Total greenhouse gas column measurements in the Paris region

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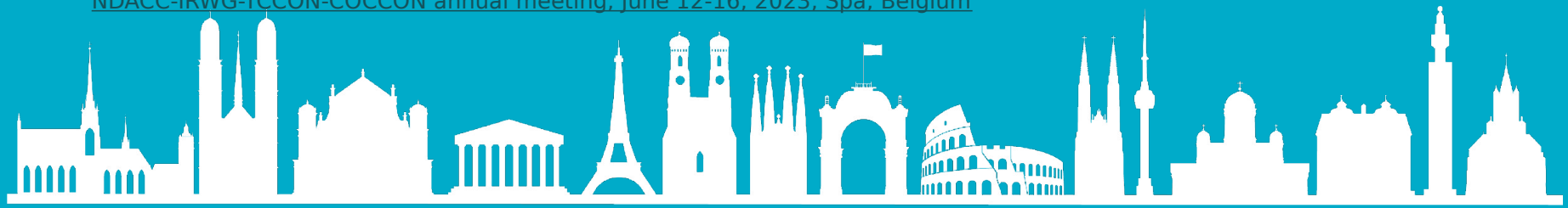
NDACC-IRWG-TCCON-COCCON annual meeting, June 12-16, 2023, Spa, Belgium



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

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Project’s presentation

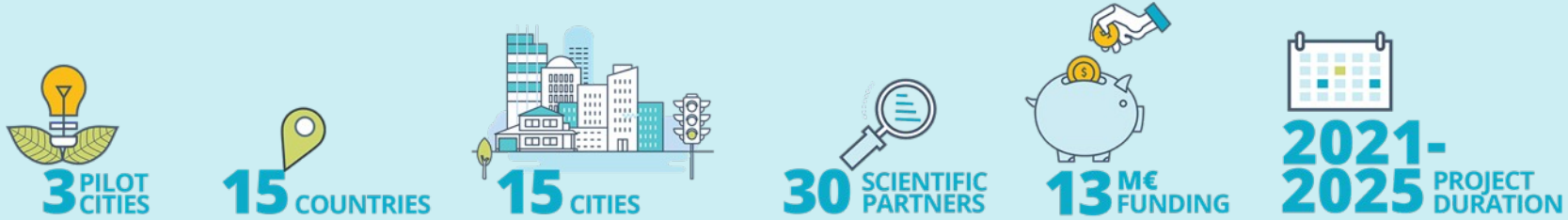
ICOS Cities, aka Pilot Applications in Urban Landscapes - Towards integrated city observatories for greenhouse gases (PAUL), has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 101037319

What is the ICOS Cities project about?

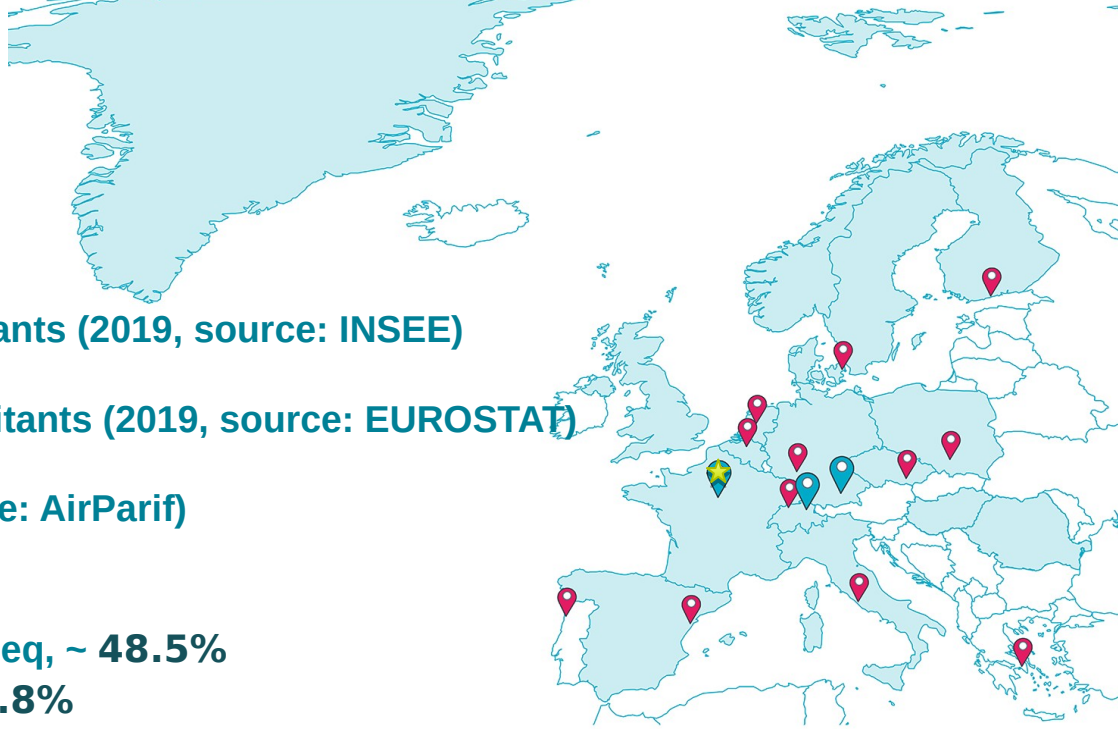
A European Green Deal project with **3** PILOT CITIES:

Paris, Munich and Zurich

- **develops systematic observations to monitor the level of greenhouse gas emissions in urban areas**
- **creates useful tools and services for cities in support of their local climate action plans**
- **provides data services that have societal impact**



Focus on Paris



- City-center: **2.16** million inhabitants (2019, source: INSEE)
- Urban area: **12.21** million inhabitants (2019, source: EUROSTAT)
- **64.630** Mt CO_2eq in 2019 (source: AirParif)
- Main sectors:
  - **Road trafic**: 31.360 Mt CO_2eq, ~ **48.5%**
  - **Airports**: 7 Mt CO_2eq, ~ **10.8%**
  - **Residential**: 5.990 Mt CO2eq, ~ **9.3%**
  - **Others** (energy, industry, wastes, ...): 20.280 Mt CO2eq, ~ **31.4%**

ICOS Cities

Network and method

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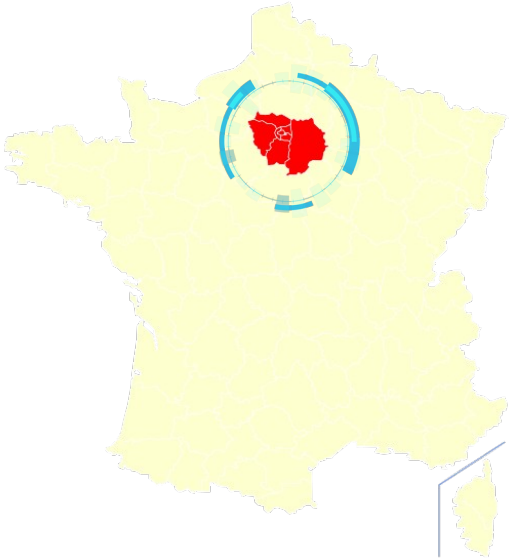
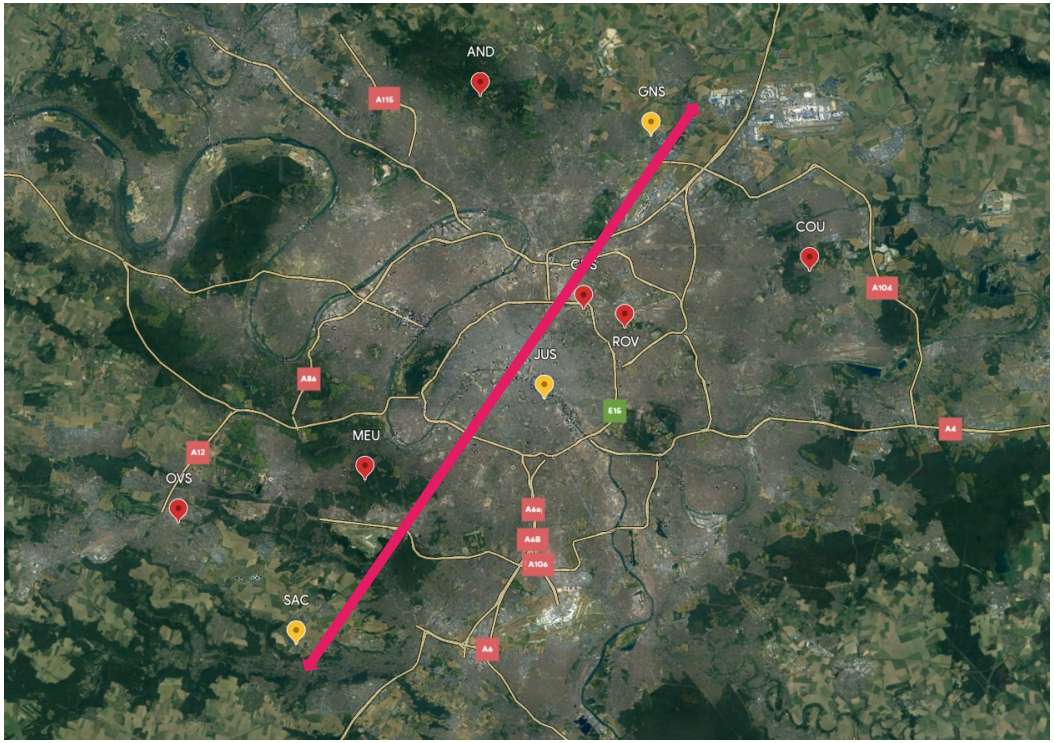
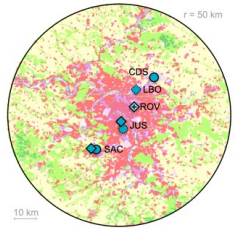
Network



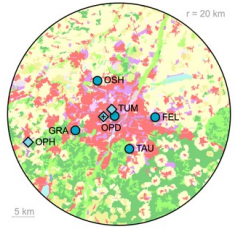
Prevailing wind



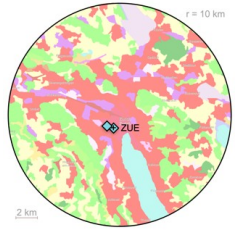
Paris
3 total column CO_2
4 Doppler wind LIDARS



Munich
5 total column CO_2
3 Doppler wind LIDARS



Zurich
2 Doppler wind LIDARS



ICOS Cities

Network

Jussieu

Sorbonne-University

- Paris’ city-center
- TCCON (+ EM27)

site operated by LERMA

- Co-located with an

in-situ ICOS station

ICOS Cities

Network

Saclay

LSCE

- 21 km, SW of Paris
- Operated by LSCE
- Co-located with an in-situ ICOS station
- Works since 2021

