10:30:42 OCA PAD INITIATION - PROJECT HEADER INFORMATION 02/20/89

Active

Project #: G-35-624a
Cost share #: G-35-391
Rev #: 0
Center # : R6677-0A0
Center shr #: F6677-0A0
OCA file #:
Work type : RES

Contract#: AGR DTD 2/2/89
Mod #:
Document : AGR
Prime #:
Contract entity: GTRC

Subprojects ? : N
Main project #:

Project unit: GEO SCI Unit code: 02.010.140
Project director(s):
CHAMEIDES W L GEO SCI (404)894-3883
RODGERS M O GEO SCI (404)-

Sponsor/division names: EXXON CORPORATION / BATON ROUGE, LA
Sponsor/division codes: 204 / 040

Award period: 890301 to 900228 (performance) 900228 (reports)

Sponsor amount	New this change	Total to date
Contract value	156,500.00	156,500.00
Funded	156,500.00	156,500.00
Cost sharing amount		20,000.00

Does subcontracting plan apply ?: N

Title: BATON ROUGE OZONE PRECURSOR STUDY

PROJECT ADMINISTRATION DATA

OCA contact: Ina R. Lashley 894-4820

Sponsor technical contact	Sponsor issuing office
GORDON JOLLEY	GORDON JOLLEY
(504)359-8556	(504)359-8556
	EXXON CORPORATION
SAME***	P O BOX 241
	BATON ROUGE LA 70821

Security class (U,C,S,TS) : U
ONR resident rep. is ACO (Y/N): N
Defense priority rating : N/A
N/A supplemental sheet
Equipment title vests with: Sponsor
GIT X
(PER COST-SHARE BUDGET).

Administrative comments -
INITIATION OF COST-REIMBURSEMENT, ONE-YEAR AGREEMENT.

FEB 1989
RECEIVED
SUPPORT SERVICES
OCA

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

NOTICE OF PROJECT CLOSEOUT

Closeout Notice Date 02/14/91

Project No. G-35-624a

Center No. R6677-0A0

Project Director CHAMEIDES W L

School/Lab E & A SCI

Sponsor EXXON CORPORATION/

Contract/Grant No. AGR DTD 2/2/89

Contract Entity GTRC

Prime Contract No.

Title BATON ROUGE OZONE PRECURSOR STUDY

Effective Completion Date 900228 (Performance) 900228 (Reports)

Closeout Actions Required:	Y/N	Date Submitted
Final Invoice or Copy of Final Invoice	Y	
Final Report of Inventions and/or Subcontracts	N	
Government Property Inventory & Related Certificate	N	
Classified Material Certificate	N	
Release and Assignment	N	
Other	N	

Comments

Subproject Under Main Project No.

Continues Project No.

Distribution Required:

Project Director	Y
Administrative Network Representative	Y
GTRI Accounting/Grants and Contracts	Y
Procurement/Supply Services	Y
Research Property Managment	Y
Research Security Services	N
Reports Coordinator (OCA)	Y
GTRC	Y
Project File	Y
Other	N
	N

5 FEB 92

G-35-624a

A GRIDDED INVENTORY OF BIOGENIC HYDROCARBON EMISSIONS FOR THE BATON ROUGE NON-ATTAINMENT AREA

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I. Introduction

The development of an effective ozone abatement strategy in any urban area first requires reliable estimates of all sources of hydrocarbons and nitrogen oxides to the area's air-shed. In sylvan cities, it is important that these estimates include one for biogenic or natural hydrocarbons since these species have been found to react in the atmosphere in a manner roughly analogous to that of anthropogenic hydrocarbons and, in the presence of nitrogen oxides, can produce ozone (c.f., Chameides, et al, 1988). In this work we summarize the results of a study of natural hydrocarbon emissions in the Baton Rouge non-attainment area. Our results are presented in two formats: Total inventories for the entire area are presented in tabular form and a gridded inventory (using an array of 6400 2km x 2 km boxes identical to that being adopted for the SAI Urban Air Shed Model application to Baton Rouge) is submitted in magnetic tape format and can be accessed through a computer algorithm also included on magnetic tape.

II. Estimate of Biogenic Hydrocarbon Emissions

The rate at which biogenic hydrocarbons are emitted in the Baton Rouge area was estimated by combining land-use data with empirically-derived natural hydrocarbon emission factors as described by Zimmerman (1979), Lamb et al. (1987) and others. Following the methodology developed by Zimmerman (1979), $BHER_j$, the biogenic hydrocarbon emission rate of species j in a given area, was estimated from:

$$BHER_j = \Sigma [F_i * E_{ij}] \qquad (1)$$

where F_i is the fraction of the area covered by forest type i and E_{ij} is the biogenic hydrocarbon emission factor of species j for land-type i (typically in units of $g/km^2/hr$). Since over 90% of all biogenic hydrocarbon emissions appear to arise from trees, we limit the sum in Equation (1) to forests typical of the Baton Rouge area (i.e., i = deciduous forests, coniferous forests, mixed forests and wetland forests). Values for $BHER_j$ were derived for isoprene, alpha-pinene and beta-pinene emissions as well as total non-methane biogenic hydrocarbons (TNMHC).

EMISSION FACTORS: Two sets of emission factors E_{ij} were used in our study: one was based on the forest emission factors developed by Zimmerman (1979) and the other on those developed by Lamb (1987). The two sets of emission factors, normalized to a temperature of 30 degrees Celsius, are displayed in Tables 1A and 1B. (Note that the emission factors from Lamb differ somewhat from those that actually appeared in the literature; the differences are the result of small revisions that Lamb deemed appropriate upon further analysis after publication of the paper (B. Lamb, private communication, 1989)). While both sets of factors are based on essentially the same set of measurements of natural emissions from vegetation in the Tampa/St. Petersburg area, the Lamb emission factors tend to be significantly smaller than those of Zimmerman; according to Lamb (private communication, 1989) the discrepancy between the two sets of factors arises from different averaging procedures adopted by the two investigators to obtain representative values from a disperse population of measurements. At the present time, the emission factors from Lamb that appear in Table 1B are the factors that EPA is using to derive biogenic emission rates for input to their Regional Oxidant Model (T. Pierce, private communication, 1989).

Since biogenic emissions are in general sensitive to temperature and light intensity, a method should be employed for adjusting the emission factors for variations in ambient temperature and light intensity. In this study temperature and light intensity adjustments were made using an algorithm based on the data appearing in Tingey (1981). This algorithm is included on the magnetic tape accompanying this report and a description of its use is given in a subsequent section.

LAND-USE DATA: Land-use information on the coverage of the four forest types in the Baton Rouge area was obtained from an analysis of digitized data from the Multispectral Scanner (MSS) aboard the U.S. Landsat satellite. The scene selected for the analysis covered an area of 110 km by 120 km centered in downtown Baton Rouge. Aerial photographs taken over specific locations in the Baton Rouge metropolitan area by Exxon Chemicals America were used as "ground truth" for our analysis of the remotely sensed data. Each pixel element from the Landsat scene corresponds to a 57 meter by 57 meter area. For each of these pixels spectral information from the MSS can be used to distinguish the specific land use type (eg., deciduous forest, coniferous forest, mixed forest, wetland forest, urban, residential, grassland, etc) within the area.

In order to make the biogenic hydrocarbon inventory compatible with the UAM model for Baton Rouge, the Landsat scene used in our analysis was divided into 2 km by 2 km cells corresponding to the 2 km grid of UAM. Given the 57 m resolution of the Landsat data, it follows that each grid cell was represented by 1225 pixels. By determining the number of pixels in each grid cell that had a specific land-use type, the percentages of the area in that grid cell covered by the four forest types in that cell were calculated. Since the total area covered by the Landsat scene was somewhat smaller than the total gridded area simulated by the UAM (see Figure 1), an extrapolation procedure had to be adopted to extend our land-use analysis to the edges of the model grid. The resulting distribution of forest types within the UAM grid are tabulated in the magnetic tape accompanying this report and a description of how to access this data and determine emission rates from it is included in a subsequent section.

TOTAL BIOGENIC EMISSIONS: Biogenic hydrocarbon emission rates for the Baton Rouge area for a typical summer day were calculated by combining the gridded distribution of forest types derived from the Landsat data with the emission [illegible] following

Equation (1). For these calculations, we assumed 15 hours of daylight and 9 hours of night with a daytime temperature of 30 degrees Celsius and a nighttime temperature of 25 degrees Celsius. A nominal light intensity of 800 micro Einsteins per square meter per second for the daytime was also assumed. The total integrated emission rates for the modelling area (160 km by 160 km) and for the 7 parish non-attainment area (see Figure 2) are presented in Table 2.

III. Instructions for Calculating Gridded Biogenic Inventory From Tape X0181

Tape X0181 accompanying this report contains the algorithms and data files necessary to calculate the gridded emissions of natural hydrocarbons as a function of ambient temperature and time of day. X0181 is an ASCII, unlabelled, nine track, 1600 bpi tape. It contains five files. Each record is 80 characters long and there are 10 records per block. The first file is a Fortran program called "BIOHC" that can be used to calculate the gridded inventories of isoprene, alpha-pinene, beta-pinene, and TNMHC; the program also outputs the total, integrated inventories as a reference and cross-check. A listing of BIOHC can be found in Appendix A.

BIOHC requires three data files as input; two of these files are supplied on Tape X0181 while the third must be supplied by the user. The input files supplied on the tape are: EMLAMB and EMZIMM, which contain the Lamb and Zimmerman emission factors, respectively and are read in on unit 8 and FOREST, which contains the forest-area data and is read in on unit 7. The user-supplied file (file DATAIN) is read in on unit 5. This file must contain 3 lines: Line 1 should list the temperature in degrees C; Line 2 should indicate the time of day in hours (i.e., 1:00 PM should be listed as 1300); the third line should contain a "1" if the Lamb emission factors are to be used or a "2" if the Zimmerman emission factors are to be used. An example of file DATAIN is included on the magnetic tape as the fifth file.

BIOHC outputs 2 files of data: 1. "BIOEMIS contains the gridded emissions for isoprene, alpha-pinene, beta-pinene, and TNMHC; and 2. "TOTAL" contains a listing of the total integrated emissions of isoprene, alpha-pinene, beta-pinene, and TNMHC for the 7-Parish non-attainment area and for the entire modelling area. All emissions are output in units of kg/hr.

The format for the outputted gridded inventories is similar to the format adopted for the input file FOREST. A section of this file in included in Appendix B. The first number on each line represents the gird cell number in the x-direction and the second number represents the grid cell number in the y-direction. (Note that we are following the convention used in the description of the UAM model, so that grid cell (1,1) is at the left bottom corner.) Columns three to six on each line of FOREST contain the percentage of area cover by each forest type for that grid cell. The order is: deciduous, coniferous, mixed and wetland. For example cell (50,11) has 26.37% of deciduous forests, .24% of coniferous, 12.57% of mixed and 34.2% of wetland forests. In the output file "BIOEMIS" columns three to six on each line list the biogenic emission rates in kg/hr for isoprene, alpha-pinene, beta-pinene, and TNMHC, respectively.

Table 1. Biogenic Hydrocarbon Emission Factors (in units g/km^2/hr)

A. Emission Factors From Zimmerman

	isoprene	alpha-pinene	beta-pinene	TNMHC
deciduous	4595	285	225	6766
coniferous	2483	639	631	5173
mixed	3539	462	428	5969
wetland	1385	1044	36	6807

B. Emission Factors From Lamb

	isopene	alpha-pinene	beta-pinene	TNMHC
deciduous	3114	110	118	4240
coniferous	745	640	729	3098
mixed	1676	392	443	3433
wetland	1676	392	443	3433

Table 2. Total Integrated Biogenic Emissions for a Typical Summer Day (in kg/day)

A. Entire Modelling Area (160 km x 160 km)

	isoprene	alpha-pinene	beta-pinene	TNMHC
Lamb factors	481,146	63,811	71,885	1,074,727
Zimmerman factors	699,745	135,394	62,257	1,817,676

B. 7-Parish Non-Attainment Area

	isoprene	alpha-pinene	beta-pinene	TNMHC
Lamb factors	172,587	23,984	27,048	389,299
Zimmerman factors	253,034	49,621	23,336	659,168

References

Chameides, W.L., R.W. Lindsay, J. Richardson, and C.S. Kiang, The role of biogenic hydrocarbons in urban photochemical smog: Atlanta as a case study, *Science,* 241, 1988.

Lamb, B., A. Guenther, D. Gay, and H. Westberg, A national inventory of biogenic hydrocarbon emissions, *Atmos. Environ.,* 21, 1695-1705, 1987.

Tingey, D.T., The effect of environmental factors on the emission of biogenic hydrocarbons for live oak and slash pine. In: *Atmospheric Biogenic Hydrocarbons,* Vol. 1, J.J. Bufalini and R.R. Arnts, eds., Ann Arbor Science, Ann Arbor, MI, 1981.

Zimmerman, P.R., Determination of emission rates of hydrocarbons from indigenous species of vegetation in the Tampa/St. Petersburg Florida Area, *EPA 904.9-77-028,* Environmental Protection Agency, 1979.

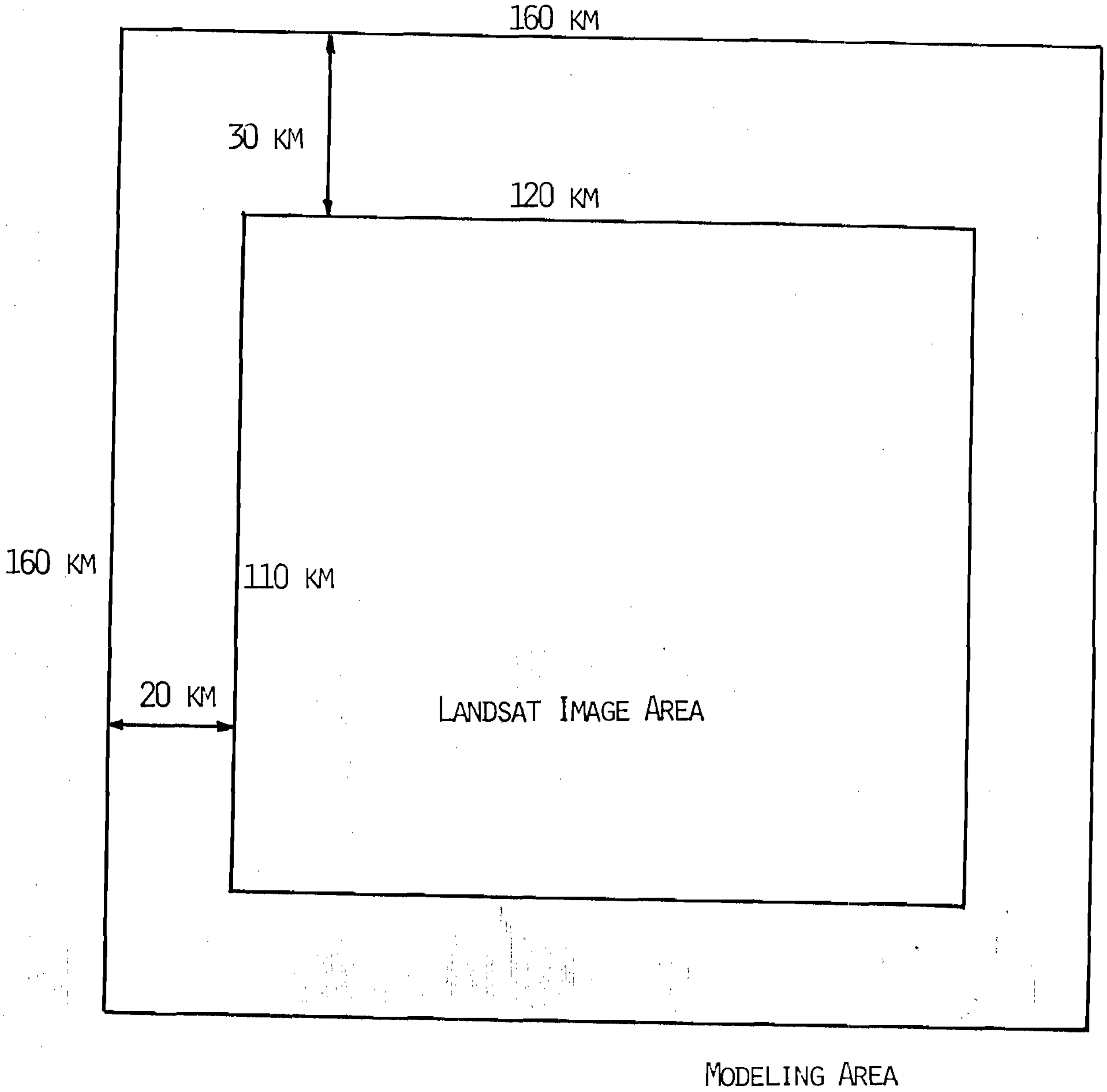

Figure 1. Modelling area (160 km x 160 km) and the Landsat image area (100 km x 120 km). An extrapolation procedure extended the Landsat data to the edges of the modelling area.

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Figure 2. Grid approximation of the Baton Rouge seven parish non-attainable area is represented by "1's". The "0's" complete the total grid domain (80 cells x 80 cells). Note that the horizontal and vertical scales are different.

Appendix A

Computer listing of program BIOHC

```
      program BIOHC (datain,total,forest,emlamb,emzimm,bioemis,
     1              tape5=datain,tape6=total,tape7=forest,tape8=
     2              emlamb,tape9=emzimm,tape10=bioemis)
C
      real iso,isoptf,mix
      dimension dec(80,80),con(80,80),mix(80,80),wet(80,80)
      dimension iso(80,80),alp(80,80),bet(80,80),thc(80,80)
      dimension emis(4,4),emtmp(4,4)
C
C     read forest-area data (file: FOREST)
C
      do 10 i = 1,6400
      read (7,100) nc,nr,dec(nr,nc),con(nr,nc),mix(nr,nc),wet(nr,nc)
  100 format (2i4,4f8.4)
   10 continue
C
C     read in selection of temperature, time of day and emission
C     factors (1 for Lamb, 2 for Zimmerman)   (file: DATAIN)
C
      read (5,300) temp
  300 format (f8.2)
      read (5,300) time
      read (5,310) index
  310 format (i2)
C
      iu = 8
      if (index.eq.2) iu = 9
C
C     read emission factors for a temperature of 30C
C     (file: EMLAMB or EMZIMM)
C
      do 20 i = 1,4
      read (iu,200) (emis(i,j),j=1,4)
  200 format (4f6.0)
      do 20 k = 1,4
      emis(i,k) = emis(i,k) / 1000.
   20 continue
C
C     emission factors for a temperature of T=temp in units of degrees C
C     and a light intensity of sole in units of micro-Einstein per square
C     meter per second.
C
      pi = 4. * atan(1.)
C
      if (time.lt.600.or.time.gt.2100.) then
        sole = 0.
      else
        s = pi * (time - 600.) / 1500.
        sole = 900. * sin (s)
      endif
C
      isoptf = cori(temp,sole)
      alphtf = alph(temp)
      terptf = terp(temp)
C
      do 30 i = 1,4
      emtmp(i,1) = isoptf * emis(i,1)
      emtmp(i,2) = alphtf * emis(i,2)
      emtmp(i,3) = terptf * emis(i,3)
      emtmp(i,4) = terptf * emis(i,4)
   30 continue
C
      do 40 i = 1,80
      do 40 j = 1,80
      iso(i,j) = 0.
      alp(i,j) = 0.
```

```
      bet(i,j) = 0.
      thc(i,j) = 0.
   40 continue
C
      sumi = 0.
      suma = 0.
      sumb = 0.
      sumt = 0.
      sumi7 = 0.
      suma7 = 0.
      sumb7 = 0.
      sumt7 = 0.
C
      do 50 i = 1,80
      do 50 j = 1,80
      iso(i,j) = ( dec(i,j) * emtmp(1,1) + con(i,j) * emtmp(2,1) +
     1             mix(i,j) * emtmp(3,1) + wet(i,j) * emtmp(4,1) ) * 4.
      alp(i,j) = ( dec(i,j) * emtmp(1,2) + con(i,j) * emtmp(2,2) +
     1             mix(i,j) * emtmp(3,2) + wet(i,j) * emtmp(4,2) ) * 4.
      bet(i,j) = ( dec(i,j) * emtmp(1,3) + con(i,j) * emtmp(2,3) +
     1             mix(i,j) * emtmp(3,3) + wet(i,j) * emtmp(4,3) ) * 4.
      thc(i,j) = ( dec(i,j) * emtmp(1,4) + con(i,j) * emtmp(2,4) +
     1             mix(i,j) * emtmp(3,4) + wet(i,j) * emtmp(4,4) ) * 4.
C
      sumi = sumi + iso(i,j)
      suma = suma + alp(i,j)
      sumb = sumb + bet(i,j)
      sumt = sumt + thc(i,j)
C
      if (i.gt.65) go to 50
      if (j.le.18) go to 50
      if (i.le.4) go to 50
      if (i.gt.50.and.j.gt.29) go to 50
      if (i.gt.46.and.j.gt.61) go to 50
      if (i.le.23.and.j.gt.73) go to 50
      if (i.le.13.and.j.le.59) go to 50
      if (i.le.23.and.j.le.33) go to 50
      if (i.le.36.and.j.le.24) go to 50
C
      sumi7 = sumi7 + iso(i,j)
      suma7 = suma7 + alp(i,j)
      sumb7 = sumb7 + bet(i,j)
      sumt7 = sumt7 + thc(i,j)
C
   50 continue
C
C     OUTPUT SECTION
C
      write (6,400)
  400 format (23x,' TOTALS IN KG/HOUR FOR ')
      write (6,401)
  401 format (7x,'ISOPRENE',6x,'ALPHA-PINENE',3x,'BETA-PINENE',7x,
     1         'TNMHC')
      write (6,402) sumi,suma,sumb,sumt
  402 format (4f15.1)
C
      write (6,403)
  403 format (/18x,'7-PARISH TOTALS IN KG/HOUR FOR ')
      write (6,401)
      write (6,402) sumi7,suma7,sumb7,sumt7
C
C     Output of the gridded emissions to file BIOEMIS
C
      do 500 nr = 1,80
      do 500 nc = 1,80
      write (10,100) nc,nr,iso(nr,nc),alp(nr,nc),bet(nr,nc),thc(nr,nc)
```

```
 500  continue
C
      stop
      end
      FUNCTION CORI(TEMP,SOLE)
C        COMPUTES THE ISOPRENE CORRECTION FACTOR
C        INPUTS ARE TEMP IN DEGREES CELSIUS AND
C                   SOLE IN UE/M**2/SEC
C...NOTE: THESE CORRECTION FACTORS WERE ADAPTED FROM TINGEY
C...      1981.  THEY ARE NOT HIS EXACT FORMULATIONS HOWEVER.
      IF (SOLE .GE. 800.) THEN
         CORI = 10.**(1.200/(1.+EXP(-0.400*(TEMP-28.30)))-.796)
      ELSE IF (SOLE .GE. 400.) THEN
         F800   = 10.**(1.200/(1.+EXP(-0.400*(TEMP-28.30)))-.796)
         F400   = 10.**(0.916/(1.+EXP(-0.239*(TEMP-29.93)))-.462)
         CORI = F400/1.95 + (F800 - F400/1.95) * (SOLE - 400.)/400.
      ELSE IF (SOLE .GE. 200.) THEN
         F400   = 10.**(0.916/(1.+EXP(-0.239*(TEMP-29.93)))-.462)
         F200   = 10.**(0.615/(1.+EXP(-0.696*(TEMP-32.79)))-.077)
         CORI = F200/4.75 + (F400/1.95-F200/4.75)*(SOLE-200.)/200.
      ELSE IF (SOLE .GE. 100.) THEN
         F200   = 10.**(0.615/(1.+EXP(-0.696*(TEMP-32.79)))-.077)
         F100   = 10.**(0.437/(1.+EXP(-0.312*(TEMP-31.75)))-.160)
         CORI = F100/10.73 + (F200/4.75-F100/10.73)*(SOLE-100.)/100.
      ELSE IF (SOLE .GT. 0.) THEN
         F100   = 10.**(0.437/(1.+EXP(-0.312*(TEMP-31.75)))-.160)
         CORI = (F100/10.73)*SOLE/100.
      ELSE
         CORI = 0.
      ENDIF
      RETURN
      END
      FUNCTION ALPH(TEMP)
C        COMPUTES THE ALPHA-PINENE CORRECTION FACTOR
C        INPUT IS TEMP IN DEGREES CELSIUS
C
C...NOTE: THESE CORRECTION FACTORS WERE ADAPTED FROM TINGEY
C...      1981.  THEY ARE NOT HIS EXACT FORMULATIONS HOWEVER.
C
         ALPH = EXP(0.0739*(TEMP-30.0))
      RETURN
      END
      FUNCTION TERP(TEMP)
C        COMPUTES THE MONOTERPENE  CORRECTION FACTOR
C        INPUT IS TEMP IN DEGREES CELSIUS
C
C...NOTE: THESE CORRECTION FACTORS WERE ADAPTED FROM TINGEY
C...      1981.  THEY ARE NOT HIS EXACT FORMULATIONS HOWEVER.
C
         TERP = EXP(0.0670*(TEMP-30.0))
      return
      end
```

