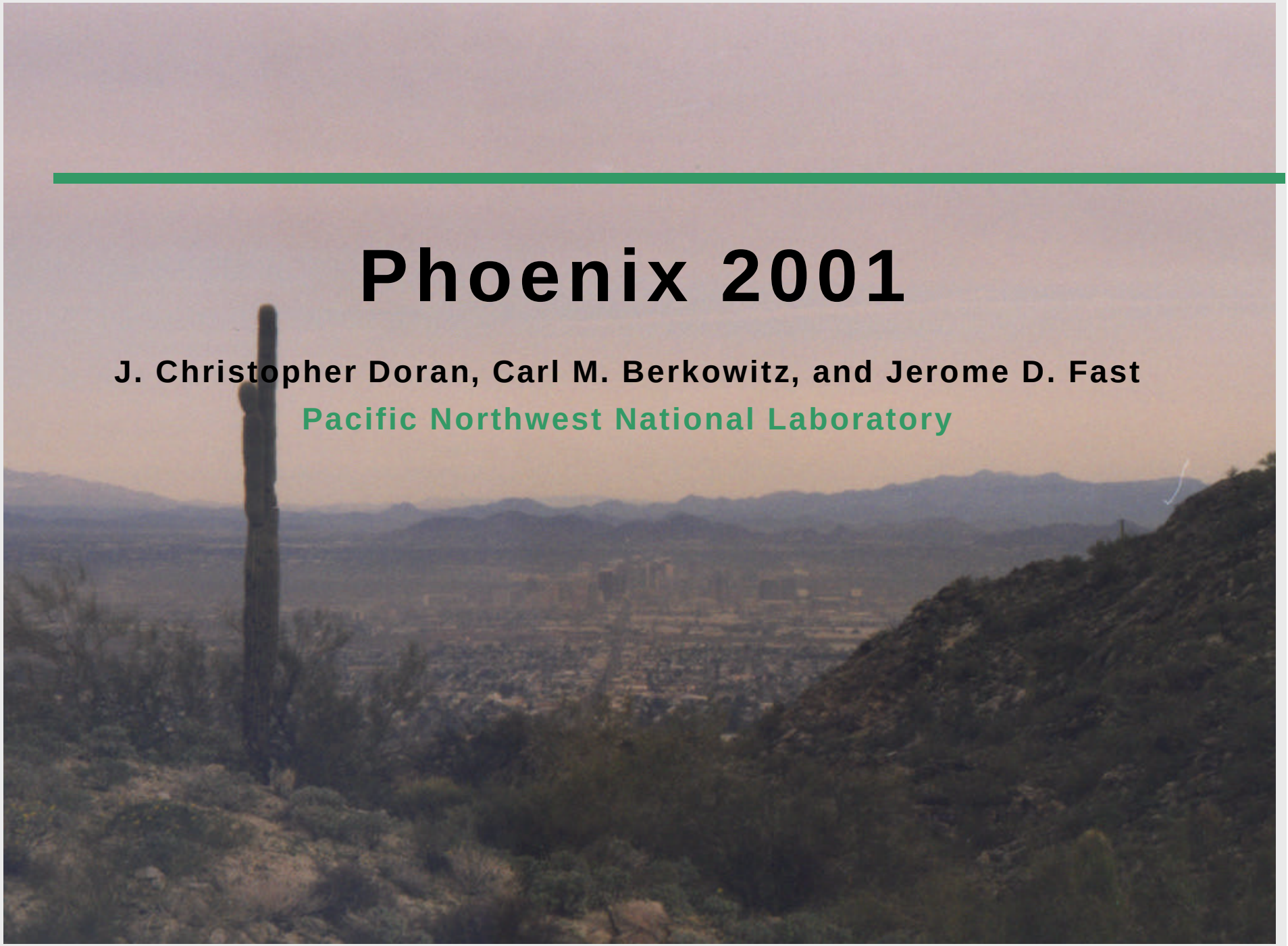
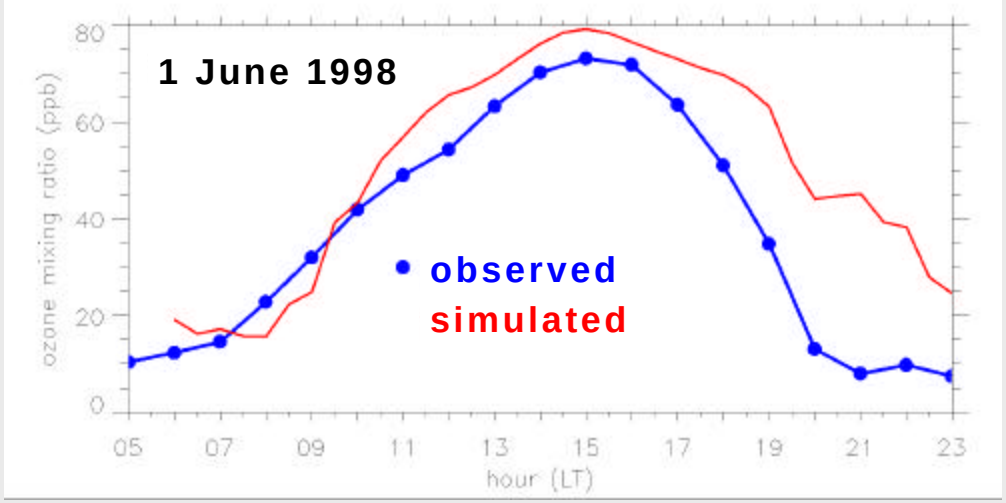


Phoenix 2001

J. Christopher Doran, Carl M. Berkowitz, and Jerome D. Fast

Pacific Northwest National Laboratory

Ozone Production and Destruction



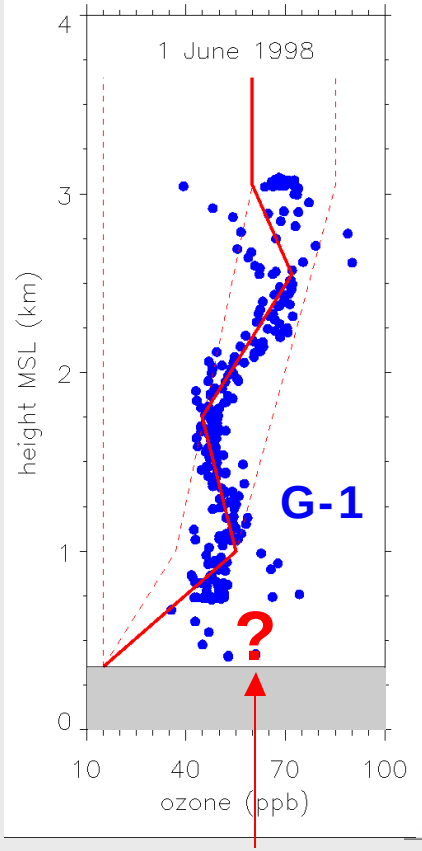
- peak ozone mixing ratios similar; however,
- ozone production rate slower than observed after sunrise
- ozone remains high during early evening

