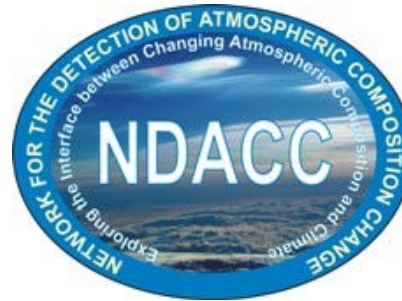


Altzomoni, Mexico site report

NDACC



M. Grutter, W. Stremme, A. Bezanilla, J. Baylón, E. Plaza, N. Taquet
Centro de Ciencias de la Atmósfera, UNAM



T. Blumenstock, F. Hase, M. Schneider
Karlsruhe Institute of Technology, IMK-KIT

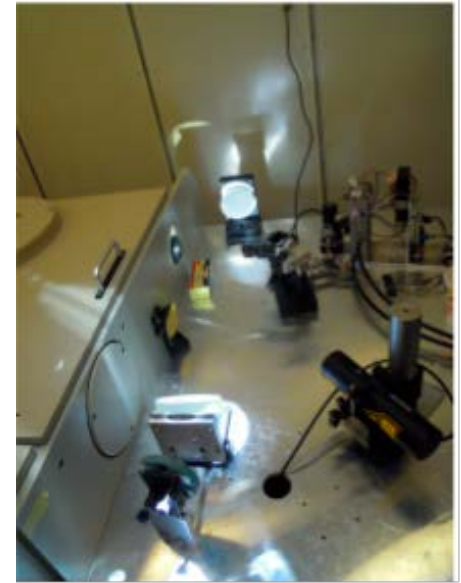
Chronology



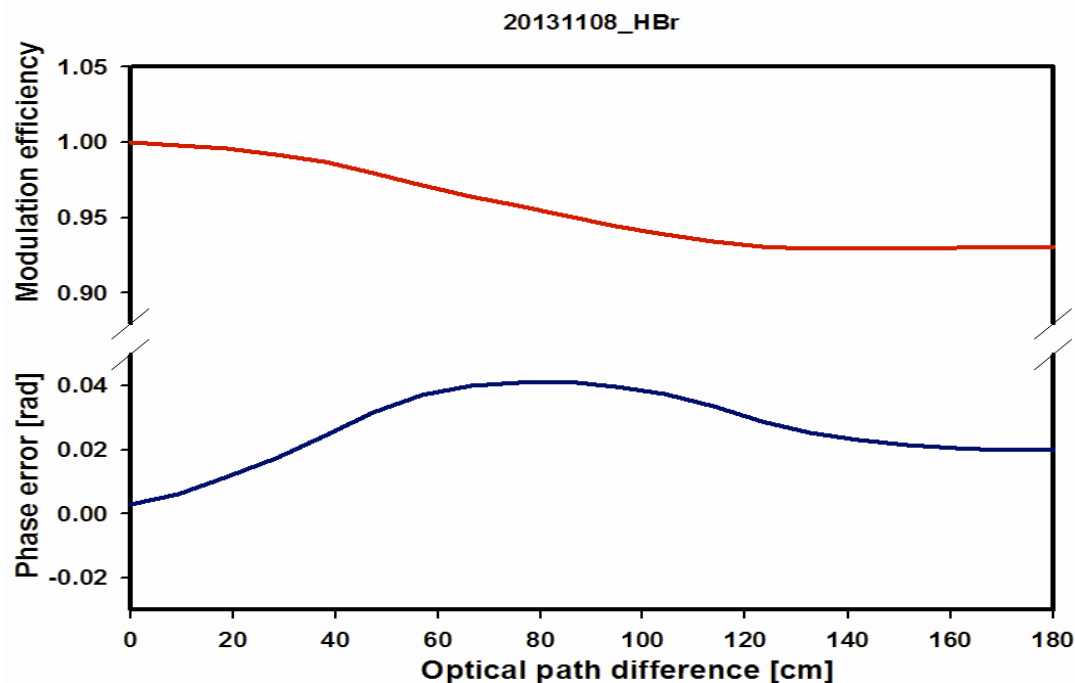
June 2011	Construction of plataforma, Met station, RS of volcanic gases
March 8 th , 2012	Arrival of FTIR container to Mexico
April 10 th , 2012	Measurement of the 1 st spectrum with IFS 120/5 HR
April 17 th , 2012	Inaguration with local authorities
May - June 2012	Construction of 2 nd phase (kitchen, 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 th , 2013	IRWG/TCCON meeting. Referee asiigned (M. Coffee)
June 2013	Site becomes part of RUOA (www.ruoa.unam.mx)
May 12 th , 2014	IRWG/TCCON meeting.
Oct 10 th , 2014	Submission of validation results
Jan 13 st , 2015	Submission of revised validation document
May 29 th , 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 cm^{-1}
- Beam splitters: KBr and CaF₂ (10 and 8 mrad wedges, resp.)
- Detectors: MCT, InSb (N₂-cooled) and InGaAs
- Sealed compartment (not evacuated), ZnSe window
- Solar tracker: KIT “Camtracker” design using a commercial telescope mount



Instrumental line shape

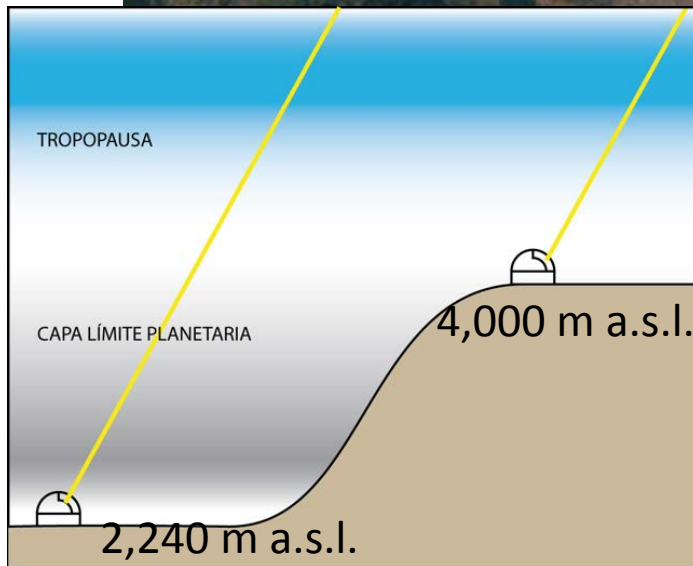


Microwindows used by LINFIT

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 1.2×10^{17} molec./cm²
- Modulation efficiency better than 95%
- ILS determination every 2-3 months

The site



The site

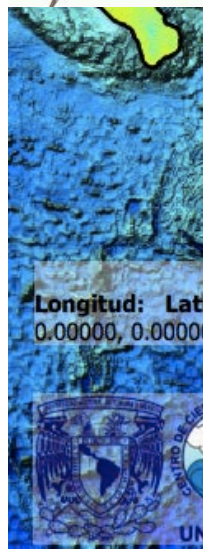
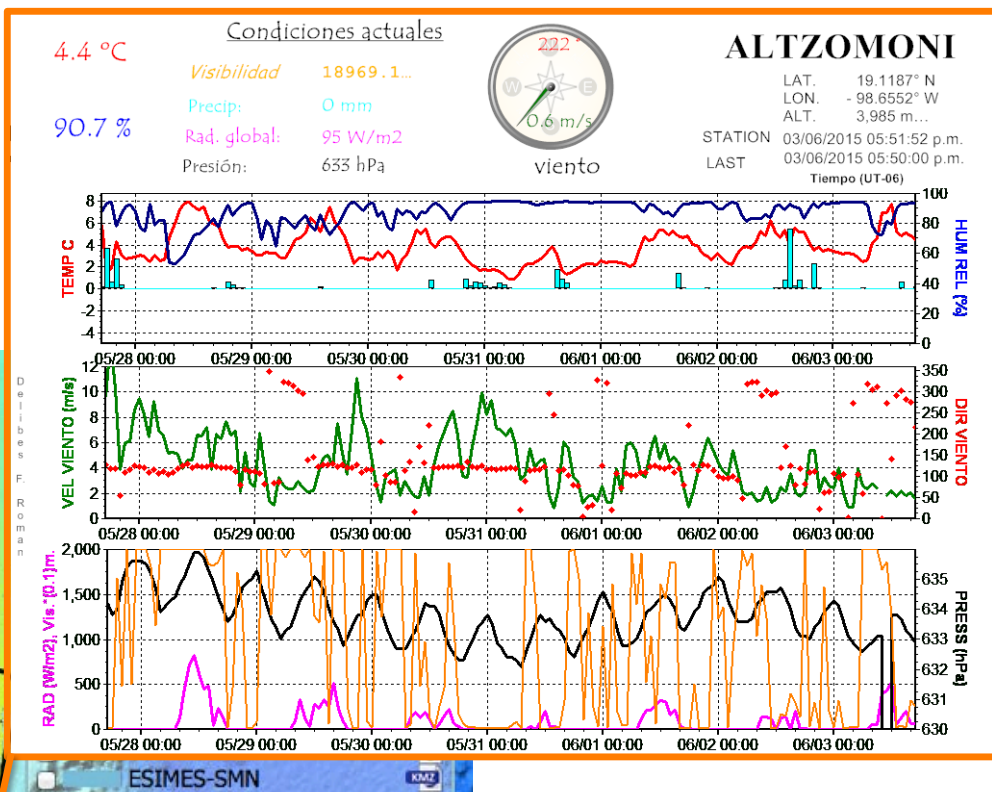


