ICOS Cities

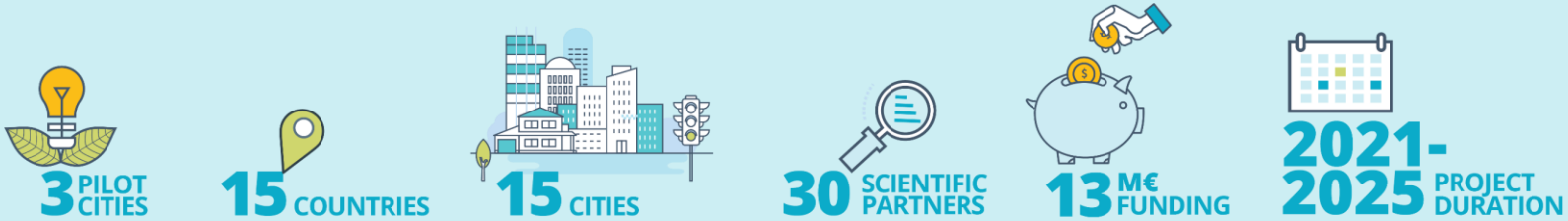
Blueprint for Urban Scale Greenhouse Gas Measurements

COINS webinar, Claudio D'Onofrio, 2023-03-01

ICOS Cities, aka Pilot Applications in Urban Landscapes - Towards integrated city observatories for greenhouse gases (PAUL), has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037319

PAUL – ICOS Cities project

- **P**ilot **A**pplication in **U**rban **L**andscapes – towards integrated city observatories for greenhouse gases
- Urban green-house gas observation
  - ICOS Cities bring together and evaluate the most innovative measurement approaches of greenhouse gas emissions in densely populated urban areas.
  - The project supports the European Green Deal and aims at developing useful tools and services for cities in support of their local climate action plans.
  - The project aims at creating data services that have societal impact.



