NASA Technical Memorandum 103498

Climate Of The Kennedy Space Center And Vicinity

June 1990

National Aeronautics and
Space Administration

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Abstract

Climate plays a large role in determining the biota of a region. Summary data are presented for climate variables of ecological importance including precipitation, temperature, evapotranspiration, wind, insolation, lightning, and humidity. The John F. Kennedy Space Center, Cape Canaveral Air Force Station, and surrounding area are sampled intensively for climatic conditions; data are presented for the barrier island, Merritt Island, and the mainland, which represents the range of conditions in the local area. Climatic figures, database listings, and historic data (pre-1931) are presented in the appendix.

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Acknowledgements

This report was prepared under the direction of Dr. William M. Knott, III, Biological Sciences Officer, Life Science Research Office, Dr. Albert M. Koller, Jr., formerly Chief, Programs and Planning Office, and Burton Summerfield, Pollution Control Officer, Biomedical Operations and Research Office, John F. Kennedy Space Center (KSC), under NASA contracts NAS10-10285 and NAS10-11624. I thank Paul A. Schmalzer, Ph.D. of The Bionetics Corporation for providing data and information, and for guidance during the preparation of this manuscript. Thomas W. Dreschel provided information about rain and temperature data collection for the area. Lee A. Maull provided data from the NADP site location. Peter Chetirkin, Naresa Reddick, and Glenn Markwell provided computer support in accessing and processing the data.

Introduction

It is difficult to overstate the importance of climate in determining the biota of an area. Climate influences the distribution of species directly through temperature, precipitation, and insolation regimes, and indirectly through modification of soils and landforms. The influence is such that the distribution of generalized vegetation communities can be predicted based on climatic variables (Greller 1980, Walter 1979).

The John F. Kennedy Space Center (KSC) and neighboring Cape Canaveral Air Force Station (CCAFS) are located on central peninsular Florida's eastern coast, at approximately 28.5 degrees north latitude and 81.7 degrees west longitude (Fig. 1). CCAFS is situated on the northern portion of a barrier island complex; KSC is located on Merritt Island, a relict barrier island. These lands are surrounded by large water bodies: the Atlantic Ocean, Banana and Indian Rivers, and Mosquito Lagoon. The landform is a flat, low elevation plain, with dune features along the coastline and dune/swale topography in some areas inland. Elevation ranges to slightly over 6 meters. The main factors influencing climate at KSC are latitude and proximity to these large bodies of water, which moderate temperature fluctuations.

Data gathered from several collecting stations are presented. These stations and the abbreviations used throughout this report (in italics) are as follows: Titusville (*Titusville*), Merritt Island (*Merritt Island*), Cape Canaveral Air Force Station (*CCAFS*), Patrick Air Force Base (*Patrick*), National Atmospheric Deposition Program Site (*Nadpsite*), Launch Complex 39A (*LC39A*), Shuttle

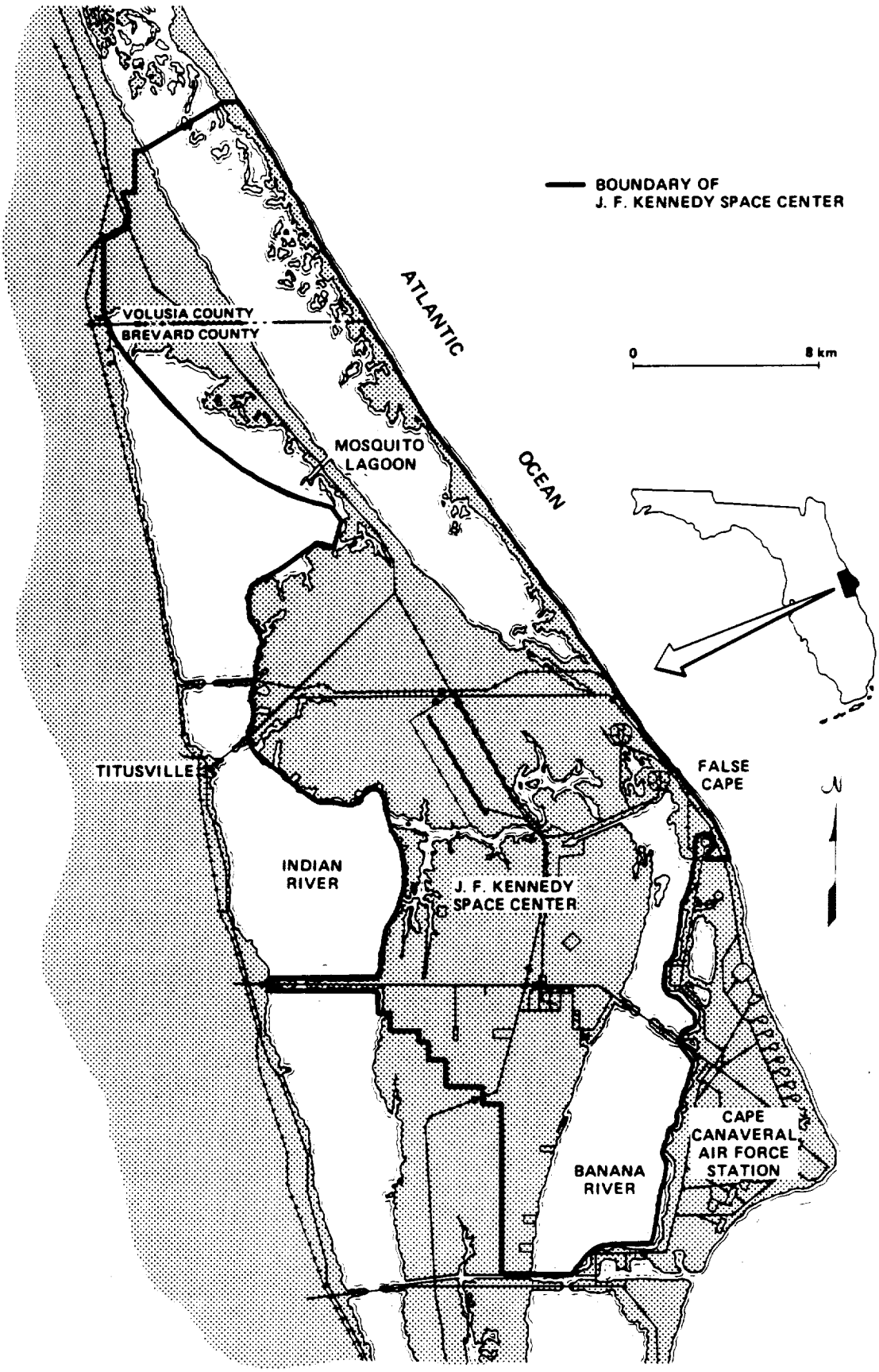

Figure 1. Map of the John F. Kennedy Space Center.

Landing Facility (*Shuttle1*), and a wetland site near the Vehicle Assembly Building (*Marsh*). The locations of these stations are presented in Fig. 2; ancillary information is given in Appendix II, Tables II-1 and II-2.

Precipitation

Two long data sets exist for this area: the *Merritt Island* set spans 78 years (1878-1955) with 76 complete years of records and the *Titusville* set spans 100 years (1888-1987) with 86 complete years of records (Appendix I, Figs. I-1 and I-2)(U.S. Department of Commerce, Weather Bureau 1933, 1960, 1964, National Climatic Data Center computer tape). The *Merritt Island* station was located approximately 8.3 km (5.1 mi) south of KSC boundaries for the period before 1952, then was moved north approximately 7.6 km (4.7 mi) for the duration of the record; the *Titusville* station is located on the mainland 4.5 km (2.8 mi) west of KSC boundaries. Data are also available for several stations located on KSC property (*Marsh*, *Nadpsite*, *Shuttle1*, *LC39A*), the Cape Canaveral Air Force Station (*CCAFS*), and Patrick Air Force Station (*Patrick*); these records contain useful data but are shorter and probably do not include the full range of variability for the area.

Mean annual rainfall for the *Merritt Island* and *Titusville* records are 51.6 in (131 cm) and 53.8 in (136.6 cm), respectively. Annual rainfall amount varies widely; values for *Merritt Island* range from 30.5 in (77.5 cm) to 85.7 in (217.7 cm), and for *Titusville* range from 33.4 in (84.8 cm) to 81.7 in (207.5 cm).

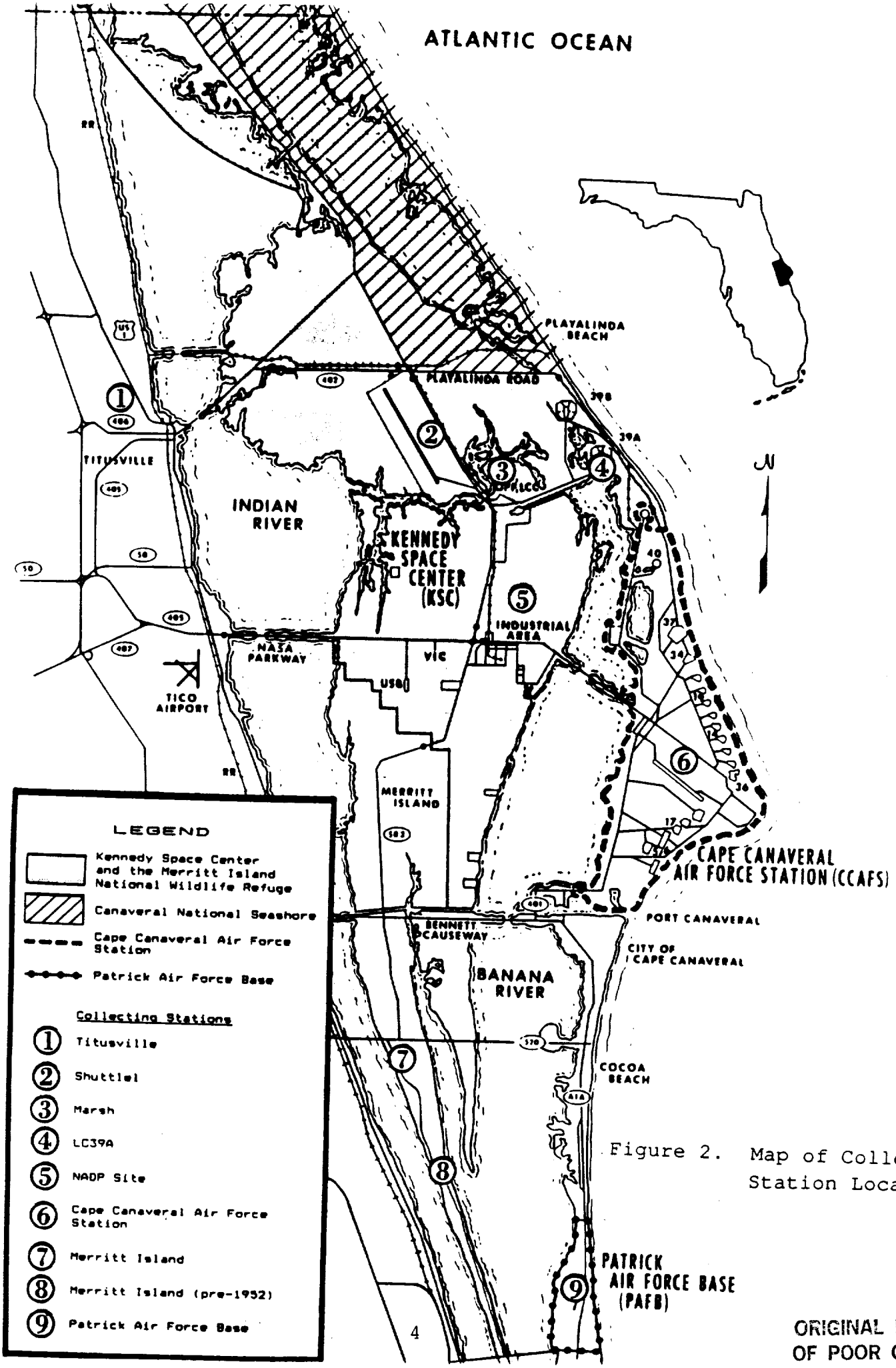

Figure 2. Map of Collecting Station Locations.

Annual rainfall values for the *CCAFS* and *Nadpsite* stations are plotted in Appendix I, Figs. I-3 and I-4. The standard deviation for the *Merritt Island* record is 10.7 in (27.2 cm) and for *Titusville* is 10.1 in (25.6 cm). The probability of yearly precipitation volume has been calculated from the *Titusville* and *Merritt Island* station records (Appendix I, Figs. I-5 and I-6) using the equation $F_i = m/(n+1) \cdot 100\%$, where F_i is the cumulative percentage frequency of the variable, or the percentage of years with a rainfall equal to or less than the particular annual rainfall having rank *m*; *n* is the number of years of record. The percentage frequency of past events is taken as the probability (also in percent) of future events (Dunne and Leopold 1978).

Distribution of rainfall is bimodal, with a wet season occurring from May to October and the rest of the year being relatively dry (Appendix I, Figs. I-7 through I-11). Wet season precipitation mainly stems from convectional cells, with the dryer season (winter/spring) precipitation resulting from cold fronts, pre-frontal squalls, and low pressure systems (Doehring et al. 1986). There is noticeable variation in mean monthly rainfall among the wet season months; the mean monthly rainfall amounts for the dry season all fall within 0.5 in (1.3 cm) of each other for *Merritt Island* and 0.9 in (2.3 cm) for *Titusville* (Table 1). Monthly mean number of days with measurable precipitation for *CCAFS* is shown in Appendix I, Fig. I-12. On average, 148 days with measurable precipitation occur per year, with just under 60 percent of these in the wet season. Over the 21 years of record,

Table 1. Monthly Mean Rainfall for KSC Area Collecting Stations.

Station	Titusville	Merritt Island	CCAFS	NADP Site	LC39A	Shuttle1	Patrick
Length of record(yrs)	86	75	21	5	3	3	2
January	2.22	2.68	2.39	2.41	2.22	2.41	2.72
February	2.80	2.56	2.91	1.97	2.34	1.97	1.98
March	3.06	2.79	3.41	3.95	3.30	3.95	6.12
April	2.53	2.77	1.30	2.23	1.89	2.23	0.74
May	4.09	3.70	2.77	3.14	2.73	3.14	4.58
June	7.12	6.65	5.74	3.95	6.48	3.95	4.16
July	7.52	5.99	5.17	4.31	2.50	4.31	6.27
August	6.69	5.52	5.41	7.79	3.53	5.79	2.46
September	7.96	7.76	6.48	5.05	4.48	5.05	6.97
October	5.41	6.14	4.32	3.38	2.81	3.38	5.56
November	2.52	2.52	3.24	4.83	2.99	4.83	8.80
December	2.32	2.30	2.00	4.08	3.90	4.08	2.56

CCAFS has had an average of 66 percent of the annual rainfall during the wet season.

Year to year variability in precipitation is high; on occasion, several years in a row will have significantly less rainfall than average, creating a drought condition (Appendix I, Figs. I-13 and I-14). There does not seem to be a distinct recurrence interval for drought, though several have occurred during the period of record. Frost damaged plant tissues exposed to drought conditions are especially susceptible to burning, as evidenced by the wildfires in 1958 and 1981 (Davison and Bratton 1986).

Temperature data has been plotted with precipitation data to determine seasonality of drought and moisture surplus (Fig I-15) (Walter et al. 1975). Two periods of moisture deficit occur in an average year: a two month period between mid-March and mid-May, and a one month period between mid-November and mid-December. The bulk of the moisture surplus occurs between June and November.