The site



Red Universitaria de Ob (RUOA)

www.ruoa.unam.mx



Parameter	Instrument	Institution	Operating since
Solar IR spectra: Gas profiles/columns	Bruker IFS 120/5HR	UNAM-CCA KIT	05/2012
H ₂ O tot. column	GPS-Met	UNAM-IGF/CCA	10/2013
In situ: PM2.5, CO, O ₃ , SO ₂ , NOx	Gas analyzers	Ministry of the Environment. GDF	06/2012
In situ: CO ₂ , CH ₄ , H ₂ 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 ₂ , SiF ₄	Bruker Opag22	UNAM-CCA	only on occasion

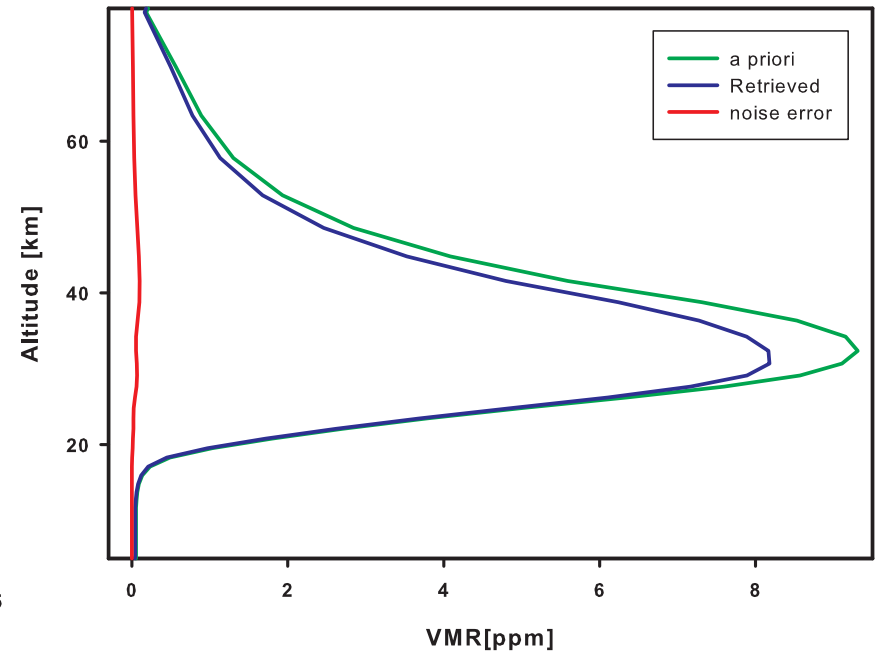
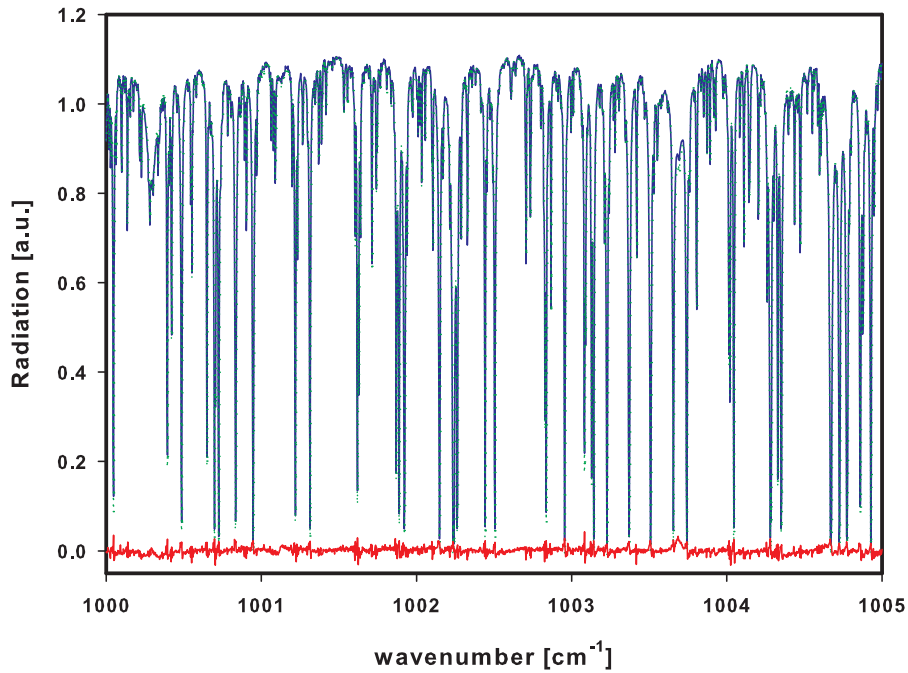
certification/validation procedure

1. Detailed description of observing system / site
2. Record and provide spectra and retrievals for HCl, HNO₃, O₃, N₂ and HF
3. Record spectra of HBr cell and fit results
4. Analyze provided spectra (unknowns) and submit results

