VI. MEASUREMENT OF GASEOUS POLLUTANTS BY LONGPATH DIFFERENTIAL OPTICAL ABSORPTION SPECTROSCOPY: IMPLICATIONS FOR NIGHTTIME ATMOSPHERIC CHEMISTRY

A. Introduction

Measurements, using long pathlength differential optical absorption spectroscopy, of the nitrate (NO_3) radical and of nitrous acid (HONO) in ambient nighttime atmospheres have now been made at a variety of locations in the United States, Europe and the mid-Pacific (Perner and Platt 1979, Platt and Perner 1980, Noxon et al. 1980, Platt et al. 1980a,b, 1981, 1982, 1984, Harris et al. 1982, Noxon 1983). The resulting data have focussed attention on the importance of these species in the chemistry of nighttime atmospheres (Platt et al. 1982, Pitts 1983, Stockwell and Calvert 1983, Noxon 1983, Richards 1983, Jones and Seinfeld 1983, Heikes and Thompson 1983, Winer et al. 1984, Atkinson et al. 1984c). Thus recent measurements of the NO_3 radical reaction rate constants for a wide range of organics of anthropogenic and biogenic origin have shown that NO_3 radical reactions at night can in many cases compete with the reactions of O_3 and OH radicals (the latter during sunlight hours only) as major loss processes for these compounds (Atkinson et al. 1984b,c, Winer et al. 1984).

However, when the present CARB/SAPRC investigation began, the available data did not include simultaneous measurements at a given site of HONO and the NO_3 radical, nor associated measurements of NO, NO_2, O_3, HCHO and other species. This precluded the development of reliable reaction mechanisms and the testing of computer models of the nighttime chemistry of these species. To address this need, we carried out simultaneous measurement of NO_3 radical and HONO concentrations in ambient air, as well as the concentrations of related species, as an integral part of the field study described in Section II. Specifically, we utilized our unique *in situ* long pathlength differential optical absorption spectroscopic (DOAS) technique to monitor key trace pollutant species such as HONO, the NO_3 radical, NO_2, HCHO, SO_2 and O_3. The data obtained, in conjunction with those from the continuous monitoring instruments used in the September 1983 field study, provided an extensive record of the gaseous pollutant concentrations and their time-dependent behavior.

The fact that this study yielded, for the first time, simultaneous time-concentration profiles of HONO, NO_2, the NO_3 radical and HCHO, allowed us to investigate the proposal of Stockwell and Calvert (1983) that the nighttime chemistries of HONO, NO_2, HCHO and NO_3 radicals are linked via the reactions

$$NO_3 + HCHO \rightarrow HNO_3 + HCO \qquad (1)$$

$$HCO + O_2 \rightarrow HO_2 + CO \qquad (2)$$

$$HO_2 + NO_2 \rightleftarrows HO_2NO_2 \qquad (3,-3)$$

$$HO_2 + NO_2 \rightarrow HONO + O_2 \qquad (4)$$

In particular, the suggestion by Stockwell and Calvert (1983), that this homogeneous gas phase mechanism accounts for our observation of HONO in the South Coast Air Basin, was in contradiction to our conclusions that ambient concentrations of HONO arise primarily from direct emissions from light duty motor vehicles (Pitts et al. 1984h) and from heterogeneous reactions of NO_2 with H_2O (Sakamaki et al. 1983, Pitts et al. 1984g).

B. Experimental

During the field measurements in September 1983 the DOAS system (Figure VI-1) was set up on the campus of the University of California, Riverside. The light source was placed on a flat roof of a one-story house located on a slight hill 640 m away from the detector site. The relatively short distance was chosen so that the equipment and the light path could be kept on the campus for safety reasons. As discussed below, one consequence of the short optical path was that absorption features of some compounds were near to, or below, the detection level. The rapid scanning spectrometer was placed in a small shed on top of a one-story building at the location where SAPRC's air monitoring and sampling equipment was set up.

Spectra were taken at four different wavelength regions: at approximately 300 nm (SO_2), 340 nm (HCHO and NO_2), 360 nm (HONO, NO_2 and HCHO), and 660 nm (NO_3). At each wavelength region spectra were averaged for ~10

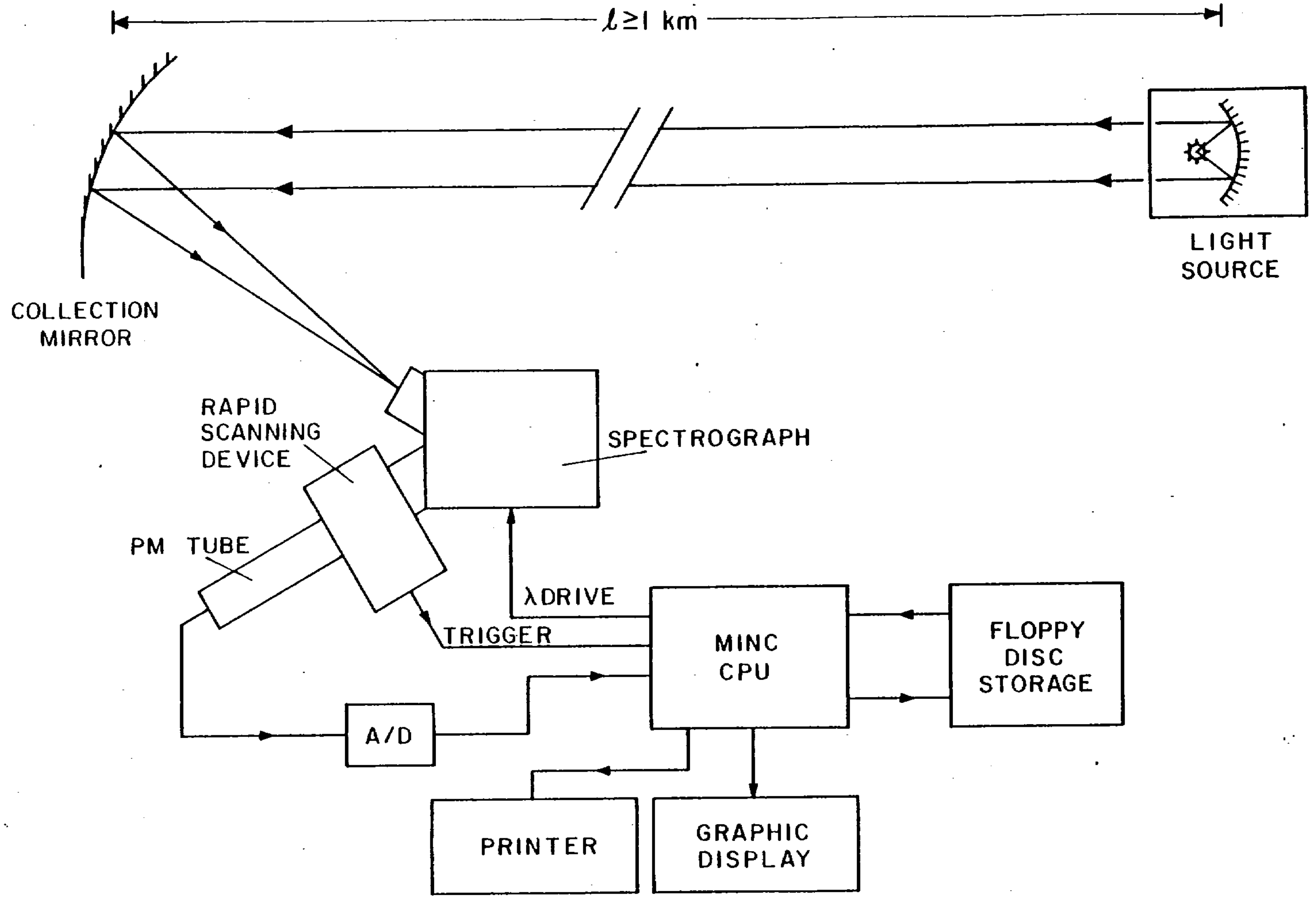


Figure VI-1. Long pathlength differential optical absorption spectrometer.

min to maintain the same time resolution as the other continuous monitoring equipment provided. The differential absorption cross-sections (cm^2 molecule^{-1} units) and the specific wavelengths used for the species monitored by DOAS were as follows (Platt and Perner 1983): SO_2, 5.7 x 10^{-19} (300 nm); HCHO, 7.8 x 10^{-20} (340 nm); HONO, 4.2 x 10^{-19} (354 nm); NO_2, 1.0 x 10^{-19} (363 nm); and NO_3, 1.8 x 10^{-17} (662 nm). At the optical pathlength of 640 m used, the detection limits for SO_2, HCHO, HONO, NO_2 and the NO_3 radical were ~1, ~20, ~1, ~4 and ~0.008 ppb, respectively. These detection limits reflect not only the different absorption coefficients, but also take into account the actual noise levels encountered in the different wavelength regions.

The central part of the rapid scanning device is a thin metal disk with a series of narrow slits etched into it radially. The disk spins in the exit focal plane of the spectrograph and at any given time one particular slit is used as the exit slit. The width of the scanned spectrum depends on the length of the arc that a slit covers and on the dispersion of the grating. For a 600 groove mm^{-1} grating the scan width is about 30 nm. The light passing through the exit slit is measured by a photomultiplier tube; the output signal is digitized by a high speed analog-to-digital converter and read by a minicomputer (PDP 11/23). During one scan, about 350 digitized data samples are taken. Consecutive scans, at a rate of approximately 100 scans per second, are signal averaged by the computer software. Appropriate software is also used for spectral deconvolution and for the calculation of optical densities.

During the scan of a spectrum the central wavelength of the scan is selected by the spectrograph setting and the width of the scan region is determined by a mask located very close to the slotted disk (Figure VI-2). The distance between the slits along the rim of the disk is slightly larger than the aperture of the mask, so that at any given time no more than one slit is irradiated. As a slit becomes visible at the left edge of the mask (see Figure VI-2), it is detected by an infrared light switch and a trigger signal is sent to the computer. While the slit sweeps over the spectrum, the computer continuously takes digitized samples of the light intensity. During each scan, the digitized samples are added to the corresponding channels in the computer, thereby superimposing and signal

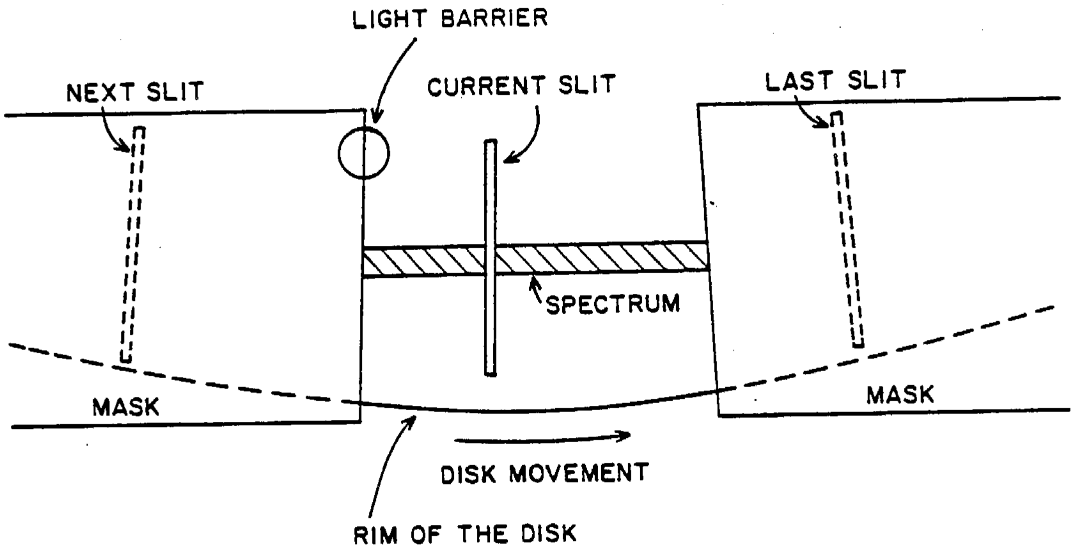


Figure VI-2. The "slotted disk" rapid scanning device located in the focal plane of the differential optical absorption spectrometer (from Platt and Perner 1983).

averaging all scans in memory. After finishing one scan, the computer waits for another trigger pulse to indicate the next slit approaching the left edge of the mask. In order to preserve the spectral resolution while superimposing a large number of scans (10,000-100,000), the rotational speed of the slotted disk must be maintained constant to within ±0.1%.

Due to the limited wavelength scanning range, the use of signal averaging and single beam operation, the DOAS system cannot detect compounds with absorption features that are broad compared to the 30 nm scan width. However, a molecule with a pronounced banded structure can be measured quantitatively from the difference between a suitable absorption band minimum and its adjacent maxima, ignoring any superimposed continuum. The procedure for identifying and measuring gaseous pollutants first involves determination of the differential absorption coefficients of the pure species in air, using known vapor pressures of the gases in 10 cm pathlength cells. These reference spectra are then used to deconvolute the complex ambient air spectra. Details of this procedure have been described elsewhere (Platt and Perner 1983).

C. Results

During the period of September 12, 13 and 14, 1983, the DOAS system acquired simultaneous spectra for nitrogen dioxide (NO_2), nitrous acid (HONO) and formaldehyde (H_2CO). On September 15, 16 and 17, 1983, in addition to these compounds, absorption bands of sulfur dioxide (SO_2) and the nitrate radical (NO_3) were monitored. The observed optical densities and the corresponding concentrations for the main absorption bands of the measured compounds are given in Tables VI-1 through VI-3. No data for formaldehyde are given because its concentration, at the pathlength employed, was always below the detection limit of 20 ppb.

The time period of this study was characterized by moderate photochemical air pollution episodes, with afternoon ozone levels reaching approximately 250 ppb. For the nights of September 15 to 16 and September 16 to 17, time-concentration profiles of NO_2, HONO, NO, O_3 and NO_3 are shown in Figures VI-3 and VI-4 and the corresponding data are given in Tables VI-2 and VI-3, respectively. The NO and O_3 profiles are taken from the data described in Section II. For both nights, at the time of the maximum NO_3 radical concentration the temperature and relative humidity were ~302 K and 60-65%, respectively. As seen from comparison of Figures VI-3 and VI-4 with Figure V-1, this time-behavior of the NO_3 radical concentration was consistent with our previous observations in polluted air masses at Riverside and Claremont, CA (Platt et al. 1980a), but quite different from the time-concentration profiles recently observed in clean air masses at a variety of semi-arid/desert sites in California (Platt et al. 1984). At these semi-arid/desert sites, the maximum concentrations of NO_3 radicals were generally observed to persist until sunrise.

The HONO profiles observed in this study were also qualitatively similar to our previous observations at Riverside (Platt et al. 1980b), rising from below the detection limit (1 ppb) near sunset to a peak of ~4 ppb at ~0700 hr. This was followed by a rapid decrease in the HONO concentrations to below the detection limit at sunrise due to photodissociation.

Table VI-1. Observed Concentrations of NO_2 and HONO on September 12-14, 1983

Date and Time (hr)	NO_2		HONO	
	O.D.	ppb	O.D.	ppb
<u>September 12</u>				
15:19 - 15:29	0.0006	9	a	
15:37 - 15:46	0.0007	10	a	
15:46 - 15:56	0.0007	10	a	
15:56 - 16:06	0.0006	9	a	
16:06 - 16:16	0.0007	10	a	
16:16 - 16:26	0.0007	10	a	
16:26 - 16:36	0.0007	10	a	
16:36 - 16:46	0.0008	12	a	
16:46 - 16:56	0.0008	12	a	
16:56 - 17:08	0.0009	13	a	
17:06 - 17:16	0.0010	15	a	
17:16 - 17:26	0.0011	16	a	
17:26 - 17:36	0.0010	15	a	
17:36 - 17:46	0.0010	15	a	
17:46 - 17:56	0.0013	19	a	
17:56 - 18:06	0.0012	18	a	
18:06 - 18:16	0.0011	16	a	
18:16 - 18:25	0.0012	18	a	
18:25 - 18:35	0.0015	22	a	
18:35 - 18:45	0.0017	25	a	
18:45 - 18:55	0.0024	36	a	
18:55 - 19:05	0.0027	40	a	
19:05 - 19:15	0.0021	31	a	
19:15 - 19:25	0.0018	27	a	
19:25 - 19:35	0.0021	31	a	
19:35 - 19:45	0.0023	34	a	
19:45 - 19:54	0.0022	33	a	
19:54 - 20:14	0.0021	31	a	
20:04 - 20:14	0.0021	31	a	
20:14 - 20:24	0.0019	28	a	
20:24 - 20:34	0.0019	28	0.0003	1.1
20:34 - 20:44	0.0018	27	a	
20:44 - 20:54	0.0019	28	0.0003	1.1
20:54 - 21:04	0.0016	24	0.0003	1.1
21:04 - 21:13	0.0016	24	0.0003	1.1
21:13 - 21:33	0.0021	31	0.0003	1.1
21:23 - 21:33	0.0021	31	0.0003	1.1
21:33 - 21:43	0.0018	27	0.0003	1.1
21:43 - 21:53	0.0016	24	0.0003	1.1
21:53 - 22:03	0.0014	21	a	
22:03 - 22:13	0.0014	21	a	
22:13 - 22:23	0.0010	15	a	
22:23 - 22:32	0.0016	24	0.0003	1.1
22:32 - 22:42	0.0028	41	a	
22:42 - 22:52	0.0021	31	a	

Table VI-1 (continued) - 2

Time (hr)	NO_2 O.D.	NO_2 ppb	HONO O.D.	HONO ppb
22:52 - 23:02	0.0019	23	a	
23:02 - 23:12	0.0019	28	a	
23:12 - 23:22	0.0024	36	a	
23:22 - 23:32	0.0022	33	a	
23:32 - 23:42	0.0021	31	a	
23:42 - 23:52	0.0014	21	a	
23:52 - 0:02	0.0014	21	a	
September 13				
0:02 - 0.12	0.0018	27	a	
0:12 - 0:21	0.0015	22	a	
0.21 - 0.31	0.0015	22	a	
0:31 - 0.41	0.0018	27	a	
0:41 - 0:51	0.0014	21	a	
0:51 - 1:01	0.0010	15	a	
1:01 - 1:11	0.0008	12	a	
1:11 - 1:21	0.0007	10	0.0003	1.1
1:21 - 1:31	0.0008	12	0.0003	1.1
1:31 - 1:41	0.0008	12	0.0003	1.1
1:41 - 1:51	0.0009	13	0.0003	1.1
1:51 - 2:00	0.0011	16	0.0003	1.1
2:00 - 2:10	0.0016	24	0.0003	1.1
2:10 - 2:20	0.0018	27	0.0003	1.1
2:20 - 2:30	0.0016	24	0.0003	1.1
2:30 - 2:40	0.0022	33	0.0003	1.1
2:40 - 2:50	0.0021	31	0.0003	1.1
2:50 - 3:00	0.0016	24	0.0004	1.4
3:00 - 3:10	0.0014	21	0.0003	1.1
3:10 - 3:20	0.0012	18	a	
3:20 - 3:30	0.0014	21	a	
3:30 - 3:39	0.0014	21	a	
3:39 - 3:49	0.0014	21	a	
3:49 - 3:59	0.0014	21	a	
3:59 - 4:09	0.0014	21	a	
4:09 - 4:19	0.0015	22	a	
4:19 - 4:29	0.0018	27	a	
4:29 - 4:39	0.0018	27	a	
4:55 - 5:05	0.0023	34	0.0003	1.1
5:05 - 5:15	0.0022	33	0.0004	1.4
5:15 - 5:25	0.0032	47	0.0003	1.1
5:25 - 5:35	0.0035	52	0.0003	1.1
5:36 - 5:46	0.0032	47	0.0004	1.4
5:46 - 5:56	0.0031	46	0.0004	1.4
5:56 - 6:06	0.0025	37	0.0004	1.4
6:06 - 6:16	0.0029	43	0.0004	1.4
6:16 - 6:26	0.0028	41	0.0003	1.1
6:26 - 6:35	0.0027	40	0.0004	1.4

Table VI-1 (continued) - 3

Time (hr)	NO_2		HONO	
	O.D.	ppb	O.D.	ppb
6:35 - 6:45	0.0028	41	0.0005	1.8
6:45 - 6:55	0.0029	43	0.0005	1.8
6:55 - 7:05	0.0028	41	0.0005	1.8
7:05 - 7:15	0.0030	44	0.0004	1.4
7:15 - 7:25	0.0024	36	0.0004	1.4
7:25 - 7:35	0.0023	34	0.0003	1.1
7:35 - 7:45	0.0027	40	0.0003	1.1
7:45 - 7:55	0.0034	50	0.0004	1.4
7:55 - 8:05	0.0034	50	0.0004	1.4
8:05 - 8:15	0.0034	50	0.0003	1.1
8:15 - 8:25	0.0034	50	a	
8:30 - 8:40	0.0032	47	a	
8:40 - 8:50	0.0036	53	a	
8:50 - 9:00	0.0041	61	a	
9:00 - 9:10	0.0046	68	a	
9:10 - 9:20	0.0047	70	a	
9:20 - 9:29	0.0044	65	a	
9:29 - 9:39	0.0035	52	a	
9:39 - 9:49	0.0032	47	a	
9:49 - 9:59	0.0032	47	a	
9:59 - 10:09	0.0029	43	a	
10:09 - 10:19	0.0030	44	a	
10:19 - 10:29	0.0026	38	a	
10:29 - 10:39	0.0024	36	a	
10:39 - 10:49	0.0023	34	a	
10:49 - 10:58	0.0033	49	a	
10:58 - 11:08	0.0046	68	a	
11:08 - 11:18	0.0042	62	a	
11:18 - 11:28	0.0034	50	a	
11:28 - 11:38	0.0025	37	a	
11:38 - 11:48	0.0017	25	a	
11:48 - 11:58	0.0012	18	a	
11:58 - 12:08	0.0011	16	a	
12:08 - 12:18	0.0008	12	a	
12:18 - 12:28	0.0006	9	a	
12:28 - 12:38	0.0006	9	a	
12:38 - 12:48	0.0007	10	a	
12:48 - 12:58	0.0006	9	a	
12:58 - 13:08	0.0005	7	a	
13:08 - 13:18	0.0004	6	a	
13:18 - 13:28	0.0004	6	a	
13:28 - 13:38	0.0004	6	a	
13:38 - 13:48	0.0004	6	a	
13:49 - 13:59	0.0003	4	a	
13:59 - 14:09	0.0003	4	a	
14:09 - 14:19	0.0004	6	a	
14:19 - 14:29	0.0004	6	a	

Table VI-1 (continued) - 4

	NO_2		HONO	
Time (hr)	O.D.	ppb	O.D.	ppb
14:29 - 14:39	0.0004	6	a	
14:39 - 14:49	0.0005	7	a	
14:49 - 14:59	0.0006	9	a	
14:59 - 15:09	0.0006	9	a	
15:09 - 15:19	0.0006	9	a	
15:19 - 15:29	0.0005	7	a	
15:29 - 15:39	0.0006	9	a	
15:39 - 15:49	0.0006	9	a	
15:49 - 16:00	0.0007	10	a	
17:30 - 17:40	0.0017	25	a	
17:40 - 17:50	0.0018	27	a	
17:50 - 18:00	0.0017	25	a	
20:37 - 20:46	0.0023	34	a	
21:10 - 21:19	0.0021	31	a	
21:40 - 21:48	0.0024	36	a	
22:09 - 22:18	0.0025	37	a	
22:39 - 22:47	0.0021	31	a	
23:08 - 23:17	0.0021	31	a	
23:59 - 0:05	0.0020	30	0.003	1.1
<u>September 14</u>				
0:11 - 0:17	0.0020	30	0.0004	1.4
0:18 - 0:24	0.0020	30	0.0003	1.1
0.42 - 0.47	0.0019	28	0.0003	1.1
0:56 - 1:01	0.0021	31	0.0003	1.1
1:03 - 1:08	0.0018	27	0.0003	1.1
1:27 - 1:32	0.0023	34	0.0003	1.1
1:33 - 1:39	0.0025	37	0.0004	1.4
1:57 - 2:02	0.0024	36	0.0004	1.4
2:04 - 2:09	0.0024	36	0.0004	1.4
2:27 - 2:33	0.0024	36	0.0005	1.8
2:34 - 2:40	0.0024	36	0.0004	1.4
2:58 - 3:03	0.0023	34	0.0005	1.8
3:05 - 3:10	0.0023	34	0.0005	1.8
3:29 - 3:35	0.0024	36	0.0006	2.1
3:36 - 3:42	0.0023	34	0.0006	2.1
4.00 - 4:06	0.0029	43	0.0004	1.4
4:07 - 4:13	0.0027	40	0.0006	2.1
4:30 - 4:36	0.0023	34	0.0006	2.1
4:37 - 4:43	0.0024	36	0.0005	1.8
5:01 - 5:06	0.0024	36	0.0004	1.4
5:08 - 5:13	0.0024	36	0.0005	1.8
5:32 - 5:37	0.0026	38	0.0006	2.1
5:39 - 5:44	0.0027	40	0.0007	2.5
6:02 - 6:07	0.0026	38	0.0008	2.8
6:09 - 6:14	0.0025	37	0.0007	2.5
6:34 - 6:39	0.0030	44	0.0008	2.8
6:41 - 6:46	0.0030	44	0.0008	2.8

[a] Not detected.

Table VI-2. Observed Concentrations of NO_2, HONO, NO_3 Radicals and SO_2 on September 15, 1983

Time (hr)	NO_2		HONO		NO_3		SO_2	
	O.D.	ppb	O.D.	ppb	O.D.	ppt	O.D.	ppb
4:13 - 4:19	0.0035	52	0.0005	1.8				
4:38 - 4:44							0.0020	5.2
4:47 - 4:53	0.0032	47	0.0005	1.8				
5:19 - 5:25	0.0032	47	0.0004	1.4				
5:43 - 5:49							0.0017	4.4
5:51 - 5:57	0.0031	46	0.0005	1.8				
6:23 - 6:29	0.0030	44	0.0004	1.4				
6:47 - 6:53							0.0018	4.7
6:55 - 7:01	0.0028	41	0.0004	1.4				
7:27 - 7:33	0.0033	49	0.0004	1.4				
7:51 - 7:57							0.0017	4.4
8:00 - 8:06	0.0032	47	0.0003	1.1				
8:31 - 8:37	0.0059	87	a					
8:56 - 9:02							0.0053	13.8
9:04 - 9:10	0.0049	73	a					
9:36 - 9:42	0.0056	83	a					
10:00 - 10:06							0.0027	7.0
10:08 - 10:14	0.0045	67	a					
10:40 - 10:46	0.0046	68	a					
11:04 - 11:10							0.0020	5.2
11:13 - 11:18	0.0026	38	a					
11:44 - 11:50	0.0011	16	a					
12:09 - 12:15							0.0017	4.4
12:17 - 12:23	0.0009	13	a					
12:49 - 12:55	0.0005	7	a					
13:13 - 13:19							0.0017	4.4
13:22 - 13:28	0.0004	6	a					
13:54 - 13:59	0.0006	9	a					
14:18 - 14:24							a	
14:26 - 14:32	0.0005	7	a					
14:58 - 15:04	0.0005	7	a					
15:22 - 15:28							a	
15:31 - 15:37	0.0004	6	a					
16:03 - 16:09	0.0006	9	a					
16:27 - 16:33							0.0006	1.6
16:35 - 16:41	0.0006	9	a					
17:07 - 17:13	0.0010	15	a					
17:19 - 17:25					0.0002	16		
17:32 - 17:38							0.0005	1.3
17:40 - 17:46	0.0010	15	a					
17:52 - 17:58					0.0002	16		
18:12 - 18:21	0.0013	19	a					
18:37 - 18:43	0.0017	25	a					
18:48 - 18:54					0.0003	25		
19:01 - 19:07							0.0025	6.5

Table VI-2 (continued) - 2

Time (hr)	NO$_2$		HONO		NO$_3$		SO$_2$	
	O.D.	ppb	O.D.	ppb	O.D.	ppt	O.D.	ppb
19:09 - 19:16	0.0015	22	a					
19:22 - 19:29					0.0008	66		
19:45 - 19:52	0.0012	18	a					
19:58 - 20:04					0.0009	74		
20:11 - 20:17							0.0008	2.1
20:19 - 20:25	0.0013	19	a					
20:31 - 20:37					0.0009	74		
20:51 - 20:57	0.0016	24	a					
21:02 - 21:08					0.0007	58		
21:15 - 21:21							0.0013	3.4
21:23 - 21:29	0.0018	27	0.0003	1.1				
21:35 - 21:41					0.0003	25		
21:55 - 22:01	0.0018	27	0.0005	1.8				
22:07 - 22:13					0.0003	25		
22:20 - 22:25							0.0005	1.3
22:28 - 22:34	0.0021	31	0.0006	2.1				
22:40 - 22:46					0.0002	16		
23:00 - 23:06	0.0020	30	0.0007	2.5				
23:24 - 23:30							0.0006	1.6
23:32 - 23:39	0.0029	43	0.0008	2.8				

[a] Not detected.

Table VI-3. Observed Concentrations of NO$_2$, HONO, NO$_3$ Radicals and SO$_2$ on September 16, 1983

Time (hr)	NO$_2$		HONO		NO$_3$		SO$_2$	
	O.D.	ppb	O.D.	ppb	O.D.	ppt	O.D.	ppb
0:08 - 0.14	0.0031	46	0.0010	3.5				
0:35 - 0:43							0.0011	2.9
1:22 - 1:29	0.0032	47	0.0012	4.2				
1:49 - 1:56							0.0007	1.8
1:58 - 2:04	0.0030	44	0.0012	4.2				
2:31 - 2:37	0.0031	46	0.0009	3.2				
2:56 - 3:02							0.0013	3.4
3:05 - 3:11	0.0030	44	0.0009	3.2				
3:37 - 3:43	0.0032	47	0.0008	2.8				
4:05 - 4:12							0.0011	2.9
4:15 - 4:22	0.0029	43	0.0010	3.5				
4:52 - 4:59	0.0030	44	0.0009	3.2				
5:20 - 5:29							0.0007	1.8
5:32 - 5:39	0.0028	41	0.0012	4.2				

Table VI-3 (continued) - 2

	NO_2		HONO		NO_3		SO_2	
Time (hr)	O.D.	ppb	O.D.	ppb	O.D.	ppt	O.D.	ppb
6:06 - 6:12	0.0029	43	0.0011	3.9				
6:30 - 6:36							0.0008	2.1
6:38 - 6:44	0.0028	41	0.0012	4.2				
7:10 - 7:16	0.0031	46	0.0013	4.6				
7:35 - 7:41							0.0011	2.9
7:43 - 7:49	0.0035	52	0.0008	2.8				
8:15 - 8:21	0.0055	81	0.0005	1.8				
8:34 - 8:40	0.0056	83	0.0003	1.1				
8:58 - 9:04							0.0073	19.0
9:06 - 9:12	0.0060	89		a				
9:38 - 9:44	0.0046	68		a				
10:03 - 10:09							0.0026	6.8
10:11 - 10:17	0.0049	73		a				
10:43 - 10:49	0.0035	52		a				
11:07 - 11:13							0.0015	3.9
11:16 - 11:22	0.0029	43		a				
11:48 - 11:54	0.0022	33		a				
12:12 - 12:18							0.0008	2.1
12:21 - 12:27	0.0018	27		a				
12:53 - 12:59	0.0010	15		a				
13:18 - 13:24							0.0011	2.9
13:26 - 13:32	0.0007	10		a				
13:59 - 14:05	0.0006	9		a				
14:24 - 14:32							0.0010	2.6
14:35 - 14:43	0.0008	12		a				
19:00 - 19:06					0.0007	58		
19:14 - 19:21							0.0011	2.9
19:37 - 19:43					0.0011	91		
19:23 - 19:31	0.0018	27		a				
19:58 - 20:04	0.0017	25		a				
20:10 - 20:16					0.0010	82		
20:23 - 20:29							0.0024	6.2
20:32 - 20:38	0.0019	28		a				
20:44 - 20:49					0.0008	66		
21:04 - 21:10	0.0018	27		a				
21:15 - 21:21					0.0007	58		
21:28 - 21:34							0.0013	3.4
21:37 - 21:43	0.0015	22	0.0003	1.1				
21:48 - 21:54					0.0003	25		
22:09 - 22:15	0.0018	27	0.0005	1.8				
22:20 - 22:26					0.0003	25		
22:33 - 22:39							0.0008	2.1
22:41 - 22:47	0.0020	30	0.0007	2.5				
22:53 - 22:59					0.0002	16		
23:13 - 23:19	0.0024	36	0.0008	2.8				
23:38 - 23:44							0.0005	1.3
23.46 - 23:52	0.0019	28	0.0009	3.2				

[a] Not detected.

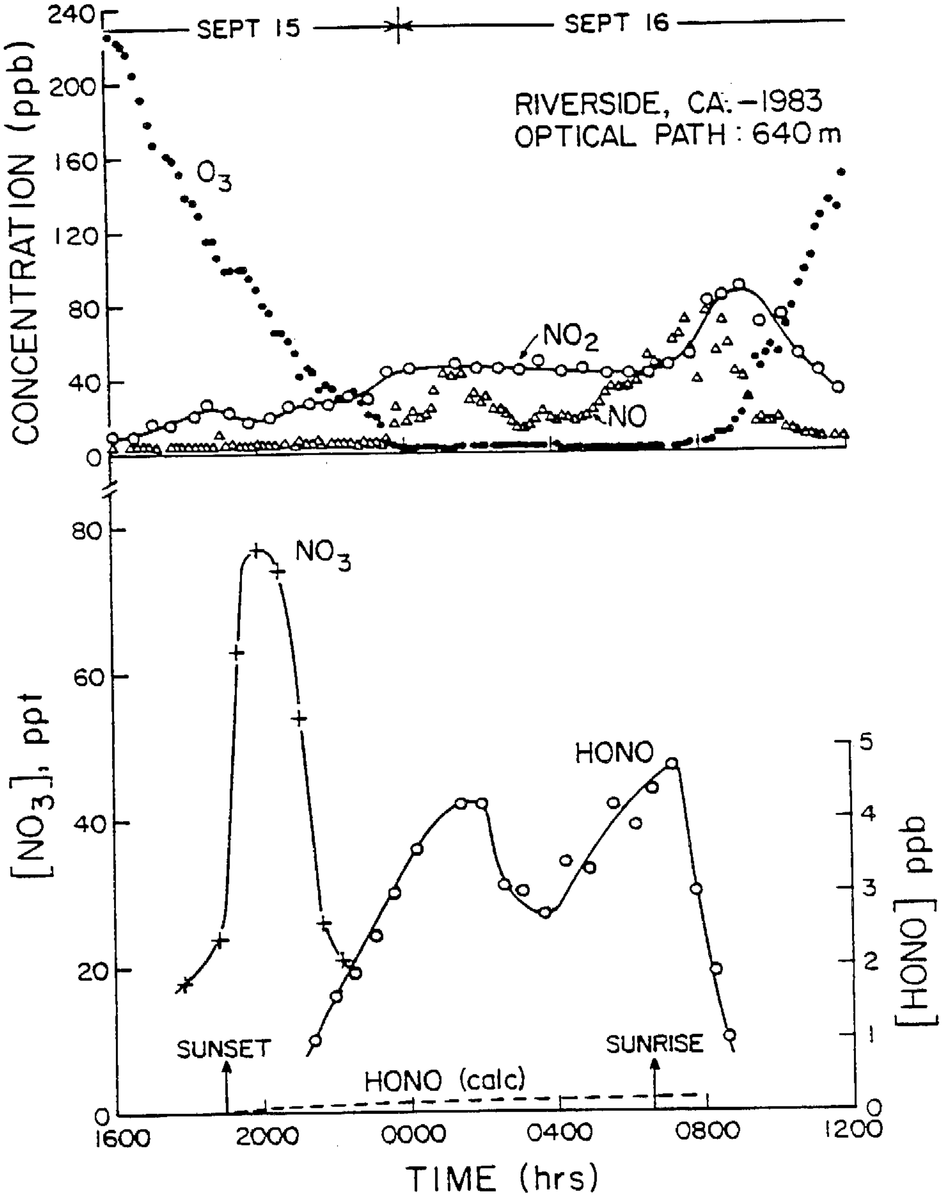


Figure VI-3. Experimental time-concentration profiles for O_3, NO, NO_2, the NO_3 radical and HONO for 1600 hr, September 15, 1983 through 1200 hr, September 16, 1983. --- Calculated HONO concentrations based upon reactions (1-4) of text, using the $NO_2 + NO_3 \rightleftarrows N_2O_5$ equilibrium constant of Malko and Troe (1982) to derive our experimental rate constant for reaction (1).

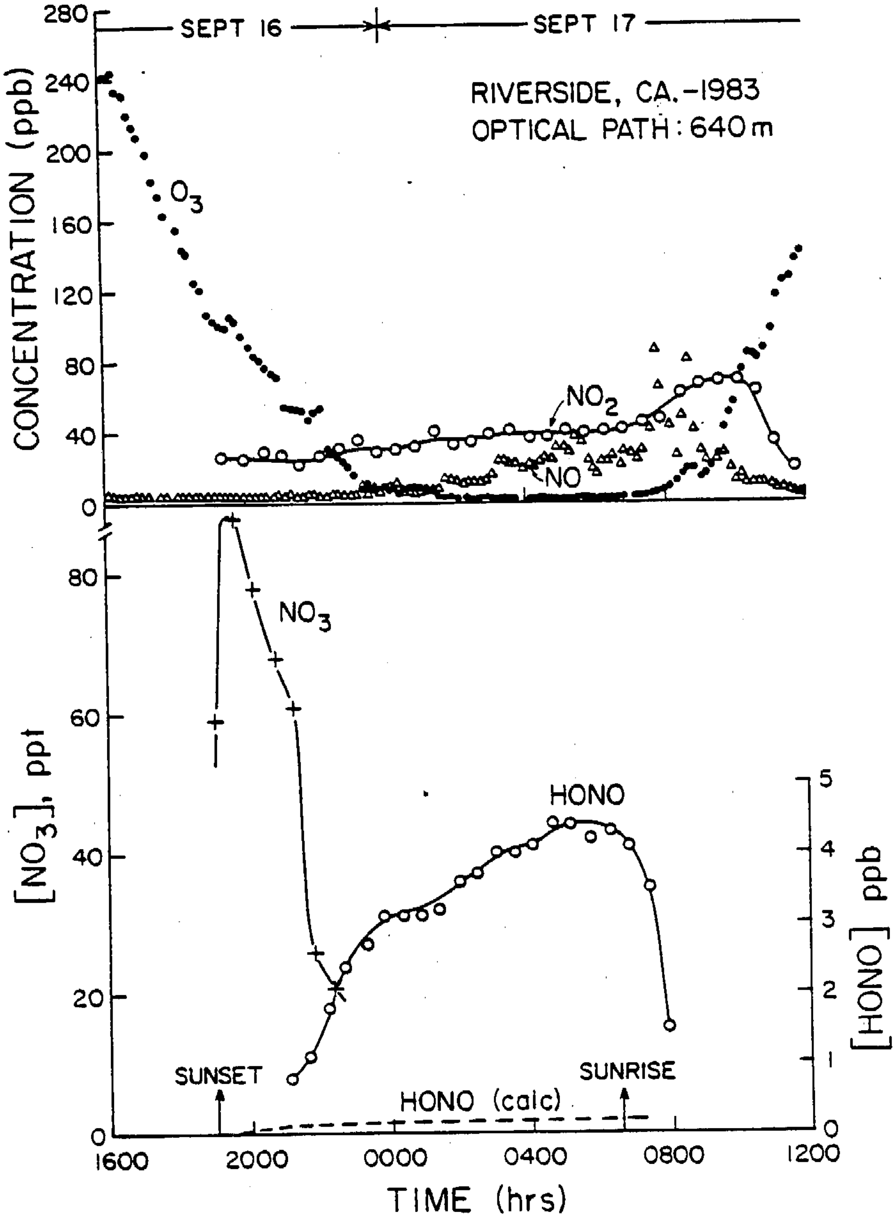


Figure VI-4. Experimental time-concentration profiles for O_3, NO, NO_2, the NO_3 radical and HONO for 1600 hr, September 16, 1983 through 1200 hr, September 17, 1983. --- Calculated HONO concentrations based upon reactions (1-4) of text, using the $NO_2 + NO_3 \rightleftarrows N_2O_5$ equilibrium constant of Malko and Troe (1982) to derive our experimental rate constant for reaction (1).

D. Discussion

The time-concentration profiles of NO_2, HONO, O_3, NO and the NO_3 radical presented shown in Figures VI-3 and VI-4 yield a more complete data set than any as yet reported with respect to the simultaneous observations of those species in ambient atmospheres. This data set can then be used to assess the importance or likelihood of various reaction pathways.

The behavior of the observed NO_3 radical time-concentration profiles can be interpreted in terms of the O_3 and NO profiles in Figures VI-3 and VI-4. Thus, the O_3 concentrations decrease rapidly from ~240 ppb at 1600 h to below the detection limit of ~3 ppb by 2300-2400 h, while after 2400 h on both nights NO concentrations exceeded the detection limit of the chemiluminescence instruments (~5 ppb), rising to ~80 ppb by 0800 h. Hence, although the influence of air parcel transport cannot be eliminated entirely, the form of the NO_3 radical time-concentration profiles appear to be determined by the formation reaction

$$NO_2 + O_3 \rightarrow NO_3 + O_2$$

and the destruction reaction

$$NO_3 + NO \rightarrow 2\ NO_2$$

though other loss processes involving NO_3 radicals and/or N_2O_5 cannot be ruled out.

Our inability to monitor NO at sub-ppb concentrations [the NO_3 radical lifetime in the presence of 10 ppt of NO is only ~3 min (NASA 1983)] prevents detailed chemical modeling of these NO_3 radical profiles. However, for the purposes of the present investigation of ambient HONO concentrations and their relationship to the NO_3 radical, only the experimentally observed NO_3 radical concentrations are necessary.

Taking into account the rapid photolysis of HONO during daylight hours, the HONO nighttime time-concentration profiles generally parallel the NO_2 time-concentration profiles. While the source(s) of this nighttime HONO is not yet established, several possible explanations have been proposed. Thus Stockwell and Calvert (1983) have recently postulated that the majority of the nighttime HONO observed in our initial study in Riverside, CA (Platt et al. 1980b) was formed homogeneously from the reaction sequence (1-4):

$$NO_3 + HCHO \rightarrow HCO + HNO_3 \tag{1}$$

$$HCO + O_2 \rightarrow HO_2 + CO \tag{2}$$

$$HO_2 + NO_2 \overset{M}{\rightleftarrows} HO_2NO_2 \tag{3,-3}$$

$$\rightarrow HONO + O_2 \tag{4}$$

where reaction (1), followed by the rapid reaction of HCO with O_2 (NASA 1983), together with other more minor reaction pathways, leads to HO_2 formation.

Although laboratory studies (Niki et al. 1977, Howard 1977, Graham et al. 1977, 1978) have shown that the reaction of HO_2 with NO_2 proceeds mainly via formation of thermally unstable HO_2NO_2, Stockwell and Calvert (1983) argued that reaction (4), which has an upper limit rate constant of $\lesssim 3 \times 10^{-15}$ cm^3 molecule^{-1} sec^{-1} at room temperature (Howard 1977), could account for the observed HONO formation. Additionally, since no data were then available for the rate constant for reaction (1), they assumed a value of 1.4×10^{-15} cm^3 molecule^{-1} sec^{-1}, identical to that for the reaction of NO_3 radicals with acetaldehyde (Morris and Niki 1974) [this value is derived using the $NO_2 + NO_3 \rightleftarrows N_2O_5$ equilibrium constant of Malko and Troe (1982)].

