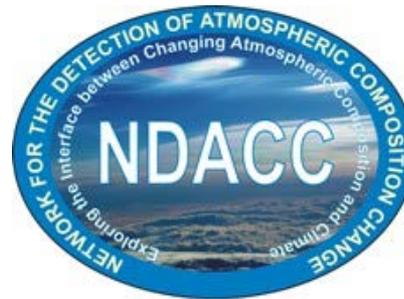


# Altzomoni, Mexico site report

NDACC



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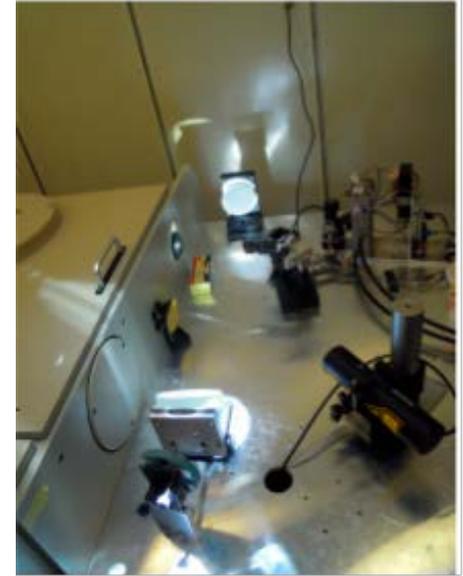
# Chronology



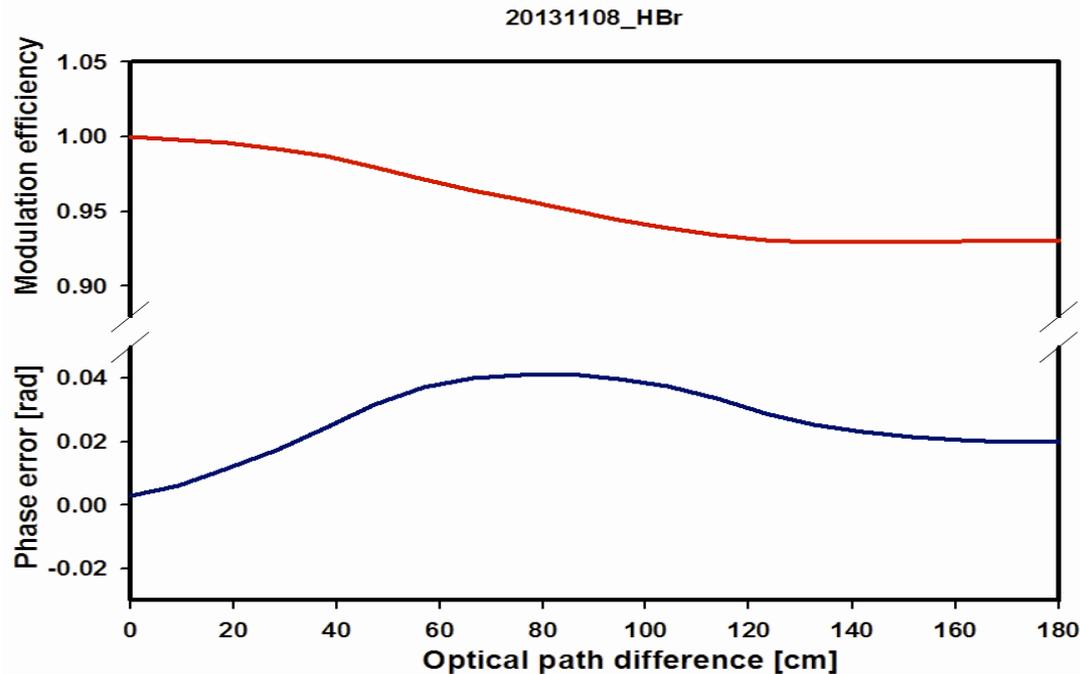
June 2011	Construction of plataforma, Met station, RS of volcanic gases
March 8 <sup>th</sup> , 2012	Arrival of FTIR container to Mexico
April 10 <sup>th</sup> , 2012	Measurement of the 1 <sup>st</sup> spectrum with IFS 120/5 HR
April 17 <sup>th</sup> , 2012	Inaguration with local authorities
May - June 2012	Construction of 2 <sup>nd</sup> phase (kitchen, small dormitory) Instalation of MW antenna (telemetry) and SMN Met tower
Oct. 2012	Optical alignment, ILS determination
Nov 2012 – May 2013	Automation and remote control Diverse In situ instrumentation installed
June 14 <sup>th</sup> , 2013	IRWG/TCCON meeting. Referee asiigned (M. Coffee)
June 2013	Site becomes part of RUOA ( <a href="http://www.ruoa.unam.mx">www.ruoa.unam.mx</a> )
May 12 <sup>th</sup> , 2014	IRWG/TCCON meeting.
Oct 10 <sup>th</sup> , 2014	Submission of validation results
Jan 13 <sup>st</sup> , 2015	Submission of revised validation document
May 29 <sup>th</sup> , 2015	Affiliation approved by IRWG and NDACC Steering Committees

# Instrument

- IFS 120HR from Bruker (model year 1988, S/N A58-HI0420)
- Donation from DLR to KIT in 2010 (M. Birk, DLR)
- Full electronics upgrade to IFS 120/5HR in 2011
- Max. OPD of 257 cm  $\rightarrow$  spectral resolution of  $0.0035 \text{ cm}^{-1}$
- Beam splitters: KBr and CaF<sub>2</sub> (10 and 8 mrad wedges, resp.)
- Detectors: MCT, InSb (N<sub>2</sub>-cooled) and InGaAs
- Sealed compartment (not evacuated), ZnSe window
- Solar tracker: KIT “Camtracker” design using a commercial telescope mount



# Instrumental line shape

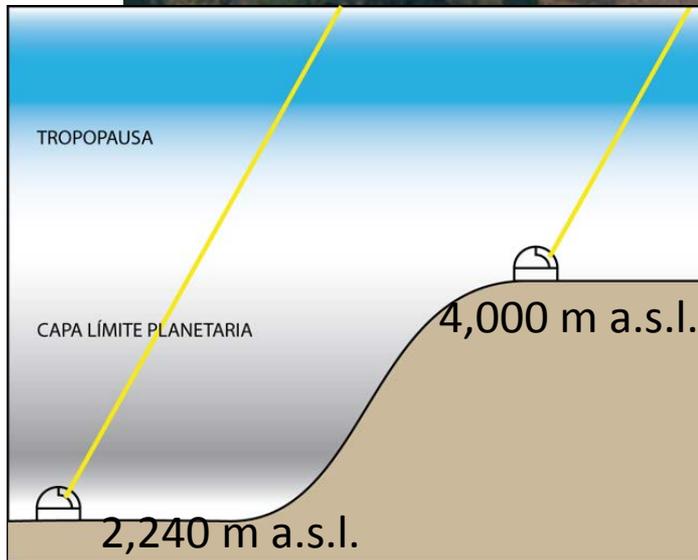


## Microwindows used by LINFIT

2412.48-2412.88
2412.80-2413.20
2432.20-2432.60
2432.53-2432.93
2451.49-2451.89
2451.95-2452.15
2470.38-2470.78
2470.74-2471.14
2488.85-2489.25
2489.21-2489.61
2506.90-2507.30
2507.25-2507.65
2524.48-2524.88
2524.95-2525.15

- HBr cell #57
- Code LINEFIT (F. Hase)
- T=290 K, P=240 Pa and a gas column of  $1.2 \times 10^{17}$  molec./cm<sup>2</sup>
- Modulation efficiency better than 95%
- ILS determination every 2-3 months