Temperature

Three stations have recorded temperature data. Both the *Merritt Island* and *Titusville* data sets contain entries for daily minimum and maximum temperatures, as well as temperature at the time of observation. The *CCAFS/Shuttle1* data have been presented together by the Air Force in summary form (ESMC 1989), showing monthly mean temperatures and mean maximum and minimum temperatures. No further analysis of the *CCAFS/Shuttle1* data was possible. *Titusville* has the longest record, extending from 1931

to 1987, with summary data available for 1887 to 1930 (Appendix III).

Mean monthly maximum and minimum temperatures for *CCAFS, Merritt Island,* and *Titusville* are presented in Appendix I, Figs. I-16 through I-18. The *Merritt Island* daily record extends from 1948 to 1956, with summary data available from 1891 to 1930 (Appendix III, Table III-1). January is on average the coldest month for *Titusville* and *Merritt Island,* with mean minimum temperatures of 49.2°F (9.6°C) and 53.3°F (11.8°C) respectively, and mean maximum temperatures of 72.2°F (22.3°C) for both stations. February is the coldest month on average for *CCAFS/Shuttle1,* with a mean minimum temperature of 51°F (10.6°C) and a mean maximum temperature of 69°F (20.6°C). The warmest month for *Titusville* and *CCAFS/Shuttle1* is July, with mean minimum temperatures of 71.4°F (21.9°C) and 73°F (22.8°C) respectively, and mean maximum temperatures of 91.9°F (33.3°C) (*Titusville*) and 88°F (31.1°C) (*CCAFS/Shuttle1*). *Merritt Island* records August as the warmest month, with a mean minimum temperature of 74.0°F (23.3°C) and a mean maximum temperature of 90.6°F (32.6°C). The mean daily range of temperatures for *CCAFS/Shuttle1, Merritt Island,* and *Titusville* are 15.3°F (8.6°C), 17.5°F (9.7°C), and 21.4°F (11.8°C) respectively, showing an increase in temperature range with increasing distance from the coast.

The occurrence of freezing temperatures affects the distribution of frost sensitive plant species and can adversely affect populations of poikilothermic animals in the area (Provancha et al. 1986). *Titusville* shows 351 days with

temperatures below freezing over the 93 years of record, while *Merritt Island* shows 44 such days over its 47 year record. There are 40 years of concurrent records for *Merritt Island* and *Titusville* temperature data. For this period, *Titusville* shows 121 days with temperatures below freezing, while *Merritt Island* has only 30 such days. The bulk of these concurrent records were in the early days of recorded temperature data; these summary data are presented in Appendix III, Tables III-2 and III-3. For freeze events occurring at both stations, lower temperatures are recorded at *Titusville* compared to *Merritt Island* (Appendix III, Table III-3). More frosts were recorded at *Titusville* in the period up to 1930 (Appendix III, Table III-4); frosts occurred earlier in the fall and later in the spring at *Titusville*.

Post-1931 freeze data for *Titusville* and *Merritt Island* are presented in Appendix I, Figs. I-19 and I-20. Length and severity of freeze determine the extent of damage; *Titusville* has more frequent and more severe freeze events than *Merritt Island*. This would be expected because cold air originates in the north or northwest; Merritt Island (including the Kennedy Space Center) has the Indian River to moderate temperatures before cold air reaches the island. From the 1887-1930 and 1931-1987 records, *Titusville* shows 41 days with minimum temperatures at or below 25°F, which is 12 percent of all days with temperatures below freezing. By counting consecutive days with minimum temperatures below freezing as a single freeze event, 43 percent of all freeze events last 2 or more consecutive days (based on 1931 - 1987 data)(Table 2). No record shows any day with a maximum temperature below freezing.

Table 2. Titusville: Length of Freeze Events.

No. of Consecutive Nights	No. of Occurances	Percent of All Freeze Events [a]
1	82	56.6
2	38	26.2
3	18	12.4
4	3	2.1
5	2	1.4
6	1	0.7
7	1	0.7

a Consecutive nights with temperatures below freezing are counted as one freeze event for calculating percentages.

Evapotranspiration

Potential evapotranspiration (PET) and actual evapotranspiration (AET) figures are available for Cape Canaveral and for Cocoa Beach (Dohrenwend 1977)(Table 3). Both stations show nearly identical results, with an annual AET of slightly over 37 in (94.0 cm). In assuming an average annual precipitation of 55.4 in (140.7 cm), Dohrenwend (1977) predicted an annual surplus of roughly 18 in (45.7 cm) of water. The 21 years of data from the *CCAFS* site shows a mean annual rainfall of 45 in , which would yield an annual surplus of 8 in (20.3 cm) for the Cape Canaveral area. Dohrenwend's annual precipitation value is close to that of the mean annual rainfall for both the *Merritt Island* and *Titusville* records, which indicates his surplus value of 18 in (45.7 cm) may be accurate for most of the KSC area in an average year.

Wind

Wind data summarized by the Air Force indicate that prevailing wind direction is from the north or northeast during the dry season, and from the east during the wet season (ESMC 1989)(Table 4). Wind conditions over short time periods are variable, depending on local convectional forces or land/sea breeze effects. Average monthly wind speed ranges from 6 kts (3.1 m/s)(July and August) to 9 kts (4.6 m/s)(March); monthly maximum recorded gusts for the period of record (8/1950 to 12/1952 and 1/1957 to 12/1985) range from 40 kts (20.6 m/s)(October and

Table 3. Potential and Actual Evapotranspiration Values for Cape Canaveral and Cocoa Beach.[a]

STATION	PET (in)	Precipitation (in)	PET/ Precipitation	AET (in)	AET/ PET	Surplus (Precip-AET) (in)
Cape Canaveral	47.8	55.4	0.86	37.3	0.78	18.1
Cocoa Beach	50.6	55.4	0.91	37.5	0.74	17.9
Cape Canaveral[b]	47.8	45.1	1.06	37.3	0.78	7.8

PET - Potential Evapotranspiration AET - Actual Evapotranspiration

a. adapted from Dohrenwend 1977

b substituted our 21 year mean rainfall value for precipitation and calculated surplus using Dohrenwend's PET and AET values

Table 4. Wind and Humidity Values for KSC/CCAFS.

	WIND			HUMIDITY
	Prevailing (Dir. + Kts.)	Peak Gust (Kts.)	Direction of Peak Gust	Mean Percent Relative Humidity
JANUARY	NW8	46	270	80
FEBRUARY	N8	60	240	79
MARCH	N9	48	180	77
APRIL	E8[a]	53	200	75
MAY	E8	46	270	77
JUNE	E7	50	160	81
JULY	S6	50	220	83
AUGUST	E6	60	090	84
SEPTEMBER	E7	68	160	82
OCTOBER	E8	40	030	78
NOVEMBER	NW8	46	190	78
DECEMBER	NW7	40	310	79

SOURCE: Eastern Space and Missile Command (USAF) (1989)
a Eastern Space and Missile Command (USAF) (1982)

December) to 68 kts (35 m/s)(September)(ESMC 1989). The highest wind speeds are encountered during tropical storms and hurricanes, which can produce sustained wind speeds over 87 kts (161 km/hr) (Bradley 1972). There is a 7 percent chance of hurricane-force winds (over 65 kts (120.7 km/hr)) reaching the 50 mile (80.5 km) segment of coastline which includes KSC and CCAFS in any one year (Simpson and Lawrence 1971, as cited in Bradley 1972); the hurricane season for the east coast is from August through November (Davison and Bratton 1986).

Insolation

Mean monthly insolation values for the Kennedy Space Center are presented in Appendix I, Fig. I-21. One would expect June to have the highest insolation value as the solstice occurs in this month, but the May figure is slightly higher due to increasing cloudiness from convectional storms in the summer months. December has the lowest insolation value with 46 percent of the light energy of May. The solar elevation at solar noon ranges from a maximum of 85.5 degrees above the horizon on June 21 to a minimum of 38.5 degrees on December 21. The maximum possible direct sunlight on June 21, the longest day of the year, is 14 hours; the shortest day, December 21, has a maximum possible direct sunlight period of 10 hours. Mean daily direct sunshine is a maximum of 9.5 hours in April and May and a minimum of 6 hours in December (Doehring et al. 1986).

Lightning

During summer, the central Florida coast has one of the highest frequencies of thunderstorms in the world. Lightning detection systems indicate that 1400 ± 840 cloud to ground strikes per month occur in the summer months in the 350 km^2 KSC area, which is equivalent to 3.9 ± 2.4 flashes per square kilometer per month (ESMC 1989). This is an important potential source of fire ignition and may have determined the natural fire regime historically. Mean monthly number of days with thunderstorms for the Cape Canaveral Air Force Station is presented in Appendix I, Fig. I-22. Eighty percent of the storms occur in the period from May through September, with a maximum of 16 thunderstorm days on average in July.

Humidity

Mean monthly relative humidities for the *CCAFS/Shuttle1* range from 75% in April to 84% in August (ESMC 1989)(Table 4). Seasonally, humidity tends to be approximately 3% higher in the summer months; diurnally, humidities range from 50-65% during afternoon hours to 85-95% during night and early morning hours (Bradley 1972). Mean monthly days with fog (visibility < 11.3 km (7 mi)) ranges from 2 in June-Sept to 9 in January (ESMC 1989)(Fig. I-23); most fogs occur from November to March and are light, usually burning off by mid-morning.

Summary

The distribution of species depends upon both abiotic (or physical) conditions and the biotic environment provided by other organisms (Kellman 1980). With the exception of soil and atmospheric chemical content, these abiotic conditions largely refer to climatic conditions. Kennedy Space Center is located approximately 90 km (56 mi) north of the isotherm which denotes a true tropical climate (mean temperature of the coldest month greater than 64.4^{o}F (18^{o}C)(Bradley 1972)); however, a number of frost sensitive species approach the northern limit of their distributions in this area. In addition to this north/south temperature gradient, a more pronounced east/west temperature gradient occurs with distance from the moderating effects of the Atlantic Ocean, Indian River, Banana River, and Mosquito Lagoon. This can be seen in the smaller mean diurnal temperature range at the coast compared to the mainland, and in the more frequent and more severe freeze events on the mainland than those on Merritt Island.

Other climatic variables are less sensitive to local effects and reflect the conditions of the central peninsular Florida region. Precipitation is variable in both annual amount and spatial distribution over short time periods, and is seasonal with relatively wet summers and dry winters. Insolation is high because of Florida's latitude, which at 28 degrees north still causes noticeable seasonality in insolation amounts and length of day. Humidity is high year round, with a seasonal fluctuation less than the diurnal fluctuation of 30%.

Climate directly or indirectly controls many disturbance events which affect biota such as fire seasonality and frequency, occurrence of high intensity winds, occurrence of flood and drought, and severity and frequency of freeze events. In addition to these extreme events, mean values for climatic variables help define the set of conditions for an area. It is important to consider the length of record when using mean and extreme values because of the high variability some types of weather events have.

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Appendix I

Climate Figures

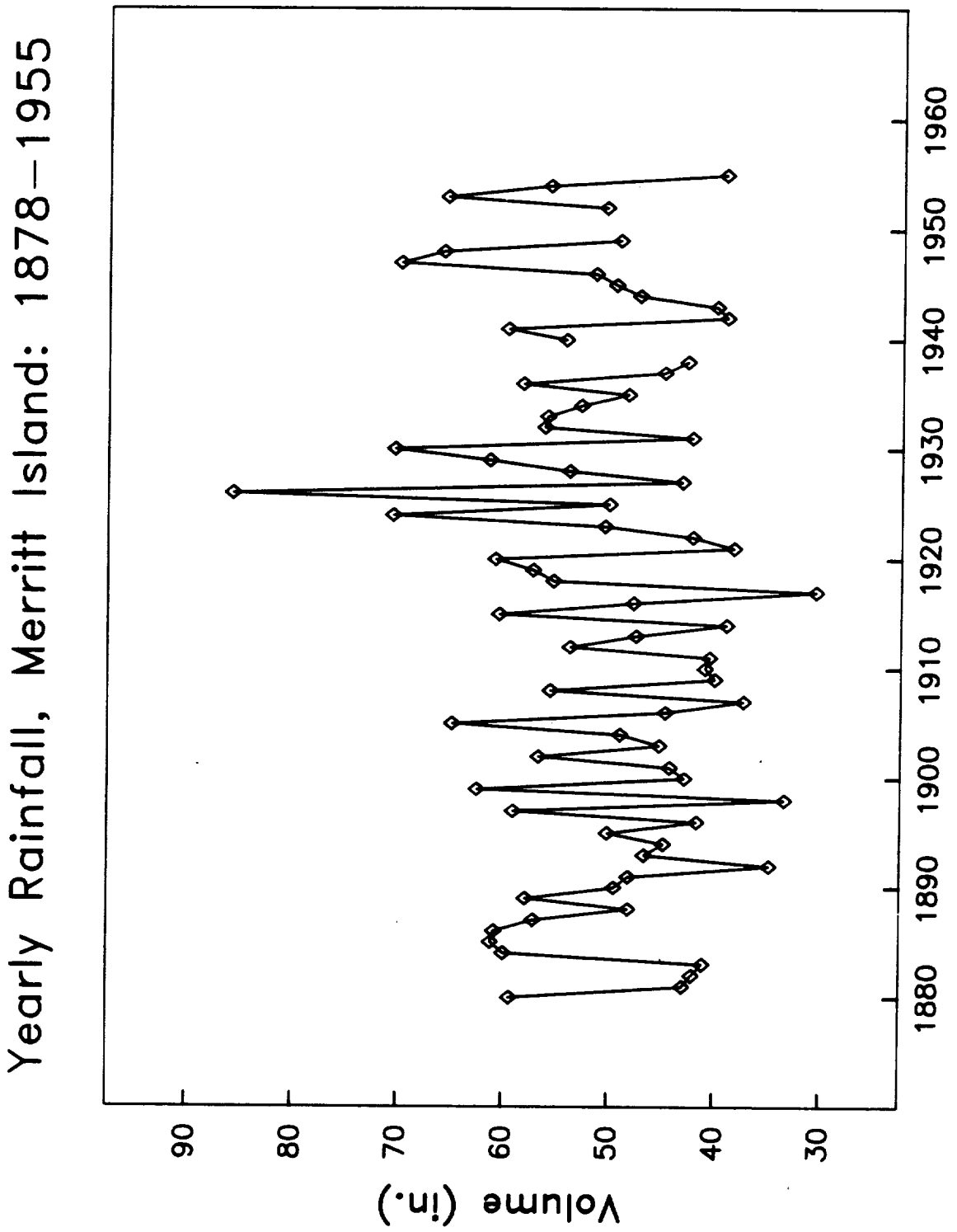

Figure I-1. Yearly Rainfall, Merritt Island: 1878-1955.