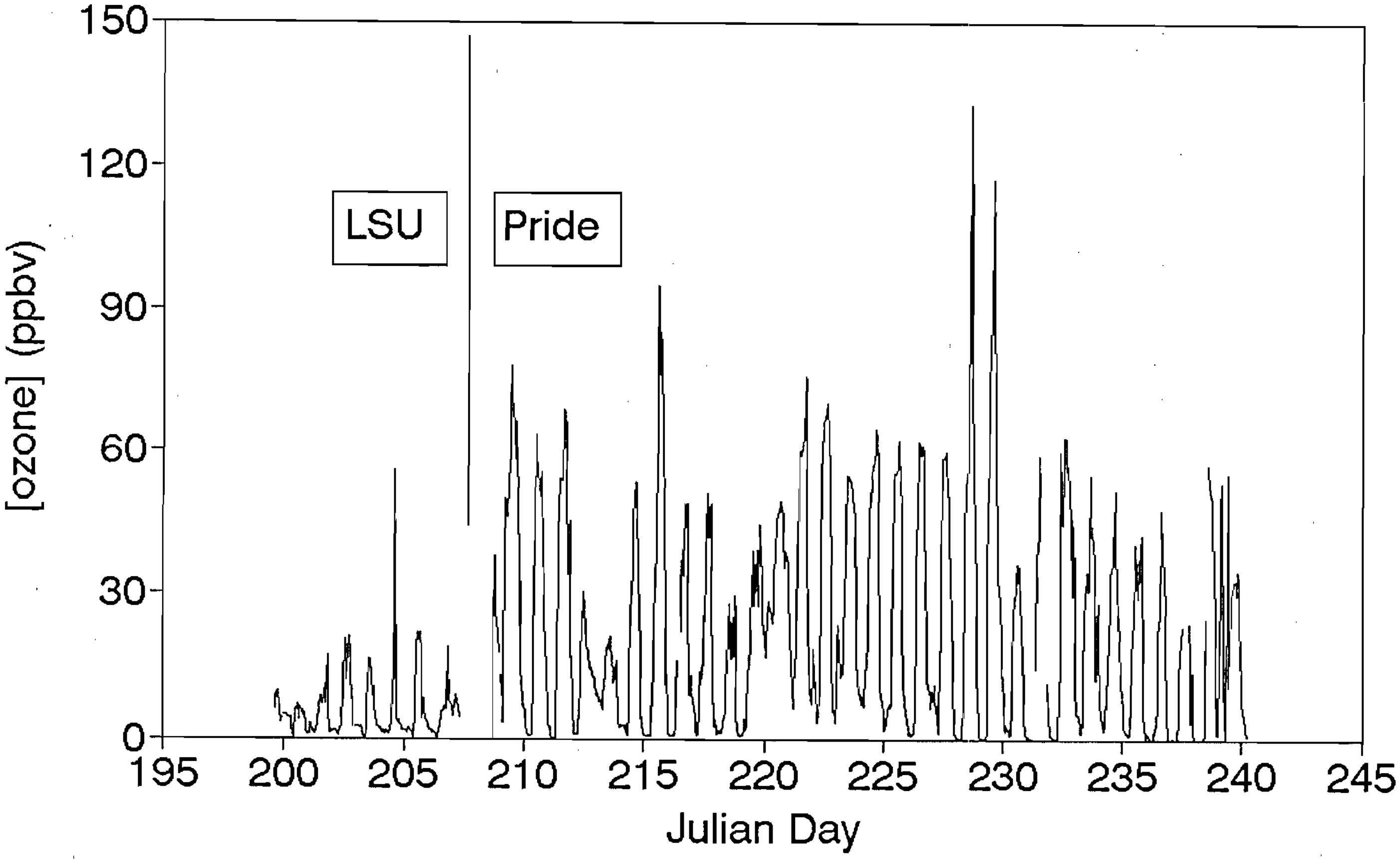
Appendix B

Section of file FOREST

14	11	.1086	0.0000	.0090	0.0000
15	11	.0073	0.0000	.0041	0.0000
16	11	.0865	0.0000	.0024	0.0000
17	11	.0294	0.0000	.0106	.0016
18	11	.0931	.0016	.0351	.0261
19	11	.0645	0.0000	.0400	.0302
20	11	.0278	0.0000	.0049	.0090
21	11	.0163	0.0000	.0090	.0090
22	11	.0155	0.0000	.0131	.0114
23	11	.0131	0.0000	.0155	.0057
24	11	.1812	0.0000	.0351	.0065
25	11	.7616	0.0000	.0359	.0661
26	11	.2351	0.0000	.0024	.0024
27	11	.4376	0.0000	.0131	.0441
28	11	.6041	.0008	.0620	.1804
29	11	.5935	.0090	.0351	.3045
30	11	.3959	.0049	.0767	.2751
31	11	.0669	.0008	.0384	.2490
32	11	.0653	.0033	.0482	.1584
33	11	.4302	.0008	.1380	.3127
34	11	.5518	0.0000	.0971	.1861
35	11	.4424	.0057	.1135	.1861
36	11	.4898	.0122	.1265	.2980
37	11	.0710	.0106	.1184	.7780
38	11	.0988	.0065	.0555	.7282
39	11	.0237	.0024	.0245	.8229
40	11	.0335	0.0000	.0245	.8465
41	11	.0310	.0033	.0424	.8612
42	11	.1616	.0008	.1331	.6629
43	11	.1306	0.0000	.1135	.6718
44	11	.1396	0.0000	.0824	.6147
45	11	.4620	.0114	.1453	.2082
46	11	.3714	0.0000	.1208	.2849
47	11	.3420	0.0000	.1763	.3820
48	11	.2727	0.0000	.1698	.3339
49	11	.4098	.0016	.2057	.2890
50	11	.2637	.0024	.1257	.3420
51	11	.2229	0.0000	.0963	.1706
52	11	.0914	0.0000	.0286	.0220
53	11	.0261	0.0000	.0073	0.0000
54	11	.0678	0.0000	.0082	.0008
55	11	.0073	0.0000	.0041	.0016
56	11	.0939	0.0000	.0180	.0016
57	11	.3984	0.0000	.0645	.0188
58	11	.4522	0.0000	.1820	.2008
59	11	.1110	.0008	.2310	.6571
60	11	.7200	0.0000	.1837	.0906

