More than 10 years of TCCON, NDACC-IRWG and COCCON measurements at Paris

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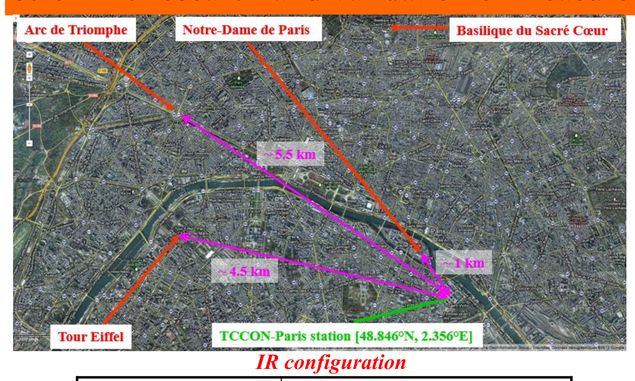
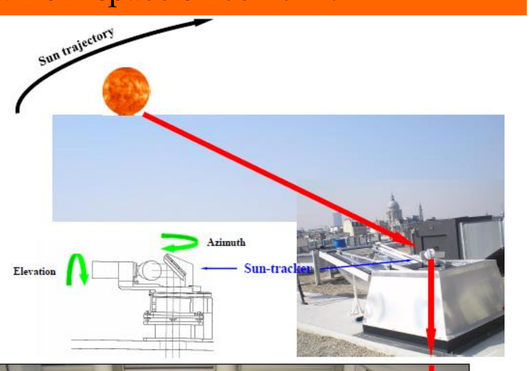
TCCON-Paris site

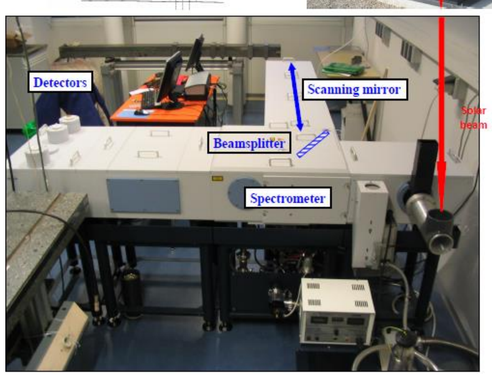
The FTS-Paris ground-based Fourier Transform Spectrometer is located in downtown Paris at the Jussieu campus of Sorbonne Université. The FTS-Paris instrument (Bruker IFS-125HR) is associated to a suntracker installed on the roof terrace of the QualAir platform to perform solar absorption observations. Since September 2014, FTS-Paris is part of TCCON. The TCCON-Paris station provides rare hot spot measurements and contributes to GHG satellite instrument validation. The site has joined the NDACC-IRWG network providing urban air pollutants abundances for scientific research and validation of measurement from space since 2024.



IR configuration

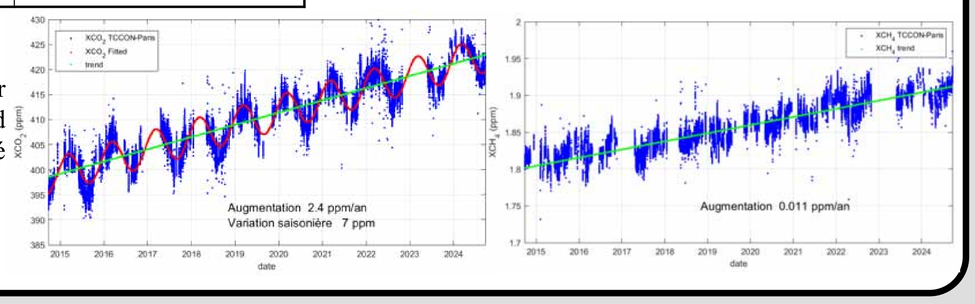
Internal source	Globar or tungsten lamp
Beamsplitter	KBr : 450 - 4800 cm^{-1} CaF_2 : 1850 - 14000 cm^{-1}
Entrance window	KBr : 450 - 25000 cm^{-1} CaF_2 : 1850 - 14000 cm^{-1}
MCT detector	D* > 2.5x10^{10} cmHz$^{1/2}$W^{-1}
InSb detector	D* > 1.5x10^{11} cmHz$^{1/2}$W^{-1}
InGaAs detector	NEP < 5x10^{-12} W/Hz$^{1/2}$
HBr & N_2O cells	NDACC Ref. #80 & #26
HCl cell	TCCON Ref. #15





