Carbon monoxide retrieved from ground based FTIR remote sensing in the mid- and near infrared spectral region

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CO data assessment

- Task: find a recommendation regarding data in the NDACC-TCCON overlapping region e.g. for satellite validation.
- Assessment of overall comparability of the different instruments and retrieval strategies of the FTIR measurement networks NDACC and TCCON.

Site	Network	Lat	Lon	Height
Bremen	NDACC & TCCON	53.10 ° N	8.85 ° E	27 m
Izana (Tenerife)	NDACC & TCCON	28.30 ° N	16.48 ° W	2367 m
St. Denis (La Réunion)	NDACC & TCCON	20.90 ° S	55.49 ° E	87 m
Jungfraujoch	NDACC	46.55 ° N	7.98 ° E	3580 m

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Overview

- Comparison between TCCON and NDACC regarding CO:
- NDACC FTIR stations
  - Bruker 120M instruments or better
  - 3 narrow retrieval windows in the mid infrared
  - Profile retrieval algorithm
- TCCON FTIR stations
  - Bruker 125HR instruments
  - 2 wide retrieval windows in the near infrared
  - Profile scaling algorithm

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Retrieval windows

- NDACC:

Window [wavenumbers]	Width [wavenumbers]	Interfering gases
2057.70 - 2058.00	0.30	O_3, CO_2, OCS
2069.56 - 2069.76	0.20	O_3, CO_2, OCS
2157.50 – 2159.15	1.65	O_3, CO_2, OCS, N_2O, H_2O

- TCCON:

Window [wavenumbers]	Width [wavenumbers]	Interfering gases
4233.00	48.60	CH_4,H_2O, HDO
4290.40	56.80	CH_4, H_2O, HDO

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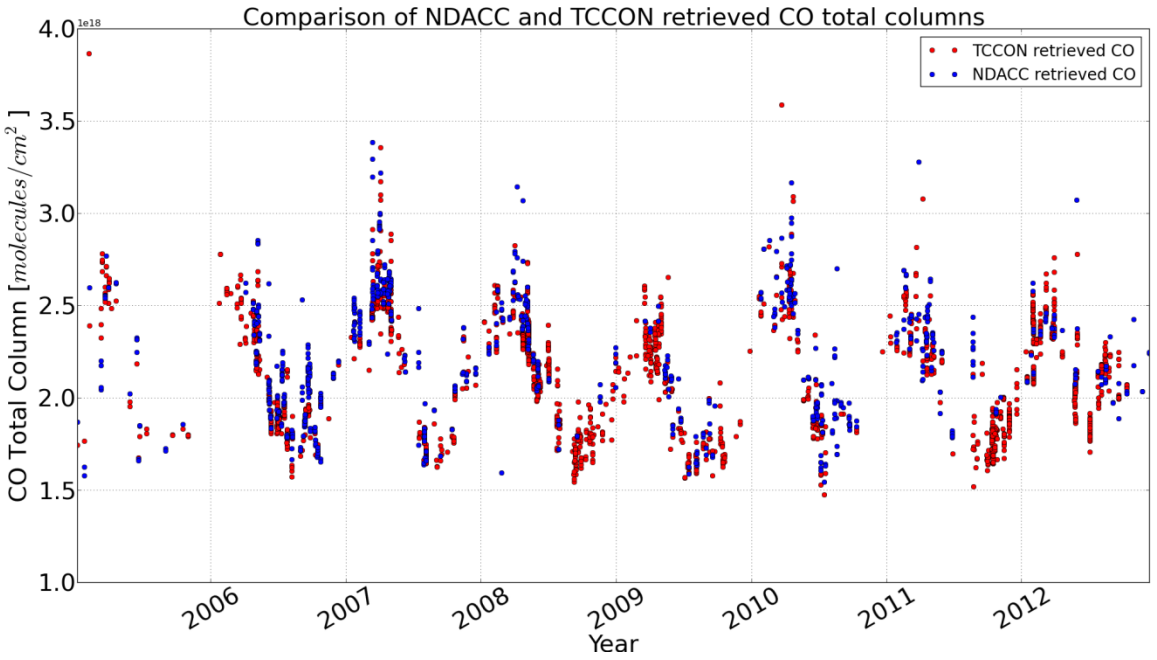
Timeseries at Bremen station

- Very good agreement in seasonal variations.
- Mean NDACC value is ~5% higher than TCCON.



- Postcorrections for the official data products are not taken into account.

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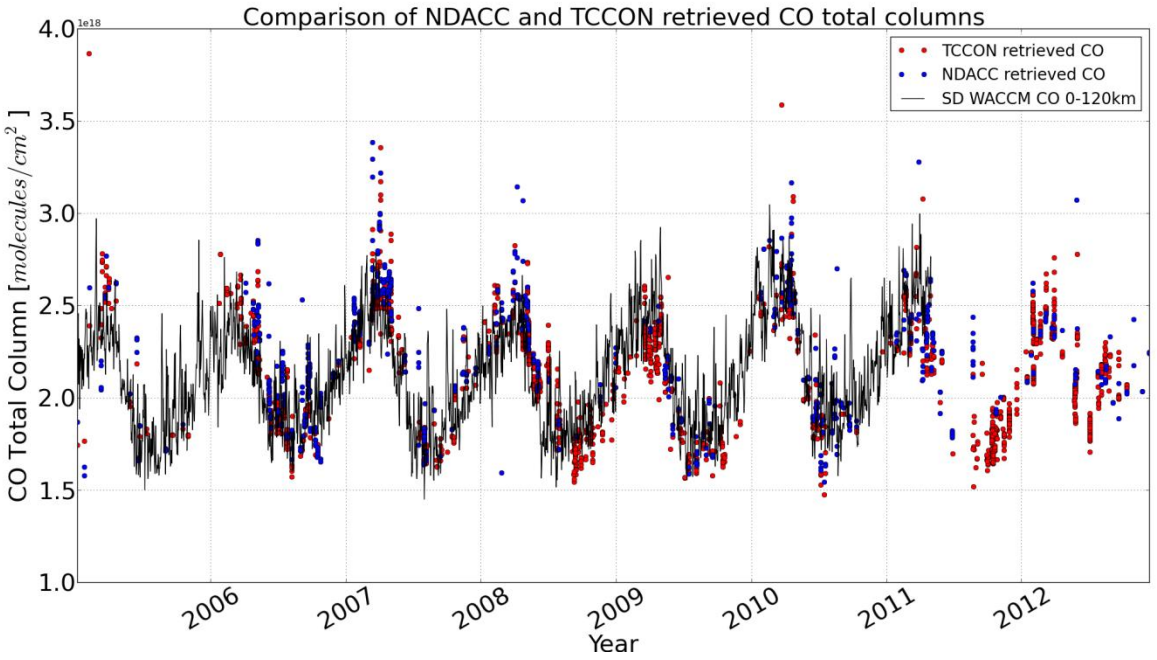
SD-WACCM comparison

- Model comparison also shows a very good agreement.
- SD-WACCM data by the Douglas Kinnision group, UCAR, Boulder.