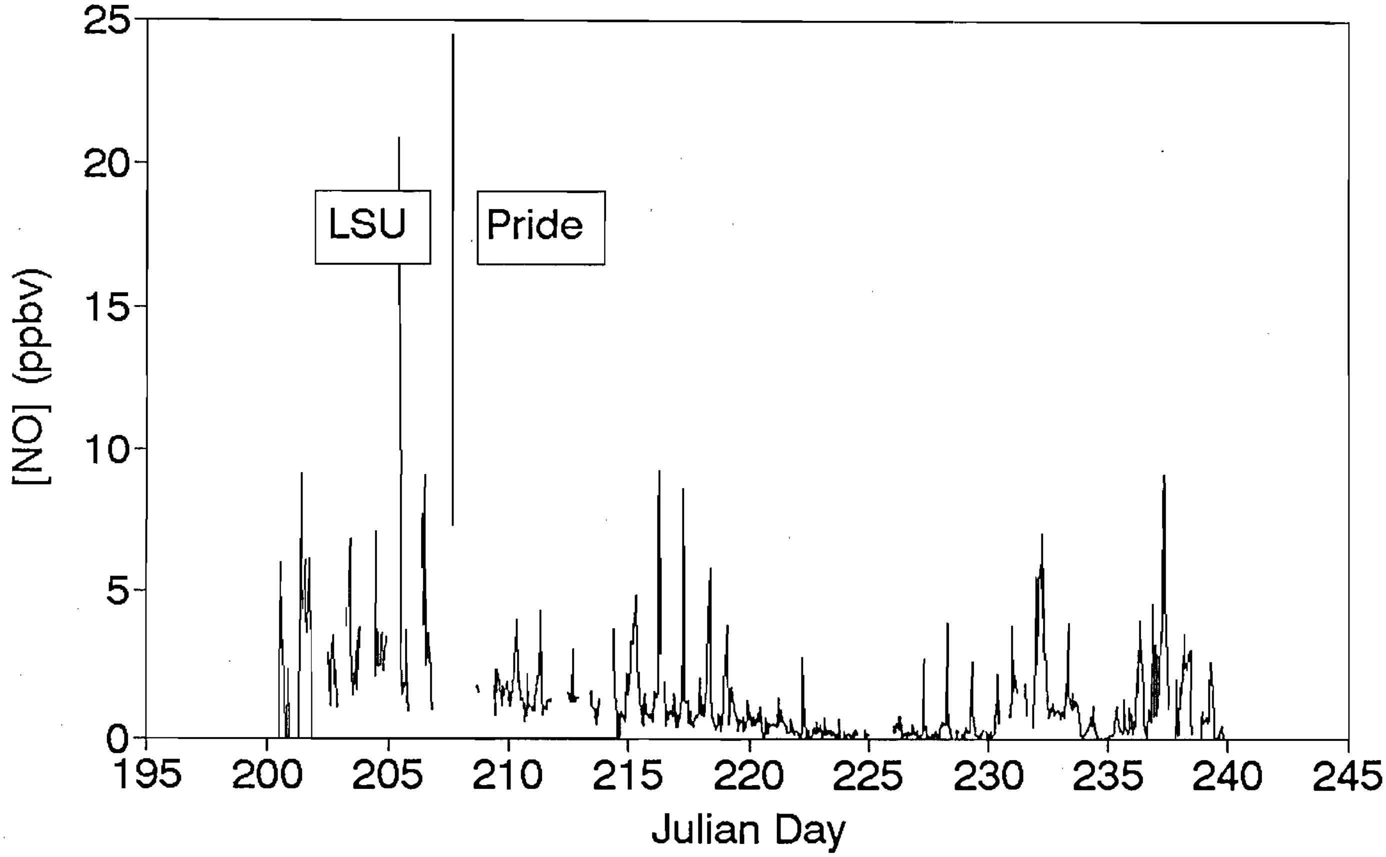
Ozone Time Series

Baton Rouge and Pride, LA



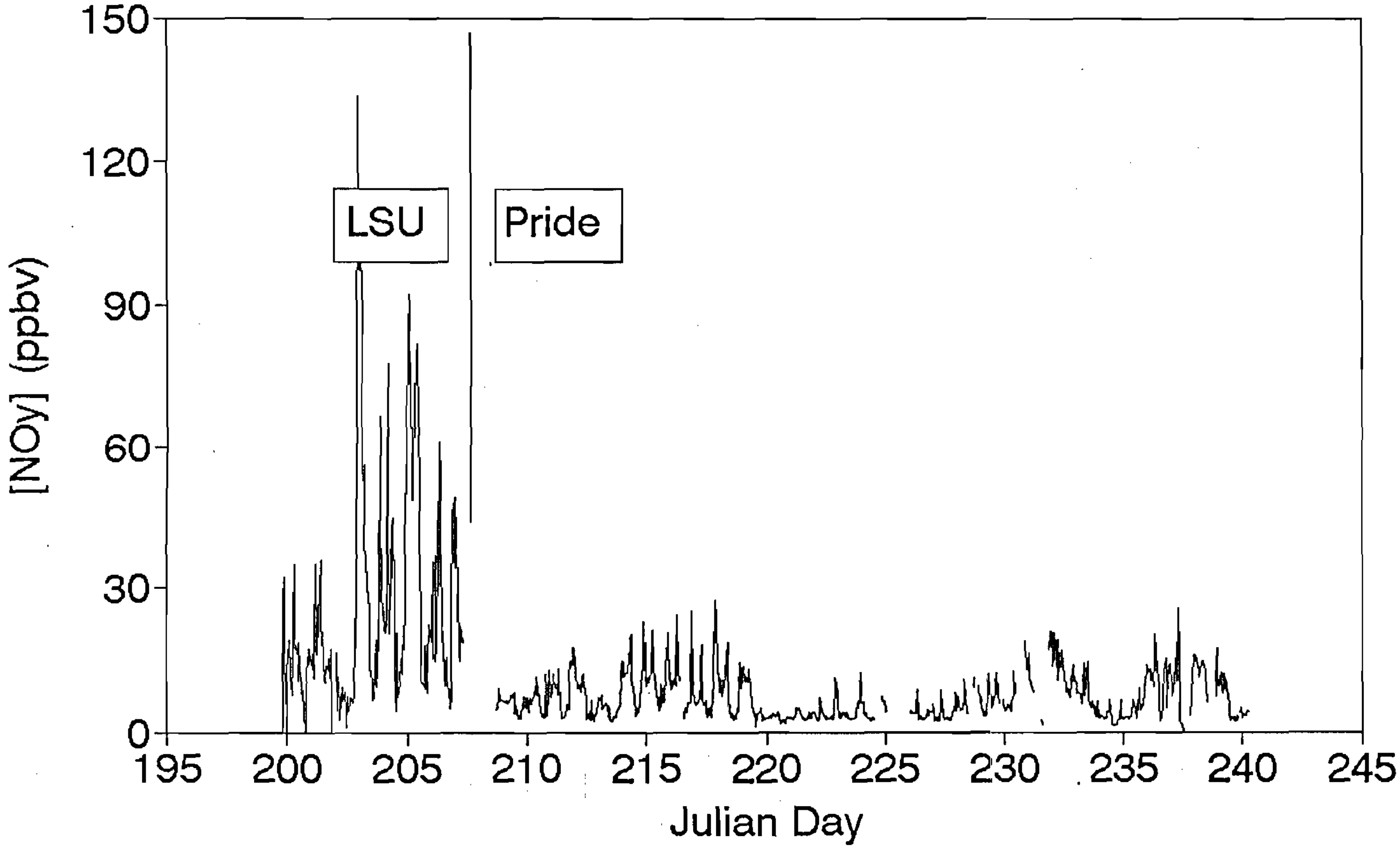
Nitric Oxide Time Series

Baton Rouge and Pride, LA



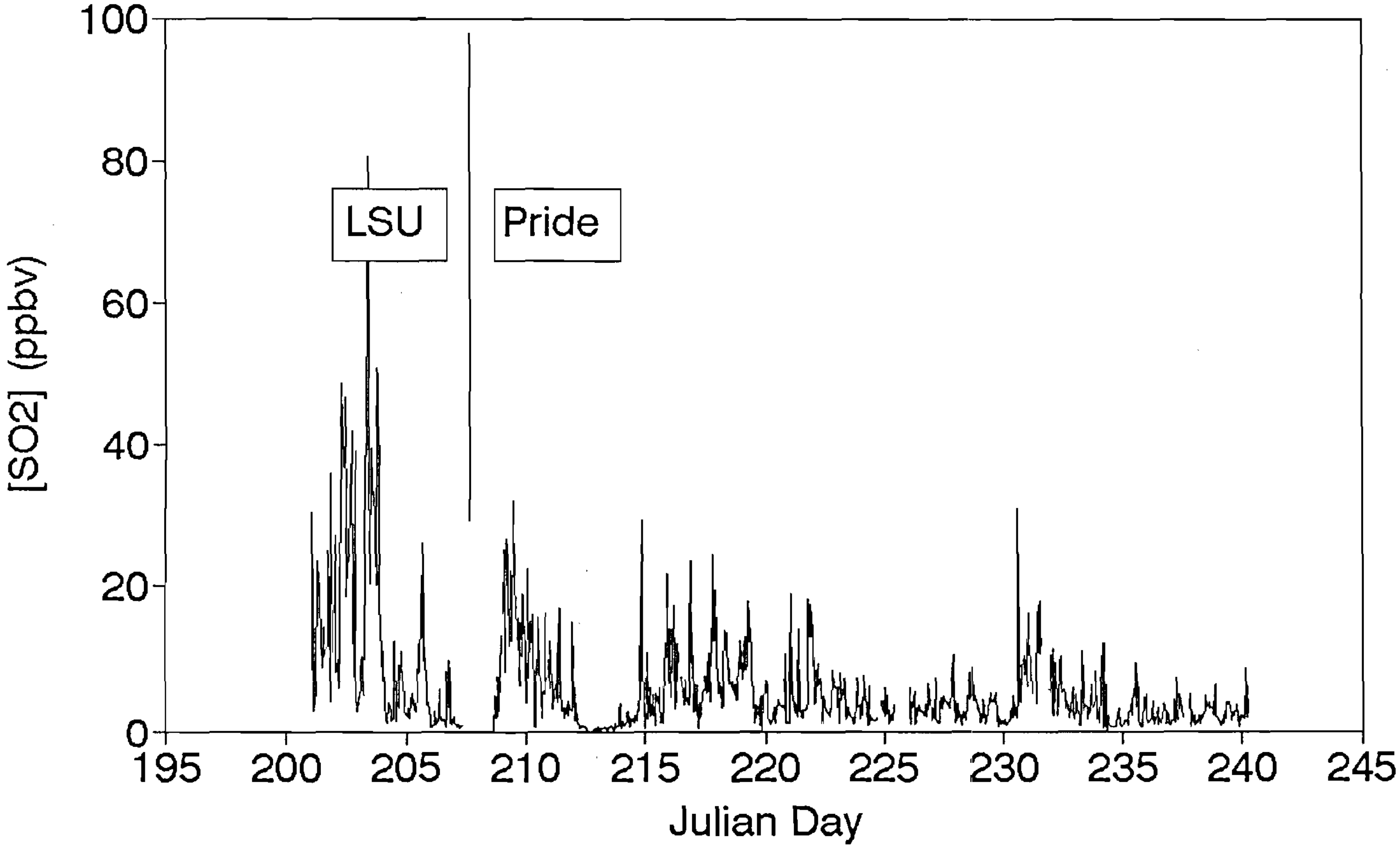
Reactive Odd Nitrogen Time Series

Baton Rouge and Pride, LA



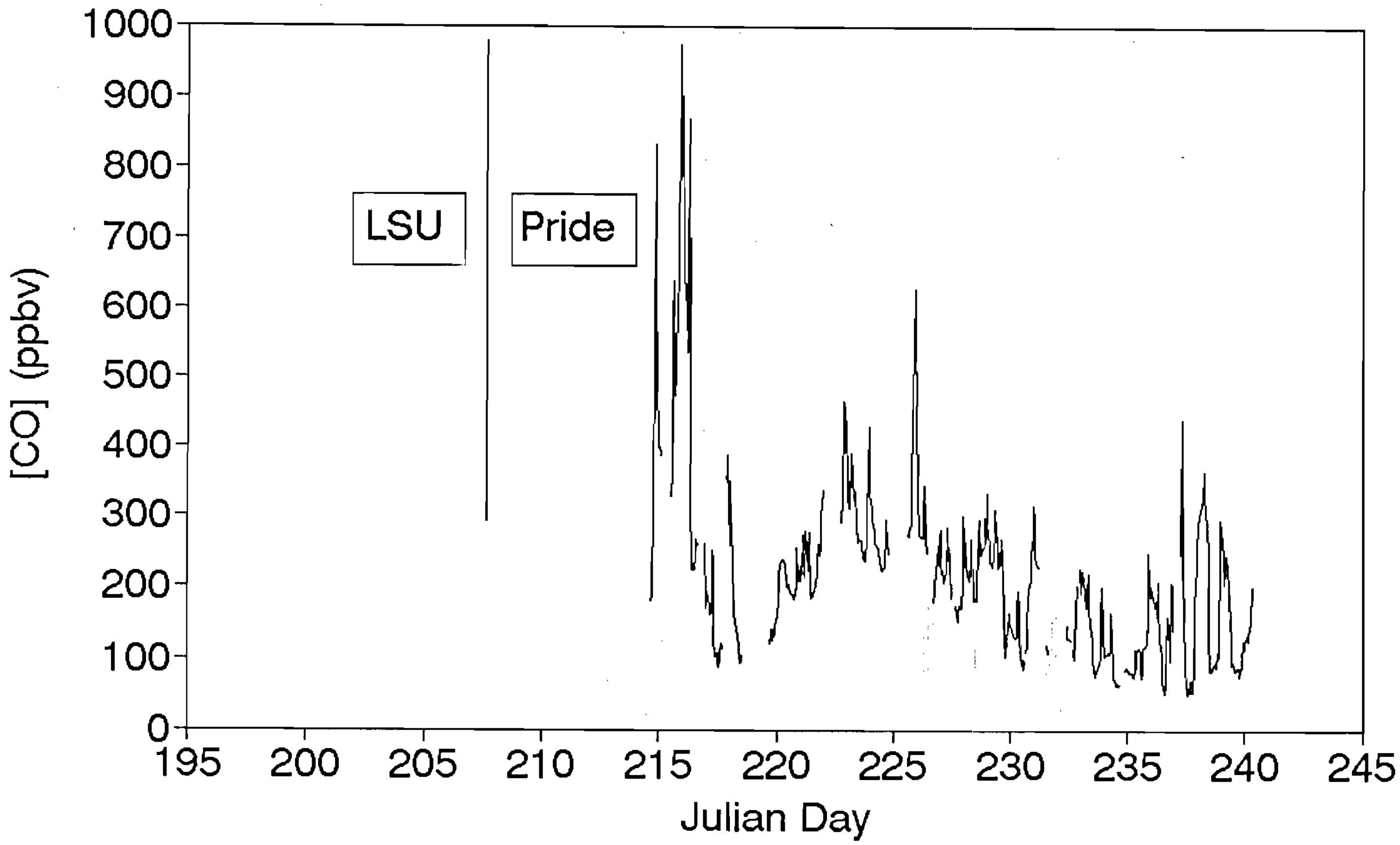
Sulfur Dioxide Time Series

Baton Rouge and Pride, LA



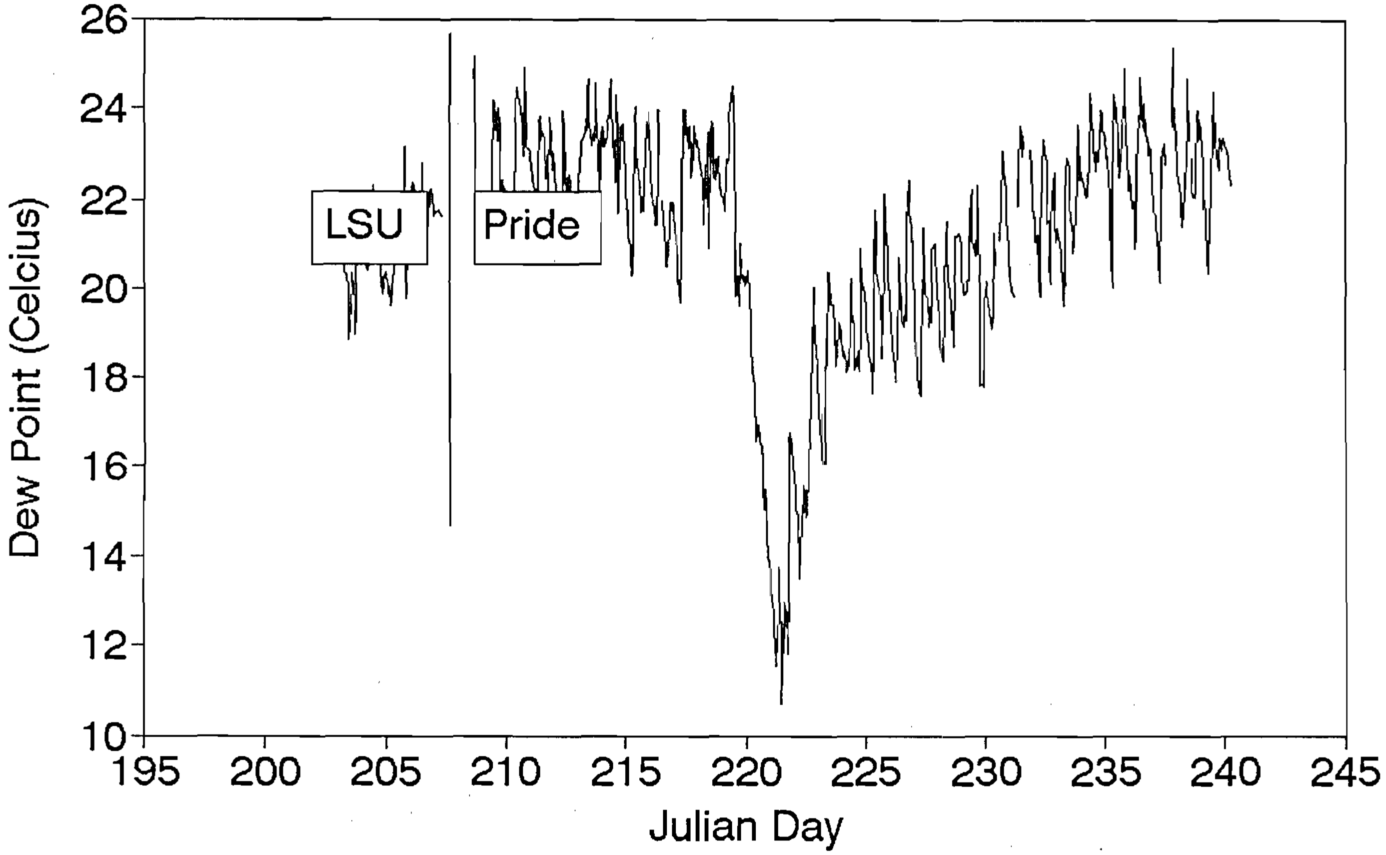
Carbon Monoxide Time Series

Baton Rouge and Pride, LA



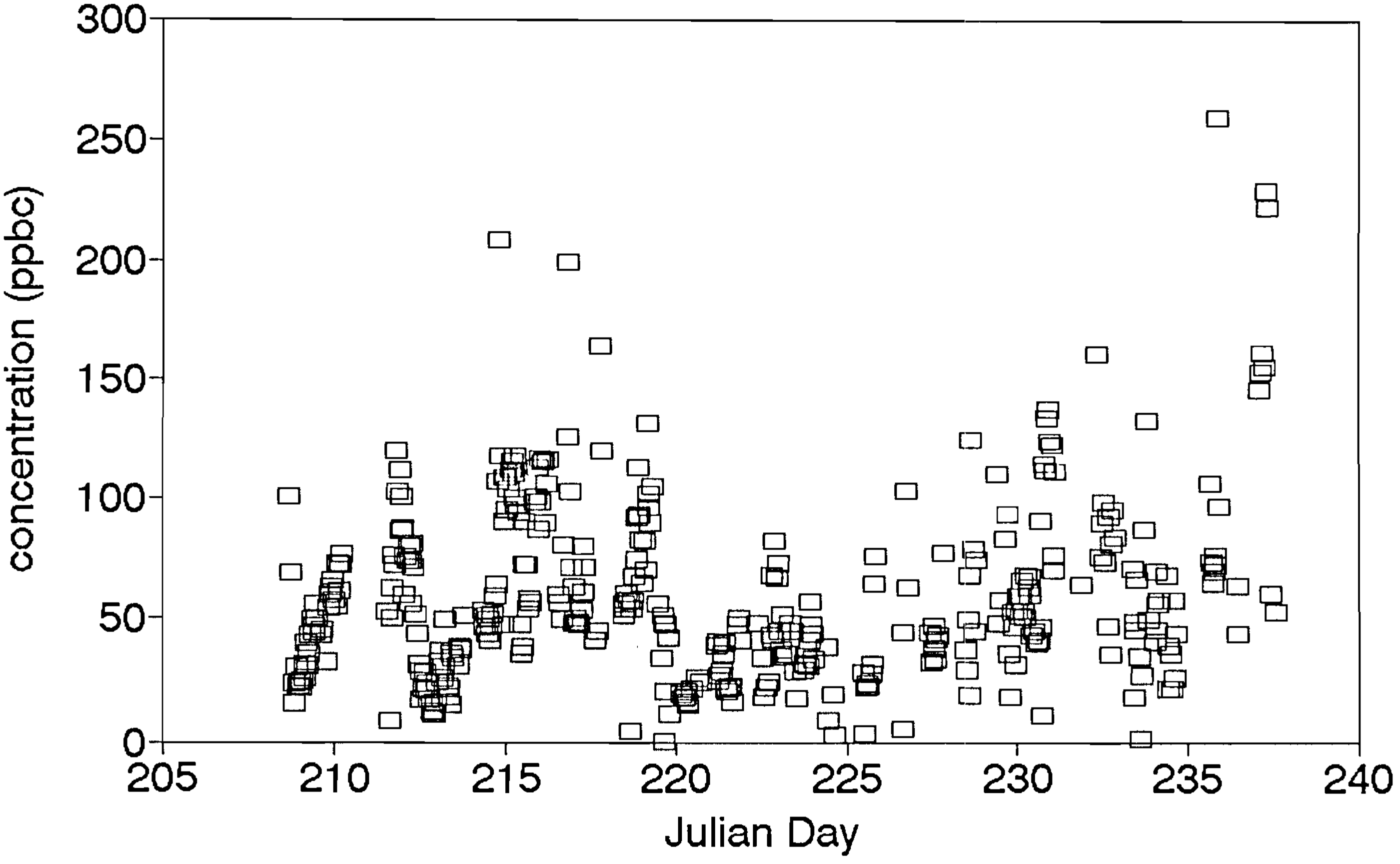
Dew Point Time Series

Baton Rouge and Pride, LA



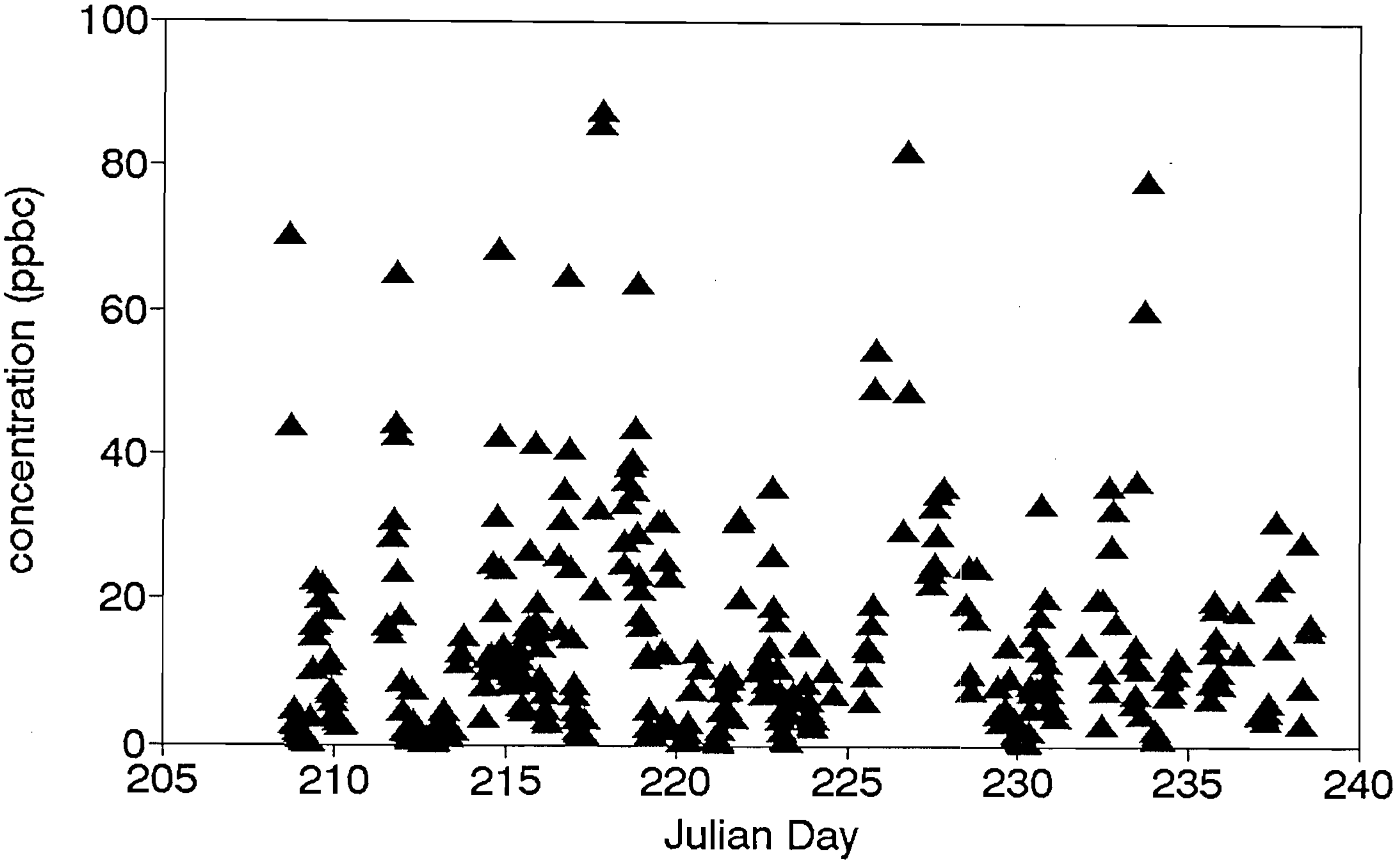
Speciated NMHC

Pride, LA (1989)



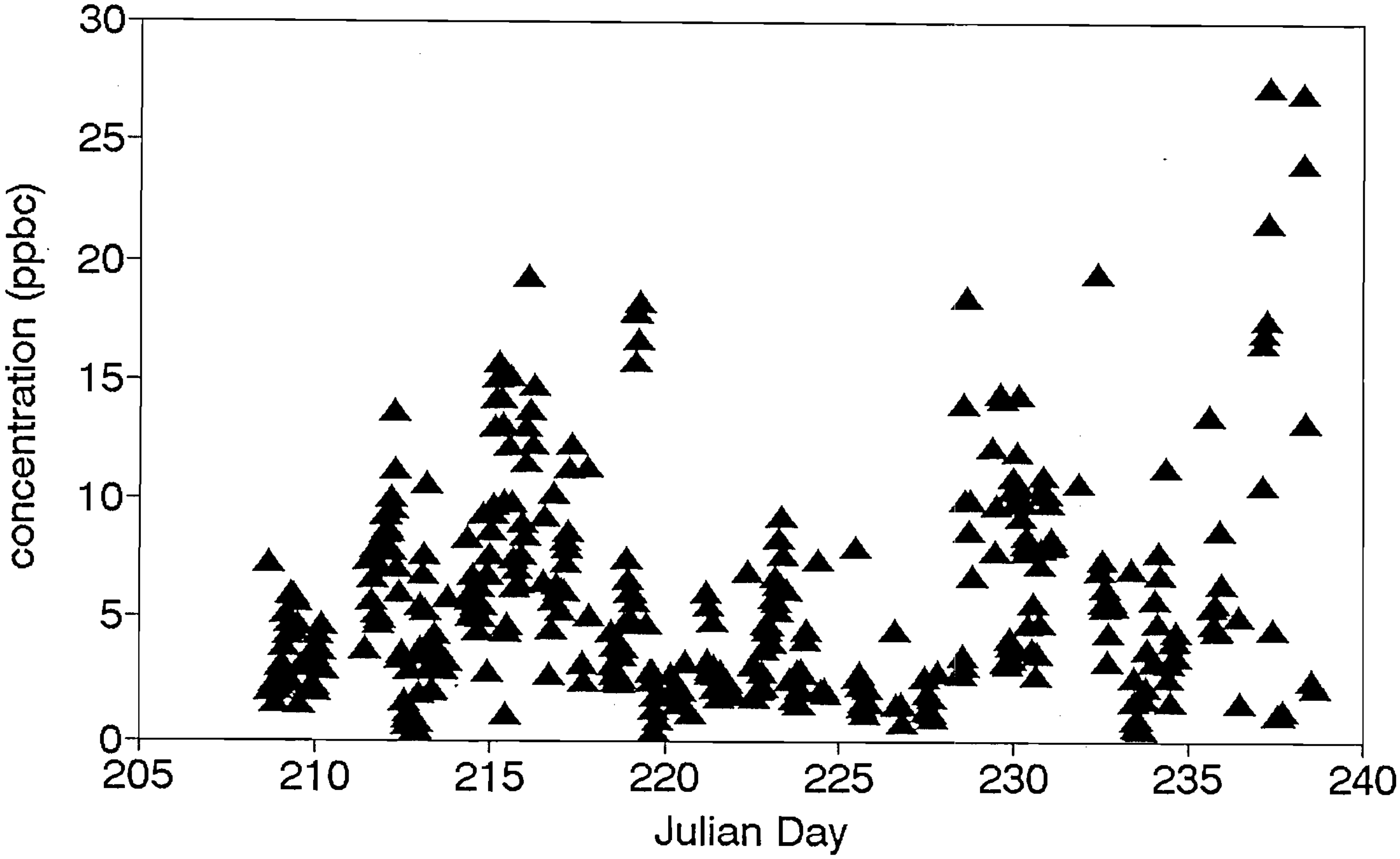
Isoprene Time Series

Pride, LA (1989)



