Mexican activities with regard to TEMPO

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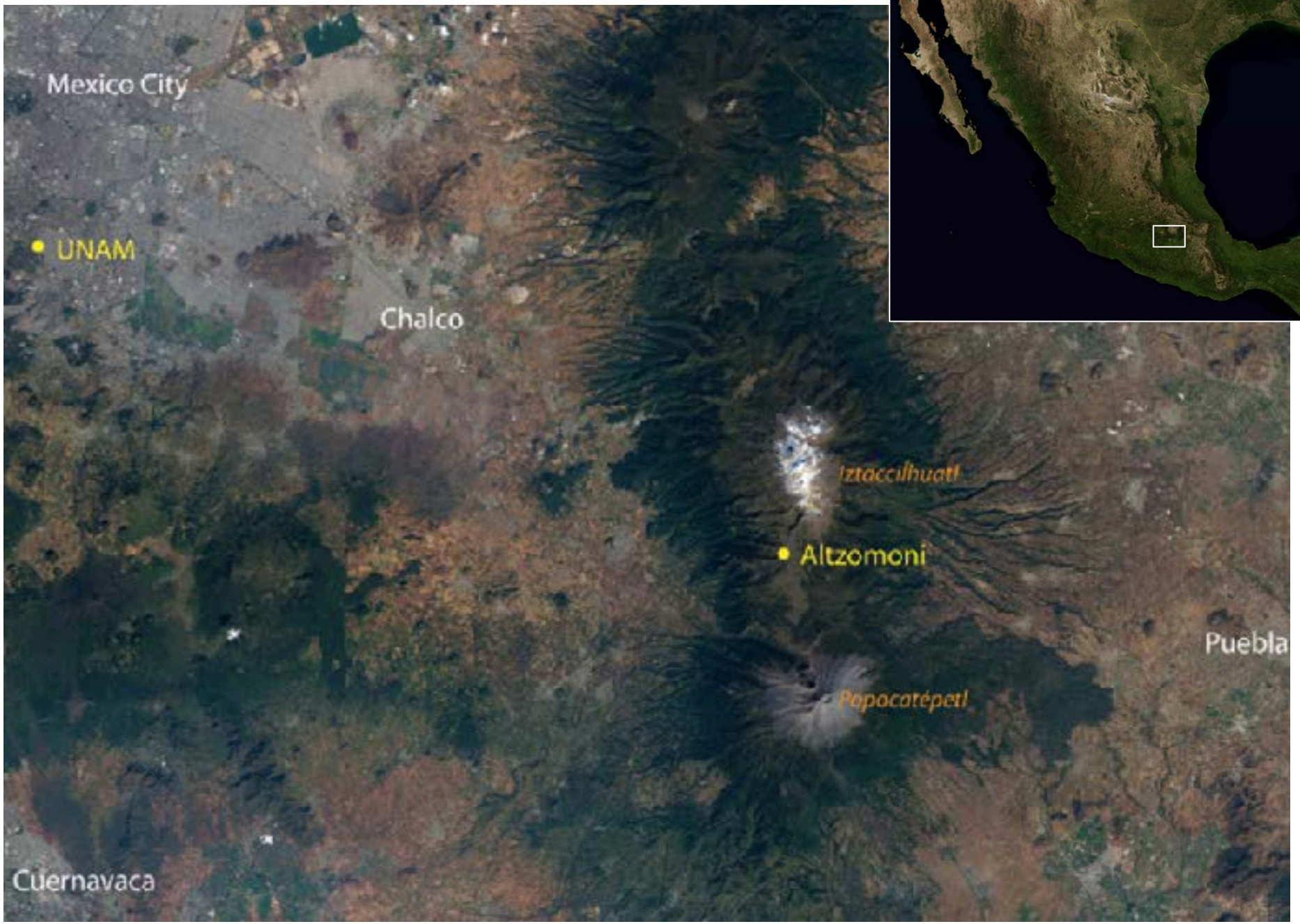
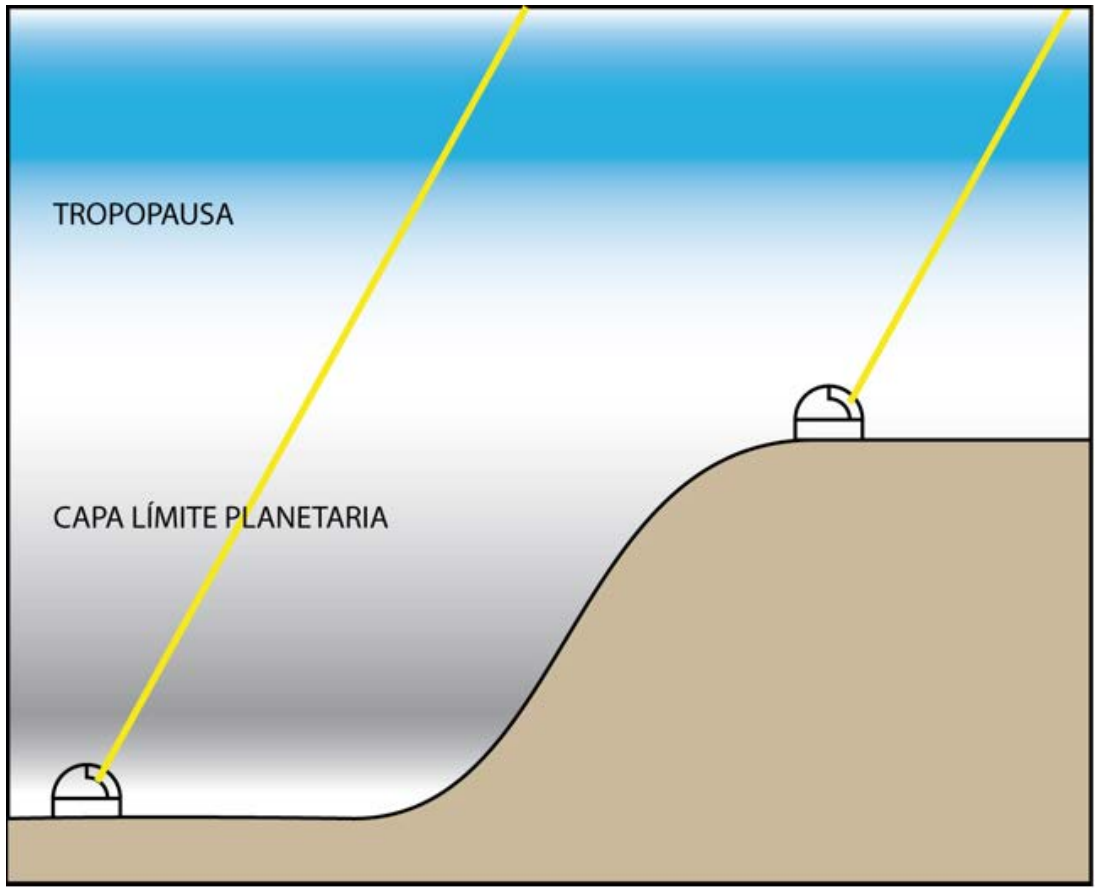
Second Tempo Science Team Meeting
May 21-22, 2014
Hampton, Virginia


Mexico City
UNAM
Chalco
Iztaccíhuatl
Altzomoni
Puebla
Popocatépetl
Cuernavaca

two main ground stations



4,000 m a.s.l.

ALTZOMONI

2,240 m a.s.l

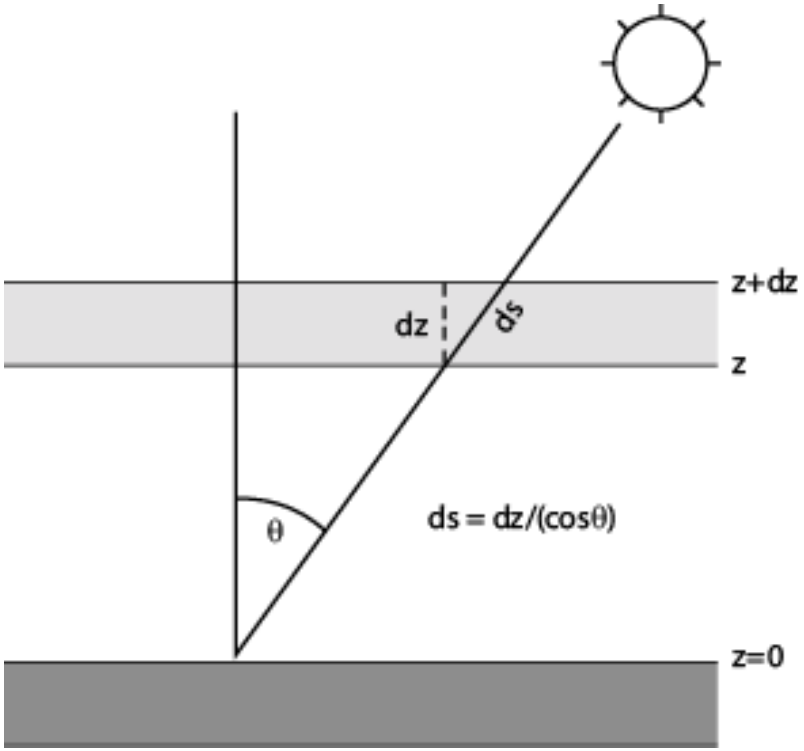
UNAM

experiments

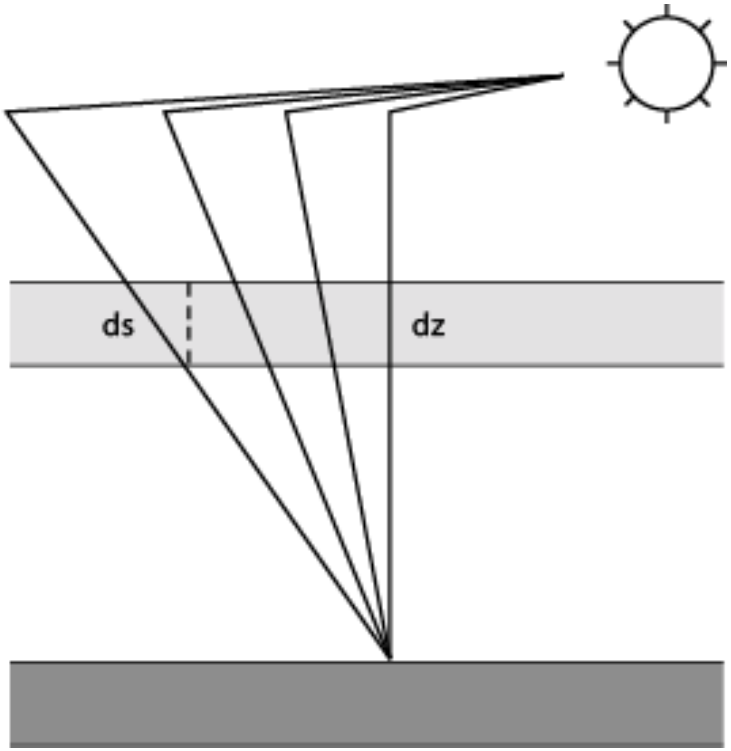
FTIR for Solar Absorption Infrared Spectroscopy