# The site



# The site

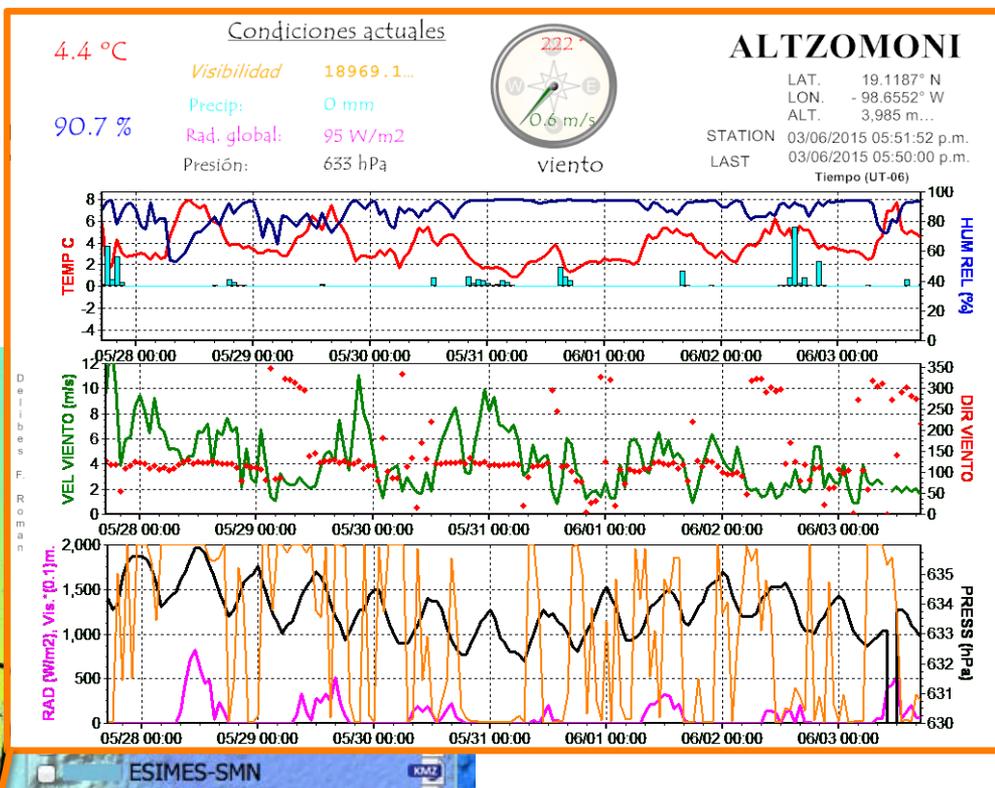


# The site



# Red Universitaria de Observatorios (RUOA)

[www.ruoa.unam.mx](http://www.ruoa.unam.mx)



Parameter	Instrument	Institution	Operating since
Solar IR spectra:	Bruker IFS	UNAM-CCA	05/2012
Gas profiles/columns	120/5HR	KIT	
H <sub>2</sub> O tot. column	GPS-Met	UNAM-IGF/CCA	10/2013
In situ: PM2.5, CO, O <sub>3</sub> , SO <sub>2</sub> , NOx	Gas analyzers	Ministry of the Environment. GDF	06/2012
In situ: CO <sub>2</sub> , CH <sub>4</sub> , H <sub>2</sub> O	Picarro CRDS	UNAM-RUOA*	08/2014
Temp., Pres., WS, WD, RH, Rain	Met. station Met. station	UNAM-RUOA* SMN (Met Service)	04/2011 12/2012
Volcanic SO <sub>2</sub> , SiF <sub>4</sub>	Bruker Opag22	UNAM-CCA	only on occasion

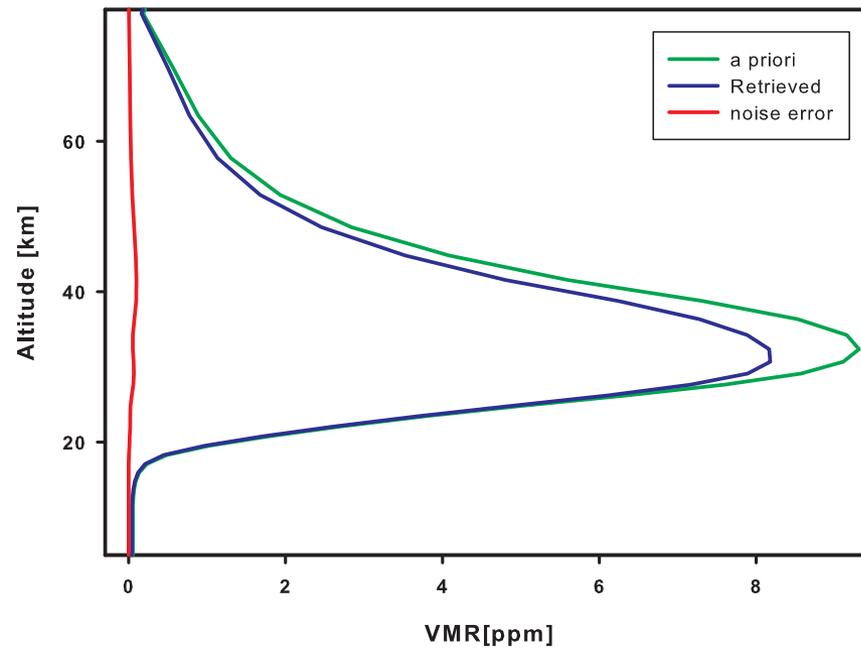
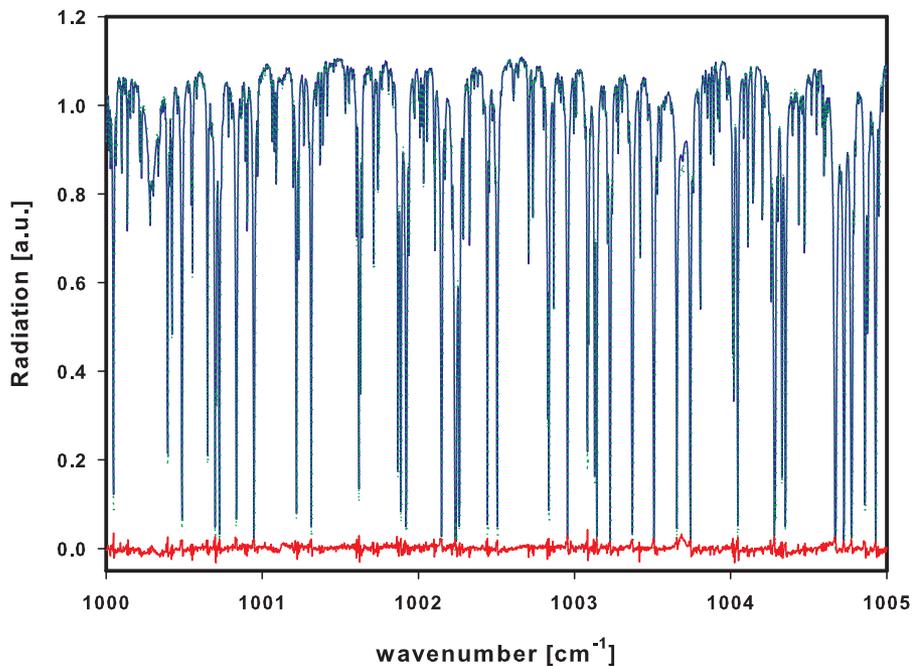
# certification/validation procedure

1. Detailed description of observing system / site
2. Record and provide spectra and retrievals for HCl, HNO<sub>3</sub>, O<sub>3</sub>, N<sub>2</sub> and HF
3. Record spectra of HBr cell and fit results
4. Analyze provided spectra (unknowns) and submit results

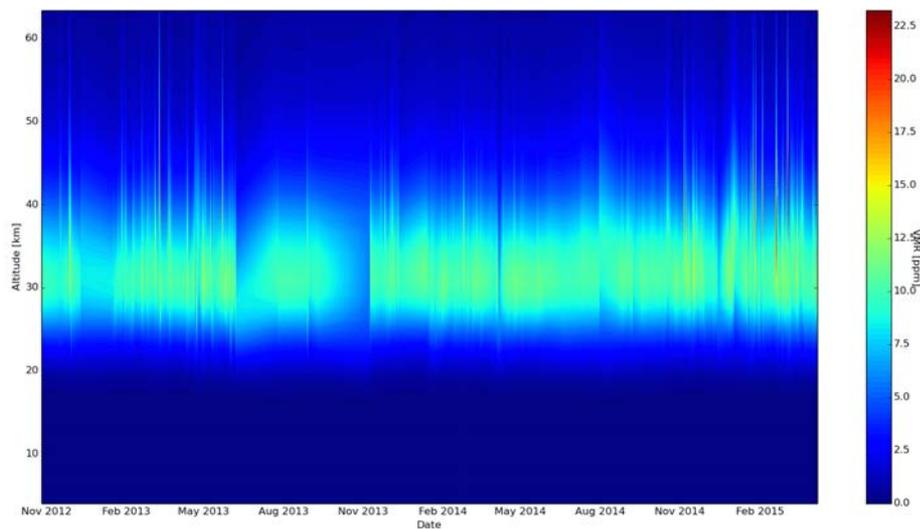
# Retrieval method

- Sequenced remotely-initialized measurements
- Preprocessing: Python script preparing PROFFIT format
  - Quality flags (clouds, SNR, non-linearity)
  - P,T profiles (daily radiosondes)
  - apparent SZA
- PROFFIT retrievals
  - P,T profiles (NCEP)
  - A priori: WACCAM 6
  - Linelist: HITRAN (different versions)
  - Tikhonov regularization
- Filtering
- NDACC database compilation. HDF archiving

