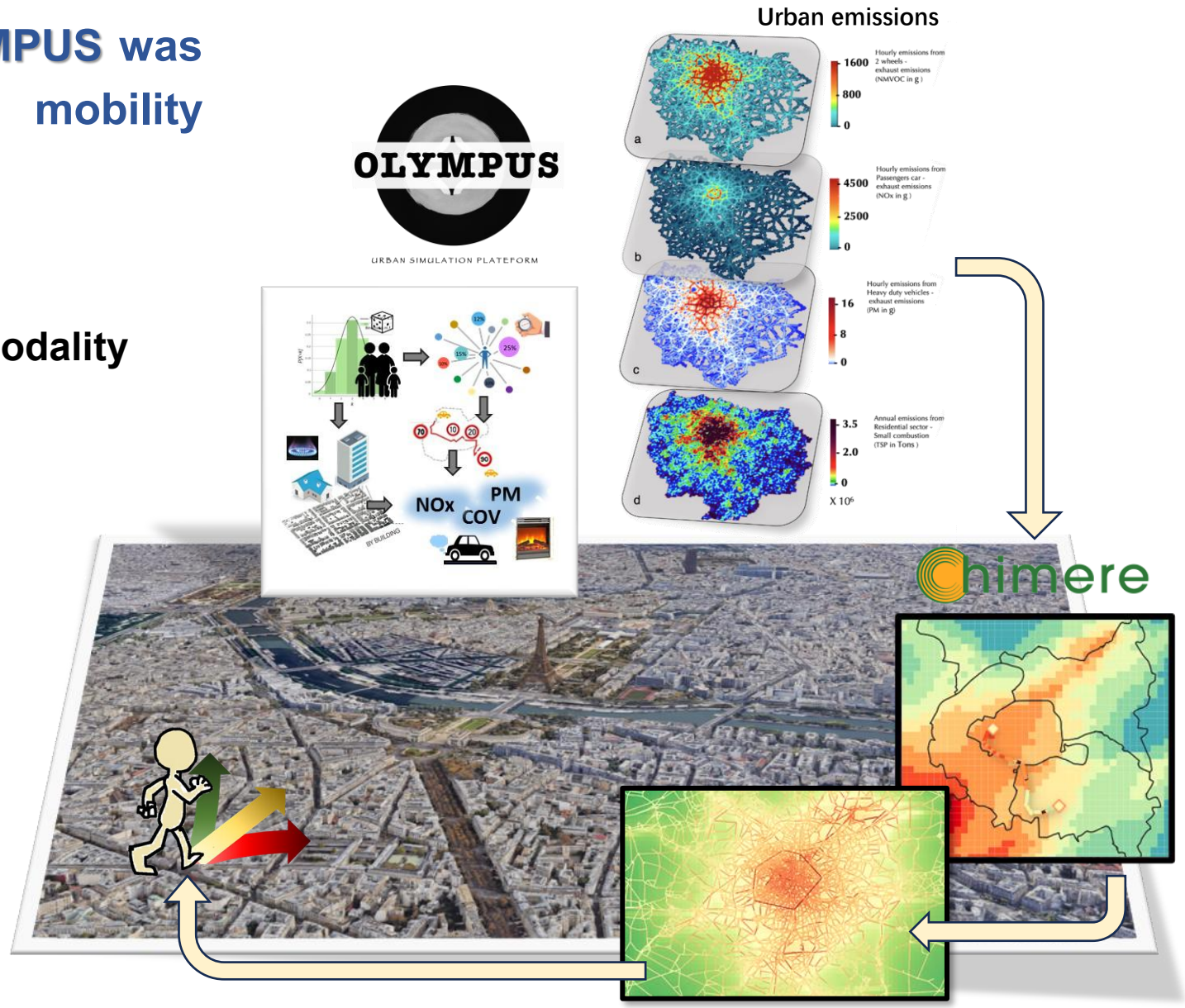
Health impacts

Modelling chain for study of suitable urban mobility for Paris

The emission activity-based model OLYMPUS was developed to study sustainable urban mobility under different city configurations.