Our present time-concentration data set can now be used to evaluate the validity of this homogeneous gas phase reaction mechanism. Specifically, the reaction sequence (1), (2), and (4) was used, with reaction (2) occurring effectively instantaneously (in less than 0.1 μsec) under atmospheric conditions. Due to the rapid back-decomposition of HO_2NO_2 via reaction (-3), reaction (3) was taken to be unimportant. Rate constants of 3.2×10^{-16} cm^3 molecule^{-1} s^{-1} for reaction (1) (Atkinson et al. 1984b) [a factor of 4 lower than assumed by Stockwell and Calvert (1983)] and 3×10^{-15} cm^3 molecule^{-1} s^{-1} for reaction (4) [as assumed by Stockwell and Calvert, (1983)] were used. The observed NO_3 radical and NO_2

concentration profiles were fit by polynomial expressions, with the NO_3 radical concentrations being conservatively set at 8 ppt whenever the absorption signal fell below the detection limits. The concentration of HCHO was set at 20 ppb, our detection limit, since it was never observed directly during these nighttime studies.

Input of our simultaneous NO_3 radical and NO_2 concentrations, together with this maximum HCHO value of 20 ppb, allows the maximum HONO concentrations arising from the homogeneous gas phase reaction sequence (1), (2) and (4) to be calculated. As shown in Figures VI-3 and VI-4 these predicted HONO concentrations are factors of ~20 lower than the observed HONO concentrations. These calculations used a rate constant for reaction (1) based upon the $NO_2 + NO_3 \rightleftarrows N_2O_5$ equilibrium constant of Malko and Troe (1982). Recently however, we have determined directly, using *in situ* spectroscopic techniques (Tuazon et al. 1984), an equilibrium constant at 298 K a factor of 1.8 higher than that given by Malko and Troe (1982). The use of this equilibrium constant leads to calculated HONO concentrations a factor of 1.8 higher than those shown in Figures VI-3 and VI-4, but still a factor of ~10 lower than those we observed.

E. Conclusions

Our results thus show that the homogeneous reaction of NO_3 radicals with HCHO to yield HO_2 radicals, which then form HONO from their reaction with NO_2, cannot be an important source of HONO, at least under the atmospheric conditions we investigated. Rather, we continue to believe that the nighttime HONO concentrations we have observed near downtown Los Angeles, Claremont and Riverside, CA, arise predominately from heterogeneous reactions of NO_2 with water (Sakamaki et al. 1983, Pitts et al. 1984g), direct emissions from automobile exhaust (Pitts et al. 1984h), or a combination of both, as well as from other possible heterogeneous processes involving surface phenomena.

VII. IDENTIFICATION AND MEASUREMENT OF NITROUS ACID (A GAS PHASE MUTAGEN) IN AN INDOOR ENVIRONMENT

A. Introduction

Nitrogen dioxide is a primary pollutant emitted as a combustion byproduct and its production indoors by heating and cooking appliances has been the subject of many investigations (Thompson et al. 1973, Derham et al. 1974, Wade et al. 1975, Palmes et al. 1977, 1979, Traynor et al. 1982, Nero and Grimsrud 1983, Yamanaka 1984). Recently it has been established that an individual's overall exposure to NO_2 can be significantly influenced by indoor air pollution (Spengler et al. 1979, Nero and Grimsrud 1983). In some cases indoor NO_2 levels may be comparable to, or greater than, concentrations found in ambient air; moreover, the exposure time indoors is usually much greater. For example, typical NO_2 levels measured inside homes equipped with gas stoves (Spengler and Sexton 1983) have been observed to range from 0.1 to 0.3 part per million (ppm) with levels as high as 1 ppm being reported in some cases (Andrews et al. 1984).

Recent measurements (Sakamaki et al. 1983, Pitts et al. 1984g) of the rate of formation of gaseous nitrous acid (HONO) from NO_2-air mixtures in environmental chambers suggested that HONO may also be formed in indoor atmospheres polluted with NO_2. While it does not appear to be known whether gaseous HONO may have toxicological effects of its own, it is known to be an effective nitrosating agent, reacting rapidly with gaseous secondary amines in air (Pitts et al. 1978b) to form carcinogenic nitrosamines (Shapley 1976, Magee 1982). This raises the possibility of *in vivo* formation of nitrosamines from inhalation of gaseous HONO (Pitts 1979, 1983). Furthermore, although amine levels are generally low in ambient air, in certain occupationally related indoor environments higher concentrations may be present. Finally, HONO has been shown to be a gas phase mutagen (Mahler and Cordes 1971, Watson 1976).

As part of our investigation of gas phase mutagens we became concerned that indoor exposures of HONO might equal or exceed those experienced in ambient atmospheres. The latter can be estimated based on our earlier measurements of HONO in the South Coast Air Basin (Platt et al. 1980b, Harris et al. 1982, Pitts et al. 1984b).

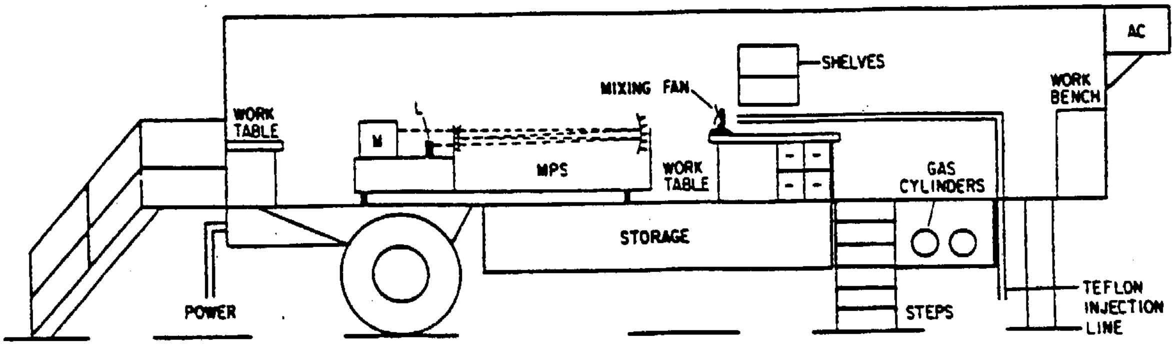
In order to investigate the potential for HONO formation from NO_2-air mixtures in indoor environments, we have conducted experiments using a rapid scanning differential optical absorption spectrometer (DOAS) coupled to a multiple reflection optical system (Pitts et al. 1984h and references therein). We report here the unequivocal detection and measurement of HONO formed in a laboratory approximately the size of a small mobile home containing 5.2-11.5 ppm of NO_2 in air. These conditions obviously are quite different from those encountered in a typical "inhabited" environment, but were chosen to test the hypothesis that HONO can be formed in such environments. Extrapolation of our initial results obtained under these conditions to those more typical of indoor environments is discussed below.

B. Experimental

All experiments were conducted inside an instrumented mobile laboratory furnished by the California Air Resources Board and used in the early 1970's for the ACHEX experiments (Appel et al. 1978). Its internal dimensions were 2.3 x 2.4 x 11.8 m, with a total volume of 65.1 m^3. During the experiments the room lighting was switched off and all windows were covered to prevent any photolysis of HONO, although as discussed below this appears to be minimal. Furthermore, all openings of the laboratory were sealed to minimize physical exchange of air from outside. Experiments were performed at temperatures ranging from 295 to 307 K at relative humidities ranging from 31 to 60%. Initial NO_2 levels were varied from 5.2-11.5 ppm.

Nitrous acid and NO_2 were monitored by the DOAS technique using a White type (White 1942) multiple pass optical system with a 2.2 m base path. The arrangement of the DOAS system inside the laboratory is shown in Figure VII-1. The apparatus was similar to that used for the first spectroscopic detection of HONO in auto exhaust (Pitts et al. 1984h) and is only briefly described here.

A 75 W Xe lamp was focused by a spherical mirror chosen to match the apperture of the multiple reflection optical system. Typically, forty passes were used which, together with the 2.2 m pathlength of the beam before entering and after exiting the multiple pass system, yielded a total pathlength of 90 m.



M-MONOCHROMATOR; L-LAMP; MPS-MULTIPLE PASS SYSTEM

Figure VII-1. Experimental arrangement of the differential optical absorption spectrometer (DOAS) within the mobile laboratory.

After traversing the multipass system, the beam was focused on the entrance slit of a 0.5 m monochromator (SPEX 1870) equipped with a 600 groove mm^{-1} grating (dispersion 4 nm mm^{-1}). Attached to the monochromator was a special rotating metal disc carrying radial slits (100 μm wide, 10 mm spacing) across the exit focal plane. With this arrangement, an approximately 35 nm segment of the spectrum was scanned at a rate of ~110 spectra per second. The light intensity passing through the slits was detected by a photomultiplier (EMI 9659QA), and the resulting analog signal digitized and stored by a DEC MINC 11/23 computer. Nitrogen dioxide and HONO were monitored at 363 and 354 nm, respectively, using the differential absorption cross sections of 1.0×10^{-19} and 4.2×10^{-19} cm^2 $molecule^{-1}$ given by Platt and Perner (1983). At the optical pathlength typically used (90 m), and for our observed noise levels, the detection limits for NO_2 and HONO were ~100 and ~25 ppb, respectively.

The NO_2 was generated by the reaction of NO with excess O_2 in a Pyrex syringe and was injected into the laboratory via a 0.125 in. Teflon tube which passed through one wall of the laboratory and was aimed towards a fan for rapid mixing. Nitric oxide and oxygen were supplied by Matheson Gas Products and Liquid Carbonic Corporation at stated purities of 99.0 and 99.993%, respectively.

The procedure for each experiment was to fill the laboratory with between 5 and 12 ppm of NO_2 as measured by the DOAS instrument, and then acquire and average spectra for ~10 minute periods over a 3-4 hour duration. To obtain HONO spectra, NO_2 features were subtracted using an appropriate NO_2 reference spectrum. The HONO concentrations were then calculated from the measured differential optical density at 354 nm. Small amounts of NO_2 were added in order to maintain the NO_2 concentration at an approximately constant (within 10%) level.

In order to establish the lifetime of air inside the mobile laboratory with respect to physical exchange with outside air, a small quantity of ethane was admitted into the laboratory. The subsequent decay of ethane was monitored by gas chromatography with flame ionization detection using a 5-ft x 0.125-in. stainless steel column packed with Porapak N (80/100 mesh), operated at 333 K. The ethane decay obeyed first order kinetics with a lifetime of 4.1 ± 0.9 hr (all errors quoted represent two standard deviations) determined by linear least squares analysis of the plot of ln[ethane] versus time. The decay of NO_2 within the trailer followed first order kinetics with a lifetime of ~90 minutes. This shorter lifetime presumably reflects loss by adsorption and/or reaction of NO_2 within the laboratory.

Because HONO exhibits significant absorption in the wavelength region of 300 to 400 nm (Cox and Derwent 1976) and photodissociates with a quantum yield of unity (Cox 1974), experiments were carried out to assess its approximate photolytic lifetime under typical indoor lighting conditions (fluorescent lighting plus indirect sunlight). These experiments involved exposing Teflon bags filled with CH_3ONO/air mixtures to indoor lighting. Methyl nitrite was chosen as a substitute for HONO on the basis of its ease of handling and the fact that its absorption spectrum and quantum yield closely parallels that of HONO over the wavelength 300-400 nm. Gas chromatography was used to monitor CH_3ONO. No observable loss of CH_3ONO was detected over a period of five hours even in a brightly illuminated room, suggesting that photolysis does not represent a significant loss process of HONO within indoor environments.

C. Results and Discussion

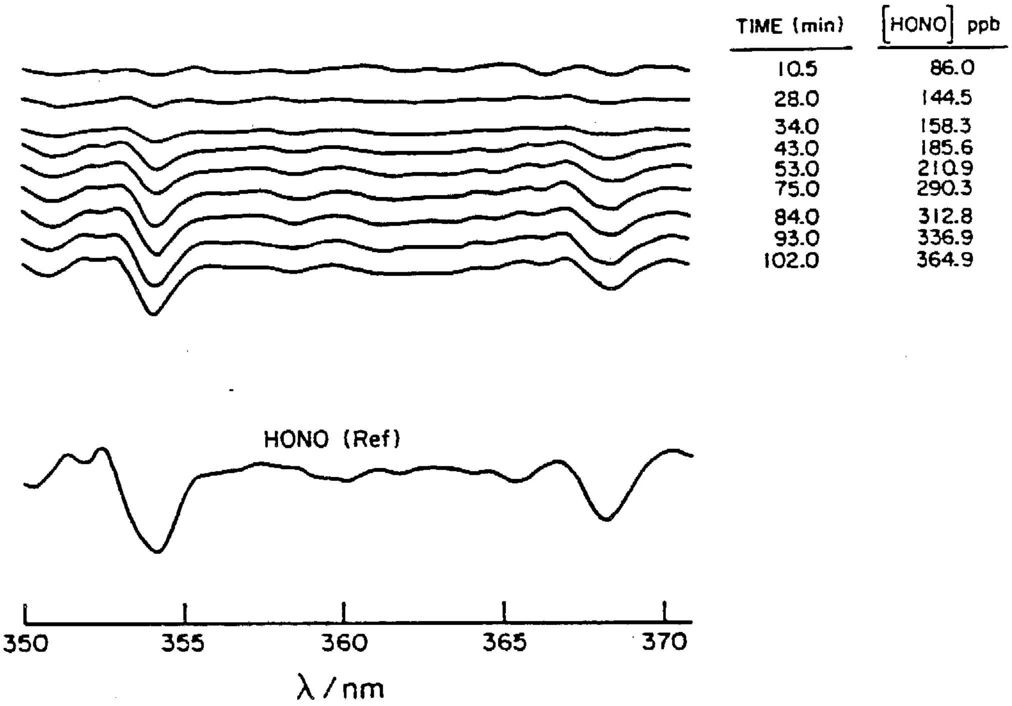
A total of five experiments were performed in which the NO_2 concentrations in the mobile laboratory were maintained at 11.5, 11.4, 9.1, 6.6, and 5.2 ppm.

Figure VII-2 shows spectra obtained during the experiment with 11.5 ppm of NO_2 after the features attributed to NO_2 were subtracted; also shown is a HONO reference spectrum. As seen in Figure VII-3, the HONO concentrations increased linearly with time. A least squares analysis yields a HONO production rate for this experiment of (2.92 ± 0.47) ppb min^{-1}.

The rates of HONO formation, d[HONO]/dt, obtained by least squares analyses of the slopes of the HONO concentration versus time are given in Table VII-1 for the various concentrations of NO_2 employed. Although there appeared to be no discernible effect of H_2O concentration upon the rate of HONO production, the range of concentrations of water vapor used in the present experiments were rather limited and further experiments are needed to examine this in greater detail.

The HONO formation rates, (d[HONO]/dt) given in Table VII-1 are plotted as a function of the NO_2 concentration in Figure VII-4 (on a log-log scale). In the same figure are plotted data obtained by Sakamaki et al. (1983) [for the National Institute of Environmental Studies, Japan (NIES) chamber] and Pitts et al. (1984g) in their studies of HONO formation from NO_2 in environmental chambers.

For a given chamber these plots of log(d[HONO]/dt) against $\log[NO_2]$ are, within the scatter of the data, linear with a slope close to unity, suggesting that the HONO formation rate in the various reaction systems is first order in NO_2. Despite numerous studies of the kinetics and mechanism of the processes occurring in NO_2-air mixtures considerable uncertainty remains as to the nature of the process or processes leading to HONO formation. Initially, a homogeneous mechanism was proposed by England and Corcoran (1974) after they observed no change in the initial rate of NO_2 disappearance using two Pyrex vessels of different surface area-to-volume ratios. However, subsequent work (Carter et al. 1981, 1982, Sakamaki et al. 1983, Pitts et al. 1984g) has suggested that this reaction proceeds via a heterogeneous mechanism.



TIME (min)	[HONO] ppb
10.5	86.0
28.0	144.5
34.0	158.3
43.0	185.6
53.0	210.9
75.0	290.3
84.0	312.8
93.0	336.9
102.0	364.9

Figure VII-2. DOAS spectra showing generation of nitrous acid for mobile laboratory filled with 11.5 ppm of NO_2 in air.

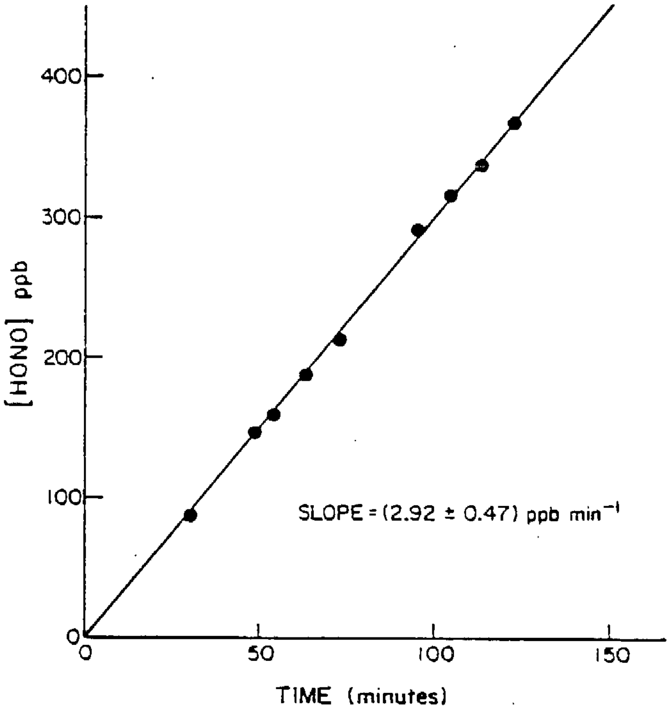


Figure VII-3. HONO concentrations plotted as a function of time for mobile laboratory filled with 11.5 ppm of NO_2.

Table VII-1. Experimental Conditions and Corresponding Rates of HONO Formation

$[NO_2]$ (ppm)	R.H. (%)	Temperature (K)	$[H_2O]$ (molecule cm^{-3})	(d[HONO]/dt) (ppb min^{-1})	10^3 x (d[HONO]/dt)/$[NO_2]$ (min^{-1})
11.5	43	307	5.44×10^{17}	2.92 ± 0.47	0.25 ± 0.04
11.4	31	306	3.71×10^{17}	3.02 ± 0.48	0.25 ± 0.04
9.1	31	304	3.31×10^{17}	2.18 ± 0.55	0.24 ± 0.06
6.6	60	295	3.77×10^{17}	1.76 ± 0.91	0.27 ± 0.14
5.2	38	304	4.06×10^{17}	1.16 ± 0.55	0.22 ± 0.10

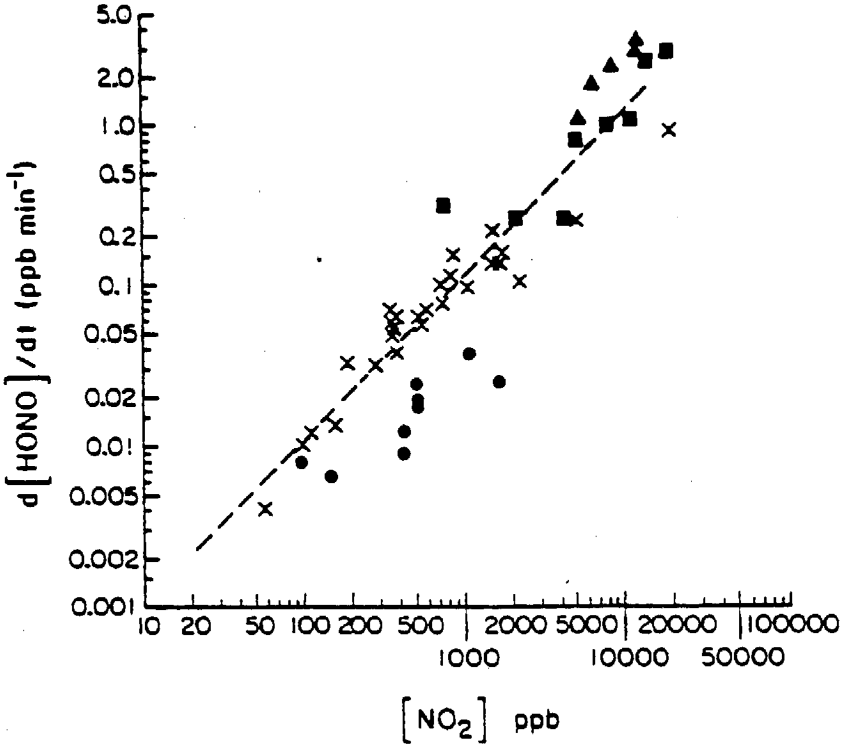


Figure VII-4. Initial HONO formation rate, d[HONO]/dt versus $[NO_2]$ for several experimental systems. (▲ This work; T = 301 ± 6 K, RH = 45 ± 15%: X SAPRC 5800-liter evacuable chamber; T = 301 ± 4 K, RH ≈ 50%: ● SAPRC 4300-liter all Teflon chamber; T = 297 K, RH ≈ 50%: ■ NIES 6065-liter evacuable chamber; T = 303 K, RH ≈ 50%. The dashed line is the best fit line with unit slope through the data for the SAPRC 5800-liter evacuable chamber.

The results from the present study, while admittedly limited, have a number of implications with respect to indoor air pollution. For example, assuming that these data can be extrapolated to the lower NO_2 concentrations which correspond to indoor air pollution situations, formation rates of HONO associated with such pollution may be calculated. Thus, since our average HONO formation rate normalized to the NO_2 concentration was 0.25 ppb min^{-1} per ppm of NO_2, an indoor NO_2 concentration of 1 ppm, which has been measured in certain situations (Andrews et al. 1984), would lead to a HONO formation rate of ~0.25 ppb min^{-1}. Measurement of the decay of HONO following cessation of NO_2 additions to the mobile laboratory yielded a lifetime for HONO of ~2 hr (slightly longer than the NO_2 decay rates, as expected since formation of HONO from NO_2 continues to occur during this decay process). Allowing for the substantially higher ventilation rates expected in a typical home environment, we can assume a lifetime for HONO of 1 hr with respect to both physical and chemical removal processes. This leads to an estimated steady state concentration of ~15 ppb of HONO in an indoor environment similar to our laboratory.

D. Conclusions

While admittedly an approximation, the estimated steady state concentration of ~15 ppb HONO (for 1 ppm of NO_2) in an indoor environment is approximately 2-4 times the HONO levels we have previously measured in polluted ambient air at several sites in the Los Angeles basin (Platt et al. 1980b, Harris et al. 1982). If future experiments employing more realistic situations (e.g., a gas stove or kerosene heater in a furnished mobile home) support this calculation of such relatively high levels of HONO, there is then the possibility of a previously unrecognized health risk associated with exposure to high indoor levels of NO_2. However, a definitive risk-assessment of this aspect of indoor air pollution will not be possible until HONO measurements are conducted in more realistic settings, and until health effects studies of inhaled HONO are developed and carried out.

The present work represents the first application of differential optical absorption spectroscopy, a technique which has proven itself a useful analytical tool in the natural and polluted troposphere, to the study of indoor air pollution. Clearly, the DOAS technique, while relatively expensive and sophisticated, can provide for the simultaneous unequivocal identification and quantification of many potentially important indoor gaseous pollutants that are difficult to measure in "real time" by more conventional methods. Among the compounds which can be observed with our present "indoor" DOAS system (and their detection limits) are SO_2 (~20 ppb), NO_2 (~100 ppb), HONO (~25 ppb), HCHO (~130 ppb), the gaseous NO_3 radical (~60 ppt) together with certain aromatic compounds such as benzene (~20 ppb), benzaldehyde (~30 ppb) and naphthalene (~2 ppb).

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IX. APPENDICES

A. September 1983 Field Study

   1. Twenty-Four Hour Air Mass Trajectories

   2. Correlation Coefficients for El Monte Data

   3. Correlation Coefficients for Riverside Data

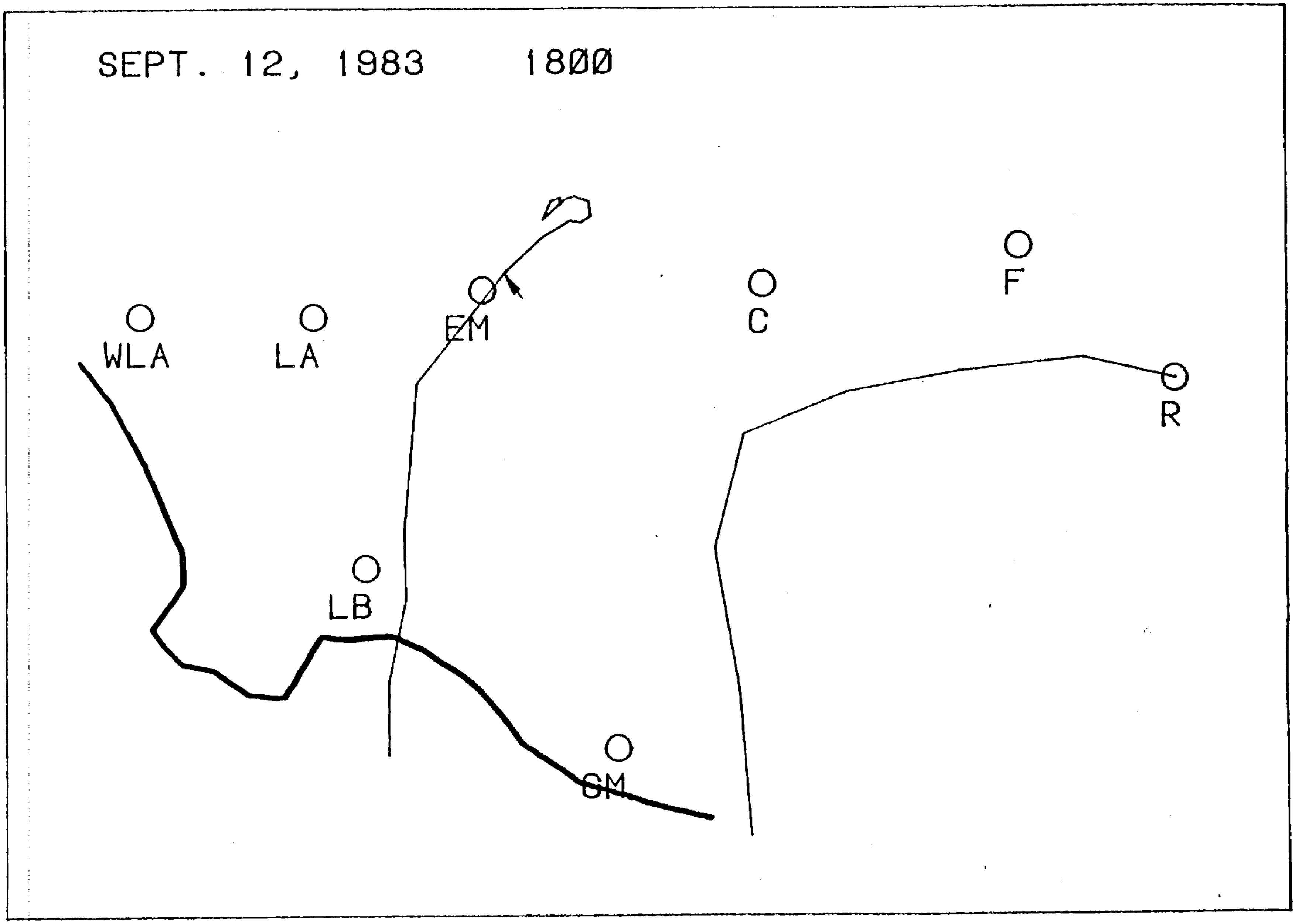
B. DOAS Measurements During the September 1984 Field Study

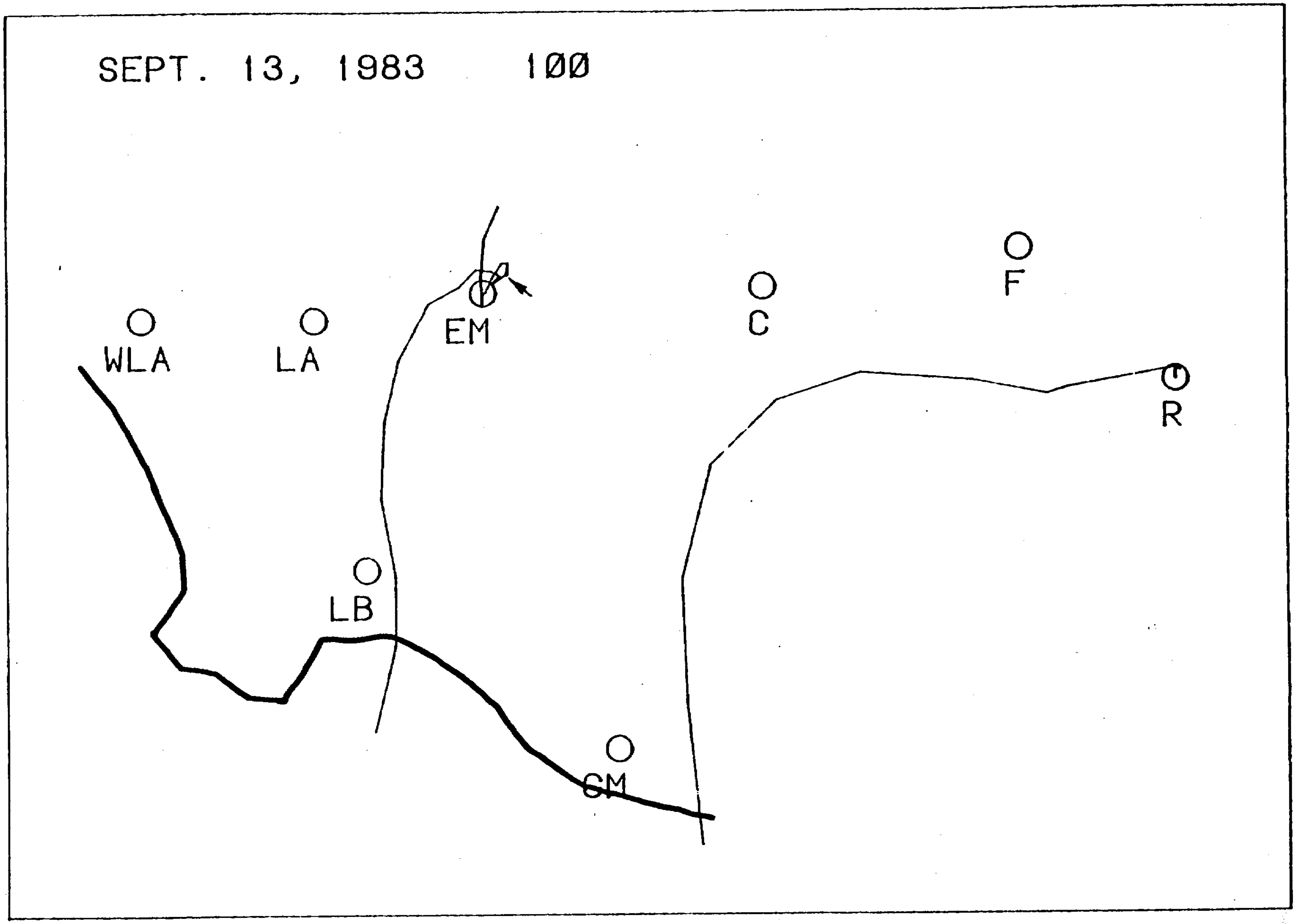
C. Ambient Air Data For the September 1984 Field Study

D. Electron Impact Mass Spectra of a Series of Standard Nitroarenes

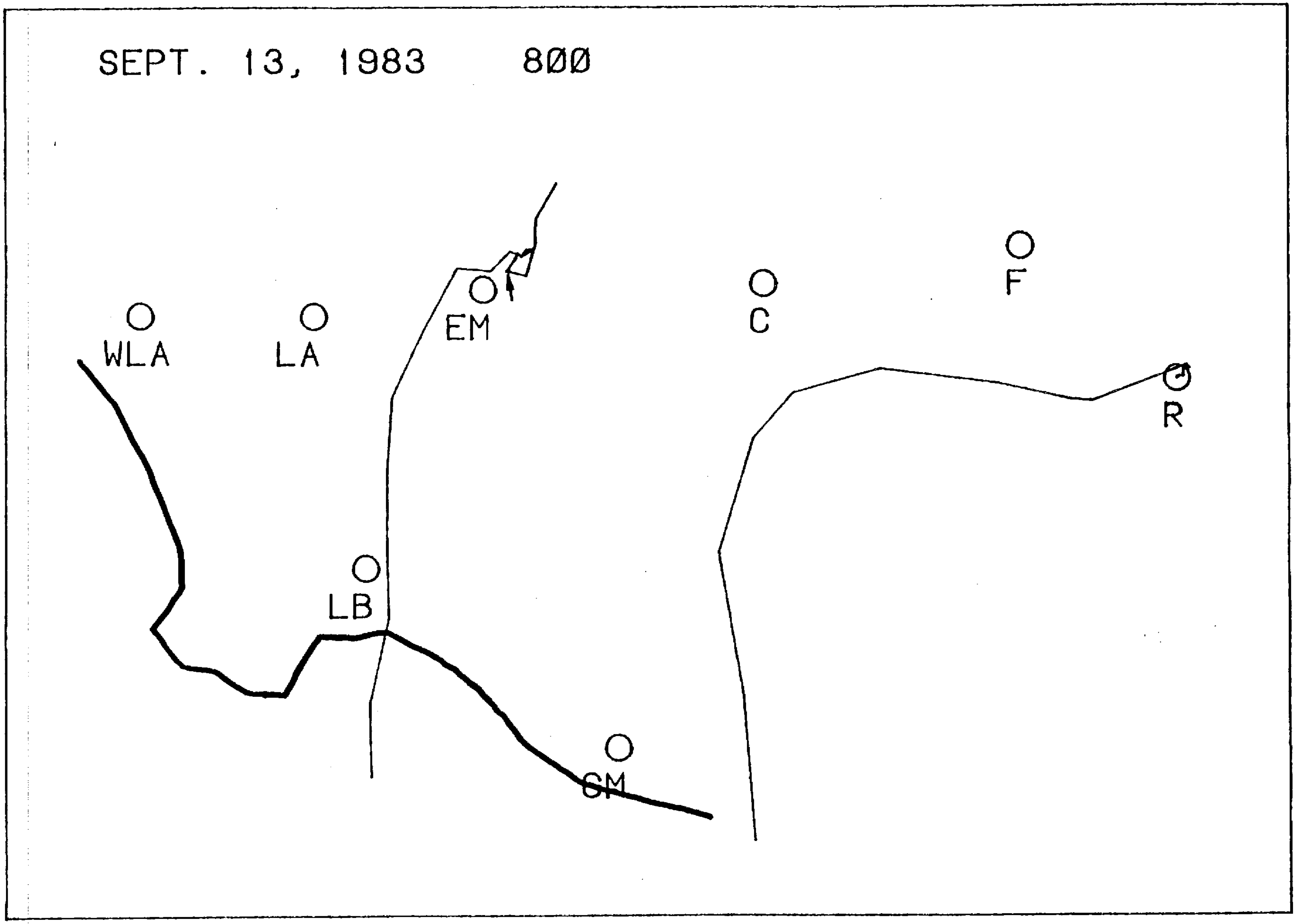
A.1. TWENTY-FOUR HOUR AIR MASS TRAJECTORIES

The trajectories shown were generated backward from Riverside and El Monte and forward from El Monte. The arrow marks the monitoring station closest to El Monte and the starting point for the 24-hr forward and 24-hr backward trajectory for El Monte. A description of the procedure used to generate these trajectories is given in Section II.C.5. The cities shown are: West Los Angeles (WLA), Los Angeles (LA), Long Beach (LB), El Monte (EM), Costa Mesa (CM), Claremont (C), Fontana (F) and Riverside (R). The date and starting time of the trajectories are given on each figure.


SEPT. 12, 1983 1800
WLA
LA
EM
C
F
R
LB
SM


SEPT. 13, 1983 100

SEPT. 13, 1983 800



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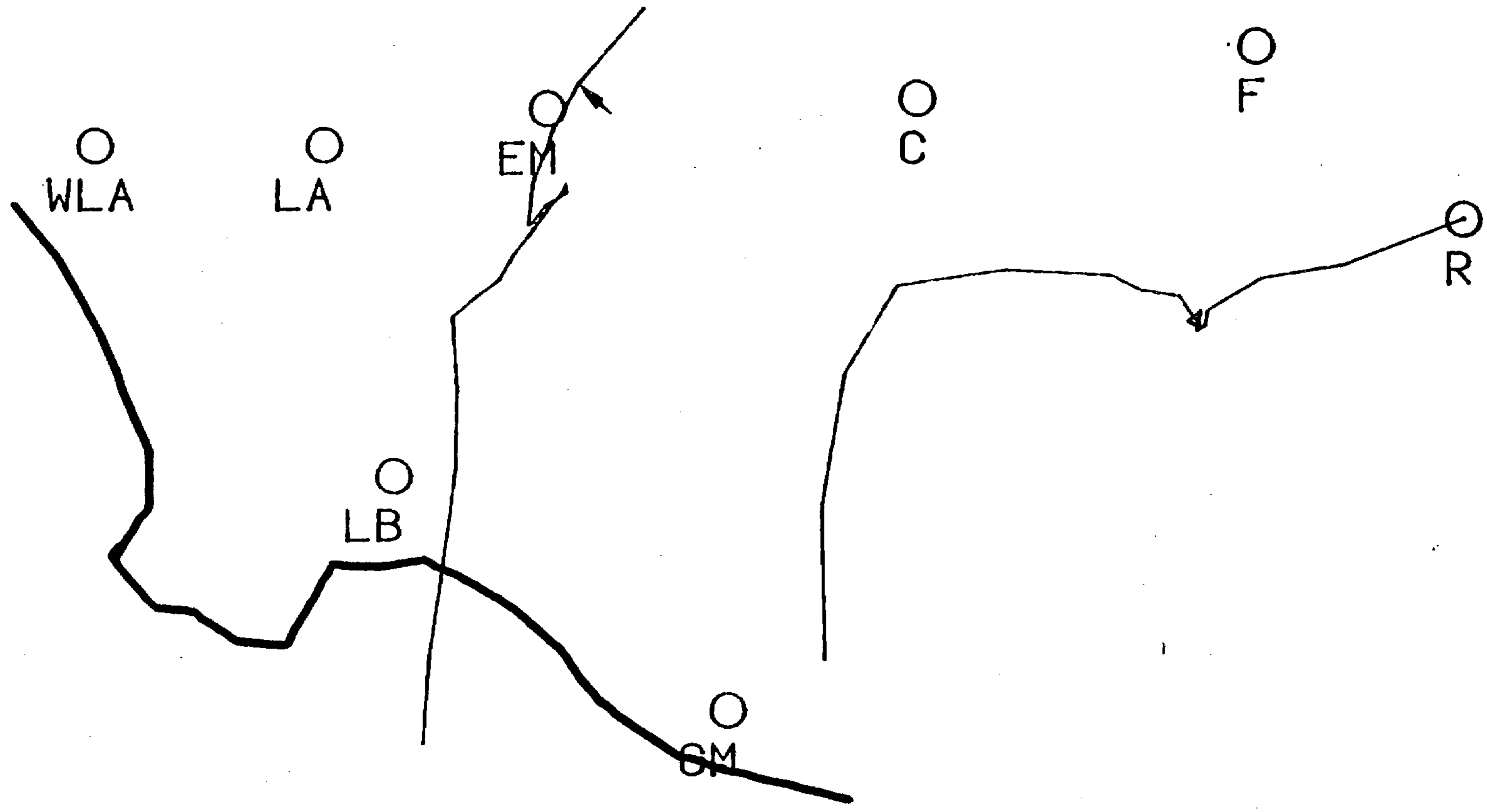

