

## Journée scientifique de la Plateforme OCAP (Plateforme d'Observation de la Composition Atmosphérique Parisienne de l'IPSL)

*Jussieu, France, 10 December 2015*

### The new ground-based remote sensing TCCON-Paris site

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Case 76, 4 Place Jussieu, 75005 Paris, France

# TCCON network



## TOTAL CARBON COLUMN OBSERVING NETWORK



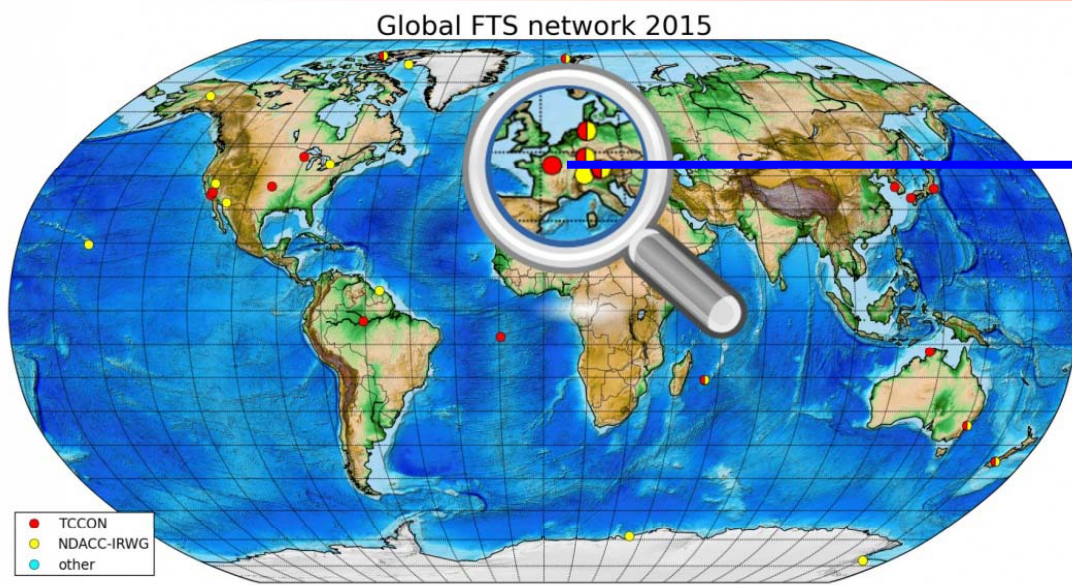
TCCON is a network of ground-based Fourier Transform Spectrometers recording direct solar spectra in the near-infrared spectral region. From these spectra, accurate and precise column-averaged abundance of CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HF, CO, H<sub>2</sub>O, and HDO are retrieved.

TCCON provides an essential validation resource for the *Orbiting Carbon Observatory (OCO)*, *Sciamachy*, and *GOSAT*.

For the latest TCCON information, please visit the *TCCON Wiki* at <https://tccon-wiki.caltech.edu>.

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- International network
- More than 29 stations equipped with ground-based FTIR ( $<0.02 \text{ cm}^{-1}$ )
- Dedicated to greenhouse gases observation
  - **Absolute measurements**
  - **X<sub>CO<sub>2</sub></sub> accuracy at 0.5 ppmv or 0.1% (dry air mole fraction of CO<sub>2</sub>)**



> Indianapolis
> Izaña
> Jena
> JPL
> Karlsruhe
> Lamont
> Lauder
> Manaus
> Ny-Ålesund
> Orleans
> Oxfordshire
▼ <b>Paris</b>
Instrument History
> Park Falls
> Poker Flat
> Reunion Island
> Rikubetsu
> Saga
> Sodankylä
> Tsukuba
> Wollongong
> Yekaterinburg

### Paris, France

TCCON Status: Provisional



48.846° N, 2.356° E, 60 meters above sea level

FTS-Paris : Bruker IFS 125HR

Operated by LERMA (Laboratoire d'Etudes du Rayonnement Atmosphérique, UMR 8112), Université Pierre et Marie Curie / Collaborators : Yao Té (PI), Pascal Jeseck, Christof Janssen

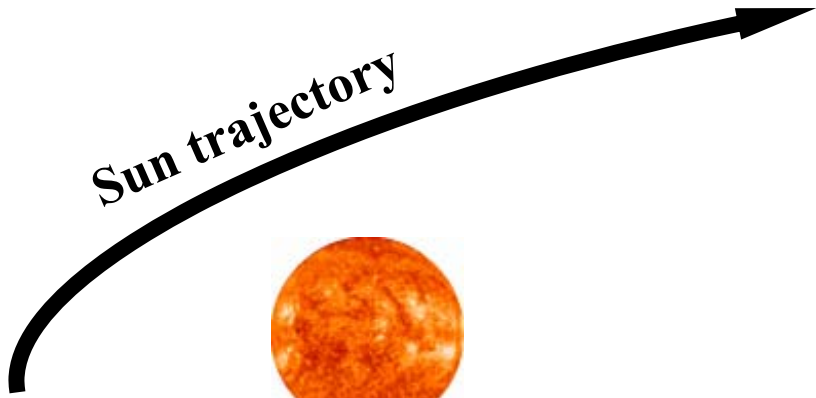
# TCCON-Paris : the first TCCON site in an European megacity