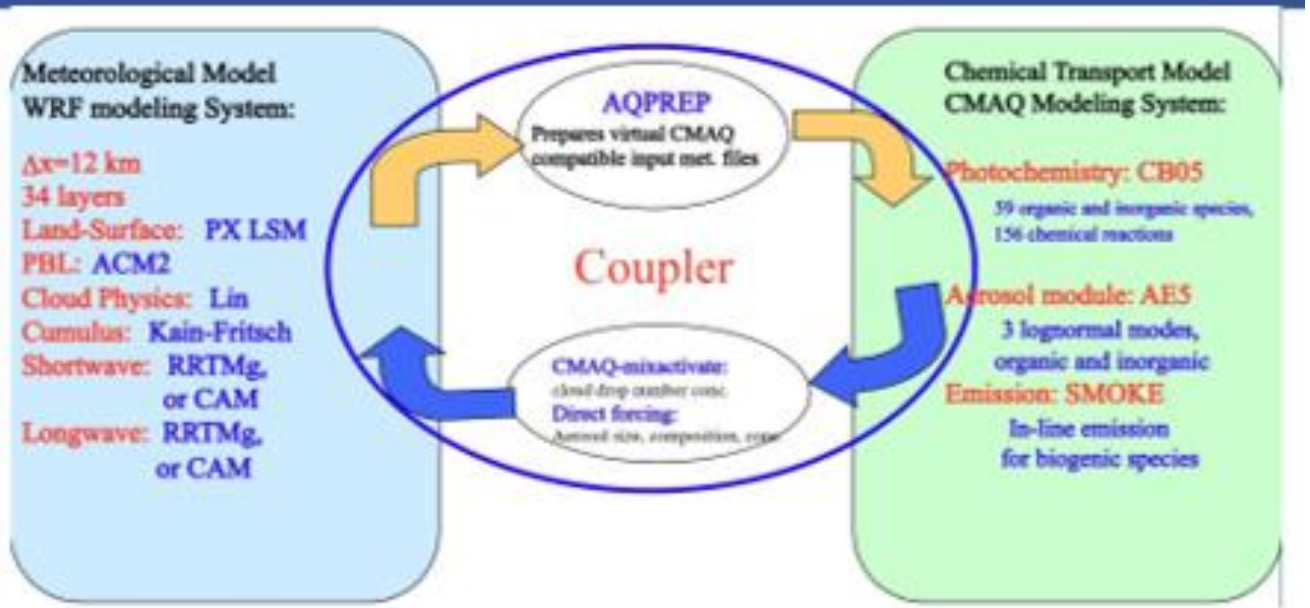
- Population activity
- Urban form / transport networks
- Mobility / modal share / congestion / multimodality
- Energy consumption
- Environmental inequalities

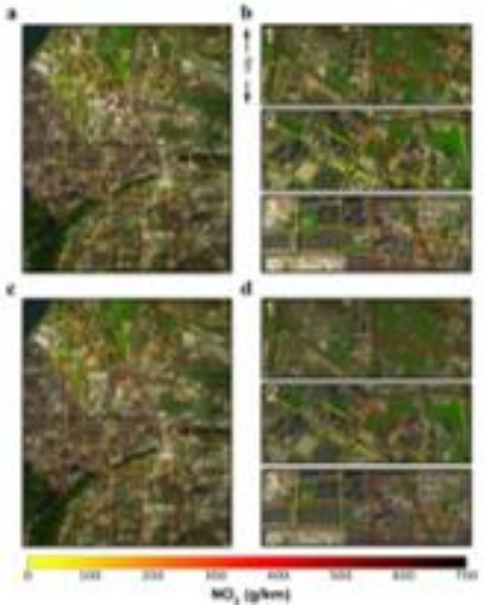
The model is dedicated to the production of scenarios integrated into an air quality and population exposure modeling chain relying on the CHIMERE AQ model

