



# **CAMS27: CAMS funding for NDACC**

Bavo Langerock & Martine De Mazière

- <https://atmosphere.copernicus.eu>



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## What we do

We add value to observations, providing consistent information on the atmosphere anywhere in the world, allowing you to assess the past and to predict the next few days.

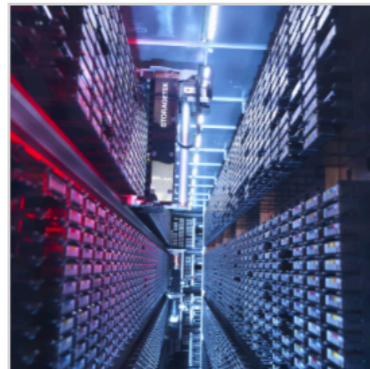
At the core of our service is direct access to reliable data and expertise related to air quality, solar energy, and the role atmospheric gases and particles play in climate change.

We use satellite and ground-based observations with forecast models to support businesses, policy makers and scientists dealing with the challenges and opportunities related to the composition of the atmosphere.



### Observations

Satellite and non-satellite observations are a crucial input to CAMS.



### Production systems

CAMS uses computer models to produce global and regional data sets.



### Thematic output areas

Our information products support users in different societal domains.

- <https://atmosphere.copernicus.eu>



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### In situ observations used for the CAMS services

Application in CAMS	Measured species	Networks
Input for regional services	O <sub>3</sub> , NO <sub>2</sub> , SO <sub>2</sub> , CO, PM2.5, PM10, pollen	<a href="#">EEA/EIONET</a>
Input for CO <sub>2</sub> flux inversions	CO <sub>2</sub>	<a href="#">NOAA-CCGG</a> , <a href="#">WDCGG</a> , <a href="#">RAMCES</a>
Input for CH <sub>4</sub> flux inversions	CH <sub>4</sub>	<a href="#">NOAA-CCGG</a>
Input for N <sub>2</sub> O flux inversions	N <sub>2</sub> O	<a href="#">NOAA-CCGG</a> , <a href="#">AGAGE</a> , <a href="#">CSIRO</a> , <a href="#">NIES</a> , <a href="#">ECN</a> , <a href="#">EMPA</a> , <a href="#">U. of Edinburgh</a> , <a href="#">FMI</a> , <a href="#">HMS</a> , <a href="#">MPI-Jena</a> , <a href="#">Tohoku University</a> , <a href="#">CONTRAIL</a>
EQA of global services	O <sub>3</sub> , CO, NO <sub>2</sub> , Aerosol, CO <sub>2</sub> , CH <sub>4</sub>	<a href="#">ACTRIS</a> , <a href="#">GAW</a> , <a href="#">EMEP</a> , <a href="#">IAGOS</a> , <a href="#">ICOSP</a> , <a href="#">NDACC</a>
EQA of regional services	O <sub>3</sub> , NO <sub>2</sub> , SO <sub>2</sub> , CO, PM2.5, PM10, pollen	<a href="#">EEA/EIONET</a> , <a href="#">EMEP</a>
EQA of solar services	Global, direct at normal incidence and diffuse solar radiation	<a href="#">BSRN</a> , <a href="#">EnerMENA</a> , <a href="#">SHMI</a> , <a href="#">LEGMC</a> , <a href="#">LHMS</a> , <a href="#">KNMI</a> , <a href="#">Academy of Sciences Moldova</a>
EQA of UV forecasts	UV radiation	<a href="#">COST-713 UV Index Database</a> , <a href="#">ARPANSA</a> , <a href="#">IMS</a> ,

## What

We add value in the world, and

At the core of energy, and the

We use satellite businesses, for the composition



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DATA



DATA

ABOUT US

WHAT WE DO

SEARCH

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Application in CAMS	Meas
Input for regional services	O <sub>3</sub> , NO <sub>2</sub> , SO <sub>2</sub> , PM10, polle
Input for CO <sub>2</sub> flux inversions	CO <sub>2</sub>
Input for CH <sub>4</sub> flux inversions	CH <sub>4</sub>
Input for N <sub>2</sub> O flux inversions	N <sub>2</sub> O
EQA of global services	O <sub>3</sub> , CO, NO <sub>2</sub> , CH <sub>4</sub>
EQA of regional services	O <sub>3</sub> , NO <sub>2</sub> , SO <sub>2</sub> , PM10, polle
EQA of solar services	Global, dire incidence & radiation
EQA of UV forecasts	UV radiatio

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# EQA reports of global services

The global forecasting system is continually being evaluated to assure the output meets the expected requirements. Comprehensive Evaluation and Quality Assurance (EQA) reports are being provided documenting the daily forecasts, planned system upgrades and the reanalyses.

[DAILY ANALYSES AND FORECASTS](#) [SYSTEM UPGRADES](#) [REANALYSIS](#)  
[METHODOLOGY & CASE STUDIES](#)

## Daily analyses and forecasts

The global analyses and forecasts are assessed on a quarterly basis. Statistics and graphics of the comparisons against independent observations are presented in these reports together with a description of the main findings.

## What

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### Observations

Satellite and non-satellite observations are a crucial input to CAMS.