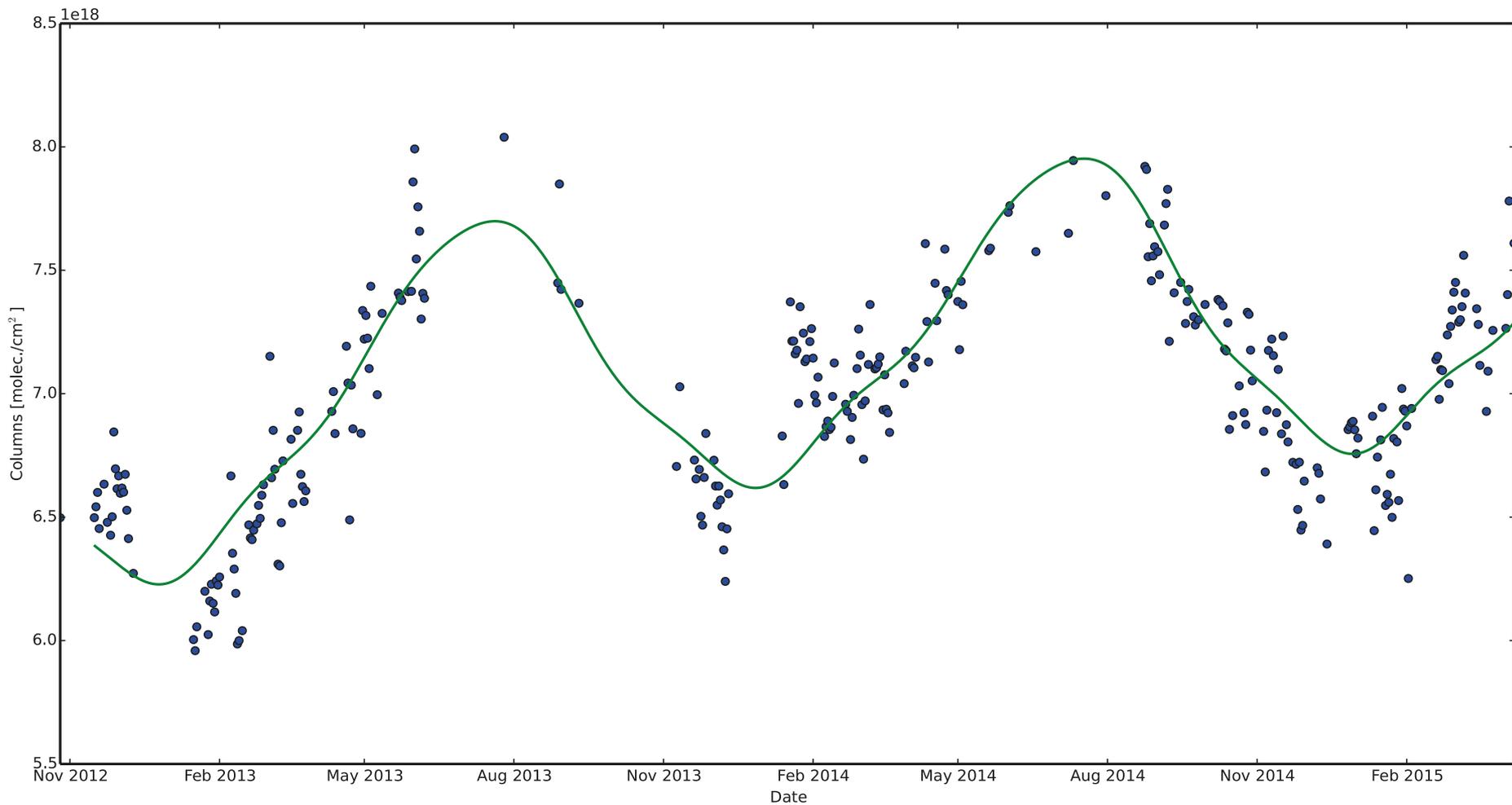
# Ozone



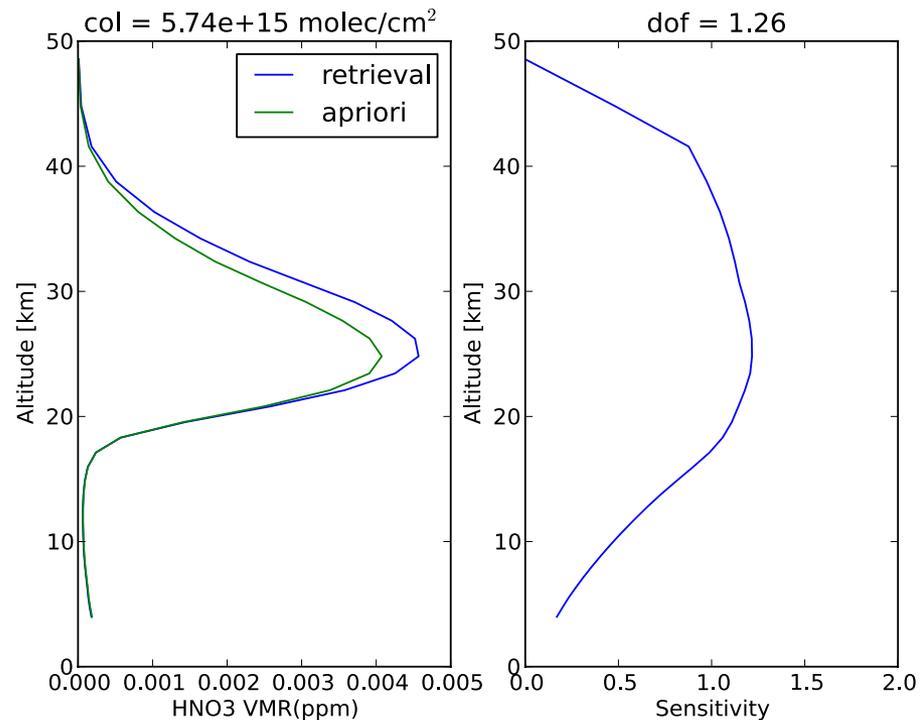
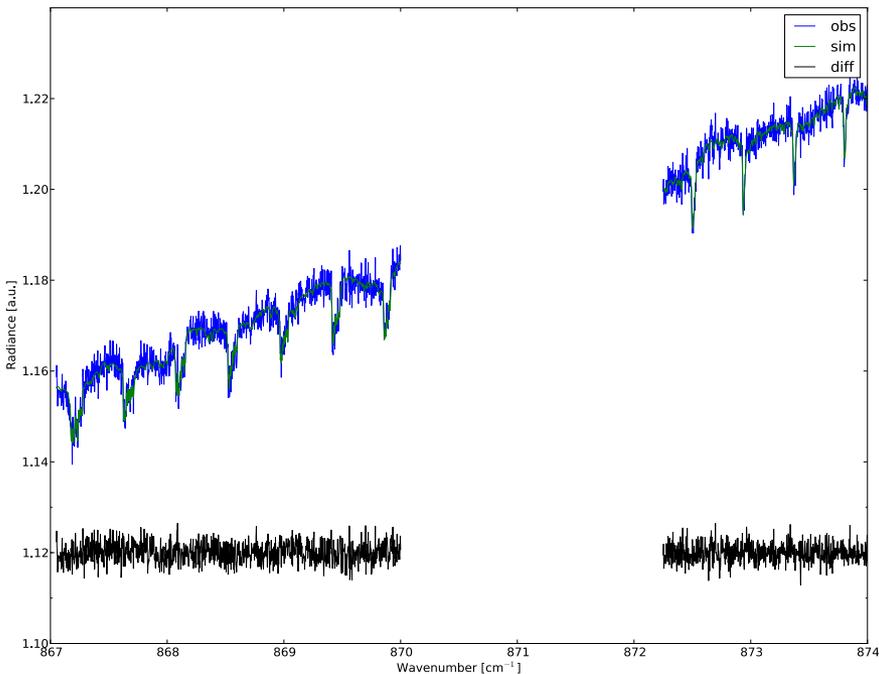
File name	121114_161640SF
Date	2012-11-14
Time	16:16:40
SZA	48.17°
OPD (cm)	180
Interferences	H <sub>2</sub> O, CO <sub>2</sub> , CH <sub>4</sub> , O <sup>668</sup> , O <sup>686</sup>
Microwindows (cm <sup>-1</sup> )	1000.00 – 1005.00
A priori	WACCM 6
Total column (molec./cm <sup>2</sup> )	6.5144E+18
RMS	0.92 %
SNR	107.9
DOF	3.33