MAX-DOAS for Multi-Axis Differential Optical Absortion Spectroscopy

SAIRS



DOAS

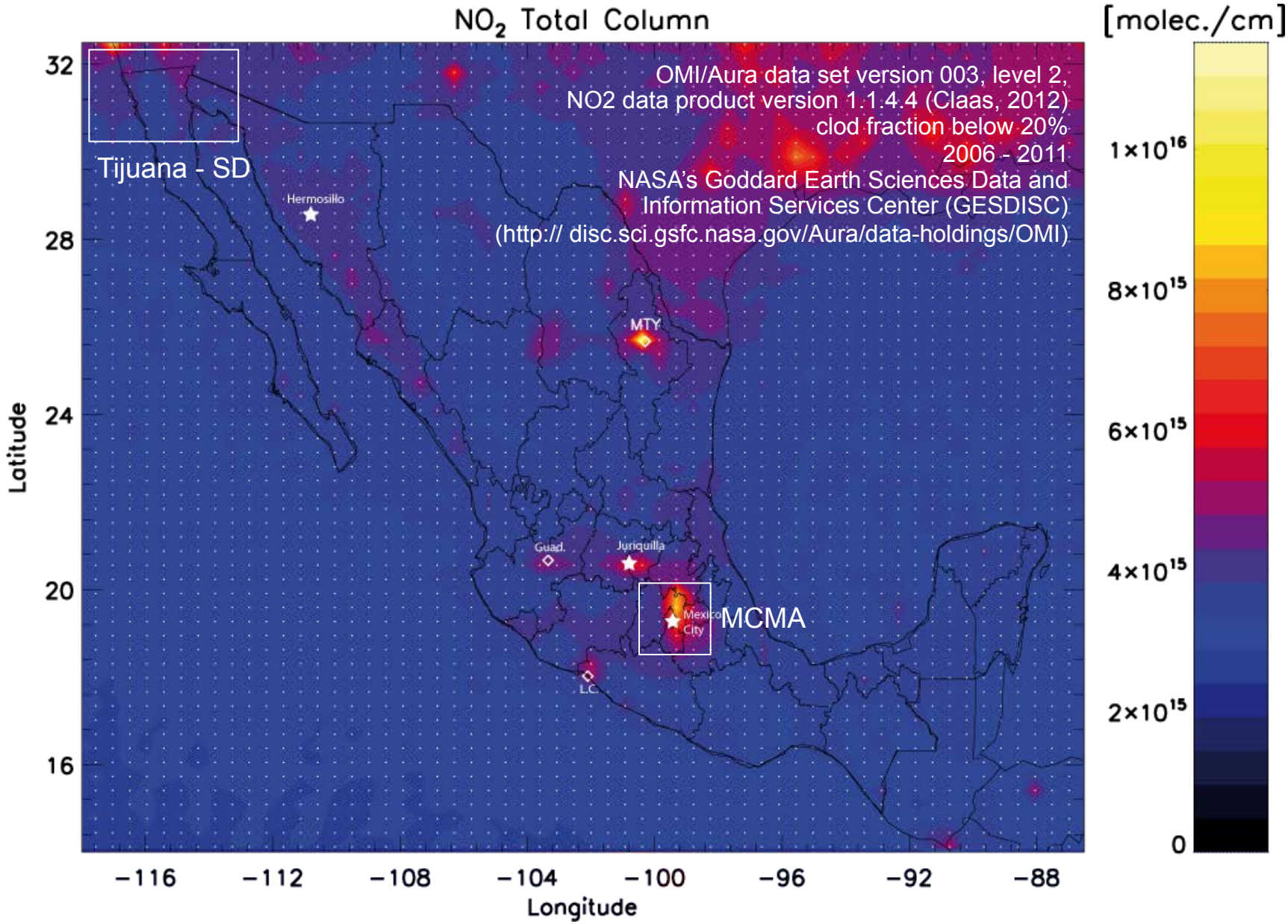


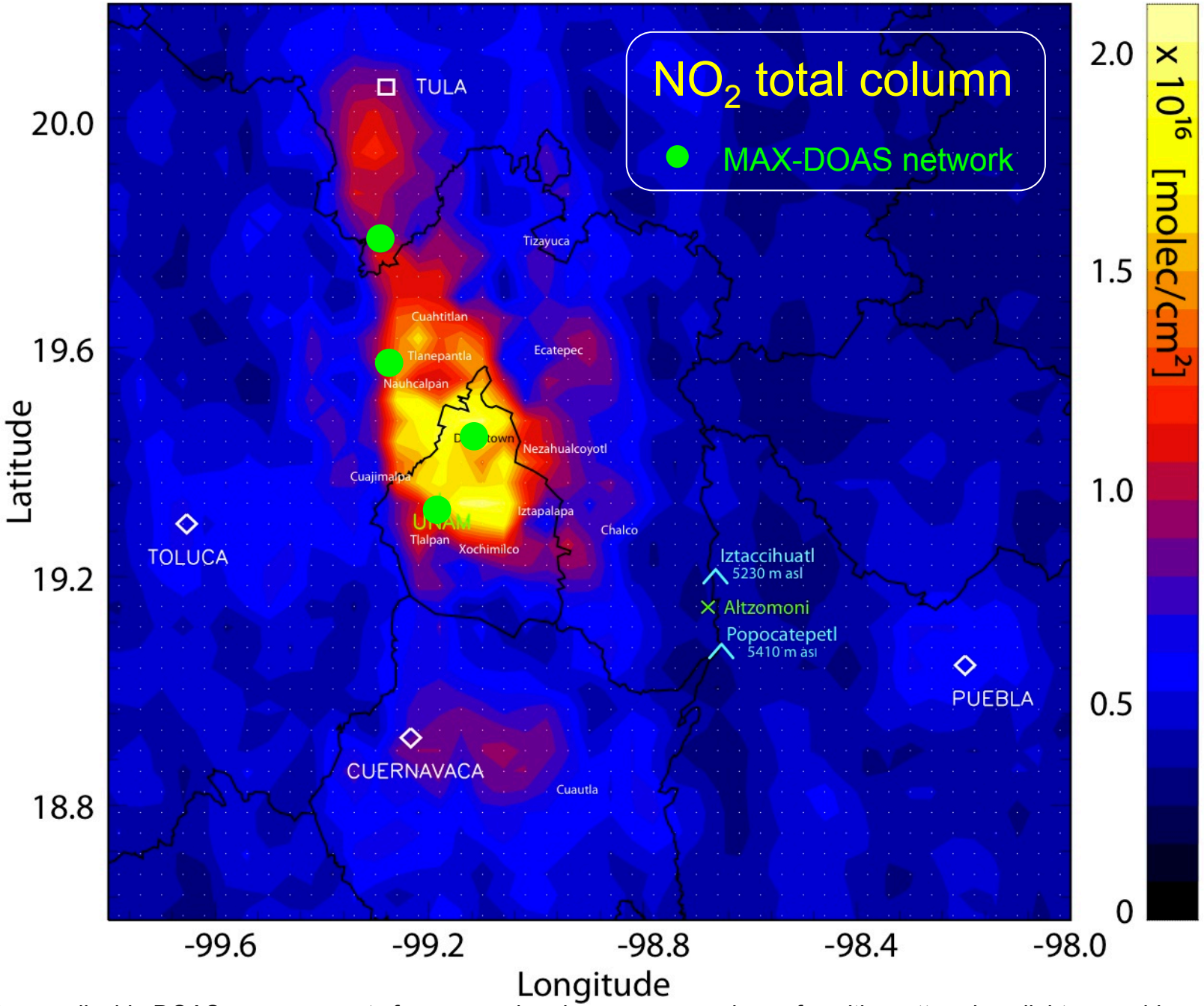
MAX-DOAS instrument

- Made at UNAM (6 instruments built, 4 installed)
- 280 – 450 nm spectrometer (Res=0.6 nm, Ocean Optics USB2000+)
- ± 0.1 ºC temperature controlled (Peltier element + ventilation)
- Scanning unit with stepper motor (-90 to 90 º elev. angle)
- 2” concave lens (f=10 cm) telescope
- Linux based program for system control & data aqcuisition

MAX-DOAS sites

OMI (NASA-Aura)



