



URBAN GREENHOUSE GAS (GHG) MONITORING ACROSS THE BARCELONA METROPOLITAN AREA

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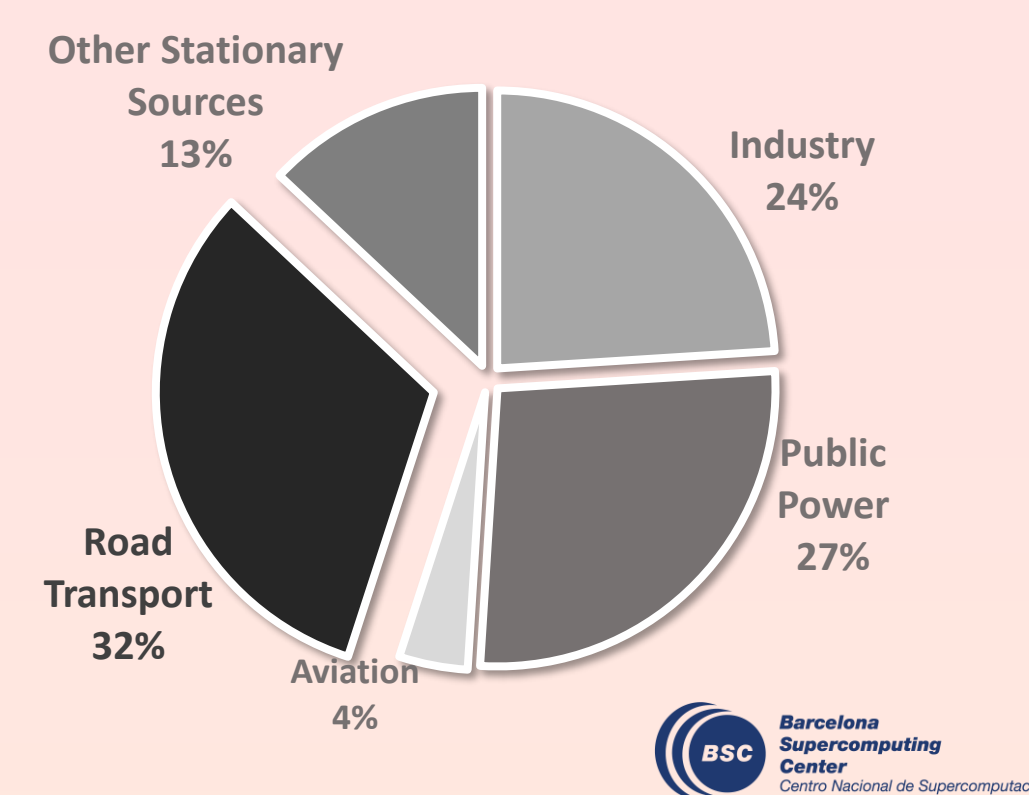
The Barcelona Metropolitan Area (Area Metropolitana de Barcelona (AMB)) is a densely populated urban region of over 3 million people, characterized by a compact coastal city core surrounded by suburban and industrial zones, and framed by diverse landscapes including the Mediterranean coastline, river deltas, and nearby mountain ranges such as Collserola.



How much carbon dioxide (CO₂) does the AMB emit?

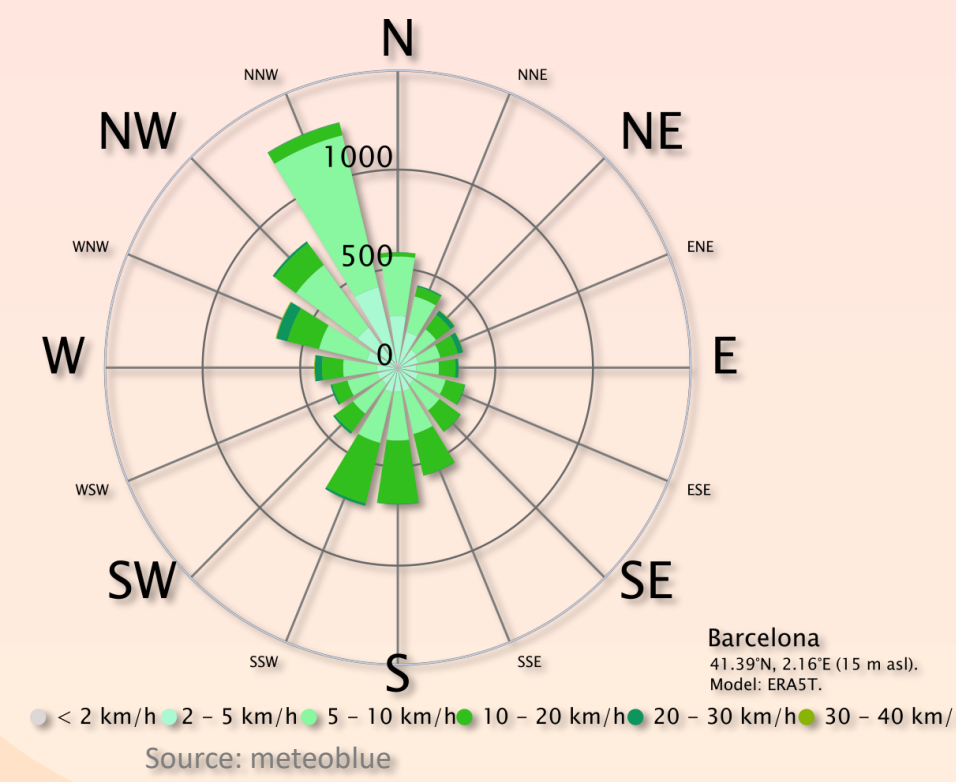
Urban areas are responsible for ~70% of atmospheric greenhouse gas (GHG) emissions.

