

MEGAMex

Measurements of the Emissions of Gases and Aerosols from Mexico

**Izta-Popo National Park, State of Mexico
November 12, 2005 – January 1, 2008**

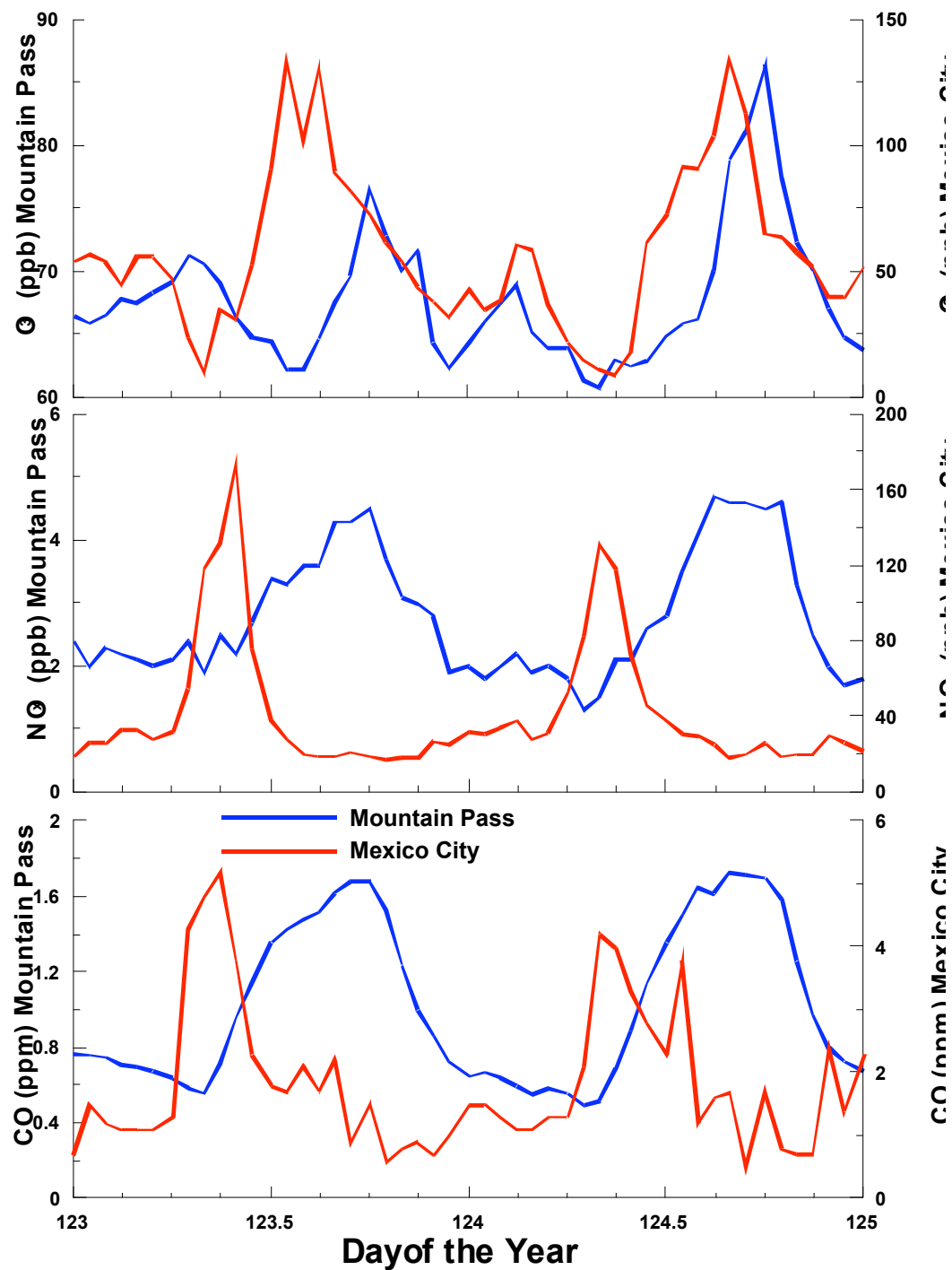
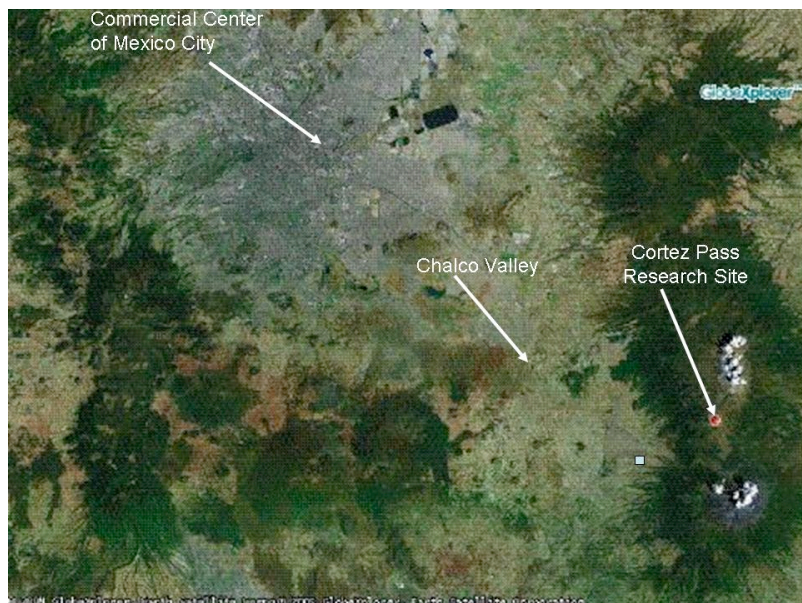
Research Questions

