



**Calhoun: The NPS Institutional Archive**  
**DSpace Repository**

---

Theses and Dissertations

1. Thesis and Dissertation Collection, all items

---

1981-09

A statistical analysis of daily and weekly  
rainfall for the Monterey Peninsula, in Central California.

Kirca, Davut

Monterey, California. Naval Postgraduate School

---

<https://hdl.handle.net/10945/20679>

---

Copyright is reserved by the copyright owner

*Downloaded from NPS Archive: Calhoun*



Calhoun is the Naval Postgraduate School's public access digital repository for research materials and institutional publications created by the NPS community. Calhoun is named for Professor of Mathematics Guy K. Calhoun, NPS's first appointed -- and published -- scholarly author.

**Dudley Knox Library / Naval Postgraduate School**  
**411 Dyer Road / 1 University Circle**  
**Monterey, California USA 93943**

<http://www.nps.edu/library>



DUNLEAVY BOOK LIBRARY  
NAVAL POSTGRADUATE SCHOOL  
MONTEREY, CALIF, 93940











# NAVAL POSTGRADUATE SCHOOL

## Monterey, California



# THESIS

A STATISTICAL ANALYSIS OF DAILY AND WEEKLY  
RAINFALL FOR THE MONTEREY PENINSULA,  
IN CENTRAL CALIFORNIA

by

Davut Kirca

September 1981

Thesis Advisor:

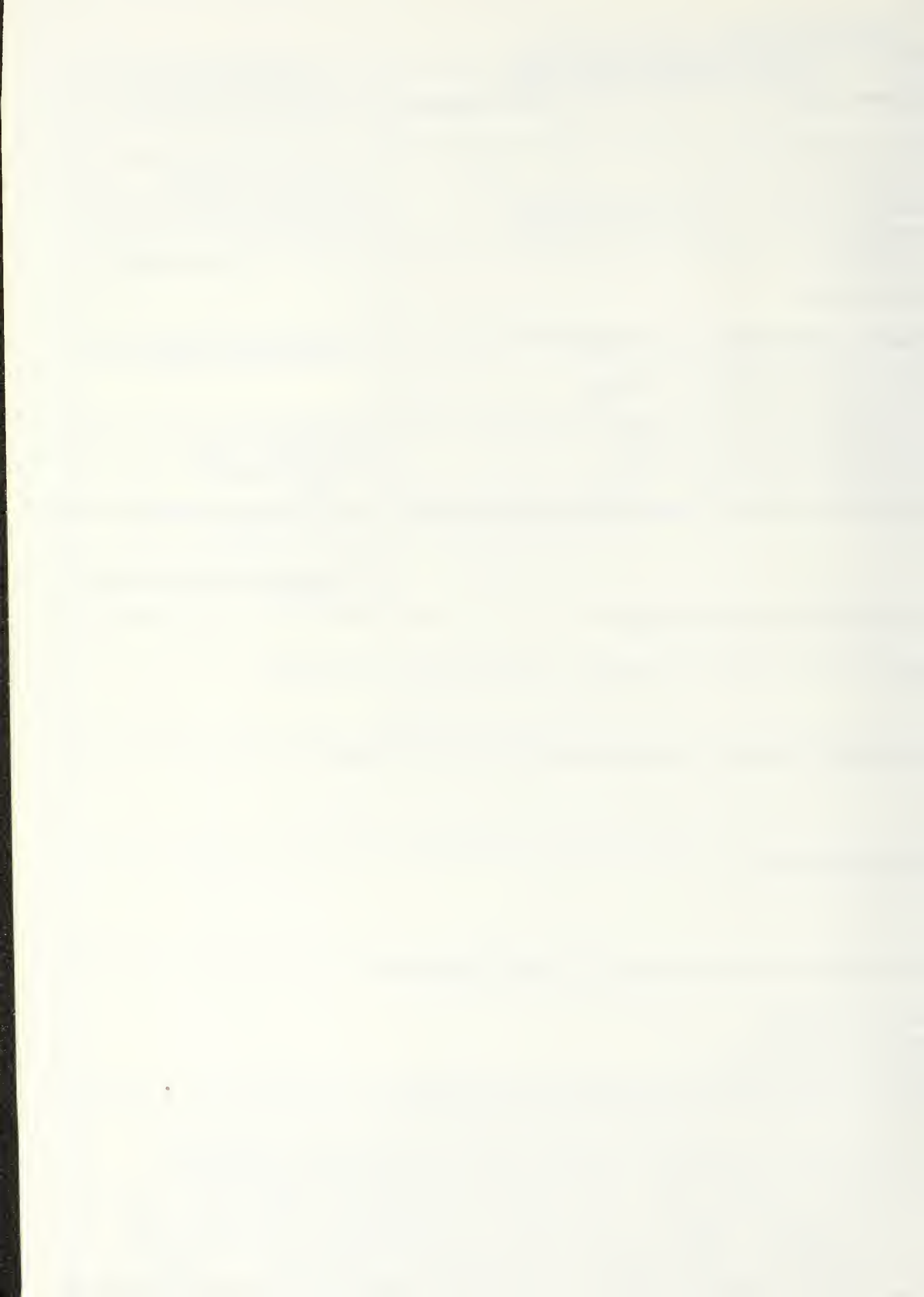
D. P. Gaver

Approved for public release; distribution unlimited.

T20230



REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A Statistical Analysis of Daily and Weekly Rainfall for the Monterey Peninsula, in Central California		5. TYPE OF REPORT & PERIOD COVERED Master's thesis; September 1981
7. AUTHOR(s) Davut Kirca		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE September 1981
		13. NUMBER OF PAGES 222
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report)  Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)  Daily rainfall Weekly rainfall Logistic analysis		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  This thesis presents a preliminary statistical analysis of the daily and weekly rainfall for the Monterey Peninsula, in central California. The analysis begins by examining the daily rainfall data, also the relationship among the length of the storms, amount of rainfall in the storms and length of the successive days of rain. Also included is a study of the distribution of the amount of rainfall in the storms. Also		



## 20. ABSTRACT (continued)

study of the distribution was carried out for non-zero weekly rainfalls. 4x4 contingency tables are used to identify dependence/independence among the weeks in a given month. Also, 2x2 contingency tables are used to examine dependencies between weekly rainfalls; logistic analysis is used as a parameteric model for dependence.

This paper attempts to analyze rainfall data in the statistical sense. No attempt is made to provide a physical explanation of the findings from the point of view of a meteorologist.





Approved for public release, distribution unlimited.

A Statistical Analysis of Daily and Weekly Rainfall  
for the Monterey Peninsula, in Central California

by

Davut Kirca  
Lieutenant, Turkish Navy  
B.S., Naval Postgraduate School, 1981

Submitted in partial fulfillment of the  
requirements for the degree of

MASTER OF SCIENCE IN OPERATIONS RESEARCH

from the

NAVAL POSTGRADUATE SCHOOL  
September, 1981



ABSTRACT

This thesis presents a preliminary statistical analysis of the daily and weekly rainfall for the Monterey Peninsula, in central California. The analysis begins by examining the daily rainfall data, also the relationship among the length of the storms, amount of rainfall in the storms and length of the successive days of rain. Also included is a study of the distribution of the amount of rainfall in the storms. Also study of the distribution was carried out for non-zero weekly rainfalls. 4x4 contingency tables are used to identify dependence/independence among the weeks in a given month. Also, 2x2 contingency tables are used to examine dependencies between weekly rainfalls; logistic analysis is used as a parametric model for dependence.

This paper attempts to analyze rainfall data in the statistical sense. No attempt is made to provide a physical explanation of the findings from the point of view of a meteorologist.



## TABLE OF CONTENTS

I.	INTRODUCTION -----	17
II.	DATA -----	18
	A. GENERAL -----	18
	B. WEEKLY DATA -----	18
III.	ANALYSIS OF STORMS -----	24
	A. GENERAL -----	24
	B. STORMS -----	24
IV.	ANALYSIS OF WEEKLY RAINFALL -----	39
	A. DISTRIBUTION OF POSITIVE WEEKLY RAINFALL ----	39
	1. Theory -----	39
	2. Empirical Distribution of Positive Weekly Rainfall -----	39
	B. SKEWNESS AND KURTOSIS ANALYSIS FOR POSITIVE WEEKLY RAINFALL -----	46
	1. Theory -----	46
	2. Skewness and Kurtosis Analysis for Positive Weekly Rainfall -----	55
	C. 2X2 CONTINGENCY TABLES -----	62
	1. Summary -----	62
	2. Chi-Squared Test for Independence -----	66
	D. 4X4 CONTINGENCY TABLES -----	80
	1. General -----	80
	2. Classification of Rainfall -----	83
	3. Chi-Squared Test for Independence -----	84
	E. LOGISTIC ANALYSIS -----	92



1. Theory -----	92
2. Analysis -----	94
APPENDIX A: DAILY RAINFALL DATA -----	117
APPENDIX B: WEEKLY RAINFALL DATA -----	151
APPENDIX C: WEEKLY AMOUNT OF RAINFALL -----	156
APPENDIX D: EXPONENTIAL DISTRIBUTION -----	172
APPENDIX E: HISTORGRAMS OF AMOUNT OF RAINFALL IN EXACTLY n DAYS LASTING STORMS -----	176
APPENDIX F: PLOT OF EXPONENTIAL SCORES VERSUS OBSERVED SCORES FOR WEEKLY DATA -----	190
LIST OF REFERENCES -----	221
INITIAL DISTRIBUTION LIST -----	222





LIST OF TABLES

1.	MEANS AND VARIANCES FOR WEEKLY RAINFALL (WITH ZERO RAINFALL) -----	20
2.	MEANS AND VARIANCES FOR POSITIVE WEEKLY RAINFALL --	21
3.	MEAN OF LENGTH OF THE NON-RAINY PERIOD FOLLOWING EXACTLY N DAYS LASTING STORMS IN THE 36-YEAR PERIOD -----	35
4.	SOME STATISTICS FOR THE LS, AR, AND LN -----	37
5.	ESTIMATED # OF OCCURRENCES/YEAR FOR THE EXACTLY N DAYS LASTING STORMS IN THE 36-YEAR PERIOD -----	38
6.	MEANS AND VARIANCES FOR POSITIVE WEEKLY RAINFALL --	40
7.	MEANS, STANDARD DEVIATIONS, AND COEFFICIENTS OF VARIATION FOR POSITIVE WEEKLY RAINFALL -----	42
8.	ESTIMATED AND THEORETICAL VALUES OF MEDIAN, LOWER AND UPPER QUARTILE FOR THE POSITIVE WEEKLY RAINFALL -----	47
9.	SLOPES OF THE ESTIMATED VALUES AGAINST THEORETICAL VALUES FOR MEDIAN AND LOWER AND UPPER QUANTILES -----	51
10.	90% CONFIDENCE INTERVAL FOR AVERAGE POSITIVE WEEKLY RAINFALL WITH EXPONENTIAL DISTRIBUTION -----	52
11.	SKEWNESS AND KURTOSIS FOR WEEKLY RAINFALL DATA ----	56
12.	ESTIMATED AND SIMULATED MEANS FOR THE SKEWNESS AND KURTOSIS COEFFICIENTS -----	57
13.	SLOPES FOR SKEWNESS AND KURTOSIS -----	60
14.	ESTIMATED AND SIMULATED VALUES FOR SKEWNESS AND KURTOSIS FOR SAME SAMPLE SIZES -----	61
15.	TEST STATISTICS, APPROXIMATED CHI-SQUARED AND SIGNIFICANCE LEVEL FOR THE WEEKS -----	73
16.	TEST STATISTICS, APPROXIMATED CHI-SQUARED AND SIGNIFICANCE LEVEL FOR THE WEEKS -----	81
17.	AMOUNT OF RAINFALL LIMITS FOR THE WEEKLY RAINFALL IN INCHES -----	84



18.	WEEK NAMES FOR CONSTRUCTING 4X4 CONTINGENCY TABLES -----	85
19.	TEST STATISTIC, APPROXIMATE CHI-SQUARED VALUES, SIGNIFICANCE LEVEL FOR THE MONTH -----	91
20.	RESULTS OF THE LOGISTIC ANALYSIS FOR THE WEEKS ----	96
21.	RESULT OF LOGISTIC ANALYSIS FOR THE WEEKS -----	107
22.	ESTIMATED AND SIMULATED VALUES FOR SKEWNESS AND KURTOSIS FOR SAME SAMPLE SIZES -----	175



LIST OF FIGURES

1.	Weekly means and variances for the weeks zero rainfalls included -----	22
2.	Weekly means and variances for the positive weekly rainfalls -----	23
3.	Time series plot of the LS for December-February --	26
4.	Time series plot of the AR for December-February --	27
5.	Time series plot of the LN for December-February --	28
6.	Plot of the LS against AR for October-April ---	29
7.	Plot of the LS against LN for October-April ---	30
8.	Plot of the LN against AR for October-April -----	31
9.	Plot of the LS against AR for December-February ---	32
10.	Plot of the LS against LN for December-February ---	33
11.	Plot of the LN against AR for December-February ---	34
12.	Plot of the LS against mean of the non-rainy period for October-April and December-February ----	36
13.	Weekly means and variances for the positive weekly rainfall data in the 36-year period -----	41
14.	Weekly coefficients of variation for the positive weekly rainfalls in the 36-year period ---	44
15.	Plot of means against standard deviations for the positive weekly rainfall in the 36-year period ----	45
16.	Plot of estimated median against theoretical median for positive weekly rainfall -----	48
17.	Plot of estimated L-quartile against theoretical L-quartile for positive weekly rainfall -----	49
18.	Plot of estimated U-quartile against theoretical U-quartile for positive weekly rainfall -----	50
19.	Weekly skewness and kurtosis coefficients for the positive weekly rainfall -----	58



20.	Plot of weekly skewness against weekly kurtosis for positive weekly rainfall -----	59
21.	Plot of estimated skewness against simulated skewness for the positive weekly rainfall -----	63
22.	Plot of estimated kurtosis against simulated kurtosis for the positive weekly rainfall -----	64
23.	Typical 2x2 contingency table -----	65
24.	2x2 Contingency tables for weeks 01, 02, 03, 04, ON, N1 -----	67
25.	2x2 Contingency tables for weeks N2, N3, N4, D1, D2, D3, D4 -----	68
26.	2x2 Contingency tables for weeks for weeks D4, J1, J2, J3, J4, JF, F1 -----	69
27.	2x2 Contingency tables for weeks F1, F2, F3, FM, M1, M2, M3 -----	70
28.	2x2 Contingency tables for weeks M3, M4, A1, A2, A3, A4, AM -----	71
29.	2x2 Contingency tables for weeks 01, 02, 03, 04, ON, N1 -----	75
30.	2x2 Contingency tables for weeks N2, N3, N4, D1, D2, D3, D4 -----	76
31.	2x2 Contingency tables for weeks D4, J1, J2, J3, J4, JF, F1 -----	77
32.	2x2 Contingency tables for weeks F1, F2, F3, FM, M1, M2, M3 -----	78
33.	2x2 Contingency tables for weeks M3, M4, A1, A2, A3, A4, AM -----	79
34.	Typical 4x4 contingency table -----	80
35.	4x4 contingency table for October -----	87
36.	4x4 contingency table for November -----	87
37.	4x4 contingency table for December -----	88
38.	4x4 contingency table for January -----	88
39.	4x4 contingency table for February -----	89





40.	4x4 contingency table for March -----	89
41.	4x4 contingency table for April -----	90
42.	Plot of alpha coefficient for the weeks -----	115
43.	Plot of beta coefficient for the weeks -----	116
44.	Weekly rainfall in inches for weeks 01 and 02 -----	156
45.	Weekly rainfall in inches for weeks 03 and 04 -----	157
46.	Weekly rainfall in inches for weeks 0N and N1 -----	158
47.	Weekly rainfall in inches for weeks N2 and N3 -----	159
48.	Weekly rainfall in inches for weeks N4 and D1 -----	160
49.	Weekly rainfall in inches for weeks D2 and D3 -----	161
50.	Weekly rainfall in inches for weeks D4 and J1 -----	162
51.	Weekly rainfall in inches for weeks J2 and J3 -----	163
52.	Weekly rainfall in inches for weeks J4 and JF -----	164
53.	Weekly rainfall in inches for weeks F1 and F2 -----	165
54.	Weekly rainfall in inches for weeks F3 and FM -----	166
55.	Weekly rainfall in inches for weeks M1 and M2 -----	167
56.	Weekly rainfall in inches for weeks M3 and M4 -----	168
57.	Weekly rainfall in inches for weeks A1 and A2 -----	169
58.	Weekly rainfall in inches for weeks A3 and A4 -----	170
59.	Weekly rainfall in inches for week AM -----	171
60.	Histogram of the LS in days for October through April in the 36-year period -----	176
61.	Histogram of the LS in days for December through February in the 36-year period -----	177
62.	Histogram of the AR in inches in all storms for October through April in the 36-year period -----	178
63.	Histogram of the AR in inches in all storms for December through February in the 36-year period ---	179



64.	Histogram of the LN in days for October through April in the 36-year period -----	180
65.	Histogram of the LN in days for December through February in the 36-year period -----	181
66.	Histogram of AR in inches in the exactly 1 day lasting storms for October through April in the 36-year period -----	182
67.	Histogram of the AR in inches in the exactly 1 day lasting storms for December through February in the 36-year period -----	183
68.	Histogram of the AR in inches in the exactly 2 days lasting storms for October through April in the 36-year period -----	184
69.	Histogram of the AR in inches in the exactly 2 days lasting storms for December through February in the 36-year period -----	185
70.	Histogram of the AR in inches in the exactly 3 days lasting storms for October through April in the 36-year period -----	186
71.	Histogram of the AR in inches in the exactly 3 days lasting storms for December through February in the 36-year period -----	187
72.	Histogram of AR in inches in the exactly 4 days lasting storms for October through April in the 36-year period -----	188
73.	Histogram of AR in inches in the exactly 4 days lasting storms for December through February in the 36-year period -----	189
74.	Exponential scores versus observed scores for week 01 -----	190
75.	Exponential scores versus observed scores for week 02 -----	191
76.	Exponential scores versus observed scores for week 03 -----	192
77.	Exponential scores versus observed scores for week 04 -----	193
78.	Exponential scores versus observed scores for week ON -----	194



79.	Exponential scores versus observed scores for week N1 -----	195
80.	Exponential scores versus observed scores for week N2 -----	196
81.	Exponential scores versus observed scores for week N3 -----	197
82.	Exponential scores versus observed scores for week N4 -----	198
83.	Exponential scores versus observed scores for week D1 -----	199
84.	Exponential scores versus observed scores for week D2 -----	200
85.	Exponential scores versus observed scores for week D3 -----	201
86.	Exponential scores versus observed scores for week D4 -----	202
87.	Exponential scores versus observed scores for week J1 -----	203
88.	Exponential scores versus observed scores for week J2 -----	204
89.	Exponential scores versus observed scores for week J3 -----	205
90.	Exponential scores versus observed scores for week J4 -----	206
91.	Exponential scores versus observed scores for week JF -----	207
92.	Exponential scores versus observed scores for week F1 -----	208
93.	Exponential scores versus observed scores for week F2 -----	209
94.	Exponential scores versus observed scores for week F3 -----	210
95.	Exponential scores versus observed scores for week FM -----	211
96.	Exponential scores versus observed scores for week M1 -----	212



97.	Exponential scores versus observed scores for week M2 -----	213
98.	Exponential scores versus observed scores for week M3 -----	214
99.	Exponential scores versus observed scores for week M4 -----	215
100.	Exponential scores versus observed scores for week A1 -----	216
101.	Exponential scores versus observed scores for week A2 -----	217
102.	Exponential scores versus observed scores for week A3 -----	218
103.	Exponential scores versus observed scores for week A4 -----	219
104.	Exponential scores versus observed scores for week AM -----	220





GLOSSARY OF SYMBOLS

JULIAN

WEEK	DATE	DESCRIPTION
----	----	-----
J1:	001-007	is first week of January.
J2:	008-014	is second week of January.
J3:	015-021	is third week of January.
J4:	022-028	is fourth week of January.
JF:	029-035	is end of January--beginning of February.
F1:	035-042	is first week of February.
F2:	043-049	is second week of February.
F3:	050-056	is third week of February.
FM:	056--63	is end of February--beginning of March.
M1:	064-070	is first week of March.
M2:	071-077	is second week of March.
M3:	078-084	is third week of March.
M4:	085-091	is fourth week of March.
A1:	092-098	is first week of April.
A2:	099-105	is second week of April.
A3:	106-112	is third week of April.
A4:	113-119	is fourth week of April.
AM:	120-126	is end of April--beginning of May.
O1:	272-278	is first week of October.
O2:	279-285	is second week of October.
O3:	286-292	is third week of October.



O4: 292-299 is fourth week of October.  
ON: 300-306 is end of October-beginning of November.  
N1: 307-313 is first week of November.  
N2: 314-320 is second week of November.  
N3: 321-327 is third week of November.  
N4: 328-334 is fourth week of November.  
D1: 335-341 is first week of December.  
D2: 342-348 is second week of December.  
D3: 349-355 is third week of December.  
D4: 356-362 is fourth week of December.



## I. INTRODUCTION

The Monterey Peninsula Water District, in the central California coastal area, has as one of its responsibilities the duty to recommend and/or impose water rationing on its constituents.

To do this in a rational way requires the district to have some way for predicting future water availability. This thesis analyzes rainfall data for the Forest Lake station of Monterey by purely statistical methodology in order to identify possible ways for predicting future water availability.

No strong evidence for useful procedures has been uncovered in this thesis, although some weak indications of possible dependencies have been found.



## II. DATA

### A. GENERAL

Daily and weekly rainfall data were used in this analysis. The data were accumulated at the Forest Lake station of Monterey, in Central California. Rainfall data has been gathered by the California American-Water Company since 1891.

Although this data set started quite early, the data prior to 1938 has frequent missing observations. Therefore this data set includes observations from January 1938 through December 1974. Appendix A contains a listing of the daily rainfall data.

Weekly rainfall amounts have been obtained by summing daily rainfall amounts, starting from the beginning of October and running to the end of the April (which is considered the rainy season for Monterey Peninsula area) for the 36-year period (1938-1939 through 1973-1974). A week is defined in terms of Julian dates rather than the usual calendar week. For example the first week of January is defined to include the first seven days of the year. For other definitions of weeks, see the Table of Symbols.

### B. WEEKLY DATA

Appendix B contains a listing of weekly rainfall data. Appendix C shows plots of the weekly rainfall. As can be seen the data are strongly seasonal. This is enough to indicate that it is quite non-stationary.





Means and variances of the weekly rainfall are shown in Tables 1 and 2 for weeks with and without positive rainfall respectively. Figures 1 and 2 show plots of means and variances for weeks with and without positive rainfalls. On the figures week 1 represents the first week of October as 01 and week 31 represents the end of April and beginning of May as AM.



Table 1 : MEANS AND VARIANCES FOR WEEKLY  
RAINFALL (WITH ZERO RAINFALL)

WEEK	MEAN	VARIANCE
----	-----	-----
O1	0.07	0.04
O2	0.20	0.15
O3	0.16	0.11
O4	0.15	0.09
ON	0.23	0.28
N1	0.44	0.40
N2	0.77	1.08
N3	0.50	0.85
N4	0.55	1.32
D1	0.71	0.65
D2	0.39	0.37
D3	0.57	0.36
D4	1.04	1.87
J1	0.60	0.80
J2	0.79	0.98
J3	0.85	1.20
J4	0.73	0.73
JP	0.92	1.11
F1	0.74	0.85
F2	0.50	0.36
F3	0.67	0.80
FM	0.86	1.28
M1	0.54	0.37
M2	0.67	0.66
M3	0.47	0.37
M4	0.72	1.34
A1	0.52	0.65
A2	0.25	0.16
A3	0.24	0.25
A4	0.30	0.13
AM	0.13	0.03



Table 2: MEANS AND VARIANCES FOR POSITIVE WEEKLY RAINFALL

WEEK	MEAN	VARIANCE
-----	-----	-----
O1	0.29	0.11
O2	0.42	0.22
O3	0.36	0.18
O4	0.37	0.15
ON	0.58	0.53
N1	0.79	0.45
N2	0.99	1.18
N3	0.94	1.22
N4	0.89	1.88
D1	0.91	0.65
D2	0.63	0.45
D3	0.73	0.34
D4	1.55	2.00
J1	0.83	0.92
J2	1.13	1.02
J3	1.46	1.17
J4	0.97	0.74
JF	1.14	1.13
F1	0.98	0.89
F2	0.67	0.36
F3	1.15	0.83
FM	1.03	1.36
M1	0.61	0.38
M2	0.86	0.69
M3	0.67	0.40
M4	1.13	1.65
A1	0.90	0.78
A2	0.42	0.18
A3	0.61	0.42
A4	0.50	0.12
AM	0.26	0.03



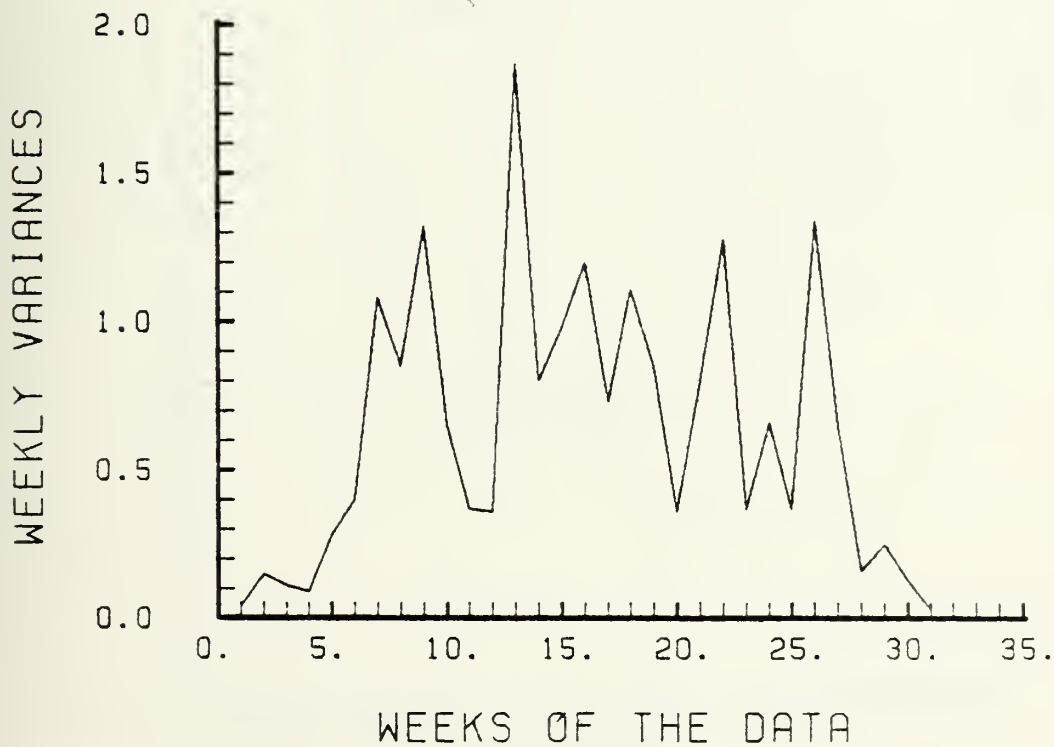
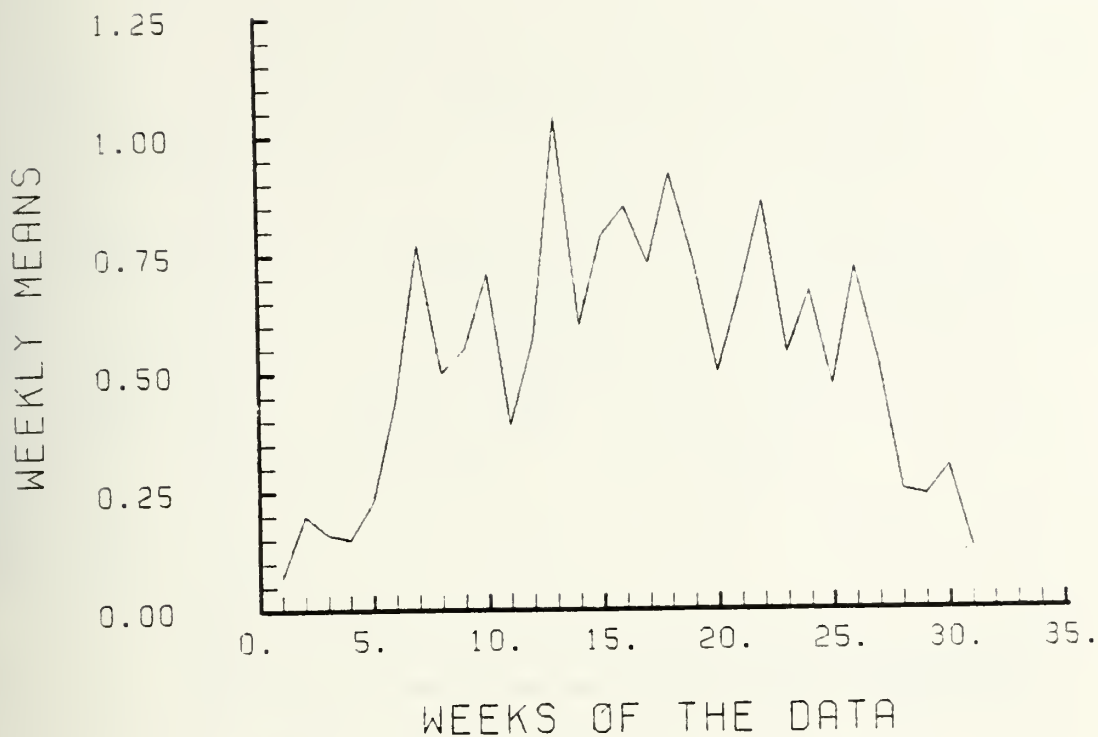


Figure 1. Weekly means and variances for the weeks zero rainfalls included.





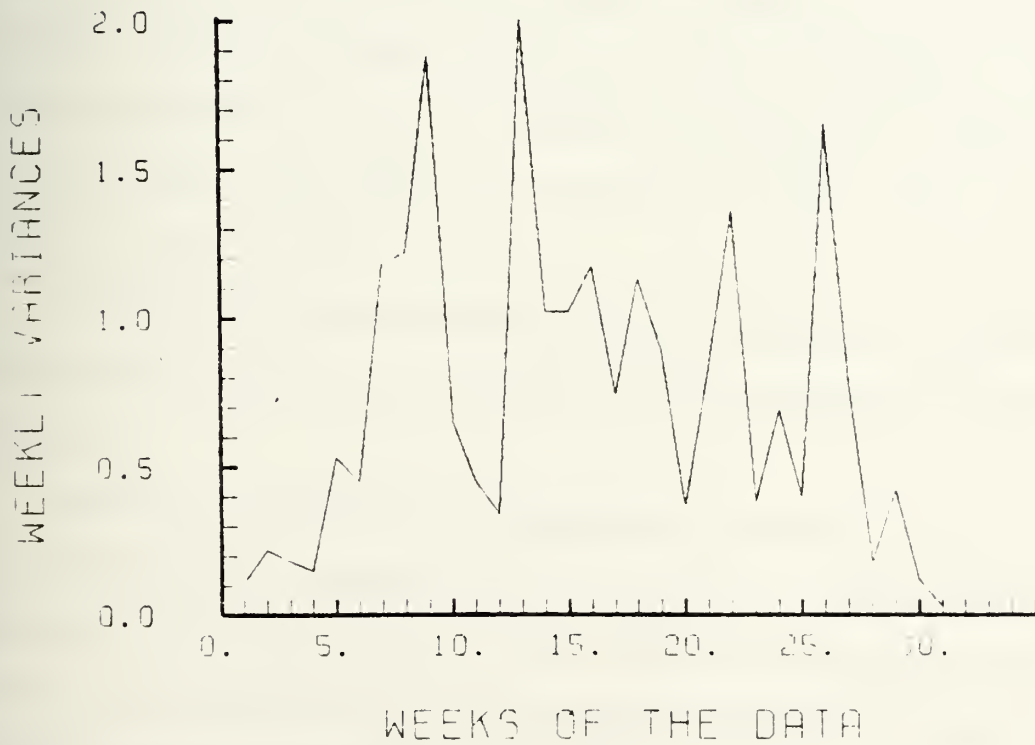
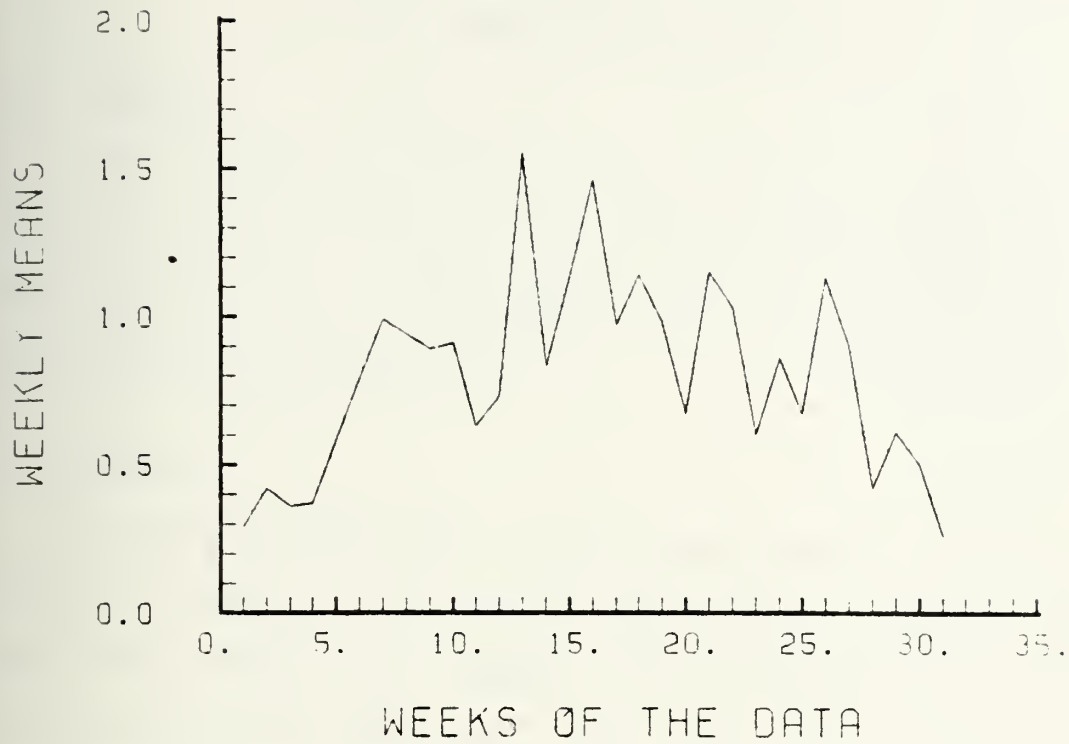


Figure 2. Weekly means and variances for the positive weekly rainfalls



### III. ANALYSIS OF STORMS

#### A. GENERAL

This analysis is carried out on rainfall data from October to May for a 36-year period (1938-1939 through 1973-1974). The rainy period is considered to run from October to May for the Monterey Peninsula.

#### B. STORMS

It will be said that a storm lasts exactly  $n$  days if there are exactly  $n$  consecutive days having rainfall greater than 0.02 inches. For example, if on January 10th there is no rainfall and on the 11th, 12th, and 13th of January there are 0.30", 0.15", 1.15" recorded in inches of rain respectively, and on the 14th of January there is again no rainfall, this means that a storm of length of duration 3 days has occurred, and the amount of rainfall in this storm is 1.60" ( $0.30 + 0.15 + 1.15 = 1.60$ ).

Based on the above definition the historical lengths of storms and the amount of rainfall in the storms will be examined.

Appendix E shows the histograms of length of the storms, as denoted by LS, amount of the rainfall in the storms, as denoted by AR, and length of the non-rainy period after the storms, as denoted by LN for October through April and December through February in the 36-year period. The rainy period in the December through February months is more



homogeneous than the October through April period so for this reason the December through February period is also examined. Figures 3 through 5 show the time series plots of the LS, AR, and the LN in the 36-year period. On the figures, dot (.) indicates the beginning of each year from 1938-1939 through 1973-1974. Figures 6 through 11 show the plot of LS against AR, LS against LN, and LN against AR for the October through April and December through February months in the 36-year period.

Plots of LS versus LN indicates that if the length of the storms is small then the following non-rainy period (dry period) is large. Table 3 shows the LS and the mean of the length of the following non-rainy period for the October through April and December through February months. Figure 12 shows the LS versus the mean of the following non-rainy period for the October through April and December through February in the 36-year period. The length of the storms (LS) and amount of the rainfall (AR) in the storms appear to have a linear relationship. By using median methods the slope of the length of the storms against the amount of the rainfall in the storm was computed as 0.71 for October through April and 0.79 for December through February.

Here are some statistics from the histograms of LS, AR, and LN (Table 4).

Appendix E shows the histograms of the amount of rainfalls in exactly n days lasting storms which are made for



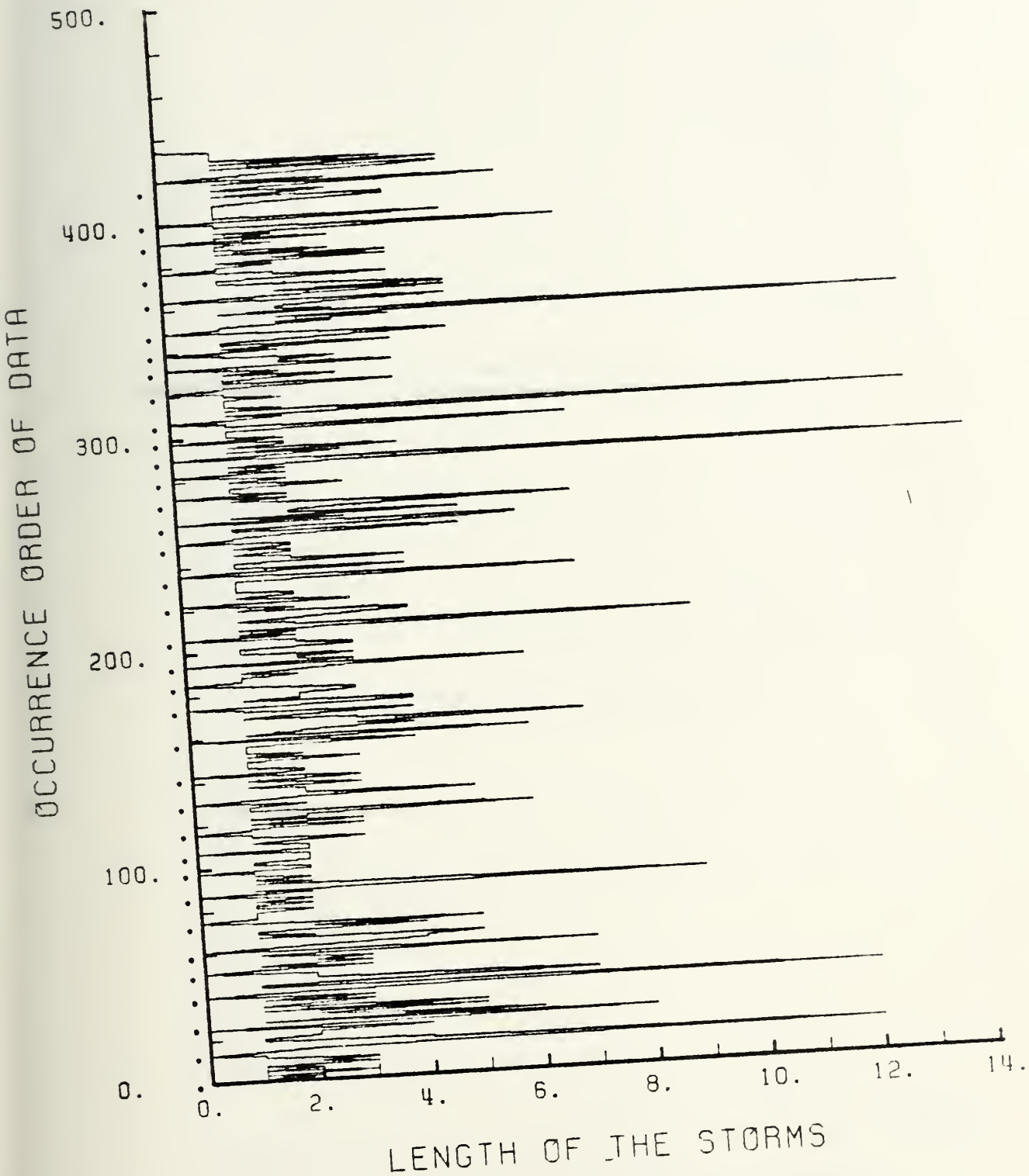


Figure 3. Time series plot of the LS for December-February.





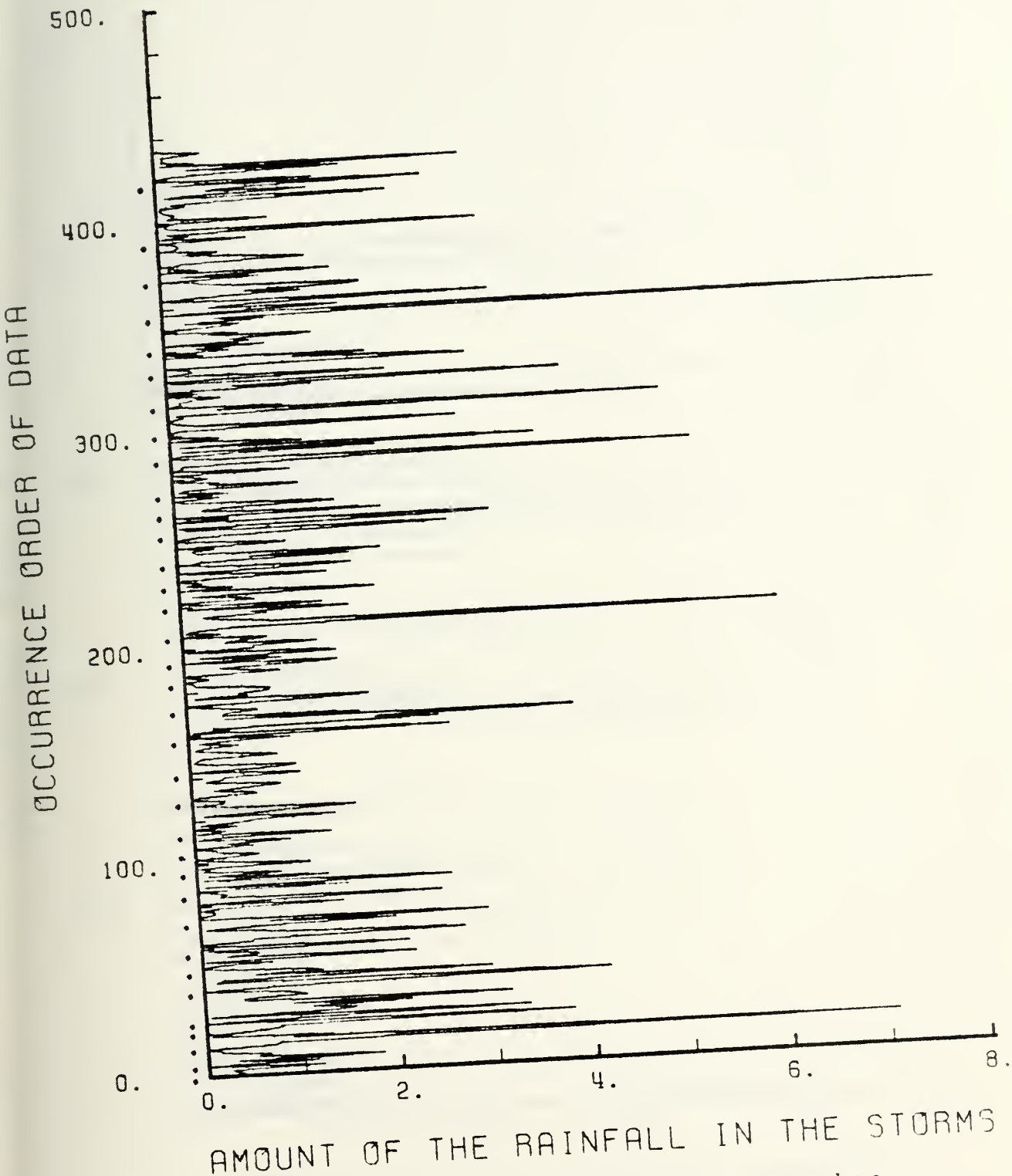


Figure 4. Time series plot of the AR for December-February.



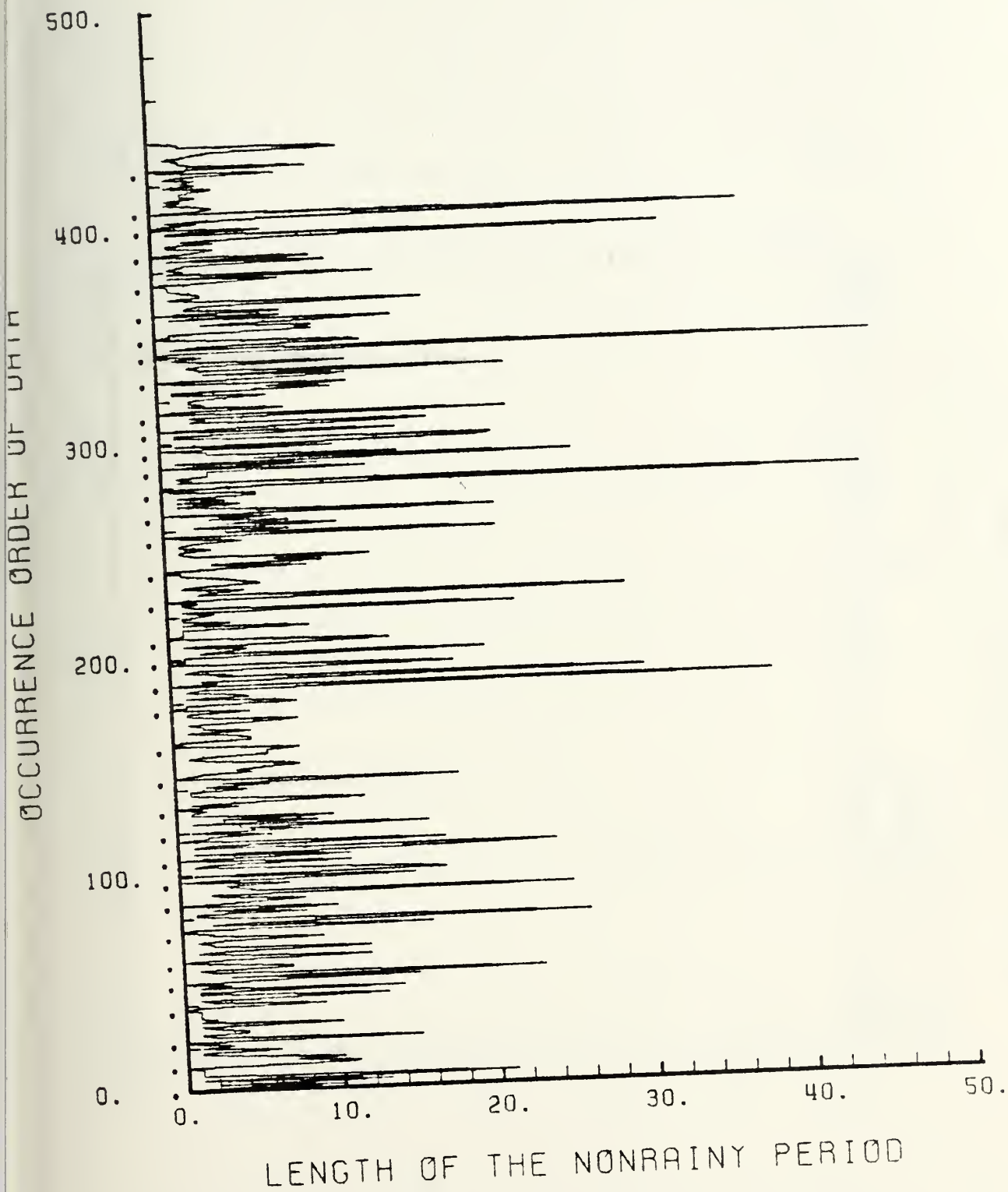


Figure 5. Time series plot of the LN for December-February.



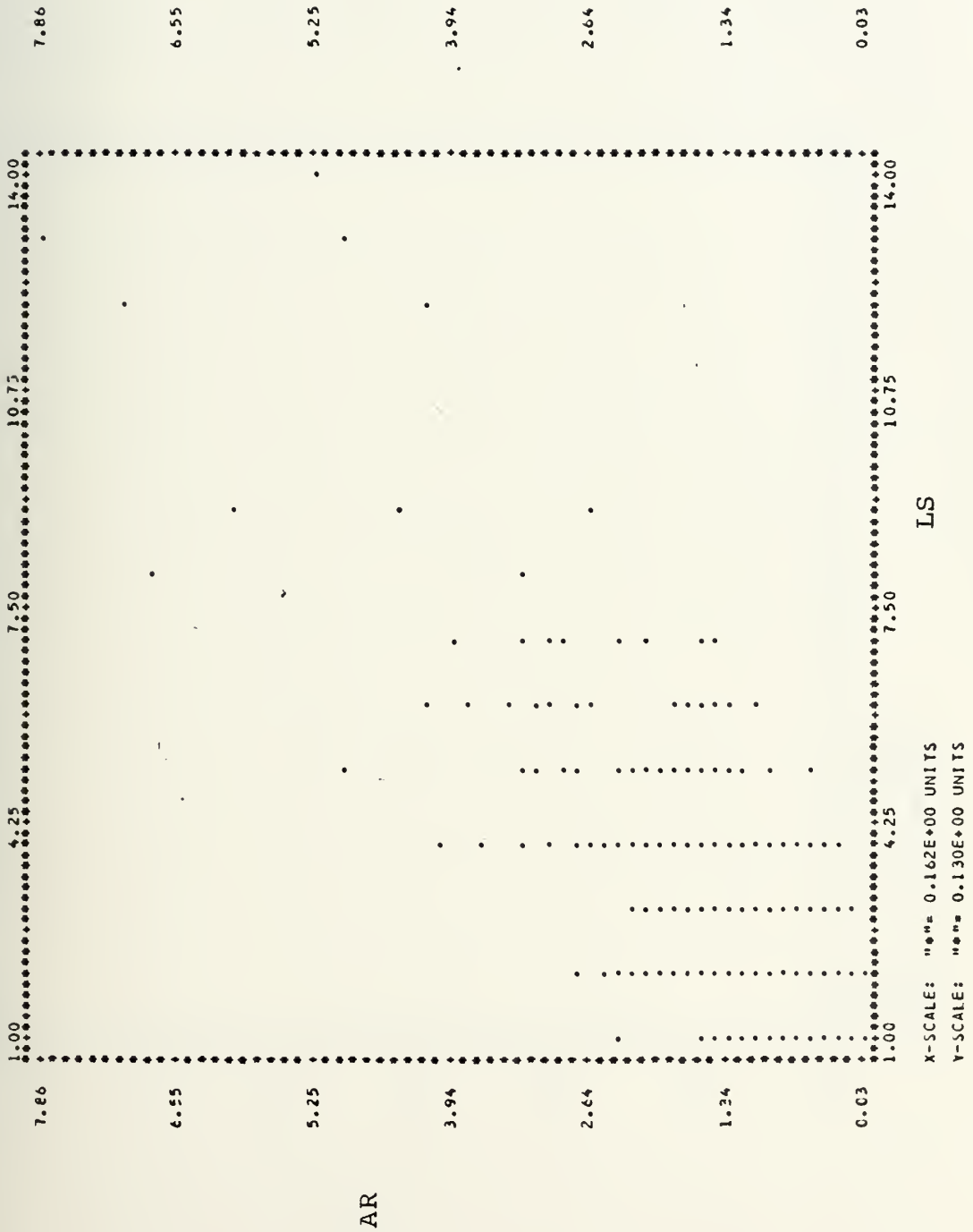


Figure 6. Plot of the LS against AR for October-April



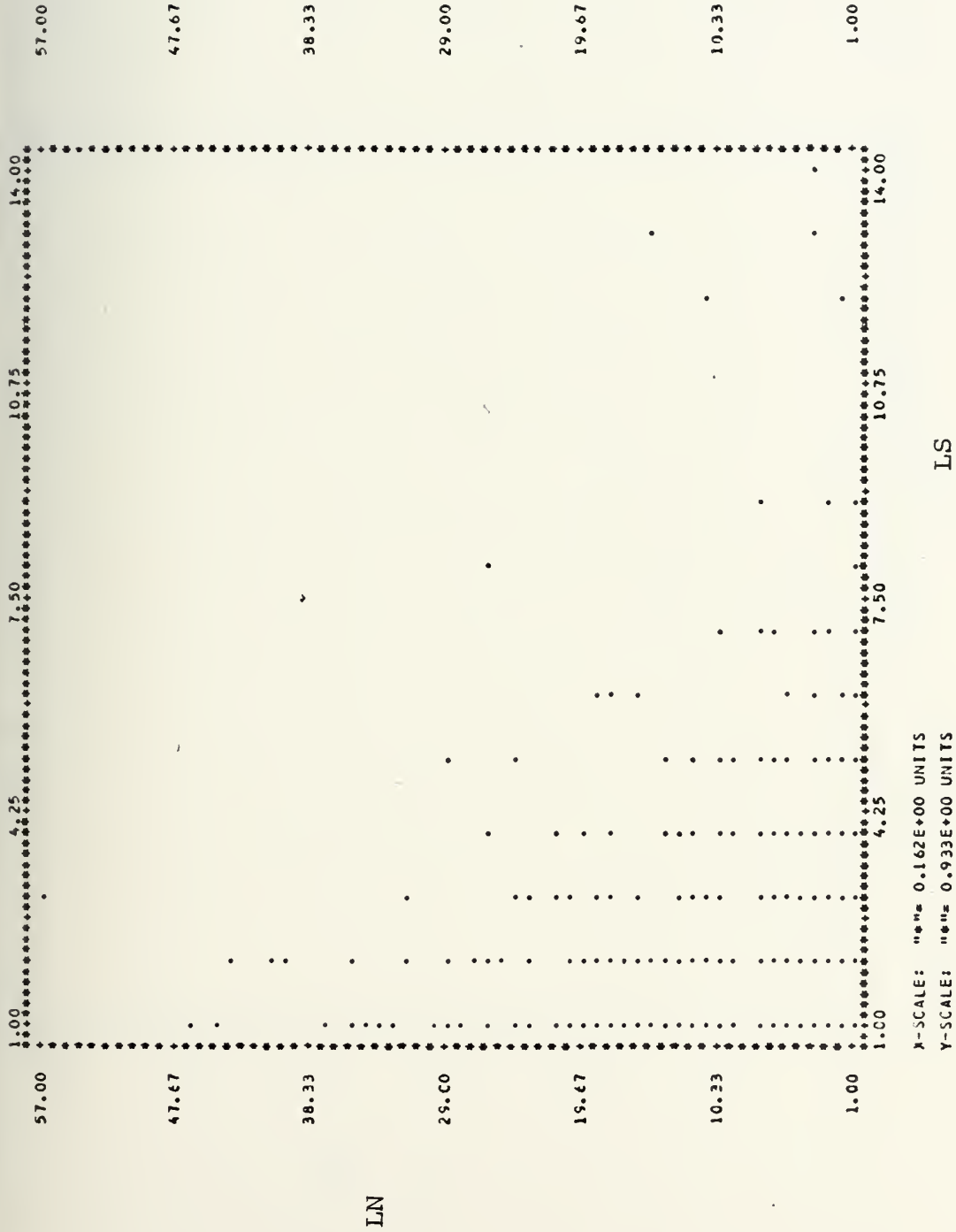


Figure 7. Plot of the LS against LN for October-April





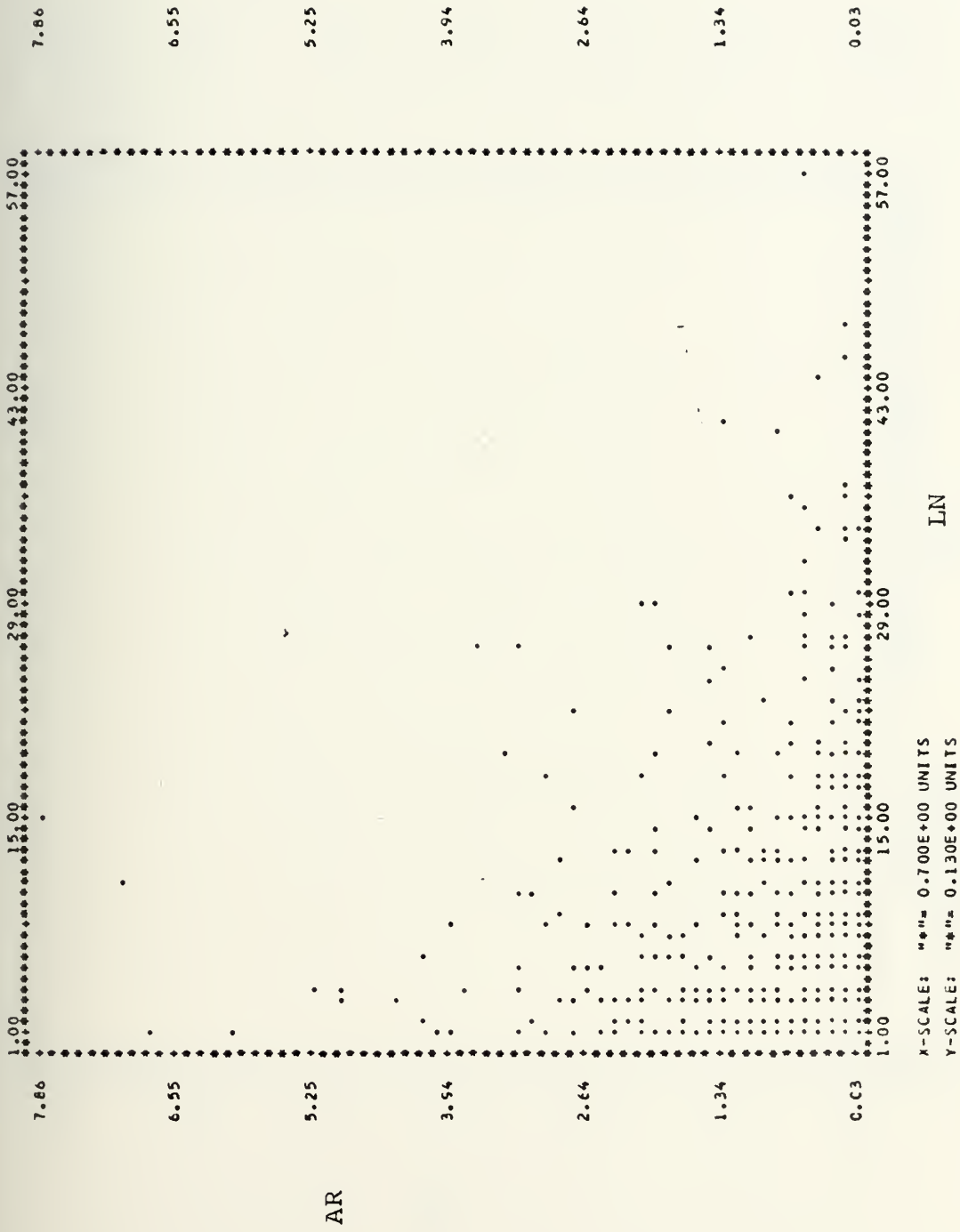


Figure 8. Plot of the LN against AR for October-April



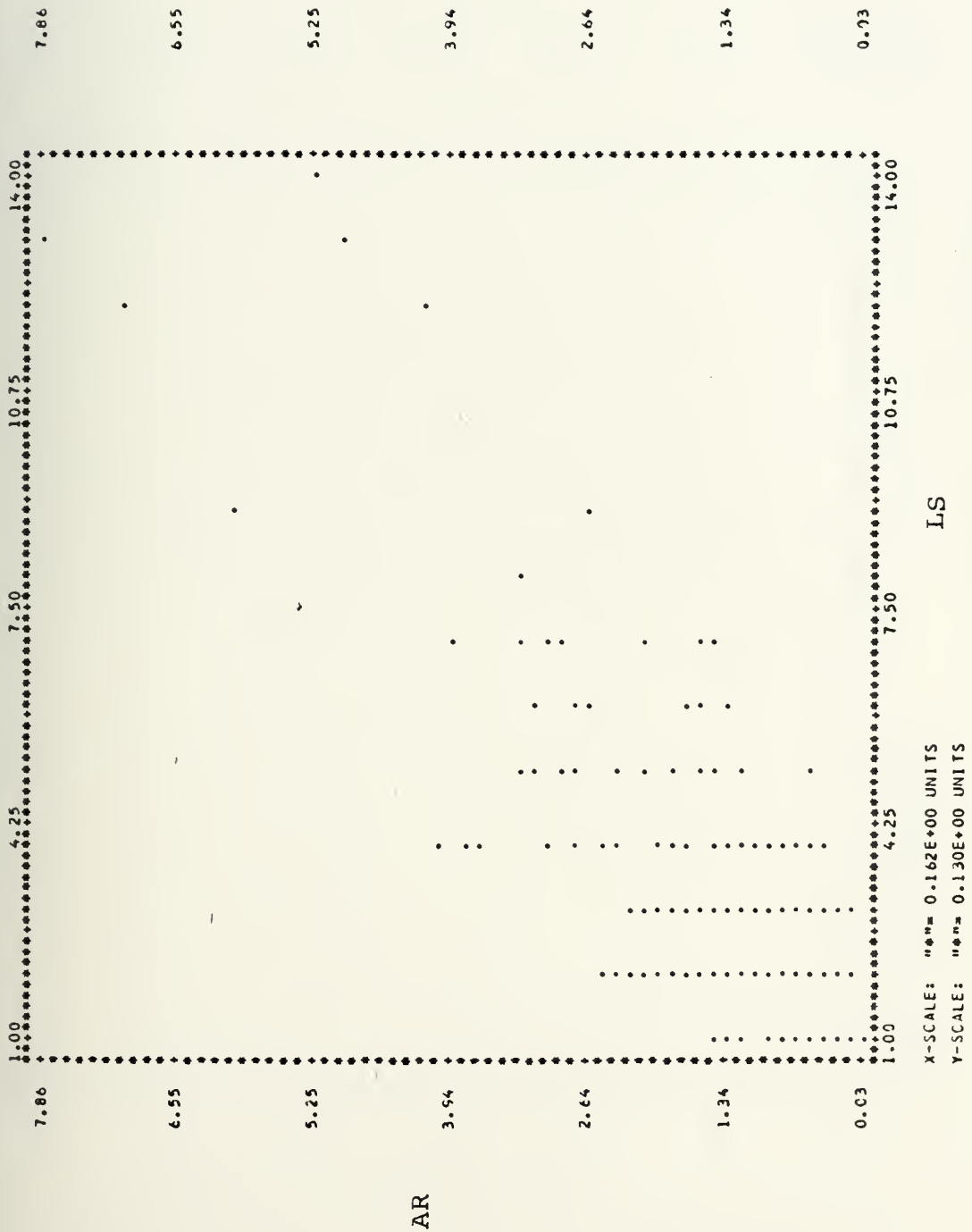


Figure 9. Plot of the LS against AR for December-February



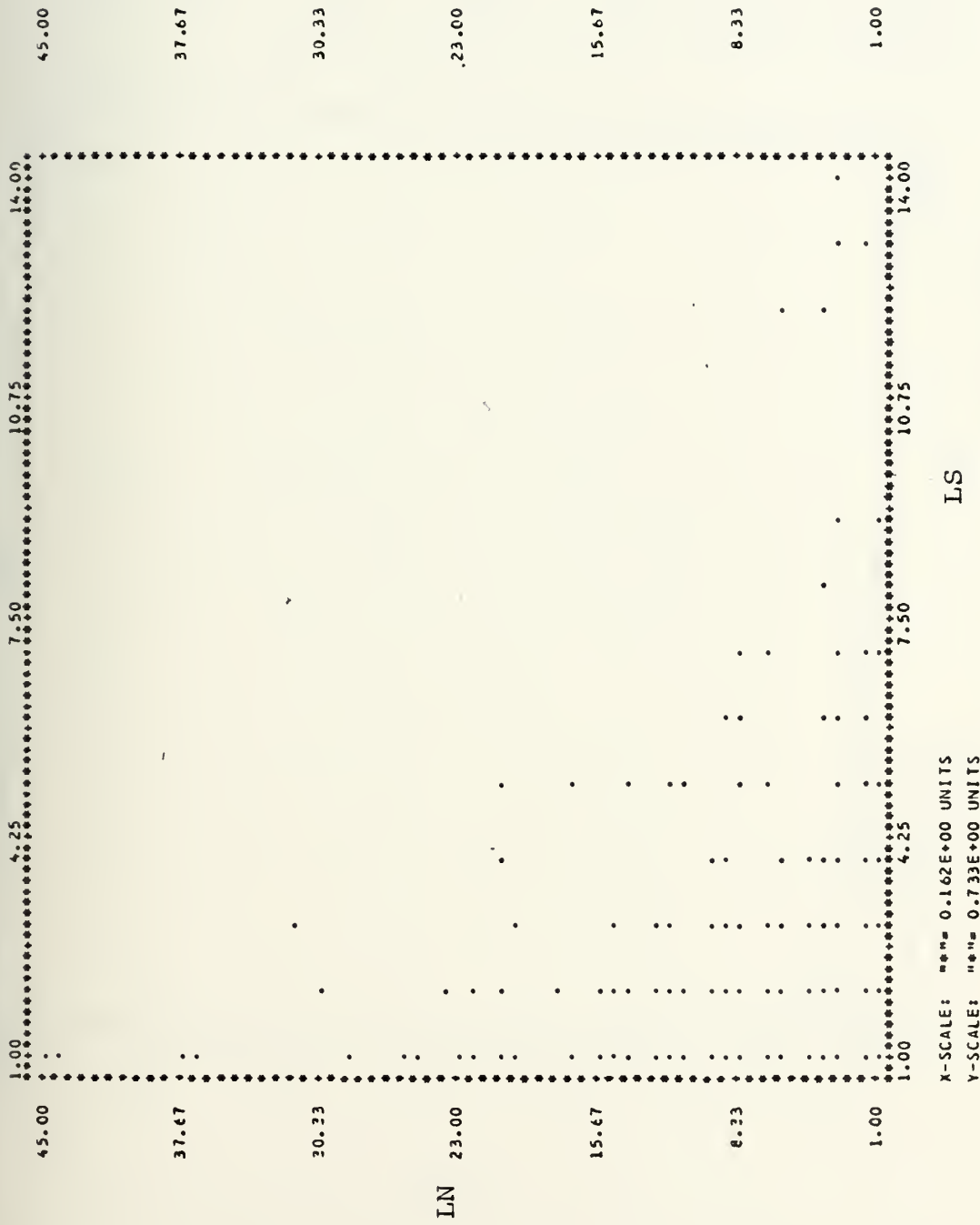
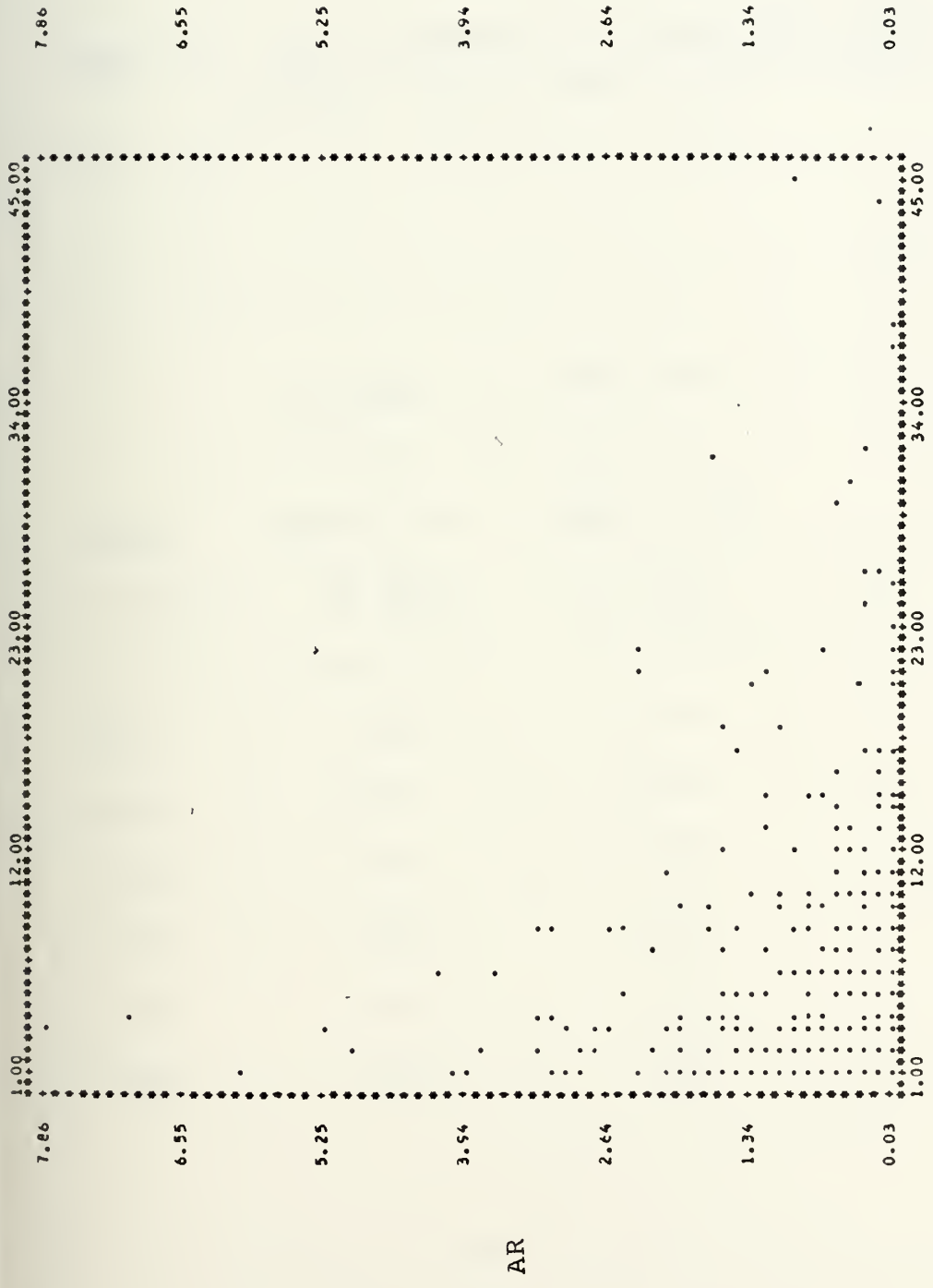


Figure 10. Plot of the LS against LN for December-February





X-SCALE: "\*"= 0.550E+00 UNITS  
 Y-SCALE: "\*"= 0.130E+00 UNITS

LN

Figure 11. Plot of the LN against AR for December-February





Table 3: MEAN OF LENGTH OF THE NON-RAINY PERIOD FOLLOWING EXACTLY N DAYS LASTING STORMS IN THE 36-YEAR PERIOD.