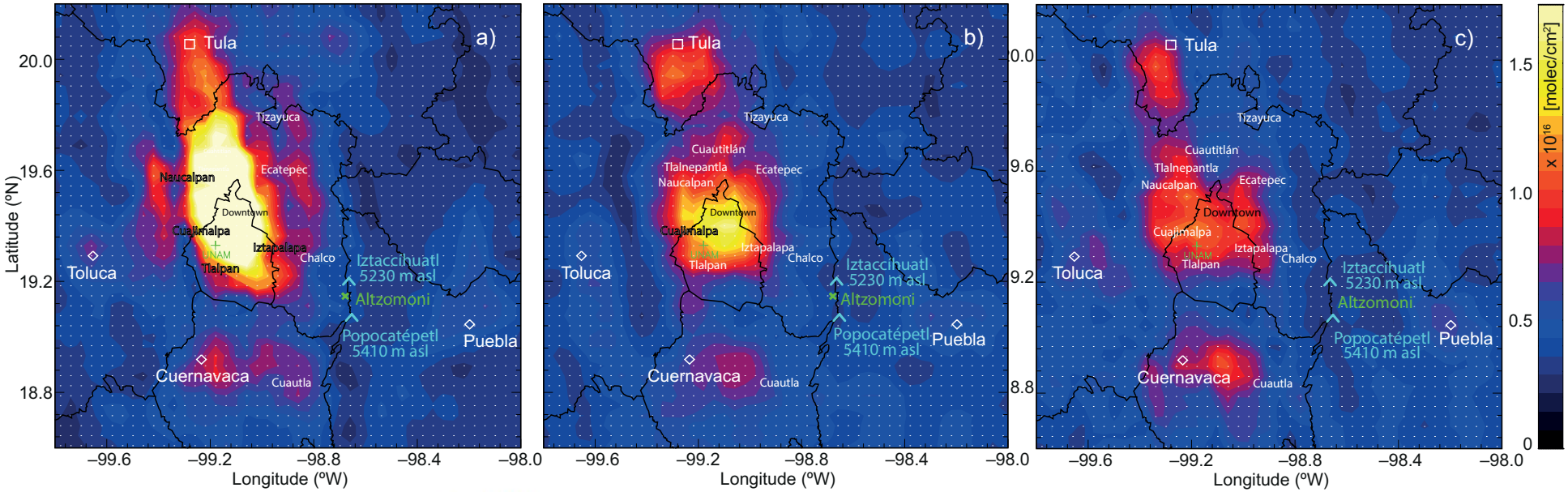


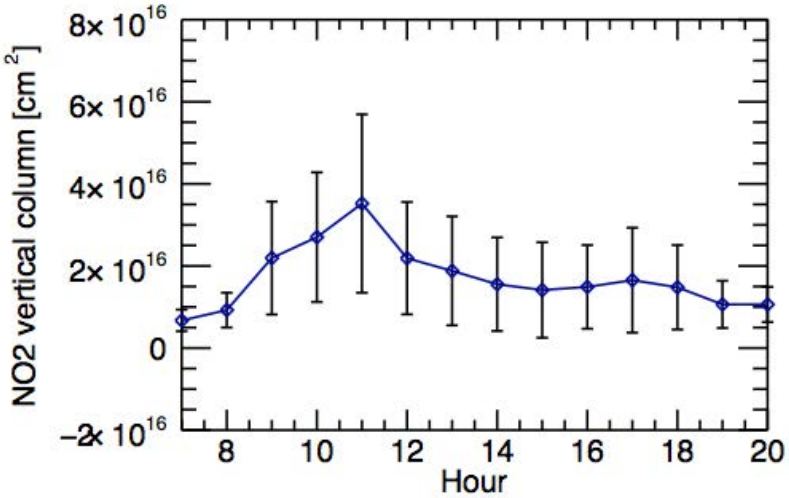
Nitrogen dioxide DOAS measurements from ground and space: comparison of zenith scattered sunlight ground-based measurements and OMI data in Central Mexico. C. Rivera, W. Stremme and M. Grutter. *Atmosfera*, **26**(3). 2013.

NDJF
dry and cold

MAM
dry and hot

JJASO
wet





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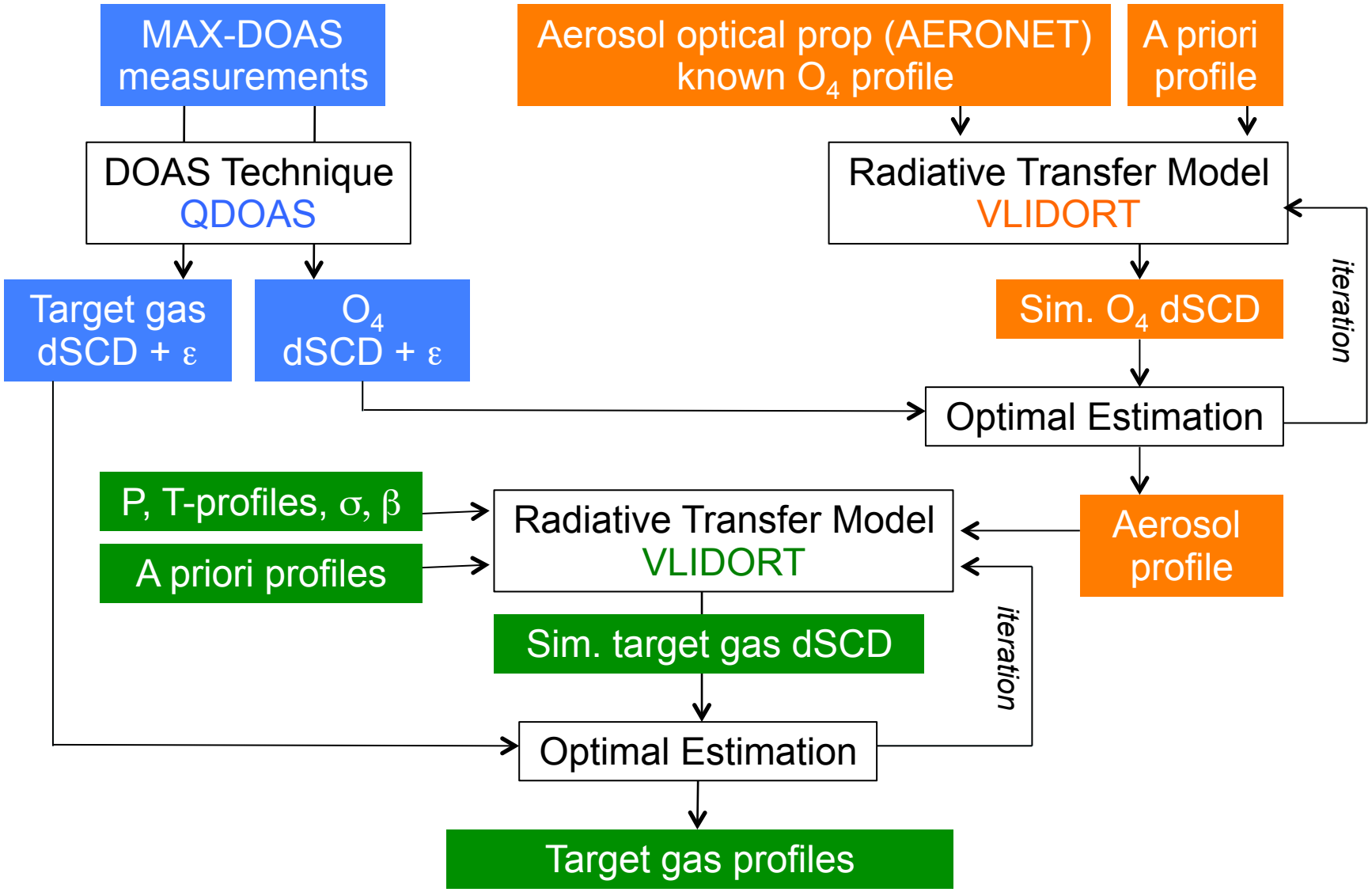
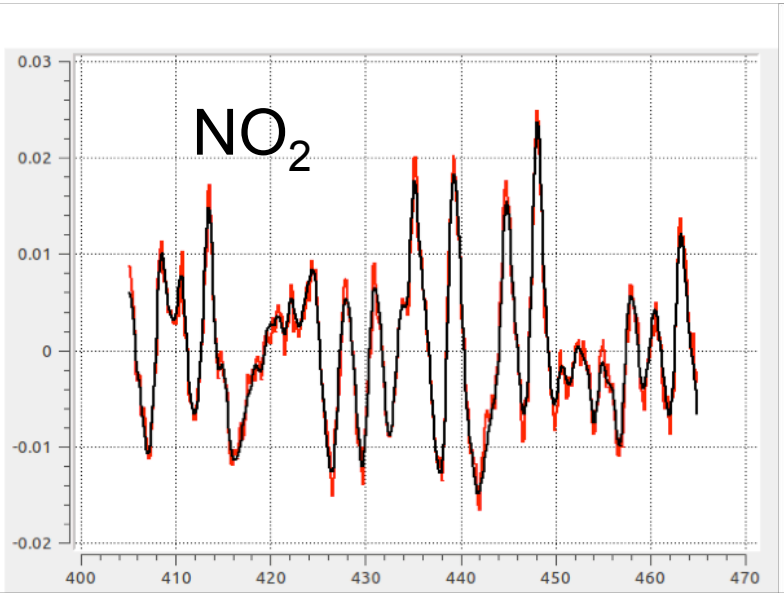
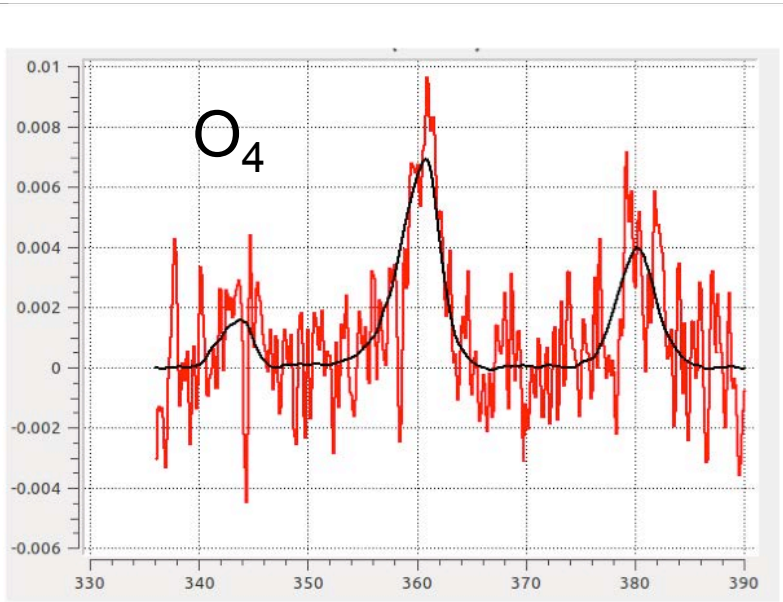
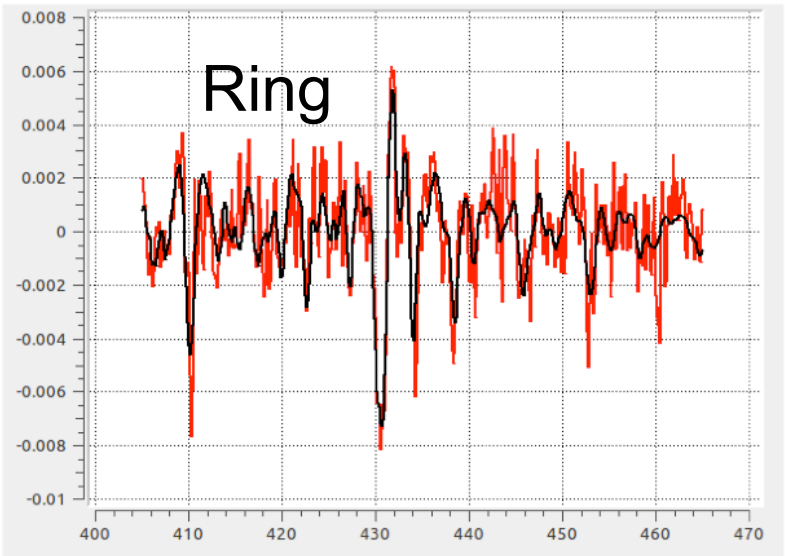
MAX-DOAS retrievals



