TexAQS II Radical Measurement Project (TRAMP)

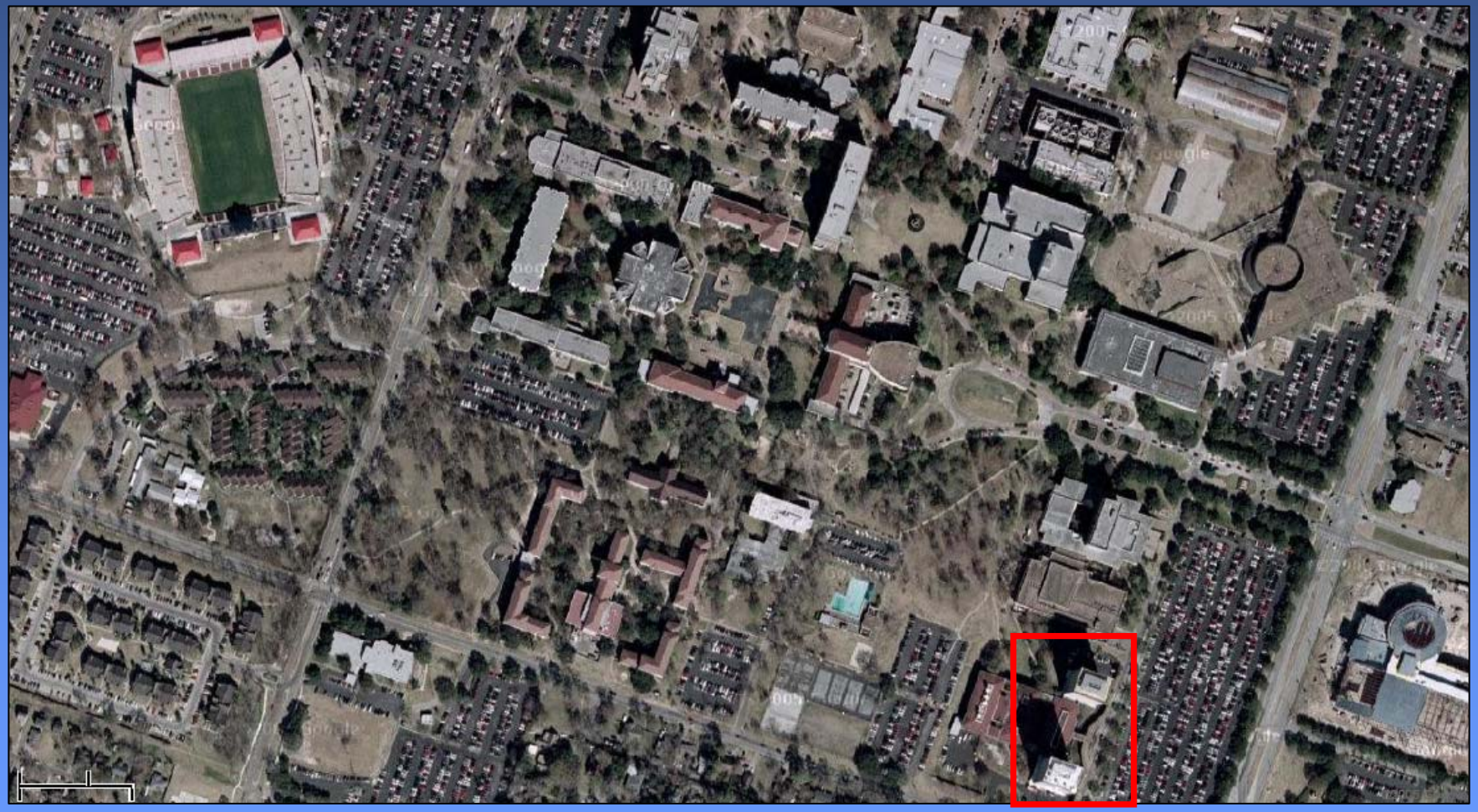
Bernhard Rappenglueck, Barry Lefer

- What are the main sources and sinks for radicals in the urban air of Houston?
- What processes determine the radical budget in the urban air of Houston?
- What are the impacts with regard to the formation of secondary species?
- What are the anthropogenic vs biogenic contributions to photochemical processes in Houston?