	OCT-APR	DEC-FEB
	-----	-----
STORM	MEAN OF LN	MEAN OF LN
IN DAYS	IN DAYS	IN DAYS
-----	-----	-----
LS=1	7.33	6.04
LS=2	6.71	5.92
LS=3	6.47	5.34
LS=4	6.66	3.83
LS=5	6.44	6.17
LS <sub>&gt;</sub> 6	5.91	3.76



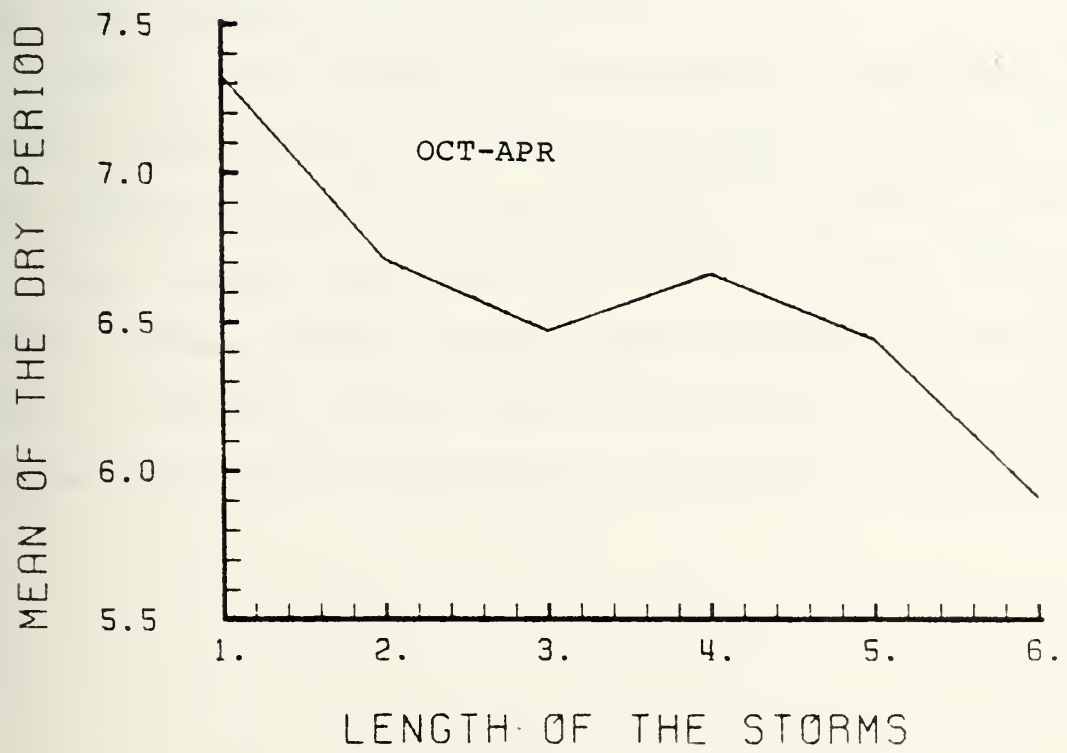
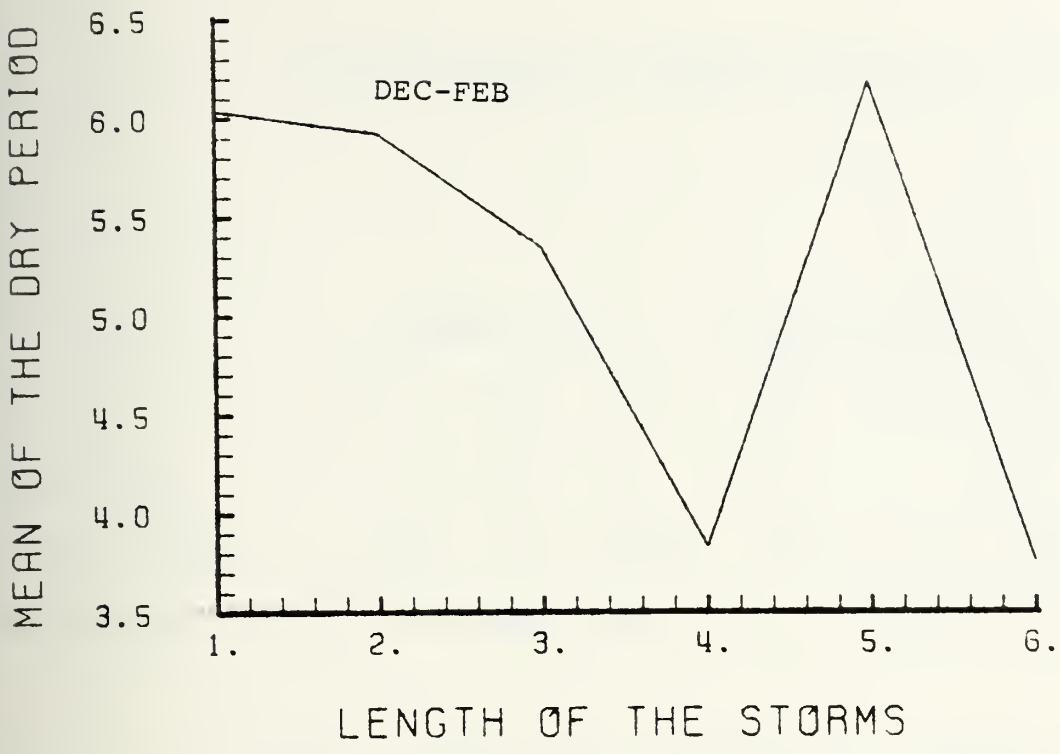


Figure 12. Plot of the LS against mean of the non-rainy period for October-April and December-February



Table 4: SOME STATISTICS FOR THE LS, AR, AND LN

	OCTOBER-APRIL			DECEMBER-FEBRUARY		
	Min.	Mean	Max.	Min.	Mean	Max.
LS in days	1.	2.09	14.	1.	2.31	14.
AR in inches	0.03	0.71	7.86	0.03	0.83	7.86
LN in days	1.	6.86	57.	1.	5.64	45.

n = 1, 2, 3, 4 days in the 36-year period for October through April and December through February.

From the total number of occurrences for each exactly n days lasting storms estimated of occurrences for a year were computed in the following way and are shown in Table 5.

This suggests that many of the small storms, especially exactly one day lasting storms, occur during the months of October, November, March, and April and many of the large storms occur during the months of December, January, February.



Table 5: ESTIMATED # OF OCCURRENCES/YEAR FOR THE EXACTLY  
 N DAYS LASTING STGRMS IN THE 36-YEAR PEPIOD.

	OCT, NOV, MAR, APR	DEC, JAN, FEB
	-----	-----
STORMS	ESTIMATED	ESTIMATED
(EXACTLY)	OCCURRENCE/YEAR	OCCURRENCE/YEAR
-----	-----	-----
LS=1	6.52	4.64
LS=2	2.97	3.17
LS=3	1.06	1.31
LS=4	0.78	0.84
LS=5	0.28	0.47
LS <sub>&gt;</sub> 6	0.36	0.58





#### IV. ANALYSIS OF WEEKLY RAINFALL

##### A. DISTRIBUTION OF POSITIVE WEEKLY RAINFALL

###### 1. Theory

In this section we will explore the distribution of positive weekly amounts of rainfall. A week is said to have a positive amount of rainfall if the amount of rain exceeds 0.02 inches. Table 6 is a listing of estimates of means and variances for positive weekly rainfalls. They were computed by using the program "HISTG". Figure 13 shows a plot of the weekly means and variances respectively. The pattern of weekly means again indicates nonstationarity of rainfall with more rain on the average falling during the weeks D4, J2, J3, JF, F3, FM, M4 where the average amount of rainfall in these weeks is more than 1.00 inches.

###### 2. Empirical Distribution of Positive Weekly Rainfall

In order to fit a theoretical distribution to the positive weekly rainfall it is necessary to use some statistics computed from the data such as the mean, median, variance, standard deviation, quartiles, coefficients of variation, and skewness and kurtosis coefficients. Agreement of these statistics with the theoretical values for the exponential model (or some others) helps to identify and support that model.

Table 7 shows a listing of means, standard deviations, and coefficients of variation of the non-zero (positive)



Table 6: MEANS AND VARIANCES FOR POSITIVE WEEKLY RAINFALL

WEEK	MEAN	VARIANCE
----	----	-----
O1	0.29	0.11
O2	0.42	0.22
O3	0.36	0.18
O4	0.37	0.15
ON	0.58	0.53
N1	0.79	0.45
N2	0.99	1.18
N3	0.94	1.22
N4	0.89	1.88
D1	0.91	0.65
D2	0.63	0.45
D3	0.73	0.34
D4	1.55	2.00
J1	0.83	0.92
J2	1.13	1.02
J3	1.46	1.17
J4	0.97	0.74
JF	1.14	1.13
F1	0.98	0.89
F2	0.67	0.36
F3	1.15	0.83
FM	1.03	1.36
M1	0.61	0.38
M2	0.86	0.69
M3	0.67	0.40
M4	1.13	1.65
A1	0.90	0.78
A2	0.42	0.18
A3	0.61	0.42
A4	0.50	0.12
AM	0.26	0.03



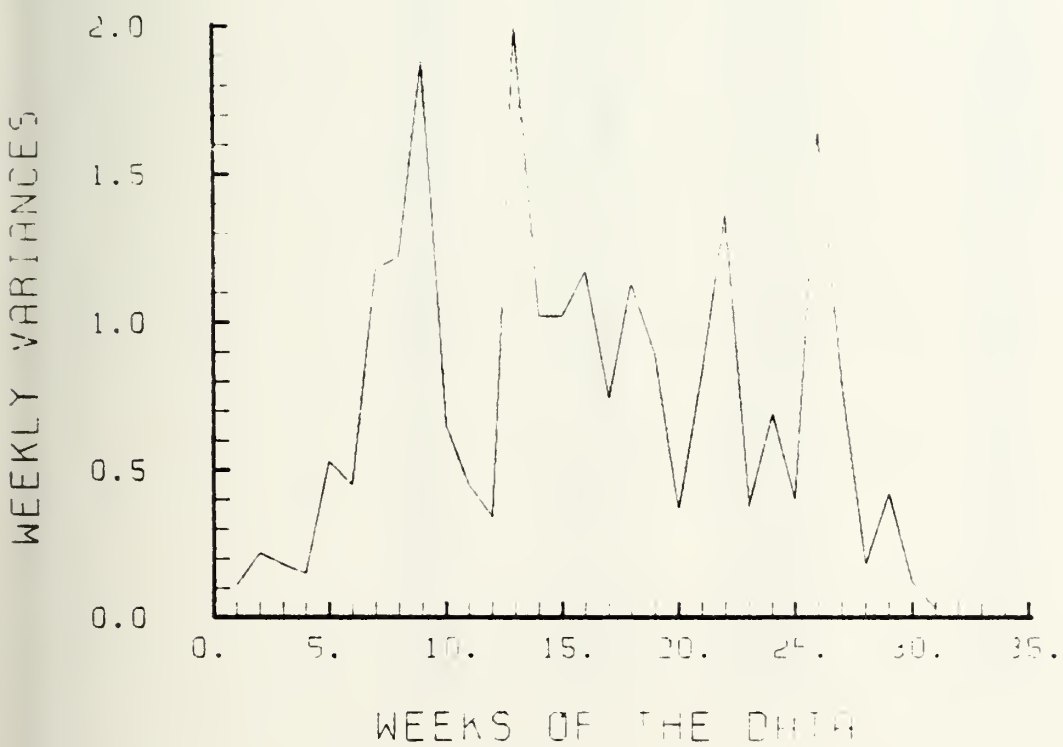


Figure 13. Weekly means and variances for the positive weekly rainfall data in the 36-year period



Table 7: MEANS, STANDARD DEVIATIONS, AND COEFFICIENTS OF VARIATION FOR POSITIVE WEEKLY RAINFALL.

WEEK	MEAN	STANDARD DEVIATIONS	COEFFICIENT OF VARIATIONS
O1	0.29	0.33	1.14
O2	0.42	0.47	1.11
O3	0.36	0.43	1.16
O4	0.37	0.39	1.04
ON	0.58	0.73	1.24
N1	0.79	0.67	0.85
N2	0.99	1.08	1.08
N3	0.94	1.10	1.17
N4	0.89	1.37	1.54
D1	0.91	0.81	0.90
D2	0.63	0.67	1.06
D3	0.73	0.58	0.81
D4	1.55	1.41	0.91
J1	0.83	0.96	1.15
J2	1.13	1.01	0.90
J3	1.46	1.08	0.74
J4	0.97	0.86	0.88
JF	1.14	1.06	0.93
F1	0.98	0.94	0.96
F2	0.67	0.60	0.90
F3	1.15	0.91	0.90
FM	1.03	1.17	1.13
M1	0.61	0.61	1.01
M2	0.86	0.83	0.96
M3	0.67	0.64	0.95
M4	1.13	1.28	1.13
A1	0.90	0.89	0.99
A2	0.42	0.43	1.02
A3	0.61	0.65	1.05
A4	0.50	0.35	0.71
AM	0.26	0.18	0.70





weekly rainfalls. Figure 14 shows the weekly coefficients of variation for the positive weekly rainfalls.

As can be seen, the means and standard deviations of the data are approximately equal to each other, and the coefficients of variation of the data are close to one. These facts indicate that the distribution of the data may be approximately exponential. This is suggested since for data from an exponential distribution, the mean of the data equal the standard deviation of the data, and the coefficient of variation is one.

The fit of an exponential model for the positive weekly data will not be explored in more detail.

A plot of the means against standard deviations of the positive weekly rainfall is shown in Figure 15. These data appear to have a linear relationship. By using the median method (McNeil [Ref. 3]) the slope of the means versus standard deviations was computed as 0.84. This indicates that the means of the data are little higher than the standard deviations of the data.

Next, by using the subroutine EXPLT (which is a NONIMSL subroutine at the Naval Postgraduate School computer library), a plot exponential scores versus observed scores of the data can be examined. If the data is distributed exponentially, the the plot should be a straight line. Appendix E shows the exponential scores versus observed scores for the positive weekly rainfall. Most of the weeks seem to fit the exponential.



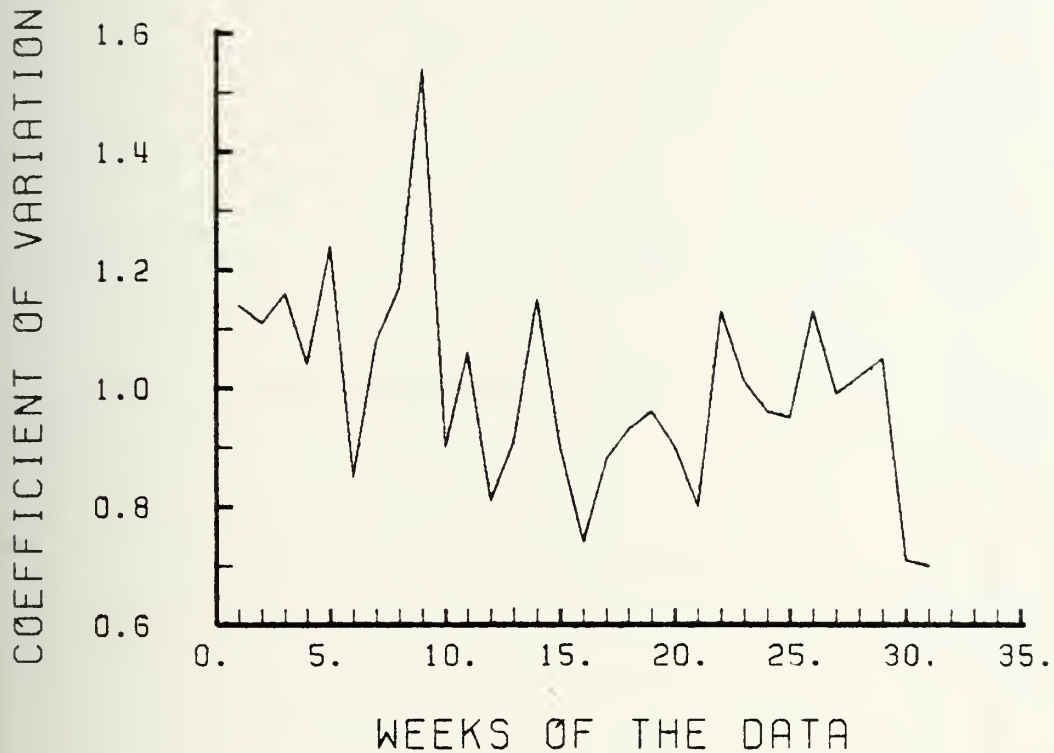


Figure 14. Weekly coefficients of variation for the positive weekly rainfalls in the 36-year period



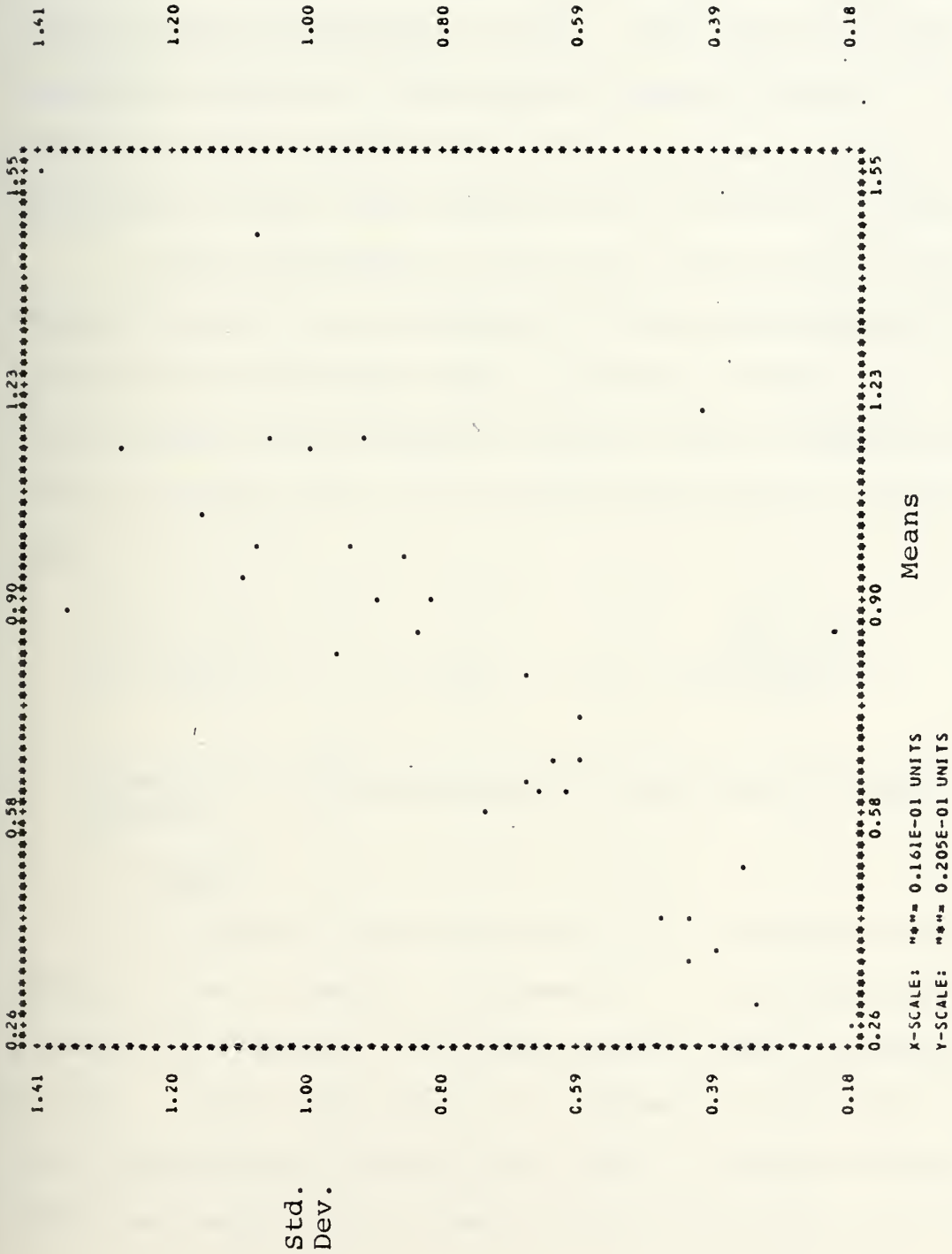


Figure 15. Plot of means against standard deviations for the positive weekly rainfall in the 36-year period



Also, estimated and theoretical values of median, lower and upper quartiles were examined against each other. Table 8 shows the estimated and theoretical values of the median, and lower and upper quartiles for the positive weekly rainfalls. Figures 16 through 18 show the plot of estimated values against theoretical values. They seem to support the exponential model for the positive weekly rainfall. Again using the median method the slope of estimated values against theoretical values were computed and are shown in Table 9.

A 90% confidence interval for the average positive weekly rainfall can be computed by assuming exponential distribution for the weeks which are shown in Table 10. Let  $\bar{x}$  be average positive weekly rainfall with  $n$  observations, then the formula for  $(1-\alpha)\%$  confidence interval for the mean with  $\alpha = 0.10$  is

$$\bar{x} \left[ \frac{\chi^2_{2n} (1-\alpha/2)}{2n} \right]^{-1} \leq E[x] = \frac{1}{\lambda} \leq \bar{x} \left[ \frac{\chi^2_{2n} (\alpha/2)}{2n} \right]^{-1}$$

## B. SKEWNESS AND KURTOSIS ANALYSIS FOR POSITIVE WEEKLY RAINFALL

### 1. Theory

In general the third moment of a distribution is considered to be a measure of skewness. If the distribution of a sample is symmetric, its third moment about the mean will be zero. If the distribution is skewed to the right, the third moment about the mean will have a positive value, because the large size of observations on the long tail will





Table 8 : ESTIMATED AND THEORETICAL VALUES OF MEDIAN, LOWER AND UPPER QUARTILE FOR THE POSITIVE WEEKLY RAINFALL

WEEK	ESTIM.		THEOR.		ESTIM.		THEOR.	
	MEAN	MEDIAN	MEDIAN	QUARTILE	LOWER	UPPER	LOWER	UPPER
O1	0.29	0.12	0.20	0.08	0.08	0.28	0.40	
O2	0.42	0.15	0.29	0.07	0.12	0.77	0.58	
O3	0.36	0.21	0.25	0.08	0.10	0.41	0.50	
O4	0.37	0.29	0.26	0.06	0.11	0.67	0.51	
ON	0.58	0.28	0.40	0.19	0.17	0.62	0.80	
N1	0.79	0.70	0.55	0.15	0.23	1.52	1.10	
N2	0.99	0.74	0.69	0.23	0.28	1.24	1.37	
N3	0.94	0.39	0.65	0.20	0.27	1.37	1.30	
N4	0.89	0.35	0.62	0.11	0.26	1.27	1.23	
D1	0.91	0.63	0.63	0.33	0.26	1.18	1.26	
D2	0.63	0.38	0.44	0.20	0.18	0.91	0.87	
D3	0.73	0.66	0.51	0.17	0.21	1.19	1.01	
D4	1.55	1.01	1.07	0.63	0.45	2.32	2.15	
J1	0.83	0.50	0.57	0.12	0.24	1.31	1.15	
J2	1.13	0.83	0.78	0.23	0.32	1.88	1.57	
J3	1.46	1.39	1.01	0.37	0.42	2.14	2.02	
J4	0.97	0.68	0.67	0.31	0.28	1.77	1.34	
JF	1.14	0.83	0.79	0.27	0.33	1.65	1.58	
F1	0.98	0.60	0.68	0.25	0.28	1.44	1.36	
F2	0.67	0.53	0.46	0.14	0.19	1.00	0.93	
F3	1.15	0.98	0.80	0.49	0.33	1.55	1.59	
FM	1.03	0.42	0.71	0.18	0.30	1.99	1.43	
M1	0.61	0.45	0.42	0.07	0.18	0.96	0.85	
M2	0.86	0.58	0.60	0.17	0.25	1.45	1.19	
M3	0.67	0.54	0.46	0.14	0.19	1.06	0.93	
M4	1.13	0.46	0.78	0.19	0.32	1.73	1.57	
A1	0.90	0.33	0.62	0.18	0.26	1.63	1.25	
A2	0.42	0.27	0.29	0.08	0.12	0.53	0.58	
A3	0.61	0.38	0.42	0.12	0.18	1.02	0.85	
A4	0.50	0.42	0.35	0.17	0.14	0.77	0.69	
AM	0.26	0.23	0.18	0.13	0.07	0.37	0.36	



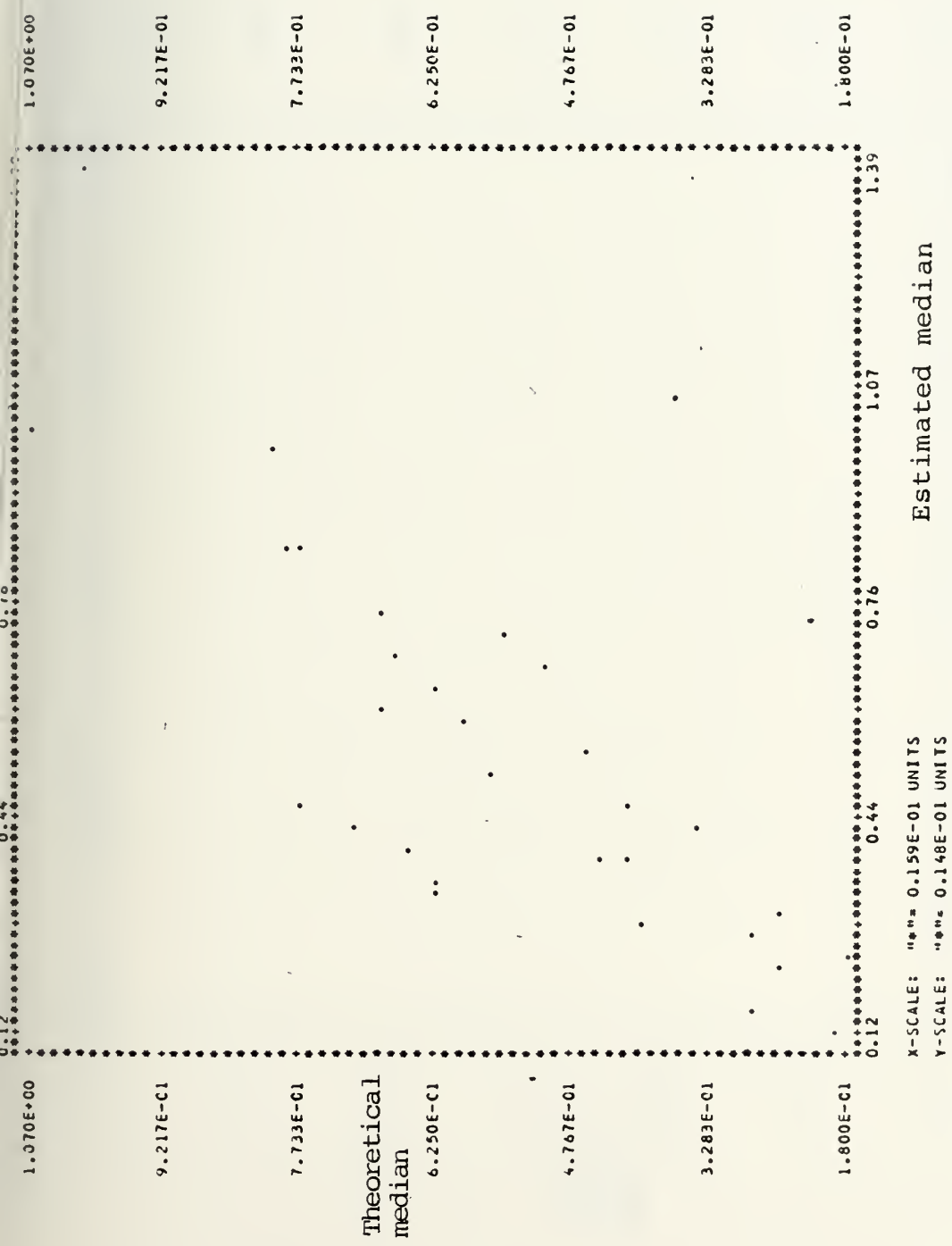


Figure 16. Plot of estimated median against theoretical median for positive weekly rainfall



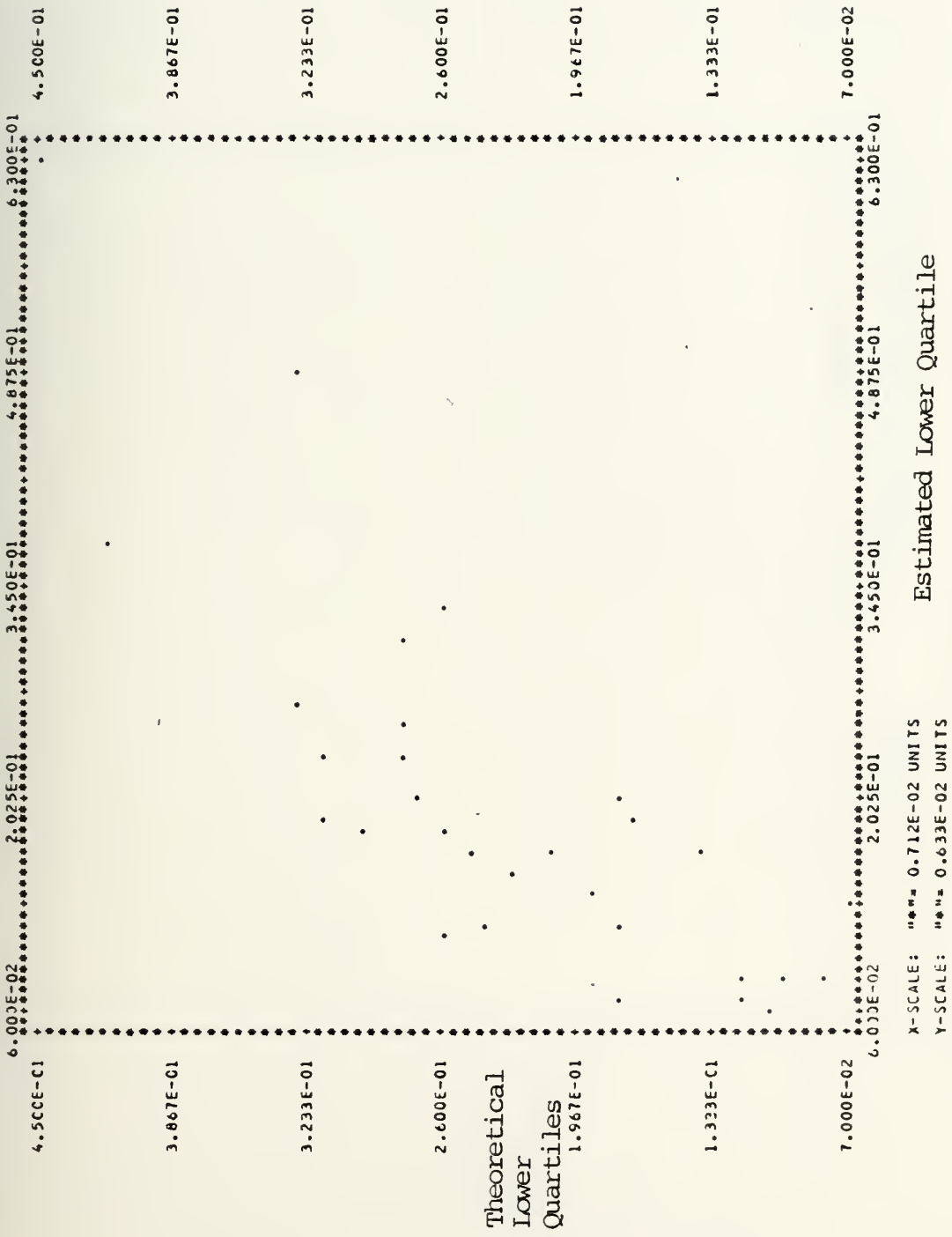
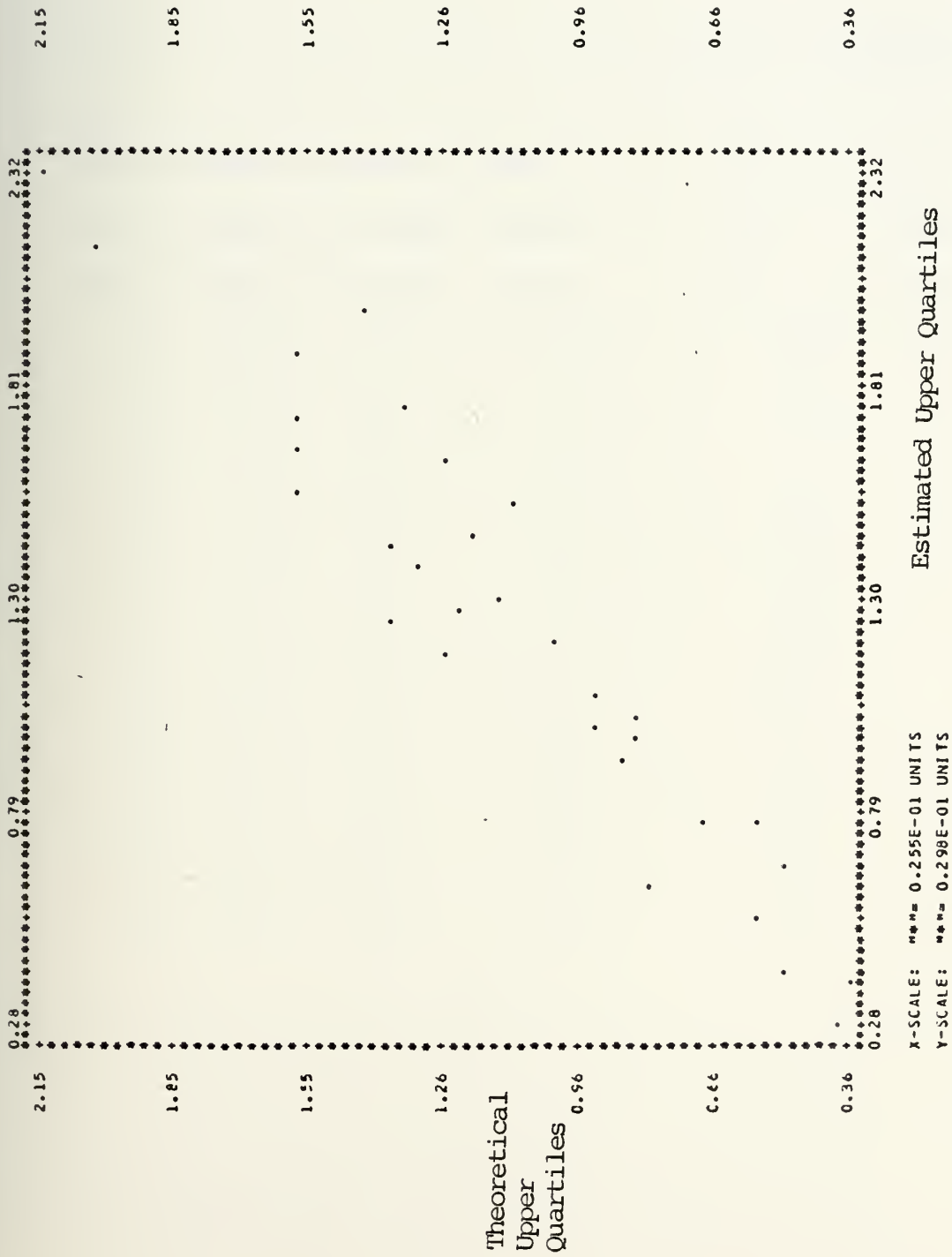


Figure 17. Plot of estimated L-quartile against theoretical L-quartile for positive weekly rainfall





X-SCALE: \*\*\*\*\* 0.255E-01 UNITS  
 Y-SCALE: \*\*\*\*\* 0.298E-01 UNITS

Figure 18. Plot of estimated U-quartile against theoretical U-quartile for positive weekly rainfall





Table 9 : SLOPES OF THE ESTIMATED VALUES AGAINST THEORETICAL  
VALUES FOR MEDIAN AND LOWER AND UPPER QUANTILES.

	SLOPE	INTERCEPT
	-----	-----
EST. MEDIAN VS THEO. MEDIAN	0.96	0.03
EST. L.QUAR. VS THEO. L.QUAR.	0.95	0.04
EST. U.QUAR. VS THEO. U.QUAR.	0.88	0.01



Table 10: 90% CONFIDENCE INTERVAL FOR AVERAGE POSTIVE WEEKLY  
RAINFALL WITH EXPONENTIAL DISTRIBUTION

WEEK	MEAN	STD DEV	LOWER LIMIT	UPPER LIMIT
O1	0.29	0.33	0.18	0.56
O2	0.42	0.47	0.29	0.66
O3	0.36	0.43	0.25	0.58
O4	0.37	0.39	0.25	0.60
ON	0.58	0.73	0.39	0.96
N1	0.79	0.67	0.57	1.19
N2	0.99	1.08	0.74	1.40
N3	0.94	1.10	0.67	1.44
N4	0.89	1.37	0.65	1.31
D1	0.91	0.81	0.68	1.29
D2	0.63	0.67	0.46	0.93
D3	0.73	0.58	0.55	1.03
D4	1.55	1.41	1.14	2.25
J1	0.83	0.96	0.62	1.19
J2	1.13	1.01	0.84	1.63
J3	1.46	1.08	1.06	2.18
J4	0.97	0.86	0.73	1.38
JF	1.14	1.06	0.88	1.55
F1	0.98	0.94	0.74	1.39
F2	0.67	0.60	0.50	0.95
F3	1.15	0.91	0.83	1.72
FM	1.03	1.17	0.78	1.43
M1	0.61	0.61	0.47	0.84
M2	0.86	0.83	0.65	1.22
M3	0.67	0.64	0.50	0.96
M4	1.13	1.28	0.82	1.66
A1	0.90	0.89	0.65	1.34
A2	0.42	0.43	0.31	0.62
A3	0.61	0.65	0.42	1.00
A4	0.50	0.35	0.36	0.74
AM	0.26	0.18	0.18	0.40



more than offset the greater number of smaller observations on the shorter tail of the distribution. Hence for a positively skewed distribution (i.e., one with the long tail to the right), the third moment ( $\mu_3$ ) will be positive. For these reasons the third moment around the mean is taken as a measure of the absolute skewness of a distribution. The theoretical skewness for a random variable  $X$  is given by

$$\gamma_1 = \frac{E[(X-E(X))^3]}{(\text{Var}[X])^{3/2}}$$

The empirical skewness for data  $\{x_i, i = 1, \dots, n\}$  having average  $\bar{x}$  is given by

$$g_1 = \frac{\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^3}{\left[ \frac{1}{n-1} \left( \sum_{i=1}^n (x_i - \bar{x})^2 \right) \right]^{3/2}}$$

If a distribution is symmetric,  $\gamma_1$  will be zero. If the distribution of  $X$  is exponential with parameter  $\lambda = 1$ , then  $\gamma_1$  has the value 2 (see Appendix D for the algebraic computation).

The kurtosis for a random variable  $X$  is given by

$$\gamma_2 = \frac{E[(X-E(X))^4]}{[\text{Var}(X)]^2} - 3$$

The empirical kurtosis for data  $\{x_i, i = 1, \dots, n\}$  having average  $\bar{x}$  is given by



$$g_2 = \frac{\frac{1}{n} \left( \sum_{i=1}^n (x_i - \bar{x})^4 \right)}{\left[ \frac{1}{n-1} \left( \sum_{i=1}^n (x_i - \bar{x})^2 \right) \right]^2} - 3$$

If the fourth moment ( $\mu_4$ ) about the mean of the random variable X is large relative to the variance ( $\sigma^2$ ), it indicates relatively large tails.

For the normal distribution,  $\mu_4/\sigma^4$  has the value 3. Since the normal distribution arises very frequently and is often used as a basis of reference for distributions that are not normal, the quantity  $\gamma_2$  is defined so that it will be 0 when a distribution has the kurtosis of a normal distribution. Thus  $\gamma_2 > 0$  means that a distribution has a sharper peak, thinner shoulder, and fatter tails than the normal distribution.  $\gamma_2 < 0$  means that a distribution has a flatter peak, fatter shoulders, and thinner tails than the normal distribution. Cramer [Ref. 5] and Duncan [Ref. 6] contain a discussion of the skewness and kurtosis coefficients.

If the distribution of X is exponential, then  $\gamma_2$  has the value 6 (see Appendix D for algebraic computations). Appendix D also contains a discussion of the sample properties of the skewness and kurtosis coefficients.

It is suspected that the sample size has some effect on the values of sample skewness and sample kurtosis. To study this effect a simulation study was done as described below.





By using the random number generator (LLRANDOM) N independent unit exponential random numbers were generated as a sample. Then the sample skewness and kurtosis were computed from the sample. M independent replications of the procedure were done and sample means and standard deviations were computed for the skewness and kurtosis.

Appendix D shows the simulation results for sample skewness and sample kurtosis of a unit exponential distribution with various sample size (standard deviations of them are given in parentheses).

As can be seen in Appendix D if the sample size is small, then the sample skewness and kurtosis values are smaller than their theoretical values. When sample size is between 2000-3000 they reach the theoretical values 2 and 6 for the skewness and kurtosis respectively.

## 2. Skewness and Kurtosis Analysis for Positive Weekly Rainfall

Histograms, and plots of exponential scores versus observed values of positive weekly rainfalls are given in Appendix F; they suggest that the distribution of weekly positive rainfall is approximately exponential. The examination of classical skewness and kurtosis coefficients of positive weekly rainfall can be used to further examine the fit of this exponential model.

Table 11 shows a listing of the values of skewness and kurtosis for the positive weekly rainfall.



Table 11: SKEWNESS AND KURTOSIS FOR WEEKLY RAINFALL DATA

WEEK	NUMBER OF YEARS		
	SKEWNESS	KURTOSIS	POSITIVE RAINFALL
O1	1.577	0.434	9
O2	1.231	0.101	17
O3	2.051	3.164	16
O4	1.499	1.652	15
ON	2.616	5.815	14
N1	0.390	-1.576	20
N2	1.781	2.257	28
N3	1.637	1.645	19
N4	3.387	11.390	22
D1	1.448	1.076	28
D2	1.835	3.028	22
D3	0.696	0.170	28
D4	1.340	1.099	24
J1	1.733	2.657	26
J2	0.834	-0.733	25
J3	0.756	0.441	21
J4	1.038	-0.009	27
JF	1.002	-0.108	29
F1	1.450	1.238	27
F2	1.099	0.471	27
F3	1.053	0.651	21
FM	1.306	0.455	30
M1	1.248	0.842	32
M2	0.831	-0.813	28
M3	1.073	0.170	25
M4	1.342	0.388	23
A1	0.805	-0.940	21
A2	1.341	0.593	22
A3	0.147	1.486	14
A4	0.561	-0.721	22
AM	1.032	0.554	18



Figure 19 shows the skewness and kurtosis of the positive weekly rainfall, and a plot of skewness against kurtosis values is shown in Figure 20.

Figure 19 shows that the skewness and kurtosis values are reasonably stable. But relatively high values occur early in the year. There is some tendency for the distribution to change throughout the rainy season. Average skewness and kurtosis values of the positive weekly rainfall are shown in Table 12.

Table 12: ESTIMATED AND SIMULATED MEANS FOR THE SKEWNESS AND KURTOSIS COEFFICIENTS

	SKEWNESS	KURTOSIS
ESTIMATED MEAN	1.29	1.19
SIMULATED MEAN	1.45	1.84

The estimated kurtosis is somewhat lower than its simulated value. This might suggest that the distribution of positive weekly rainfall has a shorter right tail than the exponential. Perhaps a Gamma or Weibull distribution would fit these data slightly better.

Table 14 shows the estimated and simulated values of the skewness and kurtosis coefficients for the actual sample sizes observation. By using the median method the slopes of estimated values against simulated values were computed for skewness and kurtosis and are shown in Table 13.



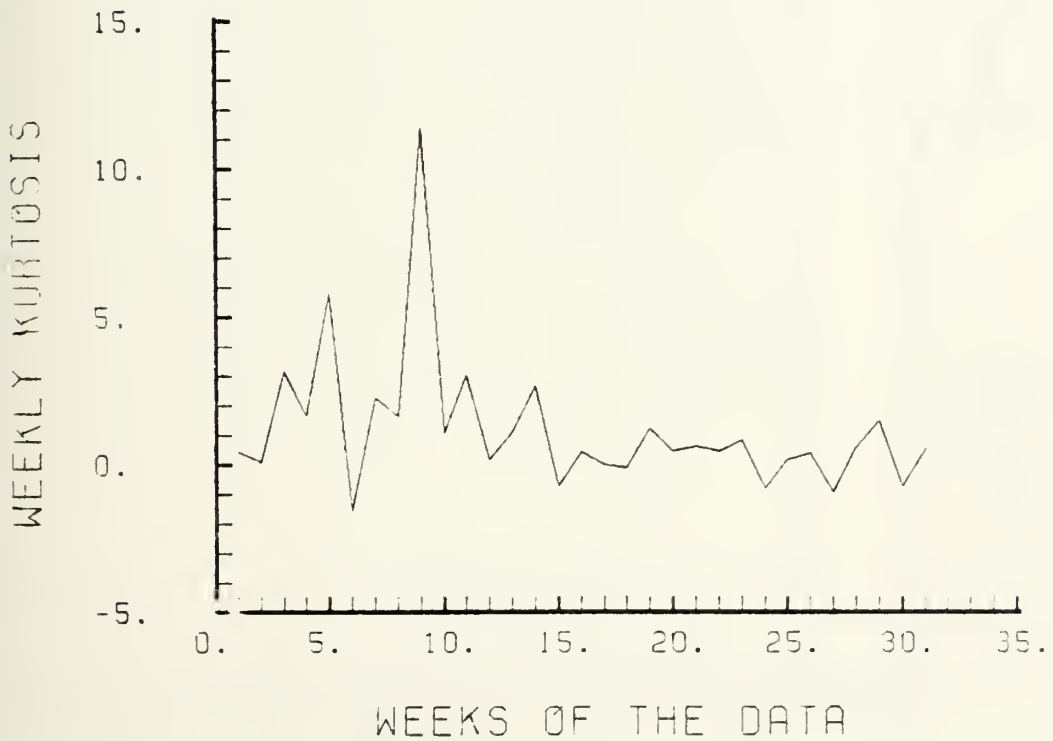
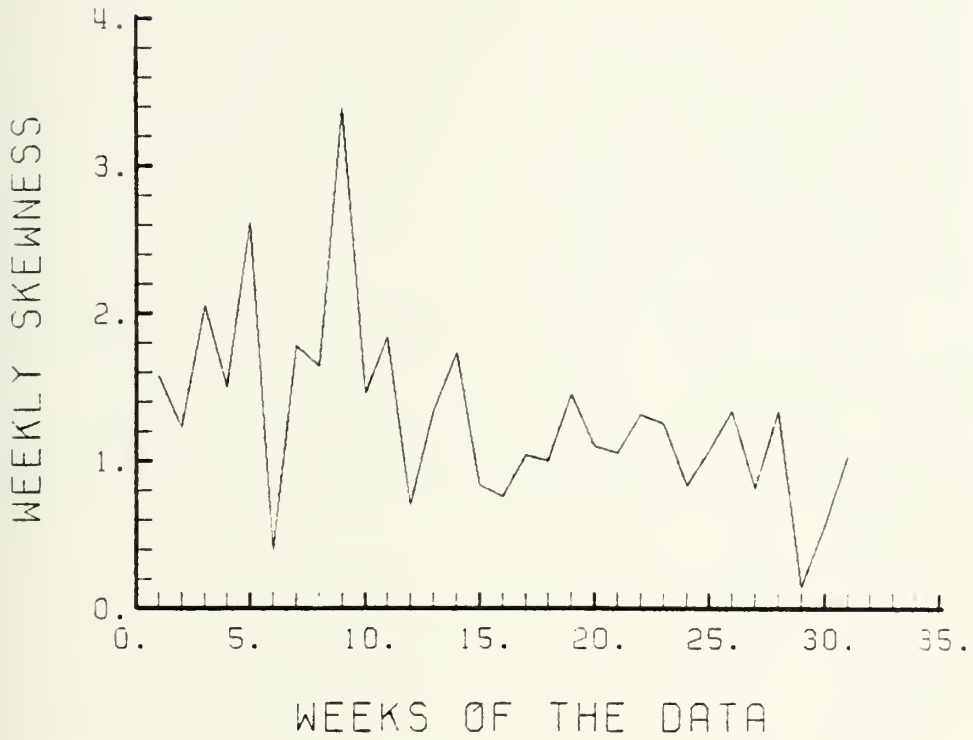


Figure 19. Weekly skewness and kurtosis coefficients for the positive weekly rainfall





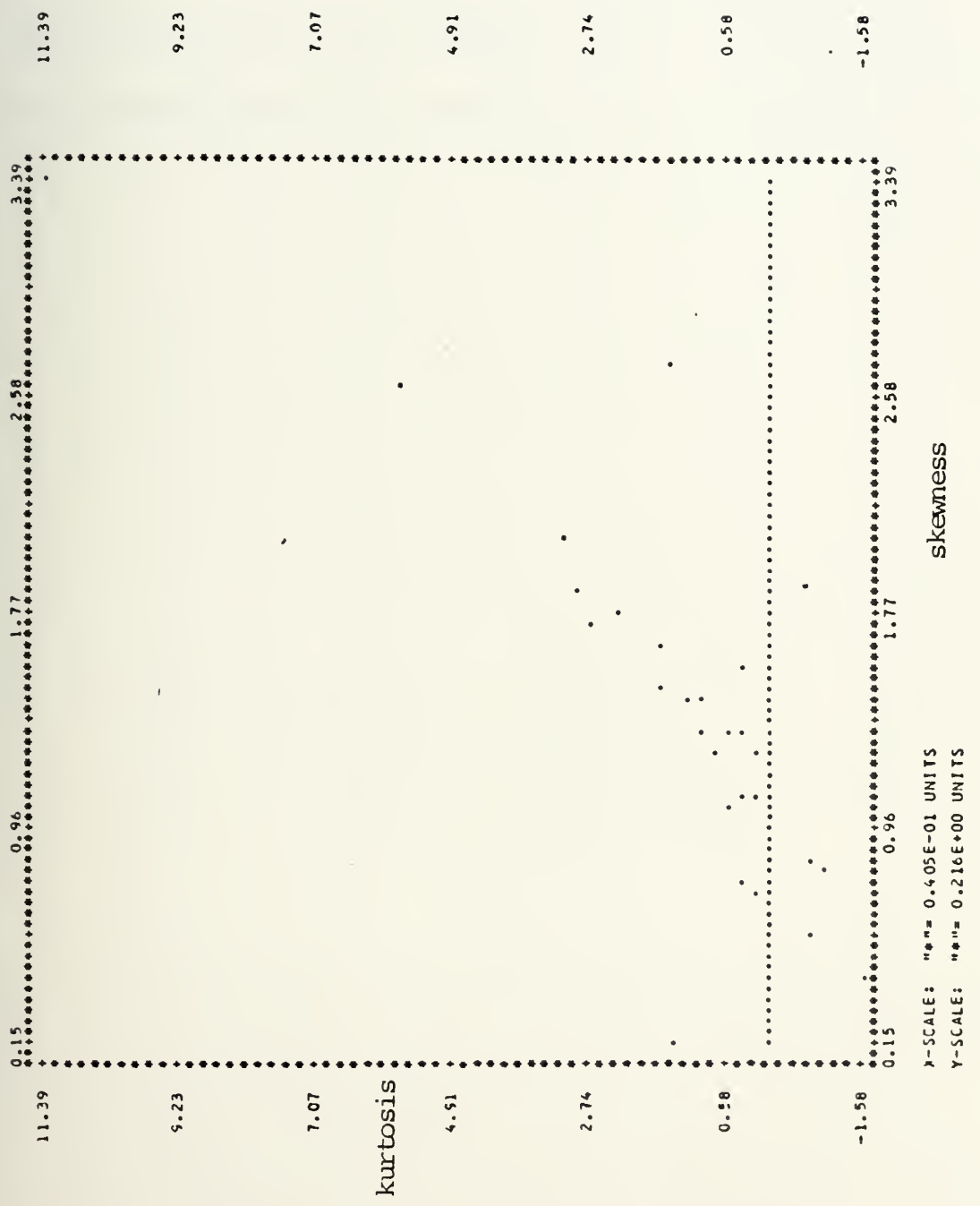


Figure 20. Plot of weekly skewness against weekly kurtosis for positive weekly rainfall



Table 13: SLOPES FOR SKEWNESS AND KURTOSIS

	SLOPE	INTERCEPT
	-----	-----
EST. SKEWNESS VS SIM. SKEWNESS	0.19	1.20
EST. KURTOSIS VS SIM. KURTOSIS	0.40	1.32



Table 14: ESTIMATED AND SIMULATED VALUES FOR SKEWNESS AND KURTOSIS FOR SAME SAMPLE SIZES.

# OF YEARS		ESTIM.	SIMULATED	ESTIM.	SIMULATED
WEEK	POS. RAINFALL	SKEWNESS	SKEWNESS	KURTOSIS	KURTOSIS
O1	9	1.57	1.11	0.43	0.24
O2	17	1.23	1.37	0.10	1.36
O3	16	2.05	1.34	3.16	1.25
O4	15	1.50	1.33	1.65	1.17
ON	14	2.62	1.29	5.82	1.02
N1	20	0.39	1.43	-1.58	1.70
N2	28	1.78	1.54	2.26	2.31
N3	19	1.64	1.41	1.65	1.57
N4	22	3.39	1.45	11.39	1.83
D1	28	1.45	1.54	1.08	2.31
D2	22	1.84	1.45	3.03	1.83
D3	28	0.70	1.54	0.17	2.31
D4	24	1.34	1.49	1.10	2.02
J1	26	1.73	1.52	2.66	2.19
J2	25	0.83	1.50	-0.73	2.09
J3	21	0.76	1.44	-0.44	1.76
J4	27	1.04	1.52	-0.01	2.22
JF	29	1.00	1.55	-0.11	2.37
F1	27	1.45	1.52	1.24	2.22
F2	27	1.10	1.52	0.47	2.22
F3	21	1.05	1.44	0.65	1.76
FM	30	1.31	1.55	0.46	2.40
M1	32	1.25	1.57	-0.84	2.50
M2	28	0.83	1.54	-0.81	2.31
M3	25	1.07	1.50	0.17	2.09
M4	23	1.34	1.47	0.39	1.94
A1	21	0.81	1.44	-0.94	1.76
A2	22	1.34	1.45	0.59	1.83
A3	14	0.15	1.29	1.49	1.02
A4	22	0.56	1.45	-0.72	1.83
AM	18	1.03	1.39	0.55	1.50



As can be seen they are not fitted very well. Estimated values are lower than the simulated values for the skewness and kurtosis. Figures 21 and 22 show the estimated values against simulated values for the skewness and kurtosis.

### C. 2X2 CONTINGENCY TABLES

#### 1. Summary

The idea to be explored in this section is whether or not some weeks of the weekly rainfall, to be called the control, may be used to predict in some way the behavior of another weeks of the weekly rainfall, to be called the complement.

Let  $X$  be a week of a month, to be called the control, and let  $Y$  be a week of a month, which is different from  $X$ , to be called the complement. It is necessary that  $X \cap Y = \emptyset$ ; that is, the intersection of these two weeks is empty. The weeks are then compared for some quality in  $X$  and for some quality in  $Y$ . The question is then; does the presence (or absence) of quality in  $X$  affect the presence (or absence) of quality in  $Y$ ? An example of a typical table is shown below in Figure 23.

The elements, a typical one of which is  $n_{ij}$ , represent the number of years which display quality  $i$  in the control and quality  $j$  in the complement. The marginal entries  $n_{i.}$  and  $n_{.j}$  represent the number of years for which the control has quality  $i$  and the number of years the complement has quality  $j$  respectively. The overall number of years,  $N$ , appear in the lower right of the table.