### Production sys

CAMS uses computer to produce global regional data se



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# CAMS27

## Support for The Provision Of NDACC Observations

- CAMS provides support to NDACC for **rapid delivery** of **quality** data to NDACC DHF for  
**FTIR:** CH<sub>4</sub>, CO, O<sub>3</sub>                      **MWR, LIDAR:** O<sub>3</sub>  
**UVVIS zenith:** NO<sub>2</sub>, O<sub>3</sub>                      **UVVIS offaxis:** HCHO, NO<sub>2</sub>, Aerosol
- Start/End = July 2017 - July 2021
- Second Service Contract: 2018
- NDACC data stream monitoring in place since March 1 2018
- funding for submission (2400€/y/site) and for development (5000k€/PI)

# CAMS



**Validation report of the CAMS  
near-real time global  
atmospheric composition service**

**September - November 2017**

Issued by: KNMI

Date: 7/3/2018

Ref: CAMS84\_2015SC3\_D84.1.1.10\_2017SON\_v1

- NDACC data is used in quarterly validation reports  
requires data of  
1/ sufficient quality (QC)  
2/ delivered within 1 month after measurement (RD)



### 4.3 Validation against FTIR observations from the NDACC network

In this section, we compare the CO profiles of the CAMS models with FTIR measurements at Maido (21°S, 55°E, i.e. southern tropics, altitude 2.2km) and Lauder (46°S, 169.7°E, altitude 370m). These ground-based, remote-sensing instruments are sensitive to the CO abundance in the troposphere and lower stratosphere, i.e. between the surface and up to 20 km altitude. Tropospheric CO profiles and columns are validated (up to 10km). A description of the instruments and applied methodologies can be found at <http://nors.aeronomie.be>.

Table 4.3.1 and Fig. 4.3.1 show that the tropospheric columns of CO agree well. The o-suite underestimates CO at Lauder with values around 2%, which is within the measurements uncertainty range (6%). At Maido the o-suite underestimates the CO abundance (approx. -6%, underestimation seems to decrease in time). The mean uncertainty on these measurements is 5%, so the observed o-suite biases are now only slightly larger than the measurement uncertainty). During the biomass burning season (SON) the bias of the control run decreases. For both stations, the control run overestimates the background CO with MBs between 20%-30%, clearly showing the positive effect of assimilation.

Table 4.3.1: Seasonal relative mean bias (MB, %), standard deviation (STD, %) for the considered period and number of observations used (NOBS), compared to NDACC FTIR observations at Lauder and Maido (mean bias and stddev in %). The overall uncertainty for the CO measurements at Lauder and Maido is approximately 5%.

		DJF			MAM			JJA			SON		
		MB	stddev	nobs	MB	stddev	nobs	MB	stddev	nobs	MB	stddev	nobs
o-suite	Lauder	0.93	6.27	168	-0.29	6.65	160	5.89	3.94	135	0.01	4.61	221
control	Lauder	44.32	10.46	168	54.65	7.04	160	42.47	7.63	133	20.80	8.28	221
o-suite	Maido	-5.14	10.12	324	-2.04	5.64	457	-5.06	3.67	234	-3.20	3.93	337
control	Maido	42.79	6.77	324	43.05	7.86	457	24.95	7.78	234	6.44	11.34	337