TASQ team  
from LERMA-Jussieu  
T32-33, Floor 2



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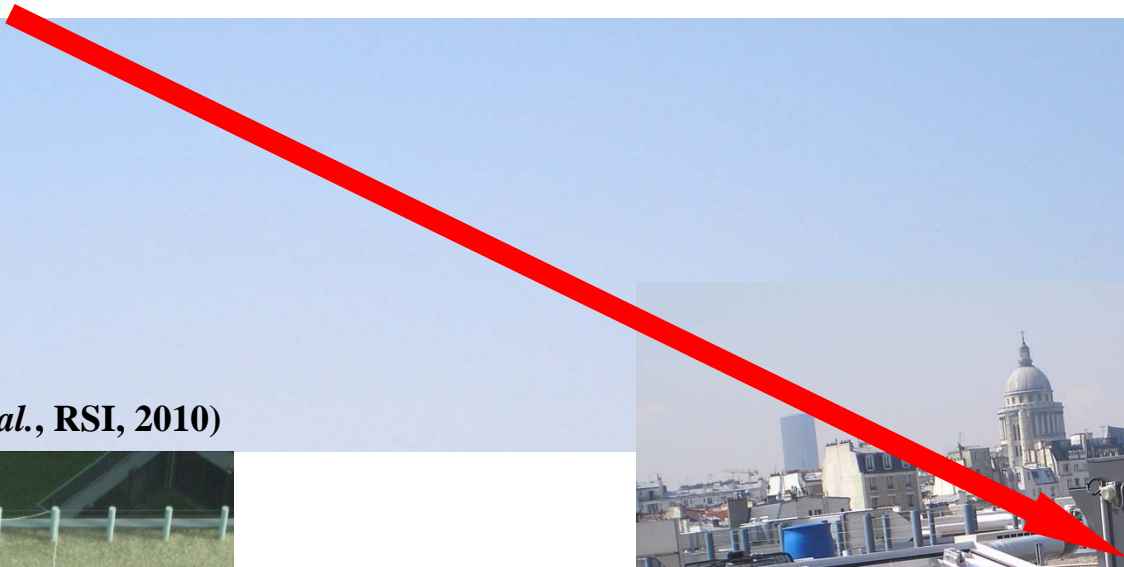
**Ground-based remote sensing FTIR  
measurement technique**



Sun trajectory

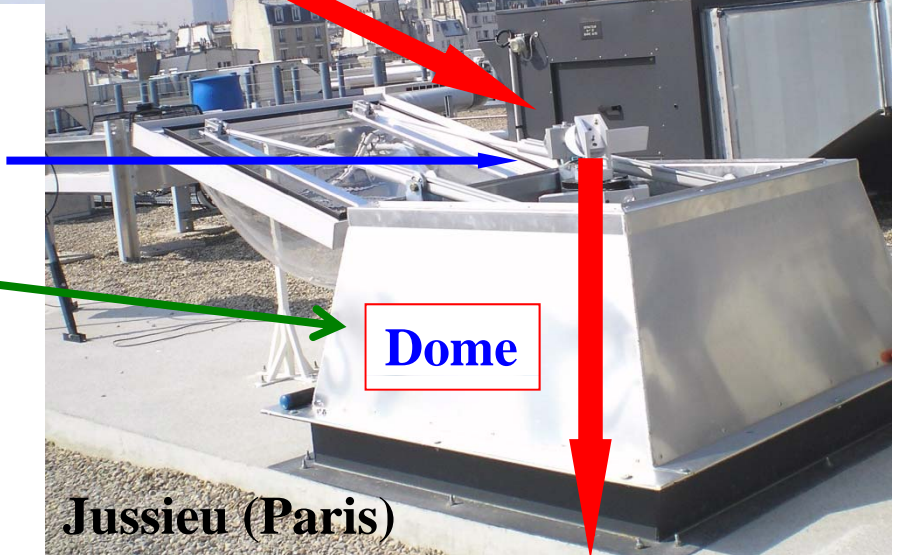


(Té *et al.*, RSI, 2010)