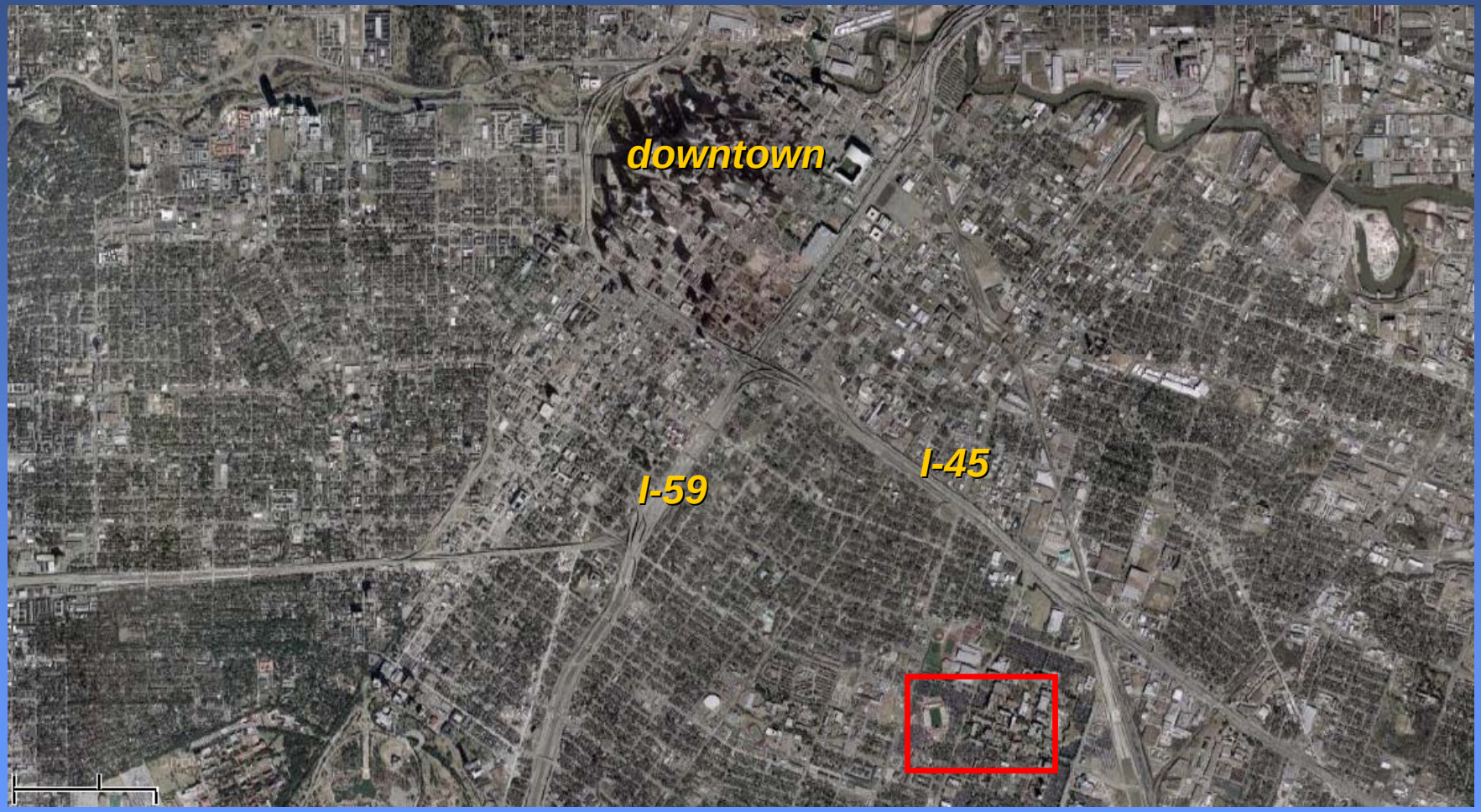
UH Moody Tower

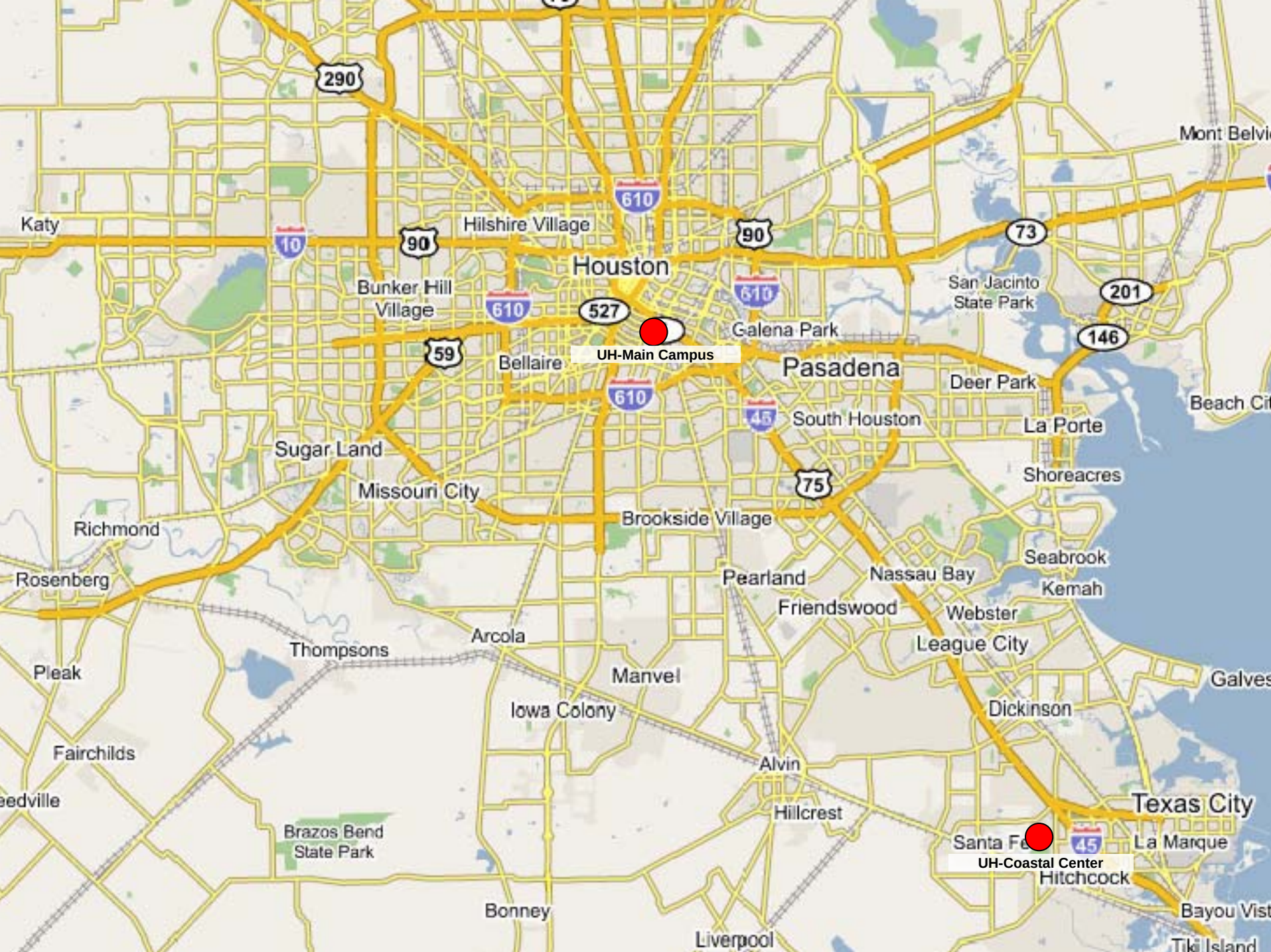
- 18 story tall building (200 ft tall)
- 30 ft Met Tower
- representative site with no direct surface emission impacts