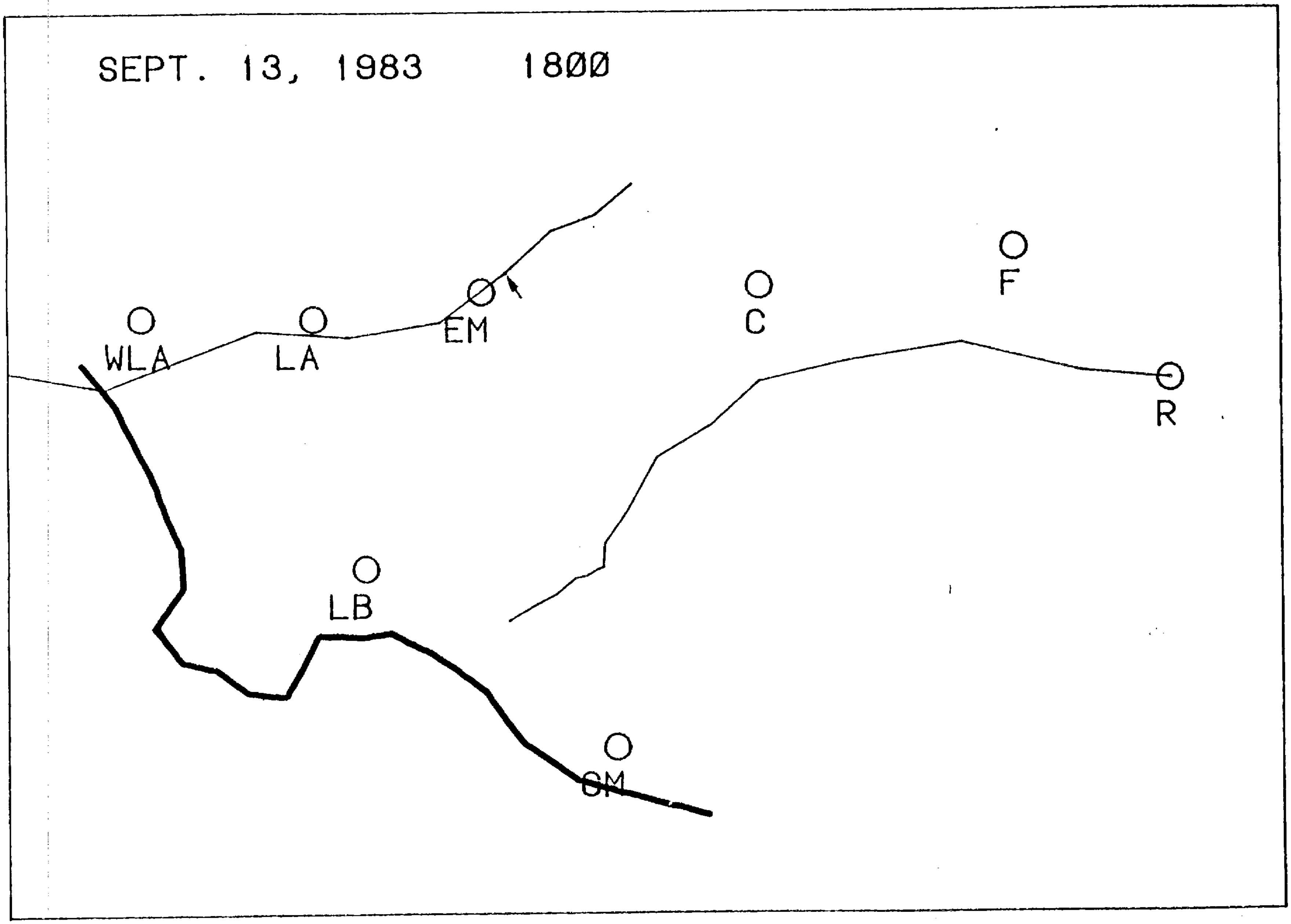
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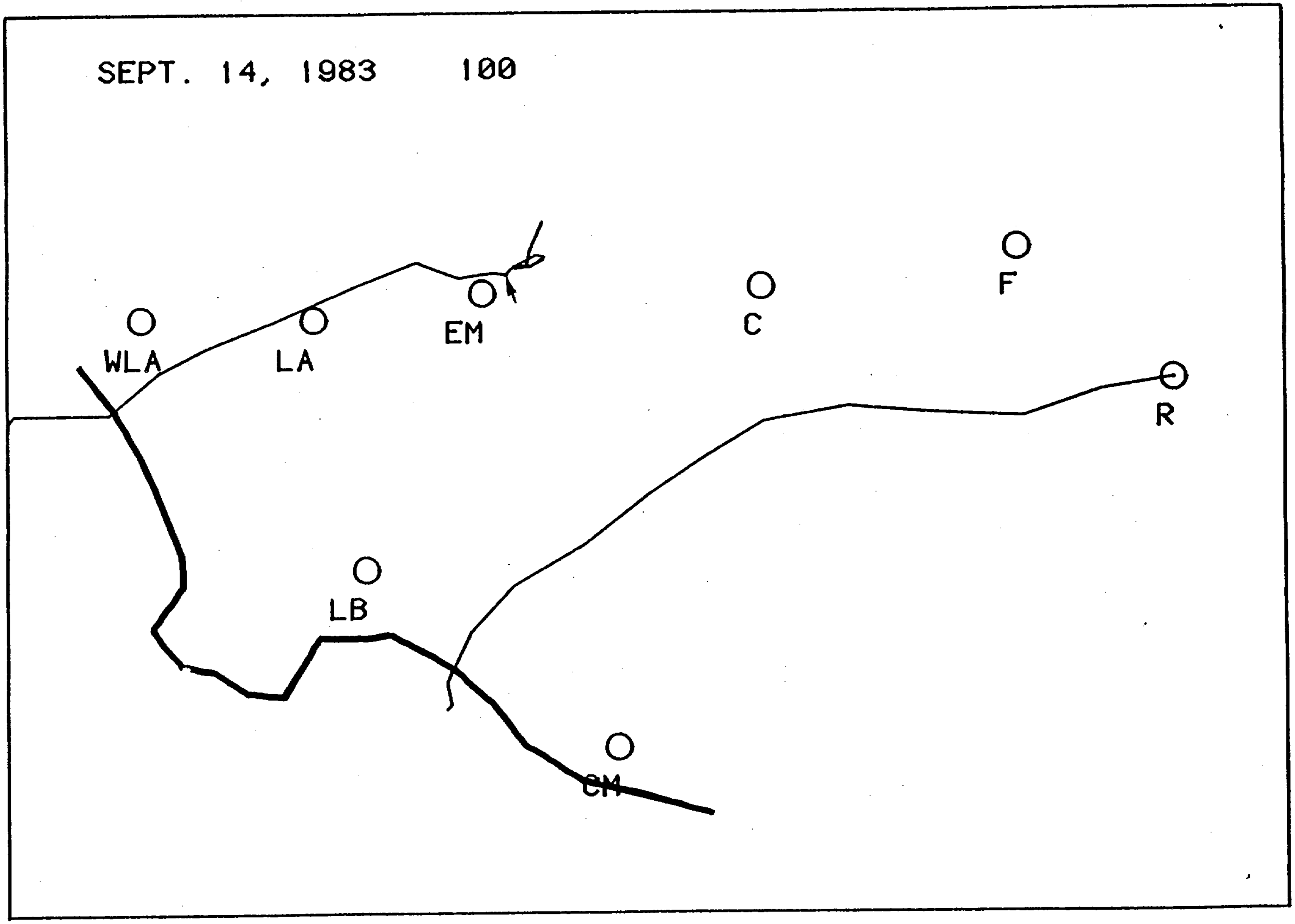
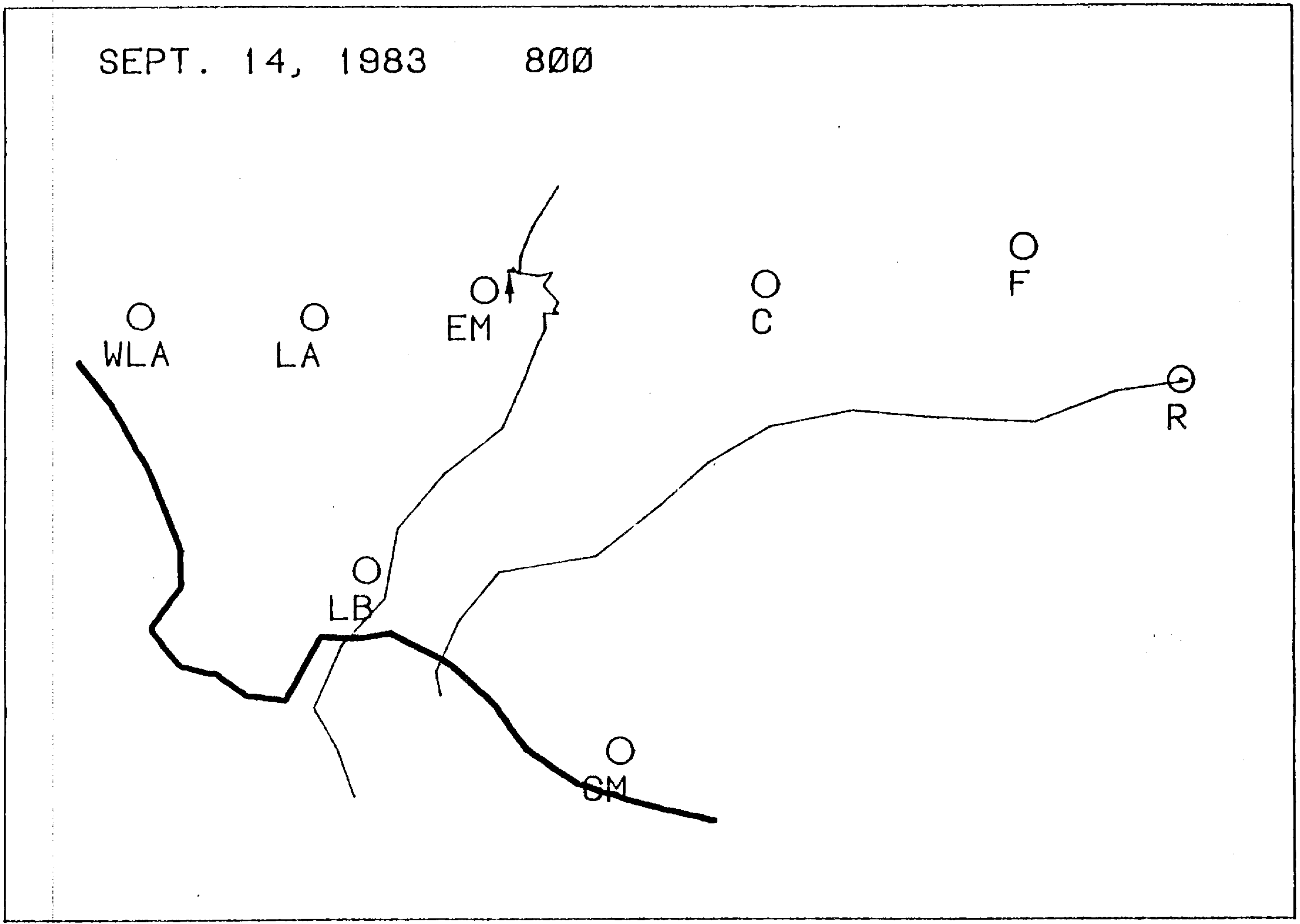

SEPT. 14, 1983 100
WLA
LA
EM
C
F
R
LB
CM



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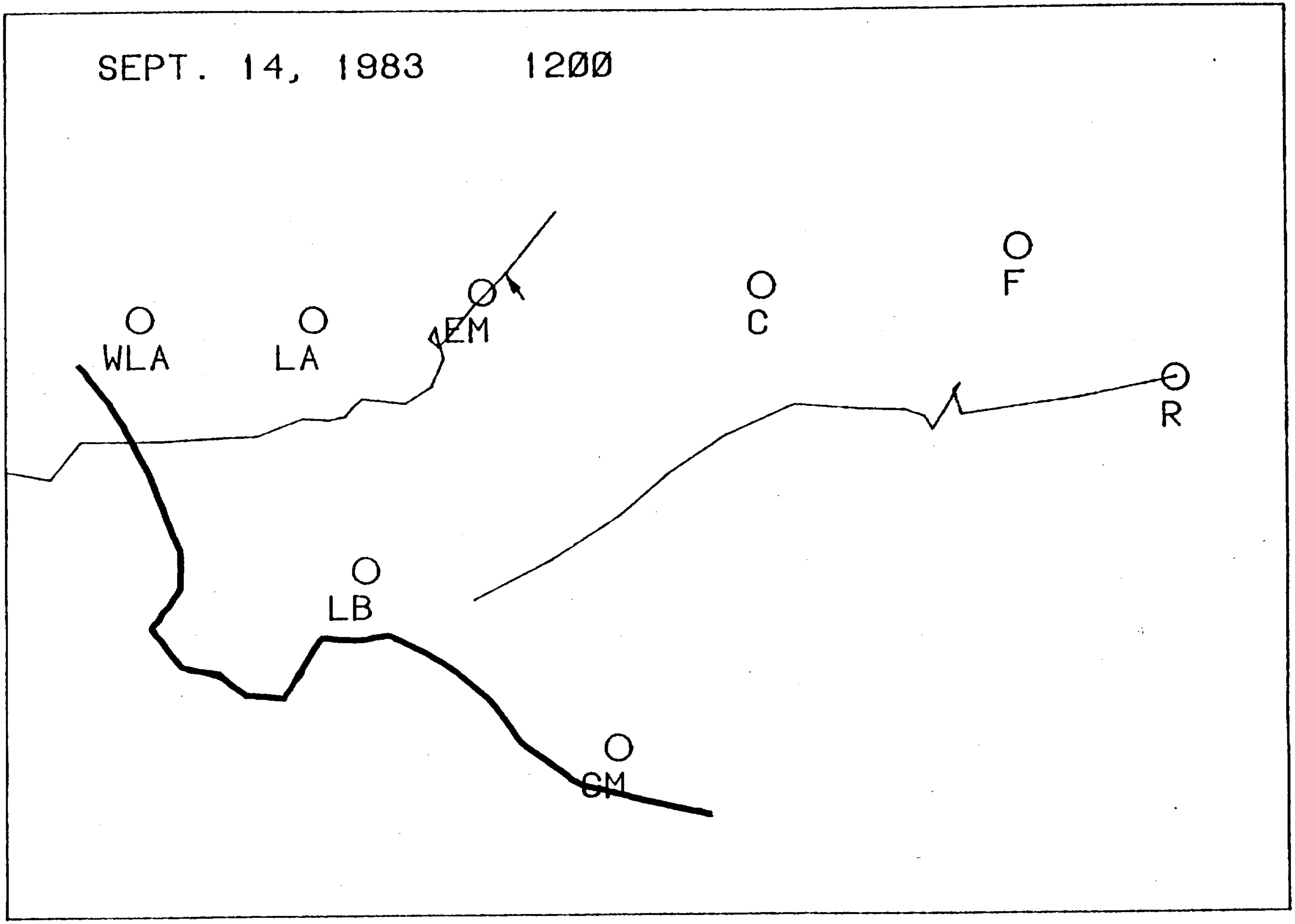
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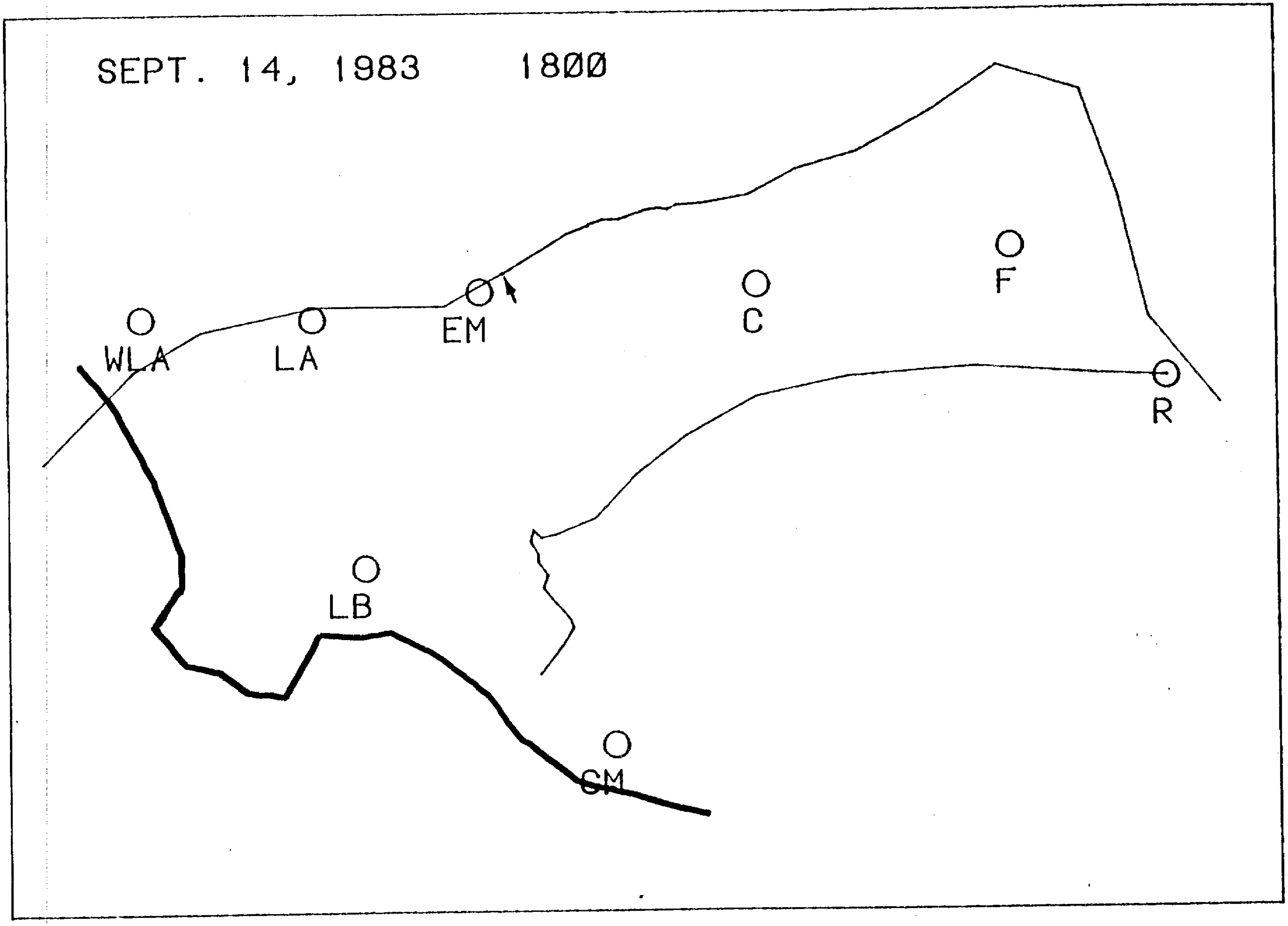
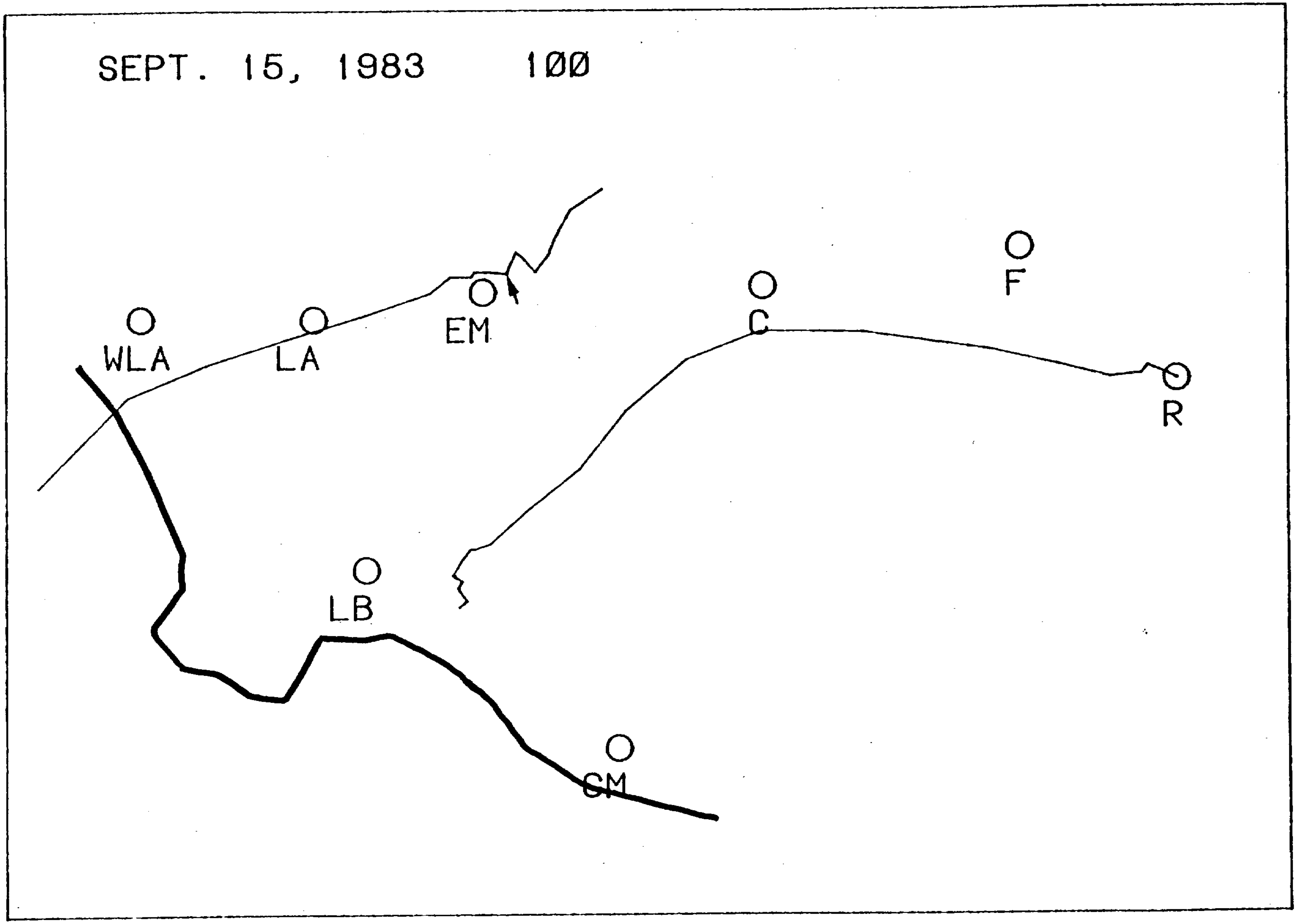
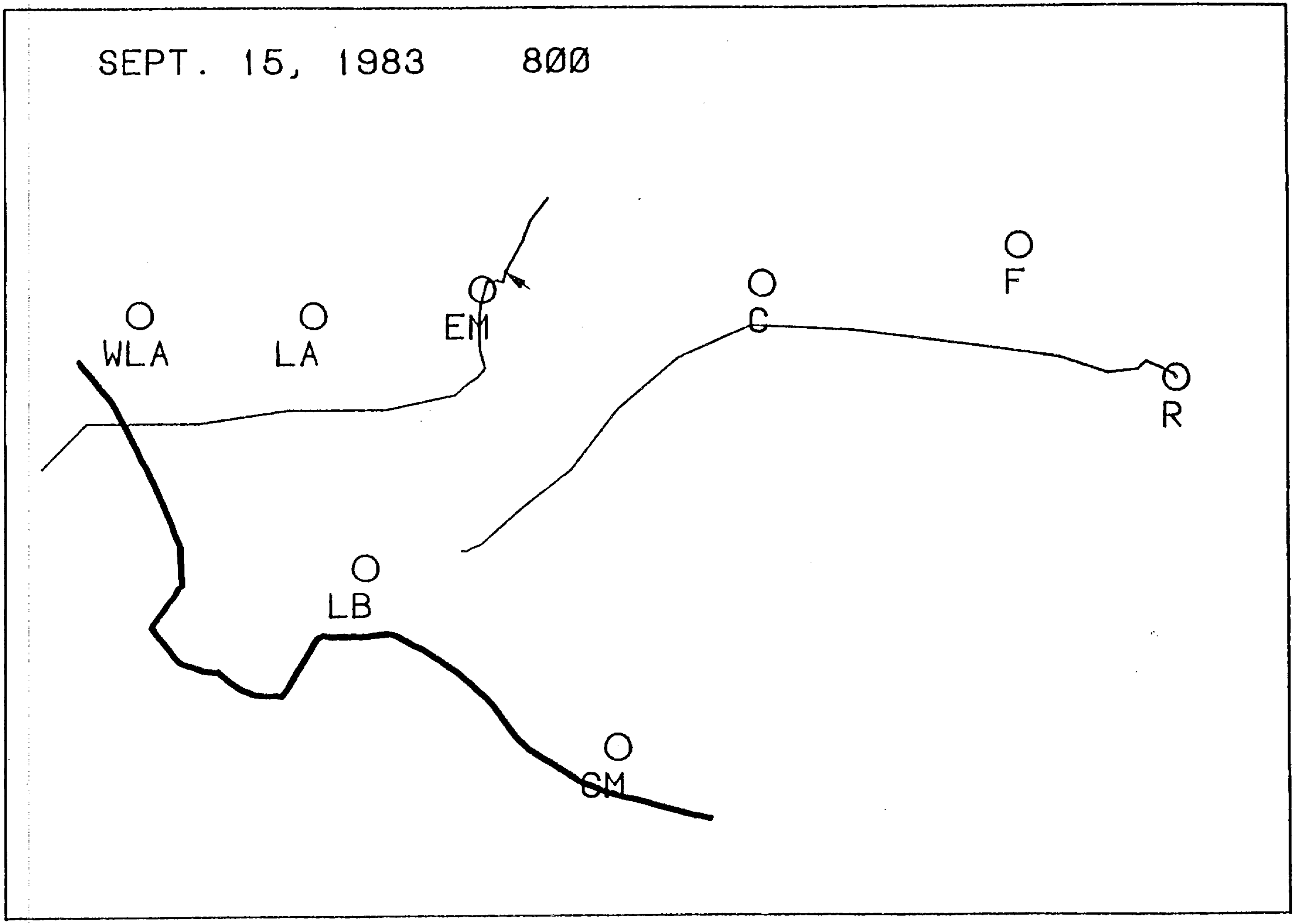


SEPT. 14, 1983 1800


SEPT. 15, 1983 100
WLA
LA
EM
C
F
R
LB
CM



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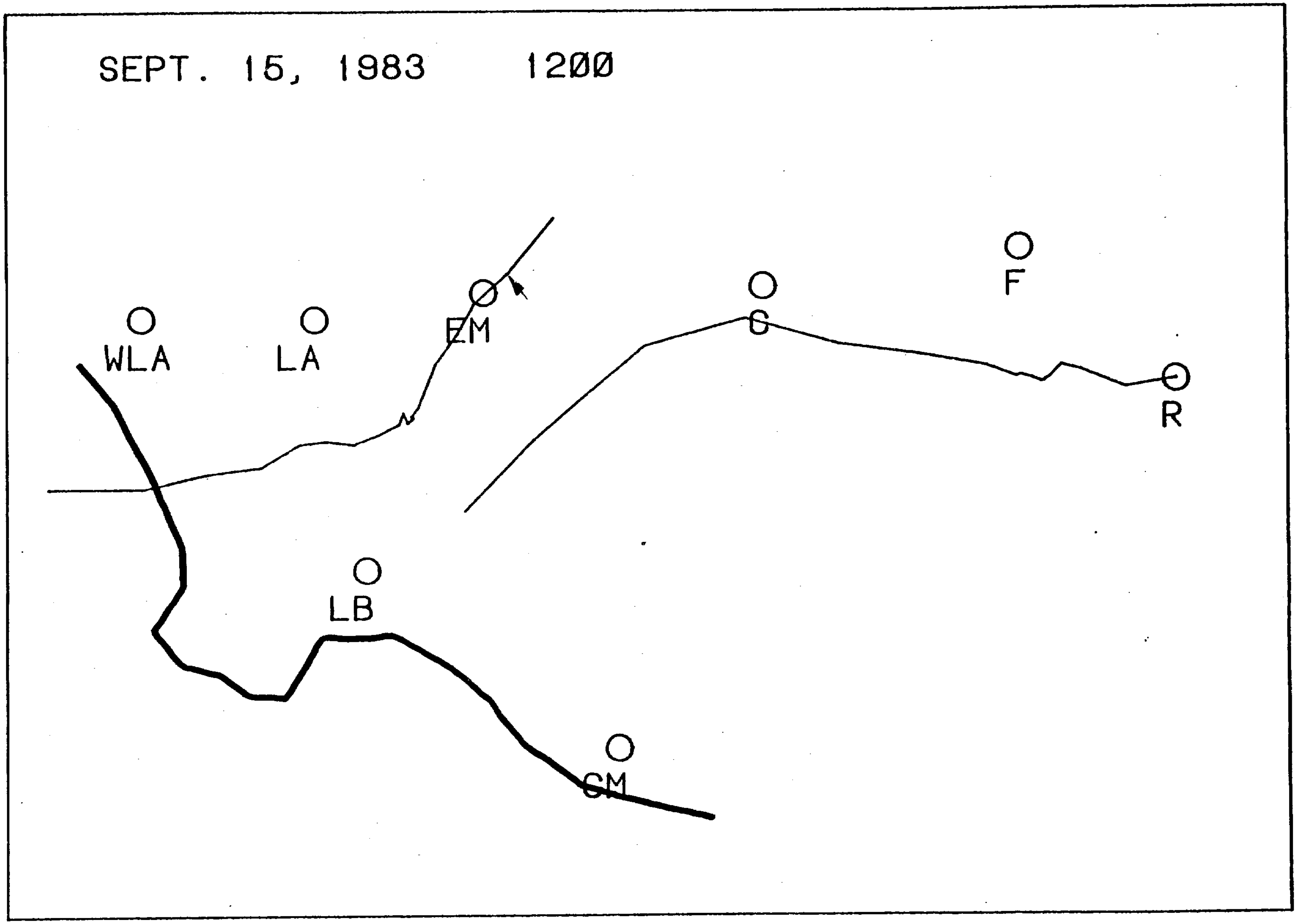

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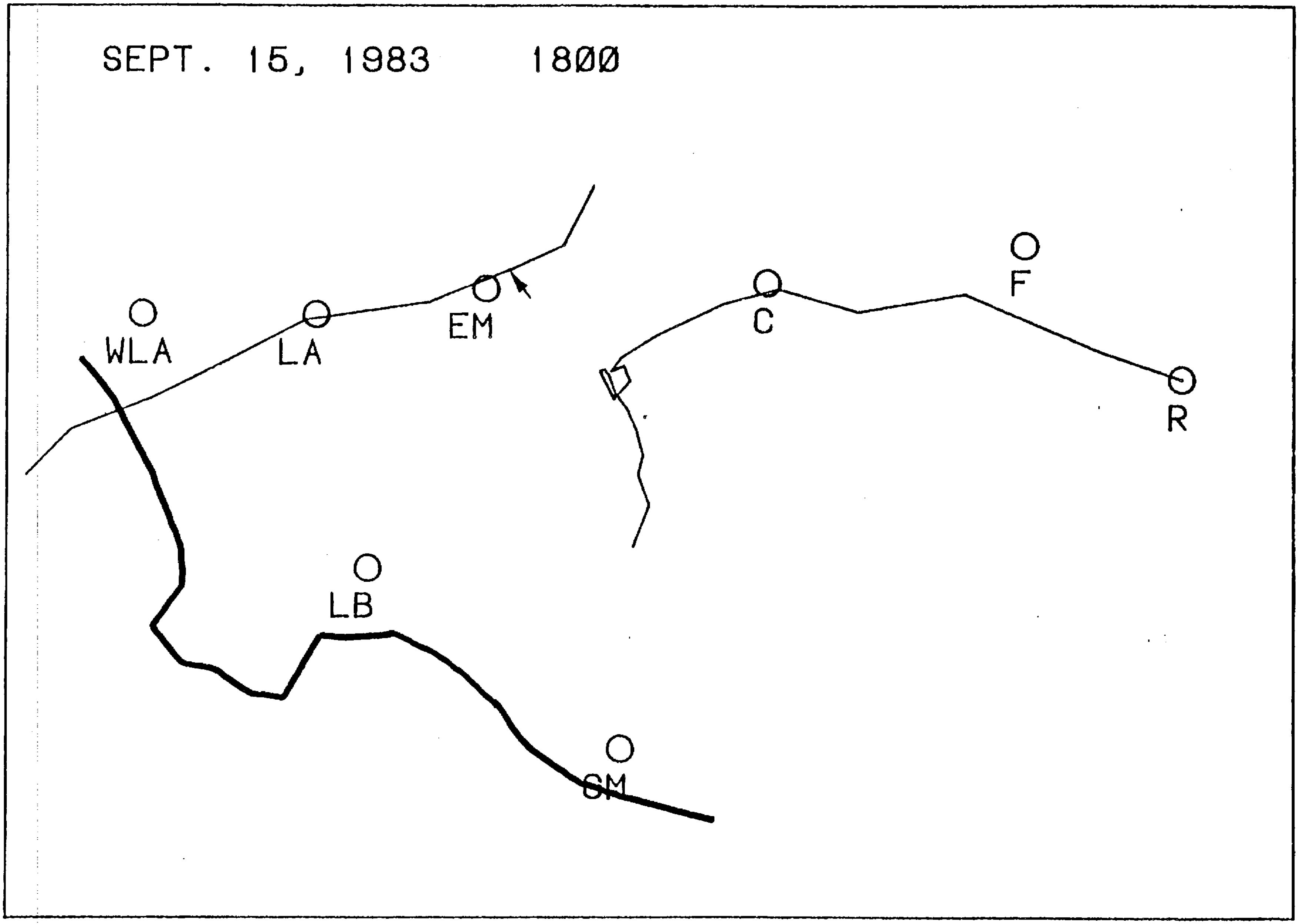

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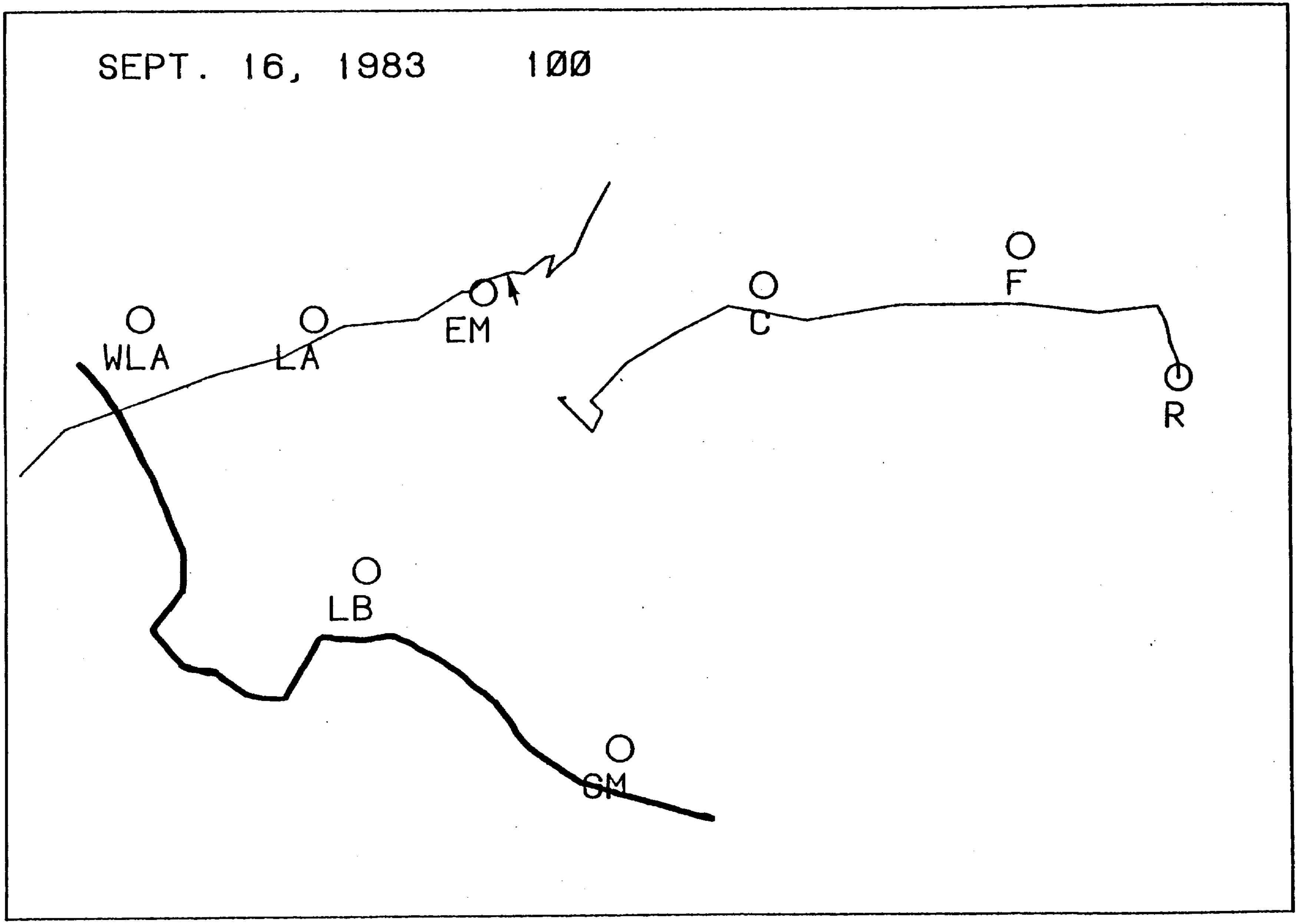
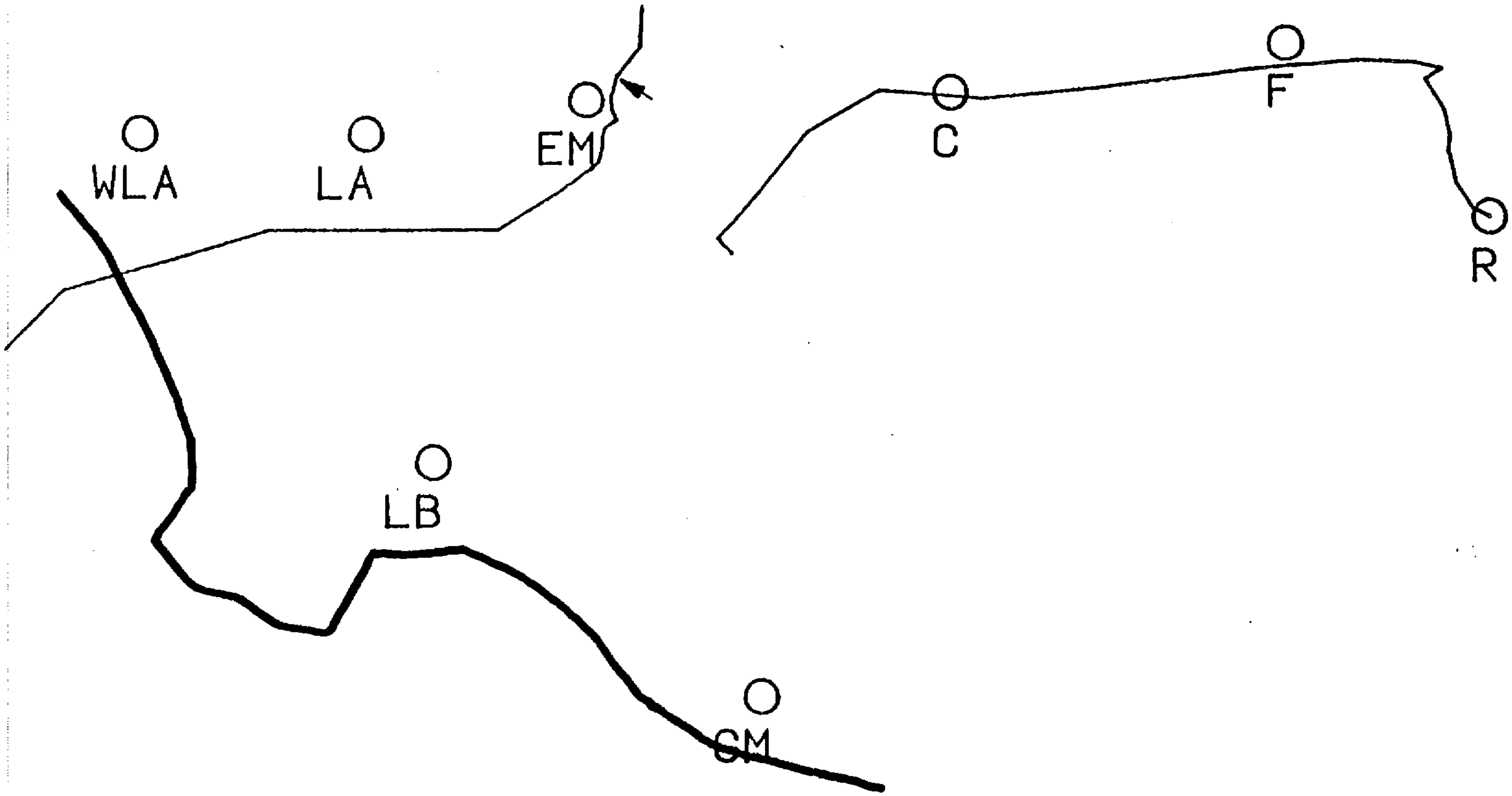
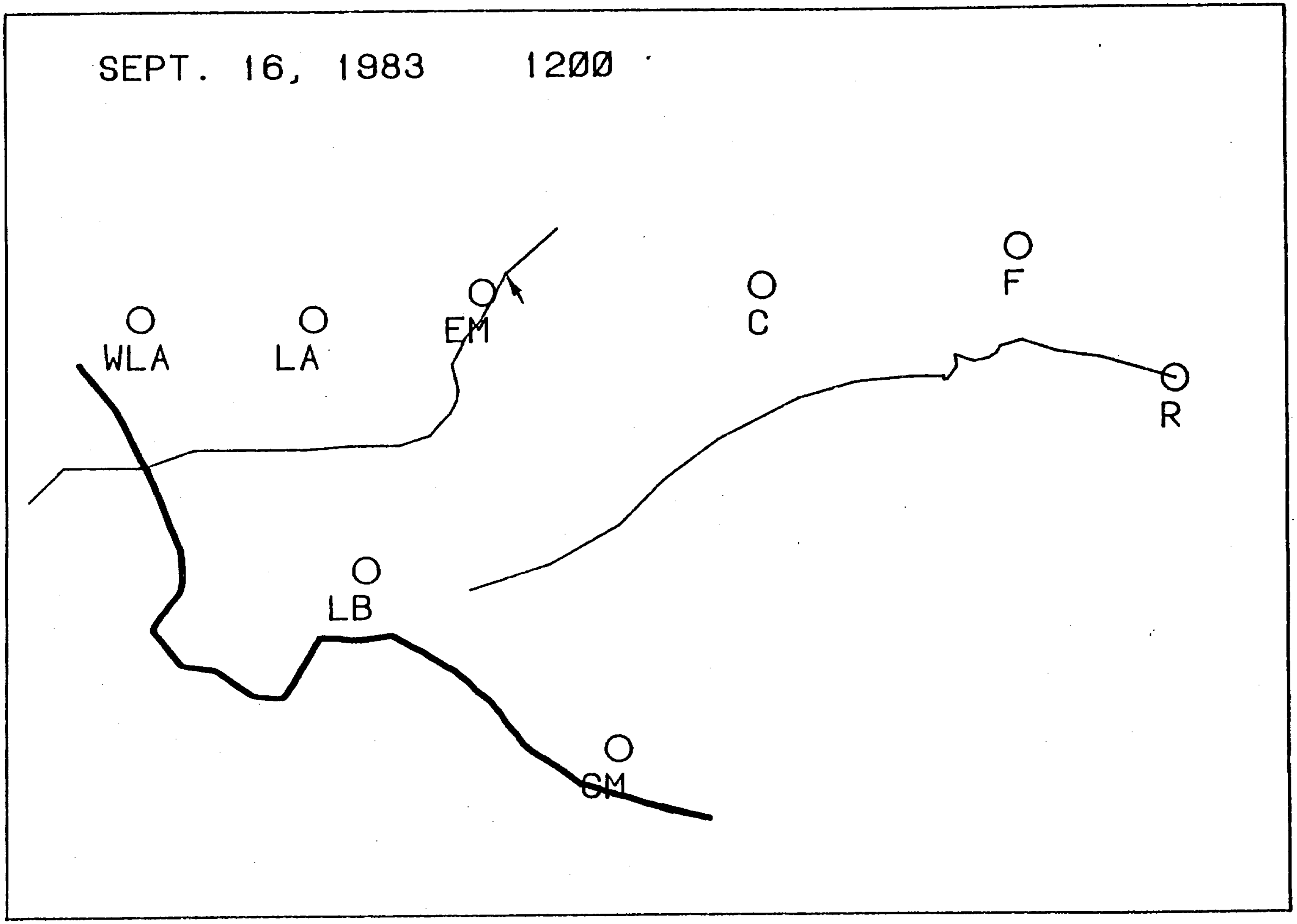