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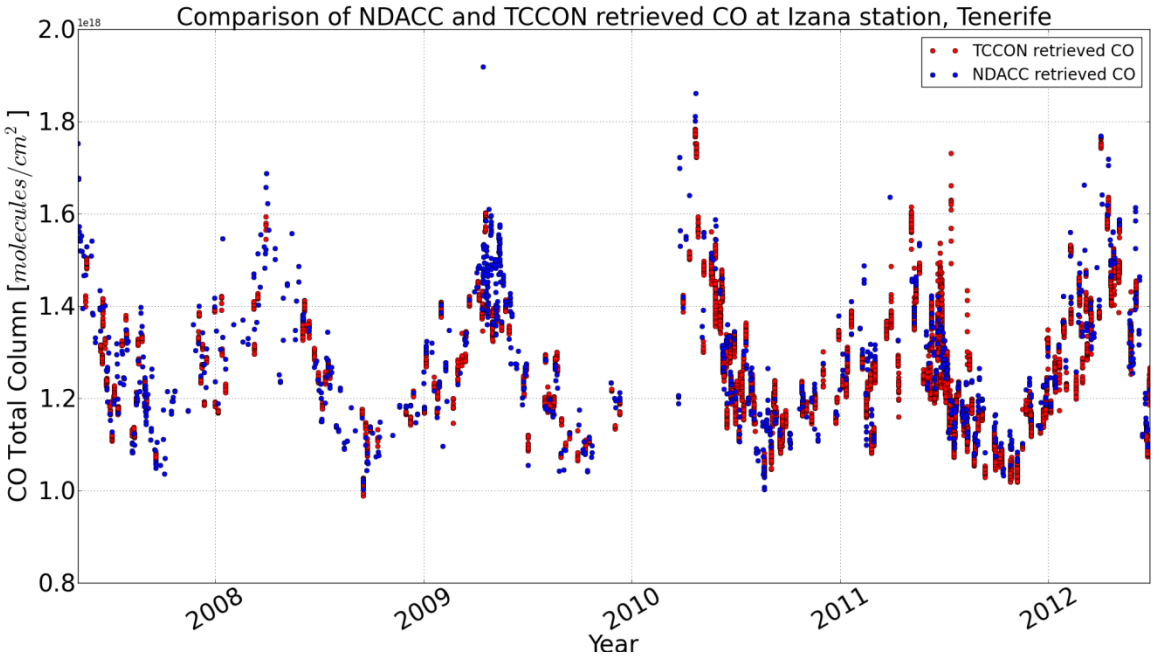
CO time series at Izana station

- Slightly different windows for NDACC are used (C. Rinsland).
- Lower values are in close agreement.
- For higher values NDACC is more sensitive.



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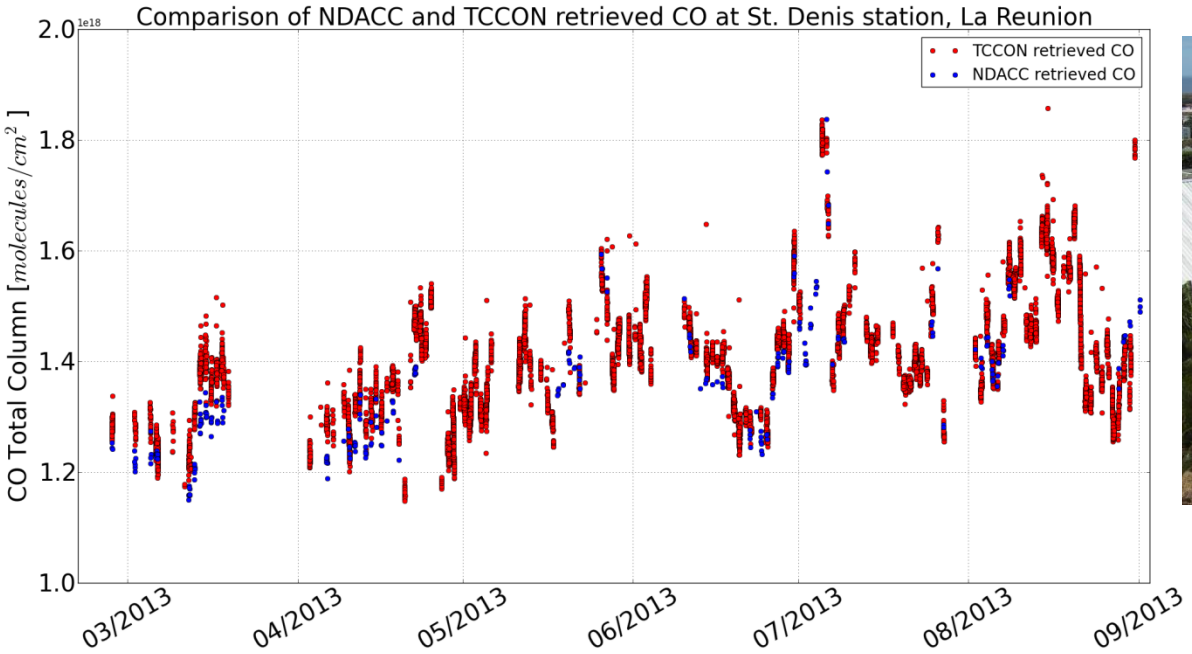
CO time series at St. Denis

- NDACC is ~2.5% lower than TCCON.
- Southern hemisphere → seasonal cycle vice versa.