- 1) What are the rates of turbulent exchange of momentum, energy, latent heat, CO₂ and particles within the Mexico City boundary layer?**
- 2) What is the deposition flux of particles in the surface layer at the national park of Izta-Popo Zoquiapan?**
- 3) How do the properties of particles emitted from Mexico City change with age and photochemical processing?**
- 4) How do the hygroscopic properties of particles emitted from Mexico City impact the properties of clouds and precipitation?**
- 5) Is there an indication for nucleation from biogenic precursors or volcanic sources?**
- 6) How do the optical properties of particles emitted from the Mexico City area alter radiative fluxes?**

Research Objectives

- 1) Measure the properties of aerosol particles and trace gases at the Cortez Pass during a two year period to evaluate diurnal and seasonal variations.**
- 2) Participate in the Megacity Impact on Regional and Global Environment (MIRAGE) field campaign with an expanded set of instrumentation and aircraft.**
- 3) Compare the measurements at the Cortez Pass with those from the C-130 and Enduro microlight.**
- 4) Closure studies using in situ measurements of radiation and particle physical properties from vertical profiles measured with lidar, aircraft and ground based instrumentation (German lidars and aircraft)**
- 5) Utilize the measurements in micrometeorological, radiative transfer and cloud models to evaluate the effect of anthropogenic emissions on the ecosystems, climate and clouds of local and regional areas.**
- 6) Develop a Global Atmospheric Watch (GAW) regional monitoring station for long term measurements of greenhouse gases and anthropogenic aerosols.**

Measurements from April 26 to May 11, 1999
by the mobile monitoring station of RAMA in
the Cortez Pass, 4000 m



View from the Cortez Pass



9 am, March 12, 2005



11 am, March 12, 2005

View from Iztacíhuatl



9 am, April 16, 2005



9 am, April 16, 2005



Altzomoni Measurement Station

16 m flux tower

Momentum

Heat

CO₂

CN

PSD

O₃

Radiation

Global Diffuse

UV

Actinic Flux

Gases

CO, CO₂, SO₂, O₃, CH₄

N₂O, NH₃, NO, NO₂, H₂CO

Column SO₂, NO₂, O₃

VOC

PAN, PPN

Particles

CN

CCN

B_{scat}, B_{abs}

BC/EC/OC

PPAH

PSD

Commercial Center
of Mexico City

Chalco Valley

Cortez Pass
Research Site

Aircraft measurements



Ceilometer/Lidar
DOAS (O_3 , SO_2 , NO_2)
Ozone Sondes
Actinic Flux

Aircraft type:
Aircraft identification:
Cruise Speed
Max Altitude
Climb rate (m/s)
Endurance (max)
Total payload
Wing span / area
Electrical power
C-Mode Transponder

Ultralight Enduro
D-MIFU
50 kts
>15000 ft
1000 ft/min (MSL)
7 h
200 kg incl. pilot
10 m, 17 m²
600 W 12 VDC, 24 VDC



Clouds, aerosols and radiation

Instrumental installations for MIRAGE MEX

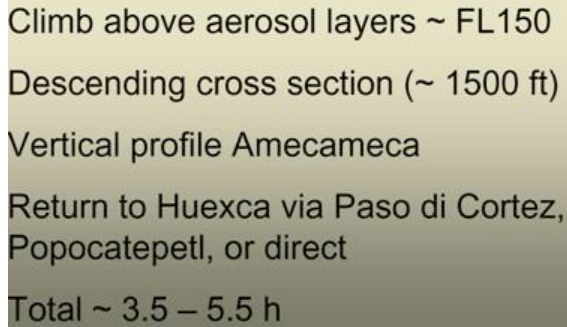
Parameter	Instrument	time-resol.	remarks
Ozone	UV-Photometer	2 sec,	DL 2 ppb
CO ₂	OPA IR absorption	10 Hz	
H ₂ O	OPA IR absorption	10 Hz	
VOC	absorption tubes C5-C15	30 min	selected compounds
Act. Rad. 300 nm J _{O₁D}	2 Filtrerradiometers	1 sec,	↑↓ up and down
Act. Rad. 380 nm J _{NO₂}	2 Filtrerradiometers	1 sec,	↑↓ up and down
Global radiation	2 LICOR Pyranometers	1 sec	↑↓ up and down
UV-B	2 UV-B Sensors	1 sec	↑↓ up and down
Temperature	Pt 100	2 sec,	0.1 degree
Humidity	Chilled mirror	2 sec,	0.1 degree
Pressure		1 sec,	0.1 hPa
Position	GPS	2 sec,	acc. 2 m
Wind (horizontal)	GPS/Compass/INS	10Hz,	prec. 0.5 m/sec
CNC / number	TSI 3010	1 sec	> 0.01 - 3 μm,
Aerosols / number	METONE 4903, 2 channels	2 sec	> 0.3, > 0.5 μm
Aerosols / size distr.	Aerosol Spectrometer, 15 ch.	6 sec	> 0.3- 20 μm
Submicron aerosol size distr.	(SMPS/FCE)	2 min	10 – 500 nm
Scatt. coeff. / visibility	HSS-AVMIII	1 sec	870 nm, 0-60 km
Absorption coefficient	Magee Aethalom.	2 min	350 – 95 nm equiv. to BC [ng]
Turbulence, 3D windvector	5 hole noseboom probe	10 Hz	> 0.1 m/sec
Attitude / Heading	Oxford Tech. INS	100 Hz	acc. 0.1 / 0.6 degree
Graphic documentation	2 digital cameras	3 sec	looking → and ↓



Small size instruments



Biomass burning HCHO + aerosol



Participants*

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