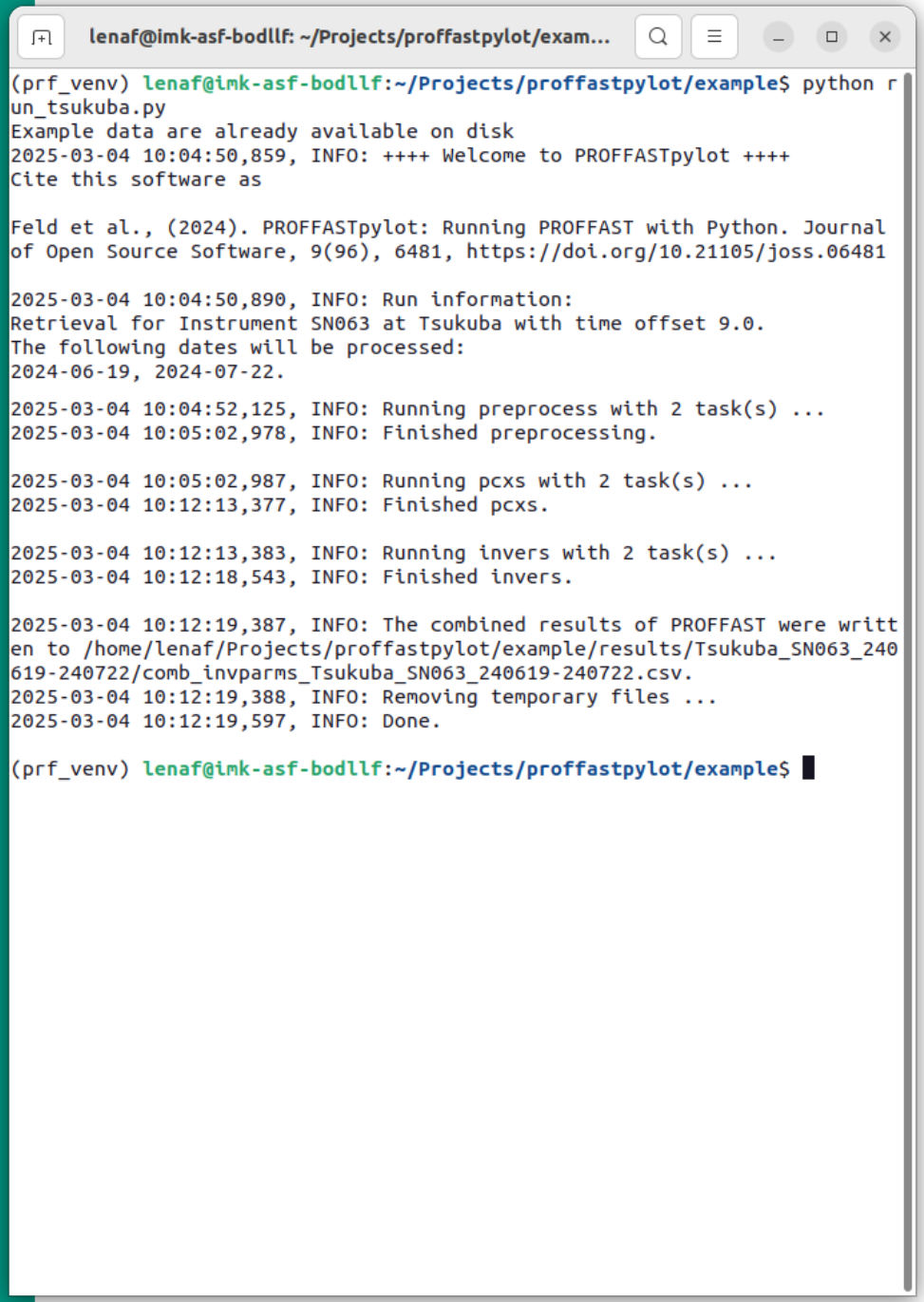
Outline

1. PROFFAST and PROFFASTpylot
   current developments
2. ITMS Project
   Support from the German COCCON community

PROFFAST and PROFFASTpylot

upcoming updates



Lena Feld, COCCON Telecon
03.05.2025

Changes currently under development

- Output
  - **HDF files** following the GEOMS conventions (EVDC requirement)
  - NetCDF file following the cf convention (similar to TCCON output)
  - Extended variables in comb_invparms csv file
- Recording near dateline
  - Extended use cases and new example
- Moving observer
- Diagnosis for sun centering
  - Investigation of the residuals to detect Doppler shift