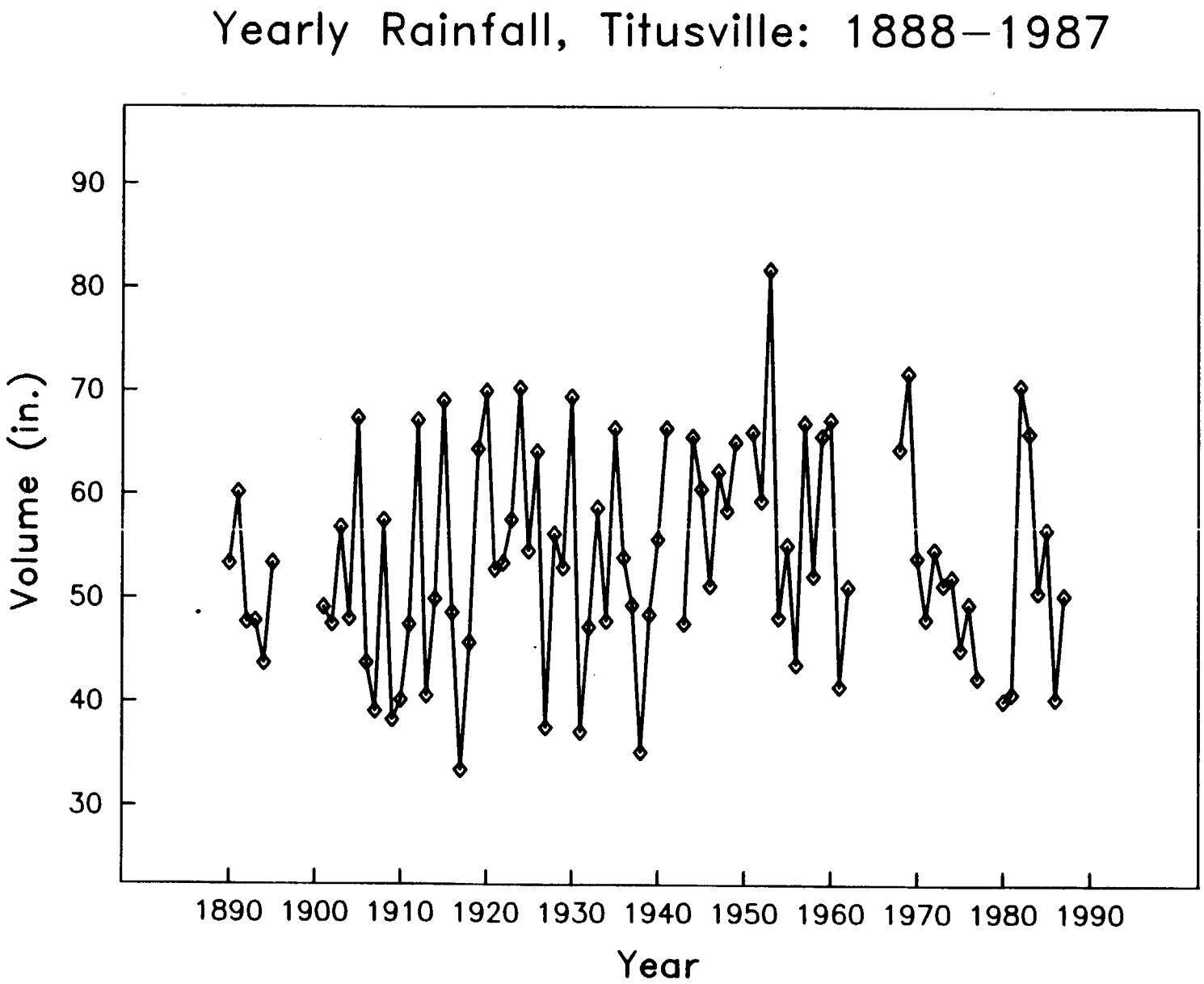

Figure I-2. Yearly Rainfall, Titusville: 1888-1987.

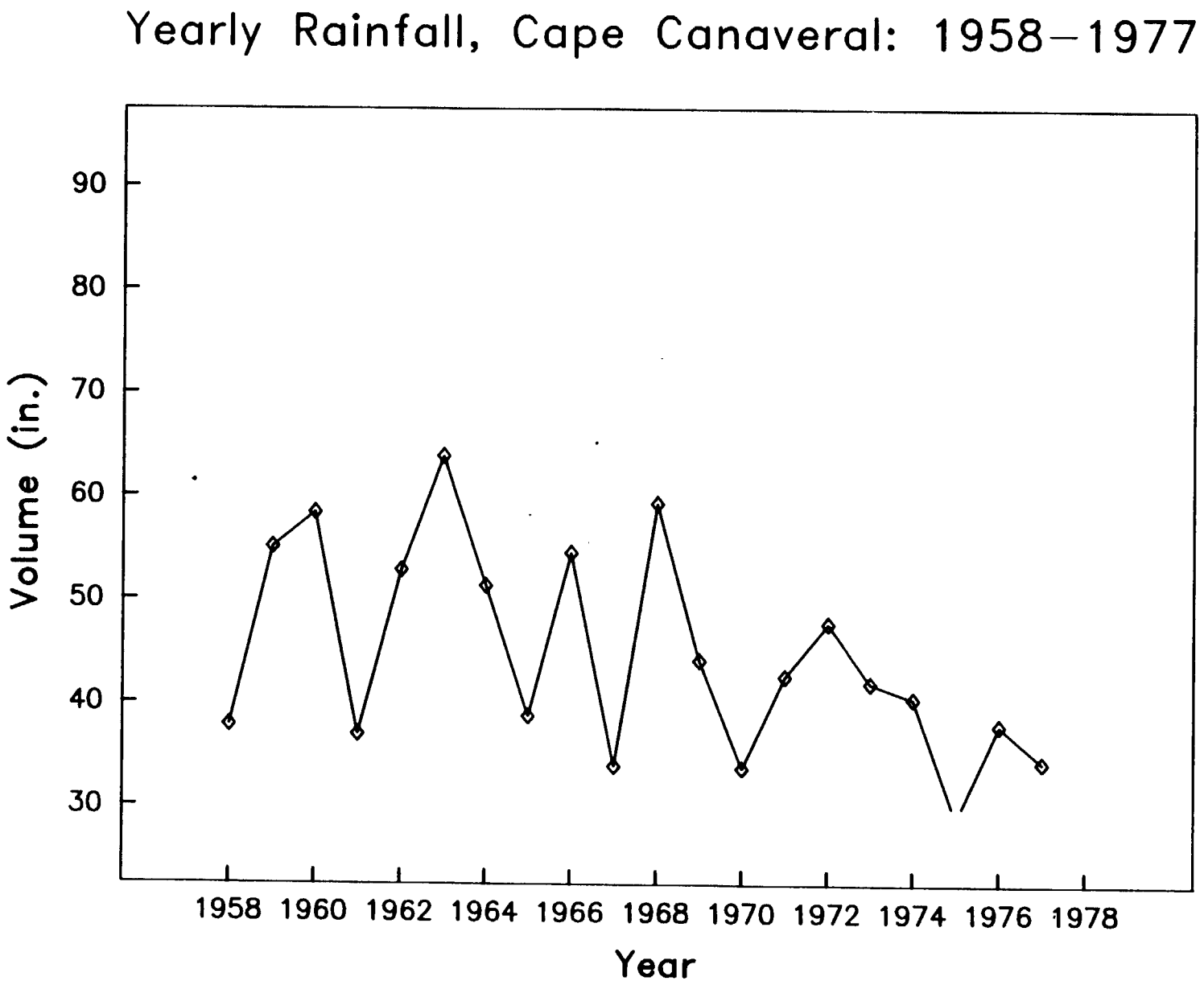

Figure I-3. Yearly Rainfall, Cape Canaveral: 1958-1977.

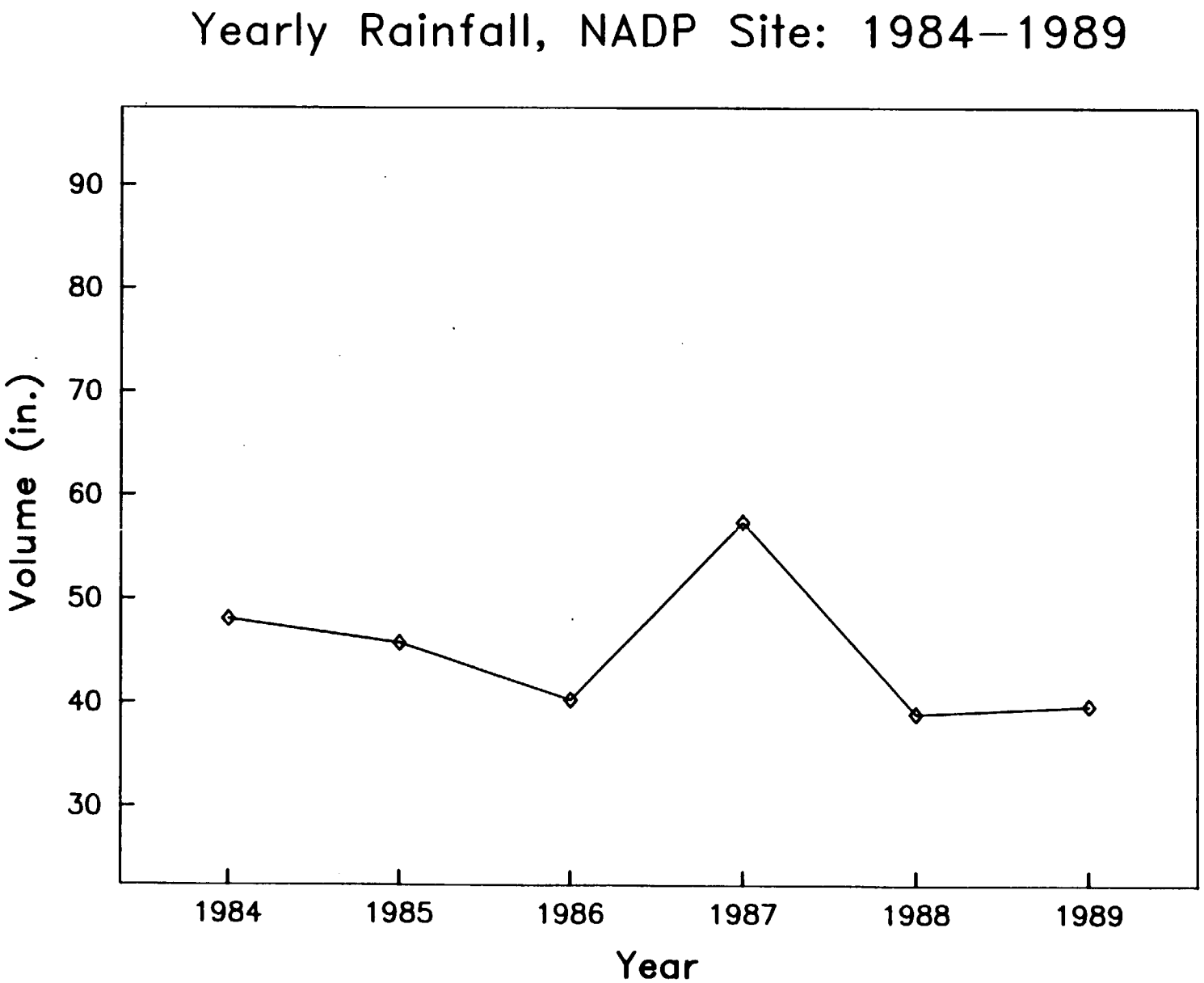

Figure I-4. Yearly Rainfall, NADP Site: 1984-1989.

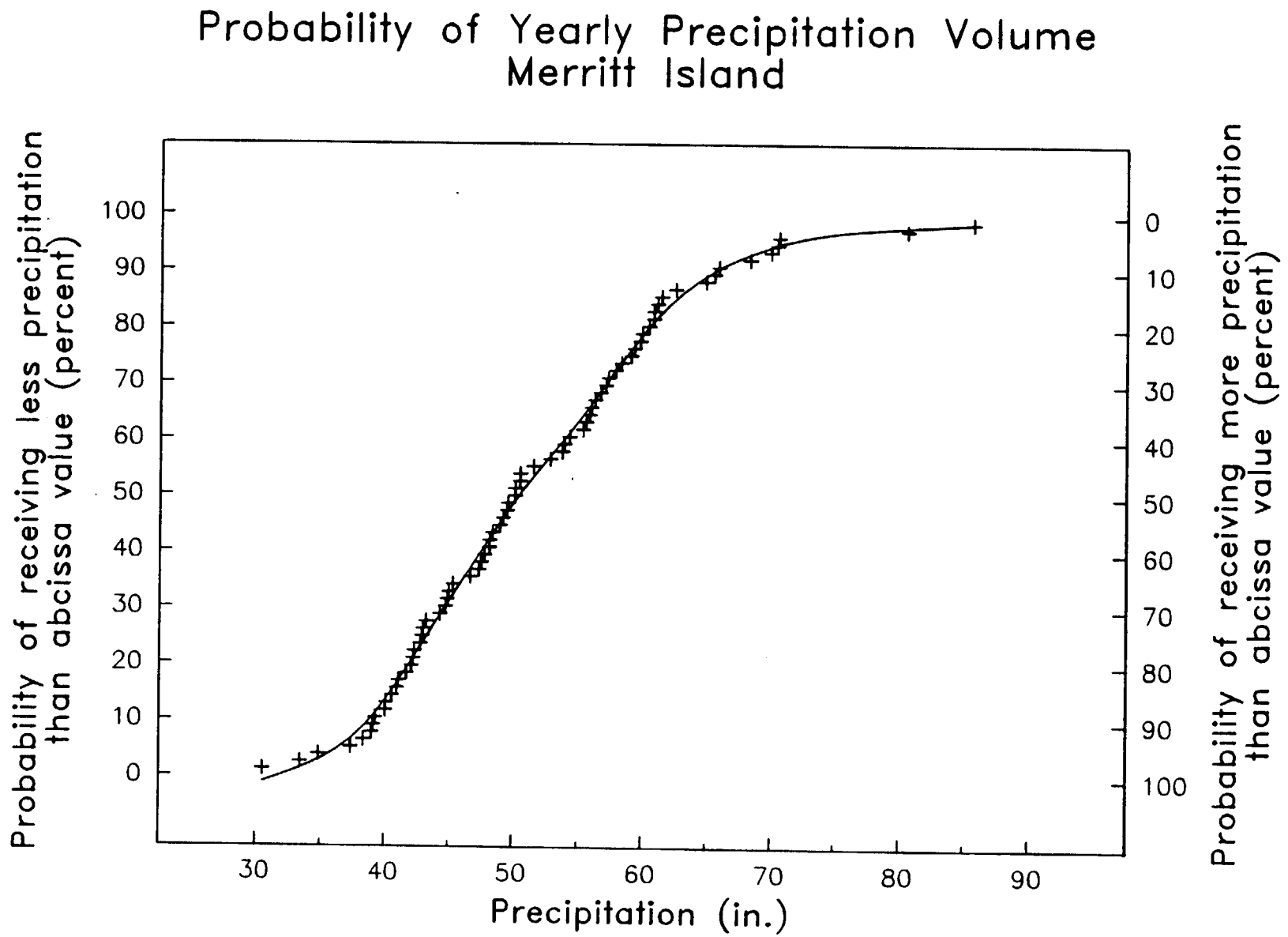

Figure I-5. Probability of Yearly Precipitation Volume, Merritt Island.