This may be attributed to:

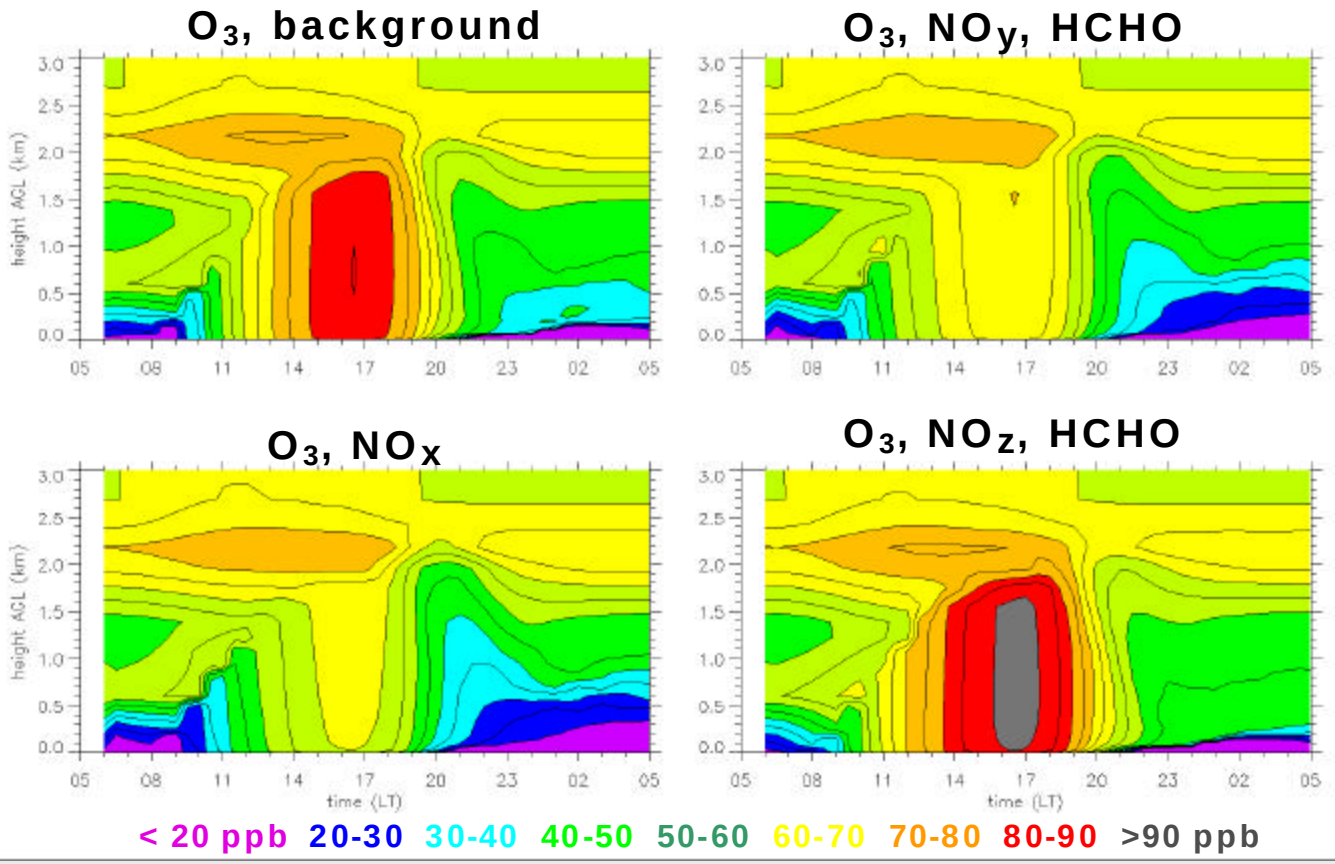
- **chemistry:** uncertainties associated with emissions, photolytic rates, chemical reactions, deposition, etc.
- **meteorology:** poor description of reservoirs of ozone and ozone precursors aloft, vertical mixing within the boundary layer during the evening and transition periods, etc.

Ozone and Precursor Reservoirs

Initial Ozone



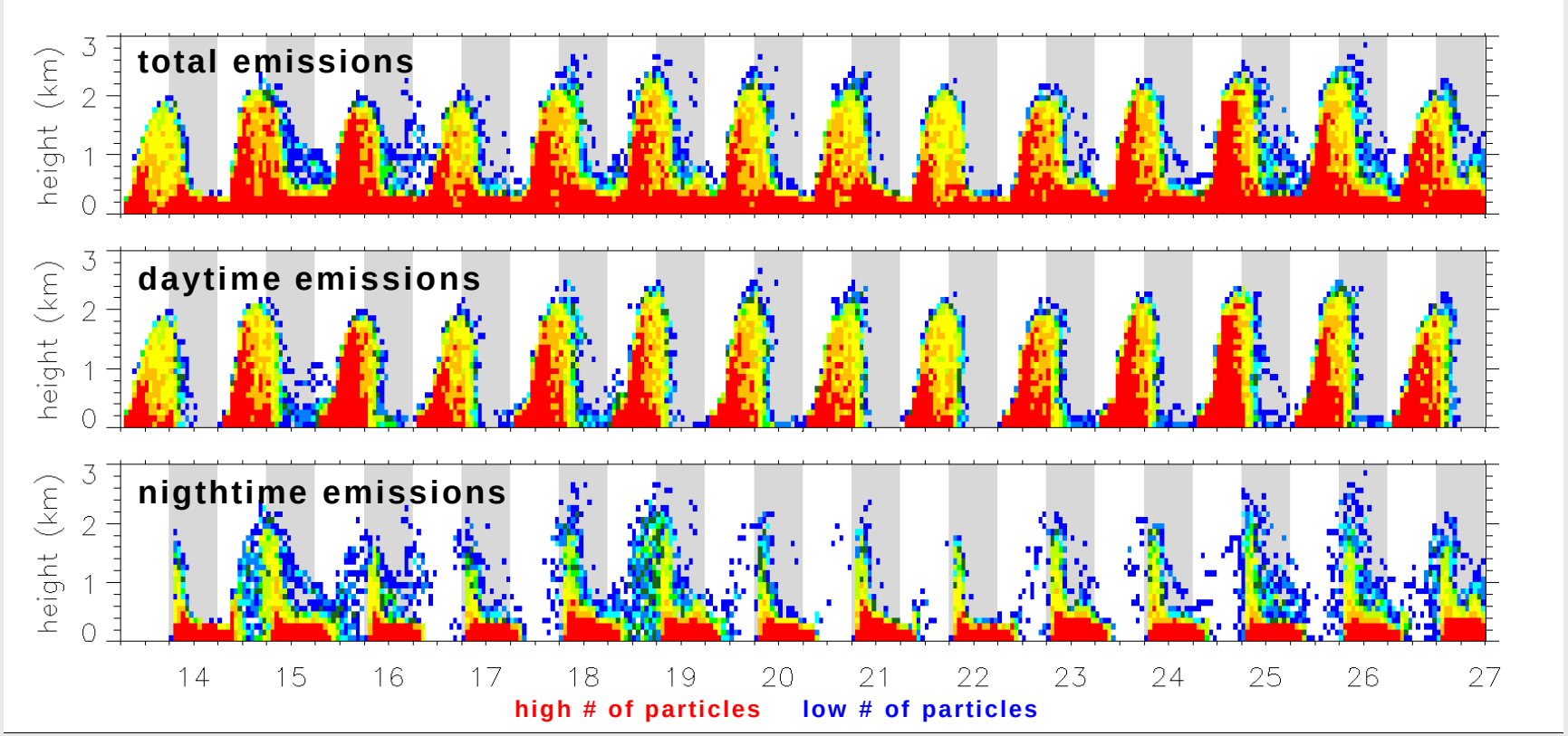
Sensitivity Simulations of Ozone with 4 Initial Profiles