SEPT. 16, 1983 100

SEPT. 16, 1983 800





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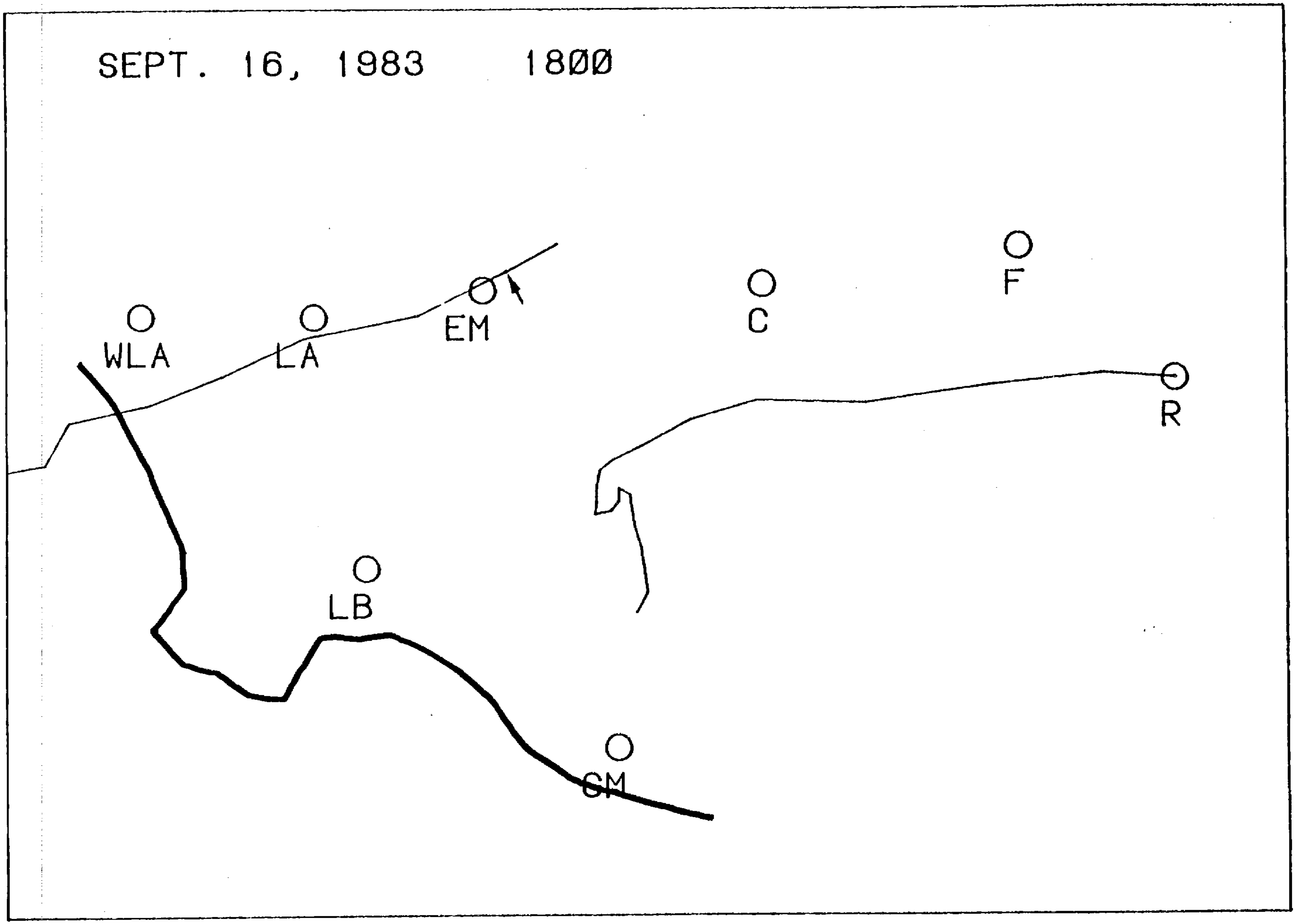
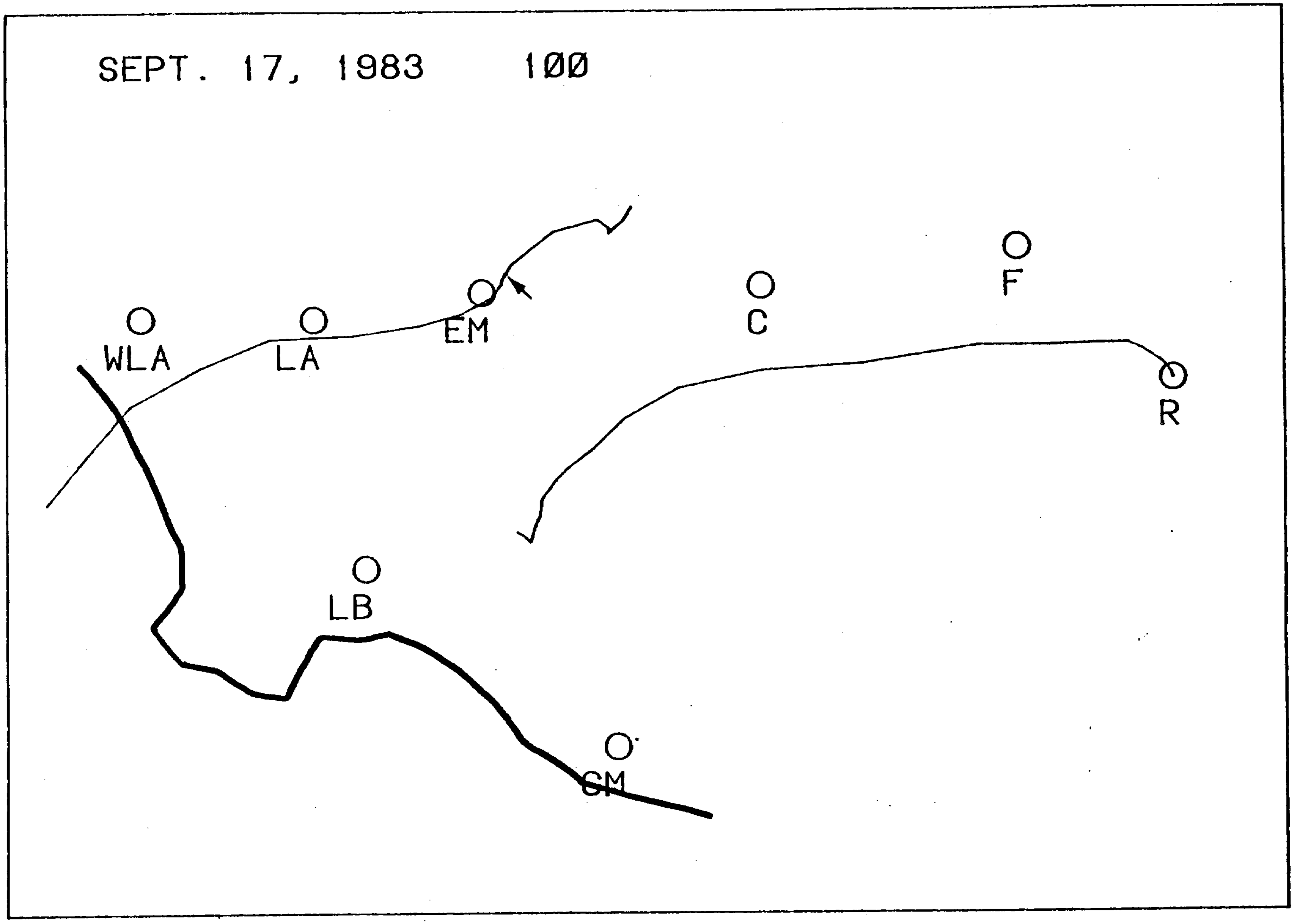
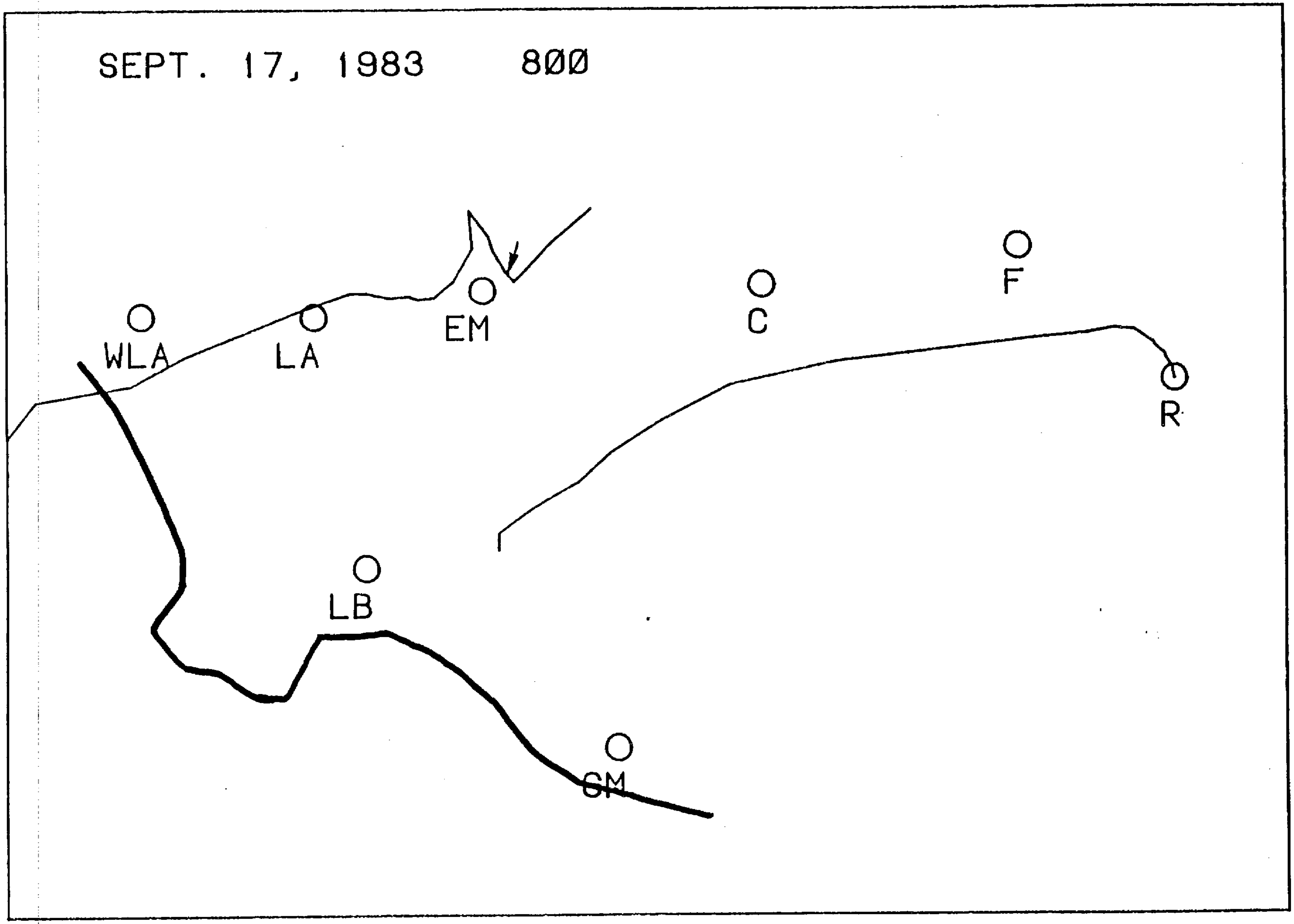
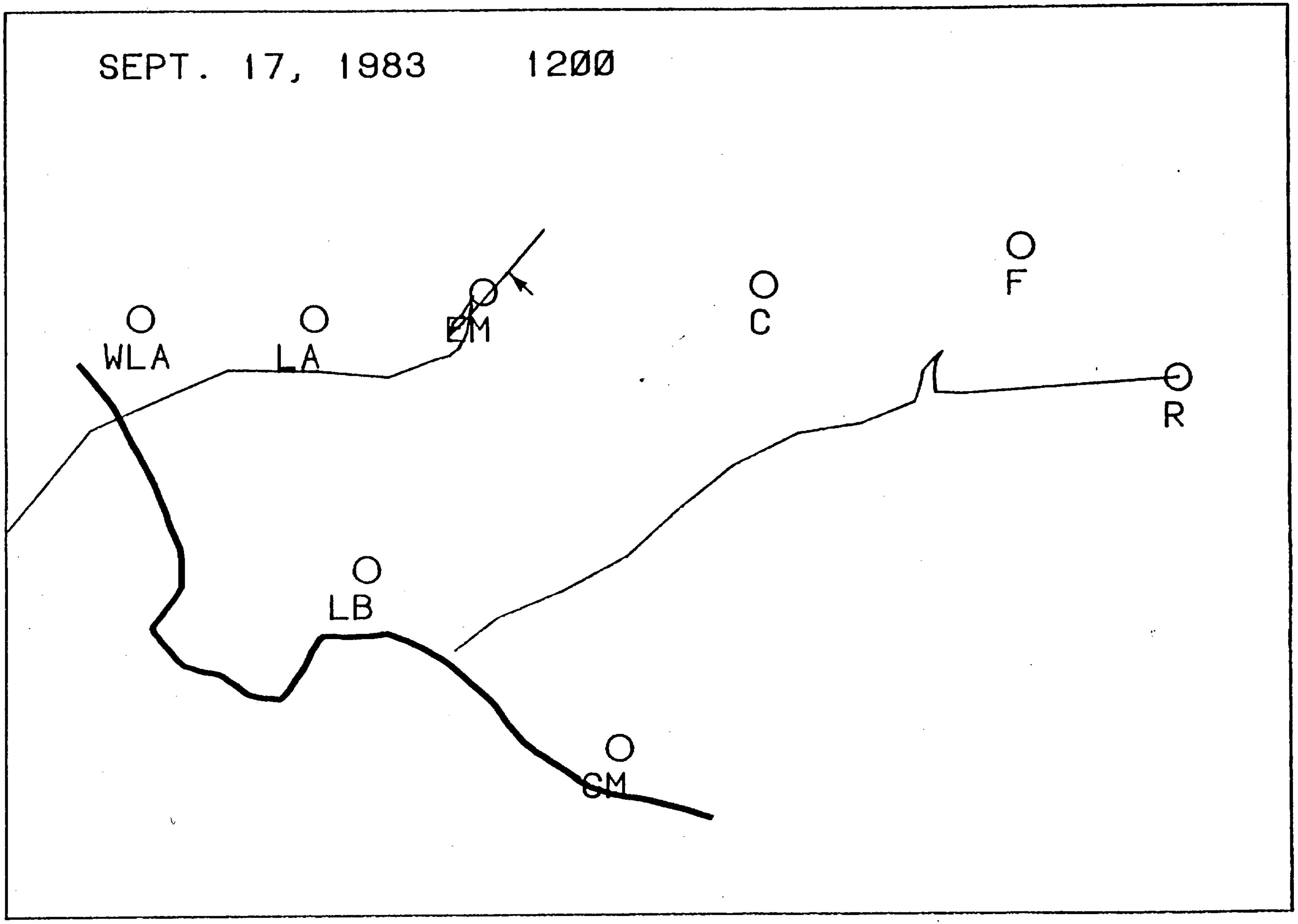

SEPT. 16, 1983 1800
WLA
LA
EM
C
F
R
LB
CM


SEPT. 17, 1983
100
WLA
LA
EM
C
F
R
LB
CM


SEPT. 17, 1983 800
WLA
LA
EM
C
F
R
LB
SM


SEPT. 17, 1983 1200

A.2. CORRELATION COEFFICIENTS FOR EL MONTE DATA

In the following table a matrix is printed in which the lower triangle contains the correlation coefficients and the upper triangle contains the number of cases used in building each correlation coefficient. A value of 99.00000 is printed if a correlation cannot be computed. The abbreviations for the variables used in the correlations and their definitions are:

NETWTP	Net weight of particles
NETWTE	Net weight of material solvent extracted from the particles
PERCEX	Percent extractable (NETWTE/NETWTP)
TA98ACT	TA98 Activity (rev μg^{-1})
TA98MD	TA98 Mutagen density (rev m^{-3})
ORGC	Organic carbon
ELEMC	Elemental carbon
TA98ML	TA98 Mutagen loading (rev μg^{-1} particulate)
TA98NRAC	TA98NR Activity (rev μg^{-1})
TA98NRMD	TA98NR Mutagen density (rev m^{-3})
TA98NRML	TA98NR Mutagen loading (rev μg^{-1} particulate)
DNP6ACT	TA98/1,8-DNP_6 Activity (rev μg^{-1})
DNP6MD	TA98,1,8-DNP_6 Mutagen density (rev m^{-3})
DNP6ML	TA98/1,8-DNP_6 Mutagen loading (rev μg^{-1} particulate)
OZONE	Ozone
BSCAT	Aerosol light scattering
NO	Nitric oxide
NO2UNC	Nitrogen dioxide uncorrected for PAN positive interference
PAN	Peroxyacetylnitrate
CO	Carbon monoxide
THC	Total hydrocarbons
METHANE	Methane