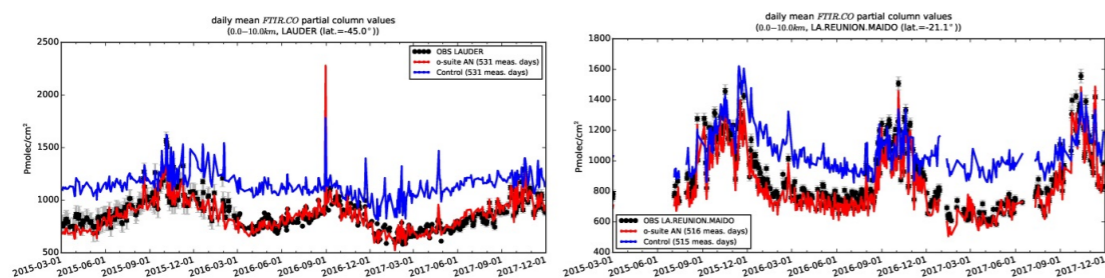


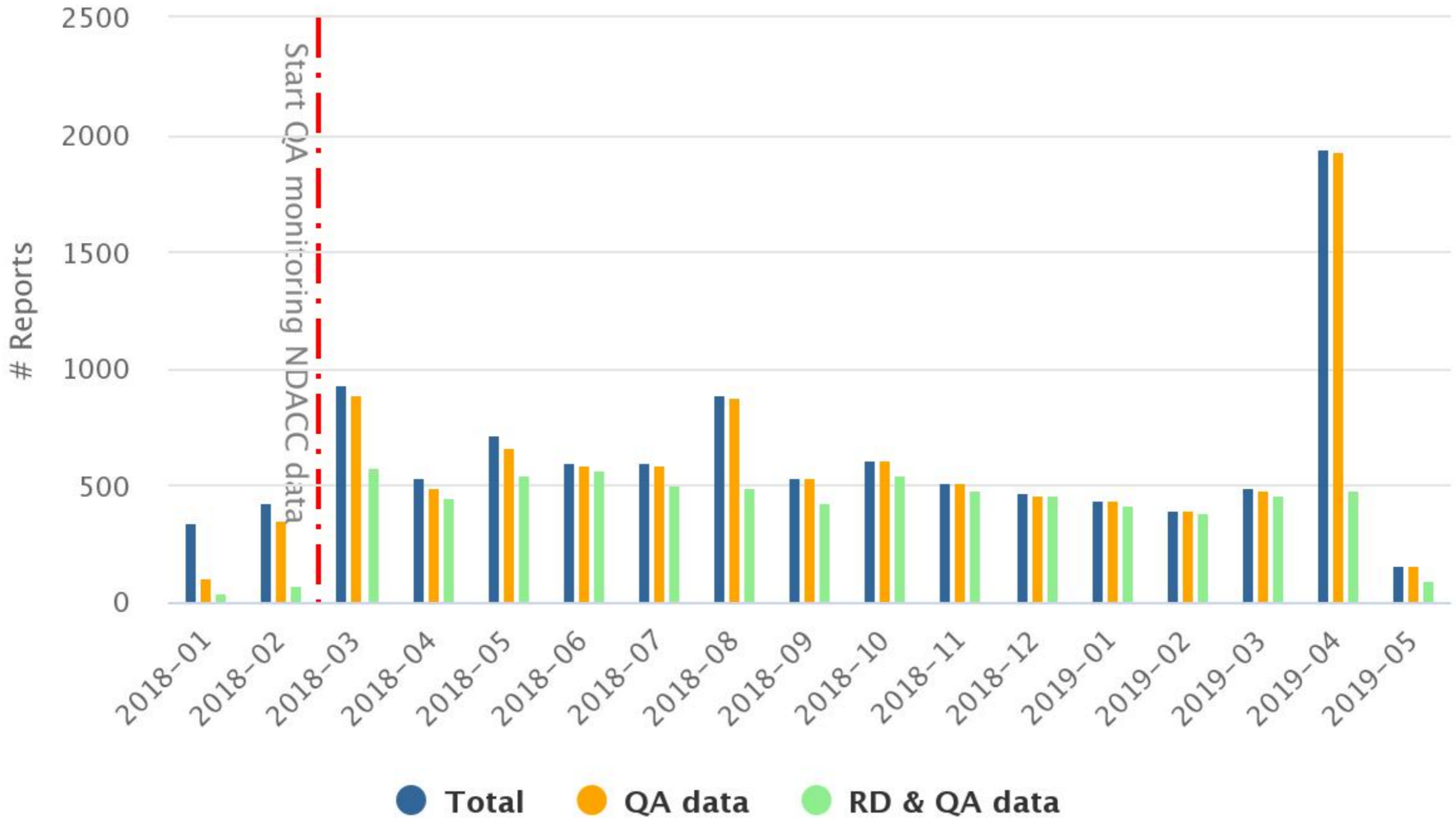
Figure 4.3.1: Daily mean values of tropospheric CO columns (till 10km) by the o-suite (red) and the Control run (blue) compared to NDACC FTIR data at Lauder, New Zealand (45°S, 169.7°E) (left) and Maido (21°S, 55°E) (right) for the period March 2015-December 2017. The number of measurement days is indicated in the legend. In Lauder a spike is seen at the end of August 2016. This is caused by a drifting fire source in the model, as discussed in a previous report.

## Before CAMS27

- Limited number of stations in reports: CO -> Lauder (Dan Smale) & Maido
- O3: 2 MWR and 2 LIDAR
- ...