FTS-Paris with its sun-tracker, cf. Té *et al.*, RSI, 2010

FTS-Paris and all other equipments were financed by Sorbonne Université and MONARIS



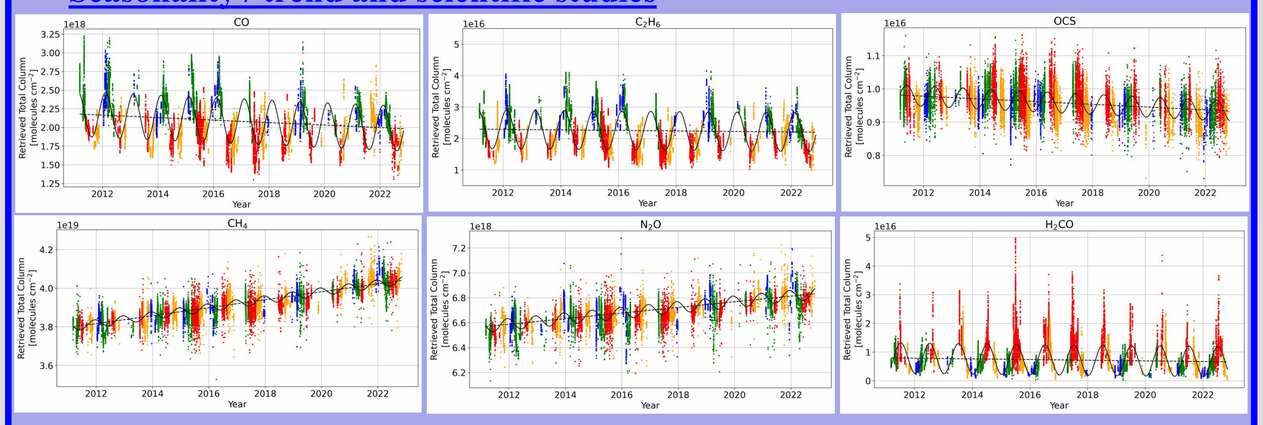
NDACC-IRWG data of the Paris site

Mid-infrared measurement of the FTS-Paris

- Use of InSb detector + 4 optical filters
- Provide urban pollutants CO, CH_4, C_2H_6, N_2O, OCS, H_2CO, NO_2, HF, HCN, HCl and O_3 (upcoming) using the radiative transfer code SFIT4

[HITRAN2020 & ATM2020, WACCM7 (a priori), OEM & Tikhonov (profile retrieval)]

Seasonality / trend and scientific studies



⇨ Ortega *et al.* 2023: *Anomalies of O_3, CO, C_2H_2, H_2CO, and C_2H_6 detected with multiple ground-based FTIR and assessed with model simulation in 2020: COVID-19 lockdowns vs natural variability*

⇨ Hannigan *et al.* 2021: *Global Atmospheric OCS Trend Analysis from 22 NDACC Stations*

⇨ Blumenstock *et al.* 2021: *Characterisation and potential for reducing optical resonances in FTIR spectrometers of the NDACC Network*

⇨ Vigouroux *et al.* 2018: *NDACC harmonized formaldehyde time-series from 21 FTIR stations covering a wide range of column abundances*