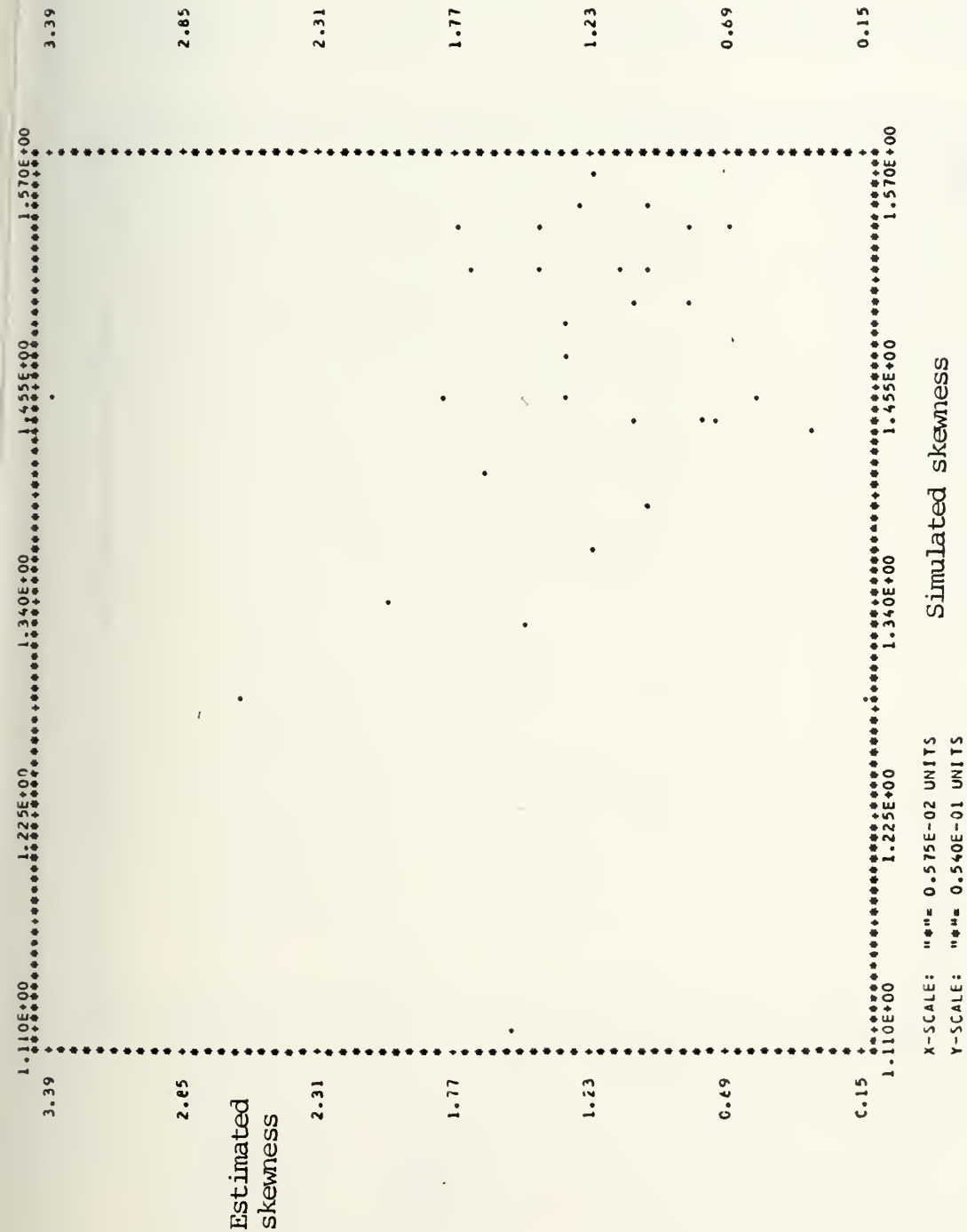


Figure 21. Plot of estimated skewness against simulated skewness for the positive weekly rainfall



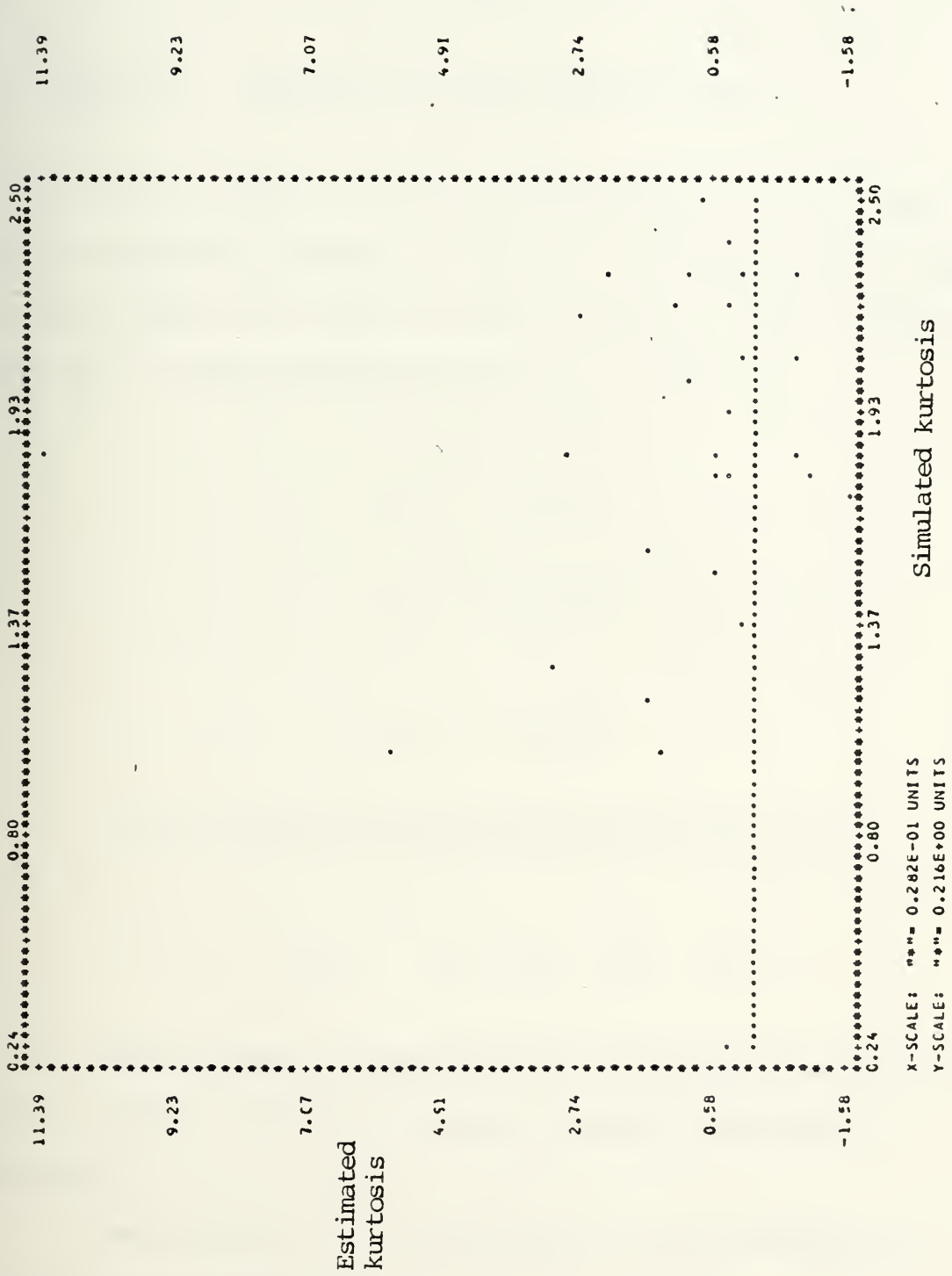


Figure 22. Plot of estimated kurtosis against simulated kurtosis for the positive weekly rainfall



$n_{11}$	$n_{12}$	$n_{1.}$
$n_{21}$	$n_{22}$	$n_{2.}$
$n_{.1}$	$n_{.2}$	$N$

Figure 23. Typical 2X2 contingency table

Conover [Ref. 2] gives a discussion of the theory and use of contingency tables. Let  $\theta_{ij}$  be the probability that any given year will have a control quality  $i$  and a complement quality  $j$ . Then estimates of the  $\theta_{ij}$ 's are

$$\hat{\theta}_{ij} = n_{ij}/N$$

$$\hat{\theta}_{i.} = n_{i.}/N$$

$$\hat{\theta}_{.j} = n_{.j}/N$$

If the control and complement are independent,

$$\theta_{ij} = \theta_{i.} \theta_{.j}, \text{ for all } i, j.$$

These simple assumptions allow for an investigation of the possible interrelationships between the weekly rainfalls.

The question of independence may be approached in the was as described below.



## 2. Chi-Squared Test for Independence

Let  $E_{ij}$  equal  $n_{i.}n_{.j}/N$ . Then for a 2x2 contingency table the test statistics are given by

$$Q = \sum_{i=1}^2 \sum_{j=1}^2 \frac{(n_{ij} - E_{ij})^2}{E_{ij}}$$

or simplifying for the calculation

$$Q = \sum_{i=1}^2 \sum_{j=1}^2 \frac{n_{ij}^2}{E_{ij}} - N$$

The exact distribution of  $Q$  is difficult to tabulate because of all the different combinations of values possible for  $n_{11}$ ,  $n_{12}$ ,  $n_{21}$ ,  $n_{22}$ . Therefore the large sample approximation is used for the distribution of  $Q$ ; this turns out to be chi-square distribution with one degree of freedom.

Hypothesis

$$H_0: \theta_{ii} = \theta_{i.}\theta_{.j}, \quad \text{for all } i, j$$

$$H_1: \theta_{ij} \neq \theta_{i.}\theta_{.j}, \quad \text{for some } i, j$$

Decision Rule: Reject  $H_0$  if  $Q$  exceeds the  $(1-\alpha)$  quantile of a chi-square random variable with one degree of freedom. The approximate level of significance is then  $\alpha$ .

Figures 24 through 28 show 2x2 contingency tables for the weekly rainfall. In these tables,  $X = 1$  occurs when the week  $i$  falls below its mean of weekly rainfall and  $X = 2$





01 VS 02

	1	2	
1	22	7	29
2	6	1	7
	28	8	36

$Q=0.32$   
(a)

02 VS 03

	1	2	
1	21	7	28
2	4	4	8
	25	11	36

$Q=1.83$   
(b)

03 VS 04

	1	2	
1	18	7	25
2	9	2	11
	27	9	36

$Q=0.39$   
(c)

04 VS 0N

	1	2	
1	21	6	27
2	5	4	9
	26	10	36

$Q=1.66$   
(d)

0N VS N1

	1	2	
1	17	10	27
2	7	2	9
	24	12	36

$Q=0.67$   
(e)

N1 VS N2

	1	2	
1	17	7	24
2	5	7	12
	22	14	36

$Q=2.86$   
(f)

Figure 24: 2x2 contingency tables for weeks 01,02,03,04,0N,N1.



N2 VS N3

	1	2	
1	19	3	22
2	9	5	14
	28	8	36

$Q=2.41$

(a)

N3 VS N4

	1	2	
1	22	6	28
2	5	3	8
	27	9	36

$Q=0.86$

(b)

N4 VS D1

	1	2	
1	16	11	27
2	7	2	9
	23	13	36

$Q=1.00$

(c)

D1 VS D2

	1	2	
1	15	8	23
2	10	3	13
	25	11	36

$Q=0.54$

(d)

D2 VS D3

	1	2	
1	16	9	25
2	4	7	11
	20	16	36

$Q=2.36$

(e)

D3 VS D4

	1	2	
1	16	4	20
2	8	8	16
	24	12	36

$Q=3.60$

(f)

Figure 25: 2x2 contingency tables for weeks N2,N3,N4,D1,D2,D3,D4.



D4 VS J1

	1	2	
1	18	6	24
2	5	7	12
	23	13	36

$Q=3.85$

(a)

J1 VS J2

	1	2	
1	16	7	23
2	7	6	13
	23	13	36

$Q=0.89$

(b)

J2 VS J3

	1	2	
1	15	8	23
2	7	6	13
	22	14	36

$Q=0.45$

(c)

J3 VS J4

	1	2	
1	18	4	22
2	6	8	14
	24	12	36

$Q=5.84$

(d)

J4 VS JF

	1	2	
1	14	10	24
2	9	3	12
	23	13	36

$Q=0.96$

(e)

JF VS F1

	1	2	
1	16	7	23
2	9	4	13
	25	11	36

$Q=0.01$

(f)

Figure 26: 2x2 Contingency tables for weeks D4, J1, J2, J3, J4, JF, F1.



F1 VS F2

	1	2	
1	17	8	25
2	5	6	11
	22	14	36

$Q=1.63$

(a)

F2 VS F3

	1	2	
1	16	6	22
2	7	7	14
	23	13	36

$Q=1.92$

(b)

F3 VS FM

	1	2	
1	17	6	23
2	8	5	13
	25	11	36

$Q=0.60$

(c)

FM VS M1

	1	2	
1	17	8	25
2	5	6	11
	22	14	36

$Q=1.63$

(d)

M1 VS M2

	1	2	
1	14	8	22
2	9	5	14
	23	13	36

$Q=0.01$

(e)

M2 VS M3

	1	2	
1	17	6	23
2	6	7	13
	23	13	36

$Q=2.77$

(f)

Figure 27: 2x2 Contingency tables for weeks F1,F2,F3,FM,M1,M2,M3.





M3 VS M4

	1	2	
1	16	7	23
2	11	2	13
	27	9	36

Q=1.00

(a)

M4 VS A1

	1	2	
1	22	5	27
2	4	5	9
	26	10	36

Q=4.62

(b)

A1 VS A2

	1	2	
1	20	6	26
2	5	5	10
	25	11	36

Q=2.47

(c)

A2 VS A3

	1	2	
1	21	4	25
2	7	4	11
	28	8	36

Q=1.83

(d)

A3 VS A4

	1	2	
1	17	11	28
2	6	2	8
	23	13	36

Q=0.55

(e)

A4 VS AM

	1	2	
1	16	7	23
2	8	5	13
	24	12	36

Q=0.24

(f)

Figure 28: 2x2 Contingency tables for weeks M3, M4, A1, A2, A3, A4, AM.



occurs when week  $i$  falls above its mean of weekly rainfall. Similarly,  $Y = 1$  occurs when the week  $i+1$  falls below its mean of weekly rainfall and  $Y = 2$  occurs when the week  $i+1$  falls above its mean of weekly rainfall.

The control consists of the binary category of rainfall for week  $i$  and the complement consists of the binary category of rainfall for week  $i+1$  in the 36-year period.

Results of the test statistics suggest that the weeks  $N1$  vs  $N2$ ,  $D4$  vs  $J1$ ,  $J3$  vs  $J4$ ,  $M2$  vs  $M3$ , and  $M4$  vs  $A1$  are not independent with  $\alpha = 0.10$  significance level. The rest of the weeks appeared independent of each other at  $\alpha = 0.10$  significance level. Table 15 shows the test statistics and their chi-square values with  $\alpha$  significance levels.

The expected number of  $30 \chi^2$  random variables that would be over .10 is 3. So it seems that the result could be explained by random sampling.

Figures 29 through 33 show the  $2 \times 2$  contingency tables for which the weekly  $X$  and  $Y$  values are determined differently from those shown above. On these figures,  $X = 1$  occurs when the week  $i$  has no rainfall (no rainfall means rainfall of less than 0.02") in year  $t$  and  $X = 2$  occurs when week  $i$  has rainfall in year  $t$ . Similarly,  $Y = 1$  occurs when the week  $i+1$  has no rainfall in year  $t$  and  $Y = 2$  occurs when the week  $i+1$  has rainfall in year  $t$ .

The control consists of the binary category of rainfall for week  $i$  and the complement consists of the binary category of rainfall for week  $i+1$  in the 36-year period.



Table 15: TEST STATISTICS, APPROXIMATED CHI-SQUARED AND SIGNIFICANCE LEVEL FOR THE WEEKS.

WEEK	TEST STATISTICS	APPROXIMATED $\chi^2_{1-\alpha}$ VALUE	SIGNIFICANCE LEVEL
01 VS 02	0.32	$\chi^2_{.40}$	0.60
02 VS 03	1.83	$\chi^2_{.82}$	0.18
03 VS 04	0.39	$\chi^2_{.47}$	0.53
04 VS 0N	1.66	$\chi^2_{.80}$	0.20
0N VS N1	0.67	$\chi^2_{.57}$	0.43
N1 VS N2	2.85	$\chi^2_{.91}$	0.09
N2 VS N3	2.41	$\chi^2_{.88}$	0.12
N3 VS N4	0.86	$\chi^2_{.63}$	0.37
N4 VS D1	1.00	$\chi^2_{.68}$	0.32
D1 VS D2	0.54	$\chi^2_{.52}$	0.48
D2 VS D3	2.36	$\chi^2_{.87}$	0.13
D3 VS D4	3.60	$\chi^2_{.94}$	0.06
D4 VS J1	3.85	$\chi^2_{.95}$	0.05
J1 VS J2	0.89	$\chi^2_{.65}$	0.35
J2 VS J3	0.45	$\chi^2_{.49}$	0.51
J3 VS J4	5.84	$\chi^2_{.98}$	0.02



J4 VS JF	0.96	$\chi^2$ .67	0.33
JF VS F1	0.01	$\chi^2$ .12	0.88
F1 VS F2	1.63	$\chi^2$ .80	0.20
F2 VS F3	1.92	$\chi^2$ .84	0.16
F3 VS FM	0.60	$\chi^2$ .55	0.45
FM VS M1	1.63	$\chi^2$ .79	0.21
M1 VS M2	0.01	$\chi^2$ .12	0.88
M2 VS M3	2.77	$\chi^2$ .90	0.10
M3 VS M4	1.00	$\chi^2$ .79	0.21
M4 VS A1	4.62	$\chi^2$ .97	0.03
A1 VS A2	2.47	$\chi^2$ .88	0.12
A2 VS A3	1.83	$\chi^2$ .82	0.18
A3 VS A4	0.55	$\chi^2$ .52	0.48
A4 VS AM	0.24	$\chi^2$ .38	0.52





01 VS 02  
1 2

1	13	14	27
2	6	3	9
	19	17	36

$Q=0.93$   
(a)

02 VS 03  
1 2

1	11	8	19
2	9	8	17
	20	16	36

$Q=0.09$   
(b)

03 VS 04  
1 2

1	12	8	20
2	9	7	16
	21	15	36

$Q=0.05$   
(c)

04 VS 0N  
1 2

1	15	6	21
2	7	8	15
	22	14	36

$Q=2.26$   
(d)

0N VS N1  
1 2

1	11	11	22
2	5	9	14
	16	20	36

$Q=0.71$   
(e)

N1 VS N2  
1 2

1	5	11	16
2	3	17	20
	8	28	36

$Q=1.36$   
(f)

Figure 29: 2x2 contingency tables for weeks 01,02,03,04,0N,N1.



N2 VS N3

	1	2	
1	5	3	8
2	12	16	28
	17	19	36

Q=0.96

(a)

N3 VS N4

	1	2	
1	8	9	17
2	6	13	19
	14	22	36

Q=0.91

(b)

N4 VS D1

	1	2	
1	4	10	14
2	4	18	22
	8	28	36

Q=0.54

(c)

D1 VS D2

	1	2	
1	3	5	8
2	11	17	28
	14	22	36

Q=0.01

(d)

D2 VS D3

	1	2	
1	4	10	14
2	4	18	22
	8	28	36

Q=0.54

(e)

D3 VS D4

	1	2	
1	5	3	8
2	7	21	28
	12	24	36

Q=3.94

(f)

Figure 30: 2x2 contingency tables for weeks N2, N3, N4, D1, D2, D3, D4.



D4 VS J1

	1	2	
1	3	9	12
2	7	17	24
	10	26	36

Q=0.07

(a)

J1 VS J2

	1	2	
1	6	4	10
2	5	21	26
	11	21	36

Q=5.66

(b)

J2 VS J3

	1	2	
1	8	3	11
2	7	18	25
	15	21	36

Q=6.29

(c)

J3 VS J4

	1	2	
1	5	10	15
2	4	17	21
	9	27	36

Q=0.95

(d)

J4 VS JF

	1	2	
1	3	6	9
2	4	23	27
	7	29	36

Q=1.48

(e)

JF VS F1

	1	2	
1	5	2	7
2	4	25	29
	9	27	36

Q=9.99

(f)

Figure 31: 2x2 Contingency tables for weeks D4, J1, J2, J3, J4, JF, F1.



F1 VS F2

	1	2	
1	2	7	9
2	7	20	27
	9	27	36

$Q=0.05$

(a)

F2 VS F3

	1	2	
1	4	5	9
2	11	16	27
	15	21	36

$Q=0.04$

(b)

F3 VS FM

	1	2	
1	4	11	15
2	2	19	21
	6	30	36

$Q=1.85$

(c)

FM VS M1

	1	2	
1	1	5	6
2	3	27	30
	4	32	36

$Q=0.23$

(d)

M1 VS M2

	1	2	
1	0	8	8
2	4	24	28
	4	32	36

$Q=1.29$

(e)

M2 VS M3

	1	2	
1	3	5	8
2	8	20	28
	11	25	36

$Q=0.23$

(f)

Figure 32: 2x2 Contingency tables for weeks F1, F2, F3, FM, M1, M2, M3.





M3 VS M4

	1	2	
1	6	5	11
2	7	18	25
	13	23	36

$Q=2.33$

(a)

M4 VS A1

	1	2	
1	6	7	13
2	9	14	23
	15	21	36

$Q=0.17$

(b)

A1 VS A2

	1	2	
1	7	8	15
2	7	14	21
	14	22	36

$Q=0.65$

(c)

A2 VS A3

	1	2	
1	11	3	14
2	11	11	22
	22	14	36

$Q=2.94$

(d)

A3 VS A4

	1	2	
1	10	12	22
2	4	10	14
	14	22	36

$Q=1.03$

(e)

A4 VS AM

	1	2	
1	9	5	14
2	9	13	22
	18	18	36

$Q=1.87$

(f)

Figure 33: 2x2 Contingency tables for weeks M3, M4, A1, A2, A3, A4, AM.



Table 16 shows the test statistics and their approximated chi-square value with  $\alpha$  significance level.

Results of the test statistics showed that the weeks D3 vs D4, J1 vs J2, J2 vs J3, JF vs F1, and A2 vs A3 are not independent with  $\alpha = 0.10$  significance level. The rest of the weeks appeared independent of each other at  $\alpha = 0.10$  significance level. According to this procedure, the overall association among the weeks is not strong.

#### D. 4X4 CONTINGENCY TABLES

##### 1. General

Figure 34 shows a typical 4x4 contingency table. The table element,  $n_{ij}$ , represents the number of years which display quality  $i$  in the control and quality  $j$  in the complement. The marginal entries  $n_{i.}$  and  $n_{.j}$  represent the number of years

	COMPLEMENT				
	WEEK <sub>i+1</sub> (Y)				
	$n_{11}$	$n_{12}$	$n_{13}$	$n_{14}$	$n_{1.}$
CONTROL	$n_{21}$	$n_{22}$	$n_{23}$	$n_{24}$	$n_{2.}$
WEEK <sub>i</sub>	$n_{31}$	$n_{32}$	$n_{33}$	$n_{34}$	$n_{3.}$
	$n_{41}$	$n_{42}$	$n_{43}$	$n_{44}$	$n_{4.}$
	$n_{.1}$	$n_{.2}$	$n_{.3}$	$n_{.4}$	$N$

Figure 34. Typical 4x4 contingency table



Table 16: TEST STATISTICS, APPROXIMATED CHI-SQUARED AND SIGNIFICANCE LEVEL FOR THE WEEKS.

WEEK	TEST STATISTICS	APPROXIMATED $\chi^2_{1-\alpha}$ VALUE	SIGNIFICANCE LEVEL
01 VS 02	0.93	$\chi^2_{.66}$	0.34
02 VS 03	0.09	$\chi^2_{.25}$	0.75
03 VS 04	0.05	$\chi^2_{.21}$	0.79
04 VS ON	2.26	$\chi^2_{.87}$	0.13
ON VS N1	0.71	$\chi^2_{.59}$	0.41
N1 VS N2	1.36	$\chi^2_{.75}$	0.25
N2 VS N3	0.96	$\chi^2_{.67}$	0.33
N3 VS N4	0.91	$\chi^2_{.66}$	0.34
N4 VS D1	0.54	$\chi^2_{.52}$	0.48
D1 VS D2	0.01	$\chi^2_{.12}$	0.88
D2 VS D3	0.54	$\chi^2_{.52}$	0.48
D3 VS D4	3.94	$\chi^2_{.95}$	0.05
D4 VS J1	0.07	$\chi^2_{.24}$	0.76
J1 VS J2	5.66	$\chi^2_{.98}$	0.02
J2 VS J3	6.29	$\chi^2_{.99}$	0.01
J3 VS J4	0.95	$\chi^2_{.67}$	0.33
J4 VS JF	1.48	$\chi^2_{.77}$	0.23
JF VS F1	9.99	$\chi^2_{.99}$	0.01



F1 VS F2	0.05	$X^{.21^2}$	0.79
F2 VS F3	0.04	$X^{.18^2}$	0.82
F3 VS FM	1.85	$X^{.88^2}$	0.18
FM VS M1	0.23	$X^{.38^2}$	0.62
M1 VS M2	1.29	$X^{.74^2}$	0.26
M2 VS M3	0.23	$X^{.38^2}$	0.62
M3 VS M4	2.33	$X^{.87^2}$	0.13
M4 VS A1	0.17	$X^{.33^2}$	0.67
A1 VS A2	0.65	$X^{.56^2}$	0.44
A2 VS A3	2.94	$X^{.91^2}$	0.09
A3 VS A4	1.03	$X^{.69^2}$	0.31
A4 VS AM	1.87	$X^{.83^2}$	0.17





for which control has quality  $i$  and the numbers of years the complement has quality  $j$  respectively. The overall number of years,  $N$ , is in the lower right of the table.

Conover [Ref. 2] discusses the theory and use of rxc contingency tables.

## 2. Classification of Rainfall

The National Weather Association classifies the daily positive rainfall in 3 categories, as light rainfall, moderate rainfall, and heavy rainfall. Any rainfall amount less than 0.02 inches is defined as zero rainfall. The observed positive rainfall data is ordered from least to highest for a given year. Then, the first 1/3 of the ordered positive rainfall data is called light rainfall, the second 1/3 of the ordered positive rainfall data is called moderate rainfall, and the remaining 1/3 of the ordered positive rainfall data is called heavy rainfall.

To construct a 4x4 contingency table using the weekly rainfall data, a similar procedure was used and is described below.

The weekly positive rainfall data was ordered from least to highest for a given month in the 36-year period; then 3 categories of rainfall were defined as described above. Additionally, a weekly rainfall of less than 0.02" inches is called zero rainfall and is considered as one category so that weekly rainfall data was broken down to 4 categories. Thus  $X = 1$  occurs when the week  $i$  has zero rainfall in year  $t$ ,



2 occurs when week  $i$  has light rainfall in year  $t$ ,  $X = 3$   
 occurs when week  $i$  has moderate rainfall in year  $t$ , and  $X = 4$   
 occurs when week  $i$  has heavy rainfall in year  $t$  for a given  
 th.

Table 17 shows the amount of rainfall limits of 3  
 categories of rainfall for the 7-month rainy period.

Table 17: AMOUNT OF RAINFALL LIMITS FOR  
 THE WEEKLY RAINFALL IN INCHES

MONTH	LIGHT RAINFALL	MODERATE RAINFALL	HEAVY RAINFALL
OCTOBER	0.03-0.12	0.13-0.34	0.35-over
NOVEMBER	0.03-0.31	0.32-1.00	1.01-over
DECEMBER	0.03-0.37	0.38-1.07	1.08-over
JANUARY	0.03-0.38	0.39-1.34	1.35-over
FEBRUARY	0.03-0.40	0.41-1.19	1.20-over
MARCH	0.03-0.26	0.27-0.86	0.87-over
APRIL	0.03-0.17	0.18-0.60	0.61-over

### 3. Chi-Squared Test for Independence

A 4x4 contingency table was constructed the category  
 or rainfall in week  $i$  and the category of rainfall in week  $i+1$



by grouping all weeks in a month together. Table 18 shows the name of the weeks which were included to construct the contingency table for each month. Each month was analyzed separately since the rainfall data is seasonal. Each paired week contains 36 observations so that the total 144 ( $4 \times 36 = 144$ ) observations are formed in each contingency table. For example in the December contingency table the paired weeks used are (D1,D2), (D2,D3), (D3,D4), (D4,J1). The chi-square test was used to explore possible relationships between rainfall in successive weeks for a given month.

**Table 18: WEEK NAMES FOR CONSTRUCTING 4x4 CONTINGENCY TABLES**

MONTH	WEEKS
-----	-----
OCTOBER	O1, O2, O3, O4, ON
NOVEMBER	N1, N2, N3, N4, D1
DECEMBER	D1, D2, D3, D4, J1
JANUARY	J1, J2, J3, J4, JF
FEBRUARY	JF, F1, F2, F3, FM
MARCH	FM, M1, M2, M3, M4
APRIL	A1, A2, A3, A4, AM

Let  $E_{ij}$  equal  $n_{i.}n_{.j}/N$ . Then for a 4x4 contingency table the test statistic is given by:



$$Q = \sum_{i=1}^4 \sum_{j=1}^4 \frac{(n_{ij} - E_{ij})^2}{E_{ij}}$$

or simplifying for the calculation

$$Q = \sum_{i=1}^4 \sum_{j=1}^4 \frac{n_{ij}^2}{E_{ij}} - N$$

The exact distribution of  $Q$  is difficult to tabulate because of all the combinations of values possible for  $n_{ij}$ . Therefore the large sample approximation, the chi-square distribution with 9 degrees of freedom is used for the distribution of  $Q$ .

Figures 35 through 41 show the 4x4 contingency tables for the weekly rainfall. The control consists of the category of rainfall for week  $i$  and the complement consists of category of rainfall for week  $i+1$  for a given month, where the categories are given in Table 14.

The results of the test statistics suggest that the weeks of January, the weeks of February, and the weeks of April are not independent at  $\alpha = .10$  significance level ( $\chi_{.90}^2(9) = 14.7$  with  $\alpha = .10$ ). The rest of the months, October, November, December, and March appear independent at the  $\alpha = .10$  significance level.

Table 19 shows the test statistics, approximate chi-squared values, and the achieved significance level  $\alpha$ .





OCTOBER

	1	2	3	4	
1	51	11	10	15	87
2	14	3	3	3	23
3	10	2	4	0	16
4	7	3	4	4	18
	82	19	21	22	144

Figure 35: 4x4 contingency table for OCTOBER.

NOVEMBER

	1	2	3	4	
1	22	11	12	10	55
2	9	7	9	6	31
3	7	9	3	8	27
4	9	3	10	9	31
	47	30	34	33	144

Figure 36: 4x4 contingency table for NOVEMBER.



DECEMBER

	1	2	3	4	
1	15	11	7	9	42
2	7	10	10	4	31
3	11	7	7	11	36
4	11	8	5	11	35
	44	36	29	35	144

Figure 37: 4x4 contingency table for DECEMBER

JANUARY

	1	2	3	4	
1	22	9	5	9	45
2	8	9	10	7	34
3	6	4	12	10	32
4	6	8	8	11	33
	42	30	35	37	144

Figure 38: 4x4 contingency table for JANUARY



FEBRUARY

	1	2	3	4	
1	15	11	6	8	40
2	5	9	12	4	30
3	13	11	7	8	39
4	6	6	10	13	35
	39	37	35	33	144

Figure 39: 4x4 contingency table for FEBRUARY

MARCH

	1	2	3	4	
1	10	10	5	4	29
2	9	8	12	11	40
3	13	9	6	10	38
4	4	11	12	10	37
	36	38	35	35	144

Figure 40: 4x4 contingency table for MARCH



APRIL

	1	2	3	4	
1	37	13	9	6	65
2	10	9	3	4	26
3	10	4	6	2	22
4	11	2	8	10	31
	68	28	26	22	144

Figure 41: 4x4 contingency table for APRIL





Table 19: TEST STATISTIC, APPROXIMATE CHI-SQUARED VALUES,  
SIGNIFICANCE LEVEL FOR THE MONTH.

MONTHS	TEST STATISTIC	APPROXIMATED CHI-SQUARED $\chi^2_{1-\alpha} (9)$	SIGNIFICANCE LEVEL $\alpha$
OCTOBER	7.24	$\chi^2_{.40} (9)$	0.60
NOVEMBER	10.45	$\chi^2_{.68} (9)$	0.32
DECEMBER	8.43	$\chi^2_{.50} (9)$	0.50
JANUARY	18.64	$\chi^2_{.97} (9)$	0.03
FEBRUARY	15.92	$\chi^2_{.93} (9)$	0.07
MARCH	11.94	$\chi^2_{.77} (9)$	0.23
APRIL	19.71	$\chi^2_{.98} (9)$	0.02



## E. LOGISTIC ANALYSIS

### 1. Theory

The logistic analysis to be described in this section was developed from Cox [Ref. 1].

The basic approach is to view the complement as having a binary representation, with success being defined to mean that a complement has rainfall, while failure means that the complement has no rainfall for week  $t+1$ . The problem then is to find the conditional probability of a success given that the control takes on a particular value.

Let  $X_t$  be the rainfall in week  $t$ . If the probability of "success" = rainfall in week  $t+1$ , given  $X_t$ , is written as

$$\theta_t = P(\text{rainfall in week } t+1 | X_t),$$

the logistic model is

$$\theta_t = \frac{e^{\alpha + \beta X_t}}{1 + e^{\alpha + \beta X_t}},$$

where the  $X_t$  are the explanatory variables.

The likelihood function is then

$$L(X, Y; \alpha, \beta) = \prod_{t=1}^N \left( \frac{e^{\alpha + \beta X_t}}{1 + e^{\alpha + \beta X_t}} \right)^{Y_{t+1}} \left( \frac{1}{1 + e^{\alpha + \beta X_t}} \right)^{1 - Y_{t+1}}$$

where:



$$Y_{t+1} = \begin{cases} 1 & \text{if week } t+1 \text{ has rainfall} \\ 0 & \text{if week } t+1 \text{ has no rainfall} \end{cases}$$

and the log-likelihood is

$$L(X, Y; \alpha, \beta) = \alpha \sum_{t=1}^N Y_t + \beta \sum_{t=1}^N X_t Y_t - \sum_{t=1}^N \ln(1 + e^{\alpha + \beta X_t})$$

The gradient, and Hessians are:

$$\frac{\partial \text{Log } L}{\partial \alpha} = \sum_{t=1}^N Y_t - \sum_{t=1}^N \left( \frac{e^{\alpha + \beta X_t}}{1 + e^{\alpha + \beta X_t}} \right)$$

$$\frac{\partial \text{Log } L}{\partial \beta} = \sum_{t=1}^N X_t Y_t - \sum_{t=1}^N X_t \left( \frac{e^{\alpha + \beta X_t}}{1 + e^{\alpha + \beta X_t}} \right)$$

Hessian:

$$- \sum_{t=1}^N \frac{e^{\alpha + \beta X_t}}{(1 + e^{\alpha + \beta X_t})^2} - \sum_{t=1}^N \frac{X_t e^{\alpha + \beta X_t}}{(1 + e^{\alpha + \beta X_t})^2}$$

$$H_L =$$

$$- \sum_{t=1}^N \frac{X_t e^{\alpha + \beta X_t}}{(1 + e^{\alpha + \beta X_t})^2} - \sum_{t=1}^N \frac{X_t^2 e^{\alpha + \beta X_t}}{(1 + e^{\alpha + \beta X_t})^2}$$

Information Matrix:

$$I_{s_1 s_2} = -H_L$$



to solve for  $\alpha$  and  $\beta$  use of Newton's method as follows;

$$\begin{pmatrix} \alpha \\ \beta \end{pmatrix}_{k+1} = \begin{pmatrix} \alpha \\ \beta \end{pmatrix}_k - H_L^{-1} \nabla t_L$$

All necessary elements may be calculated in one pass of the computer algorithm.

One beneficial byproduct of the maximum likelihood approach is the asymptotic covariance matrix,  $(I_{s_1 s_2}^{-1})$ . Cos [Ref. 3] states that the diagonal elements of this matrix provide good estimates of  $\text{Var}(\alpha)$  and  $\text{Var}(\hat{\beta})$  under assumptions of normality.

Next, by using the diagonal elements of the asymptotic covariance matrix to put approximately symmetric confidence limits on  $\alpha$  and  $\beta$ ; for 90%

$$\hat{\alpha} - 1.64 \sqrt{I^{s,s}(\hat{\alpha})} < \alpha < \hat{\alpha} + 1.64 \sqrt{I^{s,s}(\hat{\alpha})}$$

$$\hat{\beta} - 1.64 \sqrt{I^{s,s}(\hat{\beta})} < \beta < \hat{\beta} + 1.64 \sqrt{I^{s,s}(\hat{\beta})}$$

## 2. Analysis

In this analysis, given week  $i$  has rainfall/no rainfall in year  $t$  is considered as a control  $X$ , then conditional probability of success which week  $i+1$  has rainfall in year  $t$  is considered as a complement  $Y$ . Let

$$Y_{i+1} = \begin{cases} 1 & \text{if week } i+1 \text{ has rainfall} \\ 0 & \text{if week } i+1 \text{ has no rainfall} \end{cases}$$





and

$$X_i = \begin{cases} 1 & \text{if week } i \text{ has rainfall} \\ 0 & \text{if week } i \text{ has no rainfall} \end{cases}$$

Then, the model

$$P\{Y_{i+1} = 1 | X_i\} = \theta = \frac{e^{\alpha + \beta X_i}}{1 + e^{\alpha + \beta X_i}}$$

and

$$\log \text{Odds} = \psi = \ln\left(\frac{\theta}{1-\theta}\right) = \alpha + \beta X_i$$

Using the computer package "BMDPLR" estimates of  $\alpha$  and  $\beta$  were obtained using maximum likelihood. Other quantities computed were conditional observed and predicted. These values are shown in Table 20. Also the number of successes, number of failures, predicted log odds and parameters  $\alpha$  and  $\beta$  and their 90% confidence interval are shown in the same tables for the weeks. In the tables weeks are shown with their names which are indicated in the glossary of symbols tables.

In the 2x2 tables, the  $\chi^2$  test results have suggested that the weeks O2 vs O3, D3 vs D4, J1 vs J2, J2 vs J3, JF vs F1, and A2 vs A3 are not independent with  $\alpha = 0.10$  significance level. Logistic model also indicates that these weeks



Table 20: RESULTS OF THE LOGISTIC ANALYSIS FOR THE WEEKS

MODEL : P(O2=1|O1=x)  
 -----

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	O1
8	7	0.5333	0.5333	0.134	0
14	7	0.6667	0.6667	0.693	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.133	0.518	0.258
Beta	0.560	0.694	0.806
Var[ $\alpha$ ]=0.15		Var[ $\beta$ ]=0.65	

90% Confidence limits

	Lower	Upper
Alpha	-0.502	0.768
Beta	-0.762	1.882

MODEL : P(O3=1|O2=x)  
 -----

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	O2
3	11	0.2143	0.2143	-1.299	0
11	11	0.5000	0.5000	0.0	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-1.299	0.651	-1.995
Beta	1.299	0.778	1.669
Var[ $\alpha$ ]=0.31		Var[ $\beta$ ]=0.55	

90% Confidence limits

	Lower	Upper
Alpha	-2.212	-0.386
Beta	0.083	2.515



MODEL : P(O4=1|O3=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	O3
12	10	0.5455	0.5455	0.182	0
10	4	0.7143	0.7143	0.916	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.182	0.428	0.426
Beta	0.734	0.730	1.005
Var[ $\alpha$ ]=0.20		Var[ $\beta$ ]=0.51	

90% Confidence limits

	Lower	Upper
Alpha	-0.551	0.915
Beta	-0.437	1.905

MODEL : P(ON=1|O4=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	O4
5	9	0.3571	0.3571	-0.588	0
13	9	0.5909	0.5909	0.368	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.588	0.558	-1.054
Beta	0.956	0.707	1.352
Var[ $\alpha$ ]=0.21		Var[ $\beta$ ]=0.48	

90% Confidence limits

	Lower	Upper
Alpha	-1.340	0.164
Beta	-0.180	2.092

MODEL : P(N2=1|N1=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	N1
11	5	0.6875	0.6875	0.788	0
17	3	0.8500	0.8500	1.735	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.788	0.539	1.462
Beta	0.947	0.826	1.145
Var[ $\alpha$ ]=0.29		Var[ $\beta$ ]=0.68	

90% Confidence limits

	Lower	Upper
Alpha	-0.095	1.671
Beta	-0.405	2.299



MODEL : P(N3=1|N2=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	N2
3	5	0.3750	0.3750	-0.511	0
16	12	0.5714	0.5714	0.288	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.511	0.730	-0.699
Beta	0.799	0.824	0.969
Var[ $\alpha$ ]=0.53		Var[ $\beta$ ]=0.68	

90% Confidence limits

	Lower	Upper
Alpha	-1.705	0.693
Beta	-0.553	2.151

MODEL : P(N4=1|N3=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	N3
9	8	0.5294	0.5294	0.118	0
13	6	0.6842	0.6842	0.773	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.118	0.486	0.242
Beta	0.655	0.693	0.946
Var[ $\alpha$ ]=0.24		Var[ $\beta$ ]=0.48	

90% Confidence limits

	Lower	Upper
Alpha	-0.685	0.921
Beta	-0.481	1.791

MODEL : P(D1=1|N4=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	N4
10	4	0.7143	0.7143	0.916	0
18	4	0.8182	0.8182	1.504	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.916	0.592	1.549
Beta	0.588	0.810	0.726
Var[ $\alpha$ ]=0.35		Var[ $\beta$ ]=0.66	

90% Confidence limits

	Lower	Upper
Alpha	-0.054	1.886
Beta	-0.744	1.920





MODEL : P(D2=1|D1=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	D1
5	3	0.6250	0.6250	0.511	0
17	11	0.6071	0.6071	0.435	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.511	0.730	0.699
Beta	-0.076	0.826	-0.091
Var[ $\alpha$ ]=0.53		Var[ $\beta$ ]=0.68	

90% Confidence limits

	Lower	Upper
Alpha	-0.683	1.705
Beta	-1.428	1.276

MODEL : P(D3=1|D2=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	D2
10	4	0.7143	0.7143	0.916	0
18	4	0.8182	0.8182	1.504	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.916	0.592	1.549
Beta	0.588	0.810	0.726
Var[ $\alpha$ ]=0.31		Var[ $\beta$ ]=0.52	

90% Confidence limits

	Lower	Upper
Alpha	0.003	1.829
Beta	-0.595	1.771

MODEL : P(D4=1|D3=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	D3
3	5	0.3750	0.3750	-0.511	0
21	7	0.7500	0.7500	1.099	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.511	0.730	-0.699
Beta	1.609	0.851	1.892
Var[ $\alpha$ ]=0.53		Var[ $\beta$ ]=0.72	

90% Confidence limits

	Lower	Upper
Alpha	-1.705	0.683
Beta	0.217	3.001



MODEL : P (J1=1|D4=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	D4
4	4	0.5000	0.5000	0.000	0
22	6	0.7857	0.7857	1.299	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.000	0.707	0.000
Beta	1.299	0.844	1.540
Var[ $\alpha$ ]=0.44		Var[ $\beta$ ]=0.65	

90% Confidence limits

	Lower	Upper
Alpha	-1.088	1.088
Beta	-0.023	2.621

MODEL : P (J2=1|J1=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	J1
4	6	0.4000	0.4000	-0.405	0
21	5	0.8077	0.8077	1.435	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.405	0.645	-0.628
Beta	1.840	0.815	2.258
Var[ $\alpha$ ]=0.42		Var[ $\beta$ ]=0.66	

90% Confidence limits

	Lower	Upper
Alpha	-1.468	0.658
Beta	0.508	3.172

MODEL : P (J3=1|J2=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	J2
3	8	0.2727	0.2727	-0.981	0
18	7	0.7200	0.7200	0.944	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.981	0.677	-1.449
Beta	1.925	0.810	2.376
Var[ $\alpha$ ]=0.46		Var[ $\beta$ ]=0.65	

90% Confidence limits

	Lower	Upper
Alpha	-2.093	0.131
Beta	0.603	3.247



MODEL : P(J4=1|J3=x)

-----

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	J3
10	5	0.6667	0.6667	0.693	0
17	4	0.8095	0.8095	1.447	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.693	0.548	1.266
Beta	0.754	0.780	0.966
Var[ $\alpha$ ]=0.30		Var[ $\beta$ ]=0.61	

90% Confidence limits

	Lower	Upper
Alpha	-0.205	1.591
Beta	-0.527	2.035

MODEL : P(JF=1|J4=x)

-----

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	J4
6	3	0.6667	0.6667	0.694	0
23	4	0.8519	0.8519	1.749	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.694	0.707	0.980
Beta	1.056	0.891	1.186
Var[ $\alpha$ ]=0.50		Var[ $\beta$ ]=0.80	

90% Confidence limits

	Lower	Upper
Alpha	-0.466	1.854
Beta	-0.411	2.523

MODEL : P(F1=1|JF=x)

-----

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	JF
2	5	0.2857	0.2857	-0.916	0
25	4	0.8621	0.8621	1.833	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.916	0.837	-1.095
Beta	2.749	0.995	2.763
Var[ $\alpha$ ]=0.70		Var[ $\beta$ ]=1.00	

90% Confidence limits

	Lower	Upper
Alpha	-2.288	0.456
Beta	1.109	4.389



MODEL : P(F2=1|F1=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	F1
7	2	0.7778	0.7778	1.050	0
20	7	0.7407	0.7407	1.253	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	1.253	0.802	1.562
Beta	-0.203	0.914	-0.222
Var[ $\alpha$ ]=0.64		Var[ $\beta$ ]=0.84	

90% Confidence limits

	Lower	Upper
Alpha	-0.059	2.565
Beta	-1.706	1.300

MODEL : P(F3=1|F2=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	F2
5	4	0.5556	0.5556	0.223	0
16	11	0.5926	0.5926	0.375	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.223	0.671	0.333
Beta	0.152	0.777	0.195
Var[ $\alpha$ ]=0.45		Var[ $\beta$ ]=0.60	

90% Confidence limits

	Lower	Upper
Alpha	-0.877	1.323
Beta	-1.118	1.422

MODEL : P(FM=1|F3=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	F3
11	4	0.7333	0.7333	1.012	0
19	2	0.9048	0.9048	2.251	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	1.011	0.584	1.733
Beta	1.241	0.945	1.311
Var[ $\alpha$ ]=0.34		Var[ $\beta$ ]=0.89	

90% Confidence limits

	Lower	Upper
Alpha	0.055	1.967
Beta	-0.306	2.788





MODEL : P(M1=1|FM=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	FM
5	1	0.8333	0.8333	1.609	0
27	3	0.9000	0.9000	2.197	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	1.609	1.095	1.469
Beta	0.588	1.253	0.469
Var[ $\alpha$ ]=1.19		Var[ $\beta$ ]=1.57	

90% Confidence limits

	Lower	Upper
Alpha	-0.180	3.398
Beta	-1.467	2.643

MODEL : P(M2=1|M1=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	M1
4	0	1.0000	0.9999	2.197	0
24	8	0.7500	0.7500	1.009	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	2.197	0.000	0.000
Beta	-1.098	0.408	-2.691
Var[ $\alpha$ ]=2.78		Var[ $\beta$ ]=2.94	

90% Confidence limits

	Lower	Upper
Alpha	-0.537	4.931
Beta	-3.910	1.714

MODEL : P(M3=1|M2=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	M2
5	3	0.6250	0.6250	0.511	0
20	8	0.7143	0.7143	0.916	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.511	0.730	0.699
Beta	0.405	0.842	0.482
Var[ $\alpha$ ]=0.53		Var[ $\beta$ ]=0.71	

90% Confidence limits

	Lower	Upper
Alpha	-0.683	1.705
Beta	-0.977	1.787



MODEL : P(M4=1|M3=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	M3
5	6	0.4545	0.4545	-0.182	0
18	7	0.7200	0.7200	0.944	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.182	0.606	-0.301
Beta	1.127	0.752	1.499
Var[ $\alpha$ ]=0.37		Var[ $\beta$ ]=0.57	

90% Confidence limits

	Lower	Upper
Alpha	-1.180	0.816
Beta	-0.111	2.365

MODEL : P(A1=1|M4=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	M4
7	6	0.5385	0.5385	0.154	0
14	9	0.6087	0.6087	0.442	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.154	0.556	0.277
Beta	0.288	0.701	0.410
Var[ $\alpha$ ]=0.31		Var[ $\beta$ ]=0.49	

90% Confidence limits

	Lower	Upper
Alpha	-0.759	1.067
Beta	-0.860	1.436

MODEL : P(A2=1|A1=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	A1
8	7	0.5333	0.5333	0.134	0
14	7	0.6667	0.6667	0.693	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.134	0.518	0.258
Beta	0.560	0.694	0.806
Var[ $\alpha$ ]=0.27		Var[ $\beta$ ]=0.48	

90% Confidence limits

	Lower	Upper
Alpha	-0.718	0.986
Beta	-0.576	1.696



MODEL : P(A3=1|A2=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	A2
3	11	0.2143	0.2143	-1.299	0
11	11	0.5000	0.5000	0.000	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-1.299	0.651	-1.995
Beta	1.299	0.778	1.669
Var[ $\alpha$ ]=0.42		Var[ $\beta$ ]=0.61	

90% Confidence limits

	Lower	Upper
Alpha	-2.362	-0.236
Beta	0.018	2.580

MODEL : P(A4=1|A3=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	A3
12	10	0.5455	0.5455	0.182	0
10	4	0.7143	0.7143	0.916	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.182	0.428	0.426
Beta	0.733	0.730	1.005
Var[ $\alpha$ ]=0.18		Var[ $\beta$ ]=0.53	

90% Confidence limits

	Lower	Upper
Alpha	-0.514	0.878
Beta	-0.461	1.927

MODEL : P(A5=1|A4=x)

# OF SUCCESS	# OF FAIL	OBSERVED PROBABILITY	PREDICTED PROBABILITY	LOG ODDS	A4
5	9	0.3571	0.3571	-0.588	0
13	9	0.5909	0.5909	0.368	1

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.588	0.558	-1.054
Beta	0.956	0.707	1.352
Var[ $\alpha$ ]=0.30		Var[ $\beta$ ]=0.50	

90% Confidence limits

	Lower	Upper
Alpha	-1.486	0.310
Beta	-0.204	2.116



are dependent on each other at the 10% significance level since the 90% confidence interval for beta does not cover zero.

The following logistic model was also considered.

$$P\{Y_{t+1} = 1 | R_t\} = \frac{e^{\alpha + \beta R_t}}{1 + e^{\alpha + \beta R_t}},$$

where  $R_t$  is the amount of rainfall in week  $t$  and  $Y_{t+1}$  is a binary random variable taking the value 1 if week  $t+1$  has positive rainfall. Tabel 21 shows the alpha and beta coefficients, standard errors (ss) and the 90% confidence limits for the alpha and beta coefficients. These numbers were computed using computer package "BMDPLR".

The 90% confidence intervals for do not cover zero only for the weeks D3 vs D4, JF vs F1, and M2 vs M3. This suggests that for these weeks the amount of rainfall in the previous weeks exceeds the amount of rainfall in the current week. Figures 42 and 43 show the plots of estimated alpha and beta coefficients by week.





Table 21: RESULT OF LOGISTIC ANALYSIS FOR THE WEEKS

MODEL : P(O2=1|O1=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.438	0.409	1.071
Beta	0.027	0.432	0.062
Var[ $\alpha$ ]=0.13		Var[ $\beta$ ]=2.91	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.153	1.029	
Beta	-2.771	2.825	

MODEL : P(O3=1|O2=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.735	0.424	-1.735
Beta	1.067	1.175	1.173
Var[ $\alpha$ ]=0.16		Var[ $\beta$ ]=0.87	
90% Confidence limits			
	Lower	Upper	
Alpha	-1.391	-0.079	
Beta	-0.463	2.597	

MODEL : P(O4=1|O3=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.380	0.379	1.002
Beta	0.317	0.748	0.424
Var[ $\alpha$ ]=0.14		Var[ $\beta$ ]=1.18	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.334	0.994	
Beta	-1.464	2.098	

MODEL : P(ON=1|O4=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.192	0.438	-0.439
Beta	0.636	0.942	0.675
Var[ $\alpha$ ]=0.14		Var[ $\beta$ ]=1.29	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.806	0.422	
Beta	-1.227	2.499	



MODEL : P(N2=1|N1=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.986	0.466	2.115
Beta	0.743	0.807	0.921
Var[ $\alpha$ ]=0.22		Var[ $\beta$ ]=0.65	
90% Confidence limits			
	Lower	Upper	
Alpha	0.217	1.755	
Beta	-0.579	2.065	

MODEL : P(N3=1|N2=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.102	0.422	-0.243
Beta	0.284	0.351	0.807
Var[ $\alpha$ ]=0.18		Var[ $\beta$ ]=0.12	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.798	0.576	
Beta	-0.384	0.852	

MODEL : P(N4=1|N3=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.595	0.395	1.507
Beta	-0.280	0.375	-0.748
Var[ $\alpha$ ]=0.16		Var[ $\beta$ ]=0.14	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.061	1.251	
Beta	-0.894	0.334	

MODEL : P(D1=1|N4=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	1.106	0.454	2.434
Beta	0.336	0.589	0.570
Var[ $\alpha$ ]=0.21		Var[ $\beta$ ]=0.35	
90% Confidence limits			
	Lower	Upper	
Alpha	0.354	1.858	
Beta	-0.634	1.306	



MODEL : P(D2=1|D1=x)

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.294	0.456	0.644
Beta	0.230	0.450	0.509
Var[ $\alpha$ ]=0.21		Var[ $\beta$ ]=0.20	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.458	1.046	
Beta	-0.503	0.963	

MODEL : P(D3=1|D2=x)

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	1.378	0.485	2.838
Beta	-0.301	0.614	-0.490
Var[ $\alpha$ ]=0.24		Var[ $\beta$ ]=0.38	
90% Confidence limits			
	Lower	Upper	
Alpha	0.575	2.181	
Beta	-1.312	0.710	

MODEL : P(D4=1|D3=x)

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.396	0.482	0.822
Beta	0.560	0.653	0.858
Var[ $\alpha$ ]=0.23		Var[ $\beta$ ]=0.43	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.391	1.183	
Beta	-0.515	1.635	

MODEL : P(J1=1|D4=x)

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.132	0.499	0.265
Beta	1.952	0.988	1.976
Var[ $\alpha$ ]=0.25		Var[ $\beta$ ]=1.07	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.688	0.952	
Beta	0.256	3.648	



MODEL : P(J2=1|J1=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.299	0.445	0.671
Beta	1.232	0.801	1.538
Var[ $\alpha$ ]=0.20		Var[ $\beta$ ]=0.64	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.434	1.032	
Beta	-0.080	2.544	

MODEL : P(J3=1|J2=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.045	0.434	-0.104
Beta	0.526	0.402	1.310
Var[ $\alpha$ ]=0.19		Var[ $\beta$ ]=0.16	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.760	0.670	
Beta	-0.130	1.182	

MODEL : P(J4=1|J3=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.809	0.472	1.712
Beta	0.394	0.428	0.922
Var[ $\alpha$ ]=0.22		Var[ $\beta$ ]=0.18	
90% Confidence limits			
	Lower	Upper	
Alpha	0.040	1.578	
Beta	-0.302	1.090	

MODEL : P(JF=1|J4=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	1.525	0.567	2.690
Beta	-0.137	0.482	-0.285
Var[ $\alpha$ ]=0.32		Var[ $\beta$ ]=0.23	
90% Confidence limits			
	Lower	Upper	
Alpha	0.597	2.448	
Beta	-0.924	0.650	





MODEL : P(F1=1|JF=x)

---

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.356	0.505	0.706
Beta	1.162	0.691	1.680
Var[ $\alpha$ ]=0.26		Var[ $\beta$ ]=0.48	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.480	1.192	
Beta	0.026	2.298	

MODEL : P(F2=1|F1=x)

---

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.986	0.491	2.008
Beta	0.161	0.454	0.354
Var[ $\alpha$ ]=0.24		Var[ $\beta$ ]=0.21	
90% Confidence limits			
	Lower	Upper	
Alpha	0.183	1.699	
Beta	-0.591	0.913	

MODEL : P(F3=1|F2=x)

---

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.135	0.444	0.304
Beta	0.412	0.606	0.679
Var[ $\alpha$ ]=0.20		Var[ $\beta$ ]=0.37	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.598	0.868	
Beta	-0.586	1.410	

MODEL : P(FM=1|F3=x)

---

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	1.445	0.546	2.647
Beta	0.272	0.578	0.471
Var[ $\alpha$ ]=0.30		Var[ $\beta$ ]=0.33	
90% Confidence limits			
	Lower	Upper	
Alpha	0.547	2.343	
Beta	-0.670	1.214	



MODEL : P(M1=1|FM=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	1.613	0.634	2.545
Beta	0.837	0.940	0.890
Var[ $\alpha$ ]=0.40		Var[ $\beta$ ]=0.88	
90% Confidence limits			
	Lower	Upper	
Alpha	0.576	2.650	
Beta	-0.701	2.375	

MODEL : P(M2=1|M1=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	1.209	0.535	2.258
Beta	0.083	0.681	0.122
Var[ $\alpha$ ]=0.29		Var[ $\beta$ ]=0.46	
90% Confidence limits			
	Lower	Upper	
Alpha	0.326	2.092	
Beta	-1.029	1.195	

MODEL : P(M3=1|M2=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.143	0.467	0.307
Beta	1.377	0.776	1.774
Var[ $\alpha$ ]=0.22		Var[ $\beta$ ]=0.60	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.626	0.912	
Beta	0.107	2.647	

MODEL : P(M4=1|M3=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.237	0.435	0.546
Beta	0.800	0.694	1.154
Var[ $\alpha$ ]=0.19		Var[ $\beta$ ]=0.48	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.478	0.952	
Beta	-0.336	1.936	



MODEL : P(A1=1|M4=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.087	0.407	-0.213
Beta	0.728	0.466	1.563
Var[ $\alpha$ ]=0.17		Var[ $\beta$ ]=0.22	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.763	0.589	
Beta	-0.041	1.497	

MODEL : P(A2=1|A1=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.438	0.409	1.071
Beta	0.027	0.432	0.062
Var[ $\alpha$ ]=0.17		Var[ $\beta$ ]=0.19	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.238	1.114	
Beta	-0.688	0.742	

MODEL : P(A3=1|A2=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.735	0.424	-1.735
Beta	1.067	0.909	1.173
Var[ $\alpha$ ]=0.18		Var[ $\beta$ ]=0.83	
90% Confidence limits			
	Lower	Upper	
Alpha	-1.431	-0.039	
Beta	-0.427	2.561	

MODEL : P(A4=1|A3=x)  
-----

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	0.380	0.379	1.002
Beta	0.317	0.748	0.424
Var[ $\alpha$ ]=0.14		Var[ $\beta$ ]=0.56	
90% Confidence limits			
	Lower	Upper	
Alpha	-0.234	0.994	
Beta	-0.910	1.544	



MODEL : P(AH=1|A4=x)

PARAMETER	COEFFICIENT	SE	COEF/SE
Alpha	-0.192	0.438	-0.439
Beta	0.636	0.942	0.675
Var[ $\alpha$ ]=0.19		Var[ $\beta$ ]=0.89	

90% Confidence limits

	Lower	Upper
Alpha	-0.907	0.523
Beta	-0.911	2.183





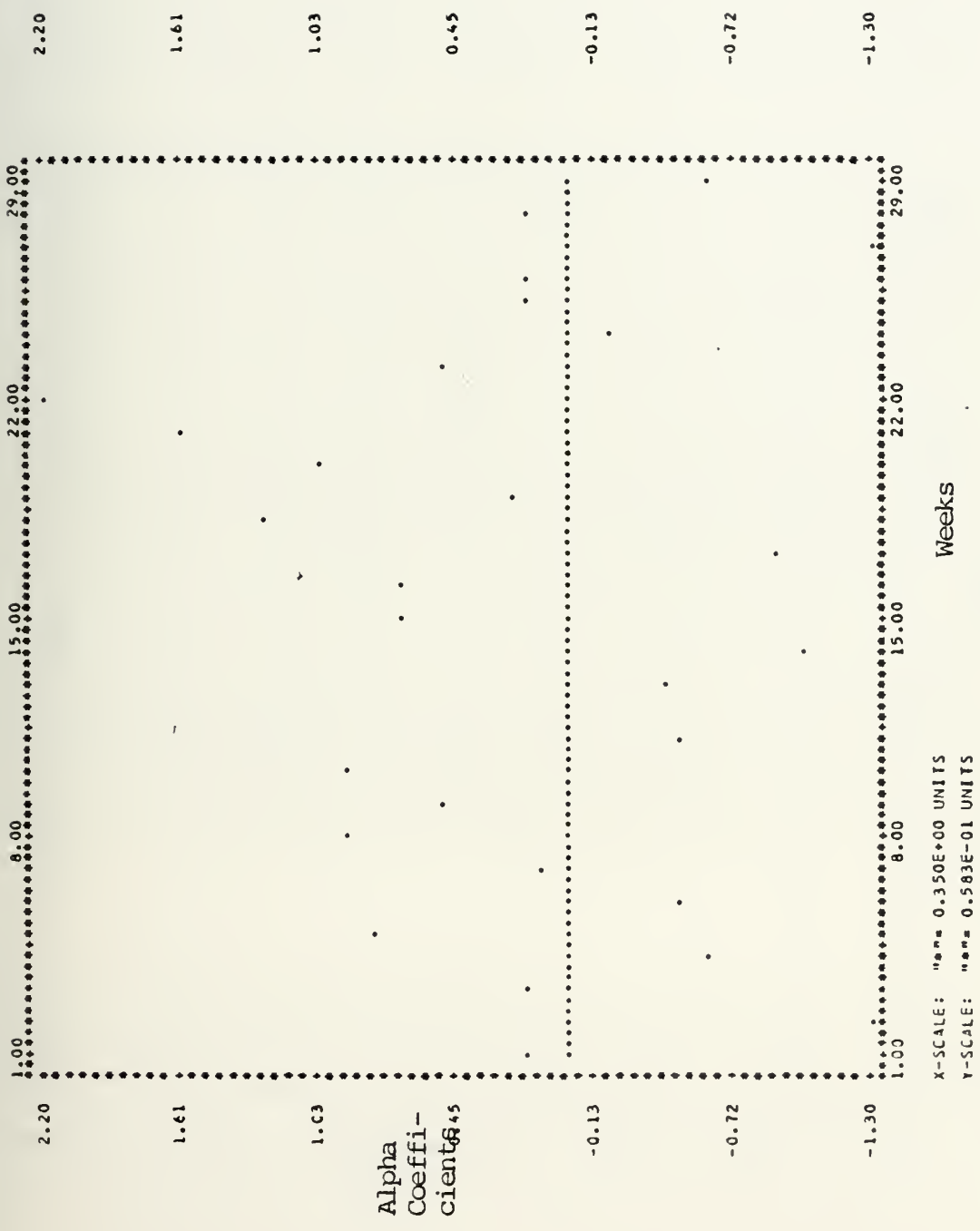


Figure 42. Plot of alpha coefficient for the weeks



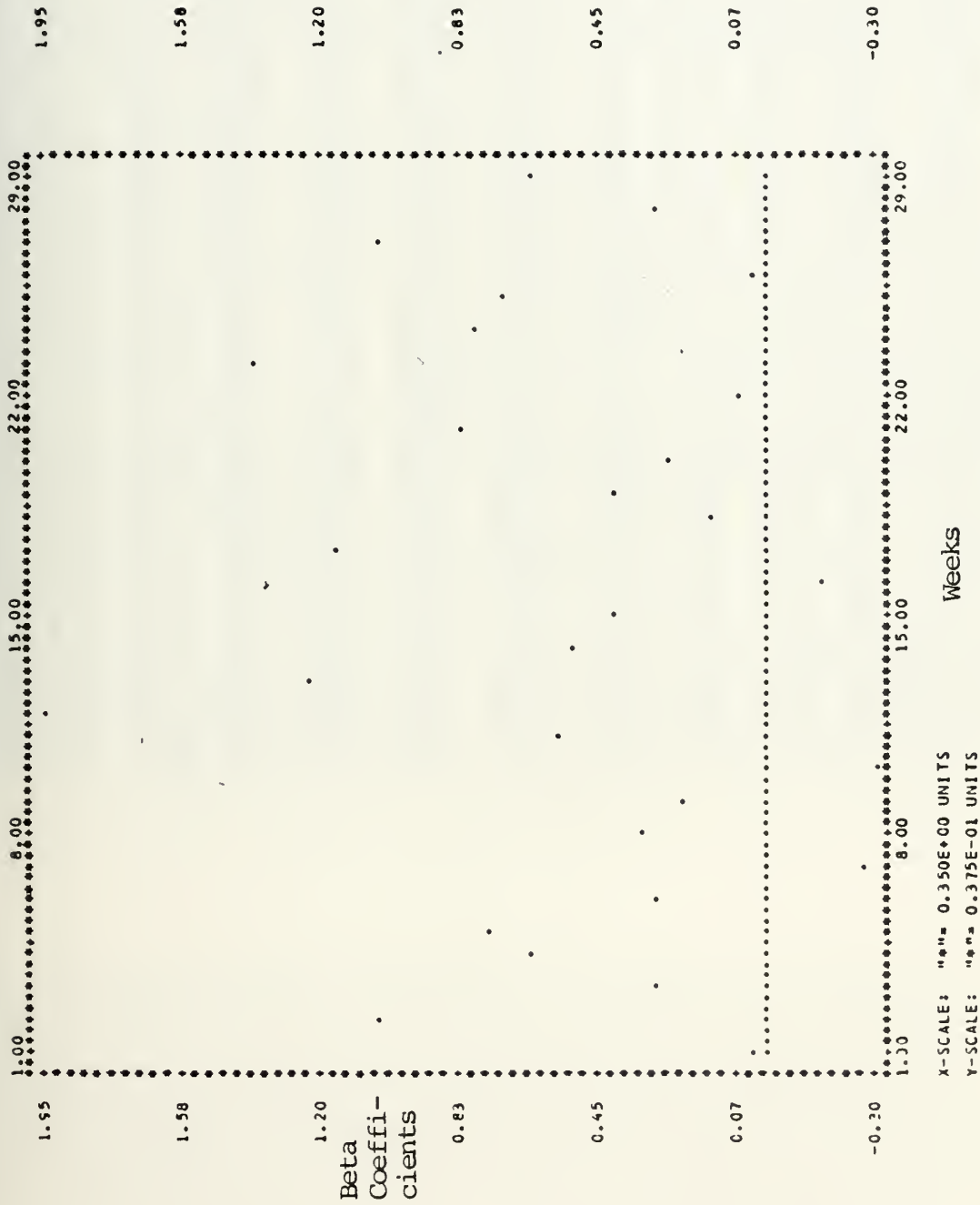


Figure 43. Plot of beta coefficient for the weeks



APPENDIX A . DAILY RAINFALL DATA

JULIAN DATE

YEAR	1	2	3	4	5	6	7	8	9	10	11
1938	0.0	0.15	0.30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.04	0.0	0.78	0.36	0.0	0.0	0.0	0.0	0.0
1940	0.16	2.13	0.10	0.72	0.07	0.45	0.19	0.72	0.25	0.79	1.34
1941	0.0	0.0	0.0	0.44	0.42	0.07	0.28	0.10	0.03	0.0	0.0
1942	0.14	0.0	0.0	0.0	0.0	0.0	0.0	0.20	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.53	0.24	0.25	0.08	0.49	0.0	0.0	0.0	0.74	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.04	0.23	0.17	0.56	0.0	0.0	0.08	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.02	0.0	0.02	0.05	0.0	0.0	0.0	0.0
1949	0.12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.18	0.05	0.0	0.02	0.0	0.0	0.44	0.12	0.0	0.61	0.31
1951	0.0	0.0	0.12	0.0	0.0	0.0	0.0	0.0	0.0	0.49	0.15
1952	0.0	0.0	0.0	0.0	0.0	0.24	1.20	0.49	0.0	0.0	0.15
1953	0.0	0.02	0.0	0.0	0.0	0.10	0.10	0.67	0.02	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.0	0.0	0.0	0.37
1955	1.23	0.03	0.0	0.0	0.05	0.0	0.0	0.0	0.01	0.74	0.0
1956	0.0	0.0	0.0	0.0	0.66	0.15	0.0	0.42	0.0	0.19	0.04
1957	0.0	0.0	0.0	0.0	0.22	0.40	0.0	0.0	0.14	0.0	0.0
1958	0.0	0.14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.26	0.01
1959	0.0	0.0	0.0	0.0	0.36	1.02	0.0	0.0	0.56	1.58	0.11
1960	0.0	0.03	0.0	0.0	0.0	0.0	0.07	0.22	0.83	0.26	0.73
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02
1963	0.0	0.0	0.02	0.0	0.0	0.0	0.12	0.0	0.0	0.0	0.0
1964	0.02	0.0	0.0	0.0	0.0	0.05	0.0	0.0	0.04	0.0	0.0
1965	0.0	0.51	0.01	0.02	0.58	0.59	0.0	0.0	0.0	0.0	0.03
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.89	0.02	0.0
1969	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.02	0.02
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.12	0.05	0.66	0.94	0.06
1971	0.24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.06	0.23
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.06	0.10	0.0	0.0	0.0	0.21	0.45	0.35	0.03	0.0