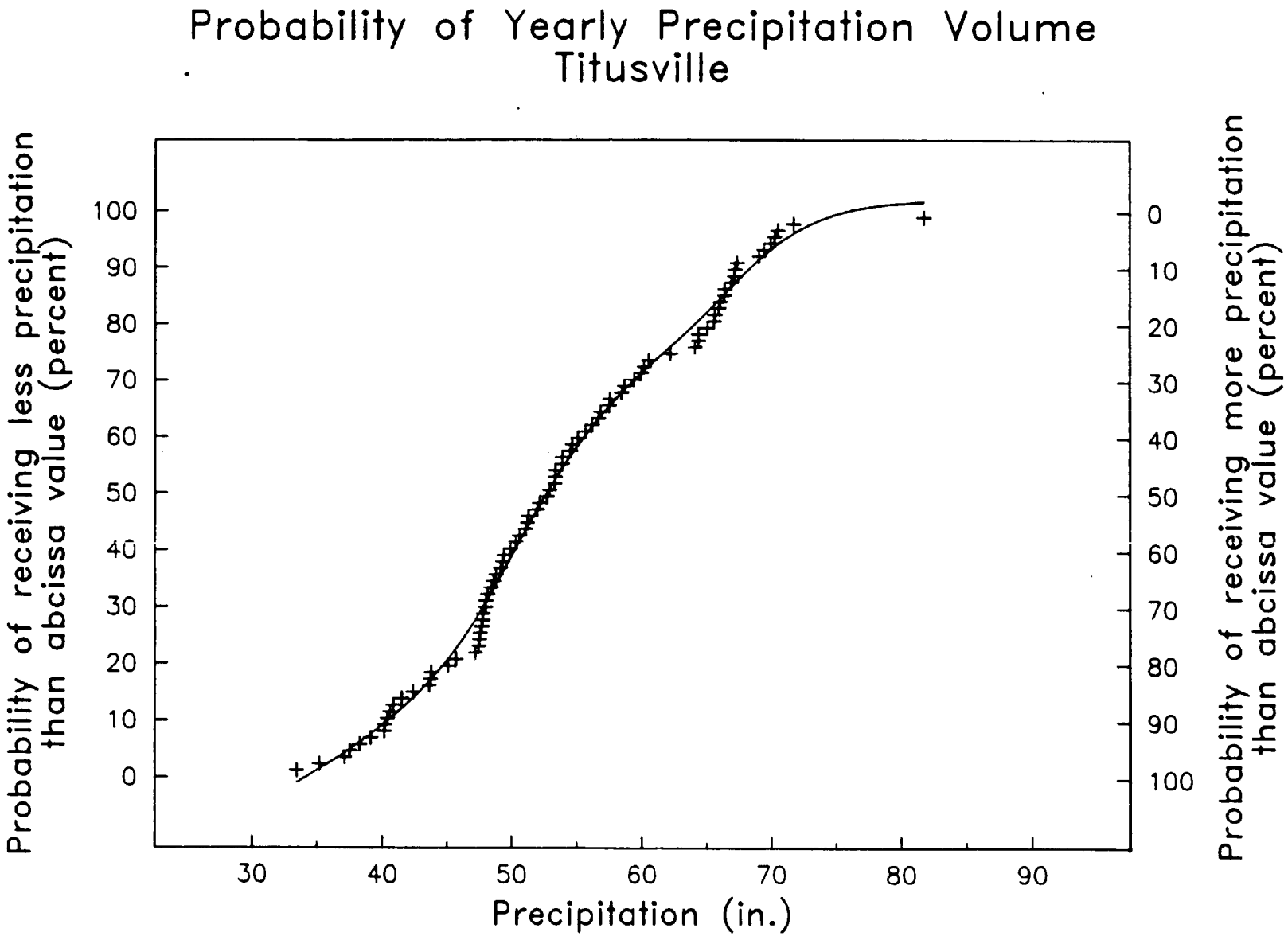

Figure I-6. Probability of Yearly Precipitation Volume, Titusville.

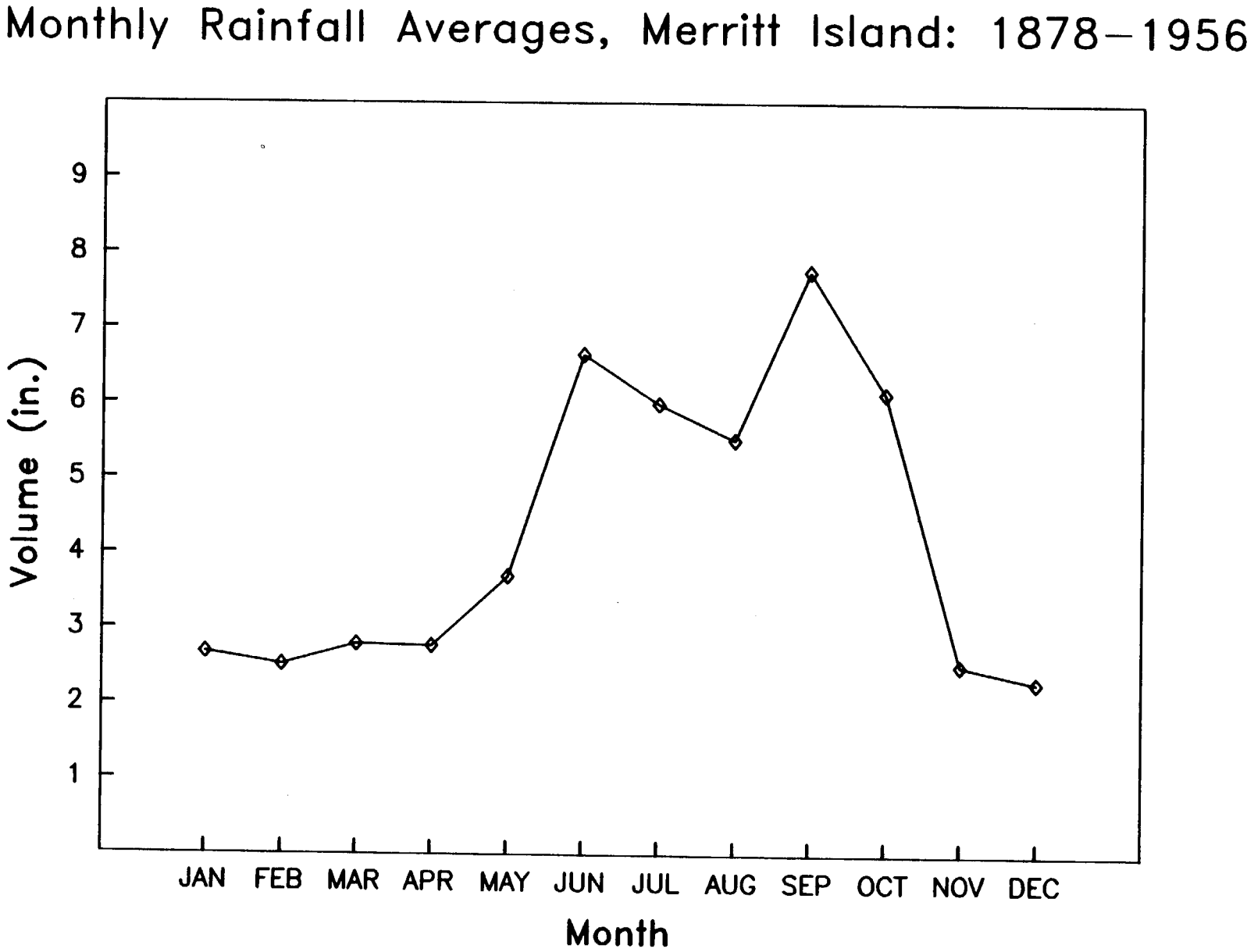

Figure I-7. Monthly Rainfall Averages, Merritt Island: 1878-1956.

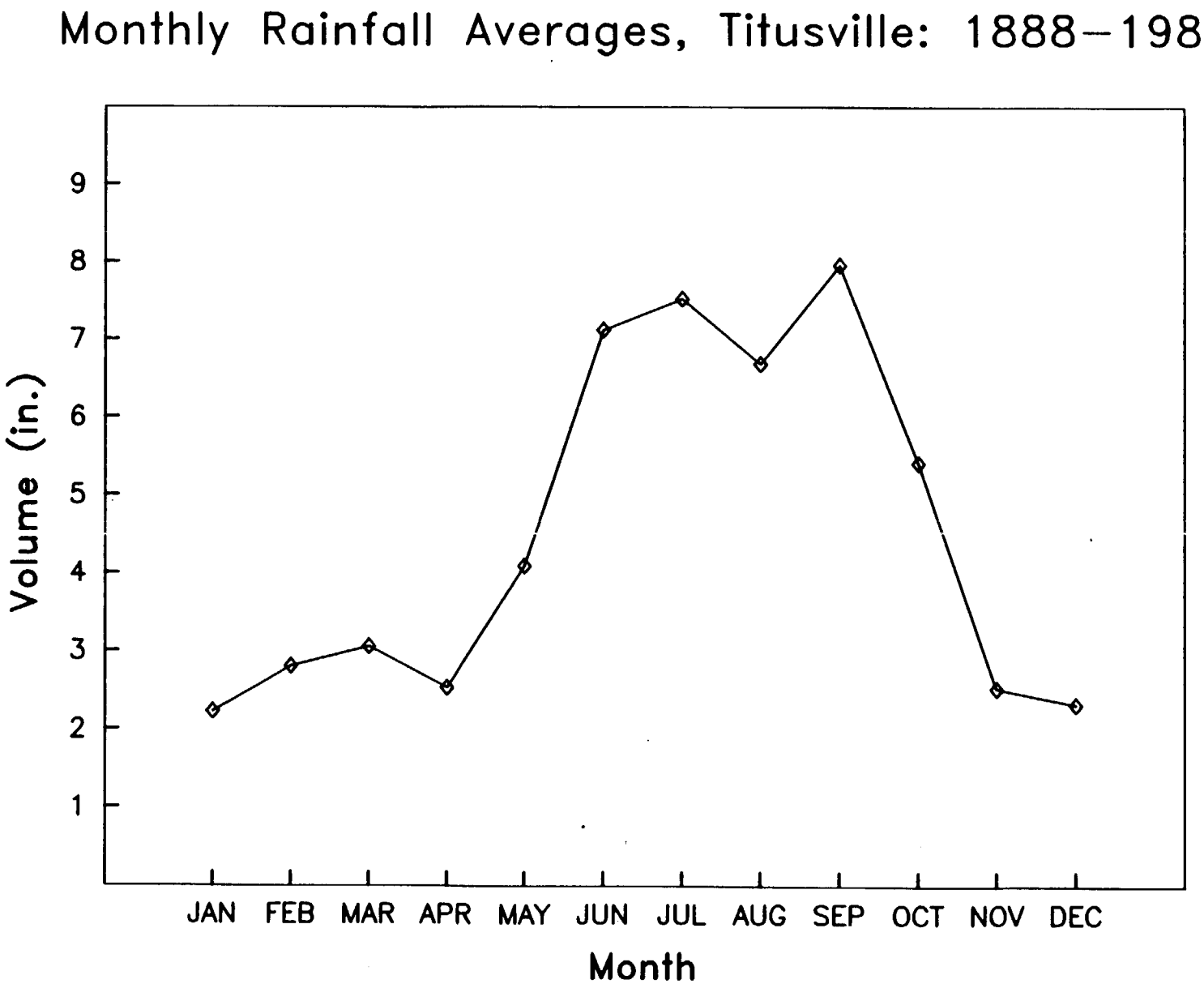

Figure I-8. Monthly Rainfall Averages, Titusville: 1888-1987.

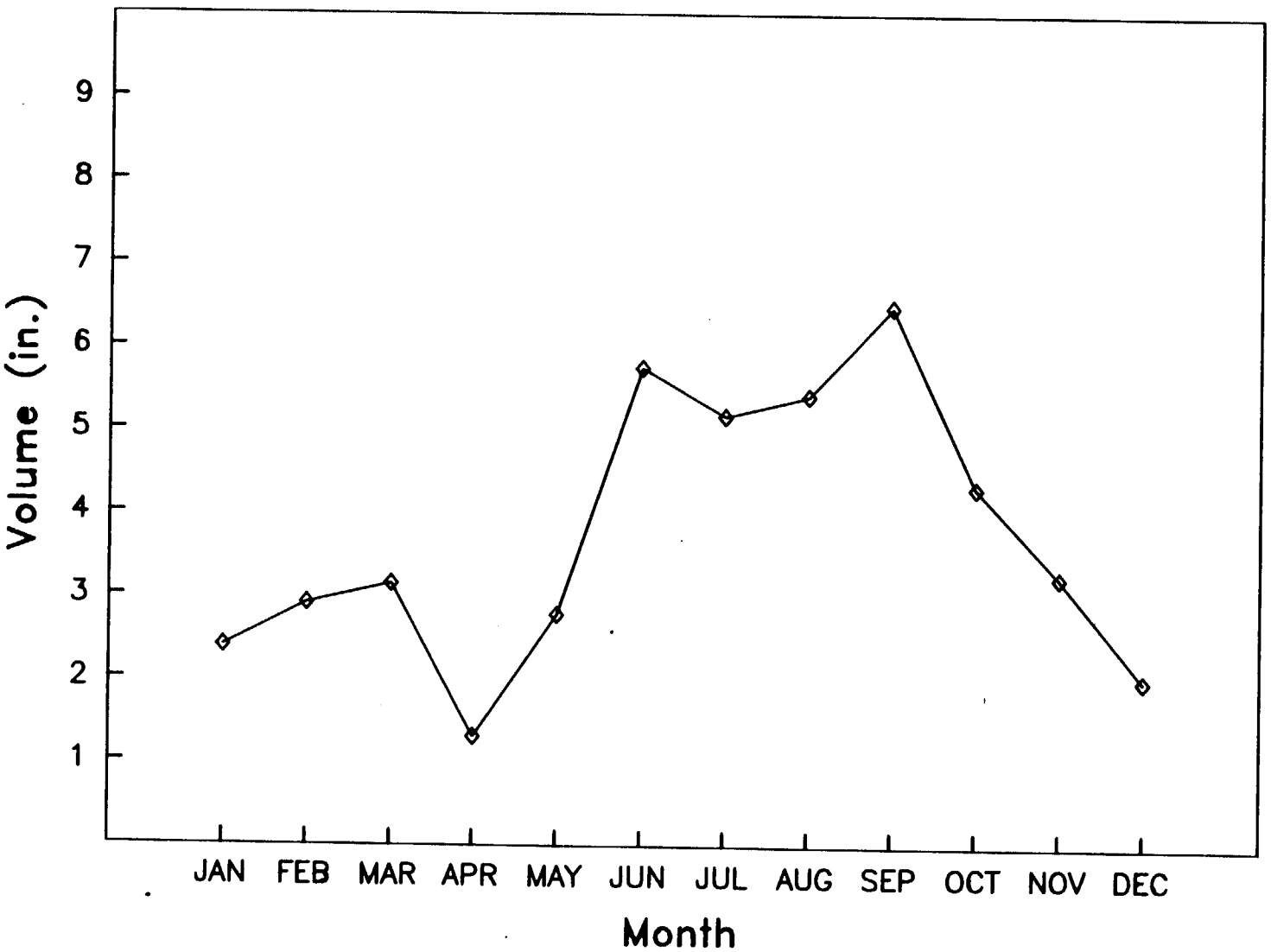

Figure I-9. Monthly Rainfall Averages, Cape Canaveral: 1958-1977.