Recording Near the Dateline

- Recording in UTC leads to unintuitive folder structure
  - Recommended: Recording in Local Time Zone (without using daylight saving time)
- Three options available in PROFFASTpylot
  - Using UTC for the Interferograms and the folder structure
  - Using a specific time zone (Local Time) for interferograms and folder structure
  - New: Using UTC for the interferograms and Local Time for the folder structure

Moving Observer

- New version of `preprocess` can use different coordinates for each spectrum
- PROFASTpylot adption in development
  - Input mechanism
  - Similar to the pressure input

Thank you

for the helpful comments, questions and ideas.

Citing PROFFASTpylot

- When using PROFFASTpylot, cite the software as

Feld et al., (2024). PROFFASTpylot: Running PROFFAST with Python. Journal of Open Source Software, 9(96), 6481, https://doi.org/10.21105/joss.06481 .

COCCON in support of ITMS

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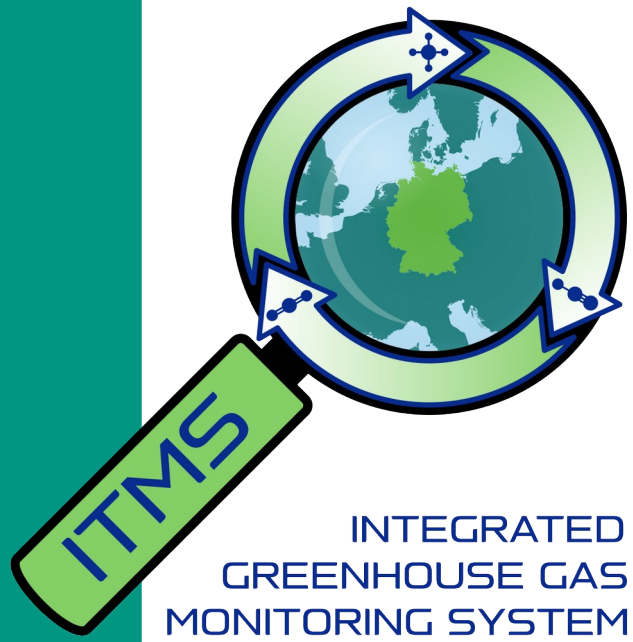
Moritz Makowski, Andreas Luther, Friedrich Klappenbach, Josef Stauber, Junwei Li, Jia Chen (TUM)

Lukas Grosch, Winfried Markert, Christof Petri, Thorsten Warneke (UB)

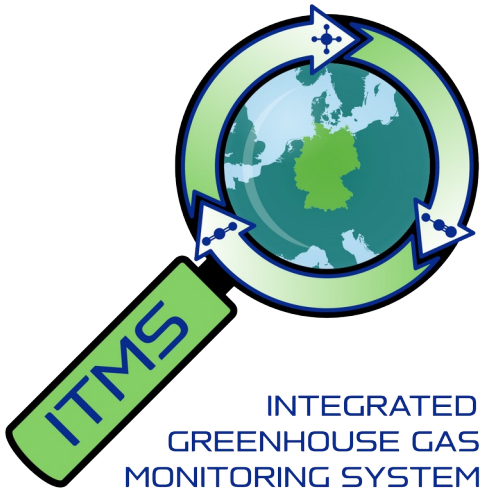
Benedikt Löw, Ralph Kleinschek, Rebekka Held, Nicolas Neumann and André Butz (UH)



INTEGRATED GREENHOUSE GAS MONITORING SYSTEM

Integrated Greenhouse Gas Monitoring System (ITMS)

