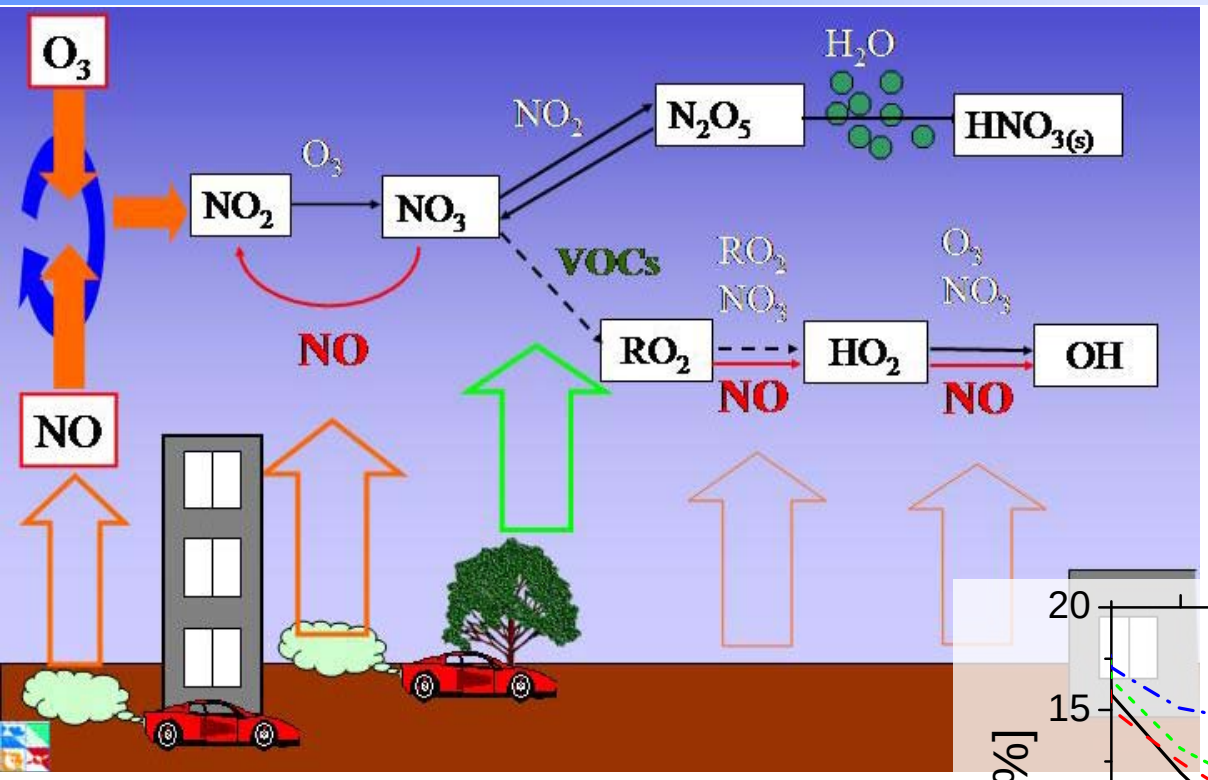
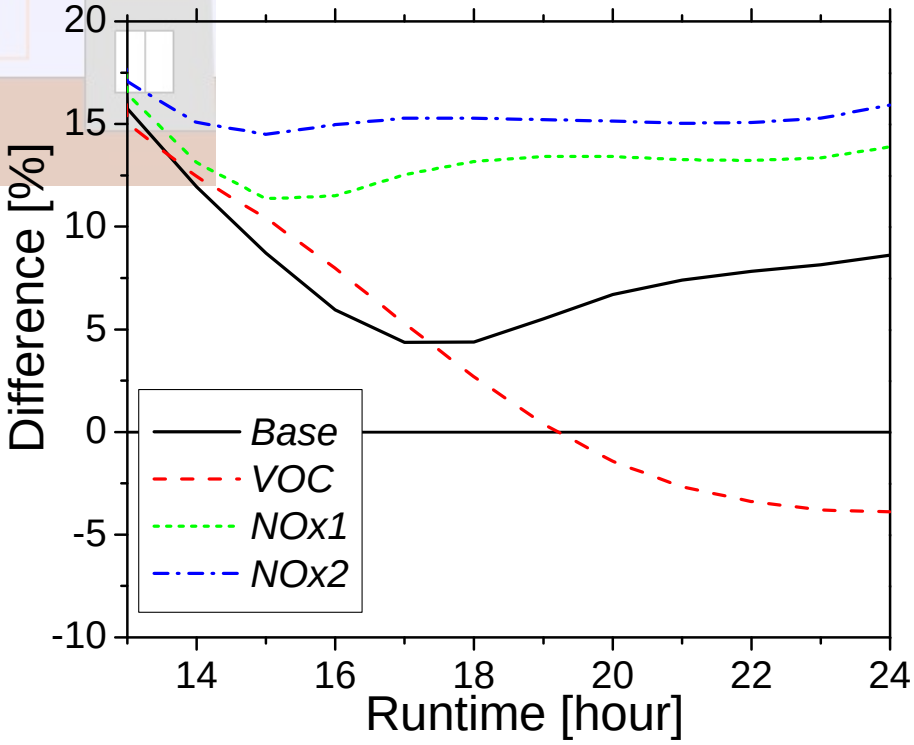
Nocturnal Chemistry: NO_3 and N_2O_5



Impacts:

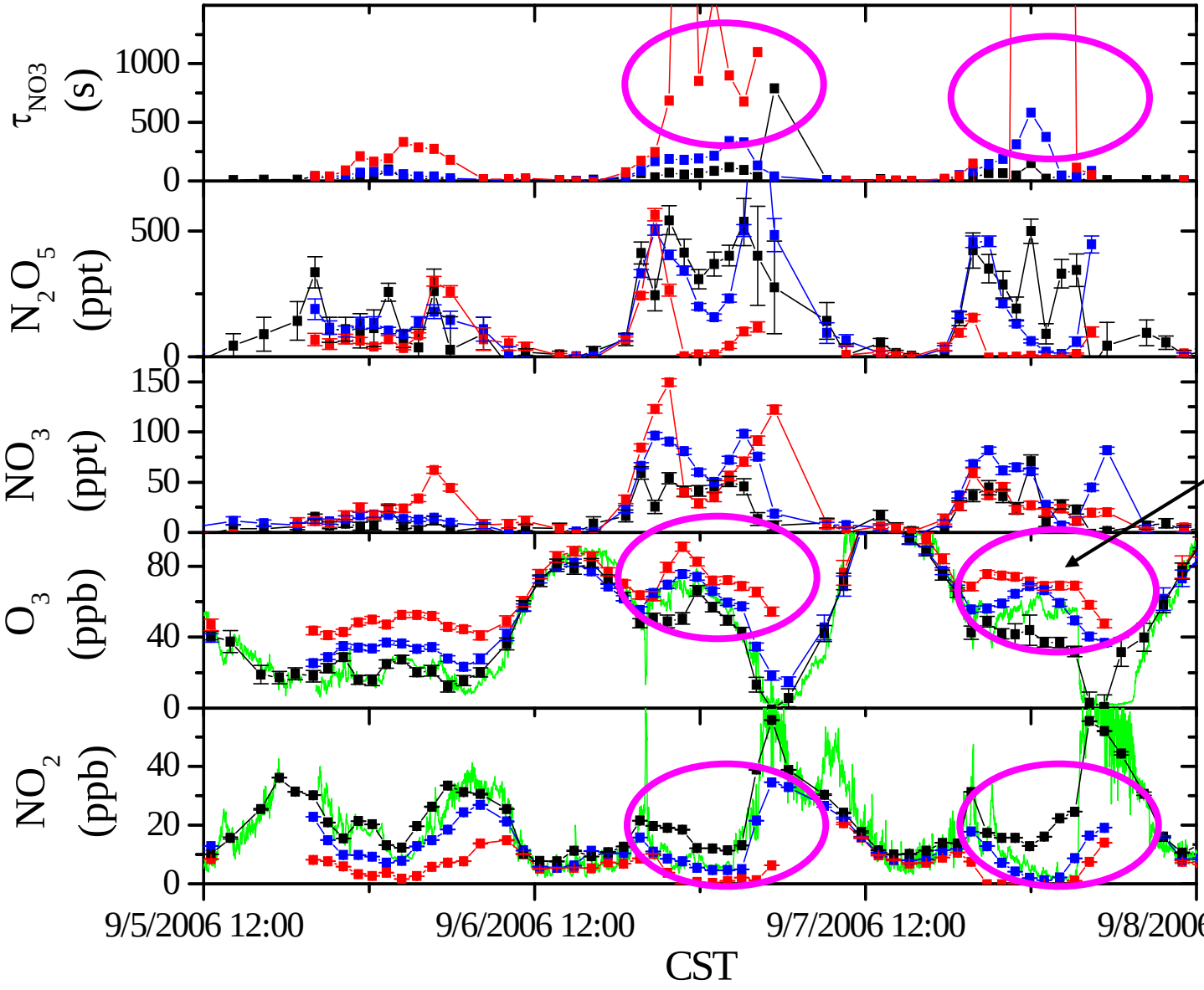
- NO_x and VOC budgets
- Aerosol number and composition
- Daytime ozone



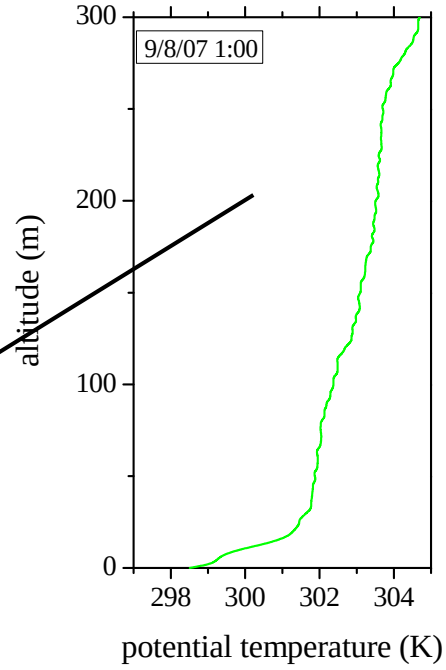
Comparison of model calculations with and without NO_3 chemistry:

Change of O_3 : up to 17%

NO_3 Chemistry in Houston: Impact of vertical mixing



Residual Layer

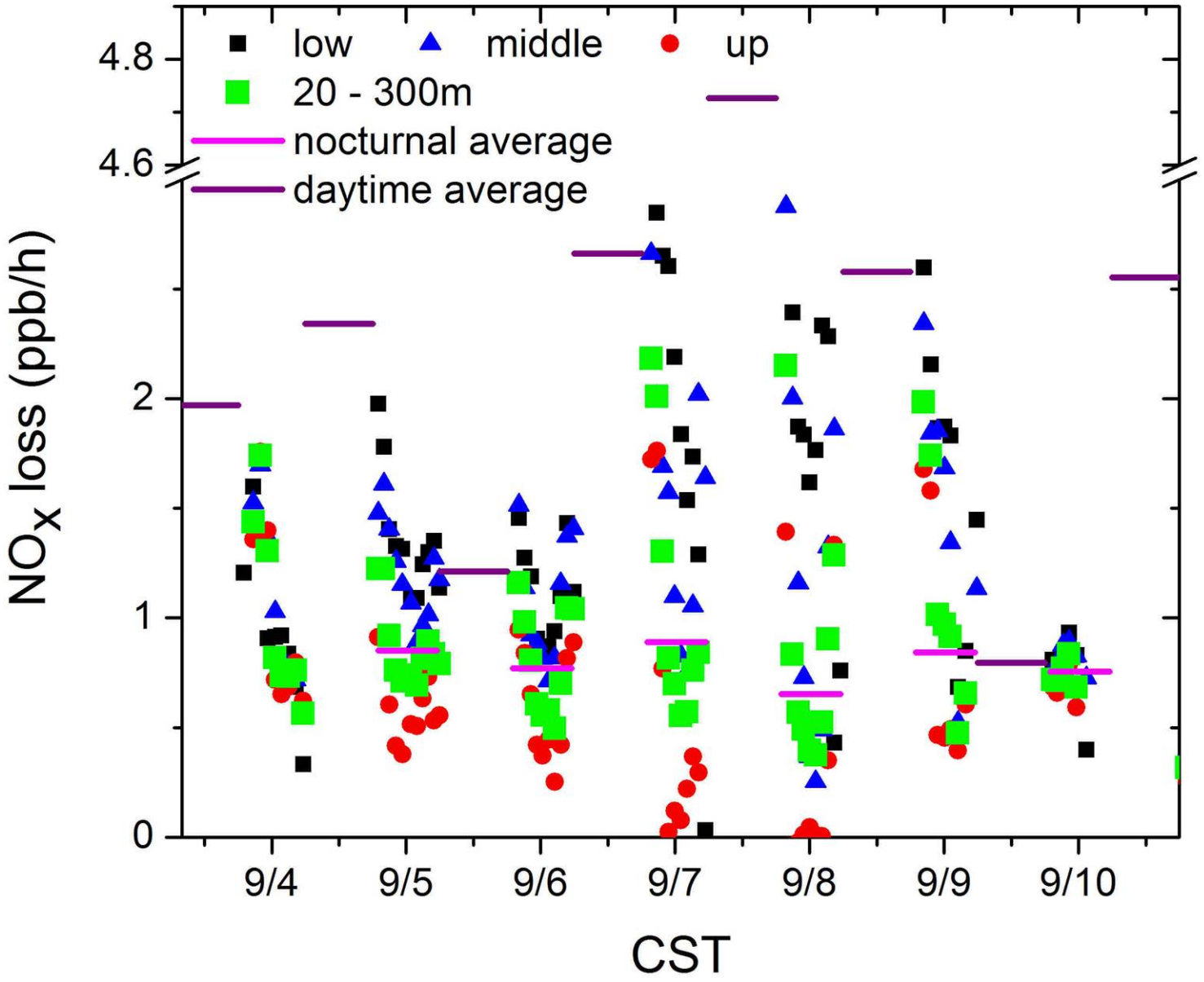


Middle

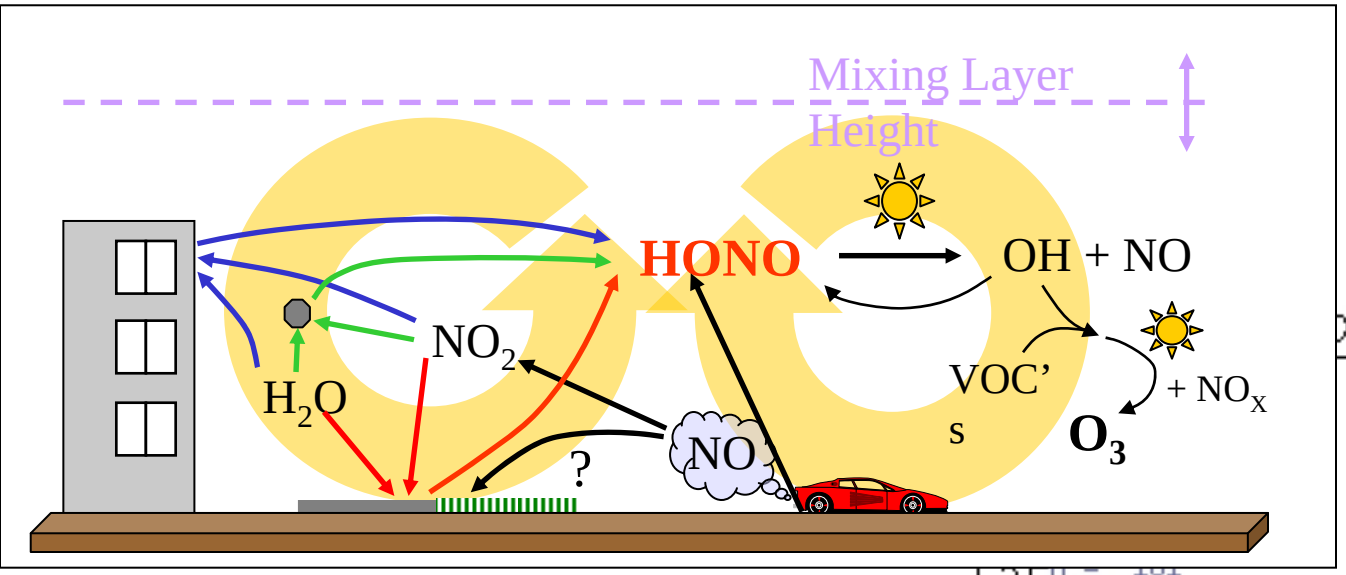
Upper

UH/UNH

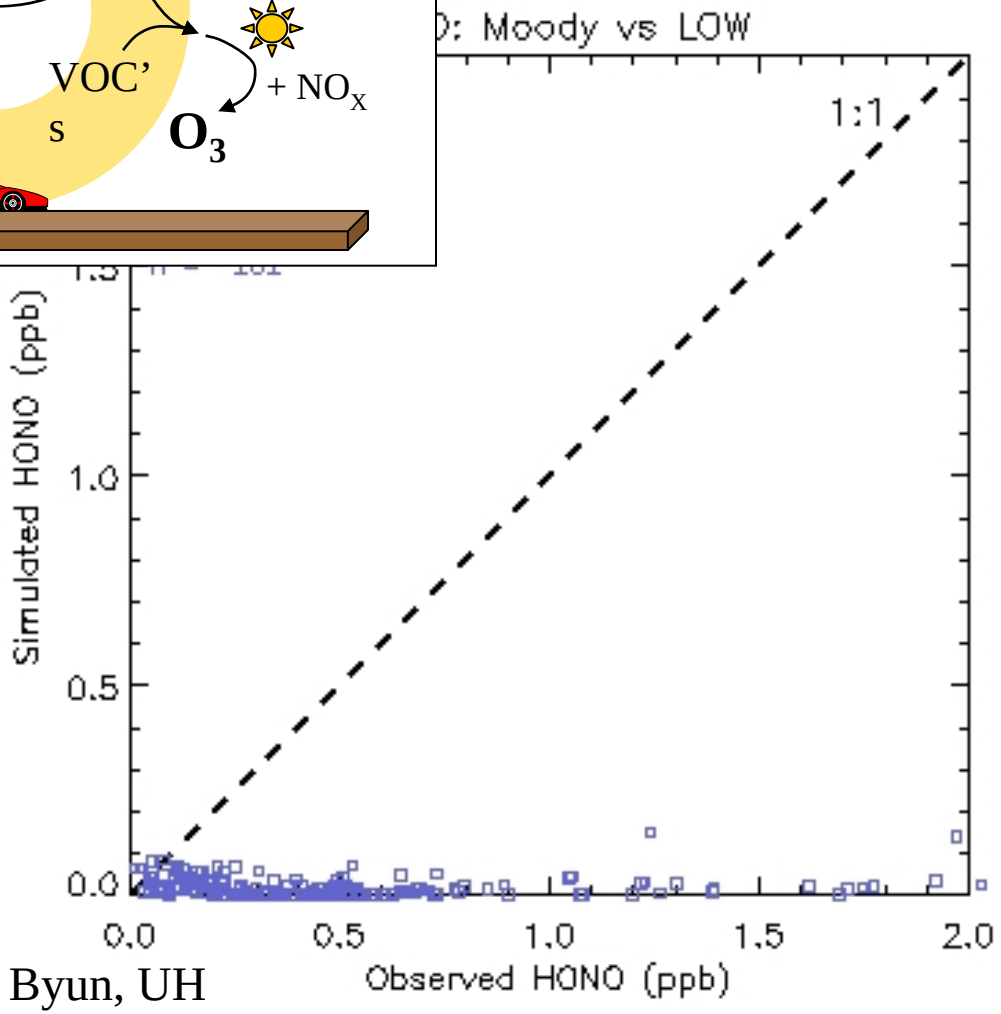
Nocturnal NO_x loss in the lowest 300m of Houston