little information between the surface and 300 m

Ventilation

Simulated Particle Dispersion over Phoenix during June 1998



- little carry-over from one afternoon to the next (well ventilated)
- nighttime accumulation remains over Phoenix during morning

Objectives and Approach

- Characterize the local nighttime accumulation of ozone precursors and their subsequent processing the next morning as the nocturnal boundary layer breaks up.
- Use fixed sites at multiple elevations and the G-1 aircraft to compare and contrast the chemical mix within and above the nocturnal surface layer and in the developing convective boundary layer during the morning transition period.
- Collect detailed meteorological measurements of the evolving boundary layer structure.
- Tentative dates: 12 June - 3 July 2001

- The design and emphasis differ from those of Phoenix 1998.
- There are some similarities to Houston 2000, but this study will be more focused and smaller in scope.

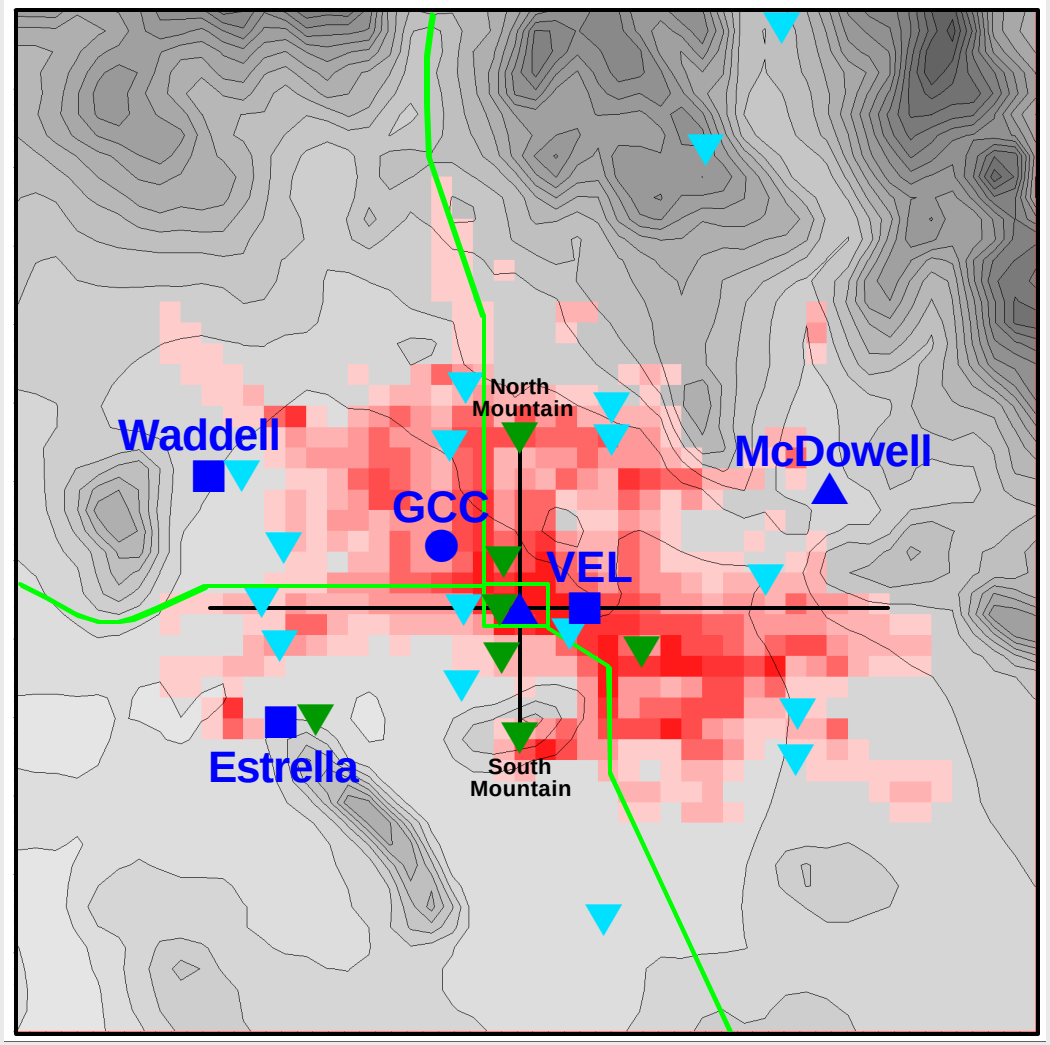
Participants

- Pacific Northwest National Laboratory - Chris Doran, Carl Berkowitz, Jerome Fast, Will Shaw, Tom Jobson, Mike Alexander
- DOE Research Aircraft Facility - Bob Hannigan, John Hubbe, Vic Morris
- Battelle-Columbus - Chet Spicer
- Argonne National Laboratory - Rich Coulter, Paul Doskey, Jeff Gaffney, Nancy Marley, Tim Martin
- Arizona State University - Jim Anderson, Joe Fernando
- University of California - Los Angeles - Jochen Stutz, Ralph Ackermann
- Lawrence Livermore National Laboratory - Cindy Atherton
- Loyola University - Martina Schmeling
- University of Alaska - Bill Simpson

and our hosts:

- Arizona Department of Environmental Quality (ADEQ) - Peter Hyde, Michael George

