Weekend/Weekday Ozone Study in the South Coast Air Basin

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Technical and Logistical Assistance

- South Coast Air Quality Management District
- California Air Resources Board
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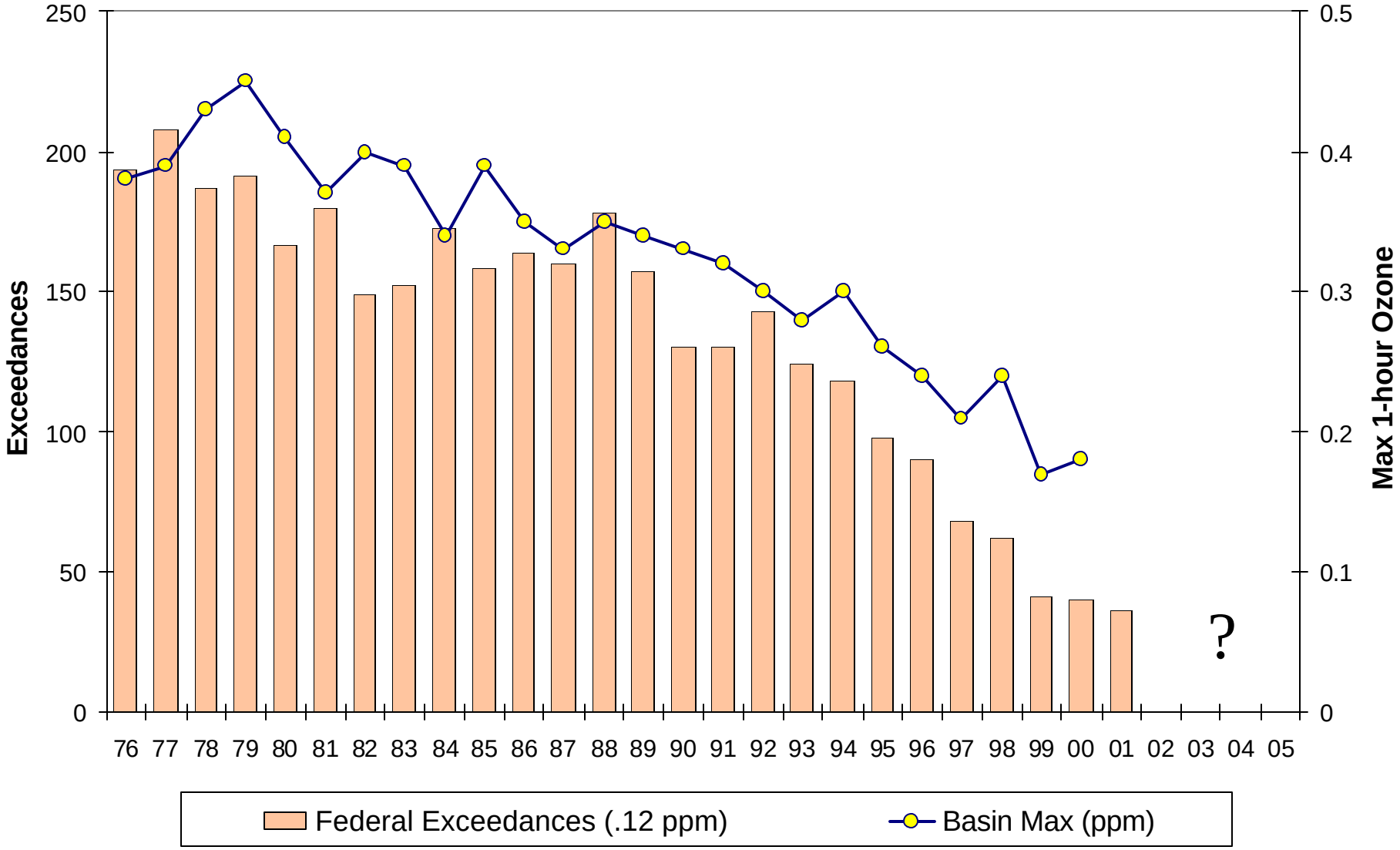
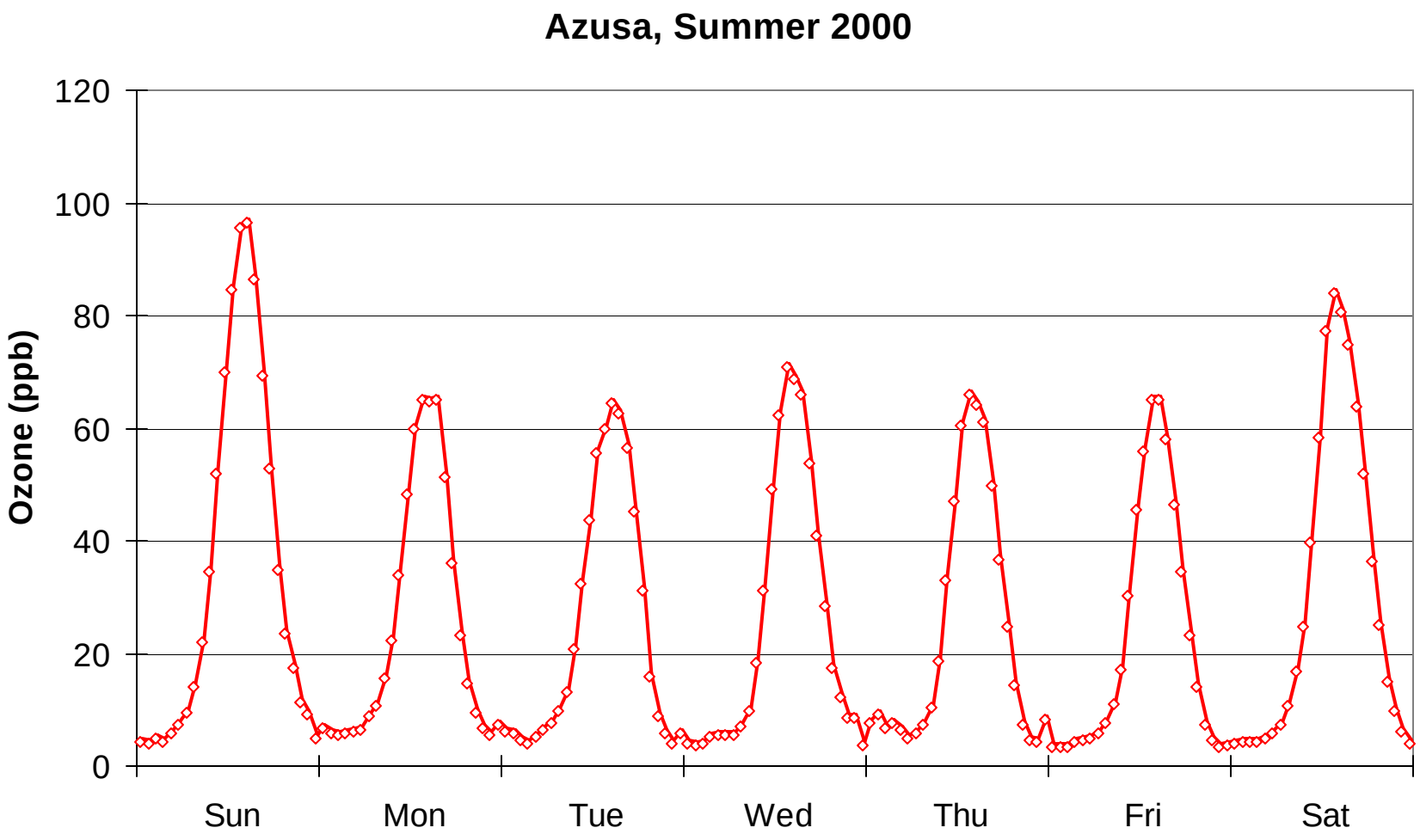
Overview of Presentation