Té *et al.*, Journée OCAPI, Jussieu, 10 December 2015

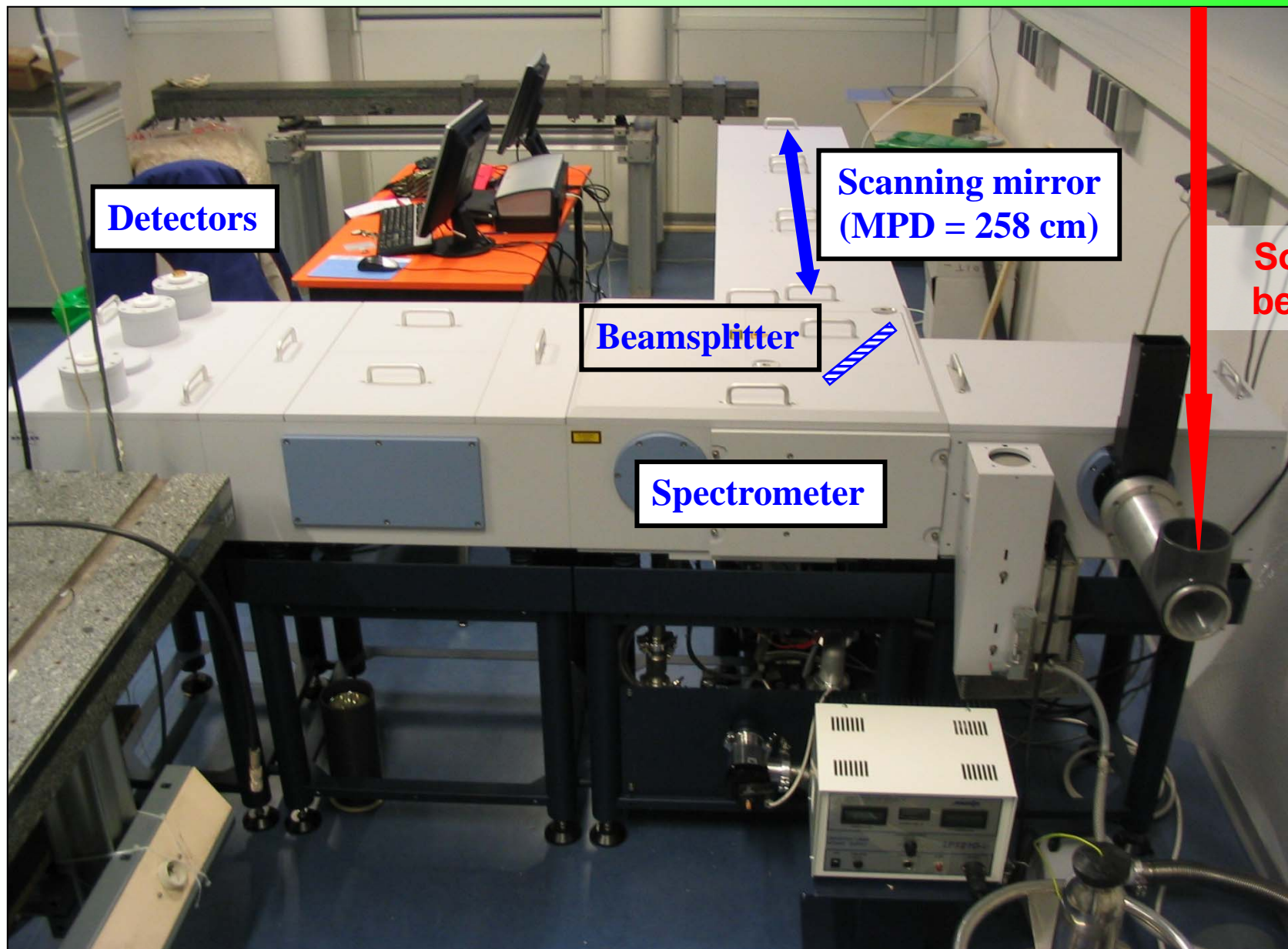
Sun-tracker