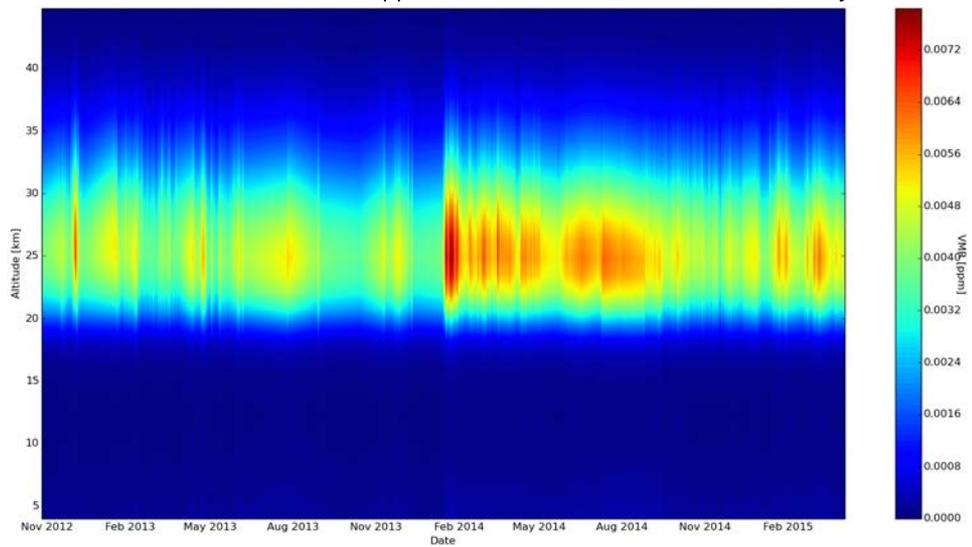
# O<sub>3</sub> timeseries



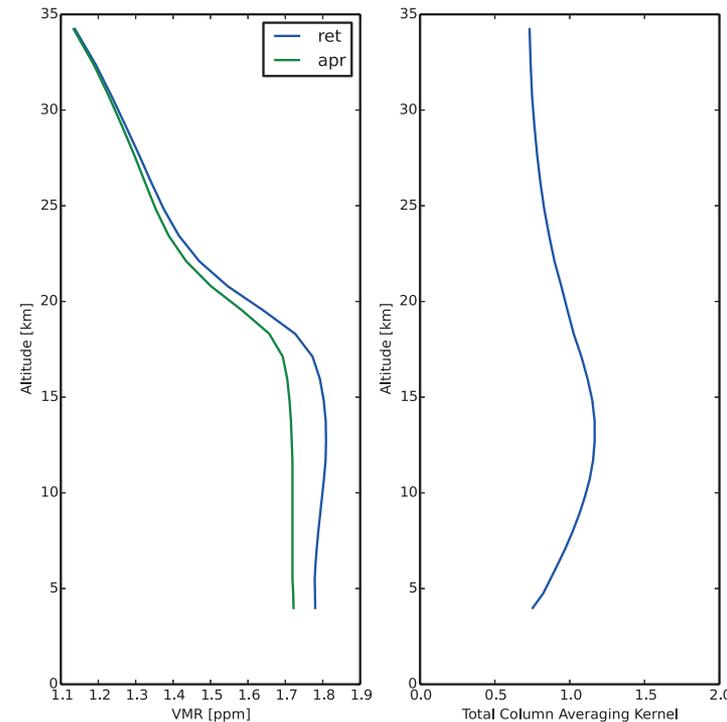
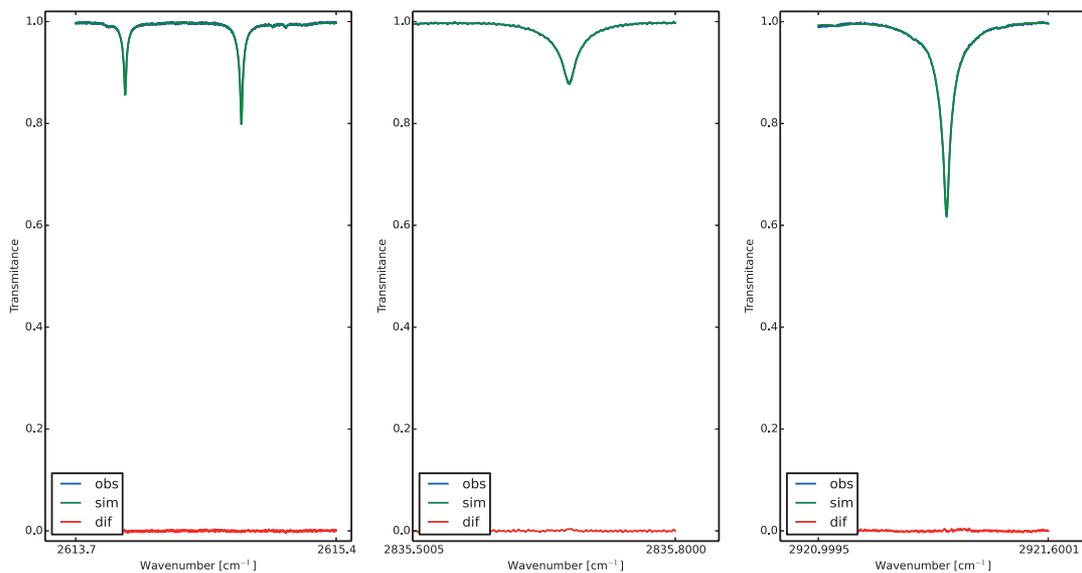
# HNO<sub>3</sub>



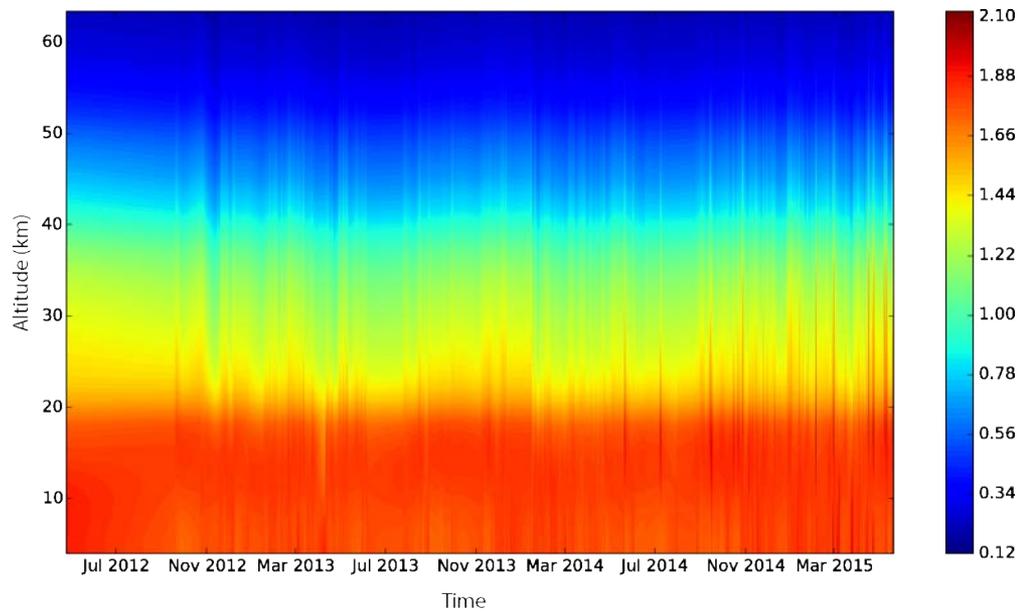
File name	130128_172635SF
Date	2013-01-28
Time	17:26:35
SZA	42.1729°
OPD (cm)	180
Interferences	H <sub>2</sub> O, CO <sub>2</sub> , OCS, C <sub>2</sub> H <sub>6</sub> , CCl <sub>2</sub> F <sub>2</sub> , NH <sub>3</sub>
Microwindows (cm <sup>-1</sup> )	867.05 – 870.00 872.25 – 874.00
A priori	WACCM 6
Total column (molec./cm <sup>2</sup> )	5.74e+15
RMS	0.18 %
SNR	559
DOF	1.26