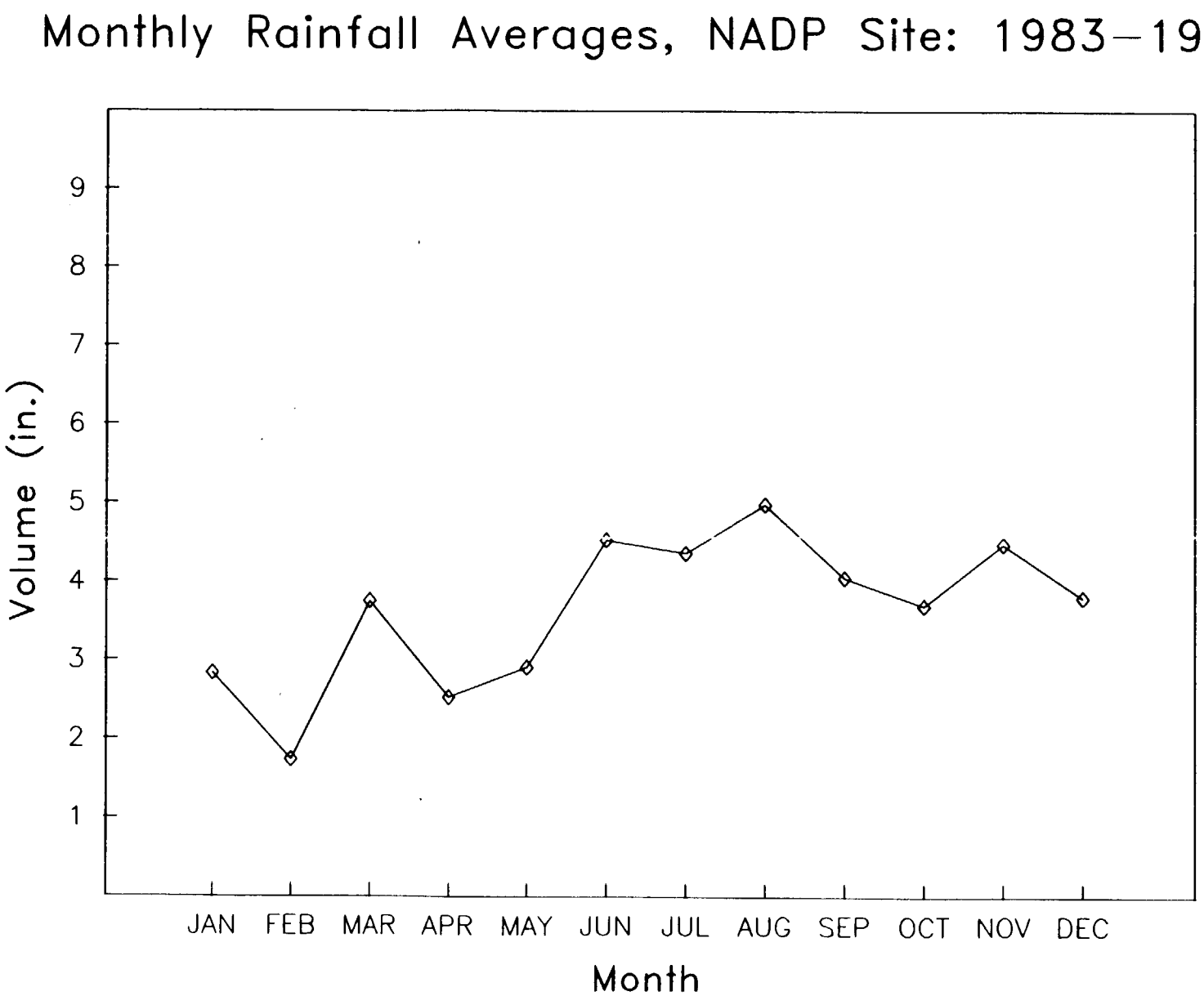

Figure I-10. Monthly Rainfall Averages, NADP Site: 1983-1989.

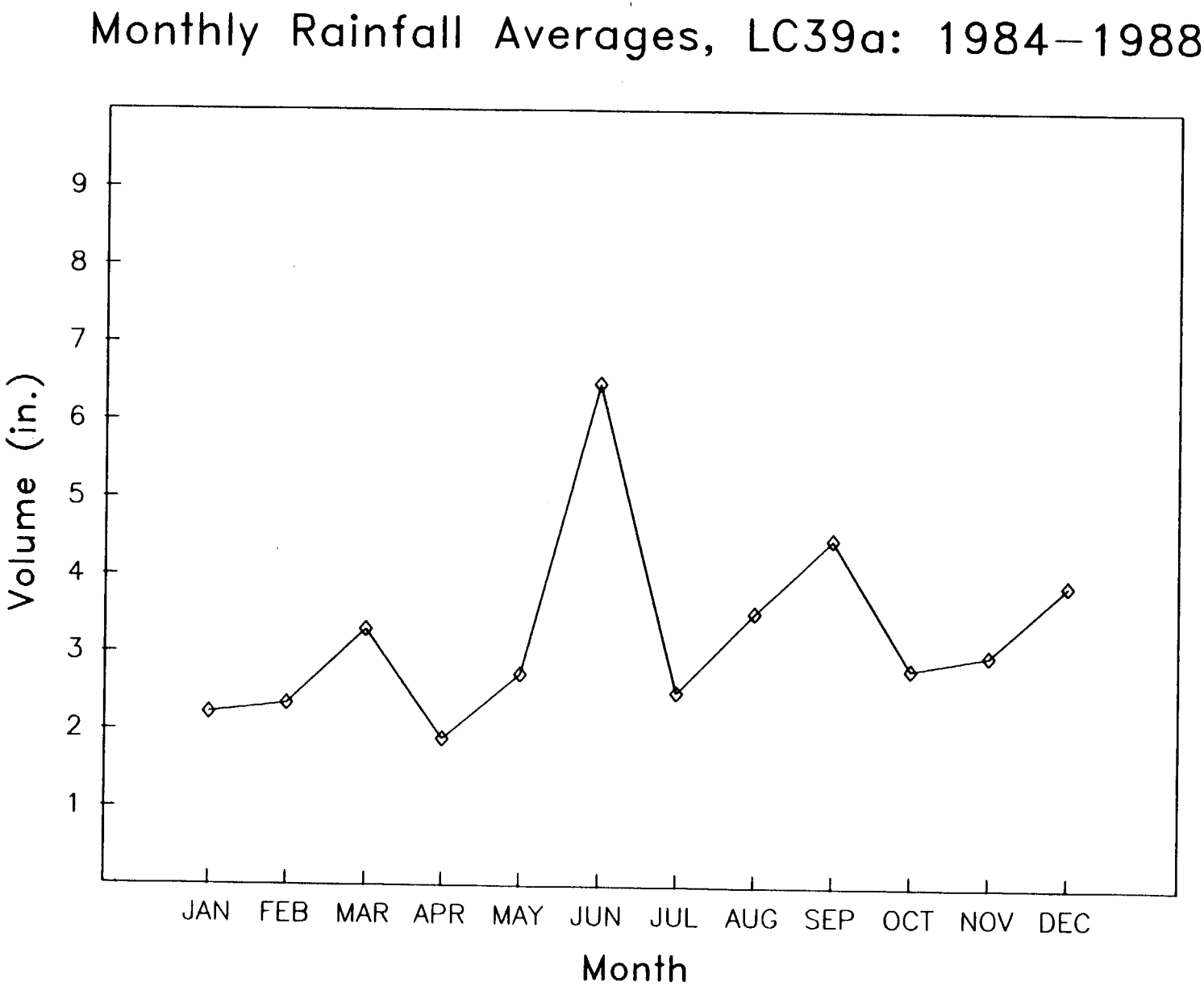

Figure I-11. Monthly Rainfall Averages, LC39A: 1984-1988.

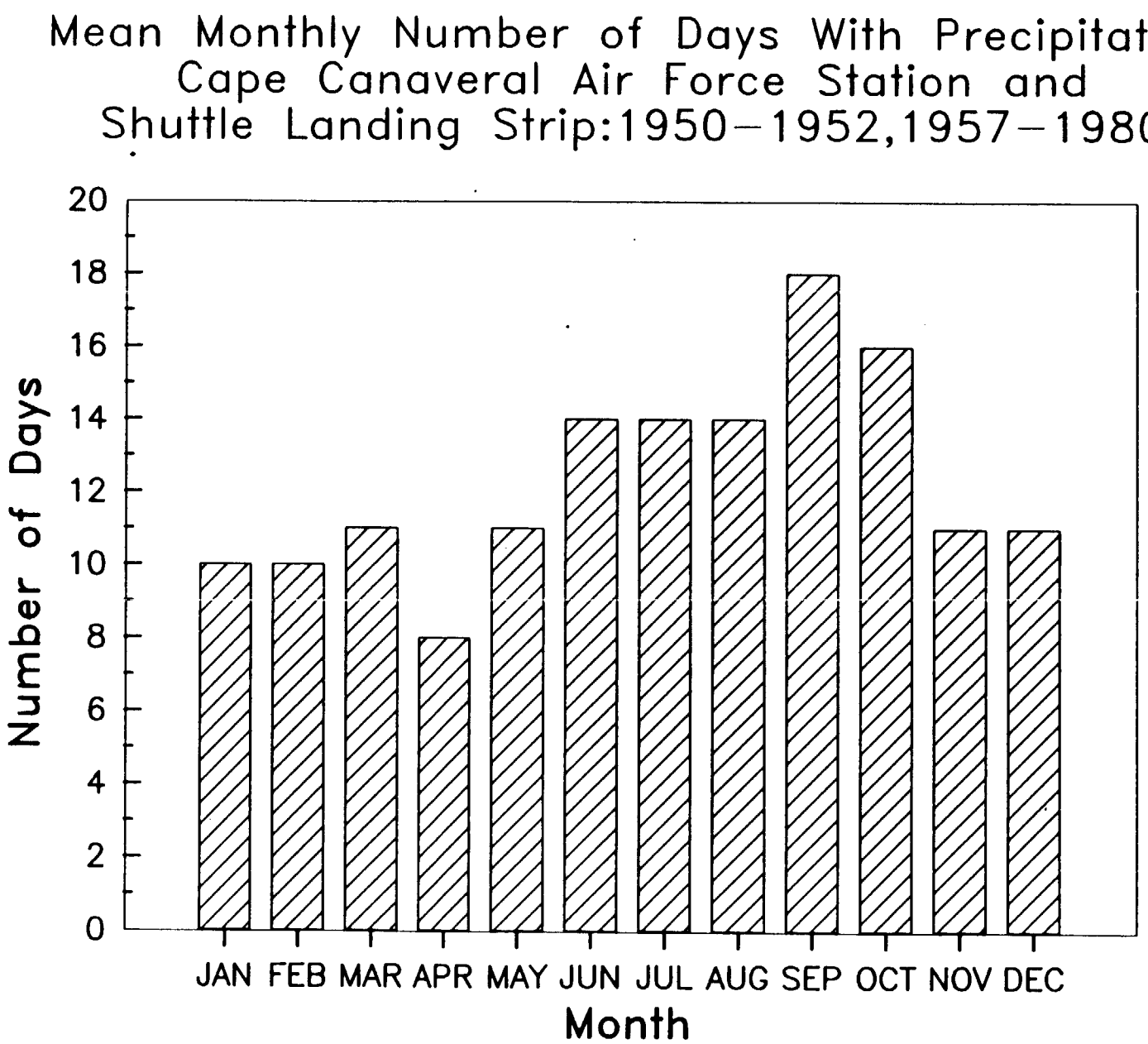

Figure I-12. Mean Monthly Number of Days with Precipitation, Cape Canaveral Air Force Station and Shuttle Landing Strip: 1950-1952, 1957-1980.

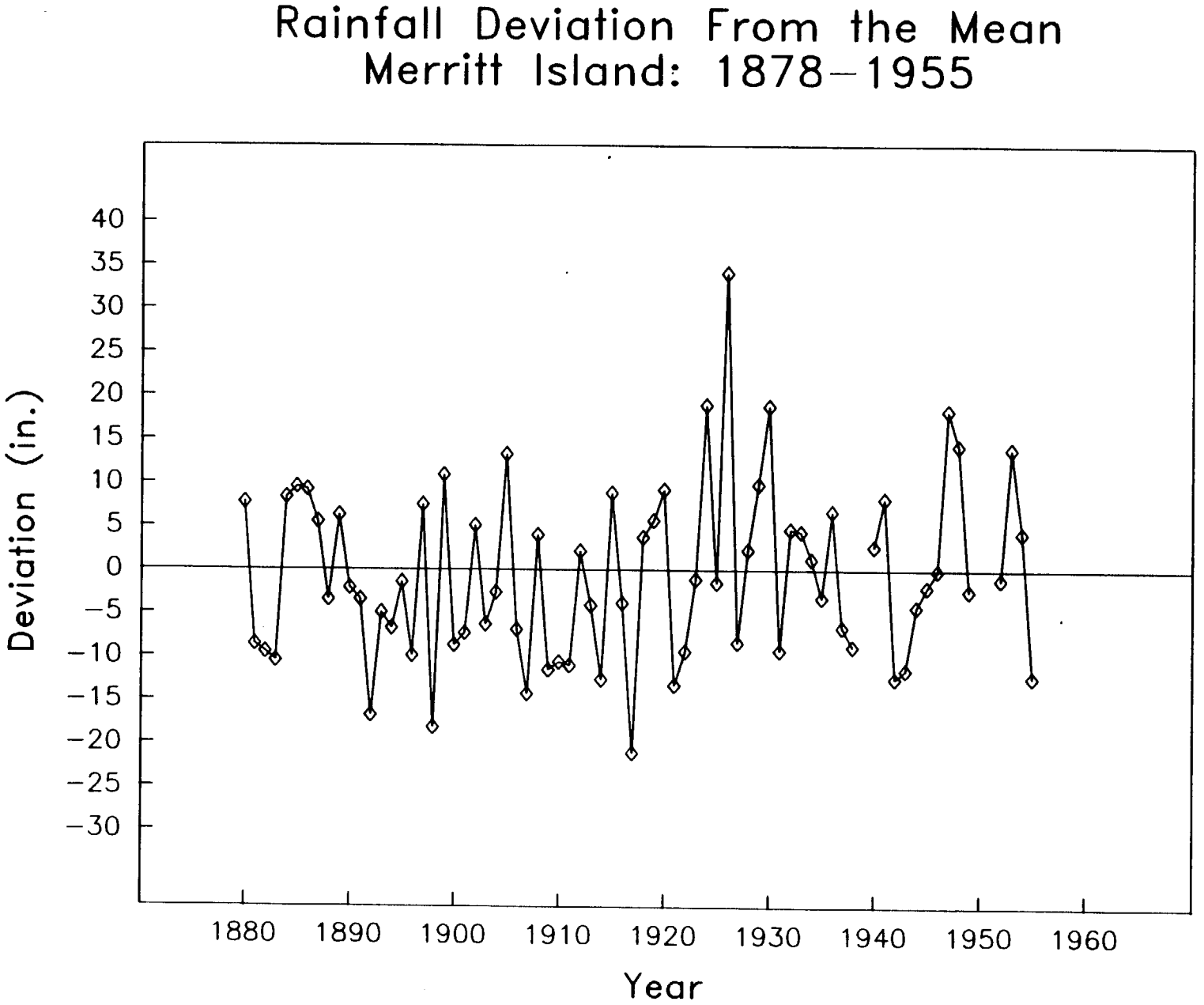

Figure I-13. Rainfall Deviation From The Mean, Merritt Island: 1878-1955.