In the AMB emissions are dominated by road transport (32%), followed by public power generation (27%) and industry (24%), highlighting the strong influence of urban mobility and energy demand.



Wind pattern

- Mistral (NW): Strong, gusty wind
- Garbí (SW): Gentle, warm wind
- Llevant (E): Moist marine wind
- Tramuntana (N): Cold, strong wind



Five cavity ring-down spectroscopy instruments continuously measuring atmospheric carbon dioxide (CO₂) and methane (CH₄) with the goal to determine the efficacy of greenhouse gas emissions mitigation strategies.

ICTA-UAB



Altitude: 147 mASL
Sampling height: 15 mAGL
Operational since 05/2021

Close to a very busy highway 2 km downwind from the Collserola range, at the Vallès Occidental valley and 13km west of the Mediterranean Sea.

IDAEA



Altitude: 80 mASL
Sampling height: 4 mAGL
Operational since 09/2021

Located in urban green spaces (Pedralbes and Cervantes Parks), ~1 km east of the Collserola range, the station is surrounded by dense development (residences, businesses). It lies near Avinguda Diagonal (one of Barcelona's busiest roads) and ~5 km inland from the port.

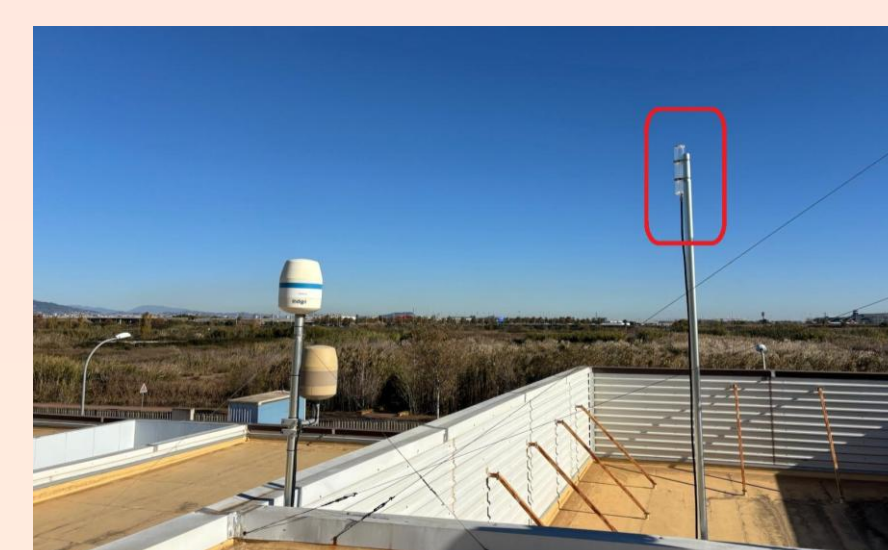
FABRA



Altitude: 415 mASL
Sampling height: 15 mAGL
Operational since 02/2022

The station is located on the eastern end of the Collserola mountain range, the highest point in the AMB. It is characterized by dense forest and lies 7km west of the sea.

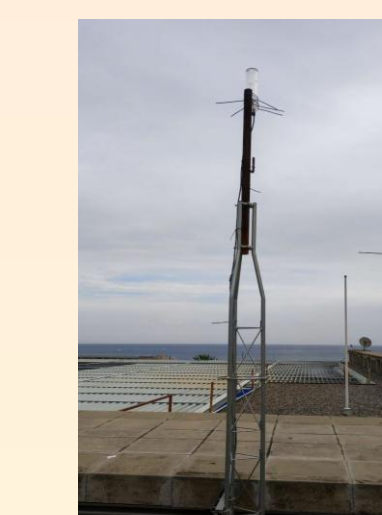
UPC-Agrópolis



Altitude: 3 mASL
Sampling height: 8 mAGL
Operational since 01/2026

Surrounded by the Agrarian Park of Baix Llobregat (one of the largest horticultural production areas in Catalonia), the station is ~1 km east of Barcelona–El Prat Airport, 8 km from the port, ~15 km NE of central Barcelona, and ~2 km north of the coast.