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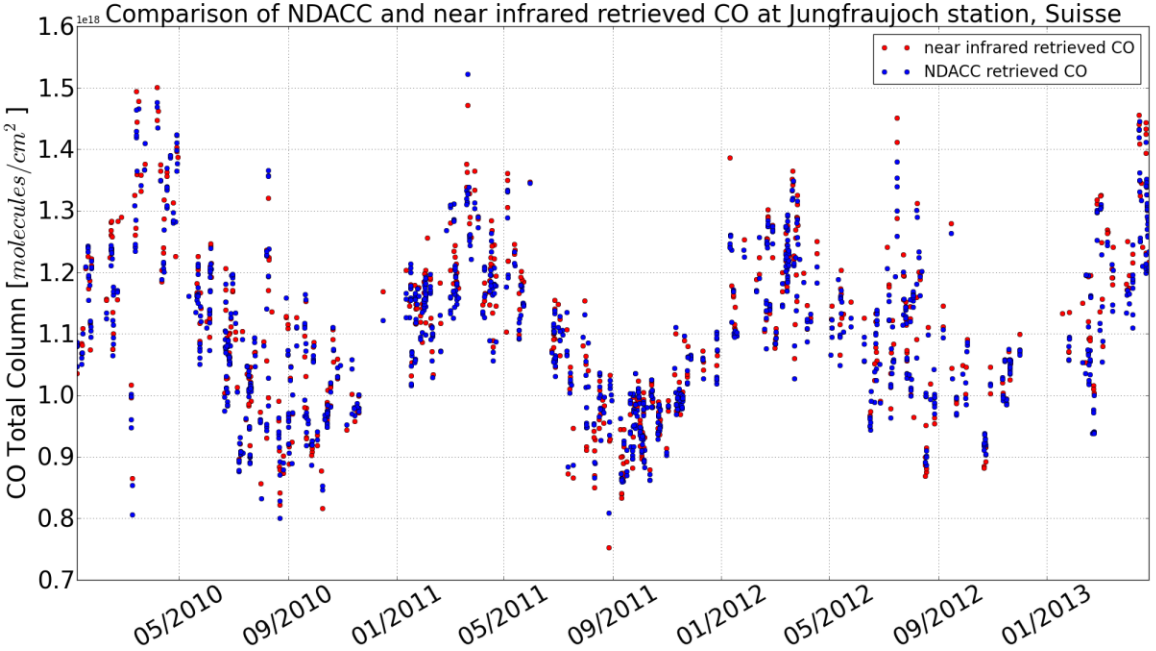
CO time series at Jungfraujoch

- Retrival of both wavenumber areas with profile retrieval.
- Better agreement, 4200 cm^{-1} area has higher DOF‘s and less residual.



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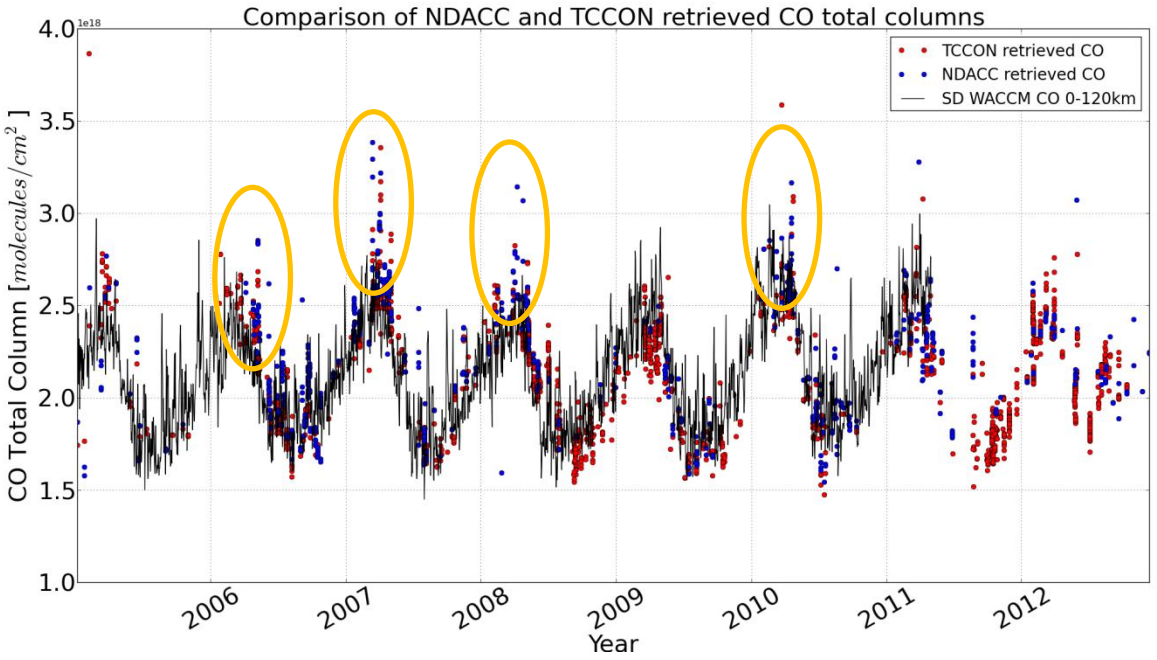

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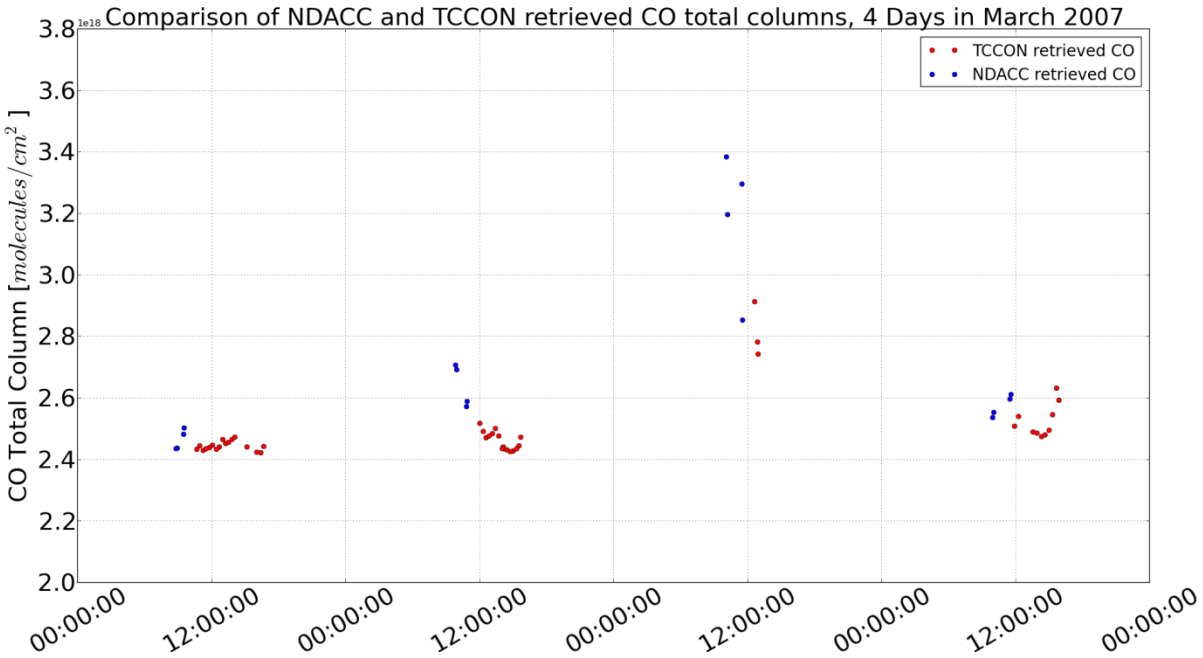
Lokal events

- Local events show a different sensitivity for NDACC and TCCON.
- Trajectories coming directly from industrial zone in germany.



