A scalable approach to high-resolution, bottom-up GHG emission inventories using open data

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Annual tonnes of CO_2 emissions

from road traffic

< 200
300 – 400
500 – 600
700 – 800
> 900

Emissions per km = $T \times F_s \times E_t$

T: Traffic volume based on road type, number of lanes, and population density, from Berlin traffic counts

F_s : Speed-dependent fuel consumption

E_t : Emission factors based on national vehicle fleet composition

from heating

< 50
50 – 100
100 – 150
150 – 200
> 200

Emissions per grid cell = $A \times C \times E_h$

A: Heated area (m^2) = Population* × Living space per capita*

C: Average energy consumption rate (kWh/m^2), based on building ages*

E_h: Average CO_2 emission factor (kg / kWh), based on energy carrier*

* gridded data at 100-m resolution from German Census 2022

Rhine-Neckar Region, Germany

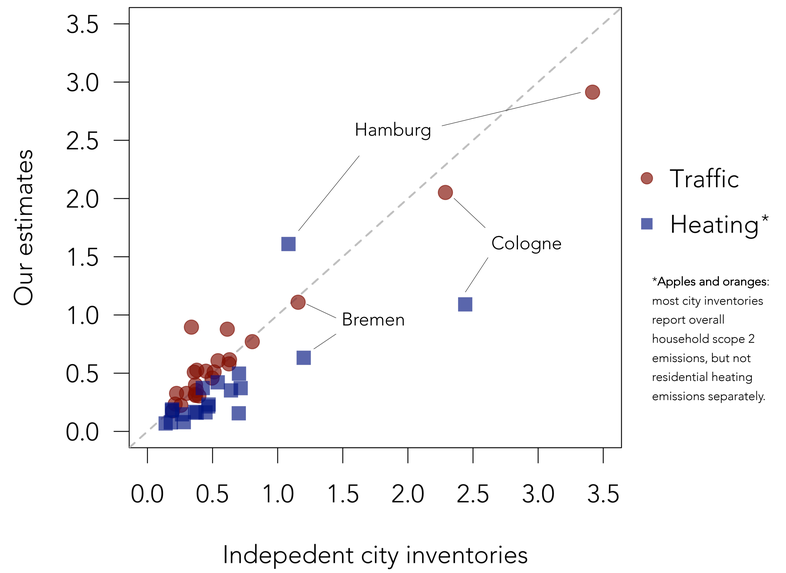
Objective

Harnessing open data to produce high-resolution inventories of urban greenhouse gas emissions to:

1. Support monitoring of urban emissions
2. Communicate local emissions to motivate action

To start, we focus on Germany and on two major sources of urban emissions: road traffic and residential space heating.

Estimates consistent with independent city inventories



*Apples and oranges: most city inventories report overall household scope 2 emissions, but not residential heating emissions separately.

Next steps

- Estimate heating emissions based on building-level data
- Quantify uncertainty
- Incorporate other sectors
- Expand geographically and in emission scope (scope 2 and 3)
- Use inventories to **motivate individual and local climate action**

Get in touch

Do you have ideas to improve our estimates? Would you like us to create an inventory for your city? Please reach out: **sebastian.block@heigit.org**

Our inventories and other climate action indicators will be available through HeiGIT's Climate Action Navigator, to be released on 15.05.2025.

Scan this to register for the launch event on World Environment Day (05.06.2025) →