- Creation of **observation based greenhouse-gas emission estimates** for Germany

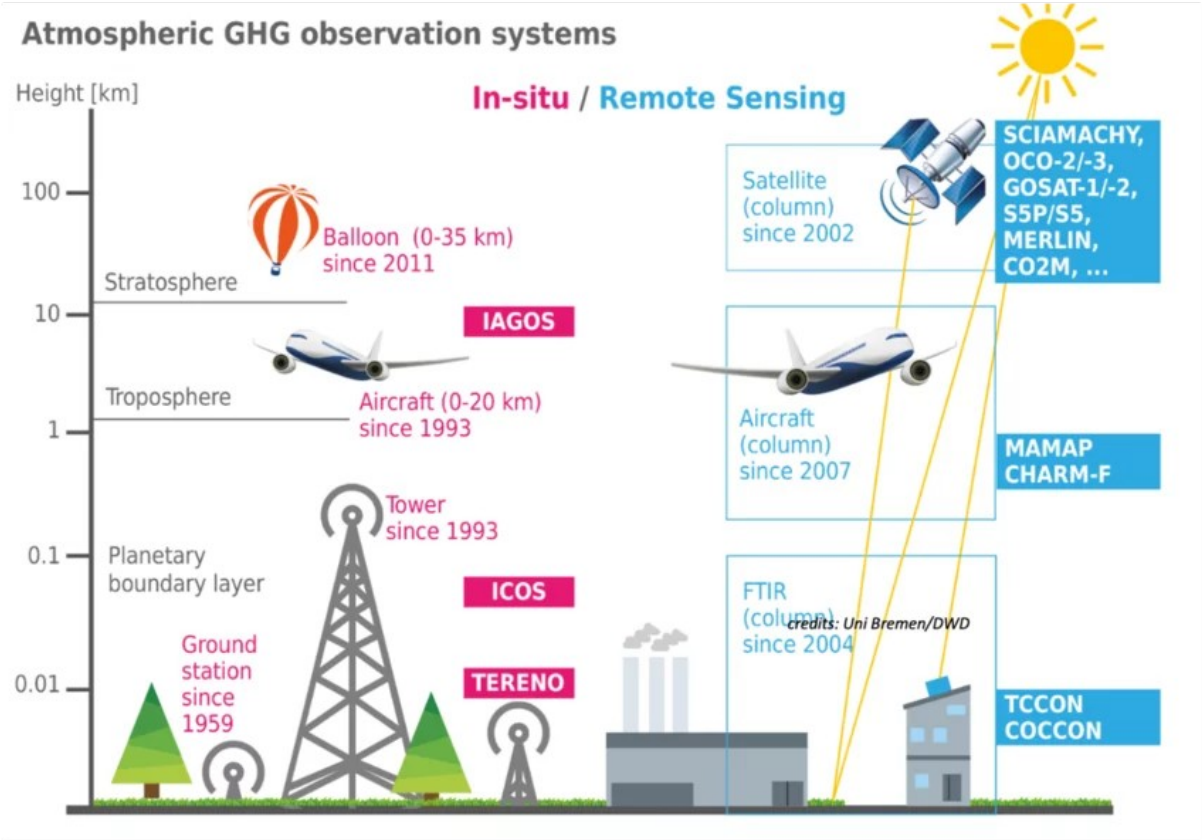


ITMS General Assembly 2023, Picture by DWD

Integrated Greenhouse Gas Monitoring System (ITMS)

National Inventories + **Atmospheric Observations** + **Models** = spatially, temporally resolved, observation based **emission estimates** for different sectors