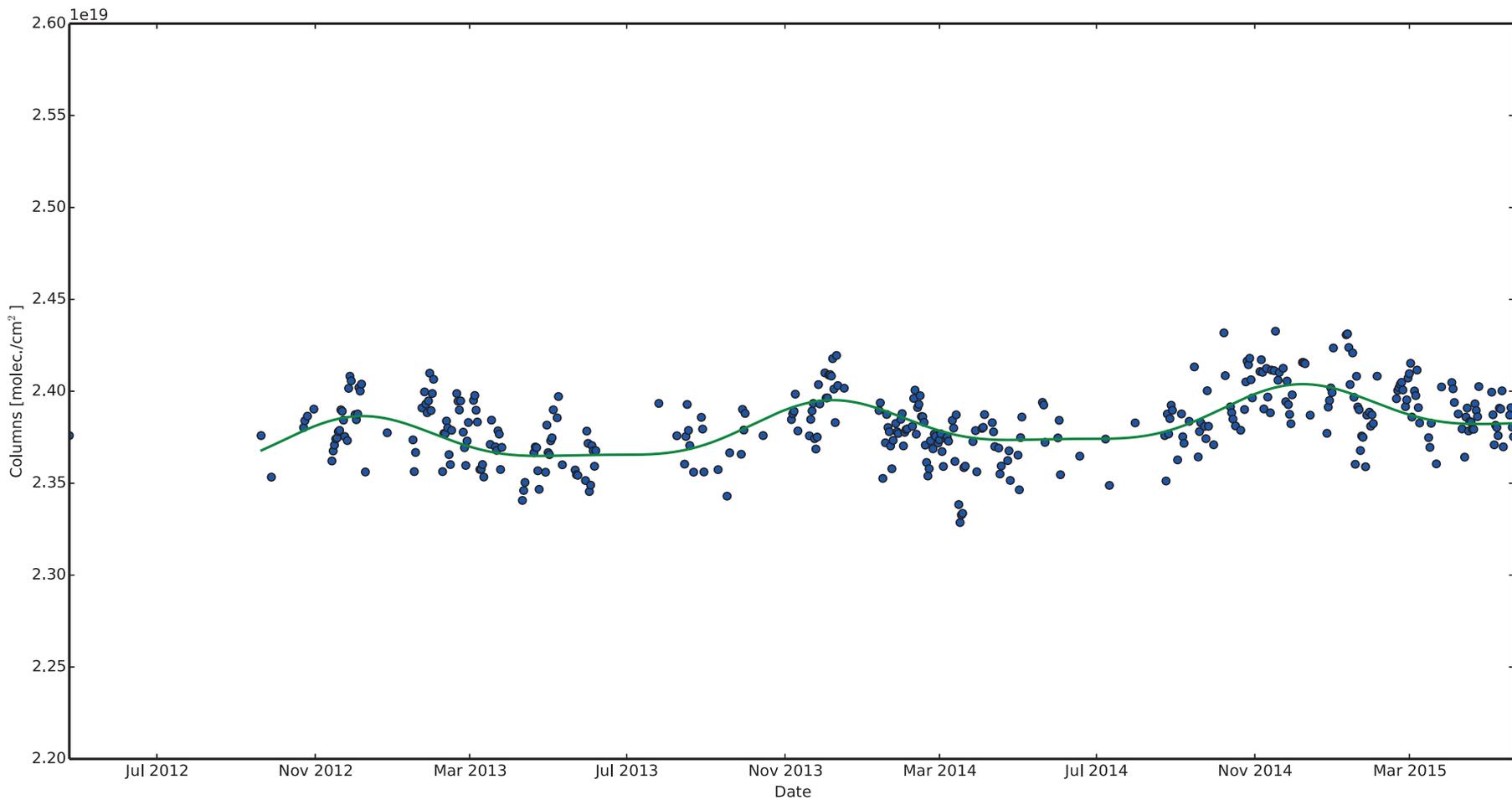
# Methane



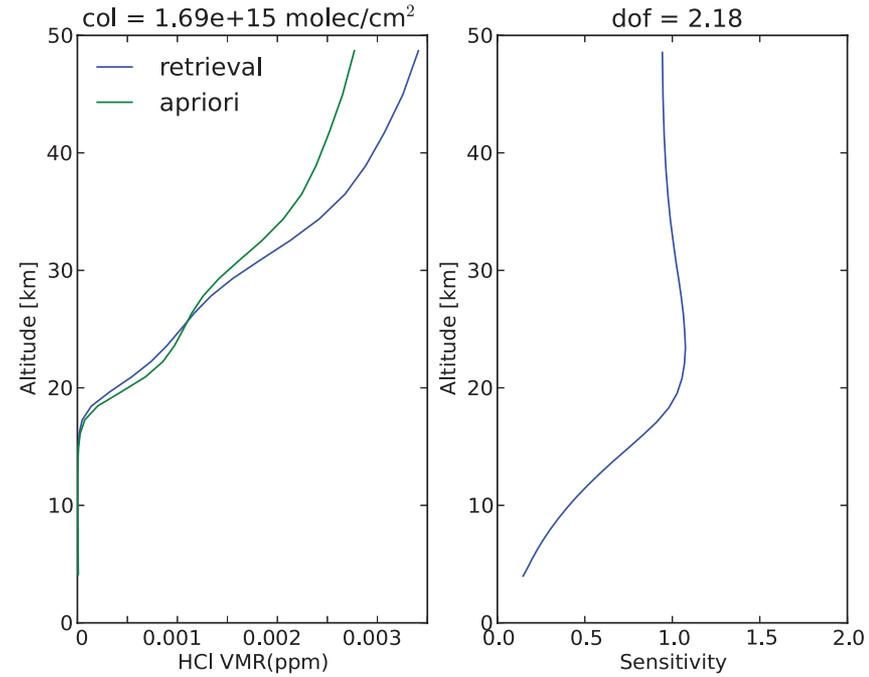
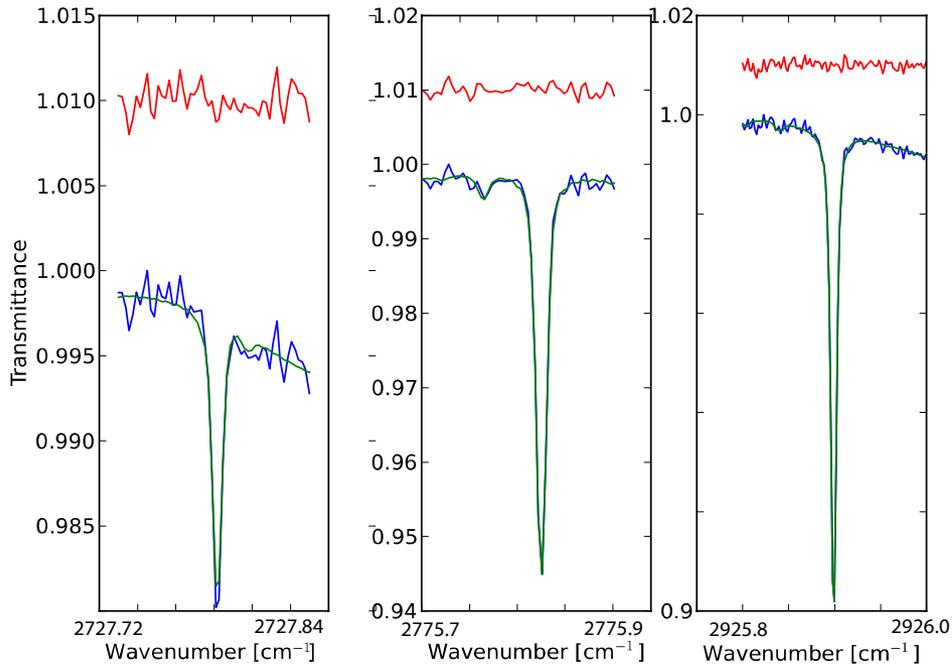
Date	2013-03-23
Time	11:52:38
SZA	20.92
OPD (cm)	180.0
Interferences	'H2O' 'H2O' 'CO2' 'NO2'
A priori	2.2848e+19
Total column (molec/cm2)	2.3782e+19
RMS	0.00153
DOF	2.368