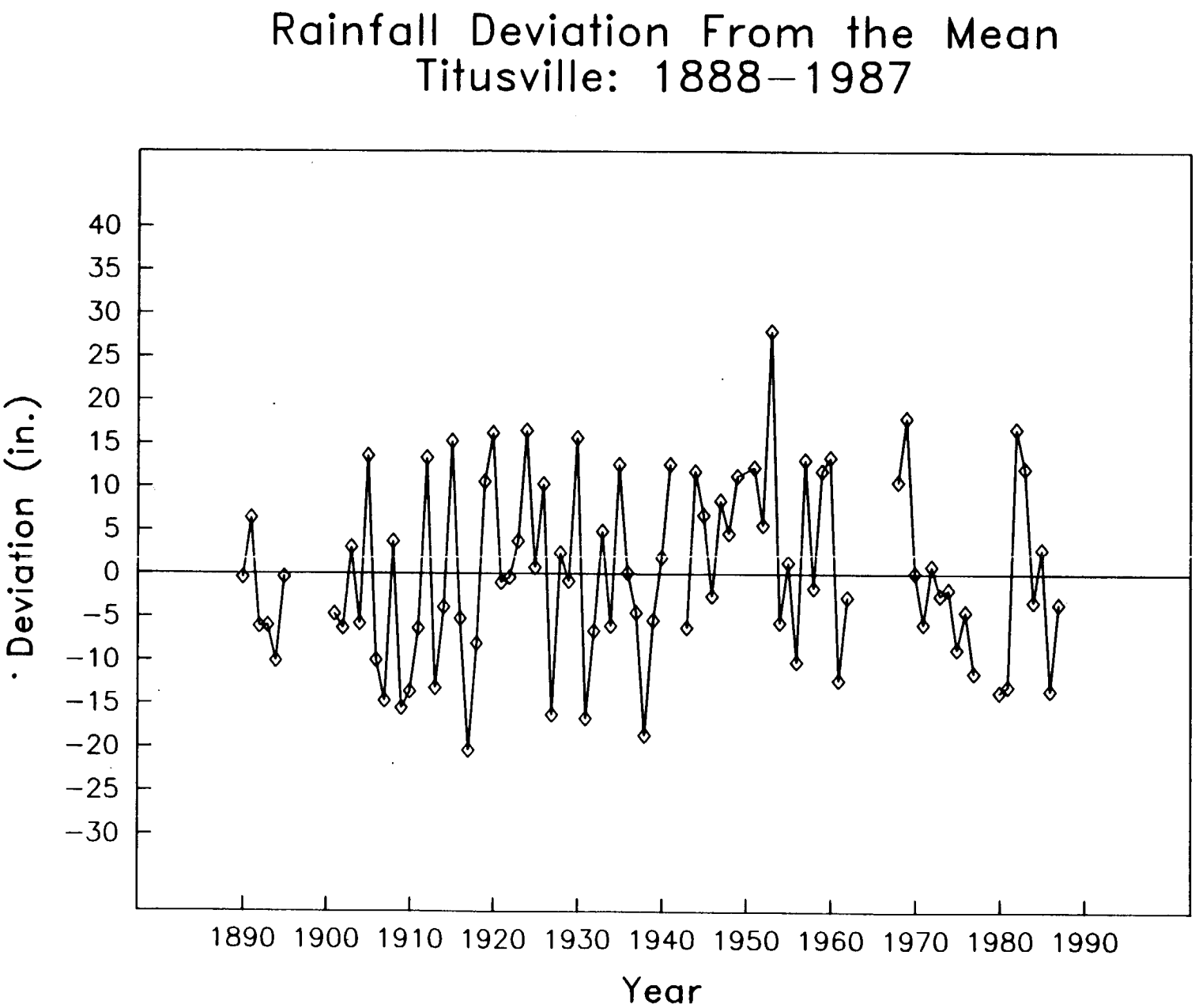

Figure I-14. Rainfall Deviation From The Mean, Titusville: 1888-1987.

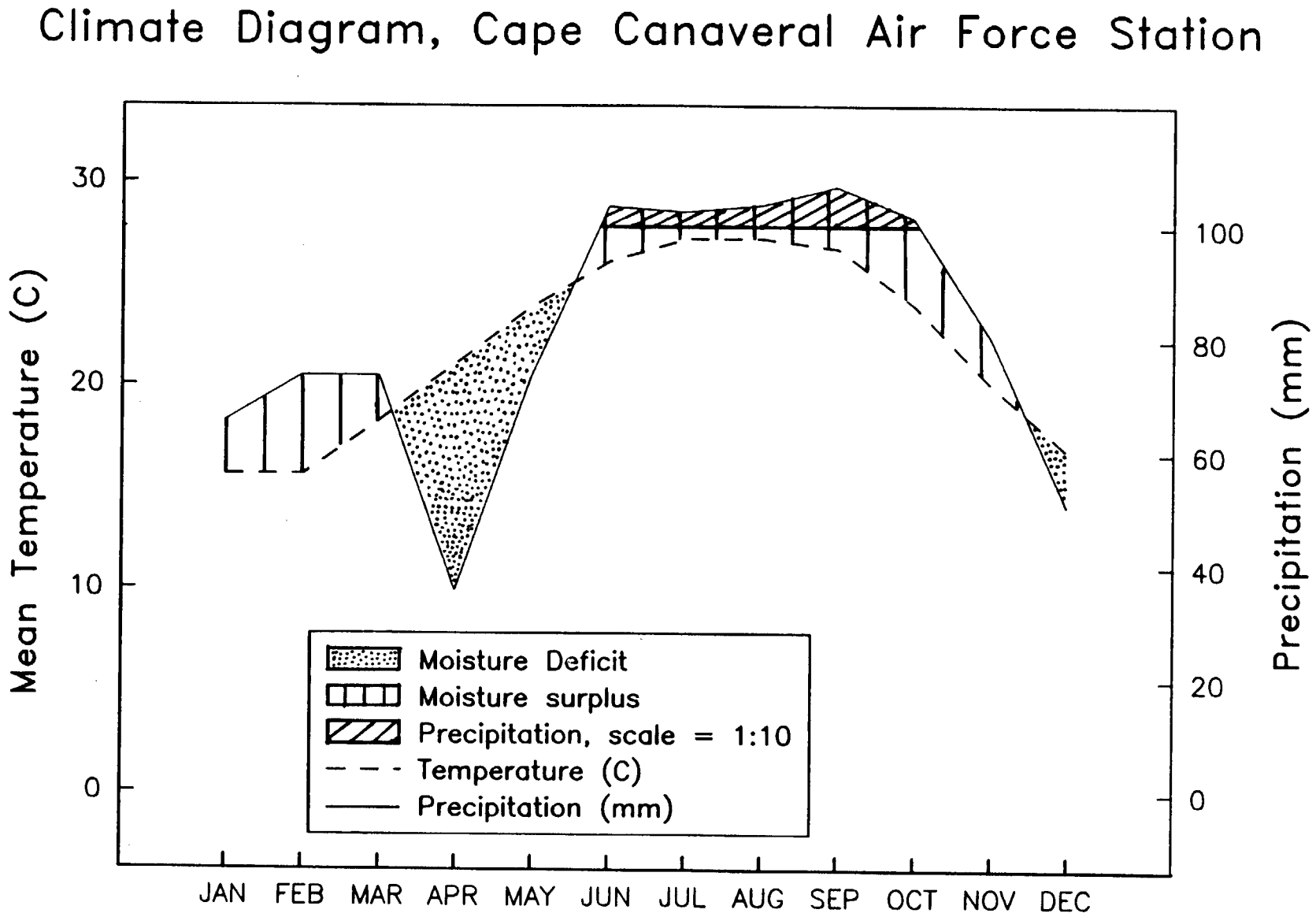

Figure I-15. Climate Diagram: Cape Canaveral Air Force Station.

Note: Precipitation above 100 mm is displayed at 1/10 ordinate scale. For example, September precipitation is actually 175 mm and is displayed at 107.5 mm. See Walter et al. (1975) for a complete description of the climate graph format.

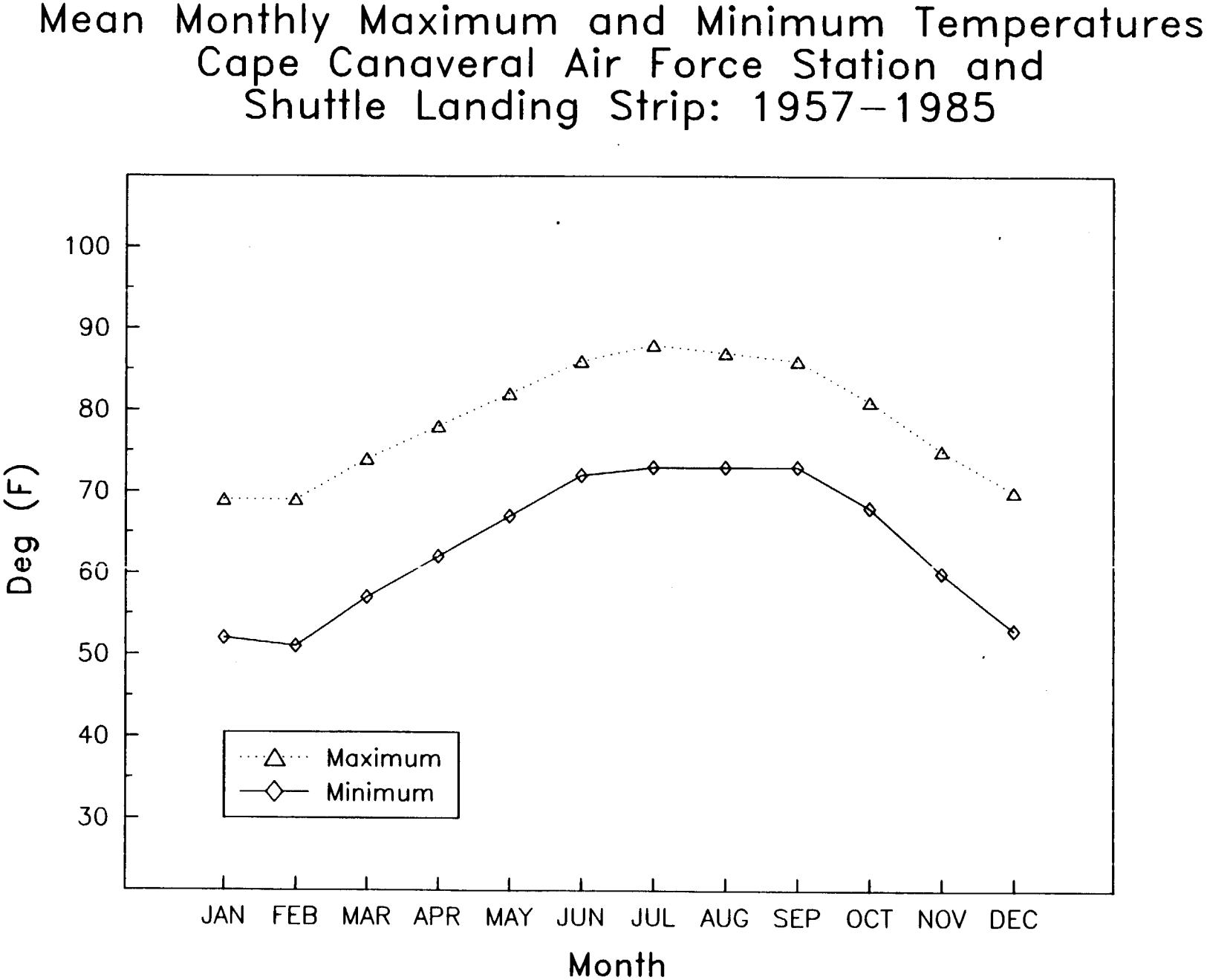

Figure I-16. Mean Monthly Maximum and Minimum Temperatures, Cape Canaveral Air Force Station and Shuttle Landing Strip: 1957-1985.

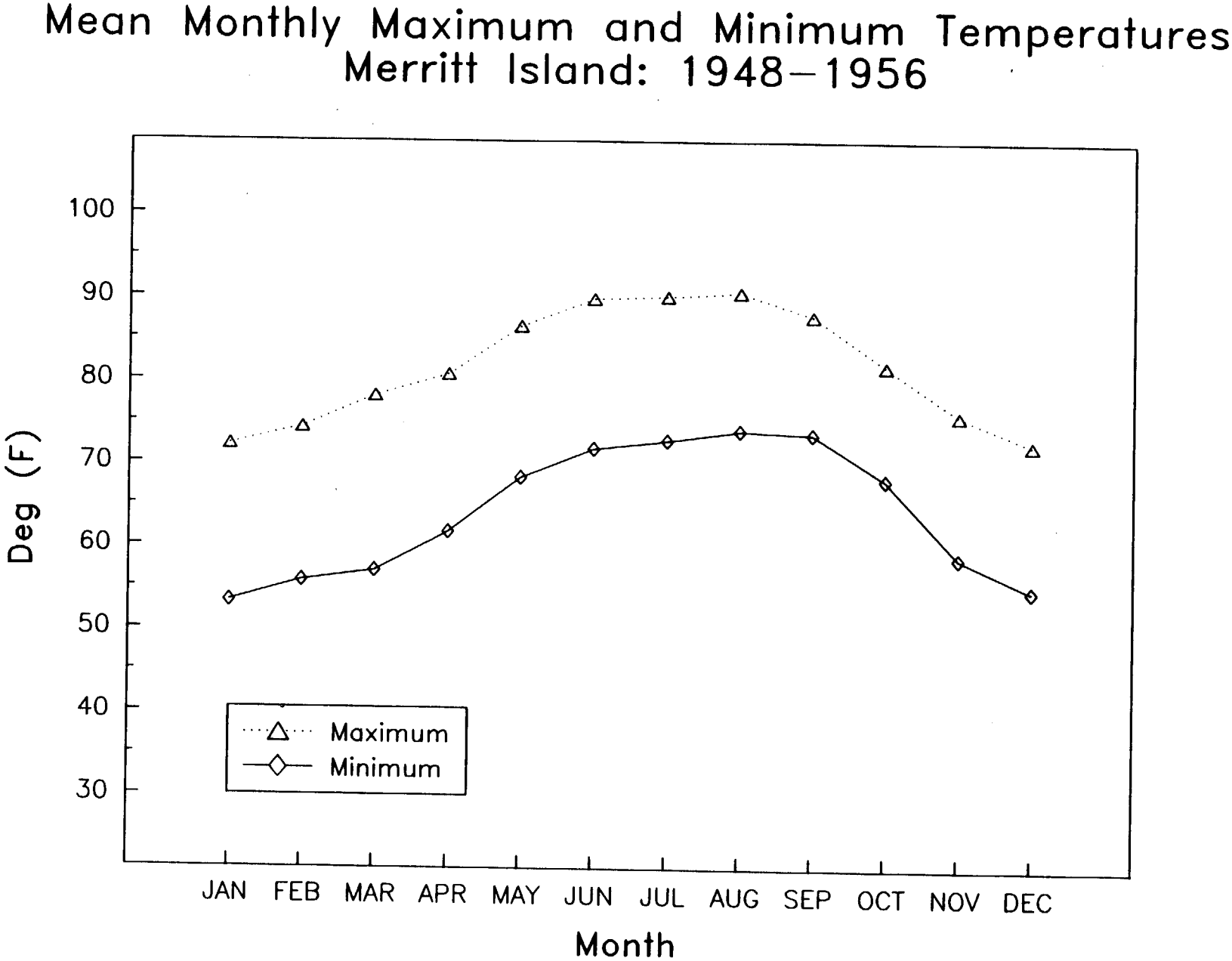

Figure I-17. Mean Monthly Maximum and Minimum Temperatures, Merritt Island, 1948-1956.