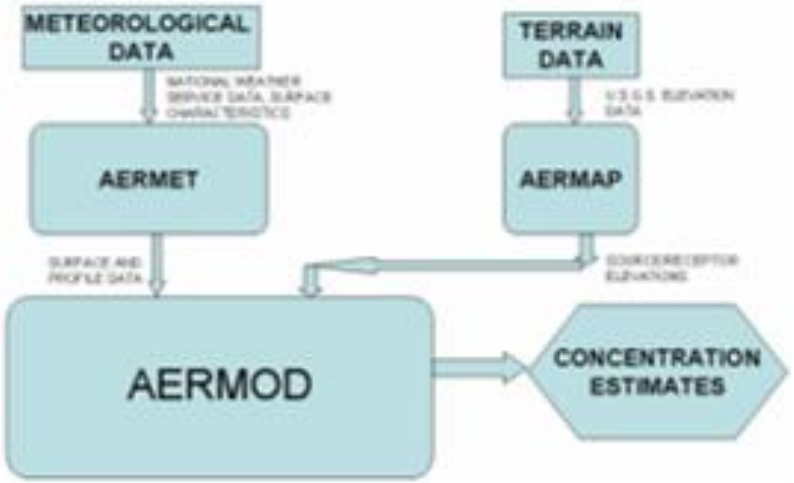


“City Brain” platform for the city of Hangzhou, China

- **Developed a comprehensive urban vehicle emission inventory via big traffic data from an intelligent transportation system.**
  - This inventory is city-wide pollutants (NO_x, CO, and HC, CO_2 and CH_4) from vehicles.
  - This inventory is characterized by high precision with a spatial resolution of 10 m and temporal resolution of 1 minute.
- **Developed a comprehensive urban air quality model.**
  - Combines mesoscale and microscale numerical models and considers both meteorological and chemical processes by coupling WRF-CMAQ and AERMOD models.
  - **Urban form / transport networks; mobility / modal share / congestion / multimodality; local-scale urban-specific climates.**



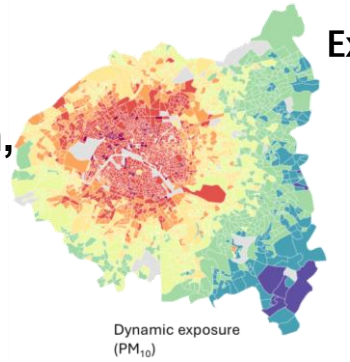




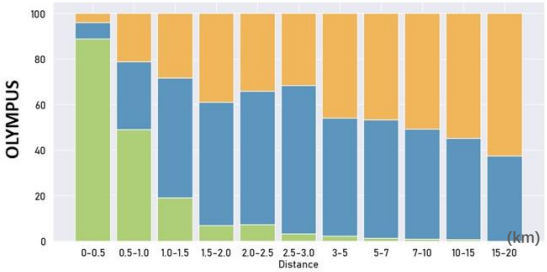
Transport Scenarios and Optimization of Urban Multimodal Mobility

Paris

- **Integrated evaluation of mobility in Paris**
- Modeling mobility in the Greater Paris under scenarios of urban planning, traffic regulation, multimodal mobility and changes in individual practices
- Identify and explore levers for mobility fluxes, modal share, sobriety and exposure