Overhead View UH Campus



Overhead View Downtown




UH-Main Campus
UH-Coastal Center
Houston
Pasadena
Texas City
Katy
Hilshire Village
Bunker Hill Village
Galena Park
Bellaire
Deer Park
South Houston
La Porte
Sugar Land
Missouri City
Shoreacres
Brookside Village
Richmond
Rosenberg
Seabrook
Kemah
Pearland
Nassau Bay
Friendswood
Webster
League City
Arcola
Thompsons
Pleak
Manvel
Iowa Colony
Dickinson
Fairchilds
Alvin
Hillcrest
Brazos Bend State Park
Santa Fe
La Marque
Hitchcock
Bonney
Liverpool
San Jacinto State Park
Mont Belvi
Beach Cit
Galves
Bayou Vist
Tiki Island
290
610
10
90
73
201
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527
59
45
75

View NNE

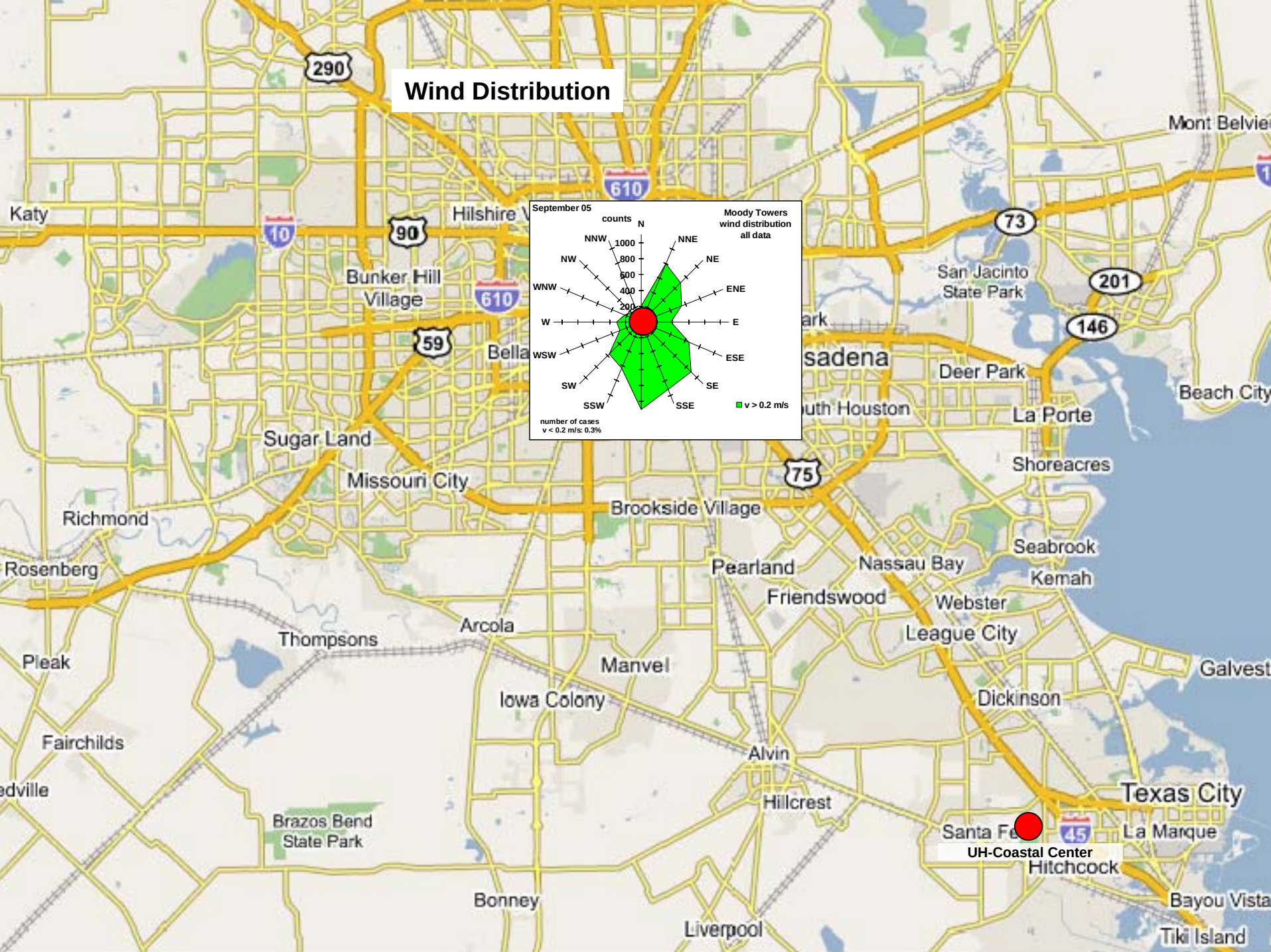
View West

View SW

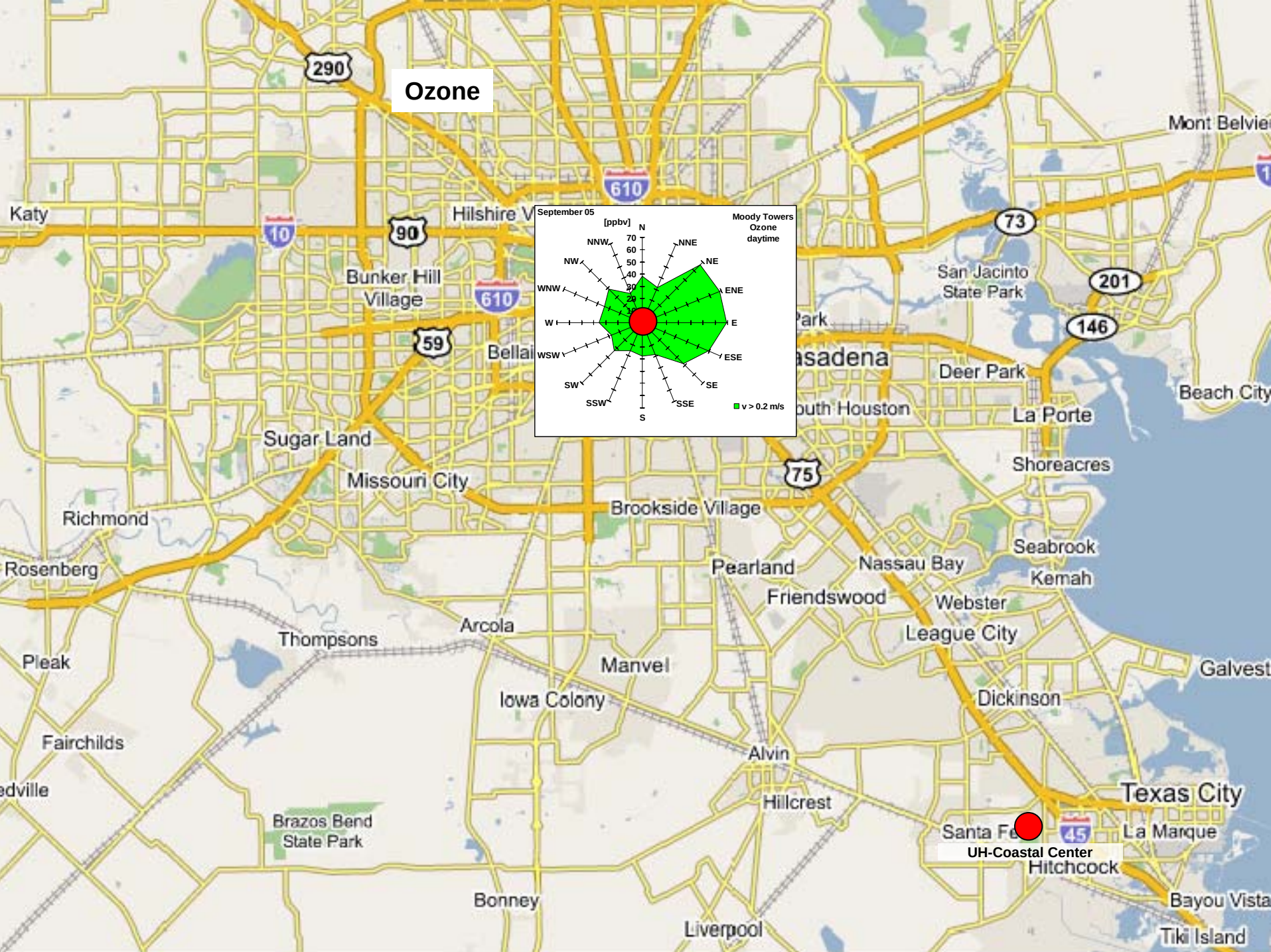
View S

View ENE

Wind Distribution



Ozone


September 05
[ppbv]
Moody Towers
Ozone
daytime
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