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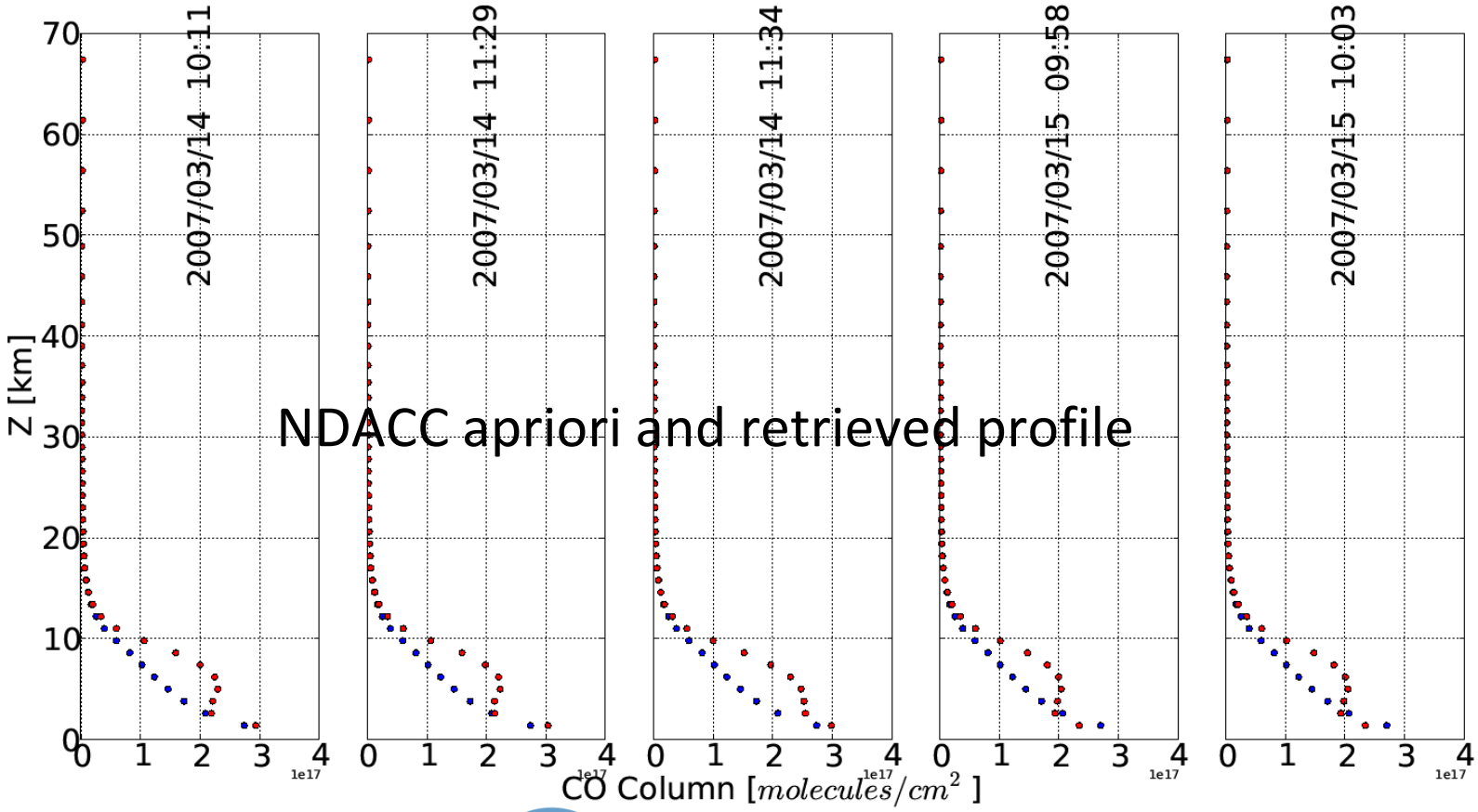
Lokal events

- Only the lowest point changes significant.



NDACC apriori and retrieved profile

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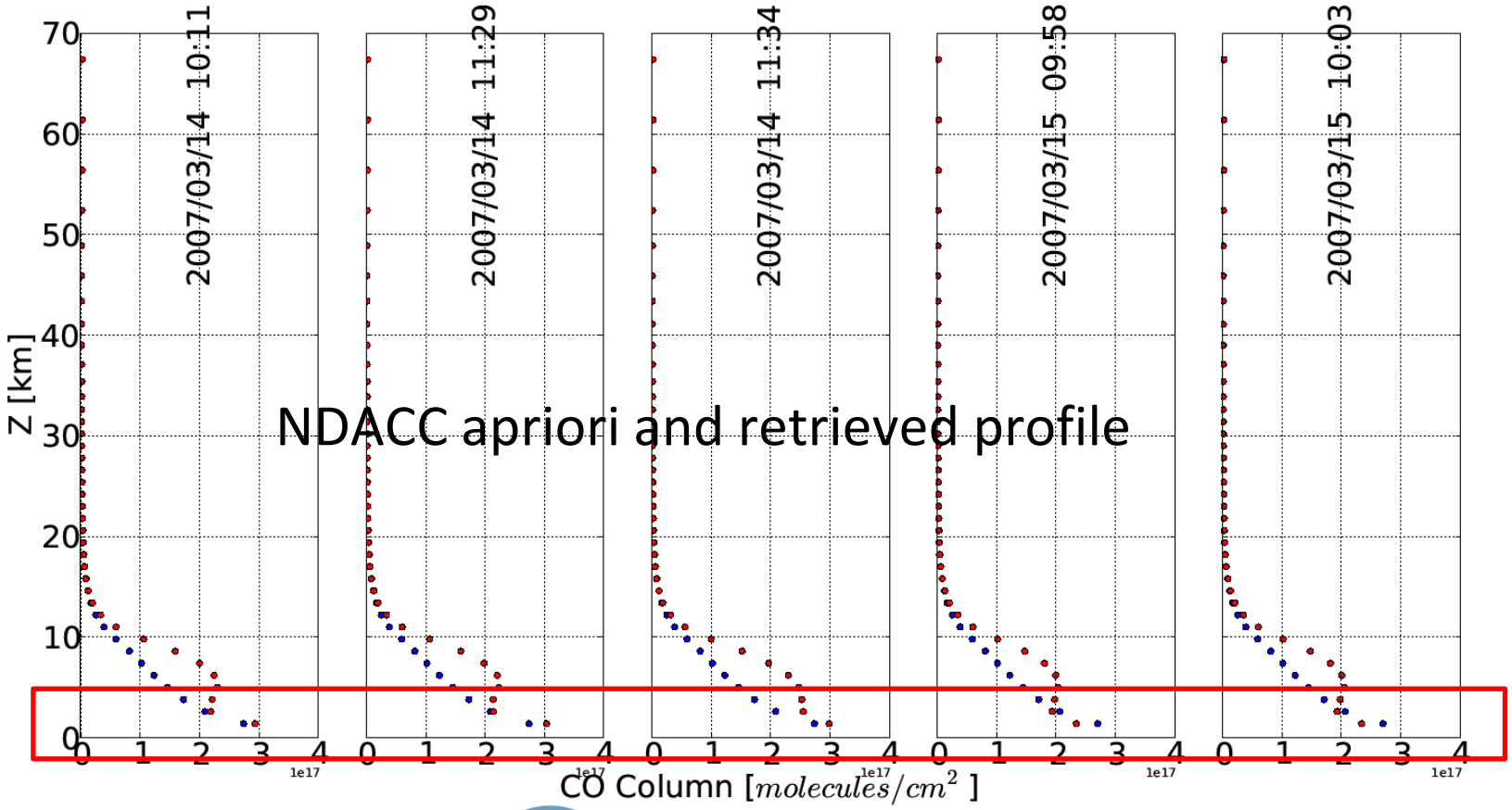