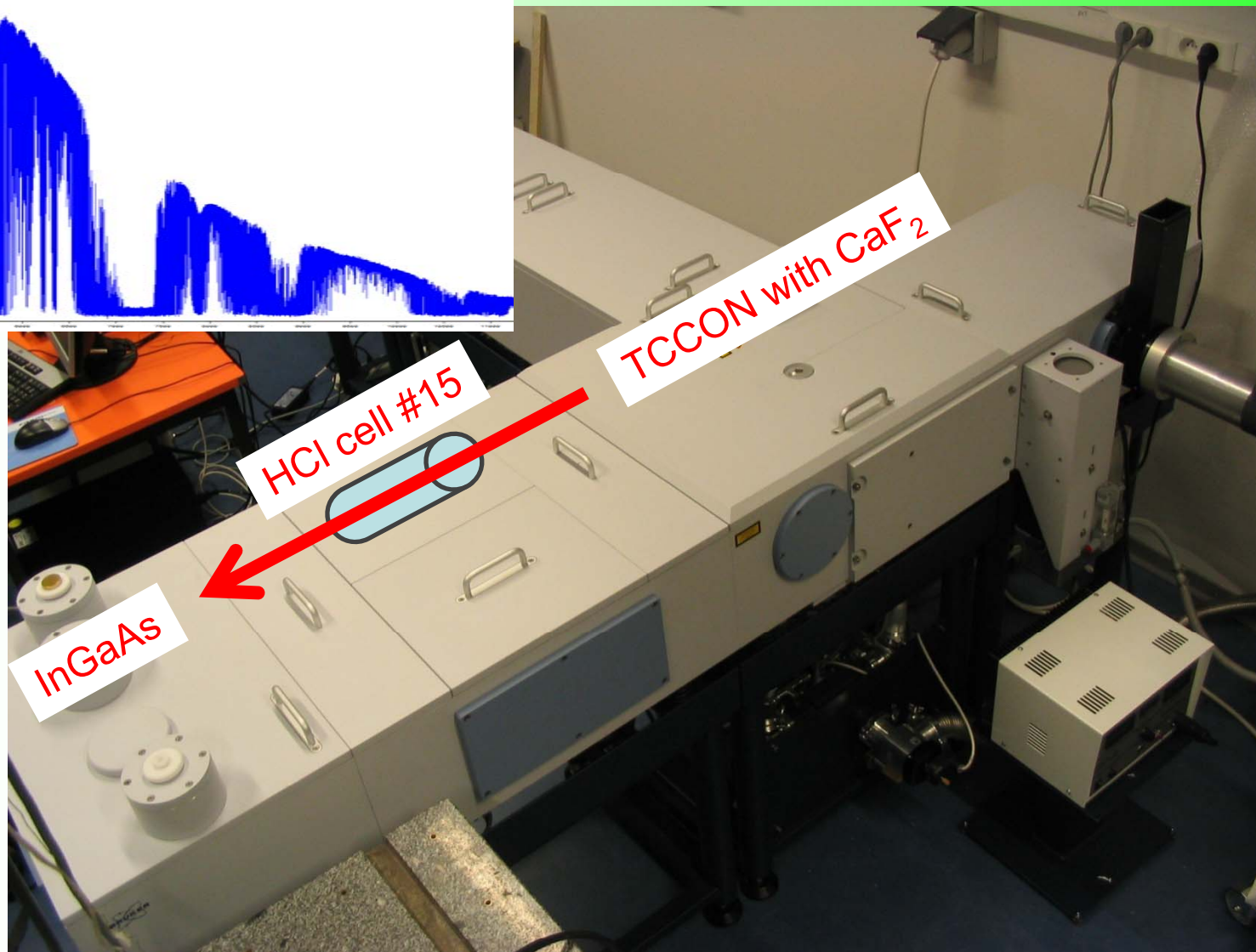
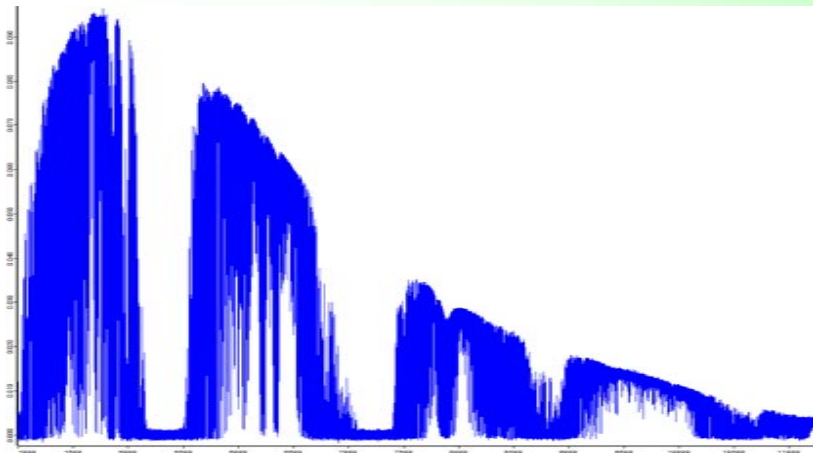
Dome

Jussieu (Paris)