70
60
50
40
30
20
10
v > 0.2 m/s
UH-Coastal Center
Katy
Hilshire V
Bunker Hill Village
Bellai
Sugar Land
Missouri City
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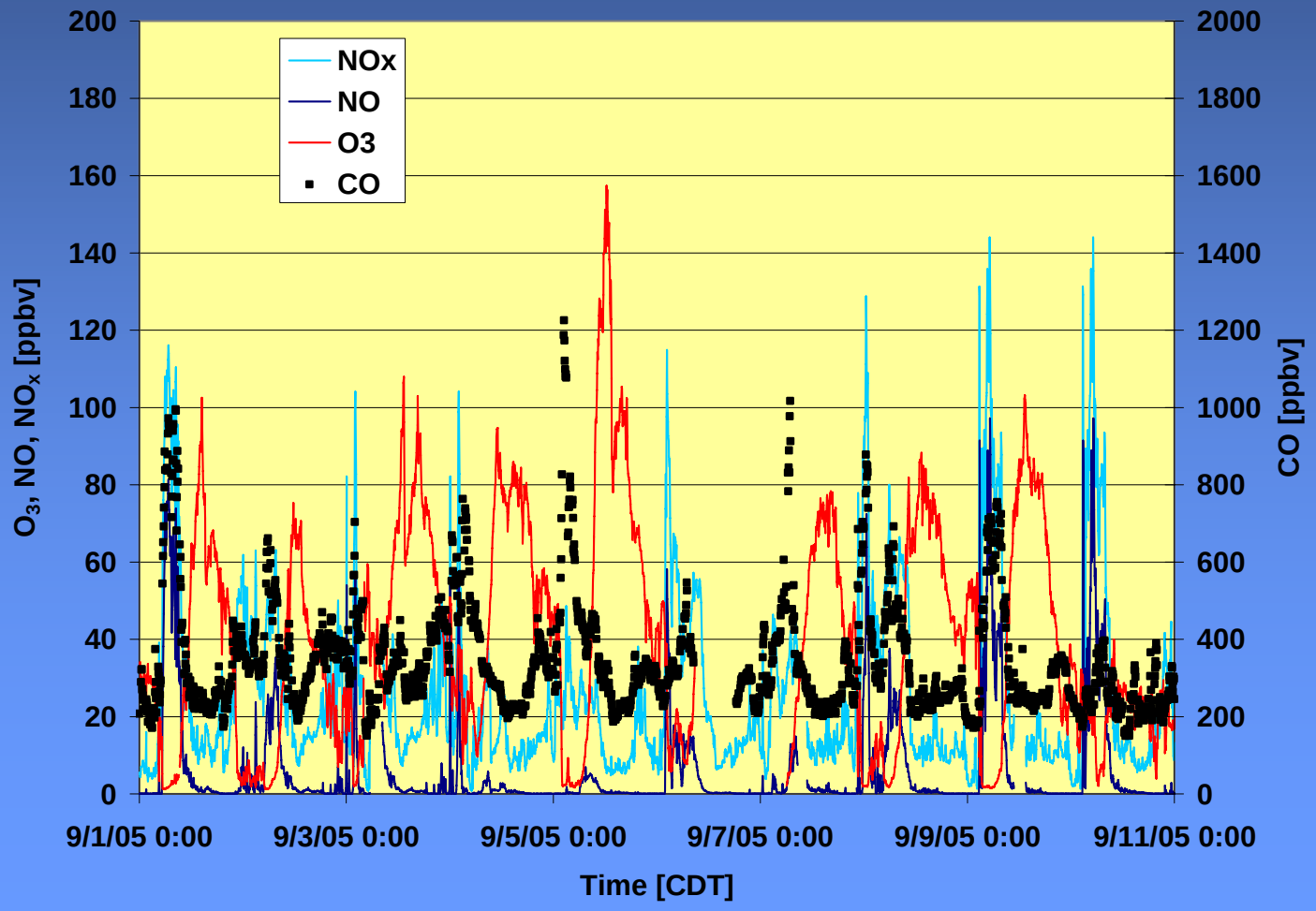
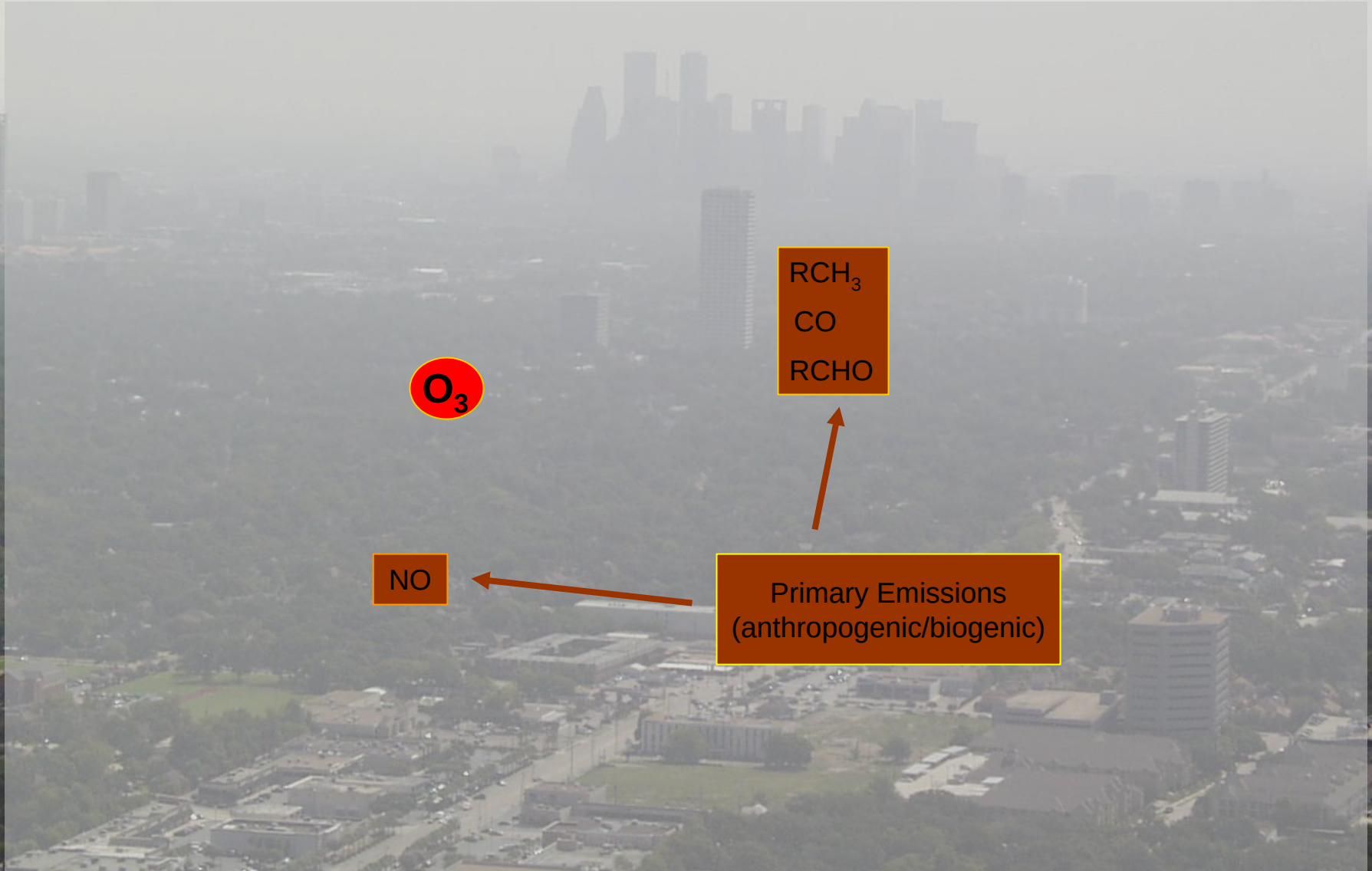
Moody Towers

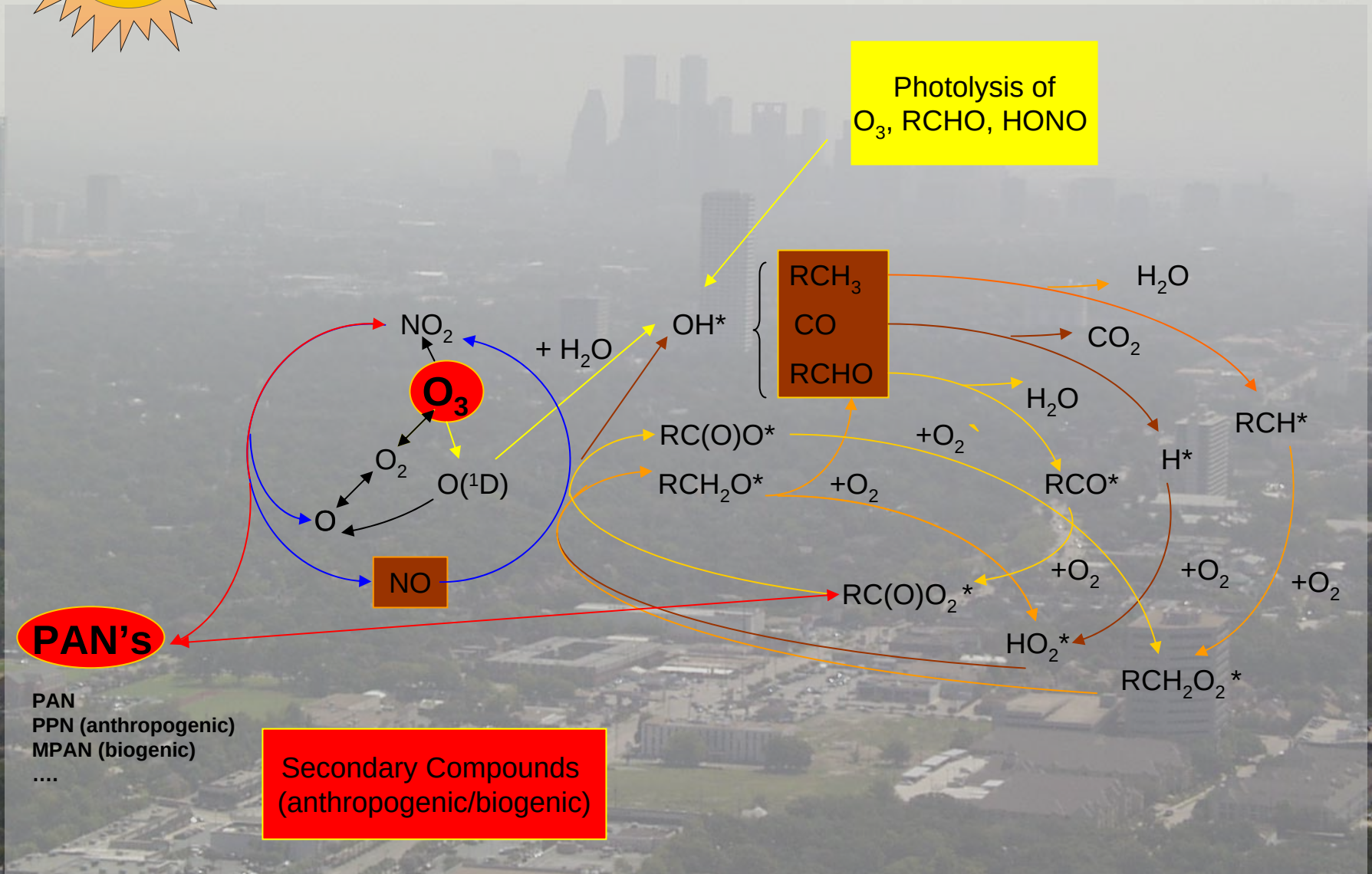
– **10-day time series**
  - **significant diurnal variations of trace gases – maximum O_3 values comparable to surface sites**