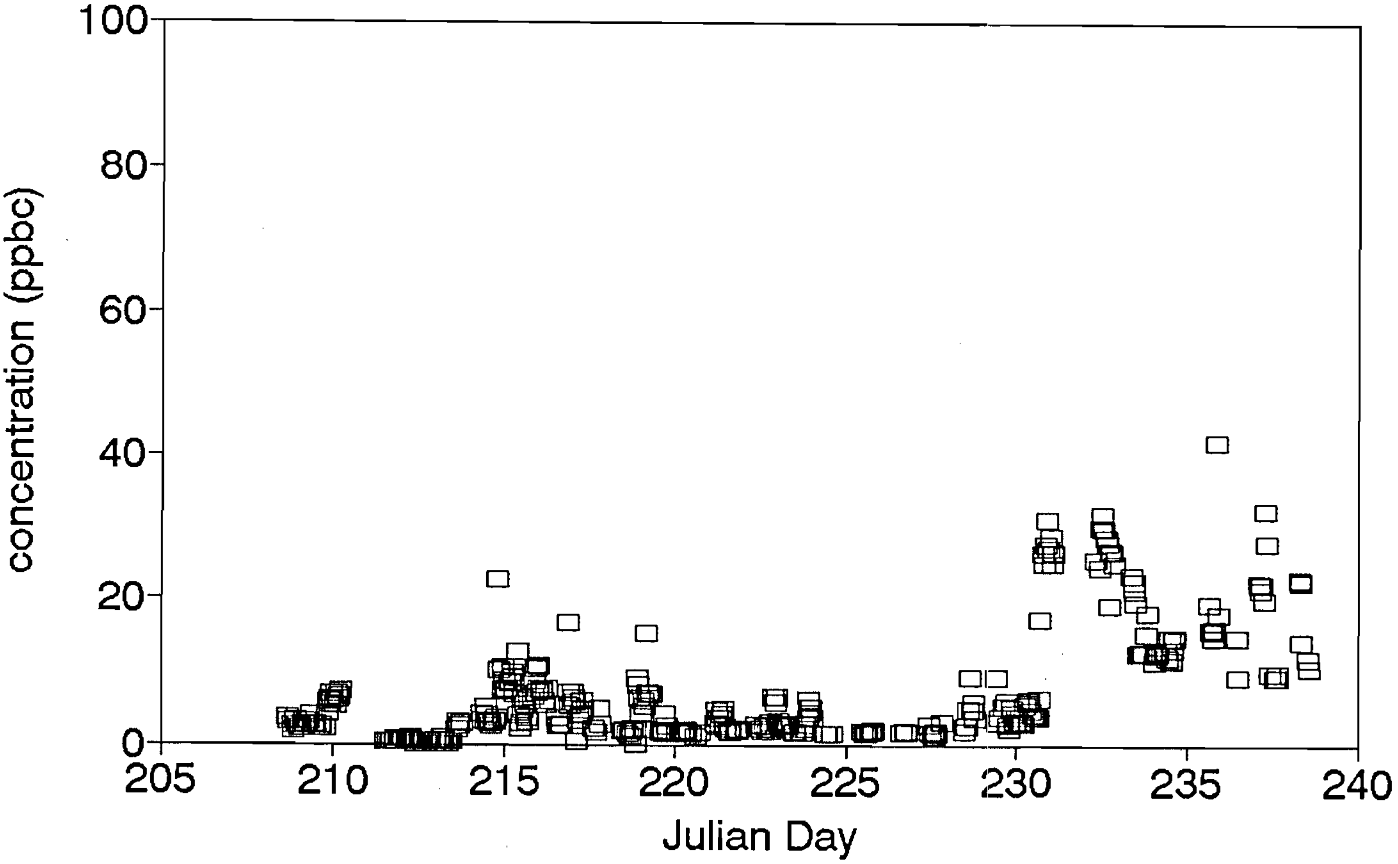
n-Butane Time Series

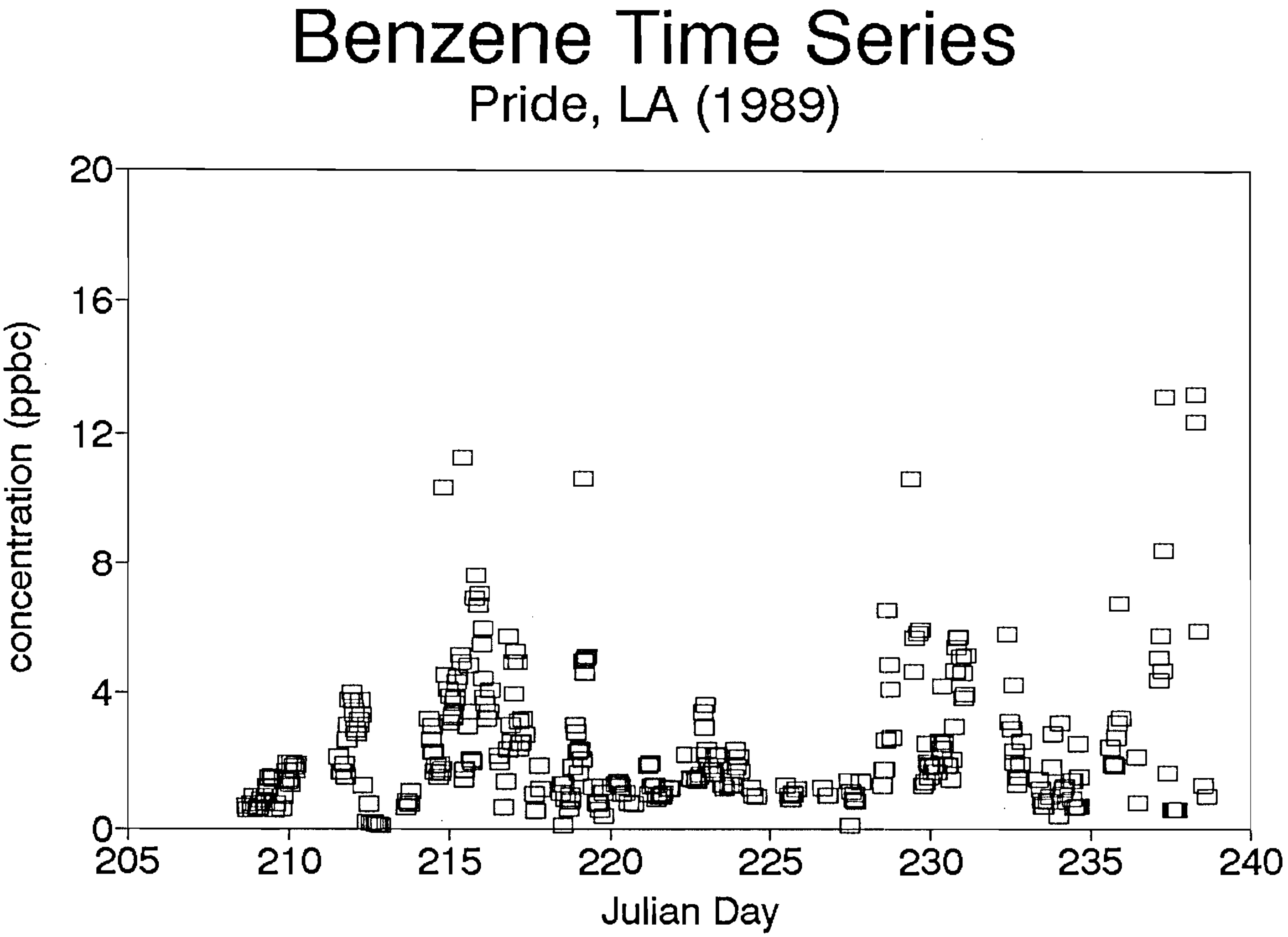
Pride, LA (1989)



Toluene Time Series

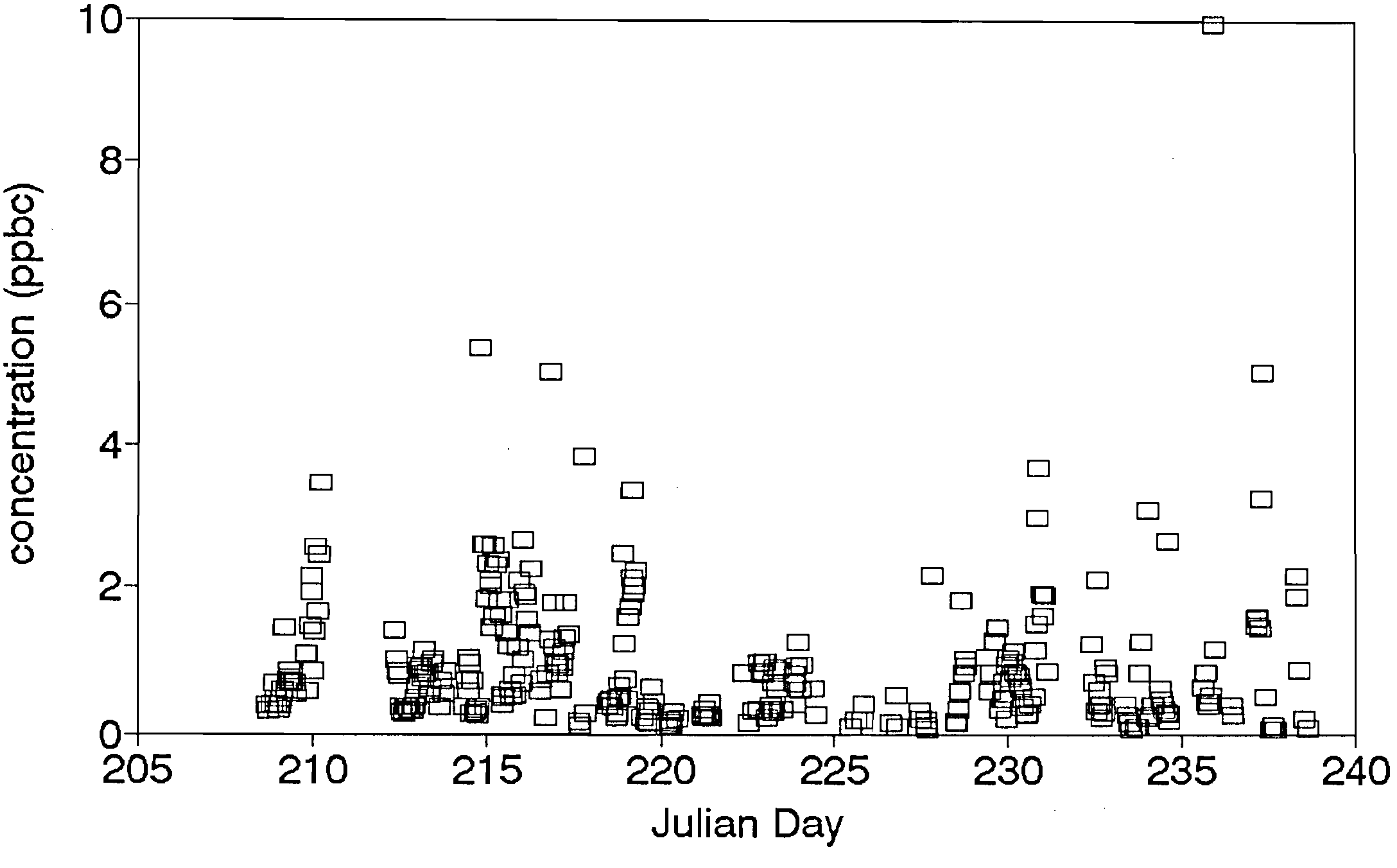
Pride, LA (1989)




Benzene Time Series
Pride, LA (1989)
20
16
12
8
4
0
concentration (ppbc)
205
210
215
220
225
230
235
240
Julian Day

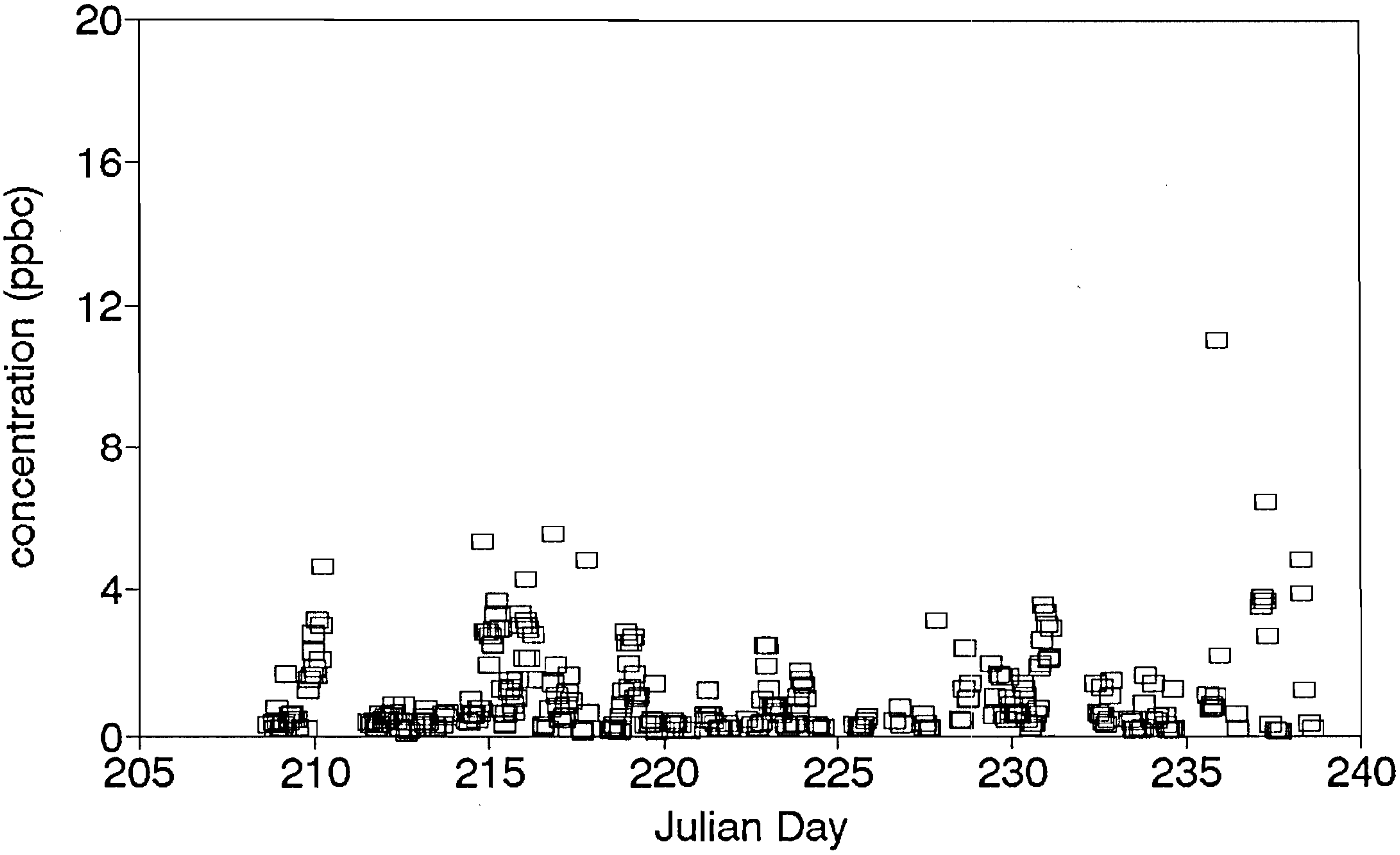
Cyclo-Hexene Time Series

Pride, LA (1989)



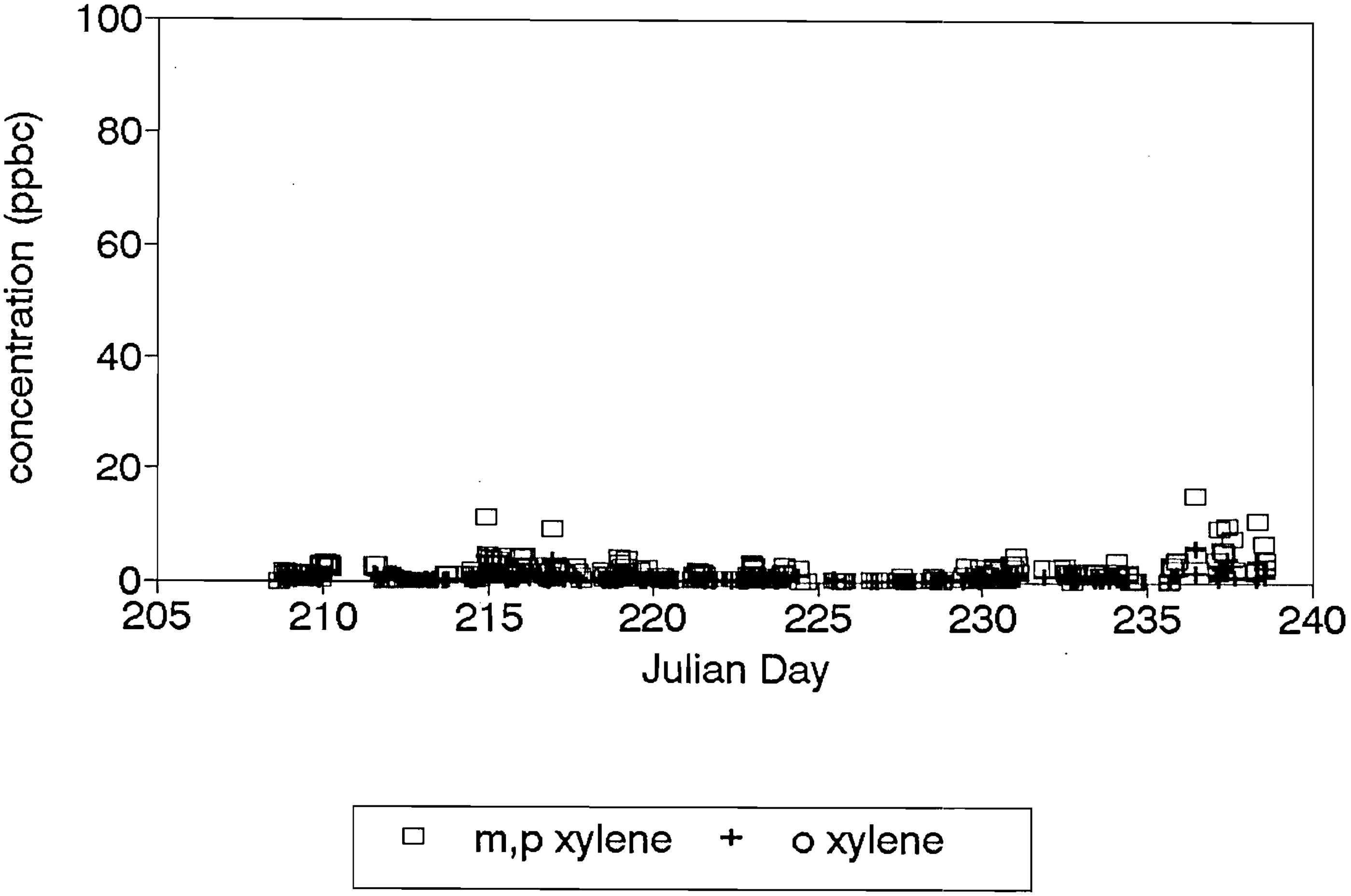
Trichloroethylene Time Series

Pride, LA (1989)



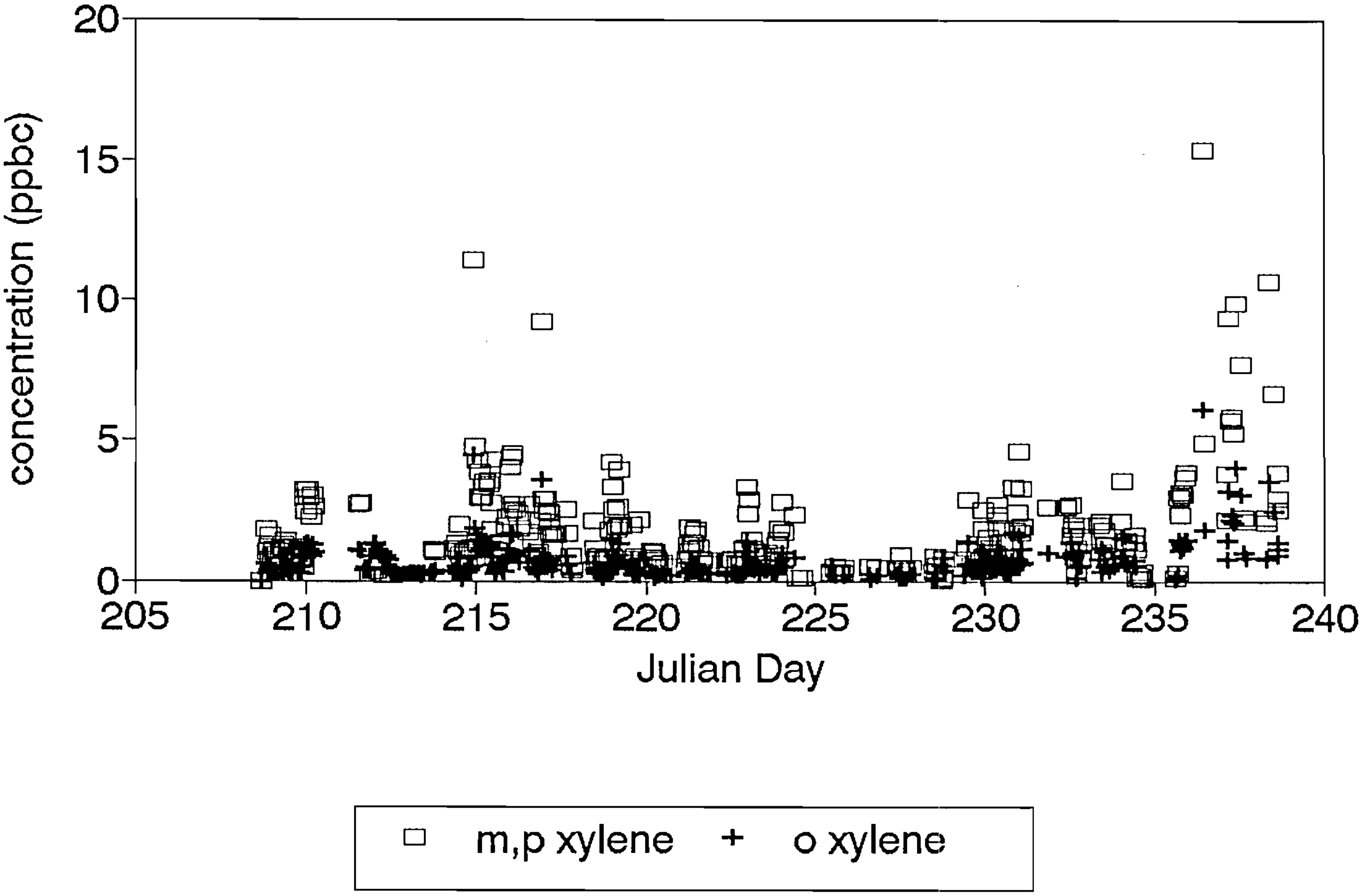
Xylene Time Series

Pride, LA (1989)



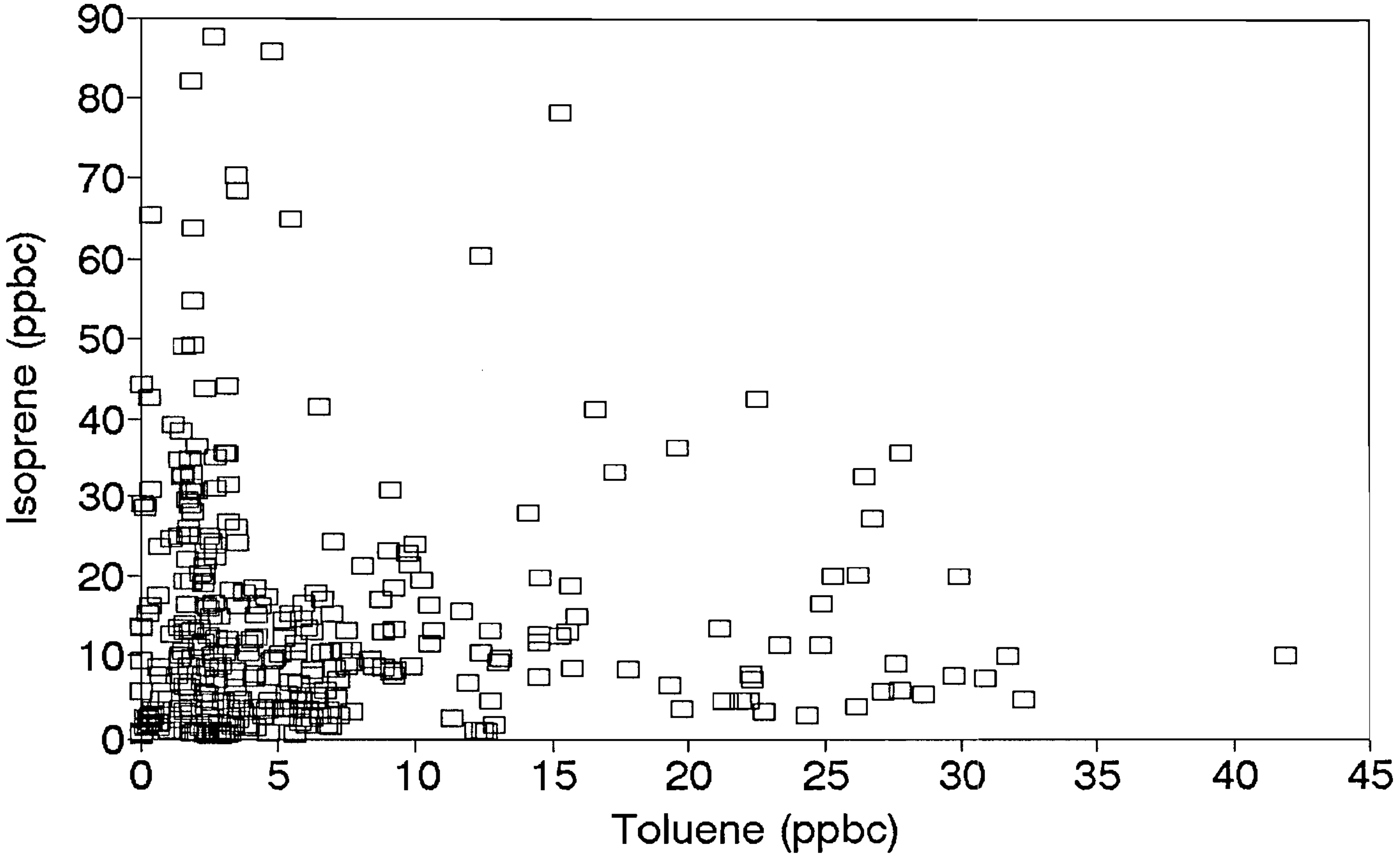
Xylene Time Series

Pride, LA (1989)