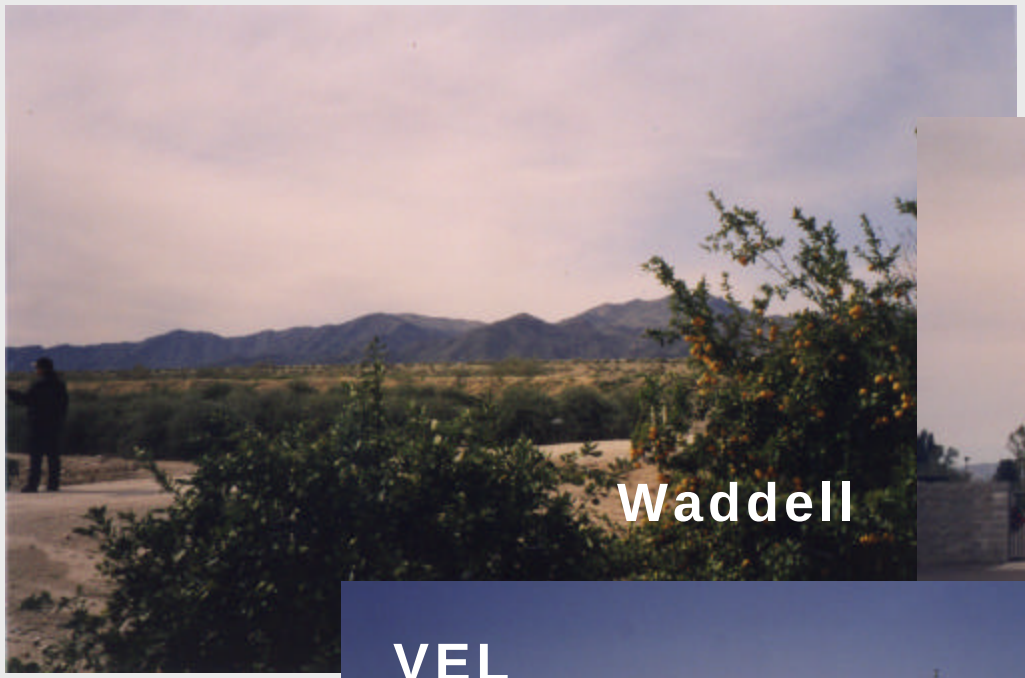
Meteorological Measurements



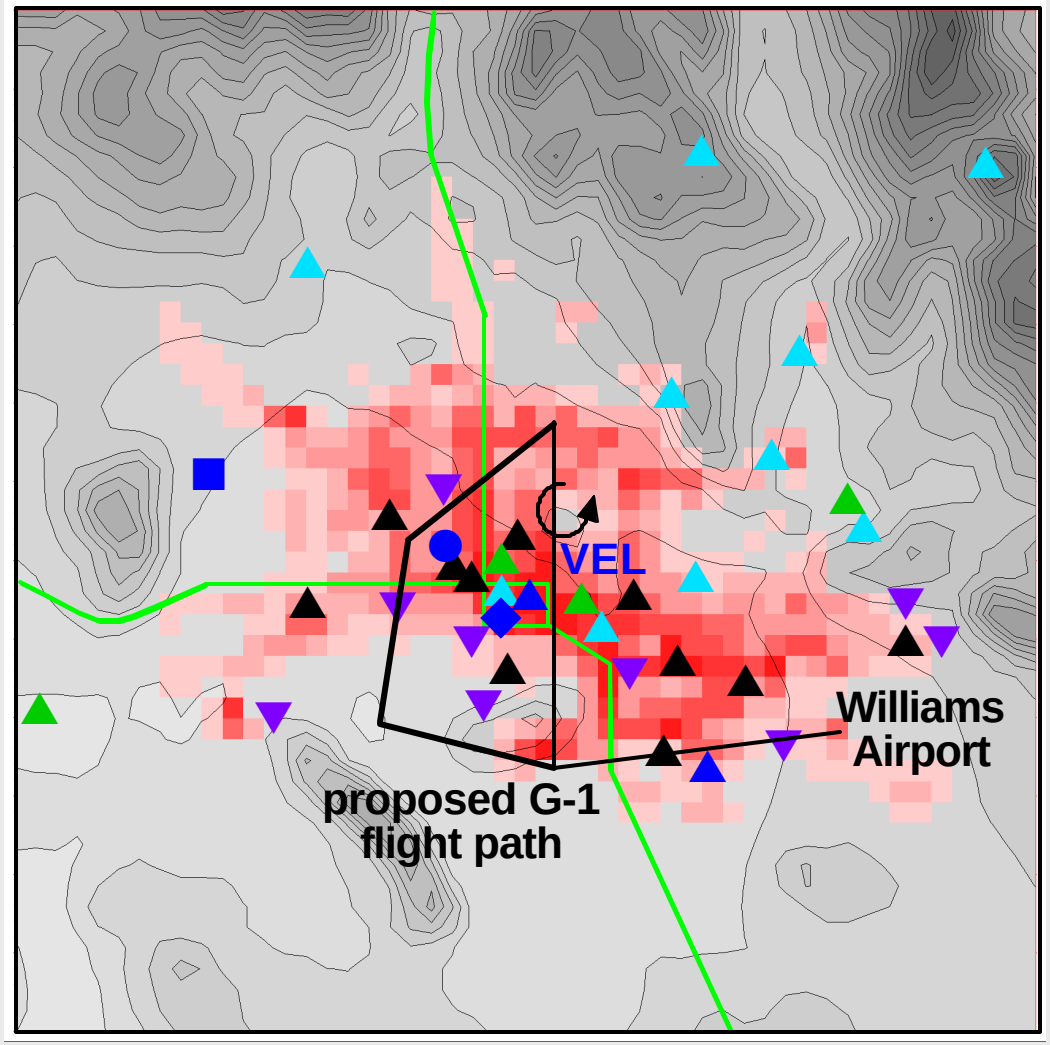
- ■ radar wind profilers and sodars

  radiosondes at 17, 02, 05, 06, 07, 08, 09, 10, and 15 LT (Waddell and VEL)
- ▲ sodar
- ● tethersonde
- ▼ routine surface meteorology
- ▼ additional surface meteorology
- — temperature data loggers (HOBOs)