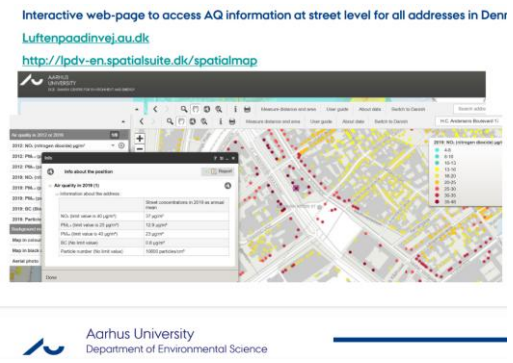


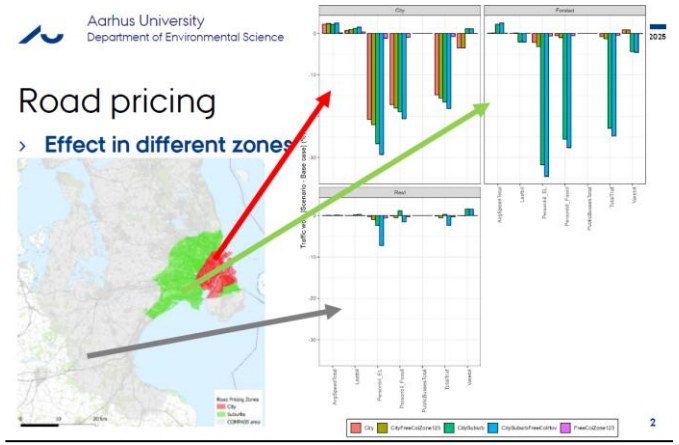
- **Evaluate urban sustainability under different scenarios**
- Provide a contextual, spatial, temporal, quantitative and integrated interpretation of pollutant (and CO_2) emissions, but also of air quality and exposure to pollutants for each scenario.
- Produce a reflection on a composite index of sustainability for the scenarios by integrating energy use, pollutant and GHG emissions, innovative and health-promoting mobility, environmental justice.



Copenhagen

- **Estimate impact of various traffic scenarios on air pollution exposure in Copenhagen**
- Identify high impact scenarios and coordinate with other pilot cities, examples:
  - Ultra Low / Zero Emission Zones
  - Road pricing
  - Super bike lanes
  - Free public transportation
  - Limitation of public parking and higher fees
- Implement scenarios in COMPASS and DEHM-UBM-AirGIS
- Estimate impact on air pollution and public health
- Effect / co-benefit for climate impact, noise pollution

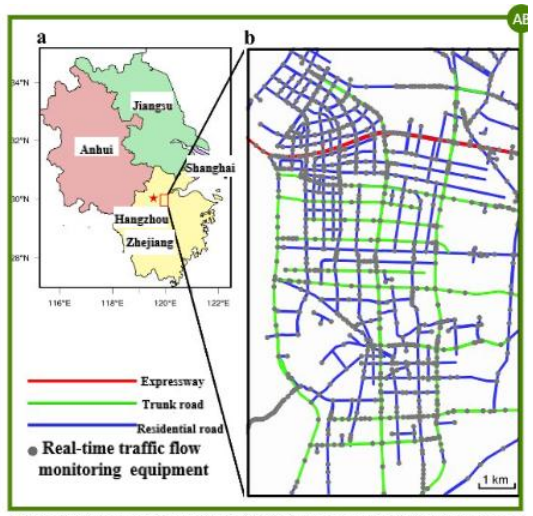




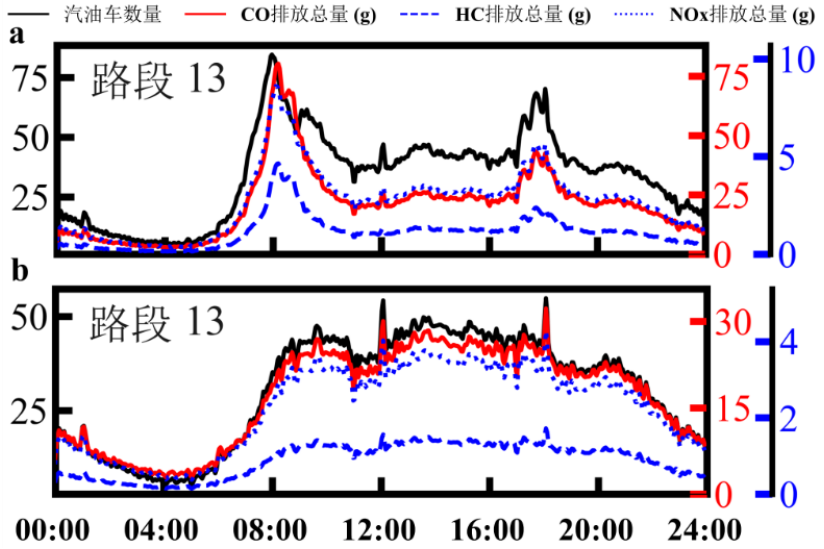
Transport Scenarios and Optimization of Urban Multimodal Mobility