# Data Submission Statistics

Source: aeronomie.be



Highcharts.com

**Since March 2018 number of RD submission increased**



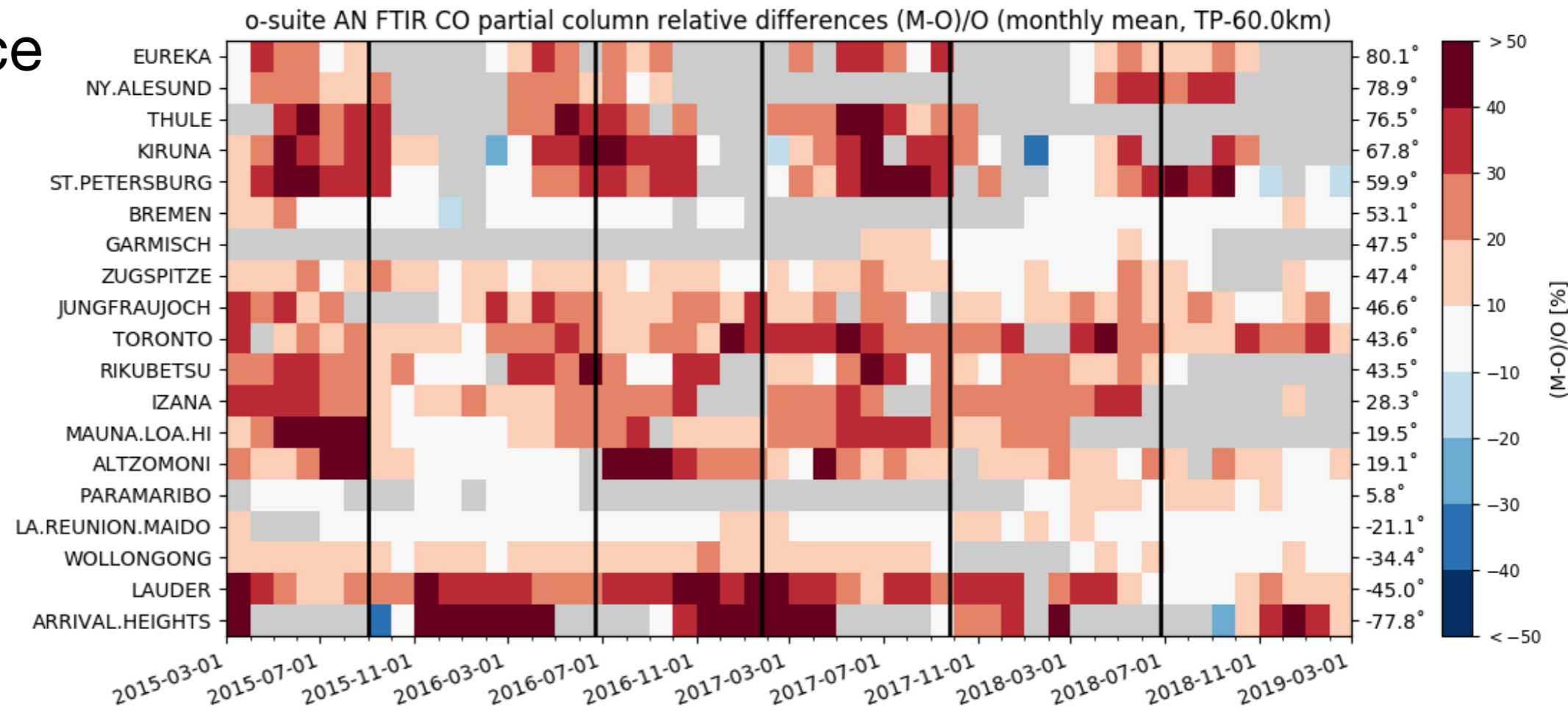
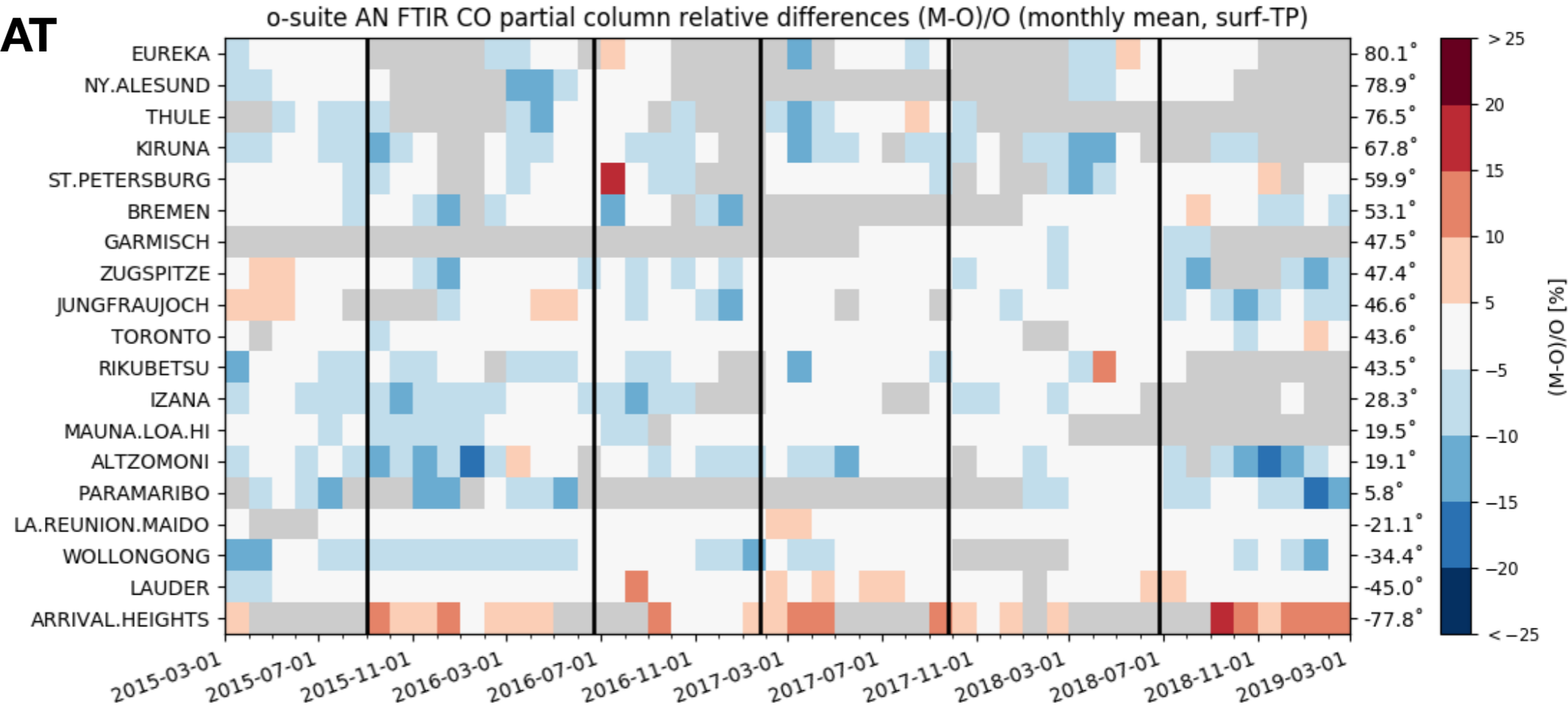
## CO – TROP/STRAT