Radar Wind Profiler Sites



Chemistry Measurements

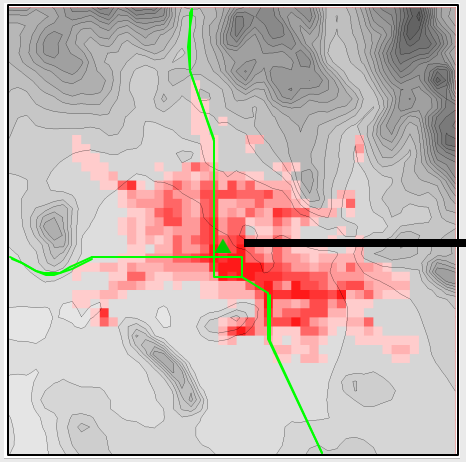


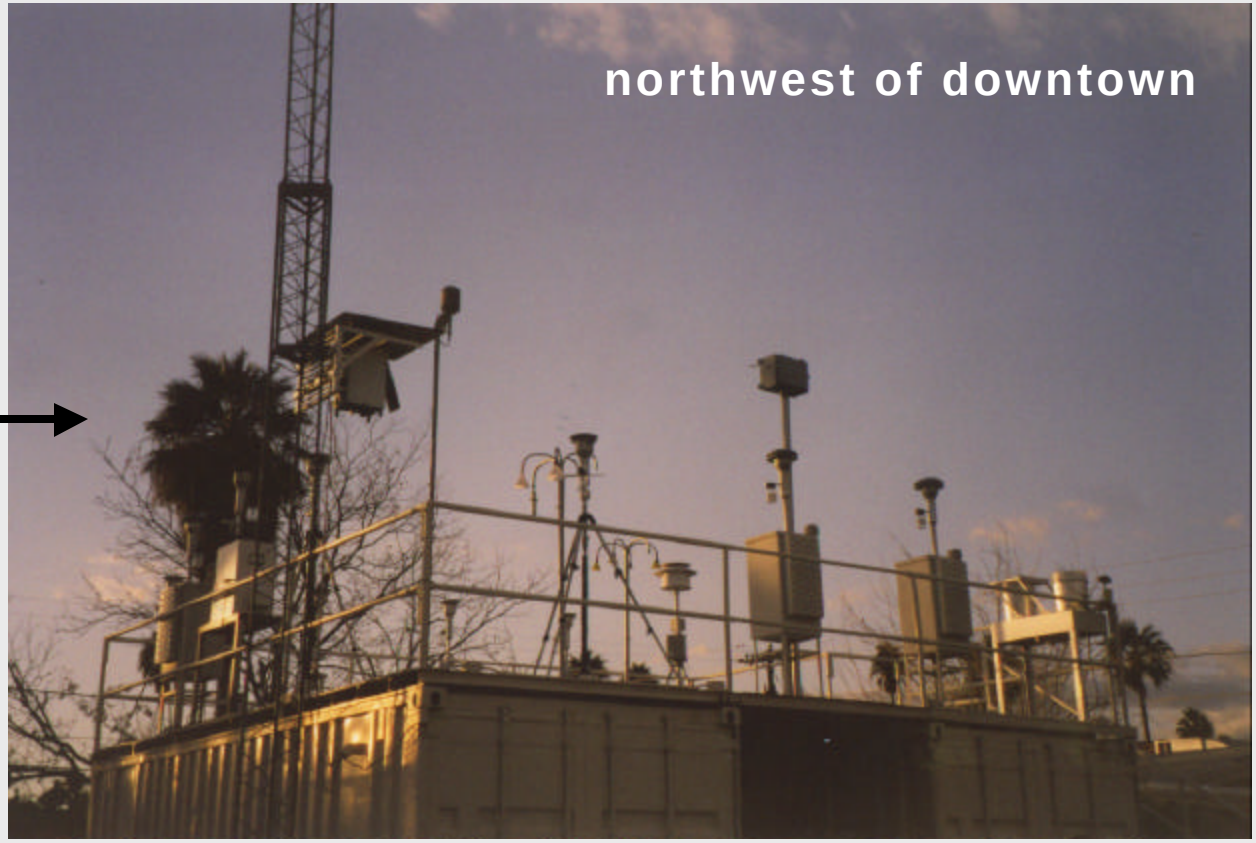
- surface: O_3, CO, NO, NO_2, NO_y, PAN, Neph., UVb, MFRSR, VOC canisters
- tethersonde: O_3, PM
- 3 building levels
- JNO_2 at VEL

Routine Observations:

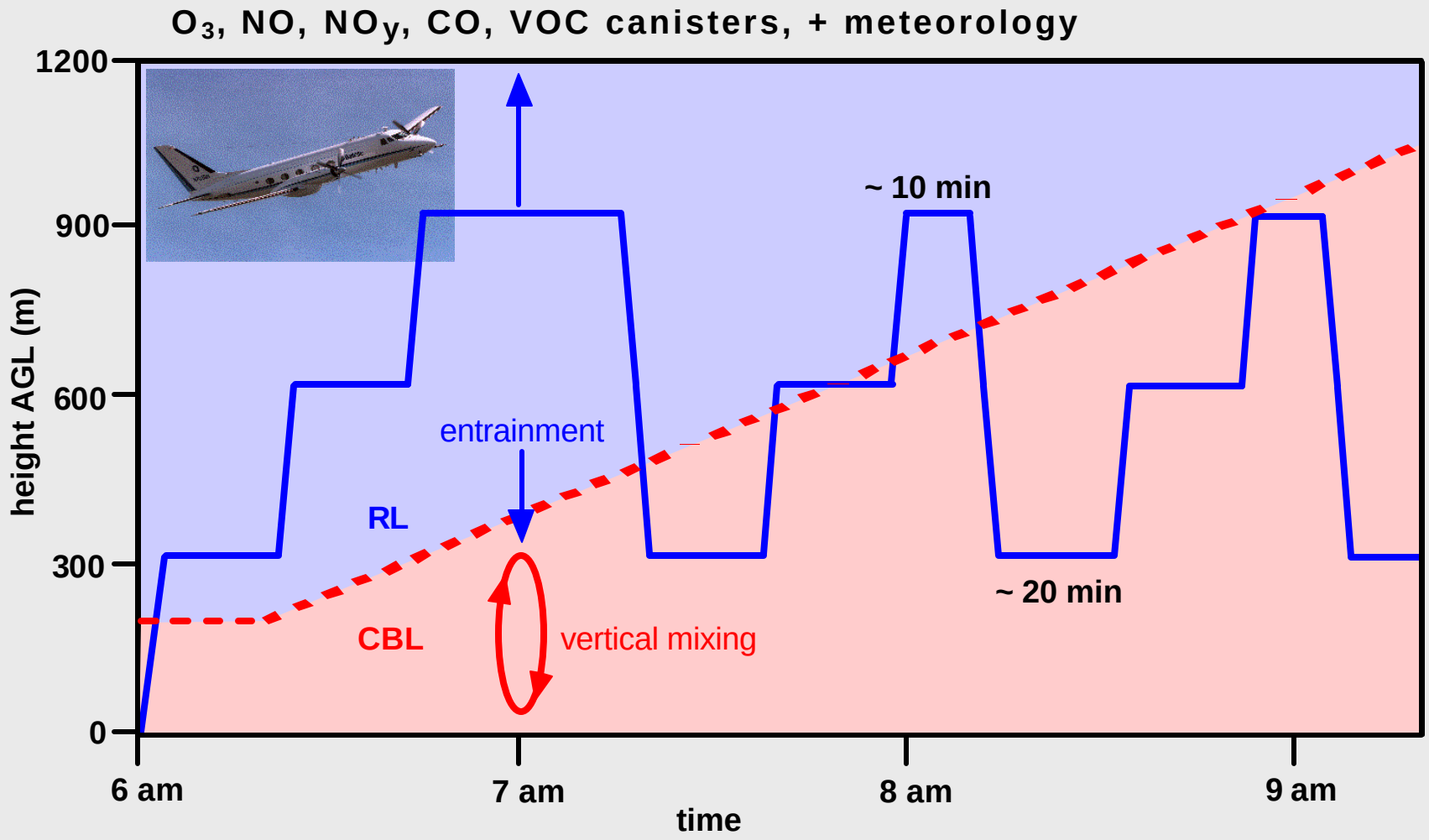
- O_3
- O_3, CO, NO, NO_2, NO_x
- O_3, CO, PM
- O_3, PM
- PM