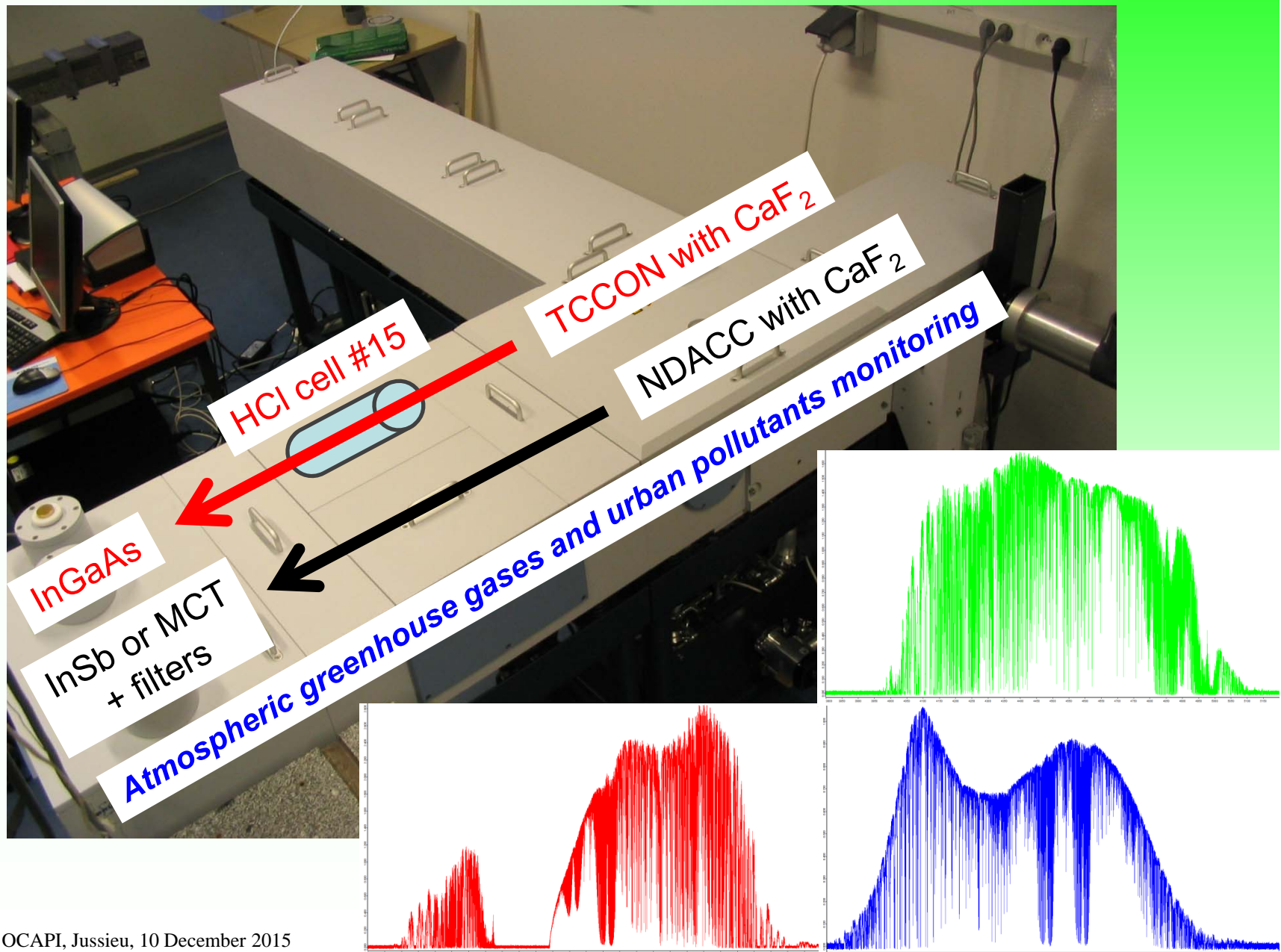
# The LERMA FTS-Paris installed @ Jussieu (QualAir platform)



# TCCON & NDACC configurations



# TCCON & NDACC configurations





## TCCON-Paris site

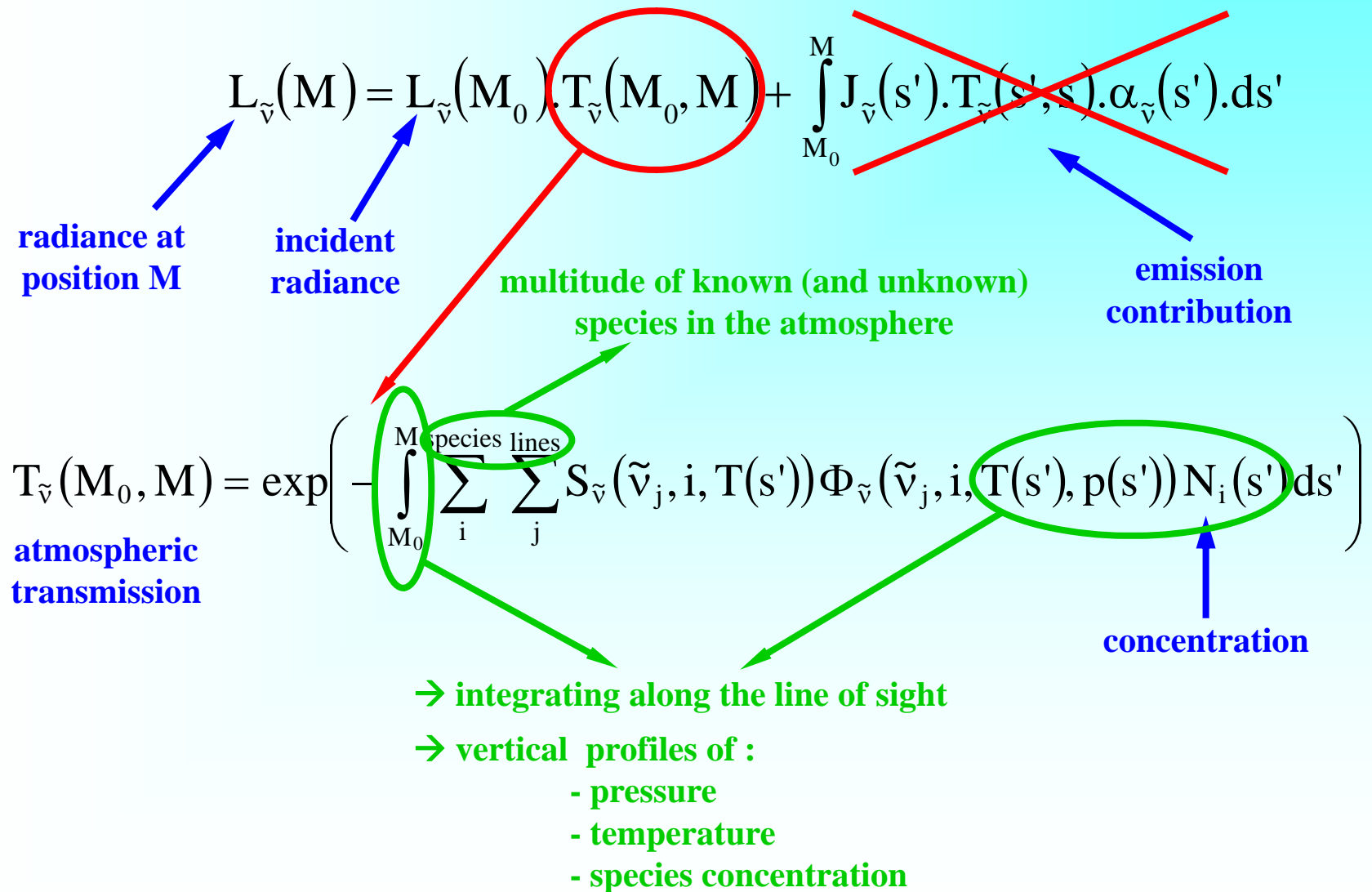
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- ⇒ First TCCON instrument managed by a French group
- ⇒ TCCON data since September 2014  
(<http://tcccon.ornl.gov/>)
- ⇒ Several multi-instruments measurement campaigns @ Paris site
  - MEGAPOLI summer campaign
  - Multi-CO<sub>2</sub> (IPSL project)
  - COCCON international scientific collaborative campaign
- ⇒ Auxiliary *in situ* measurements
  - CO IR analyser
  - O<sub>3</sub> UV analyser
  - Meteorological station (p, T, RH, wind ...)
- ⇒ Quasi-simultaneous measurement of large variety of species:
  - CO<sub>2</sub>, CO, CH<sub>4</sub>, O<sub>3</sub>, N<sub>2</sub>O, OCS, NO<sub>2</sub>, H<sub>2</sub>CO, C<sub>2</sub>H<sub>6</sub>, H<sub>2</sub>O, HCl, ...