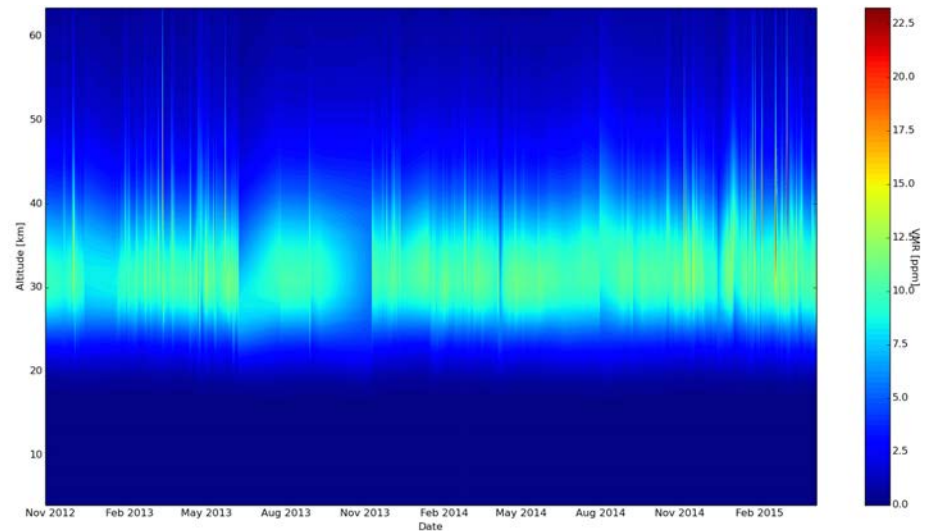
Retrieval method

- 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

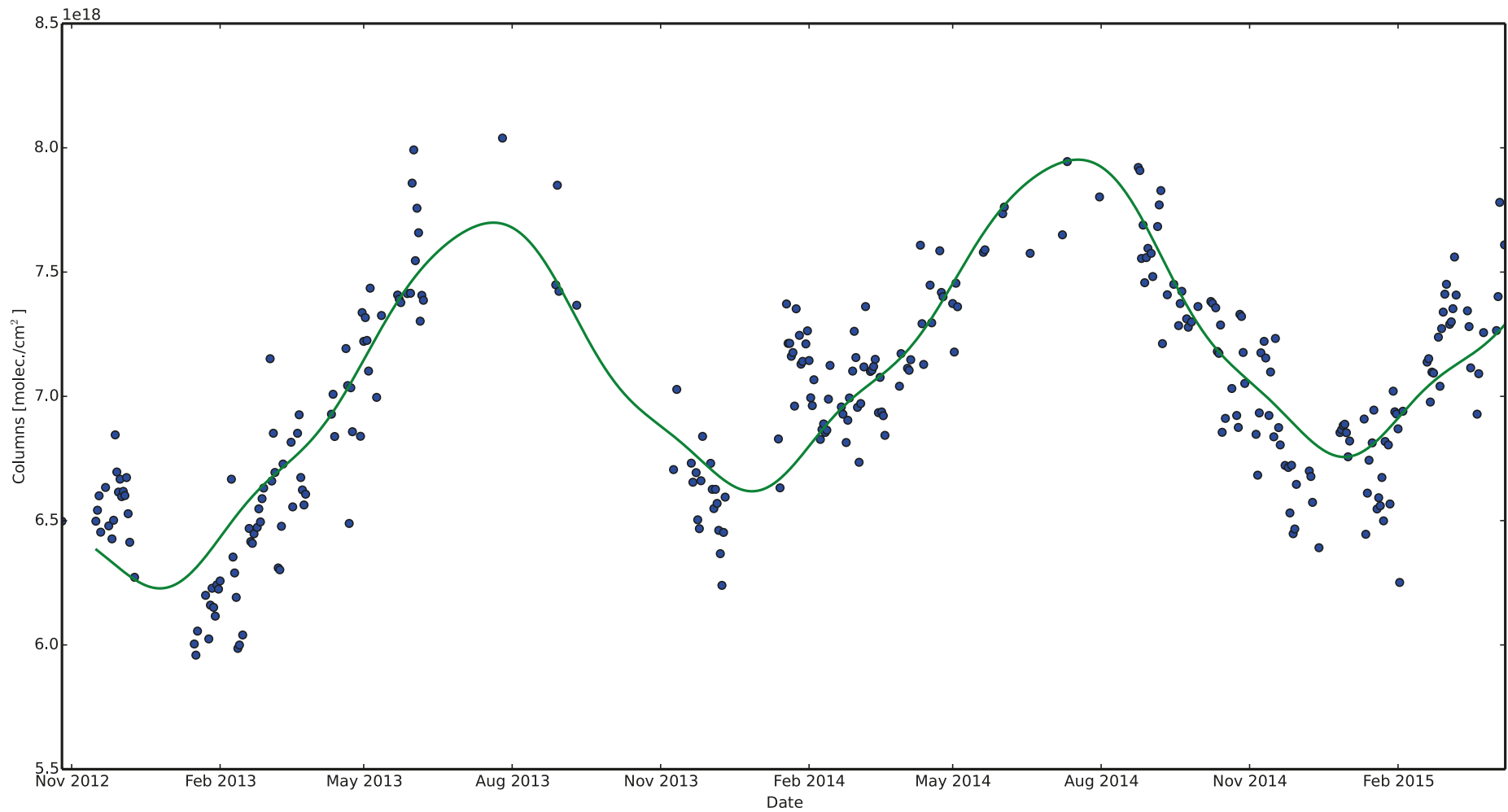
Ozone



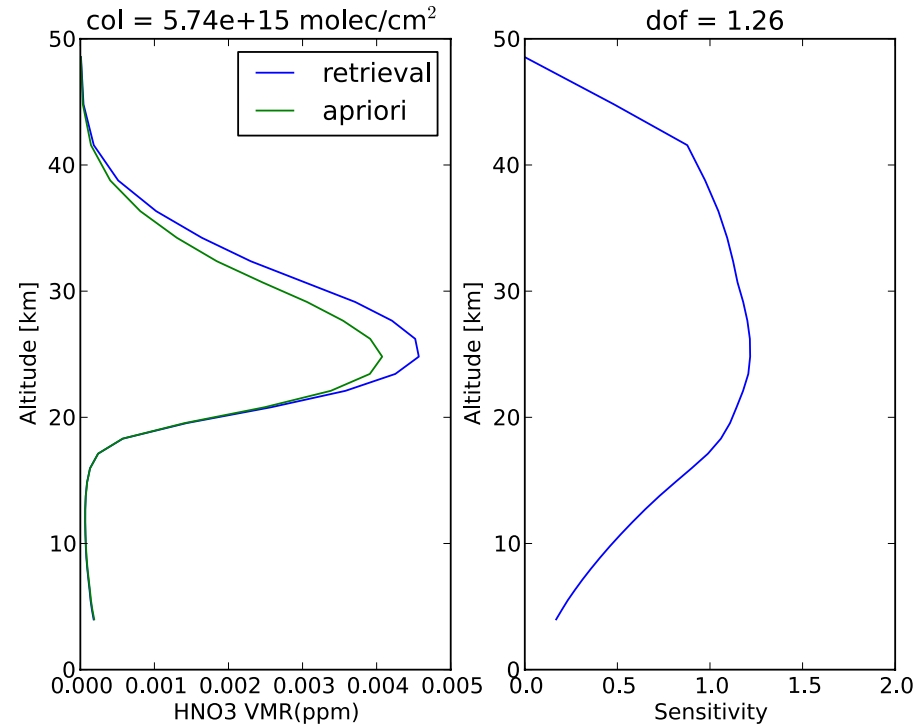
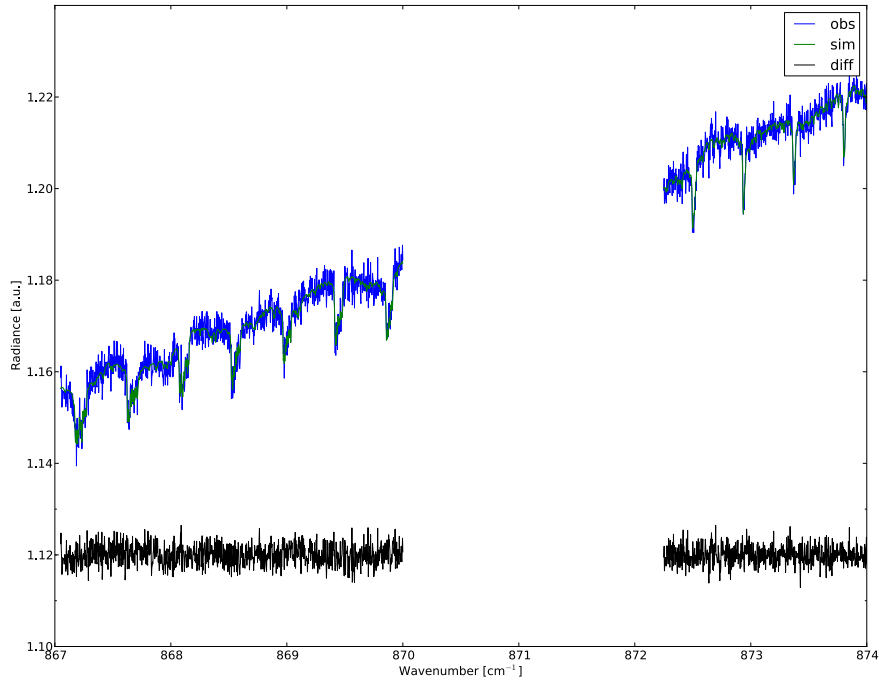
File name	121114_161640SF
Date	2012-11-14
Time	16:16:40
SZA	48.17°
OPD (cm)	180
Interferences	H ₂ O, CO ₂ , CH ₄ , O ⁶⁶⁸ , O ⁶⁸⁶
Microwindows (cm ⁻¹)	1000.00 – 1005.00
A priori	WACCM 6
Total column (molec./cm ²)	6.5144E+18
RMS	0.92 %
SNR	107.9
DOF	3.33



