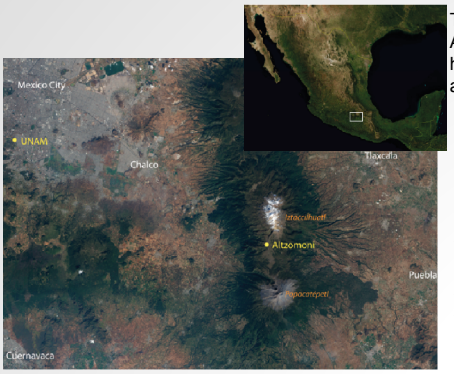
CO_2 variability in Central Mexico

J. Baylón[1], W. Stremme[1], E. Plaza[1], A Bezanilla[1], M. Grutter[1], F. Hase[2], T. Blumenstock[2]

1 Universidad Nacional Autónoma de México, Centro de Ciencias de la Atmósfera, México D.F., México
2 Karlsruhe Institute for Technology, Institute for Meteorology and Climate Research, Karlsruhe, Germany
* baylon@atmosfera.unam.mx

Introduction

There are now several space missions dedicated to measure greenhouse gases in order to improve the understanding of the carbon cycle. Ground based measurement sites are of great value in the validation process, however there are only a few stations in tropical latitudes. We present measurements of solar-absorption infrared spectra recorded on one location over Central Mexico: the High-Altitude Station Altzomoni (19.12 N, 98.65 W), located in the Izta-Popo National Park outside of Mexico City. These measurements were performed using a high resolution Fourier transform infrared spectrometer FTIR (Bruker, HR 120/5)- In this work, we present results for total vertical columns of CO_2, O_2 and XCO_2 derived from near-infrared spectra recorded in 2013 at Altzomoni using the retrieval code PROFFIT.



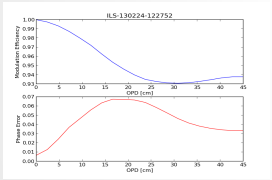
The UNAM has the great advantage of having two solar-absorption spectrometers, one located at the High-Altitude Station Altzomoni, outside of Mexico City and the other at the UNAM Campus in the southern part of the megacity. Both instruments have an altitude difference of 1800 m and a distance of 60 km. The different locations but the closeness of the instruments will allow the disentanglement of Mexico City CO_2 emissions from the background.

The UNAM has a high spectral resolution solar-absorption spectrometer located at the High-Altitude Station in Altzomoni, México. The station is located between Popocatepetl and Iztaccihuatl volcanoes and comprise a meteorological station jointly mantained by UNAM and the Servicio Meteorológico Nacional (National Meteorological Service, SMN). The deployment of the spectrometer at Altzomoni is part of a collaboration with Karlsruhe Institute of Technology (KIT). Using a solar-tracker built at KIT, solar-absorption spectra have been recorded since 2012.
A moderate resolution solar-absorption spectrometer is located at the Atmospheric Observatory of UNAM, on the rooftop of the Centro de Ciencias de la Atmósfera (Atmospheric Sciences Center, CCA), within the main campus of UNAM. The spectrometer together with a custom built solar-tracker has been operating since June 2010.

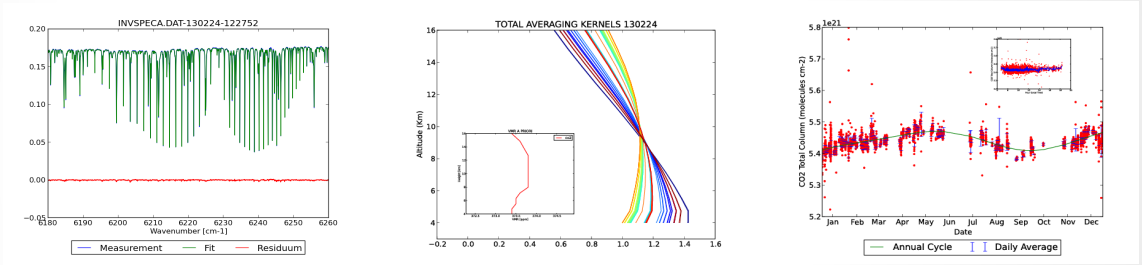
Altzomoni Technical Data

Coordinates	19.1187 N, 98.6552 W
Altitude	3,985 m.a.s.l.
FTIR Model	HR 120/5
Detector	InGaAs
Beam Splitter	KBr (CaF_2)
Resolution	0.02 cm-1
Number of days	148 (13-01-01 - 13-12-30)
Number of spectra	5,856