NO_2 spectral fit





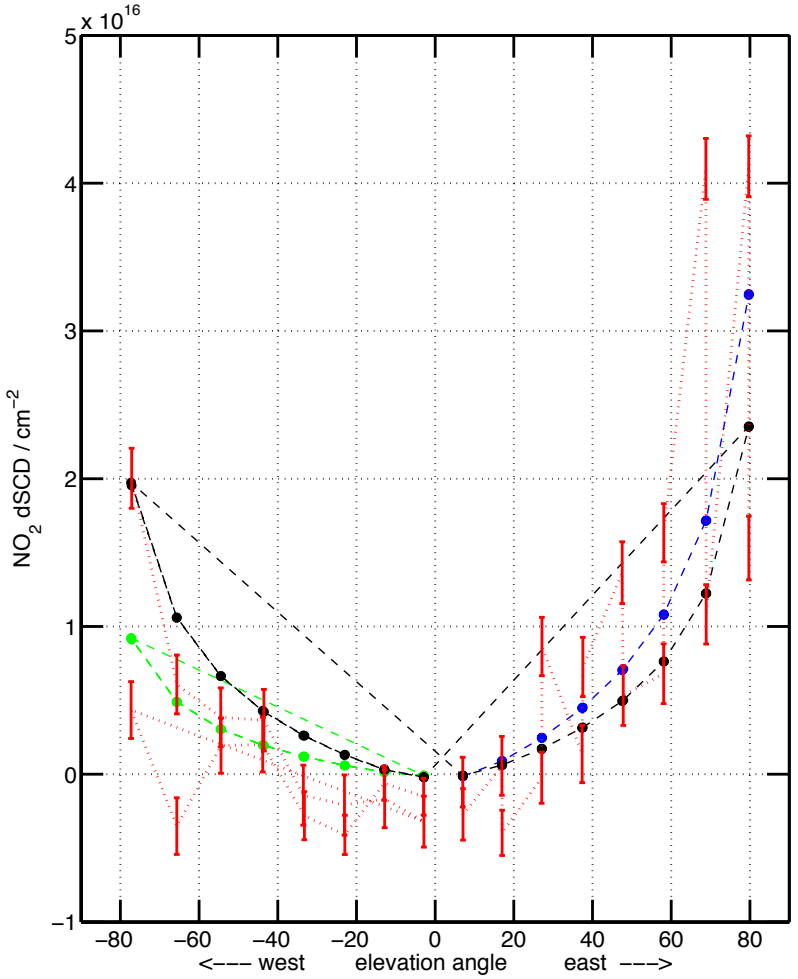


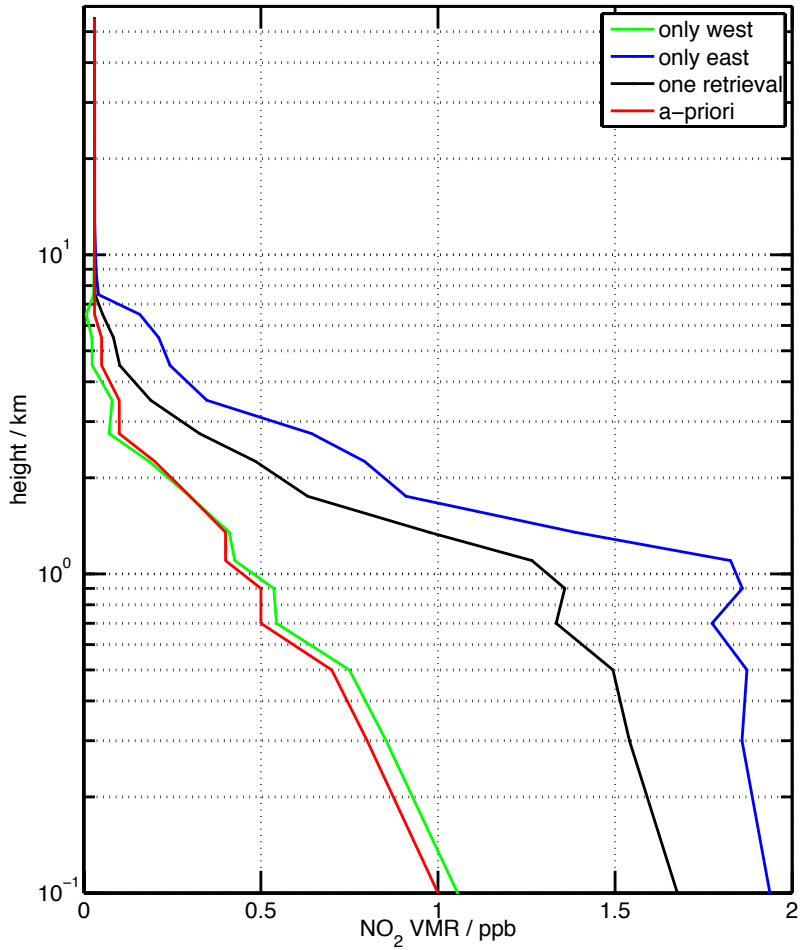
Window	405 – 465 nm
NO2 @ 294K	Vandaele et al., 1998
O3 @221, 241K	Burrows et al., 1999
O4	Hermans et al., 1999
Ring spectrum	273K