- Trends of Ozone and Precursor (VOC and NOx) Concentrations in the South Coast Air Basin (SoCAB)
- Day-of-Week Variations in Ozone and Precursor Concentrations
- Factors that explain the trends in the weekend/weekday differences in ozone
  - 1) inhibition of ozone formation by NO
  - 2) rate of ozone formation
- Source Apportionment of Ozone Precursors, NOx and Hydrocarbons
- Photochemical Box Model Results

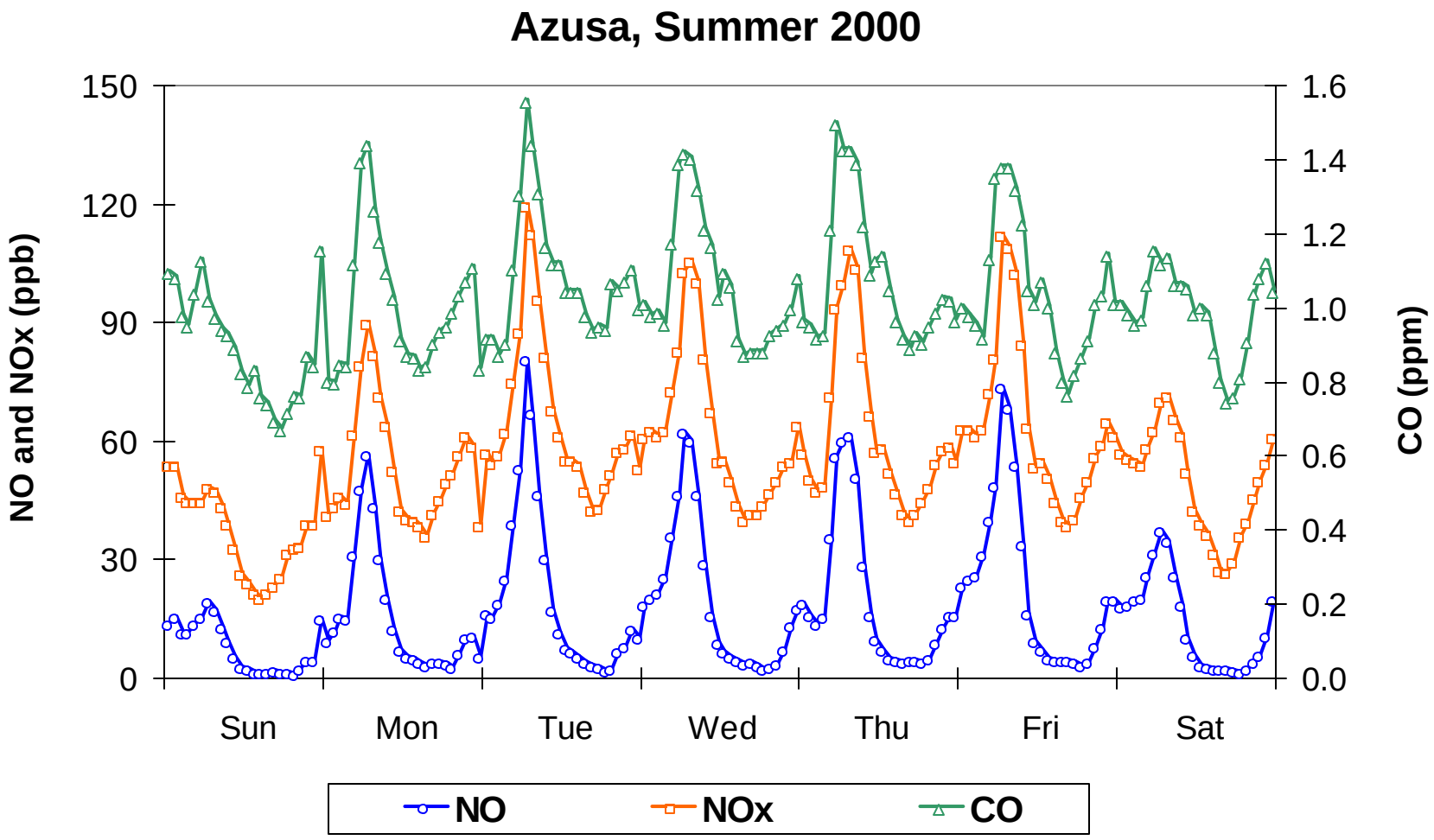
Trends in Maximum 1-hour Ozone and Number of Annual Exceedances of the Federal 1-hour Ozone Standard in the SoCAB from 1976 to 2001