ICOS – a European Research Infrastructure

ICOS IN SHORT

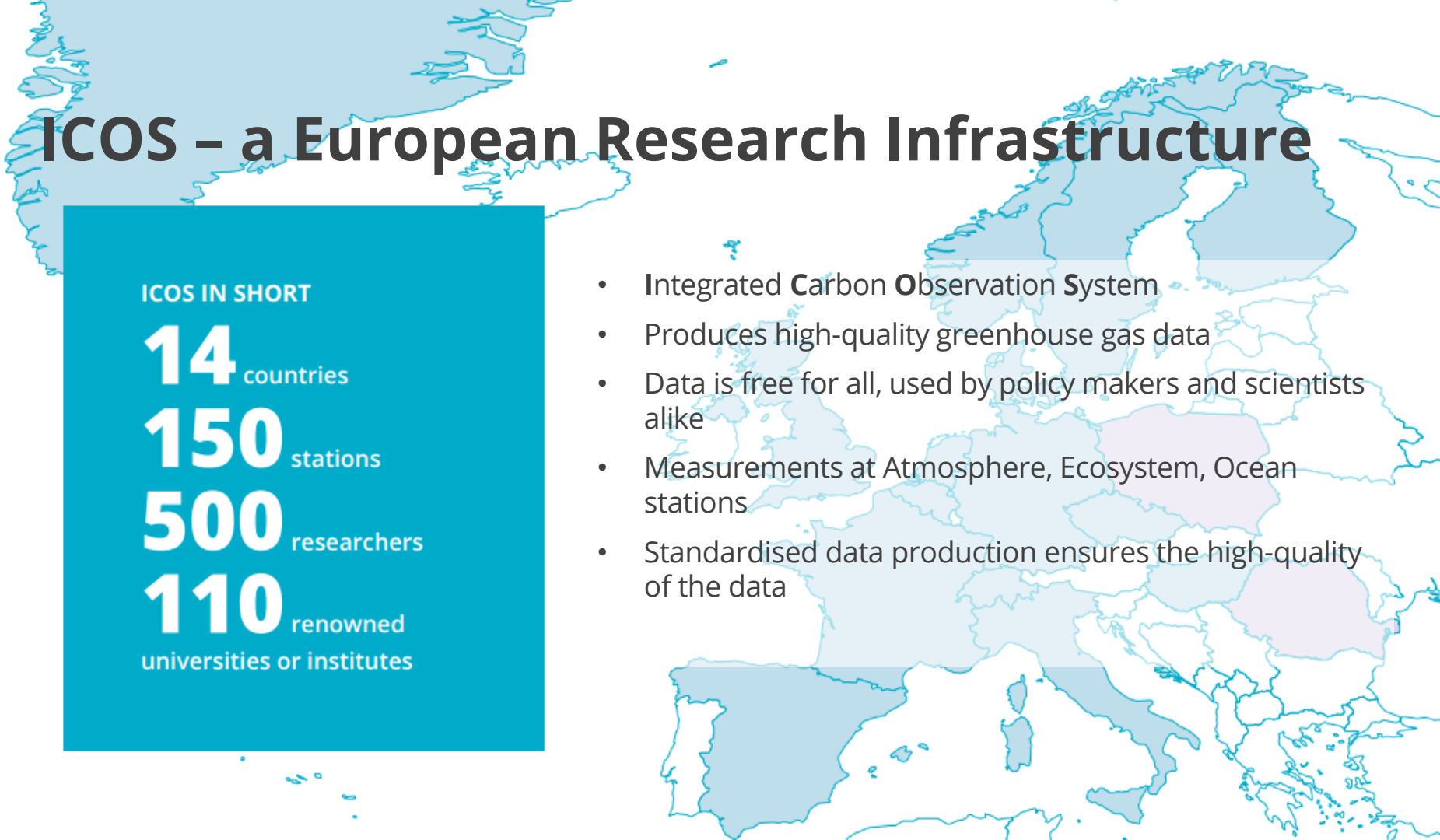
14 countries

150 stations

500 researchers

110 renowned universities or institutes

- **I**ntegrated **C**arbon **O**bservation **S**ystem
- Produces high-quality greenhouse gas data
- Data is free for all, used by policy makers and scientists alike
- Measurements at Atmosphere, Ecosystem, Ocean stations
- Standardised data production ensures the high-quality of the data



ICOS Cities

Pilot Applications in Urban Landscapes

“Cities are where the climate battle will largely be won or lost.”

António Guterres, Secretary-General, United Nations
Speech at C40 World Mayors Summit (Copenhagen), 11.10.2019

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Why urban observations of greenhouse gases?

- **The world needs to reduce its methane emissions** by about 33%, and the greenhouse gas emissions by 43% by 2030, with a peak in 2025, to meet the 1.5°C Paris goal in long term. (IPCC 2022)
- **Cities are a hot spot in terms of generating greenhouse gases**, as currently, over 55% of the world's population lives in urban areas, and the proportion is expected to grow to 68% by 2050. (UN 2018)
- **A lot of possibilities to curb emissions in cities**; e.g. lower energy consumption or more sustainable energy for buildings (e.g. construction materials, heating), electric or other more sustainably fueled transportation, and enhanced carbon uptake and storage using nature. (IPCC 2022)
- **Urban observations** – when provided in a suitable format for the city users – support cities in their decision-making and in the follow-up of their climate plans.

KEY OBJECTIVES

1

RELIABLE DATA

Develop and test comprehensive greenhouse gas measurement observatories and technologies in urban environments, to produce reliable data for cities

2

PILOT STUDIES

Conduct pilot studies in large, medium and small cities, and later implement the same methods in multiple European cities

3

SERVICES & TOOLS

Develop services and tools based on the needs of cities, for processing and analysing the observation data, while raising awareness and engaging citizens

4

SUPPORTING THE EUROPEAN AMBITION

Provide the future backbone of an urban GHG monitoring system in Europe and contribute to the European ambitious climate strategy to meet the targets of the Paris Agreement.