Photochemical Processes



Photochemical Processes



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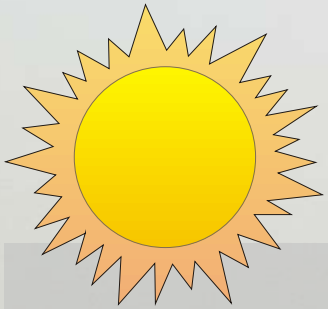
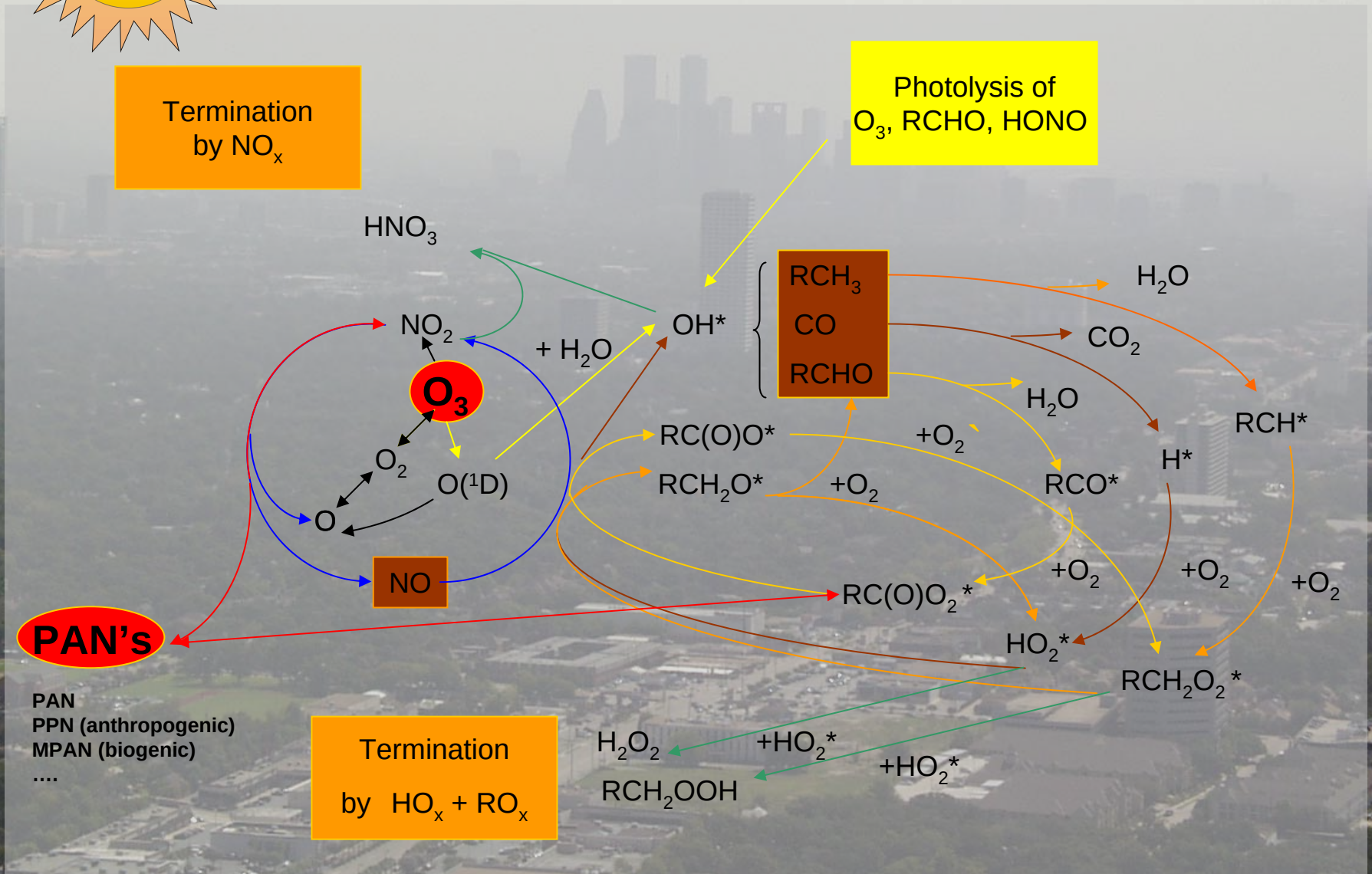