Mean Weekly Variations in Ozone

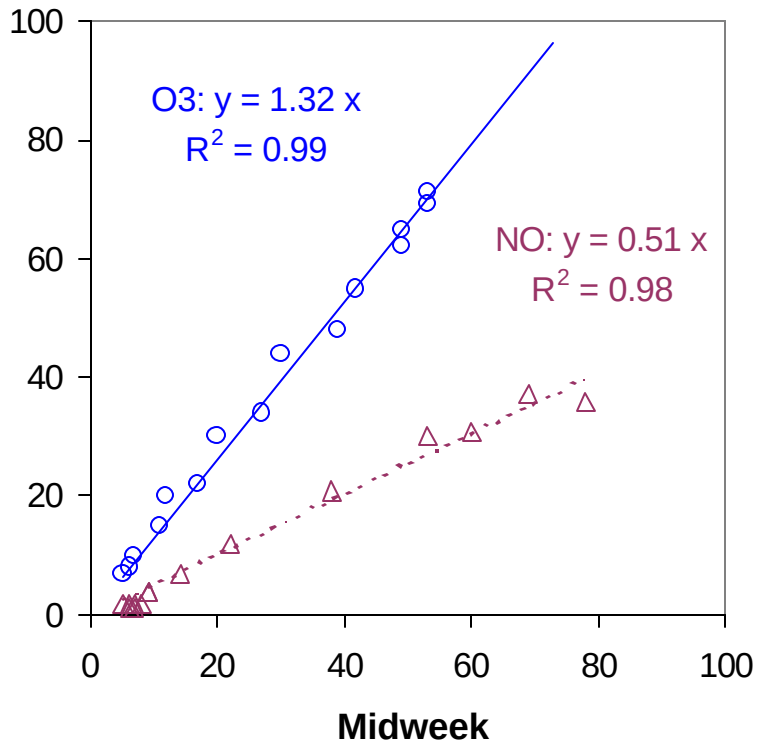


Mean Weekly Variations in NO, NOx and CO

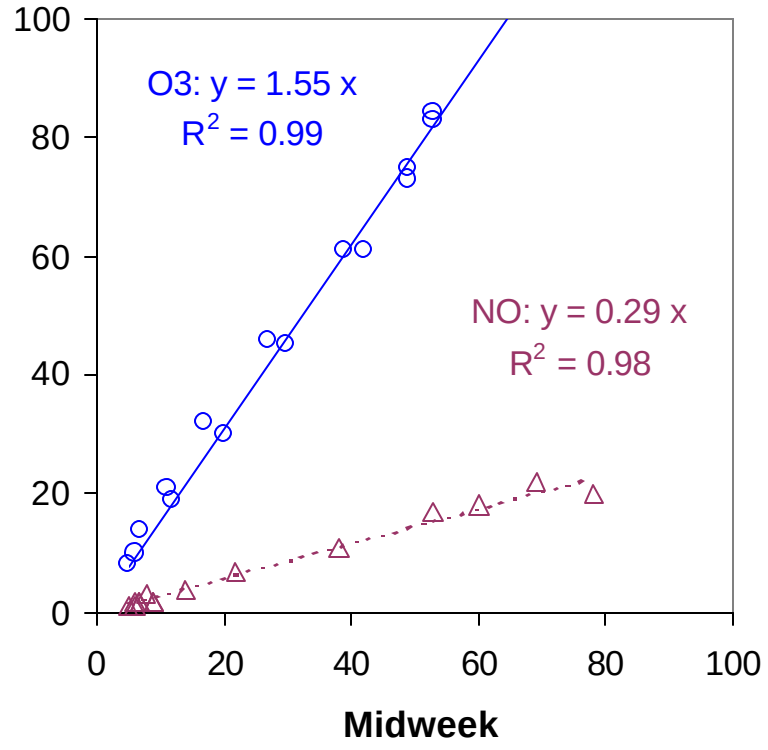


Correlations of Saturday and Sunday Versus Midweek*
Hourly Daytime (0600 to 2000, PDT) O_3 and NO at Azusa, 1999-2000