Nocturnal Chemistry: HONO

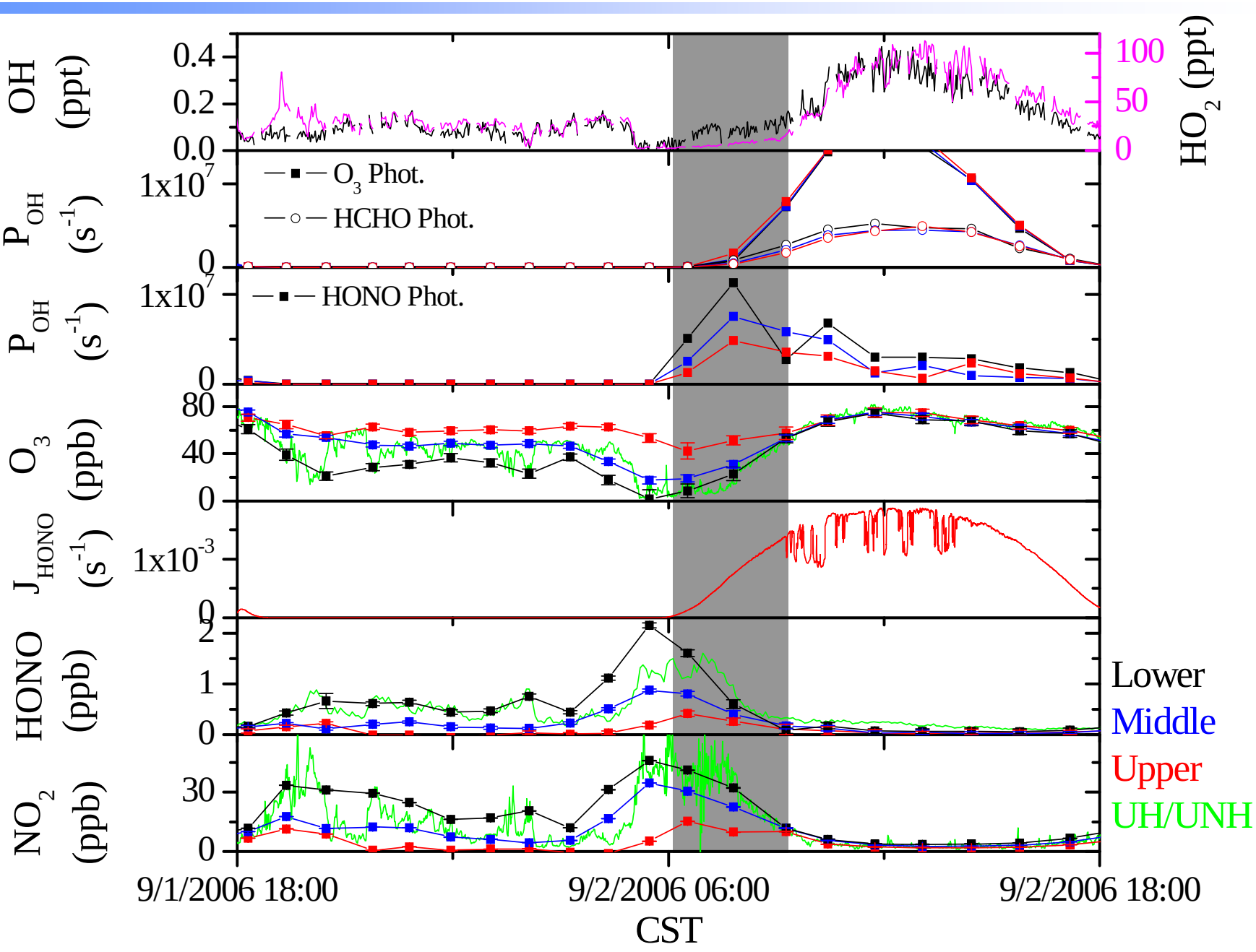


- Early morning (daytime?) source of OH
- Strong impact of vertical mixing on HONO mixing ratios
- Air Quality models do not simulate HONO well