Preliminary NO_2 retrieval

AOD : 0.05
DOFs: 1.0

$VCD_{NO2} = 0.5 \times 10^{16}$ molec/cm^2

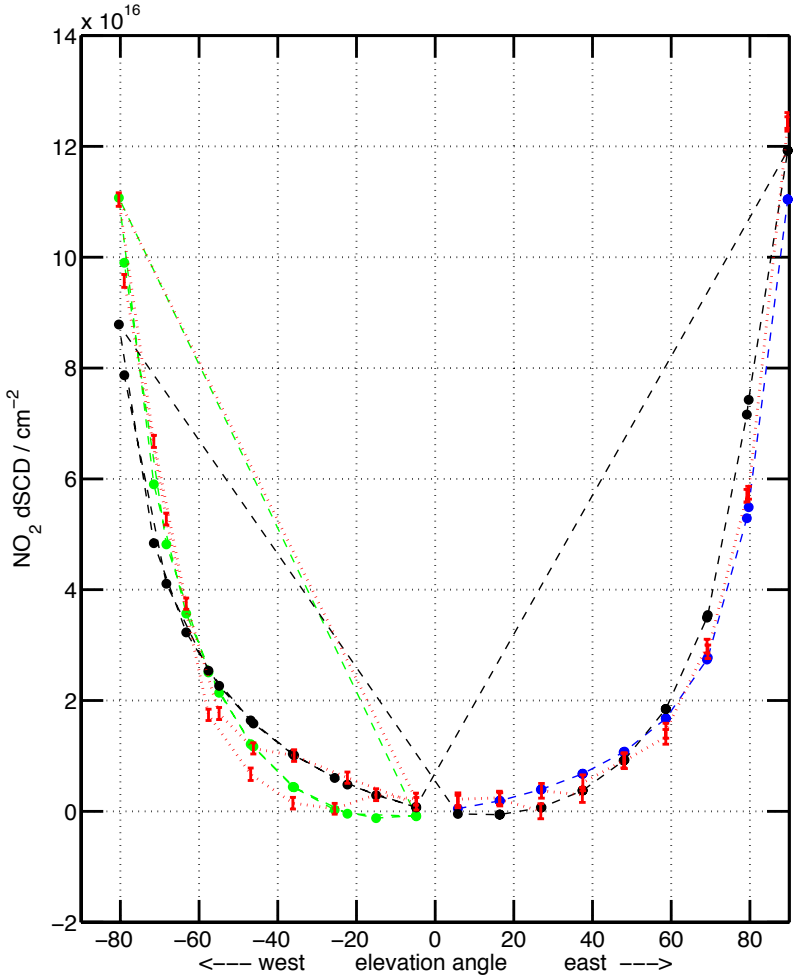


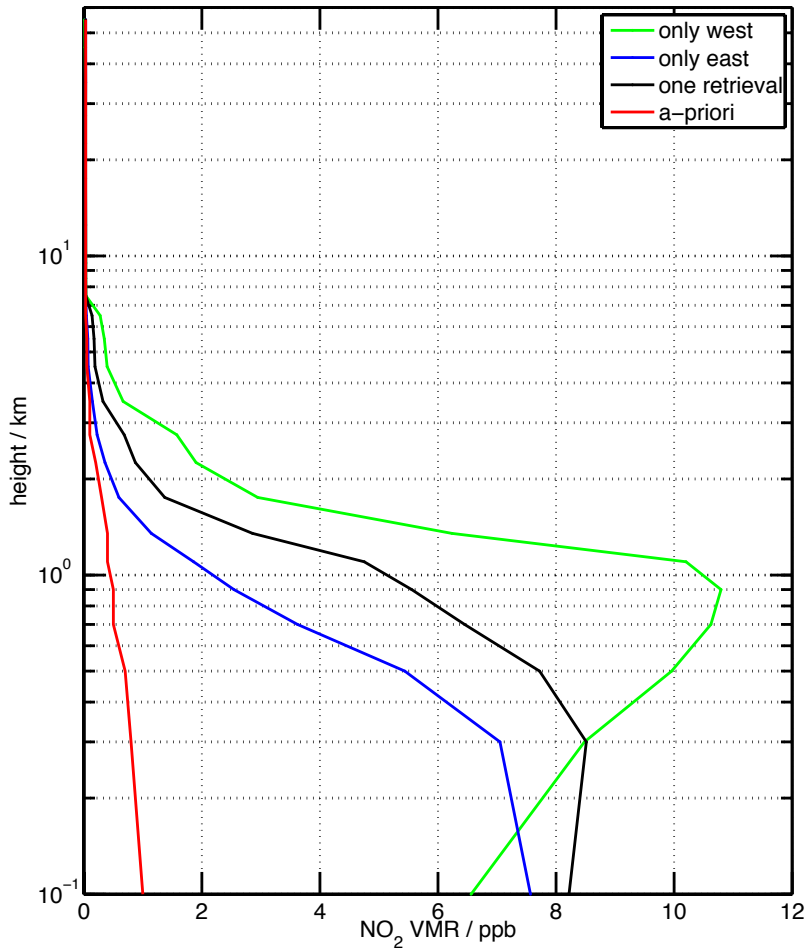


Preliminary NO_2 retrieval

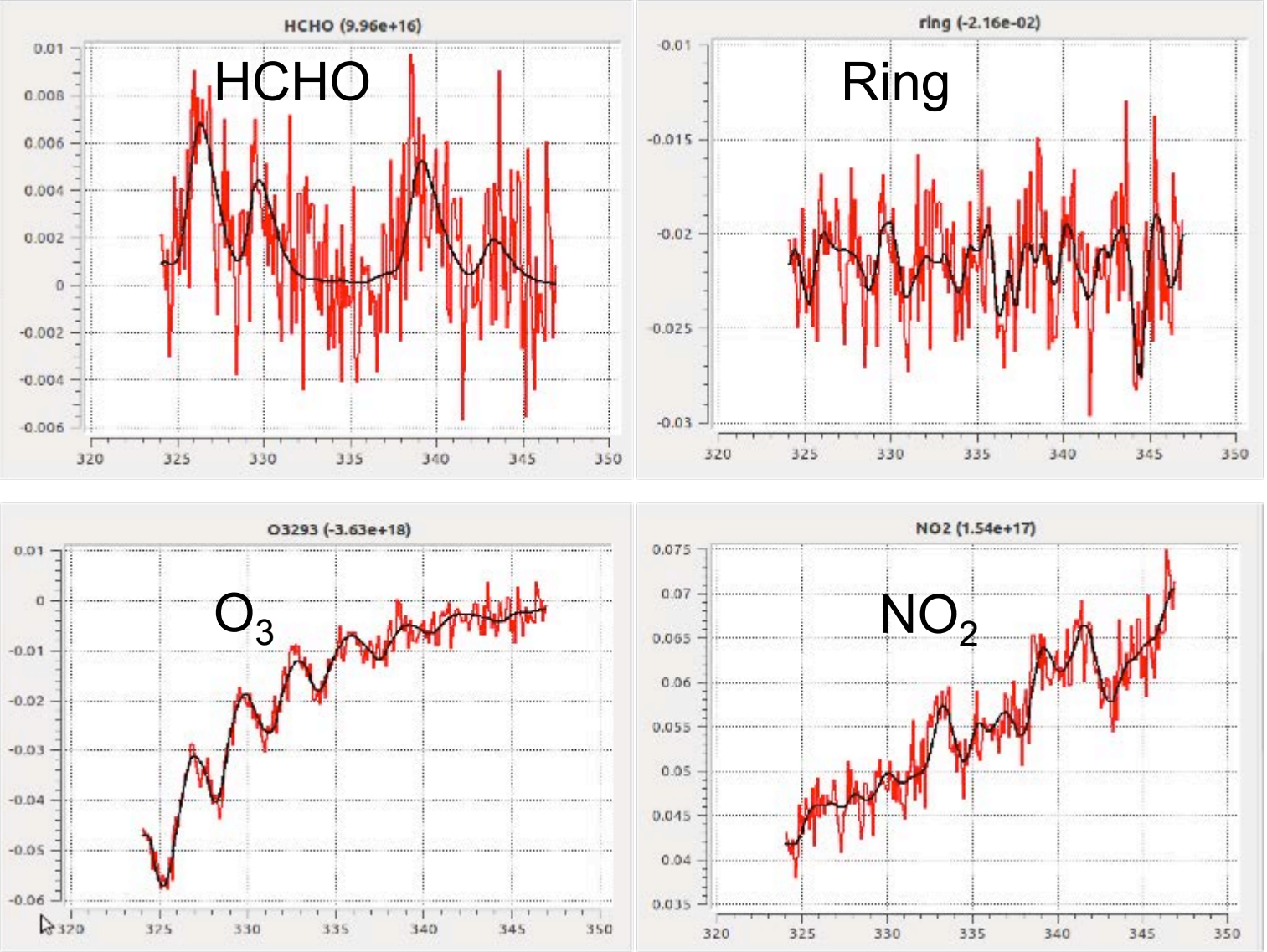
AOD : 0.12
DOFs: 1.8

$VCD_{NO2} = 2.0 \times 10^{16}$ molec/cm^2

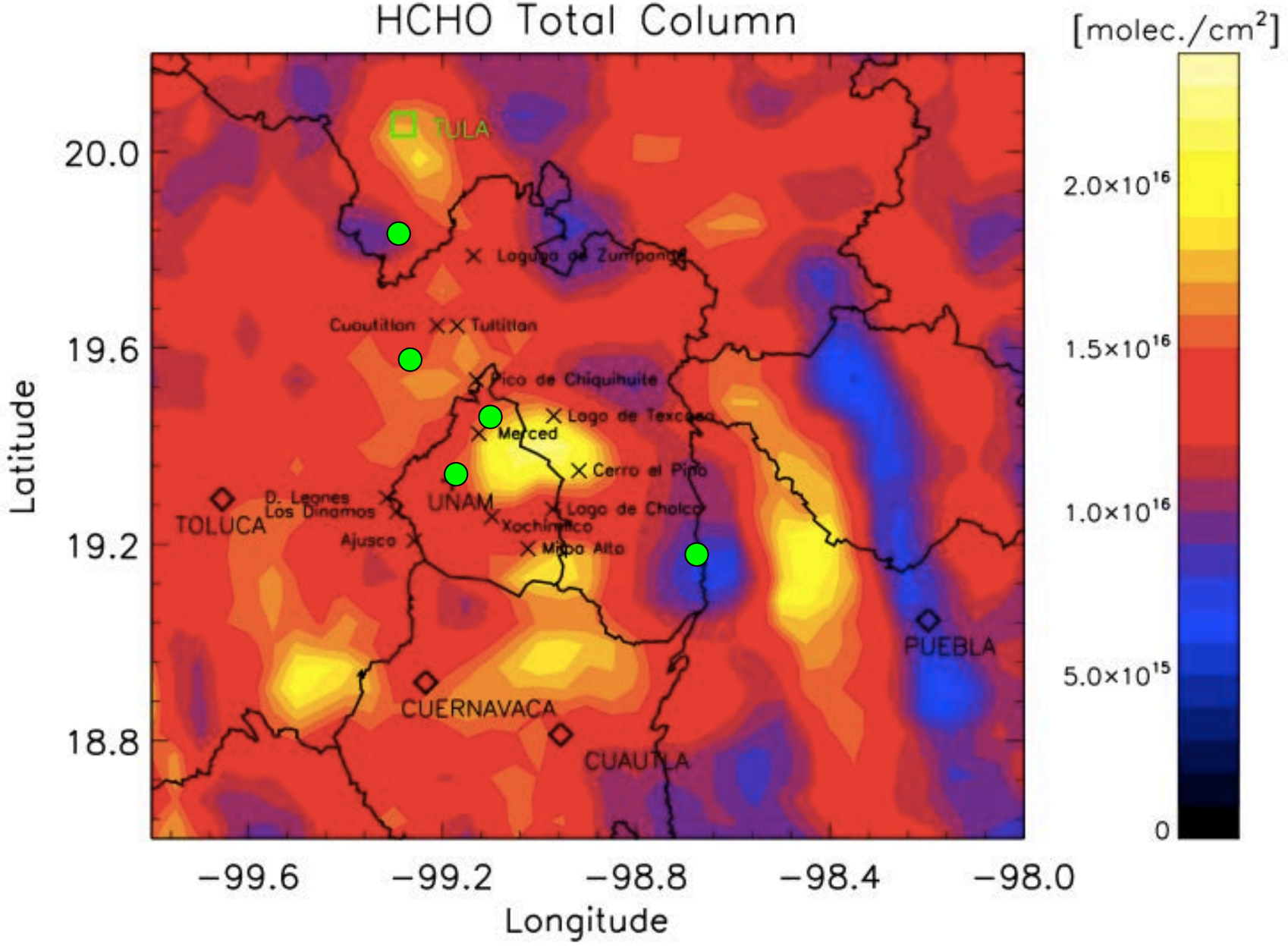




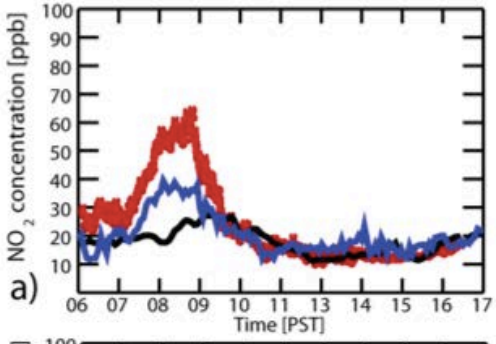
HCHO spectral fit

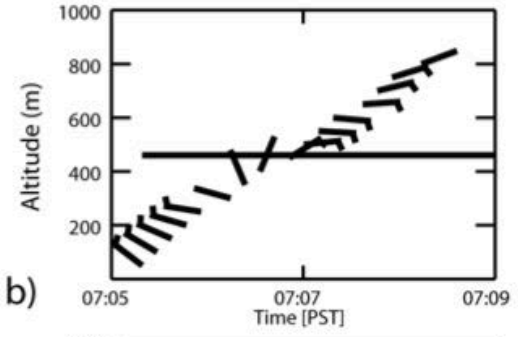


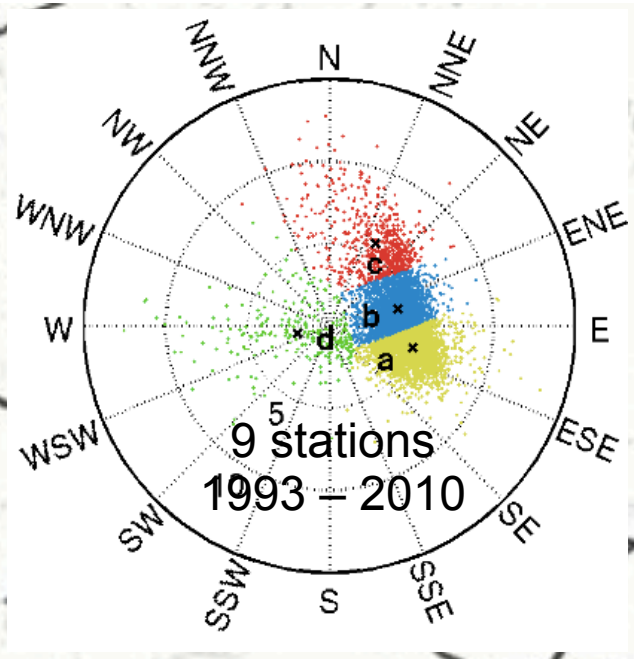