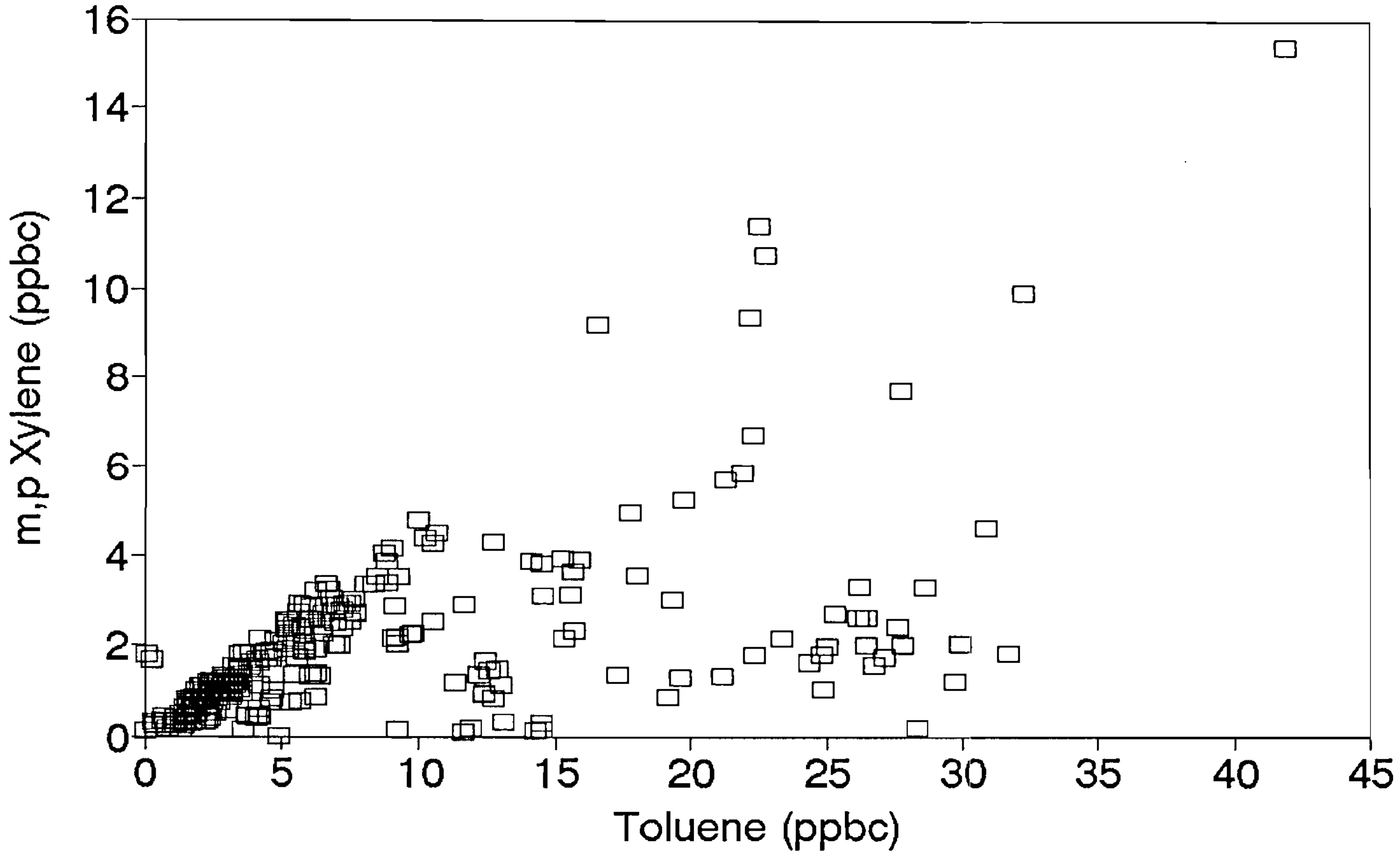
Anthropogenic Hydrocarbon Correlations

Pride, LA (1989)



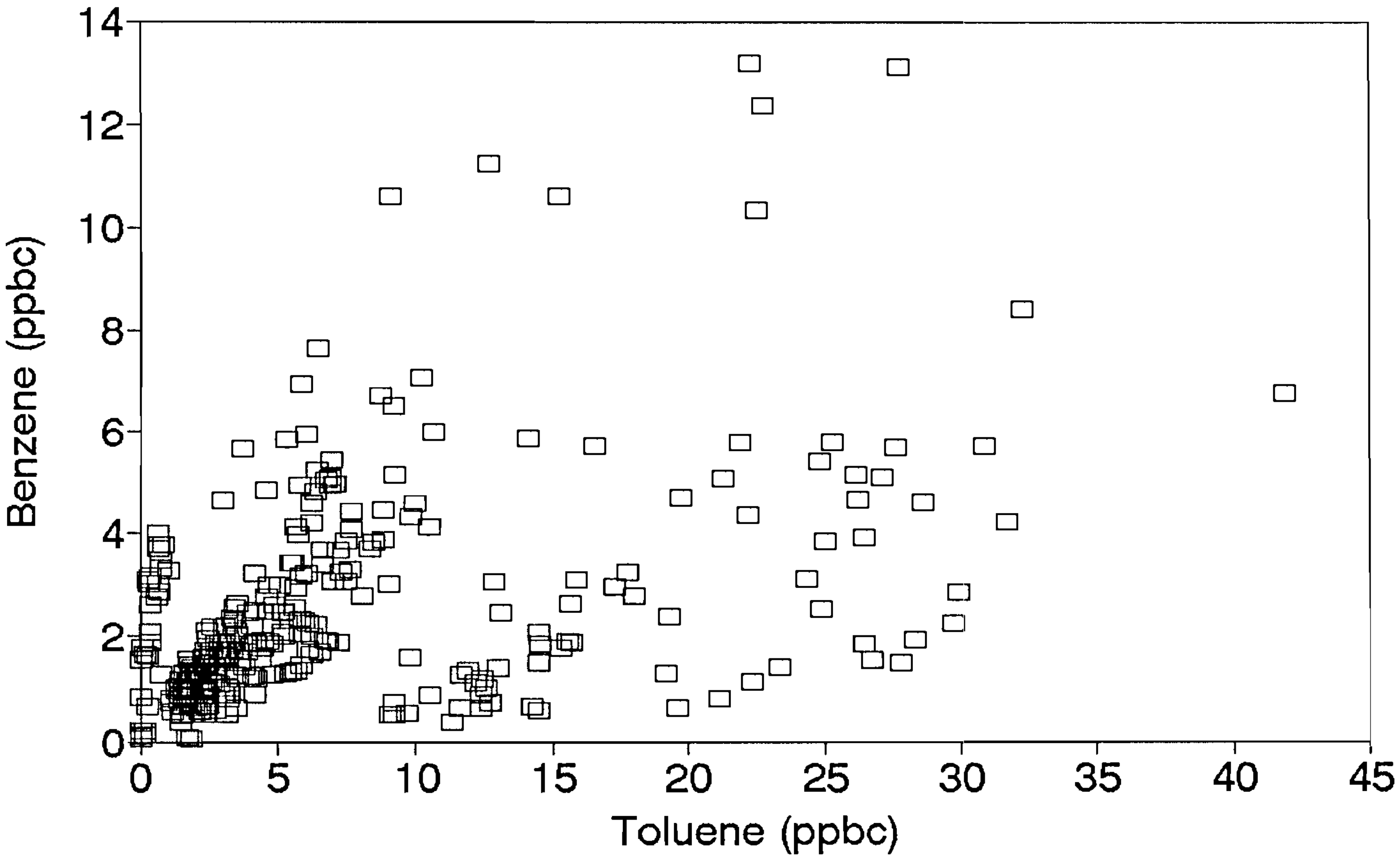
Anthropogenic Hydrocarbon Correlations

Pride, LA (1989)



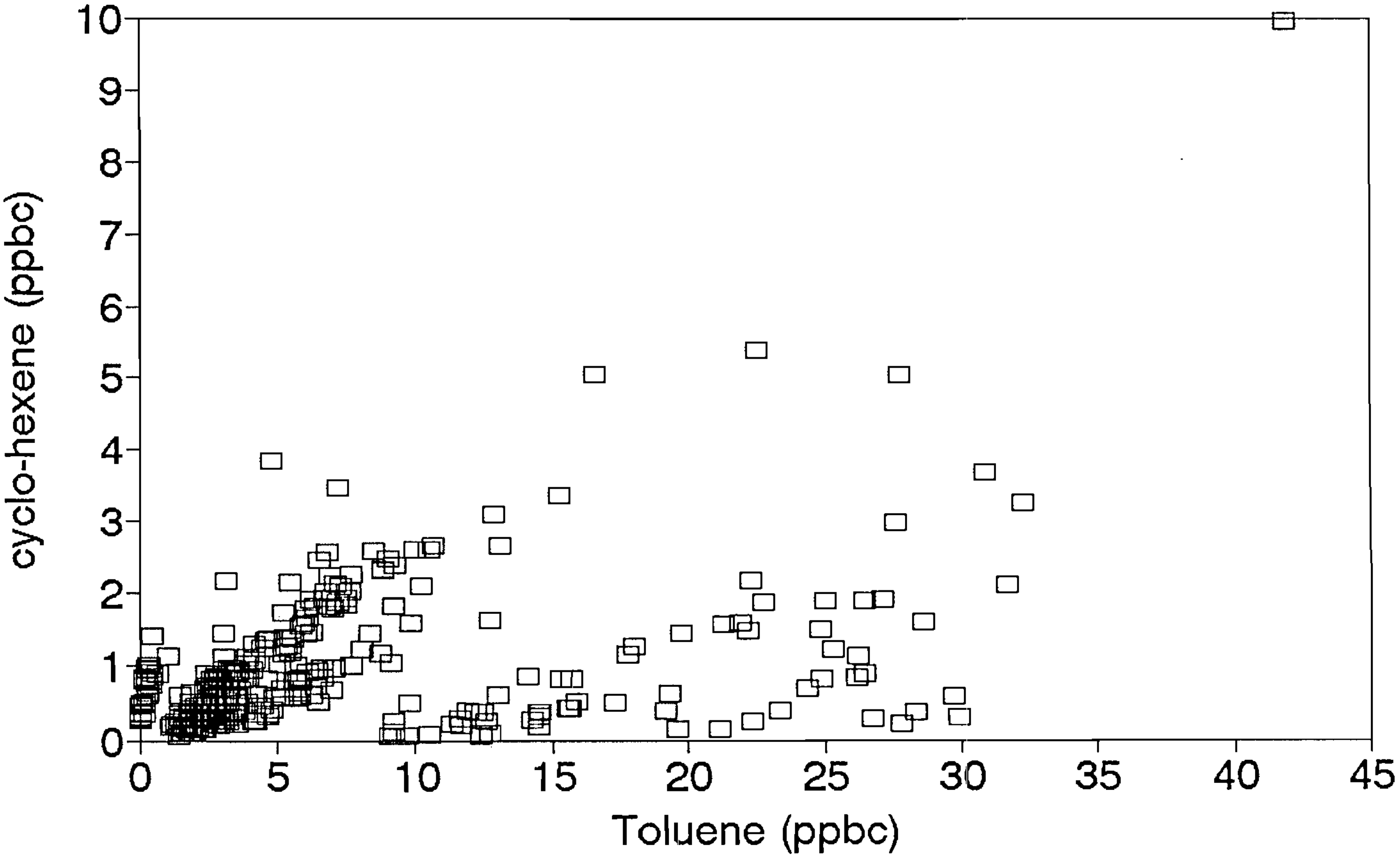
Anthropogenic Hydrocarbon Correlations

Pride, LA (1989)



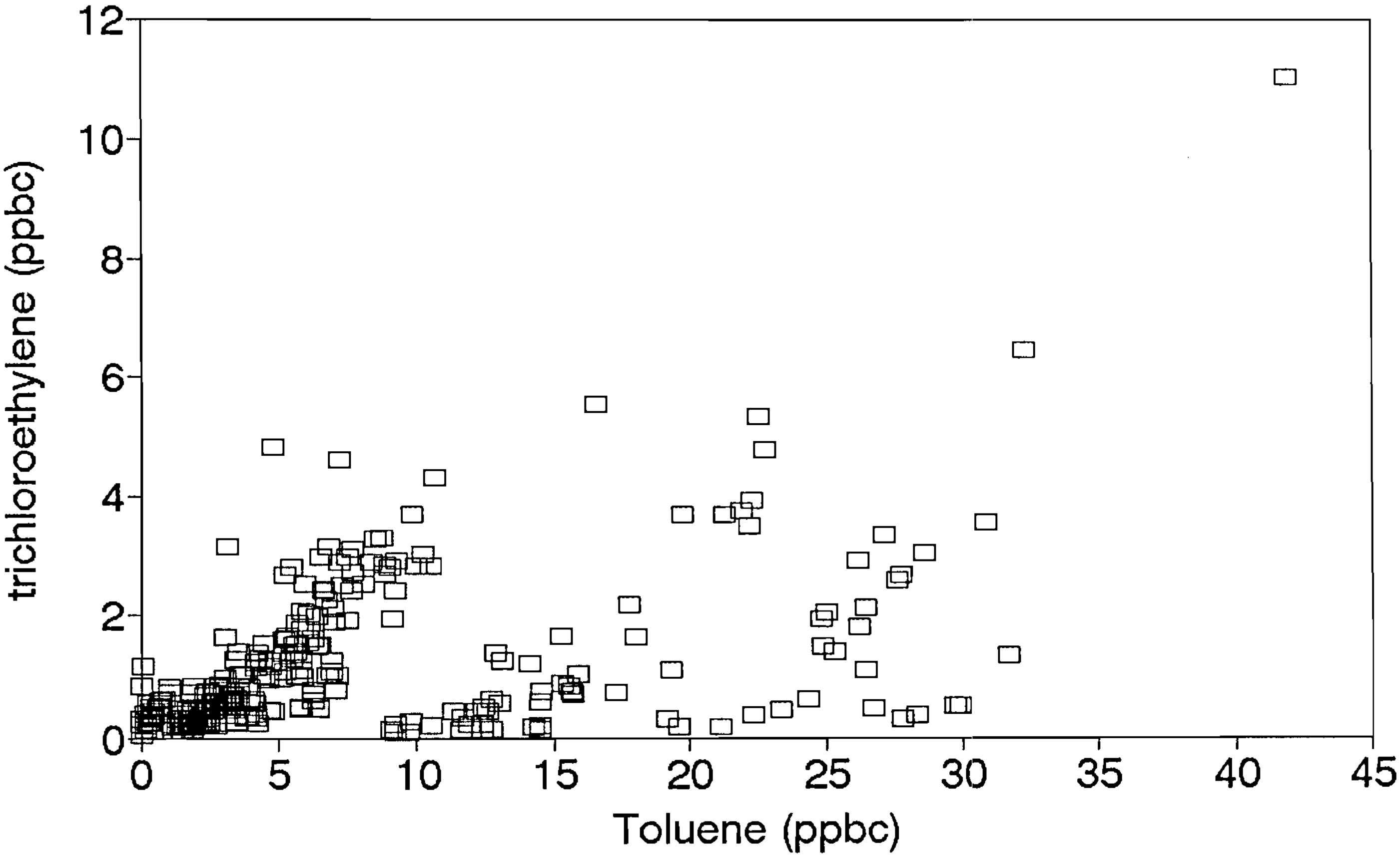
Anthropogenic Hydrocarbon Correlations

Pride, LA (1989)



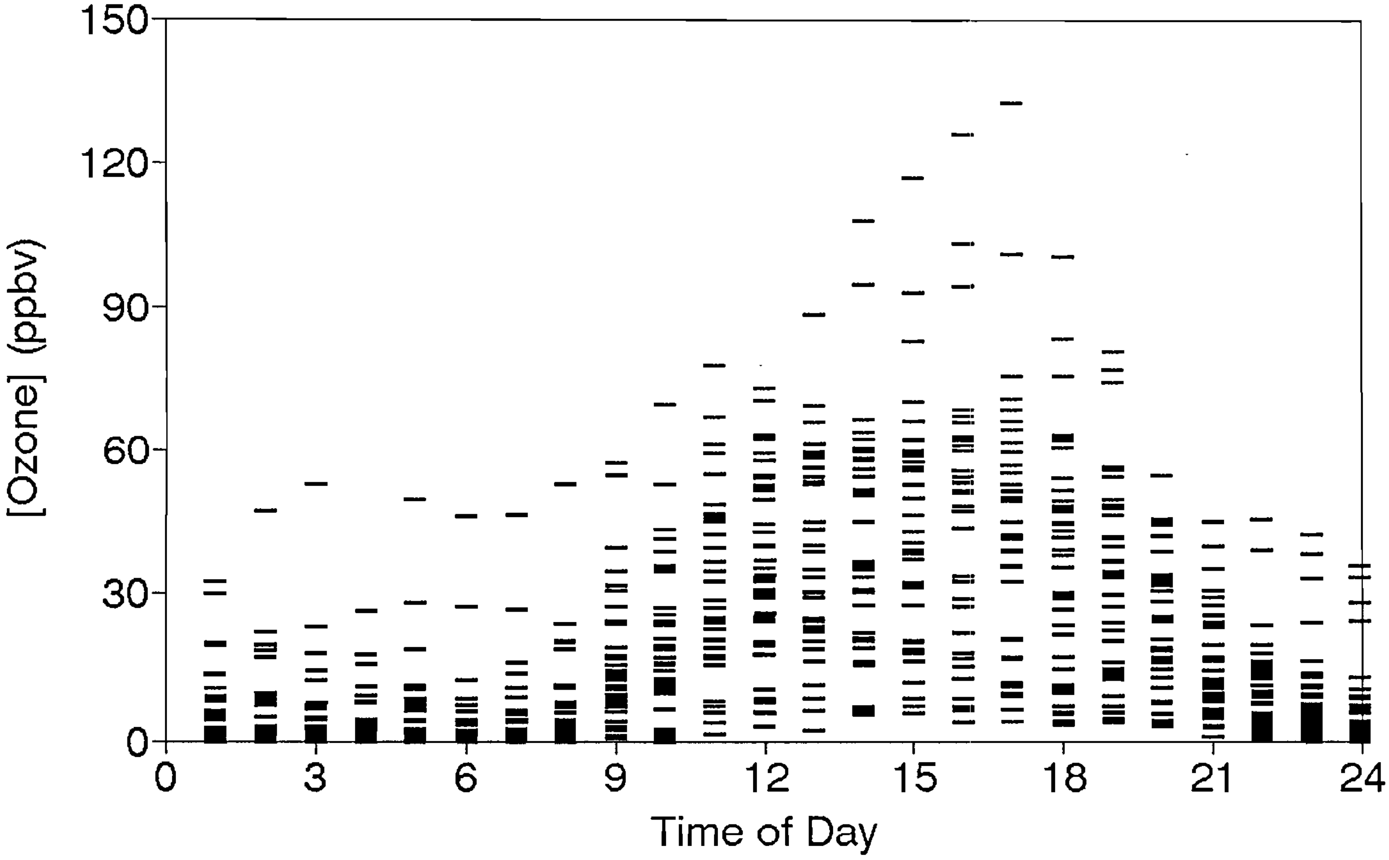
Anthropogenic Hydrocarbon Correlations

Pride, LA (1989)