- Trop/Strat
- seasonal  
dependence

# CO – TROP/STRAT

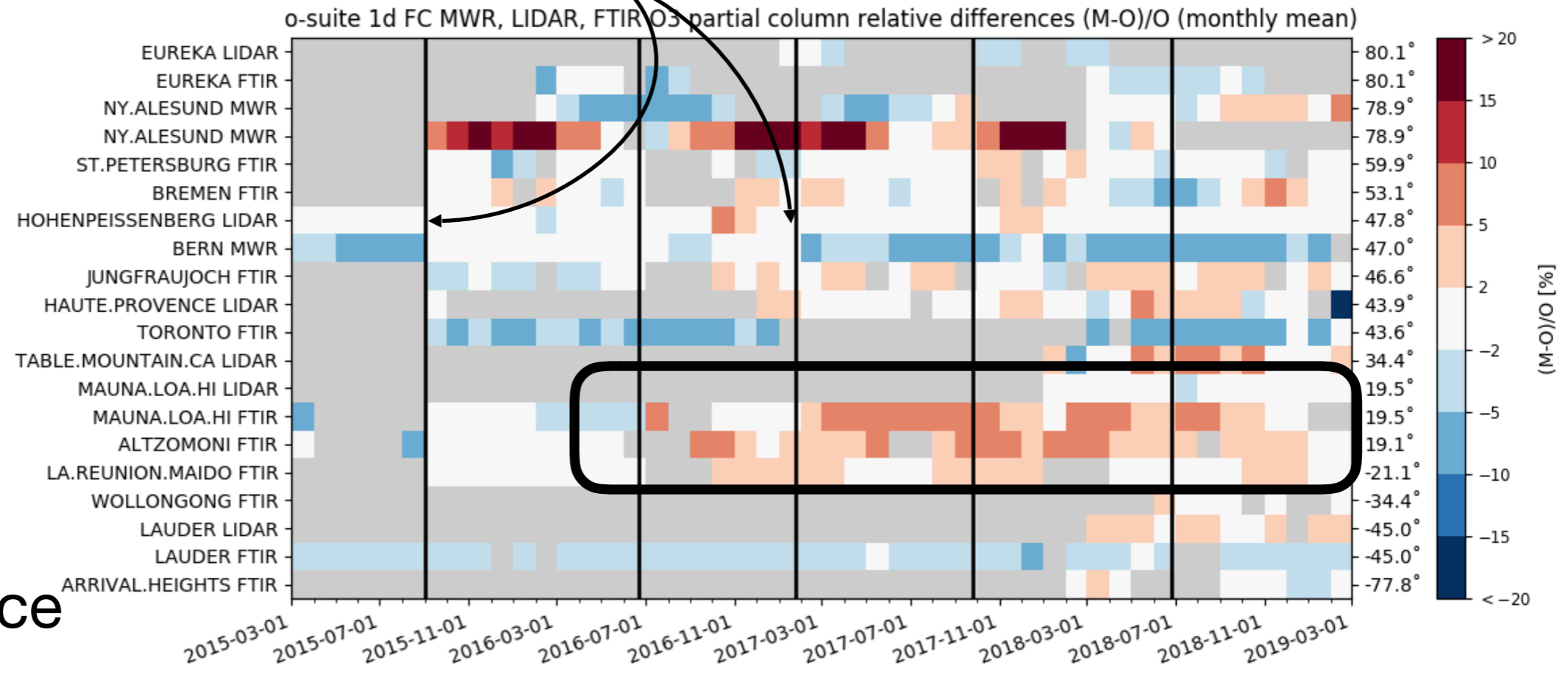
- Trop/Strat

- seasonal dependence



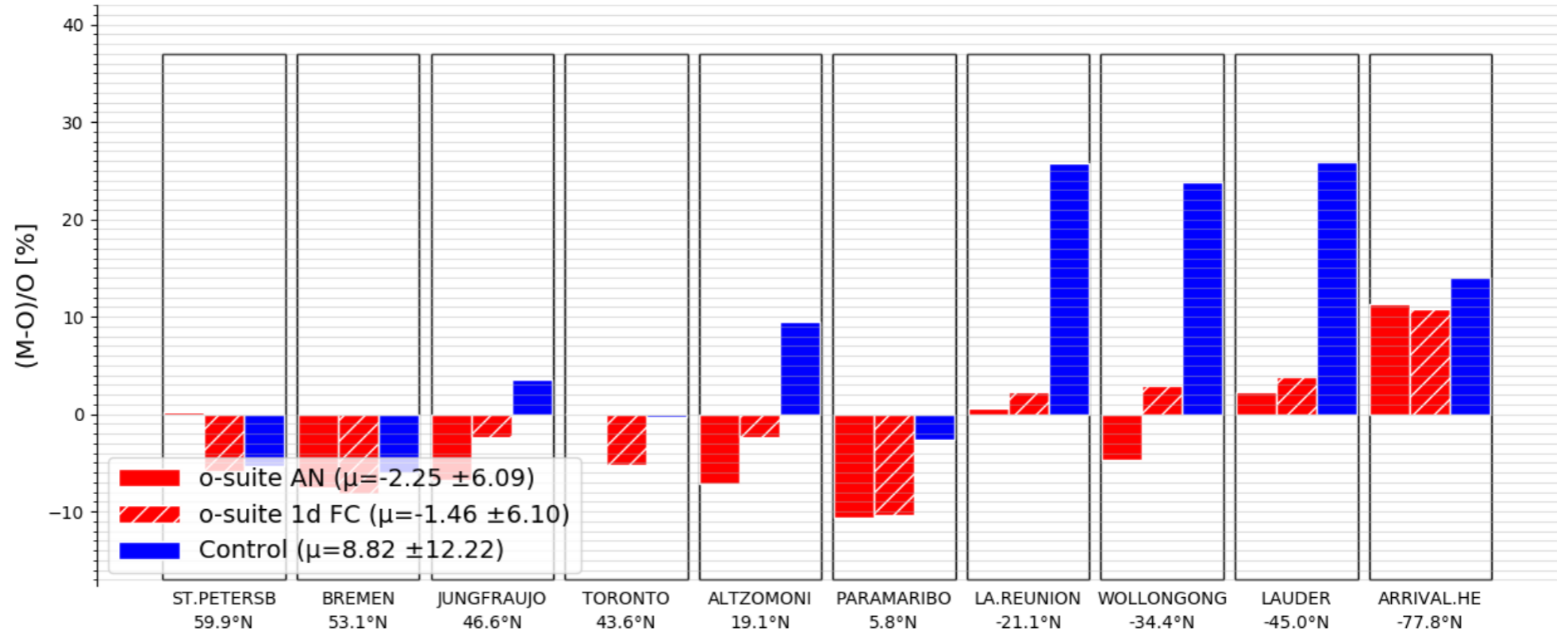
# O3 – multiple instrument techniques

**black lines=model**



- latitudinal dependence

Histogram plot of relative differences (M-O)/O for daily mean FTIR CO timeseries surf-TP