ICOS Cities

Network

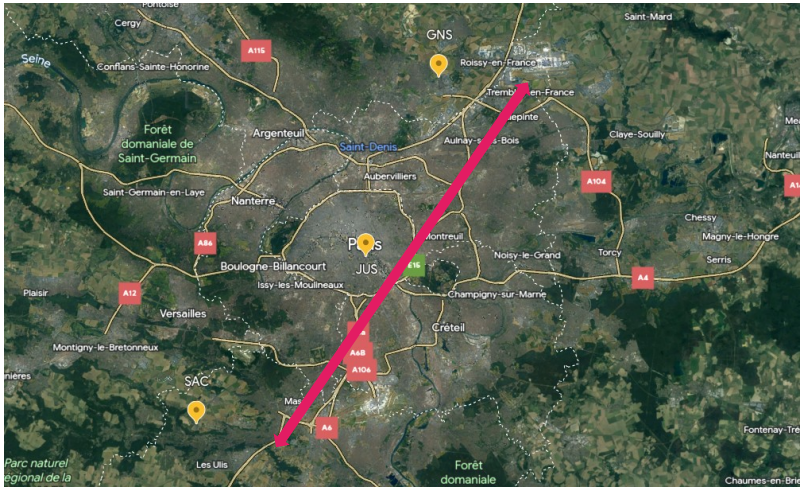
Gonesse Firefighters station

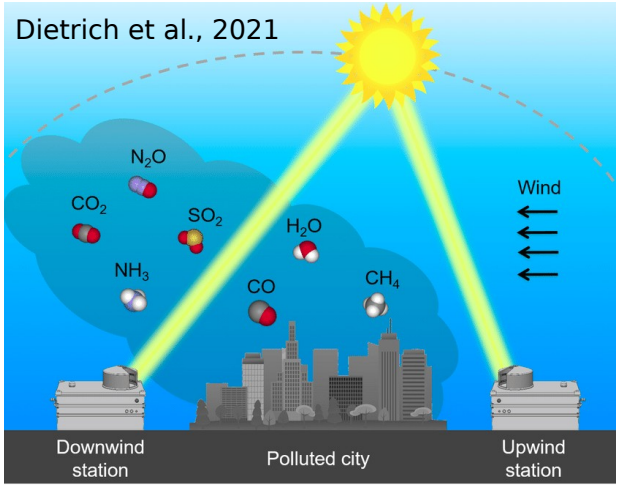
- 17 km, NE of Paris
- Operated by LSCE
- Near *CDG* (5 km, East) and *Le Bourget* airports (3 km, South)
- Co-located with an in-situ ICOS station
- Works for one year

ICOS Cities

The Differential Column Measurements method (DCM)

Prevailing wind ⟷





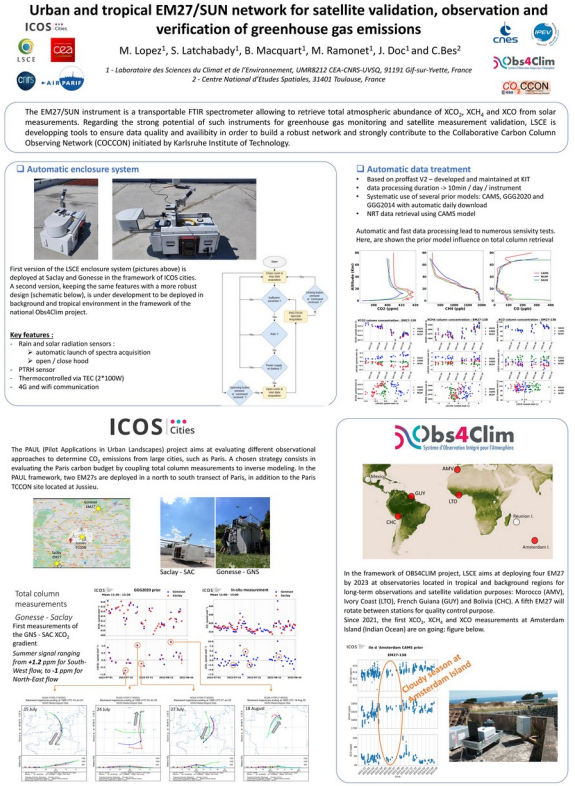
ICOS Cities

Automatic EM27/SUN enclosure system and NRT data processing chain

<u>See also:</u>

"*Urban and tropical EM27/SUN network for satellite validation, observation and verification of greenhouse gas emissions*"