5

RESEARCH IN SUPPORT OF CITIES

Design a concept for an upgraded Research Infrastructure able to support cities in implementing their climate action plans

ICOS Cities

ICOS Cities brings together European citizens, policy makers and top scientiststo co-design pioneer greenhouse gas measurement methodologies and services for cities in support of climate action.

ICOS Cities network

3 PILOT CITIES:

Paris, Munich and Zurich

12 NETWORK CITIES:

Antwerp, Barcelona, Basel, Brno, Athens, Copenhagen, Heidelberg, Helsinki, Krakow, Rome, Rotterdam and Porto

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Pilot cities & city network

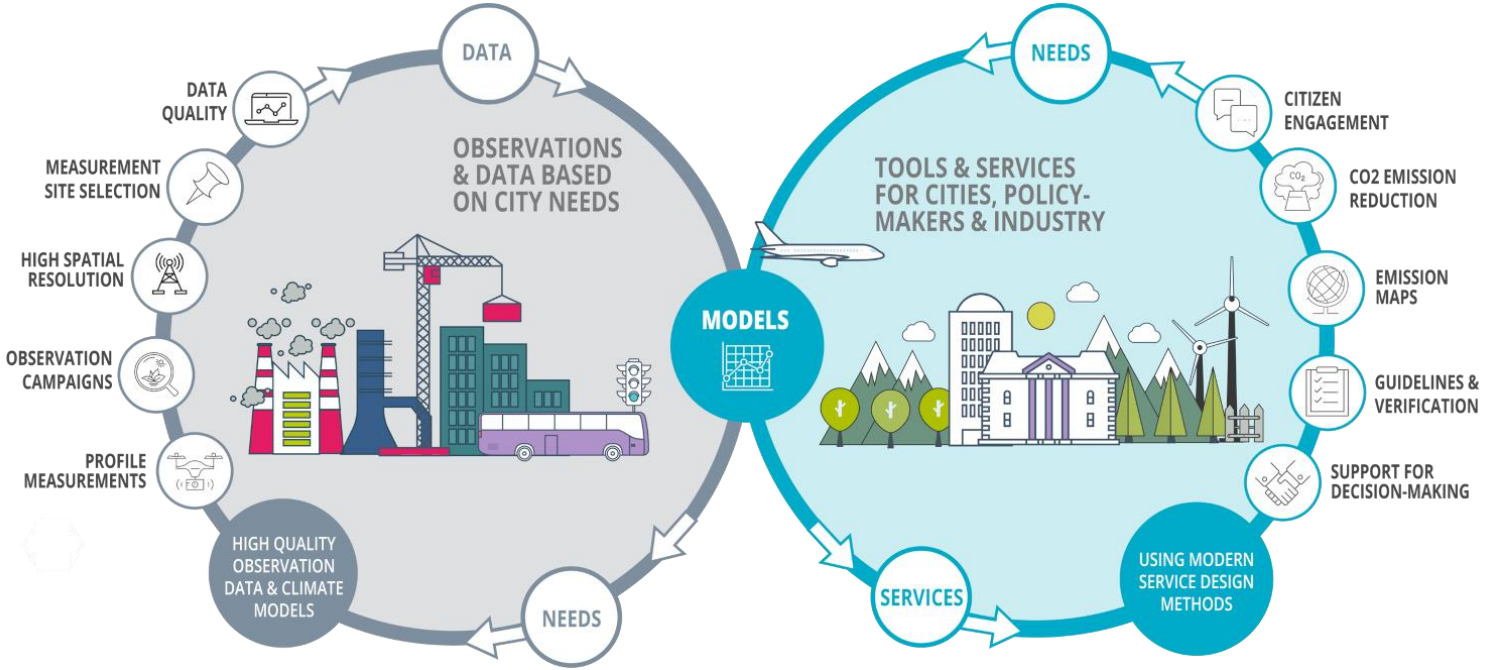
Three pilot cities selected by an international panel of scientists