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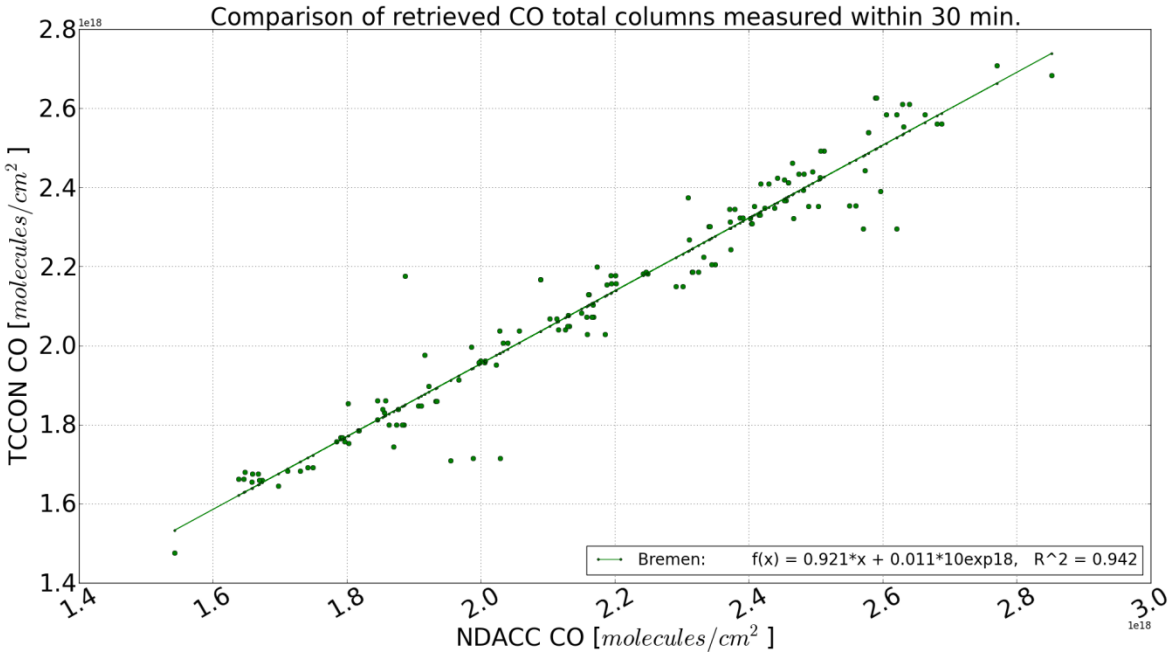
Contemporary measurements

- Lower values are in close agreement.
- For higher values NDACC is more sensitive than TCCON.



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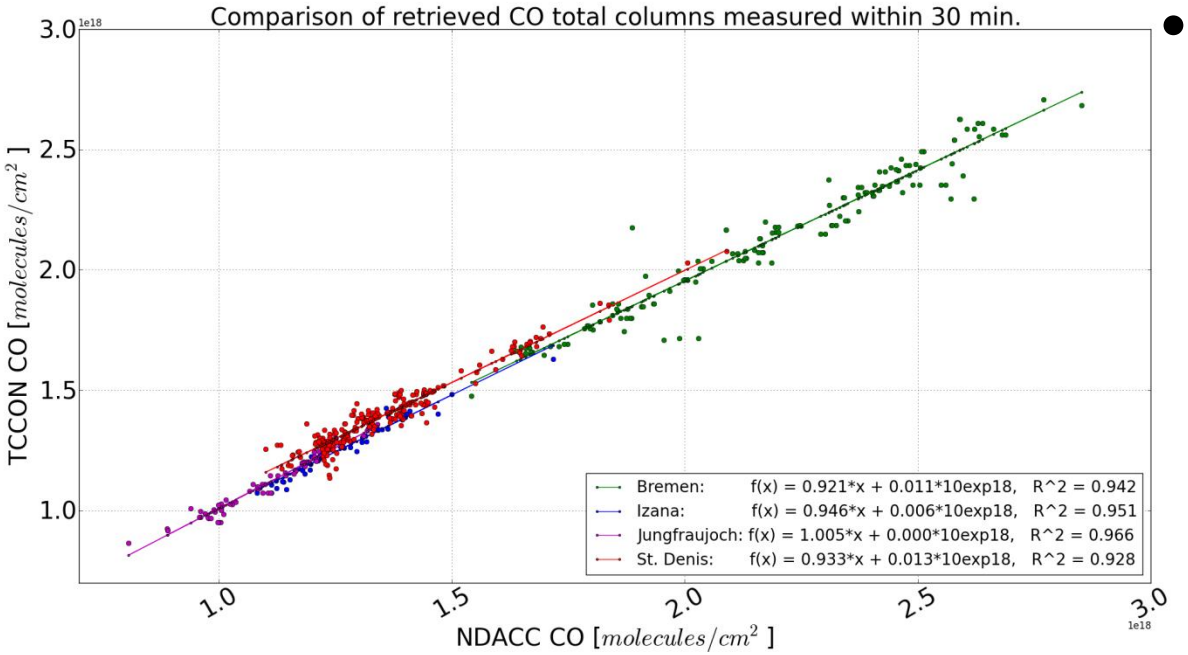
Contemporary measurements

- Lower values are in close agreement.
- For higher values NDACC is more sensitive than TCCON.
- Similar slope for all NDACC/TCCON sites



- Jungfraujoch has a slope of ~1.