Saturday

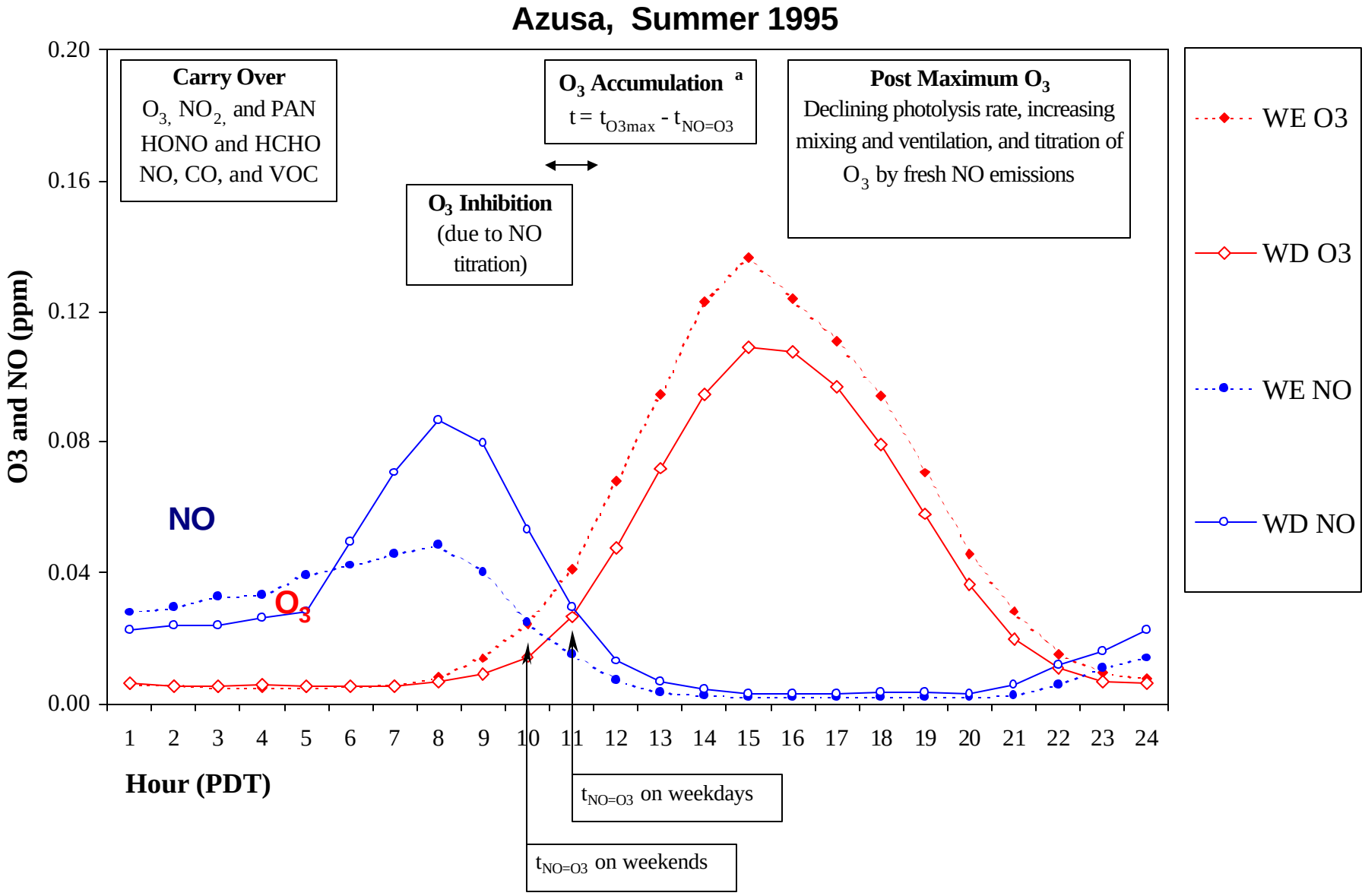


Sunday

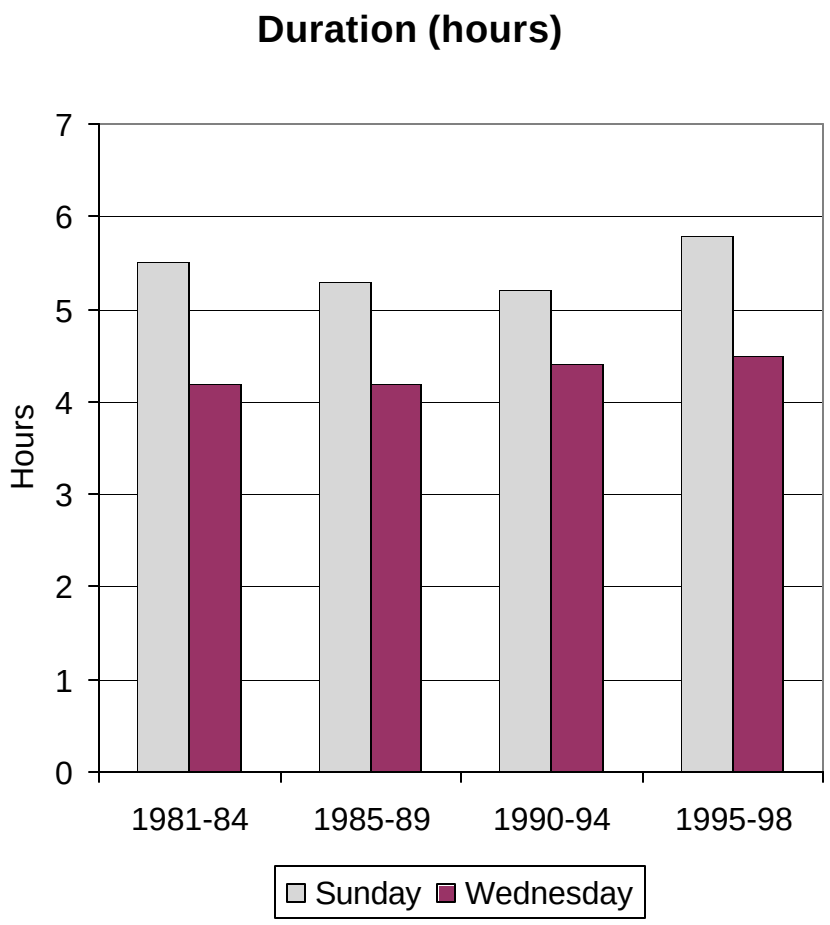


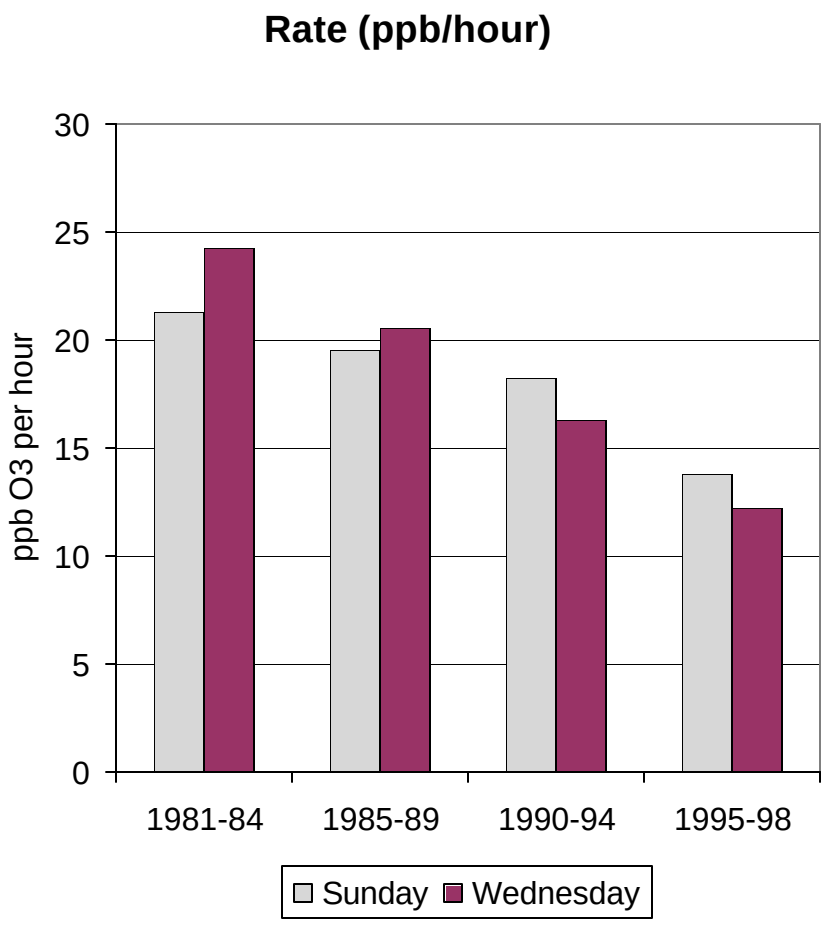
NOx emissions are 50% and 70% **lower** on Saturdays and Sundays, respectively, than on weekdays; ozone is 32% and 55% **higher** on Saturdays and Sundays than on weekdays.

* Tuesday to Thursday

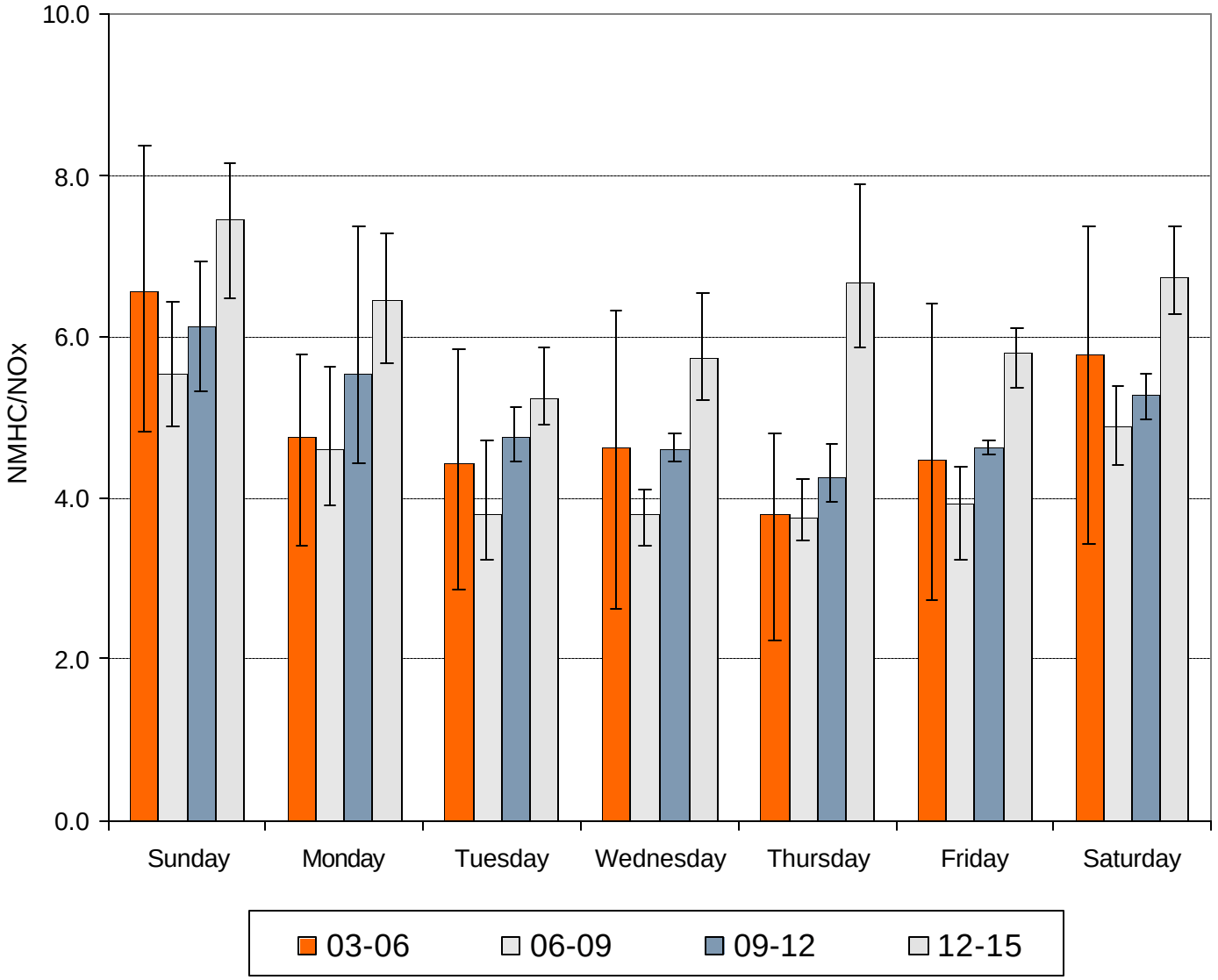

Azusa, Summer 1995
Carry Over
O3, NO2, and PAN
HONO and HCHO
NO, CO, and VOC
O3 Accumulation a
t = tO3max - tNO=O3
O3 Inhibition
(due to NO
titration)
Post Maximum O3
Declining photolysis rate, increasing
mixing and ventilation, and titration of
O3 by fresh NO emissions
WE O3
WD O3
WE NO
WD NO
NO
O3
O3 and NO (ppm)
0.20
0.16
0.12
0.08
0.04
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour (PDT)
tNO=O3 on weekdays
tNO=O3 on weekends