JULIAN DATE

YEAR	12	13	14	15	16	17	18	19	20	21	22
1938	0.0	0.0	0.0	0.22	0.0	0.47	0.0	0.72	0.11	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.72	0.05	0.80	0.0	0.0	0.36	0.75	0.0	0.75
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.51
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.57	0.49
1944	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.02	0.02	0.0	0.01	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.22	0.34	0.0	0.82	0.20
1950	0.0	0.58	0.0	0.04	0.06	0.03	0.0	0.0	0.0	0.0	0.0
1951	0.26	0.0	0.0	0.0	0.56	0.0	0.05	0.20	0.0	0.0	0.07
1952	1.49	0.45	0.16	1.01	0.23	0.46	0.01	0.0	0.21	0.11	0.04
1953	0.02	0.12	0.35	0.10	0.0	0.07	0.04	0.0	0.0	0.10	0.0
1954	0.61	0.0	0.0	0.0	0.0	0.61	0.01	0.06	0.31	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.73	0.01	1.05	0.16	0.17	0.0	0.0
1956	0.0	0.0	0.12	0.31	0.46	0.0	0.02	0.0	0.38	0.10	0.04
1957	0.02	1.52	0.48	0.0	0.0	0.0	0.0	0.0	0.82	0.11	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.05	0.48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.01	0.37	0.44	0.0	0.0	0.0	0.0	0.0	0.09	0.19	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.11	0.0	0.0	0.0	0.0	0.0	0.02	1.47	0.32	0.38	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.12	0.0	0.0	0.05	0.36	0.10	0.48	0.88	0.83	0.24
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.15	0.0	0.13	0.01
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.08
1967	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.49	1.88	0.02
1968	0.0	0.09	0.53	0.06	0.0	0.0	0.0	0.0	0.01	0.0	0.0
1969	0.10	0.41	0.0	0.0	0.02	0.18	2.39	0.31	1.39	0.07	0.03
1970	0.0	0.13	0.63	1.22	0.05	0.02	0.0	0.32	0.42	0.06	0.02
1971	0.32	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.01	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.02	0.0	0.63	0.74	0.33	0.65	0.0	0.10	0.0	0.0





JULIAN DATE

YEAR	23	24	25	26	27	28	29	30	31	32	33
1938	0.0	0.0	0.0	0.0	0.0	0.90	0.0	1.12	1.00	1.10	0.15
1939	0.0	0.0	0.0	0.0	0.02	0.31	0.0	1.26	0.42	0.14	0.0
1940	0.07	0.26	0.09	0.47	0.0	0.0	0.0	0.0	0.46	0.48	0.07
1941	0.15	0.63	0.29	0.31	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.03	1.16	0.74	0.03	0.40	0.10	0.0	0.13	0.04	0.04	0.17
1943	0.13	0.02	0.0	0.11	0.14	0.0	0.18	0.33	0.08	0.0	0.0
1944	0.40	0.25	0.0	0.0	0.07	0.0	0.0	0.62	0.0	0.42	0.08
1945	0.0	0.0	0.04	0.0	0.0	0.0	0.0	0.0	0.89	0.0	2.37
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.01
1947	0.0	0.0	0.0	0.0	0.0	0.38	0.03	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.10	0.23
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.06	0.35
1950	0.15	0.18	0.0	0.0	0.35	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.16	0.0	0.0	0.0	0.0
1952	0.0	0.75	0.88	0.13	0.0	0.0	0.0	0.0	0.0	0.0	0.37
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.06	0.23	1.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.33	0.05	0.05	0.0
1956	0.20	0.0	0.58	0.26	0.61	0.27	0.01	0.0	0.0	0.0	0.0
1957	0.03	0.0	0.0	0.55	0.0	0.01	0.02	0.0	0.0	0.0	0.08
1958	0.0	1.11	0.27	0.36	0.03	0.0	0.0	0.38	0.36	0.0	0.94
1959	0.0	0.0	0.15	0.02	0.0	0.02	0.0	0.05	0.0	0.0	0.0
1960	0.30	0.19	0.04	0.0	0.0	0.0	0.0	0.03	0.19	0.36	0.12
1961	0.18	0.0	1.28	0.0	0.0	0.03	0.13	0.22	0.0	0.45	0.03
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.49	1.97	1.23	0.03	0.0
1964	0.02	0.0	0.01	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.32	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.0	0.0	0.03	0.0	0.0	2.11	0.13	0.0	0.0	0.0
1967	1.06	0.24	0.0	0.0	0.0	0.48	1.19	0.37	0.02	0.0	0.0
1968	0.0	0.0	0.0	0.11	0.20	0.10	0.14	0.96	0.0	0.02	0.02
1969	0.62	1.10	0.49	0.32	0.30	0.12	0.54	0.01	0.03	0.0	0.01
1970	0.46	0.01	0.0	0.34	0.0	0.0	0.03	0.0	0.01	0.0	0.0
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.16	0.17	0.0	0.0	0.34	1.05	0.16	0.0	0.0	0.01



JULIAN DATE

YEAR	34	35	36	37	38	39	40	41	42	43	44
1938	0.87	0.59	0.23	0.13	0.0	0.0	0.23	0.43	1.75	0.63	0.10
1939	0.29	0.24	0.0	0.07	0.20	0.38	0.0	0.17	0.0	0.0	0.0
1940	0.29	0.0	0.06	0.0	0.19	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.91	0.0	0.60	1.36	0.65	0.22	0.32	0.0
1942	0.16	0.02	0.78	0.45	0.02	0.01	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.36	0.20	0.0	0.0	0.0	0.0
1944	1.42	0.09	0.0	0.0	0.0	0.52	0.19	0.0	0.0	0.0	0.0
1945	0.13	0.0	0.21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.34	0.0	0.0	0.02	0.0	0.0	0.11	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.07	0.59	0.0	0.17	0.06
1948	0.02	0.86	0.45	0.10	0.0	0.0	0.04	0.0	0.0	0.0	0.0
1949	0.13	0.30	0.48	0.35	0.0	0.0	0.0	0.41	0.02	0.0	0.0
1950	0.55	0.16	0.42	0.0	0.0	0.0	0.58	0.03	0.0	0.0	0.0
1951	0.0	0.0	0.51	0.0	0.0	0.0	0.0	0.0	0.02	0.11	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.30	0.10	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.29
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.25	0.01	0.0	0.0	0.0	0.04
1958	1.14	0.02	0.20	0.0	0.0	0.0	0.12	0.03	0.01	0.32	0.07
1959	0.0	0.0	0.0	0.0	0.0	0.18	0.07	0.52	1.14	0.50	0.0
1960	0.04	0.62	0.28	0.02	0.25	0.40	0.40	0.11	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.03	0.01	0.0	0.0	0.28	0.10	0.0	0.0
1962	0.0	0.0	0.01	0.25	0.14	1.07	0.82	0.17	0.07	0.11	0.58
1963	0.0	0.0	0.0	0.0	0.10	0.02	1.21	0.14	0.01	0.67	0.07
1964	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.0	0.50	0.05	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.04
1966	0.08	0.22	0.60	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.0
1967	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03
1968	0.0	0.02	0.0	0.0	0.0	0.0	0.01	0.02	0.02	0.0	0.0
1969	0.01	0.07	0.50	0.10	0.0	0.02	0.01	0.11	1.69	0.01	0.0
1970	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.09	0.15	0.66	0.12
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.04	0.04	0.17	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0
1973	0.53	0.0	0.70	0.30	0.02	0.0	0.64	0.98	0.15	0.54	0.34



JULIAN DATE

YEAR	45	46	47	48	49	50	51	52	53	54	55
1938	0.75	0.05	0.0	0.0	0.08	0.24	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.52	0.05	0.0	0.69	0.10	0.0	0.0	0.0	0.33	0.43	0.0
1941	0.0	0.42	0.0	0.36	0.06	0.0	0.13	0.42	0.51	0.0	0.97
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.04	1.00	0.0	0.06
1943	0.0	0.0	0.0	0.05	0.0	0.0	0.0	0.24	0.44	0.10	0.03
1944	0.0	0.0	0.0	0.0	0.0	0.69	0.18	0.57	0.91	0.61	0.0
1945	0.21	0.09	0.0	0.0	0.17	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.31	0.56	0.0	0.0	0.0	0.07	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.08	0.14	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.01	0.32	0.01
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.28	0.13	0.03	0.04
1952	0.0	0.0	0.04	0.25	0.15	0.29	0.01	0.41	0.0	0.19	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.80	0.03	0.10	0.05	0.31	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.0	0.0	0.07	0.56	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.08	0.0	0.0	1.20	0.26
1957	0.0	0.0	0.02	0.04	0.0	0.03	0.05	0.25	0.21	0.52	0.08
1958	0.0	0.03	0.0	0.0	0.18	0.94	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	1.11	0.07	0.21	0.14	1.66	0.03	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.10	0.04	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.42	0.18	0.21	0.11	0.68	0.49	0.0	0.0	0.01	0.16	0.28
1963	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0
1966	0.0	0.0	0.0	0.0	0.04	0.0	0.0	0.0	0.15	0.13	0.0
1967	0.01	0.01	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.41
1968	0.0	0.12	0.25	0.03	0.02	0.40	0.37	0.01	0.02	0.01	0.01
1969	0.45	0.04	0.0	0.41	0.38	0.14	0.01	0.76	0.79	0.89	0.28
1970	0.0	0.05	0.17	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971	0.03	0.0	0.18	0.0	0.22	0.0	0.0	0.0	0.02	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.08	0.0	0.0	0.0
1973	0.06	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.17	0.0





JULIAN DATE

YEAR	56	57	58	59	60	61	62	63	64	65	66
1938	0.0	0.0	0.0	0.26	0.61	1.10	0.62	0.11	0.0	0.0	0.65
1939	0.0	0.0	0.0	0.13	0.0	0.0	0.0	0.01	0.0	0.0	0.01
1940	0.79	1.56	0.66	0.77	1.21	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.31	0.03	0.46	1.05	0.61	0.09	0.76	0.04	0.0	0.0
1942	0.16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.39	0.76	0.18	0.0	0.0	0.0	0.02	0.67	0.54	0.25	0.0
1944	0.0	0.05	0.0	0.02	2.33	0.0	0.09	0.0	0.41	0.20	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.03	0.0	0.33	0.0	0.08	0.0
1946	0.0	0.0	0.14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.02	0.12	0.21	0.13	0.0	0.0	0.0	0.04
1948	0.0	0.0	0.34	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.17	0.17	0.01	0.0	0.36	1.06	0.58	0.15	0.0	0.0	0.03
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.06	0.0	0.0
1951	0.0	0.07	0.94	0.04	0.98	0.06	0.0	0.0	0.18	0.05	0.17
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.0	0.16	0.0	0.47
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.0	0.06	0.81	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.04
1957	0.38	0.0	0.19	0.46	0.26	0.02	0.0	0.23	0.09	0.07	0.0
1958	0.59	0.03	0.0	0.0	0.0	0.0	0.06	0.38	0.0	0.02	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.03	0.01	0.05	0.43	0.01	0.01	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.15	0.0	0.23	0.06	0.0
1962	0.05	0.0	0.0	0.02	0.12	0.16	0.0	0.01	1.16	0.13	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.0	0.40
1964	0.0	0.0	0.0	0.10	0.0	0.27	0.0	0.01	0.0	0.02	0.01
1965	0.0	0.32	0.0	0.0	0.0	0.0	0.0	0.06	0.34	0.03	0.0
1966	0.25	0.0	0.0	0.0	0.35	0.0	0.0	0.01	0.0	0.04	0.0
1967	0.01	0.0	0.01	0.0	0.0	0.0	0.07	0.0	0.0	0.01	0.01
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.03	0.0	0.02	0.48
1969	0.62	0.0	0.34	0.32	0.02	0.08	0.0	0.0	0.0	0.0	0.0
1970	0.0	0.0	0.69	1.05	0.28	0.03	0.15	1.17	0.0	0.0	0.04
1971	0.0	0.11	0.07	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0	0.0	0.0	0.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.32	0.38	0.91	0.0	0.0	0.0	0.76	0.11	0.23	0.05	0.59





JULIAN DATE

YEAR	67	68	69	70	71	72	73	74	75	76	77
1938	0.21	0.0	0.0	0.16	0.62	0.41	0.03	0.0	0.50	0.0	0.0
1939	0.09	1.58	0.23	0.0	0.0	0.03	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.04	0.07	0.0	0.0	0.0	0.0	0.30	0.0
1941	0.0	0.0	0.0	0.0	0.10	0.40	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0	0.0	1.42	0.02	0.18	0.45	0.36	0.0	0.0	0.0
1943	0.48	0.72	0.32	0.09	0.01	0.0	0.0	0.08	0.0	0.15	0.47
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.04	0.0	0.47	0.02	0.16	0.09
1946	0.0	0.0	0.05	0.0	0.0	0.47	0.0	0.0	0.0	0.0	0.38
1947	0.06	0.30	0.26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02
1948	0.0	0.0	0.23	0.0	0.0	0.15	1.16	0.14	0.16	0.38	0.02
1949	0.08	0.05	0.70	0.22	0.03	0.0	0.0	0.01	0.0	0.0	0.56
1950	0.0	0.0	0.0	0.05	0.0	0.0	0.04	0.0	0.0	0.0	0.02
1951	0.0	0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.75	0.02	0.0	0.16	0.07	0.24	0.25	0.07	1.27	0.33	0.0
1953	0.0	0.0	0.08	0.12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.27	0.32	0.06	0.0	0.0	0.0	0.0	0.79	0.84	0.51
1955	0.0	0.0	0.01	0.0	0.04	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.38	0.04	0.02	0.16	0.06	0.0	0.35	0.0	0.0	0.0
1958	0.06	0.01	0.0	0.0	0.02	0.12	0.27	0.55	1.66	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.0
1960	0.03	0.0	0.0	0.0	0.17	0.16	0.0	0.0	0.0	0.0	0.0
1961	0.13	0.0	0.0	0.0	0.0	0.0	1.26	0.05	0.25	0.01	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.26	0.01	0.0	0.01	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.16	1.00	0.18	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.27	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.04	0.28	0.21	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.02	0.0	0.0	0.02	0.02	0.0	0.04	0.0	0.0	0.04
1967	0.0	0.02	1.22	0.11	0.81	0.20	0.01	1.05	0.24	0.0	0.03
1968	0.0	0.02	0.0	0.0	0.88	0.19	0.02	0.52	0.47	0.01	0.0
1969	0.01	0.49	0.0	0.35	0.02	0.0	0.0	0.01	0.01	0.0	0.0
1970	0.0	0.16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971	0.0	0.0	0.0	0.03	0.96	0.0	0.0	0.02	0.0	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.04	0.0	0.0	0.0	0.01	0.0	0.0
1973	0.0	0.0	0.26	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0



JULIAN DATE

YEAR	78	79	80	81	82	83	84	85	86	87	88
1938	0.0	0.10	0.10	0.0	0.0	0.35	0.0	0.0	0.0	0.06	0.0
1939	0.0	0.0	0.0	0.04	0.0	0.0	0.02	0.23	0.13	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.83	0.15
1941	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.33	0.29	0.06
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.40	0.17	0.39	0.0	0.0	0.58	0.07	0.0	0.0
1946	0.03	0.11	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.88	0.86
1947	0.0	0.0	0.0	0.10	0.0	0.0	0.0	0.06	0.38	0.02	0.24
1948	0.34	0.0	0.0	0.04	0.0	1.43	0.31	0.0	0.0	0.0	0.04
1949	0.15	0.0	0.01	0.57	0.17	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.04	0.07	0.0	0.09	0.79	0.47	0.01	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.02	0.61	0.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953	0.12	0.36	0.09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.09	0.35	0.44	0.0	0.06	0.22	0.0	0.0	0.0	0.0	0.03
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.09	0.07
1958	0.0	0.20	0.14	1.07	0.0	0.68	0.11	0.02	0.85	0.06	0.01
1959	0.0	0.0	0.0	0.03	0.18	0.0	0.06	0.0	0.0	0.0	0.02
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.15	0.0
1961	0.04	0.0	0.0	0.07	0.02	0.10	0.01	0.01	0.01	0.0	0.0
1962	0.12	0.0	0.32	0.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.78	0.0	0.0	0.0	0.0	1.66	0.07	0.0	0.0
1964	0.0	0.0	0.13	0.41	0.60	0.19	0.03	0.0	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.05	0.0	0.0	0.32	0.0	0.0	0.0	1.07
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.0	0.04	0.01	0.10	0.0	0.0	0.01	0.01	0.0	0.31	0.03
1968	0.0	0.0	0.0	0.08	0.01	0.0	0.0	0.0	0.0	0.0	0.0
1969	0.0	0.21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971	0.0	0.0	0.0	0.02	0.05	0.03	0.73	0.10	0.0	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0
1973	1.06	0.10	0.16	0.0	0.0	0.0	0.01	0.01	0.0	0.0	0.17



JULIAN DATE

YEAR	89	90	91	92	93	94	95	96	97	98	99
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.47	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.04	1.06	1.72	0.0	0.0	0.0	0.09	0.0	0.0	0.0	0.0
1941	1.75	1.32	0.48	0.02	0.64	1.78	0.0	0.05	0.0	0.0	0.54
1942	0.0	0.0	0.0	0.0	0.16	0.35	0.90	0.55	0.0	0.0	0.01
1943	0.40	0.0	0.0	0.0	0.0	0.0	0.12	0.0	0.0	0.19	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.23	0.0	0.0	0.0	0.01
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.43
1946	0.06	0.13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.01	0.0	0.0	0.25	0.0	0.0	0.0	0.0	0.0	0.08	0.0
1948	0.21	0.0	0.0	0.0	0.36	0.06	0.47	0.16	0.0	0.05	0.03
1949	0.0	0.0	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.27	0.13	0.54	0.52	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.70	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.13	0.0
1954	0.43	0.0	0.0	0.0	0.0	0.0	0.04	0.06	0.0	0.0	0.0
1955	0.02	0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.07	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.03	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.36	0.11	1.26	0.16	0.88	0.26	0.25	0.84	0.33	0.0	0.0
1959	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.08	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.0	0.0
1961	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.02	0.0	0.0	0.0	0.0	0.06	0.50	0.04	0.14	0.20	0.01
1964	0.01	0.07	0.28	0.0	0.0	0.0	0.01	0.0	0.01	0.0	0.0
1965	0.03	0.16	0.01	0.0	0.0	0.15	0.02	0.51	0.50	0.59	0.08
1966	0.0	0.0	0.01	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.17
1967	0.57	0.21	0.47	0.01	0.14	0.02	0.64	0.72	0.0	0.0	0.09
1968	0.0	0.44	0.72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1969	0.0	0.0	0.0	0.44	0.0	0.77	0.67	0.0	0.02	0.30	0.02
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.25	0.0	0.0	0.05
1972	0.0	0.0	0.02	0.0	0.02	0.0	0.0	0.25	0.01	0.0	0.0
1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0





JULIAN DATE

YEAR	100	101	102	103	104	105	106	107	108	109	110
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.76	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.03	0.0	0.0	0.0	0.67	0.0	0.0	0.73	0.07	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.05	0.0	0.35	0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.02	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.42	0.07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0
1950	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.03	0.02	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.14	0.0	0.0	0.0	0.0	0.0
1953	0.07	0.0	0.0	0.02	0.0	0.0	0.0	0.03	0.0	0.0	0.12
1954	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.07	0.37	0.12
1956	0.0	0.05	0.42	0.59	0.0	0.09	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.02	0.0	0.08	0.0	0.0	0.0	0.88	0.0	0.28	0.03
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.05	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.09	0.03	0.0
1963	0.0	0.0	0.61	0.19	0.03	0.02	0.04	0.33	0.18	0.60	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.01	0.15	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.94	0.10	0.0	0.06	0.27	0.04	0.03	0.74	0.66	0.0	0.44
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1969	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0
1970	0.01	0.08	0.02	0.0	0.0	0.0	0.08	0.0	0.0	0.02	0.0
1971	0.0	0.0	0.0	0.48	0.0	0.0	0.33	0.0	0.0	0.0	0.06
1972	0.0	0.05	0.14	0.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.0	0.20	0.01	0.0	0.10	0.0	0.0	0.0	0.0	0.0





JULIAN DATE

YEAR	111	112	113	114	115	116	117	118	119	120	121
1938	0.0	0.0	0.0	0.12	0.23	0.0	0.0	0.80	0.10	0.53	0.0
1939	0.0	0.0	0.09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.63	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.17	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.19	0.0	0.0	0.28
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.99	0.0	0.0	0.0
1944	0.12	0.0	0.0	0.0	0.0	0.0	0.0	0.34	0.0	0.0	0.02
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.03	0.02	0.0	0.0	0.0	0.03	0.02	1.26	0.27	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03
1951	0.0	0.0	0.0	0.02	0.27	0.0	0.0	0.34	0.27	0.11	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.26	0.0	0.0	0.0	0.0
1953	0.001	0.0	0.0	0.0	0.0	0.0	0.38	0.25	0.0	0.22	0.08
1954	0.0	0.0	0.02	0.0	0.0	0.0	0.16	0.42	0.07	0.0	0.0
1955	0.0	0.17	0.25	0.0	0.0	0.0	0.36	0.0	0.0	0.06	0.26
1956	0.0	0.0	0.0	0.0	0.03	0.0	0.10	0.25	0.0	0.0	0.0
1957	0.0	0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.30
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.05	0.41	0.0	0.0	0.0	0.0	0.01	0.0
1960	0.0	0.0	0.07	0.26	0.0	0.0	0.30	0.15	0.0	0.0	0.0
1961	0.74	0.28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.15	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.07	0.30	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.04	0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.13	0.30	0.89	0.02	0.0	0.04	0.0	0.0	0.06	0.0	0.0
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1969	0.0	0.09	0.17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1970	0.0	0.0	0.0	0.02	0.0	0.02	0.0	0.0	0.01	0.0	0.0
1971	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.08
1972	0.0	0.0	0.0	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



JULIAN DATE

YEAR	122	123	124	125	126	127	128	129	130	131	132
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.13	0.0	0.0
1940	0.0	0.0	0.0	0.13	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.15	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.27	0.04
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.0	0.0	0.01
1950	0.16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.01	0.05	0.21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.02	0.0	0.0	0.0	0.0	0.0	0.02	0.06	0.0	0.0	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.03	0.01	0.24	0.11	0.0	0.0
1955	0.35	0.05	0.0	0.0	0.0	0.0	0.07	0.46	0.0	0.0	0.0
1956	0.0	0.0	0.19	0.0	0.0	0.10	0.0	0.26	0.0	0.04	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.27	0.0	0.0	0.0	0.10	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.04
1960	0.0	0.21	0.16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.04
1961	0.0	0.0	0.0	0.20	0.26	0.0	0.0	0.04	0.0	0.01	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.02	0.08	0.0	0.39	0.0	0.0	0.0
1964	0.0	0.22	0.07	0.03	0.21	0.0	0.07	0.0	0.0	0.0	0.01
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.0
1966	0.01	0.0	0.0	0.0	0.0	0.0	0.04	0.0	0.0	0.0	0.0
1967	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.43	0.02	0.0	0.0
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.07	0.01
1969	0.0	0.08	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0
1970	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.04	0.0	0.0
1971	0.01	0.06	0.02	0.0	0.0	0.0	0.0	0.0	0.02	0.0	0.02
1972	0.0	0.0	0.0	0.05	0.0	0.06	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.02



JULIAN DATE

YEAR	133	134	135	136	137	138	139	140	141	142	143
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.31	0.19	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.21	0.0	0.39	0.08	0.0	0.0	0.0
1945	0.02	0.03	0.0	0.0	0.0	0.0	0.08	0.08	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.12	0.10	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.12	0.0	0.0	0.0
1949	0.0	0.02	0.0	0.02	0.02	0.01	0.23	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953	0.0	0.05	0.0	0.0	0.0	0.0	0.0	0.07	0.02	0.0	0.02
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.29	0.02	0.0	0.0	0.37	0.90	0.31	0.08	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.20	0.28
1959	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.04	0.02	0.0
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.12	0.07	0.0	0.0	0.0	0.0
1962	0.03	0.01	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.03	0.01	0.01	0.01	0.0	0.0	0.01
1964	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.01	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.01	0.01	0.04	0.0	0.0	0.0
1966	0.0	0.0	0.01	0.0	0.02	0.0	0.01	0.0	0.0	0.0	0.0
1967	0.0	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.01
1968	0.06	0.0	0.0	0.0	0.0	0.0	0.01	0.04	0.03	0.01	0.06
1969	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.02	0.0	0.03	0.0
1970	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.01	0.0	0.0	0.0
1971	0.01	0.01	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0	0.0	0.01	0.0	0.0	0.0	0.01	0.03	0.0	0.02	0.0
1973	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.02	0.03



JULIAN DATE

YEAR	144	145	146	147	148	149	150	151	152	153	154
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>6</sup>	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0 <sup>6</sup>	0.0 <sup>5</sup>	0.0	0.0 <sup>6</sup>	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1 <sup>0</sup>	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0
1946	0.0	0.3 <sup>9</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.1 <sup>9</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0 <sup>3</sup>	0.0	0.0	0.0	0.0	0.0	0.1 <sup>2</sup>	0.1 <sup>2</sup>	0.0	0.0 <sup>3</sup>	0.0 <sup>3</sup>
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0
1953	0.0	0.0	0.1 <sup>3</sup>	0.0 <sup>16</sup>	0.0 <sup>4</sup>	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0
1955	0.0	0.0	0.0 <sup>3</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>5</sup>	0.0 <sup>1</sup>	0.0	0.0
1962	0.0	0.0 <sup>2</sup>	0.0 <sup>3</sup>	0.0 <sup>4</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0 <sup>9</sup>	0.0 <sup>6</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>
1965	0.0	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0 <sup>2</sup>	0.0	0.0	0.0 <sup>3</sup>	0.0
1966	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0
1967	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>2</sup>	0.2 <sup>6</sup>	0.4 <sup>9</sup>	0.0	0.0
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1969	0.0 <sup>1</sup>	0.0	0.0 <sup>3</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0
1971	0.0	0.0 <sup>5</sup>	0.0 <sup>3</sup>	0.2 <sup>5</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>5</sup>	0.0	0.0	0.0	0.0	0.0





JULIAN DATE

YEAR	155	156	157	158	159	160	161	162	163	164	165
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.01	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.0
1945	0.11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.02	0.0	0.08	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.04	0.07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953	0.0	0.0	0.06	0.12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.04	0.0	0.0	0.0	0.02	0.25	0.02	0.0	0.04	0.14	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.02
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.01	0.0	0.0	0.0	0.01	0.11	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.01	0.06	0.0	0.07	0.05	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.12	0.02	0.01	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.08	0.0	0.01	0.0	0.0	0.01	0.0	0.0	0.0	0.03
1967	0.02	0.0	0.0	0.0	0.01	0.01	0.0	0.09	0.08	0.01	0.03
1968	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03
1969	0.0	0.01	0.03	0.07	0.06	0.02	0.0	0.0	0.0	0.0	0.03
1970	0.0	0.01	0.12	0.0	0.0	0.01	0.0	0.05	0.0	0.01	0.0
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0	0.01	0.0	0.0	0.0	0.0	0.16	0.03	0.0	0.0	0.0
1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02



JULIAN DATE

YEAR	166	167	168	169	170	171	172	173	174	175	176
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>3</sup>	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.02	0.01	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.07	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.03	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>4</sup>	0.0	0.0	0.0 <sup>5</sup>
1951	0.0	0.03	0.04	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>5</sup>	0.0
1953	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.02	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0
1966	0.0	0.0	0.01	0.0	0.0	0.0	0.0 <sup>4</sup>	0.0	0.0	0.01	0.0
1967	0.0	0.0	0.04	0.02	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.01	0.0 <sup>3</sup>
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.0
1969	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1970	0.0	0.0	0.01	0.03	0.02	0.0	0.0 <sup>2</sup>	0.0	0.0	0.02	0.0
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0 <sup>4</sup>	0.0	0.0
1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



JULIAN DATE

YEAR	177	178	179	180	181	182	183	184	185	186	187
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>7</sup>	0.0 <sup>4</sup>	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0 <sup>2</sup>	0.0	0.0 <sup>4</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0 <sup>6</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.0 <sup>6</sup>	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>
1965	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>
1966	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0 <sup>2</sup>	0.0	0.0
1967	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1969	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0



JULIAN DATE

YEAR	188	189	190	191	192	193	194	195	196	197	198
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1969	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0





JULIAN DATE

YEAR	199	200	201	202	203	204	205	206	207	208	209
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>2</sup>	0.0 <sup>2</sup>	0.0 <sup>3</sup>	0.0 <sup>3</sup>
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>6</sup>	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0
1952	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>	0.0	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>2</sup>
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0 <sup>4</sup>
1964	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>	0.0 <sup>17</sup>
1967	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1969	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>
1971	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0 <sup>1</sup>	0.0 <sup>2</sup>	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0
1972	0.0	0.0 <sup>3</sup>	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.0 <sup>3</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0



JULIAN DATE

YEAR	210	211	212	213	214	215	216	217	218	219	220
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>2</sup>	0.0	0.0	0.0 <sup>3</sup>
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0 <sup>3</sup>
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0 <sup>5</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0	0.0	0.0	0.0
1957	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0
1960	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0 <sup>1</sup>
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0 <sup>7</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0
1964	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>
1966	0.0 <sup>8</sup>	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>2</sup>	0.0	0.0 <sup>1</sup>	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>
1967	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>
1968	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0
1969	0.0 <sup>1</sup>	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0
1970	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0 <sup>1</sup>
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0
1973	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>3</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>3</sup>	0.0	0.0	0.0



JULIAN DATE

YEAR	221	222	223	224	225	226	227	228	229	230	231
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>2</sup>	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0
1944	0.0	0.0 <sup>4</sup>	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>4</sup>
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0 <sup>4</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0 <sup>1</sup>	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0 <sup>5</sup>	0.0	0.0	0.0	0.0	0.0	0.0
1953	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0 <sup>6</sup>	0.0	0.0	0.0	0.0 <sup>6</sup>	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0 <sup>2</sup>
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>1</sup>
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0 <sup>1</sup>	0.0
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>
1962	0.0 <sup>14</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.0	0.0 <sup>14</sup>	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0	0.0	0.0	0.0	0.0
1966	0.0 <sup>2</sup>	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0 <sup>2</sup>
1968	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0 <sup>13</sup>
1969	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0 <sup>2</sup>	0.0 <sup>2</sup>
1970	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>5</sup>	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0
1971	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>	0.0 <sup>3</sup>	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0
1973	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0



JULIAN DATE

YEAR	232	233	234	235	236	237	238	239	240	241	242
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0 <sup>4</sup>	0.0	0.0 <sup>6</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>4</sup>	0.0 <sup>9</sup>	0.0
1950	0.0	0.0	0.0	0.0 <sup>7</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>
1954	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0 <sup>2</sup>
1955	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>
1956	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0
1957	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0 <sup>4</sup>	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>5</sup>	0.0 <sup>4</sup>	0.0	0.0 <sup>2</sup>	0.0
1962	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>	0.0 <sup>2</sup>
1967	0.0	0.0 <sup>3</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>
1968	0.0 <sup>1</sup>	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0
1969	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>3</sup>	0.0	0.0 <sup>3</sup>	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>
1970	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>1</sup>
1971	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0 <sup>7</sup>
1972	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>
1973	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>2</sup>	0.0 <sup>3</sup>	0.0





JULIAN DATE

YEAR	243	244	245	246	247	248	249	250	251	252	253
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0
1944	0.0	0.0 <sup>5</sup>	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0
1953	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0 <sup>4</sup>	0.0	0.0 <sup>1</sup>	0.0 <sup>2</sup>	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0 <sup>32</sup>	0.0	0.0	0.0
1959	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0
1960	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0
1961	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0
1962	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0
1963	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0
1964	0.0 <sup>4</sup>	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>
1965	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0
1967	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1968	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>
1969	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0 <sup>8</sup>	0.0	0.0	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0 <sup>1</sup>
1970	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0 <sup>1</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>



JULIAN DATE

YEAR	254	255	256	257	258	259	260	261	262	263	264
1938	0.0	0.0	0.0	0.0	0.0	0.13	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.07	0.0	0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03
1946	0.0	0.0	0.0	0.0	0.12	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.03	0.0	0.02	0.0	0.0	0.0	0.0
1952	0.0	0.15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.0
1955	0.02	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.19	0.0	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.02	0.03	2.09	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.14	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.50	0.0	0.0	0.0	0.01	0.03	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.01	0.01	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.0	0.0	0.0	0.0	0.02	0.06	0.24	0.0	0.0	0.0
1967	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.16
1968	0.01	0.0	0.0	0.0	0.01	0.04	0.01	0.0	0.01	0.0	0.0
1969	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.01	0.01	0.0
1970	0.0	0.01	0.0	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.0
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.01	0.02	0.01	0.04	0.0	0.01	0.08	0.07	0.0	0.10



JULIAN DATE

YEAR	265	266	267	268	269	270	271	272	273	274	275
1938	0.0	0.0	0.0	0.0	0.0	0.0 <sup>4</sup>	0.0	0.0	0.0	0.0	0.6 <sup>5</sup>
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>5</sup>	0.0 <sup>5</sup>
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.2 <sup>0</sup>	0.0	0.0	0.0	0.0 <sup>3</sup>
1958	0.0	0.2 <sup>3</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>4</sup>	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.0 <sup>2</sup>	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0 <sup>8</sup>	0.0
1967	0.0	0.0	0.0	0.0	0.0	0.0 <sup>3</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0 <sup>3</sup>
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>2</sup>	0.0	0.0
1969	0.0 <sup>2</sup>	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971	0.0	0.0	0.0	0.0	0.0	0.0 <sup>7</sup>	0.0	0.2 <sup>8</sup>	0.0	0.0	0.0
1972	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0 <sup>4</sup>	0.0	0.0 <sup>1</sup>	0.0	0.0	0.0	0.0
1973	0.0 <sup>2</sup>	0.0 <sup>2</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0 <sup>1</sup>	0.0	0.0 <sup>1</sup>



JULIAN DATE

YEAR	276	277	278	279	280	281	282	283	284	285	286
1938	0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.23	0.12	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.34	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.08	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.01	0.04	0.0	0.0	0.0	0.11	0.0	0.0
1946	0.08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.15	0.0	0.56	0.03	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.24	0.29
1949	0.0	0.0	0.0	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.07	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.0
1956	0.0	0.09	0.0	0.0	0.0	0.0	0.0	0.0	0.08	0.0	0.0
1957	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.74	0.10	0.0	0.06
1958	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.08	0.05	0.18	1.01
1963	0.0	0.0	0.0	0.0	0.01	0.0	0.80	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.01	0.01	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.13
1966	0.0	0.01	0.0	0.0	0.02	0.01	0.0	0.0	0.0	0.0	0.0
1967	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.01	0.02
1969	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.05
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.02	0.0	0.0	0.0
1972	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.28	0.0	0.48	0.75
1973	0.0	0.0	0.50	0.48	0.24	0.10	0.0	0.01	0.0	0.0	0.0





JULIAN DATE

YEAR	287	288	289	290	291	292	293	294	295	296	297
1938	0.16	0.07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.32
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.36	0.0	0.0	0.04
1942	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.19	0.0	0.14	0.06	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.09	0.0	0.0
1945	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.02	0.02	0.0	0.0	0.0	0.06	0.0	0.0	0.0	0.0
1948	0.78	0.82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.08	0.03	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.08	0.09	0.0
1952	0.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0	0.0	0.0	0.02
1953	0.0	0.0	0.0	0.0	0.09	0.12	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.0
1955	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.11
1957	0.01	0.0	0.0	0.0	0.0	0.0	1.04	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.0
1963	0.48	0.0	0.0	0.0	0.0	0.0	0.0	0.06	0.0	0.0	0.0
1964	0.02	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01
1968	0.0	0.21	0.02	0.01	0.0	0.0	0.01	0.0	0.0	0.01	0.0
1969	0.26	0.08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1970	0.0	0.0	0.0	0.0	0.01	0.15	0.06	0.15	0.09	0.08	0.0
1971	0.0	0.08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.11	0.60	0.01	0.0	0.02	0.0	0.0	0.0	0.02	0.0	0.01
1973	0.0	0.01	0.0	0.0	0.02	0.01	0.0	0.57	0.0	0.0	0.02



JULIAN DATE

YEAR	298	299	300	301	302	303	304	305	306	307	308
1938	0.0	0.0	0.0	0.0	0.0	0.25	0.09	0.10	0.17	0.0	0.0
1939	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.62	0.12
1941	0.0	0.28	0.0	0.10	0.0	0.0	0.0	0.0	0.09	0.0	0.0
1942	0.0	0.0	0.76	0.0	0.0	0.0	0.0	0.0	0.23	0.0	0.0
1943	0.0	0.0	0.23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.96	0.0	0.0	0.0
1945	0.0	0.0	0.02	0.14	0.74	0.31	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.06	0.04	0.0	0.22	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.22
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.06	1.24	0.0	0.0	0.0	0.27	0.0	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1952	0.0	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.06
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1956	0.0	0.0	0.05	0.0	0.0	0.01	0.28	0.0	0.0	0.0	0.0
1957	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0
1961	0.0	0.0	0.07	0.0	0.0	0.0	0.03	0.01	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.13	0.05	1.82
1964	0.0	0.0	0.0	0.15	1.20	0.50	0.02	0.65	0.20	0.14	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1968	0.0	0.0	0.0	0.0	0.0	0.01	0.09	0.0	0.02	0.05	0.78
1969	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.87
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.28	0.26
1971	0.0	0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.75
1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.21



JULIAN DATE

YEAR	309	310	311	312	313	314	315	316	317	318	319
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.06
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.18	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.48	0.16	0.0	0.12	0.0	0.01	0.84	1.40	0.80	0.22	0.02
1945	0.0	0.13	0.06	0.0	0.12	0.17	0.0	0.03	0.0	0.02	0.04
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.14	0.12	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.31	0.11
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.98	0.08	0.01	0.62	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.80	0.23	0.09
1951	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.16	0.07	0.03	0.03
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.10	0.57
1953	0.15	0.0	0.0	0.0	0.0	0.0	0.02	0.01	0.0	0.14	1.38
1954	0.0	0.0	0.0	0.0	1.06	0.06	0.11	0.26	0.0	0.0	0.02
1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.26
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.25	0.0
1958	0.0	0.01	0.01	0.0	0.0	0.14	0.0	0.0	0.0	0.05	0.18
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.16	0.0	0.0	0.0	0.0	0.0	0.21	0.07	0.10	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.09	0.0	0.0	0.0	0.0	0.0	0.0	0.09	0.83	0.09	0.0
1964	0.0	0.0	0.0	0.03	0.89	0.58	0.42	0.50	0.30	0.0	0.0
1965	0.0	0.07	0.01	0.01	0.01	0.0	0.19	0.82	0.08	0.43	1.50
1966	1.65	0.0	0.0	0.0	0.01	0.0	0.0	0.01	0.12	0.83	0.01
1967	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.07	0.15	0.0	0.01
1968	0.0	0.02	0.02	0.01	0.0	0.01	0.25	0.01	0.0	0.37	0.06
1969	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.09	0.02	0.0
1970	0.04	0.35	0.0	0.0	0.02	0.0	0.03	0.0	0.0	0.0	0.0
1971	0.0	0.0	0.0	0.0	0.0	0.13	0.72	0.26	0.03	0.0	0.0
1972	0.03	0.0	0.13	0.14	0.0	0.48	1.35	0.07	0.02	1.15	0.78
1973	0.33	0.05	0.0	0.04	0.11	0.95	0.01	0.04	0.01	0.35	0.02



JULIAN DATE

YEAR	320	321	322	323	324	325	326	327	328	329	330
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.48	0.0
1940	0.0	0.0	0.0	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942	0.14	0.49	0.32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.07
1943	0.0	0.10	0.0	0.06	0.02	0.19	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.18	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.09	0.0	0.0	0.0	0.0	0.0	0.0	0.04	0.35	0.0	0.0
1946	0.0	0.0	0.22	2.57	0.0	0.0	1.26	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.01	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.02	0.14	0.26	0.64	0.32	0.11	0.04	0.0	0.0	0.0	0.0
1951	0.0	0.0	0.0	0.0	0.57	1.81	0.30	0.04	0.0	0.0	0.0
1952	1.23	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953	0.02	0.0	0.12	0.0	0.21	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.03	0.0	0.22	0.0	0.0	0.0	0.10	0.0	0.0	0.05	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.32	0.06	0.01	0.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.80	0.06
1961	0.0	0.0	0.0	0.65	0.07	0.0	0.0	0.0	0.0	0.23	0.0
1962	0.05	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.33
1963	0.0	0.0	1.78	0.03	0.0	0.0	0.35	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.03	0.02
1965	0.83	0.10	0.0	0.0	0.0	0.60	0.40	1.07	0.13	0.0	0.0
1966	0.0	0.0	0.35	0.58	0.36	0.0	0.0	0.0	0.0	0.44	0.31
1967	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1968	0.0	0.02	0.0	0.02	0.0	0.0	0.0	0.07	0.05	0.0	0.0
1969	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.43	0.48	0.03
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.02
1972	0.34	0.23	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.02	0.0
1973	0.61	0.03	0.0	0.06	0.25	0.25	0.05	0.0	0.14	0.0	0.01





JULIAN DATE

YEAR	331	332	333	334	335	336	337	338	339	340	341
1938	0.0	0.0	0.50	0.0	0.38	0.0	0.20	0.08	0.01	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941	0.0	0.0	0.07	0.0	0.02	0.79	0.0	0.0	0.0	0.0	0.0
1942	0.04	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.20	0.0
1943	0.0	0.0	0.0	0.05	0.03	0.0	0.0	0.0	0.11	0.41	0.0
1944	0.0	0.11	0.0	0.04	0.17	0.0	0.16	0.0	0.0	0.0	0.0
1945	0.0	0.35	0.0	0.0	0.0	0.0	0.0	0.34	1.21	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	1.13	0.04
1947	0.0	0.0	0.02	0.0	0.0	0.0	0.07	0.53	0.0	0.0	0.0
1948	0.09	0.0	0.0	0.0	0.0	0.0	0.45	0.02	0.0	0.07	0.0
1949	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.09	0.0	0.03
1950	0.0	0.0	0.28	0.07	0.0	0.32	0.56	0.0	0.0	0.84	0.25
1951	0.0	0.32	0.02	0.0	0.0	0.33	0.52	0.16	0.55	0.69	0.43
1952	0.0	0.0	0.0	0.0	0.30	0.04	0.95	0.03	0.0	0.61	0.10
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.26	0.0	0.0	0.04
1954	0.0	0.0	0.0	0.0	0.0	0.12	0.12	0.77	0.0	0.09	0.09
1955	0.0	0.0	0.0	0.0	0.0	0.12	0.28	0.02	0.06	0.0	0.14
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.50	0.14	0.13
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.25	0.0	0.0
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.02	0.42	0.15	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.33	0.33	0.41	0.86	0.36	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.02	0.0	0.02	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.41
1964	0.01	0.0	0.0	0.0	0.0	0.04	0.01	0.0	0.01	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01
1966	0.0	0.0	0.06	0.74	0.01	0.66	2.14	0.21	0.05	0.0	0.0
1967	0.22	0.0	1.02	0.31	0.0	0.43	0.24	0.0	0.32	0.0	0.0
1968	0.0	0.01	0.20	0.33	0.04	0.0	0.0	0.0	0.0	0.0	0.0
1969	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.20	0.22
1970	1.91	2.38	0.32	0.89	0.40	0.02	0.10	0.02	0.0	0.01	0.08
1971	0.53	0.05	0.01	0.0	0.45	0.14	0.32	0.0	0.04	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.21	0.09	0.40	0.21
1973	0.0	0.0	1.23	0.04	0.0	0.01	0.0	0.01	0.0	0.01	0.02



JULIAN DATE

YEAR	342	343	344	345	346	347	348	349	350	351	352
1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.23	0.0	0.0	0.21
1939	0.0	0.0	0.0	0.70	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.27	0.24
1941	0.01	0.0	0.0	0.01	0.28	0.64	1.26	0.60	0.08	0.0	0.0
1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945	0.0	0.0	0.0	0.07	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.16	0.18	0.0
1948	0.02	0.0	0.0	0.0	0.0	0.22	0.23	0.03	0.0	0.68	0.0
1949	0.64	0.0	0.0	0.0	0.0	0.0	0.0	0.21	0.05	0.14	0.04
1950	0.0	0.0	0.0	0.0	0.0	0.27	0.0	0.0	0.0	0.0	0.05
1951	0.0	0.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0	0.0	0.0
1952	0.93	0.23	0.0	0.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01
1954	0.0	0.48	1.09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.05	0.0	0.57	0.02	0.0	0.0	0.0	0.0	0.0	0.02	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.91	0.13	0.26	0.48
1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.01	0.0	0.0	0.0	0.03	0.0	0.08	0.04	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.09	0.04	0.01	0.96	0.63	0.51	0.0
1963	0.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.02	0.01	0.10	0.06	0.0	0.0	0.09	0.02	0.0	0.0
1965	0.0	0.01	1.49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.46	0.44	0.07
1968	0.0	0.0	0.58	0.0	0.02	0.24	0.04	0.52	0.0	0.0	0.06
1969	0.01	0.02	0.0	0.02	0.0	0.0	0.01	0.0	0.03	0.15	0.38
1970	0.07	0.0	0.0	0.0	0.0	0.24	0.0	0.35	0.38	0.55	0.21
1971	0.0	0.08	0.24	0.01	0.10	0.0	0.02	0.0	0.0	0.0	0.0
1972	0.23	0.0	0.0	0.01	0.0	0.11	0.0	0.0	0.0	0.16	0.02
1973	0.0	0.0	0.02	0.03	0.01	0.0	0.0	0.17	0.03	0.0	0.0



JULIAN DATE

YEAR	353	354	355	356	357	358	359	360	361	362	363
1938	0.60	0.38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939	0.0	0.0	0.0	0.0	0.43	0.34	0.0	0.0	0.0	0.0	0.0
1940	0.56	0.02	0.0	0.11	0.88	0.91	0.24	0.19	0.04	0.76	0.21
1941	0.23	0.03	0.03	0.38	0.28	0.11	0.20	0.16	1.54	0.71	0.28
1942	0.0	0.0	0.0	0.05	0.32	0.35	0.0	0.0	0.0	0.04	0.0
1943	0.06	0.32	0.11	0.06	0.0	0.0	0.02	0.0	0.0	0.45	1.03
1944	0.0	0.03	0.0	0.0	0.23	0.02	0.0	0.0	0.0	0.0	0.73
1945	0.0	0.06	0.66	0.47	0.03	0.22	0.15	0.21	0.77	0.04	0.0
1946	0.0	0.0	0.0	0.0	0.25	0.30	0.02	0.21	0.0	0.0	0.0
1947	0.22	0.76	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.46	0.83	0.17	0.0
1949	0.17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1950	0.0	0.0	0.0	0.0	0.0	0.0	0.08	0.0	0.0	0.0	0.0
1951	0.33	0.10	0.0	0.0	0.0	0.02	0.13	0.14	0.0	0.37	1.64
1952	0.0	0.20	0.44	0.0	0.0	0.0	0.02	0.0	0.0	0.22	0.33
1953	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1954	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1955	0.01	0.05	0.48	0.04	0.28	2.39	1.87	0.80	0.14	0.03	0.0
1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	0.0	0.0	0.0	0.35	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	0.0	0.0	0.01	0.10	0.0	0.0	0.02	0.0	0.27	0.0	0.0
1959	0.0	0.01	0.0	0.04	0.28	0.24	0.01	0.0	0.0	0.0	0.0
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.26	1.10	0.10	0.03	0.68	0.32	0.14	0.16	0.70	0.21	0.39
1965	0.0	0.0	0.0	0.0	0.68	0.0	0.0	0.02	1.84	1.26	0.61
1966	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03
1968	0.17	0.0	0.01	0.0	0.10	0.30	0.61	0.04	0.02	0.0	0.0
1969	0.05	0.83	0.0	0.07	0.79	0.01	0.01	0.0	0.0	0.0	0.0
1970	0.0	1.05	0.15	0.0	0.0	0.0	0.02	0.44	0.20	0.13	0.03
1971	0.0	0.0	0.83	0.07	0.04	1.24	0.33	0.65	0.10	0.0	0.02
1972	0.19	0.01	0.01	0.08	0.02	0.05	0.0	0.0	0.0	0.05	0.0
1973	0.24	0.41	0.06	0.05	0.02	0.01	1.26	0.27	0.12	0.19	0.06



YEAR	364	365	366
1938	0.0	0.0	-1.00
1939	0.0	0.0	-1.00
1940	0.0	0.06	0.0
1941	0.23	0.0	-1.00
1942	0.0	0.0	-1.00
1943	0.71	0.52	-1.00
1944	0.76	0.01	0.0
1945	0.0	0.0	-1.00
1946	0.0	0.0	-1.00
1947	0.0	0.0	-1.00
1948	0.0	0.0	0.02
1949	0.0	0.0	-1.00
1950	0.0	0.0	-1.00
1951	0.40	0.16	-1.00
1952	0.0	0.24	0.60
1953	0.0	0.0	-1.00
1954	0.0	0.06	-1.00
1955	0.44	0.50	-1.00
1956	0.0	0.0	0.0
1957	0.0	0.0	-1.00
1958	0.0	0.0	-1.00
1959	0.0	0.02	-1.00
1960	0.0	0.0	0.0
1961	0.0	0.0	-1.00
1962	0.0	0.0	-1.00
1963	0.0	0.0	-1.00
1964	0.55	0.37	0.0
1965	0.31	0.0	-1.00
1966	0.0	0.0	-1.00
1967	0.0	0.0	-1.00
1968	0.0	0.0	0.0
1969	0.0	0.0	-1.00
1970	0.0	0.0	-1.00
1971	0.0	0.0	-1.00
1972	0.0	0.30	0.0
1973	0.02	0.33	-1.00





APPENDIX B

WEEKLY RAINFALL DATA

WEEKS

YEAR	01	02	03	04	05	N1	N2
1938	0.77	0.00	0.23	0.00	0.67	0.00	0.00
1939	0.28	0.12	0.00	0.35	0.00	0.00	0.00
1940	0.00	0.00	0.00	0.00	0.62	0.12	0.00
1941	0.00	0.00	0.00	0.68	0.19	0.00	0.12
1942	0.00	0.34	0.03	0.76	0.23	0.00	0.81
1943	0.00	0.00	0.33	0.29	0.00	0.00	0.10
1944	0.00	0.08	0.00	0.09	0.96	0.76	3.26
1945	0.00	0.15	0.00	0.00	1.19	0.48	0.16
1946	0.11	0.00	0.18	0.00	0.00	0.00	0.26
1947	0.00	0.74	0.06	0.00	0.35	0.00	0.42
1948	0.00	0.53	1.60	0.00	0.00	0.22	0.00
1949	0.00	0.03	0.00	0.00	0.00	1.68	0.00
1950	0.05	0.00	0.03	1.41	0.27	0.00	1.26
1951	0.00	0.00	0.00	0.67	0.00	0.00	0.29
1952	0.00	0.00	0.09	0.00	0.00	0.00	1.90
1953	0.00	0.07	0.21	0.00	0.00	0.15	1.52
1954	0.00	0.00	0.00	0.00	0.00	1.18	0.97
1955	0.00	0.03	0.00	0.00	0.00	0.00	1.29
1956	0.12	0.08	0.00	0.16	0.28	0.00	0.00
1957	0.00	0.90	1.04	0.05	0.00	0.00	0.63
1958	0.00	0.00	0.00	0.00	0.00	0.14	0.23
1959	0.00	0.00	0.00	0.03	0.00	0.00	0.00
1960	0.05	0.00	0.00	0.00	0.00	0.16	0.47
1961	0.00	0.00	0.00	0.07	0.03	0.00	0.00
1962	0.00	1.32	0.00	0.00	0.00	0.03	0.05
1963	0.00	0.80	0.48	0.06	0.18	1.91	1.01
1964	0.00	0.00	0.00	0.00	2.84	1.50	1.22
1965	0.00	0.13	0.00	0.00	0.00	0.07	3.95
1966	0.08	0.00	0.00	0.00	0.00	1.65	0.95
1967	0.23	0.00	0.00	0.00	0.00	0.00	0.22
1968	0.00	0.00	0.21	0.00	0.14	0.78	0.68
1969	0.00	0.05	0.34	0.00	0.00	0.90	0.09
1970	0.00	0.00	0.21	0.32	0.28	0.65	0.03
1971	0.00	0.00	0.08	0.06	0.00	0.13	1.01
1972	0.00	1.51	0.71	0.00	0.00	1.53	3.92
1973	0.98	0.34	0.00	0.57	0.00	1.69	1.03



## WEEKS

YEAR	N3	N4	D1	D2	D3	D4
1938	0.00	0.88	0.28	0.23	1.19	0.00
1939	0.00	0.48	0.00	0.70	0.00	0.77
1940	0.05	0.00	0.00	0.00	1.21	3.23
1941	0.00	0.07	0.79	2.78	0.75	3.28
1942	0.32	0.11	0.20	0.00	0.05	0.71
1943	0.25	0.08	0.52	0.00	0.55	1.48
1944	0.18	0.32	0.16	0.00	0.03	0.96
1945	0.39	0.35	1.55	0.07	1.19	1.42
1946	4.05	0.00	1.17	0.00	0.00	0.76
1947	0.00	0.00	0.60	0.00	1.32	0.00
1948	0.03	0.09	0.52	0.48	0.68	1.46
1949	0.00	0.00	0.76	0.21	0.40	0.00
1950	1.37	0.35	1.97	0.27	0.05	0.08
1951	2.72	0.32	2.68	0.07	0.43	2.28
1952	0.00	0.30	2.66	0.33	0.64	0.55
1953	0.33	0.00	0.30	0.00	0.00	0.00
1954	0.00	0.00	1.19	1.57	0.00	0.00
1955	0.32	0.05	0.65	0.57	0.57	5.51
1956	0.00	0.00	0.77	0.00	0.00	0.00
1957	0.20	0.00	1.25	0.91	1.22	0.00
1958	0.00	0.00	0.00	0.00	0.10	0.27
1959	0.00	0.00	0.00	0.00	0.04	0.52
1960	0.00	1.28	0.15	0.07	0.00	0.00
1961	0.72	2.16	0.36	0.11	0.04	0.00
1962	0.00	0.33	0.00	1.09	1.14	0.00
1963	2.16	0.00	0.51	0.00	0.03	0.00
1964	0.00	0.03	0.04	0.25	1.49	2.60
1965	2.20	0.00	0.00	1.49	0.00	4.39
1966	1.29	1.55	3.06	0.00	0.00	0.00
1967	0.00	1.55	0.99	0.00	1.03	0.03
1968	0.12	0.57	0.00	1.38	0.23	1.05
1969	0.00	0.00	0.42	0.00	1.51	0.79
1970	0.43	6.41	0.25	0.59	2.34	0.80
1971	0.00	1.03	0.50	0.42	0.90	2.36
1972	0.00	0.00	1.14	0.11	0.43	0.10
1973	0.75	1.27	0.00	0.20	0.79	1.90



## WEEKS

YEAR	J1	J2	J3	J4	JF	F1
1939	1.78	0.00	0.00	0.37	2.35	0.82
1940	3.82	3.26	0.00	0.89	1.30	0.25
1941	1.21	0.85	1.96	2.13	0.00	3.74
1942	0.14	0.20	0.00	2.97	0.54	1.23
1943	0.00	0.00	1.57	0.87	0.59	0.56
1944	1.59	0.74	0.00	0.72	2.63	0.71
1945	0.00	0.00	0.00	0.04	3.39	0.21
1946	1.08	0.00	0.00	0.00	1.35	0.11
1947	0.00	0.03	0.00	0.38	0.03	0.66
1948	0.05	0.00	0.00	0.00	1.19	0.59
1949	0.12	0.00	1.38	0.20	0.84	1.24
1950	0.67	1.62	0.13	0.68	0.71	1.03
1951	0.12	0.90	0.81	0.07	0.16	0.51
1952	1.44	2.74	2.02	1.80	0.37	0.30
1953	0.20	1.14	0.31	0.00	0.00	0.00
1954	0.03	0.98	0.98	1.33	0.00	0.00
1955	1.31	0.74	2.11	0.00	0.43	0.00
1956	0.81	0.77	1.25	1.96	0.00	0.00
1957	0.62	2.14	0.93	0.58	0.08	0.25
1958	0.14	0.26	0.00	1.77	2.82	0.35
1959	1.38	2.78	0.00	0.15	0.05	1.91
1960	0.10	2.85	0.28	0.53	1.36	1.44
1961	0.00	0.00	0.00	1.49	0.83	0.41
1962	0.00	0.11	2.17	0.00	0.00	2.52
1963	0.12	0.00	0.00	0.00	3.72	1.45
1964	0.05	0.16	2.70	0.24	0.00	0.00
1965	1.68	0.03	0.28	0.32	0.50	0.05
1966	0.00	0.00	0.00	0.11	2.54	0.60
1967	0.00	0.00	2.37	1.78	1.56	0.00
1968	0.00	1.51	0.06	0.41	1.10	0.00
1969	0.00	0.51	4.34	2.98	0.64	2.40
1970	0.12	2.47	2.07	0.80	0.03	0.24
1971	0.24	0.61	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.08	0.17
1973	0.37	0.83	2.45	0.67	1.74	2.77
1974	3.11	0.07	0.42	0.00	0.08	0.00



## WEEKS

YEAR	F2	F3	FM	M1	M2	M3
1939	0.00	0.00	0.73	1.90	0.03	0.04
1940	1.36	1.55	4.20	0.04	0.37	0.00
1941	1.16	2.03	3.31	0.04	0.50	0.00
1942	0.00	1.26	0.00	1.42	0.99	0.00
1943	0.05	1.20	1.61	2.40	0.70	0.04
1944	0.00	2.96	2.47	0.61	0.00	0.00
1945	0.47	0.00	0.36	0.08	0.76	0.96
1946	0.87	0.07	0.14	0.05	0.85	0.14
1947	0.45	0.00	0.46	0.66	0.00	0.10
1948	0.00	0.00	0.34	0.23	1.99	2.12
1949	0.00	0.54	2.32	1.08	0.59	0.89
1950	0.00	0.00	0.00	0.11	0.04	1.46
1951	0.11	0.48	2.09	0.44	0.00	0.00
1952	0.54	0.89	0.03	1.54	2.23	0.71
1953	0.00	0.00	0.00	0.20	0.00	0.57
1954	1.58	0.00	0.00	0.65	2.14	1.16
1955	0.63	0.00	0.87	0.00	0.04	0.00
1956	0.00	1.54	0.20	0.04	0.00	0.05
1957	0.08	1.52	1.14	0.58	0.57	0.00
1958	0.60	1.53	0.47	0.06	2.60	2.20
1959	1.89	1.83	0.00	0.00	0.03	0.27
1960	0.14	0.03	0.48	0.03	0.33	0.00
1961	0.21	0.00	0.15	0.42	1.56	0.21
1962	2.29	0.98	0.28	1.29	0.26	0.54
1963	0.74	0.00	0.00	0.45	1.34	0.78
1964	0.29	0.00	0.37	0.00	0.27	1.36
1965	0.04	0.00	0.38	0.41	0.49	0.37
1966	0.04	0.53	0.35	0.04	0.08	0.00
1967	0.03	0.41	0.07	1.33	2.33	0.14
1968	0.40	0.77	0.03	0.48	2.06	0.08
1969	1.28	3.48	0.74	0.84	0.00	0.21
1970	1.00	0.00	3.37	0.20	0.00	0.00
1971	0.43	0.00	0.18	0.03	0.96	0.81
1972	0.00	0.08	0.10	0.00	0.04	0.00
1973	0.94	0.49	2.16	1.13	0.00	1.32
1974	0.53	0.00	1.99	0.58	0.03	0.21