TDRY	Ambient Temperature
RADIOM	Light intensity
RELHUM	Relative humidity
NOXUNC	Total oxides of nitrogen, uncorrected for PAN interference
TSP	Total Solid Particulate weight
GFtoTIGF	Ratio of the mutagen density of POM collected on a GF filter to the mutagen density of POM simultaneously collected on a TIGF filter
Al	Aluminum
Si	Silica
S	Sulfur
Cl	Chlorine
K	Potassium
Ca	Calcium
Ti	Titanium
V	Vanadium
Mn	Manganese
Fe	Iron
Ni	Nickel
Cu	Copper
Zn	Zinc
Ge	Germanium
As	Arsenic
Se	Selenium
Br	Bromine
Rb	Rubidium
Sr	Strontium
Pb	Lead
Ag	Silver
Sn	Tin
Sb	Antimony
Ba	Barium

```
EL MONTE 1983 FIELD STUDY
CORRELATION COEFFICIENTS
A VALUE OF 99.00000 IS PRINTED IF A COEFFICIENT CANNOT BE COMPUTED.
LOWER TRIANGLE:  CORRELATION COEFFICIENTS
UPPER TRIANGLE:  N OF CASES FOR CORRELATION

              NETWTP     NETWTE     PERCEX    TA98ACT     TA98MD       ORGC      ELEMC     TA98HL  TA98NRAC  TA98NRMD  TA98NRML   DNP6ACT

NETWTP           20.        20.        20.        20.        20.        20.        20.        20.       20.       20.       20.       20.
NETWTE       0.95470        20.        20.        20.        20.        20.        20.        20.       20.       20.       20.       20.
PERCEX       0.18259    0.45282        20.        20.        20.        20.        20.        20.       20.       20.       20.       20.
TA98ACT     -0.24075   -0.13814    0.24438        20.        20.        20.        20.        20.       20.       20.       20.       20.
TA98MD       0.06011    0.12987    0.25130    0.75869        20.        20.        20.        20.       20.       20.       20.       20.
ORGC        -0.02192   -0.16288   -0.45488   -0.19340    0.22672        20.        20.        20.       20.       20.       20.       20.
ELEMC       -0.03691   -0.09729   -0.21205    0.17950    0.46834    0.80612        20.        20.       20.       20.       20.       20.
TA98HL      -0.16907   -0.01046    0.47208    0.96509    0.75719   -0.26000    0.11977        20.       20.       20.       20.       20.
TA98NRAC    -0.07965    0.06861    0.47460    0.93732    0.71958   -0.35707   -0.00977    0.97865       20.       20.       20.       20.
TA98NRMD     0.17692    0.28504    0.42297    0.79874    0.93732   -0.00208    0.27620    0.84608   0.85141       20.       20.       20.
TA98NRML    -0.03758    0.14554    0.61071    0.88195    0.69577   -0.37333   -0.02397    0.96775   0.98373   0.84898       20.       20.
DNP6ACT     -0.19974    0.00401    0.64306    0.74351    0.35011   -0.61953   -0.25666    0.82422   0.83583   0.50401   0.85373       20.
DNP6MD       0.11262    0.29169    0.64741    0.82380    0.80890   -0.22325    0.13435    0.91307   0.91028   0.90405   0.93517   0.77716
DNP6ML      -0.15253    0.07946    0.76189    0.67622    0.33764   -0.60583   -0.25030    0.79904   0.80394   0.50837   0.85366   0.98265
OZONE        0.06860   -0.15180   -0.64656   -0.61115   -0.37222    0.67338    0.27595   -0.67975  -0.69734  -0.47916  -0.71689  -0.81493
BSCAT        0.46197    0.47252    0.19583    0.05695    0.62408    0.52386    0.43672    0.13188   0.12986   0.55869   0.17400  -0.21101
NO          -0.33742   -0.22603    0.28657    0.56425    0.28558   -0.14025    0.32938    0.54313   0.44099   0.23916   0.42999   0.60431
NO2UNC       0.37536    0.26226   -0.25930    0.10227    0.43801    0.47581    0.55056   -0.00269  -0.06452   0.24248  -0.12257  -0.29381
PAN          0.33302    0.12110   -0.47114   -0.60895   -0.35010    0.54913    0.21158   -0.62872  -0.59662  -0.37793  -0.59747  -0.70808
CO          -0.06424   -0.06991   -0.06459    0.37889    0.42400    0.44739    0.80676    0.30378   0.16811   0.26477   0.14399   0.08312
THC         -0.13689   -0.04983    0.29997    0.54254    0.53425    0.14172    0.42648    0.57893   0.50094   0.49222   0.51902   0.46355
METHANE     -0.23258   -0.25239   -0.17311    0.22962   -0.10147   -0.28832   -0.02517    0.11208   0.04088  -0.16684  -0.01772   0.19770
TDRY        -0.13844   -0.35160   -0.76242   -0.57752   -0.62520    0.29935   -0.05818   -0.70395  -0.70888  -0.69067  -0.76603  -0.73136
RADIOM      -0.17814   -0.33793   -0.57075   -0.46758   -0.24832    0.73858    0.47495   -0.52514  -0.58507  -0.38802  -0.59155  -0.71489
RELHUM       0.16718    0.38095    0.80470    0.51576    0.61389   -0.23818    0.09645    0.65910   0.65266   0.67150   0.72436   0.68529
NOXUNC      -0.19238   -0.12556    0.18161    0.54529    0.39428    0.01798    0.46864    0.49390   0.38193   0.29211   0.35413   0.46046
TSP          0.36672    0.23316   -0.29997   -0.09811    0.47463    0.81269    0.66880   -0.14769  -0.19038   0.28320  -0.21126  -0.55415
GFtoTIGF     0.89521    0.72863   -0.22291   -0.51486   -0.29068    0.19255   -0.04143   -0.49220  -0.43538  -0.33092  -0.42274  -0.43450
Al           0.11465   -0.07786   -0.51085   -0.37974   -0.48065   -0.00038   -0.26930   -0.45110  -0.45471  -0.47955  -0.48703  -0.44335
Si           0.04389   -0.18685   -0.62758   -0.49757   -0.34316    0.32774   -0.05547   -0.58181  -0.61192  -0.46500  -0.64400  -0.69271
S            0.36573    0.30334   -0.07984   -0.23343    0.33882    0.61393    0.24829   -0.19526  -0.17426   0.21742  -0.15513  -0.44562
Cl          -0.24174   -0.07351    0.53042   -0.08143   -0.30096   -0.42098   -0.27335    0.00580  -0.04855  -0.25784   0.02132   0.39258
K           -0.06554   -0.30961   -0.70023   -0.44193   -0.36082    0.31986    0.01295   -0.56569  -0.62612  -0.52116  -0.67431  -0.65117
Ca          -0.00968   -0.27298   -0.70443   -0.55196   -0.29794    0.55806    0.16501   -0.65643  -0.69602  -0.49036  -0.74103  -0.76038
Ti           0.19561   -0.09473   -0.71884   -0.27966   -0.21084    0.32158    0.01535   -0.41423  -0.41278  -0.30207  -0.49377  -0.50702

                                                                                                                            (continued)
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EL MONTE 1983 FIELD STUDY (continued) - 2

	NETWTP	NETWTE	PERCEX	TA98ACT	TA98MD	ORGC	ELEMC	TA98ML	TA98NRAC	TA98NRMD	TA98NRML	DNP6ACT
V	0.39626	0.35731	0.01529	0.04718	0.23986	0.05048	-0.22309	0.07645	0.13894	0.22467	0.13794	0.01709
Mn	0.14953	0.05623	-0.30086	-0.35454	-0.19737	0.16431	0.07962	-0.37407	-0.41871	-0.25982	-0.40405	-0.53719
Fe	-0.07815	-0.32862	-0.69177	-0.44761	-0.33305	0.42863	0.15734	-0.55823	-0.61875	-0.48784	-0.66149	-0.67517
Ni	-0.00675	-0.00729	0.04024	-0.08327	-0.36970	-0.74999	-0.68954	-0.09355	0.00135	-0.26654	-0.02871	0.23834
Cu	-0.09066	-0.08057	0.04606	0.26737	-0.11891	-0.52503	-0.40304	0.21519	0.24843	-0.08034	0.19479	0.50790
Zn	-0.22308	-0.26187	-0.09212	0.43513	0.47661	0.45425	0.57208	0.36692	0.26934	0.35168	0.22669	0.19009
Ge	0.07787	0.00636	-0.14374	-0.11958	-0.14886	-0.30742	-0.34757	-0.14344	-0.11983	-0.13446	-0.13910	-0.12815
As	0.15224	0.07438	-0.12649	-0.39950	-0.27098	0.28008	-0.00180	-0.35685	-0.31187	-0.21948	-0.28457	-0.33893
Se	-0.05001	-0.00371	0.18827	0.07933	0.32552	0.02418	-0.17843	0.11867	0.15566	0.25749	0.15739	0.12463
Br	-0.10256	-0.17141	-0.17248	0.18375	0.23902	0.40929	0.70168	0.08346	-0.02833	0.04775	-0.07101	0.01172
Rb	-0.10019	-0.21687	-0.37080	0.07079	-0.12727	-0.09634	0.21533	-0.07451	-0.12353	-0.22636	-0.20441	-0.04408
Sr	0.02838	-0.02217	-0.10118	-0.38817	-0.00817	0.36336	0.04540	-0.37712	-0.39954	-0.21212	-0.38296	-0.36657
Pb	-0.09913	-0.15811	-0.13783	0.25109	0.38456	0.49911	0.73699	0.16502	0.05360	0.17095	0.01450	0.03470
Ag	-0.38136	-0.27930	0.25815	0.40688	0.26138	0.13595	0.22973	0.43041	0.36174	0.23156	0.37131	0.47426
Sn	0.05799	0.08174	0.11121	0.14395	0.31878	0.03597	-0.03024	0.13676	0.15441	0.18700	0.13044	0.20229
Sb	0.09860	0.09603	0.03450	0.22207	-0.07792	-0.51304	-0.41481	0.18412	0.25823	-0.01623	0.20700	0.43501
Ba	0.07787	0.00636	-0.14374	-0.11958	-0.14886	-0.30742	-0.34757	-0.14344	-0.11983	-0.13446	-0.13910	-0.12815

	DNP6MD	DNP6ML	OZONE	BSCAT	NO	NO2UNC	PAN	CO	THC	METHANE	TDRY	RADIOM
NETWTP	20.	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
NETWTE	20.	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
PERCEX	20.	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
TA98ACT	20.	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
TA98MD	20.	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
ORGC	20.	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
ELEMC	20.	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
TA98ML	20.	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
TA98NRAC	20.	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
TA98NRMD	20.	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
TA98NRML	20.	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
DNP6ACT	20.	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
DNP6MD	20.	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
DNP6ML	0.78822	20.	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
OZONE	-0.70646	-0.80500	20.	20.	20.	20.	20.	20.	19.	20.	20.	19.
BSCAT	0.35455	-0.14307	0.13391	20.	20.	20.	20.	20.	19.	20.	20.	19.
NO	0.46481	0.57105	-0.54478	-0.26408	20.	20.	20.	20.	19.	20.	20.	19.
NO2UNC	0.10371	-0.33839	0.19181	0.41890	0.13711	20.	20.	20.	19.	20.	20.	19.

(continued)

EL MONTE 1983 FIELD STUDY (continued) - 3

	DNP6MD	DNP6ML	OZONE	BSCAT	NO	NO2UNC	PAN	CO	THC	METHANE	TDRY	RADIOM
PAN	-0.56035	-0.68465	0.84288	0.14556	-0.51487	0.16334	20.	20.	19.	20.	20.	19.
CO	0.28351	0.05851	-0.11229	0.14636	0.70676	0.47847	-0.15585	20.	19.	20.	20.	19.
THC	0.58614	0.46747	-0.20926	0.12727	0.53817	0.21560	-0.14208	0.45502	19.	19.	19.	18.
METHANE	-0.04927	0.12497	-0.22856	-0.54466	0.62363	0.17099	-0.33787	0.42616	0.18749	20.	20.	19.
TDRY	-0.86048	-0.76901	0.80093	-0.37441	-0.47066	0.01768	0.63773	-0.25859	-0.42496	0.09878	20.	19.
RADIOM	-0.59915	-0.69798	0.87229	0.16724	-0.32748	0.11545	0.66080	0.08753	0.00498	-0.14872	0.66710	19.
RELHUM	0.84007	0.74152	-0.73956	0.42918	0.48359	0.02277	-0.55864	0.27008	0.43328	-0.10778	-0.98165	-0.62346
NOXUNC	0.45514	0.41651	-0.43748	-0.11224	0.95287	0.43117	-0.41896	0.79032	0.55547	0.62042	-0.42329	-0.26630
TSP	0.00711	-0.54137	0.51488	0.79931	-0.25219	0.73255	0.43742	0.32404	0.12909	-0.30270	0.07318	0.48246
GFtoTIGF	-0.38881	-0.42072	0.68420	0.29024	-0.46613	0.40383	0.79956	-0.25950	0.19461	-0.21866	0.41299	0.45366
Al	-0.56439	-0.46940	0.58926	-0.24507	-0.42973	0.06920	0.48354	-0.38605	-0.44687	0.14306	0.76313	0.38115
Si	-0.62391	-0.71120	0.70851	0.01647	-0.50966	0.19841	0.55745	-0.28224	-0.39589	0.03068	0.74129	0.59065
S	-0.00468	-0.39719	0.43278	0.89258	-0.52219	0.29328	0.39207	-0.14947	-0.15573	-0.65137	-0.13102	0.33982
Cl	0.03159	0.45870	-0.31177	-0.42795	0.48528	-0.23411	-0.28536	0.02299	0.11442	0.41834	-0.15565	-0.33740
K	-0.63104	-0.69550	0.61831	-0.14171	-0.30298	0.23252	0.43467	-0.05020	-0.31614	0.30147	0.75004	0.57930
Ca	-0.64127	-0.79198	0.79147	0.14323	-0.40153	0.32635	0.58684	-0.11421	-0.32702	-0.03002	0.66317	0.69319
Ti	-0.42468	-0.58131	0.60214	-0.02061	-0.27896	0.36793	0.58851	-0.09638	-0.32271	0.13405	0.61971	0.38347
V	0.20444	0.01371	-0.05711	0.35658	-0.28662	0.10418	0.22072	-0.21315	-0.10847	-0.23589	-0.19105	-0.24756
Mn	-0.42324	-0.50654	0.53031	0.08384	-0.42301	0.24394	0.25523	-0.15874	-0.23712	0.04284	0.50214	0.55443
Fe	-0.60776	-0.70994	0.68136	-0.07091	-0.25966	0.27053	0.52722	-0.02267	-0.27010	0.18730	0.72955	0.65550
Ni	-0.13445	0.18614	-0.17352	-0.54628	0.01621	-0.10681	-0.21431	-0.47956	-0.05726	0.39389	0.17202	-0.33921
Cu	0.12930	0.41415	-0.29705	-0.39478	0.35569	0.03055	-0.30092	-0.05849	0.29491	0.54416	-0.09096	-0.30763
Zn	0.38656	0.14033	0.05202	0.28698	0.45639	0.57443	-0.12579	0.50442	0.46979	0.15560	-0.19354	0.26015
Ge	-0.15489	-0.14658	0.08195	-0.23283	-0.14697	0.21578	0.04470	-0.35514	-0.18704	0.27127	0.34715	-0.07017
As	-0.29319	-0.30519	0.45401	0.23654	-0.20692	-0.29873	0.50472	-0.09838	-0.28864	-0.24237	0.22800	0.43111
Se	0.29302	0.11515	-0.21031	0.34705	-0.04918	0.10416	-0.05965	-0.20628	0.18074	-0.20197	-0.31421	-0.12355
Br	0.13066	-0.03914	-0.11351	0.02596	0.73249	0.58191	-0.11259	0.86385	0.35996	0.50155	-0.21254	0.05398
Rb	-0.16837	-0.14532	-0.14496	-0.46085	0.47748	0.40830	-0.06019	0.40080	0.13971	0.65508	0.18779	-0.06789
Sr	-0.19219	-0.35532	0.14415	0.35310	-0.15885	0.24249	0.22702	-0.04546	-0.26785	-0.16278	-0.01865	0.20846
Pb	0.24357	-0.01370	-0.11311	0.20028	0.67002	0.66607	-0.11661	0.82019	0.41713	0.36357	-0.30036	0.08076
Ag	0.45250	0.46030	-0.32231	0.00186	0.48368	0.09888	-0.28510	0.29688	0.31303	-0.03265	-0.35027	-0.11174
Sn	0.30552	0.15063	-0.31231	0.29211	0.18534	0.37266	-0.17354	0.07414	0.28151	0.01302	-0.43173	-0.20145
Sb	0.12356	0.34764	-0.24226	-0.24605	0.20164	-0.01041	-0.20204	-0.12187	0.28148	0.41746	-0.13950	-0.27248
Ba	-0.15489	-0.14658	0.08195	-0.23283	-0.14697	0.21578	0.04470	-0.35514	-0.18704	0.27127	0.34715	-0.07017

(continued)

EL MONTE 1983 FIELD STUDY (continued) - 4

	RELHUM	NOXUNC	TSP	GFtoTIGF	Al	Si	S	Cl	K	Ca	Ti	V
NETWTP	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
NETWTE	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
PERCEX	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
TA98ACT	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
TA98MD	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
ORGC	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
ELEMC	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
TA98HL	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
TA98NRAC	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
TA98NRMD	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
TA98NRML	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
DNP6ACT	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
DNP6MD	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
DNP6ML	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
OZONE	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
BSCAT	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
NO	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
NO2UNC	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
PAN	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
CO	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
THC	19.	19.	19.	11.	15.	15.	15.	15.	15.	15.	15.	15.
METHANE	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
TDRY	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
RADIOM	19.	19.	19.	10.	15.	15.	15.	15.	15.	15.	15.	15.
RELHUM	20.	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
NOXUNC	0.44746	20.	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
TSP	-0.01316	-0.00534	20.	11.	16.	16.	16.	16.	16.	16.	16.	16.
GFtoTIGF	-0.38764	-0.28538	0.50439	11.	9.	9.	9.	9.	9.	9.	9.	9.
Al	-0.69426	-0.36780	0.00458	0.34137	16.	16.	16.	16.	16.	16.	16.	16.
Si	-0.66739	-0.40506	0.33056	0.34495	0.86193	16.	16.	16.	16.	16.	16.	16.
S	0.17987	-0.39093	0.82969	0.38785	-0.00639	0.30655	16.	16.	16.	16.	16.	16.
Cl	0.25797	0.37359	-0.50622	-0.34149	-0.02438	-0.22401	-0.42014	16.	16.	16.	16.	16.
K	-0.69435	-0.21013	0.23733	0.26181	0.76963	0.92197	0.10008	-0.16860	16.	16.	16.	16.
Ca	-0.58810	-0.27360	0.52409	0.40036	0.66522	0.90020	0.44979	-0.24341	0.83953	16.	16.	16.
Ti	-0.56807	-0.15229	0.33787	0.32943	0.74493	0.78257	0.20288	-0.24287	0.78319	0.77093	16.	16.
V	0.19289	-0.22978	0.20815	0.19924	0.08614	0.16932	0.42403	-0.24074	0.12552	0.04809	0.35414	16.
Mn	-0.46555	-0.31498	0.27662	0.55508	0.62063	0.63206	0.15231	-0.23546	0.55439	0.49932	0.28053	-0.17290
Fe	-0.65896	-0.16101	0.33645	0.28784	0.74614	0.92976	0.16729	-0.21726	0.93153	0.91273	0.78664	0.01418
Ni	-0.19658	-0.01402	-0.49752	0.81752	0.15784	-0.04292	-0.40707	0.31677	-0.06261	-0.09267	-0.00689	-0.14860

(continued)

EL MONTE 1983 FIELD STUDY (continued) - 5

	RELHUM	NOXUNC	TSP	GFtoTIGF	Al	Si	S	Cl	K	Ca	Ti	V
Cu	0.08747	0.32794	-0.39648	0.29393	0.16170	-0.06246	-0.36465	0.39384	0.01862	-0.09000	0.03054	-0.03493
Zn	0.23448	0.56406	0.44176	-0.20139	0.07858	0.12152	0.13500	-0.05310	0.17978	0.28373	0.34734	-0.02645
Ge	-0.32117	-0.07436	-0.05176	0.61178	0.50081	0.48710	-0.11419	-0.01456	0.41234	0.31825	0.43684	0.14741
As	-0.14999	-0.26599	0.17640	99.00000	0.03396	0.19790	0.31173	-0.12238	0.17473	0.32939	0.24380	0.03758
Se	0.34463	-0.01633	0.17878	0.19997	-0.17053	0.06603	0.39102	-0.09081	0.07406	0.11226	0.16151	0.60021
Br	0.23408	0.81427	0.32392	-0.23490	-0.26129	-0.07866	-0.10411	0.09763	0.12025	0.16351	0.12243	-0.21871
Rb	-0.19696	0.53855	-0.10131	0.16000	0.17794	0.20119	-0.45759	0.04593	0.34211	0.22203	0.21435	-0.35749
Sr	0.08939	-0.07789	0.37480	0.03012	0.07042	0.42404	0.52438	-0.09486	0.44076	0.52167	0.33291	0.51533
Pb	0.32353	0.78065	0.45622	-0.21470	-0.24559	-0.01705	0.06476	-0.02003	0.13655	0.22304	0.17369	-0.04872
Ag	0.36885	0.46129	-0.10479	-0.53423	-0.11621	-0.20461	-0.15477	0.17181	-0.12735	-0.14417	0.06062	0.19191
Sn	0.43850	0.26638	0.19935	0.15650	-0.21181	-0.04174	0.29202	-0.04768	0.03717	0.07590	0.13460	0.55589
Sb	0.11501	0.17849	-0.29859	0.42763	0.05021	-0.13144	-0.21465	0.22523	-0.08667	-0.14176	-0.06722	0.01229
Ba	-0.32117	-0.07436	-0.05176	0.61178	0.50081	0.48710	-0.11419	-0.01456	0.41234	0.31825	0.43684	0.14741

	Mn	Fe	Ni	Cu	Zn	Ge	As	Se	Br	Rb	Sr	Pb
NETWTP	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NETWTE	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
PERCEX	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98ACT	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98MD	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
ORGC	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
ELEMC	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98ML	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98NRAC	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98NRMD	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98NRML	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
DNP6ACT	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
DNP6MD	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
DNP6ML	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
OZONE	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
BSCAT	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NO	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NO2UNC	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
PAN	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
CO	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
THC	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
METHANE	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.

(continued)

EL MONTE 1983 FIELD STUDY (continued) - 6

	Mn	Fe	Ni	Cu	Zn	Ge	As	Se	Br	Rb	Sr	Pb
TDRY	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
RADIOM	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
RELHUM	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NOXUNC	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TSP	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
GFtoTIGF	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.
Al	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Si	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
S	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Cl	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
K	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Ca	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Ti	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
V	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Mn	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Fe	0.56064	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Ni	0.04073	-0.07171	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Cu	-0.17338	-0.09242	0.54898	16.	16.	16.	16.	16.	16.	16.	16.	16.
Zn	0.08382	0.27404	-0.22356	0.17799	16.	16.	16.	16.	16.	16.	16.	16.
Ge	0.43414	0.48817	0.57651	0.01776	0.04333	16.	16.	16.	16.	16.	16.	16.
As	-0.17134	0.27982	-0.14308	-0.14092	0.01567	-0.06667	16.	16.	16.	16.	16.	16.
Se	-0.26529	0.03072	0.02928	0.11920	0.26739	0.17016	0.23397	16.	16.	16.	16.	16.
Br	-0.18025	0.22909	-0.23283	0.03526	0.52590	-0.08355	0.06631	-0.02561	16.	16.	16.	16.
Rb	0.08802	0.41548	0.18519	0.31343	0.16803	0.26070	-0.15841	-0.19303	0.64025	16.	16.	16.
Sr	0.04812	0.42492	-0.20528	-0.06782	0.18565	0.12223	0.28254	0.73644	0.20121	0.01980	16.	16.
Pb	-0.12537	0.26498	-0.28997	0.00294	0.66365	-0.01730	0.04949	0.15800	0.95633	0.54101	0.35465	16.
Ag	-0.27398	-0.09785	-0.22879	0.12210	0.66501	-0.10660	-0.10660	0.36024	0.24010	-0.07438	0.21495	0.38061
Sn	-0.24097	-0.03378	0.04001	0.35202	0.39574	0.01453	0.01014	0.84289	0.22691	0.02248	0.73650	0.39830
Sb	-0.17134	-0.19533	0.54511	0.94048	0.01186	-0.06667	-0.06667	0.09893	-0.05586	0.21735	-0.10070	-0.09190
Ba	0.43414	0.48817	0.57651	0.01776	0.04333	1.00000	-0.06667	0.17016	-0.08355	0.26070	0.12223	-0.01730

(continued)

EL MONTE 1983 FIELD STUDY (continued) - 7

	Ag	Sn	Sb	Ba
NETWTP	16.	16.	16.	16.
NETWTE	16.	16.	16.	16.
PERCEX	16.	16.	16.	16.
TA98ACT	16.	16.	16.	16.
TA98MD	16.	16.	16.	16.
ORGC	16.	16.	16.	16.
ELEMC	16.	16.	16.	16.
TA98ML	16.	16.	16.	16.
TA98NRAC	16.	16.	16.	16.
TA98NRMD	16.	16.	16.	16.
TA98NRML	16.	16.	16.	16.
DNP6ACT	16.	16.	16.	16.
DNP6MD	16.	16.	16.	16.
DNP6ML	16.	16.	16.	16.
OZONE	16.	16.	16.	16.
BSCAT	16.	16.	16.	16.
NO	16.	16.	16.	16.
NO2UNC	16.	16.	16.	16.
PAN	16.	16.	16.	16.
CO	16.	16.	16.	16.
THC	15.	15.	15.	15.
METHANE	16.	16.	16.	16.
TDRY	16.	16.	16.	16.
RADIOM	15.	15.	15.	15.
RELHUM	16.	16.	16.	16.
NOXUNC	16.	16.	16.	16.
TSP	16.	16.	16.	16.
GFtoTIGF	9.	9.	9.	9.
Al	16.	16.	16.	16.
Si	16.	16.	16.	16.
S	16.	16.	16.	16.
Cl	16.	16.	16.	16.
K	16.	16.	16.	16.
Ca	16.	16.	16.	16.
Ti	16.	16.	16.	16.
V	16.	16.	16.	16.
Mn	16.	16.	16.	16.
Fe	16.	16.	16.	16.
Ni	16.	16.	16.	16.

(continued)

EL MONTE 1983 FIELD STUDY (continued) - 8

	Ag	Sn	Sb	Ba
Cu	16.	16.	16.	16.
Zn	16.	16.	16.	16.
Ge	16.	16.	16.	16.
As	16.	16.	16.	16.
Se	16.	16.	16.	16.
Br	16.	16.	16.	16.
Rb	16.	16.	16.	16.
Sr	16.	16.	16.	16.
Pb	16.	16.	16.	16.
Ag	16.	16.	16.	16.
Sn	0.47075	16.	16.	16.
Sb	-0.10660	0.32398	16.	16.
Ba	-0.10660	0.01453	-0.06667	16.

A.3. CORRELATION COEFFICIENTS FOR RIVERSIDE DATA

In the following table a matrix is printed in which the lower triangle contains the correlation coefficients and the upper triangle contains the number of cases used in building each correlation coefficient. A value of 99.00000 is printed if a correlation cannot be computed. The abbreviations for the variables used in the correlations and their definitions are as given for Appendix IX.A.2.

RIVERSIDE 1983 FIELD STUDY
CORRELATION COEFFICIENTS

A VALUE OF 99.00000 IS PRINTED IF A COEFFICIENT CANNOT BE COMPUTED
LOWER TRIANGLE: CORRELATION COEFFICIENTS
UPPER TRIANGLE: N OF CASES FOR CORRELATION

	NETWTP	NETWTE	PERCEX	TA98ACT	TA98MD	ORGC	ELEMC	TA98ML	TA98NRAC	TA98NRMD	TA98NRML	DNP6ACT
NETWTP	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
NETWTE	0.54851	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
PERCEX	0.03730	-0.40573	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
TA98ACT	-0.35965	-0.37791	0.37122	20.	20.	20.	20.	20.	20.	20.	20.	20.
TA98MD	-0.07915	0.07119	0.43199	0.72393	20.	20.	20.	20.	20.	20.	20.	20.
ORGC	-0.01393	0.17273	-0.37690	-0.30504	0.03628	20.	20.	20.	20.	20.	20.	20.
ELEMC	-0.09951	0.14250	0.01109	0.43140	0.76883	0.38247	20.	20.	20.	20.	20.	20.
TA98ML	-0.18528	-0.05579	0.44374	0.91264	0.86007	-0.33304	0.51932	20.	20.	20.	20.	20.
TA98NRAC	-0.38847	-0.35171	0.35230	0.97592	0.77236	-0.24811	0.49785	0.89729	20.	20.	20.	20.
TA98NRMD	-0.17660	-0.00556	0.39467	0.73728	0.97822	0.03331	0.75888	0.83584	0.81832	20.	20.	20.
TA98NRML	-0.25493	-0.10172	0.41799	0.91499	0.88968	-0.26815	0.57302	0.97723	0.94179	0.90444	20.	20.
DNP6ACT	-0.38781	-0.34348	0.35200	0.98714	0.75606	-0.24604	0.50035	0.91391	0.98272	0.77747	0.93101	20.
DNP6MD	-0.19394	-0.02806	0.41743	0.77943	0.98139	0.03215	0.78046	0.87506	0.83260	0.97907	0.91765	0.82801
DNP6ML	-0.25833	-0.11613	0.42404	0.92548	0.86106	-0.27319	0.57167	0.98549	0.92406	0.85303	0.98162	0.94801
OZONE	0.20403	0.21850	-0.52238	-0.79180	-0.67835	0.57777	-0.35046	-0.84377	-0.77370	-0.67868	-0.83271	-0.76654
NO	-0.41602	-0.20070	0.33352	0.67811	0.85934	0.07556	0.81436	0.71458	0.75520	0.90183	0.79747	0.72962
NO2UNC	-0.19465	-0.03889	0.41506	0.49772	0.84860	0.15953	0.79443	0.63316	0.56077	0.84762	0.68367	0.54265
NO2CORR	-0.27317	-0.12600	0.46242	0.64185	0.87362	-0.01207	0.74534	0.74822	0.68676	0.87752	0.78909	0.67405
PAN	0.40719	0.36669	-0.39111	-0.82643	-0.51906	0.61129	-0.19517	-0.77650	-0.78439	-0.53870	-0.76305	-0.79723
CO	-0.06195	0.06495	0.35715	0.37828	0.81988	0.22227	0.81367	0.53946	0.46298	0.82723	0.60823	0.43384
TDRY	0.01401	0.05271	-0.55905	-0.69066	-0.73443	0.52074	-0.45167	-0.82948	-0.68051	-0.70748	-0.80427	-0.66492
RADIOM	-0.29264	-0.22582	-0.08770	-0.33549	-0.26227	0.65334	-0.20972	-0.45565	-0.29379	-0.22296	-0.38680	-0.31733
SO2	-0.54349	-0.07799	0.06177	0.17976	0.50016	0.39919	0.61682	0.23675	0.27094	0.54133	0.32394	0.26455
RELHUM	0.22172	0.01604	0.67206	0.35202	0.61214	-0.42582	0.38021	0.55943	0.38817	0.59839	0.56547	0.34609
NOXUNC	-0.33618	-0.13972	0.37525	0.62163	0.87671	0.11175	0.82684	0.69943	0.69494	0.90253	0.77120	0.67176
NOXCORR	-0.36120	-0.17172	0.39613	0.67482	0.88153	0.03861	0.79925	0.74256	0.73925	0.90791	0.80859	0.71882
TSP	0.48189	0.32063	-0.04561	-0.38838	0.18397	0.68257	0.38054	-0.29366	-0.31219	0.14513	-0.24295	-0.35420
GPtoTIGF	-0.09307	-0.18863	-0.38025	-0.47461	-0.68611	-0.07602	-0.54059	-0.69131	-0.46055	-0.62179	-0.64873	-0.45736
CHLORIDE	-0.06027	-0.04846	0.03271	-0.04112	0.22366	0.16830	0.27604	-0.02680	0.06441	0.30594	0.08092	-0.05807
NO3	0.31183	0.28182	-0.00358	-0.59599	-0.13902	0.41194	0.06763	-0.43580	-0.52244	-0.14691	-0.40540	-0.57423
SO4	0.62411	0.10550	0.05842	-0.09939	-0.00038	0.10787	-0.13345	-0.14975	-0.10767	-0.04446	-0.15530	-0.13172
Na	-0.54572	-0.32099	-0.05212	0.07648	0.21281	0.50772	0.35860	-0.04966	0.15654	0.26996	0.05328	0.13809
NH4	0.34446	0.11149	0.21093	-0.54150	-0.01155	0.49727	0.11099	-0.42455	-0.46371	-0.02536	-0.37324	-0.51544
Al	-0.41592	-0.26047	-0.13247	0.16831	0.24680	0.23475	0.47581	0.02669	0.18862	0.24418	0.07016	0.14693
Si	-0.30277	-0.15172	-0.21165	0.03901	0.17481	0.35167	0.45693	-0.08909	0.06287	0.16235	-0.04784	0.02227

(continued)

RIVERSIDE 1983 FIELD STUDY (continued) - 2

	NETWTP	NETWTE	PERCEX	TA98ACT	TA98HD	ORGC	ELEMC	TA98HL	TA98NRAC	TA98NRHD	TA98NRHL	DNP6ACT
S	0.51421	0.10937	0.07495	-0.50912	-0.16897	0.14734	-0.04199	-0.47363	-0.43487	-0.15059	-0.40816	-0.50582
Cl	-0.22322	0.35540	-0.49356	-0.06343	0.23317	0.35576	0.59515	0.02291	-0.04109	0.18036	0.01960	-0.00896
K	-0.06667	0.40029	-0.71606	-0.19959	-0.03437	0.45961	0.23321	-0.25529	-0.13735	-0.03312	-0.20478	-0.16023
Ca	0.20269	0.05954	-0.23619	-0.16422	0.12013	0.70488	0.37005	-0.27939	-0.11663	0.09107	-0.22229	-0.14654
Ti	-0.13762	0.09666	-0.35278	-0.05124	0.22614	0.47682	0.54356	-0.10311	-0.01017	0.19798	-0.06105	-0.03903
V	0.11985	0.20869	-0.35326	-0.46806	-0.47142	0.02159	-0.18766	-0.41744	-0.49073	-0.47209	-0.45557	-0.46489
Mn	0.04560	0.00240	-0.19194	-0.09293	0.02819	0.35145	0.35603	-0.16518	-0.14016	-0.06715	-0.21260	-0.11420
Fe	-0.14268	-0.08955	-0.06410	0.02045	0.28256	0.46937	0.52738	-0.05031	0.03694	0.23374	-0.02330	0.00651
Ni	-0.30011	-0.27581	0.00745	0.26599	0.19821	0.01374	0.38644	0.22395	0.22967	0.18705	0.20425	0.29398
Cu	0.20180	0.20568	-0.27960	-0.41441	-0.20184	0.26540	-0.00737	-0.43251	-0.39451	-0.22485	-0.41688	-0.36815
Zn	-0.14065	-0.04684	0.02962	-0.04819	0.27214	0.54594	0.53260	-0.04325	-0.04940	0.20164	-0.04392	-0.06462
As	-0.16641	-0.10551	0.10192	0.01910	0.09337	-0.06909	0.20451	0.02470	-0.04230	0.01236	-0.03846	-0.04531
Se	-0.03156	-0.10142	0.46823	0.03311	0.38338	0.03183	0.19654	0.16584	0.03397	0.33428	0.15981	0.00950
Br	-0.20063	0.09683	-0.18545	0.16558	0.59883	0.68680	0.78429	0.16870	0.28497	0.62563	0.29070	0.22294
Rb	0.02388	-0.02067	0.02596	0.02120	0.23040	0.32446	0.19754	-0.03455	0.01890	0.18103	-0.02377	0.00214
Sr	0.27840	0.18654	-0.31246	-0.17117	0.15584	0.56104	0.42987	-0.20589	-0.14723	0.10559	-0.18384	-0.16667
Pb	-0.24125	-0.12950	0.35177	0.43230	0.85024	0.31507	0.80231	0.52486	0.51237	0.85456	0.60839	0.45652
Zr	-0.01431	-0.16128	-0.12314	-0.19484	-0.17052	0.02394	0.21266	-0.28227	-0.20068	-0.18275	-0.27952	-0.24798
Ag	0.15957	-0.11186	0.10888	0.15463	0.15133	0.07532	0.14918	0.06436	0.15051	0.13194	0.08216	0.20528
Sn	-0.00482	-0.10950	0.36919	-0.07546	0.30484	0.34811	0.19715	-0.00598	-0.05344	0.27263	0.01608	-0.10314
Sb	0.56885	0.13083	0.16269	-0.23996	0.08168	0.52343	0.04373	-0.23451	-0.24322	-0.00460	-0.24246	-0.23150
Ba	-0.38967	-0.22537	0.00903	0.26732	0.31270	0.13906	0.48670	0.19894	0.22756	0.25837	0.17942	0.24885

	DNP6HD	DNP6HL	OZONE	NO	NO2UNC	NO2CORR	PAN	CO	TDRY	RADIOM	SO2	RELHUM
NETWTP	20.	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
NETWTE	20.	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
PERCEX	20.	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
TA98ACT	20.	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
TA98HD	20.	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
ORGC	20.	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
ELEMC	20.	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
TA98HL	20.	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
TA98NRAC	20.	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
TA98NRHD	20.	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
TA98NRHL	20.	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
DNP6ACT	20.	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
DNP6HD	20.	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.

(continued)

RIVERSIDE 1983 FIELD STUDY (continued) - 3

	DNP6MD	DNP6ML	OZONE	NO	NO2UNC	NO2CORR	PAN	CO	TDRY	RADIOM	SO2	RELHUM
DNP6ML	0.90423	20.	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
OZONE	-0.68846	-0.81948	20.	20.	20.	20.	20.	20.	20.	18.	20.	20.
NO	0.89737	0.76603	-0.66012	20.	20.	20.	20.	20.	20.	18.	20.	20.
NO2UNC	0.84015	0.65888	-0.58951	0.89823	20.	20.	20.	20.	20.	18.	20.	20.
NO2CORR	0.87812	0.76901	-0.74442	0.92637	0.97352	20.	20.	20.	20.	18.	20.	20.
PAN	-0.56755	-0.76959	0.91924	-0.55567	-0.38603	-0.58660	20.	20.	20.	18.	20.	20.
CO	0.80455	0.56947	-0.49832	0.87311	0.95828	0.90860	-0.27418	20.	20.	18.	20.	20.
TDRY	-0.70624	-0.78463	0.93310	-0.65284	-0.66769	-0.77286	0.75541	-0.58302	20.	18.	20.	20.
RADIOM	-0.24594	-0.40963	0.54563	-0.18844	-0.15033	-0.25092	0.49390	-0.15640	0.65447	18.	18.	18.
SO2	0.54931	0.31223	-0.15573	0.65975	0.66155	0.61709	-0.14354	0.63449	-0.14990	0.20732	20.	20.
RELHUM	0.56492	0.52375	-0.71256	0.55536	0.65819	0.68306	-0.42828	0.67066	-0.85379	-0.53949	0.11678	20.