Duration and Rate of Ozone Accumulation
Mean of 12 sites in SoCAB, 1981-98





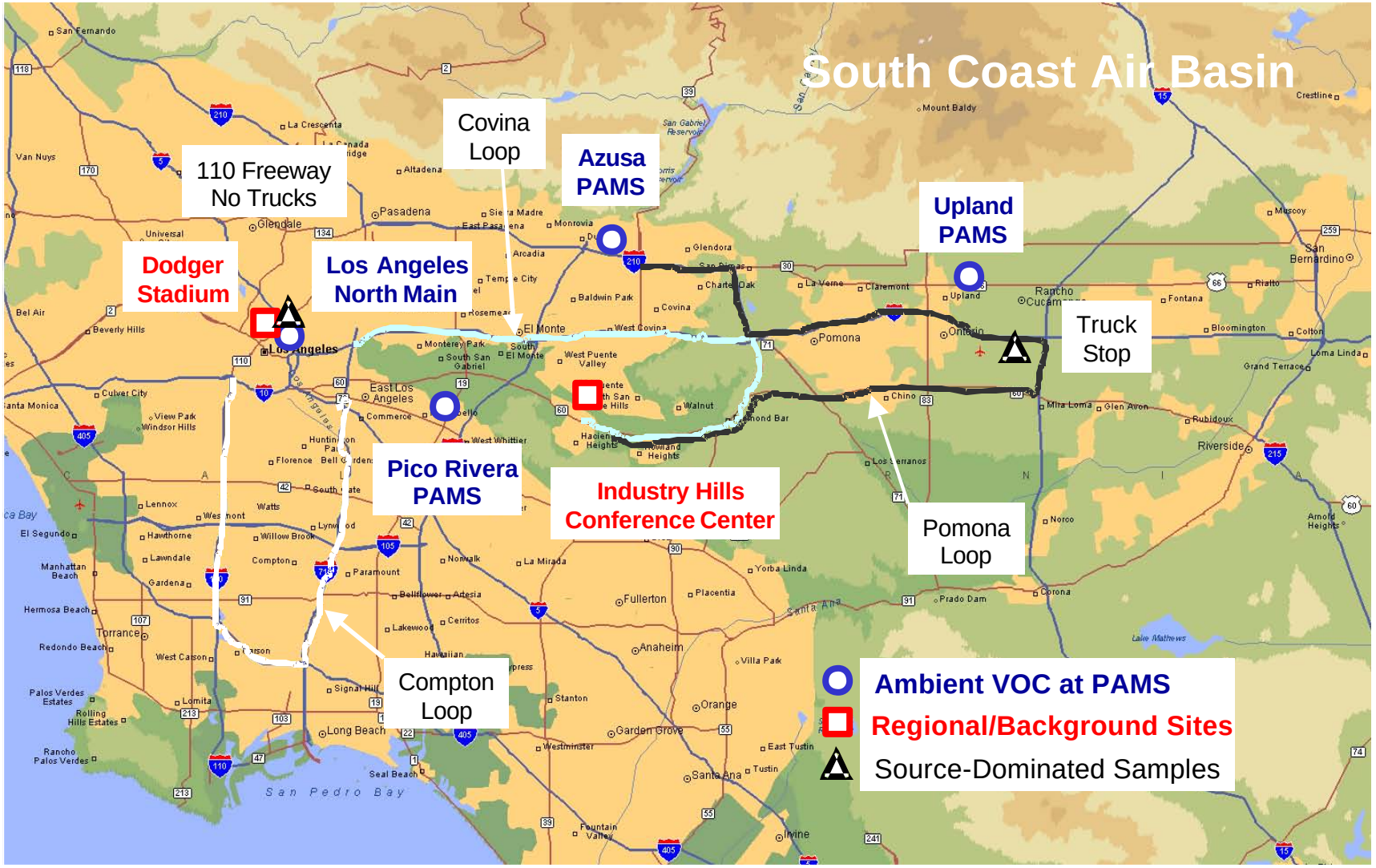
Weekday Variations in NMHC/NOx by Period
Four-Site Means and Standard Deviations of the Means