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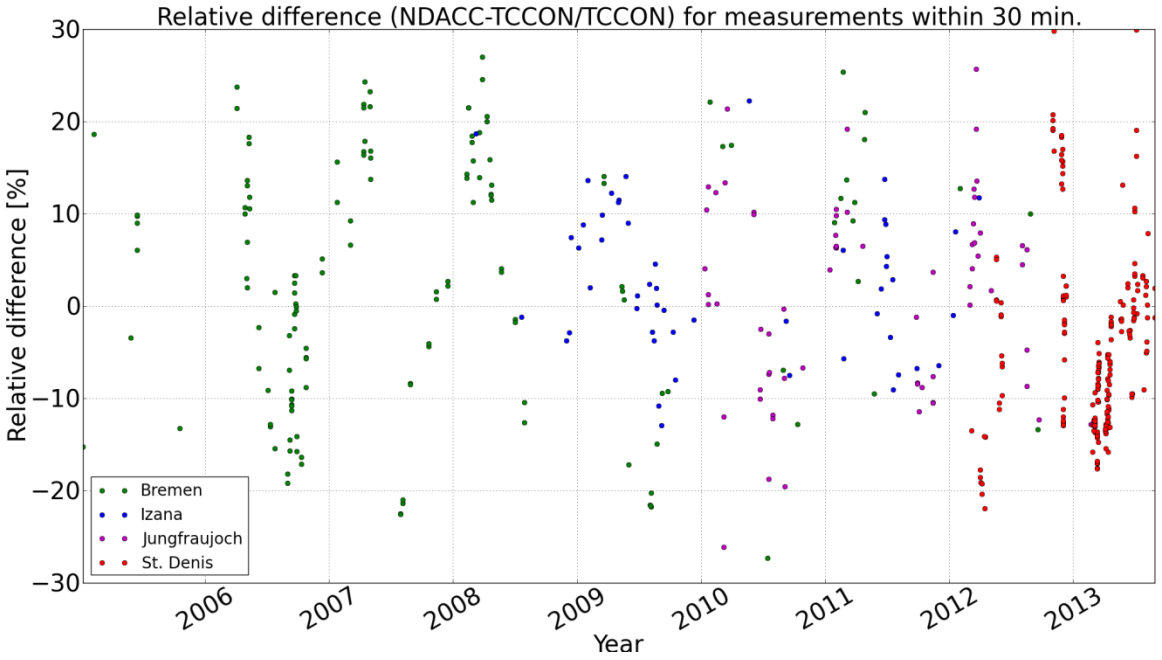
Contemporary measurements

- Relative difference with a clear seasonal cycle cause of higher values in spring.
- Vice versa for St. Denis



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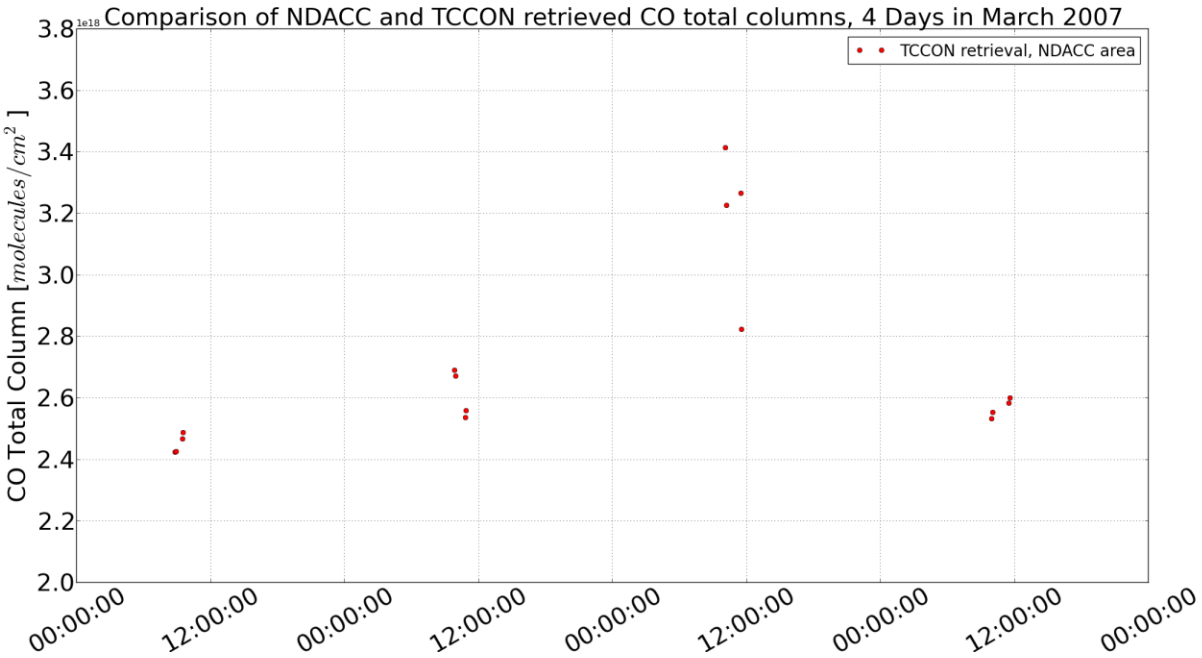
Cross retrieval

- GFIT retrieval in mid infrared gives same results as SFIT for total columns



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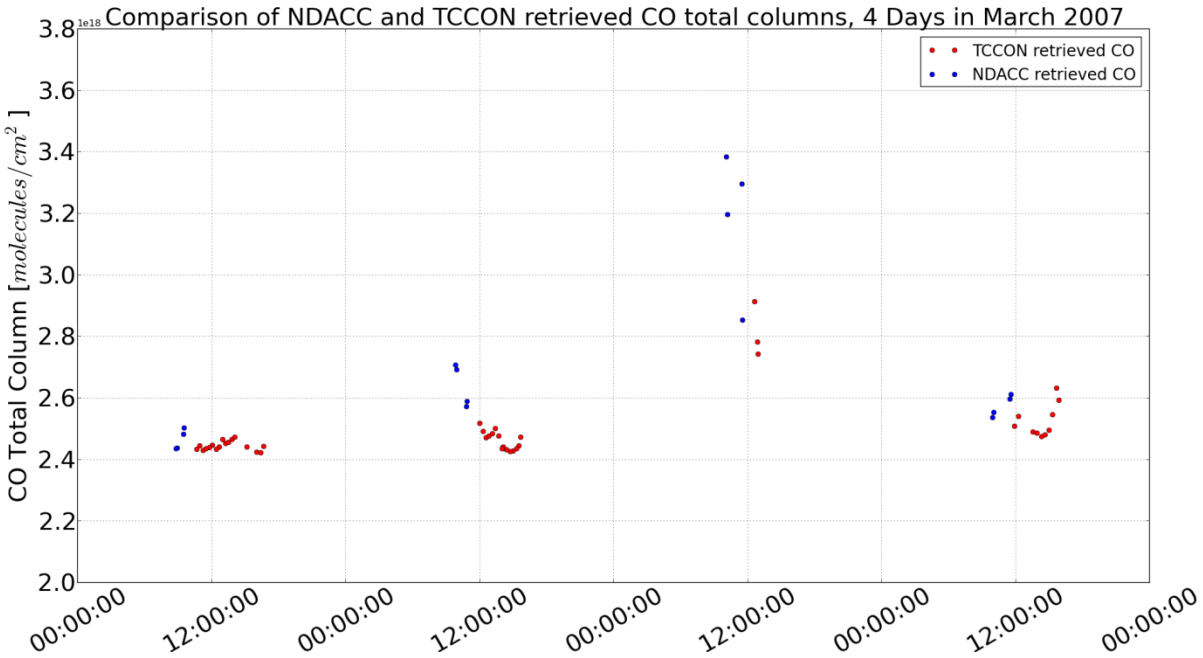