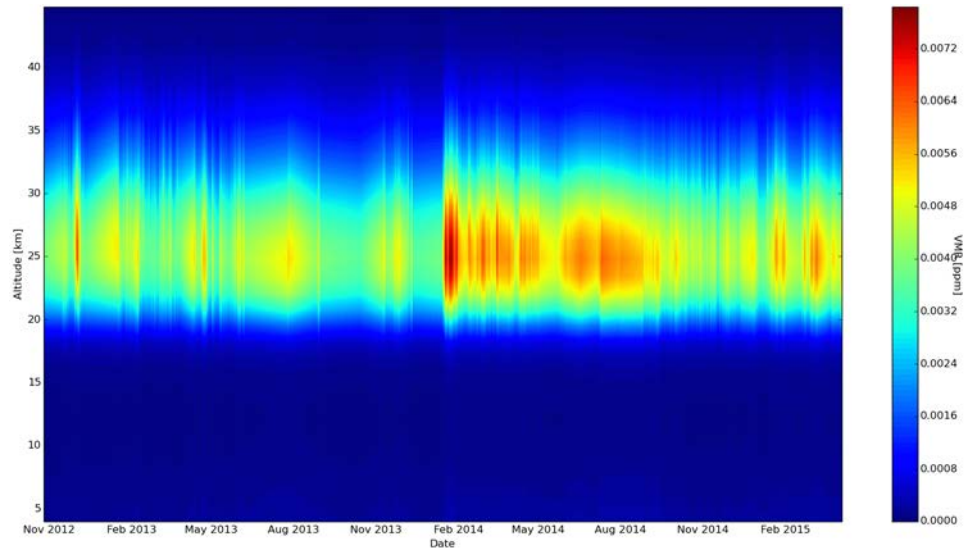
O₃ timeseries



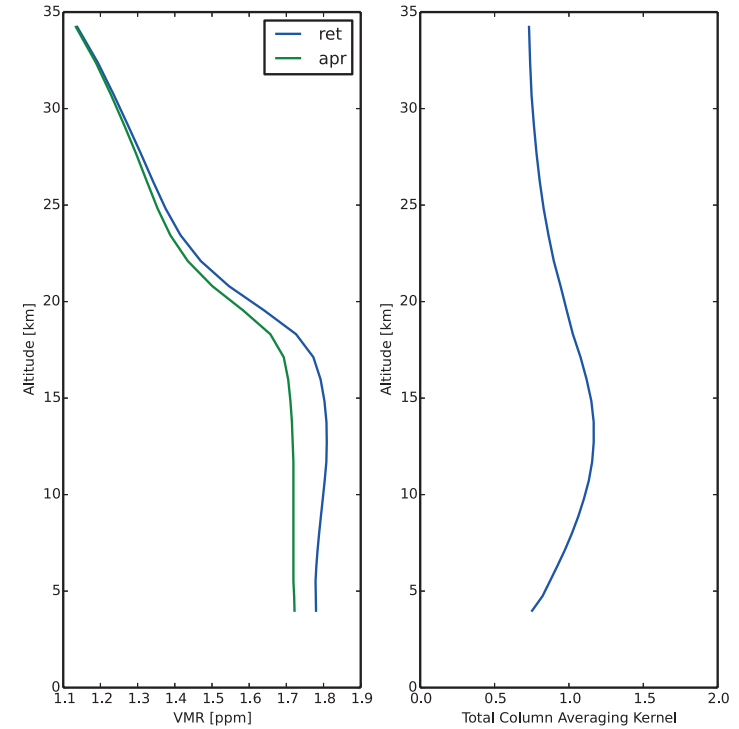
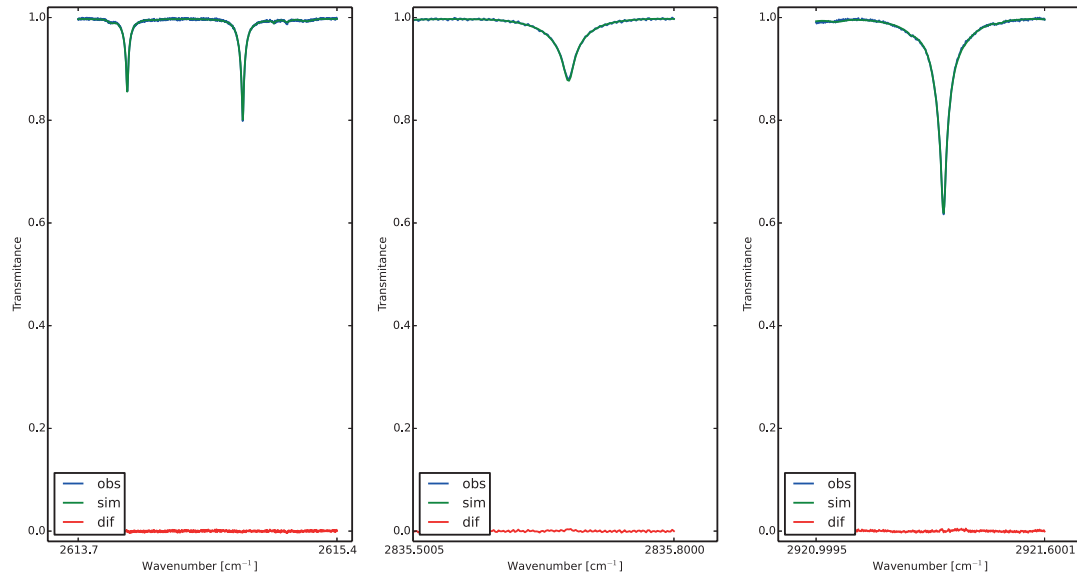
HNO₃



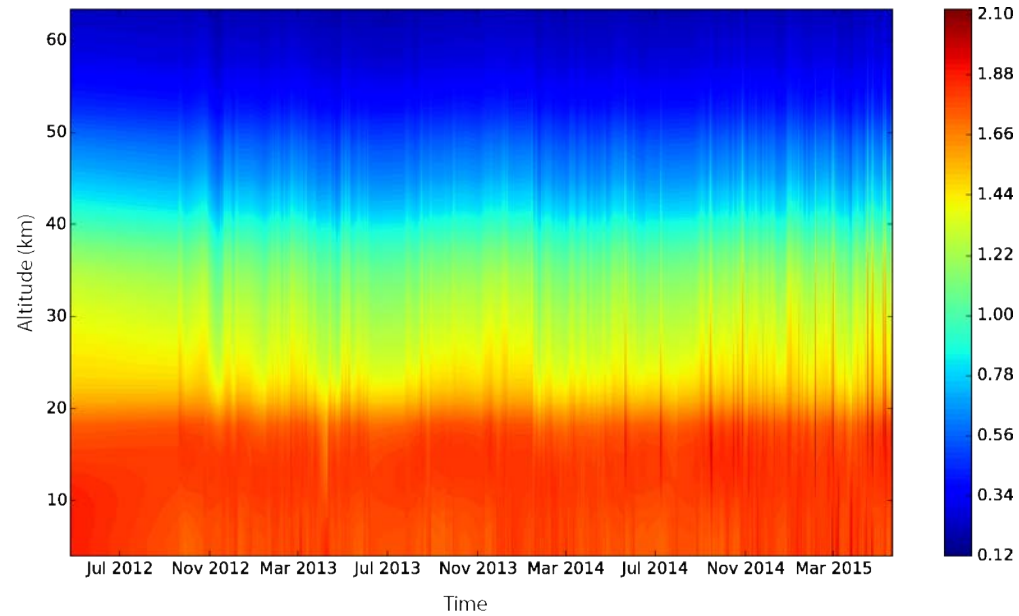
File name	130128_172635SF
Date	2013-01-28
Time	17:26:35
SZA	42.1729°
OPD (cm)	180
Interferences	H ₂ O, CO ₂ , OCS, C ₂ H ₆ , CCl ₂ F ₂ , NH ₃
Microwindows (cm ⁻¹)	867.05 – 870.00 872.25 – 874.00
A priori	WACCM 6
Total column (molec./cm ²)	5.74e+15
RMS	0.18 %
SNR	559
DOF	1.26