ADEQ Supersite





Aircraft Measurements



15 flights, 1 per day, between 12 June and 3 July

Building Measurements

Observation deck: ~ 580 ft AGL

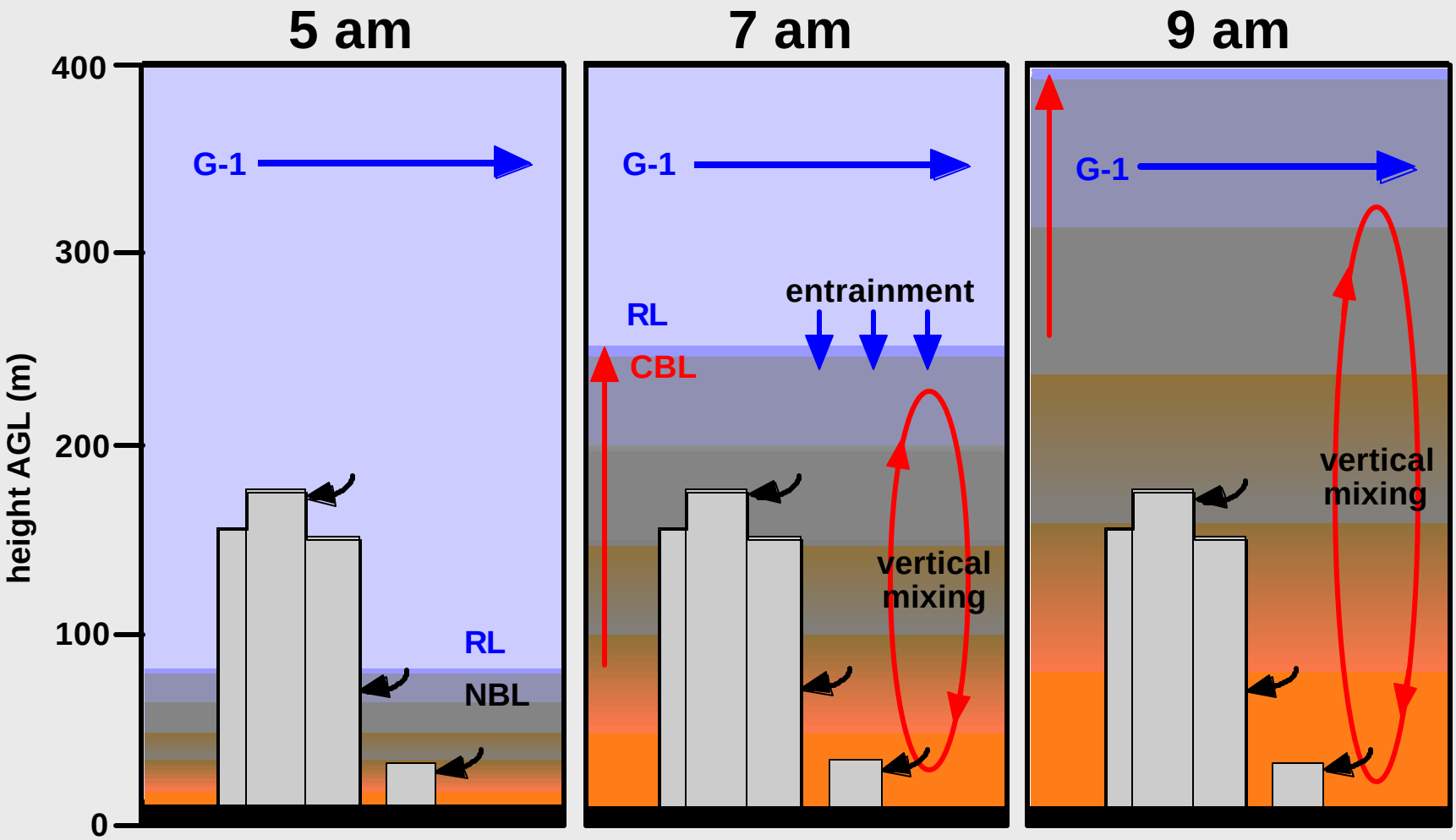
- O_3, NO, NO_y, CO, PAN, Neph., NO_3
- VOC canisters
- DOAS: O_3, SO_2, NO_2, HCHO, HONO, NO_3
- total reflection X-ray fluorescense spectrometer - aerosol composition