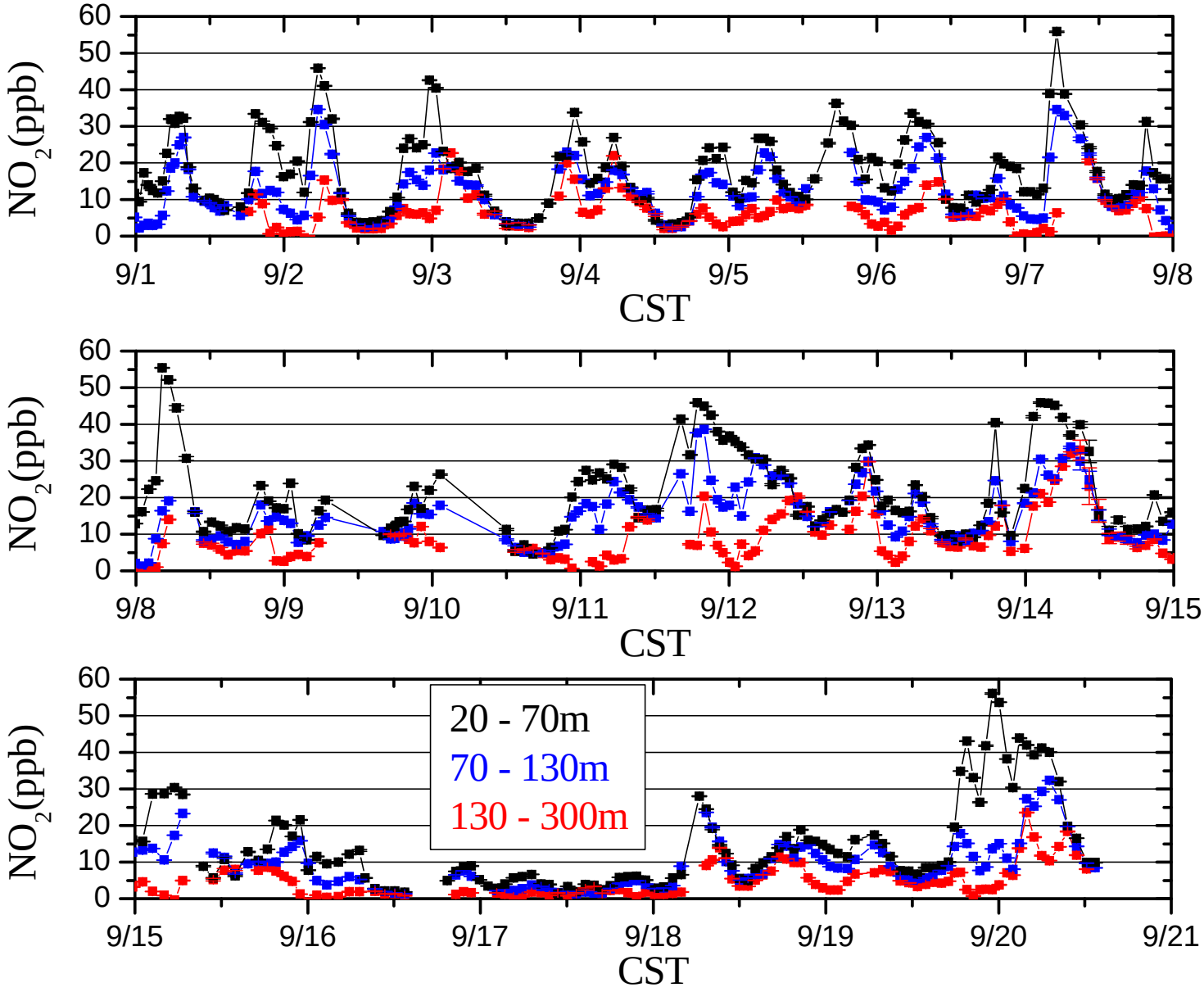


Courtesy of D. Byun, UH

P_{OH} in the Early Morning Transition



How common are vertical NO_x profiles in urban areas?



Goals of UCLA CALNEX Project

- study the vertical distribution of O_3, NO_2, NO_3 and N_2O_5 to determine how the suppressed vertical mixing impacts nocturnal chemistry and its altitude dependence.

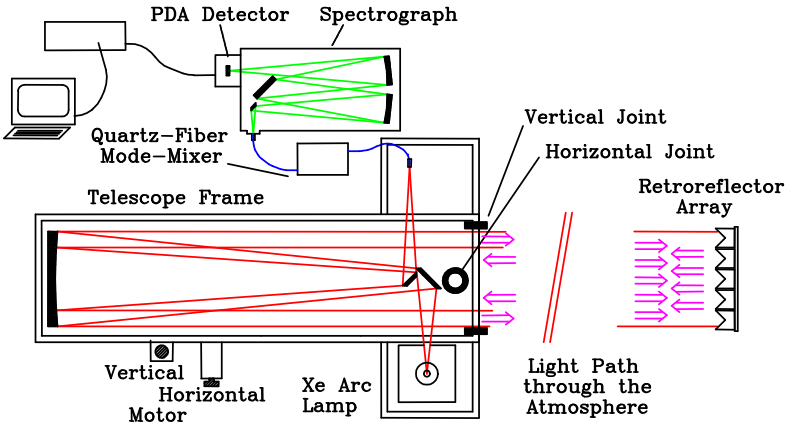
- determine the nocturnal budgets of O_3 and NO_x in the Los Angeles atmosphere.

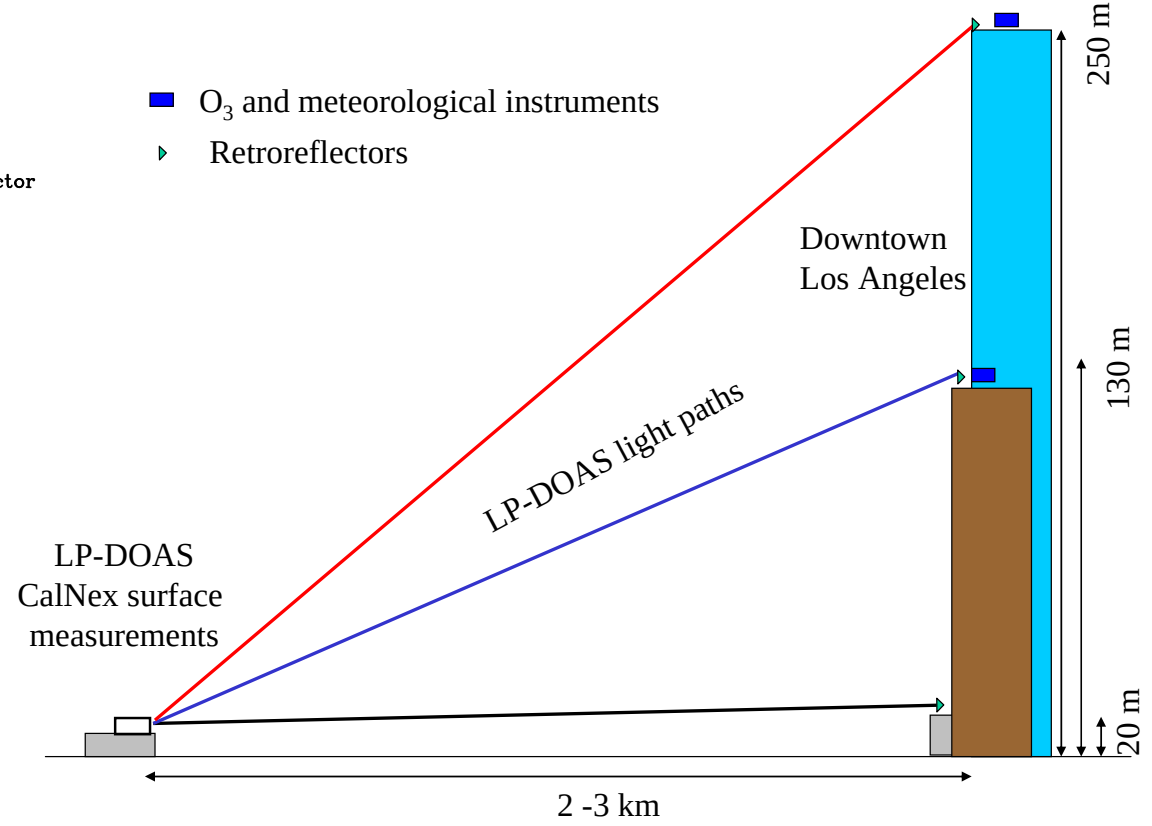
- investigate the formation of HONO in Los Angeles and develop a parameterization for chemical transport models to describe the observations

- study the impact of nocturnal chemistry on daytime ozone formation using observations and a 1D chemical transport model.