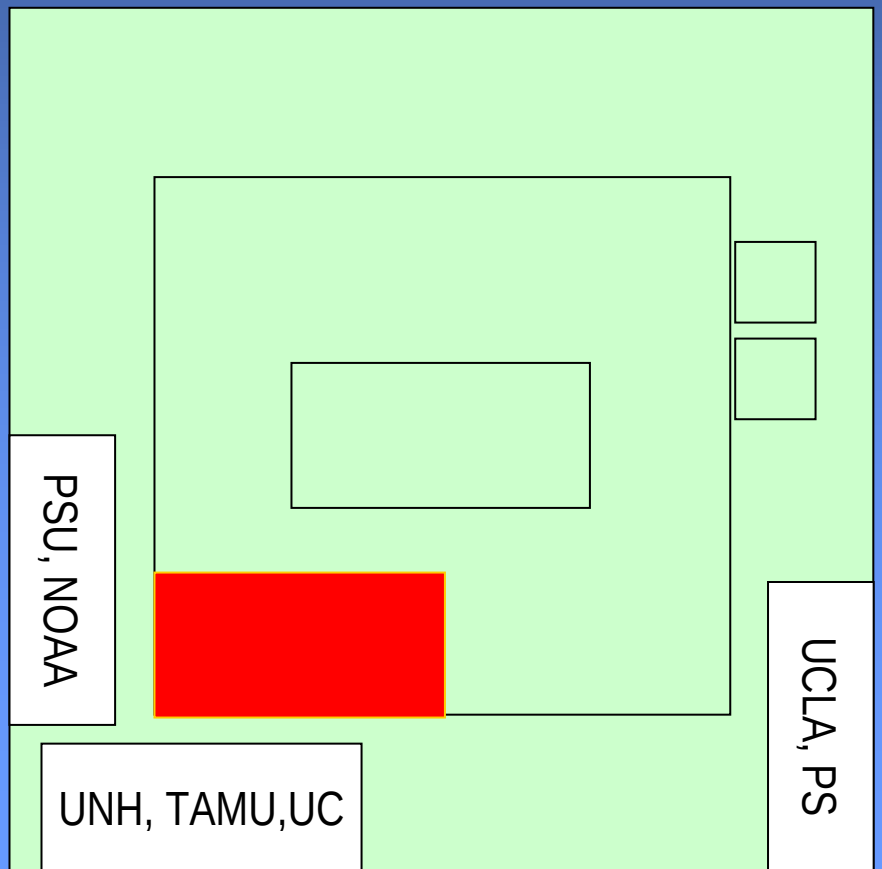


Moody Tower Measurements

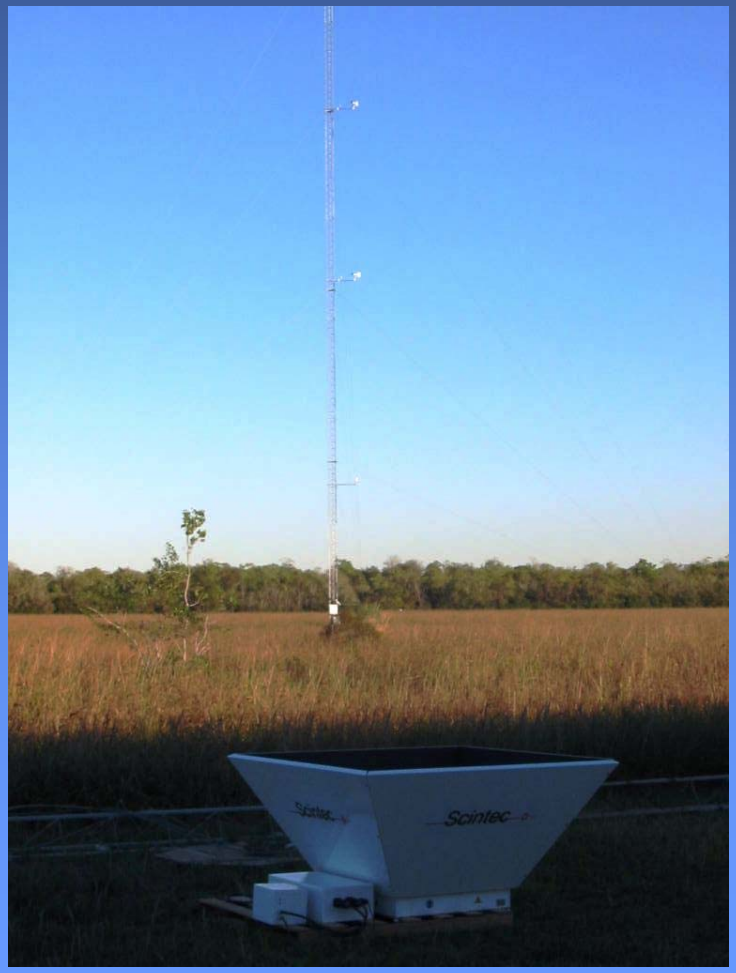
- O_3,CO, NO, NO_2, PAN, PPN, MPAN, online VOC, offline VOC (UH)
- photolysis of O_3, NO_2, HONO, HCHO and 20 other important photolysis reactions (UH)
- Meteorological parameters (UH)
- AOD at UV/VIS/IR wavelengths, Overhead O_3 Column (UH)
- Cloud Camera (UH)
- H_2O_2 and Methylhydroperoxide (UH)
- Aerosol size distribution, Aerosol Mass Spectrometer, EC/OC (R. Griffin, UNH)
- HNO_3, HONO, HCOOH, CH_3COOH (J. Dibb, UNH)
- DOAS, vertical gradient measurements O_3, NO_2, NO_3, N_2O_5, HONO, HCHO (J. Stutz, UCLA)
- OH, HO_2, RO_2 (W. Brune, PSU)
- PTr-MS oxy-VOC incl. C_2-C_6 carbonyls, MVK, MACR, methanol, ethanol (R. Zhang, TAMU)
- HNO_3, NO_3, N_2O_5 ID-CIMS (R. Zhang, TAMU)
- HCHO, NO_Y, SO_2, elemental, particle bond and reactive gaseous Hg (W. Luke, NOAA)
- Aerosol size distribution, Cloud Condensation Nuclei (P. Chuang, UC-Santa Cruz)
- Aerosol Scattering and Extinction (D. Atkinson, Portland State)
- Other measurements