## QC component of CAMS27

- During 2018 **32** instruments have actively contributed
- For a total of **71** data products
- PI's can consult the status of their submissions on [cams27.aeronomie.be](http://cams27.aeronomie.be)

# online QC check

Dr. Bavo Langerock ( baval@oma.be )

Period	2018-01-23 - 2018-05-10
Succesfull reports/Total Reports	1361/2497: <b>55%</b>
Failed Quality Assurance checks/Total Reports	422/2497: <b>17%</b>
Failed Rapid Delivery checks/Total Reports	972/2497: <b>39%</b>



## QC Reports in HTML format

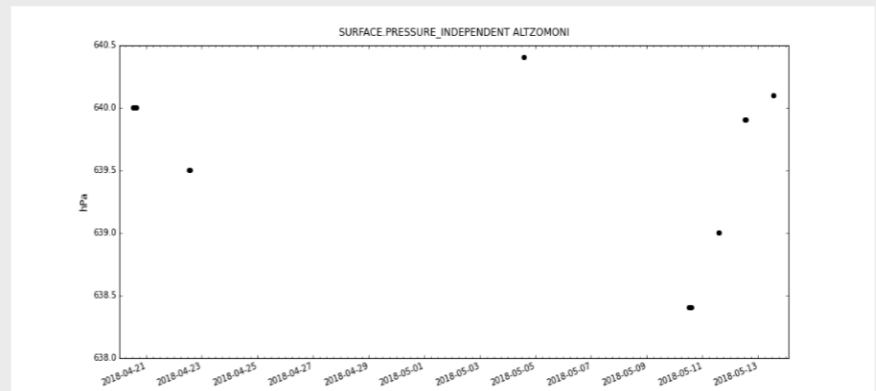
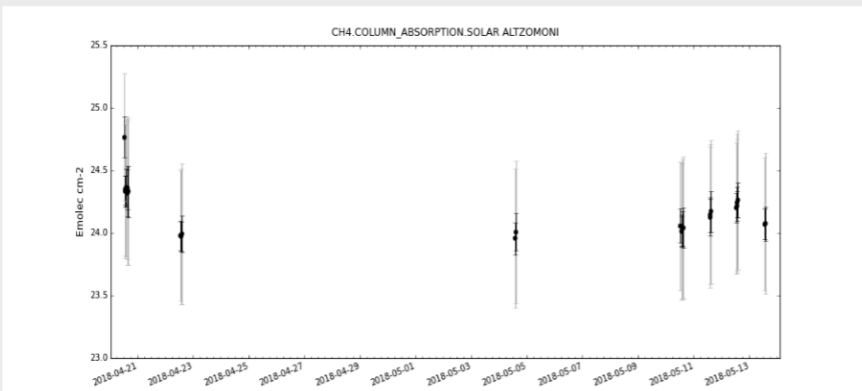
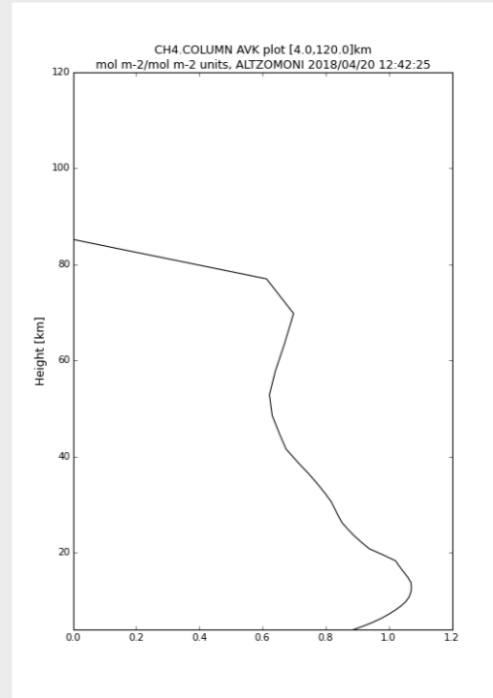
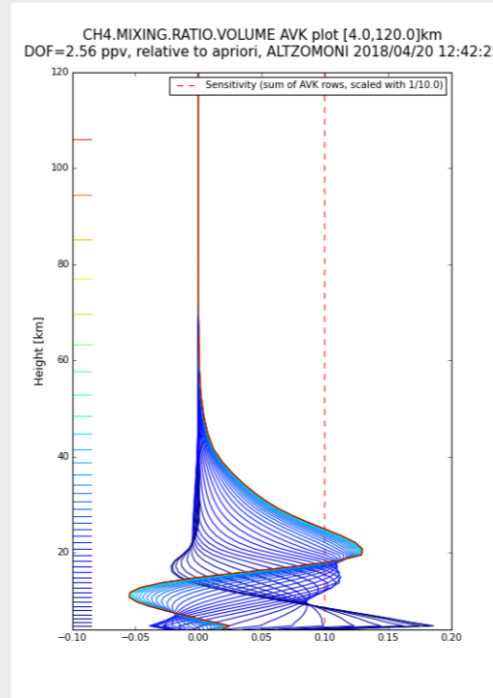
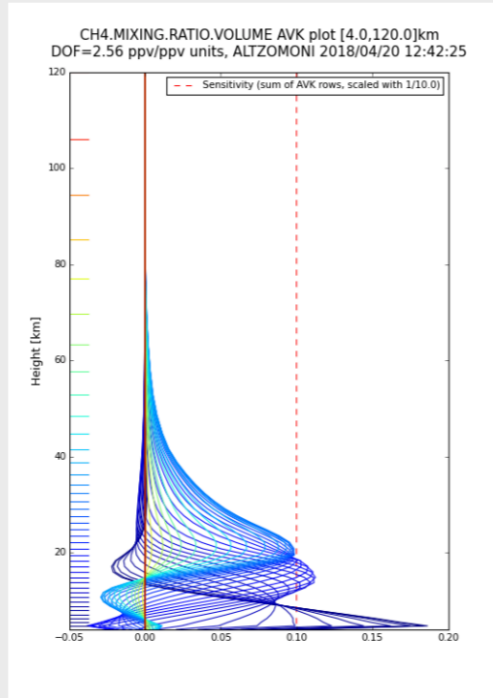
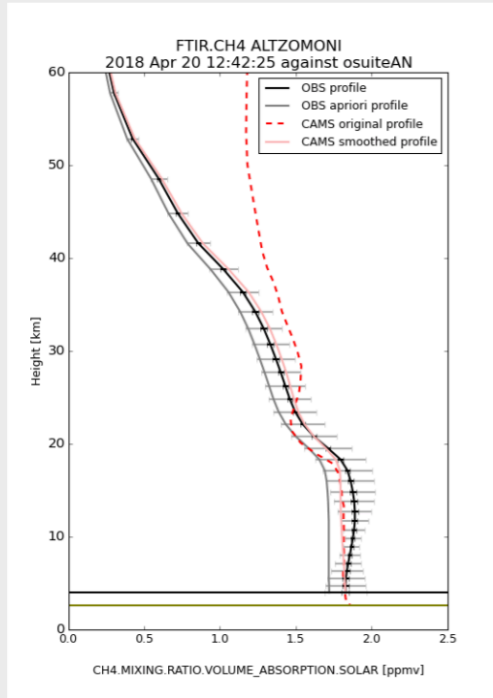
Filters:

### REPORTS

SUBMISSION DATE	PRODUCT ID	FILENAME	RD	QA	REPORT
2018-05-10	ftir.ch4_ulg002	groundbased_ftir.ch4_ulg002_jungfrauoch_20180308t073904z_20180325t090506z_005.hdf	🔴	🟢	📄
2018-05-10	ftir.co_ulg002	groundbased_ftir.co_ulg002_jungfrauoch_20180314t072523z_20180325t112154z_005.hdf	🔴	🟢	📄
2018-05-10	lidar.o3_dwd001	groundbased_lidar.o3_dwd001_hohenpeissenberg_20180506t194449z_20180507t024704z_001.hdf	🟢	🟢	📄
2018-05-10	lidar.o3_dwd001	groundbased_lidar.o3_dwd001_hohenpeissenberg_20180507t195759z_20180508t024457z_001.hdf	🟢	🟢	📄
2018-05-10	uvvis.doas.zenith.no2_cnrs.latmos013	groundbased_uvvis.doas.zenith.no2_cnrs.latmos013_haute.provence_20180504t043000z_20180504t183835z_013.hdf	🟢	🟢	📄
2018-05-10	uvvis.doas.zenith.no2_cnrs.latmos020	groundbased_uvvis.doas.zenith.no2_cnrs.latmos020_la.reunion.stdenis_20180504t023954z_20180504t134934z_013.hdf	🟢	🟢	📄
2018-05-10	uvvis.doas.zenith.o3_cnrs.latmos013	groundbased_uvvis.doas.zenith.o3_cnrs.latmos013_haute.provence_20180504t043000z_20180504t183835z_013.hdf	🟢	🟢	📄
2018-05-10	uvvis.doas.zenith.o3_cnrs.latmos020	groundbased_uvvis.doas.zenith.o3_cnrs.latmos020_la.reunion.stdenis_20180504t023954z_20180504t134934z_013.hdf	🟢	🟢	📄
2018-05-09	ftir.ch4_awi001	groundbased_ftir.ch4_awi001_ny.alesund_20180417t061717z_20180503t180524z_005.hdf	🟢	🟢	📄
2018-05-09	ftir.co_awi001	groundbased_ftir.co_awi001_ny.alesund_20180417t064107z_20180426t124855z_005.hdf	🟢	🟢	📄
2018-05-09	mwr.o3_ubern001	groundbased_mwr.o3_ubern001_bern_20180422t000017z_20180422t235935z_009.hdf	🟢	🟢	📄
2018-05-09	mwr.o3_ubern001	groundbased_mwr.o3_ubern001_bern_20180423t000003z_20180423t235953z_009.hdf	🟢	🟢	📄
2018-05-09	mwr.o3_ubern001	groundbased_mwr.o3_ubern001_bern_20180424t000023z_20180424t235958z_009.hdf	🟢	🟢	📄
2018-05-09	mwr.o3_ubern001	groundbased_mwr.o3_ubern001_bern_20180425t000028z_20180425t235939z_009.hdf	🟢	🟢	📄

groundbased\_ftir.ch4\_unam001\_altzomoni\_20180420t124225z\_20180513t141535z\_002.hdf