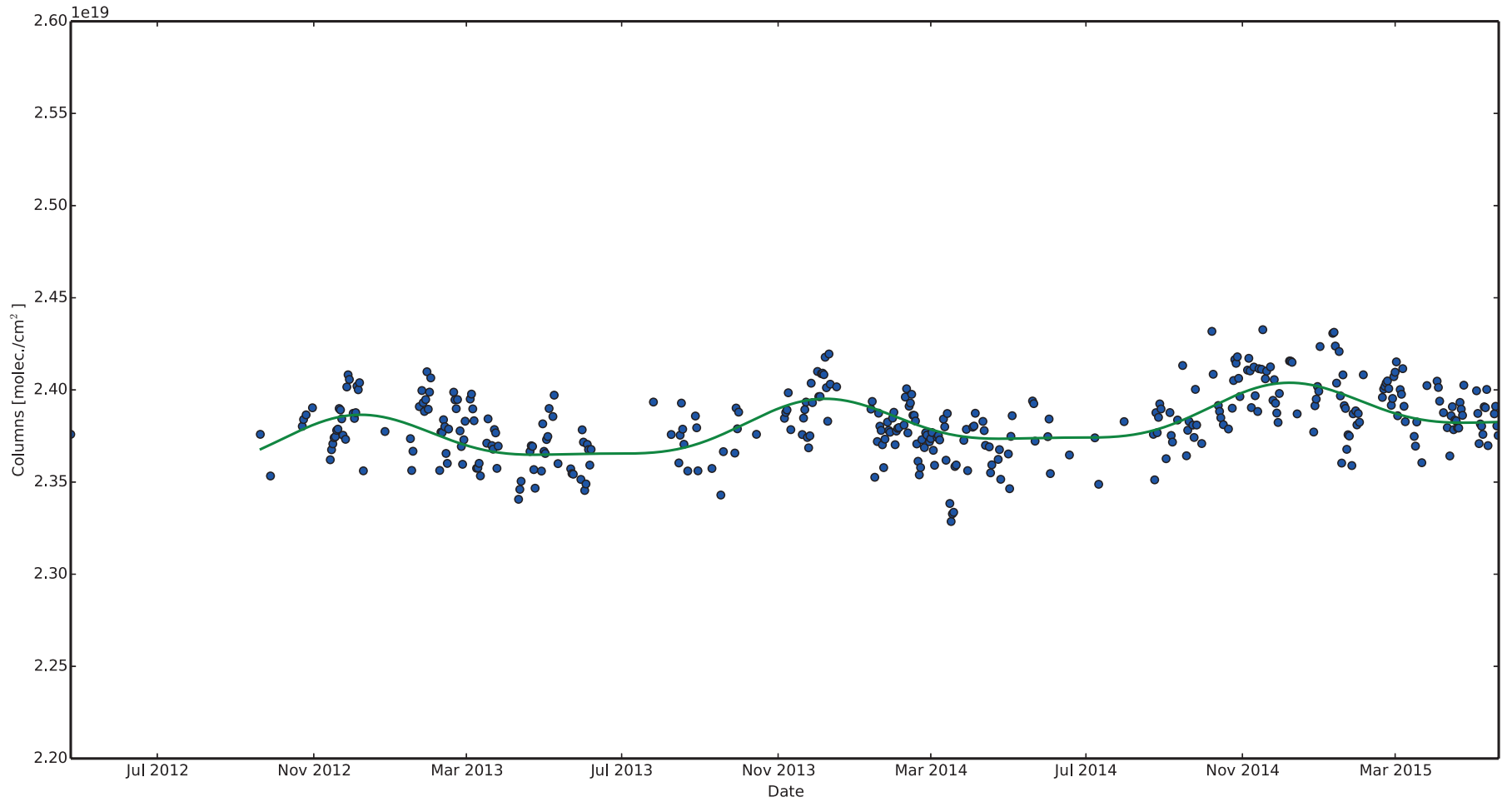
Methane



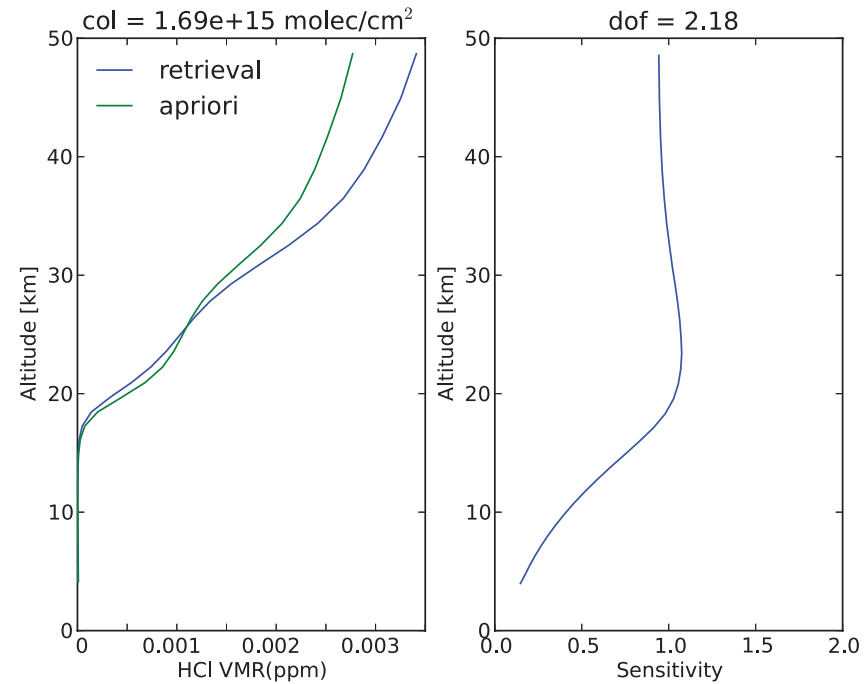
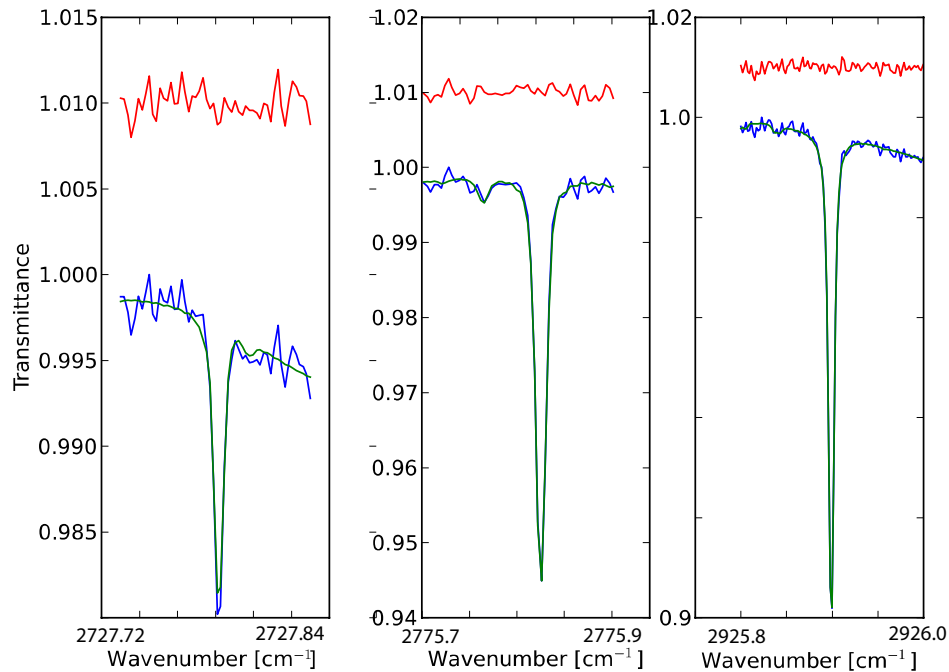
Date	2013-03-23
Time	11:52:38
SZA	20.92
OPD (cm)	180.0
Interferences	'H2O' 'H2O' 'CO2' 'NO2'
A priori	2.2848e+19
Total column (molec/cm2)	2.3782e+19
RMS	0.00153
DOF	2.368