## WEEKS

YEAR	M4	A1	A2	A3	A4	AM
1939	0.36	0.70	0.09	0.00	0.09	0.00
1940	3.83	0.09	0.00	0.00	0.63	0.13
1941	4.23	2.47	1.30	0.00	0.17	0.15
1942	0.00	1.96	0.70	0.80	0.19	0.28
1943	0.40	0.31	0.00	0.00	0.99	0.00
1944	0.00	0.23	0.44	0.12	0.34	0.12
1945	0.65	0.00	0.43	0.00	0.00	0.00
1946	1.96	0.00	0.00	0.00	0.00	0.00
1947	0.68	0.33	0.00	0.00	0.00	0.00
1948	0.25	1.10	0.52	0.03	1.29	0.27
1949	0.05	0.00	0.00	0.00	0.00	0.03
1950	0.00	1.46	0.00	0.00	0.00	0.19
1951	0.00	0.00	0.03	0.00	0.88	0.37
1952	0.00	0.70	0.14	0.00	0.26	0.00
1953	0.00	0.13	0.07	0.15	0.63	0.30
1954	0.46	0.10	0.00	0.00	0.65	0.00
1955	0.06	0.00	0.00	0.73	0.61	0.72
1956	0.07	0.03	1.15	0.00	0.38	0.19
1957	0.19	0.00	0.08	1.23	0.00	0.30
1958	2.64	2.72	0.00	0.00	0.00	0.00
1959	0.00	0.00	0.00	0.00	0.46	0.00
1960	0.28	0.00	0.05	0.00	0.78	0.37
1961	0.00	0.00	0.18	1.02	0.00	0.46
1962	0.00	0.00	0.00	0.12	0.15	0.00
1963	1.73	0.94	0.83	1.15	0.37	0.00
1964	0.35	0.00	0.00	0.00	0.08	0.53
1965	1.26	1.75	0.23	0.00	0.00	0.00
1966	0.00	0.00	0.17	0.00	0.00	0.00
1967	1.59	1.50	1.50	2.30	0.99	0.00
1968	1.16	0.00	0.00	0.00	0.00	0.00
1969	0.00	2.18	0.00	0.09	0.17	0.08
1970	0.00	0.00	0.08	0.08	0.00	0.00
1971	0.10	0.25	0.53	0.39	0.00	0.14
1972	0.00	0.25	0.39	0.00	0.05	0.05
1973	0.17	0.00	0.30	0.00	0.00	0.00
1974	3.45	0.26	0.05	0.36	0.77	0.00



APPENDIX C. WEEKLY AMOUNT OF RAINFALL

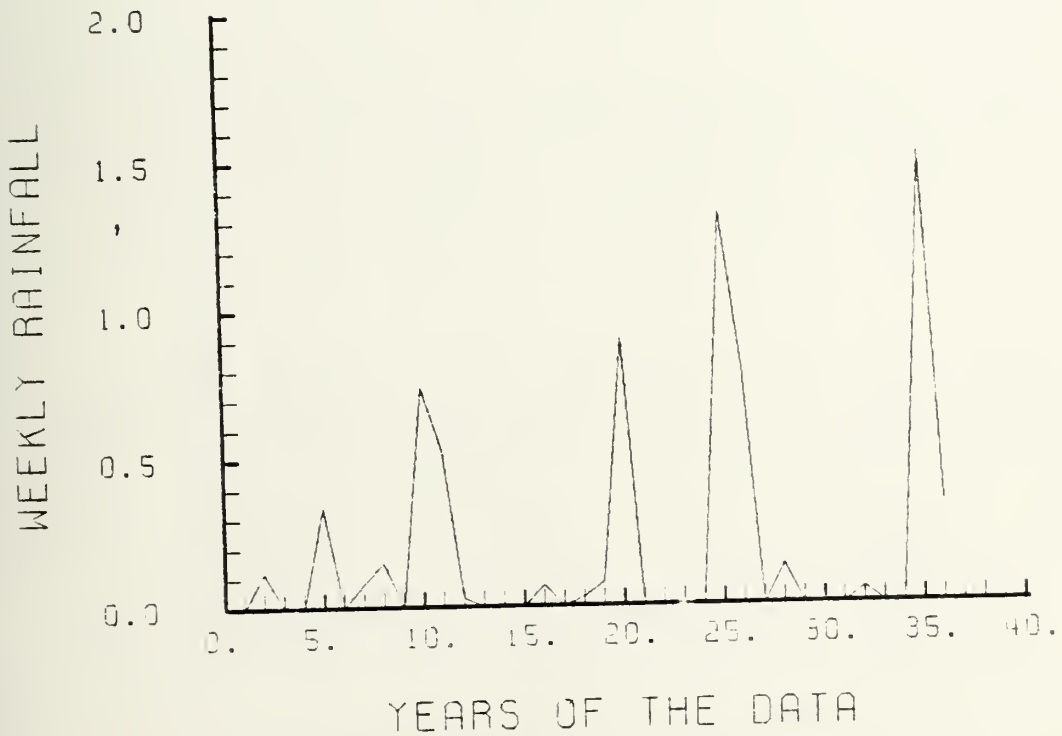
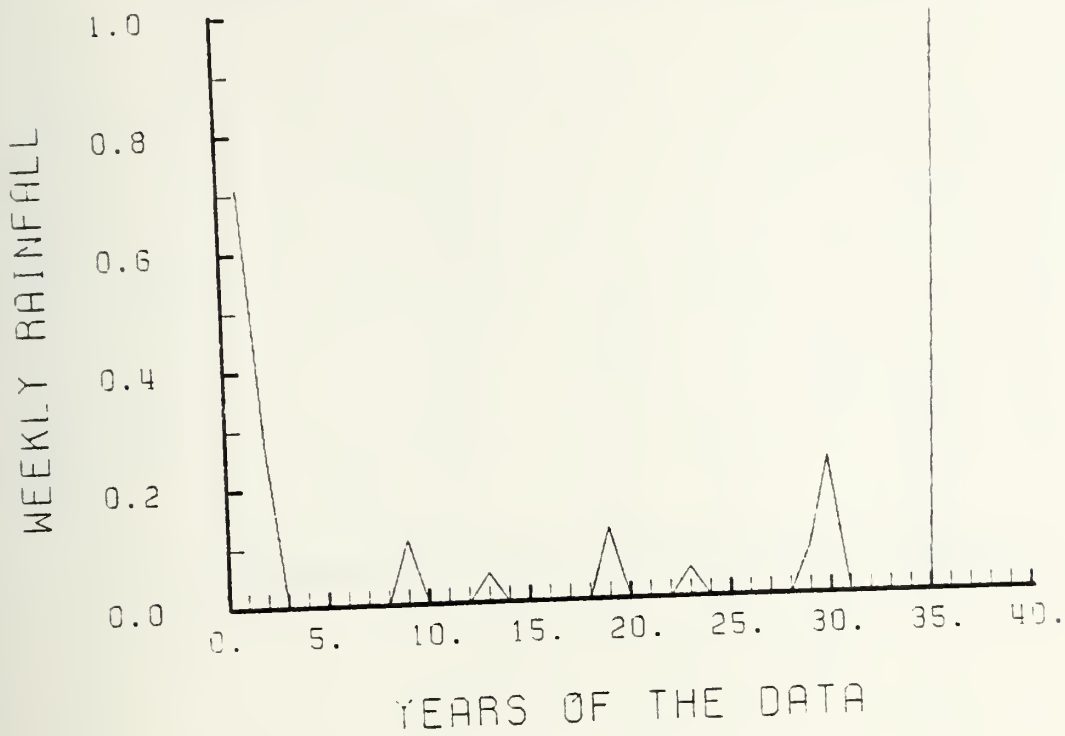


Figure 44. Weekly rainfall in inches for weeks 01 and 02



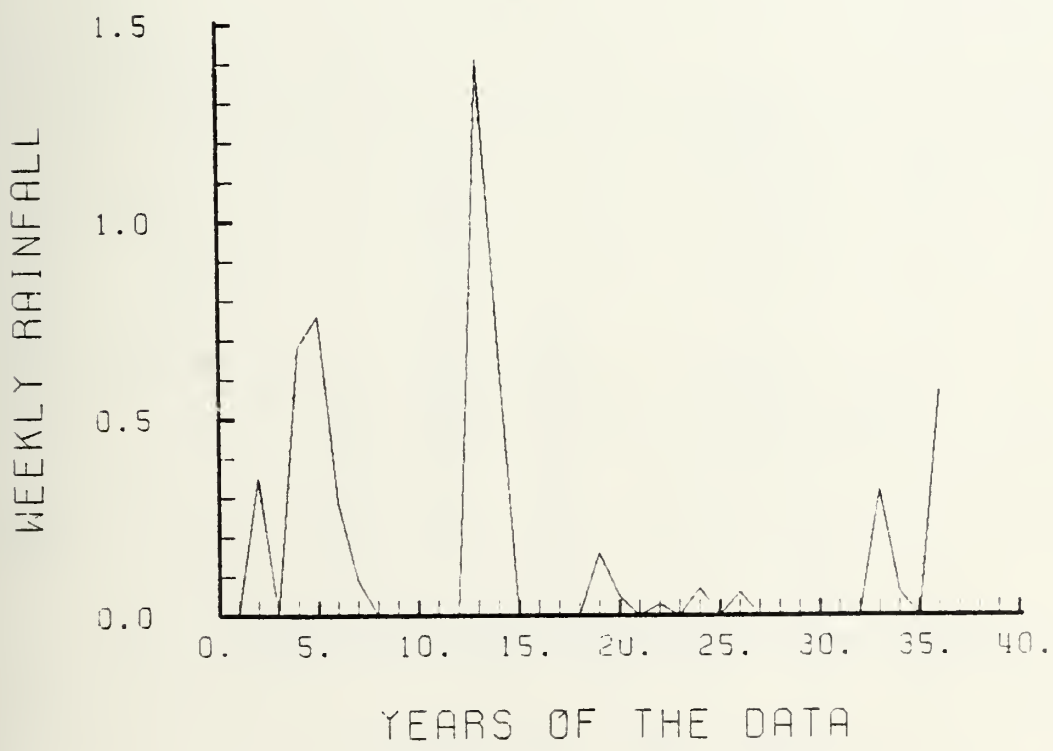
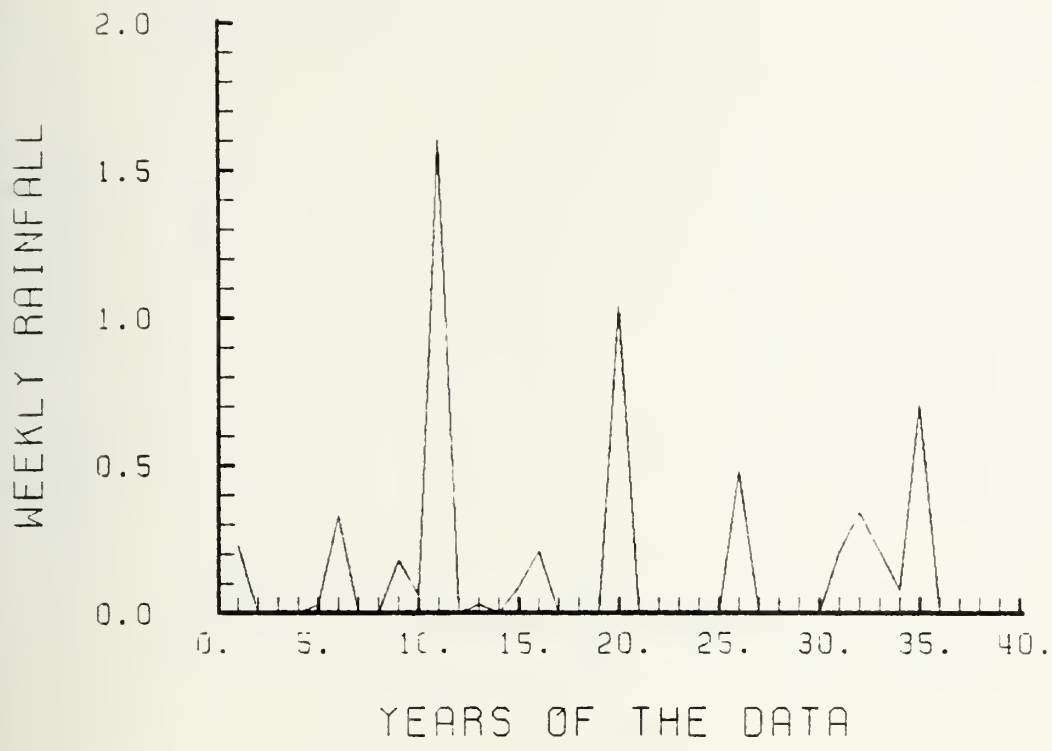


Figure 45. Weekly rainfall in inches for weeks 03 and 04



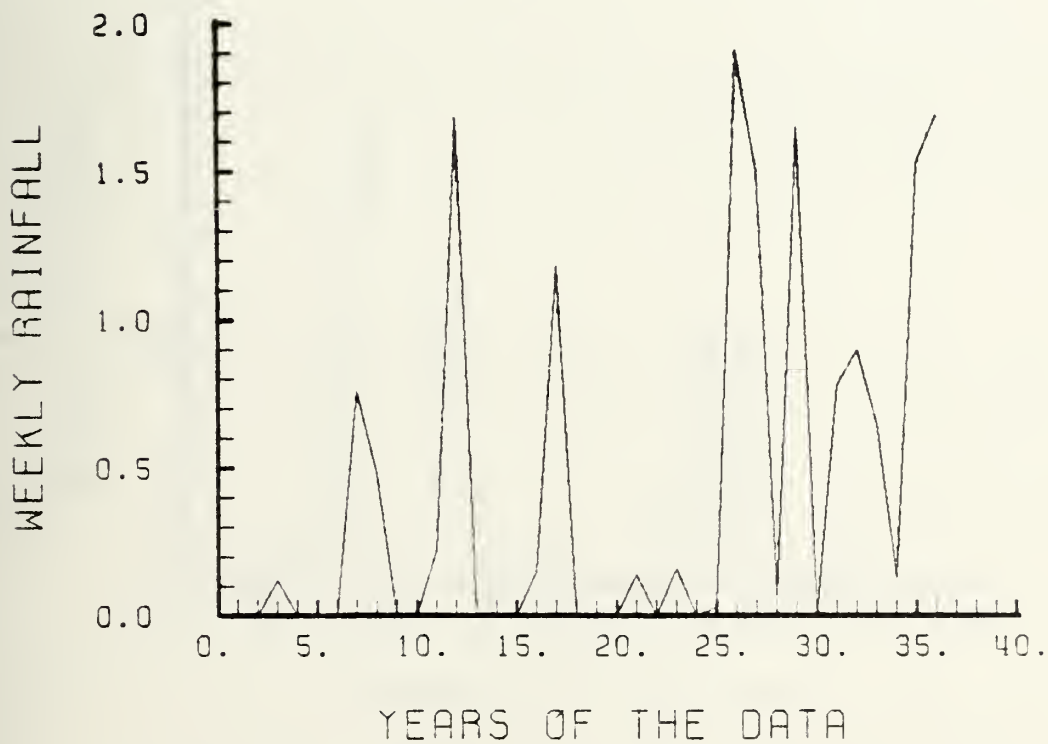
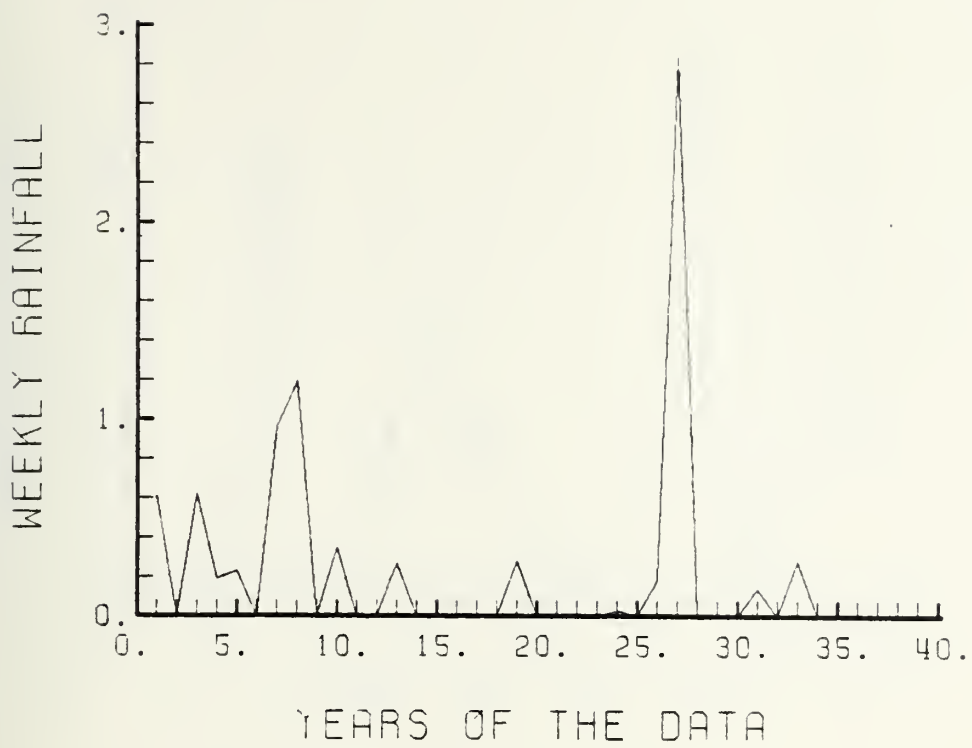


Figure 46. Weekly rainfall in inches for weeks 0N and 0N1





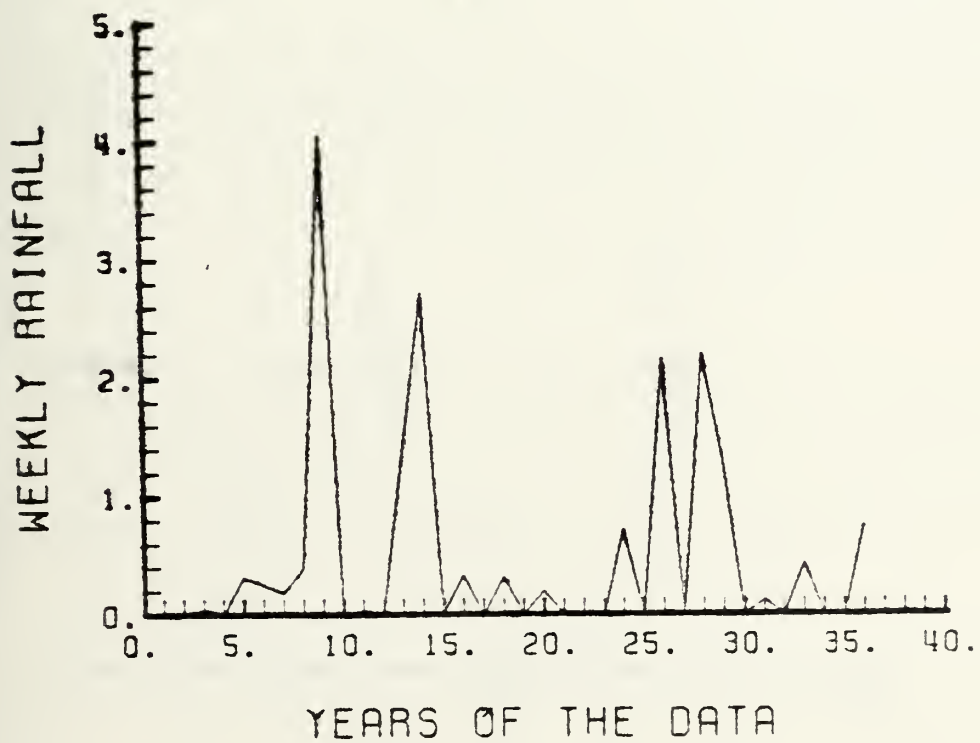
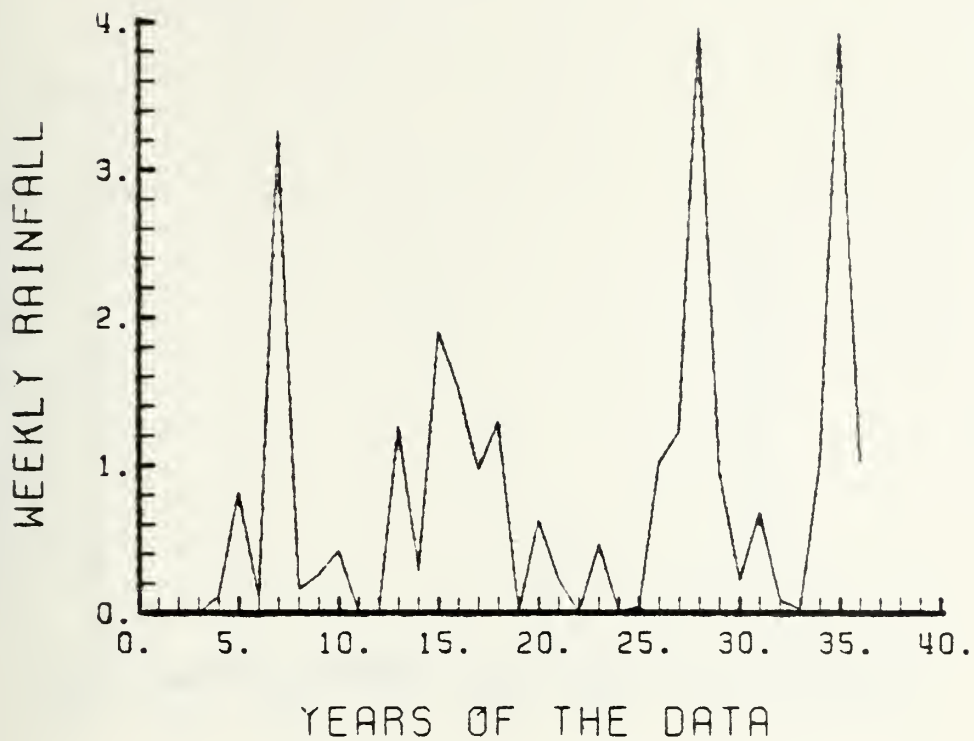


Figure 47. Weekly rainfall in inches for weeks N2 and N3



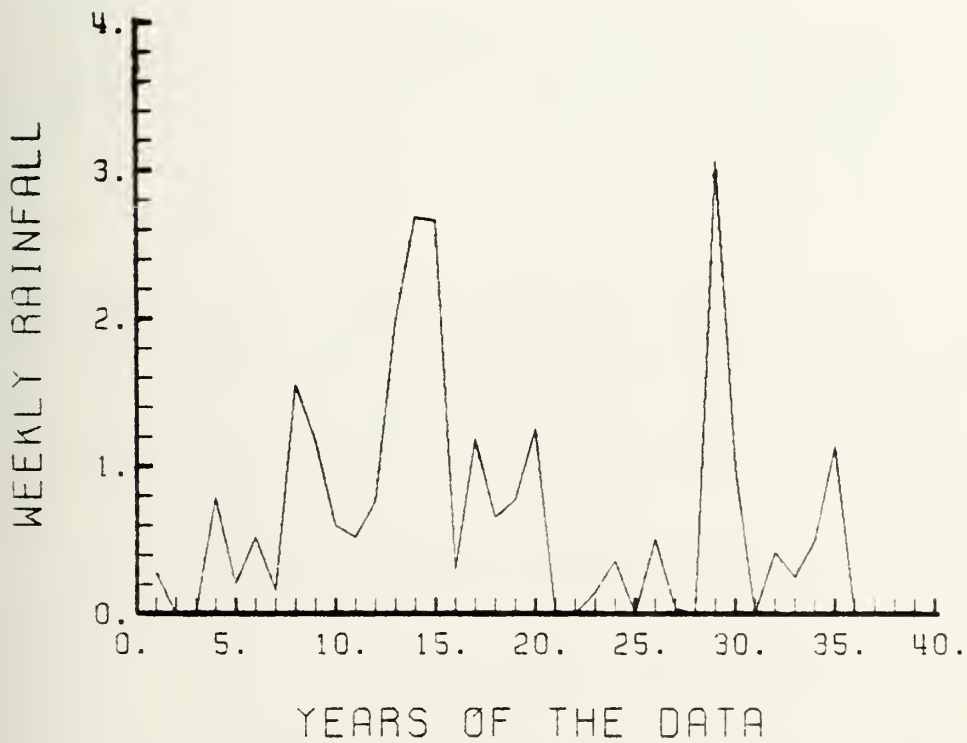
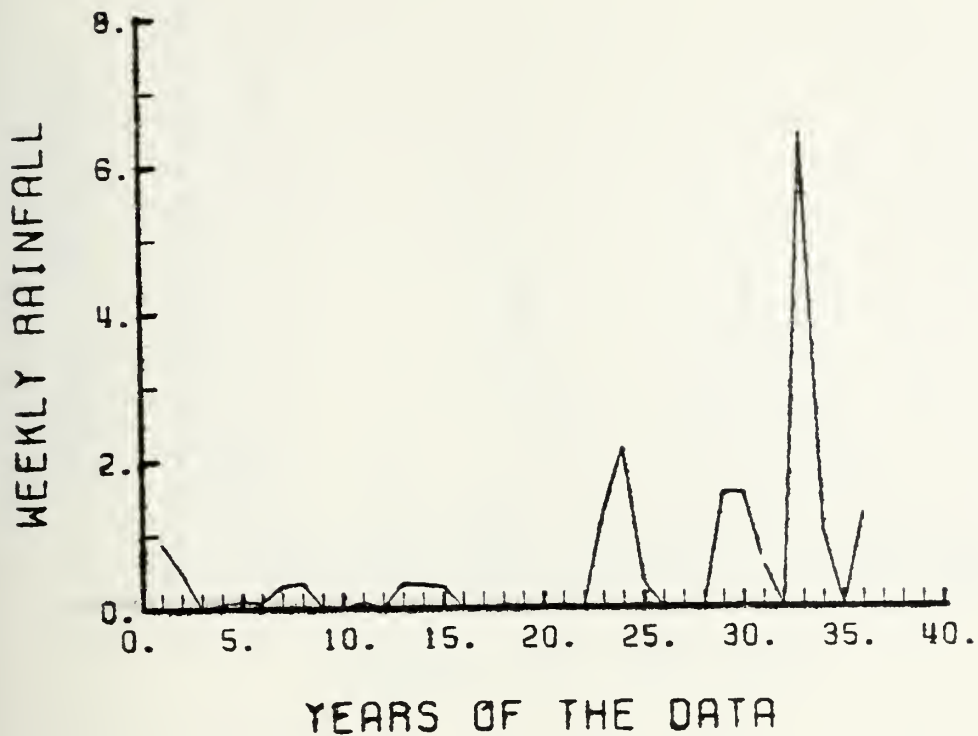


Figure 48. Weekly rainfall in inches for weeks N4 and D1



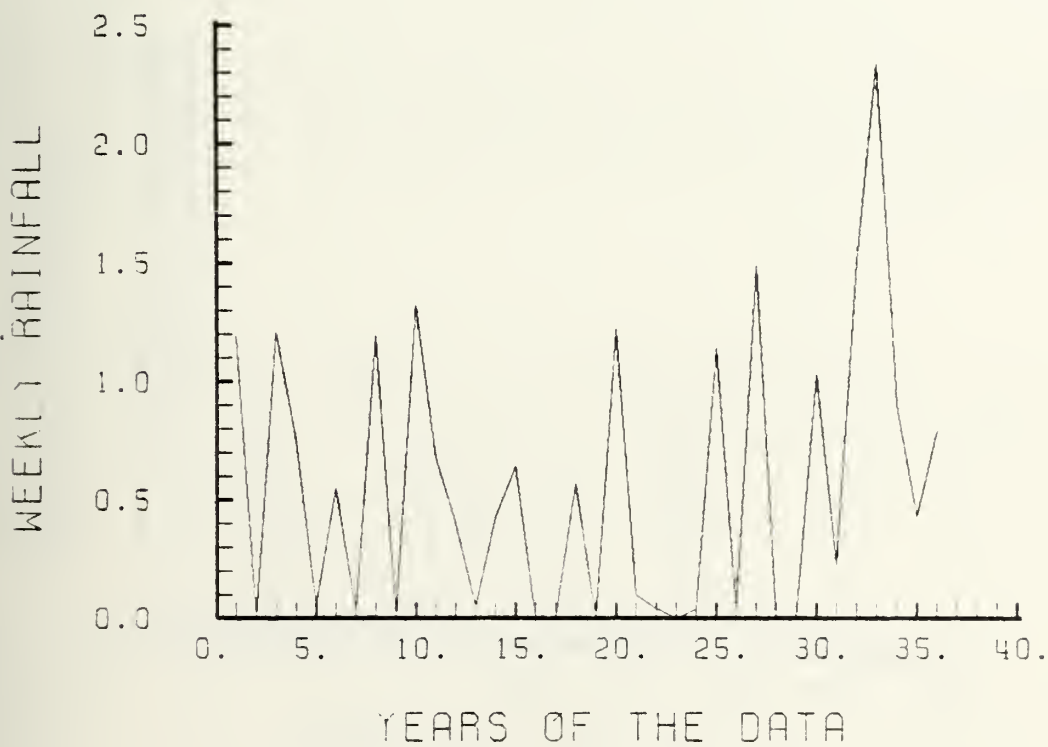
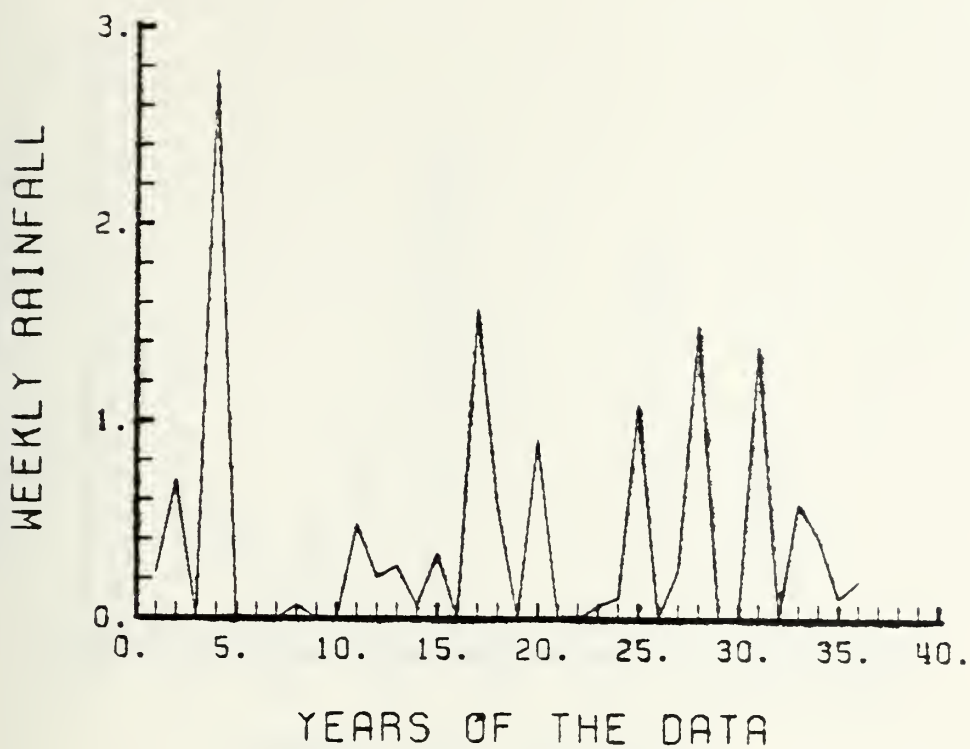


Figure 49. Weekly rainfall in inches for weeks D2 and D3



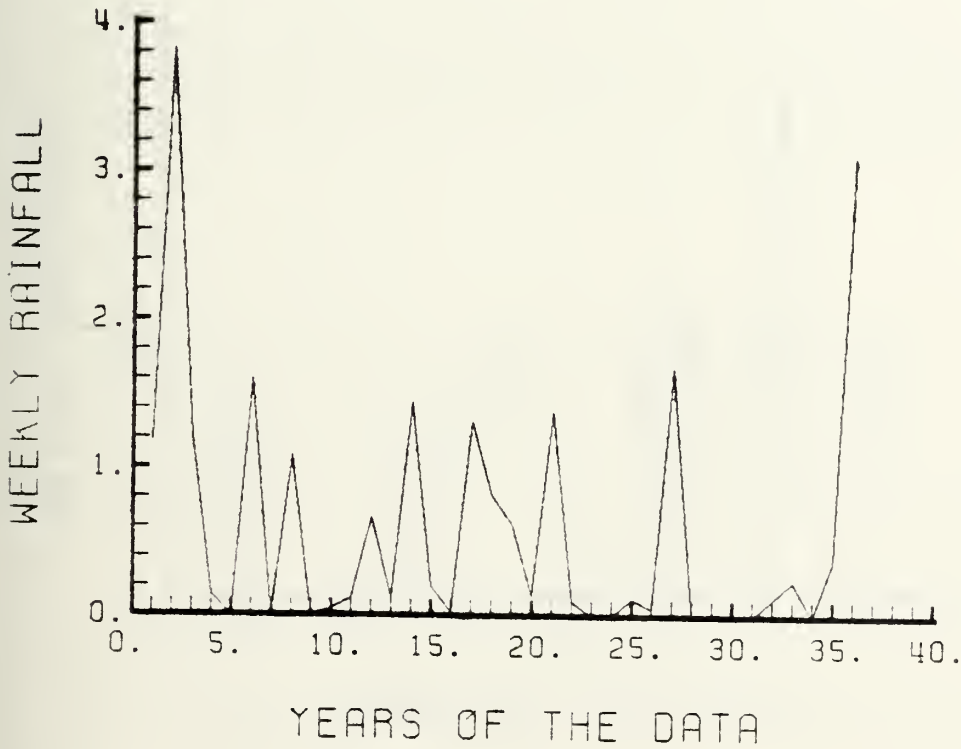
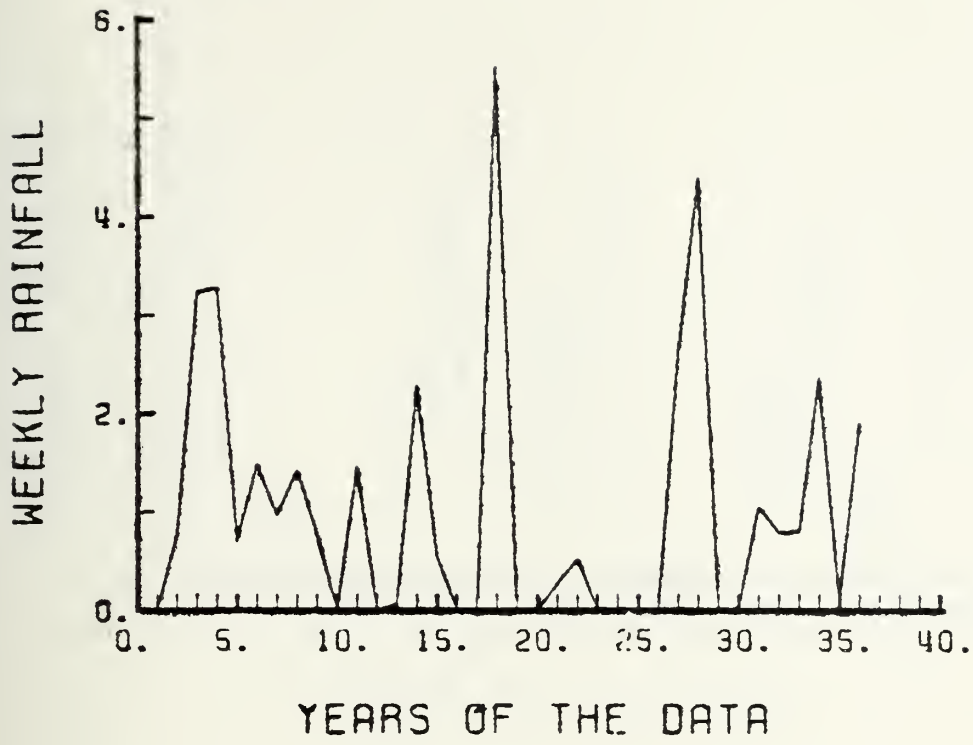


Figure 50. Weekly rainfall in inches for weeks D4 and J1





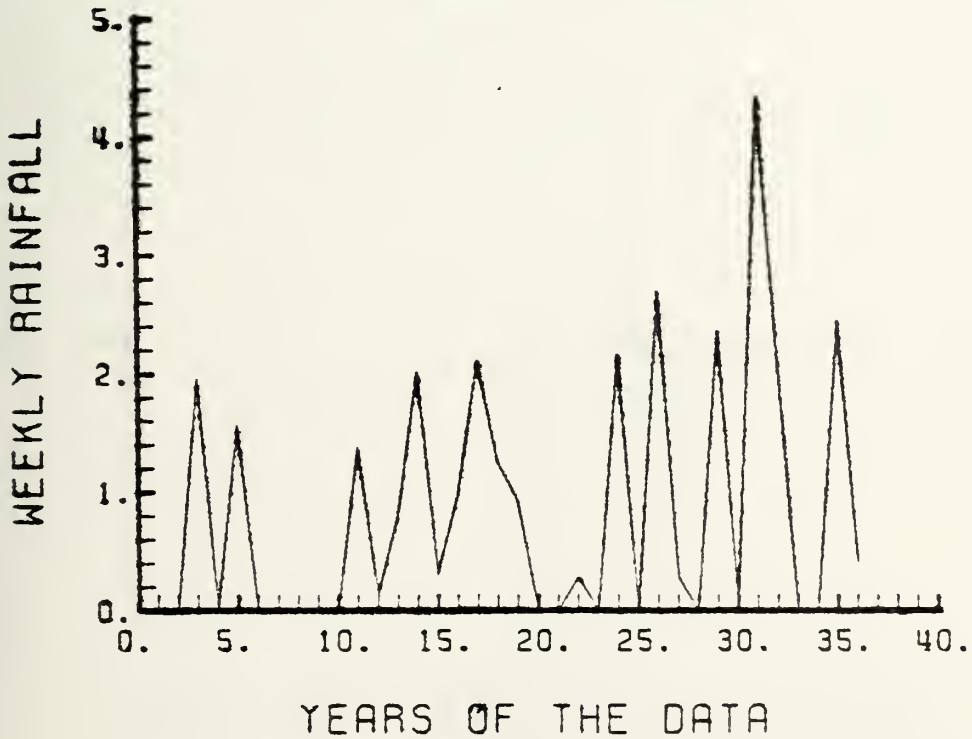
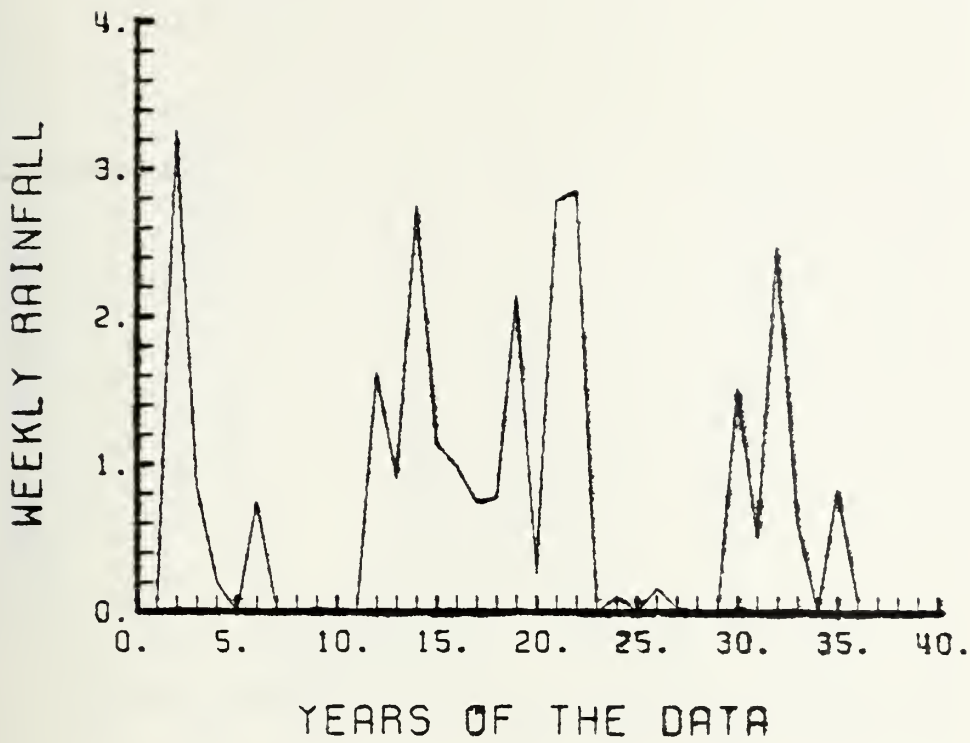


Figure 51. Weekly rainfall in inches for weeks J2 and J3



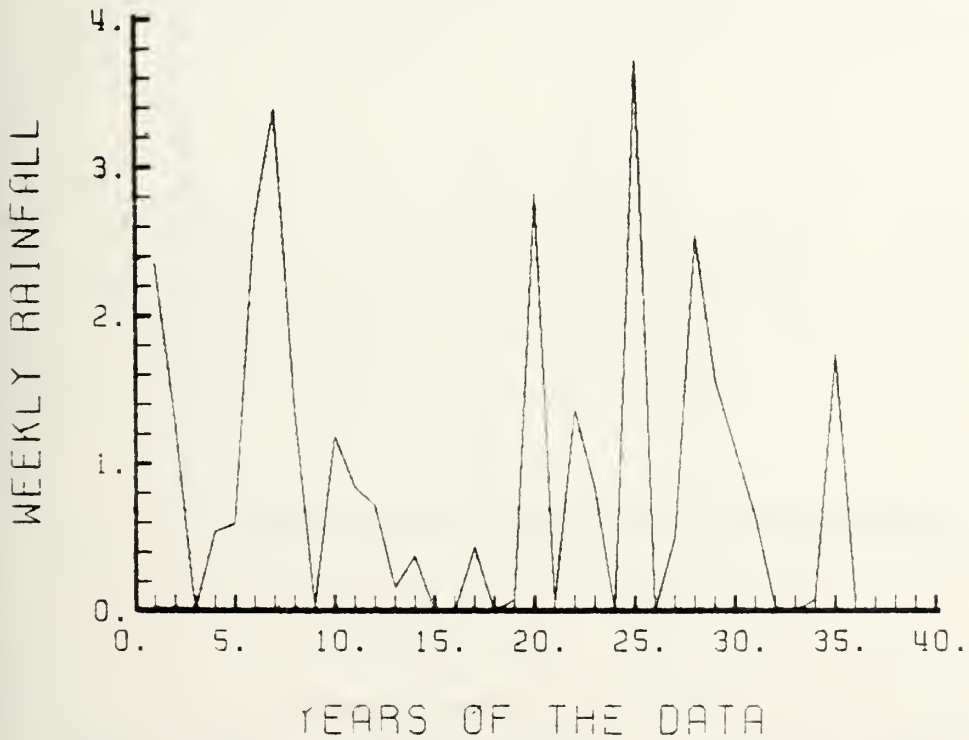
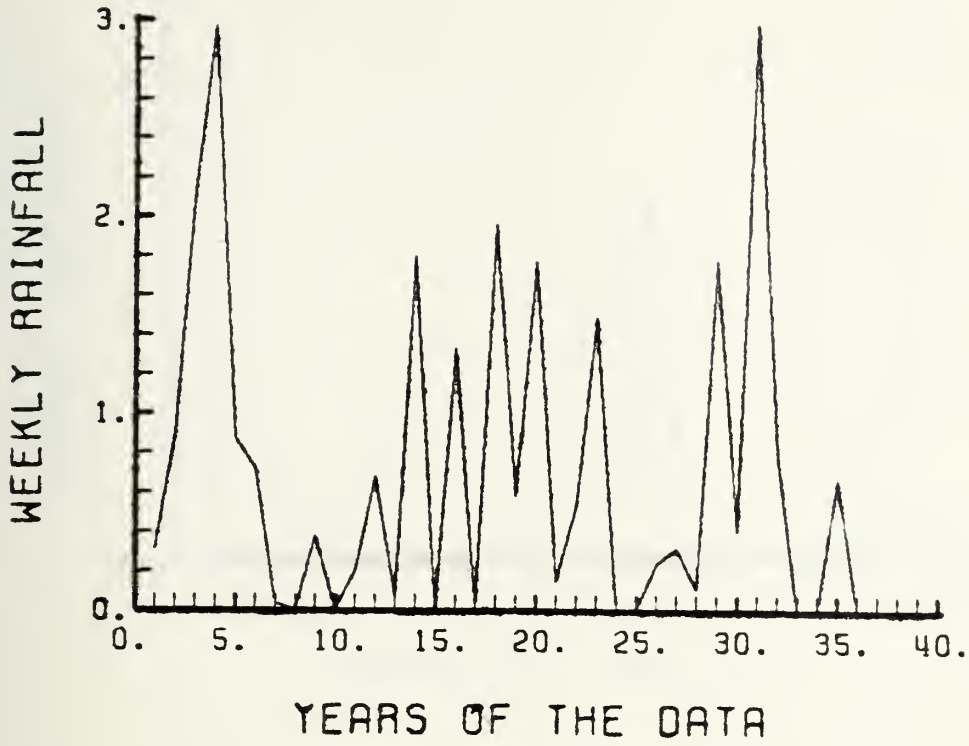


Figure 52. Weekly rainfall in inches for weeks J4 and JF



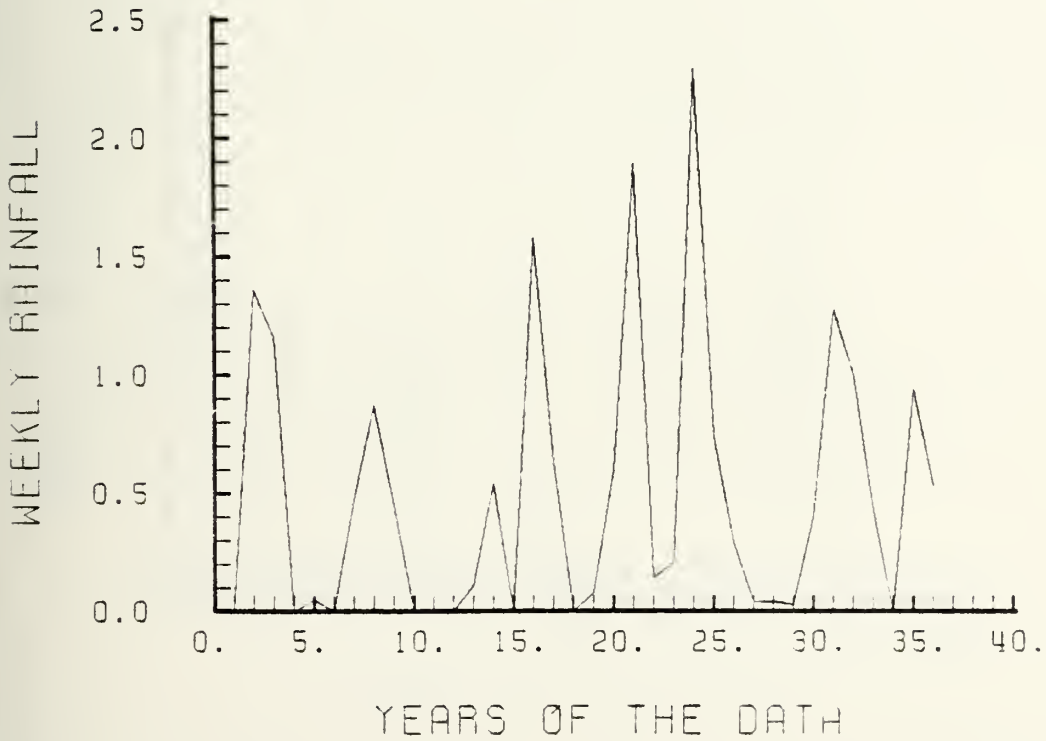
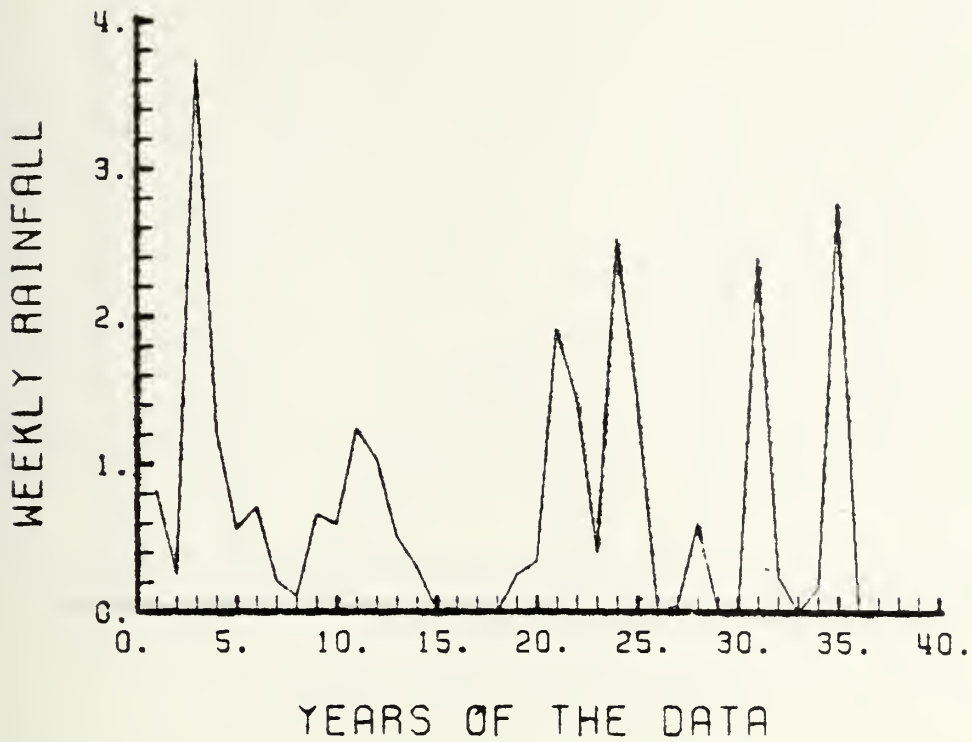


Figure 53. Weekly rainfall in inches for weeks F1 and F2



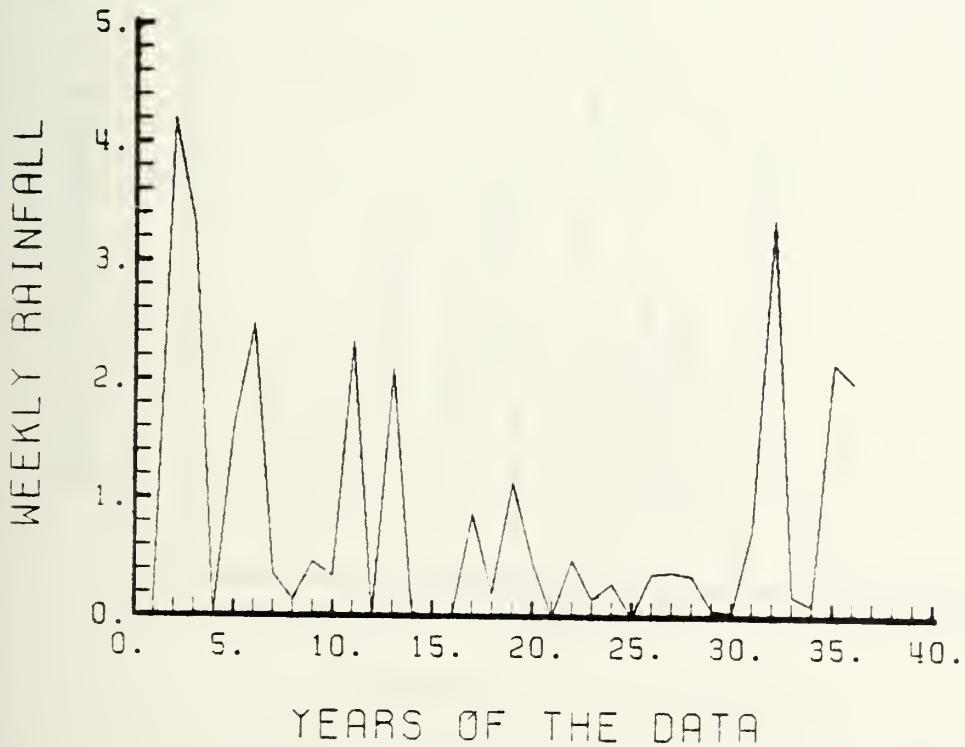
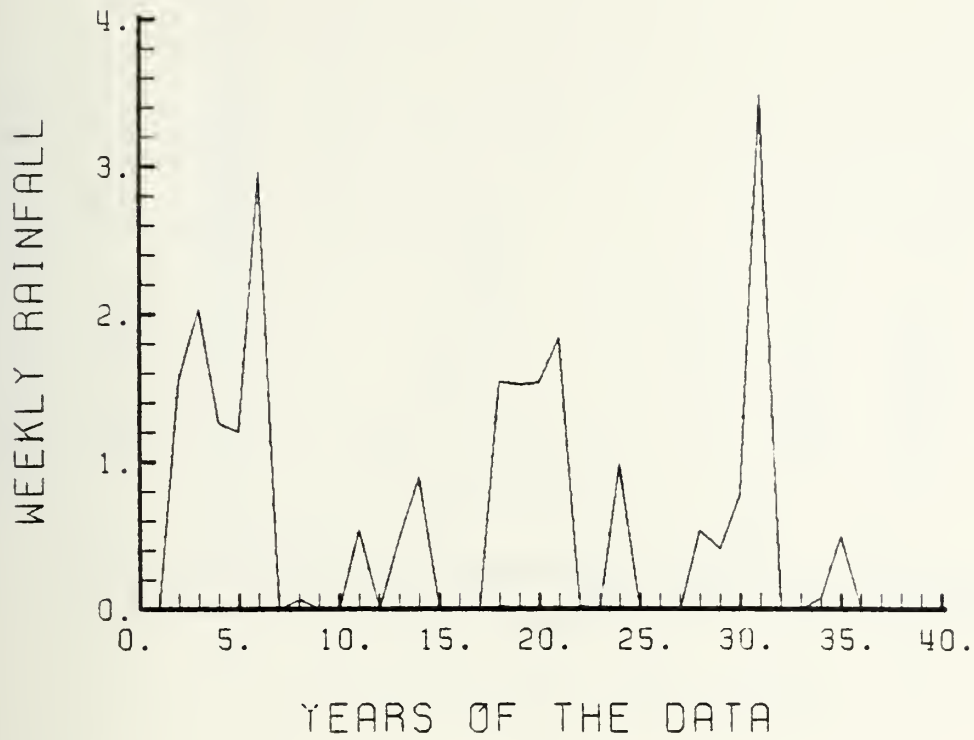


Figure 54. Weekly rainfall in inches for weeks F3 and FM





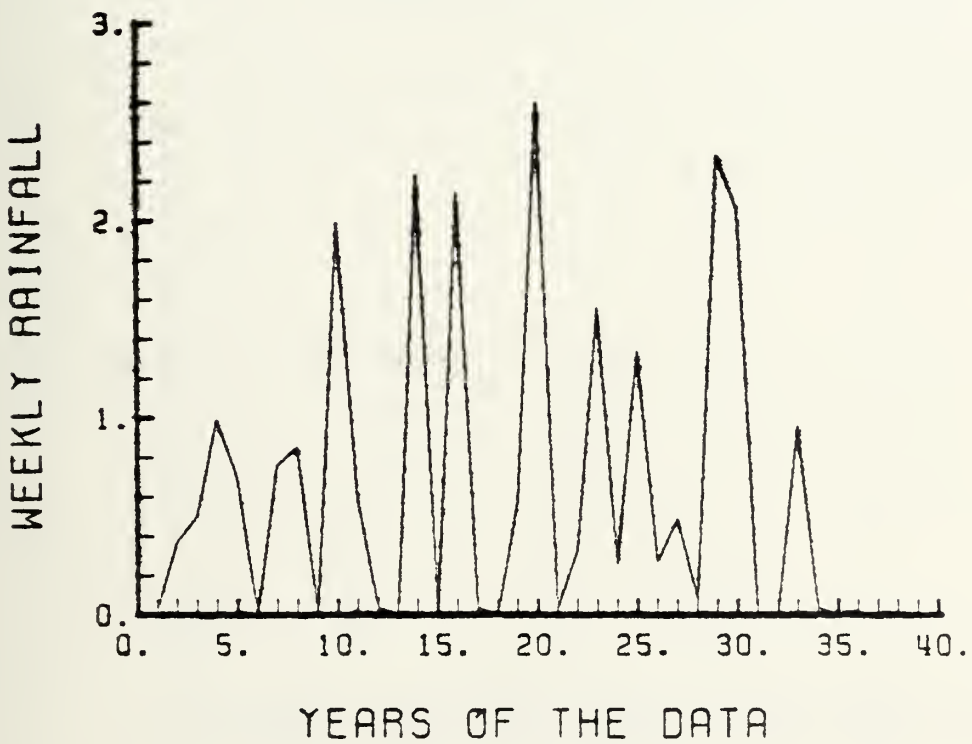
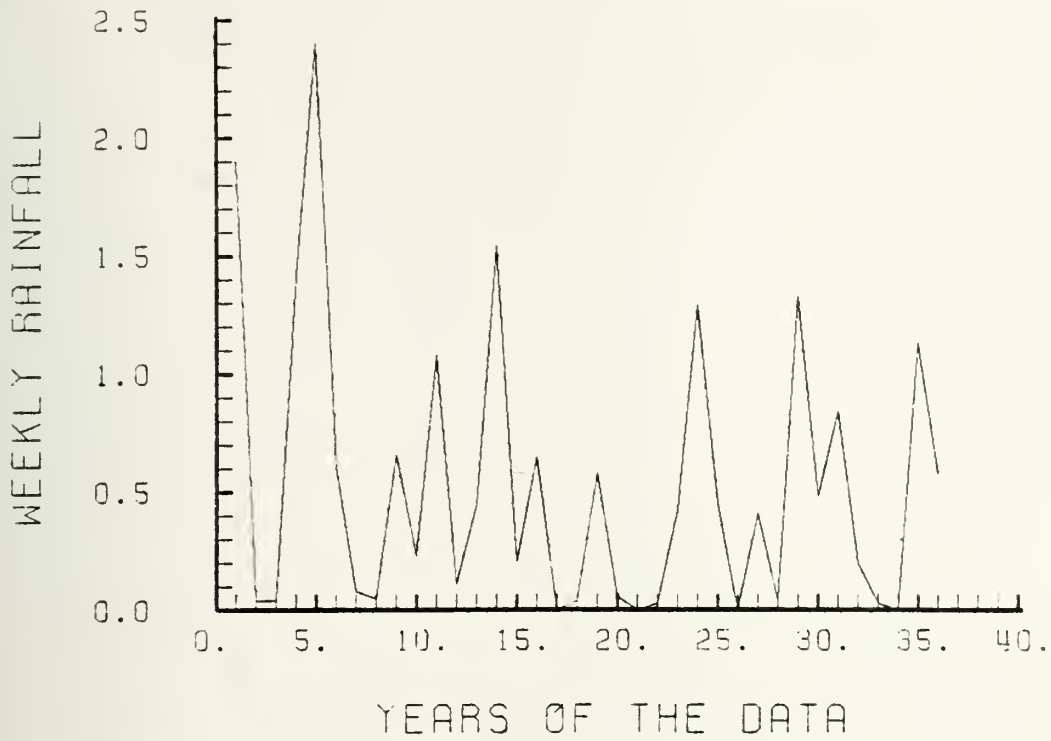


Figure 55. Weekly rainfall in inches for weeks M1 and M2



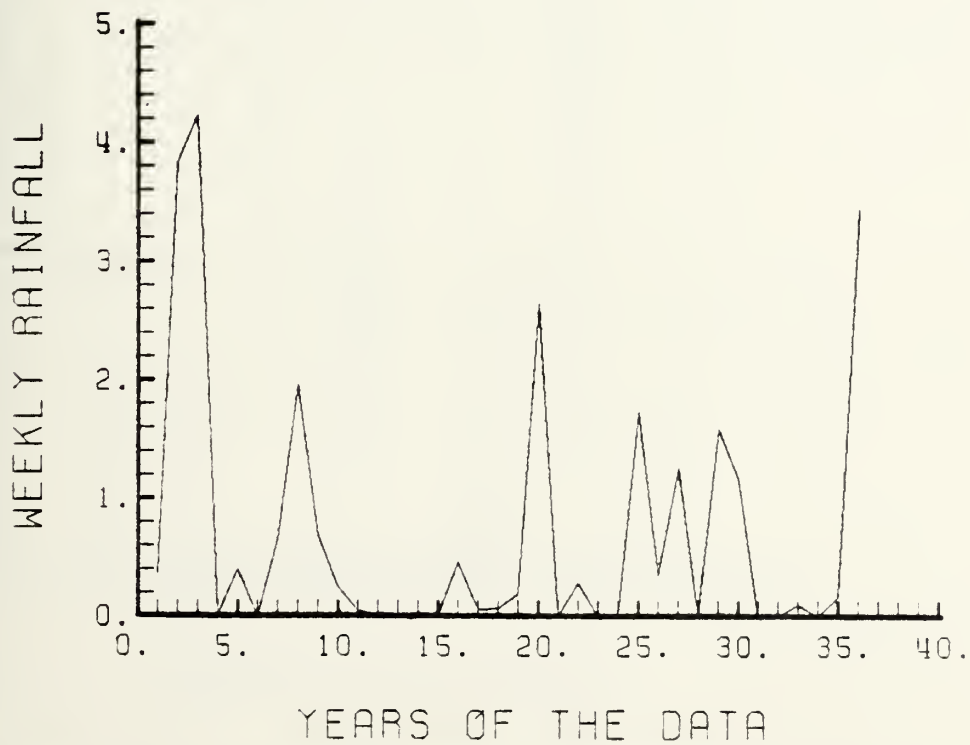
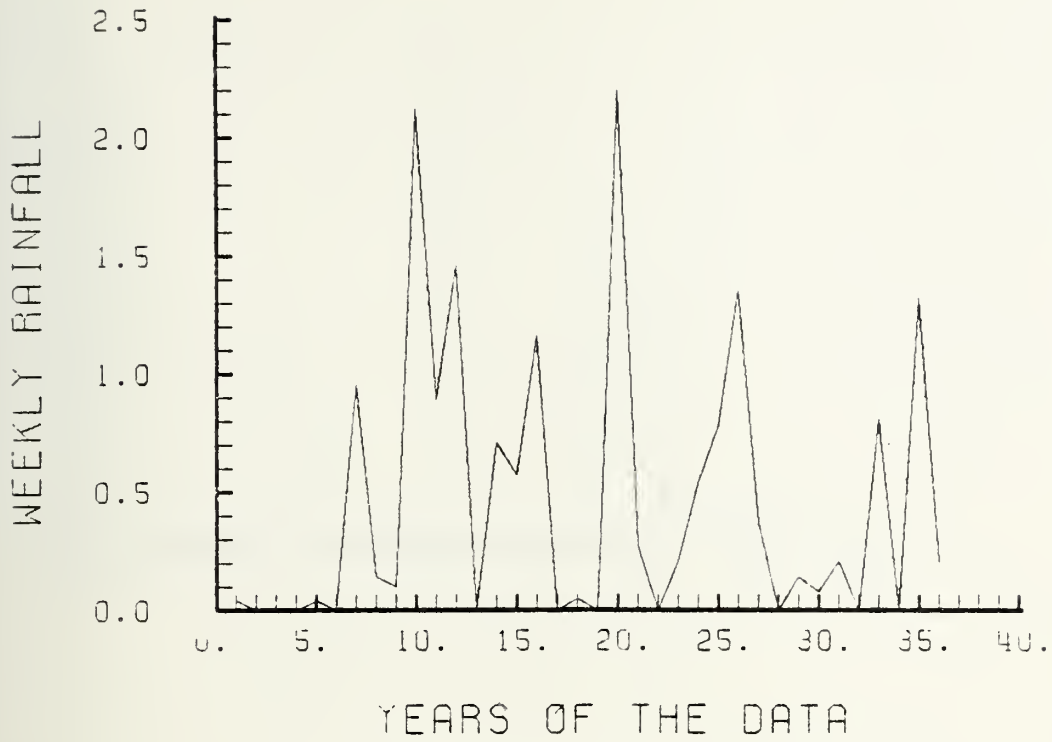