SUMMARY PART 1 OF 2

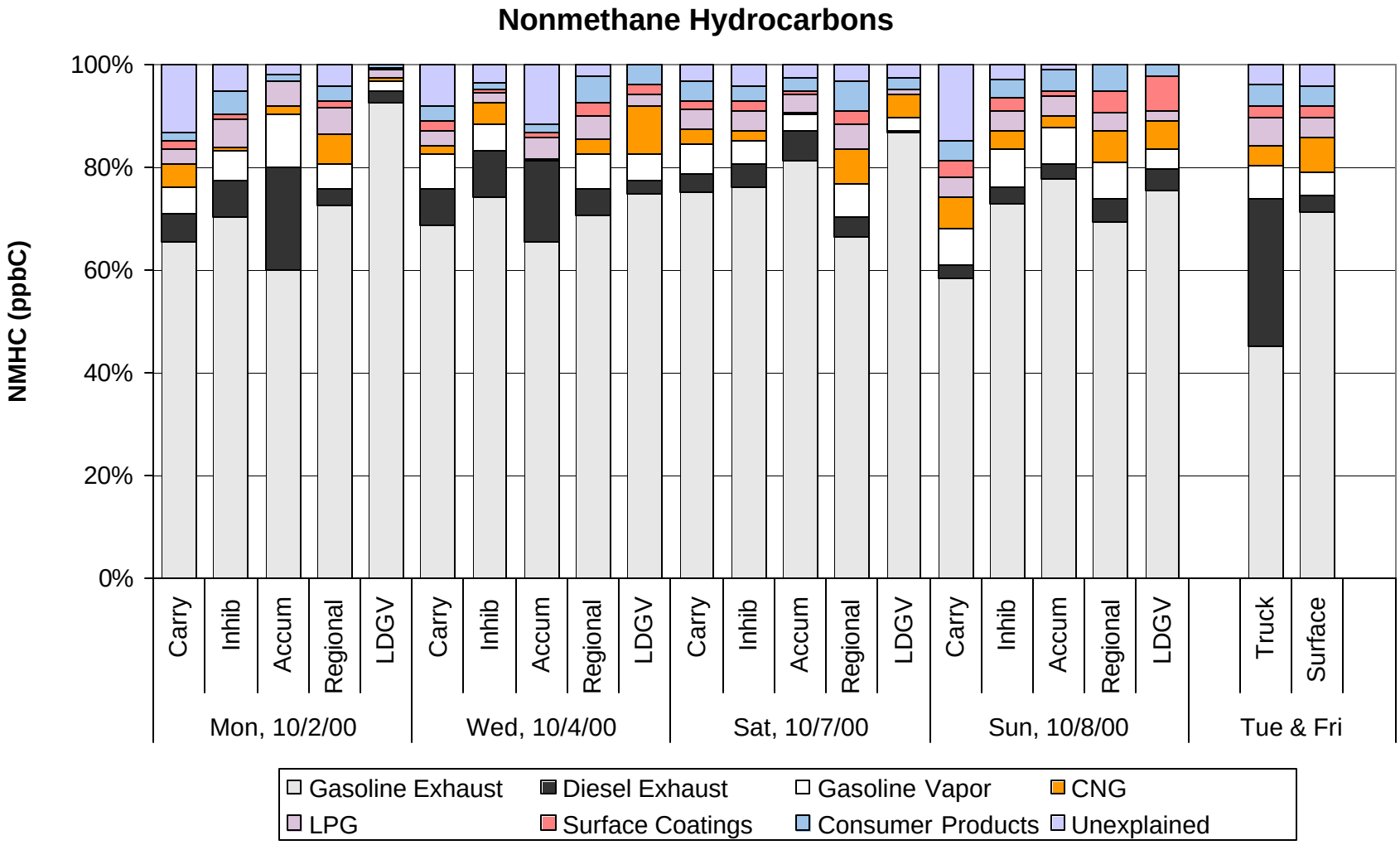
1. While ozone levels have dropped sharply in the SoCAB, highest levels now occur more frequently on weekends, with highest values on Sundays.
2. The decrease in ozone precursor concentrations on weekends is proportionately greater for NO than NMHC resulting in higher NMHC/NOx ratios.
3. Current (1999-2000) NMHC/NOx ratios in SoCAB are about half of the ratios in 1987. This decrease in ratios (and hence a decrease in ozone) is due primarily to reductions in NMHC, not decreases in NOx.
4. Ozone is higher on weekends in the SoCAB for two reasons: 1) lower early morning NOx emissions, resulting in less titration or removal of morning ozone; and 2) higher VOC or NMHC/NOx ratios, resulting in higher ozone accumulation rates.