DOAS Observations

- Measurements of vertical profiles of O_3, NO_2, SO_2, HCHO, HONO, NO_3 and glyoxal with a 15 – 30 min time resolution throughout the experiment
- Met and ozone observations on two high-rise buildings in downtown LA.



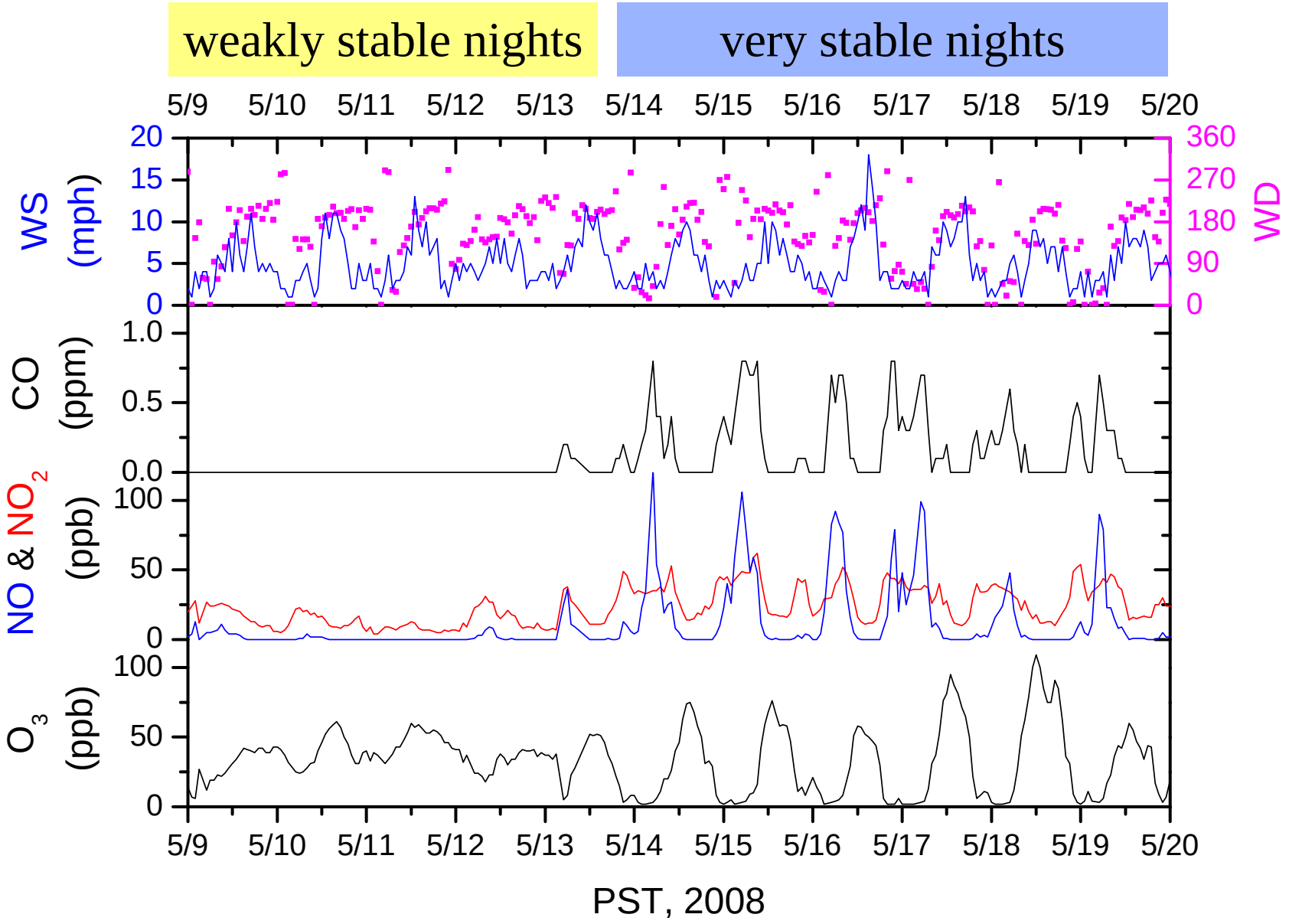


Planned Measurements

Measurements planned to address nocturnal chemistry and other gas-phase problems

Vert. Profiles NO_3, HONO, HCHO, O_3, NO_2, SO_2, glyoxal	DOAS	Stutz, UCLA
In-situ O3 at high altitude	UV	Stutz, UCLA
CO, NOx, NOy, ozone (sondes)	various	AQMD
VOCs	GC-MS	De Gouw, NOAA
Soluble gases	Mist chambers	Dibb, New Hampshire
OH, HO_2, CO, NO, ozone	CIMS	Huey, GA Tech
Standard meteorology data	various	Stutz, UCLA
Vertical T, Wind	Sodar	ARB
Vertical T, Wind	various	Clemens, CSU San Jose
Temperature profiles	Lidar	Jobson, WSU or ARB
Photolysis rates	Radiometer	Lefer, Univ, Houston