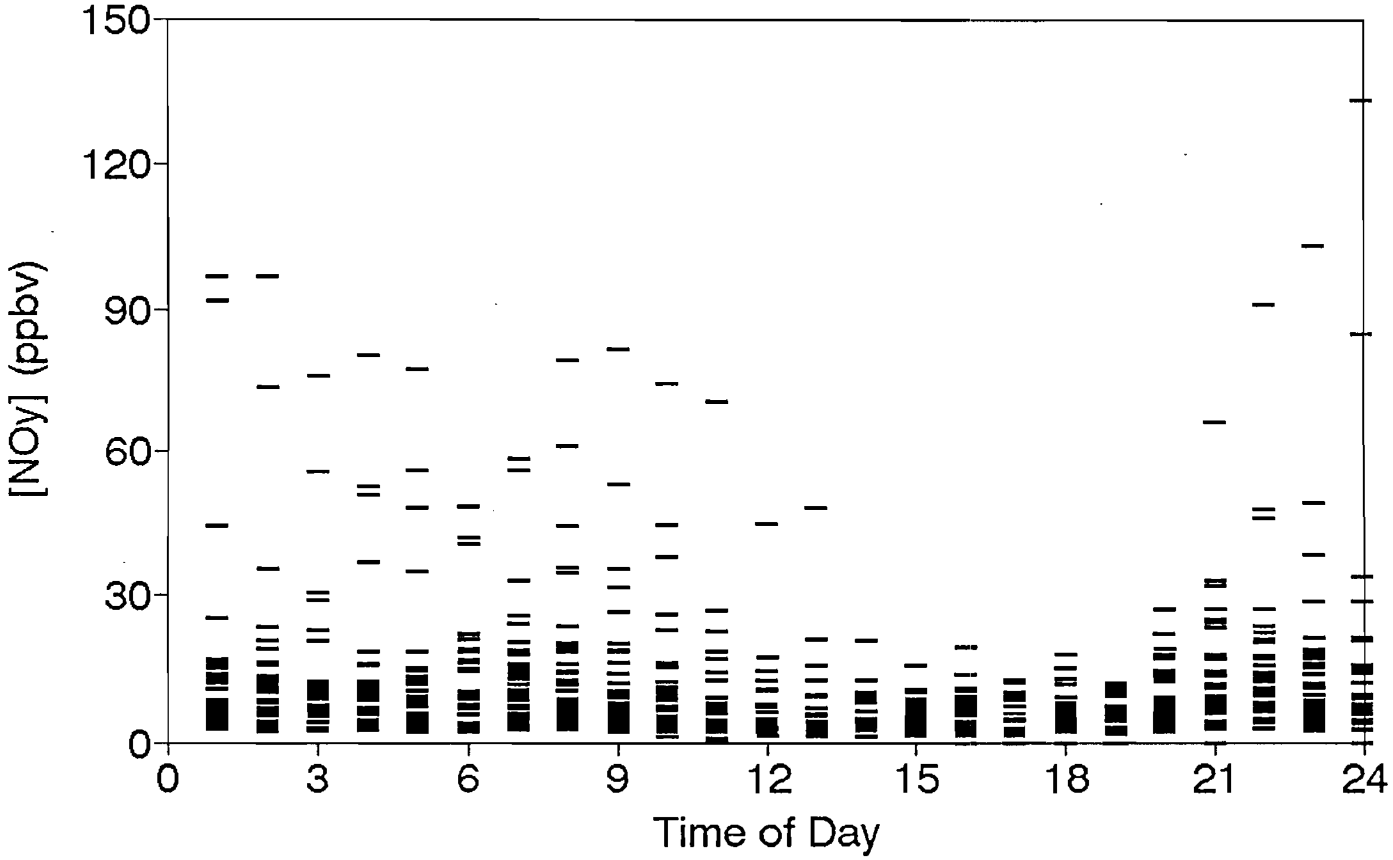
Diurnal Variation of Ozone

Baton Rouge and Pride, LA



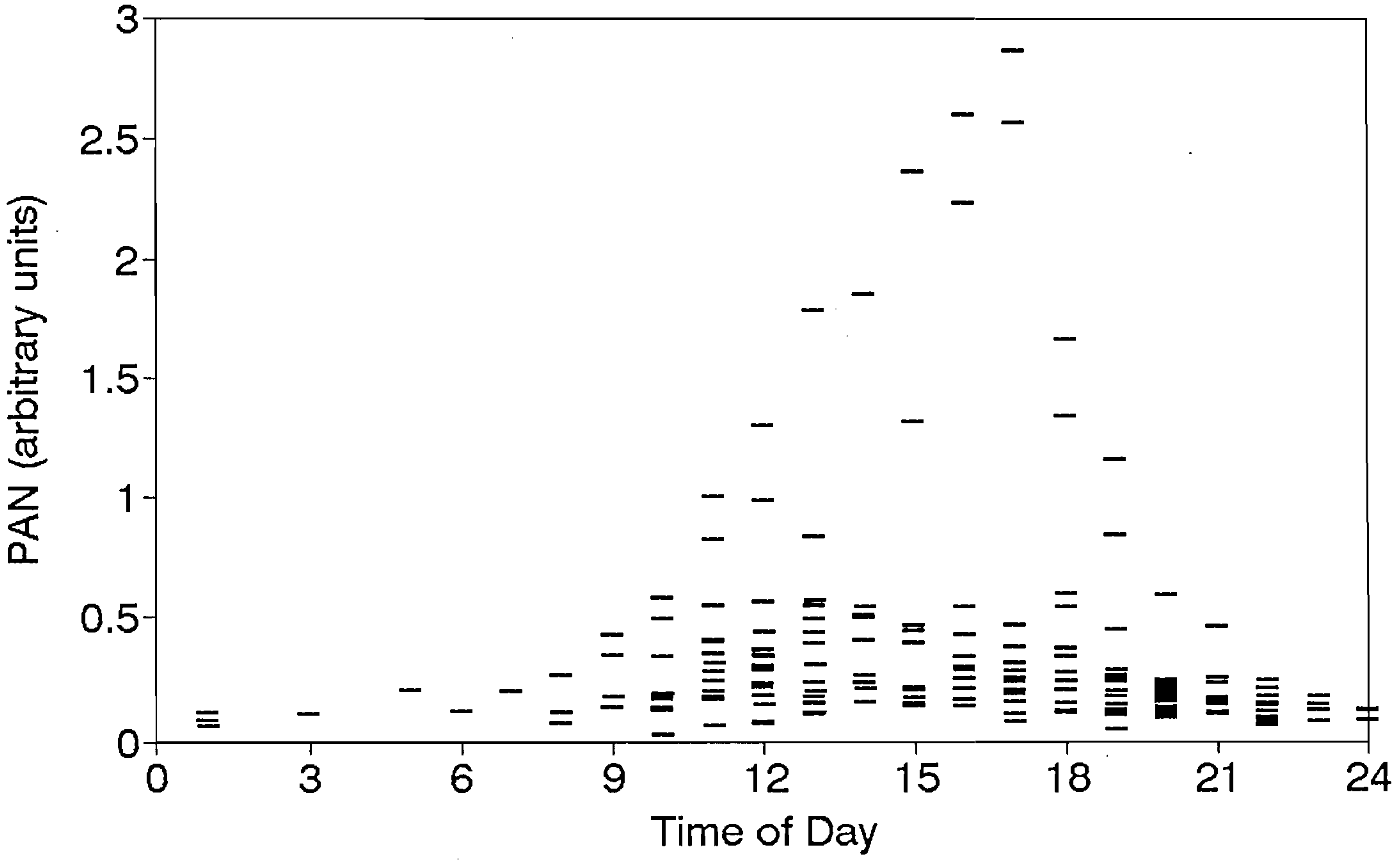
Diurnal Variation of Odd Nitrogen (NOy)

Baton Rouge and Pride, LA



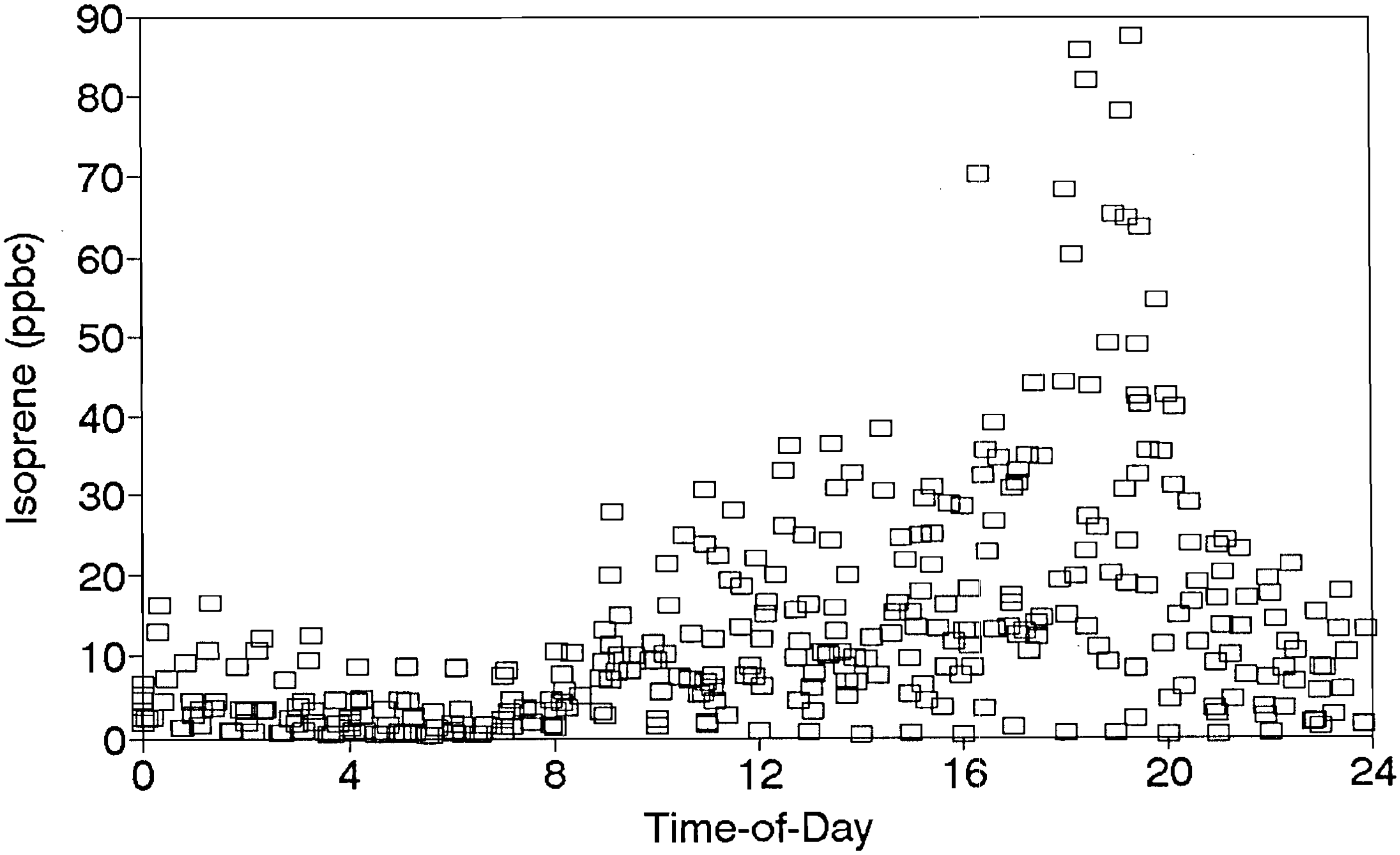
PAN Diurnal Variation

Baton Rouge and Pride, LA



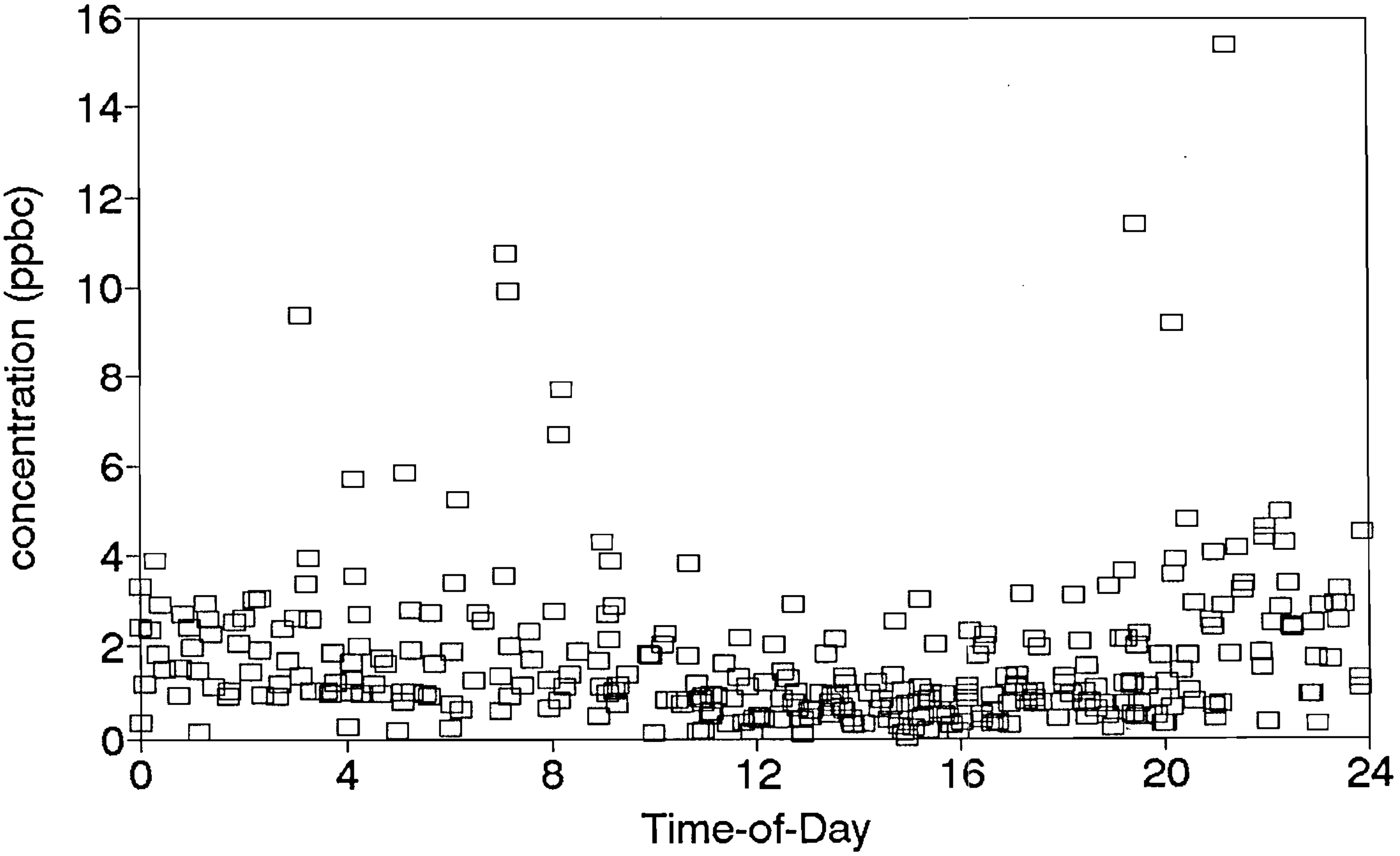
Isoprene Diurnal Profile

Pride, LA (1989)



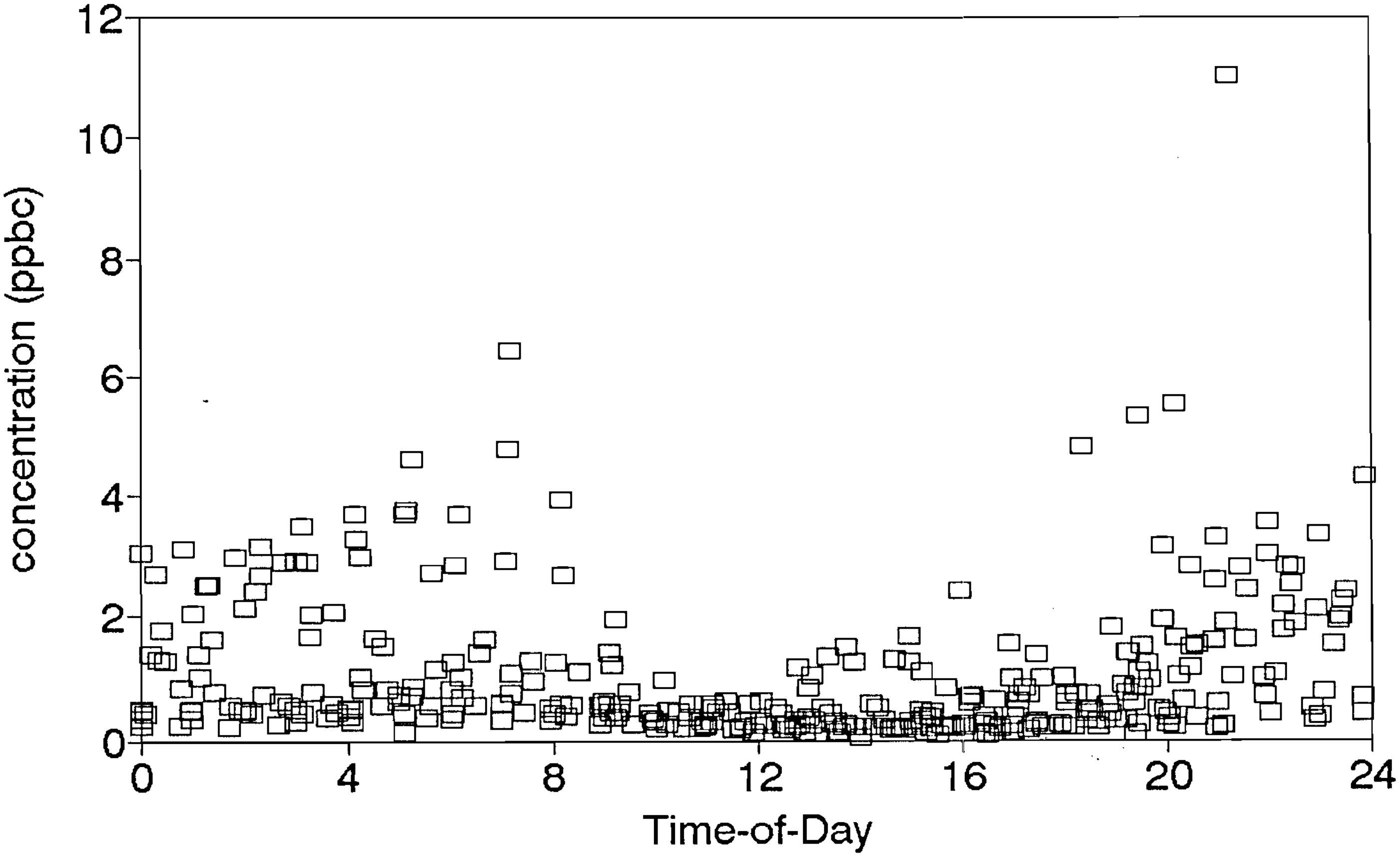
m,p Xylene Diurnal Profile

Pride, LA (1989)



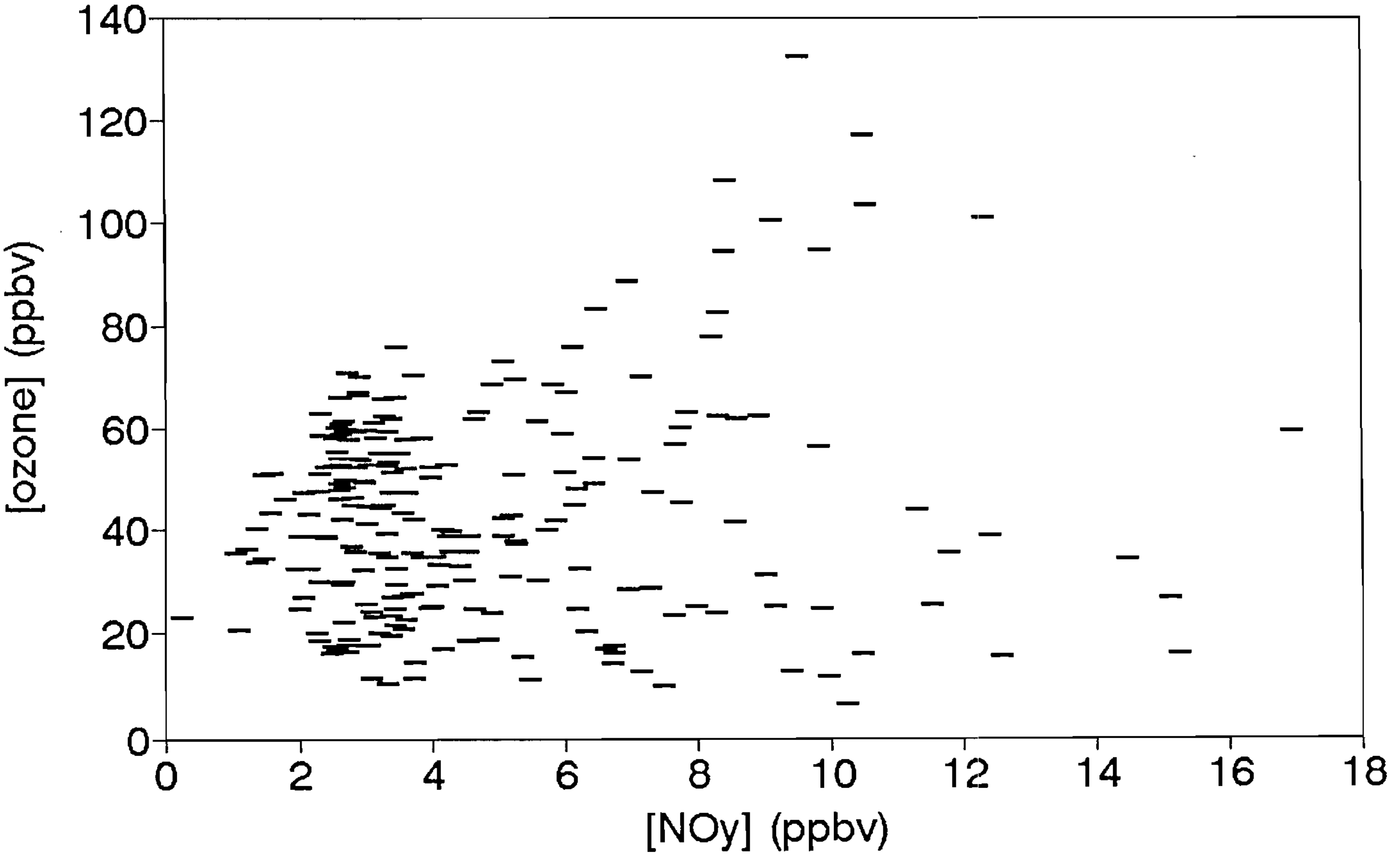
Trichloroethylene Diurnal Profile

Pride, LA (1989)