Satellite instruments validation

⇨ OMI: Müller *et al.* 2024

⇨ TROPOMI: Oomen *et al.* 2024
Vigouroux *et al.* 2020

⇨ OMPS (Suomi NPP and NOAA-20): Kwon *et al.* 2022

Research activities @TCCON-Paris

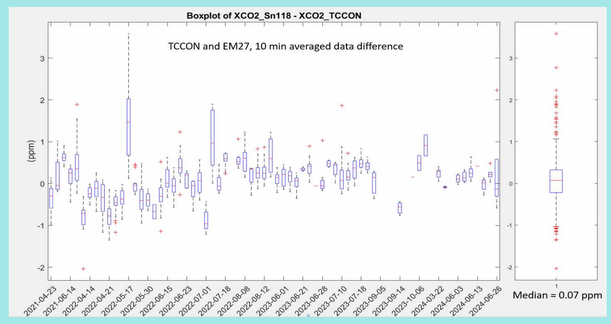
SNO ICOS France Atmosphère

⇨ The TCCON data from the Paris site is part of the CNRS / INSU National Observation Service within the SNO ICOS France Atmosphère project [2025-2029]

⇨ The TCCON-Paris data is available at the TCCON official website (https://tccondata.org) and at CNRS / IPSL AERIS website [2014-present]
XCO_2, XCH_4, XN_2O, XCO, XHF, XH_2O, OCS, NO_2, HCl, HCN

COCCON measurement @Jussieu

⇨ MONARIS **EM27/SUN** (sn#118) operated according to the COCCON requirements on field campaigns & at the **TCCON-Paris** site for **regular measurements**



⇨ COCCON data analysis using KIT PROFFAST V2.4 (+Pylot processing tool)

French COCCON consortium

⇨ **Regular intercomparison** campaigns **between EM27/SUNs** of the consortium (CNES, GSMA, LMD, LOA, MONARIS, LSCE) **@TCCON-Paris**

⇨ **ILS measurement bench** implemented at MONARIS to characterize and monitor the ILS evolution of all above EM27/SUNs (+ use of LINEFIT)

⇨ Contribution to the **MAGIC project** for monitoring anthropogenic GHG emissions and space missions validation

Contribution to space missions

⇨ **Validation of satellite instruments**
- TROPOMI, cf. Oomen *et al.*, ACP, 2024
- OMI, cf. Müller *et al.*, ACP, 2024
- GOSAT & -2, cf. Yoshida *et al.*, SOLA 2023
- OCO-2, cf. Das *et al.* [*to be printed in ESS*]

⇨ **SVANTE II project (2025-2026)**
contribution of MONARIS COCCON data for TROPOMI validation

⇨ **Preparation of upcoming space missions and their validation plans**
MicroCarb, IASI-NG, CO2M, MERLIN …

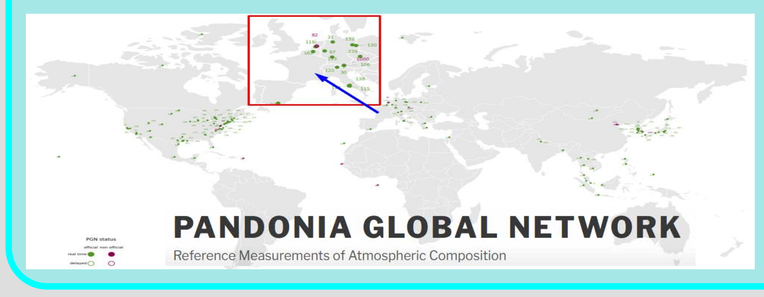
Contribution to research networks & scientific studies

⇨ **EU PAUL project** with TCCON-Paris data & EM27/SUNs inter-comparison

⇨ **OBS4CLIM French ANR project**
Upcoming implementation of surface in-situ GHG measurement (Picarro G2401) at the top of Zamansky Tower (120 masl)

⇨ **PhD co-funded by CNES and Académie Spatiale d'Île de France** on "*Aerosol and GHG simultaneous measurement to improve satellite validation*" [2025-2028]

⇨ **PANDORA-Paris project**
(Sorbonne Université platform investment)
Implementation of the first Pandora 1S in France at the Qualair platform (location of TCCON-Paris)



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⇨ Sorbonne Université, CNRS / INSU & INC, CNES, ANR, EU, IPSL, CSC, …

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