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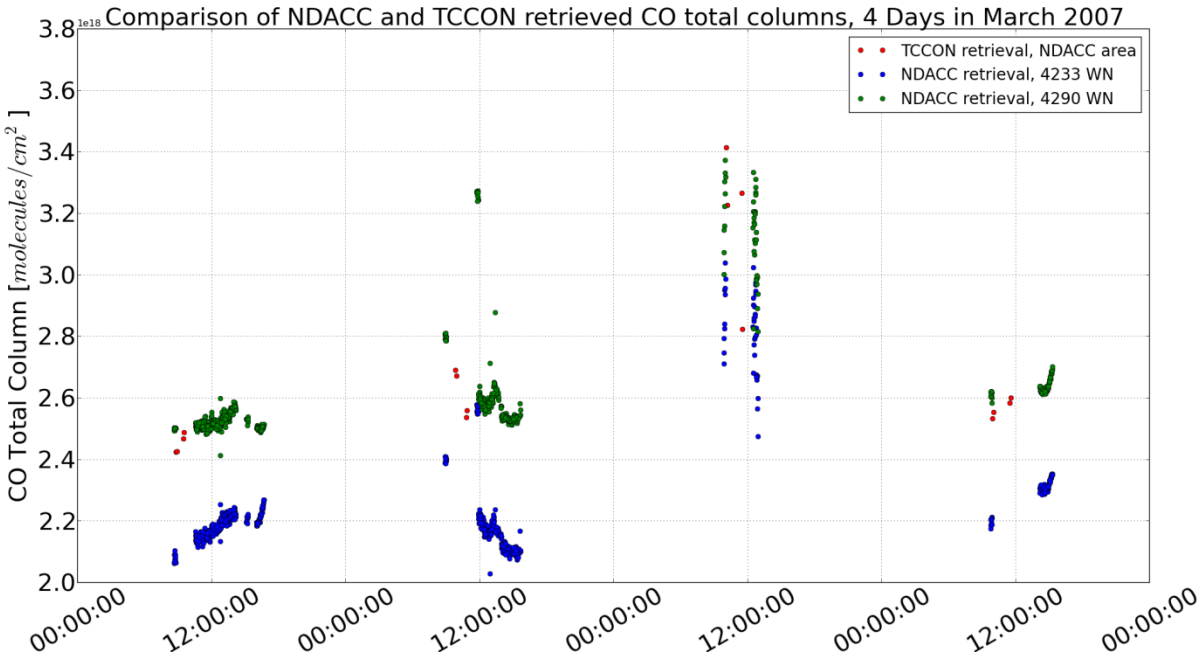
Cross retrieval

- SFIT retrieval in near infrared gives lower results as GFIT for total columns



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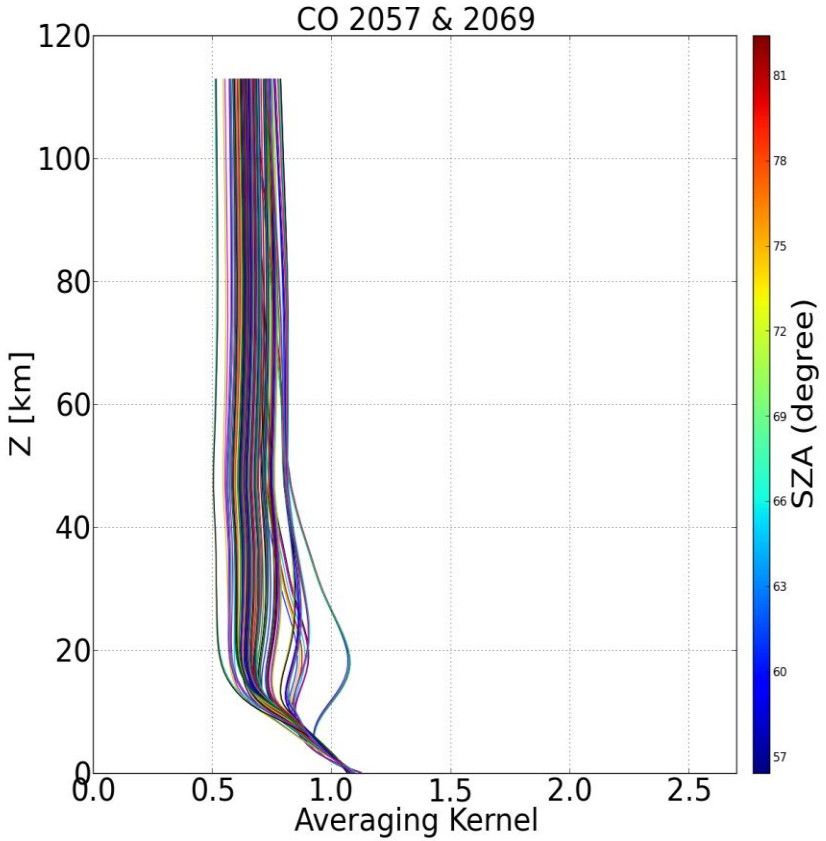
SFIT averaging kernels