Figure 56. Weekly rainfall in inches for weeks M3 and M4



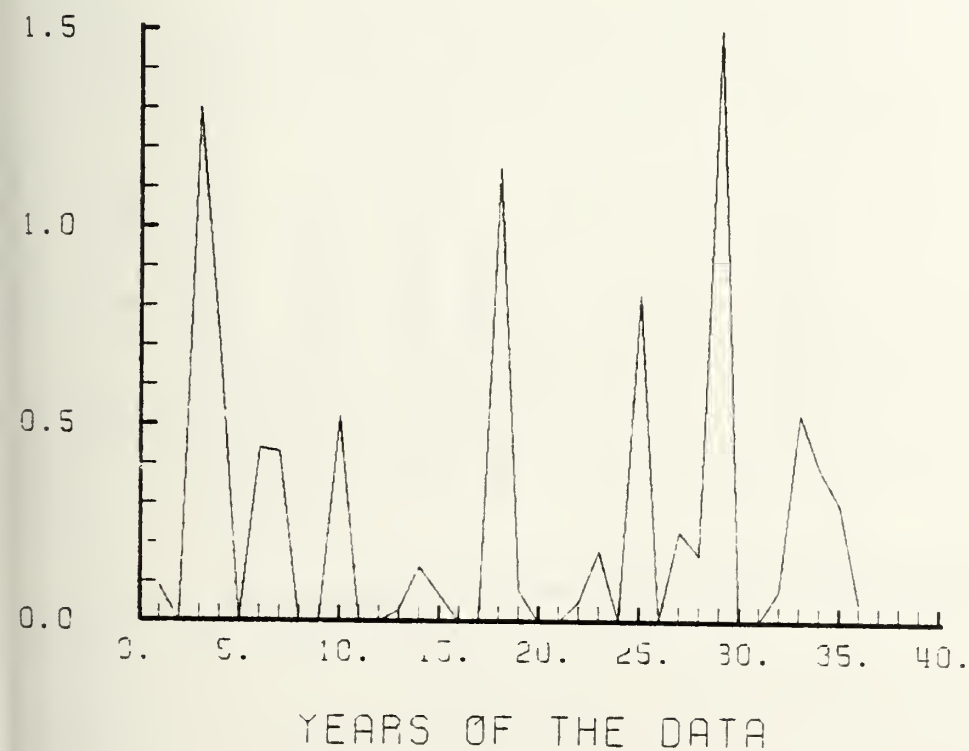
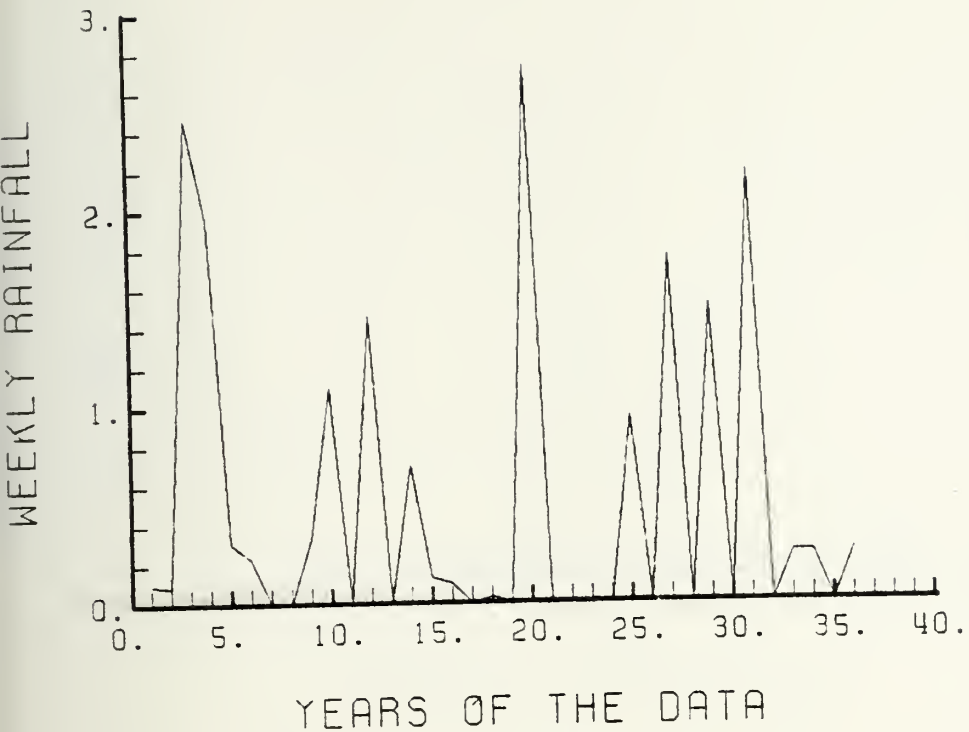
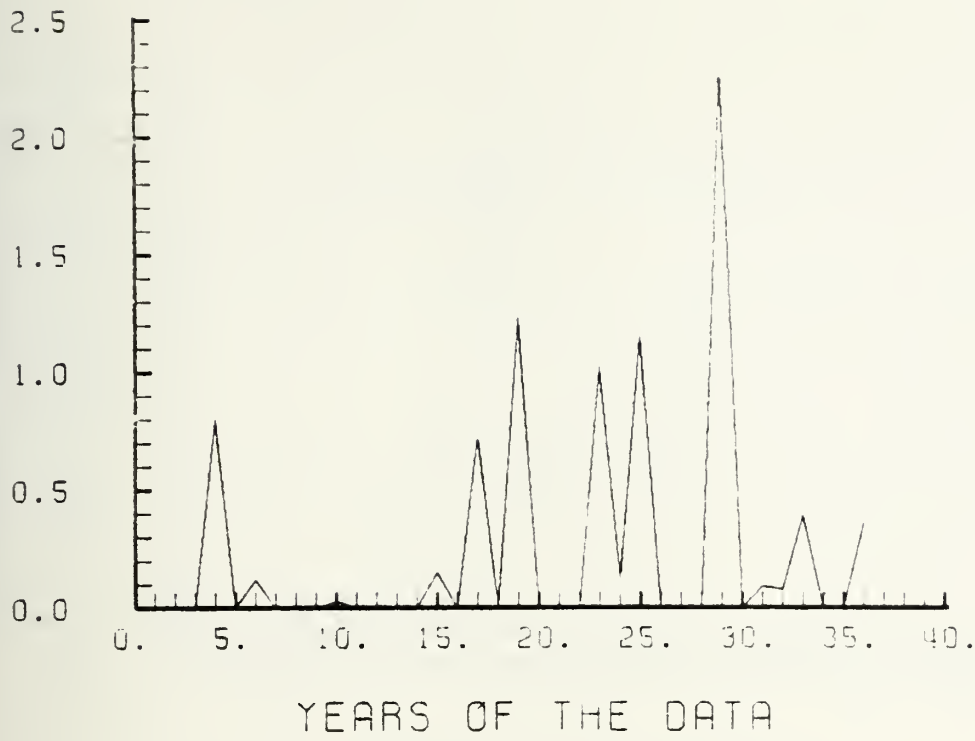


Figure 57. Weekly rainfall in inches for weeks A1 and A2



WEEKLY RAINFALL



WEEKLY RAINFALL

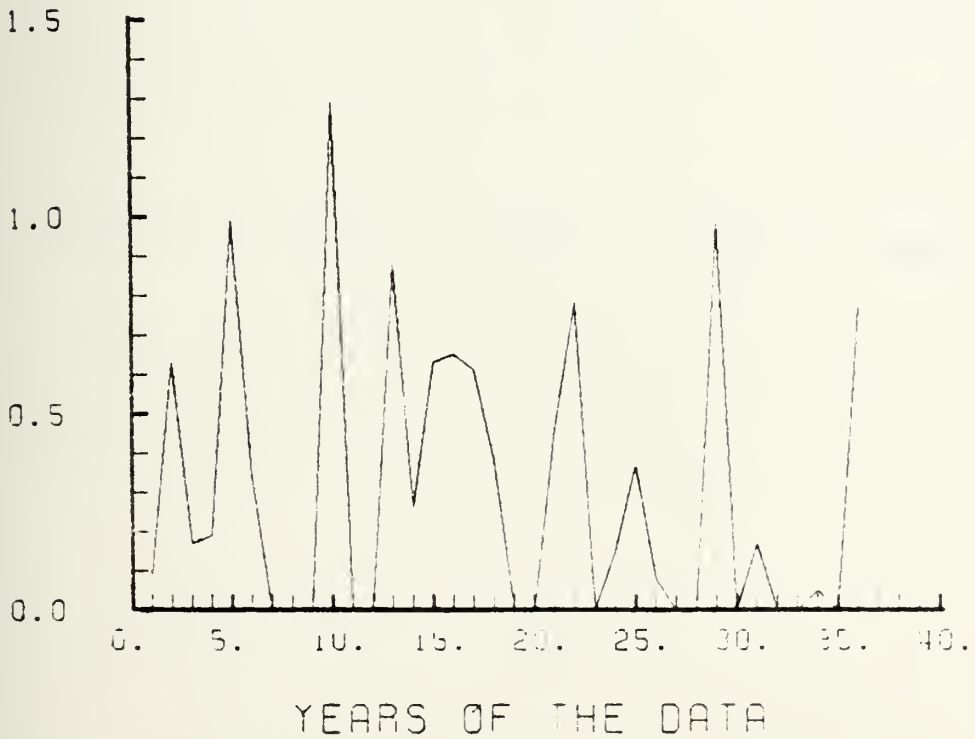


Figure 58. Weekly rainfall in inches for weeks A3 and A4





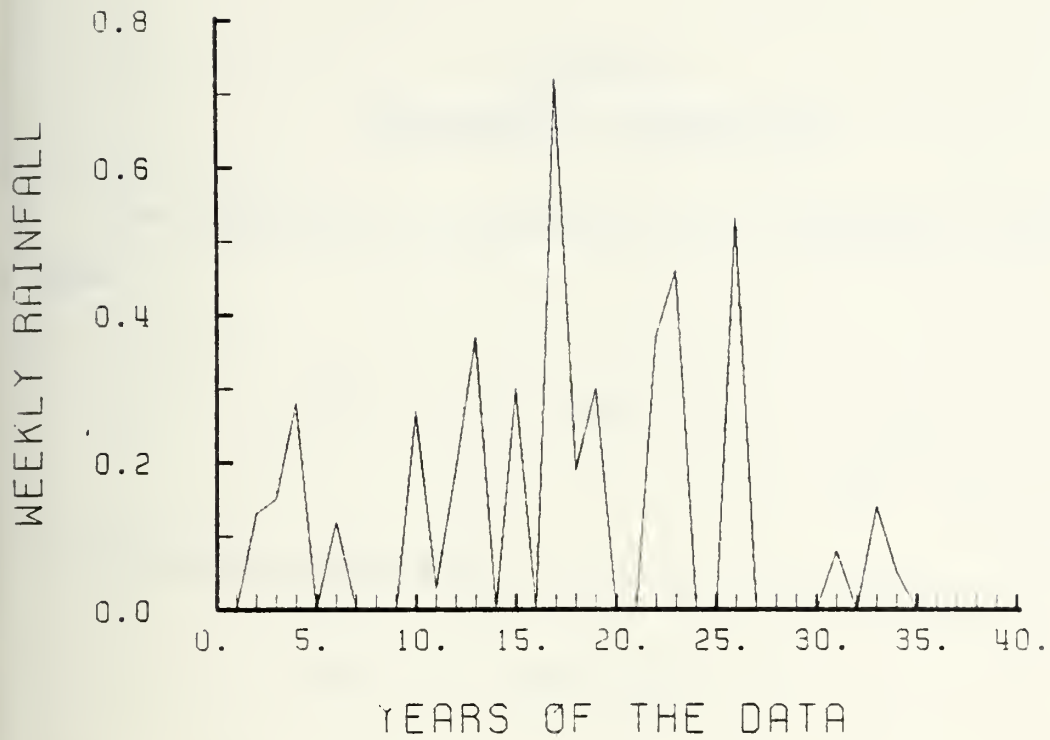


Figure 59. Weekly rainfall in inches for week AM



## APPENDIX D

### EXPONENTIAL DISTRIBUTION

The Exponential Distribution with parameter  $\lambda$  has the form

$$\begin{aligned} F(x) &= 1 - \exp(-\lambda x) & , & \quad 0 \leq x \\ &= 0 & , & \quad x < 0 \end{aligned}$$

It has density function,

$$f(x) = \lambda \exp(-\lambda x)$$

Suppose  $X$  has the exponential density with parameter  $\lambda$ .

Here are some characteristics of  $X$ .

- a) The mean :  $E[X] = 1/\lambda$
- b) The variance :  $V[X] = 1/\lambda^2$   
 std. dev  $[X] : 1/\lambda$   
 (Coef. of variation)<sup>2</sup> = 1
- c) The Median :  $X_{0.5} = 0.693E[X]$
- d) The Lower Quartile:  $X_{.25} = 0.288E[X]$
- d) The Upper Quartile:  $X_{.75} = 1.386E[X]$
- f) The Skewness : 2  
 The Kurtosis : 6

#### ALGEBRAIC COMPUTATION OF SKEWNESS AND KURTOSIS FOR EXPONENTIAL DISTRIBUTION.

Exponential distribution with parameter  $\lambda = 1$ .

Density function :  $f(x) = \exp(-x)$



Mean : 1

Variance : 1

#### A. SKEWNESS

$$\gamma_1 = \frac{E[(X-1)^3]}{(1)^{3/2}} = E[(X-1)^3]$$

$$\begin{aligned} E[(X-1)^3] &= \int_0^{\infty} (x-1)^3 e^{-x} dx ; \int_0^{\infty} x^k e^{-x} dx = k! \\ &= 3! - 3x^2! + 3x^1! - 1x^0! \end{aligned}$$

$$\gamma_1 = 2$$

#### B. KURTOSIS

$$\gamma_2 = E[(X-1)^4] - 3$$

$$\begin{aligned} E[(X-1)^4] &= \int_0^{\infty} (x-1)^4 e^{-x} dx ; \text{ again } \int_0^{\infty} x^k e^{-x} dx = k! \\ &= 4! - 4x^3! + 6x^2! - 4x^1! + 1x^0! \\ &= 9 \end{aligned}$$

$$\gamma_2 = 9 - 3 = 6$$



## SAMPLE PROPERTIES OF SKEWNESS AND KURTOSIS

Cramer [Ref. 6] gives a discussion of mean and variances of the skewness and kurtosis for sampling. In general, the mean of  $g_1$  and  $g_2$  are:

$$E[g_1] = \gamma_1, \quad E[g_2] = \gamma_2$$

and the variances are:

$$\text{Var}[g_1] = \frac{4\mu_2^2\mu_6 - 12\mu_2\mu_3\mu_5 - 24\mu_2^3\mu_4 + 9\mu_3^2\mu_4 + 35\mu_2^2\mu_3^2 + 36\mu_2^5}{4 \times n \times \mu_2^5}$$

$$\text{Var}[g_2] = \frac{\mu_2^2\mu_8 - 4\mu_2\mu_4\mu_6 - 8\mu_2^2\mu_3\mu_5 + 4\mu_4^3 - \mu_2^2\mu_4^2 + 16\mu_2\mu_3\mu_4 + 16\mu_2^3\mu_3^2}{n \times \mu_2^6}$$

When the parent population is exponential,

$$E[g_1] = 2, \quad E[g_2] = 6$$

$$\text{Var}[g_1] = \frac{225}{8xn}, \quad \text{Var}[g_2] = \frac{1332}{n}$$

for the computation.

In general for the exponential distribution with density function  $f(x) = e^{-x}$ , the  $k$ th moment;  $\mu_k = \int_0^{\infty} x^k e^{-x} dx = k!$  So, by using this formula and putting it in the equations of variance:

$$\text{Var}[g_1] = \frac{225}{8n}, \quad \text{Var}[g_2] = \frac{1332}{n}$$





Table 22: ESTIMATED AND SIMULATED VALUES FOR SKEWNESS AND KURTOSIS FOR SAME SAMPLE SIZES.

# OF YEARS		ESTIM.	SIMULATED	ESTIM.	SIMULATED
WEEK	POS. RAINFALL	SKEWNESS	SKEWNESS	KURTOSIS	KURTOSIS
O1	9	1.57	1.11	0.43	0.24
O2	17	1.23	1.37	0.10	1.36
O3	16	2.05	1.34	3.16	1.25
O4	15	1.50	1.33	1.65	1.17
ON	14	2.62	1.29	5.82	1.02
N1	20	0.39	1.43	-1.58	1.70
N2	28	1.78	1.54	2.26	2.31
N3	19	1.64	1.41	1.65	1.57
N4	22	3.39	1.45	11.39	1.83
D1	28	1.45	1.54	1.08	2.31
D2	22	1.84	1.45	3.03	1.83
D3	28	0.70	1.54	0.17	2.31
D4	24	1.34	1.49	1.10	2.02
J1	26	1.73	1.52	2.66	2.19
J2	25	0.83	1.50	-0.73	2.09
J3	21	0.76	1.44	0.44	1.76
J4	27	1.04	1.52	-0.01	2.22
JF	29	1.00	1.55	-0.11	2.37
F1	27	1.45	1.52	1.24	2.22
F2	27	1.10	1.52	0.47	2.22
F3	21	1.05	1.44	0.65	1.76
FM	30	1.31	1.55	0.46	2.40
M1	32	1.25	1.57	0.84	2.50
M2	28	0.83	1.54	-0.81	2.31
M3	25	1.07	1.50	0.17	2.09
M4	23	1.34	1.47	0.39	1.94
A1	21	0.81	1.44	-0.94	1.76
A2	22	1.34	1.45	0.59	1.83
A3	14	0.15	1.29	1.49	1.02
A4	22	0.56	1.45	-0.72	1.83
AM	18	1.03	1.39	0.55	1.50



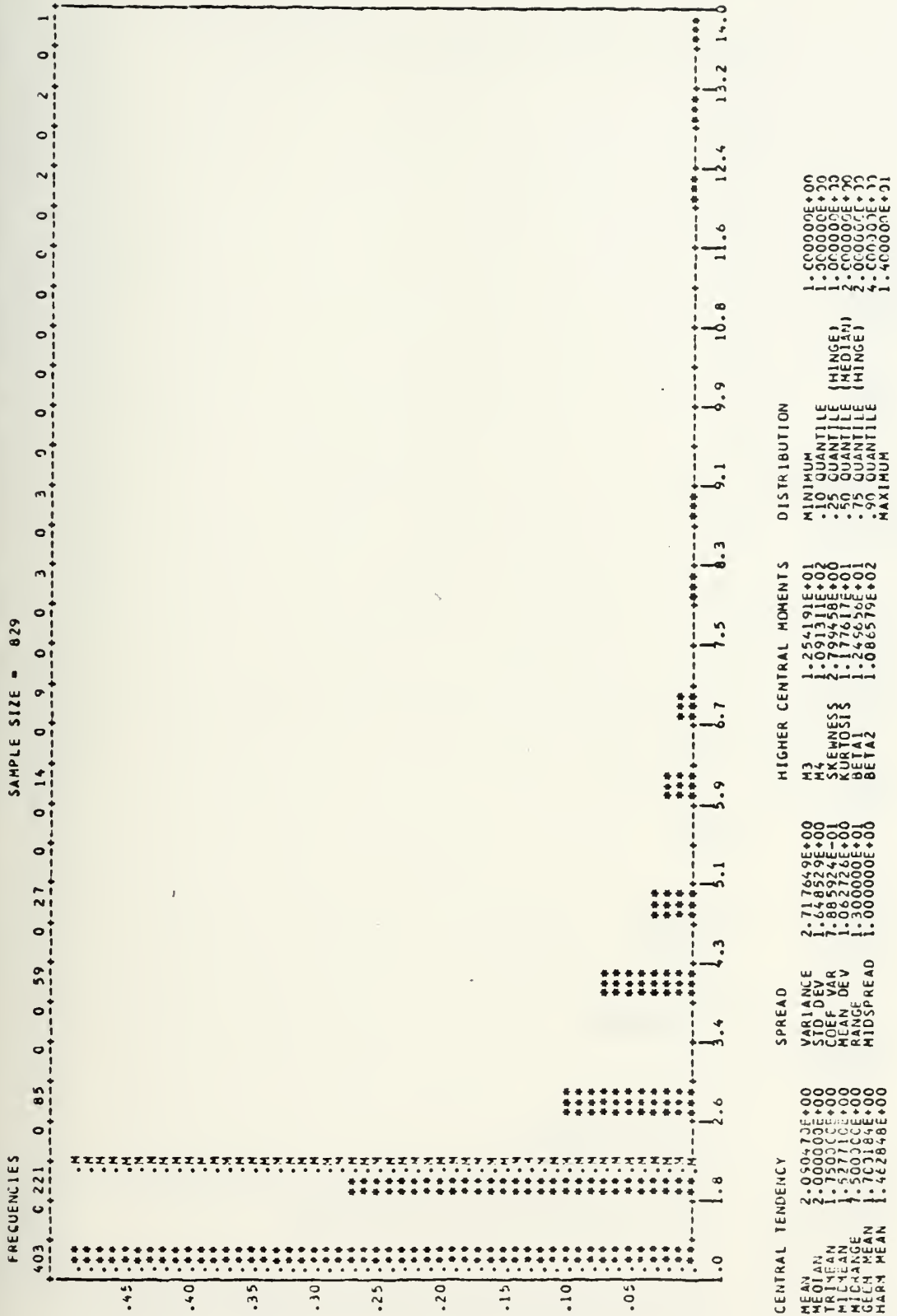
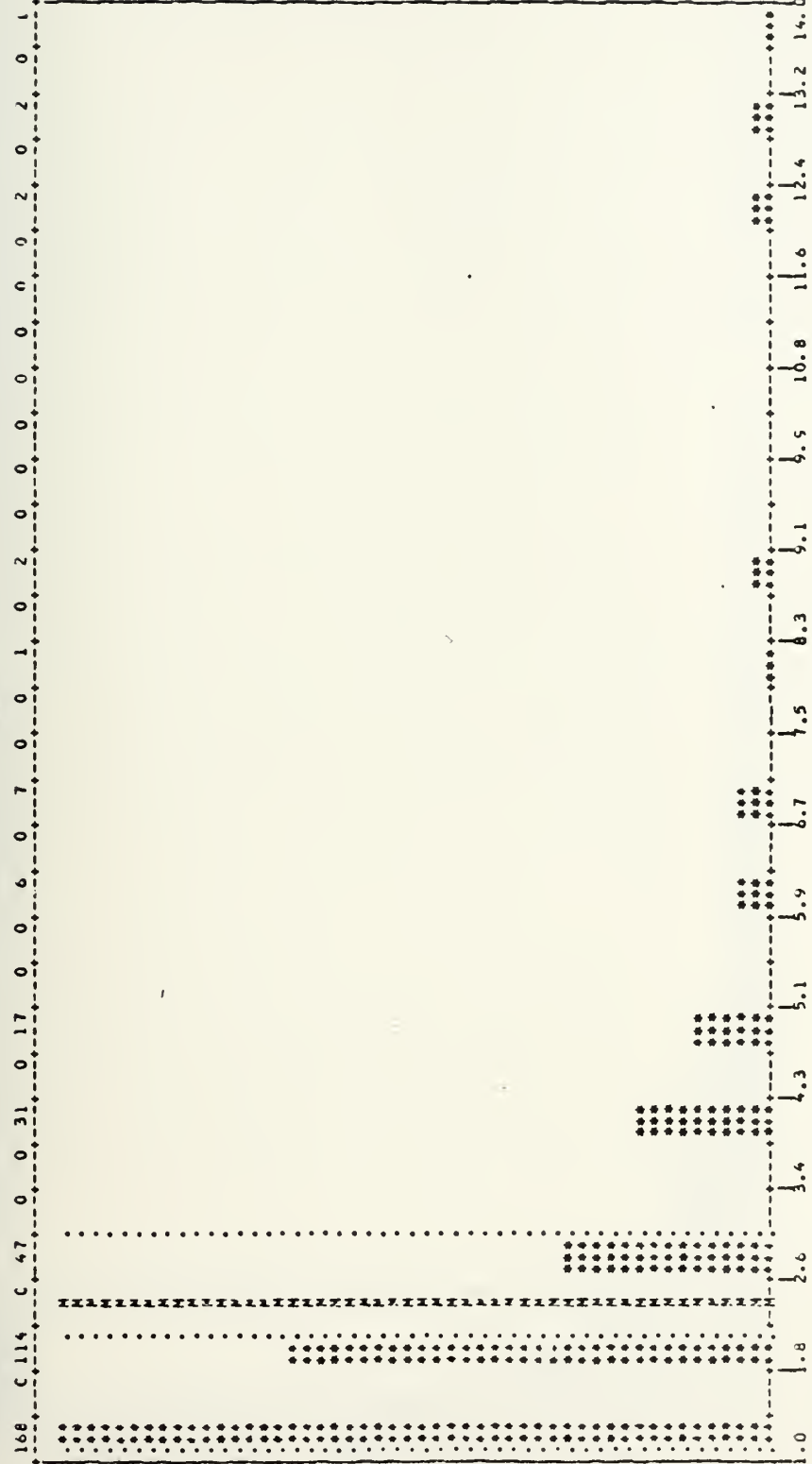


Figure 60. Histogram of the LS in days for October through April in the 36-year period



SAMPLE SIZE = 398

FREQUENCIES



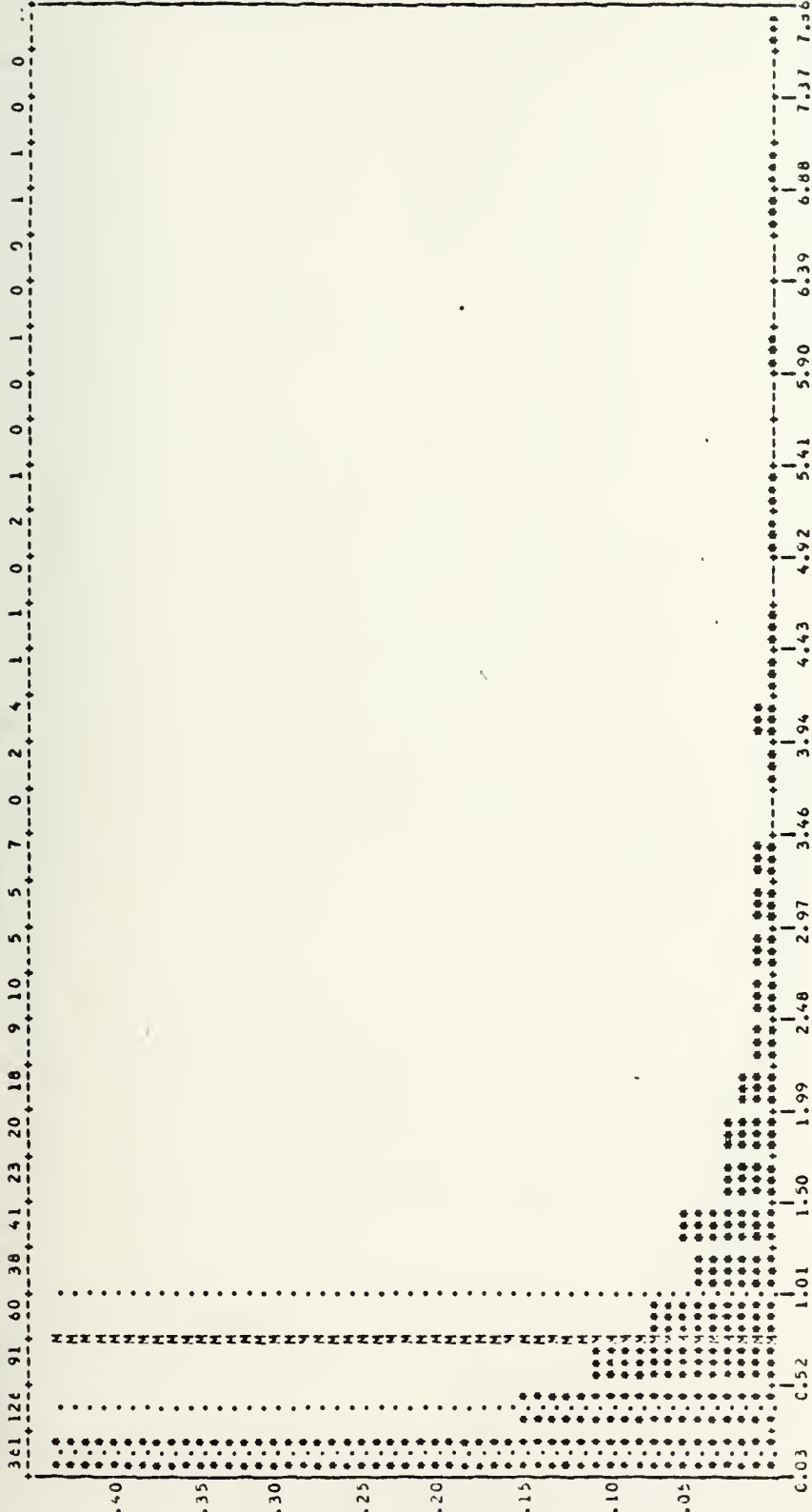
CENTRAL TENDENCY		SPREAD		HIGHER CENTRAL MOMENTS		DISTRIBUTION	
MEAN	2.314070E+00	VARIANCE	3.63626E+00	M3	1.965634E+01	MINIMUM	1.000000E+00
MEDIAN	2.000000E+00	STD. DEV.	1.906994E+00	M4	1.863538E+02	.10 QUANTILE (HINGE)	1.000000E+00
TRIM. MEAN	2.000000E+00	COEF. VAR.	8.240965E-01	SKENNESS	1.834369E+01	.25 QUANTILE (HINGE)	1.000000E+00
MID-RANGE	1.740000E+00	MEAN DEV.	1.158291E+00	KURTOSIS	1.109097E+01	.50 QUANTILE (MEDIAN)	2.000000E+00
GEOM. MEAN	1.500000E+00	RANGE	1.300000E+01	BETA1	1.950844E+01	.75 QUANTILE (HINGE)	3.000000E+00
HARM. MEAN	1.843744E+00	MIDSPREAD	2.000000E+00	BETA2	1.846795E+02	.90 QUANTILE	4.000000E+00
						MAXIMUM	1.400000E+01

Figure 61. Histogram of the LS in days for December through February in the 36-year period



SAMPLE SIZE = 829

FREQUENCIES



CENTRAL TENDENCY	SPREAD	HIGHER CENTRAL MOMENTS	DISTRIBUTION
MEAN 7.061155E-01	VARIANCE 8.632756E-01	M3 2.356102E+00	MINIMUM 3.000000E-02
TRIMEAN 3.500000E-01	STD DEV 9.291263E-01	M4 1.166496E+01	5.000000E-02
TRIMEAN 4.374998E-01	COEF VAR 1.315827E+00	SKENWNESS 2.937446E+00	.10 QUANTILE 1.000000E-01
MIDRANGE 3.544955E-00	MEAN DEV 5.646318E-01	KURTOSIS 1.285252E+01	.25 QUANTILE 3.500000E-01
MIDRANGE 3.544955E-00	RANGE 7.829997E+00	BETA1 2.347584E+00	.50 QUANTILE 6.000000E-01
GECH MEAN 3.274572E-01	MIDSPREAD 8.229996E-01	BETA2 1.161406E+01	.75 QUANTILE 7.000000E-01
HARY MEAN 1.443343E-01			.90 QUANTILE 7.000000E+00
			MAXIMUM 7.859998E+00

Figure 62. Histogram of the AR in inches in all storms in all storms for October through April in the 36-year period





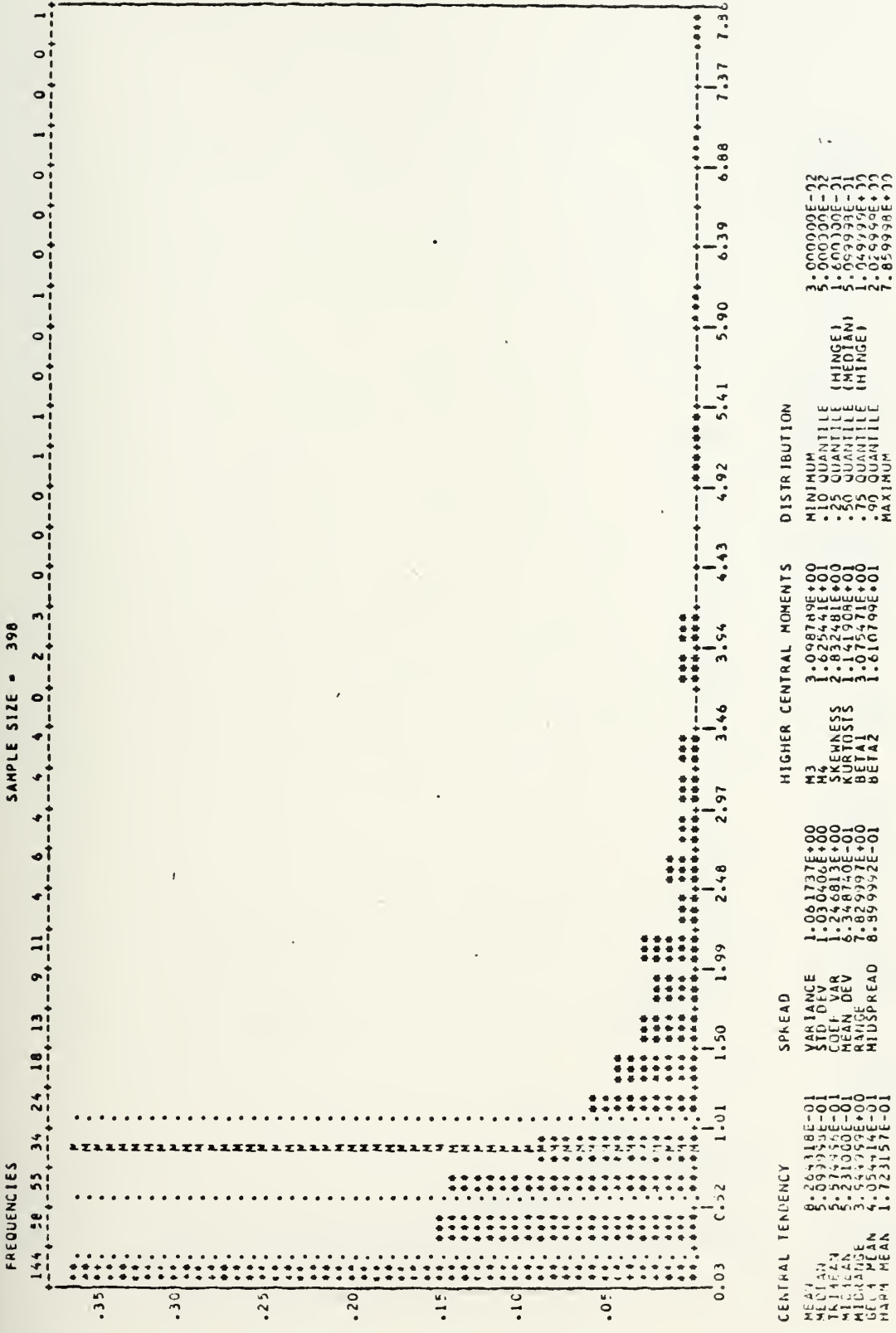
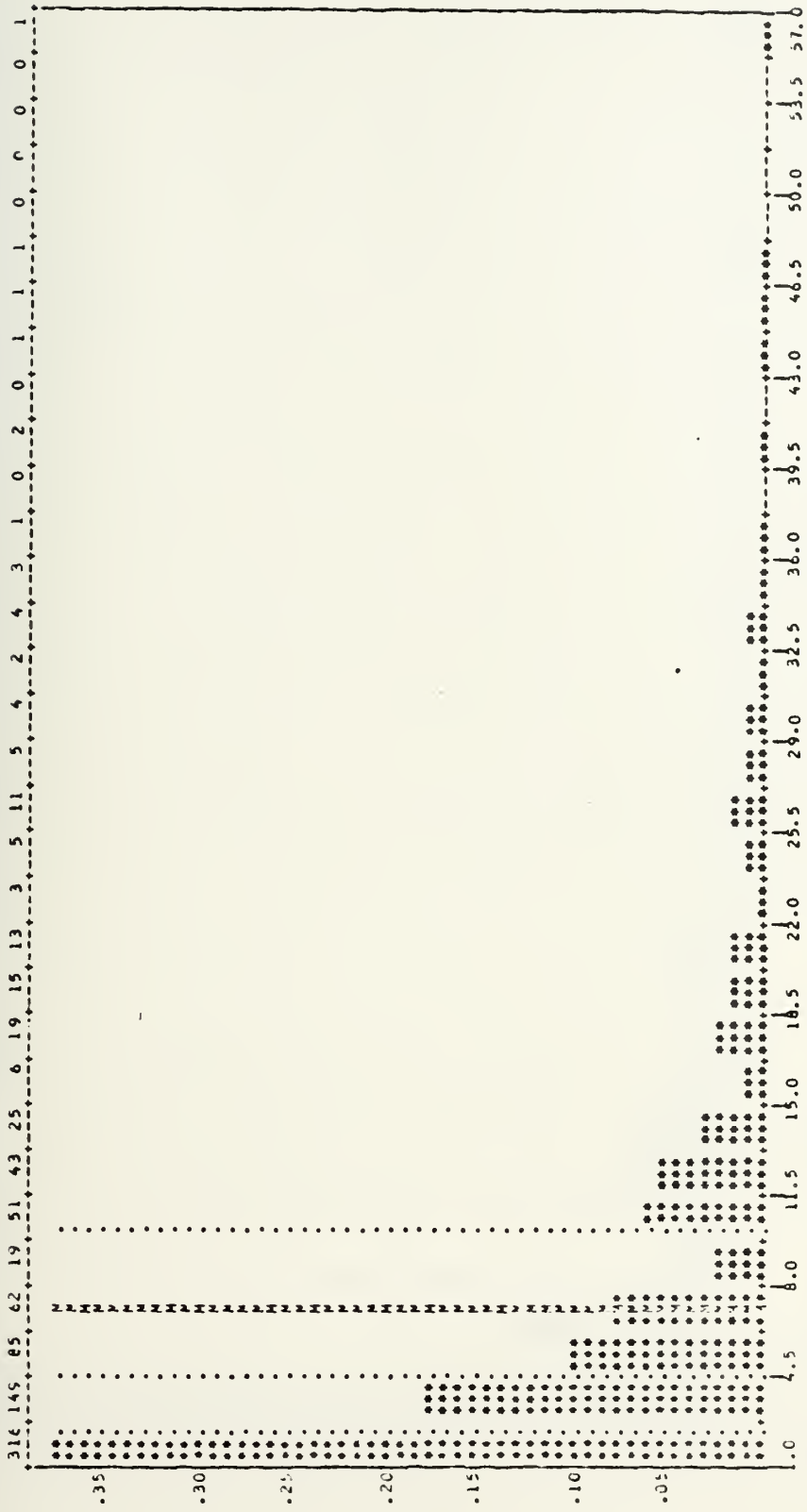


Figure 63. Histogram of the AR in inches in all storms for December through February in the 36-year period



SAMPLE SIZE = 847

FREQUENCIES



CENTRAL TENDENCY	SPREAD	HIGHER CENTRAL MOMENTS	DISTRIBUTION
MEAN 6.884297E+00	VARIANCE 6.010475E+01	M3 1.019395E+03	MINIMUM 1.000000E+00
MEDIAN 5.000000E+00	STD DEV 7.752725E+00	M4 3.252657E+04	.10 QUANTILE 1.000000E+00
TRIMMEAN 5.000000E+00	COEF VAR 1.126155E+00	SKWNESS 2.187657E+00	.25 QUANTILE 2.000000E+00
MID-MEAN 4.437000E+00	MEAN DEV 5.063754E+00	KURTOSIS 6.014765E+00	.50 QUANTILE 1.000000E+01
MEAN RANGE 2.400000E+01	RANGE 8.600000E+01	BETA1 1.014788E+03	.75 QUANTILE 1.000000E+01
GEOM MEAN 5.583950E+00	MIDSPREAD 8.000000E+00	BETA2 3.243832E+04	MAXIMUM 5.700000E+01

Figure 64. Histogram of the LN in days for October through April in the 36-year period



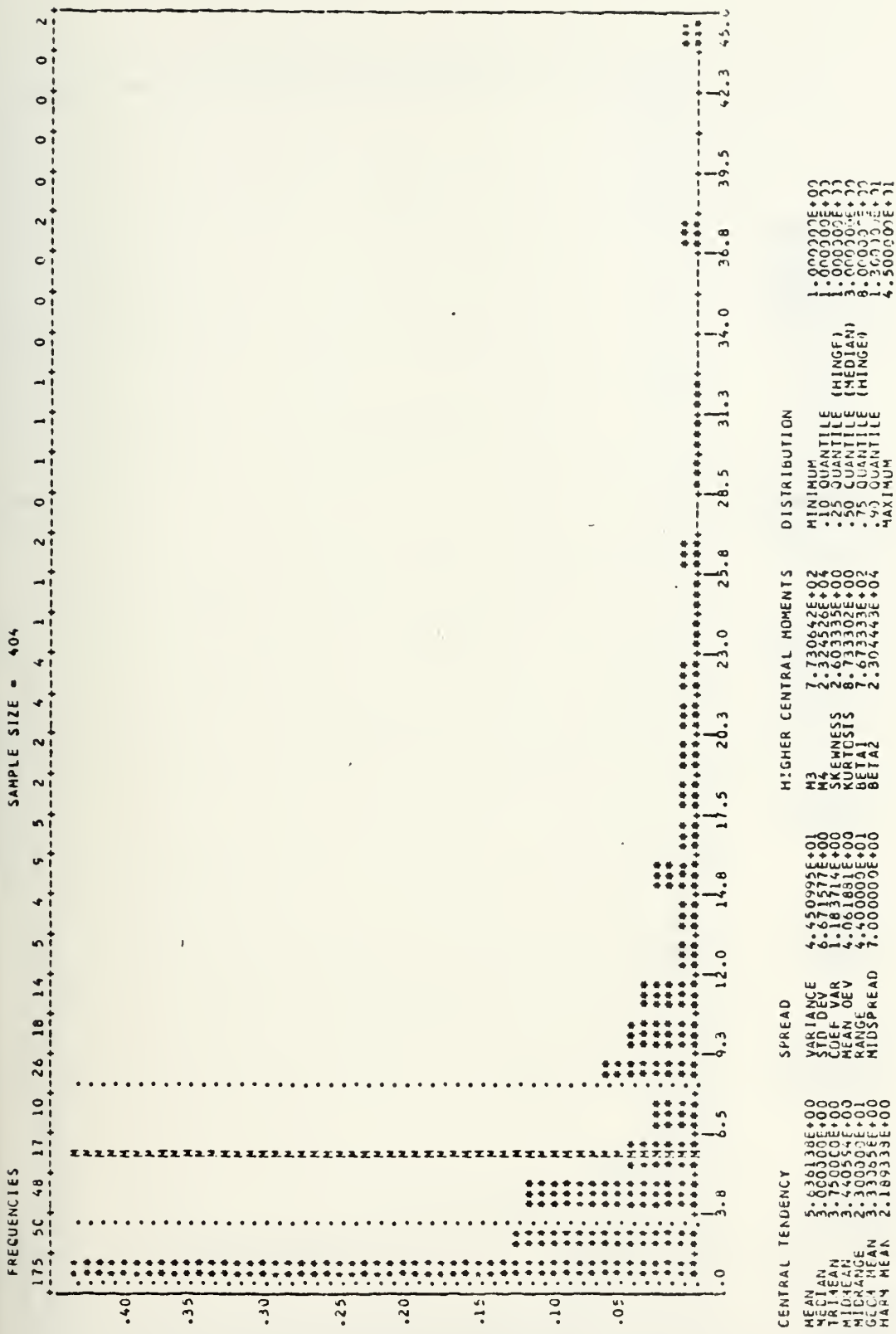
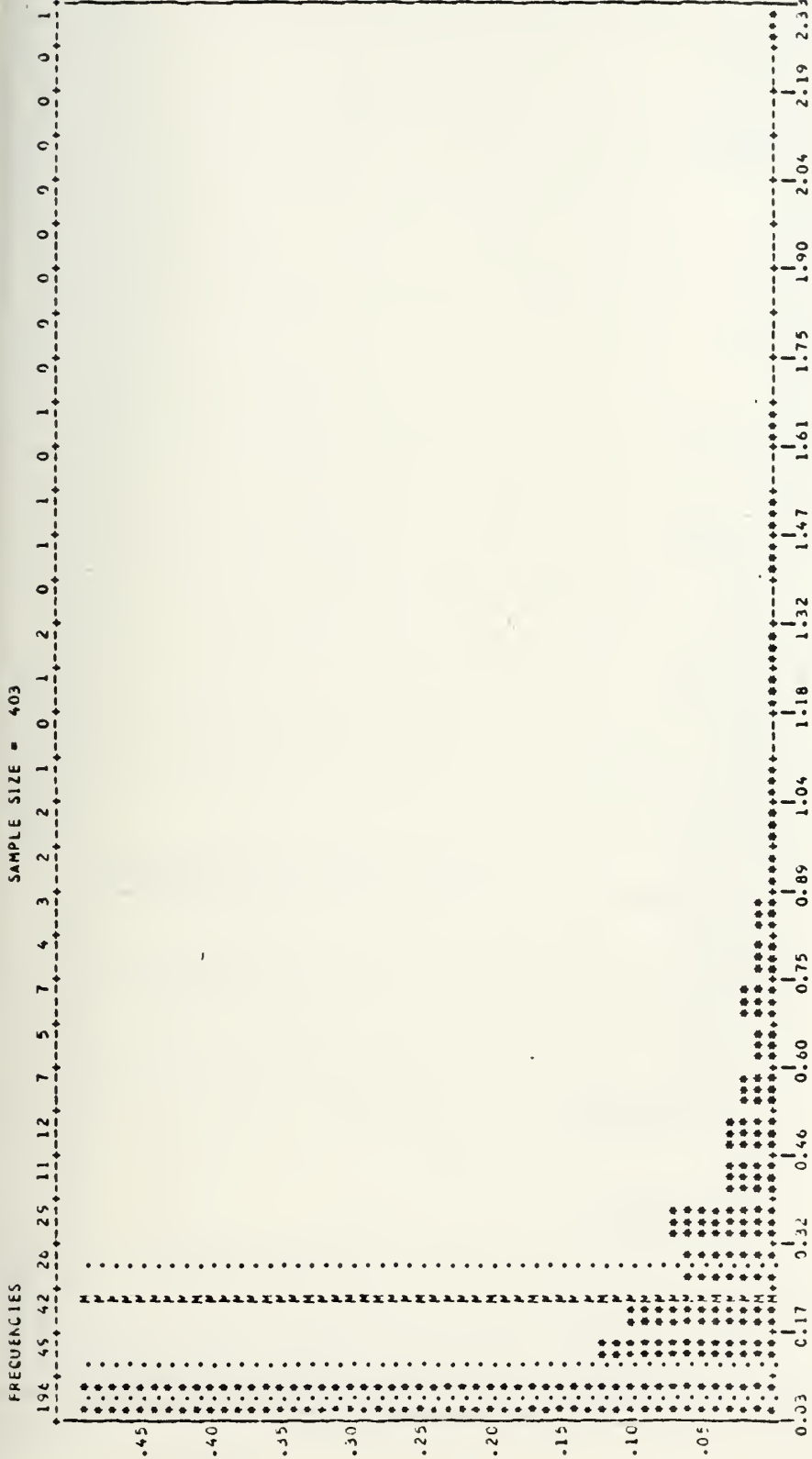


Figure 65. Histogram of the LN in days for December through February in the 36-year period



SAMPLE SIZE = 403



CENTRAL TENDENCY		SPREAD		HIGHER CENTRAL MOMENTS		DISTRIBUTION	
MEAN	2.17476E-01	VARIANCE	7.26518E-02	M2	6.11216E-02	MINIMUM	3.00000E-02
TRIMMEAN	1.36000E-01	STD DEV	2.69540E+00	SKWENESS	3.123518E+00	QUANTILE	3.00000E-02
MIDMEAN	1.33449E-01	COEFF VAR	1.56858E-01	KURTOSIS	1.404883E+01	QUANTILE	1.00000E-01
MEAN DEV	1.17393E+00	RANGE	2.29999E+00	BETA1	6.06627E-02	QUANTILE	2.100000E-01
MICRMEAN	1.26707E-01	MTDSPREAD	2.200000E-01	BETA2	8.943522E-02	QUANTILE	5.100000E-01
MACRMEAN	6.173937E-02					MAXIMUM	2.330000E+00

Figure 66. Histogram of AR in inches in the exactly 1 day lasting storms for October through April in the 36-year period





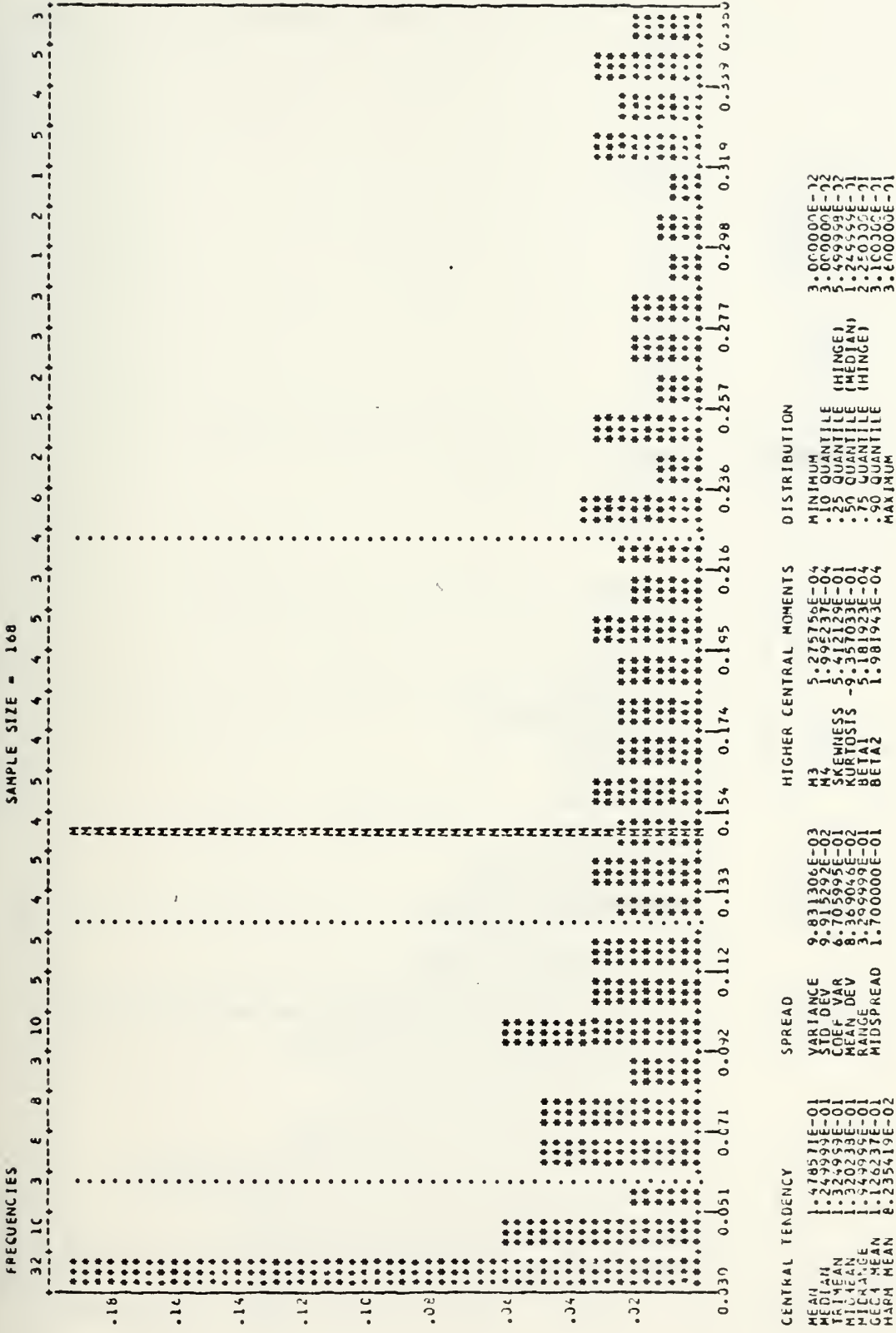


Figure 67. Histogram of the AR in inches in the exactly 1 day lasting storms for December through February in the 36-year period



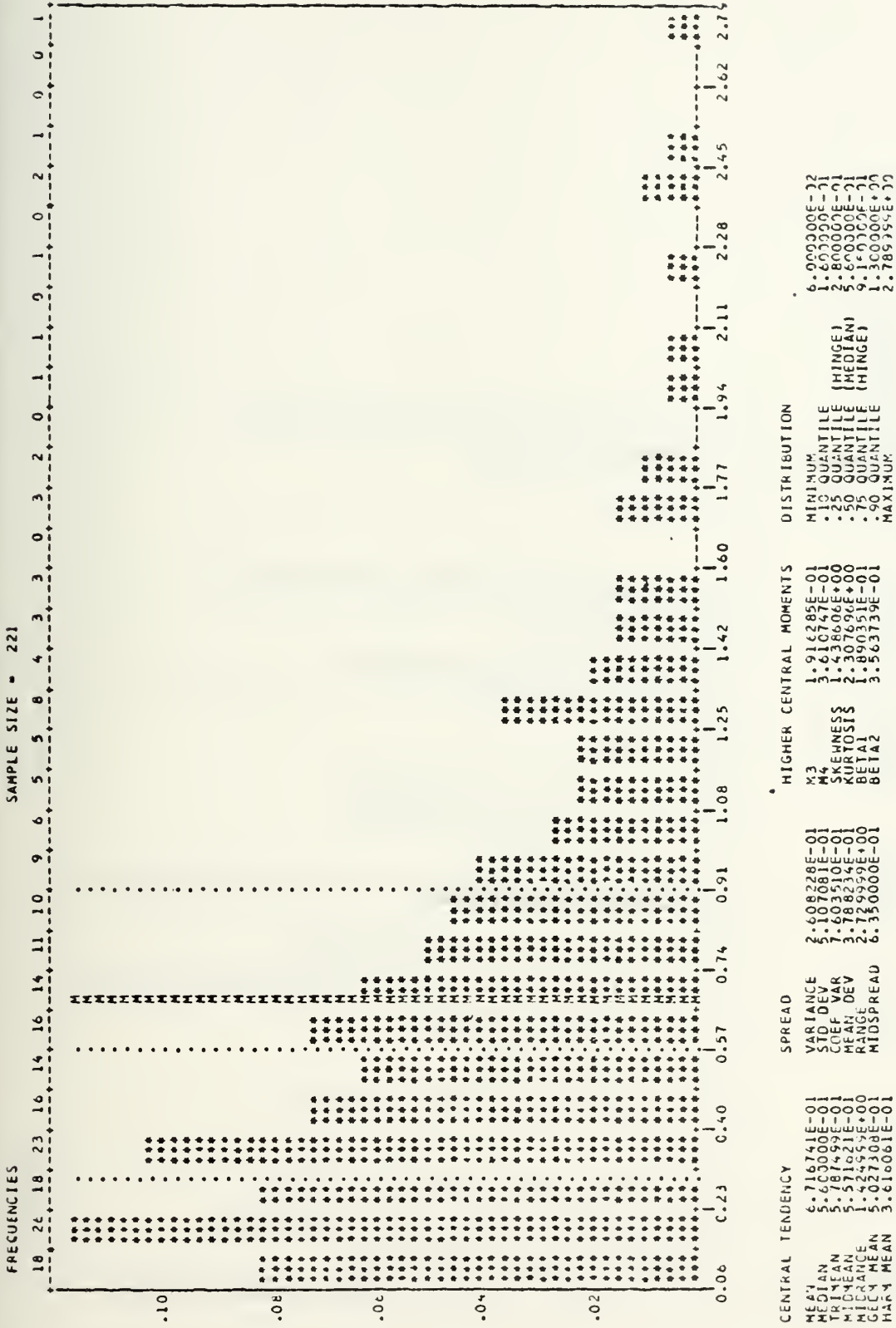
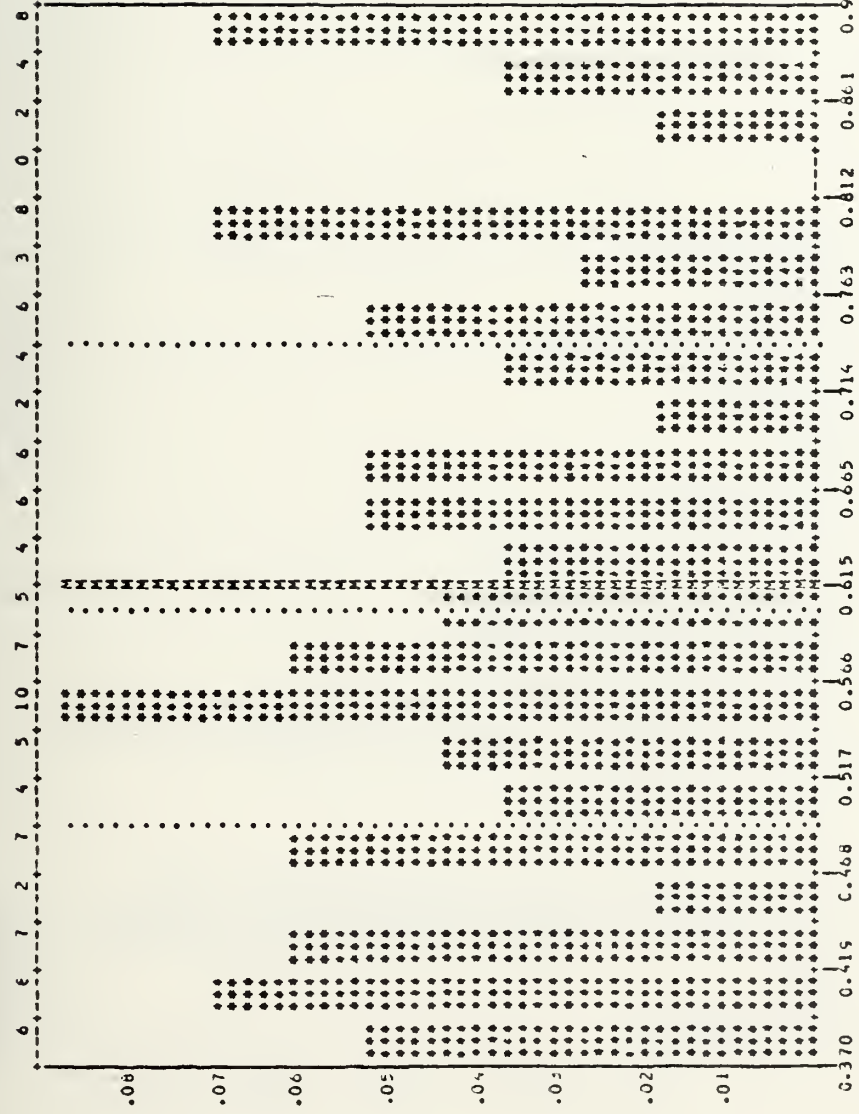


Figure 68. Histogram of the AR in inches in the exactly 2 days lasting storms for October through April in the 36-year period



SAMPLE SIZE = 114

FREQUENCIES



CENTRAL TENDENCY	SPREAD	HIGHER CENTRAL MOMENTS	DISTRIBUTION
MEAN 6.175438E-01	VARIANCE 2.486347E-02	M3 9.031123E-04	MINIMUM 3.699999E-01
MEDIAN 6.099999E-01	STD DEV 1.576181E-01	M4 1.204316E-03	10 QUANTILE 4.100000E-01
TRIMEAN 6.099999E-01	COEF VAR 2.532318E-01	SKENNESS -1.306741E-01	25 QUANTILE 6.899999E-01
MICRANGE 6.010345E-01	MEAN DEV 1.328318E-01	KURTOSIS 1.048736E+01	50 QUANTILE 7.649999E-01
PICRANGE 6.399999E-01	RANGE 5.400001E-01	BETA1 8.794854E-03	75 QUANTILE 8.400000E-01
Q1-MEAN 5.974455E-01	MIDSPREAD 2.500001E-01	BETA2 1.194116E-03	MAXIMUM 9.100000E-01
Q3-MEAN 5.775803E-01			

Figure 69. Histogram of the AR in inches in the exactly 2 days lasting storms for December through February in the 36-year period



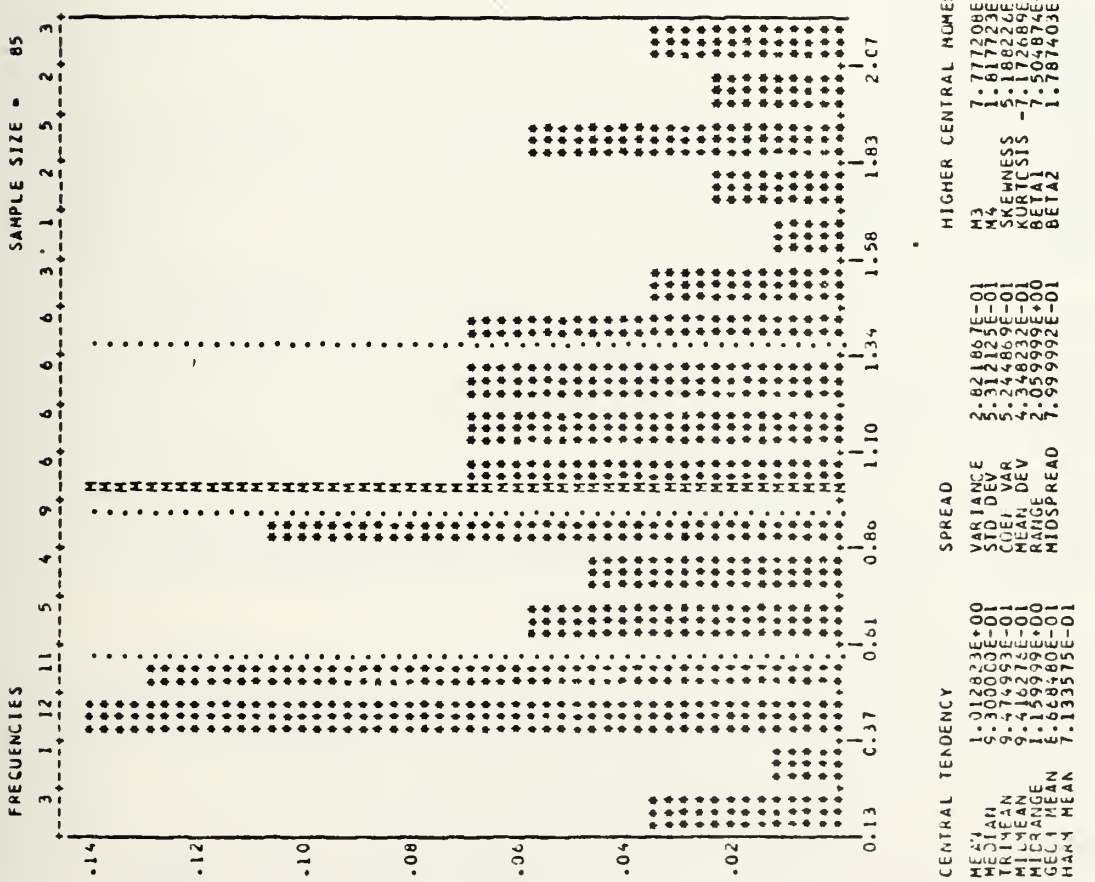
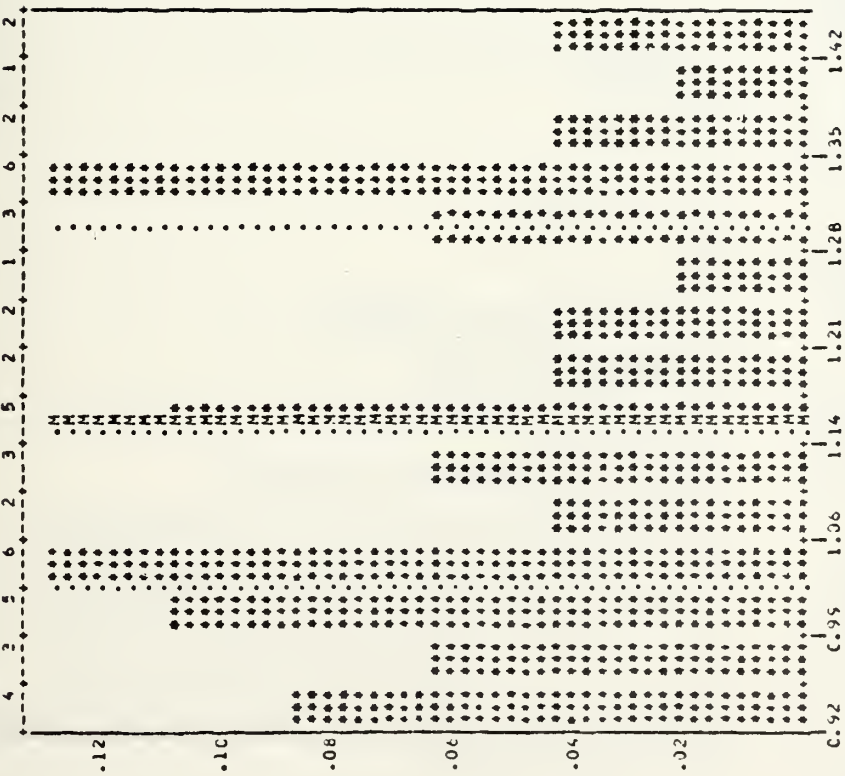