CH₄ timeseries



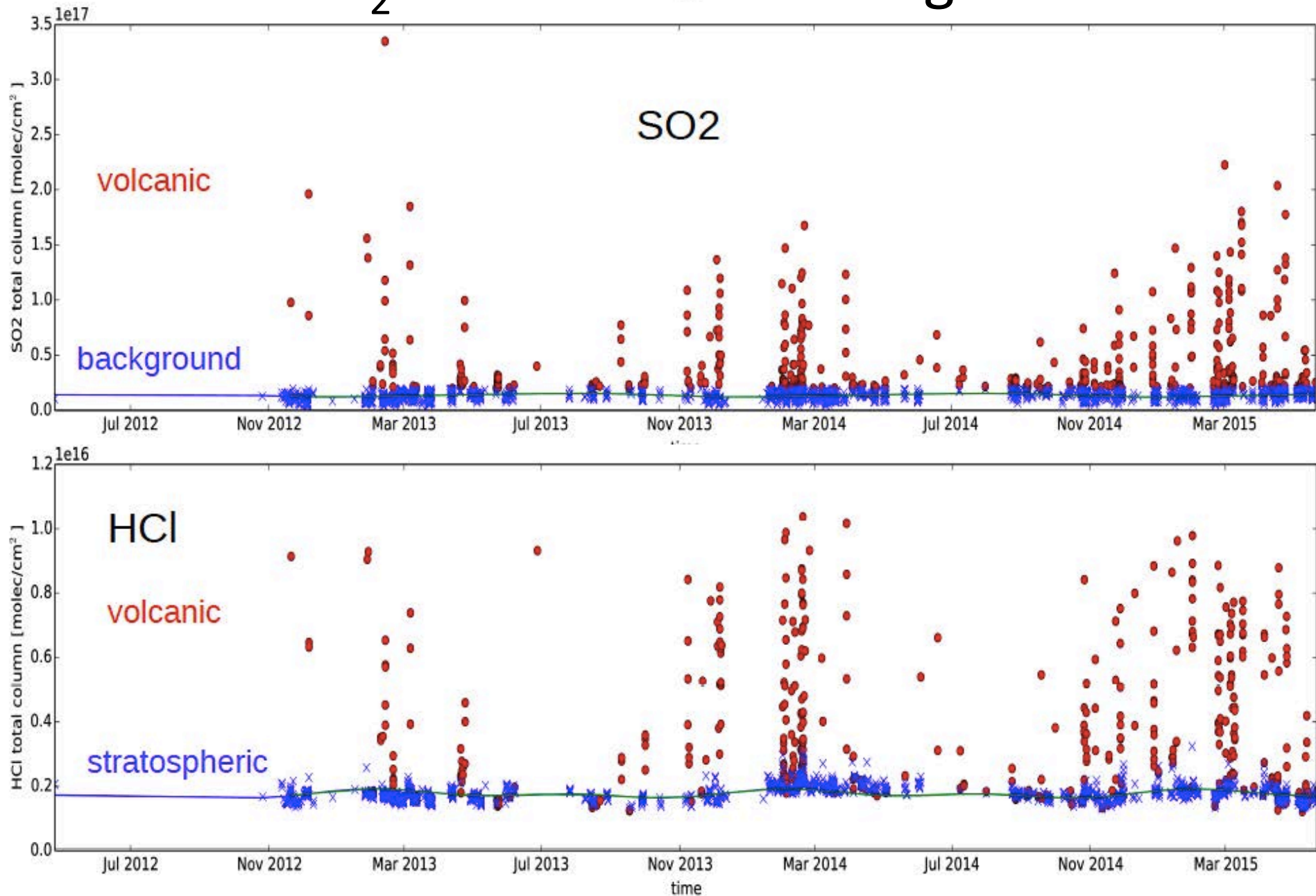
HCl



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

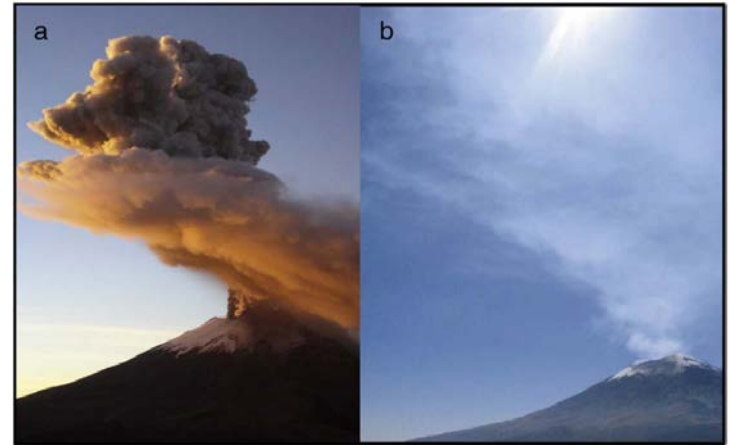
Influenced by the volcanic plume
(Wolfgang's talk)

SO₂ - tracer of volcanic gas

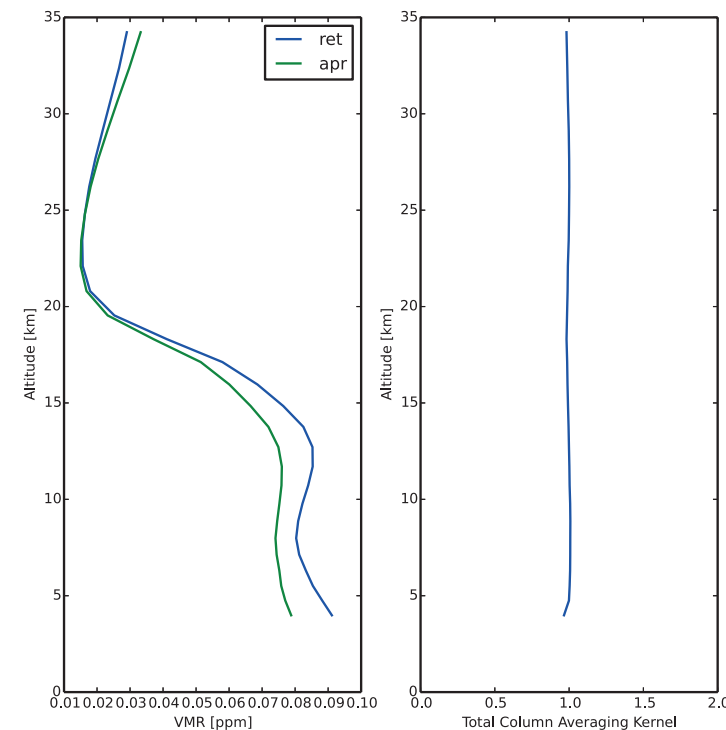
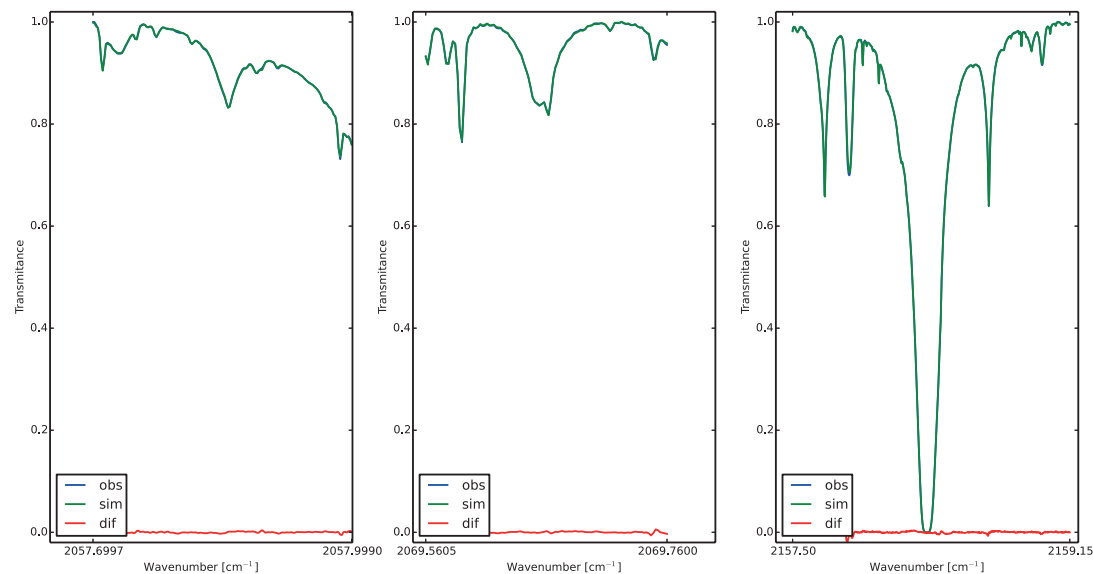