NOXUNC	0.89673	0.74168	-0.64801	0.98377	0.96252	0.96908	-0.50049	0.92998	-0.67543	-0.17807	0.67719	0.61140
NOXCORR	0.90559	0.78154	-0.70927	0.98632	0.94785	0.97578	-0.57952	0.90484	-0.71749	-0.21929	0.65331	0.62156
TSP	0.09672	-0.28697	0.39095	0.06444	0.28910	0.10234	0.60981	0.39271	0.19841	0.27772	0.22431	0.08921
GFtoTIGF	-0.61010	-0.63313	0.51255	-0.48416	-0.64664	-0.63153	0.20752	-0.55165	0.70519	0.19585	-0.07963	-0.72075
CHLORIDE	0.15926	-0.04411	-0.06382	0.36647	0.44657	0.38268	0.04249	0.47881	-0.14823	0.10832	0.19005	0.30609
NO3	-0.21472	-0.44854	0.50238	-0.13964	0.12899	-0.06332	0.71667	0.17678	0.22814	0.30638	0.12496	0.11848
SO4	-0.06613	-0.18417	0.14455	-0.28092	-0.22291	-0.24204	0.18198	-0.10382	0.17396	0.01452	-0.29307	-0.07915
Na	0.27614	0.04206	0.10766	0.37240	0.30677	0.25365	0.06502	0.24271	0.15902	0.52787	0.71259	-0.17627
NH4	-0.08161	-0.41827	0.40879	-0.03767	0.22848	0.03946	0.64823	0.32322	0.23049	0.49612	0.22234	0.20177
Al	0.21261	0.03085	-0.08918	0.42869	0.32556	0.31461	-0.12132	0.25654	-0.09631	0.11144	0.37600	-0.07791
Si	0.12508	-0.08677	0.07259	0.32516	0.25559	0.21202	0.04812	0.20676	0.04237	0.20952	0.30896	-0.16849
S	-0.22730	-0.47561	0.26477	-0.21735	-0.05958	-0.16312	0.43955	0.09938	0.18441	0.17426	0.08626	0.19063
Cl	0.21721	0.04822	0.03442	0.27569	0.29820	0.24079	0.06876	0.26725	-0.00465	0.01997	0.53110	-0.15443
K	-0.06833	-0.23851	0.37133	-0.06251	-0.13871	-0.19083	0.28900	-0.13825	0.42424	0.24364	0.15916	-0.58592
Ca	0.06218	-0.24915	0.46117	0.05625	0.09095	-0.04637	0.50558	0.15033	0.42300	0.54535	0.06486	-0.31212
Ti	0.17033	-0.08908	0.18063	0.29132	0.26064	0.17340	0.21575	0.25599	0.10569	0.21613	0.29429	-0.14719
V	-0.46051	-0.42156	0.36125	-0.40135	-0.27846	-0.33043	0.35307	-0.23795	0.30553	-0.09447	0.04844	-0.22472
Mn	-0.03320	-0.17623	0.25320	0.05656	0.07433	-0.00309	0.28155	0.04006	0.15771	0.16347	0.04367	-0.20678
Fe	0.20743	-0.05359	0.05044	0.35565	0.38598	0.30773	0.11336	0.35043	-0.01740	0.32715	0.27178	-0.03632
Ni	0.28346	0.28463	-0.13820	0.34554	0.25748	0.26529	-0.17447	0.28221	-0.11910	-0.19112	0.41720	0.07430
Cu	-0.20519	-0.38969	0.46029	-0.24467	-0.22363	-0.28256	0.36163	-0.09385	0.55164	0.35463	0.21017	-0.40259
Zn	0.18862	-0.06102	0.08582	0.32763	0.46341	0.35930	0.17550	0.42278	-0.01571	0.47726	0.39662	-0.01476
As	0.00300	-0.04105	-0.25604	0.19061	0.30279	0.30974	-0.18288	0.16164	-0.34287	-0.07176	0.07957	0.17875
Se	0.30927	0.13347	-0.33340	0.31194	0.59756	0.55279	-0.14656	0.54130	-0.41582	0.26137	0.38604	0.55381
Br	0.57102	0.21488	0.02397	0.60606	0.57717	0.47808	0.08556	0.65189	0.03053	0.48741	0.65108	-0.03353
Rb	0.15272	-0.05214	0.13574	0.17237	0.15820	0.12044	0.07840	0.20502	0.18187	0.37685	0.07190	-0.16488
Sr	0.08308	-0.20326	0.39026	0.09520	0.11659	-0.01787	0.47638	0.23117	0.29679	0.22875	0.08811	-0.15768
Pb	0.81559	0.53865	-0.49344	0.86393	0.90843	0.86575	-0.32357	0.94676	-0.52202	0.25761	0.69809	0.53984

(continued)

RIVERSIDE 1983 FIELD STUDY (continued) - 4

	DNP6HD	DNP6ML	OZONE	NO	NO2UNC	NO2CORR	PAN	CO	TDRY	RADIOM	SO2	RELHUM
Zr	-0.22800	-0.30855	0.01660	0.03977	0.10582	0.05828	0.13735	0.04808	-0.13353	-0.11856	-0.01566	0.13142
Ag	0.20724	0.13828	-0.01184	0.12662	-0.03588	-0.00610	-0.10141	0.11509	0.16417	-0.02211	-0.03484	-0.11113
Sn	0.20993	-0.03795	-0.02697	0.22617	0.54114	0.44045	0.11402	0.49064	-0.11108	0.63729	0.35355	0.27550
Sb	0.00949	-0.22828	0.35565	-0.17725	0.03863	-0.09438	0.50722	0.11430	0.30487	0.53403	-0.17776	-0.03800
Ba	0.29355	0.19811	-0.23656	0.48370	0.36736	0.39024	-0.28266	0.33950	-0.21419	-0.06602	0.31612	0.00480

	NOXUNC	NOXCORR	TSP	GFtoTIGF	CHLORIDE	NO3	SO4	Na	NH4	Al	Si	S
NETWTP	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
NETWTE	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
PERCEX	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
TA98ACT	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
TA98HD	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
ORGC	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
ELEMC	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
TA98ML	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
TA98NRAC	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
TA98NRMD	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
TA98NRML	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
DNP6ACT	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
DNP6HD	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
DNP6ML	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
OZONE	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
NO	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
NO2UNC	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
NO2CORR	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
PAN	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
CO	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
TDRY	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
RADIOM	18.	18.	18.	9.	18.	18.	18.	18.	18.	15.	15.	15.
SO2	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
RELHUM	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
NOXUNC	20.	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
NOXCORR	0.99558	20.	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
TSP	0.15778	0.08223	20.	11.	20.	20.	20.	20.	20.	16.	16.	16.
GFtoTIGF	-0.55681	-0.55198	-0.09049	11.	11.	11.	11.	11.	11.	9.	9.	9.
CHLORIDE	0.40845	0.38036	0.38352	-0.20908	20.	20.	20.	20.	20.	16.	16.	16.
NO3	-0.03351	-0.10882	0.61947	-0.29678	0.41748	20.	20.	20.	20.	16.	16.	16.
SO4	-0.26435	-0.26911	0.43801	0.65458	-0.14982	-0.14442	20.	20.	20.	16.	16.	16.
Na	0.35504	0.32733	0.34206	0.15244	0.14361	0.08694	-0.14343	20.	20.	16.	16.	16.

(continued)

RIVERSIDE 1983 FIELD STUDY (continued) - 5

	NOXUNC	NOXCORR	TSP	GFtoTIGF	CHLORIDE	NO3	SO4	Na	NH4	Al	Si	S
NH4	0.07003	-0.00460	0.81179	-0.07438	0.38786	0.78705	0.21800	0.31323	20.	16.	16.	16.
Al	0.39886	0.38787	0.22128	0.02254	0.41841	0.03432	-0.13928	0.50047	0.05534	16.	16.	16.
Si	0.30597	0.28275	0.33212	0.01642	0.46191	0.16326	-0.09775	0.46333	0.14025	0.97774	16.	16.
S	-0.16030	-0.19821	0.54123	0.57500	0.07274	0.48383	0.56593	0.07292	0.68410	-0.10973	-0.08627	16.
Cl	0.29181	0.26600	0.25950	-0.03853	0.03371	0.12703	-0.23400	0.47713	0.08398	0.60150	0.60417	-0.01530
K	-0.09442	-0.11894	0.32639	0.31258	0.11269	0.02009	0.12795	0.35884	-0.03958	0.54991	0.62908	-0.06407
Ca	0.07151	0.01318	0.76114	0.13114	0.37812	0.33543	0.40294	0.40161	0.50143	0.55306	0.66966	0.14710
Ti	0.28671	0.24620	0.52625	-0.04662	0.45015	0.27679	-0.06534	0.52831	0.27313	0.85263	0.90445	-0.07377
V	-0.36295	-0.37858	-0.07318	0.24513	-0.24397	0.26963	-0.01812	-0.23530	0.11289	-0.23949	-0.23982	0.33972
Mn	0.06509	0.03198	0.39993	-0.12591	0.17744	0.29005	0.01264	0.25376	0.19963	0.73448	0.81049	-0.00374
Fe	0.37695	0.34189	0.51523	-0.15984	0.50749	0.27654	-0.00807	0.43378	0.32781	0.89609	0.94114	-0.06285
Ni	0.31954	0.31768	-0.12701	0.07557	-0.23366	-0.16008	-0.13340	0.20671	-0.02335	0.15456	0.05496	0.03954
Cu	-0.24268	-0.26570	0.34407	0.67805	-0.07188	0.14260	0.42755	0.21437	0.29303	0.13790	0.21203	0.49415
Zn	0.39011	0.34758	0.47107	-0.32313	0.44665	0.44071	-0.08859	0.32297	0.39665	0.72288	0.78277	0.05555
As	0.24015	0.24556	0.08396	-0.21450	0.34147	0.15364	-0.26156	0.10282	0.06015	0.73871	0.72560	-0.15537
Se	0.43356	0.42162	0.39929	-0.31632	0.41664	0.29229	-0.00792	0.37783	0.56040	0.15522	0.11520	0.22075
Br	0.61034	0.56269	0.55314	-0.10892	0.46023	0.18725	0.09923	0.58890	0.35456	0.57923	0.61379	0.17185
Rb	0.17122	0.15335	0.40975	0.25964	0.45651	0.05694	0.26260	0.20867	0.20506	0.56690	0.65078	-0.07798
Sr	0.10618	0.04838	0.69115	0.06891	0.28744	0.32330	0.36846	0.26081	0.47342	0.50524	0.58181	0.24300
Pb	0.90409	0.88140	0.35591	-0.42824	0.46198	0.09726	-0.03859	0.46499	0.35975	0.42388	0.37094	0.20370
Zr	0.06705	0.04850	0.22208	-0.17616	0.35736	0.43474	-0.16347	0.08332	0.22703	0.66797	0.66742	0.16934
Ag	0.06534	0.07195	0.08827	0.55513	-0.21648	-0.37018	0.48644	-0.00837	-0.02854	0.04041	0.04618	0.08430
Sn	0.35722	0.32275	0.55737	-0.31466	0.64401	0.48872	0.06033	0.36337	0.67853	0.24441	0.28810	0.21868
Sb	-0.09607	-0.14501	0.78798	99.00000	0.09268	0.30586	0.66850	0.14902	0.66583	-0.06684	0.03715	0.28424
Ba	0.45005	0.45282	0.01454	-0.04524	0.19182	-0.15582	-0.16532	0.19723	-0.10875	0.81809	0.77129	-0.29681

	Cl	K	Ca	Ti	V	Mn	Fe	Ni	Cu	Zn	As	Se
NETWTP	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NETWTE	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
PERCEX	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98ACT	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98MD	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
ORGC	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
ELEMC	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98ML	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98NRAC	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98NRMD	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98NRML	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.

(continued)

RIVERSIDE 1983 FIELD STUDY (continued) - 6

	Cl	K	Ca	Ti	V	Mn	Fe	Ni	Cu	Zn	As	Se
DNP6ACT	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
DNP6HD	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
DNP6HL	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
OZONE	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NO	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NO2UNC	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NO2CORR	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
PAN	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
CO	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TDRY	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
RADIOM	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
SO2	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
RELHUM	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NOXUNC	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NOXCORR	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
TSP	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
GFtoTIGF	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.
CHLORIDE	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NO3	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
SO4	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Na	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
NH4	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Al	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Si	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
S	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Cl	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
K	0.69006	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Ca	0.35328	0.61158	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
Ti	0.71731	0.70864	0.77026	16.	16.	16.	16.	16.	16.	16.	16.	16.
V	0.12512	-0.13046	-0.24250	-0.26789	16.	16.	16.	16.	16.	16.	16.	16.
Mn	0.52245	0.52123	0.67088	0.79680	-0.22883	16.	16.	16.	16.	16.	16.	16.
Fe	0.55575	0.54423	0.75211	0.89769	-0.33070	0.81355	16.	16.	16.	16.	16.	16.
Ni	0.30168	-0.21956	-0.05309	0.06477	0.48877	0.00235	-0.02195	16.	16.	16.	16.	16.
Cu	0.36909	0.44789	0.39623	0.27649	0.12088	0.35435	0.16647	0.09342	16.	16.	16.	16.
Zn	0.46942	0.34727	0.56694	0.66575	-0.12788	0.75367	0.86696	-0.01319	0.19742	16.	16.	16.
As	0.45482	0.26831	0.21790	0.56870	-0.17745	0.64203	0.74918	-0.12178	-0.08969	0.71066	16.	16.
Se	0.16303	-0.20465	0.06783	0.20602	-0.15796	0.05446	0.28662	0.02488	0.02139	0.31716	0.36778	16.
Br	0.56638	0.55600	0.66644	0.66185	-0.22691	0.39763	0.64043	0.14233	0.38245	0.60070	0.14085	0.16858
Rb	0.20001	0.46308	0.70094	0.64486	-0.55248	0.64707	0.71131	-0.23428	0.46970	0.59472	0.38074	0.19924

(continued)

RIVERSIDE 1983 FIELD STUDY (continued) - 7

	Cl	K	Ca	Ti	V	Mn	Fe	Ni	Cu	Zn	As	Se
Sr	0.44089	0.47226	0.84597	0.72747	0.06663	0.60246	0.60993	0.31566	0.37730	0.42904	0.13882	0.05528
Pb	0.33992	0.01607	0.25421	0.35447	-0.30624	0.16599	0.46629	0.23912	0.09108	0.52391	0.23649	0.51439
Zr	0.37345	0.19883	0.26209	0.54308	0.10328	0.63703	0.64497	0.04040	-0.05454	0.62000	0.77394	0.18059
Ag	0.02790	0.12017	0.30663	0.07495	-0.28092	0.11357	0.09953	0.21683	0.53380	-0.03726	-0.22681	-0.19048
Sn	0.07322	-0.04186	0.38502	0.30463	-0.14749	0.20569	0.46339	-0.14596	0.10577	0.56926	0.36485	0.82292
Sb	-0.07060	0.11024	0.67284	0.23756	-0.21713	0.23488	0.28768	-0.16881	0.25452	0.19374	-0.07959	0.35343
Ba	0.50082	0.28765	0.32847	0.62011	-0.12836	0.56962	0.75102	0.37168	0.03781	0.65664	0.66985	0.07344

	Br	Rb	Sr	Pb	Zr	Ag	Sn	Sb	Ba
NETWTP	16.	16.	16.	16.	16.	16.	16.	16.	16.
NETWTE	16.	16.	16.	16.	16.	16.	16.	16.	16.
PERCEX	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98ACT	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98MD	16.	16.	16.	16.	16.	16.	16.	16.	16.
ORGC	16.	16.	16.	16.	16.	16.	16.	16.	16.
ELEMC	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98ML	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98NRAC	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98NRMD	16.	16.	16.	16.	16.	16.	16.	16.	16.
TA98NRML	16.	16.	16.	16.	16.	16.	16.	16.	16.
DNP6ACT	16.	16.	16.	16.	16.	16.	16.	16.	16.
DNP6MD	16.	16.	16.	16.	16.	16.	16.	16.	16.
DNP6ML	16.	16.	16.	16.	16.	16.	16.	16.	16.
OZONE	16.	16.	16.	16.	16.	16.	16.	16.	16.
NO	16.	16.	16.	16.	16.	16.	16.	16.	16.
NO2UNC	16.	16.	16.	16.	16.	16.	16.	16.	16.
NO2CORR	16.	16.	16.	16.	16.	16.	16.	16.	16.
PAN	16.	16.	16.	16.	16.	16.	16.	16.	16.
CO	16.	16.	16.	16.	16.	16.	16.	16.	16.
TDRY	16.	16.	16.	16.	16.	16.	16.	16.	16.
RADIOM	15.	15.	15.	15.	15.	15.	15.	15.	15.
SO2	16.	16.	16.	16.	16.	16.	16.	16.	16.
RELHUM	16.	16.	16.	16.	16.	16.	16.	16.	16.
NOXUNC	16.	16.	16.	16.	16.	16.	16.	16.	16.
NOXCORR	16.	16.	16.	16.	16.	16.	16.	16.	16.
TSP	16.	16.	16.	16.	16.	16.	16.	16.	16.
GFtoTIGF	9.	9.	9.	9.	9.	9.	9.	9.	9.
CHLORIDE	16.	16.	16.	16.	16.	16.	16.	16.	16.

(continued)

RIVERSIDE 1983 FIELD STUDY (continued) - 8

	Br	Rb	Sr	Pb	Zr	Ag	Sn	Sb	Ba
NO3	16.	16.	16.	16.	16.	16.	16.	16.	16.
SO4	16.	16.	16.	16.	16.	16.	16.	16.	16.
Na	16.	16.	16.	16.	16.	16.	16.	16.	16.
NH4	16.	16.	16.	16.	16.	16.	16.	16.	16.
Al	16.	16.	16.	16.	16.	16.	16.	16.	16.
Si	16.	16.	16.	16.	16.	16.	16.	16.	16.
S	16.	16.	16.	16.	16.	16.	16.	16.	16.
Cl	16.	16.	16.	16.	16.	16.	16.	16.	16.
K	16.	16.	16.	16.	16.	16.	16.	16.	16.
Ca	16.	16.	16.	16.	16.	16.	16.	16.	16.
Ti	16.	16.	16.	16.	16.	16.	16.	16.	16.
V	16.	16.	16.	16.	16.	16.	16.	16.	16.
Mn	16.	16.	16.	16.	16.	16.	16.	16.	16.
Fe	16.	16.	16.	16.	16.	16.	16.	16.	16.
Ni	16.	16.	16.	16.	16.	16.	16.	16.	16.
Cu	16.	16.	16.	16.	16.	16.	16.	16.	16.
Zn	16.	16.	16.	16.	16.	16.	16.	16.	16.
As	16.	16.	16.	16.	16.	16.	16.	16.	16.
Se	16.	16.	16.	16.	16.	16.	16.	16.	16.
Br	16.	16.	16.	16.	16.	16.	16.	16.	16.
Rb	0.54193	16.	16.	16.	16.	16.	16.	16.	16.
Sr	0.59461	0.51481	16.	16.	16.	16.	16.	16.	16.
Pb	0.77263	0.33833	0.26373	16.	16.	16.	16.	16.	16.
Zr	0.10725	0.13022	0.26716	0.11190	16.	16.	16.	16.	16.
Ag	0.28912	0.42742	0.24913	0.20287	-0.27393	16.	16.	16.	16.
Sn	0.37727	0.44083	0.23532	0.50746	0.18107	-0.21464	16.	16.	16.
Sb	0.22279	0.41712	0.52266	0.09473	-0.09613	0.31563	0.48461	16.	16.
Ba	0.42160	0.48330	0.37949	0.40936	0.51398	0.26747	0.07637	-0.11973	16.

B. DOAS MEASUREMENTS DURING THE SEPTEMBER 1984 FIELD STUDY

The optical arrangement of the DOAS system was very similar to that described for the 1983 field study. However, to improve sensitivity, the light source was moved further away to a house on the slope of the Box Springs Mountains. The light path of 1.6 km was ~2.5 times longer than the previous one. The system acquired spectra integrated over about six minutes in each of four different, 30 nm wide, wavelength regions centered at: 300 nm (SO_2), 320 nm (HCHO, NO_2), 360 nm (HONO, NO_2) and 660 nm (NO_3). These regions were scanned automatically in the following repetitive sequence: 300 nm, 360 nm, 660 nm, 320 nnm, 360 nm, 660 nm. Taking into account the time needed to move the grating between these wavelength regions, this whole cycle was completed in about one hour yielding one six-minute average per hour for SO_2 and HCHO, two averages per hour for HONO and the NO_3 radical, and three averages per hour for NO_2 (a major component in two of the spectral regions). The following tables list the concentrations of these compounds ordered by the time of day. Whenever the absorption bands were below the detection limits an "a" appears in the table. If the bands could not be quantified due to excessive noise a "b" is shown.

Tables include:

Nitrogen Dioxide
Nitrous Acid
Nitrate Radical
Formaldehyde
Sulfur Dioxide

SEPTEMBER 18, 1984

Time hrs	NO_2 (363 nm) ppb	HONO ppb	NO_2 (315 nm) ppb	HCHO ppb	NO_3 ppt	SO_2 ppb
00:09			36	9.6		
00:17	40	0.3				
00:28					60	
00:40						5.7
00:48	46	0.6				
00:59					64	
01:11			53	9.8		
01:19	50	0.8				
01:30					57	
01:42						6.2
01:50	38	0.7				
02:01					78	
02:13			60	9.6		
02:21	68	1.3				
02:32					a	
02:44						7.1
02:52	65	1.3				
03:03					a	
03:15			56	10		
03:23	52	1.4				
03:34					23	
03:46						6.8
03:54	43	1.4				
04:05					33	
04:17			39	8.9		
04:25	40	1.7				
04:36					48	
04:48						6.2
04:56	35	1.9				
05:08					53	
05:19			35	13		
05:27	35	2.1				
05:38					50	
05:50						5.5
05:58	43	1.7				
06:10					32	
06:21			43	9.5		
06:29	45	1.7				
06:40					a	
06:53						5.0
07:00	32	1.9				
07:12					a	
07:24			34	a		
07:31	35	1.5				
07:42					a	
07:55						4.3

(continued)

SEPTEMBER 18, 1984 (continued)

Time hrs	NO_2 (363 nm) ppb	HONO ppb	NO_2 (315 nm) ppb	HCHO ppb	NO_3 ppt	SO_2 ppb
08:05	34	1.4				
08:15					a	
08:29			31	b		
08:37	46	0.5				
08:48					a	
09:00						3.8
09:08	52	a				
09:19					a	
09:31			43	b		
09:39	53	a				
09:50					a	
10:02						4.2
10:10	70	a				
10:22					a	
10:57	54	a				
11:08					a	
11:20			33	b		2.5
11:28	40	a				
11:39					a	
11:51						2.8
11:59	28	a				
12:10					a	
12:22			15	b		
12:29	23	a				
12:41					a	
13:37						1.4
13:45	11	a				
13:56					a	
14:08			7	b		
14:27					a	
14:39						1.4
14:58					a	
16:43						7.7
16:51	27	a				
17:02					a	
17:17			24	13		
17:24	28	a				
17:48						6.8
17:56	25	a				
18:07					a	
18:19			7	13		
18:26	16	a				
18:37					55	
18:50						10.8
18:59	28	a				
19:09					210	

(continued)

SEPTEMBER 18, 1984 (continued)

Time hrs	NO_2 (363 nm) ppb	HONO ppb	NO_2 (315 nm) ppb	HCHO ppb	NO_3 ppt	SO_2 ppb
19:20			47	15		
19:28	61	a				
19:39					300	
19:51						11.3
19:59	35	a				
20:11					430	
20:22			23	16		
20:30	26	a				
20:41					340	
20:53						9.5
21:01	68	a				
21:12					83	
21:24			47	20		
21:32	43	0.3				
21:43					220	
21:55						7.5
22:03	29	0.7				
22:14					210	
22:23	19	a				
22:26			14	14		
22:45					160	
22:57						3.5
23:05	32	0.8				
23:16					49	
23:28			56	16		
23:35	47	1.2				
23:46					79	
23:59						4.5

---

[a] Not detected.

[b] Noisy background.

SEPTEMBER 19, 1984

Time hrs	NO_2 (363 nm) ppb	HONO ppb	NO_2 (315 nm) ppb	HCHO ppb	NO_3 ppt	SO_2 ppb
00:06	34	0.9				
00:18					96	
00:29			39	13		
00:37	42	1.4				
00:48					94	
01:00						a
01:08	41	1.4				
01:20					110	
01:31			40	13		
01:39	46	1.6				
01:50					110	
02:02						a
02:10	40	1.6				
02:21					72	
02:33			47	8.7		
02:41	39	1.5				
02:52					130	
03:04						a
03:12	18	1.4				
03:23					150	
03:35			18	7.0		
03:43	22	2.0				
03:54					98	
04:06						a
04:14	34	2.4				
04:25					38	
04:37			35	9.0		
04:44	31	2.2				
04:56					78	
05:08						a
05:16	38	2.2				
05:27					78	
05:39			30	4.7		
05:46	25	1.9				
05:57					52	
06:10						a
06:18	44	1.9				
06:29					26	
06:41			64	4.8		
06:48	64	1.8				
06:59					a	
07:11						a
07:19	69	1.9				
07:31					a	
07:42			67	b		
07:50	71	1.6				

(continued)

SEPTEMBER 19, 1984 (continued)

Time hrs	NO_2 (363 nm) ppb	HONO ppb	NO_2 (315 nm) ppb	HCHO ppb	NO_3 ppt	SO_2 ppb
08:01					a	
08:13						a
08:21	64	0.4				
08:33					a	
08:44			41	b		
08:52	37	a				
09:03					a	
09:15						a
09:23	56	a				
09:35					a	
09:49			48	b		
09:59	52	a				
10:12					a	
10:25						a
10:33	37	a				
10:44					a	
10:56			25	b		
11:03	36	a				
11:15					a	
11:27						a
11:35	11	a				
11:46					a	
11:58			4	b		
12:05	9	a				
12:19					a	
12:33						a
12:41	8	a				
12:52					a	
13:04			a	b		
13:11	8	a				
13:23					a	
13:35						a
13:43	9	a				
14:06			6	b		
14:13	9	a				
14:25					a	
14:37						a
14:45	12	a				
14:56					a	
15:08			3	b		
15:16	11	a				
15:27					a	
15:39						a
15:47	13	a				
15:58					a	
16:10			4	b		

(continued)

SEPTEMBER 19, 1984 (continued)

Time hrs	NO_2 (363 nm) ppb	HONO ppb	NO_2 (315 nm) ppb	HCHO ppb	NO_3 ppt	SO_2 ppb
16:18	16	a				
16:29					a	
16:41						a
16:49	18	a				
17:01					a	
17:12			12	b		
17:20	21	a				
17:31					20	
17:43						a
17:51	25	a				
18:03					26	
18:14			27	b		
18:22	31	a				
18:33					31	
18:46						a
18:54	41	a				
19:05					63	
19:17			38	9.5		
19:24	38	a				
19:35					89	
19:48						a
19:56	33	a				
20:07					130	
20:19			28	7.0		
20:37					78	
20:50						a
20:56	33	a				
20:58	33	a				
21:09					84	
21:21			27	7.2		
21:28	27	a				
21:39					110	
21:52						a
22:00	27	0.2				
22:11					110	
22:23			23	7.0		
22:30	24	0.4				
22:41					120	
22:54						a
23:02	24	0.5				
23:13					120	
23:32	29	0.4				
23:35			24	8.3		
23:43					73	
23:56						a

[a] Not detected.
[b] Noisy background.

SEPTEMBER 20, 1984

Time hrs	NO_2 (363 nm) ppb	HONO ppb	NO_2 (315 nm) ppb	HCHO ppb	NO_3 ppt	SO_2 ppb
00:04	30	0.2				
00:15					85	
00:27			36	8.9		
00:34	41	0.4				
00:46					21	
00:58						7.9
01:06	50	0.6				
01:17					15	
01:30			52	8.1		
01:39	49	0.5				
01:51					24	
02:03						5.5
02:11	48	0.7				
02:22					16	
02:34			53	6.6		
02:42	48	0.9				
02:53					16	
03:06						5.6
03:14	50	1.0				
03:25					a	
03:37			54	8.7		
03:44	49	1.1				
03:56					19	
04:08						4.6
04:16	53	1.0				
04:27					a	
04:39			62	7.4		
04:47	57	1.2				
04:58					a	
05:10						5.9
05:18	57	1.7				
05:30					a	
05:42			62	5.7		
05:49	56	2.2				
06:00					a	
06:13						5.1
06:21	56	1.5				
06:32					a	
06:44			56	a		
06:52	51	1.7				
07:03					a	
07:15						5.0
07:23	47	1.4				
07:35					a	
07:46			42	a		
07:54	42	1.2				

(continued)

SEPTEMBER 20, 1984 (continued)

Time hrs	NO_2 (363 nm) ppb	HONO ppb	NO_2 (315 nm) ppb	HCHO ppb	NO_3 ppt	SO_2 ppb
08:05					a	
08:17						5.7
08:25	48	a				
08:37					a	
08:48			57	b		
08:56	69	a				
09:08					a	
09:21						4.3
09:30	63	a				
09:41					a	
09:53			57	b		
10:01	70	a				
10:12					a	
10:25						2.1
10:33	53	a				
10:47					a	
10:59			33	b		
11:06	38	a				
11:17					a	
11:30						1.4
11:38	17	a				
11:49					a	
12:01			7	b		
12:08	9	a				
12:20					a	
12:32						1.1
12:40	10	a				
12:51					a	
13:03			5	b		
13:10	9	a				
13:22					a	
13:34						1.1
13:42	9	a				
13:53					a	
14:05			3	b		
14:13	9	a				
14:24					a	
14:36						1.2
14:44	10	a				
14:55					a	
15:07			5	b		
15:15	10	a				
15:26					a	
15:38						1.1
15:46	11	a				
15:57					a	

(continued)

SEPTEMBER 20, 1984 (continued)

Time hrs	NO_2 (363 nm) ppb	HONO ppb	NO_2 (315 nm) ppb	HCHO ppb	NO_3 ppt	SO_2 ppb
16:09			4	b		
16:16	12	a				
16:28					a	
16:40						2.6
16:48	11	a				
16:59					a	
17:11			8	b		
17:18	17	a				
17:29					a	
17:41						3.1
17:49	20	a				
18:01					a	
18:12			19	b		
18:20	30	a				
18:31					31	
18:43						6.2
18:51	32	a				
19:02					50	
19:14			36	a		
19:22	43	a				
19:33					55	
19:45						5.4
19:53	45	a				
20:04					41	
20:16			43	a		
20:23	45	a				
20:35					a	
20:47						3.7
20:55	54	a				
21:06					a	
21:18			57	a		
21:25	54	a				
21:37					a	
21:49						3.5
21:57	57	a				
22:08					a	
22:20			59	a		
22:27	57	a				
22:38					a	
22:51						4.2
22:58	53	a				
23:10					a	
23:21			55	a		
23:29	50	a				
23:40					a	
23:53						2.9

---

[a] Not detected.
[b] Noisy background.

SEPTEMBER 21, 1984

Time hrs	NO_2 (363 nm) ppb	HONO ppb	NO_2 (315 nm) ppb	HCHO ppb	NO_3 ppt	SO_2 ppb
00:00	50	a				
00:11					a	
00:23			52	5		
00:31	48	a				
00:42					a	
00:54						0.9
01:02	18	a				
01:13					a	
01:25			43	3		
01:33	39	a				
01:44					a	
01:56						1.1
02:04	30	a				
02:15					a	
02:27			18	a		
02:35	19	a				
02:46					a	
02:58						1.2
03:06	16	a				
03:17					a	
03:29			18	a		
03:36	19	a				
03:48					a	
04:00						a
04:08	25	a				
04:19					a	
04:31			20	a		
04:38	18	a				
04:49					a	
05:02						2.3
05:10	24	a				
05:21					22	
05:33			4	a		
05:40	5	a				
05:51					45	
06:03						0.4
06:11	6	a				
06:23					50	
06:35			9	a		
06:44	11	a				
06:56					38	
07:10						0.3
07:18	11	a				
07:29					a	
07:41			7	a		
07:48	8	a				

(continued)

SEPTEMBER 21, 1984 (continued)

Time hrs	NO_2 (363 nm) ppb	HONO ppb	NO_2 (315 nm) ppb	HCHO ppb	NO_3 ppt	SO_2 ppb
08:00					a	
08:12						0.5
08:20	7	a				
08:31					a	
08:43			2	a		
08:50	4	a				
09:01					a	
09:14						0.2
09:21	2	a				
09:33					a	
09:44			a	a		
09:52	1	a				
10:03					a	
10:15						0.2
10:25	2	a				
10:49			a	a		
10:56	2	a				
11:08					a	
11:20						0.2
11:28	1	a				
11:39					a	
11:51			a	a		
11:58	2	a				

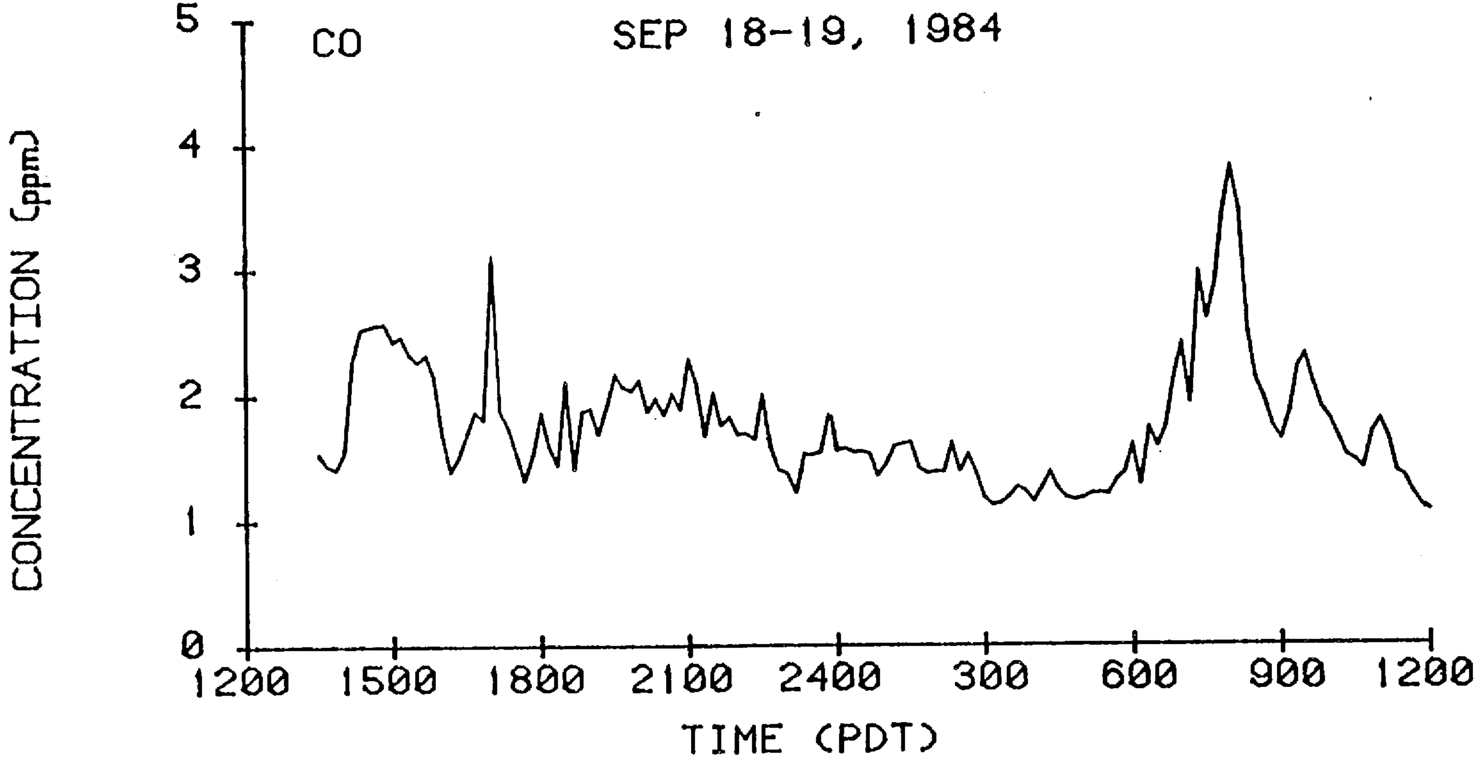
[a] Not detected.

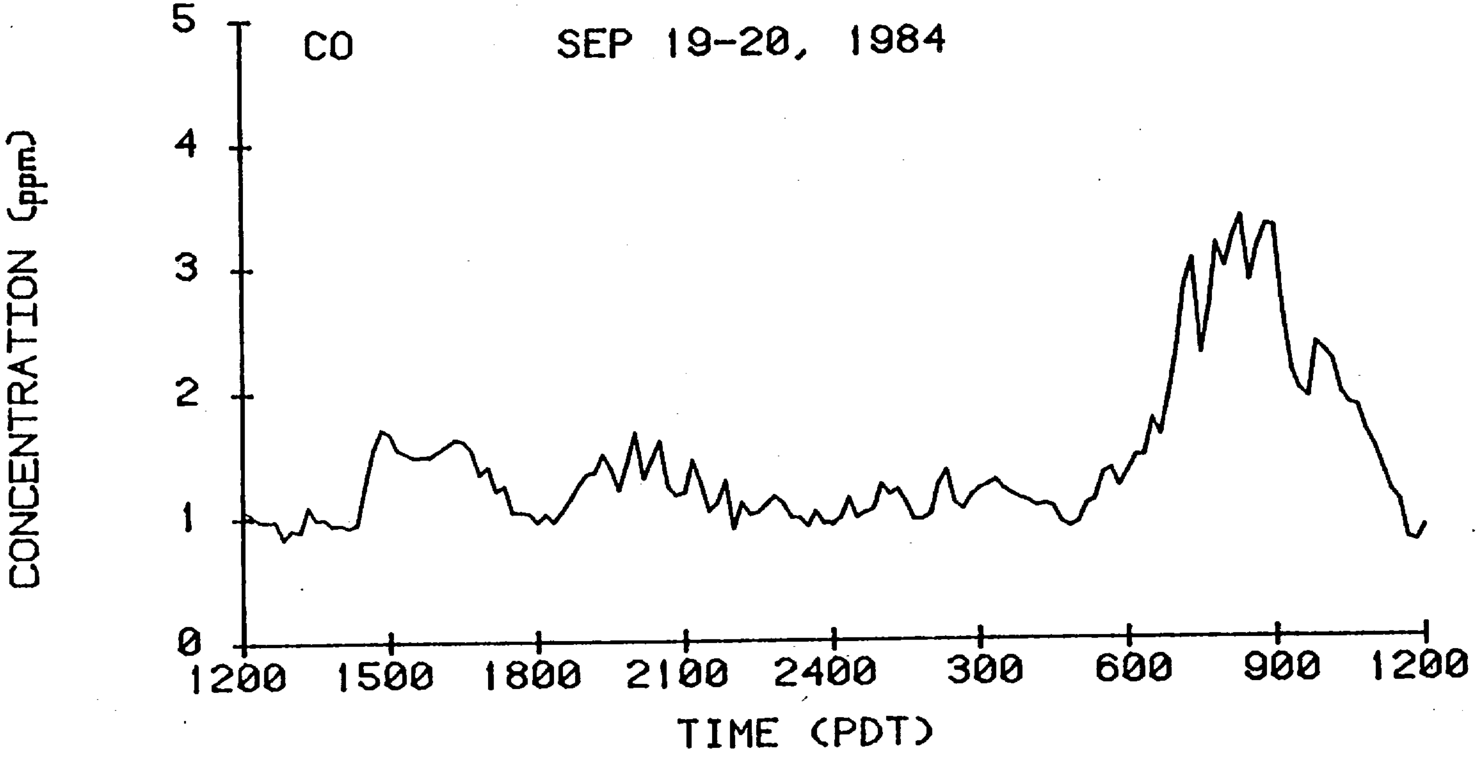
C. AMBIENT AIR DATA FOR THE SEPTEMBER 1984 FIELD STUDY

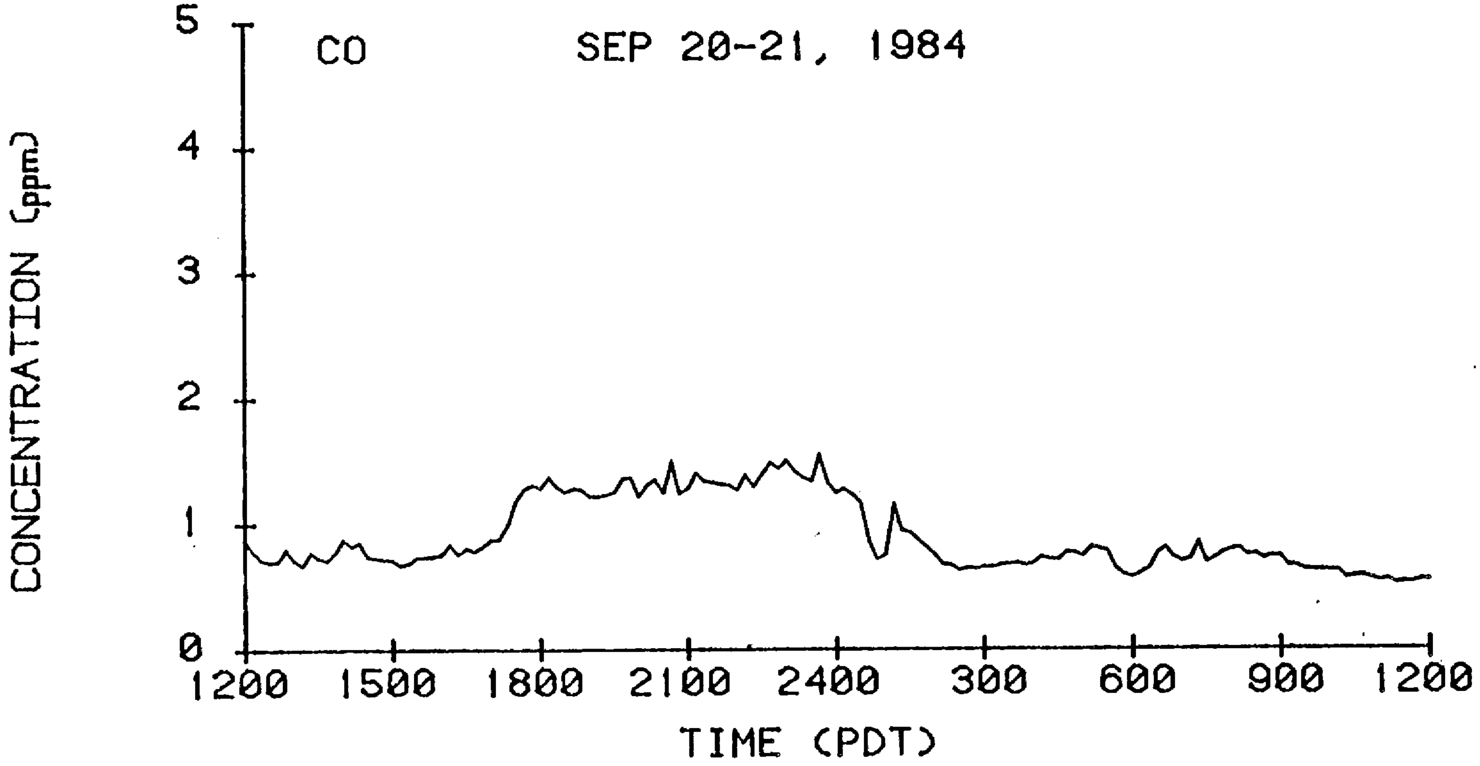
Time-concentration plots are given of carbon monoxide, nitrous oxide, nitrogen dioxide, ozone, peroxyacetyl nitrate, temperature, relative humidity, wind speed and wind direction for 1200 hr September 18 to 1200 hr September 22, 1984.

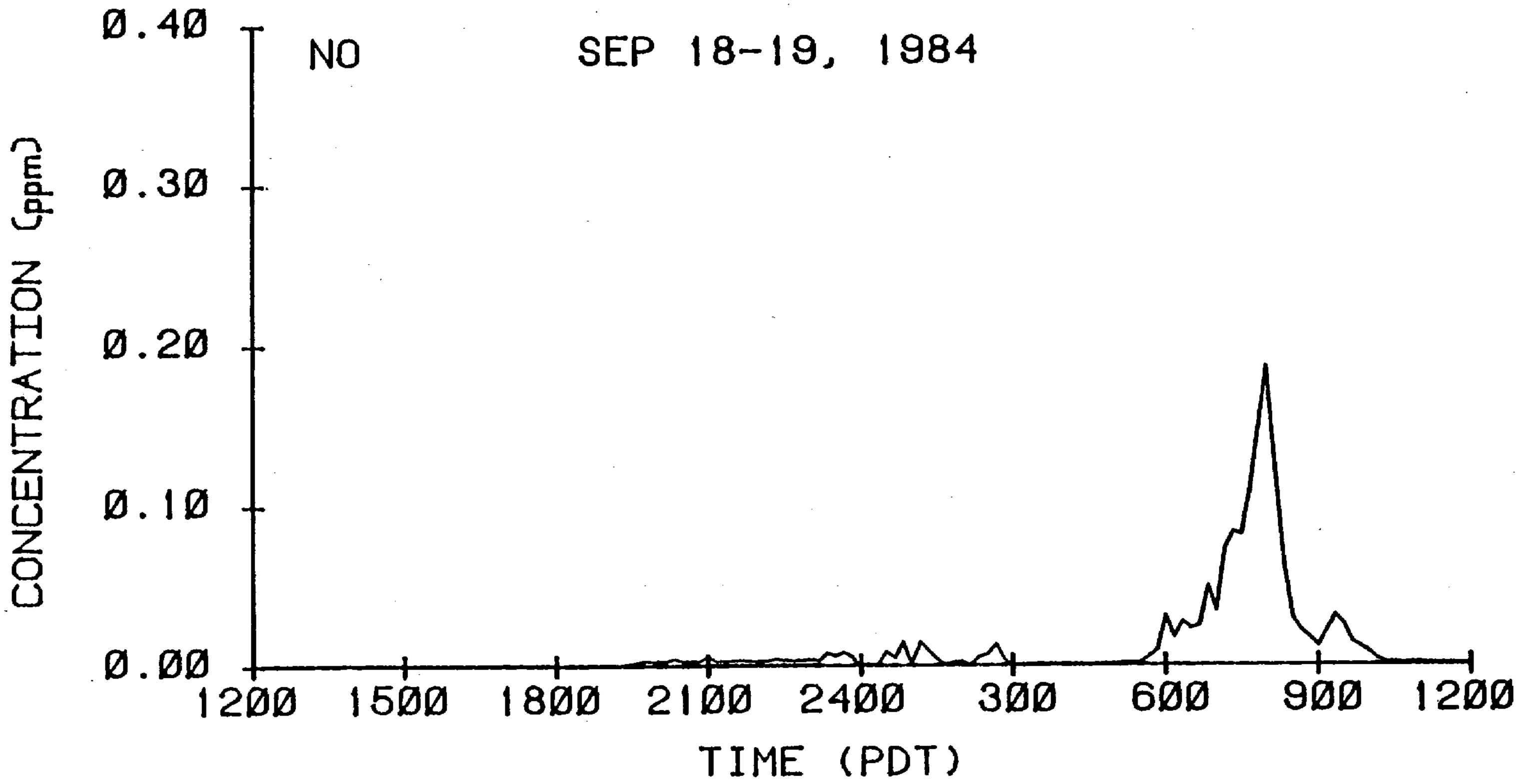
Nitrogen dioxide concentrations were determined by chemiluminescence detection and have not been corrected for interferences from PAN and other interfering nitrogenous species. Wind speed and wind direction were measured using a sensor from Meteorology Research, Inc. (MRI 10332/1074-2).

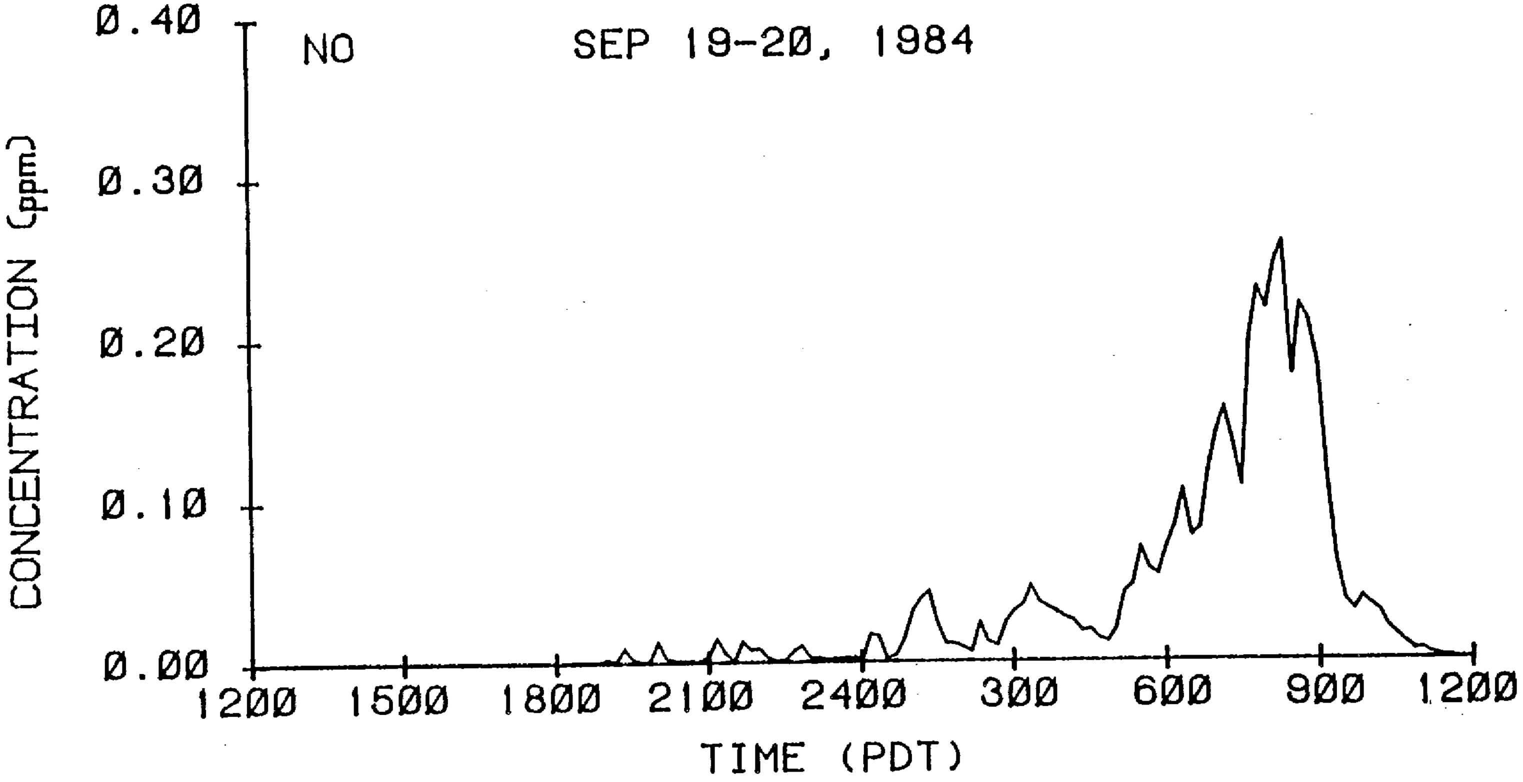
A complete list of the instrumentation employed for measurement of gaseous pollutants is given in Table III-1. With the exception of the PAN measurements, the data are 10-min averages. An air sample was taken for PAN analysis every 15 minutes.

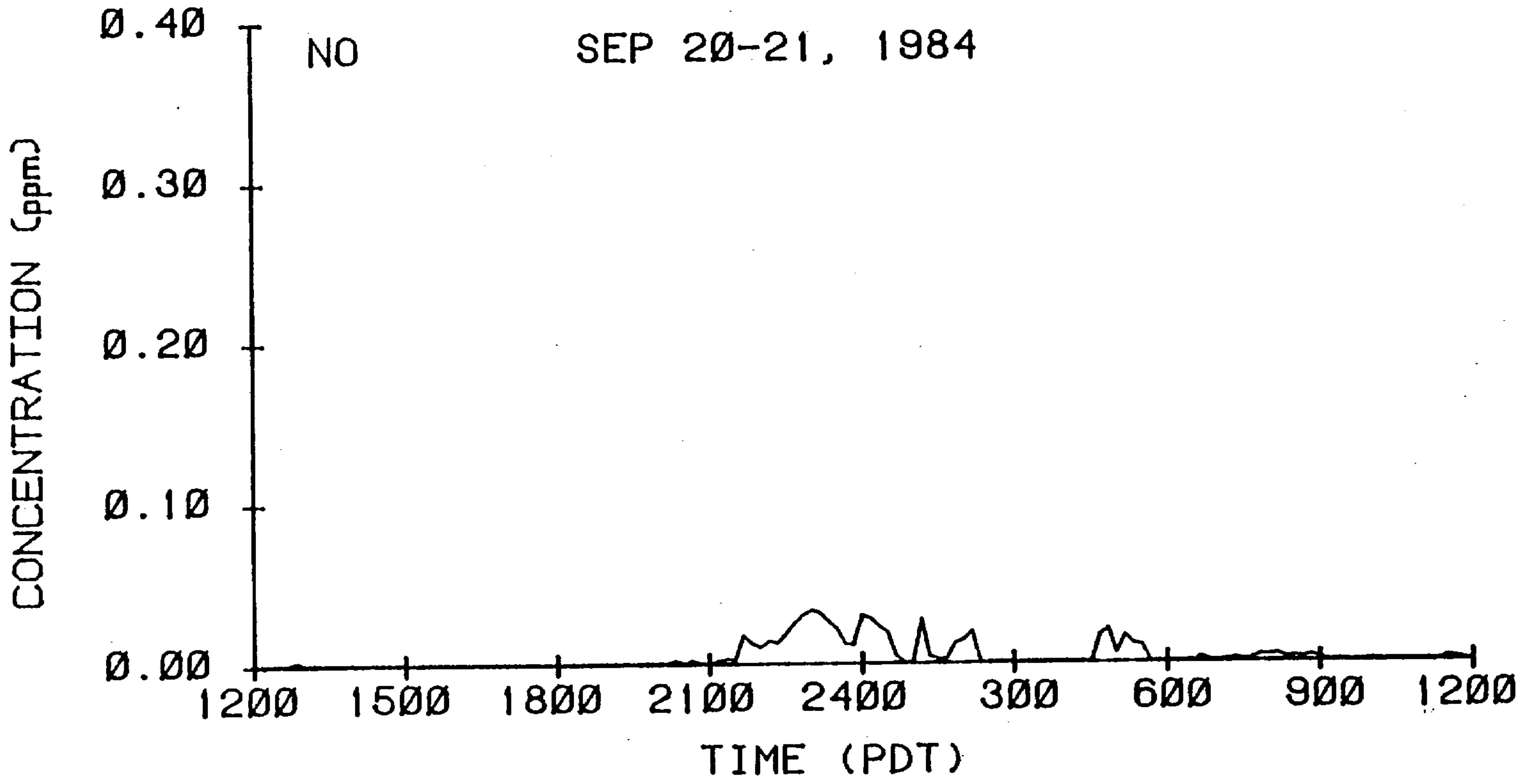

CO
SEP 18-19, 1984
CONCENTRATION (ppm)
5
4
3
2
1
0
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

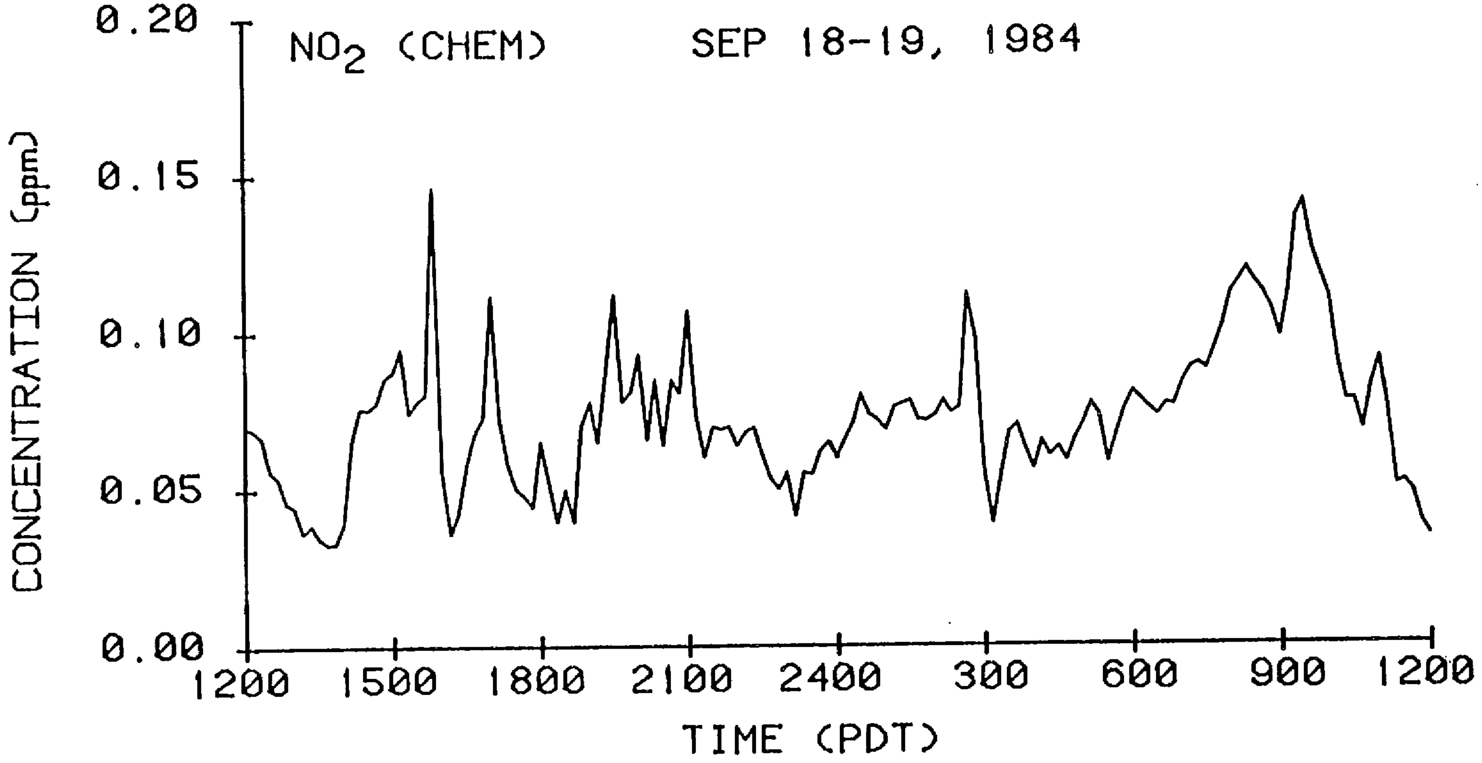

CO
SEP 19-20, 1984
CONCENTRATION (ppm)
0
1
2
3
4
5
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

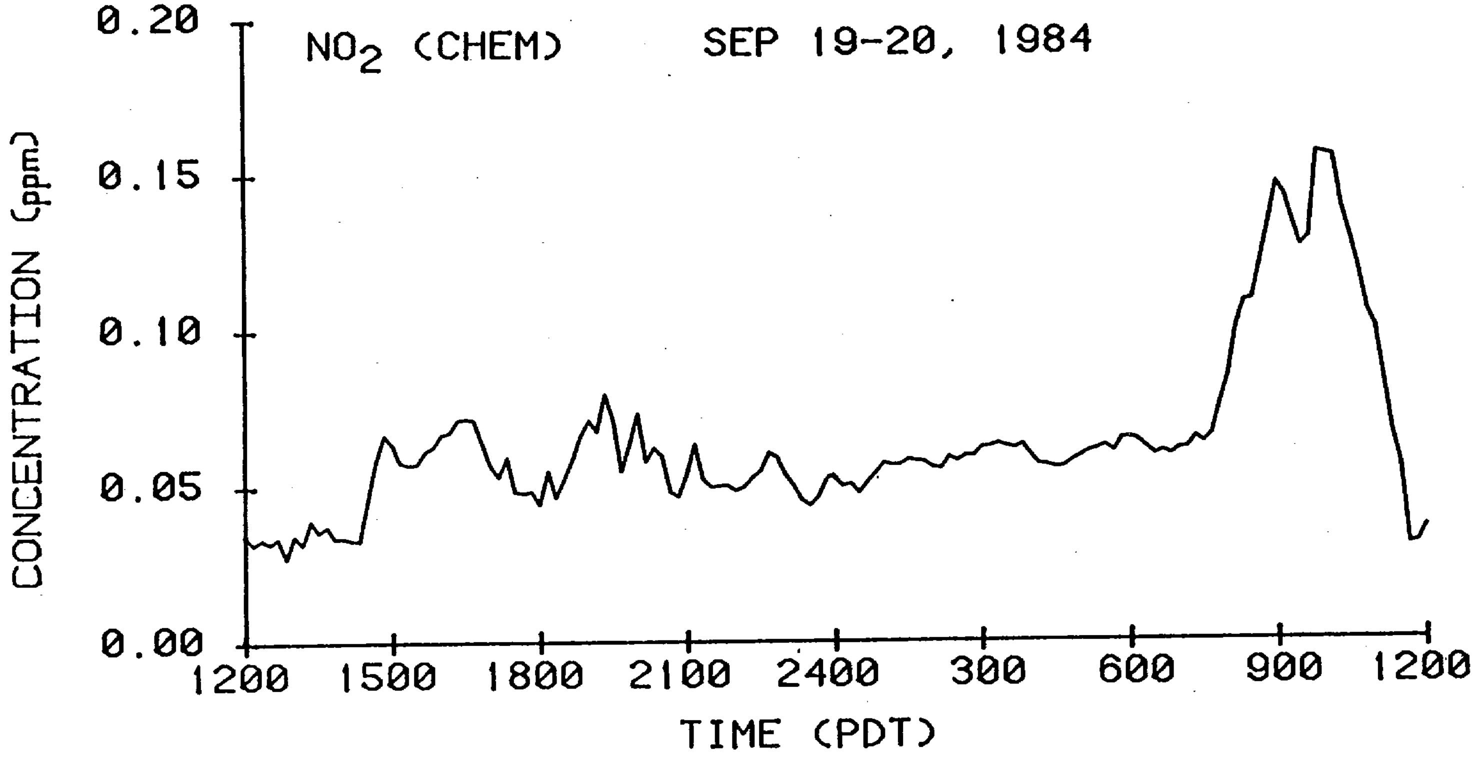

CO
SEP 20-21, 1984
CONCENTRATION (ppm)
5
4
3
2
1
0
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

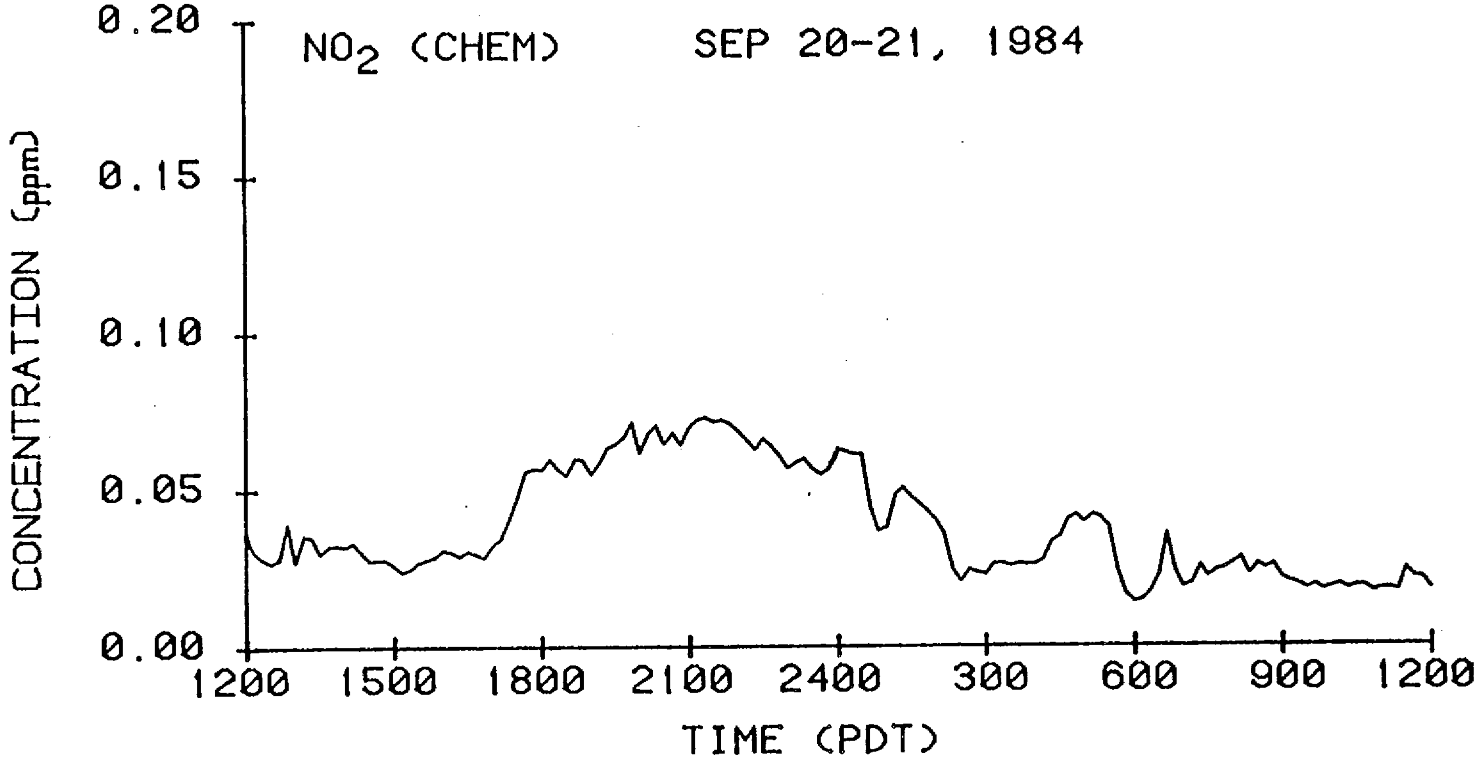

NO
SEP 18-19, 1984
CONCENTRATION (ppm)
0.40
0.30
0.20
0.10
0.00
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

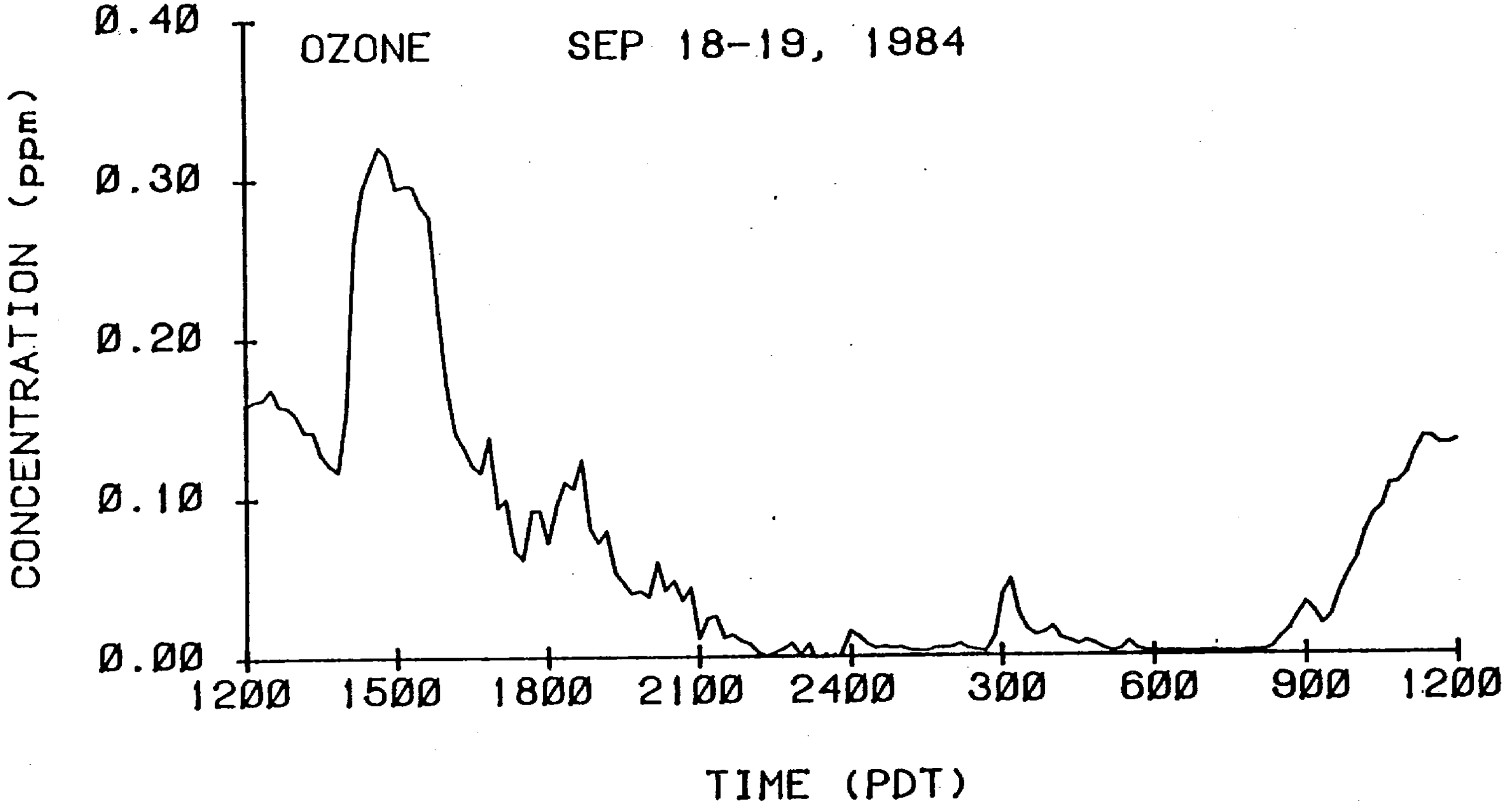

NO
SEP 19-20, 1984
CONCENTRATION (ppm)
0.40
0.30
0.20
0.10
0.00
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

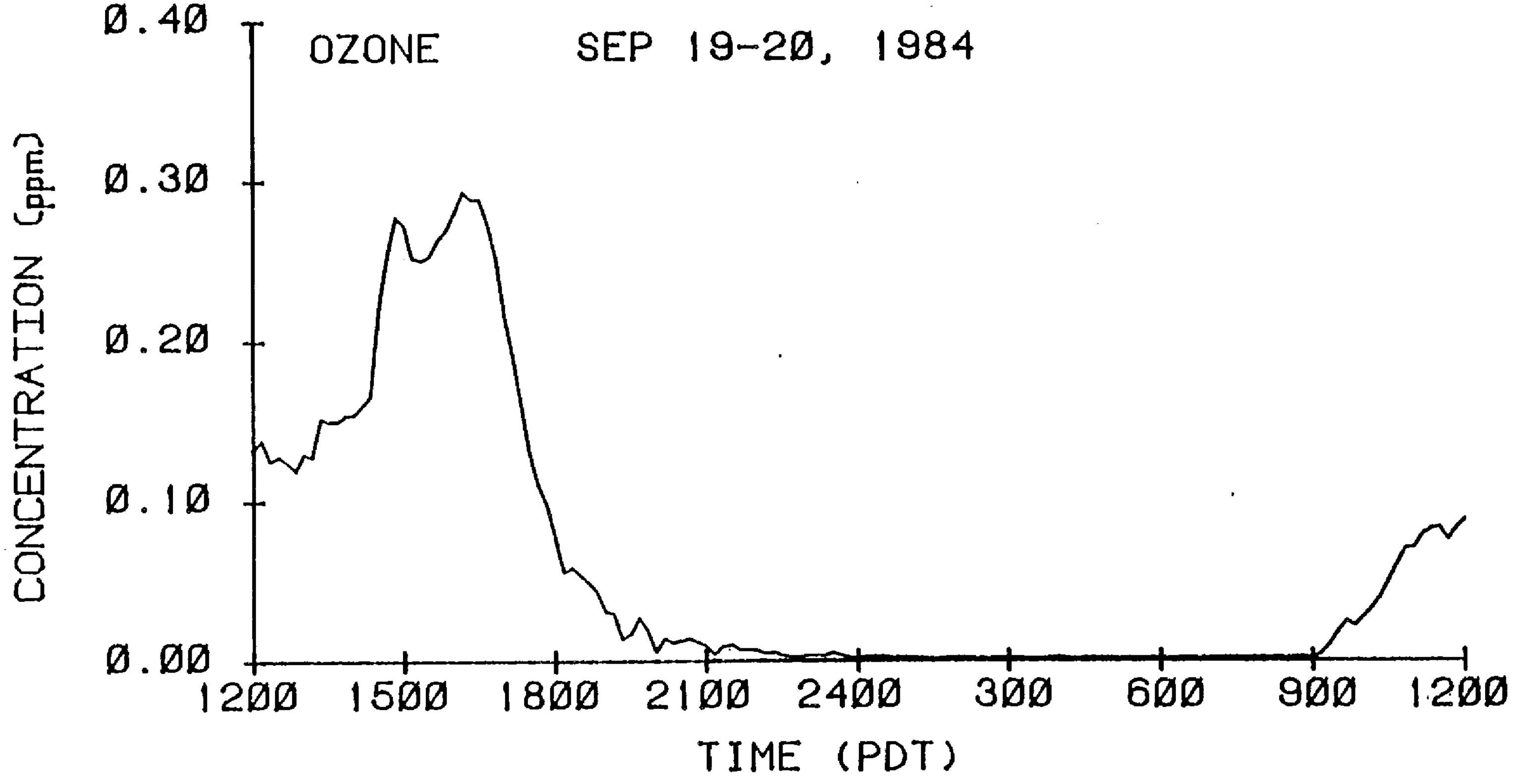
NO
SEP 20-21, 1984
CONCENTRATION (ppm)
0.40
0.30
0.20
0.10
0.00
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

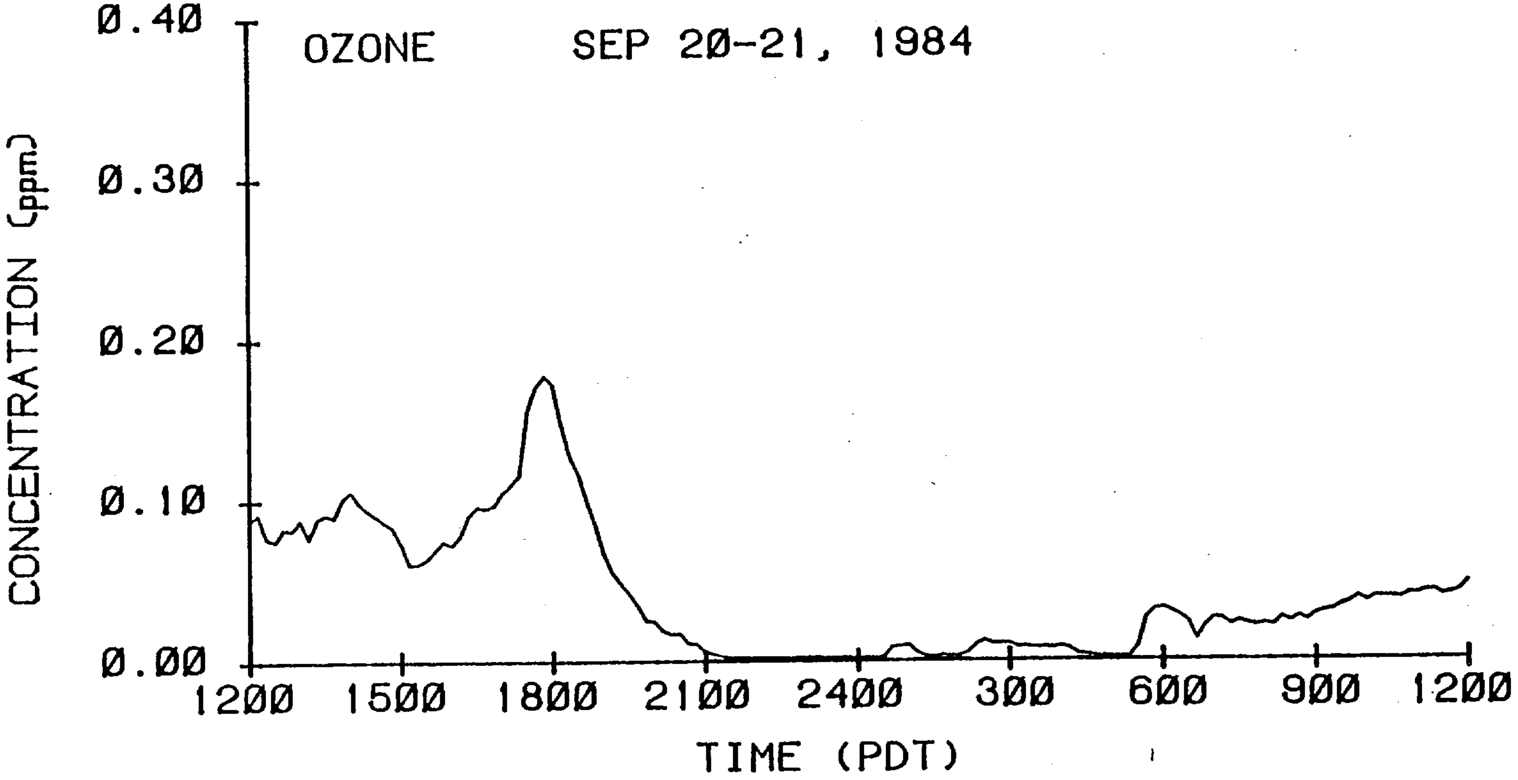

NO$_2$ (CHEM)
SEP 18-19, 1984
CONCENTRATION (ppm)
0.20
0.15
0.10
0.05
0.00
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

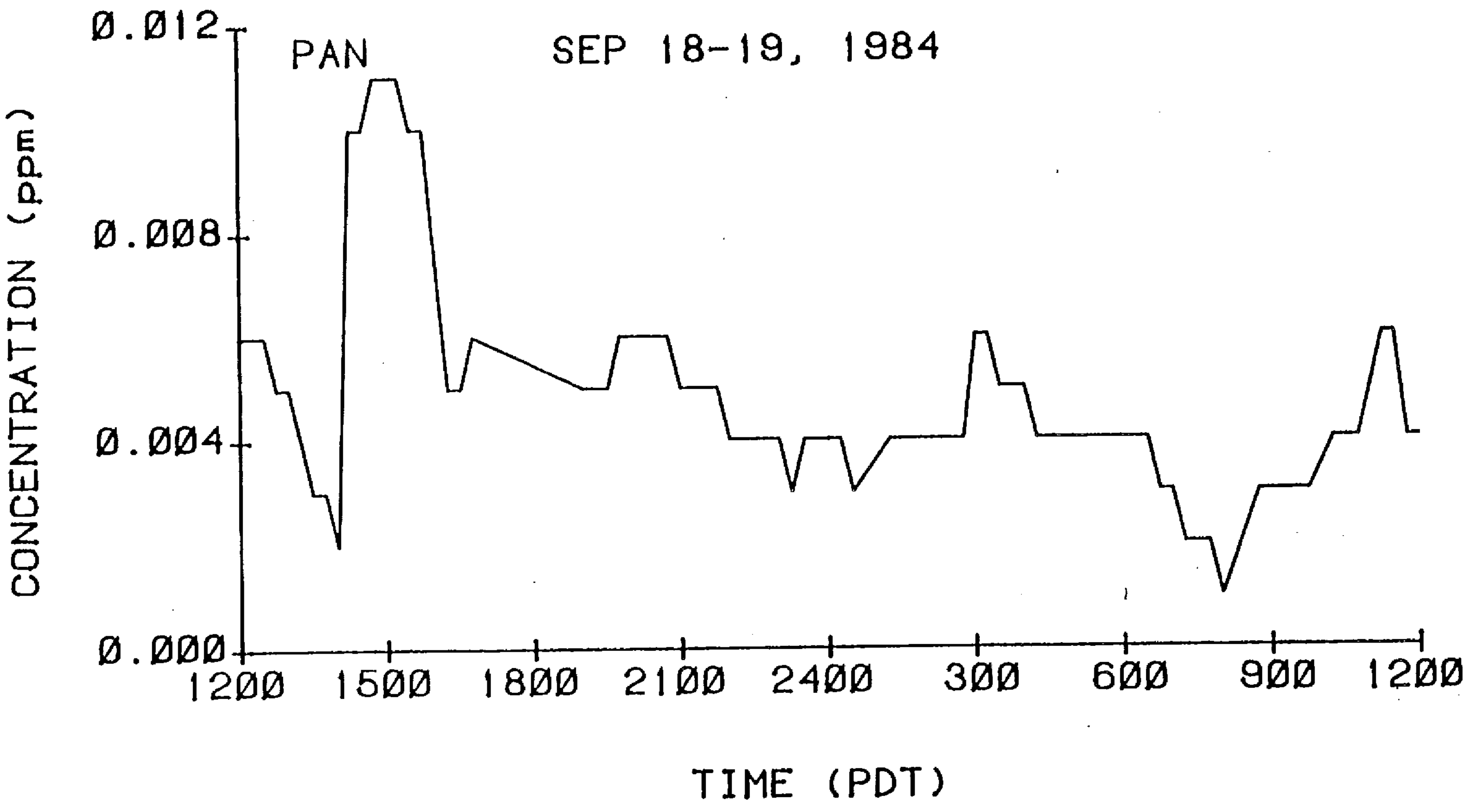

NO$_2$ (CHEM)
SEP 19-20, 1984
CONCENTRATION (ppm)
0.20
0.15
0.10
0.05
0.00
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

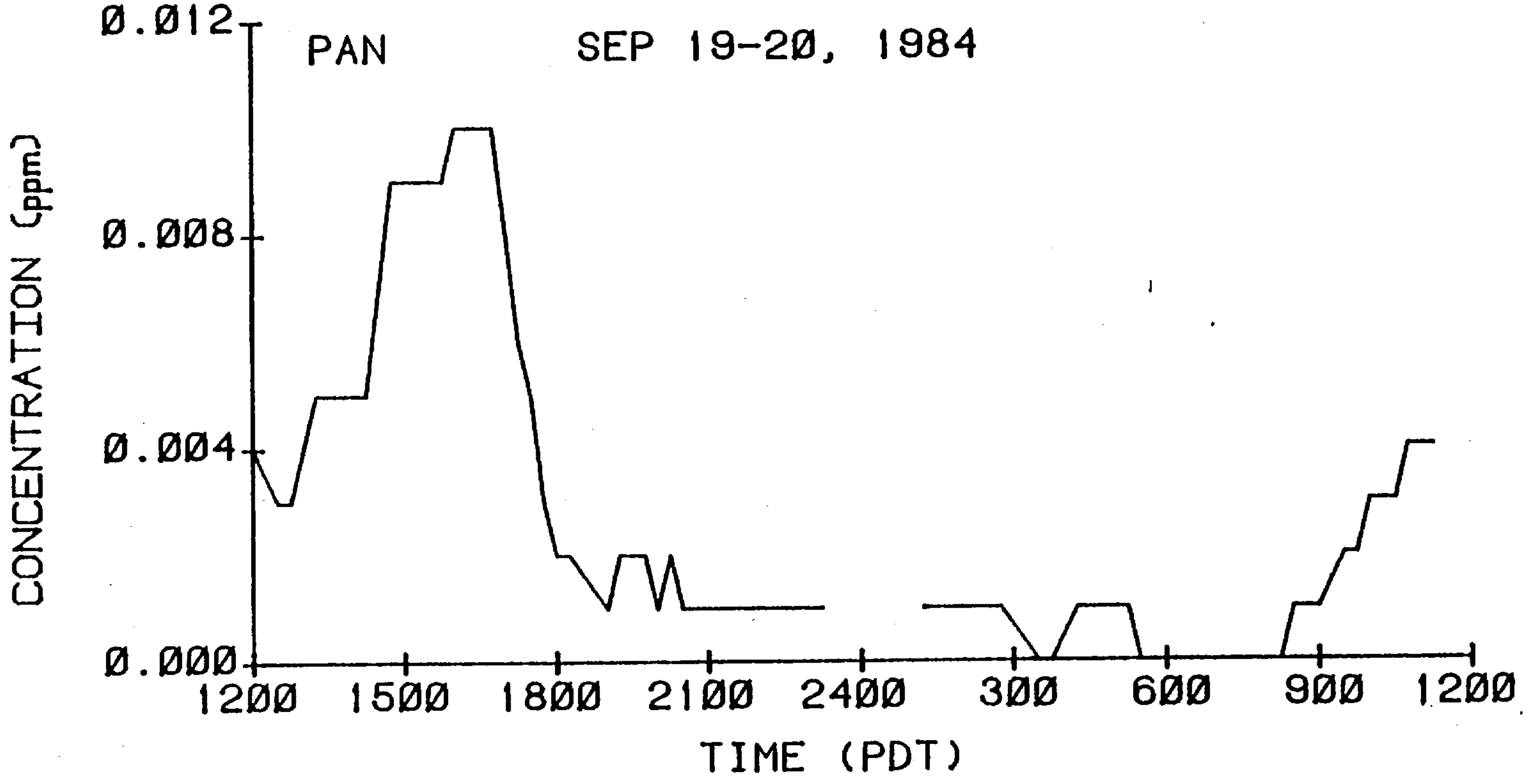

NO$_2$ (CHEM)
SEP 20-21, 1984
CONCENTRATION (ppm)
0.20
0.15
0.10
0.05
0.00
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

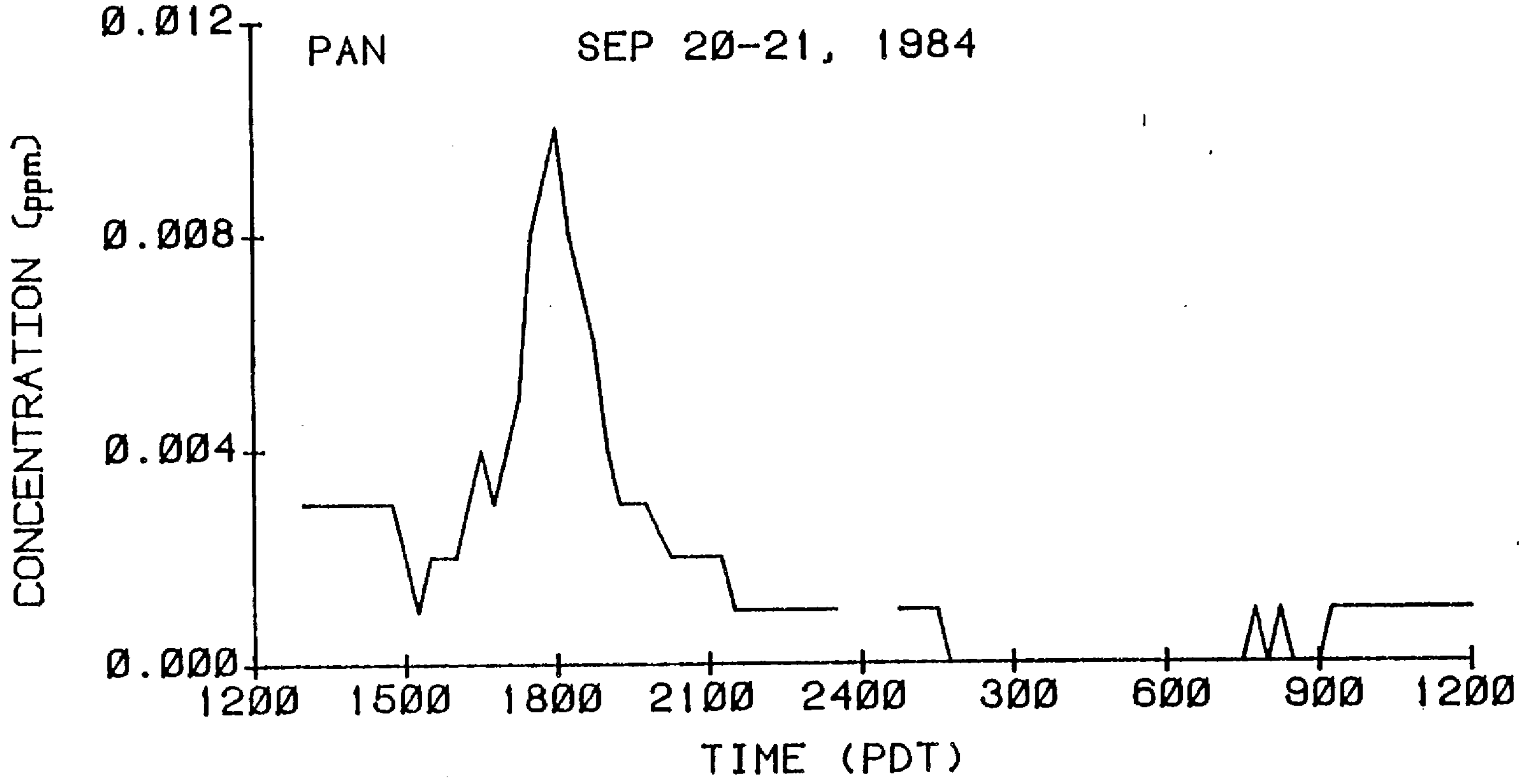

OZONE
SEP 18-19, 1984
CONCENTRATION (ppm)
0.40
0.30
0.20
0.10
0.00
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

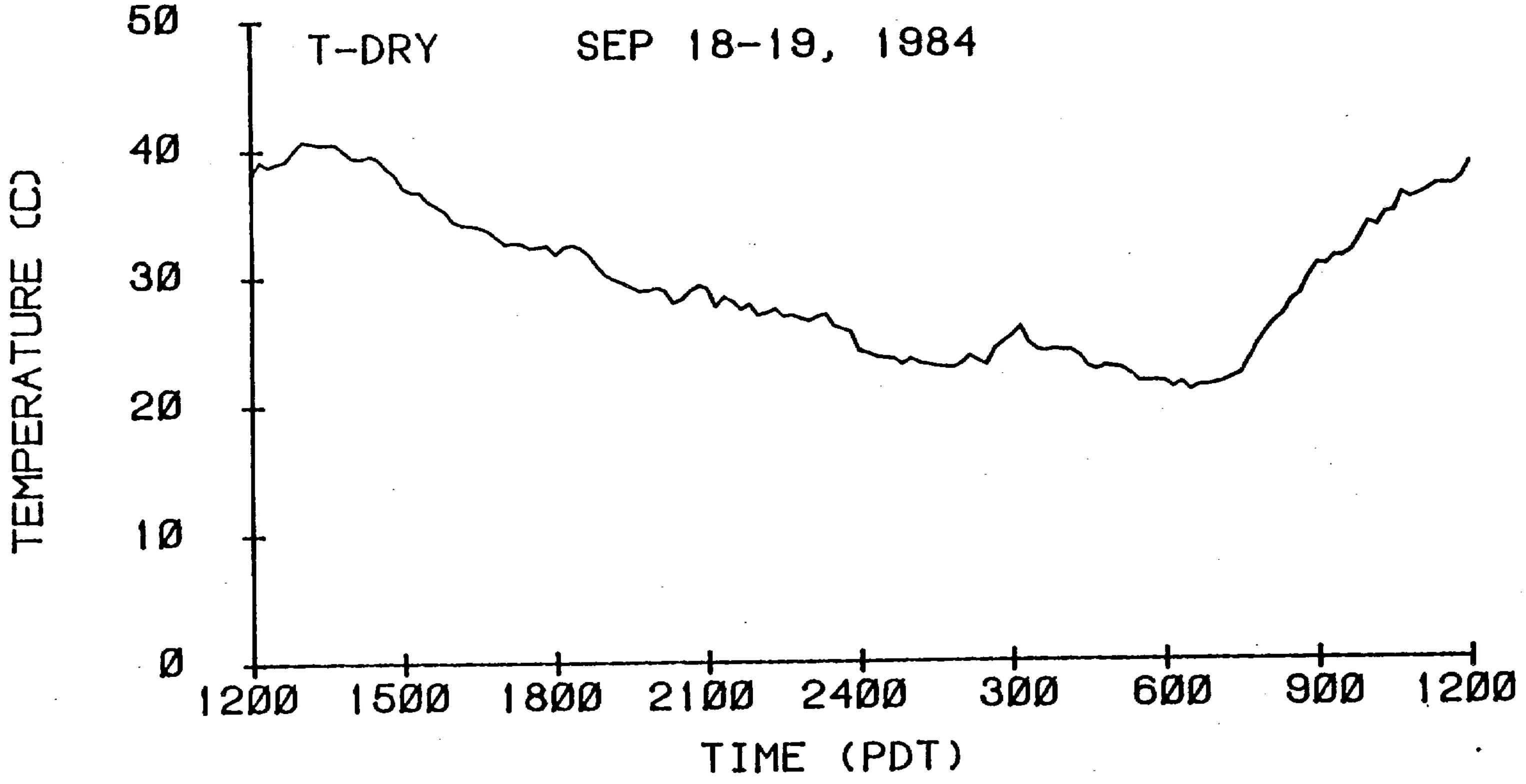

OZONE
SEP 19-20, 1984
CONCENTRATION (ppm)
0.40
0.30
0.20
0.10
0.00
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

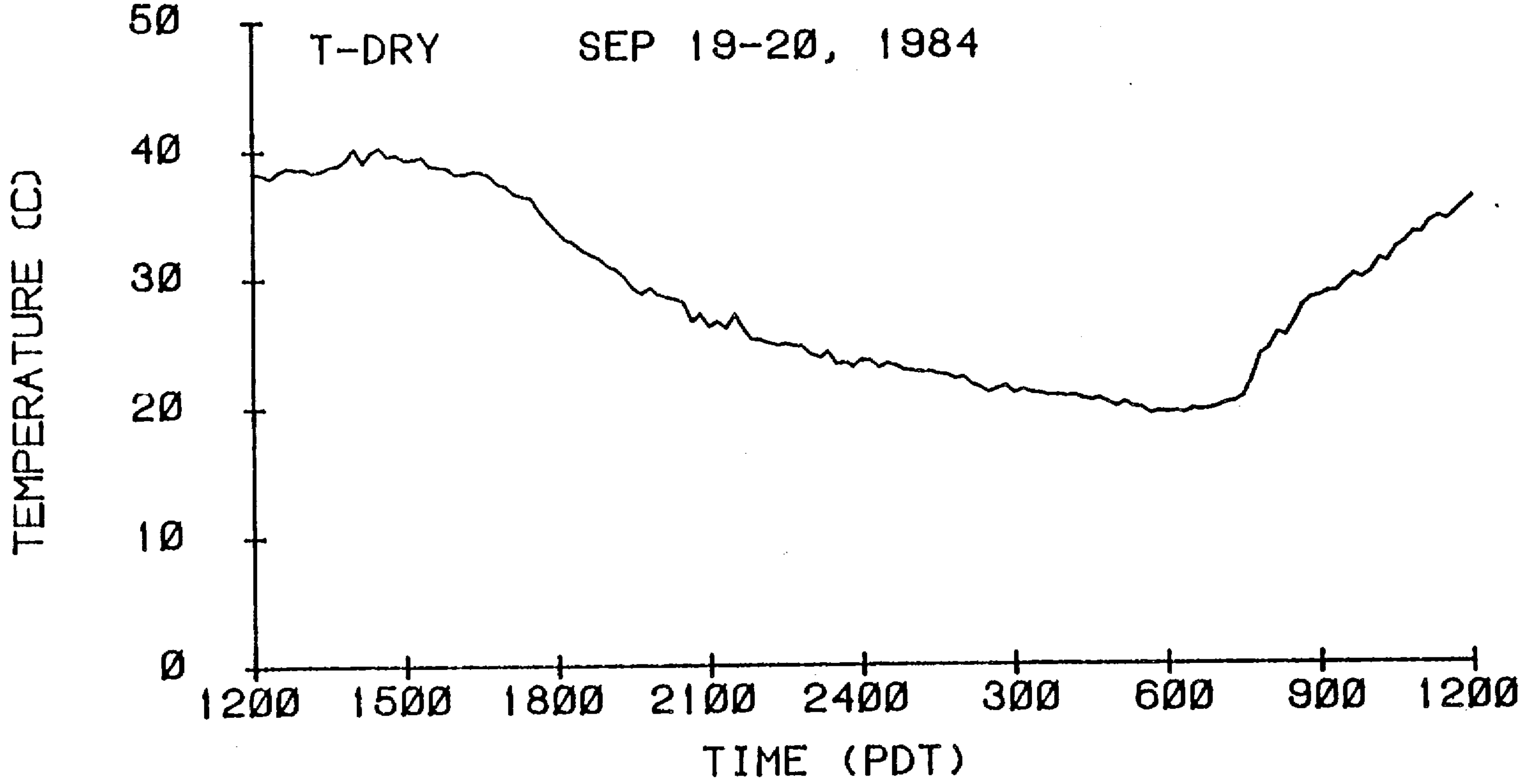

OZONE
SEP 20-21, 1984
CONCENTRATION (ppm)
0.40
0.30
0.20
0.10
0.00
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

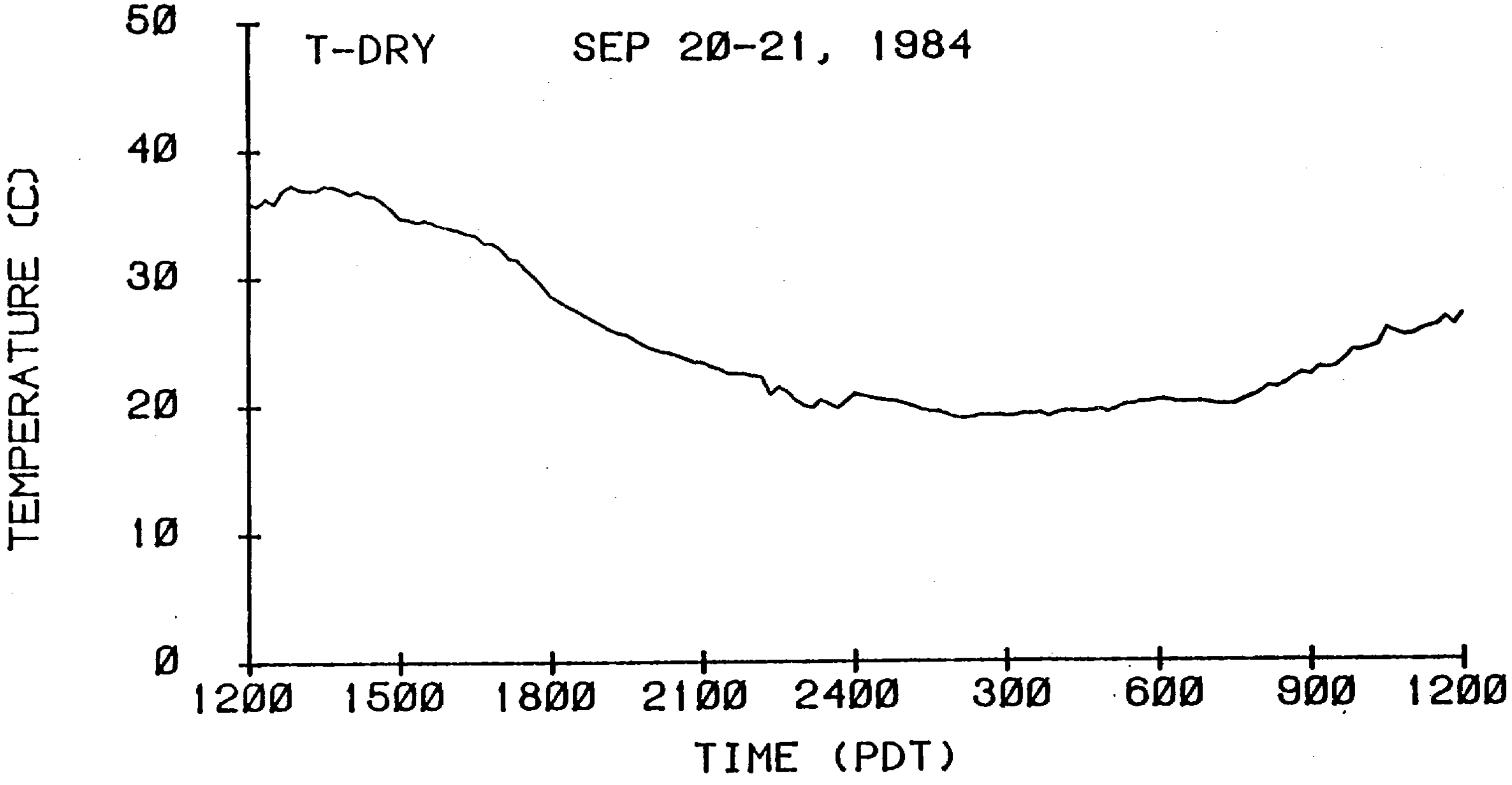

PAN
SEP 18-19, 1984
CONCENTRATION (ppm)
0.012
0.008
0.004
0.000
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

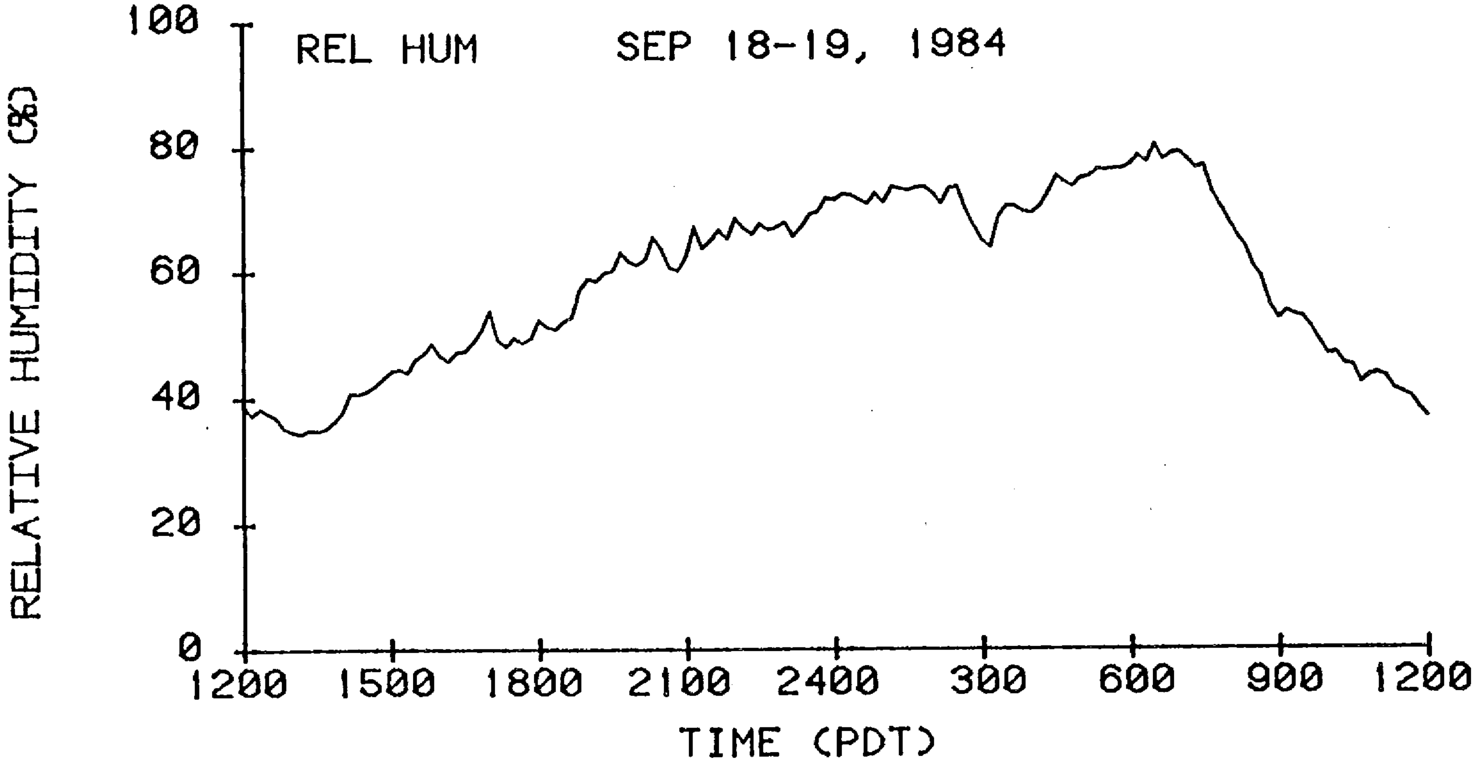

PAN
SEP 19-20, 1984
CONCENTRATION (ppm)
0.012
0.008
0.004
0.000
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

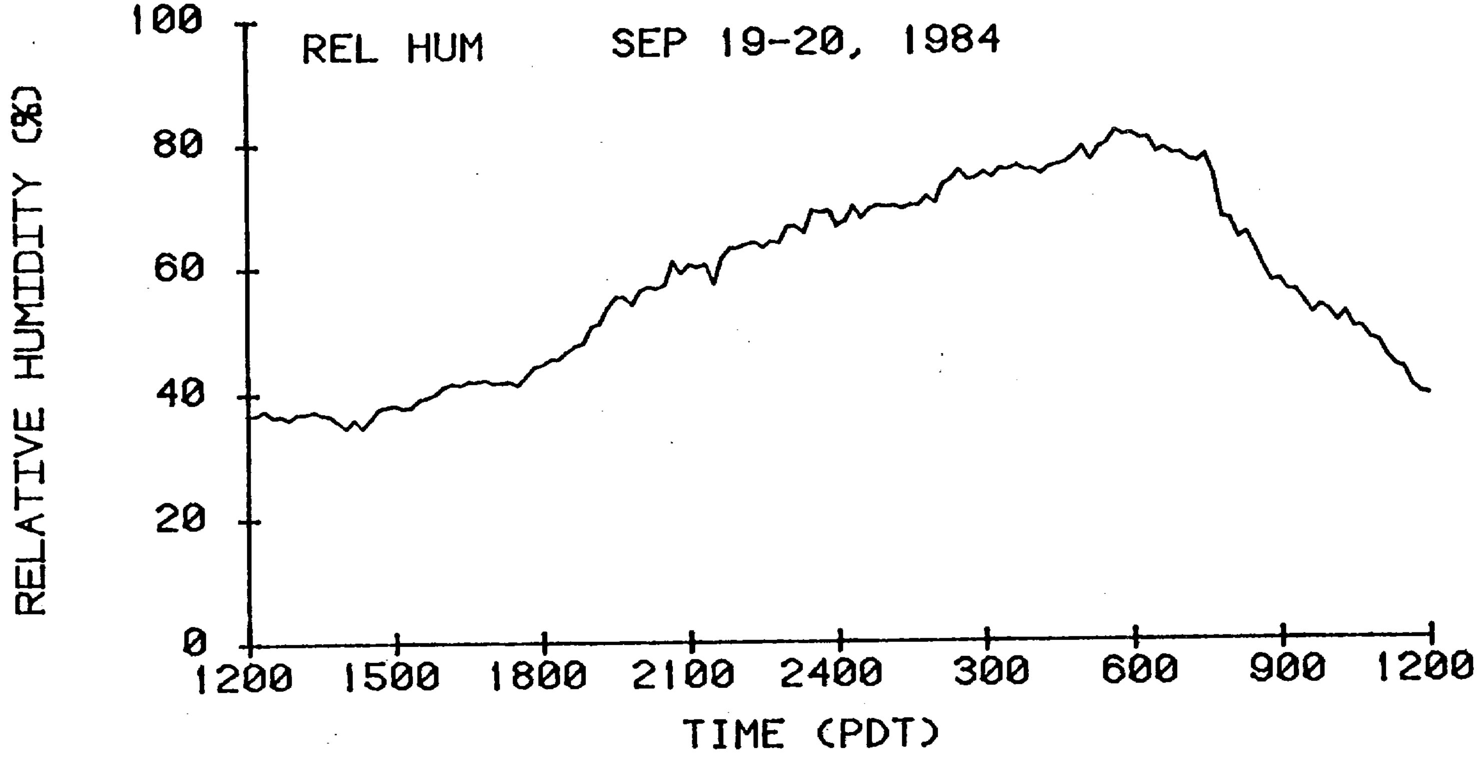

PAN
SEP 20-21, 1984
CONCENTRATION (ppm)
0.012
0.008
0.004
0.000
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

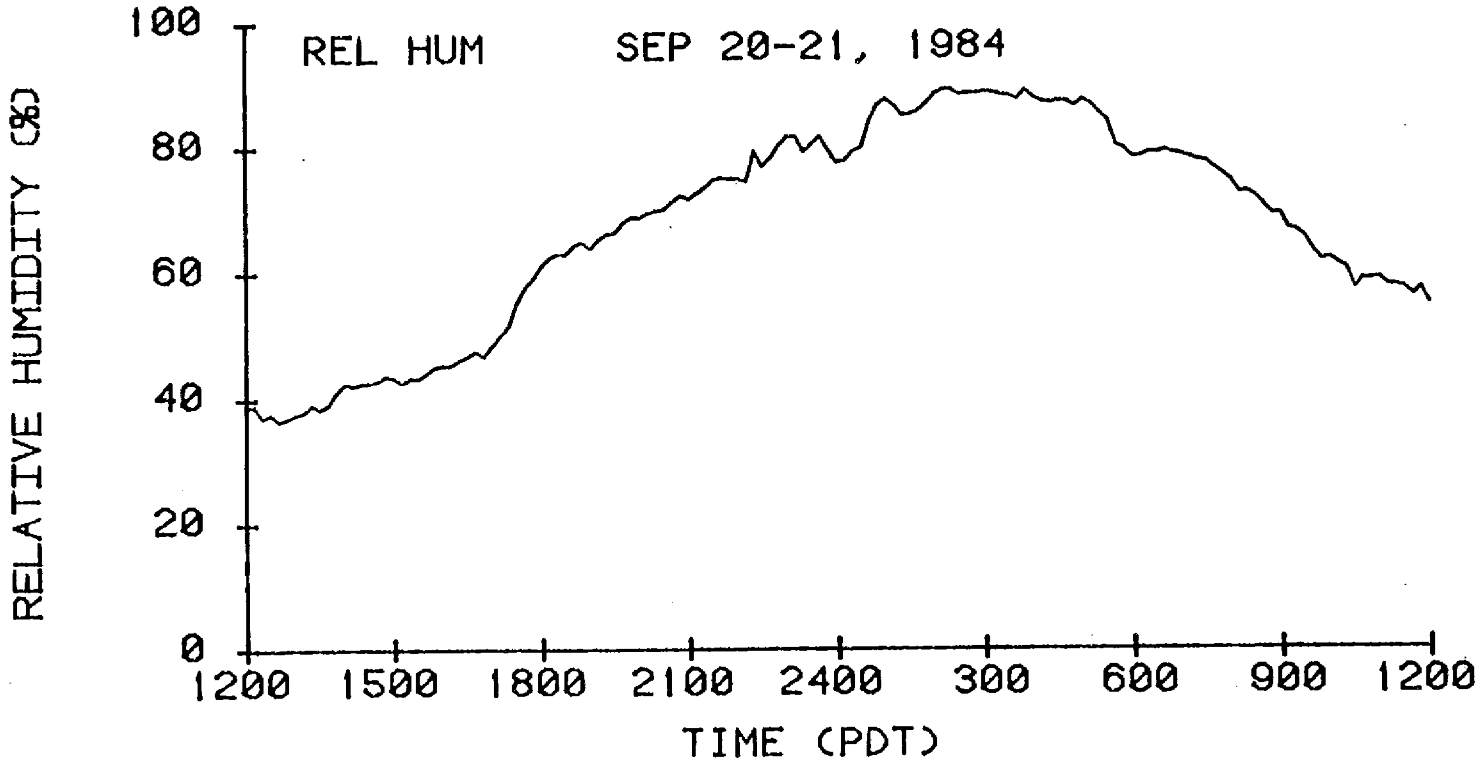

T-DRY
SEP 18-19, 1984
TEMPERATURE (C)
50
40
30
20
10
0
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

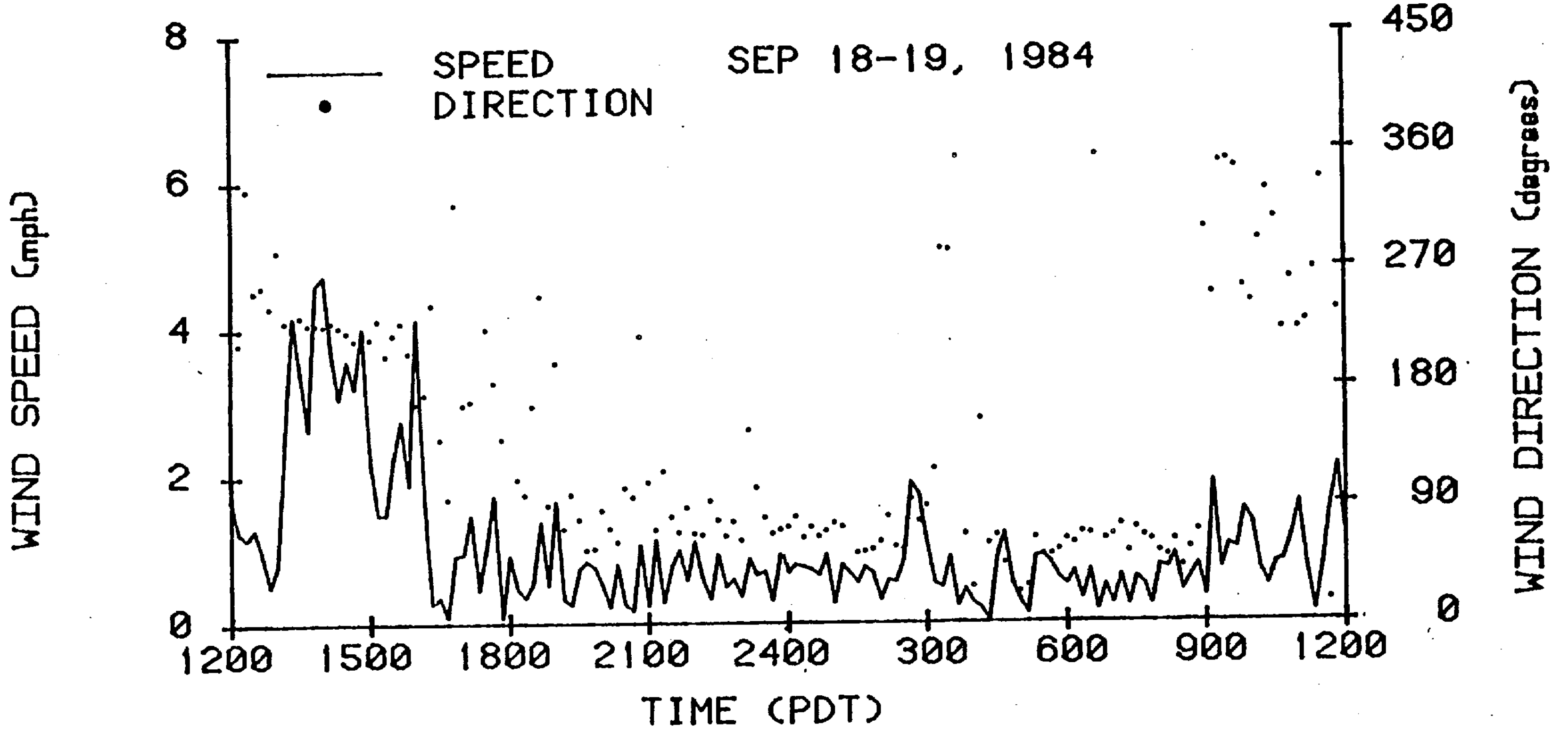

T-DRY
SEP 19-20, 1984
TEMPERATURE (C)
50
40
30
20
10
0
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

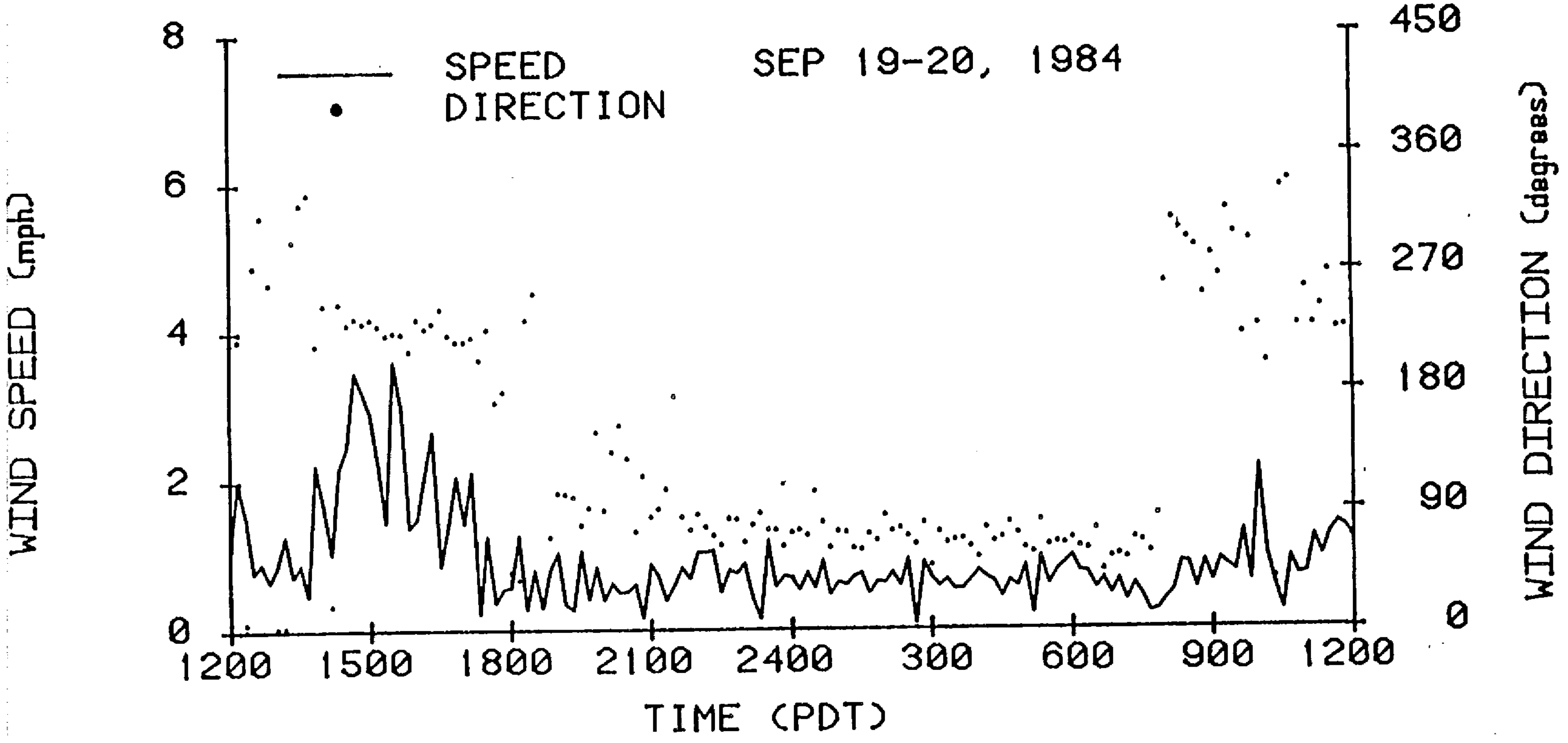

T-DRY
SEP 20-21, 1984
TEMPERATURE (C)
50
40
30
20
10
0
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

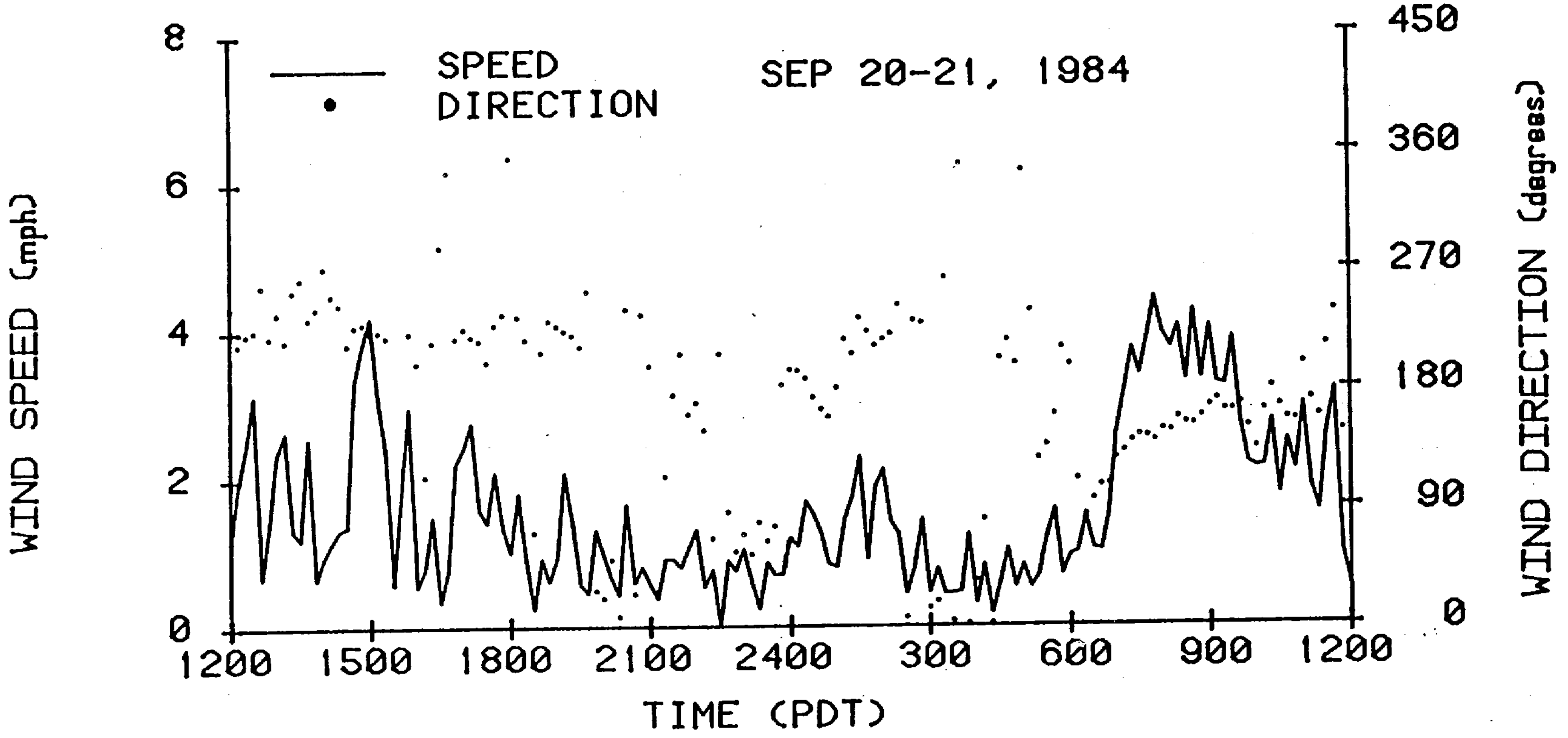

REL HUM
SEP 18-19, 1984
RELATIVE HUMIDITY (%)
100
80
60
40
20
0
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)


REL HUM
SEP 19-20, 1984
RELATIVE HUMIDITY (%)
100
80
60
40
20
0
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)


REL HUM
SEP 20-21, 1984
RELATIVE HUMIDITY (%)
100
80
60
40
20
0
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)


SPEED
DIRECTION
SEP 18-19, 1984
WIND SPEED (mph)
WIND DIRECTION (degrees)
TIME (PDT)
0
2
4
6
8
0
90
180
270
360
450
1200
1500
1800
2100
2400
300
600
900
1200


SPEED
DIRECTION
SEP 19-20, 1984
WIND SPEED (mph)
8
6
4
2
0
WIND DIRECTION (degrees)
450
360
270
180
90
0
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)


SPEED
DIRECTION
SEP 20-21, 1984
WIND SPEED (mph)
0
2
4
6
8
WIND DIRECTION (degrees)
0
90
180
270
360
450
1200
1500
1800
2100
2400
300
600
900
1200
TIME (PDT)

D. ELECTRON IMPACT MASS SPECTRA OF STANDARD NITROARENES

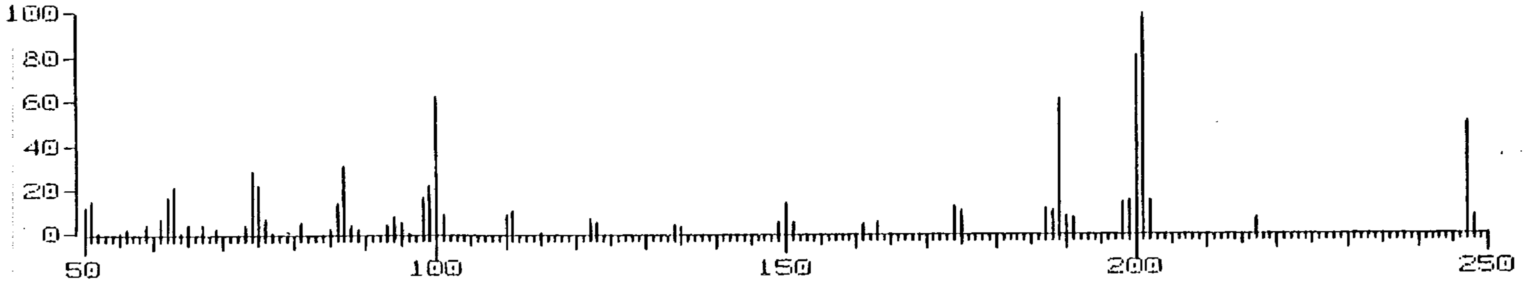
The mass spectra shown were recorded utilizing a Finnigan Model 3200 GC/MS equipped with a DB-5 capillary column and cool on-column injection. The mass spectrometer was interfaced to a Teknivent interactive data system with hard disk storage capabilities. Scanning was from 40-400 amu at a rate of 1 scan sec^{-1}. The spectra shown are for:

1-Nitrofluoranthene
7-Nitrofluoranthene
2-Nitrofluoranthene
3-Nitrofluoranthene
8-Nitrofluoranthene
1-Nitropyrene
2-Nitropyrene
1,3-Dinitropyrene
1,6-Dinitropyrene
1,8-Dinitropyrene
3-Nitrofluoranthene-d_9
8-Nitrofluoranthene-d_9
1-Nitropyrene-d_9
1,3-Dinitropyrene-d_8
1,6-Dinitropyrene-d_8
1,8-Dinitropyrene-d_8