Figure 70. Histogram of the AR in inches in the exactly 3 days lasting storms for October through April in the 36-year period



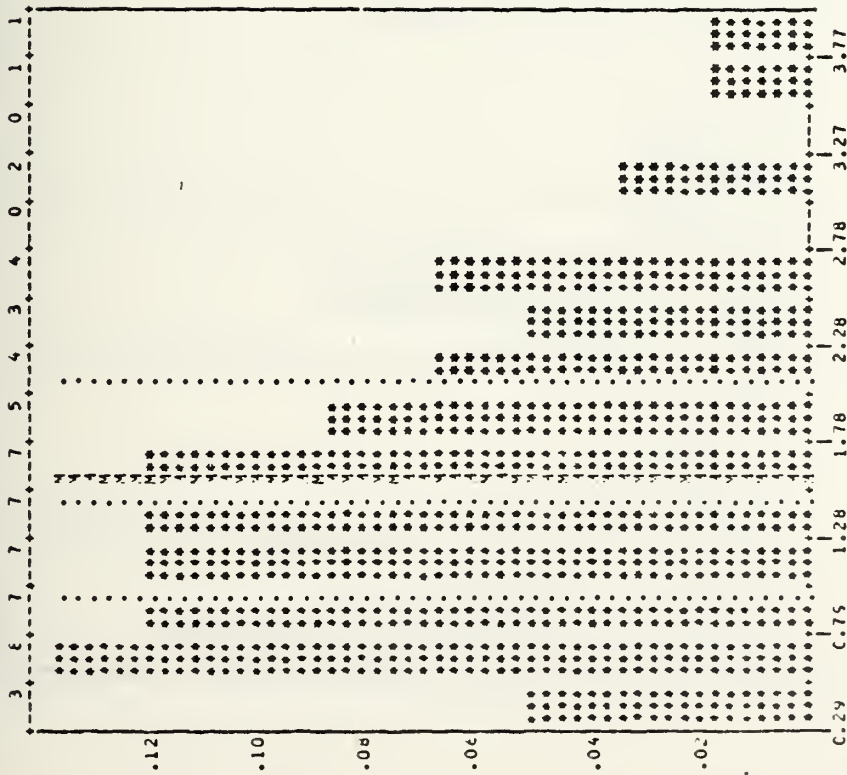




CENTRAL TENDENCY	SPREAD	HIGHER CENTRAL MOMENTS	DISTRIBUTION
MEDIAN	VARIANCE	M2	MINIMUM
TRIMEAN	STD DEV	SKEWNESS	0 QUANTILE
MICMEAN	COEF VAR	KURTOSIS	50 QUANTILE
MICRANGE	MEAN DEV	BETA1	75 QUANTILE
GEOM MEAN	RANGE	BETA2	90 QUANTILE
HARM MEAN	MIDSPREAD		MAXIMUM

Figure 71. Histogram of the AR in inches in the exactly 3 days lasting storms for December through February in the 36-year period

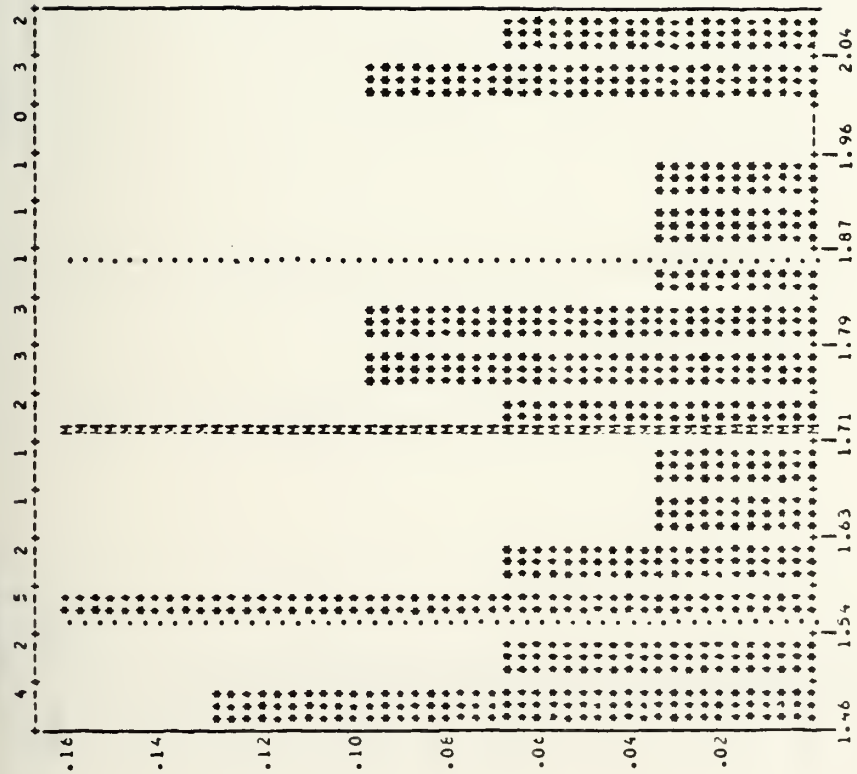




CENTRAL TENDENCY	SPREAD	HIGHER CENTRAL MOMENTS	DISTRIBUTION
MEAN 1.520827E+00	VARIANCE 6.959022E-01	M3 4.774405E-01	MINIMUM 2.900000E-01
MEAN 1.423339E+00	COEFF. OF 8.311072E-01	M4 6.926892E+00	QUANTILE (HINGE) 3.200000E-01
MEAN 1.423339E+00	MEAN DEV 2.619487E-01	M5 2.526200E-01	.50 QUANTILE (MEAN) 3.250000E+00
MEAN RANGE 1.150000E+00	RANGE 3.973000E+00	BETA1 2.542381E-01	.75 QUANTILE (HINGE) 3.015656E+00
MEAN 1.354231E+00	MIDSPREAD 1.1159998E+00	BETA2 1.548761E+00	.90 QUANTILE 2.559335E+00
MEAN 1.141141E+00			MAXIMUM 4.020000E+00

Figure 72. Histogram of AR in inches in the exactly 4 days lasting storms for October through April in the 36-year period





CENTRAL TENDENCY	SPREAD	HIGHER CENTRAL MOMENTS	DISTRIBUTION
MEAN 1.721612E+00	VARIANCE 3.656044E-02	M3 2.759031E-03	MINIMUM 1.459999E+00
STDEV 1.77399E+00	COEFF. VAR 1.112095E+01	M4 2.652312E-03	Q1 1.580000E+00
TRIMEAN 1.718374E+00	COEFF. SKW 1.439503E+01	M5 1.582311E+00	Q2 1.742997E+00
TRIMEAN 1.770000E+00	COEFF. KURT 6.200008E+01	M6 2.498718E-03	Q3 1.819997E+00
GEL1 MEAN 1.711172E+00	RANGE 4.319999E-01	BETA1 2.357678E-03	MAXIMUM 2.000000E+00
HARM MEAN 1.701172E+00	MIDSPREAD 3.199999E-01		

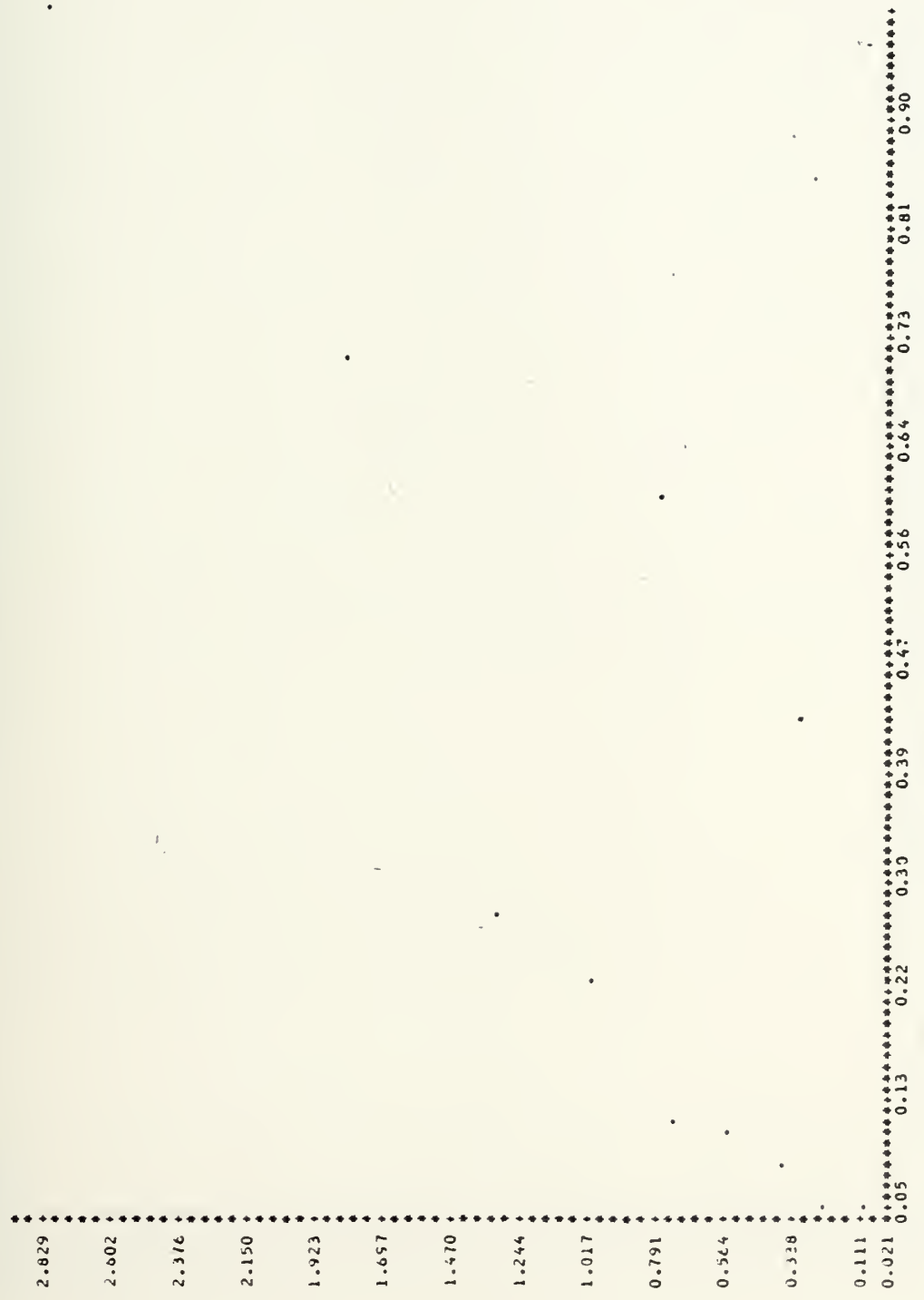
Figure 73. Histogram of AR in inches in the exactly 4 days lasting storms for December through February in the 36-year period



APPENDIX F. PLOT OF EXPONENTIAL SCORES VERSUS OBSERVED SCORES FOR WEEKLY DATA

NUMBER OF ORDERED PAIRS = 9

EXPON. SCORES



X-SCALE : \*\* = 0.845E-02 UNITS

Y-SCALE : \*\* = 0.453E-01 UNITS

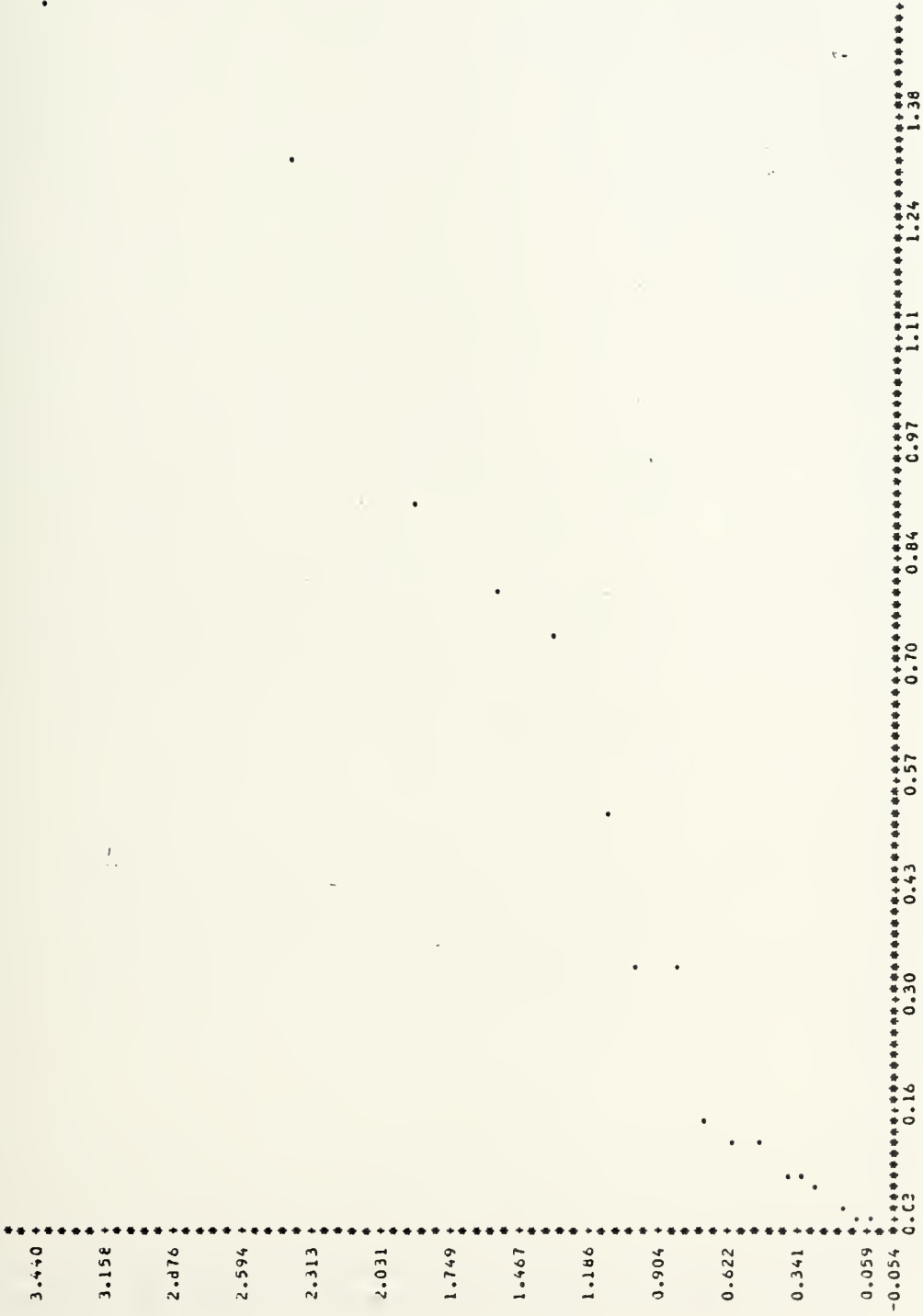
ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.571202E+00 GAMMA2 = 4.344403E-01

Figure 74. Exponential scores versus observed scores for week 01





EXPON. SCORES



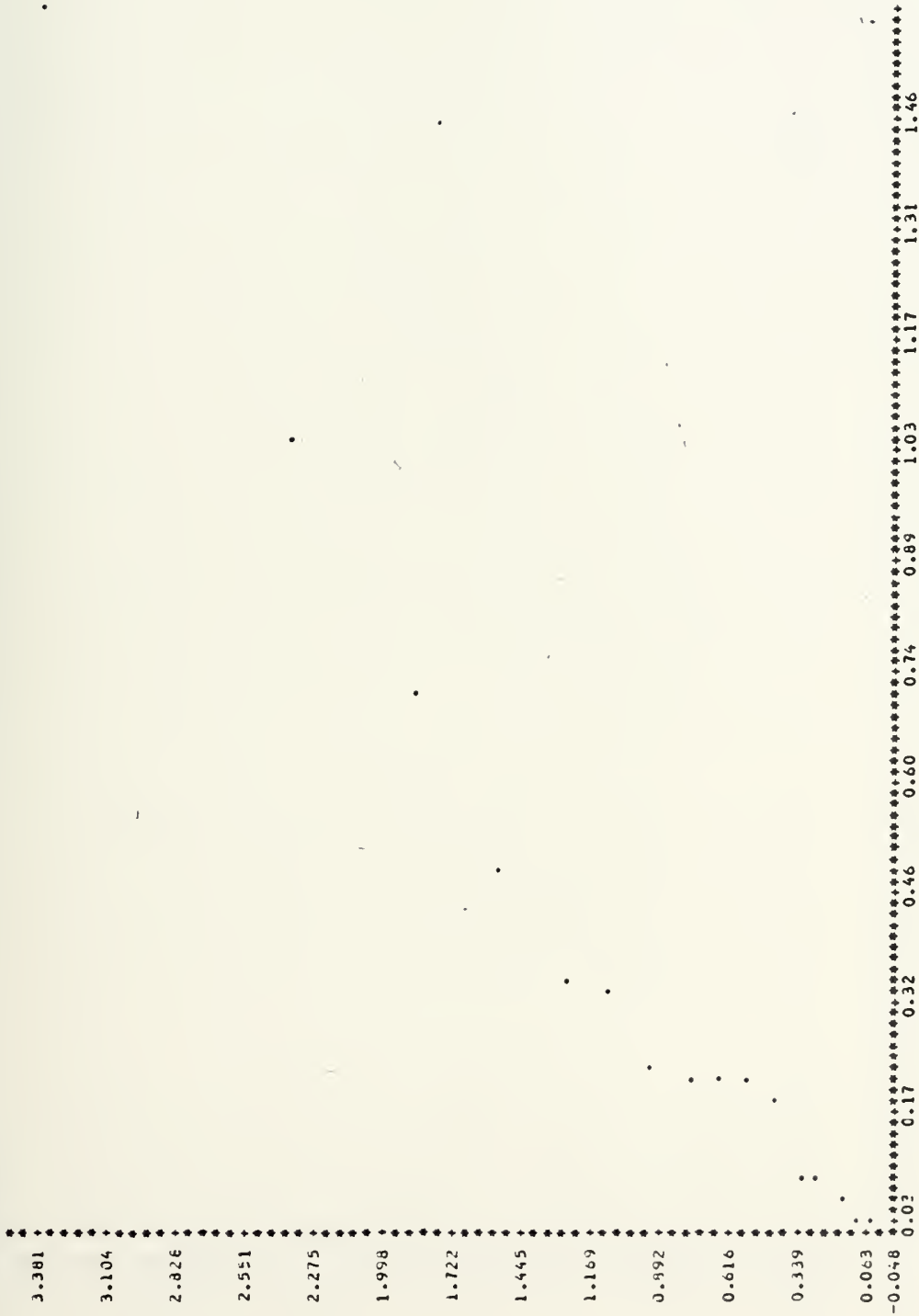
X-SCALE : \*\* = 0.135E-01 UNITS  
 Y-SCALE : \*\* = 0.563E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.231586E+00 GAMMA2 = 1.014958E-01

Figure 75. Exponential scores versus observed scores for week 02



EXPON. SCORES



X-SCALE : \*\* = 0.143E-01 UNITS

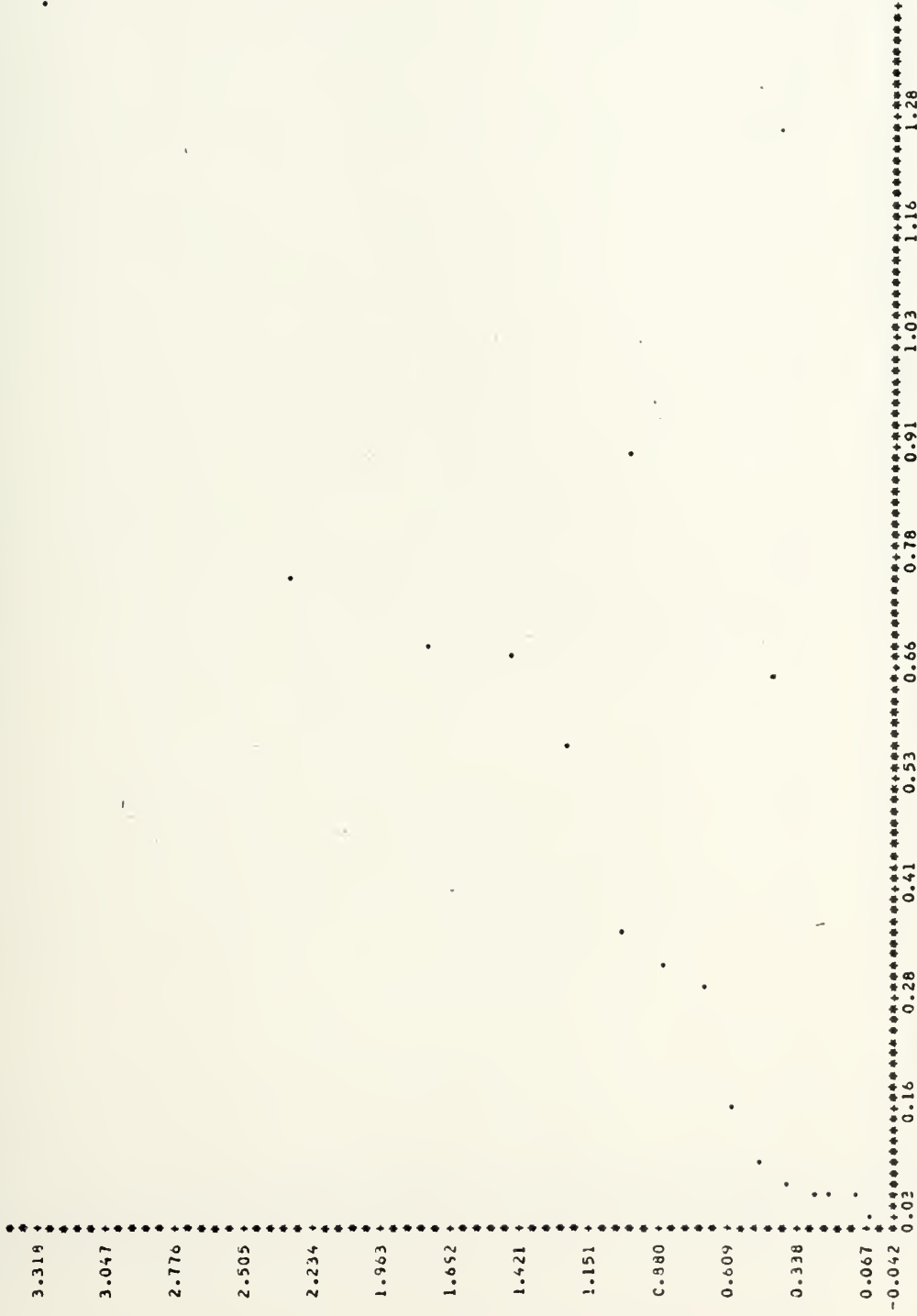
Y-SCALE : \*\* = 0.555E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 2.050803E+00 GAMMA2 = 3.163898E+00

Figure 76. Exponential scores versus observed scores for week 03



EXPON. SCORES



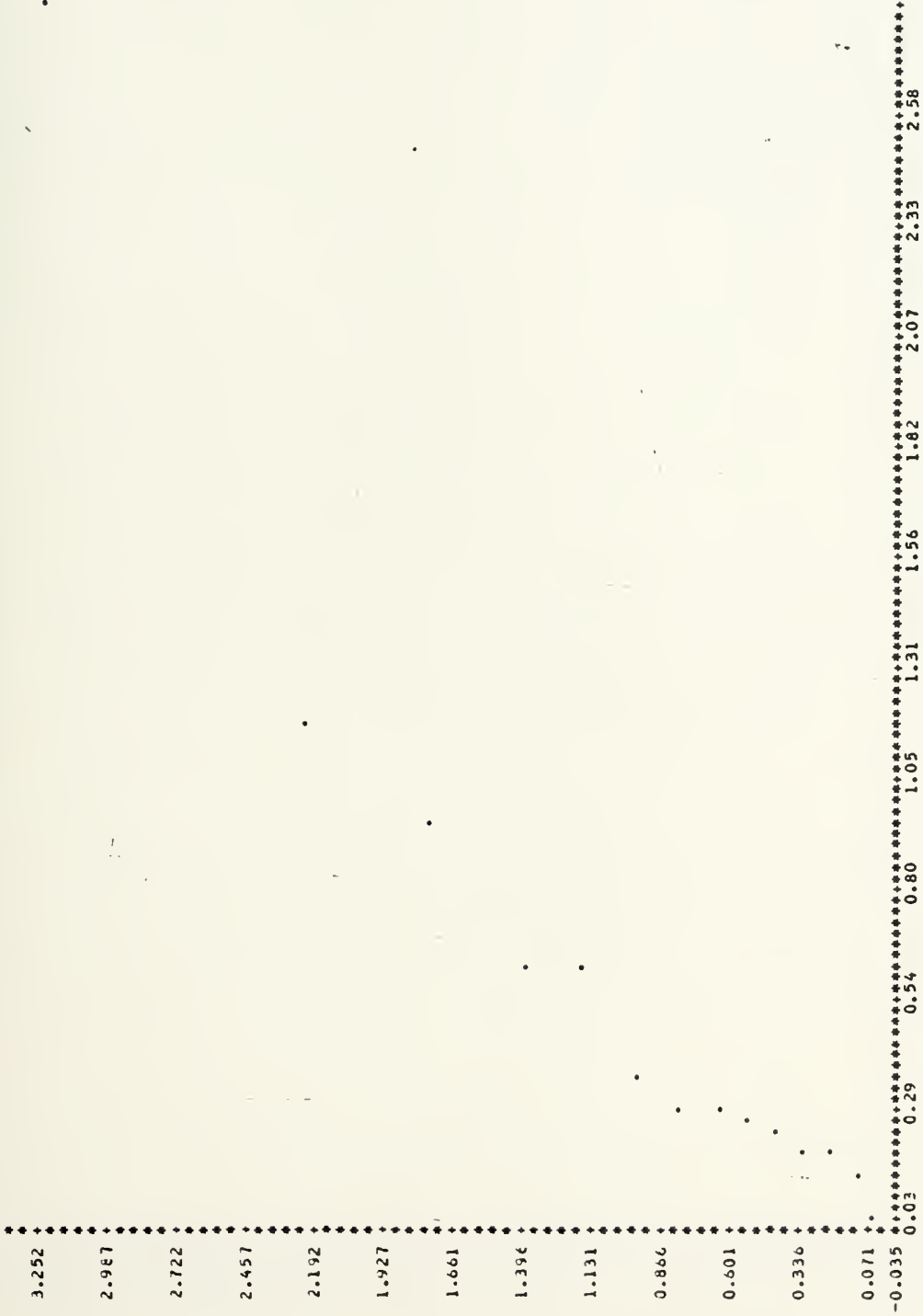
X-SCALE : \*\* = 0.125E-01 UNITS  
 Y-SCALE : \*\* = 0.542E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.498537E+00 GAMMA2 = 1.652067E+00

Figure 77. Exponential scores versus observed scores for week 04



EXPON. SCORES



X-SCALE : \*\*\* = 0.255E-01 UNITS  
 Y-SCALE : \*\*\* = 0.530E-01 UNITS

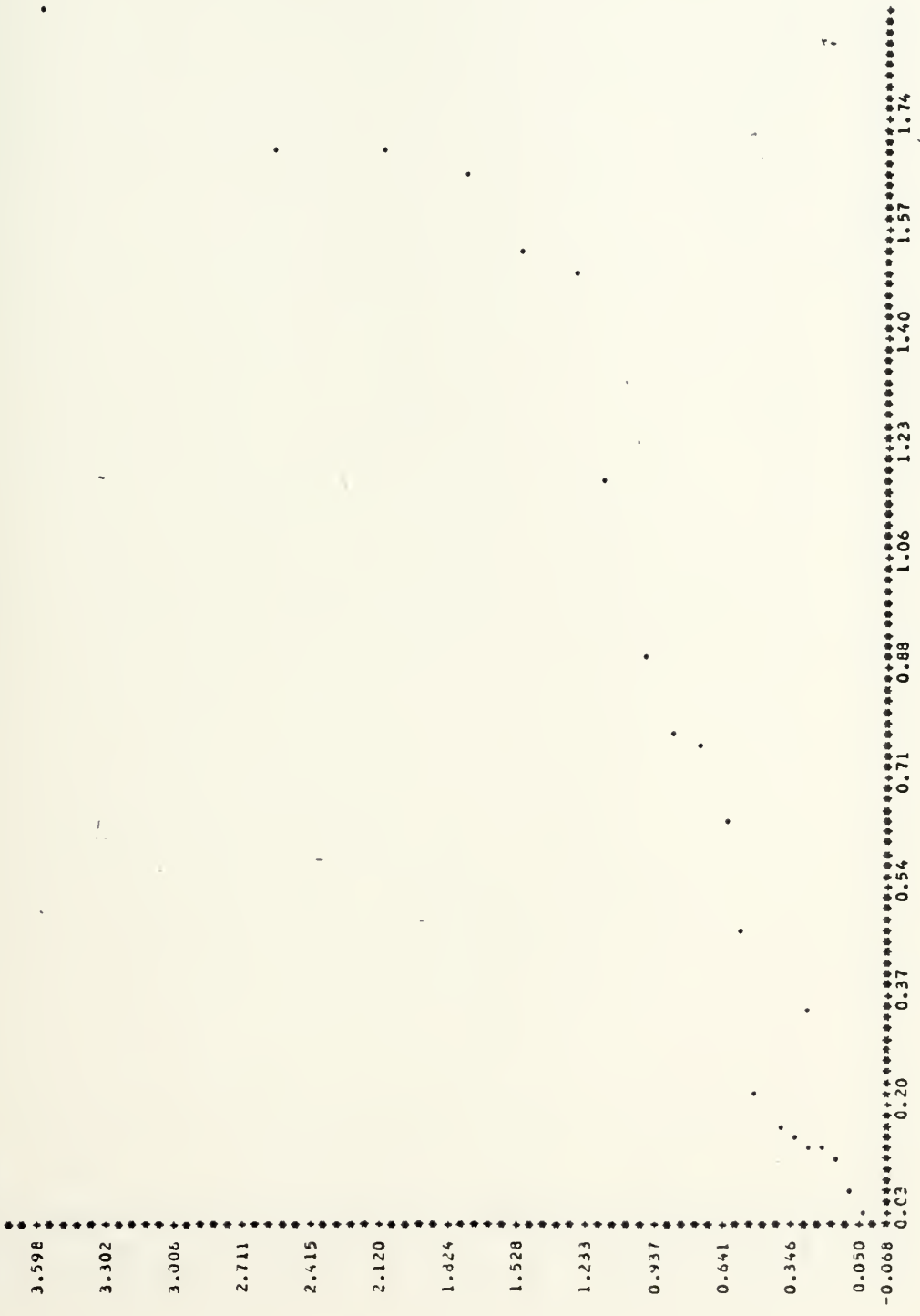
ESTIMATED PARAMETERS OF DATA : GAMMA1 = 2.615961E+00 GAMMA2 = 5.815357E+00

Figure 78. Exponential scores versus observed scores for week ON





EXPON. SCORES



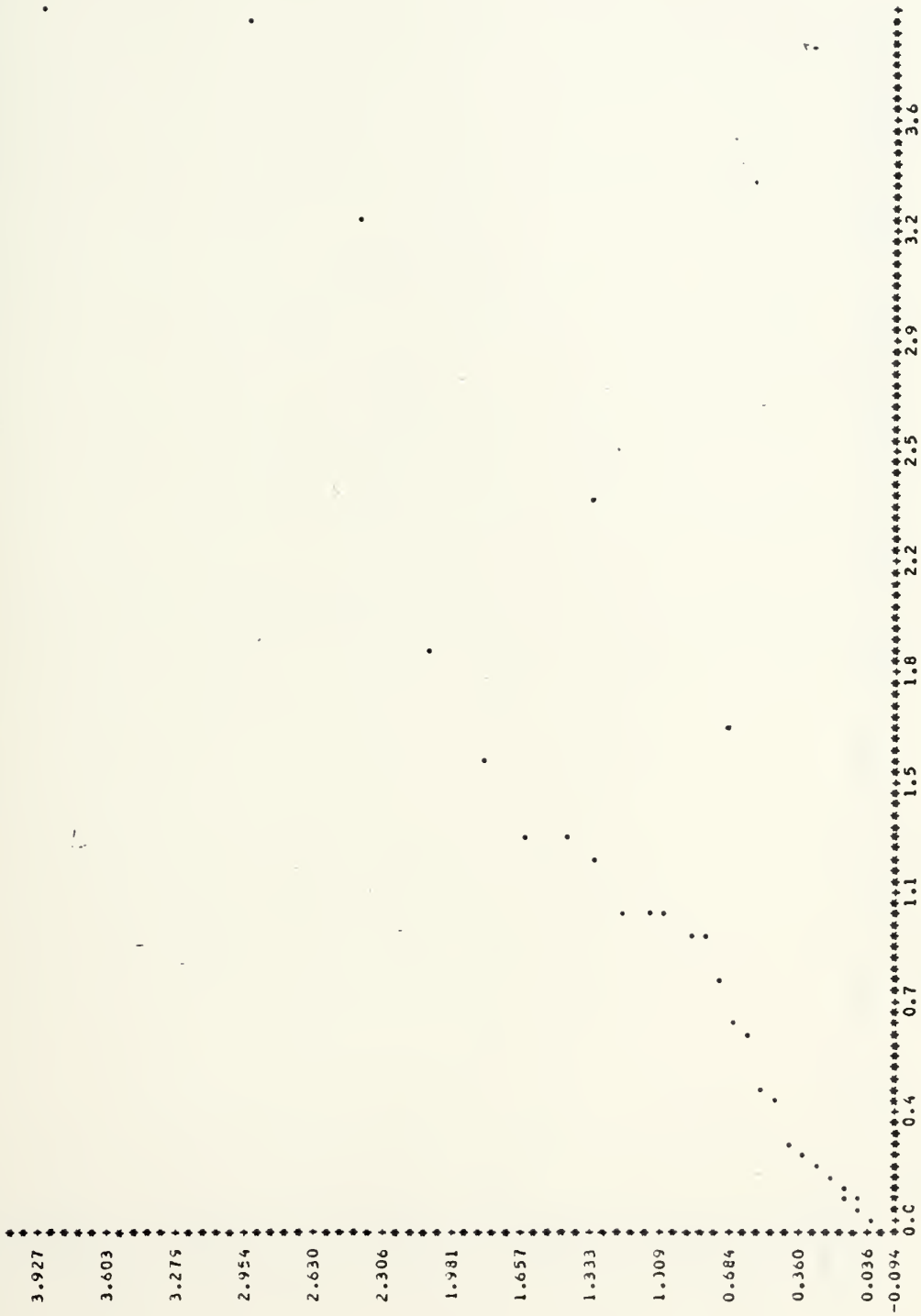
X-SCALE : \*\* = 0.171E-01 UNITS  
 Y-SCALE : \*\* = 0.591E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 3.900155E-01 GAMMA2 = -1.575627E+00

Figure 79. Exponential scores versus observed scores for week N1



EXPON. SCORES



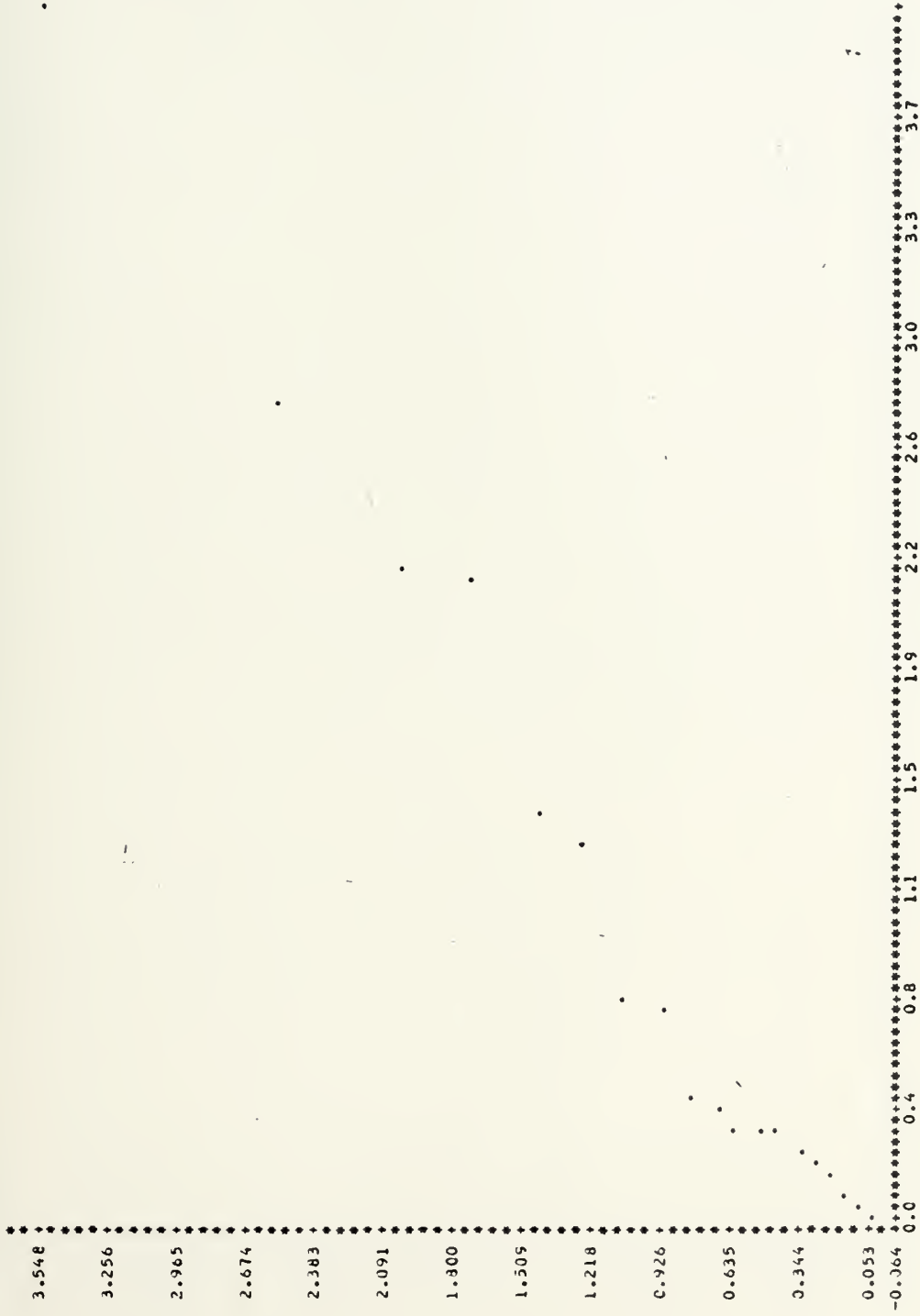
X-SCALE : \*\* = 0.356E-01 UNITS  
 Y-SCALE : \*\* = 0.649E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.781254E+00 GAMMA2 = 2.257390E+00

Figure 80. Exponential scores versus observed scores for week N2



EXPON. SCORES



X-SCALE : \*\* = 0.365E-01 UNITS

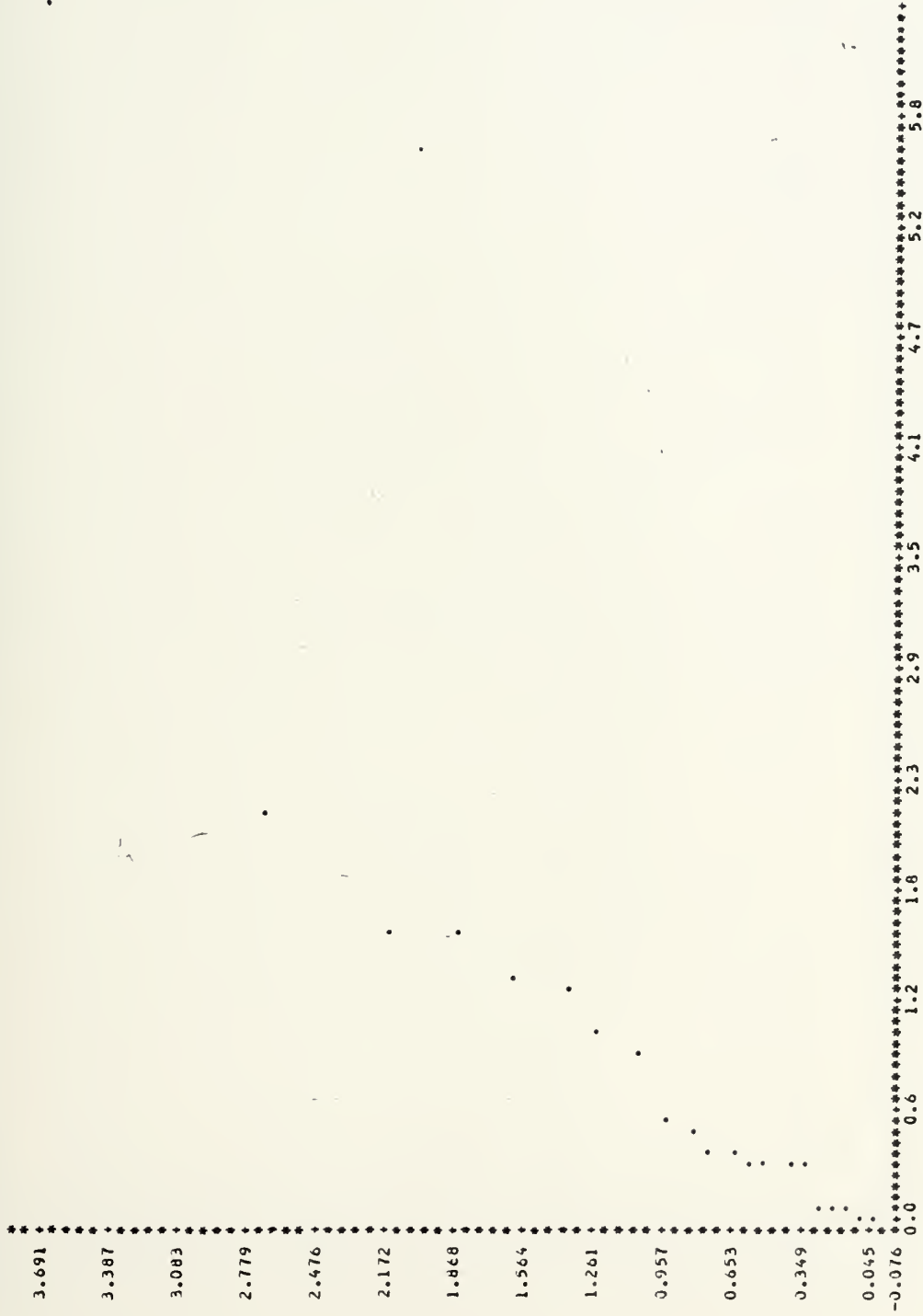
Y-SCALE : \*\* = 0.593E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.636559E+00 GAMMA2 = 1.644663E+00

Figure 81. Exponential scores versus observed scores for week N3



EXPON. SCORES



X-SCALE : \*\* = 0.580E-01 UNITS  
 Y-SCALE : \*\* = 0.608E-01 UNITS

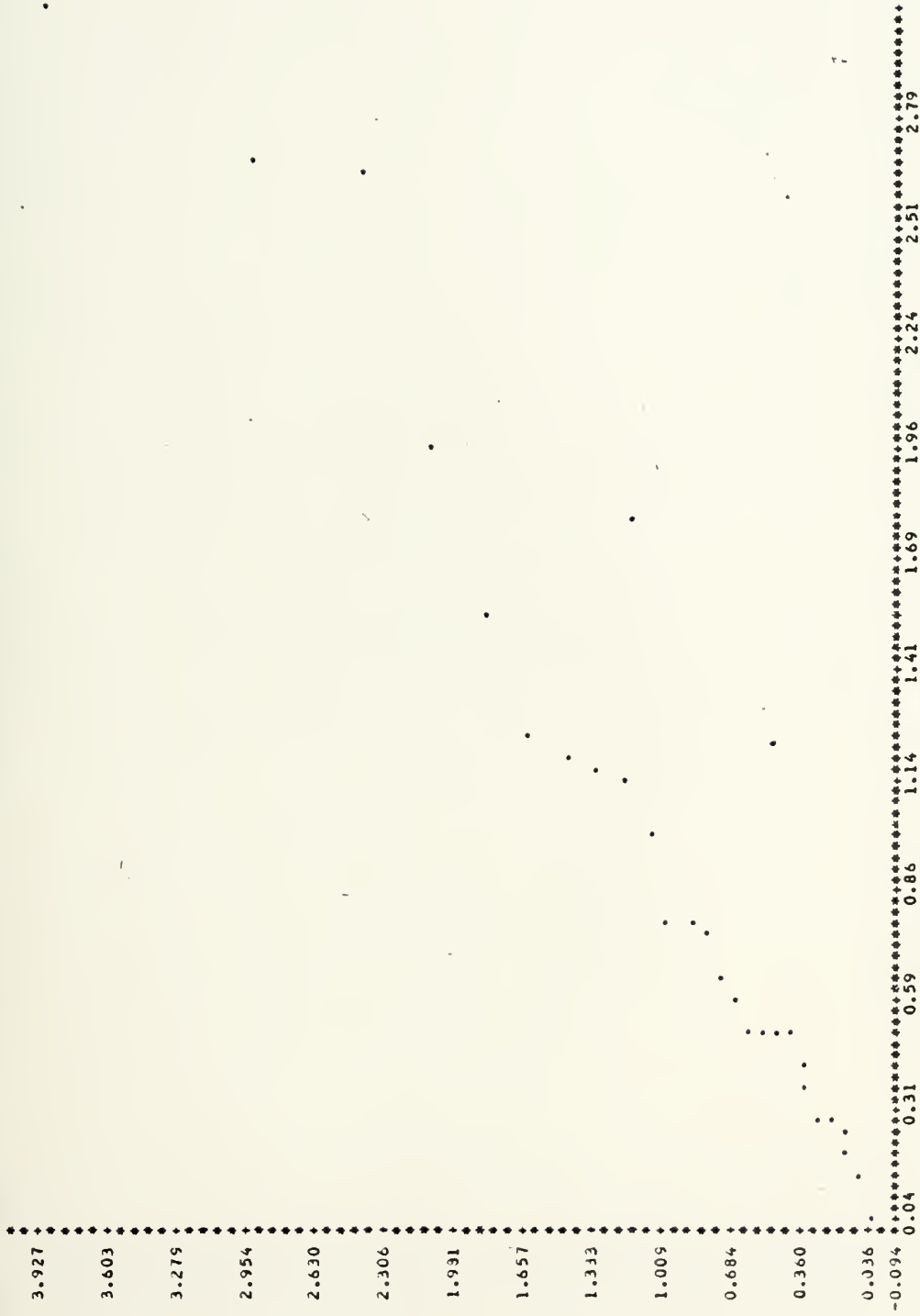
ESTIMATED PARAMETERS OF DATA : GAMMA1 = 3.385616E+00 GAMMA2 = 1.139031E+01

Figure 82. Exponential scores versus observed scores for week N4





EXPON. SCORES



X-SCALE : \*\* = 0.275E-01 UNITS

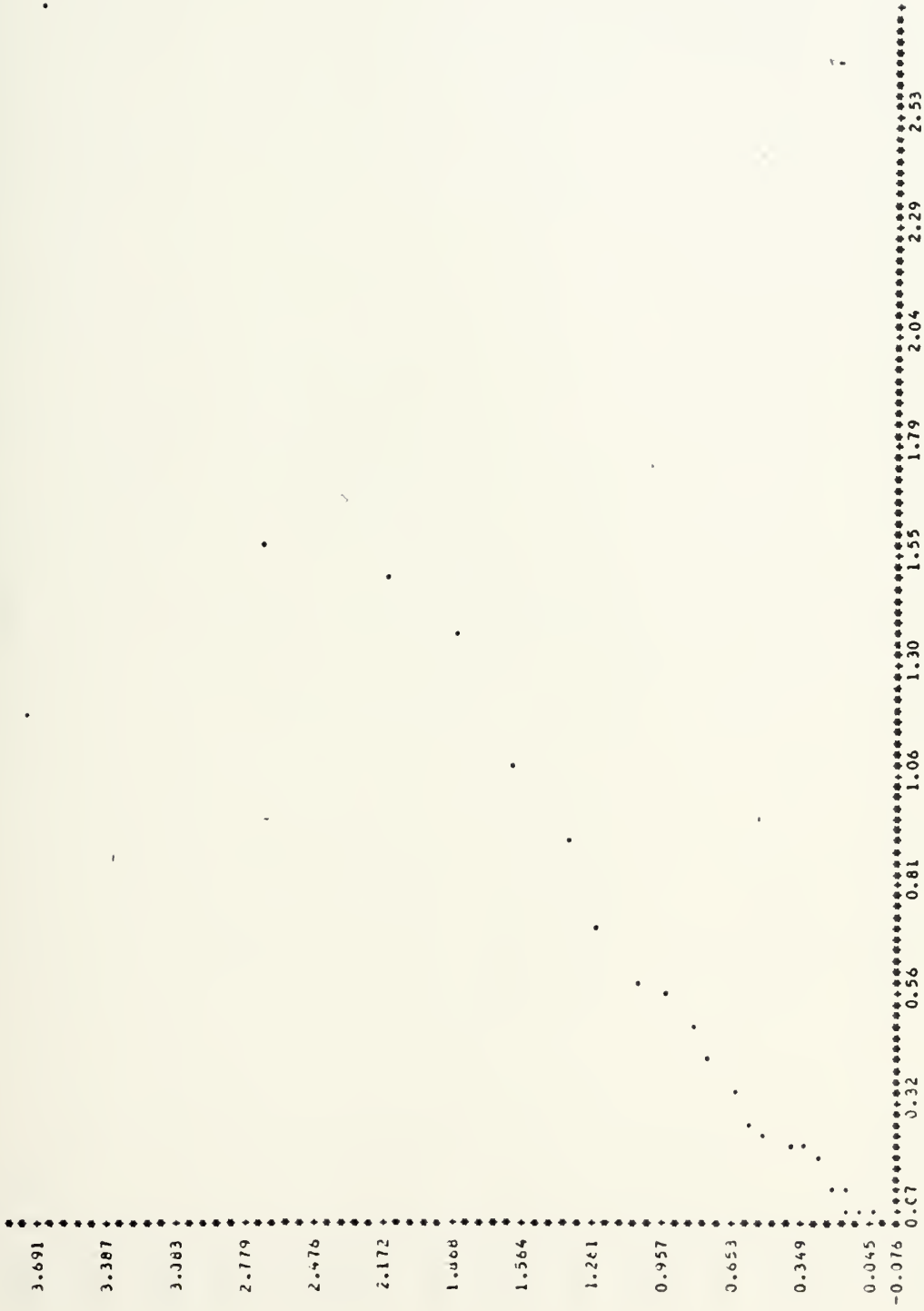
Y-SCALE : \*\* = 0.649E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.448464E+00 GAMMA2 = 1.076383E+00

Figure 83. Exponential scores versus observed scores for week D1



EXPON. SCORES



X-SCALE : \*\* = 0.246E-01 UNITS  
 Y-SCALE : \*\* = 0.608E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.834657E+00 GAMMA2 = 3.027522E+00

Figure 84. Exponential scores versus observed scores for week D2



EXPON. SCORES

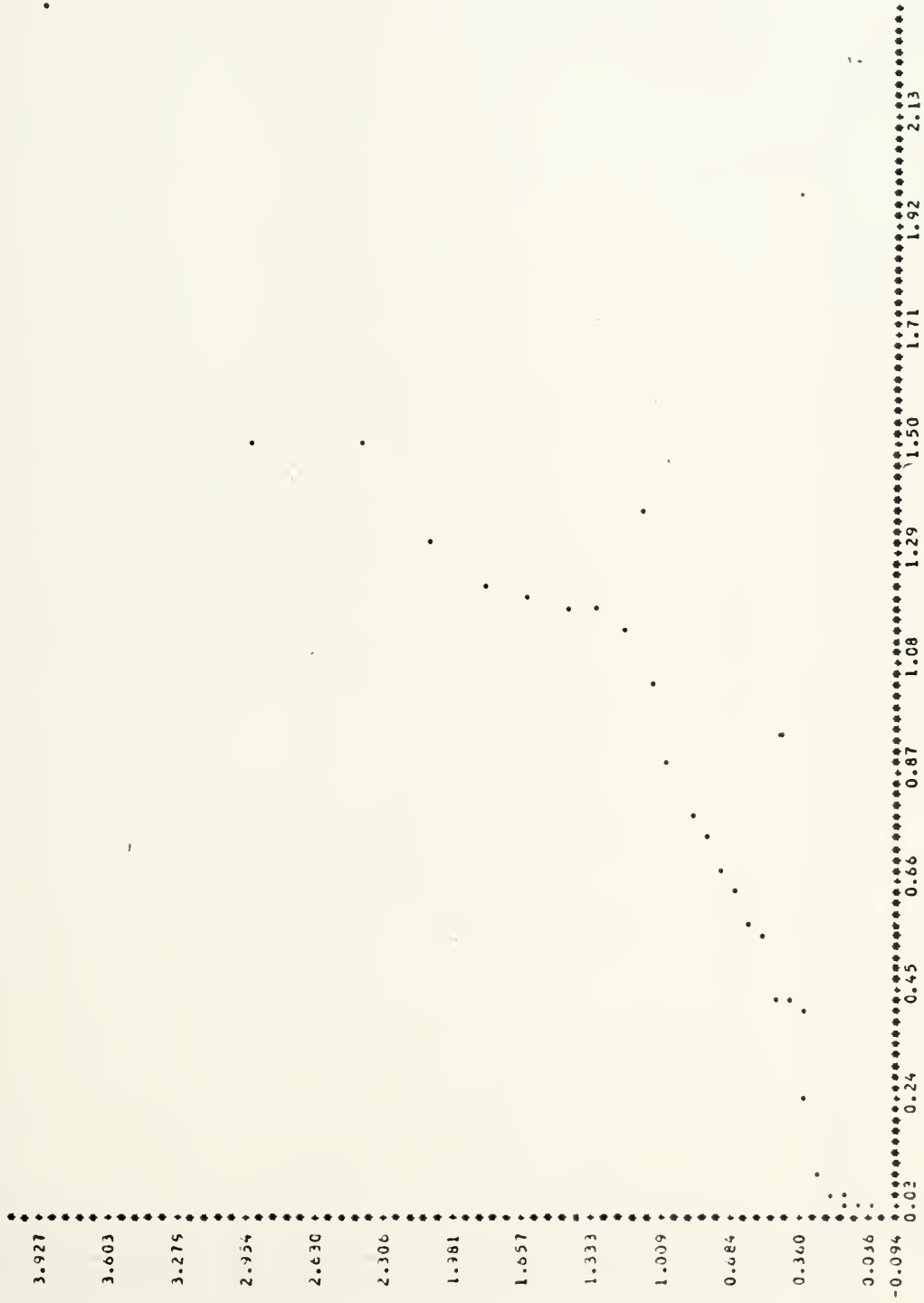
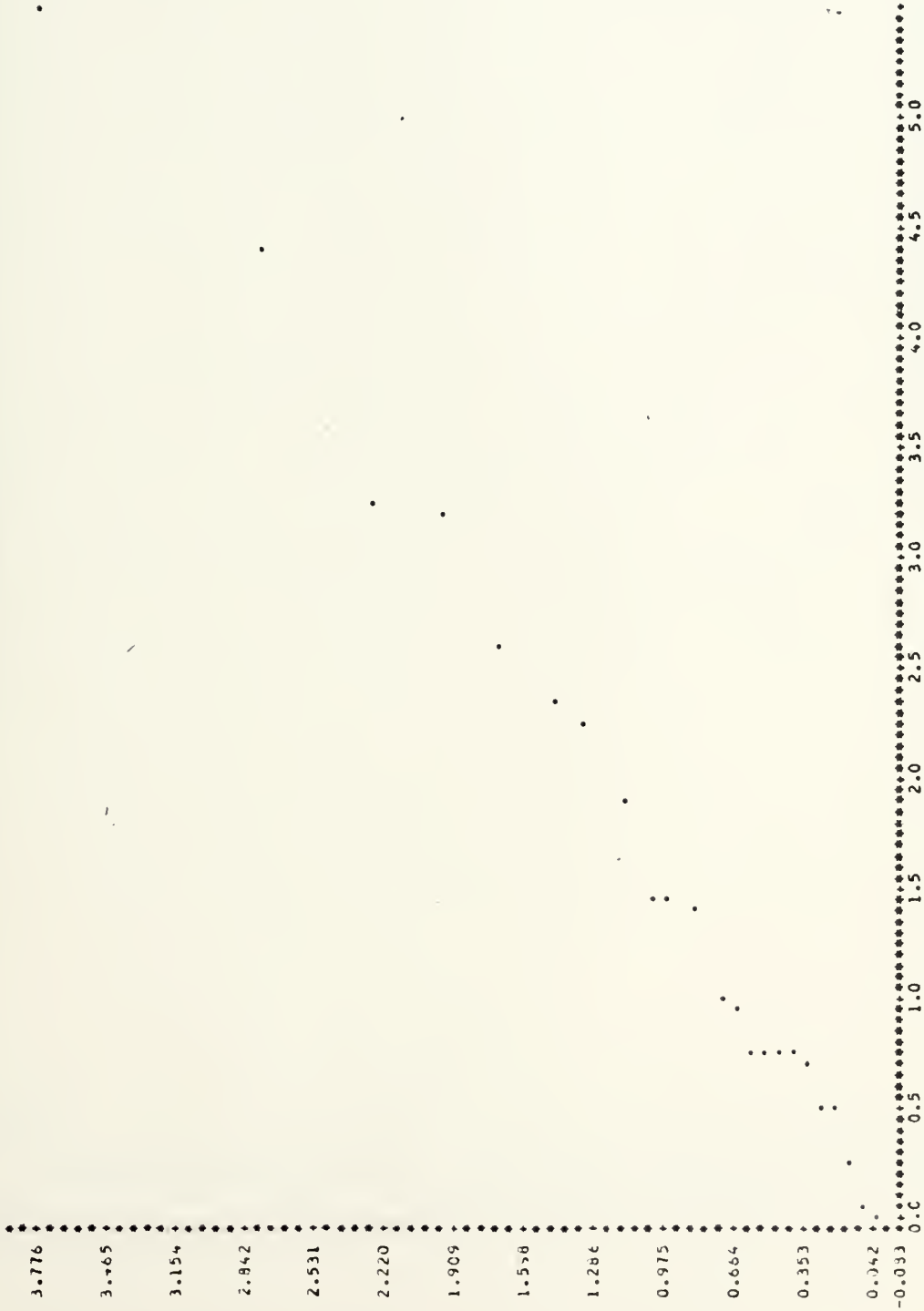


Figure 85. Exponential scores versus observed scores for week D3

X-SCALE : \* \* \* = 0.210E-01 UNITS  
 Y-SCALE : \* \* \* = 0.649E-01 UNITS  
 ESTIMATED PARAMETERS OF DATA : GAMMA1 = 6.964080E-01 GAMMA2 = 1.701009E-01



EXPON. SCORES



X-SCALE : \*\* = 0.498E-01 UNITS  
 Y-SCALE : \*\* = 0.622E-01 UNITS

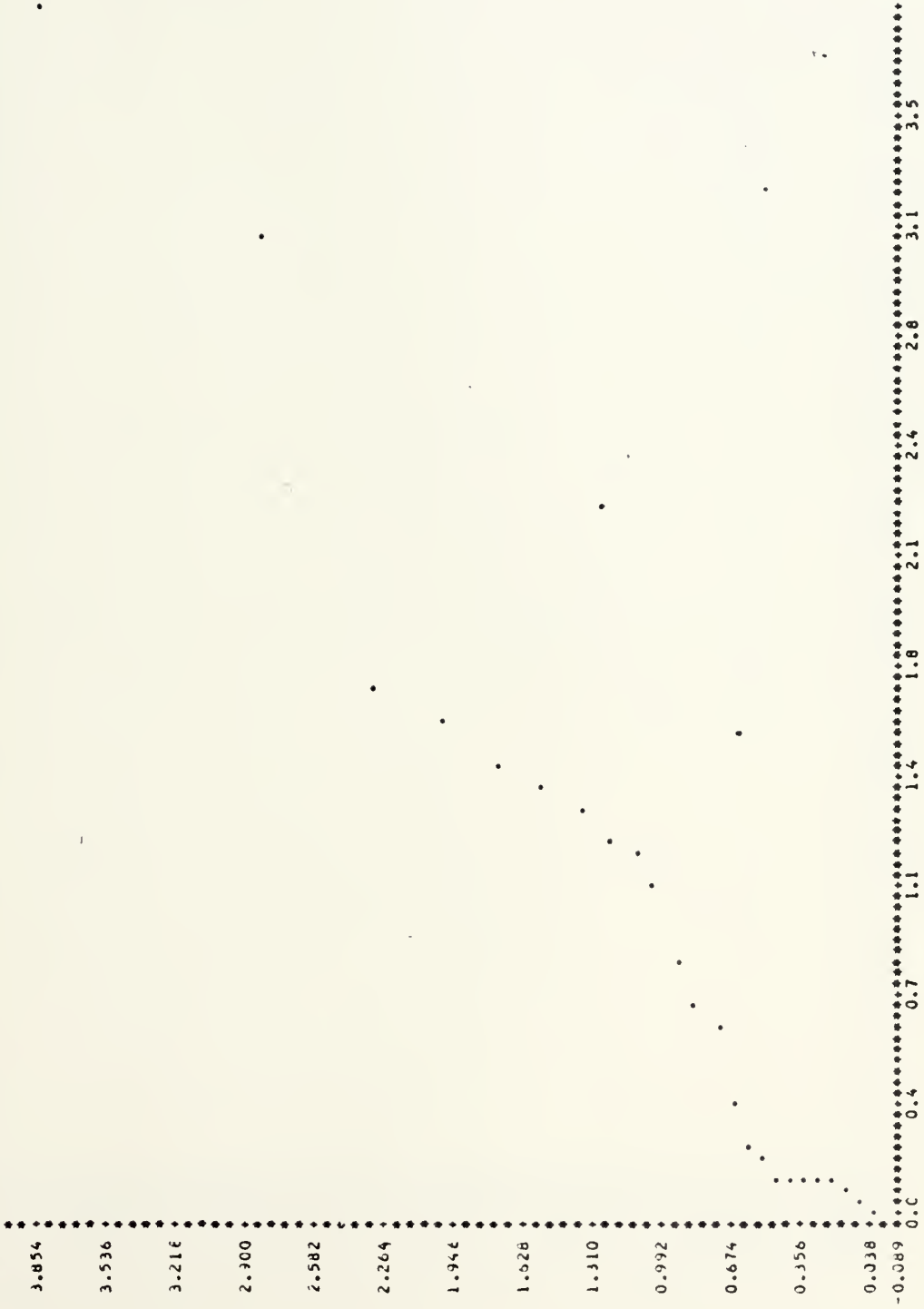
Figure 86. Exponential scores versus observed scores for week D4