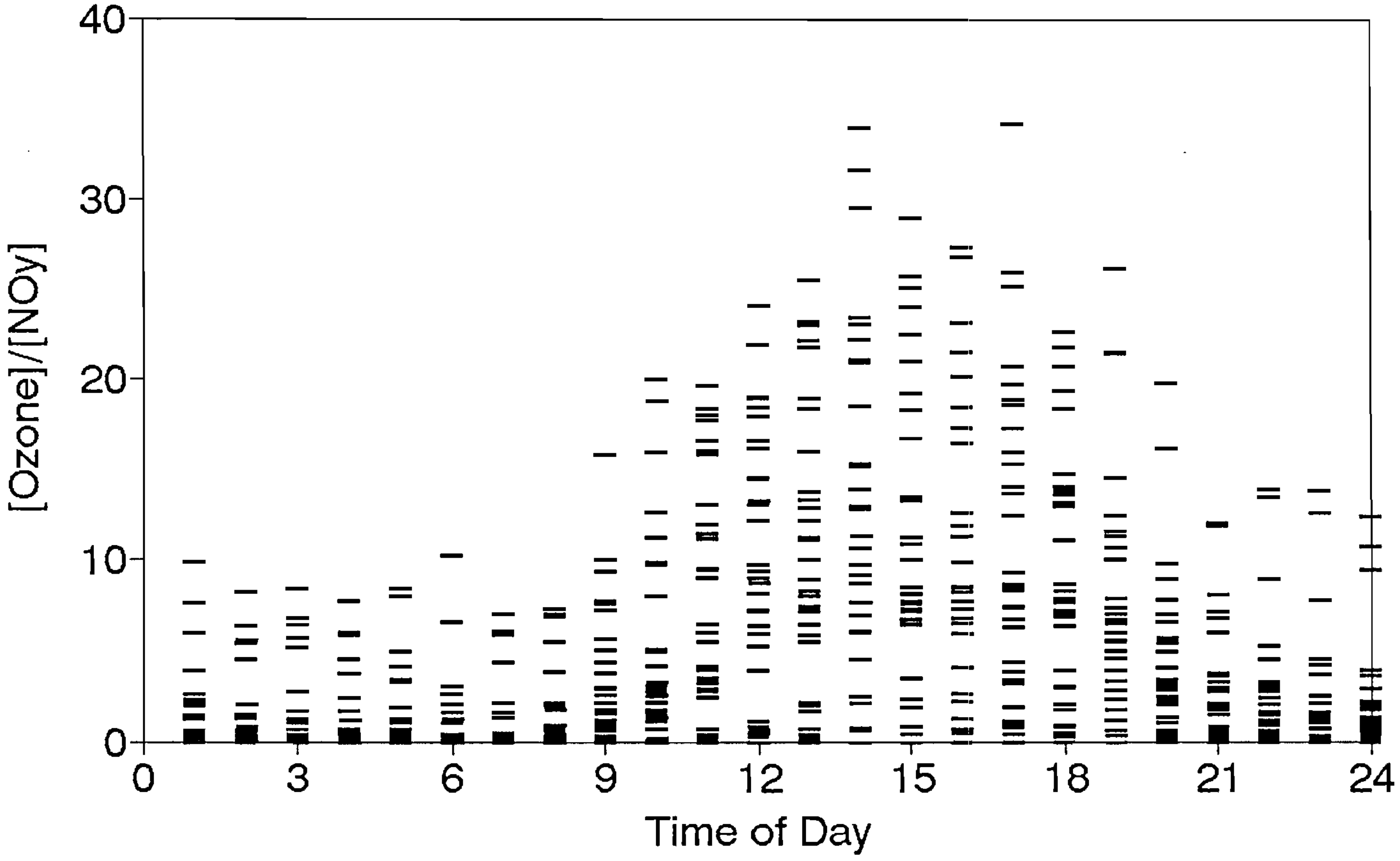
Ozone-NOy Correlation

Pride, LA (1989)



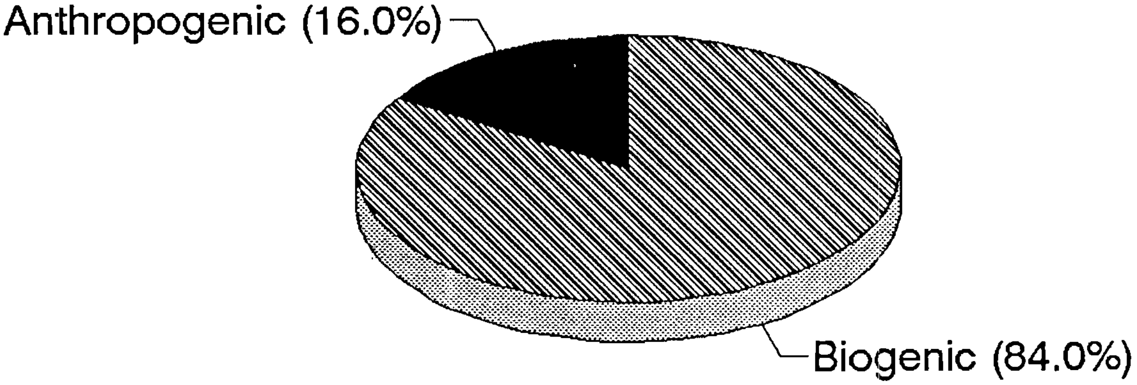
Diurnal Variation of Ozone Ratio

Baton Rouge and Pride, LA



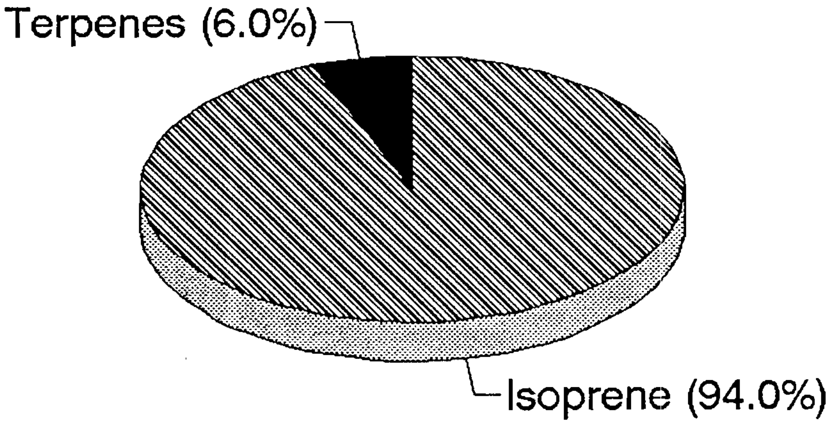
Total Hydrocarbon Reactivity

C4 and larger compounds (Pride, LA)



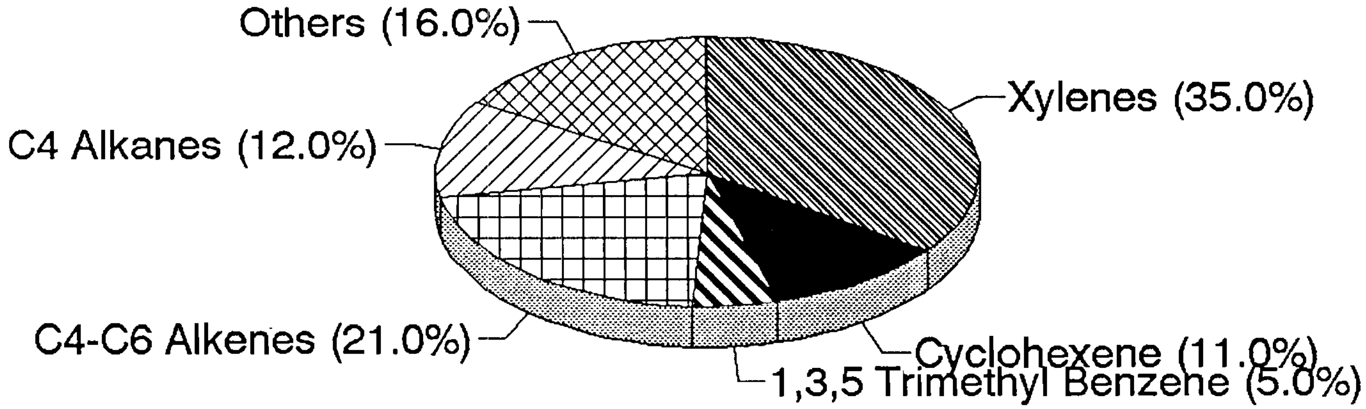
Biogenic Hydrocarbon Reactivity

C4 and larger compounds (Pride, LA)



Anthropogenic Hydrocarbon Reactivity

C4 and larger compounds (Pride, LA)



Fractional Ozone Reduction (x1000)

Observation-Based Model

	Mobile	Stationary	Total Anthro.	Biogenic
Pride (>60)	41	28	69	410
Pride (>100)	47	28	76	300
LSU	430	150	580	1,080

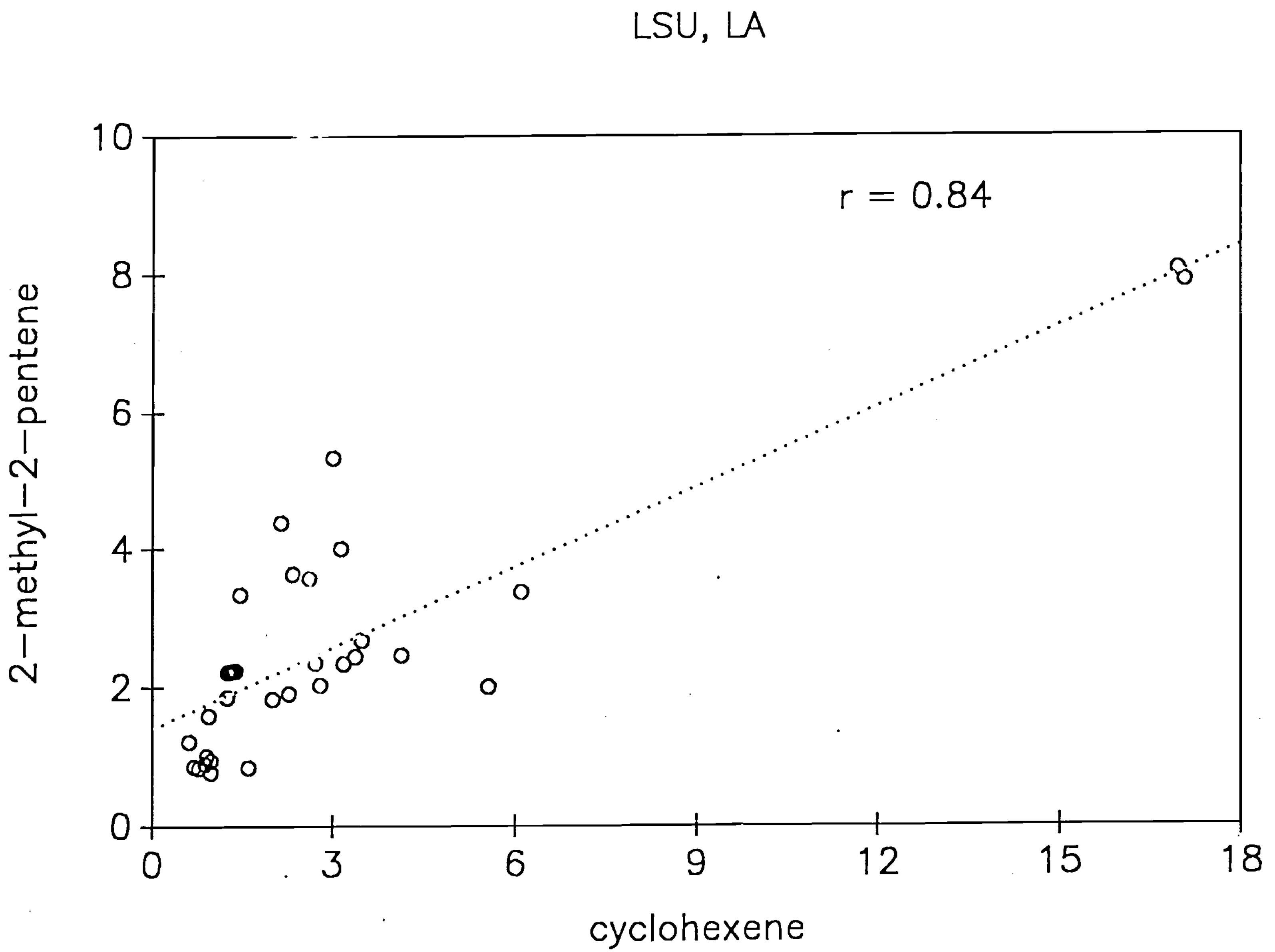
Ozone Sensitivity to NOx

Observation Based Model

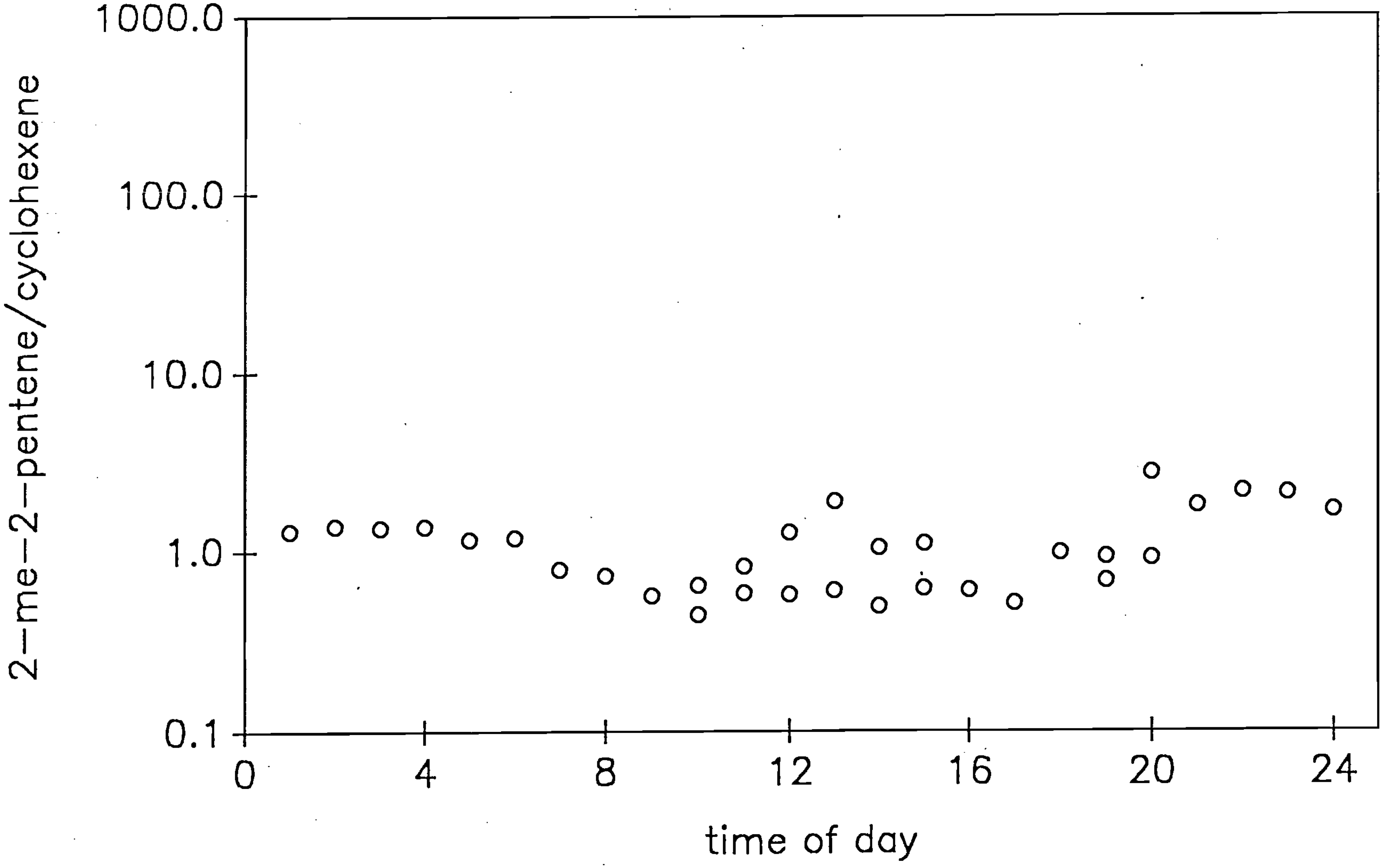
Results from Pride,La

Calculated coefficient is 0.245 (>60)

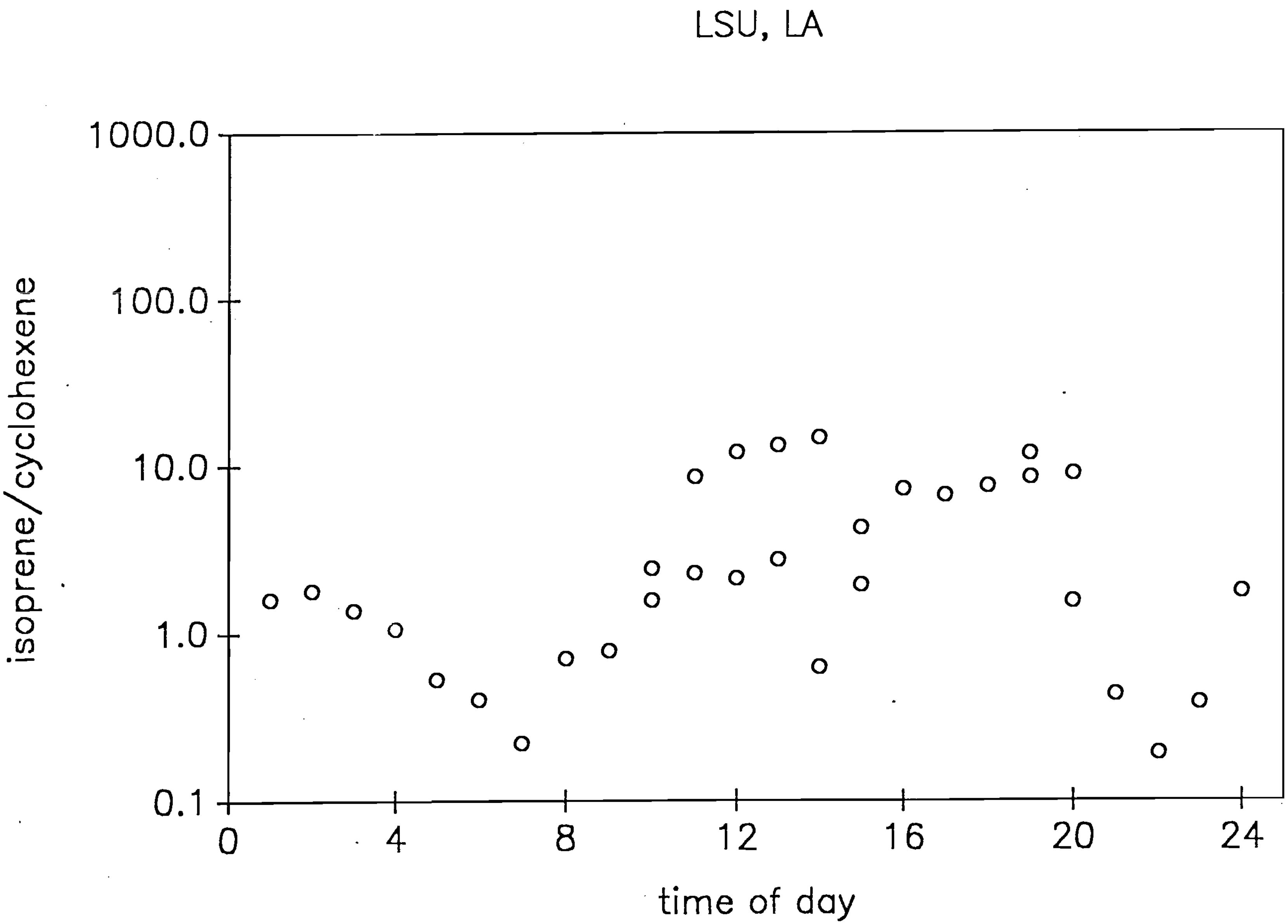
Calculated coefficient is 0.418 (>100)