M. Lopez, S. Latchabady, B. Macquart, M. Ramonet, J. Doc and C. Bes, Poster #19



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Results

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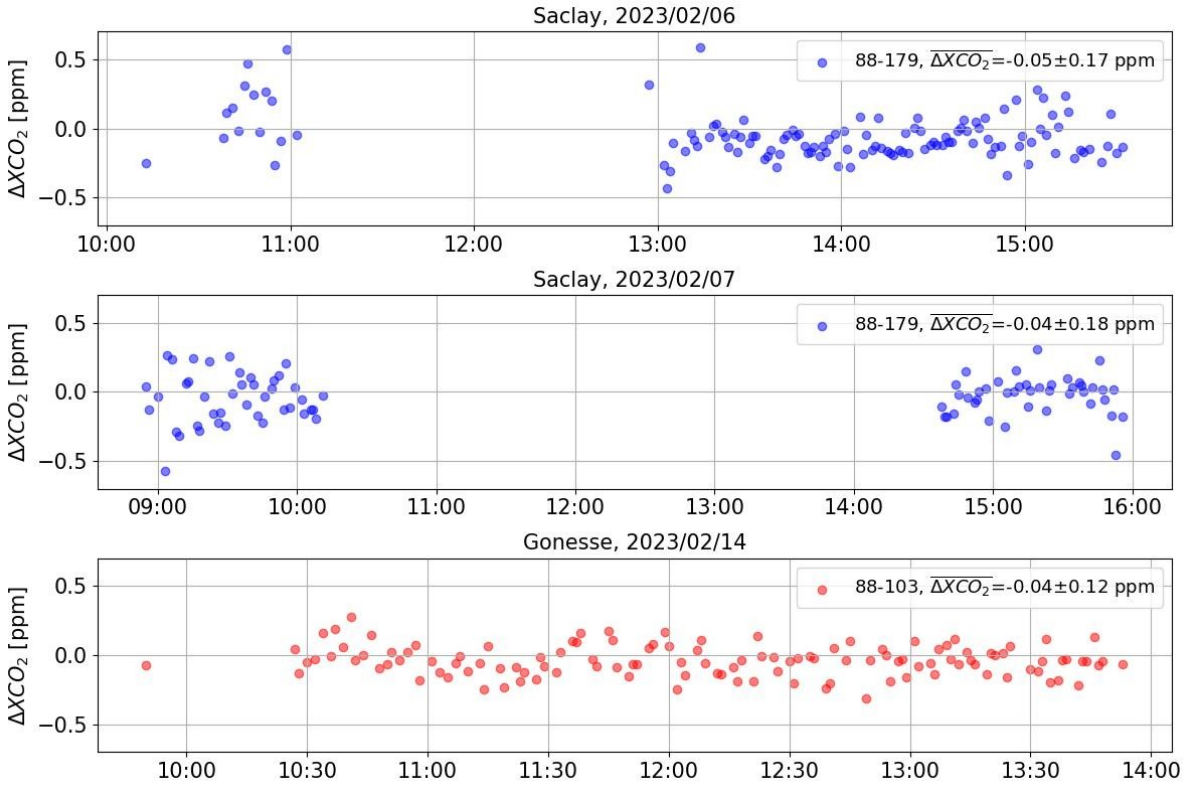
How to keep a good agreement between the instruments in the network?

- A mobile instrument travels from site to site
- Inter-comparison at least twice a year