DATA VISUALISATION



SUMMARY

no problems found

# FTIR RD status (status last meeting)

- altzomoni
- AH, lauder
- bremen, ny alesund, paramaribo
- **Garmish/zugspitze**
- eureka/toronto
- **harestua**
- jungfraujoch
- maido
- **Mauna loa / thule (wip)**
- sodankyla
- st petersburg
- **wollongong (wip)**

# FTIR RD status

- altzomoni
- AH, lauder
- bremen, ny alesund, paramaribo
- ~~Garmish/zugspitze~~
- eureka/toronto
- harestua
- jungfraujoch
- maido
- **Mauna loa / thule (wip?)**
- sodankyla
- st petersburg
- **wollongong (ch4?)**

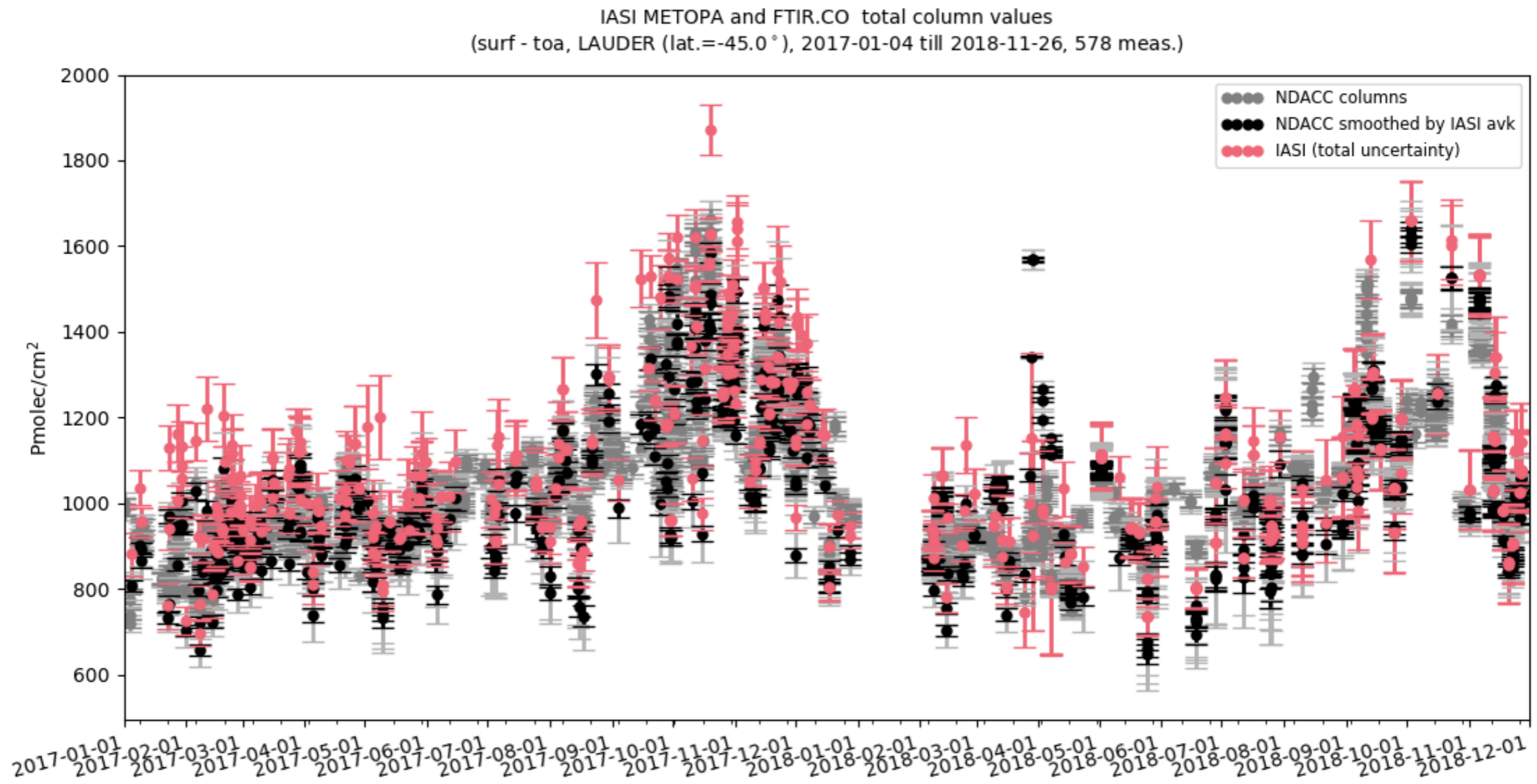


- CAMS27 will pay 63k€ for 2018 to 19 PI's
- CAMS27 will pay 40k€ for RD setup costs for 8PI's in 2018
- Unspent budget for 2018: 45k€ because
  - ▶ PI's did not respond or left the project
  - ▶ PI's say 'work in progress' :)
- Unspent budget will be used to fund the participation of the Dobson/Brewer

# Remaining issues

- Kim Strong raised the issue:  
“We adapted our retrieval strategy for the RD data stream, but would like to use old strategy for the consolidated submission to get a harmonised time series”
- QA/QC puts some restrictions on AVK: for CO this rejected sites with retrieval sensitivity in upper stratosphere/mesosphere
  - > maybe GEOMS versioning may resolve this issue: it could allow for a scientific version of a product? see Ian

- S5P validation facility: [mpc-vdaf.tropomie.be](http://mpc-vdaf.tropomie.be)
- EUMETSAT: IASI validation <http://cdop.aeronomie.be/validation/valid-results>



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