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.339972E+00 GAMMA2 = 1.098867E+00





EXPON. SCORES



X-SCALE : \*\* = 0.345E-01 UNITS

Y-SCALE : \*\* = 0.636E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.733326E+00 GAMMA2 = 2.656740E+00

Figure 87. Exponential scores versus observed scores for week J1



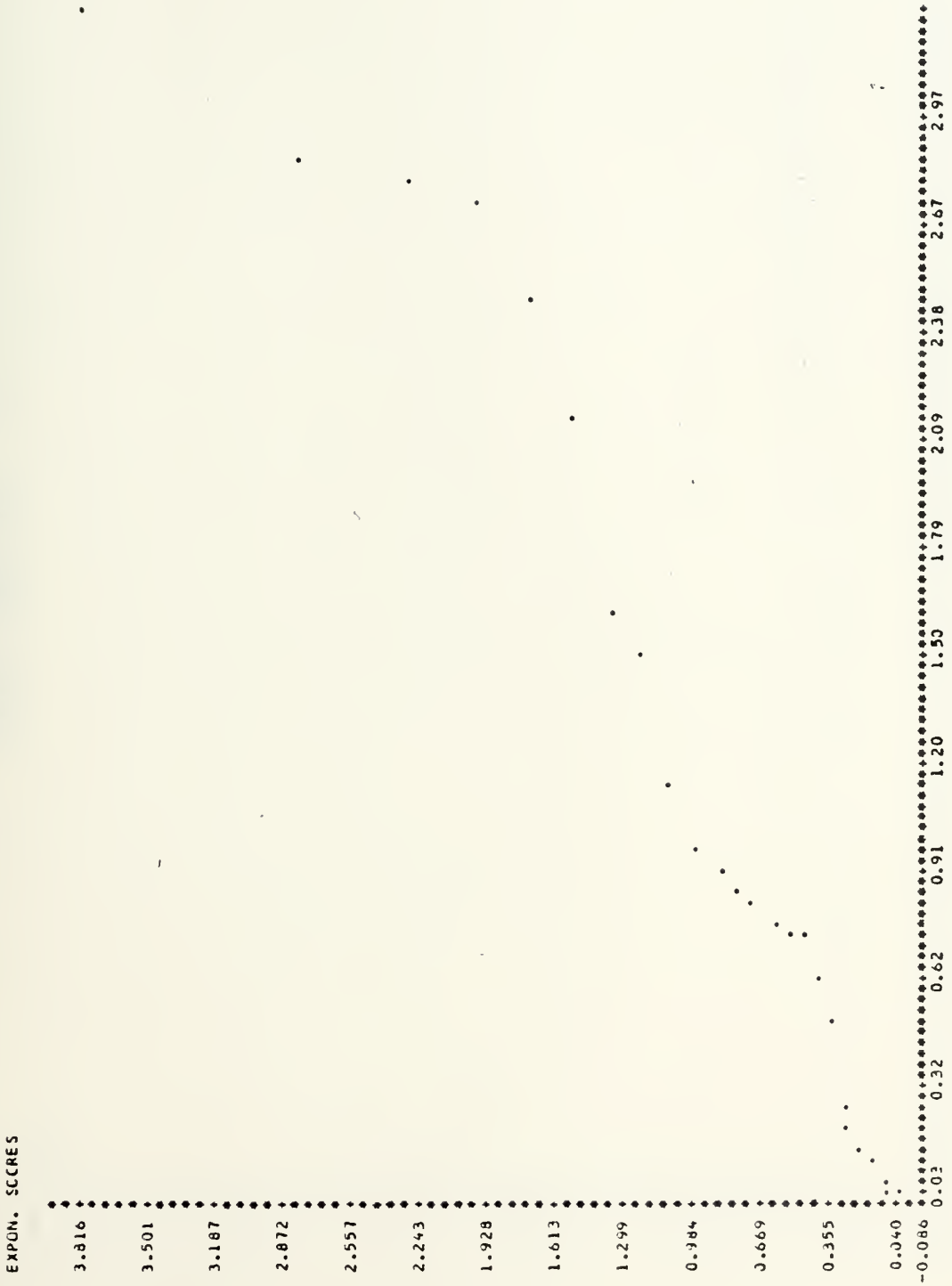


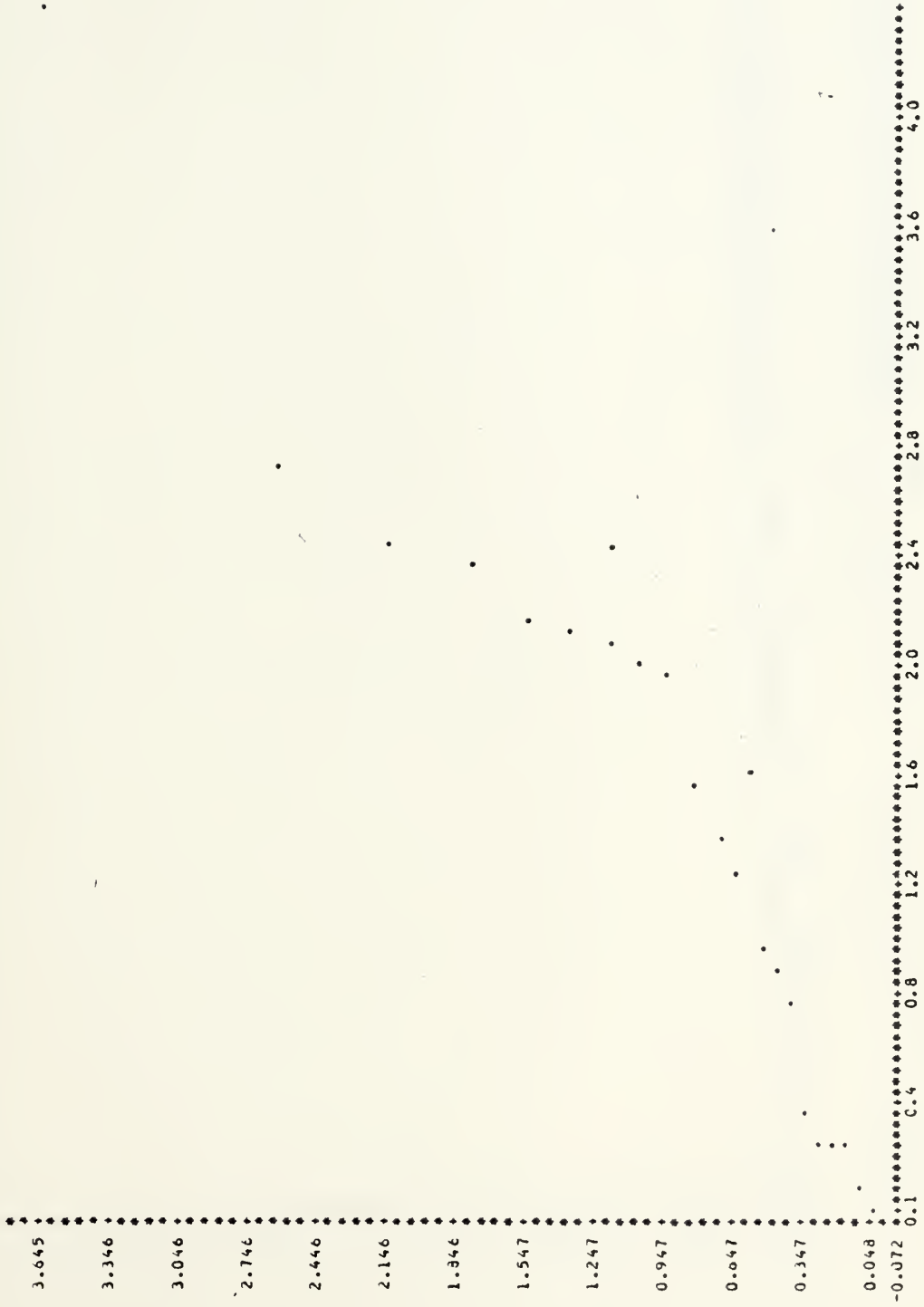
Figure 88. Exponential scores versus observed scores for week J2

X-SCALE : \*\* = 0.294E-01 UNITS  
 Y-SCALE : \*\* = 0.629E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 8.340170E-01 GAMMA2 = -7.332502E-01



EXPON. SCORES



X-SCALE : \*\* = 0.389E-01 UNITS  
 Y-SCALE : \*\* = 0.600E-01 UNITS

ESTIMATED PARAMETERS OF DATA :

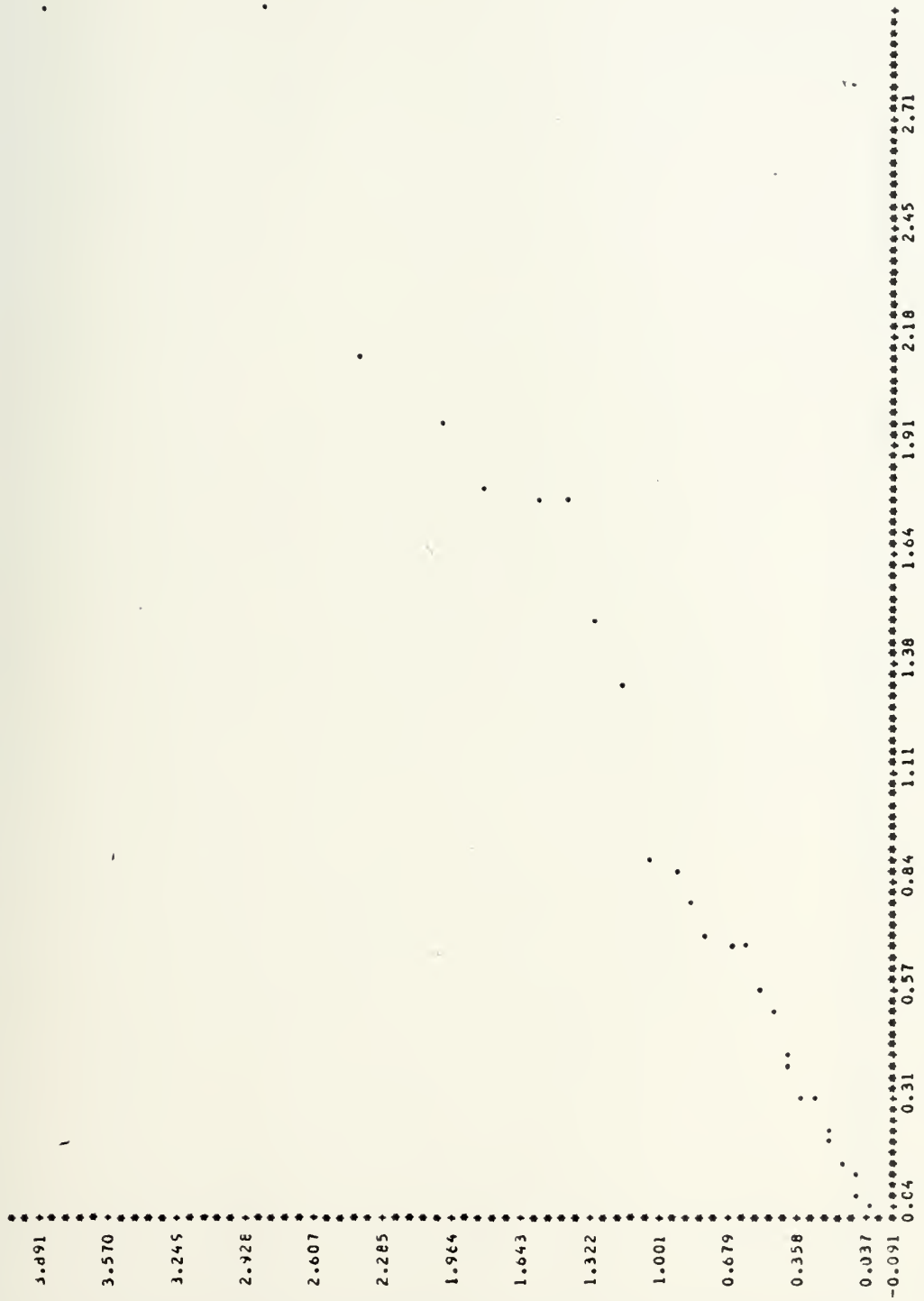
GAMMA1 = 7.564707E-01

GAMMA2 = 4.405704E-01

Figure 89. Exponential scores versus observed scores for week J3



EXPON. SCORES



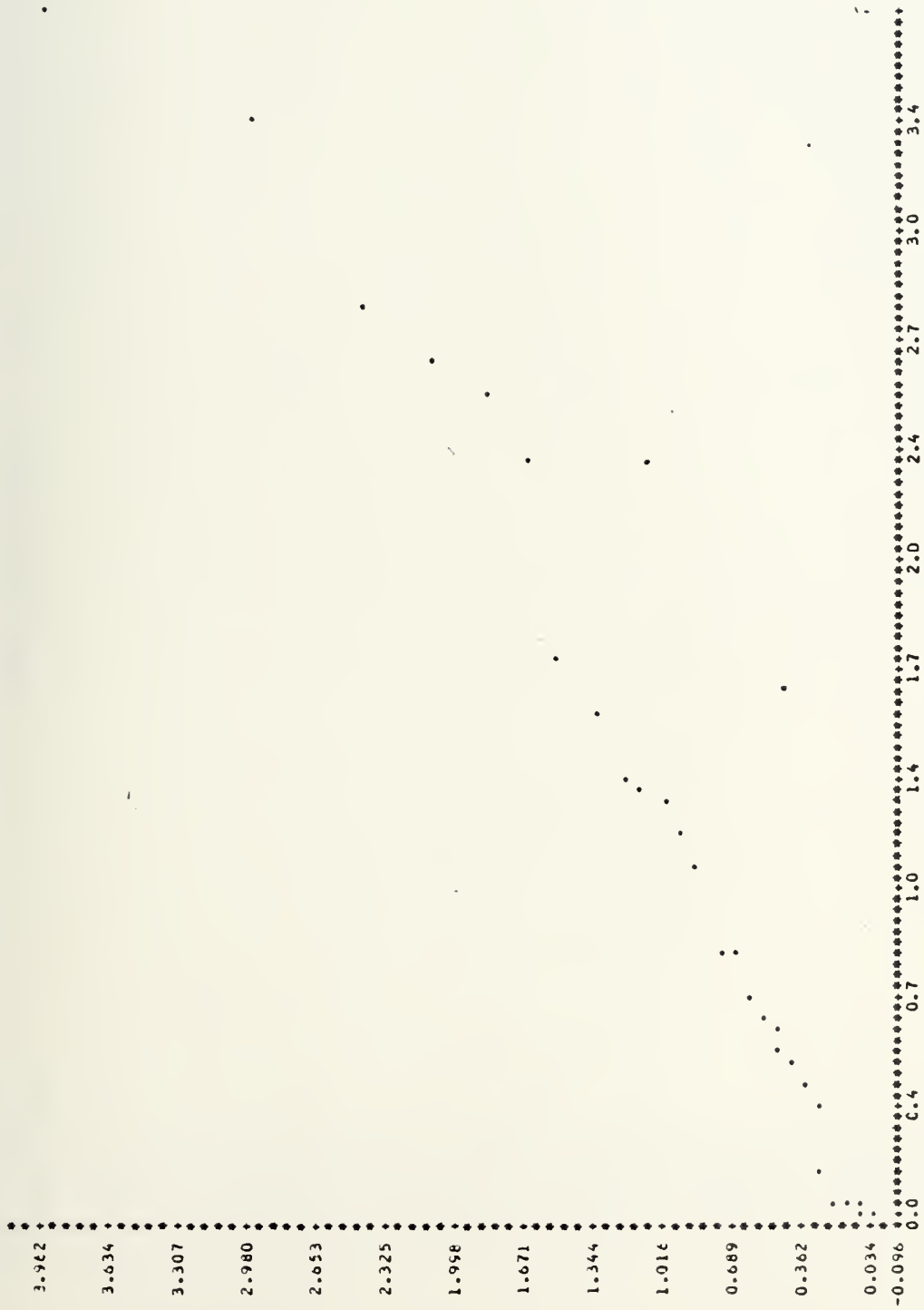
X-SCALE : 'x' = 0.267E-01 UNITS  
 Y-SCALE : 'y' = 0.642E-01 UNITS  
 ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.038048E+00 GAMMA2 = -9.423792E-03

Figure 90. Exponential scores versus Observed scores for week J4





EXPON. SCORES



X-SCALE : '\*' = 0.3335E-01 UNITS  
 Y-SCALE : '\*' = 0.6555E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.001960E+00 GAMMA2 = -1.076772E-01

Figure 91. Exponential scores versus observed scores for week JF



EXPON. SCORES

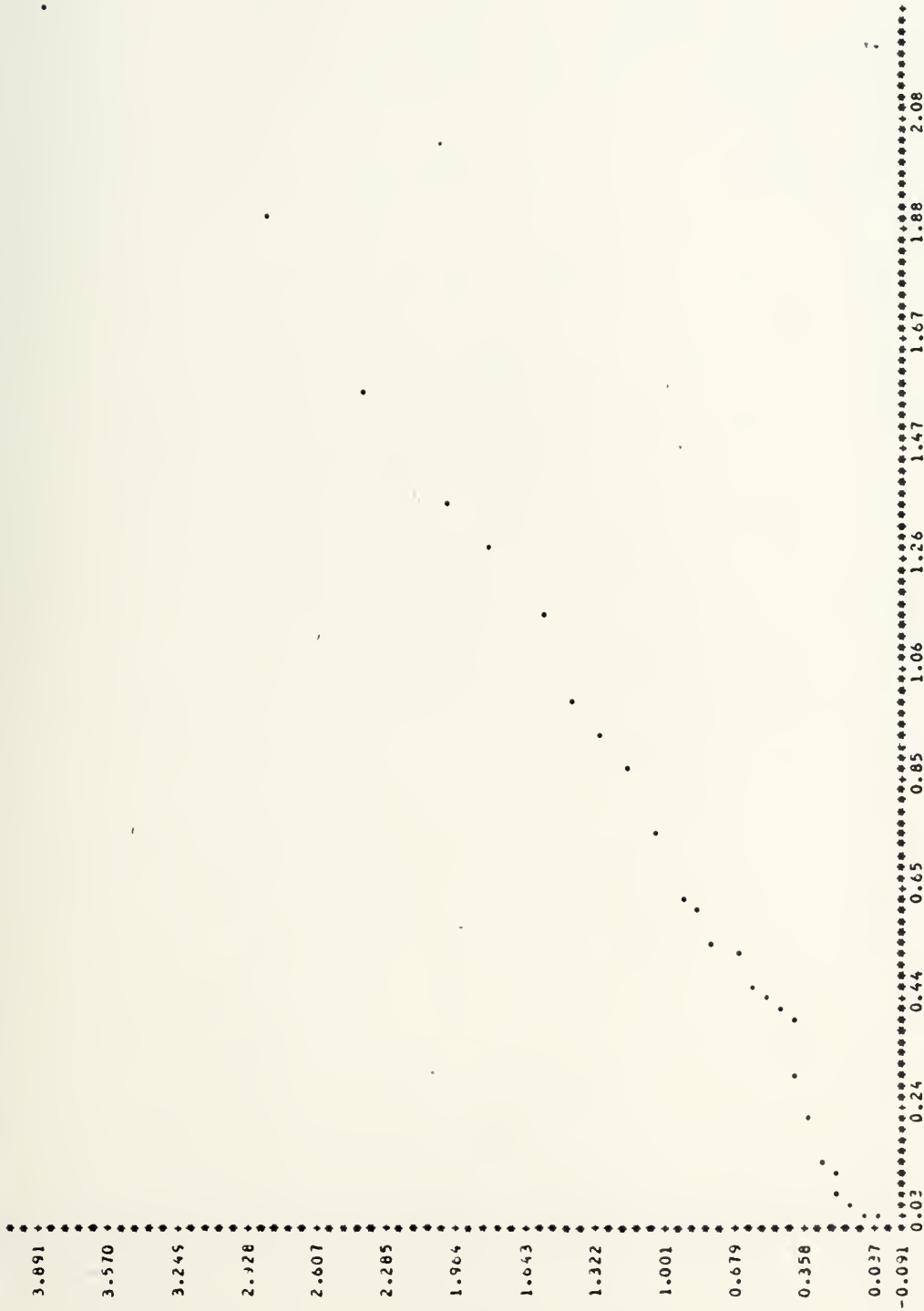


X-SCALE : \*\* = 0.335E-01 UNITS  
 Y-SCALE : \*\* = 0.642E-01 UNITS  
 ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.449948E+00 GAMMA2 = 1.238160E+00

Figure 92. Exponential scores versus observed scores for week F1



EXPON. SCORES



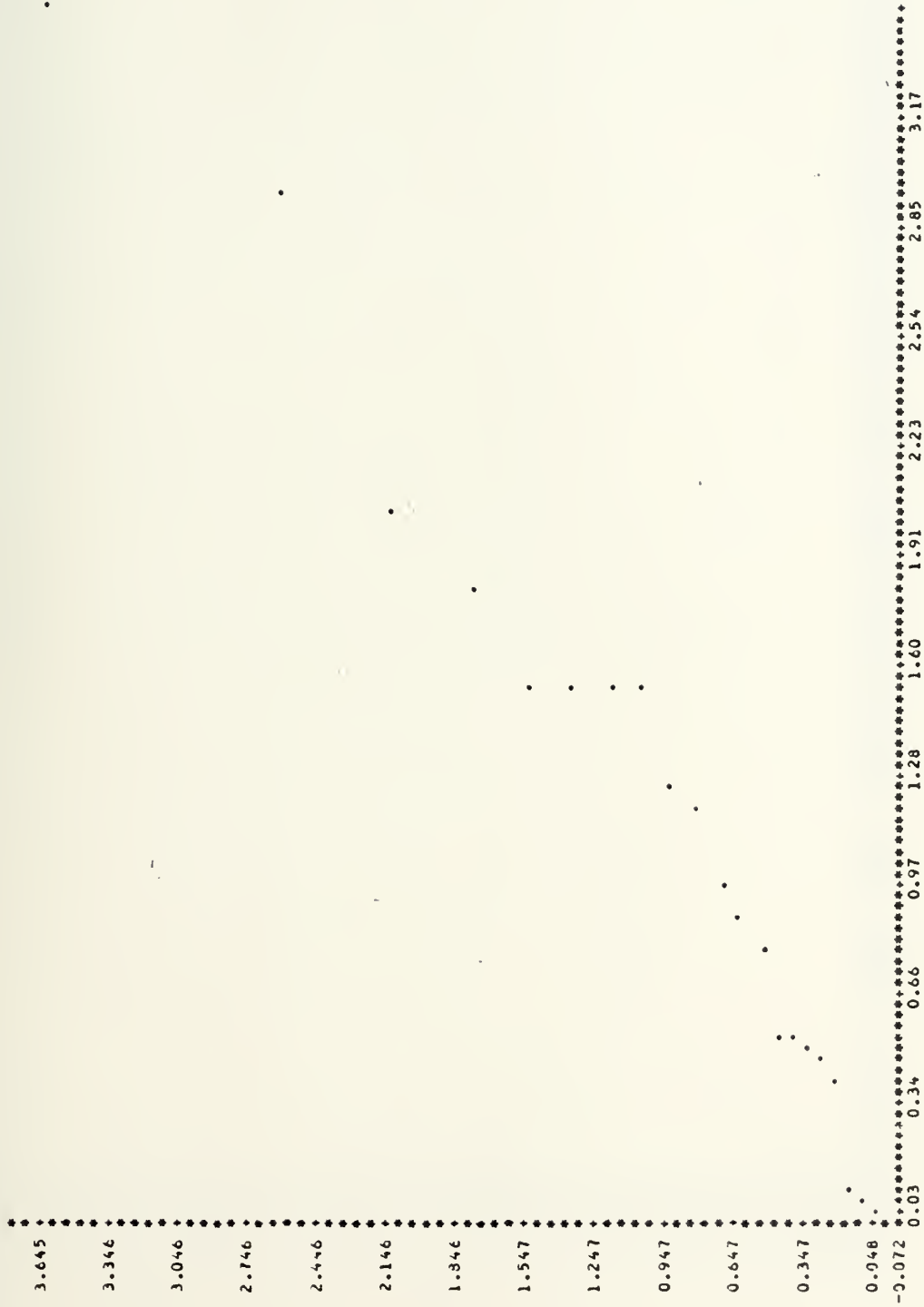
X-SCALE : \* \* = 0.205E-01 UNITS  
 Y-SCALE : \* \* = 0.642E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.098998E+00 GAMMA2 = 4.708149E-01

Figure 93. Exponential scores versus observed scores for week F2



EXPON. SCORES



X-SCALE : \* \* \*    =    0.314E-01    UNITS  
 Y-SCALE : \* \* \*    =    0.600E-01    UNITS

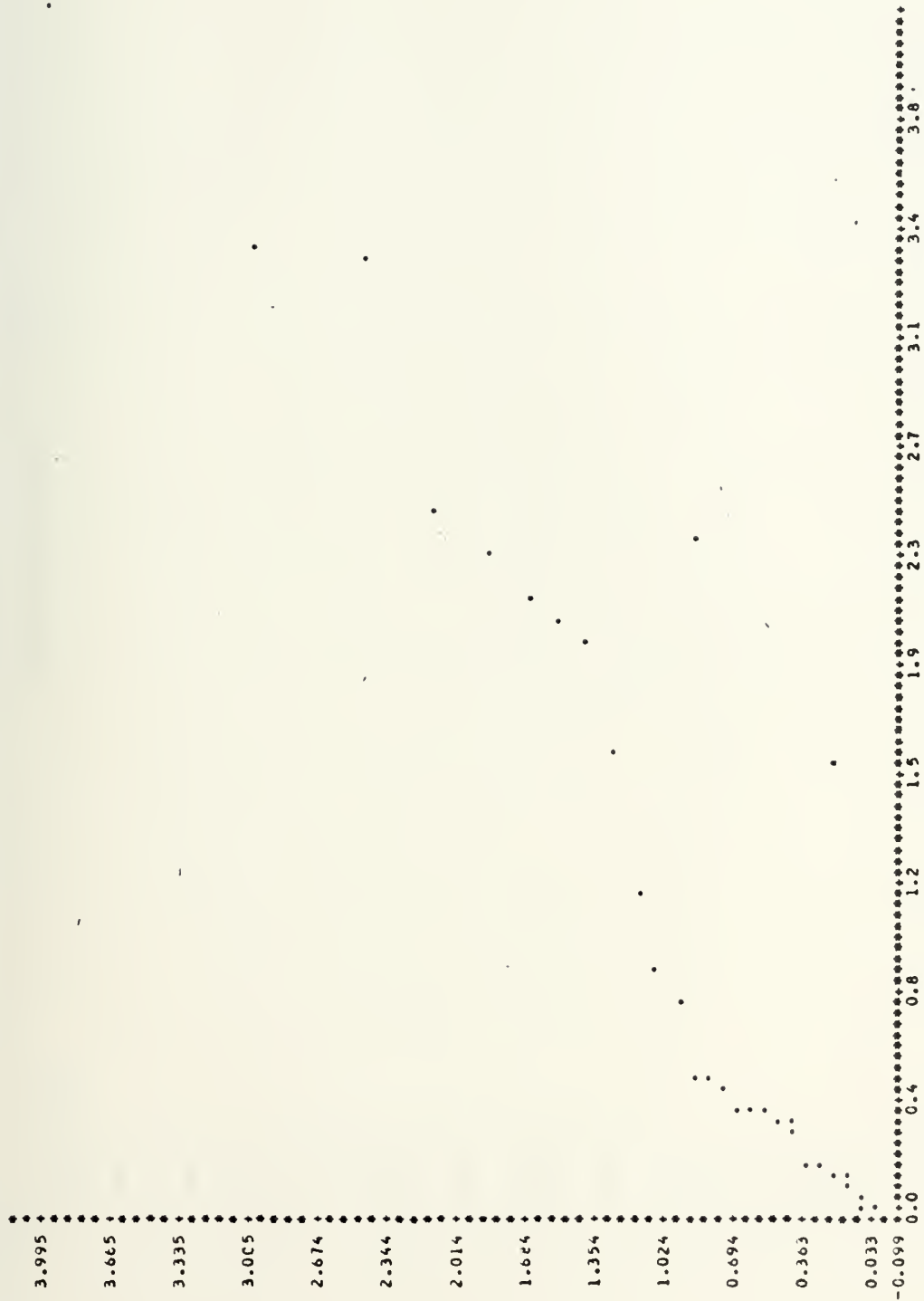
ESTIMATED PARAMETERS OF DATA :    GAMMA1 = 1.052673E+00    GAMMA2 = 6.506082E-01

Figure 94. Exponential scores versus observed scores for week F3





EXPON. SCORES



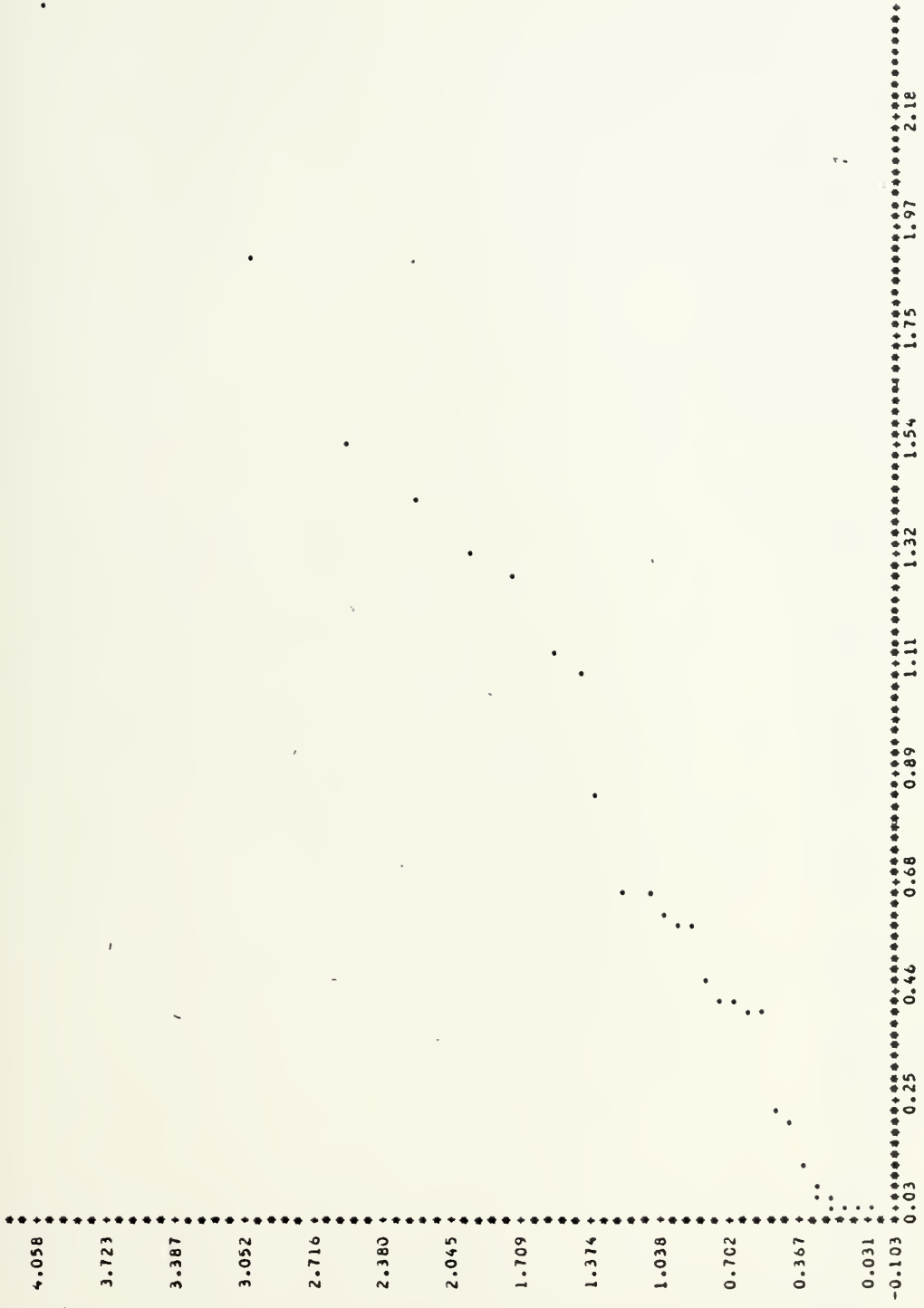
X-SCALE : \*\* = 0.379E-01 UNITS  
 Y-SCALE : \*\* = 0.660E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.306018E+00 GAMMA2 = 4.553317E-01

Figure 95. Exponential scores versus observed scores for week FM



EXPON. SCORES



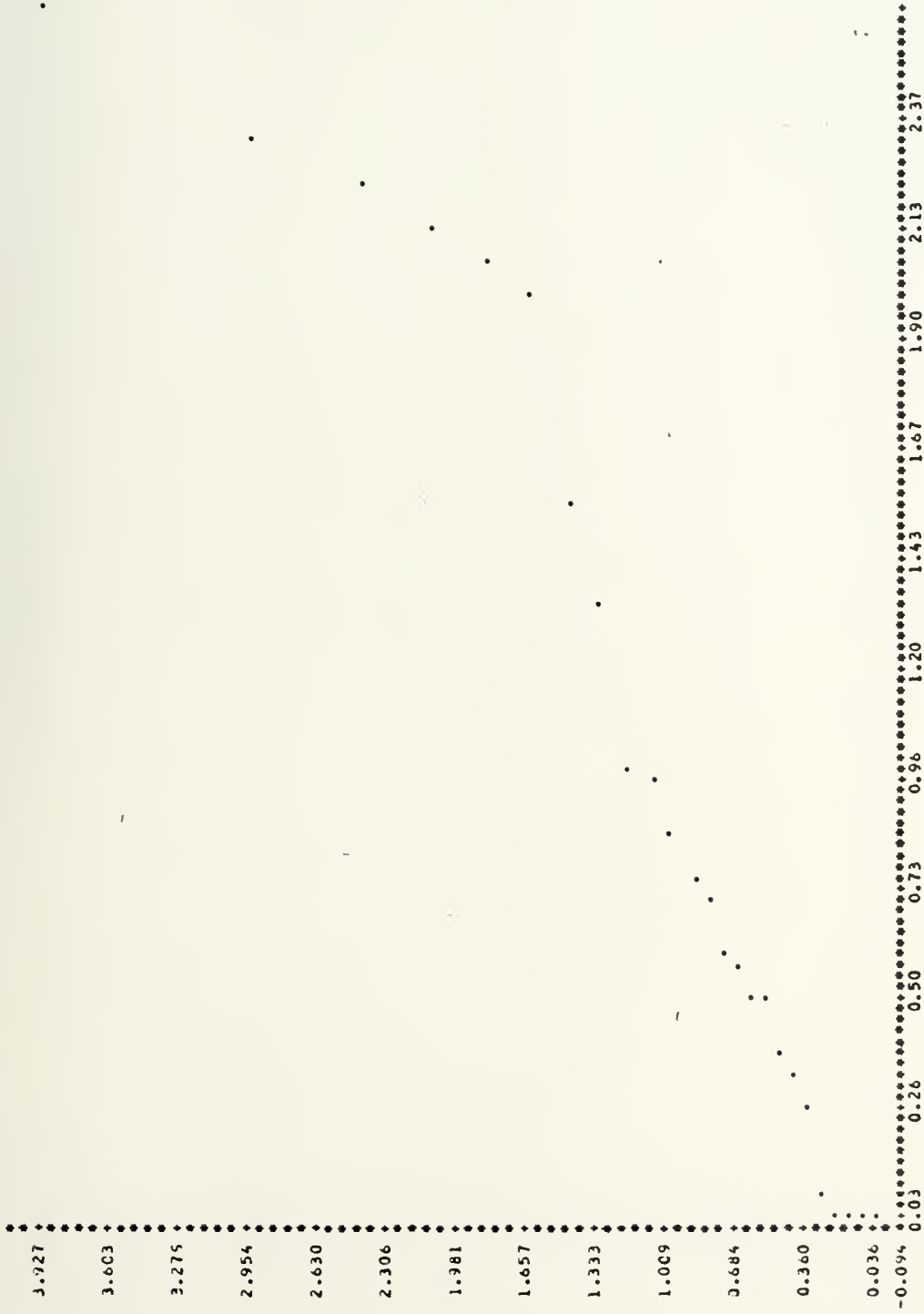
X-SCALE : \* \* = 0.215E-01 UNITS  
 Y-SCALE : \* \* = 0.671E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.247642E+00 GAMMA2 = 8.420682E-01

Figure 96. Exponential scores versus observed scores for week M1



EXPON. SCORES



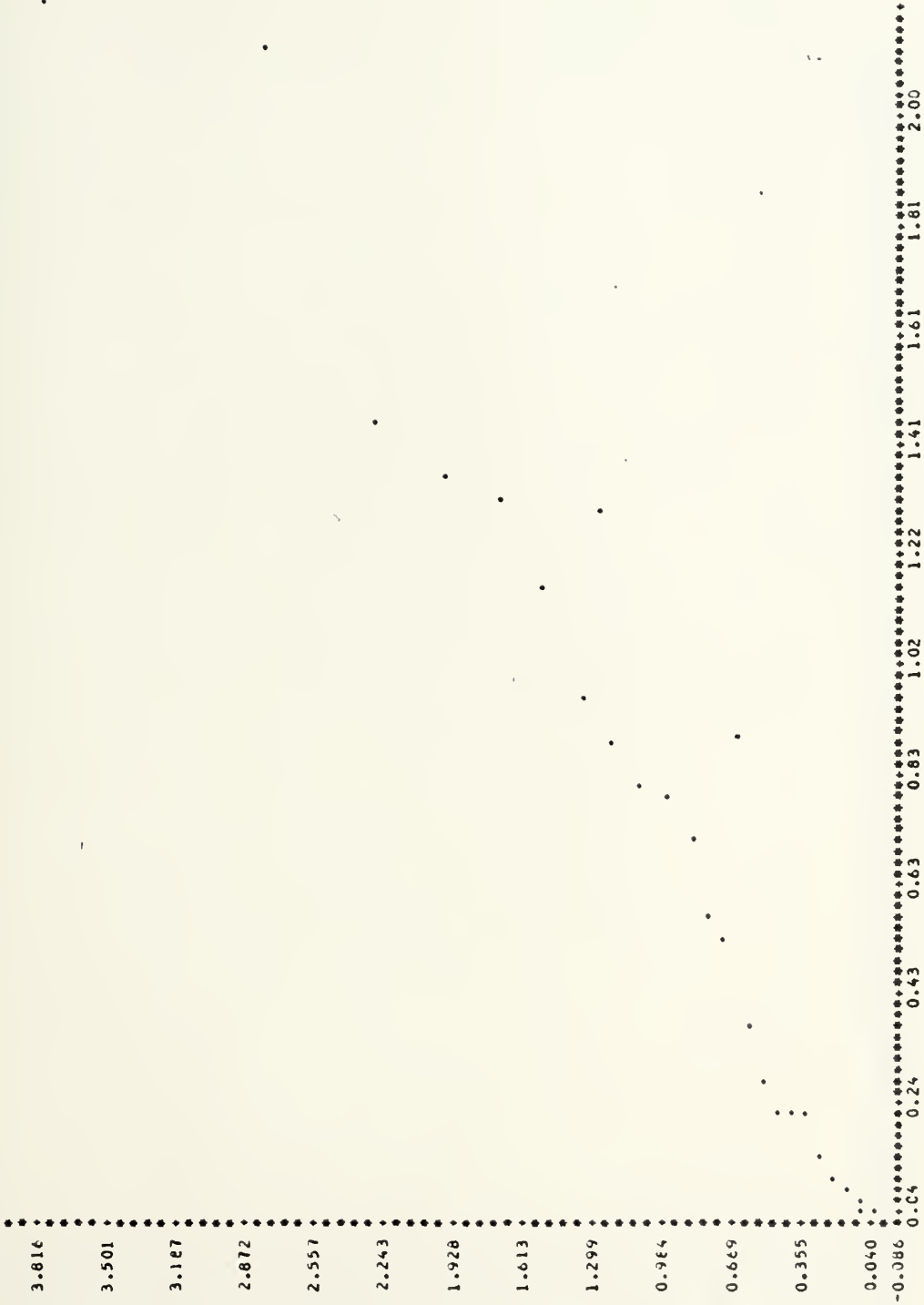
X-SCALE : '0' = 0.234E-01 UNITS  
 Y-SCALE : '0' = 0.649E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 8.310531E-01 GAMMA2 = -8.126241E-01

Figure 97. Exponential scores versus observed scores for week M2



EXPON. SCORES



X-SCALE : '\*' = 0.196E-01 UNITS  
 Y-SCALE : '\*\*' = 0.629E-01 UNITS

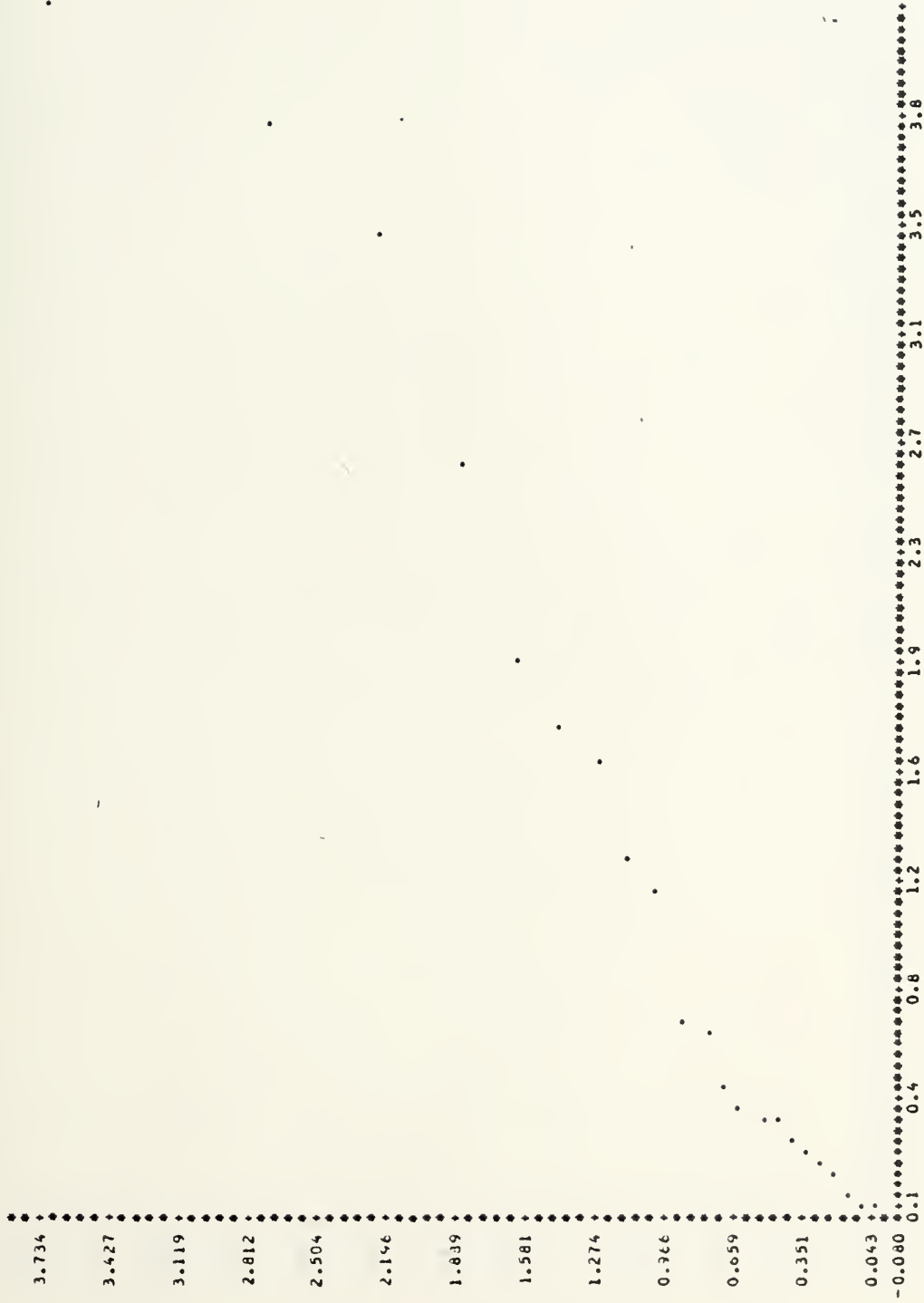
ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.072556E+00 GAMMA2 = 1.695281E-01

Figure 98. Exponential scores versus observed scores for week M3





EXPON. SCORES



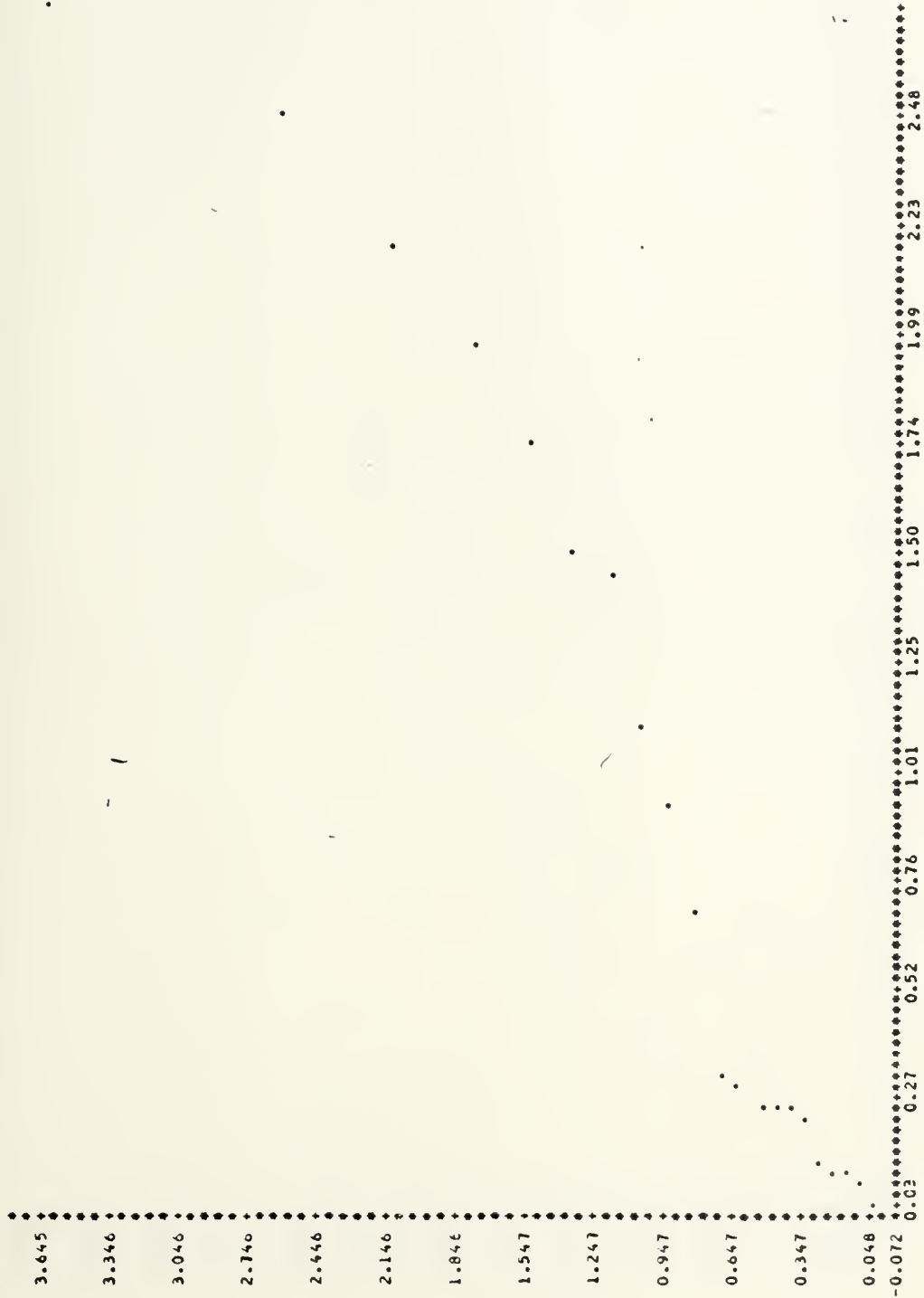
X-SCALE : '00' = 0.380E-01 UNITS  
 Y-SCALE : '00' = 0.615E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.341865E+00 GAMMA2 = 3.884540E-01

Figure 99. Exponential scores versus observed scores for week M4



EXPON. SCORES



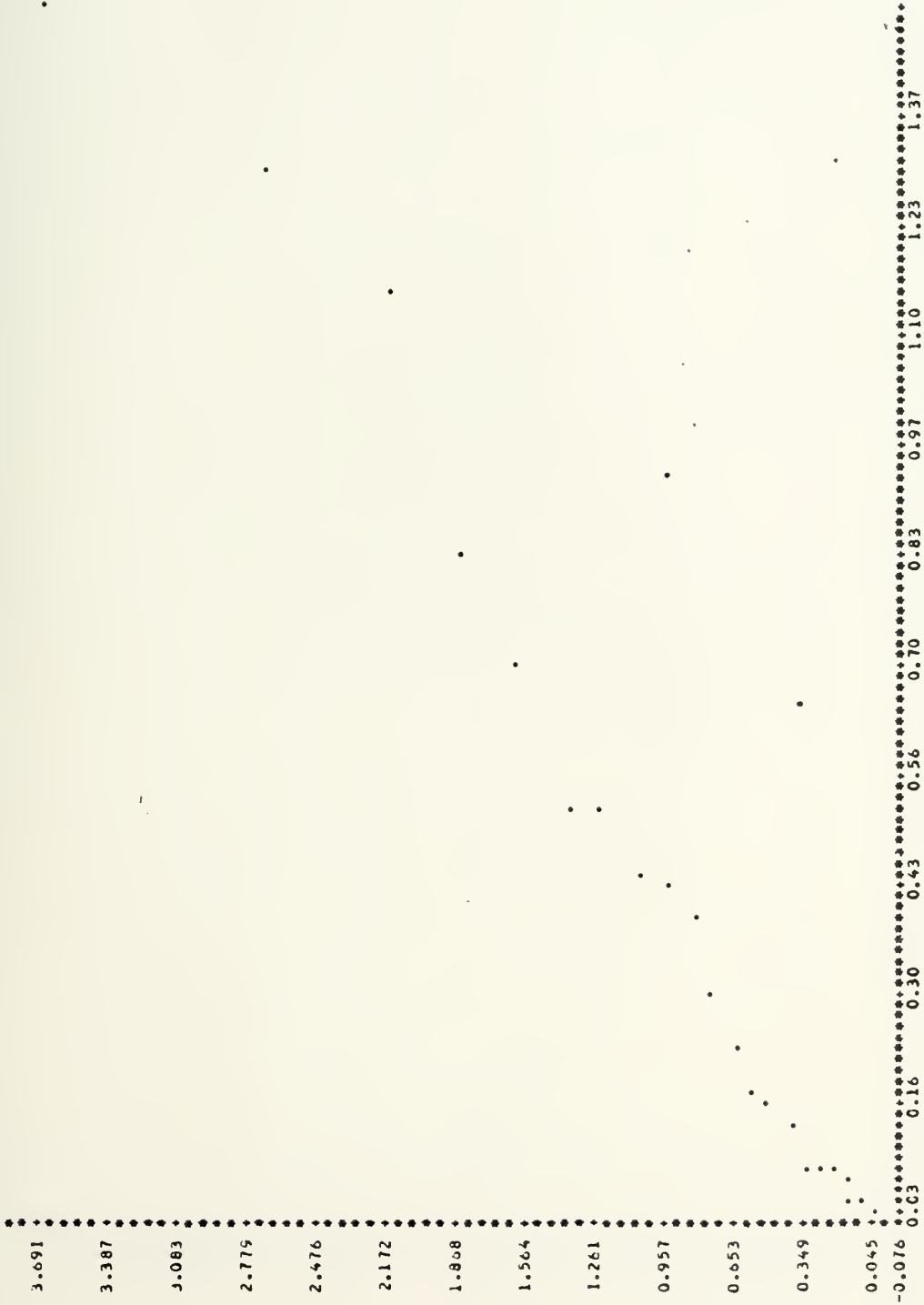
X-SCALE : \*\* = 0.245E-01 UNITS  
 Y-SCALE : \*\* = 0.600E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 8.048037E-01 GAMMA2 = -9.398052E-01

Figure 100. Exponential scores versus observed scores for week A1



EXPON. SCORES



X-SCALE : \*\* = 0.134E-01 UNITS  
 Y-SCALE : \*\* = 0.608E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.341439E+00 GAMMA2 = 5.923486E-01

Figure 101. Exponential scores versus observed scores for week A2



EXPON. SCORES



X-SCALE : \* \* \* = 0.206E-01 UNITS  
 Y-SCALE : \* \* \* = 0.530E-01 UNITS

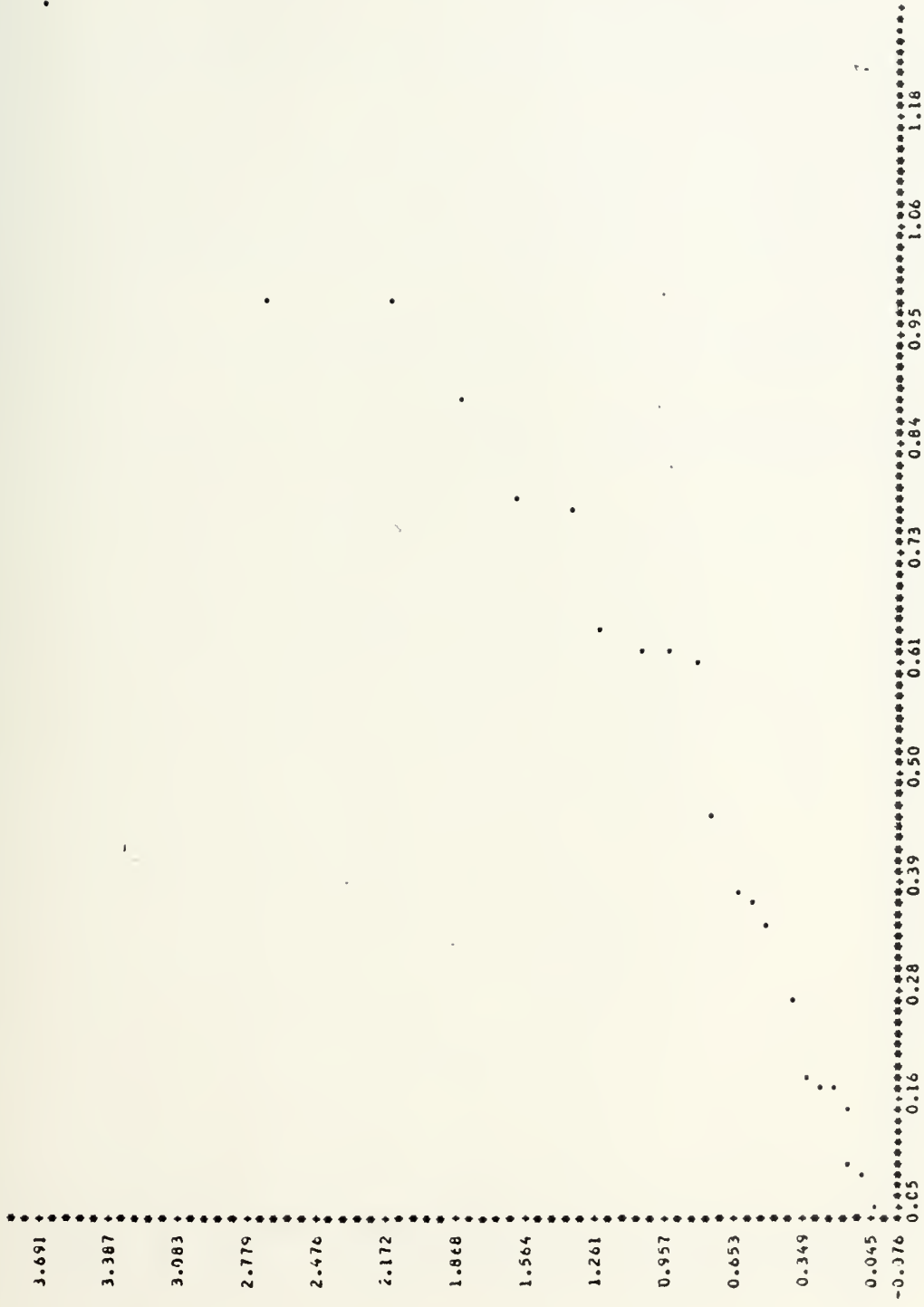
ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.465472E+00 GAMMA2 = 1.485915E+00

Figure 102. Exponential scores versus observed scores for week A3





EXPON. SCORES



X-SCALE : \*\* = 0.113E-01 UNITS

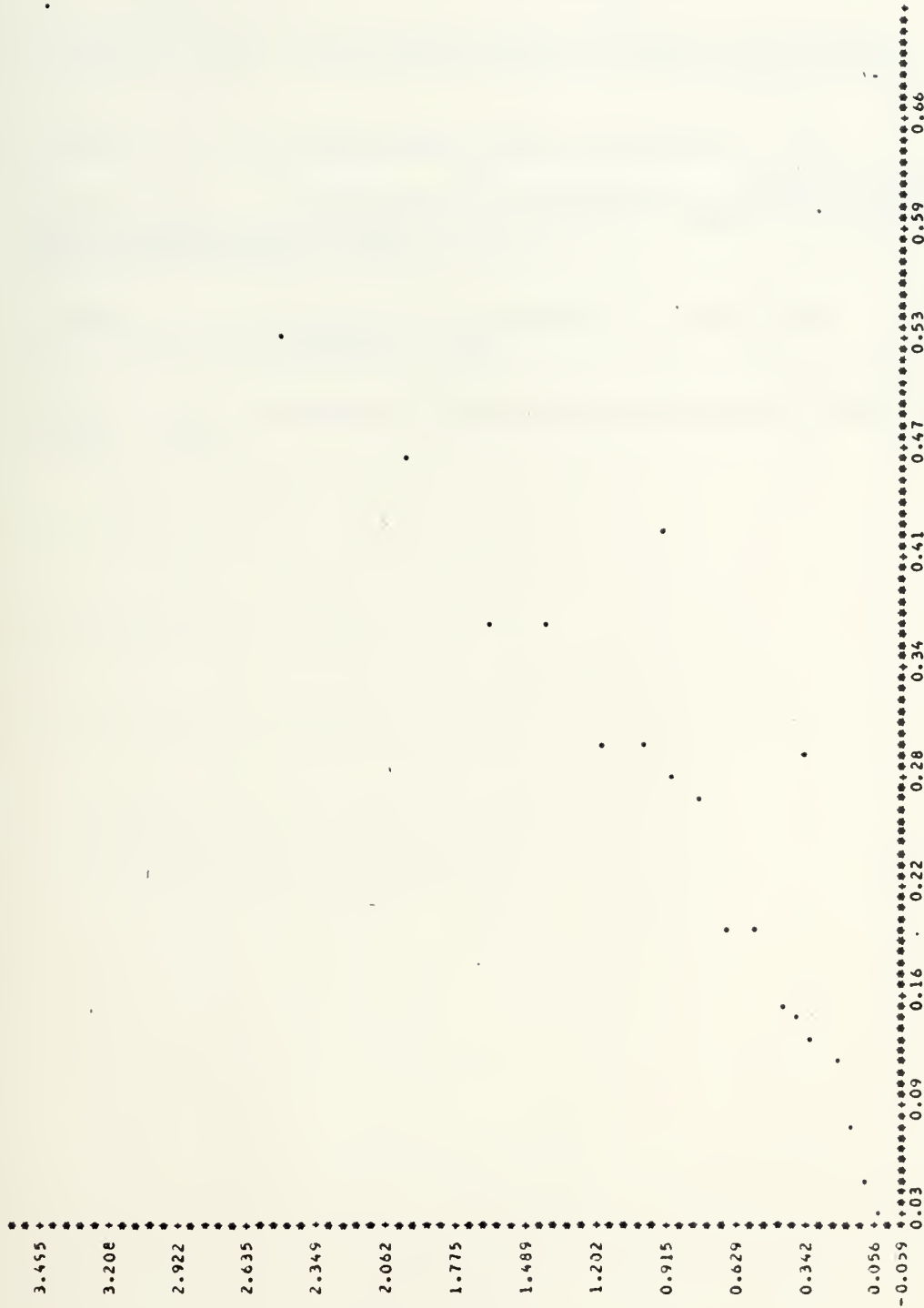
Y-SCALE : \*\* = 0.608E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 5.609644E-01 GAMMA2 = -7.214982E-01

Figure 103. Exponential scores versus observed scores for week A4



EXPON. SCORES



X-SCALE : \*\* = 0.627E-02 UNITS  
 Y-SCALE : \*\* = 0.573E-01 UNITS

ESTIMATED PARAMETERS OF DATA : GAMMA1 = 1.031787E+00 GAMMA2 = 5.5\*3498E-01

Figure 104. Exponential scores versus observed scores for week AM



LIST OF REFERENCES

1. Cox, D.R., The Analysis of Binary Data, Barnes & Noble, Inc., 1970.
2. Conover, W.J., Practical Nonparametric Statistics, Wiley, 1971.
3. McNeil, D.R., Interactive Data Analysis, Wiley, 1977.
4. Davis, D.P., A Statistical Analysis of Monthly Rainfall for Monterey Peninsula, M.S. Thesis, Naval Postgraduate School, Monterey, March 1981.
5. Cramér, H., Mathematical Methods of Statistics, Princeton University Press, 1946.
6. Duncan, A.J., Quality Control and Industrial Statistics, Irwin, 1974.



INITIAL DISTRIBUTION LIST

	No. Copies
1. Defense Technical Information Center Cameron Station Alexandria, Virginia 22314	2
2. Library, Code 0142 Naval Postgraduate School Monterey, California 93940	2
3. Professor D.P. Gaver, Code 55Gv Naval Postgraduate School Monterey, California 93940	1
4. Professor P.A. Jacobs, Code 55Jc Naval Postgraduate School Monterey, California 93940	1
5. Professor R.J. Renard, Code 63Rd Naval Postgraduate School Monterey, California 93940	1
6. Lieutenant Davut Kirca Ipras sitesi 7, sok No 4 Tutunciftlik, izmit, TURKEY	1
7. Dz. Kuvvetleri Komutanligi Bakanliklar, Ankara, TURKEY	2
8. Chairman, Department of Operations Research, Code 55 Naval Postgraduate School Monterey, California 93940	1









Thesis

195473

K494 Kirca

c.1

A statistical analysis of daily and weekly rainfall for the

MAY 4 1985  
29908  
Monterey Peninsula, in  
Central California.

Thesis

195473

K494 Kirca

c.1

A statistical analysis of daily and weekly rainfall for the Monterey Peninsula, in Central California.

A statistical analysis of daily and week



3 2768 001 02793 1

DUDLEY KNOX LIBRARY