OMI (NASA-Aura)



Tijuana – San Diego Area

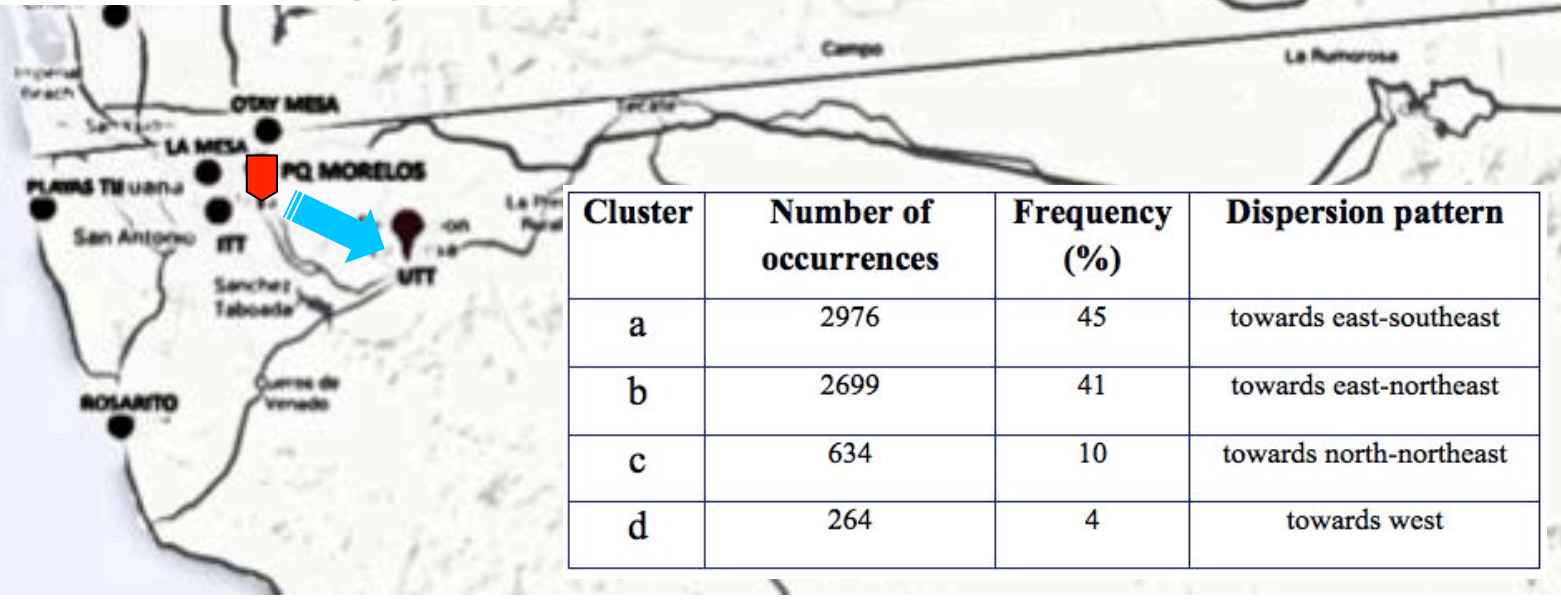






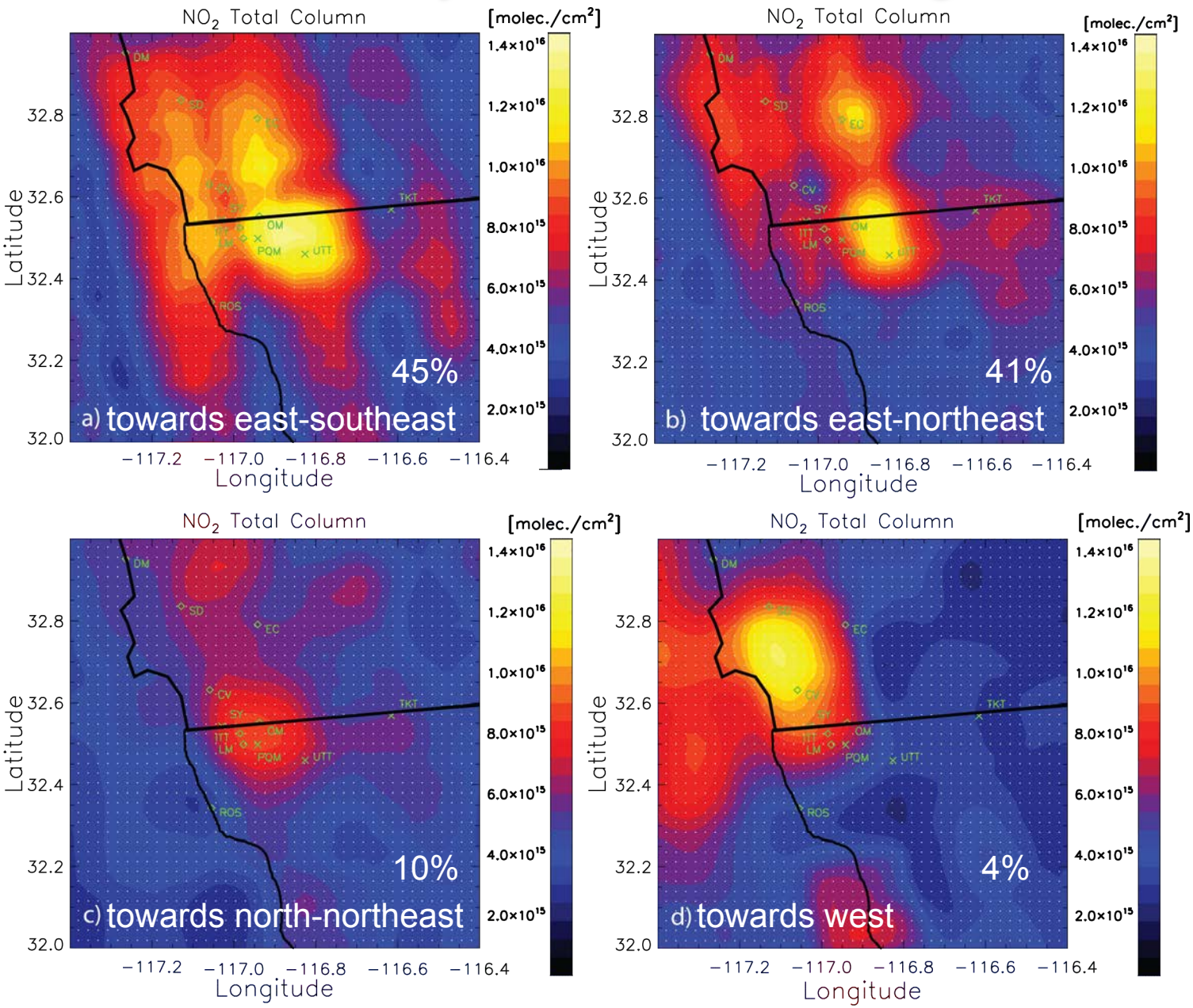
Cal-Nex / Cal-Mex
May-June 2010

- PQM DOAS
- PQM in situ
- UTT



Cluster	Number of occurrences	Frequency (%)	Dispersion pattern
a	2976	45	towards east-southeast
b	2699	41	towards east-northeast
c	634	10	towards north-northeast
d	264	4	towards west

Tijuana – San Diego Area



OMNO2 Level 2
2006 – 2011

Cloud fraction < 20%

High Altitude site "Altzomoni"

3,985 m a.s.l.