Moody Tower

- **Infrastructure:**
  - **Access of host scientists (will receive access cards)**
  - **Project Approved by University and Campus Facilities Committee**
  - **Power: Add additional 200 KW**
  - **Space: Construct 3 Additional Built-in-Place structures on roof balcony**
  - **Construction Update: Contractors Hired, to be completed 15 May to 01 June**



UH Meteorology Measurements for TexAQS II



Planned schedule for GPS sonde launch from UH main campus

- Twice daily soundings from July through September (184 sondes)

- Four additional soundings on forecasted ozone episode days (assuming 15 episodes, 60 additional sondes)

Daily morning soundings will be at the standard sounding time at 1200 UTC (0600 CST)

- Enable comparison with standard NWS upper air soundings at Lake Charles, LA
- Examine the characteristics and vertical structure of
  - Morning inversion
  - Land breeze
  - Low-level jet

Daily afternoon soundings will be launched between 1300 and 1500 LST

- **Afternoon mixed layer heights**
- **Sea breeze structure**

On forecasted ozone episode days, 6 soundings will be launched at

0600, 0800, 1000, 1200, 1400, 1800 LST

to determine the growth rate of the morning mixed layer and the afternoon maximum mixed layer heights

Tethered-balloon ozone profiles

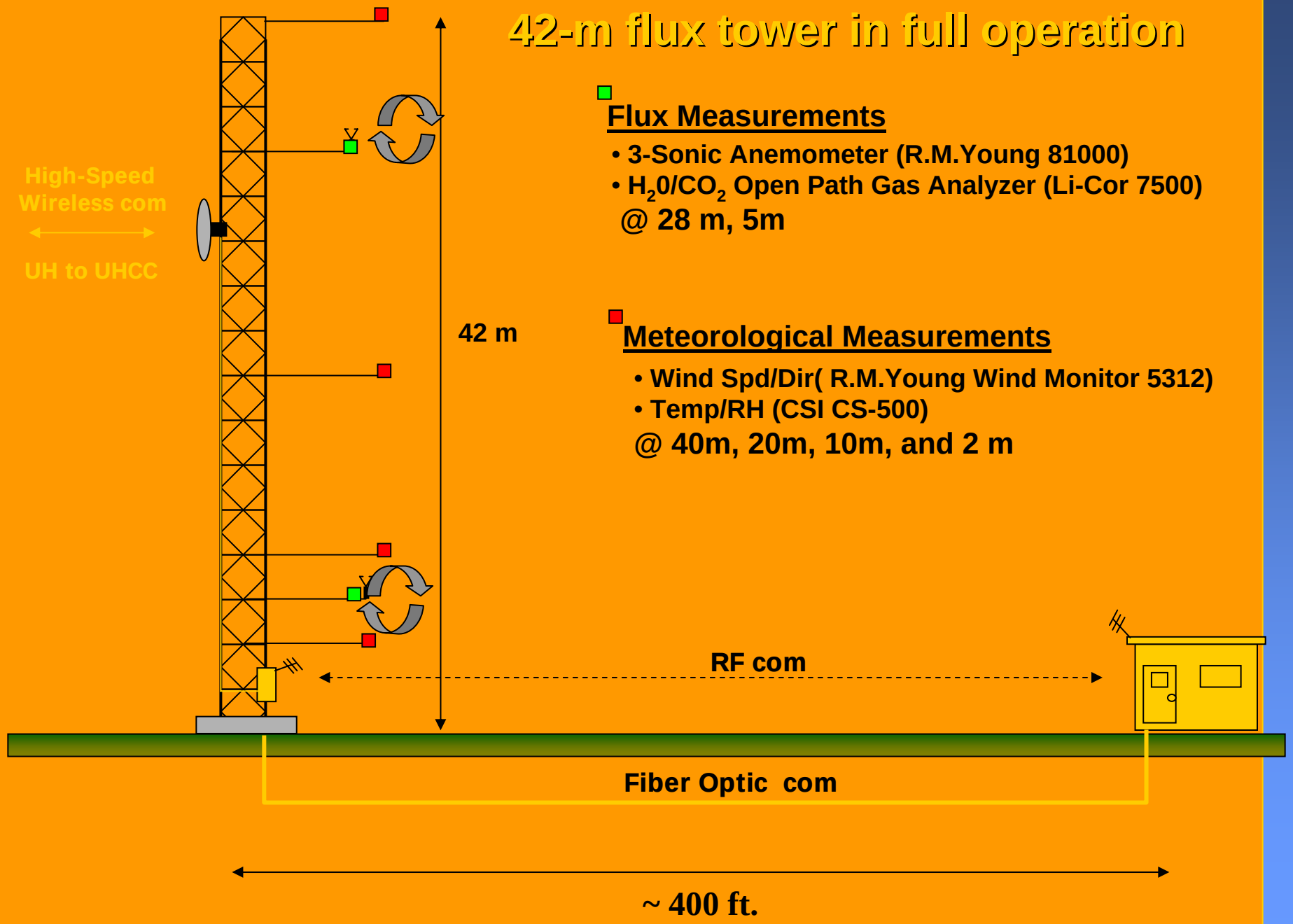
On selected ozone episode days, tethered balloon will be used as a tower to 500 ft with ozone monitors (from UNH) at two levels.

This effort will be coordinated with: UNH Smart Balloon and Ozonesonde Launches (Gary Morris)

Sodar observations of wind and turbulence

Two sodars will be operated continuously from June through September to provide hourly wind profiles from 30 m to 500 m AGL. One will be located on UH main campus and another will be at the Coastal Center to support chemistry measurements at the two locations.

42-m flux tower in full operation



Flux Measurements

- 3-Sonic Anemometer (R.M.Young 81000)
- H_20/CO_2 Open Path Gas Analyzer (Li-Cor 7500)

@ 28 m, 5m

Meteorological Measurements

- Wind Spd/Dir(R.M.Young Wind Monitor 5312)
- Temp/RH (CSI CS-500)

@ 40m, 20m, 10m, and 2 m