Importance of volcanic gas monitoring

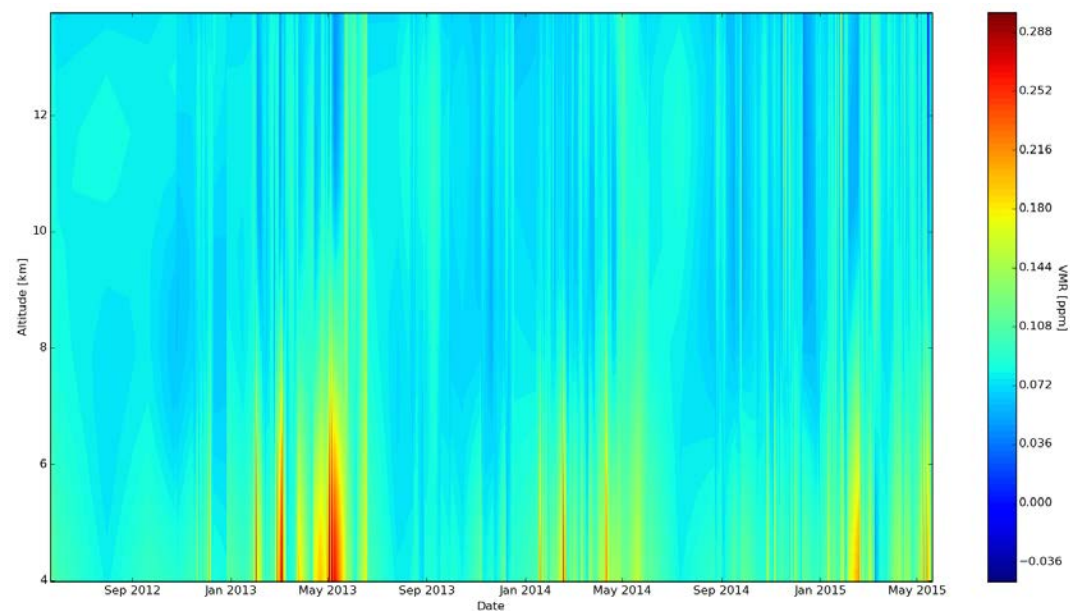
- Changes in gas ratios reflect a change in activity
- Quantify contributions into the atmosphere