Utility Rooms: ~ 240 ft AGL

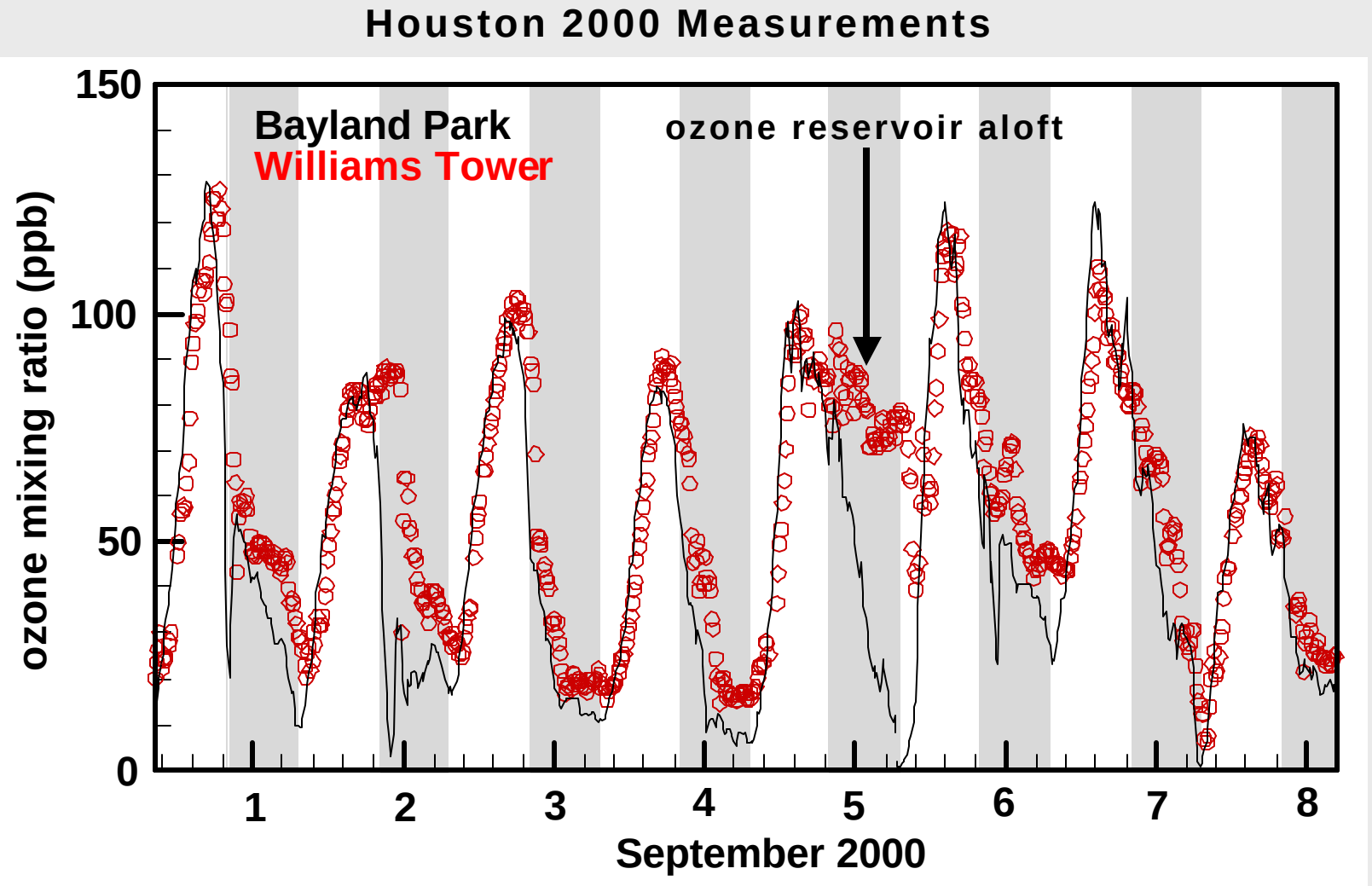
- O_3, NO, NO_y, CO, PAN, HONO, HNO_3, HCHO, Neph.
- VOC canisters
- proton transfer mass spectrometer, VOCs
- ion-trap mass spectrometer, VOCs

Building Measurements

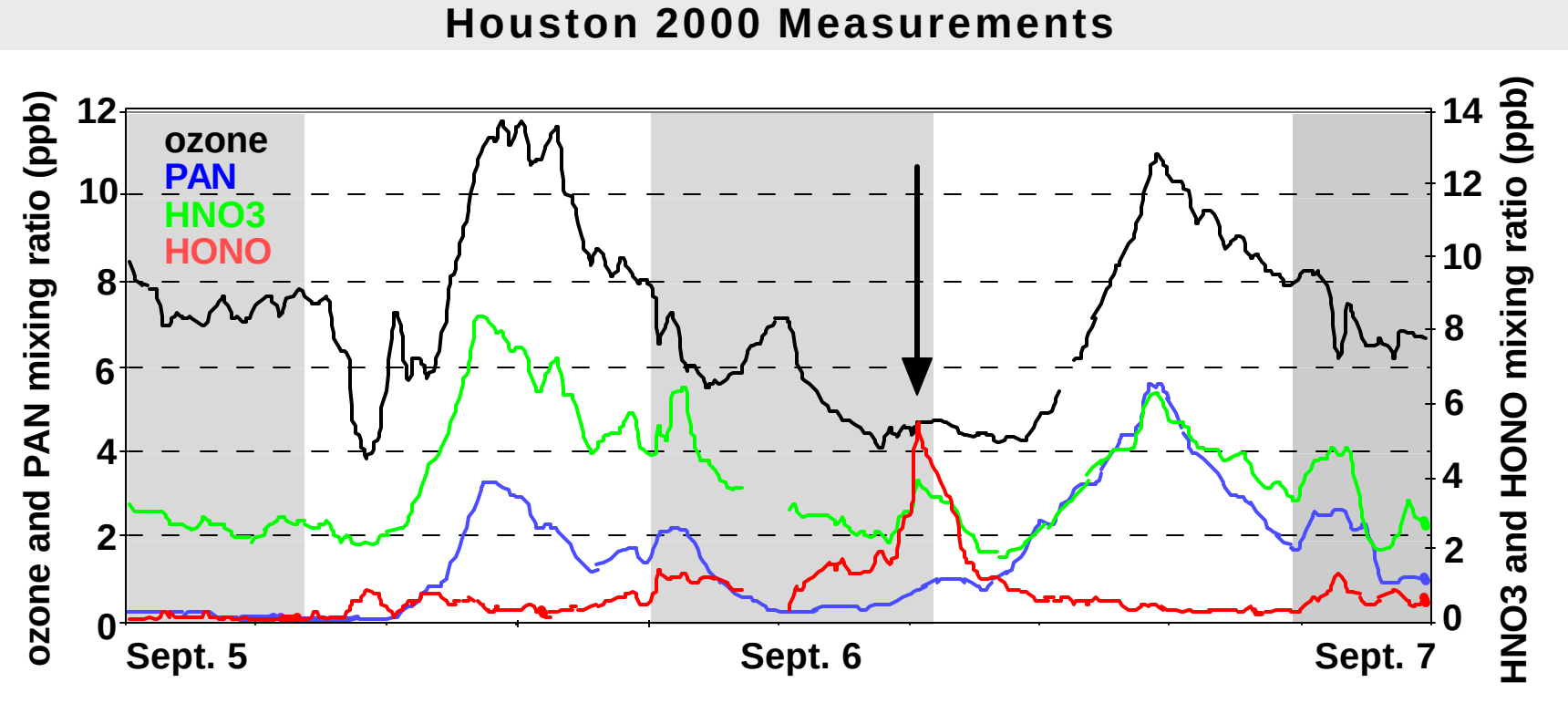
Morning Transition



What do we expect to find?