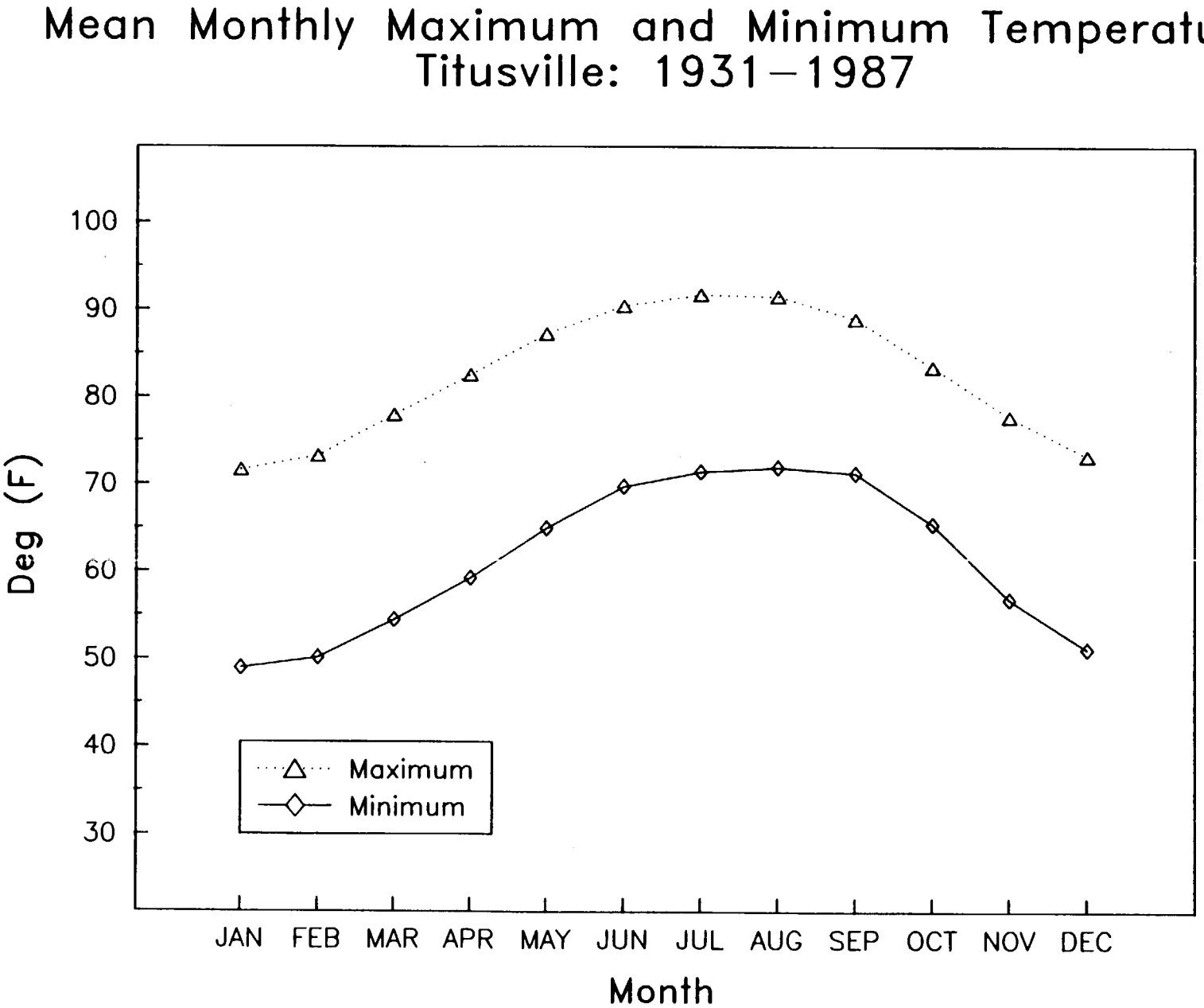

Figure I-18. Mean Monthly Maximum and Minimum Temperatures, Titusville: 1931-1987.

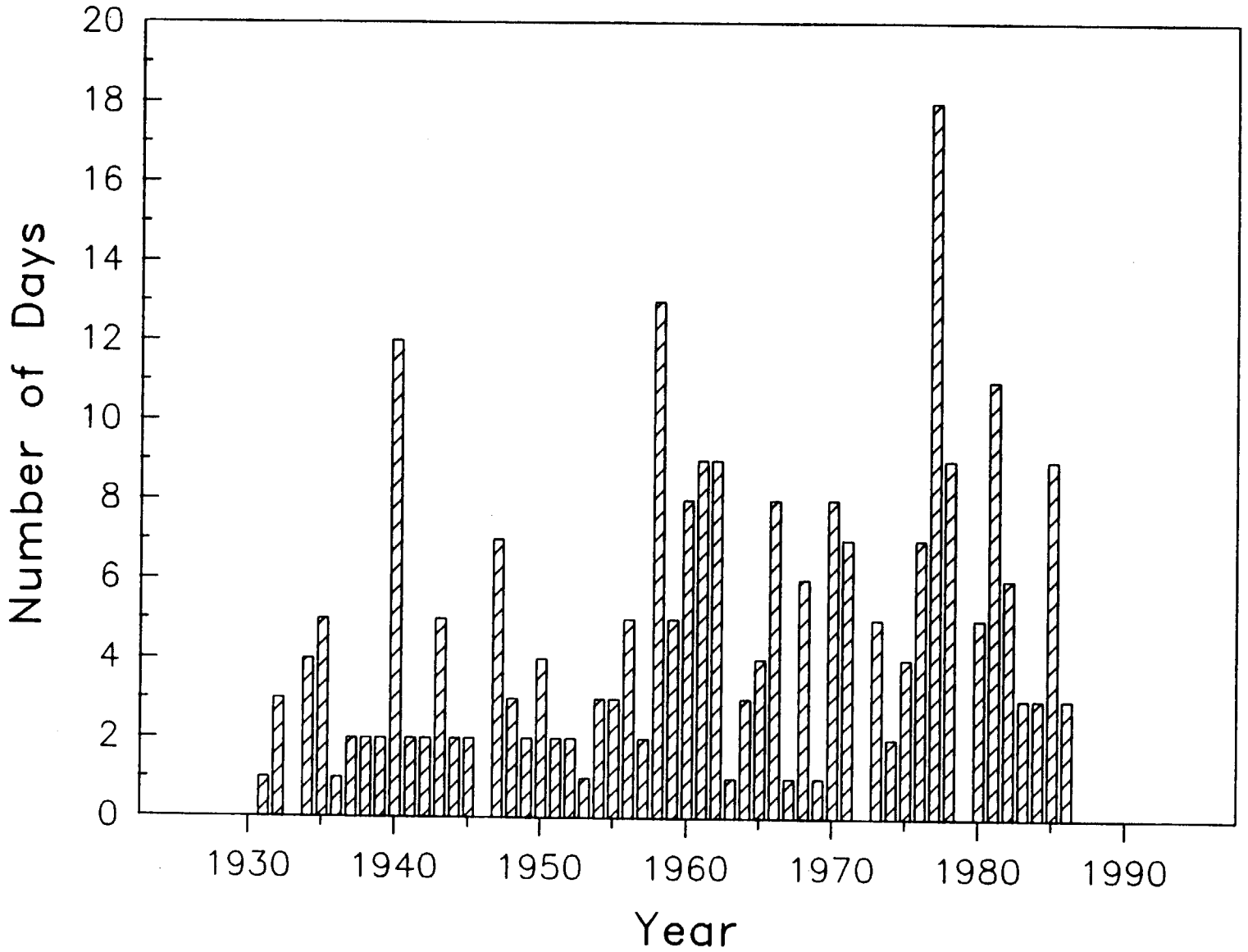

Figure I-19. Number of Days with Temperatures at or Below Freezing, Titusville: 1931-1987.

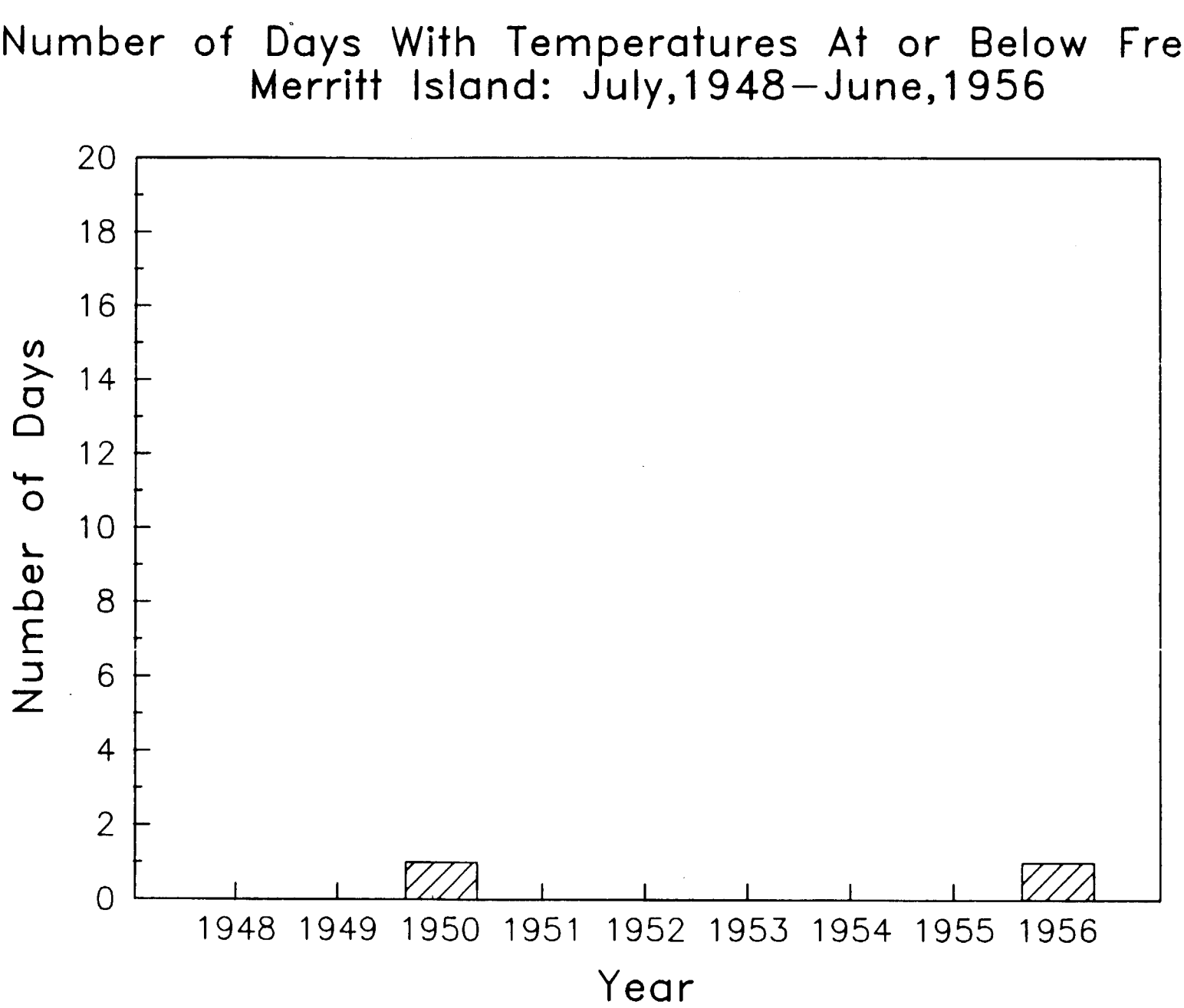

Figure I-20. Number of Days with Temperatures at or Below Freezing, Merritt Island: July 1948-June 1956.

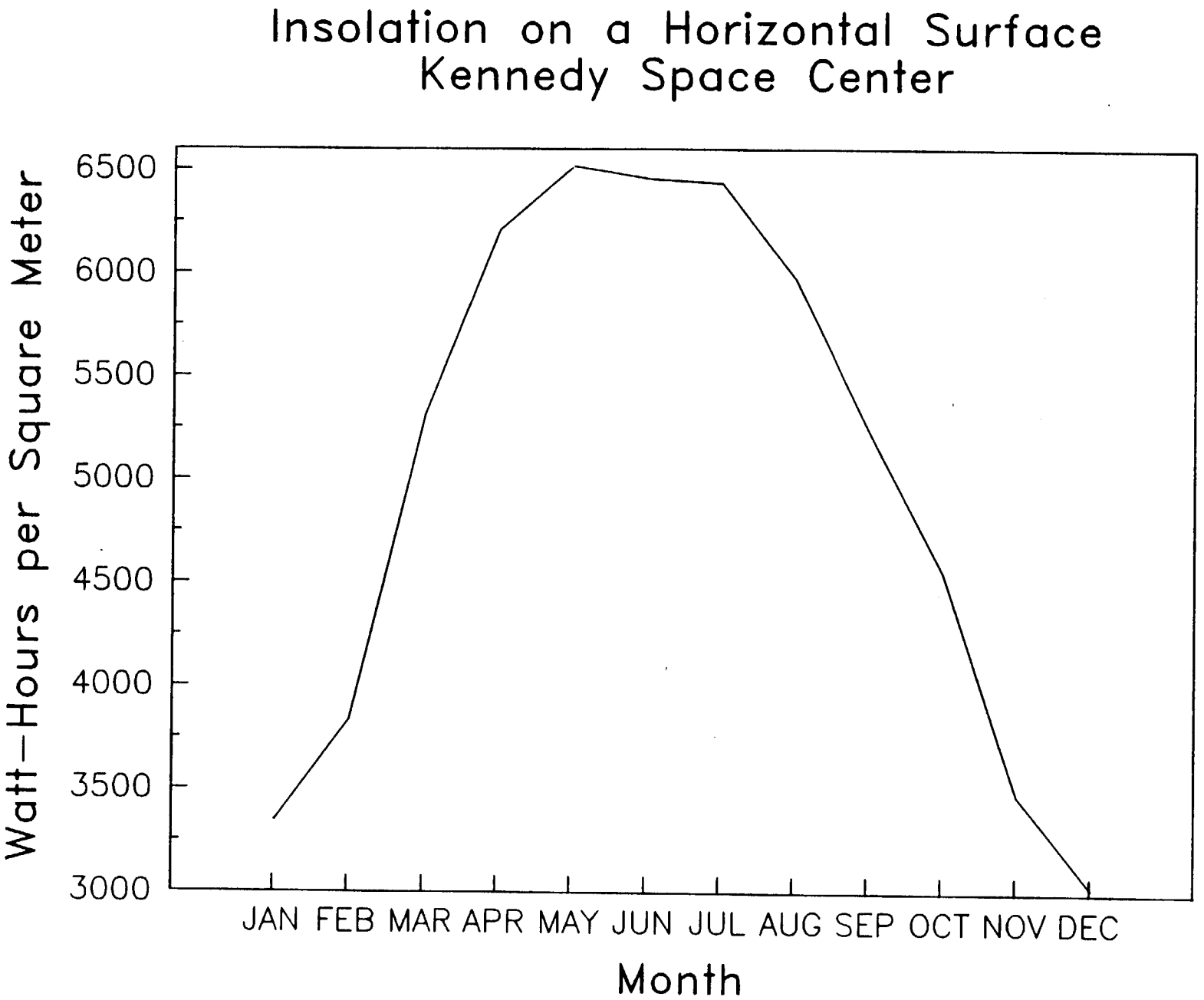

Figure I-21. Insolation on a Horizontal Surface, Kennedy Space Center.

Source: Florida Solar Energy Center (1985).