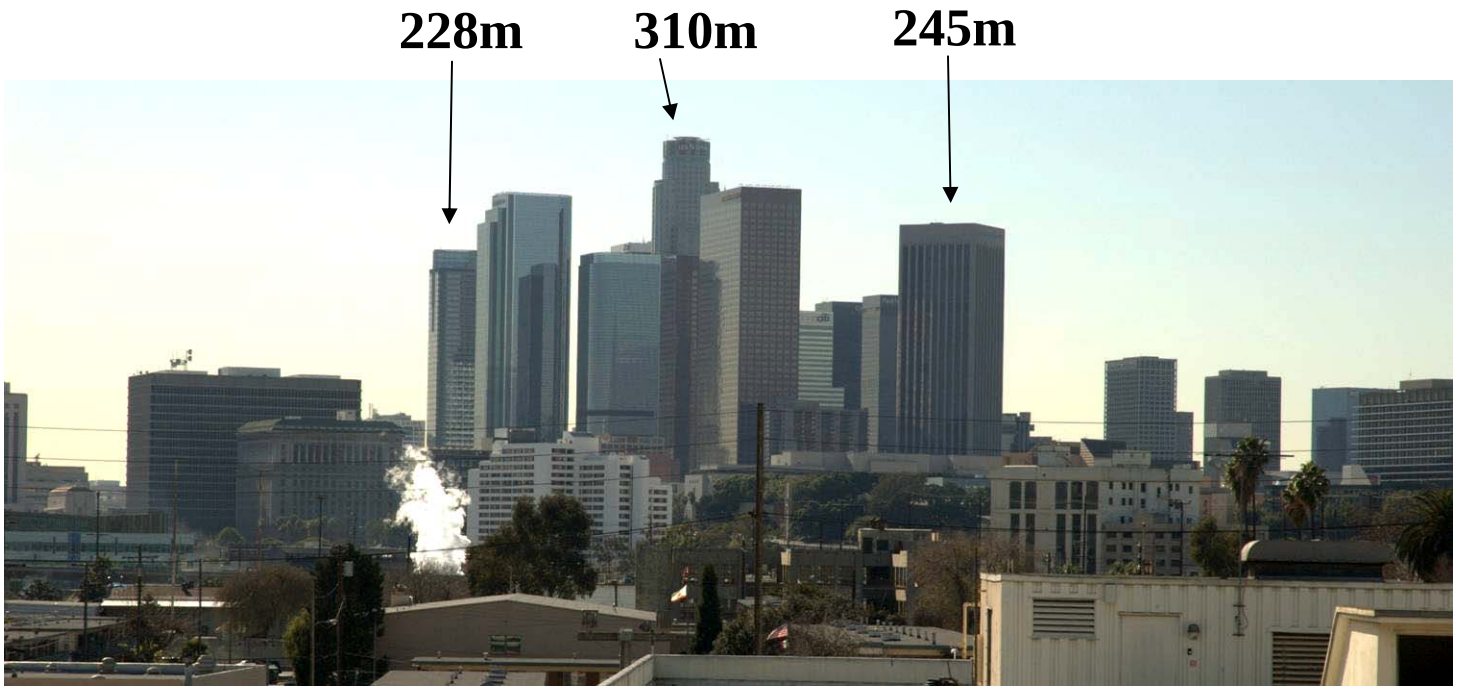
What to expect from North-Main Site?



AQMD monitoring data

DOAS at North-Main Site

- Surface Ozone and NO_2 clearly show the impact of nocturnal stability at the site.
- High buildings in ~3km distance allow probing of most, if not the entire, nocturnal boundary layer.
- Co-located aerosol measurements important for interpretation



North Main Site: Logistics

Space requirements for estimated 10 – 15 groups:

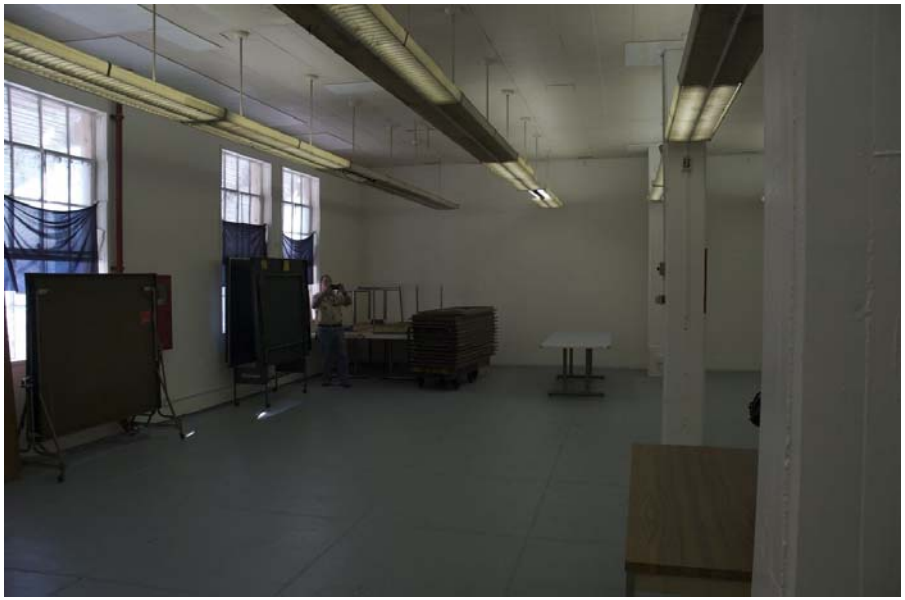
- equivalent of 5 office containers for equipment. Also some office space is needed.

  → Training room on the top floor at North-Main

- Aerosol samplers + some gas-phase measurements on roof

  → roof space available

Building Roof



Division of Water & Power Training Room

North Main Site: Logistics

- Electricity needs:

  estimated 400amp at 110V

  → need two additional electricity drops

- Permission:
  - Site belongs to LA Division of Water & Power (DWP)
  - SC-AQMD rents space from DWP

- Secure, guarded site

- Easy access for delivery

Other possible research projects at North-Main

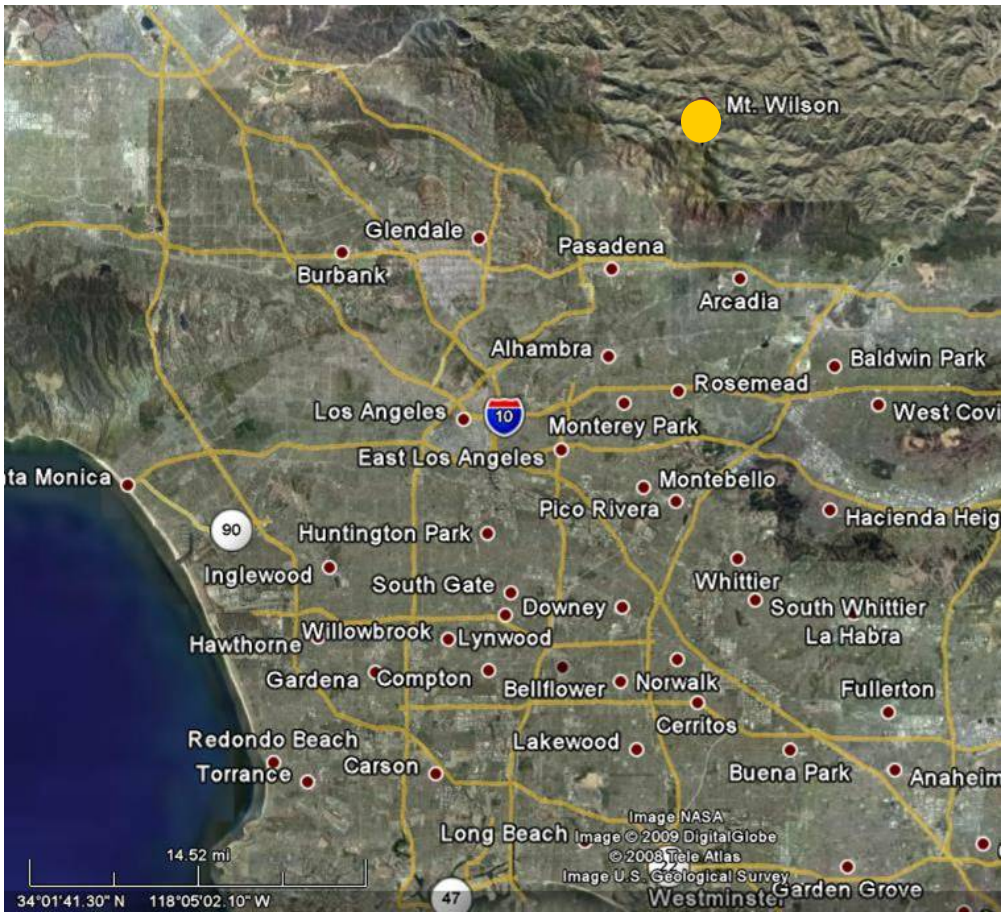
- Daytime HONO and impact on radical chemistry (UCLA, GaTech, UNH, and UH.)
- Radiative properties of urban aerosol (Atkinson, Portland State).
- Halogen Chemistry (Saltzman, Keene, Osthoff)
- Sulfur chemistry: Measurements of SO_2, aerosol sulfate, H_2SO_4 are already planned.
- *Probably more to come*