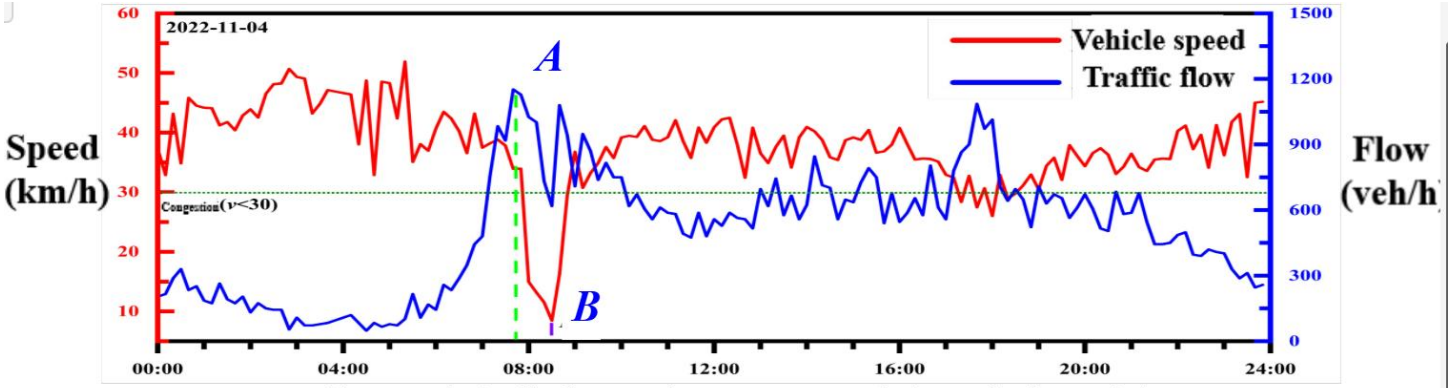
Hangzhou:

- Urban multimodal traffic (UMMT) network is developing by China partners.
- To calculate the urban traffic road impedance, we consider five factors: driving time, travel cost, comfort loss, human health exposure risk and urban climate effects by following Yang et al. (2020).
- For Hangzhou, the road network traffic path can be provided by “City Brain”, and bus and subway track lines can be obtained from Gaode Map.
- The time cost includes driving time and waiting time; monetary costs include fuel costs, line fares and parking costs; the comfort depends on the mode of transportation and travel time.
- Real-time population multimodal mobility data are obtained from the “City Brain” platform.
- Impacts of traffic congestion conditions on urban motor vehicle emissions.



Schematic diagram of intelligent transportation system (ITS) monitoring equipment locations in Hangzhou