Remote Sensing

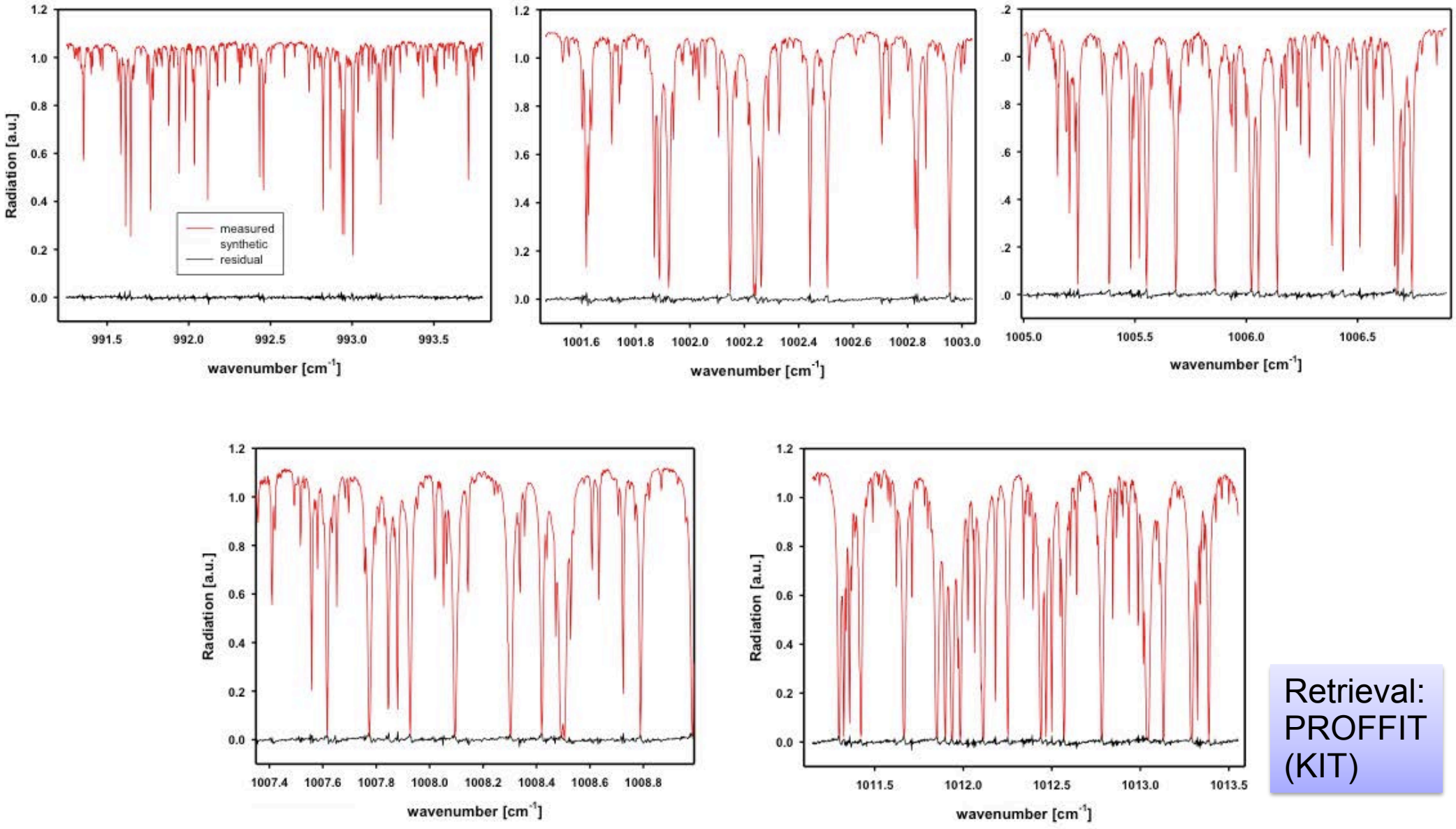
- Solar absorption FTIR (HR120/5)
- MAX-DOAS (NO_2, SO_2, HCHO, ...)
- DS-DOAS, 2D-DOAS
- Thermal emission FTIR (2D)
- Ceilometer (commercial LIDAR)
- GPS (precipitable water column)

In Situ

- Meteorology (WS, WD, T, P, RH, Rain)
- Reactive Gases (O_3, CO, NOx, SO_2)
- GHG* (CO_2, CH_4, H_2O)
- PM, Black Carbon*
- Wet/Dry deposition (Chem/Isotope)

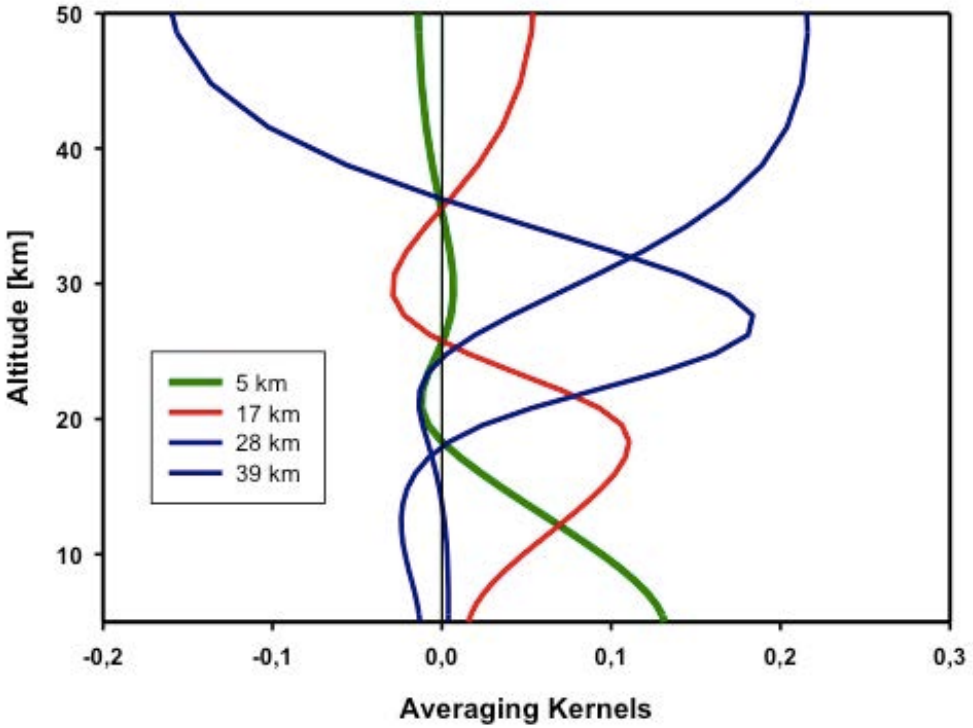
** not yet installed*

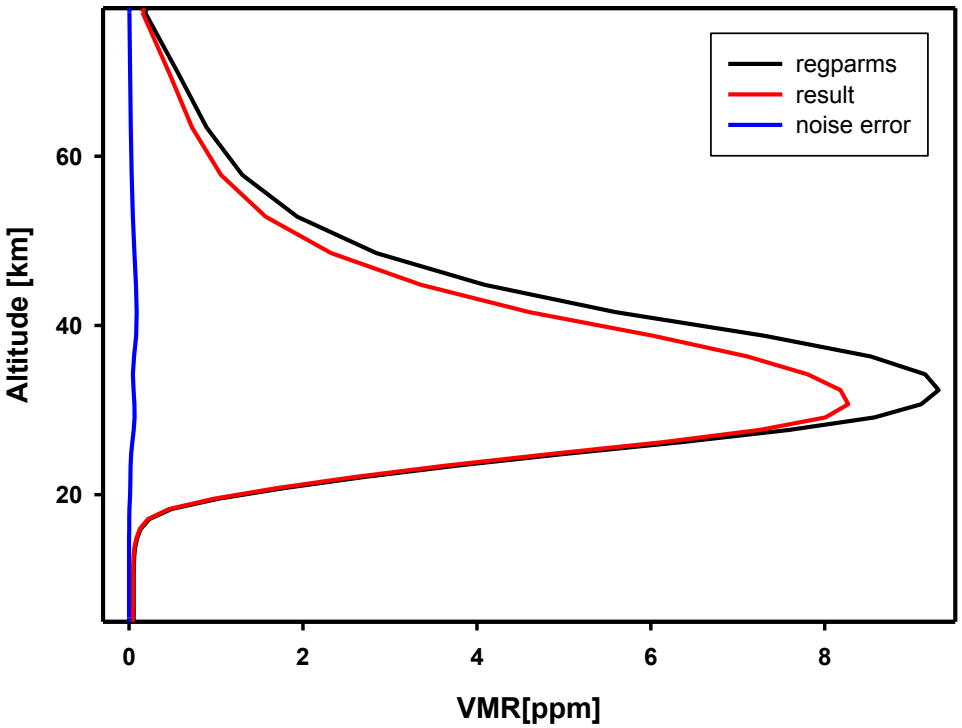
O_3 (Altzomoni)



Retrieval: PROFFIT (KIT)

O_3 (Altzomoni)