# CH<sub>4</sub> timeseries



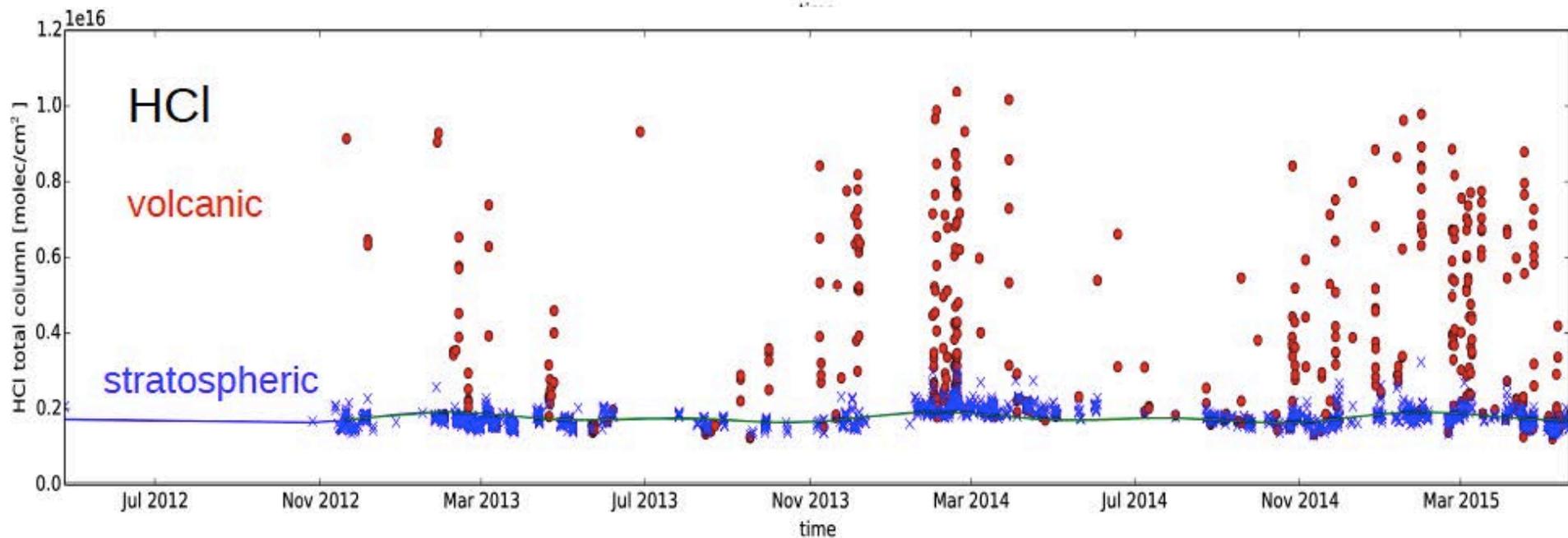
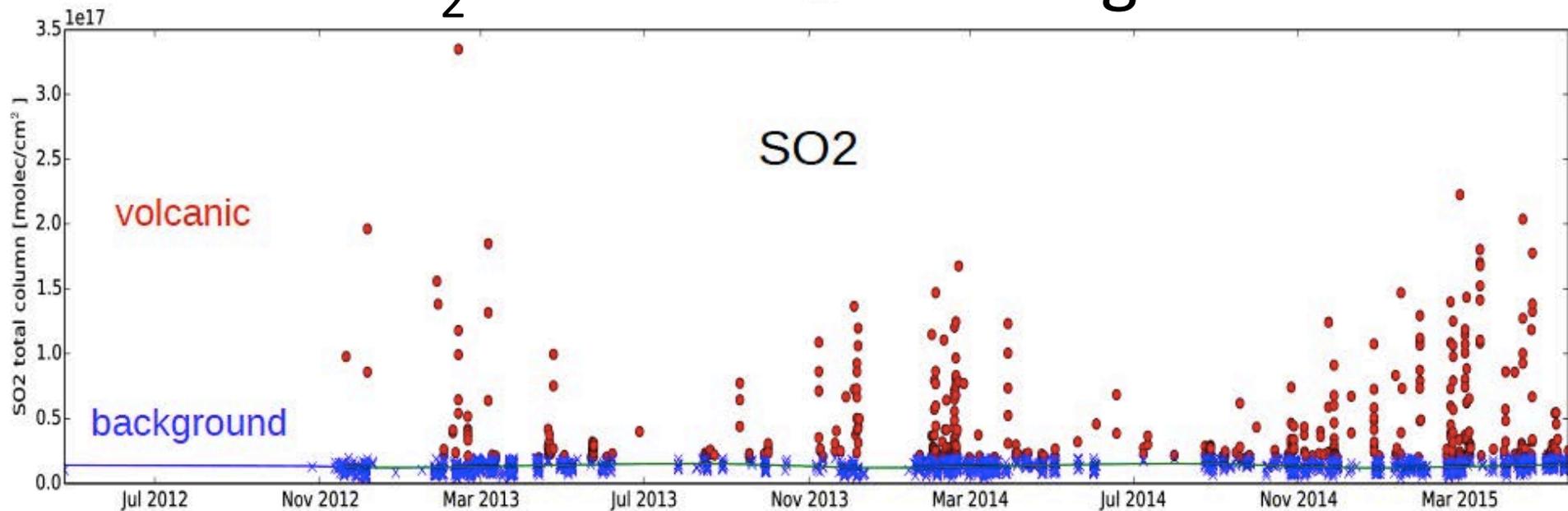
# HCl



File name	121023SC.0_182351SC
Date	2012-10-23
Time	18:23:51
SZA	30.87°
OPD (cm)	180
Interferences	H2O
Microwindows (cm <sup>-1</sup> )	2727.73 - 2727.83 2775.70 - 2775.80 2925.80 - 2926.00
A priori	WACCM 6
Total column (molec./cm <sup>2</sup> )	1.69e+15
RMS	0.081 %
SNR	1227.9
DOF	2.18

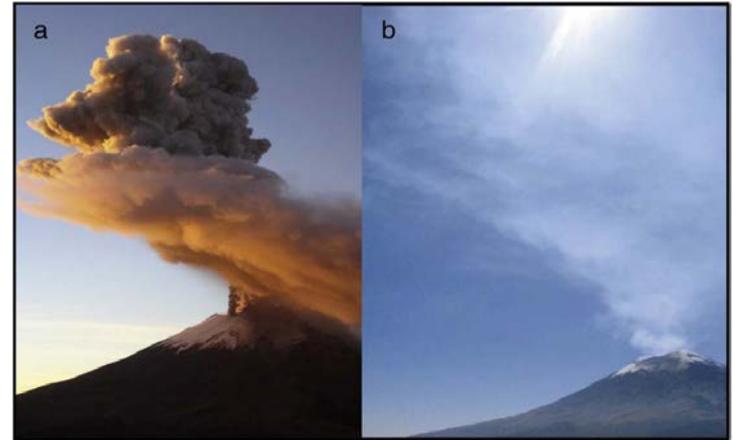
Influenced by the volcanic plume  
(Wolfgang's talk)

# SO<sub>2</sub> - tracer of volcanic gas

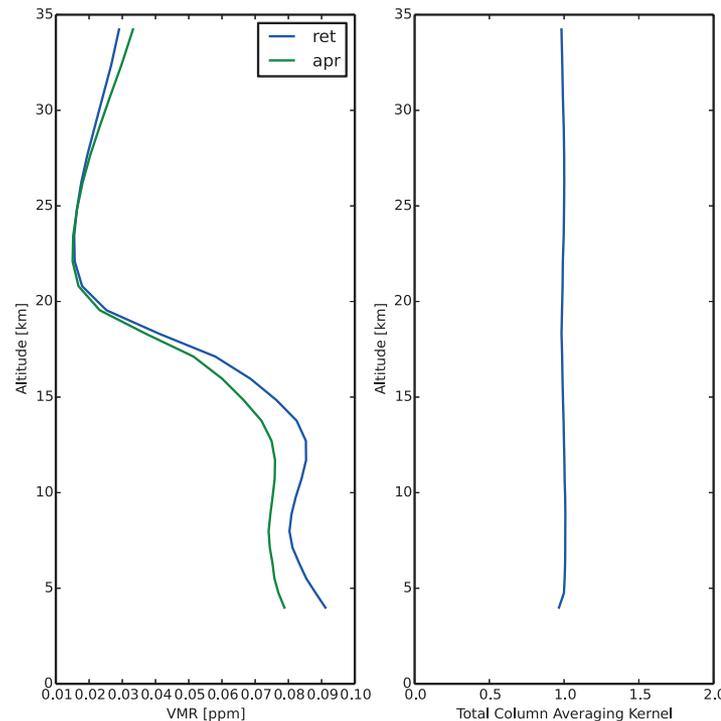
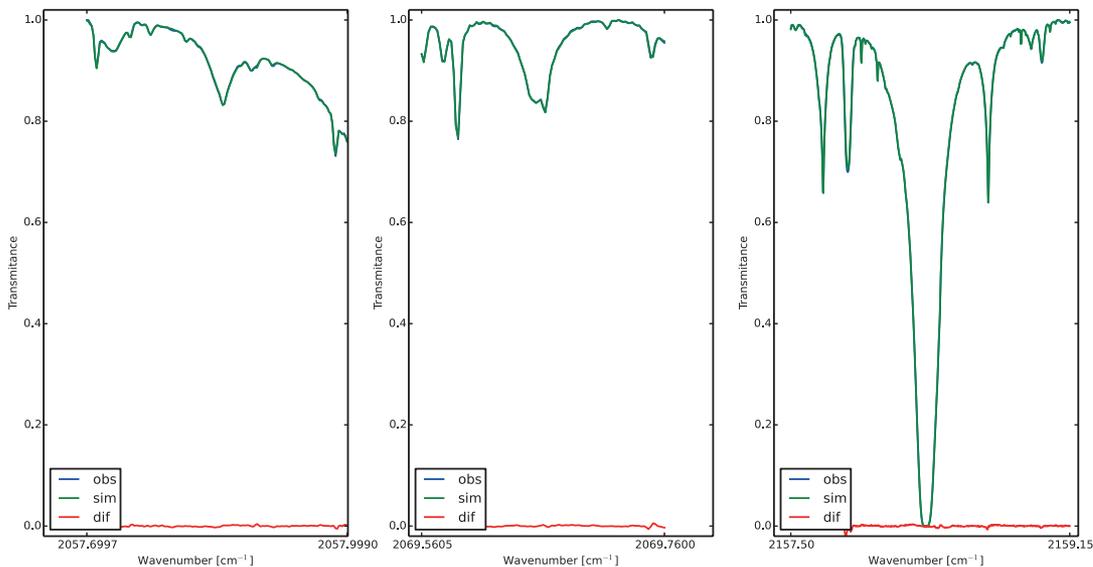