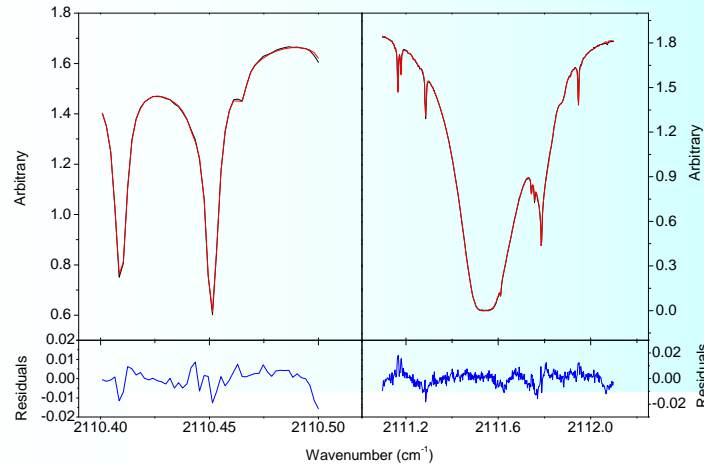
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**Atmospheric pollutants monitoring by  
FTS-Paris over Paris megacity**

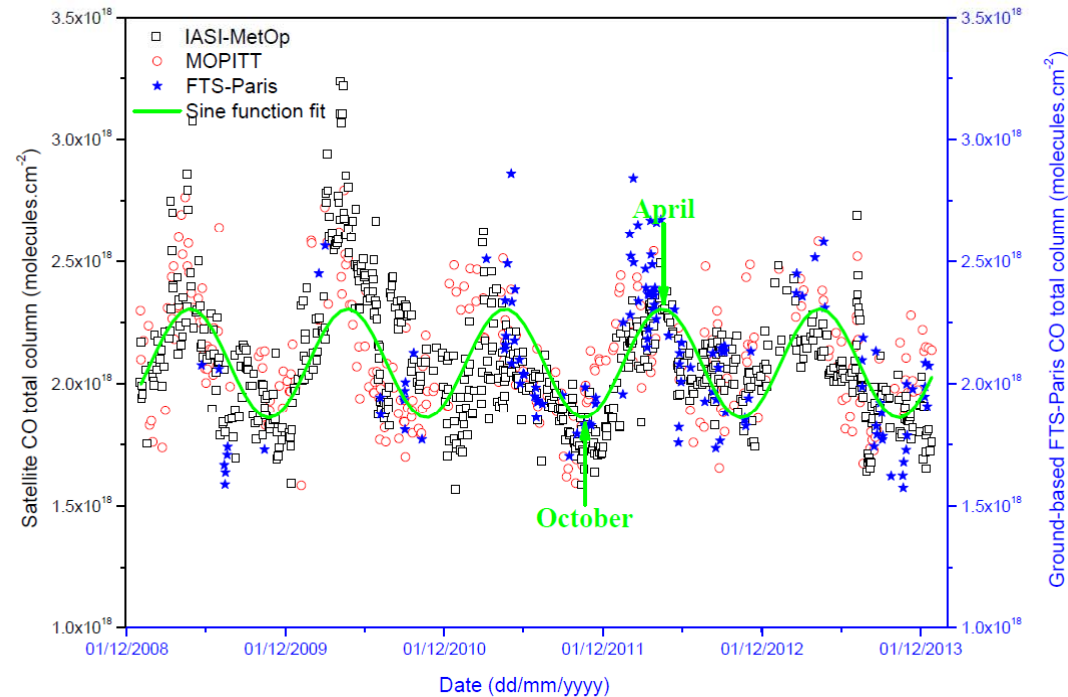
# Radiative transfer model



# CO retrieval @4.7 $\mu\text{m}$ (NDACC)



NDACC FTIR data  
since 2008



# Surface VMR of CO

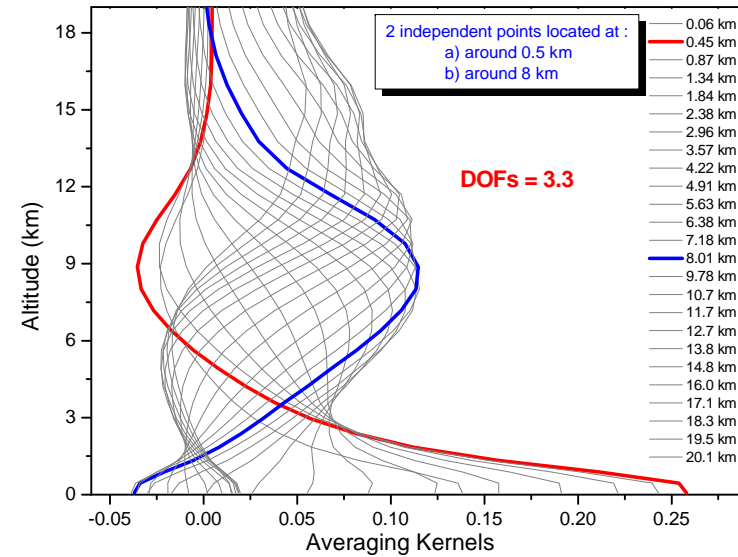


Terrace of 45-46 building

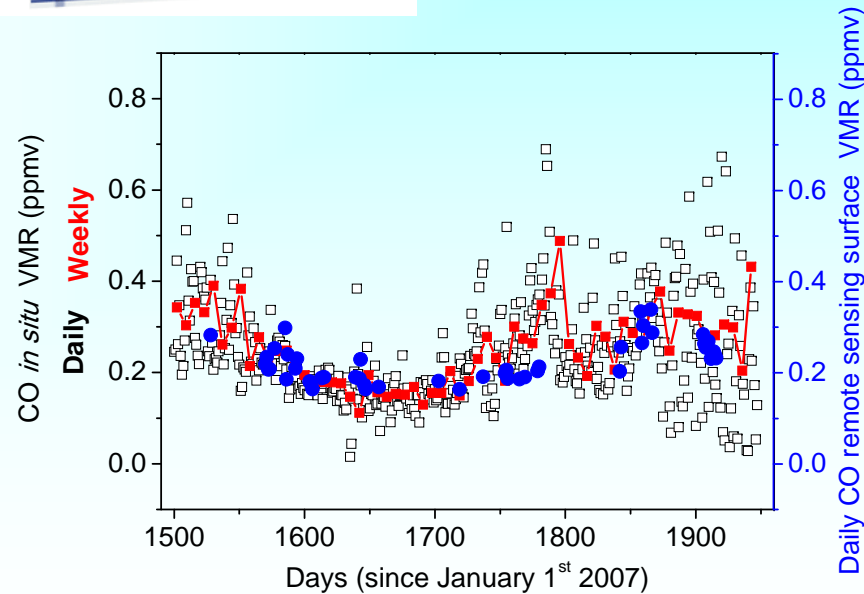
*In situ* CO data since 2006

Air sampling

Below experimental room

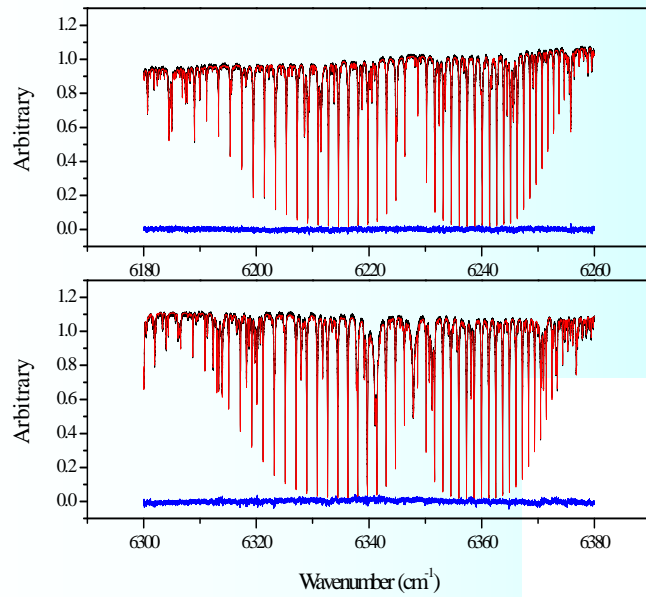


(Té *et al.*, JOAT, 2012)