CO_2

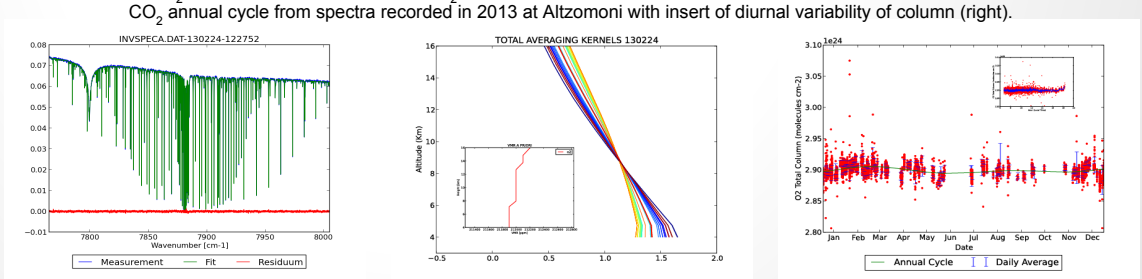


ILS used in retrievals



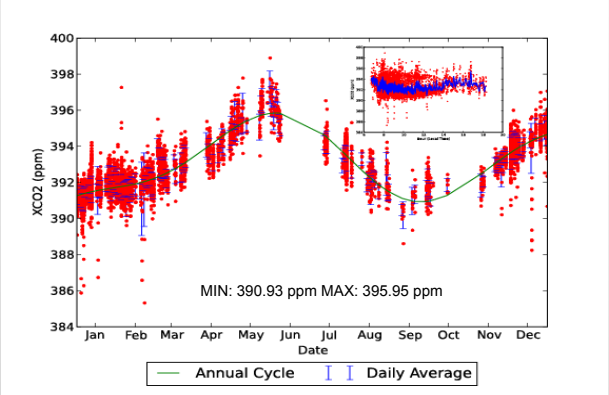
Fit of one of the CO_2 spectral windows used (left), CO_2 averaging kernels for a full day of spectra with insert of *a priori* profile (middle) and CO_2 annual cycle from spectra recorded in 2013 at Altzomoni with insert of diurnal variability of column (right).

O_2

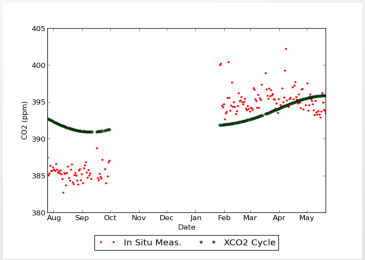


Fit of O_2 spectral windows used (left), O_2 averaging kernels for a full day of spectra with insert of *a priori* profile (middle) and O_2 annual cycle from spectra recorded in 2013 at Altzomoni with insert of diurnal variability of column (right).

XCO_2

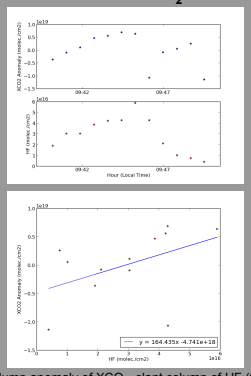


XCO_2 from 2013 at Altzomoni with insert of diurnal variability



Comparison of in-situ measurements of CO_2 from Altzomoni with XCO_2 cycle

Volcanic CO_2



Slant column anomaly of XCO_2, slant column of HF (top) and slant column ratio of XCO_2 and HF (bottom) for a volcanic event

Acknowledgements
JB is thankful for the stipend provided by Conacyt for conducting his PhD thesis work. This investigation has been partially funded by DGAPA-UNAM through PAPITT projects # IN109914 and IA101814. The HR 120/5 instrument has been made available by IMK-KIT for its deployment at Altzomoni. Alfredo Rodríguez, Héctor Soto and Omar López are thanked for their technical assistance. The Izta-Popo National Park is also acknowledged for hosting the Altzomoni station and their continuous support.