- Goal: 0.1~0.2 ppm

- These instruments are validated to work together in the network



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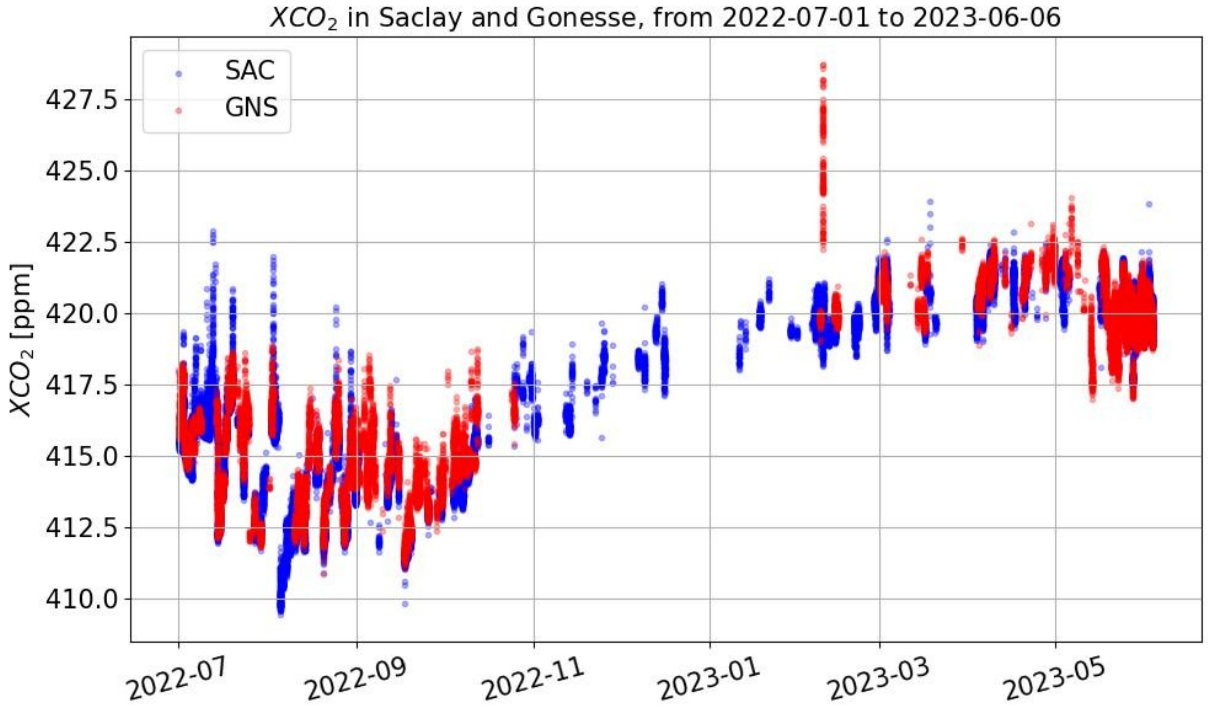
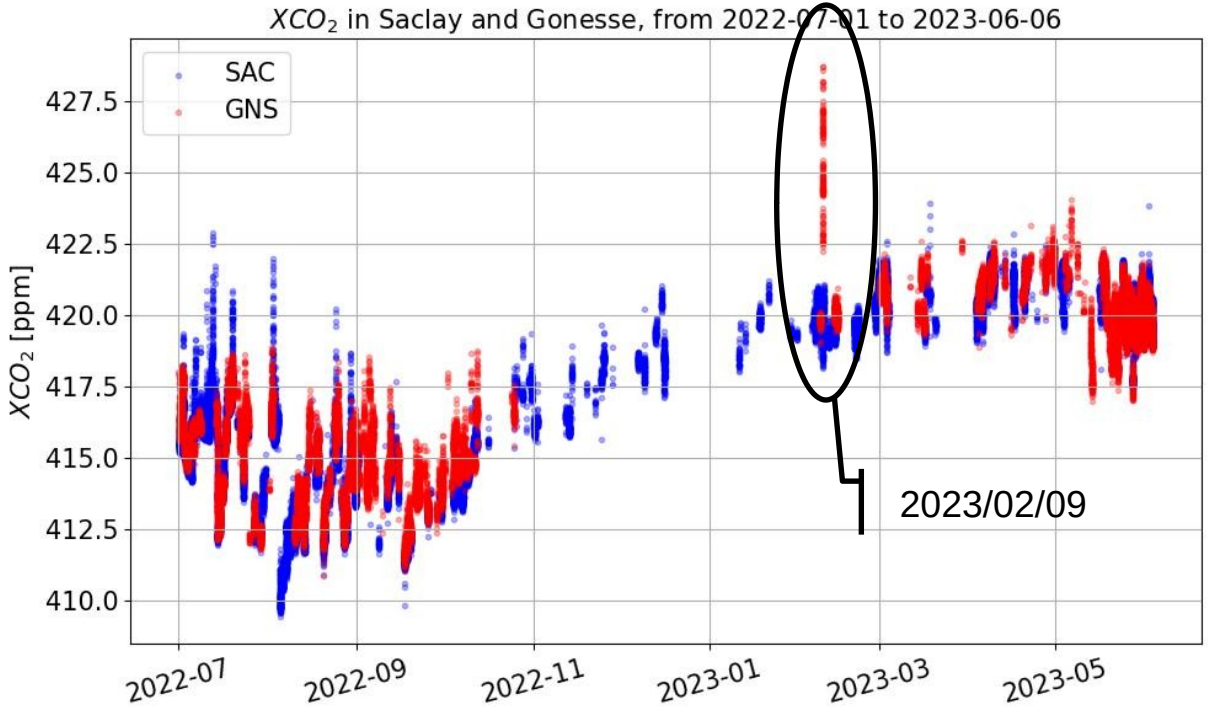
XCO_2 time series in SAC and GNS



ICOS Cities

Focus on 2023/02/09 XCO_2 peak



ICOS Cities

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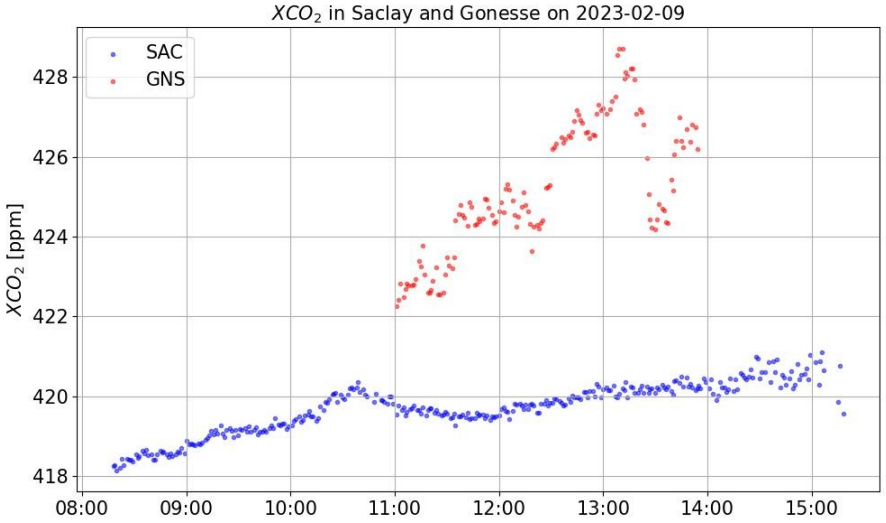