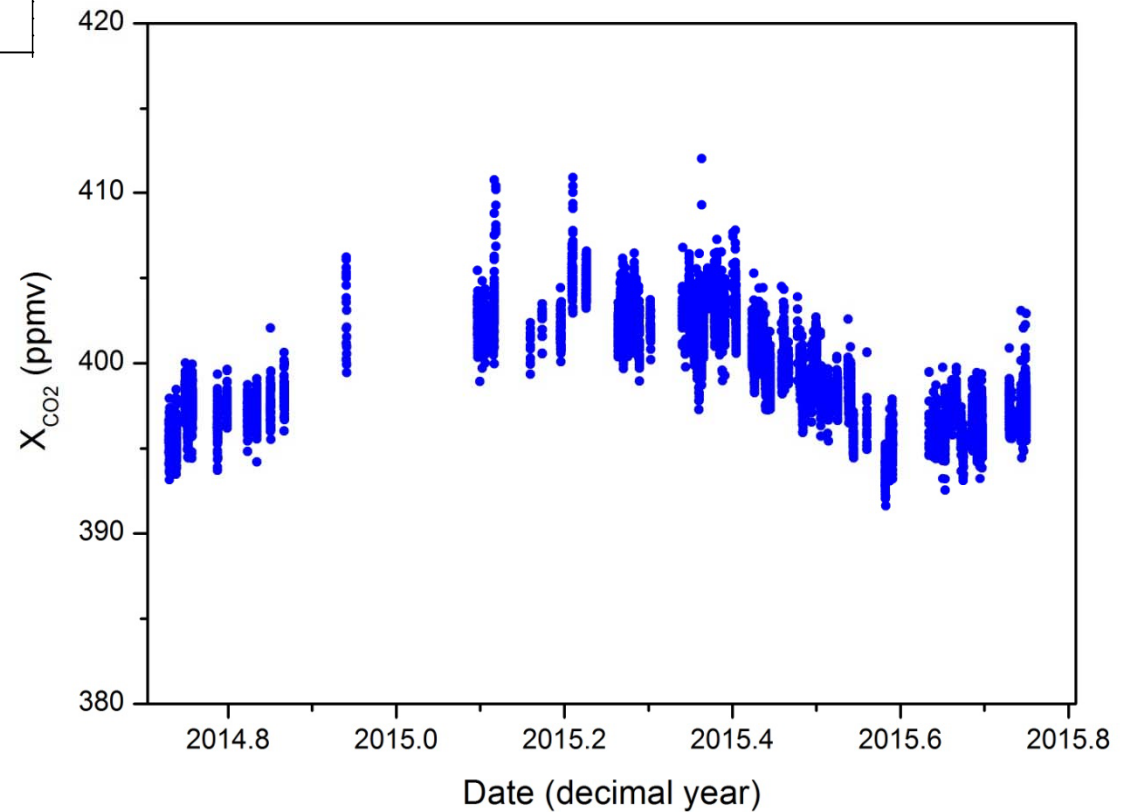


➔ Good sensitivity of the FTS-Paris in the boundary layer

# CO<sub>2</sub> retrieval @1.67 μm (TCCON X<sub>CO<sub>2</sub></sub>)

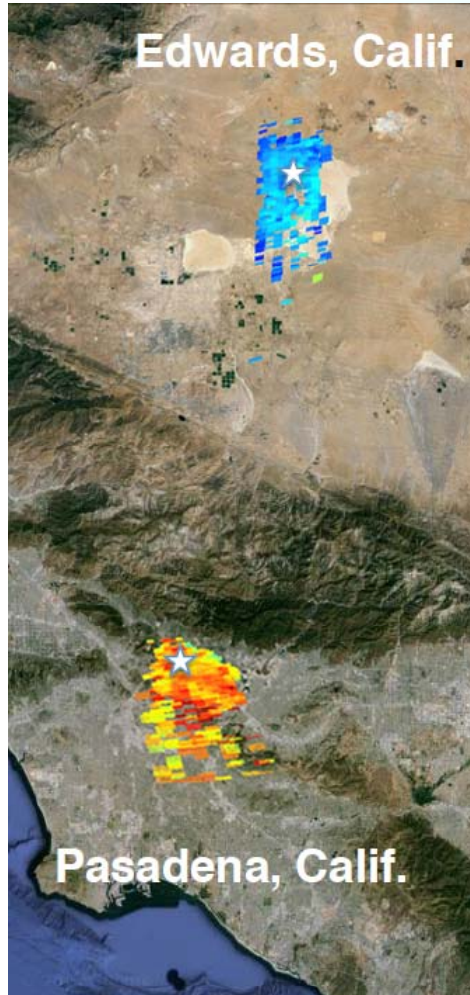


TCCON time series data  
since September 2014



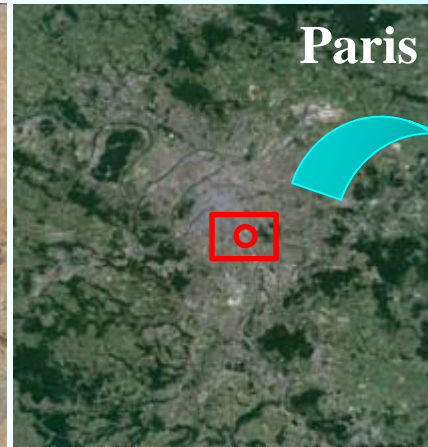
# Worldwide TCCON network for satellite validation

OCO-2  
target mode

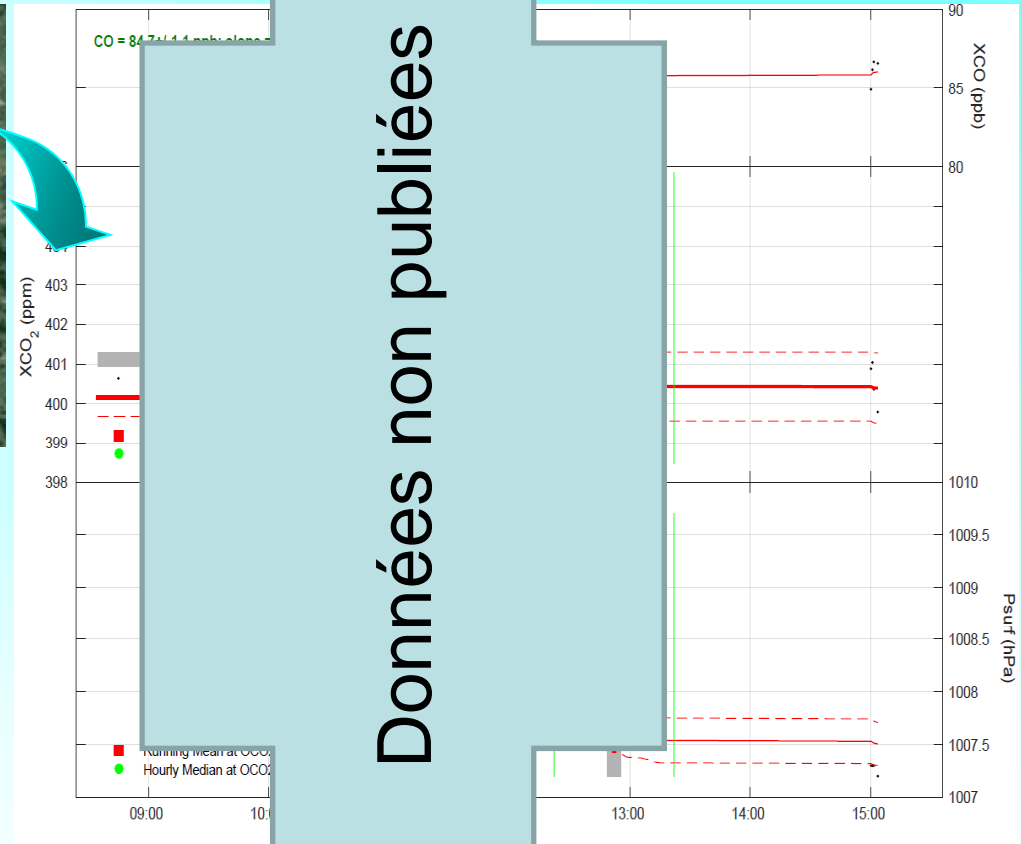


(Courtesy of D. Wunch)

Scheduled targets  
of Paris



- 07/08/2015
- 17/09/2015
- 24/09/2015
- **10/10/2015**
- 19/10/2015
- 26/10/2015
- 04/11/2015



◆ Next OCO-2 target mode  
overpass: 13/12/2015

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## **Perspectives and Future works**