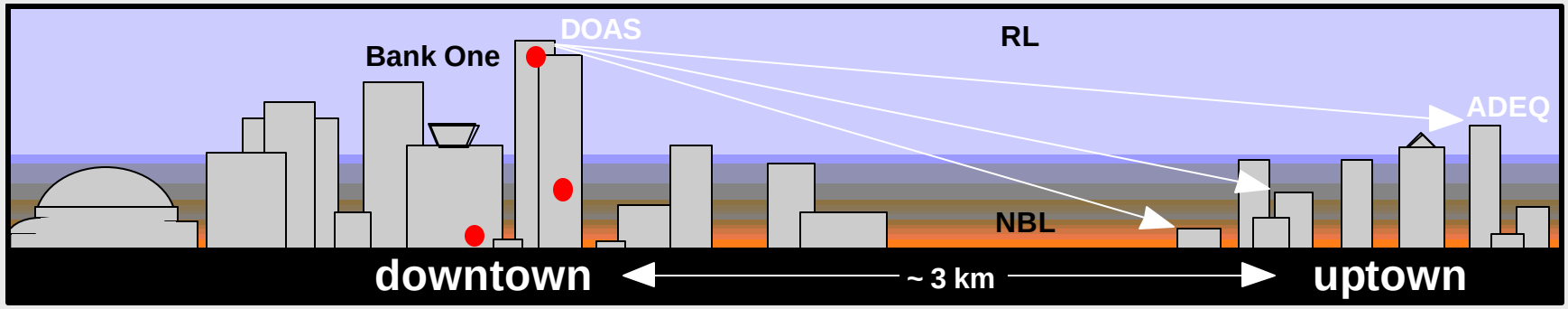


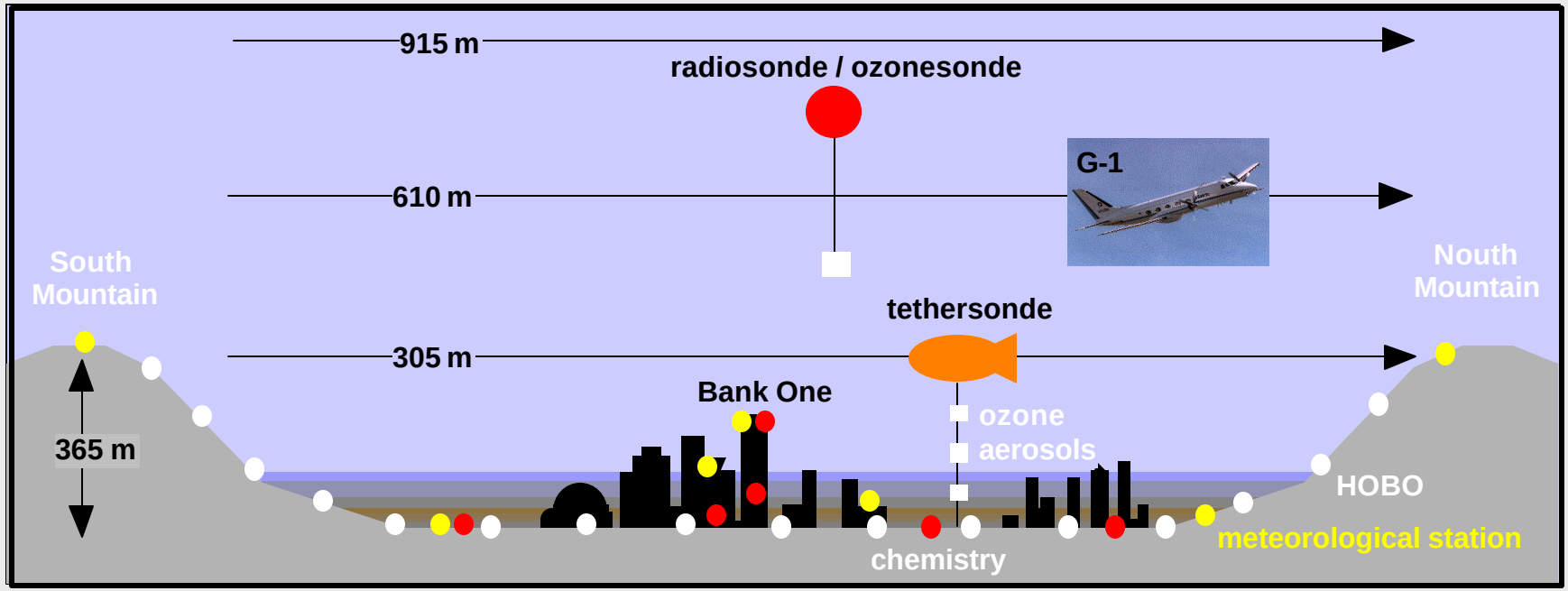
What do we expect to find?



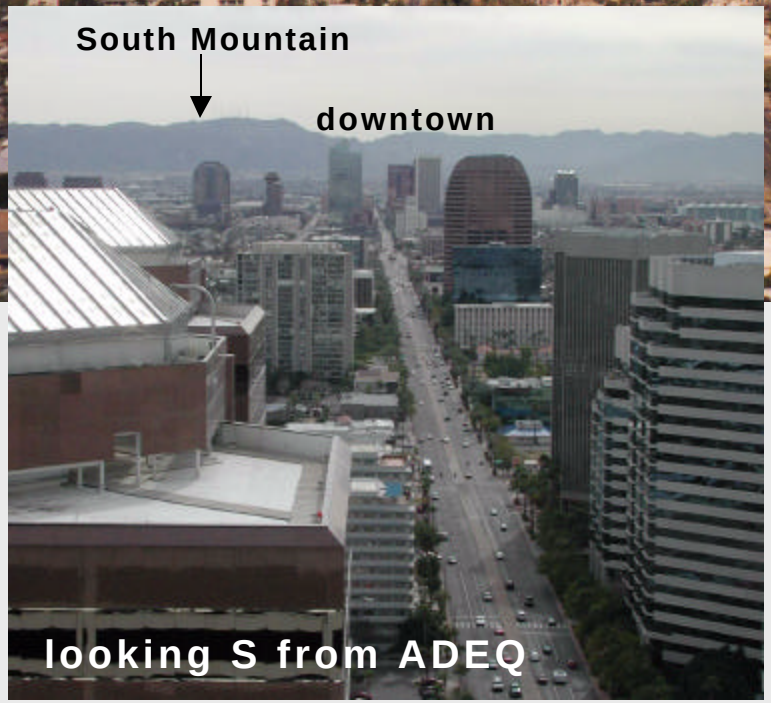
- What nocturnal boundary layer processes contribute to the build-up to NHO_3 and HONO?
- Do the elevated levels of NHO_3 and HONO affect ozone production during the morning?

Field Campaign Design





Central Phoenix



Summary

- A field campaign will be conducted in Phoenix between 12 June and 3 July 2001 to characterize the local nighttime accumulation of ozone precursors and their subsequent processing the next morning as the nocturnal boundary layer breaks up.
- Other scientists wishing to participate are welcome. Additional measurements of O_3, NO, NO_2, NO_x, NO_y, VOCs would be useful in the vicinity of downtown or at South Mountain.