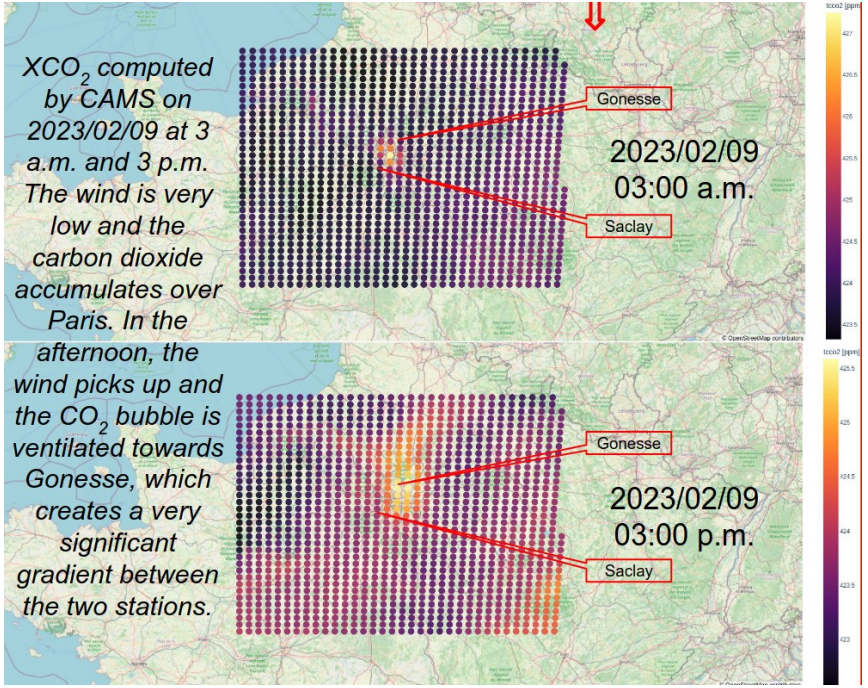

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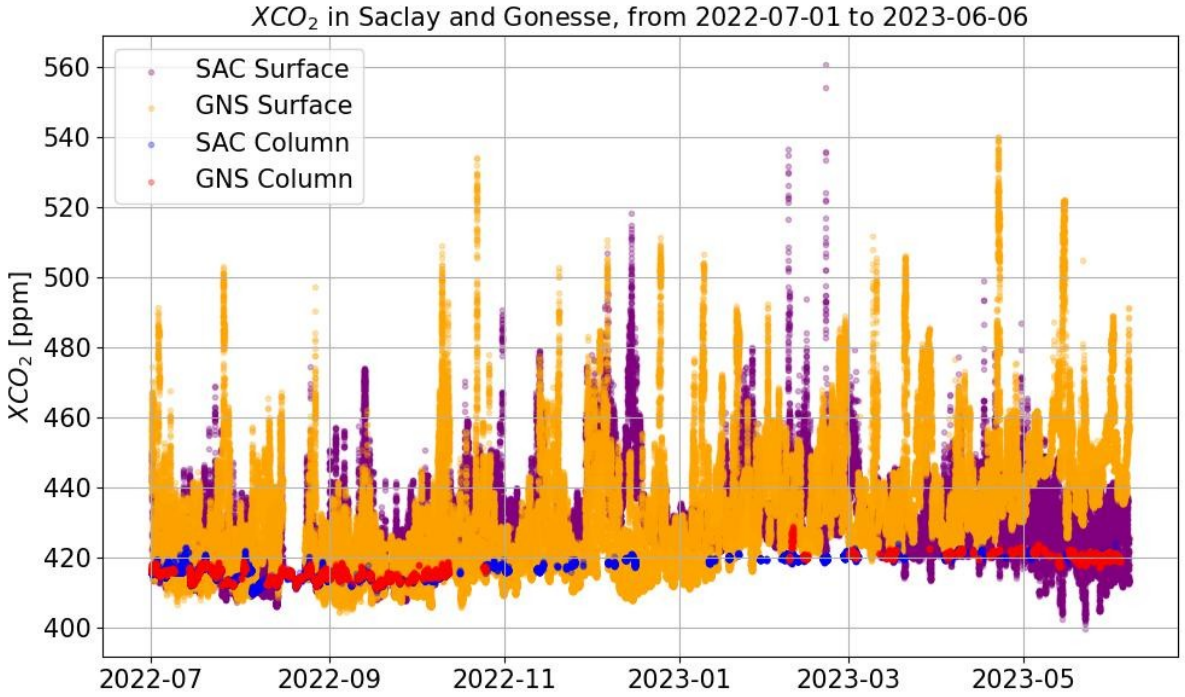
XCO_2 vs in-situ CO_2 time series