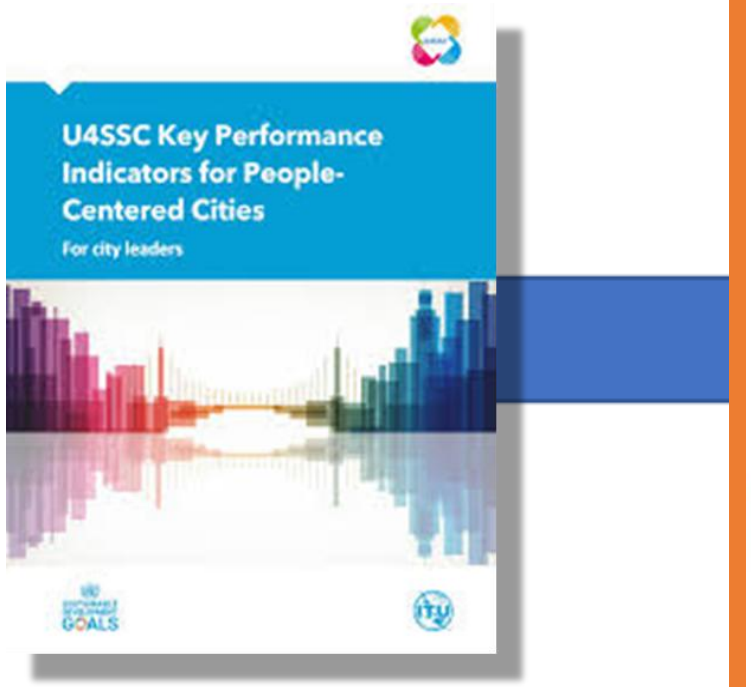


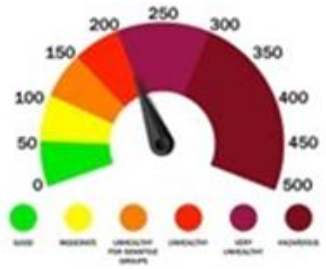


Changes in traffic flow and average speed at monitoring point

Scenario co-benefit analysis

KPIs & metrics

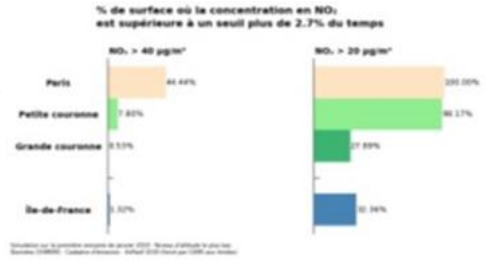


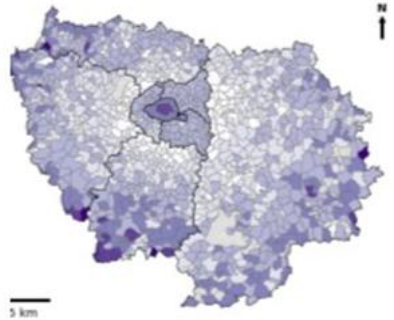


Air Quality Index

Feasibility
Interest
Complementarity

Spatial visualization
Quantitative analysis





Contribution to Carbon neutrality

Transforming technical data into strategic information

Conclusions

The integrated operation of a multimodal transport system based on optimizing urban multimodal traffic management scenarios from this **project will serve travel activities by reducing commuting times, and carbon emissions, and improve human health, urban resilience and sustainability**. More specifically, the project helps:

- **Promote multimodal mobility** as a pathway towards more efficient, climate & environmentally sustainable, and socially responsive solutions.
- Assess the impacts of multi-modal mobility on emissions on urban environment and climate, human health, and ultimately optimize public mobility. This will promote the **co-benefits of reducing both air pollution and greenhouse gases**.
- **Ease traffic congestion and improve travel efficiency**, thus enhancing the public's sense of well-being.
- Promote sustainable urban development using the **IUS methodology and key performance indicators for smart sustainable cities**.
- Propose **emission and energy consumption balances** for the cities according to economic situations, different policy orientations on **green transport and energy, and city organization**.
- Realize the full application of emerging technology in urban planning, thus **promoting the integrated approach and digital transformation of the government**.

Added value of this China and Europe collaboration

- How does the shift from fuel-powered to electric vehicles affect urban air quality and carbon neutrality? The stark differences in electric vehicle adoption between Chinese and European cities offer ideal opportunities for empirical analysis.

- Comparing the environmental impact of traffic in European and Chinese cities, that propose a diversity of structures and mobility behaviors, makes it possible to understand the levers of sustainable urban mobility in a more global manner.

- How different are the air pollution source contributions in the pilot cities in China and Europe?

- What strategies to reduce air pollution and climate impact are most efficient and can be transferred between pilot cities?