```
M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I

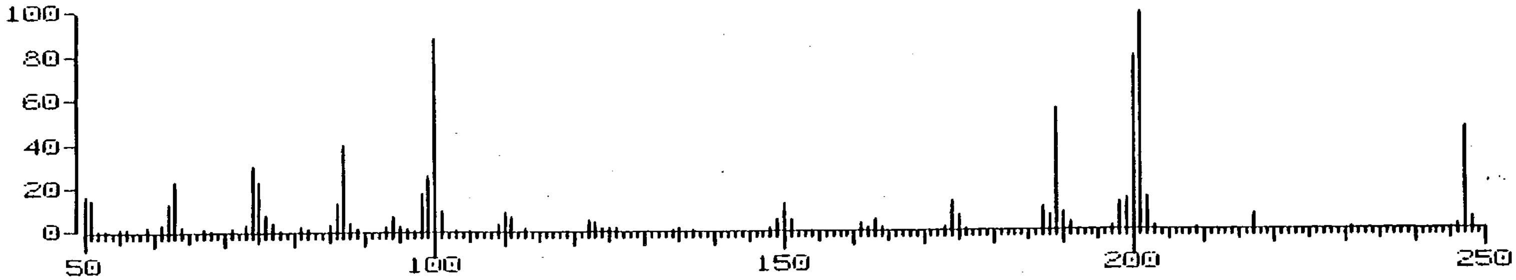
201 99.99   200 81.00   100 63.28   189 60.75   247 50.62    87 31.64    74 29.11    99 22.78    75 22.78    63 21.51
 62 17.40    98 17.40   199 15.18   202 15.18    51 15.18   198 14.87   150 14.87    86 14.87   174 12.65    50 12.65