- Less columns measurements than in-situ measurements
- Daytime only

- 10 times smaller variations
- Less sensitive to local sources



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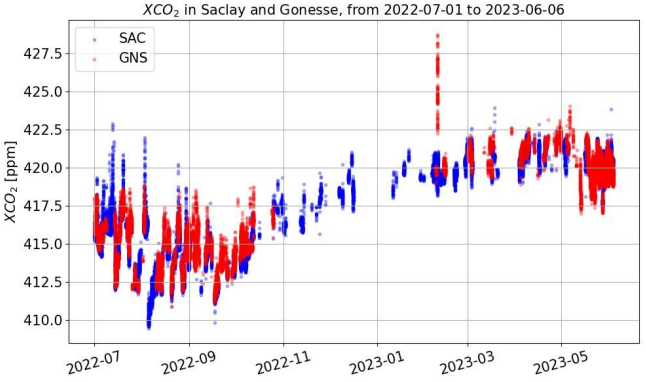
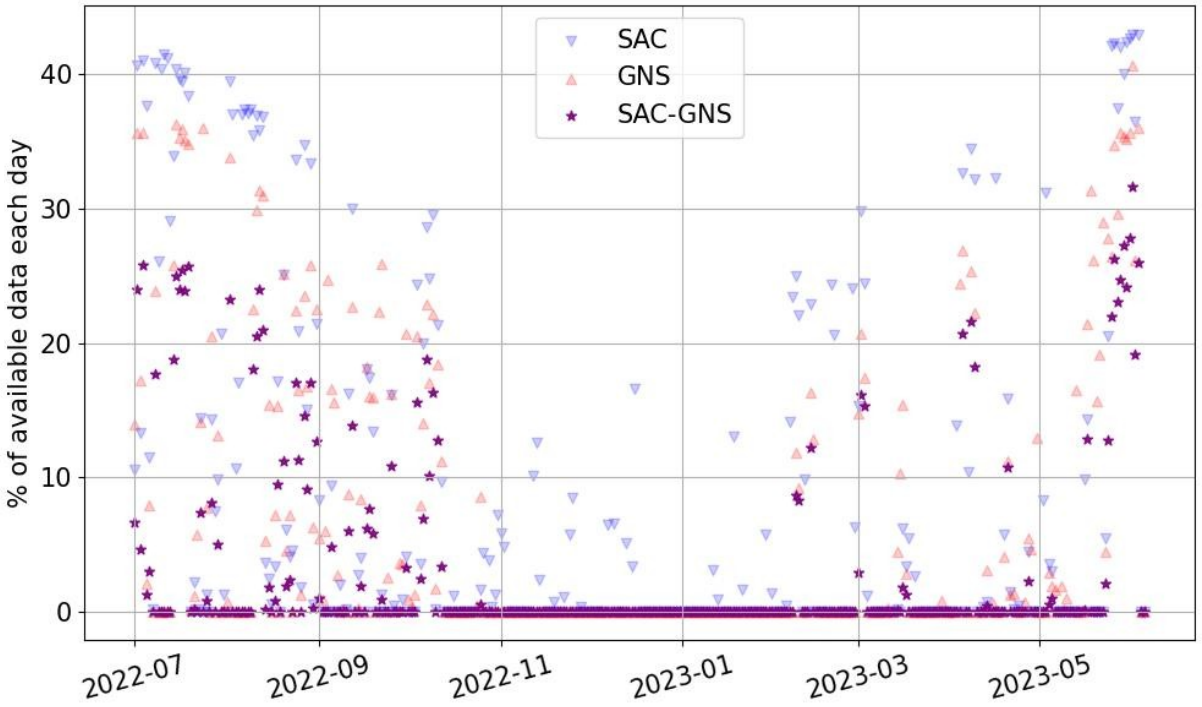
Data availability





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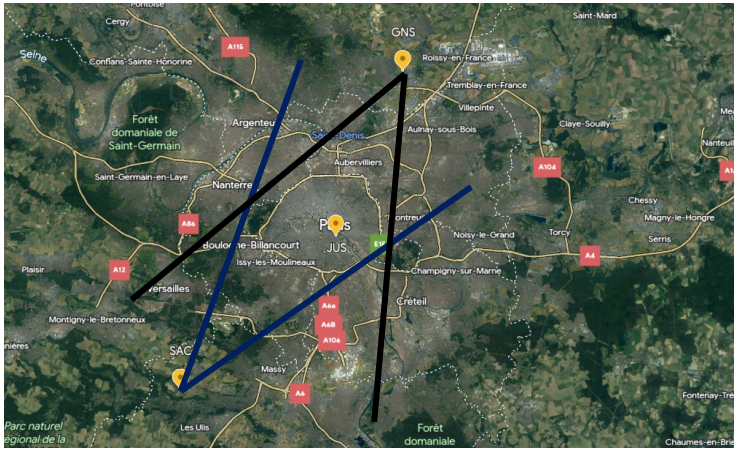
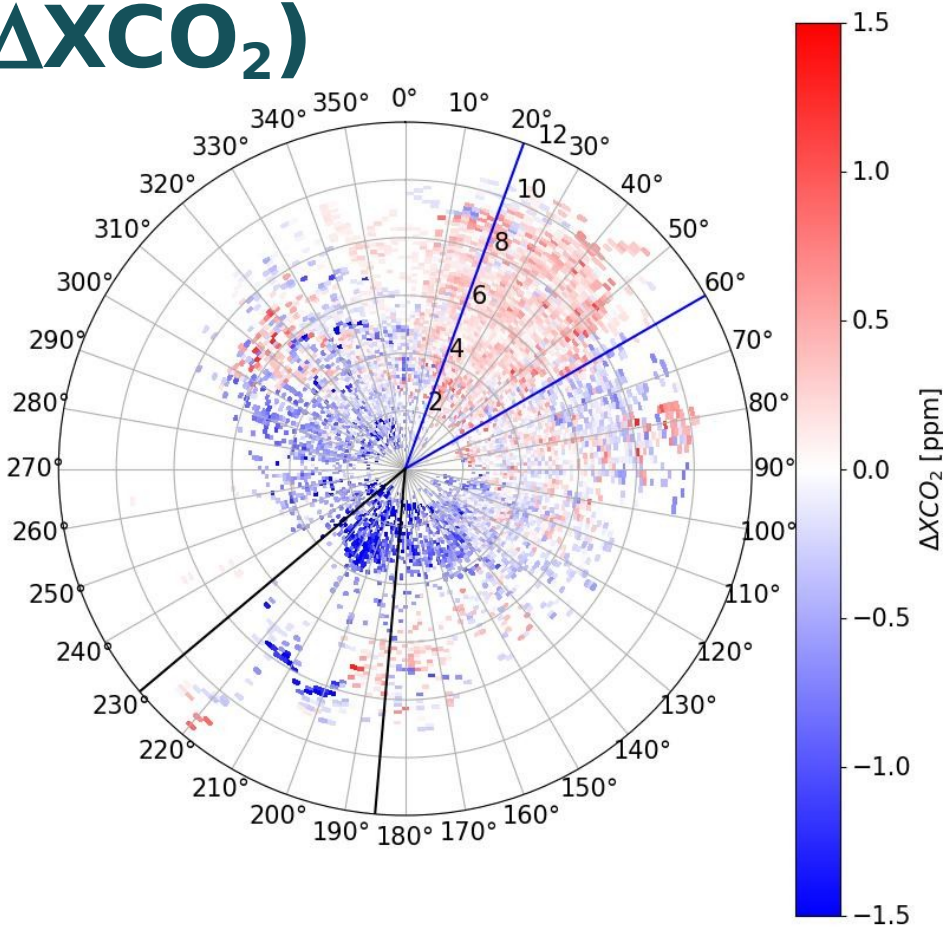
XCO_2 gradients (ΔXCO_2)