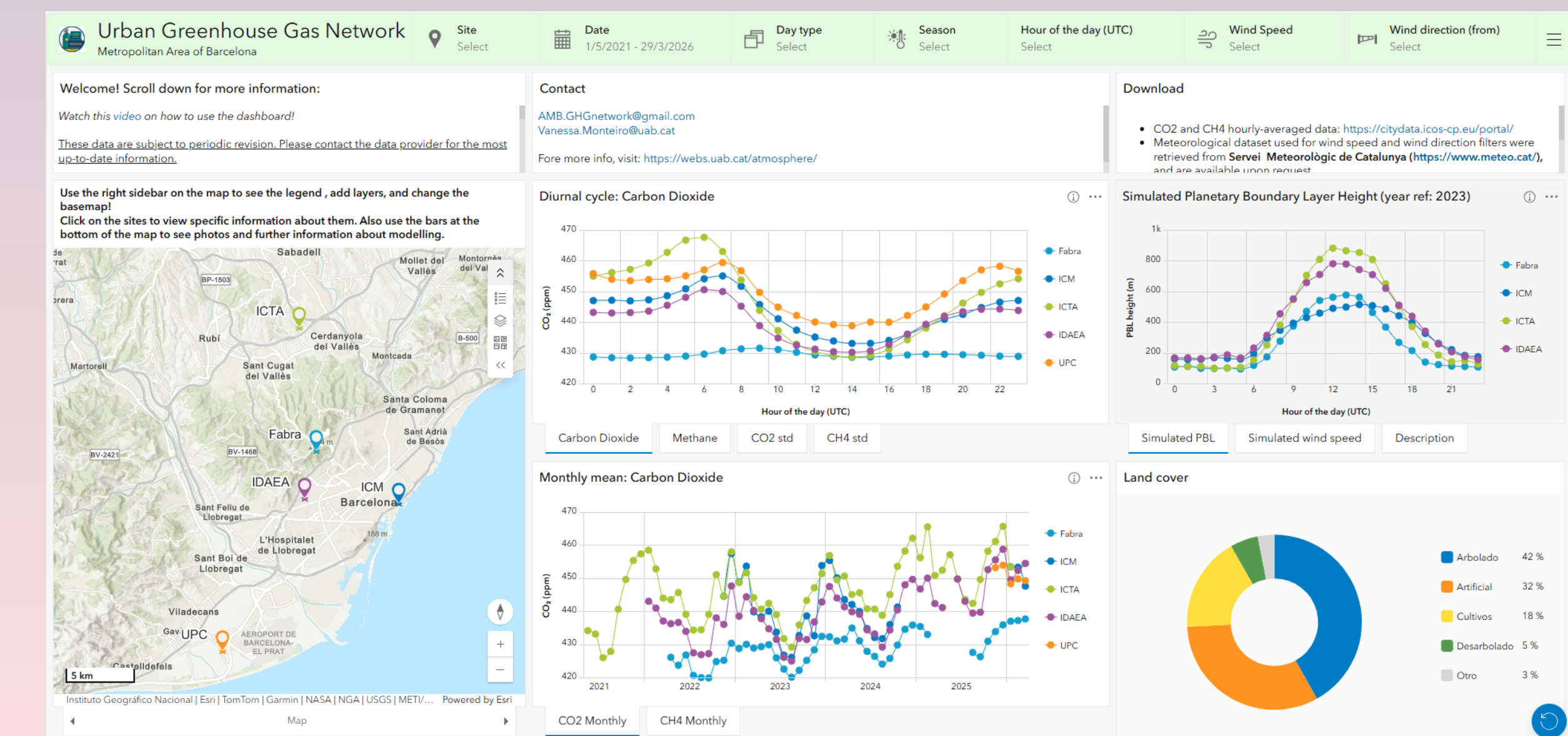
ICM



Altitude: 8 mASL
Sampling height: 15 mAGL
Operational since 11/2022

This station is located in one of the densest areas of Barcelona (Barceloneta) and is characterized by high density of buildings and no urban green. On the east side, however, the station faces the Mediterranean Sea.

CARBON DIOXIDE (CO₂) AND METHANE (CH₄) DATASETS



The interactive dashboard facilitates interpretation of atmospheric observations by integrating measurements with transport model outputs, enabling characterization of concentrations and identification of emission sources. These analyses ensure the observations reflect regional emissions.



Visit the dashboard!

- ICTA shows the highest CO₂ levels year-round and is strongly influenced by nearby highway traffic (AP-7), especially in summer.
- Strong seasonality at all sites.
- CO₂ variability at all sites is driven by boundary layer changes, with higher winter values.
- At FABRA, vegetation effects are weak (e.g., uptake from photosynthesis) and not strong enough to be clearly detected in the averaged diurnal cycle.

PERVASIVE GAS SENSING USING OPTICAL FIBERS, AS PART OF THE COMMUNICATION NETWORK OF THE FUTURE.

Use case: Greenhouse gases (GHG) monitoring

Goal: explore the potential of integrating innovative optical gas sensing nodes along optical fibers, towards their massive deployment in existing telecom infrastructures.

Approach: PTS and LHR system validated against the Barcelona GHG infrastructure and COCCON Spain.



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Cities

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aemet