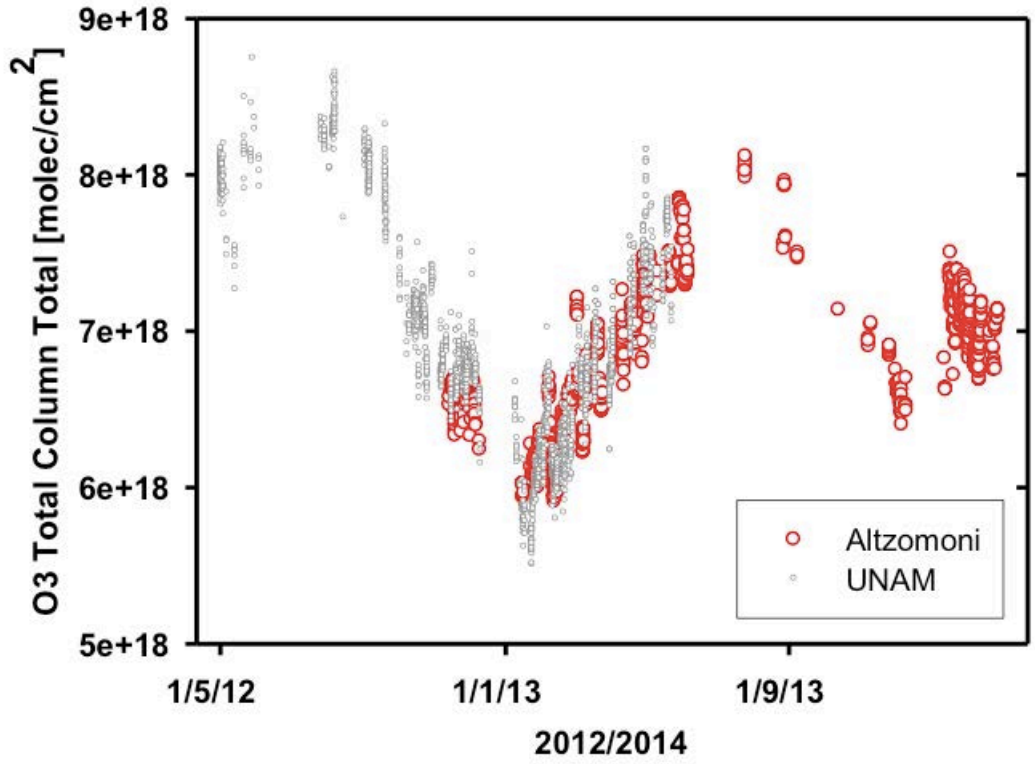
3.7 DOFs in the retrieval justifies the separation of two partial columns

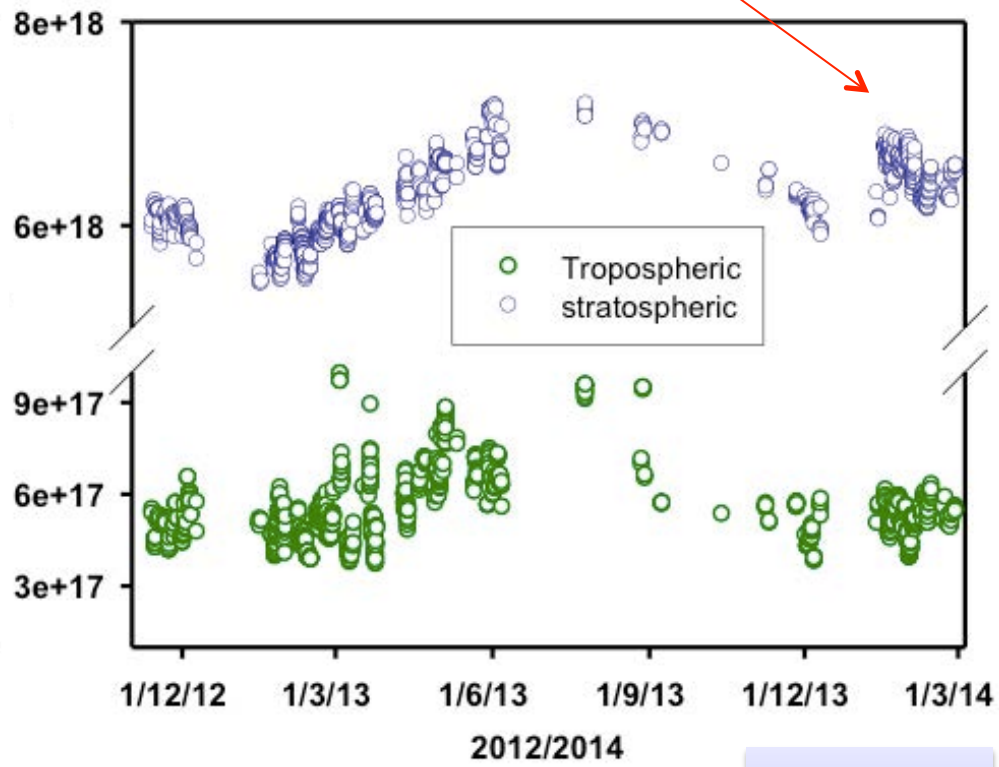
Retrieval: PROFFIT (KIT)

O_3 TC annual cycle

Strat vs Trop.

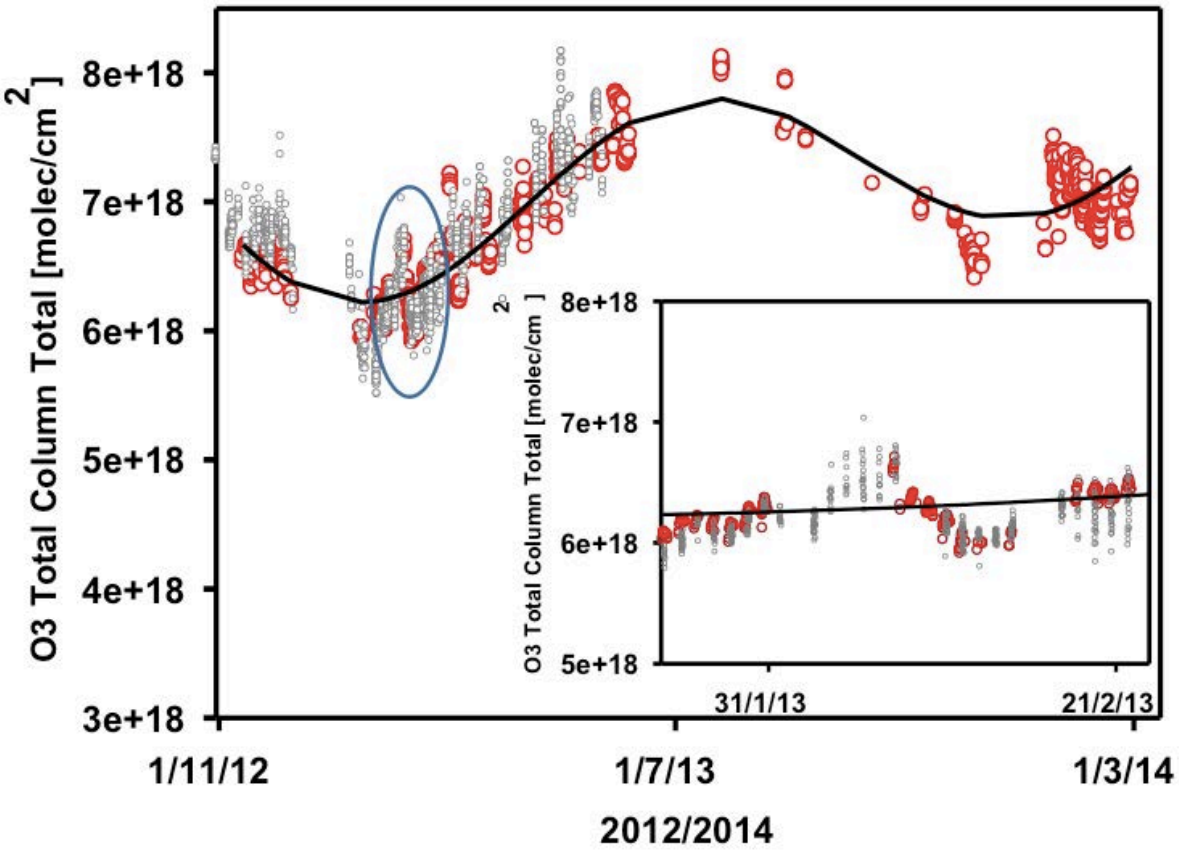
Biomass Burning



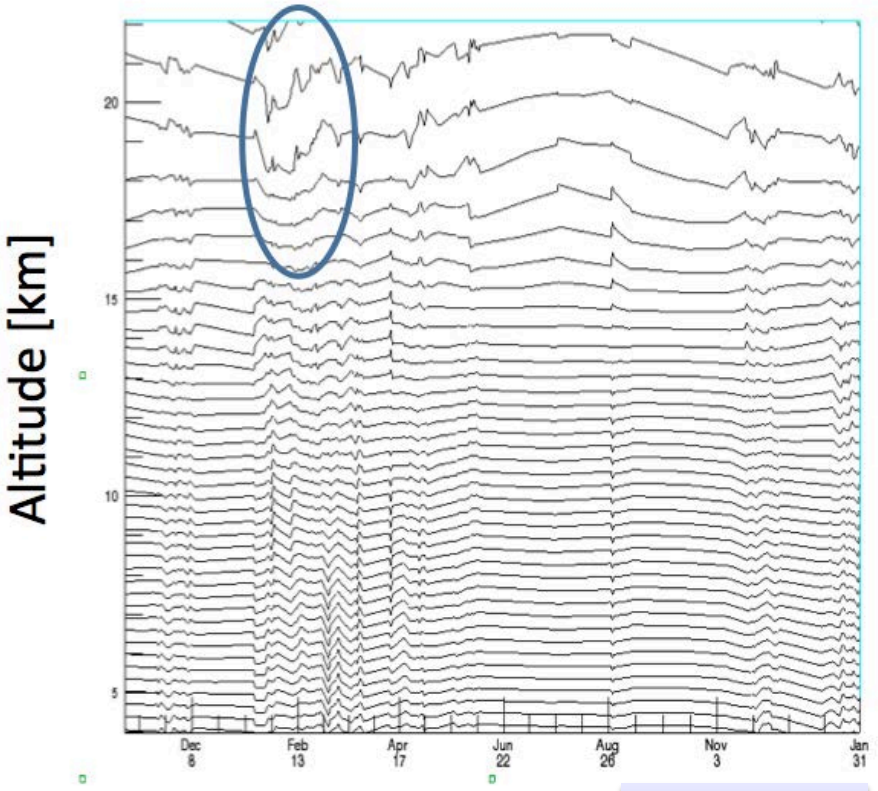


Retrieval:
PROFFIT
(KIT)

O_3 (Altzomoni)



Potential temperature



Stratospheric intrusion in the Winter 2012-2013

Retrieval: PROFFIT (KIT)

Summary

- Mexico can participate in the validation efforts of TEMPO
- Ground-based MAX-DOAS network in and around Mexico City
- Solar absorption FTIR at 2 sites: O_3, HCHO and other gases
- Collaborations, intercomparisons, visits, etc. are welcome!!

Thank you

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