- $\Delta XCO_2 = XCO_{2;SAC} - XCO_{2;GNS}$
- 10 minutes averaged gradients between Saclay and Gonesse
- Period: 2022/07/01 - 2023/06/06





ICOS Cities

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Conclusion

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Conclusion and future work

- ICOS-Cities network has been up and running for almost a year now
- Automatic enclosure system and NRT data processing give us as much data as possible
- Regular inter-comparison of instruments enables us to guarantee the quality of the data
- Averaged ΔXCO_2: ~ 1 ppm, strong dependence to the wind direction but not to the wind speed

Perspectives:

- Inverse modeling: comparison of the inversion using surface measurements
- Goal: get a fast emission inventory and correct statistical ones

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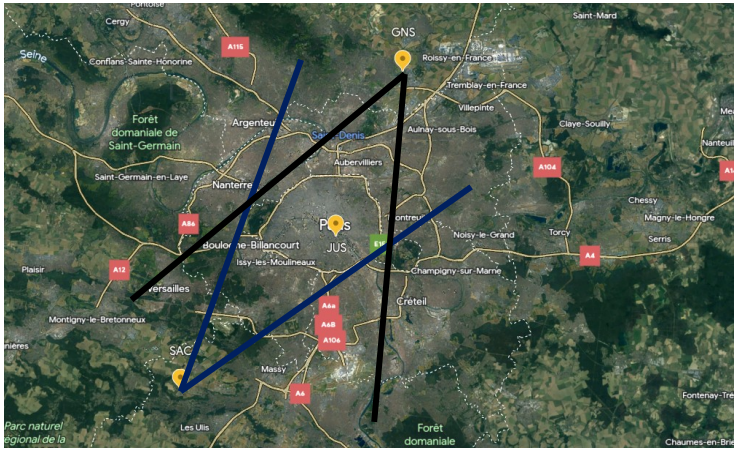

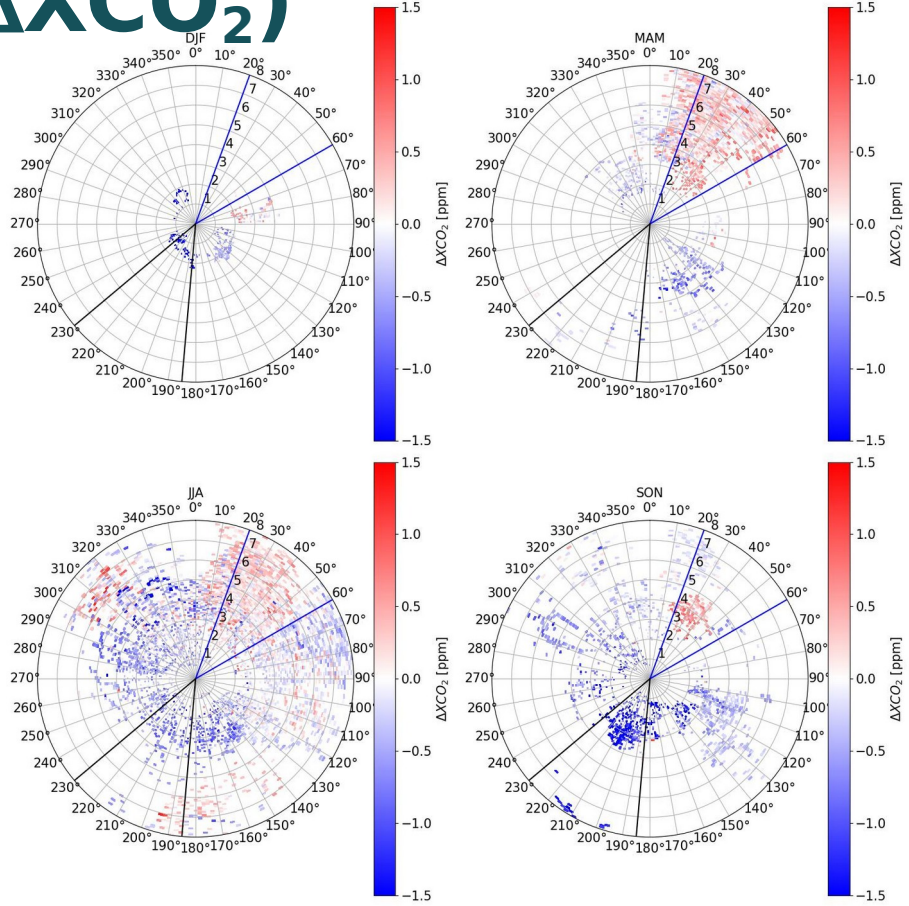

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