# Importance of volcanic gas monitoring

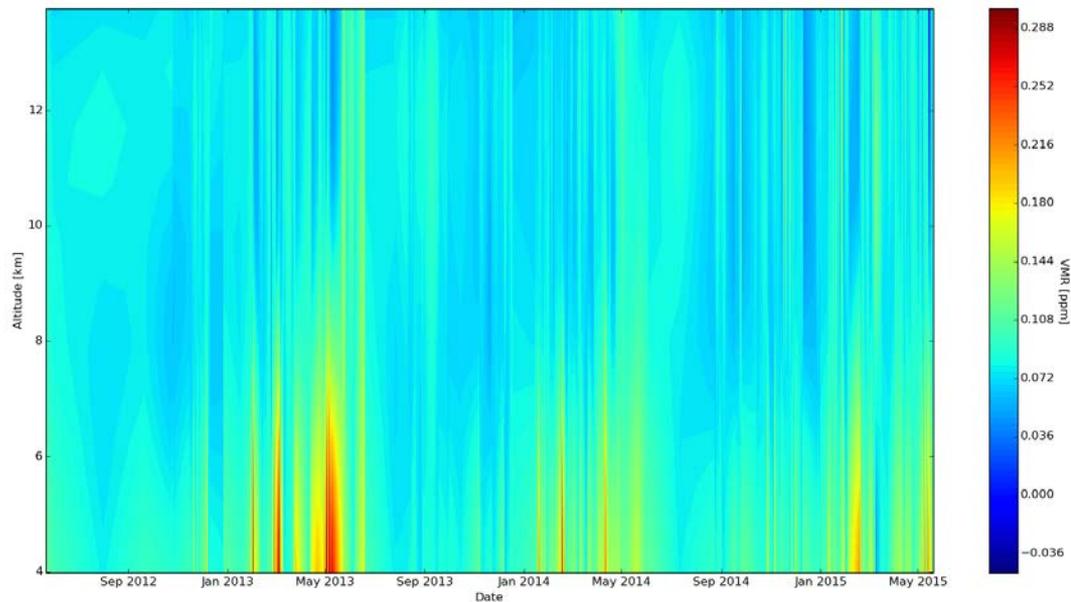
- Changes in gas ratios reflect a change in activity
- Quantify contributions into the atmosphere



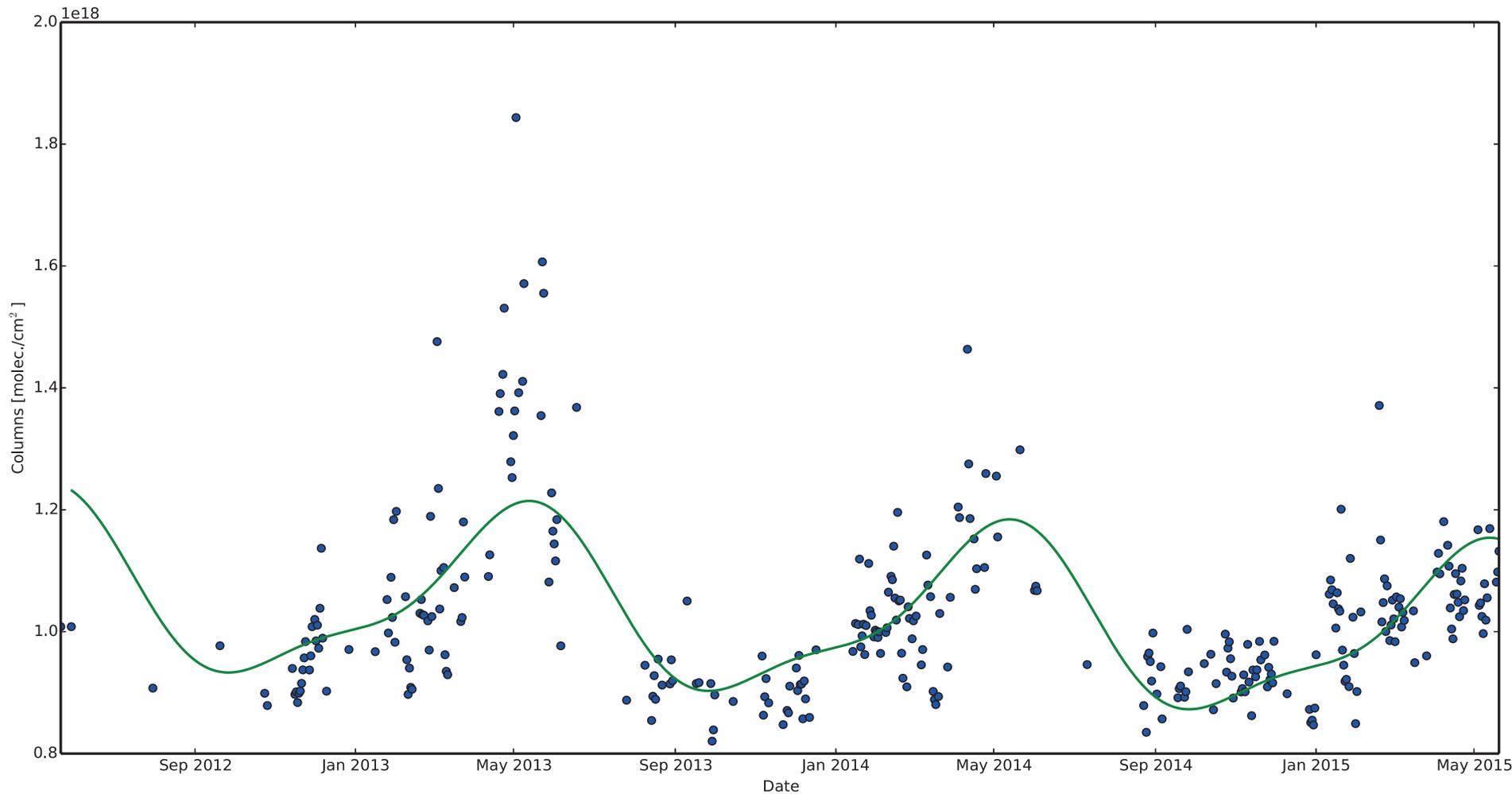
# carbon monoxide



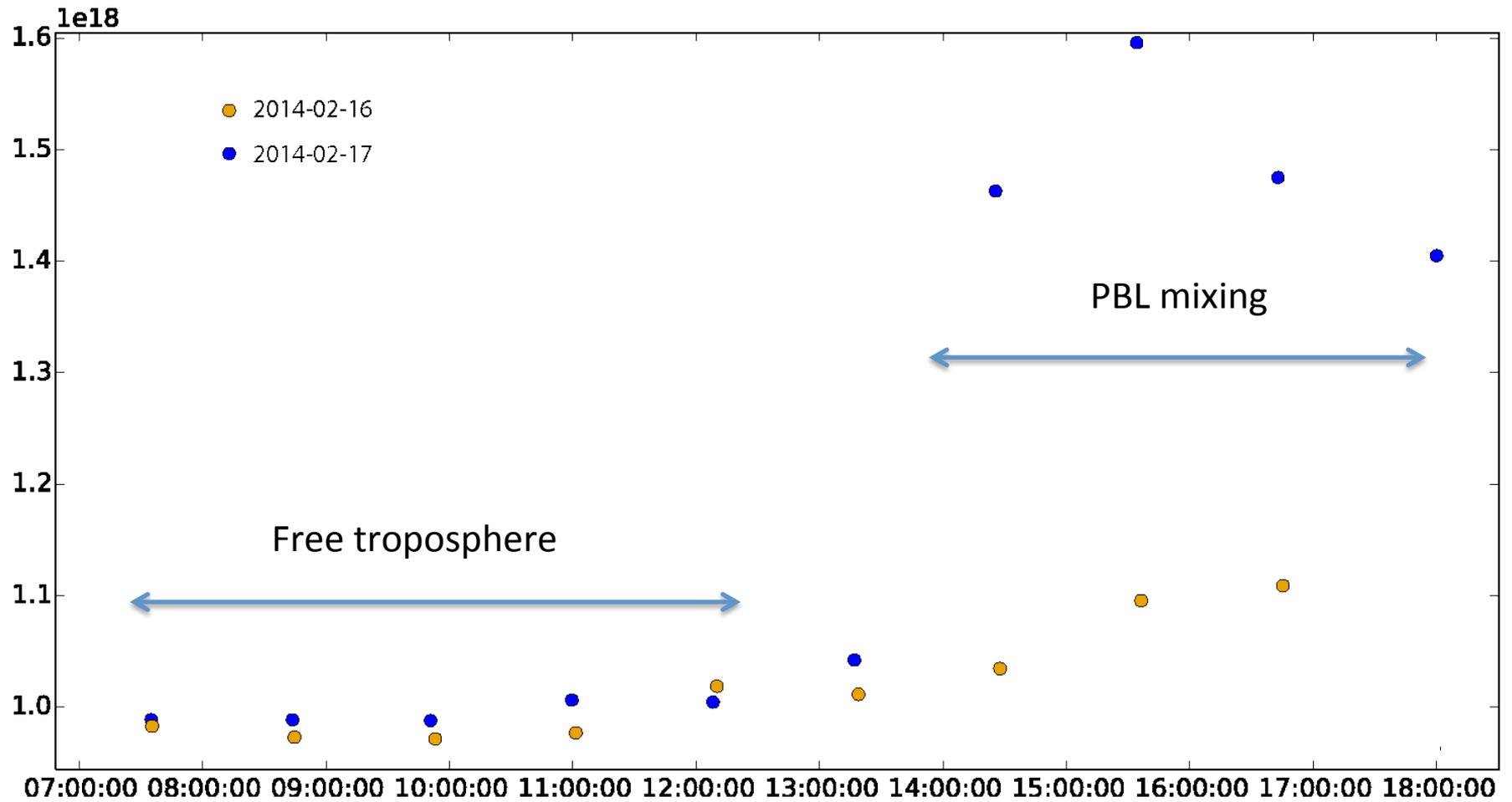
Date	2013-03-23
Time	09:06:50
SZA	54.5
OPD (cm)	180.0
Interferences	'H2O' 'CO2' 'O3' 'N2O' 'CO' 'OCS'
A priori	9.1982e+17
Total column (molec/cm2)	1.0195e+18
RMS	0.00206
DOF	3.9