- The cities were selected based on their climate action plans, current policies and climate ambition, in addition to their contribution to improve the existing greenhouse gas inventories
- The project closely collaborates with the cities in order to design relevant climate services and tools based on the city needs

City network

- 12 additional cities covering the European continent
- The cities provide a diversity of profiles in terms of geography, population, and economic activity
- They give feedback and share experiences throughout the project, while highlighting the needs of European cities in terms of climate action

From needs to data to services



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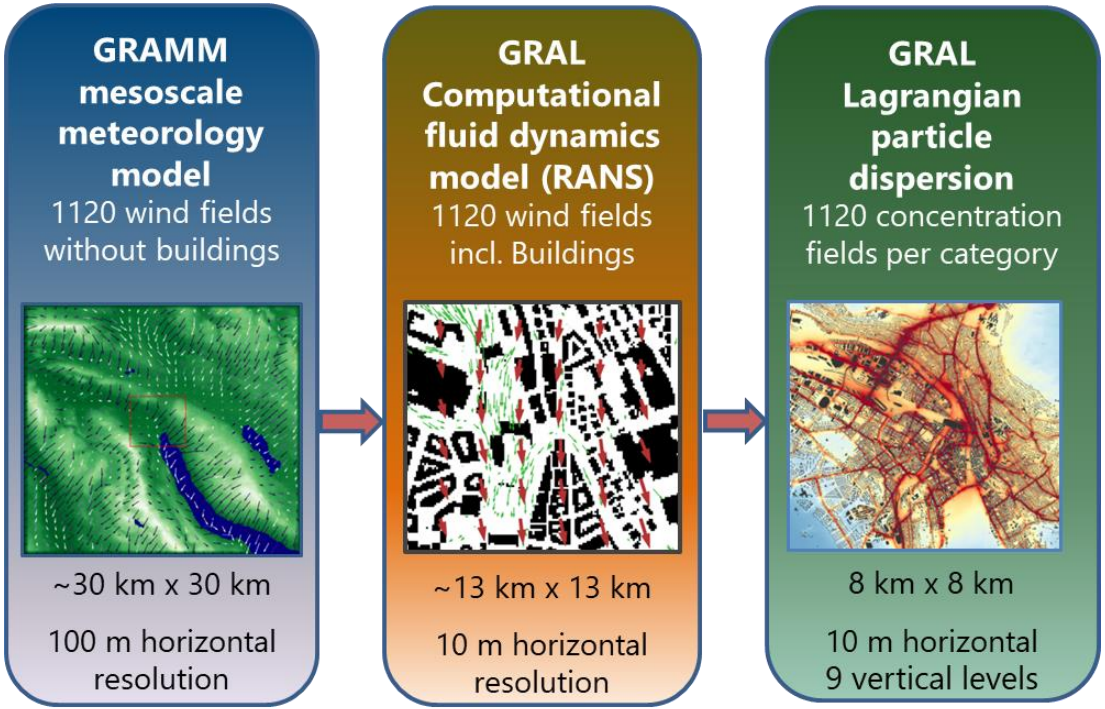
City needs and data for services

- High-resolution city emission inventory for GHGs and co-emitted species
- Analysis of climate governance structures in pilot cities
- Benchmarking of existing services for monitoring of CO2 emissions in cities
- Ongoing Interviews with stakeholders (academic, private sector, government)
- Visualisation tool for climate action plans (QGIS)
- Questionnaire in collaboration with ESS, 1st wave due to be sent out