- Other sites in LA?
  - Mt. Wilson

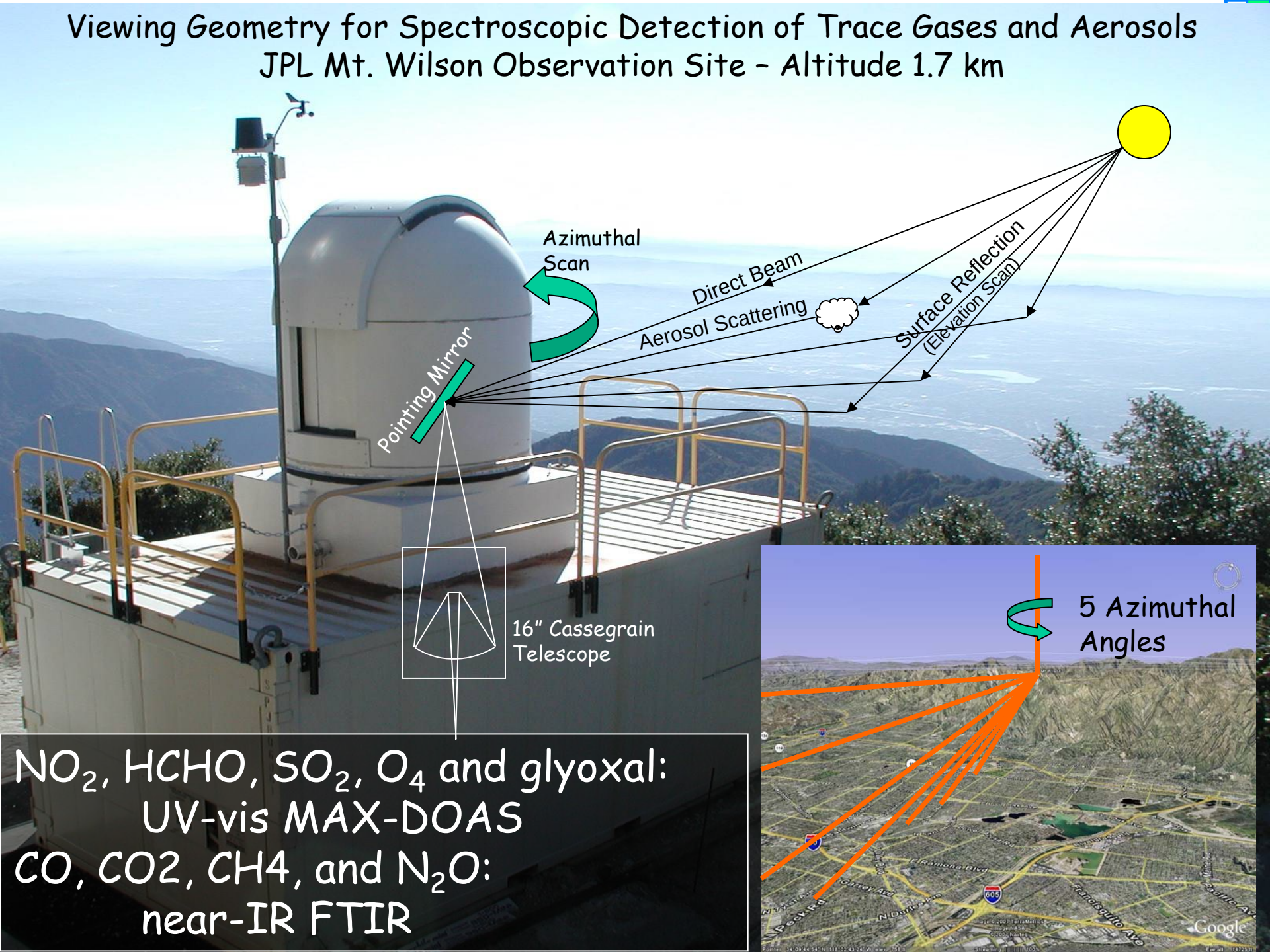
Remote sensing of the spatial distribution of ozone precursor and greenhouse gas concentrations and emissions in the LA basin from Mt. Wilson, CA

J. Stutz, Q. Li, and S. Sander, UCLA & JPL

- Measurement of the 4D distribution of NO_2, HCHO, CO, SO_2, glyoxal, CH_4, N_2O, CO_2, and aerosol extinction.
- Determination of the emissions of NO_x, VOC, CO, CH_4, and N_2O during CalNex 2010 using observations and adjoint CMAQ.
- Quantification of the trace gas levels, chemistry, and transport in and above the Southern Californian boundary layer.
- Develop a new methodology to monitor air quality remotely with a high spatial coverage.



Viewing Geometry for Spectroscopic Detection of Trace Gases and Aerosols
JPL Mt. Wilson Observation Site – Altitude 1.7 km



NO_2, HCHO, SO_2, O_4 and glyoxal:
UV-vis MAX-DOAS
CO, CO2, CH4, and N_2O:
near-IR FTIR

Temporal/Spatial Variability of NO_2 (UCLA MAX-DOAS)