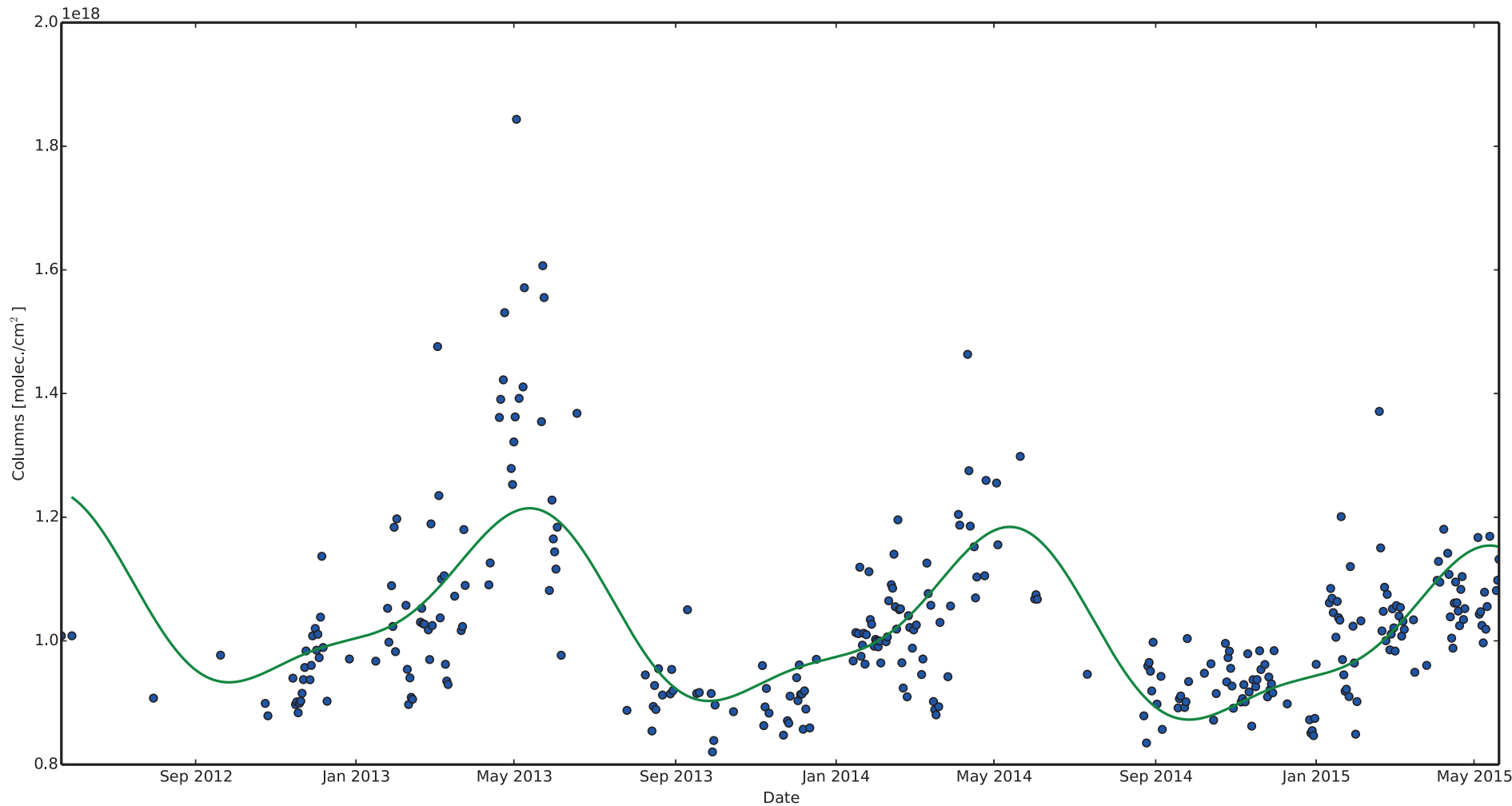
carbon monoxide



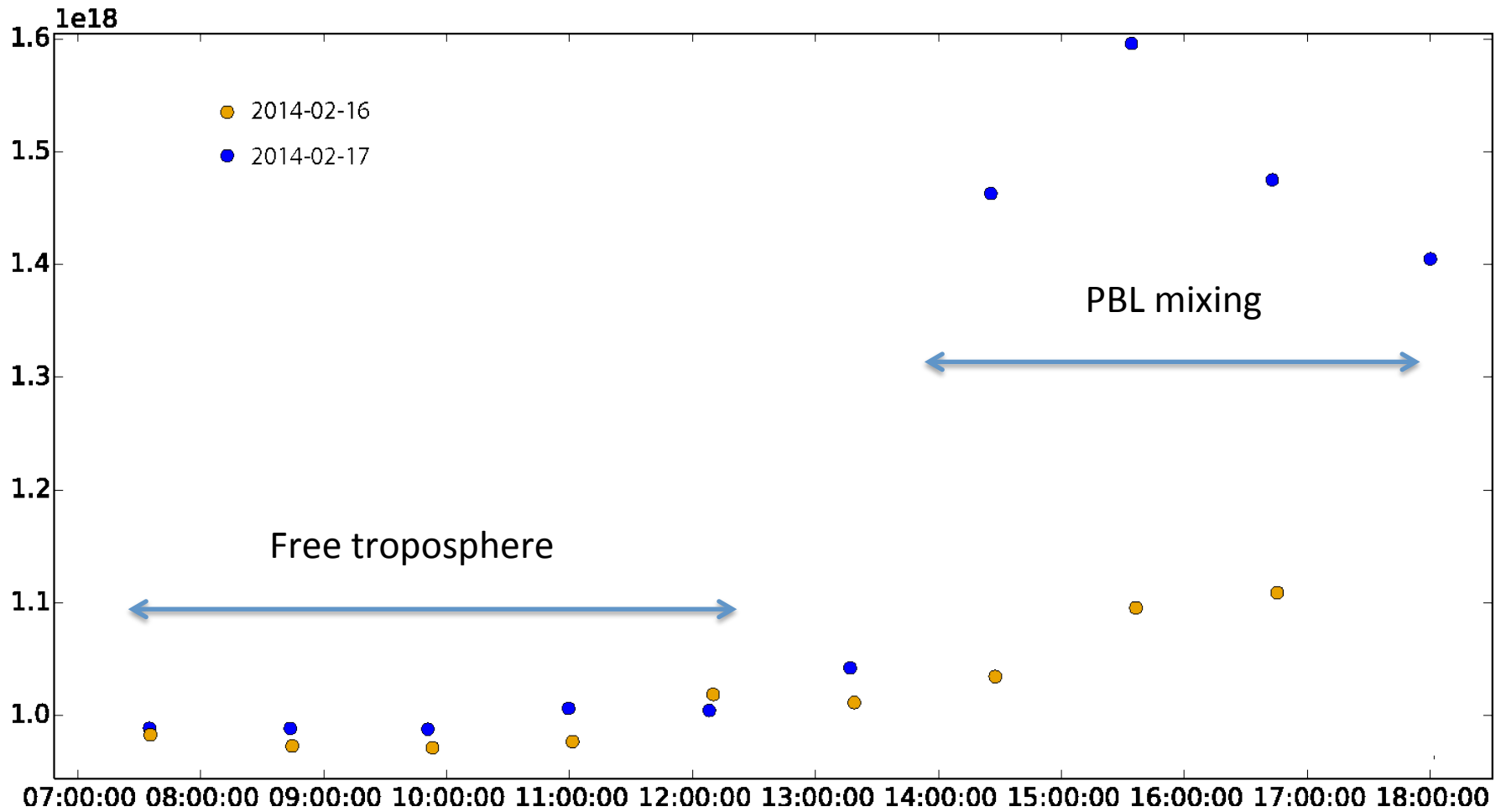
Date	2013-03-23
Time	09:06:50
SZA	54.5
OPD (cm)	180.0
Interferences	'H2O' 'CO2' 'O3' 'N2O' 'CO' 'OCS'
A priori	9.1982e+17
Total column (molec/cm2)	1.0195e+18
RMS	0.00206
DOF	3.9



CO - timeseries



CO - individual days



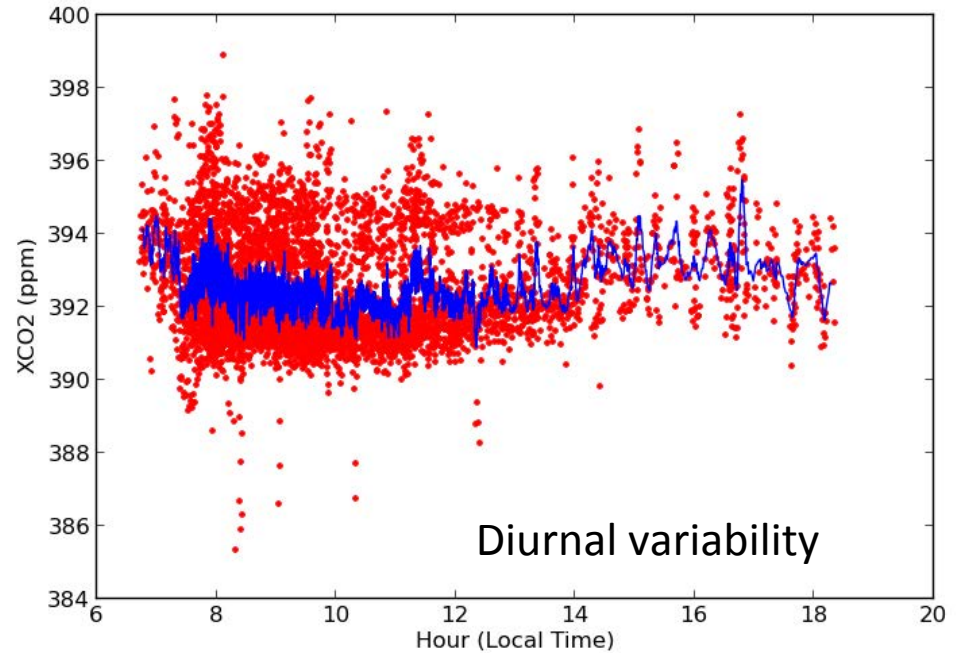
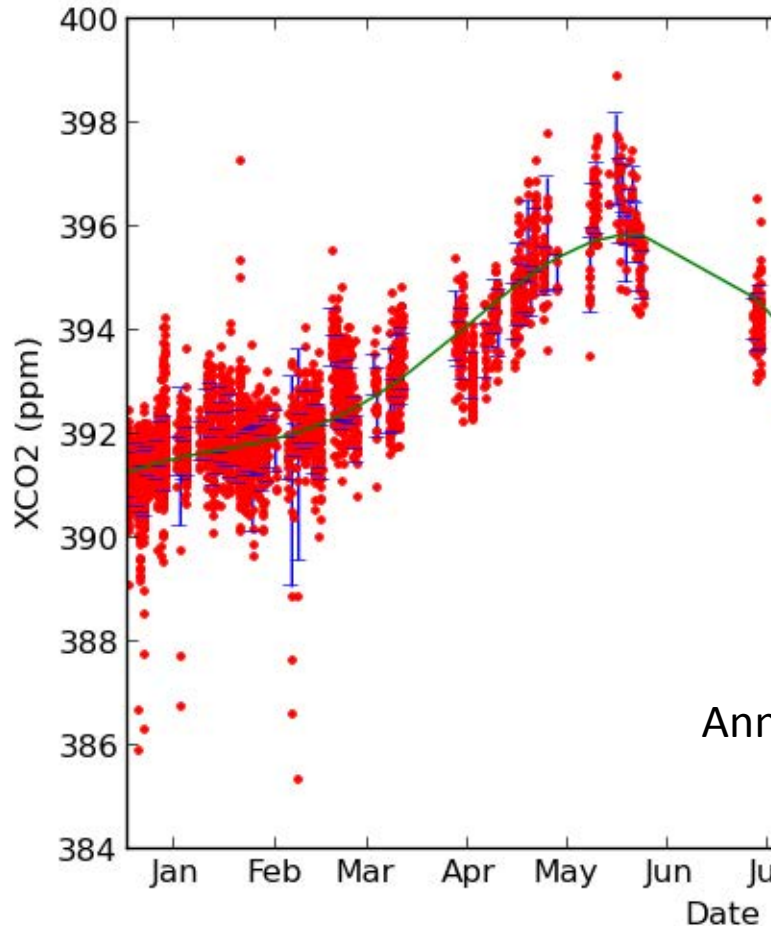
Measurement statistics

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 %



XCO₂ during 2013

see Jorge Baylon's poster



— 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
 - SO₂ is a good proxy

Gracias!