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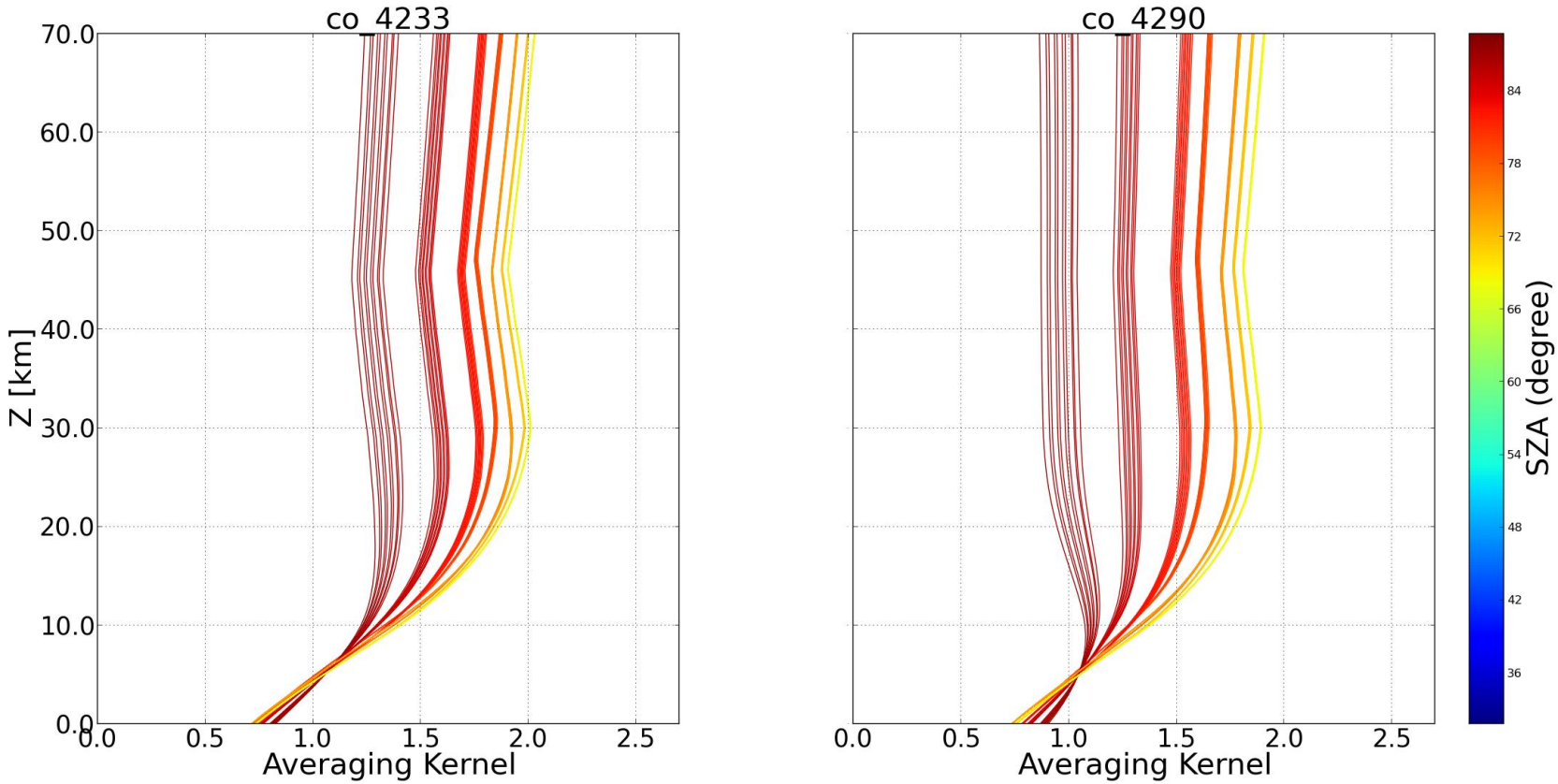
GFIT averaging kernels



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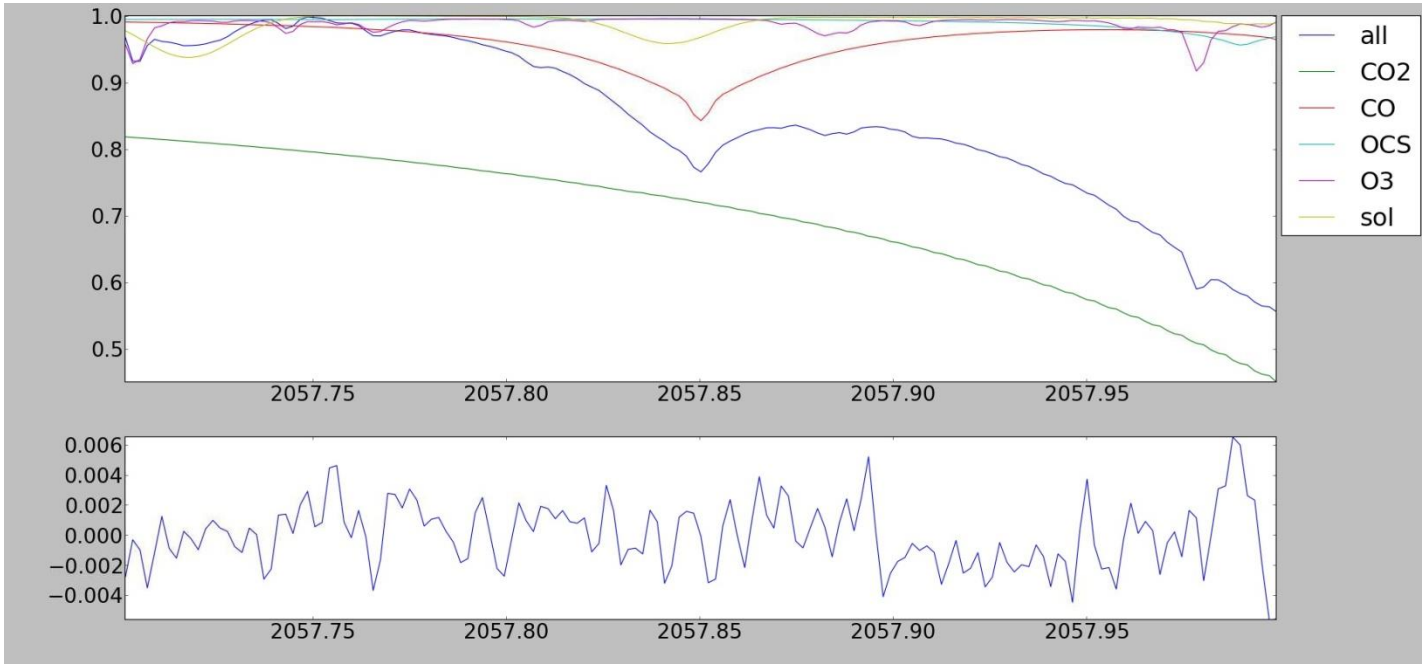
Residuals for NDACC MW's

- Using the recommended HITRAN 2008 database, residuals indicate non perfect spectroscopic data of O_3.



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Summary and Outlook

- Satisfying agreement of both retrieval strategies.
- Mid infrared aera reacts more sensitive to lokal events:
  - Different sensitivity of the wavenumber aeras.
- Spectroscopic issues.
- Using both networks for satellite validation could be a benefit due to the increased number of sites.
- Including aircraft campaigns.
- Rerun SFIT retrievals using new linelist (Toon).

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Thank you for your attention !

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