Building resolution modelling in Zurich

GRAMM/GRAL model

- Mesoscale flow with GRAMM at 100 m resol.
- Building resolving flow with GRAL at 10 m resol.
- Lagrangian particle dispersion model GRAL for simulation of CO_2
- Catalogue approach: Pre-computation for 1120 representative weather situations



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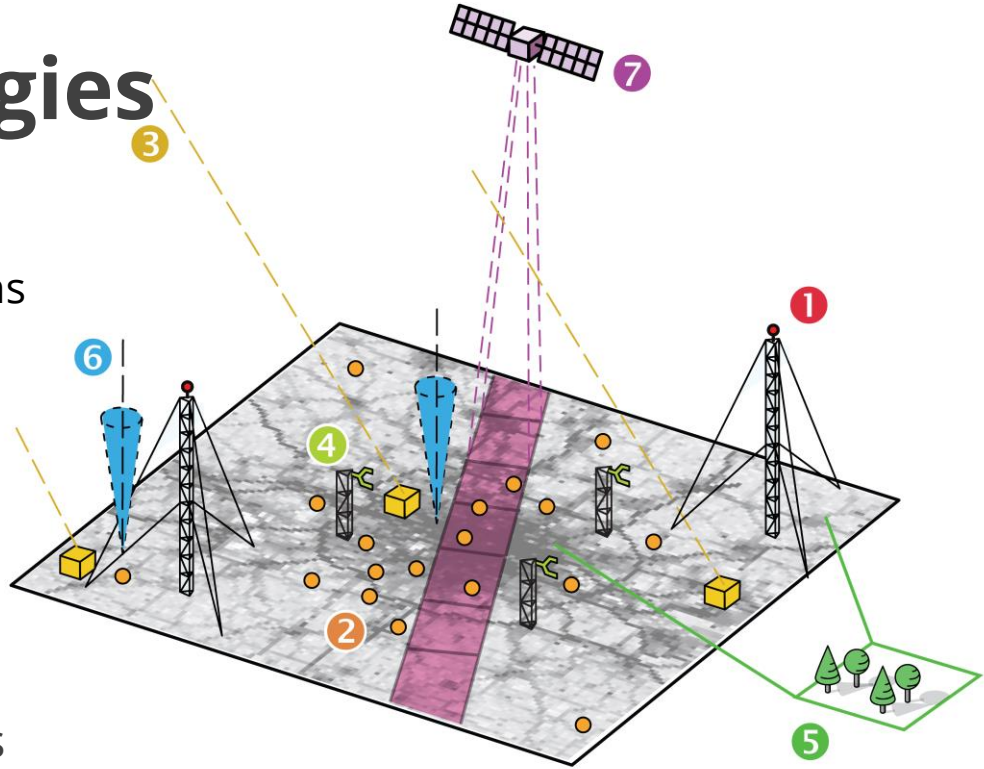
By Dominik Brunner, EMPA / ETH Zurich

Observation strategies

1. High-precision tall tower concentrations
2. Roof- and street-level networks
3. Ground-based total column network
4. Tall eddy covariance towers
5. Biogenic process observations
6. Ground-based wind and meteorology
7. Satellite total column observations



- Comparing techniques
- Identify synergies between approaches and scales
- In three cities (metropolitan, large, mid-size)

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By Samuel Hammer & Andreas Christen

Communication & Engagement

- Scientific experiment kits for schools. Easy-to-do experiments about climate change and teaching the teachers on the subject.
  To be used for classes, aged 13-16.

  (to start with, only in German, used in Zurich and Munich)

- Workshops for city network.

Lessons learned so far

- Location selection is tricky and takes more time then anticipated
- Point source influence and when do they become background signals ?
- Obtain permissions (owners, municipality) it is very time consuming
- Have a plan B location
- Interviews are tricky, difficult to find people taking time for this

The Consortium

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take home message

- **Create a blueprint for Urban GHG measurements in Europe**
- **Provide the knowledge to create tools and services for cities, citizens, policy makers, and education**

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