Umwelt Bundesamt



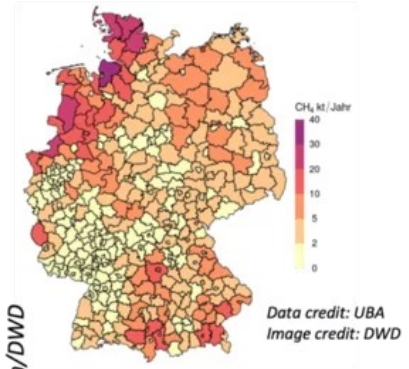
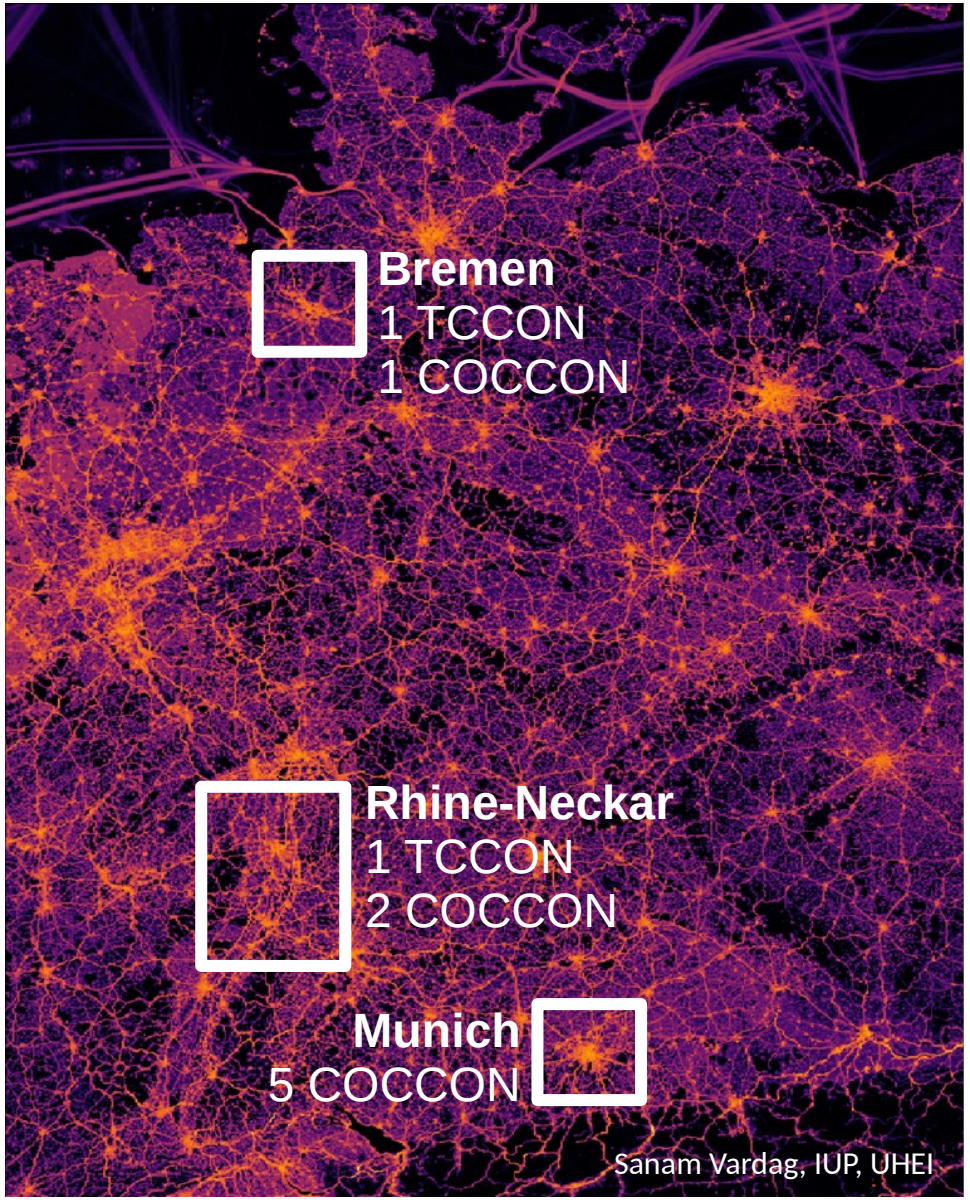


Image credits: Uni Bremen/DWD

ITMS-B-FTIR

- Collaboration between

- Data provision for ITMS
  - Inter-Calibration
  - Precision and uncertainties
  - Interpretation of the recorded dataset