 50 12.65    63 21.51    75 22.78    88  4.74    99 22.78   123  6.01   161  4.74   189 60.75   201 99.99
 51 15.18    65  4.74    76  7.59    89  3.47   100 63.28   134  4.74   163  6.01   190  8.85   202 15.18
 56  3.47    67  4.74    81  6.01    93  4.74   101  9.80   135  3.79   174 12.65   191  7.59   217  7.59
 59  4.74    69  3.47    85  3.47    94  8.85   110  9.80   149  6.01   175 11.07   198 14.87   247 50.62
 61  7.27    73  5.06    86 14.87    95  6.01   111 11.07   150 14.87   187 12.33   199 15.18   248  8.54
 62 17.40    74 29.11    87 31.64    98 17.40   122  7.27   151  6.01   188 11.07   200 81.00
```



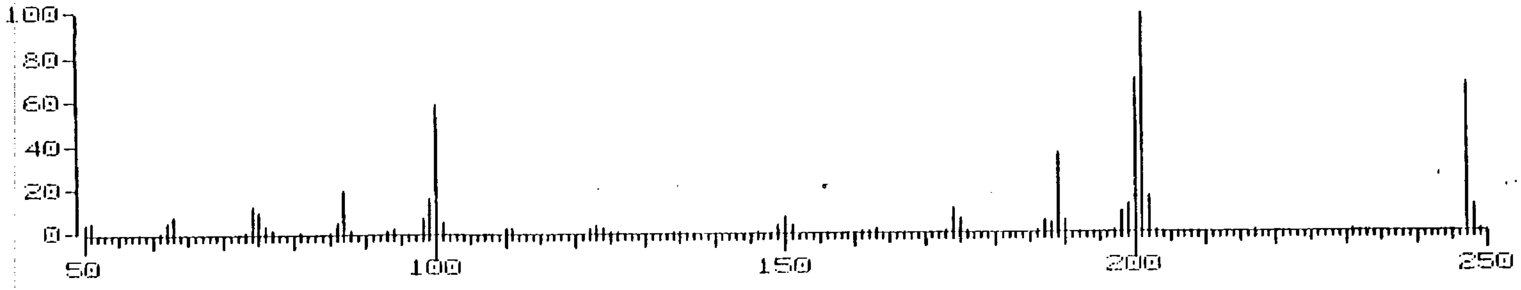
1-Nitrofluoranthene

M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I
201	99.99	100	89.21	200	80.34	189	55.62	247	46.74	87	40.40	74	30.42	99	26.46	63	23.92	75	23.45
98	18.22	50	17.11	202	15.84	51	15.21	199	15.05	62	13.78	86	13.78	174	13.78	198	12.51	150	12.51
50	17.11	64	3.00	77	5.06	89	2.37	100	89.21	123	4.91	150	12.51	174	13.78	197	2.37	217	7.44
51	15.21	67	2.37	81	3.00	93	3.00	101	10.61	124	2.37	151	6.17	175	7.44	198	12.51	246	2.37
56	2.37	71	2.37	82	2.37	94	7.44	109	3.64	125	2.37	161	3.64	187	11.24	199	15.05	247	46.74
59	3.00	73	3.80	85	3.64	95	3.00	110	9.34	126	2.37	162	2.37	188	7.44	200	80.34	248	6.17
61	3.64	74	30.42	86	13.78	96	2.53	111	7.44	135	2.53	163	6.17	189	55.62	201	99.99		
62	13.78	75	23.45	87	40.40	98	18.22	113	2.37	148	2.37	164	2.37	190	8.71	202	15.84		
63	23.92	76	8.08	88	4.91	99	26.46	122	6.17	149	5.54	173	2.37	191	3.64	203	2.37		



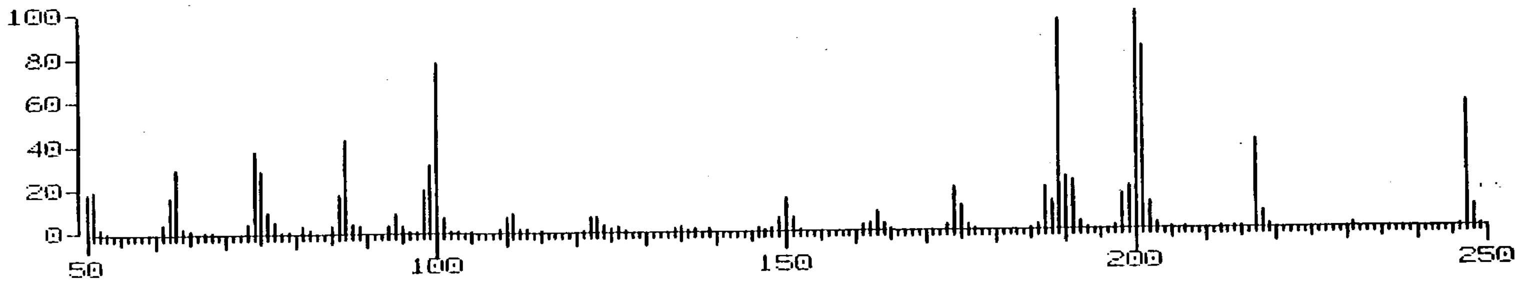
7-Nitrofluoranthene

M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I
201	99.99	200	69.79	247	67.48	100	58.97	189	36.01	87	20.33	99	16.62	202	16.34	199	13.30	74	13.12
248	11.80	174	11.18	75	10.11	198	9.57	63	8.71	150	7.65	98	7.44	175	6.87	190	6.19	101	6.14
50	4.82	74	13.12	86	5.99	99	16.62	123	4.22	149	3.60	173	1.73	189	36.01	201	99.99	248	11.80
51	6.01	75	10.11	87	20.33	100	58.97	124	3.08	150	7.65	174	11.18	190	6.19	202	16.34	249	1.32
61	1.63	76	3.81	88	2.25	101	6.14	125	1.01	151	3.96	175	6.87	197	1.26	203	1.63		
62	5.36	77	2.28	93	1.91	110	2.77	126	1.37	161	1.11	176	1.08	198	9.57	217	1.73		
63	8.71	81	1.03	94	3.11	111	2.77	134	1.01	162	1.11	187	5.73	199	13.30	231	1.01		
73	1.60	85	1.32	98	7.44	122	3.13	135	1.24	163	2.56	188	4.48	200	69.79	247	67.48		



2-Nitrofluoranthene

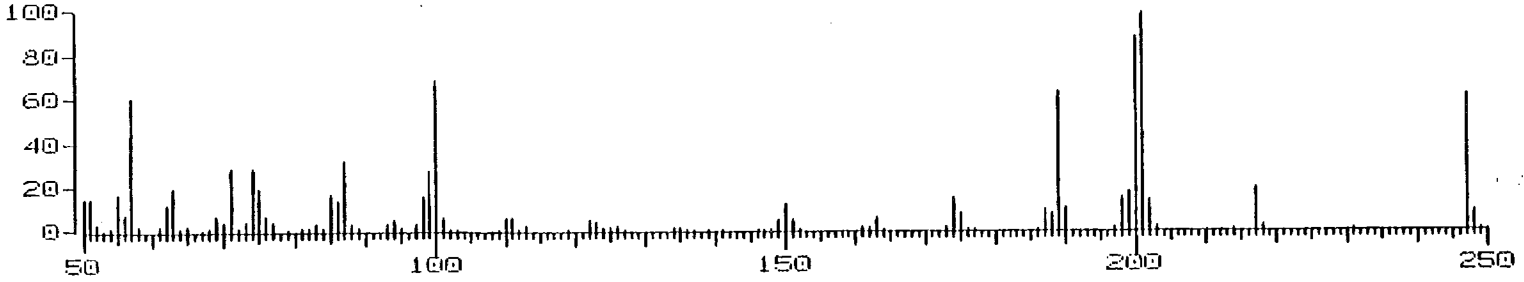
M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I
200	99.99	189	96.09	201	83.40	100	77.79	247	57.31	87	43.41	217	40.72	74	38.29	99	31.64	63	29.99
75	29.26	190	24.56	191	23.16	98	20.18	199	20.18	174	20.18	51	19.99	187	19.69	50	18.77	86	18.71
50	18.77	73	5.12	86	18.71	98	20.18	113	2.37	135	2.92	161	3.10	176	3.10	192	4.08	203	2.86
51	19.99	74	38.29	87	43.41	99	31.64	122	7.74	137	2.37	162	3.59	186	2.86	197	2.13	217	40.72
52	3.41	75	29.26	88	5.12	100	77.79	123	7.25	139	2.37	163	8.95	187	19.69	198	16.27	218	8.23
61	4.81	76	10.48	89	4.08	101	7.98	124	4.32	146	2.13	164	4.32	188	13.83	199	20.18	219	2.37
62	17.49	77	5.85	93	3.83	109	2.37	125	2.37	149	6.76	173	3.35	189	96.09	200	99.99	247	57.31
63	29.99	81	4.14	94	9.50	110	7.74	126	3.35	150	15.54	174	20.18	190	24.56	201	83.40	248	9.93
64	2.68	85	3.59	95	4.14	111	9.20	134	2.37	151	7.00	175	11.64	191	23.16	202	13.35		



3-Nitrofluoranthene

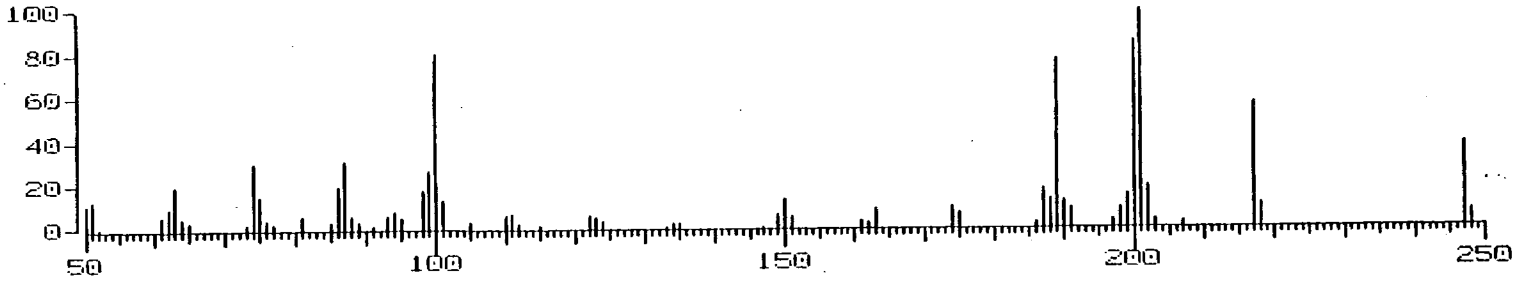
M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I
201	99.99	200	89.06	100	69.25	189	63.78	247	61.73	57	60.79	87	32.36	74	29.03	71	28.94	99	27.92
75	20.49	63	20.49	217	19.72	199	18.01	55	17.41	85	16.99	98	16.65	174	15.96	50	15.36	51	15.36

M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I
50	15.36	61	3.32	71	28.94	83	4.01	94	6.06	110	6.74	126	3.32	163	6.74	197	2.30	218	3.32
51	15.36	62	13.23	73	4.77	85	16.99	95	2.30	111	6.40	135	2.04	174	15.96	198	15.28	247	61.73
52	4.01	63	20.49	74	29.03	86	14.59	97	3.67	113	2.98	149	6.06	175	8.45	199	18.01	248	9.47
55	17.41	64	2.64	75	20.49	87	32.36	98	16.65	122	5.71	150	12.55	187	10.50	200	89.06		
56	8.88	65	2.98	76	7.42	88	4.01	99	27.92	123	5.03	151	6.06	188	8.79	201	99.99		
57	60.79	69	7.85	77	5.12	89	2.30	100	69.25	124	2.64	161	2.64	189	63.78	202	15.02		
58	2.98	70	5.03	81	2.30	93	4.01	101	7.08	125	2.30	162	2.64	190	11.52	217	19.72		



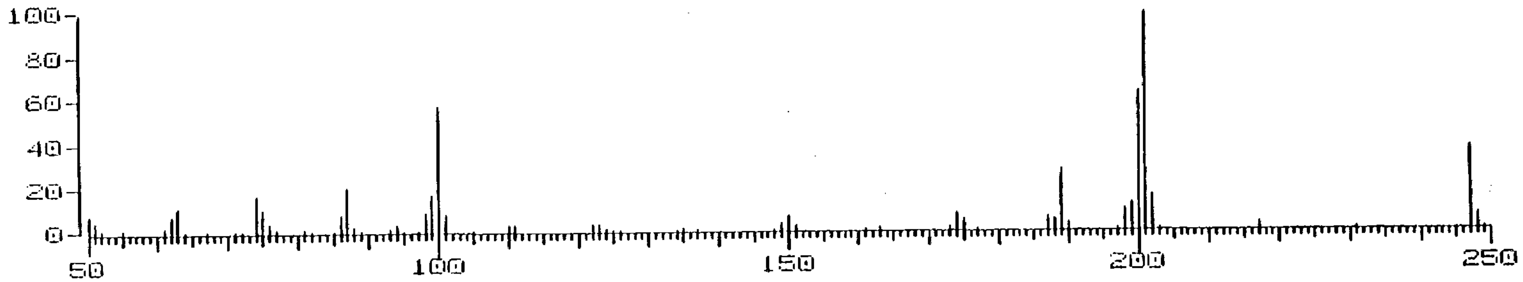
8-Nitrofluoranthene

M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I
201	99.99	200	85.70	100	80.94	189	77.37	217	57.13	247	38.09	87	32.14	74	30.95	99	27.37	63	20.23
86	19.93	202	19.04	98	18.74	187	18.74	199	15.47	75	15.47	51	14.28	101	13.98	188	13.98	150	13.98
50	11.90	73	3.57	86	19.93	95	5.65	111	8.03	135	3.57	174	10.71	191	9.52	203	4.46		
51	14.28	74	30.95	87	32.14	98	18.74	112	3.27	149	6.84	175	8.03	197	4.46	207	3.57		
61	6.84	75	15.47	88	6.84	99	27.37	115	2.38	150	13.98	186	3.27	198	9.52	217	57.13		
62	10.71	76	4.76	89	4.46	100	80.94	122	6.84	151	5.65	187	18.74	199	15.47	218	11.60		
63	20.23	77	3.57	91	2.38	101	13.98	123	5.65	161	4.46	188	13.98	200	85.70	247	38.09		
64	5.65	81	6.84	93	6.84	105	4.46	124	4.46	162	3.27	189	77.37	201	99.99	248	8.03		
65	4.46	85	4.46	94	8.33	110	6.84	134	3.27	163	9.22	190	13.09	202	19.04				



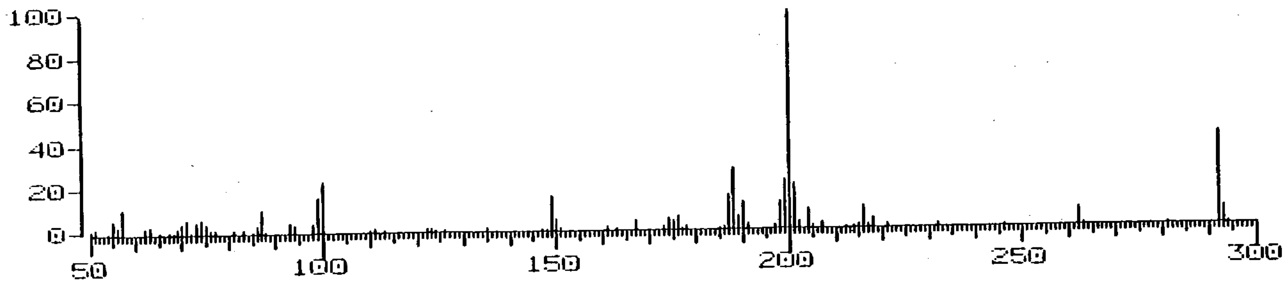
1-Nitropyrene

M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I
201	99.99	200	63.60	100	57.68	247	38.05	189	28.42	87	20.64	99	17.31	74	17.03	202	16.29	199	13.23
63	11.84	75	11.48	198	9.90	98	9.53	86	8.79	174	8.79	62	8.79	50	8.51	101	8.05	150	7.68
50	8.51	63	11.84	81	2.12	94	3.61	110	3.61	149	3.61	174	8.79	190	4.34	202	16.29		
51	5.92	74	17.03	86	8.79	98	9.53	111	3.61	150	7.68	175	5.45	198	9.90	217	3.61		
52	2.12	75	11.48	87	20.64	99	17.31	122	3.61	151	2.86	187	6.94	199	13.23	247	38.05		
61	2.86	76	5.09	88	2.86	100	57.68	123	3.97	163	2.12	188	5.45	200	63.60	248	7.31		
62	8.79	77	2.59	93	2.49	101	8.05	124	2.12	173	2.12	189	28.42	201	99.99				



2-Nitropyrene

M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I
200	99.99	292	42.32	188	28.05	100	23.71	199	23.09	201	21.23	149	16.89	187	16.27	99	16.27	190	13.17
198	13.17	57	11.93	87	11.31	216	10.69	204	9.45	262	8.21	293	8.21	74	6.97	189	6.97	55	6.35
50	2.01	69	3.25	77	2.01	98	4.49	149	16.89	175	4.49	190	13.17	202	3.87	218	4.49		
51	3.25	70	5.11	81	2.63	99	16.27	150	5.73	176	6.35	191	3.25	204	9.45	221	2.01		
55	6.35	71	6.35	83	2.01	100	23.71	151	2.01	178	2.63	197	2.01	205	2.01	232	2.01		
56	3.87	73	5.73	86	3.87	111	2.01	161	2.01	186	2.01	198	13.17	207	3.25	262	8.21		
57	11.93	74	6.97	87	11.31	122	2.01	167	4.49	187	16.27	199	23.09	215	2.01	292	42.32		
62	3.25	75	4.49	93	4.49	123	2.01	173	2.01	188	28.05	200	99.99	216	10.69	293	8.21		
63	3.87	76	2.63	94	3.87	135	2.01	174	5.73	189	6.97	201	21.23	217	2.01				



1,3-Dinitropyrene

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M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I

200 99.99   292 64.64   188 51.62   187 39.22   216 35.50   199 29.29   176 23.09   198 21.23    99 19.37   201 19.37
149 16.89   232 16.27   204 16.27    87 15.65   190 13.79   100 13.17    57 11.93   246 11.93   262 11.93    74 11.93

 50  3.87    70  5.11    85  2.01   110  3.25   151  2.01   177  4.49   197  3.87   207  3.87   234  5.73
 51  3.87    71  6.35    86  6.97   111  3.87   161  2.01   178  3.87   198 21.23   212  2.01   246 11.93
 55  6.35    73  6.97    87 15.65   122  3.87   162  2.01   185  2.63   199 29.29   215  2.01   247  2.63
 56  3.25    74 11.93    88  2.01   123  3.87   163  2.01   186  5.73   200 99.99   216 35.50   262 11.93
 57 11.93    75  8.21    93  5.73   135  2.01   167  3.87   187 39.22   201 19.37   217  6.97   263  2.01
 61  2.01    76  3.25    94  3.25   147  2.63   173  3.25   188 51.62   202  2.01   218  2.01   276  2.01
 62  4.49    77  2.01    98  8.21   148  2.01   174 11.31   189  9.45   204 16.27   221  2.01   292 64.64
 63  6.97    81  2.01    99 19.37   149 16.89   175  4.49   190 13.79   205  3.25   232 16.27   293 11.93
 69  2.63    83  2.01   100 13.17   150  9.45   176 23.09   191  3.25   206  4.49   233  2.63   294  2.01
```
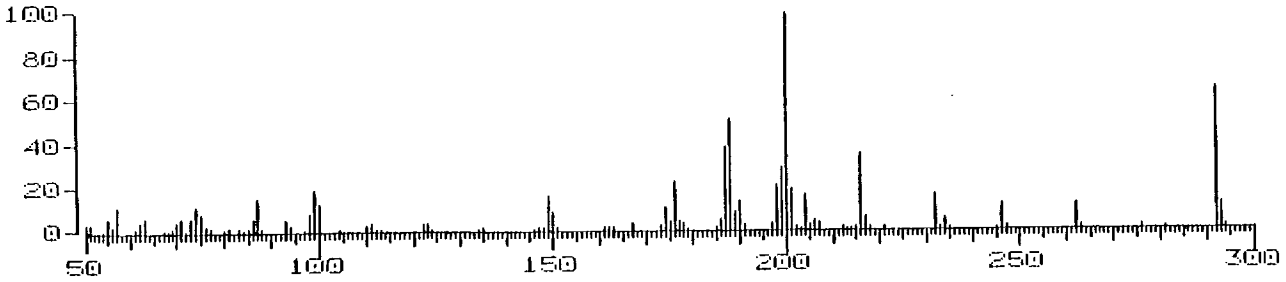
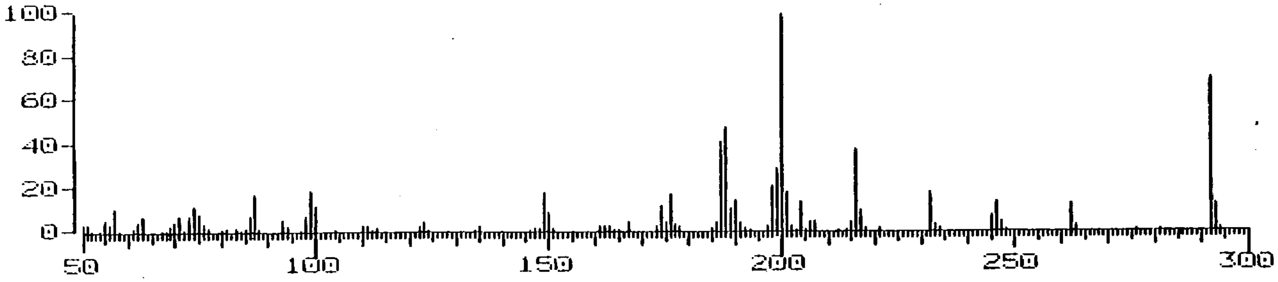



1,6-Dinitropyrene

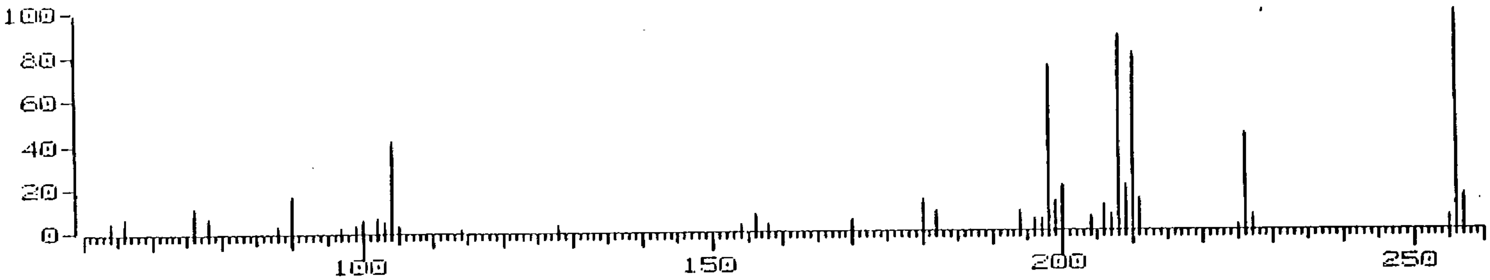
M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I
200	99.99	292	70.10	188	47.85	187	41.49	216	37.67	199	29.40	198	21.14	99	19.23	149	18.59	232	18.59
201	18.59	176	17.32	87	17.32	190	14.78	246	14.14	204	13.51	262	12.87	293	12.87	100	12.24	74	12.24

50	3.97	70	5.24	85	2.06	110	3.33	150	9.69	176	17.32	191	4.60	206	4.60	234	2.06
51	3.97	71	7.15	86	7.15	111	3.33	151	2.06	177	3.97	192	2.06	207	4.60	245	7.15
55	5.88	73	7.15	87	17.32	113	2.06	161	3.33	178	2.70	197	3.33	215	4.60	246	14.14
56	3.97	74	12.24	88	2.06	122	3.33	162	2.70	185	2.06	198	21.14	216	37.67	247	4.60
57	11.60	75	8.42	93	5.88	123	4.60	163	3.33	186	5.24	199	29.40	217	10.33	262	12.87
61	2.06	76	3.97	94	2.70	135	2.70	167	4.60	187	41.49	200	99.99	218	2.06	263	2.70
62	4.60	77	2.06	98	7.15	147	2.06	173	3.33	188	47.85	201	18.59	221	2.06	292	70.10
63	7.15	81	2.06	99	19.23	148	2.06	174	12.24	189	11.60	202	2.70	232	18.59	293	12.87
69	3.33	83	2.06	100	12.24	149	18.59	175	4.60	190	14.78	204	13.51	233	3.97	294	2.06



1,8-Dinitropyrene

M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I
256	99.99	208	88.67	210	80.49	198	75.46	226	44.49	104	41.97	209	21.22	200	20.59	90	17.44	257	16.82
211	14.30	180	14.30	199	13.67	206	11.78	76	11.78	194	9.27	182	9.27	156	8.64	78	8.01	66	7.38
52	5.50	78	8.01	100	6.75	114	2.35	170	5.50	197	6.13	206	11.78	211	14.30	256	99.99		
54	5.50	88	4.24	102	7.38	128	3.61	180	14.30	198	75.46	207	7.38	225	2.98	257	16.82		
64	5.50	90	17.44	103	6.13	154	4.24	182	9.27	199	13.67	208	88.67	226	44.49				
66	7.38	97	2.98	104	41.97	156	8.64	194	9.27	200	20.59	209	21.22	227	7.38				
76	11.78	99	4.24	105	4.24	158	4.24	196	5.50	204	6.75	210	80.49	255	6.75				



3-Nitrofluoranthene-d_9

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M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I    M/E  R I

256 99.99   210 96.36   208 77.03   198 45.61   104 37.15   226 19.03   209 17.82   257 15.40   211 14.19    90 11.77
180 10.57   206  8.15    76  8.15   156  6.94   204  5.73   182  5.73   207  5.73   255  5.73   102  5.73   199  5.73

 66  4.52   102  5.73   180 10.57   199  5.73   207  5.73   210 96.36   255  5.73
 76  8.15   104 37.15   182  5.73   204  5.73   208 77.03   211 14.19   256 99.99
 90 11.77   156  6.94   198 45.61   206  8.15   209 17.82   226 19.03   257 15.40
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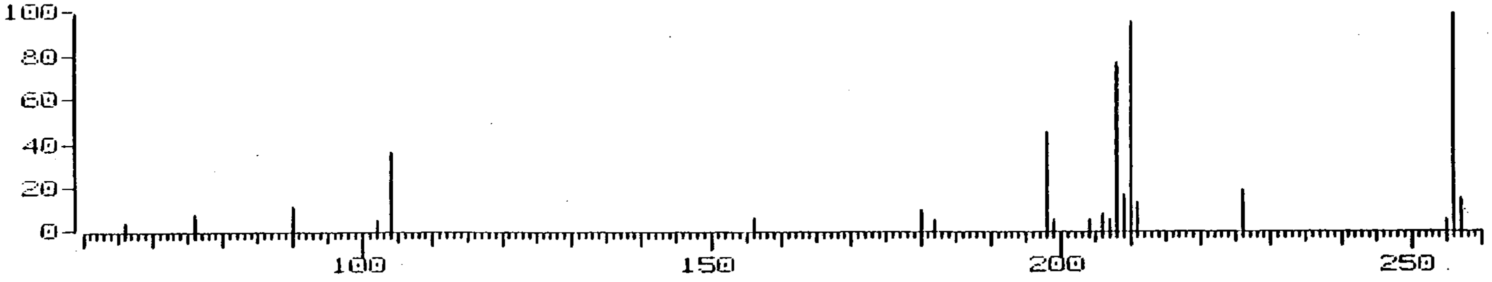
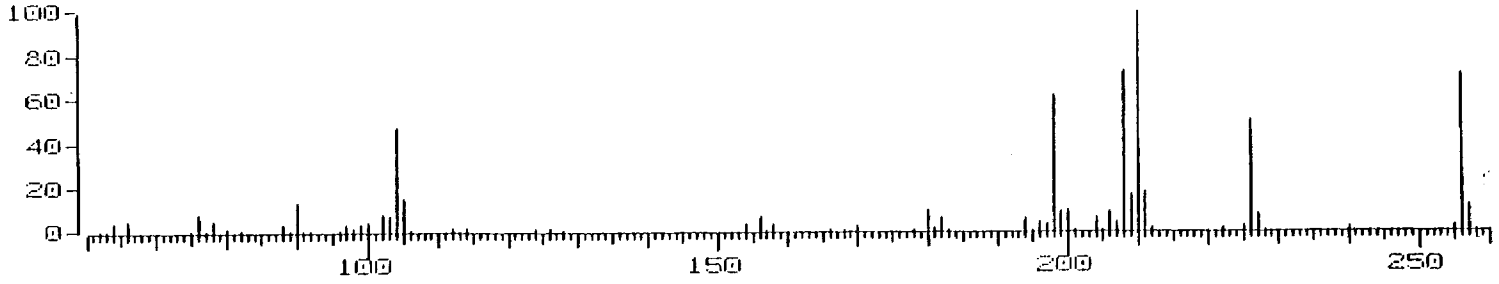


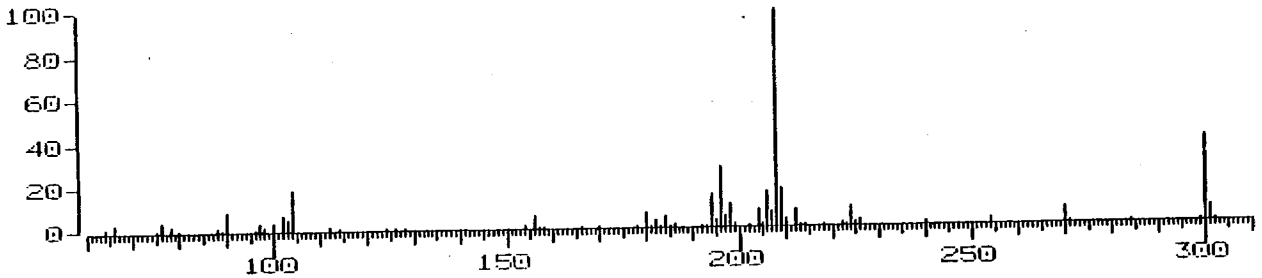
8-Nitrofluoranthene-d_9

M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I
210	99.99	208	72.52	256	70.54	198	61.75	226	50.28	104	48.13	211	17.86	209	17.45	105	15.77	90	14.25
257	12.28	200	10.18	180	10.18	199	9.60	206	9.02	76	8.78	227	8.78	102	8.09	156	7.27	103	7.15
52	5.29	78	5.58	98	2.26	104	48.13	126	2.03	180	10.18	198	61.75	207	4.65	212	2.03	255	3.54
54	4.59	80	2.03	99	4.01	105	15.77	154	3.66	182	6.46	199	9.60	208	72.52	222	2.03	256	70.54
64	4.59	88	3.66	100	5.06	112	2.26	156	7.27	194	6.92	200	10.18	209	17.45	225	2.85	257	12.28
66	6.10	90	14.25	102	8.09	114	2.15	158	3.66	196	4.47	204	7.04	210	99.99	226	50.28		
76	8.78	97	4.01	103	7.15	124	2.03	170	3.19	197	4.36	206	9.02	211	17.86	227	8.78		



1-Nitropyrene-d_9

M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I
208	99.99	300	39.93	196	28.54	104	19.03	209	18.09	206	16.69	194	15.75	198	11.54	224	9.67	90	9.35
204	8.88	212	8.42	180	7.72	270	7.48	102	7.40	207	7.17	301	7.17	156	6.62	103	6.00	184	5.84
52	3.03	78	3.27	98	2.10	104	19.03	182	4.28	195	4.13	204	8.88	208	99.99	222	2.57	254	2.72
64	2.26	88	2.57	100	3.66	154	2.10	184	5.84	196	28.54	205	2.57	209	18.09	224	9.67	270	7.48
66	3.97	90	9.35	102	7.40	156	6.62	186	2.10	197	5.45	206	16.69	210	3.97	225	2.41	300	39.93
76	5.30	97	4.28	103	6.00	180	7.72	194	15.75	198	11.54	207	7.17	212	8.42	226	2.72	301	7.17



1,3-Dinitropyrene-d_8

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M/E   R I    M/E   R I    M/E   R I    M/E   R I    M/E   R I    M/E   R I    M/E   R I    M/E   R I    M/E   R I    M/E   R I

208 99.99    300 70.59    196 45.87    224 43.64    194 37.86    184 23.71    206 20.37    209 17.14    240 16.81    204 15.47
212 14.80    180 14.14     90 13.02    254 12.80    301 12.35    270 12.13    198 11.02    102  9.90    104  9.90    156  9.46

 52  5.23     88  5.00    104  9.90    156  9.46    185  4.11    197  8.79    209 17.14    223  2.33    254 12.80    301 12.35
 54  3.22     90 13.02    112  2.78    166  3.00    186  3.00    198 11.02    210  2.78    224 43.64    255  2.33
 64  3.56     96  2.11    114  3.67    168  2.11    192  3.45    204 15.47    212 14.80    225  7.68    270 12.13
 66  6.79     97  5.67    124  2.78    178  2.78    193  2.33    205  3.22    213  2.78    226  2.11    271  2.11
 76  9.24    100  6.56    126  2.11    180 14.14    194 37.86    206 20.37    214  3.45    240 16.81    284  2.56
 78  6.34    102  9.90    128  2.11    181  2.11    195  7.90    207  7.12    218  2.33    241  3.22    299  2.78
 80  2.11    103  4.78    154  2.56    184 23.71    196 45.87    208 99.99    222  2.11    242  4.11    300 70.59
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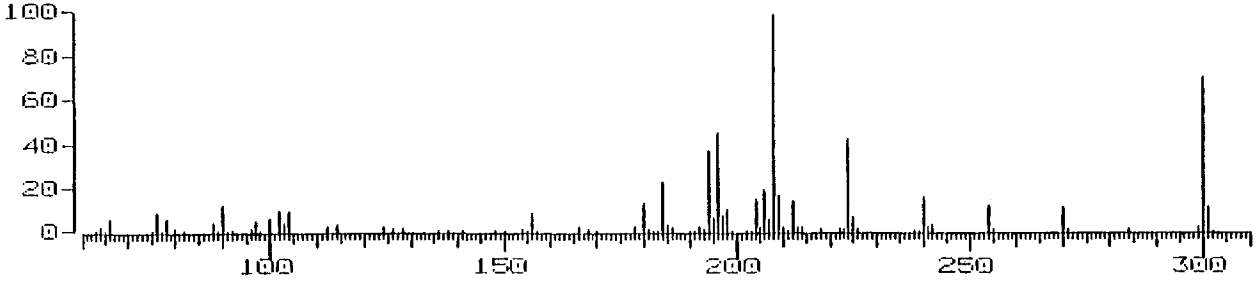
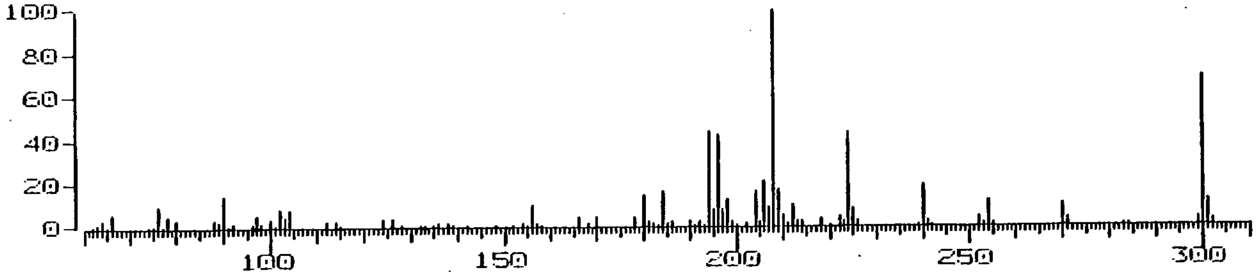


1,6-Dinitropyrene-d_8

M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I	M/E	R I
208	99.99	300	68.67	194	43.93	224	43.42	196	42.41	206	21.20	240	19.18	209	17.16	184	16.15	204	16.15
90	14.64	180	14.64	198	13.12	254	12.11	301	11.61	270	10.60	212	10.60	76	10.60	156	10.09	207	9.59
52	4.54	88	4.03	102	8.07	138	2.27	180	14.64	194	43.93	205	3.53	213	2.77	240	19.18	299	3.78
54	2.52	89	2.77	103	5.04	154	2.01	181	3.28	195	8.07	206	21.20	214	3.53	241	3.02	300	68.67
63	2.27	90	14.64	104	8.07	156	10.09	182	2.52	196	42.41	207	9.59	218	3.78	252	4.54	301	11.61
64	4.03	92	2.27	112	3.02	157	2.27	184	16.15	197	8.07	208	99.99	222	4.54	253	2.01	302	2.77
66	7.06	96	2.01	114	3.02	166	4.79	185	2.52	198	13.12	209	17.16	223	3.02	254	12.11		
76	10.60	97	6.05	124	4.29	168	2.01	186	2.77	199	2.77	210	5.80	224	43.42	255	2.01		
78	6.05	98	2.27	126	3.78	170	4.79	190	2.77	202	2.27	211	2.27	225	8.07	270	10.60		
80	3.78	100	4.03	136	2.27	178	4.79	192	3.53	204	16.15	212	10.60	226	2.77	271	3.78		



1,8-Dinitropyrene-d_8