## Future works

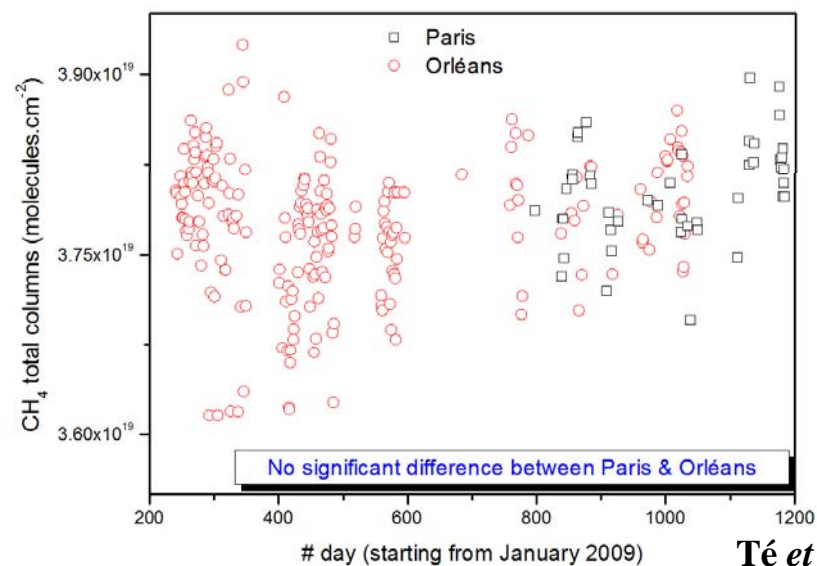
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- ➔ **Regular NDACC & TCCON measurements**
- ➔ **FTIR and *in situ*  $X_{\text{CO}_2}$  inter-comparison**  
(LERMA & LSCE)
- ➔ **Measurement campaigns in 2016**  
(KIT, LATMOS, LERMA, LISA, LSCE ...)
  - ⇒ **Paris 2030 project funded by la Région Île de France**
  - ⇒ **AO IPSL 2015 funded by IPSL**
- ➔ **TCCON supersite**  
(association of TCCON-Paris and TCCON-Orléans)

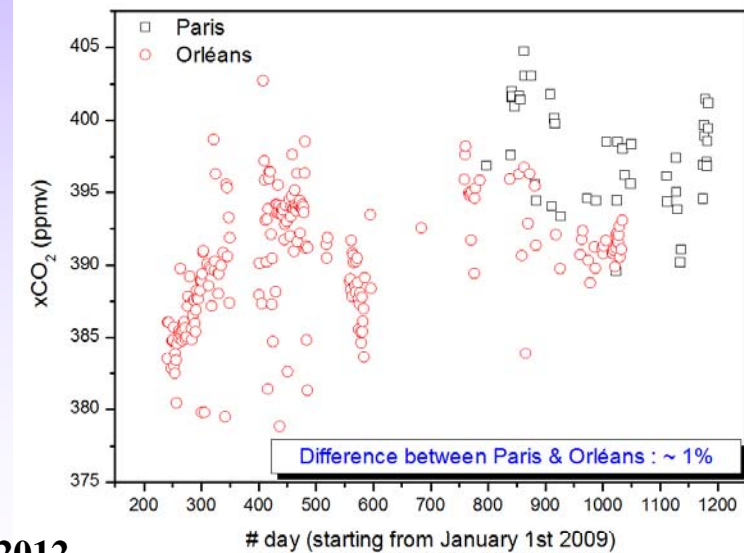
# Paris versus Orléans

## ■ TCCON-Orléans site

- <https://tcon-wiki.caltech.edu/Sites/Orleans>
- in the Orléans forest and about 100 km from Paris
- PI : J. Notholt, T. Warneke, N. Deutscher, ...



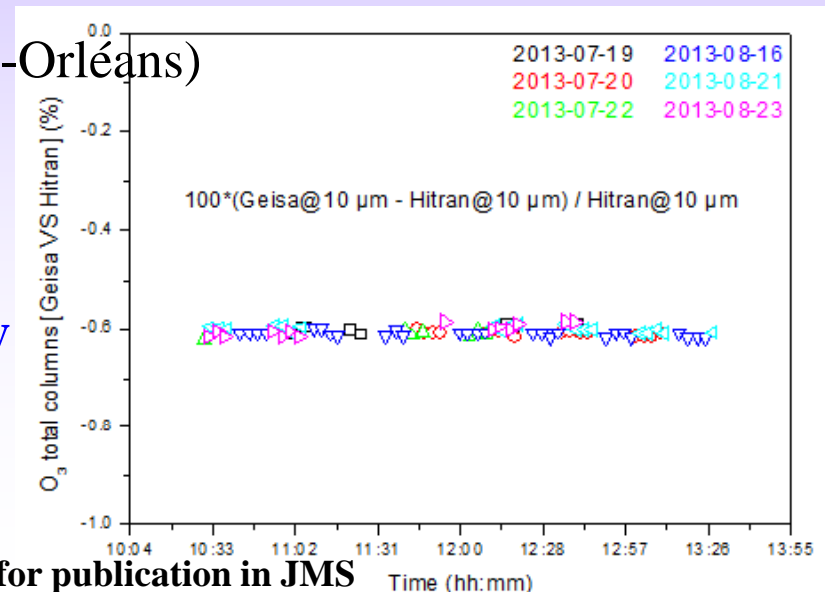
Té et al., EGU 2012



Orléans data courtesy of N. Deutscher

## Future works

- Regular NDACC & TCCON measurements
- FTIR and *in situ*  $X_{\text{CO}_2}$  inter-comparison (LERMA & LSCE)
- Measurement campaigns in 2016 (KIT, LATMOS, LERMA, LISA, LSCE ...)
  - ⇒ Paris 2030 project funded by la Région Île de France
  - ⇒ AO IPSL 2015 funded by IPSL
- TCCON supersite (association of TCCON-Paris and TCCON-Orléans)
- Molecular spectroscopy study (GSMA, MONARIS, LERMA ...)
  - ⇒ Spectroscopic parameters consistency
  - ⇒ SMO<sub>3</sub> project funded by INSU





**Thank you for your attention**



Laboratoire d'Études du Rayonnement et de la Matière en Astrophysique et Atmosphères



*If interested, please, contact me : [yao-veng.te@upmc.fr](mailto:yao-veng.te@upmc.fr)*