Inter-calibration between the stations

- One EM27/SUN dedicated for traveling between the stations
- Traveling pressure sensor

Inter-calibration between the stations

- Determine calibration factors (f) with 10 minute binning
  - Calibration factor and standard deviation of every bin (f_i ind σ_i)
  - Weighted average for overall calibration factor
- Calibration uncertainty determined from consistency of the f_i

per bin:

$$f_i = f_{\mathrm{ref}}^{\mathrm{SN}}|_i = \frac{\mathrm{X_{ref}}}{\mathrm{X_{SN}}}$$

$$\sigma_{f_i} = \Delta f_{\mathrm{ref}}^{\mathrm{SN}}|_i = f_{\mathrm{ref}}^{\mathrm{SN}}|_i \cdot \sqrt{\left(\frac{\Delta \mathrm{X_{SN}}}{\mathrm{X_{SN}}}\right)^2 + \left(\frac{\Delta \mathrm{X_{ref}}}{\mathrm{X_{ref}}}\right)^2}$$

overall:

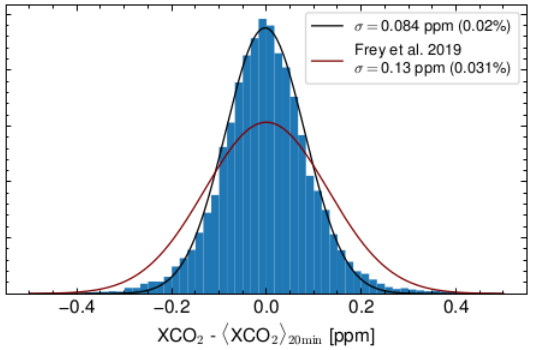
$$f = f_{\mathrm{ref}}^{\mathrm{SN}} = \frac{\sum_i \frac{f_i}{\sigma_{f_i}^2}}{\sum_i \frac{1}{\sigma_{f_i}^2}}$$

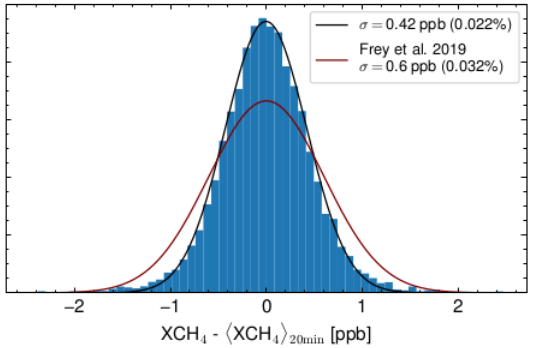
Precision of the Spectrometers

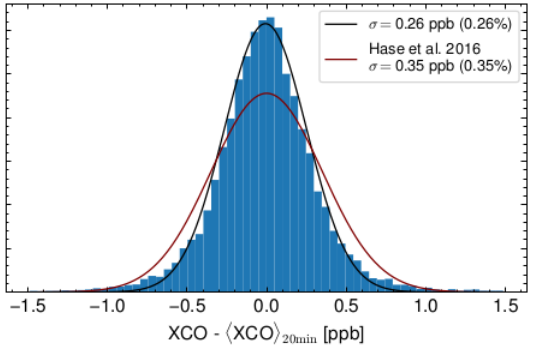
- Distribution of difference to rolling average (20 min)

  → Gaussian Fit

- Communication to the ITMS Modeling Group
  - Instrument-specific precision estimates
  - Calibration uncertainty