# CO - timeseries



# CO - individual days



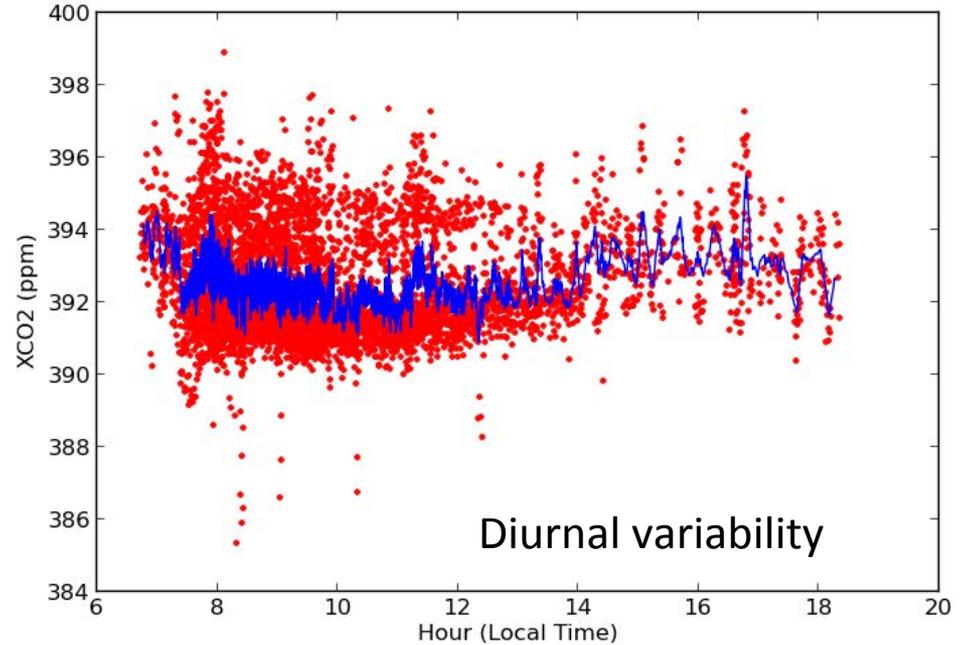
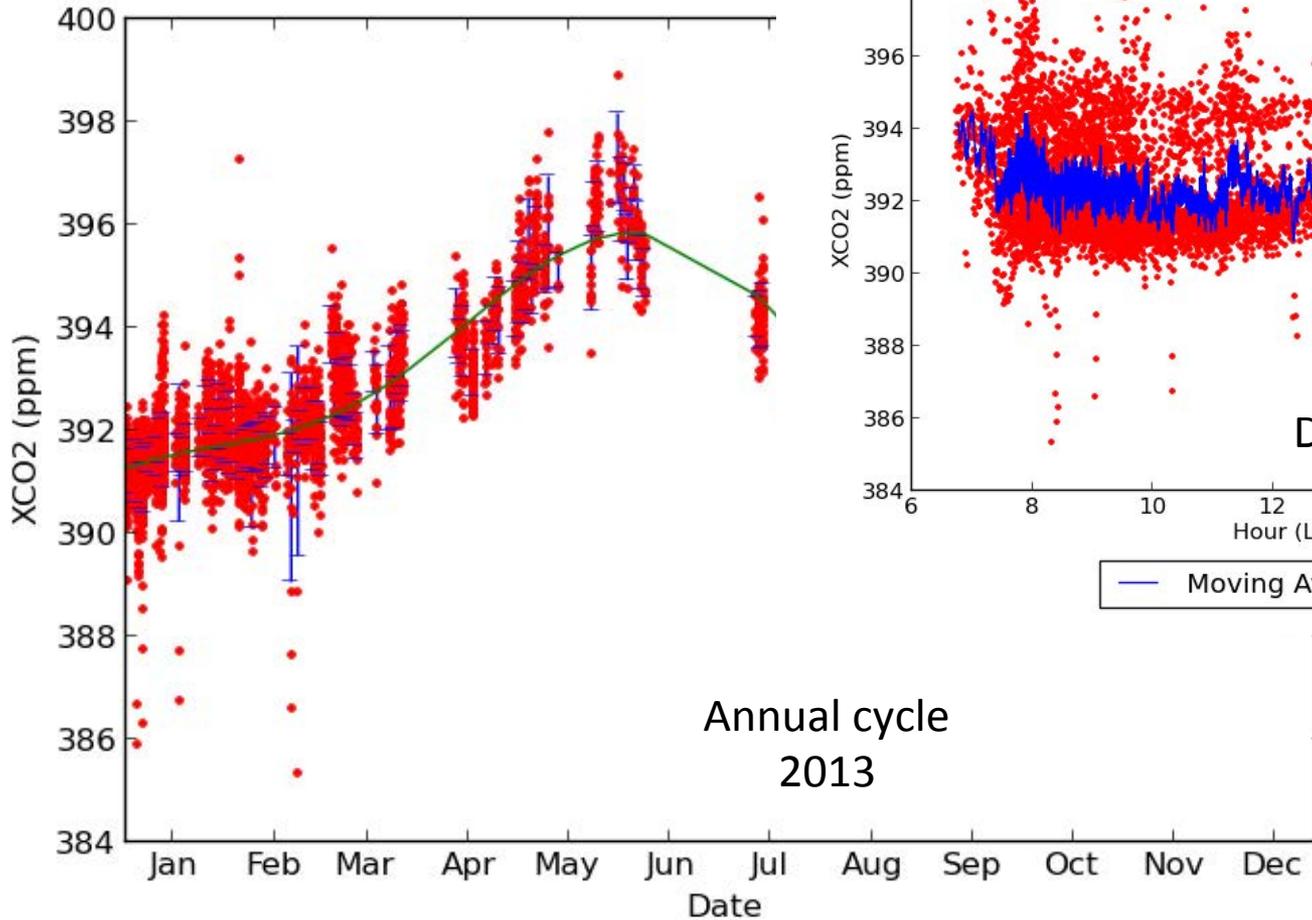
# Measurement statistics

Period	No. spectra (all filters)	No. of compl. sequences	Days with measurements	Percent days
06/2012 – 05/2013	10,417	734	169/365	46 %
06/2013 – 05/2014	14,921	951	186/365	51 %
06/2014 – 05/2015	10,758	1570	195/365	53 %



# XCO<sub>2</sub> during 2013

see Jorge Baylon's poster



Diurnal variability

— Moving Average, 10 values

— Annual Cycle    I I Daily Average

# Conclusions

- New NDACC site
- 3 years of data
- Unique location, opportunity to study:
  - transport of urban pollution
  - volcanic gas measurements
- Filtering of the data is important
  - SO<sub>2</sub> is a good proxy

Gracias!