Sampling Locations During the Fall 2000 Field Study

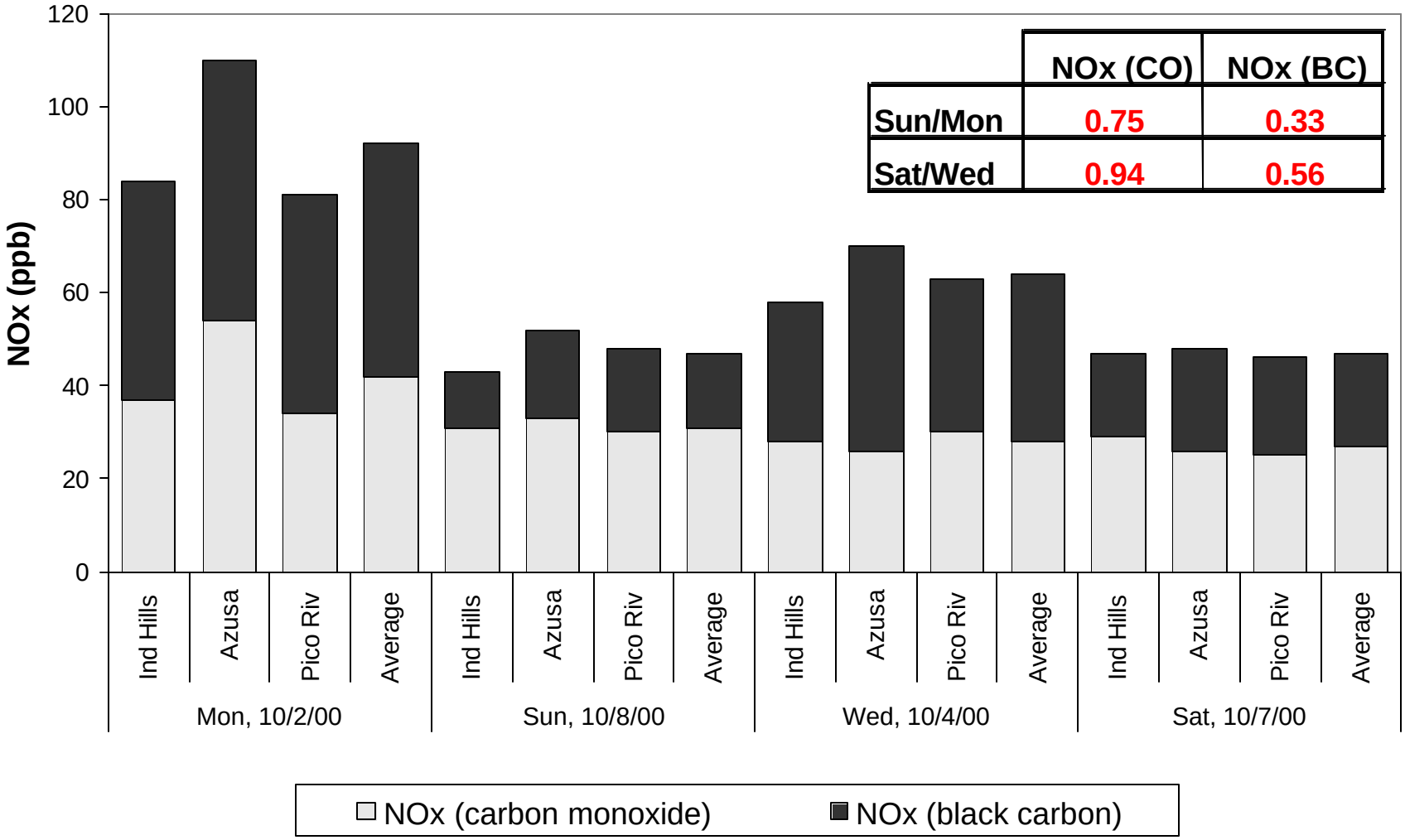


Measurements – NO, NOy, CO, C_2-C_{12} HC, C_8-C_{18} HC, and black carbon

Source Apportionment of NMHC During Fall 2000 Field Study



Weekend/Weekday Differences in Ambient NOx Associated with CO and Black Carbon During 9:00 a.m. to Noon

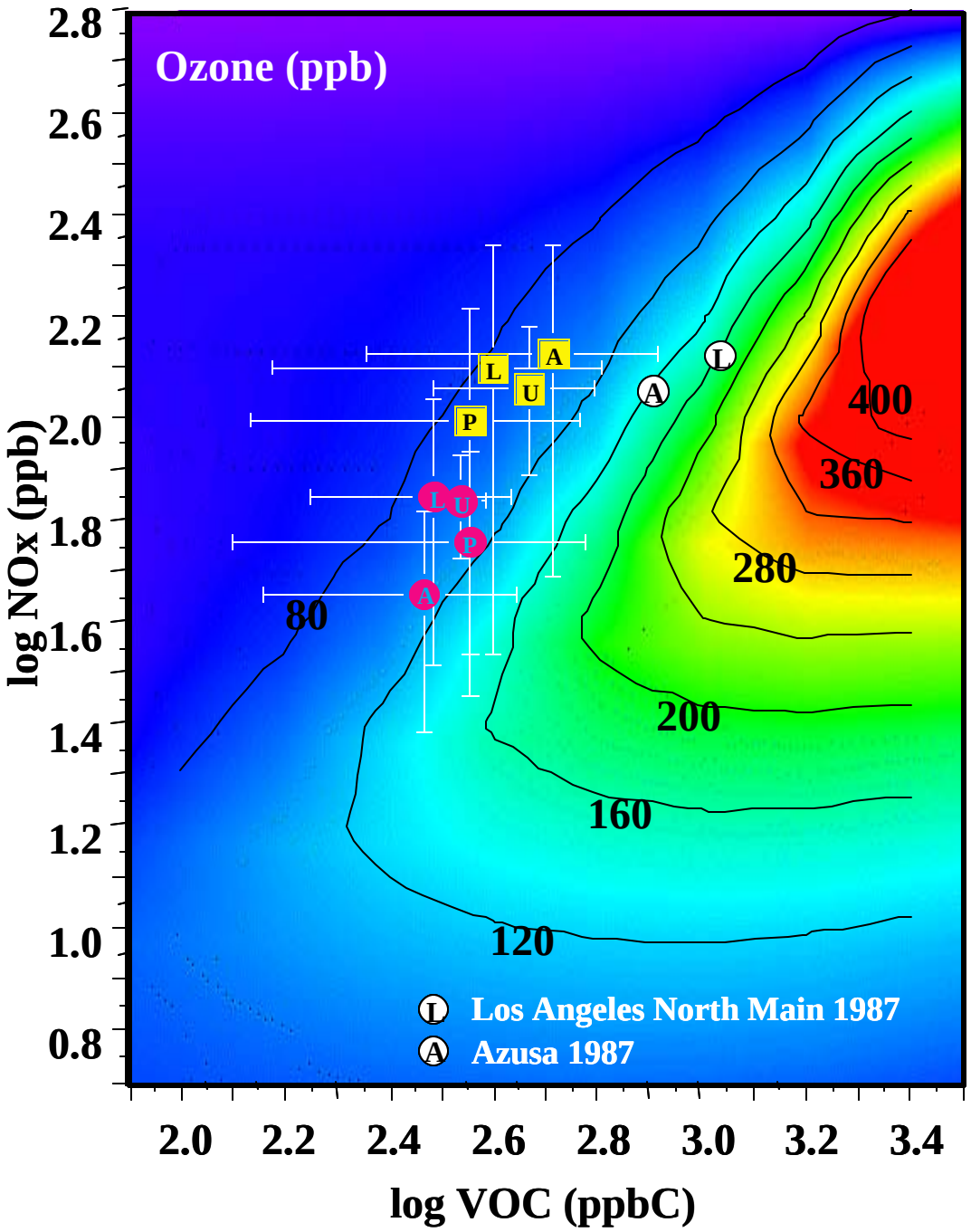


	NOx (CO)	NOx (BC)
Sun/Mon	0.75	0.33
Sat/Wed	0.94	0.56

Mean Wednesday
± 1 sigma

Mean Sunday
± 1 sigma

Monitoring Stations
A – Azusa
L – Los Angeles, N. Main
P – Pico Rivera
U – Upland



SUMMARY PART 2 OF 2

1. Gasoline exhaust and gasoline vapor account for ~80 percent of ambient NMHC in on-road samples and at regional air monitoring locations suggesting that gasoline emissions are responsible for the majority of ozone found in the SoCAB.
2. The majority of reductions in NOx emissions from mobile sources on weekends is associated with less diesel truck traffic.
3. STI investigators project that emissions of VOC and NOx in the SoCAB in 2010 are comparable to weekend emissions in 2000. If these emission projections prove to be accurate, ozone will be higher in 2010 in a large portion of the urbanized areas of SoCAB relative to current levels.
4. Ozone isopleth diagram shows that an ozone disbenefit will result if NOx emissions are decreased at current levels of VOC until ambient NOx levels are decreased by roughly 90 percent to about 10-12 ppb.