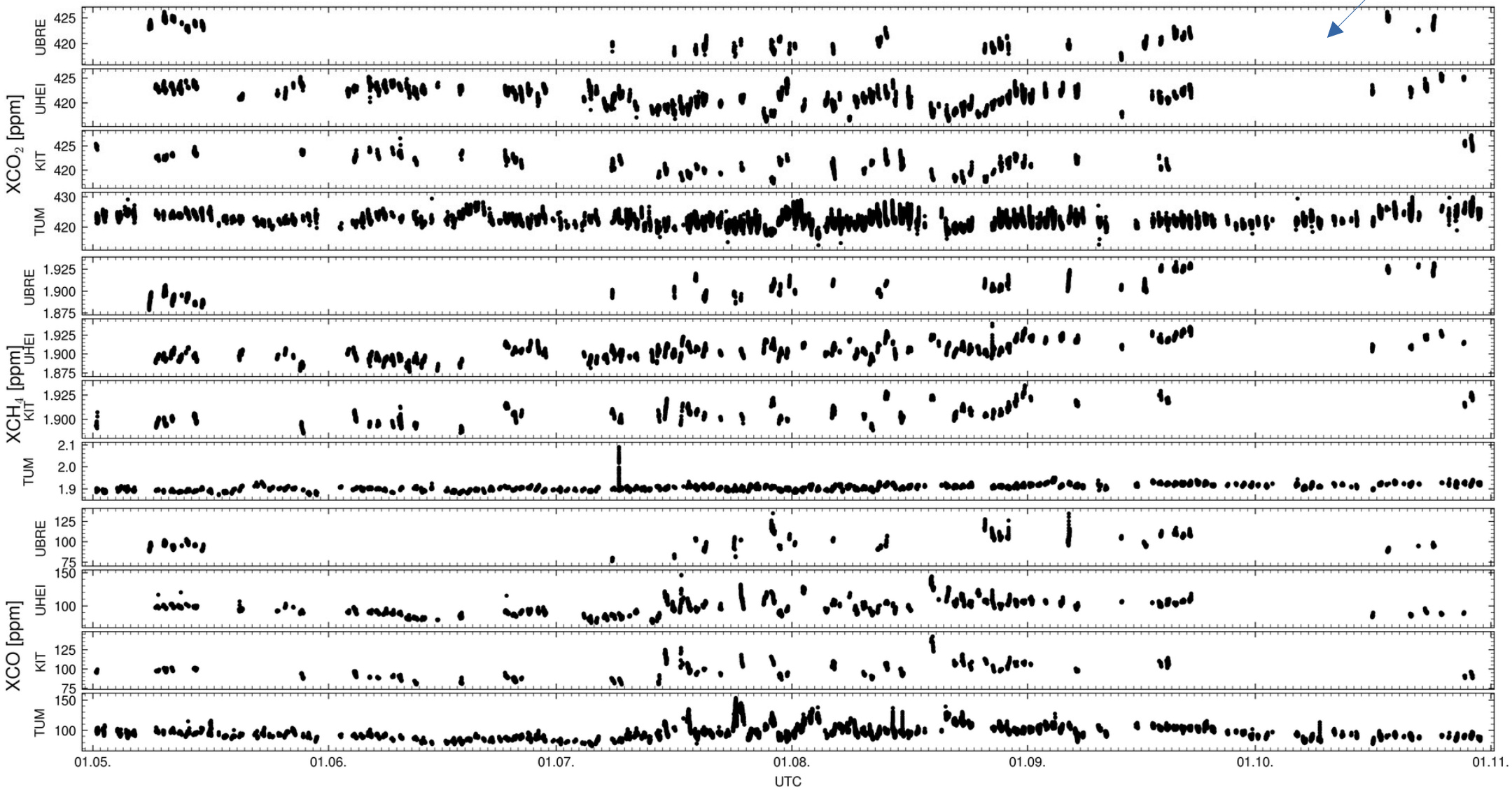






Published Dataset (May - Oct 2024)

Löw et al.: ITMS-B-FTIR Dataset (Version 1): COCCON observations in support of ITMS. COCCON [Dataset], EVDC - ESA Atmospheric Validation Data Centre, https://doi.org/10.48477/COCCON.ITMS-B-FTIR.R01, 2025.



Outlook: Investigating Observed Gradients

- Different Scales
  - Urban ~10 km (Munich),
  - Regional ~100 km (Karlsurhe ↔ Heidelberg) and
  - German-wide ~1000 km (Munich ↔ Bremen)
- Comparison to
  - Satellites
  - Models