LSU, LA
r = 0.84
2–methyl–2–pentene
cyclohexene
0
2
4
6
8
10
0
3
6
9
12
15
18

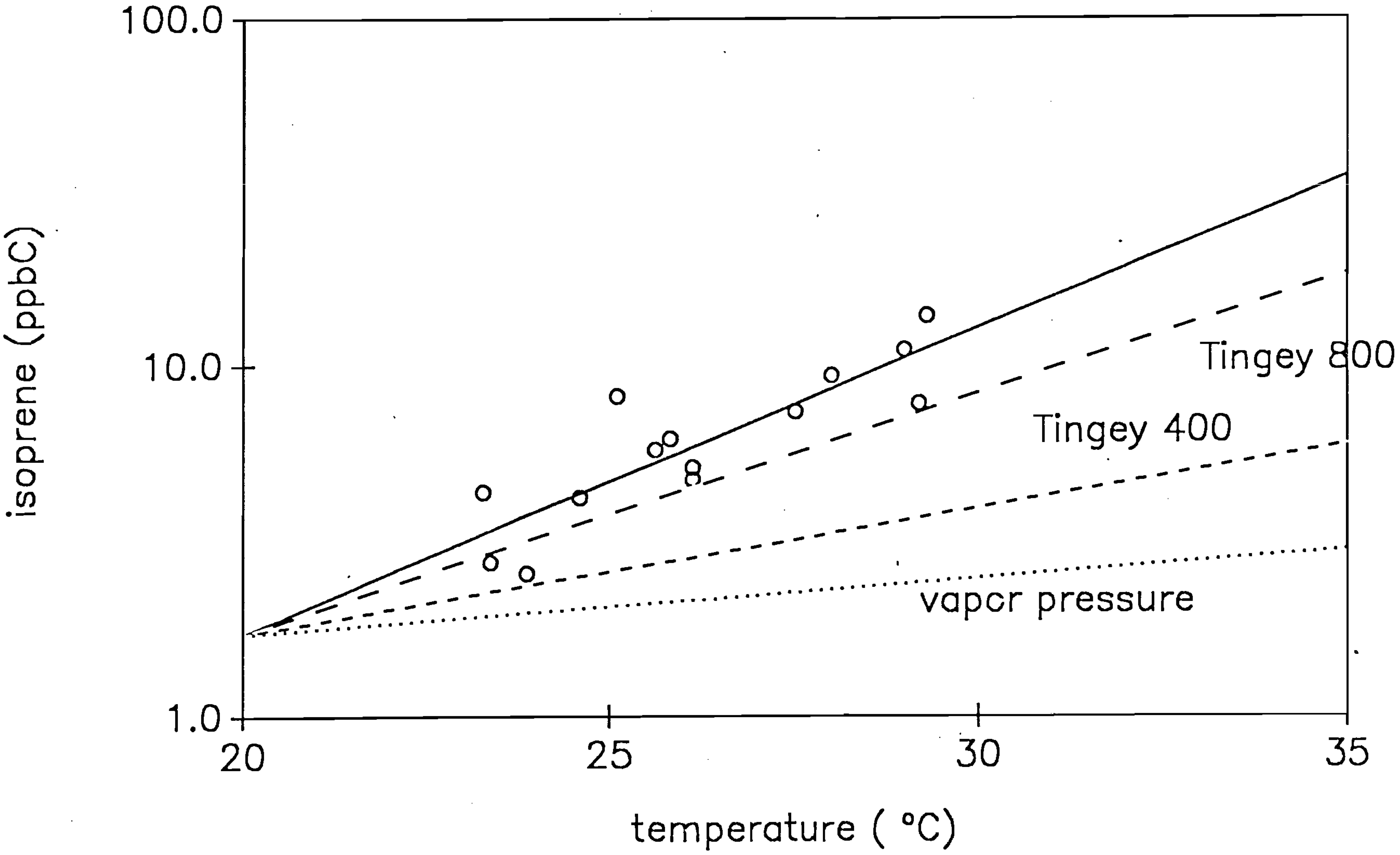
LSU, LA



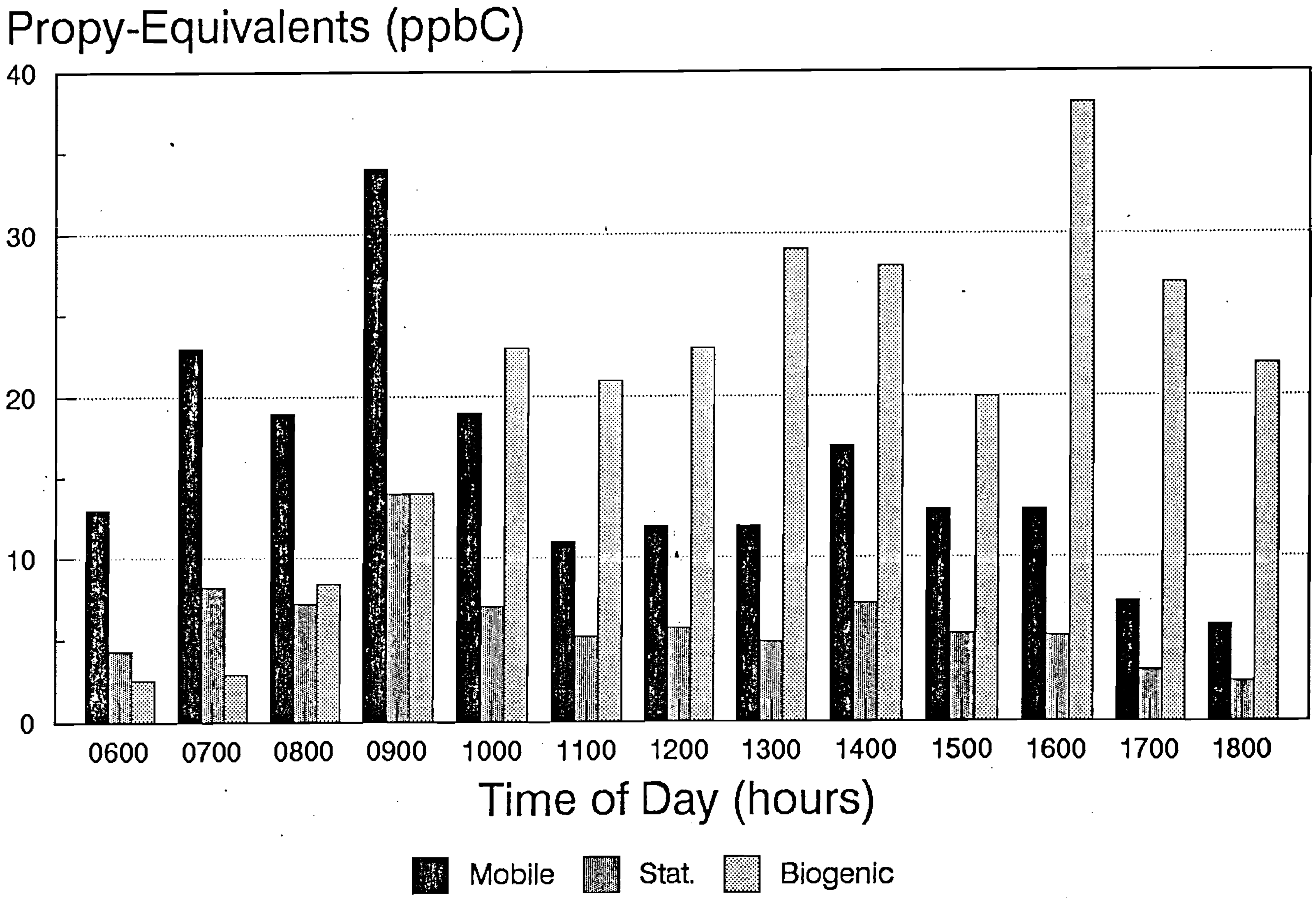
1000.0
100.0
10.0
1.0
0.1
2–me–2–pentene/cyclohexene
0
4
8
12
16
20
24
time of day

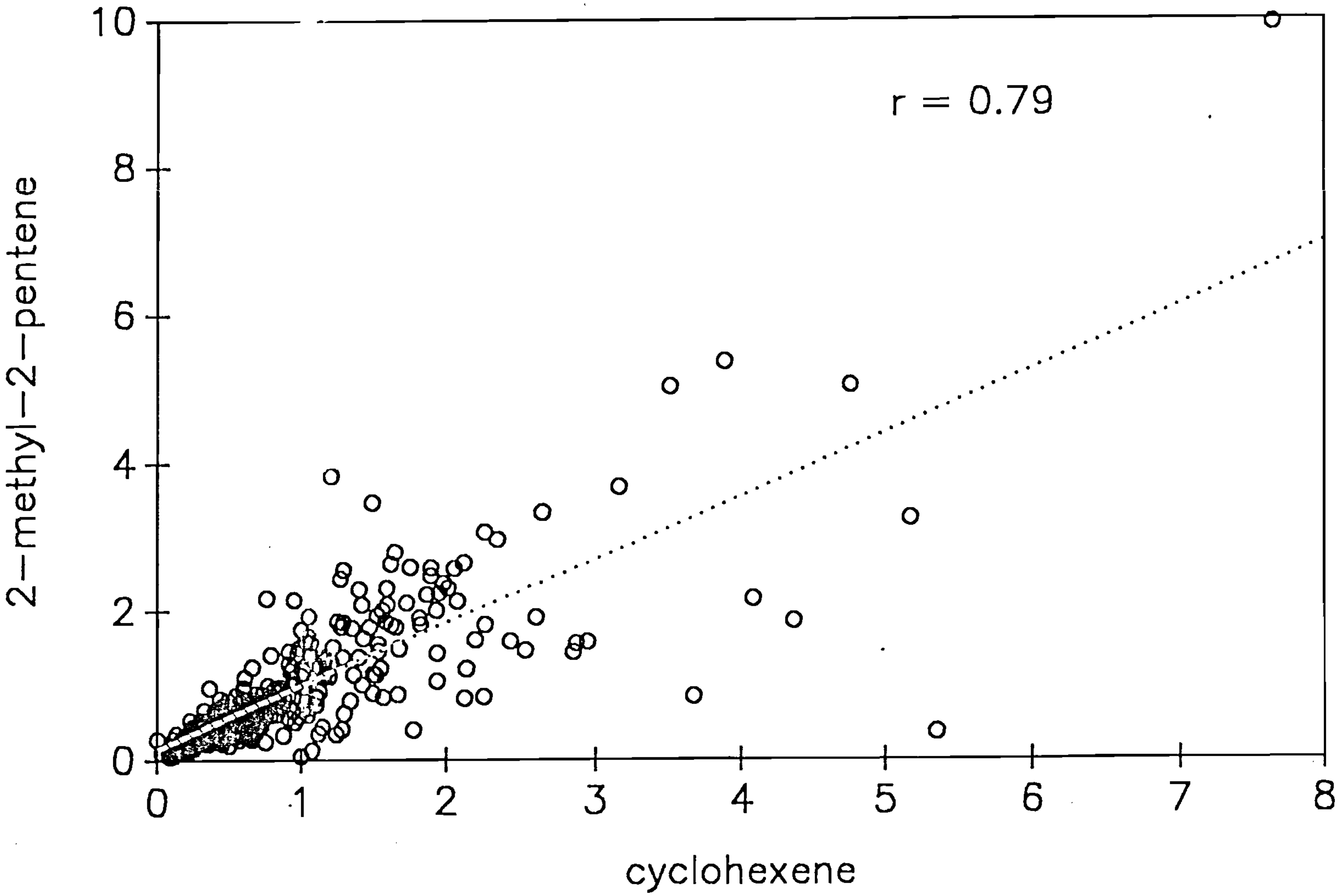

LSU, LA
isoprene/cyclohexene
1000.0
100.0
10.0
1.0
0.1
0
4
8
12
16
20
24
time of day

LSU, LA (0800–1500 LSU)

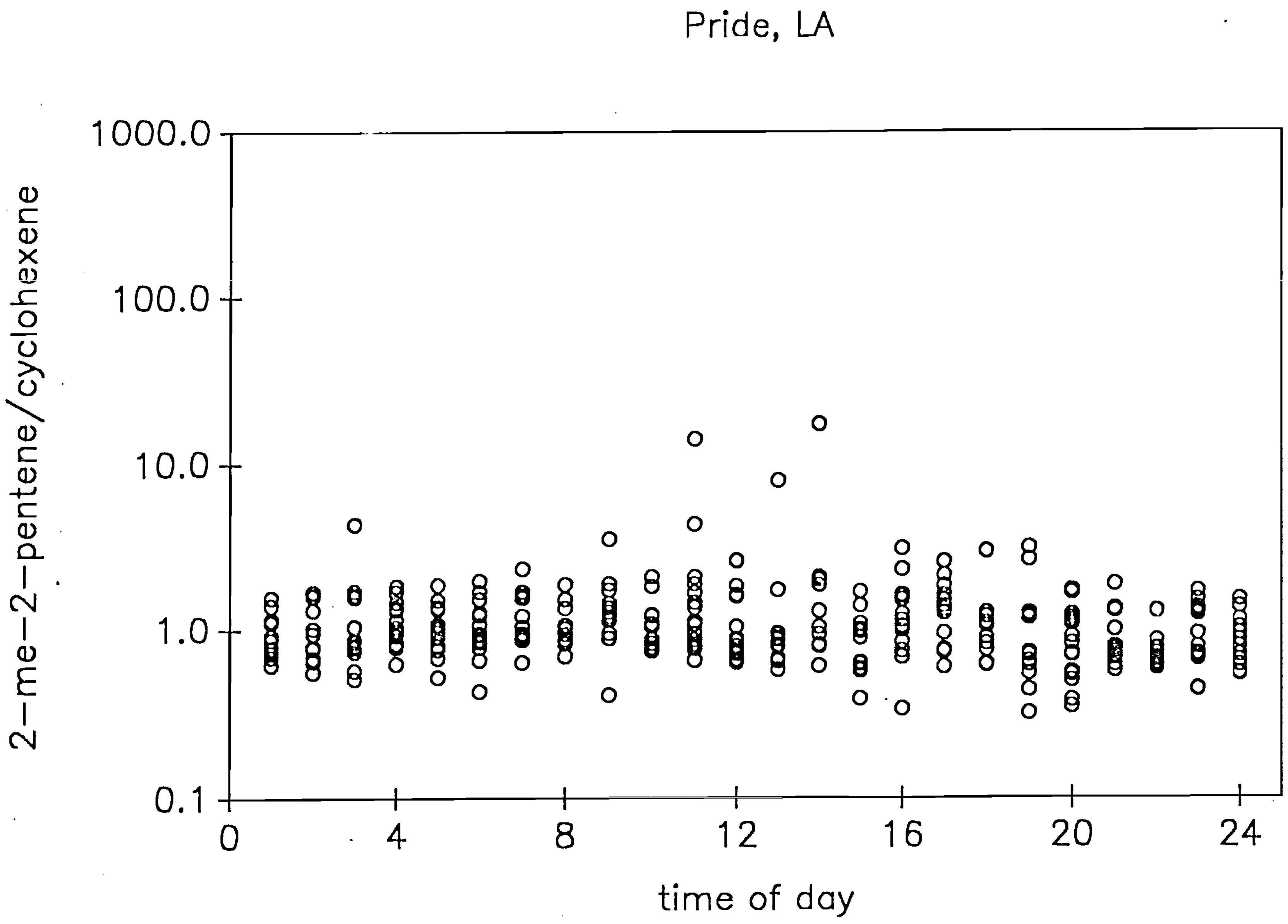


HYDROCARBON REACTIVITY AT LSU CAMPUS

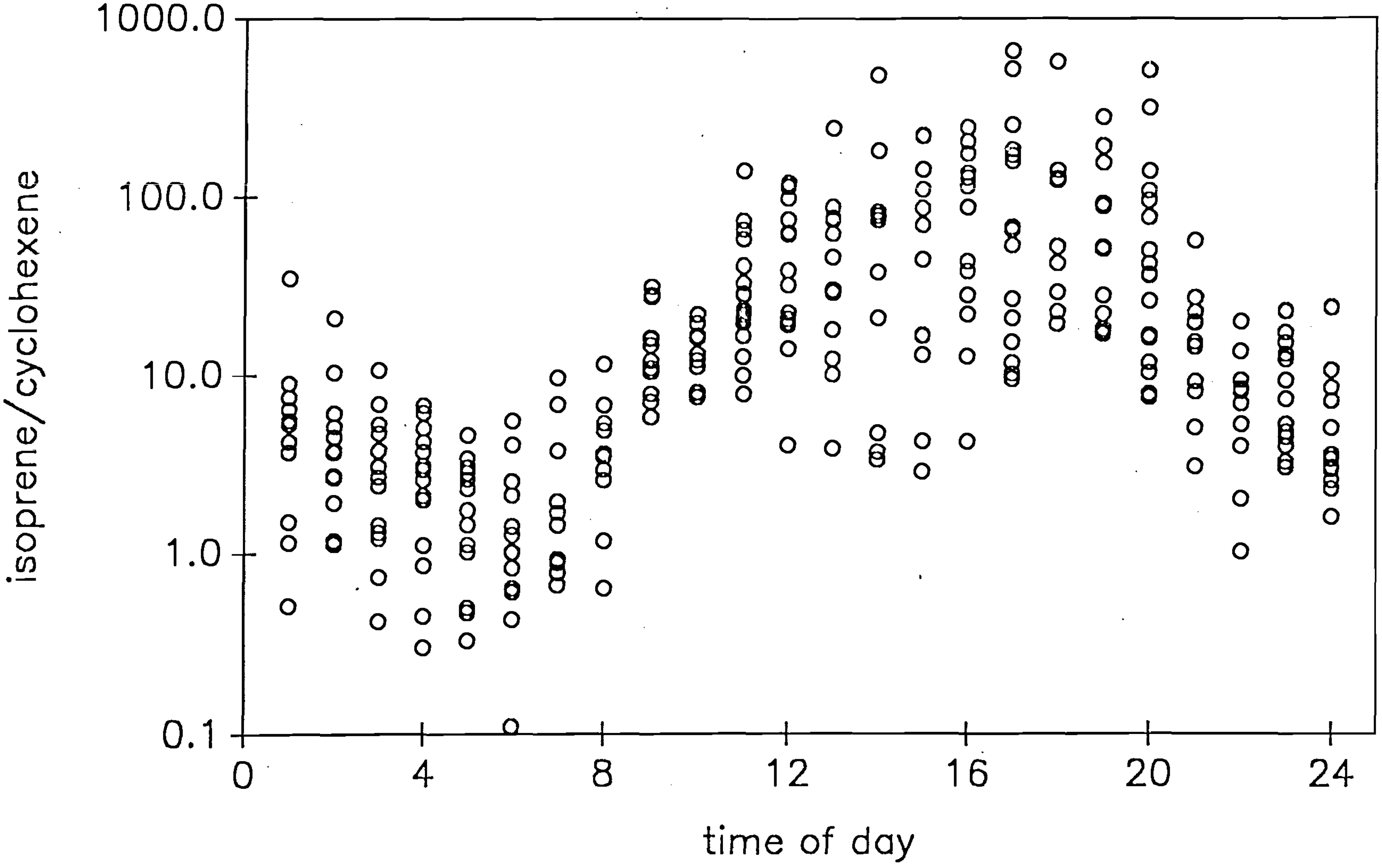




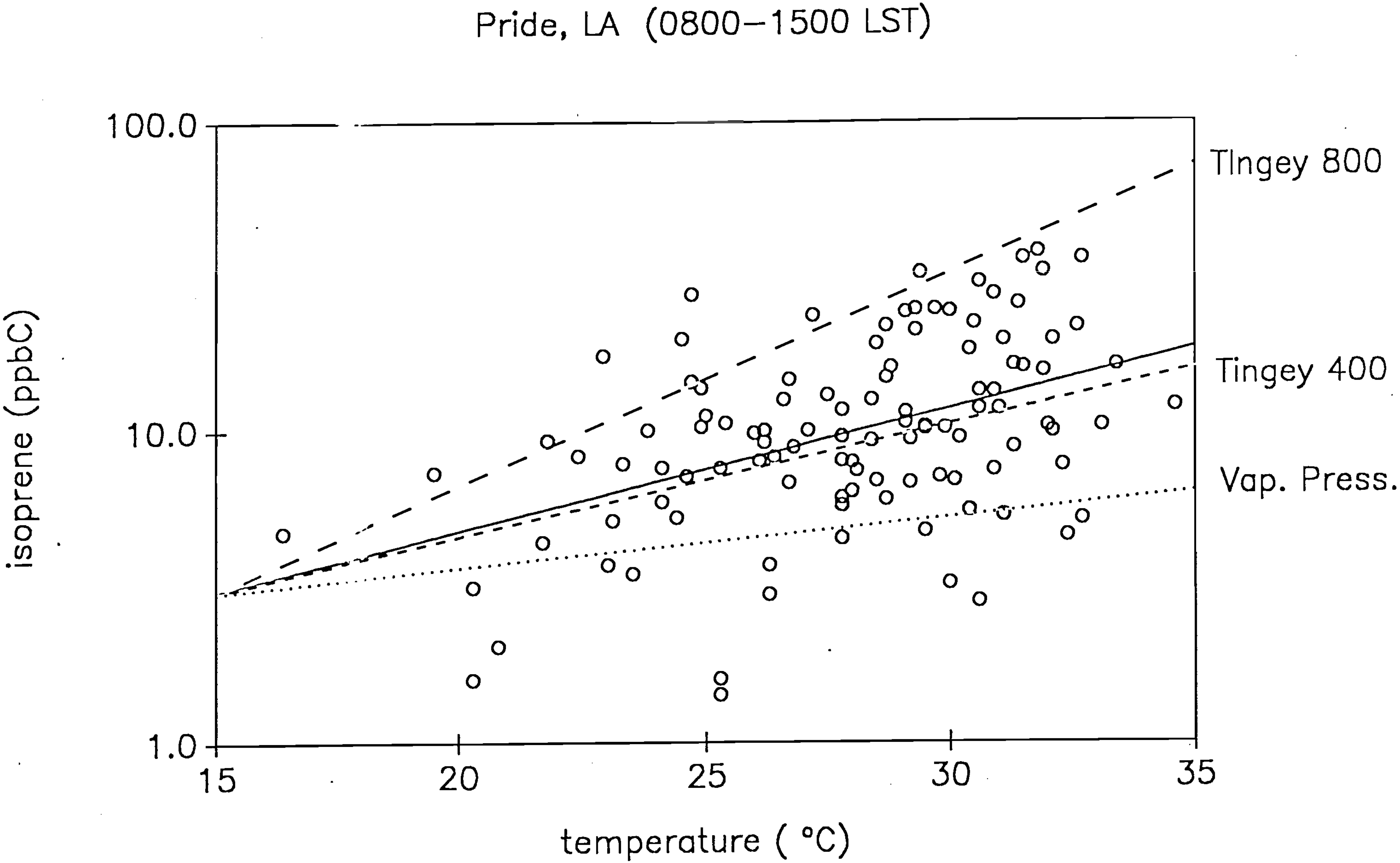
Pride, LA


Pride, LA
2-me-2-pentene/cyclohexene
1000.0
100.0
10.0
1.0
0.1
0
4
8
12
16
20
24
time of day

Pride, LA



1000.0
100.0
10.0
1.0
0.1
isoprene/cyclohexene
0
4
8
12
16
20
24
time of day


Pride, LA (0800–1500 LST)
100.0
10.0
1.0
15
20
25
30
35
isoprene (ppbC)
temperature (°C)
TIngey 800
Tingey 400
Vap. Press.

HYDROCARBON REACTIVITY AT PRIDE, LA