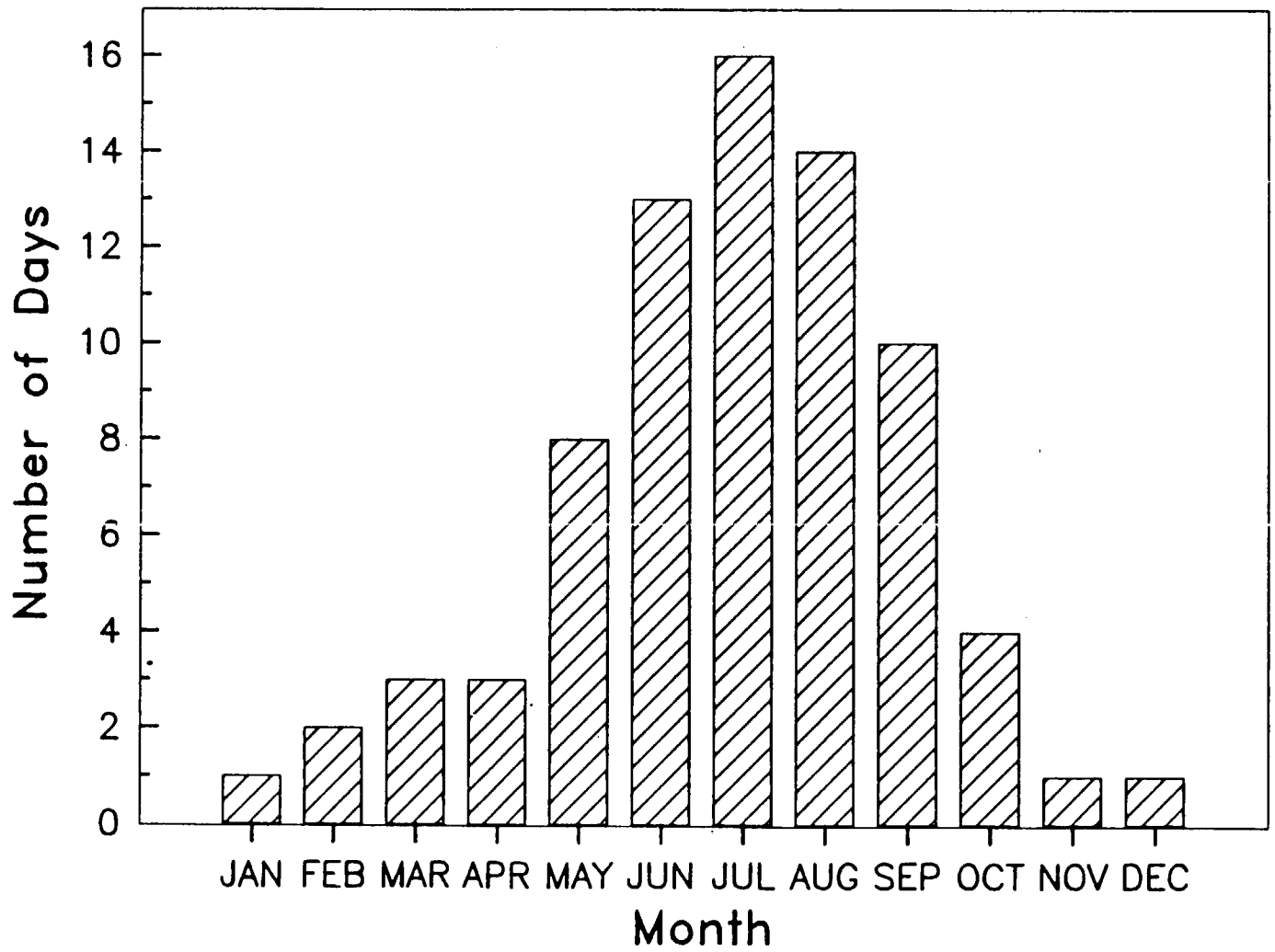

Figure I-22. Mean Monthly Number of Days with Thunderstorms, Cape Canaveral Air Force Station and Shuttle Landing Strip: 1950-1952, 1957-1980.

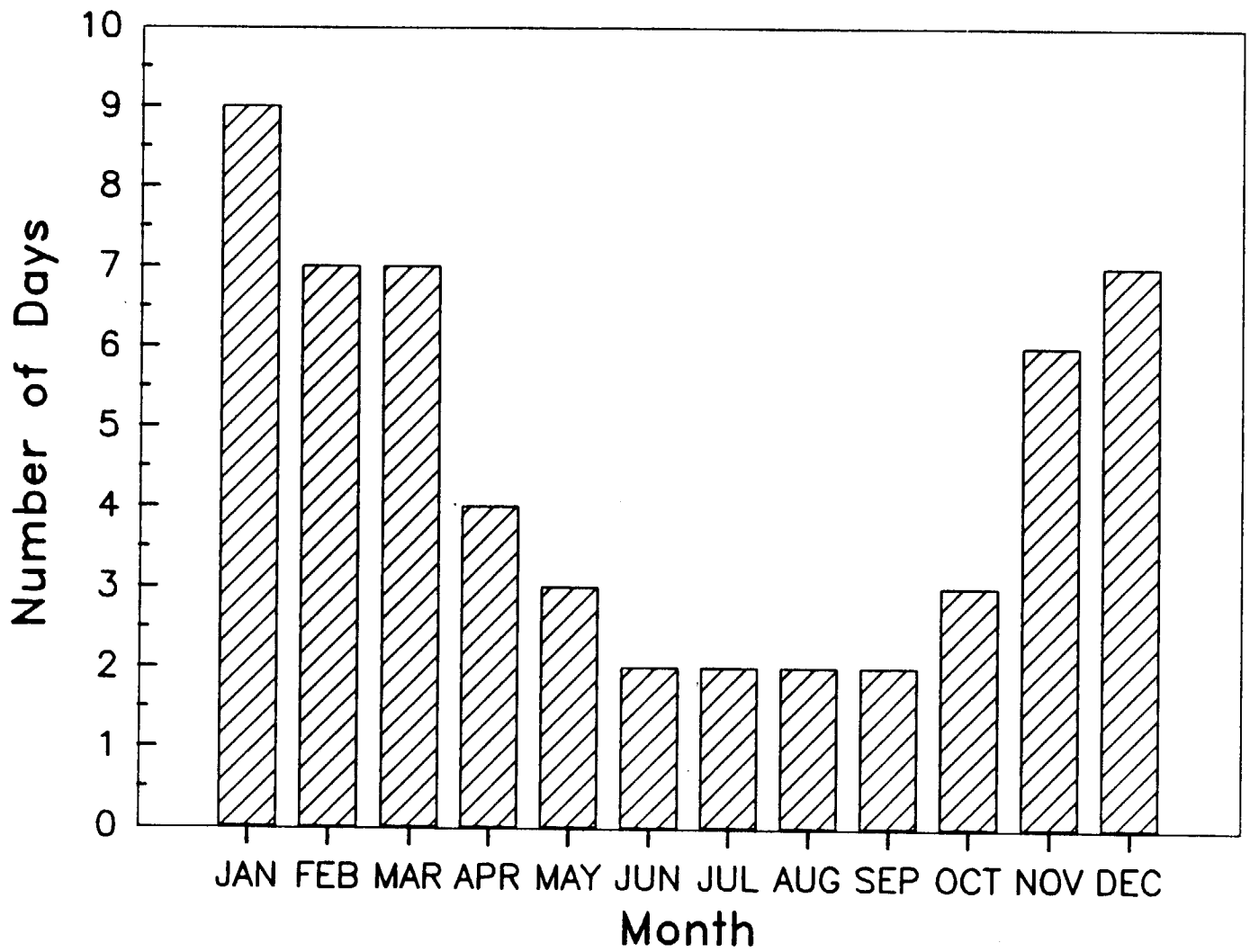

Figure I-23. Mean Monthly Number of Days with Fog, Cape Canaveral Air Force Station and Shuttle Landing Strip: 1950-1952, 1957-1980.

Appendix II

Rain Volume and Temperature Database Listing

Table II-1. Rain Volume Database Listing.

Areas	Station	Type[a]	Period	Collection Agency	Notes
Titusville	RVLTVL02	DAILY	1/2/1931 - 12/31/1983	NOAA	City of Titusville - Dunn Airport operational
	RVLTVL02	MONTHLY	7/1887 - 12/1895, 1/1901 - 9/1988[b]		
	RVLTVL02	YEARLY	1888 - 1895, 1901 - 1987[b]		
Merritt Island	RVLMTI02	DAILY	7/2/1948 - 6/30/1956	NOAA	Collected on Merritt Island defunct
	RVLMTI01	MONTHLY	1/1878 - 6/1956, 8/1978[c]		
	RVLMTI01	YEARLY	1878 - 1955[c]		
CCAFS	RVLCAS01	MONTHLY	2/1957 - 1/1978	USAF	Cape Canaveral Air Force Station-defunct
Nadpsite	RVLCIF81	DAILY	7/8/1983 - 12/23/1989	NASA	National Atmospheric Deposition Program site - near KSC industrial area operational
	RVLCIF81T	MONTHLY	8/1983 - 12/1989		
LC39A	RVLLCA01	DAILY	1/19/1984 - 5/26/1988	NASA	Launch Complex 39A on KSC operational
Shuttle1	RVLBCW01	DAILY	12/2/1981 - 5/26/1988	USAF	Shuttle Landing Facility on KSC operational
	RVLBCW01	MONTHLY	3/1979 - 11/1981		
Marsh	RVLBCE01	DAILY	3/13/1984 - 12/31/1986	NASA	Located near the Launch Control Complex on KSC defunct
Patrick	RVLPAF01	DAILY	10/7/1986 - 5/26/1988	USAF	Patrick Air Force Base Operational

Table II-1. (continued).

These records are archived on the NASA Biomedical Operations and Research Office's HP-9000 computer and are accessible using Hewlett Packard SQL Software. Address inquires to: Bioscience Officer, Biomedical Operations and Research Office, John F. Kennedy Space Center, FL 32899.

a Daily records have not been checked for missing data.
b Incomplete records for 1942, 1950, 1963, 1964, 1965, 1966, 1967, 1978, and 1979
c Incomplete records for 1939, 1950, and 1951

Table II-2. Temperature Database Listing.

Areas	Station	Type	Period[a]	Collecting Agency	Notes
Titusville	TMNTVL02	Temp. Min	1/2/1931 - 9/30/1988	NOAA	Daily minimun and maximum temperatures from city of Titusville's Dunn Airport
	TMXTVL02	Temp. Max	1/2/1931 - 9/30/1988		
Merritt Island	TMNMTI02	Temp. Min	7/2/1948 - 6/30/1956	NOAA	Daily minimun and maximum temperatures from Merritt Island
	TMXMTI02	Temp. Max	7/2/1948 - 6/30/1956		

These records are archived on the NASA Biomedical Operations and Research Office's HP-9000 computer and are accessible using Hewlett Packard SQL Software. Address inquires to: Bioscience Officer, Biomedical Operations and Research Office, John F. Kennedy Space Center, FL 32899.

a Pre-1931 summary data are presented in Appendix III.

Appendix III

Temperature Data for Merritt Island and Titusville

For the period up to 1930

Table III-1. Temperature data for Merritt Island and Titusville from the beginning of record up to 1930.[a,b]

	Mean Temperature		Mean Maximum Temperature		Mean Minimum Temperature		Highest Temperature		Lowest Temperature	
	Merritt Island	Titusville	Merritt Island	Titusville	Merritt Island	Titusville	Merritt Island	Titusville	Merritt Island	Titusville
January	62.0	60.8	69.6	70.1	54.1	51.4	89	86	24	19
February	63.6	62.1	70.9	72.0	55.0	52.4	86	90	22	19
March	67.1	65.8	75.5	75.2	59.3	55.9	90	94	35	31
April	71.4	70.3	79.1	79.8	63.4	60.2	91	95	40	34
May	76.0	75.3	83.5	84.6	68.8	65.6	96	99	48	47
June	79.4	79.3	86.4	87.9	72.8	70.3	96	100	59	57
July	81.1	81.2	88.0	90.2	74.4	72.1	95	102	65	62
August	81.3	81.4	88.3	89.9	74.6	72.9	97	100	64	64
September	79.9	79.8	86.2	87.1	73.8	72.2	94	101	56	58
October	75.3	74.2	81.4	81.8	69.7	66.3	93	99	48	42
November	68.2	66.6	75.3	75.2	61.7	58.1	89	92	33	30
December	62.9	61.7	70.4	71.1	55.2	52.1	85	87	22	18
Annual	72.4	71.5	79.6	80.4	65.2	62.5	97	102	22	18
Length of record (years)	48	38	39	38	39	38	39	38	39	38

[a] U.S. Department of Commerce, Weather Bureau. 1933. Climatic summary of the United States, Section 105, Southern Florida. Washington, D.C.

[b] Merritt Island station operated from 1878 and Titusville from 1887 but not continuously for all parameters.

Table III-2. Occurrences of freezing temperatures at Merritt Island and Titusville from the beginning of record up to 1930.[a]

Season	Number of days with minimum temperatures of 32°F, 25°F, 20°F, 18°F, or below, respectively							
	Merritt Island				Titusville			
	32°	25°	20°	18°	32°	25°	20°	18°
1887-1888	-	-	-	-	1	0	0	0
1889-1889	-	-	-	-	1	0	0	0
1889-1890	-	-	-	-	0	0	0	0
1890-1891	-	-	-	-	0	0	0	0
1891-1892	0	0	0	0	0	0	0	0
1892-1893	0	0	0	0	2	0	0	0
1893-1894	0	0	0	0	0	0	0	0
1894-1895	4	2	0	0	5	3	2	1
1895-1896	0	0	0	0	-	-	-	-
1896-1897	2	0	0	0	-	-	-	-
1897-1898	3	0	0	0	-	-	-	-
1898-1899	3	1	0	0	-	-	-	-
1899-1900	3	0	0	0	-	-	-	-
1900-1901	0	0	0	0	2	0	0	0
1901-1902	2	0	0	0	9	0	0	0
1902-1903	0	0	0	0	1	0	0	0
1903-1904	0	0	0	0	-	-	-	-
1904-1905	2	1	0	0	8	1	1	0
1905-1906	0	0	0	0	0	0	0	0
1906-1907	2	0	0	0	-	-	-	-
1907-1908	0	0	0	0	3	0	0	0
1908-1909	2	0	0	0	3	0	0	0
1909-1910	4	0	0	0	6	1	0	0
1910-1911	0	0	0	0	2	0	0	0
1911-1912	0	0	0	0	1	0	0	0
1912-1913	0	0	0	0	0	0	0	0
1913-1914	0	0	0	0	1	0	0	0
1914-1915	0	0	0	0	1	0	0	0
1915-1916	0	0	0	0	0	0	0	0
1916-1917	3	0	0	0	4	2	0	0
1917-1918	2	0	0	0	11	2	0	0
1918-1919	0	0	0	0	1	0	0	0
1919-1920	0	0	0	0	4	0	0	0

Table III-2 (continued).

Season	Number of days with minimum temperatures of 32°F, 25°F, 20°F, 18°F, or below, respectively							
	Merritt Island				Titusville			
	32°	25°	20°	18°	32°	25°	20°	18°
1920-1921	0	0	0	0	0	0	0	0
1921-1922	0	0	0	0	2	0	0	0
1922-1923	0	0	0	0	0	0	0	0
1923-1924	0	0	0	0	0	0	0	0
1924-1925	1	0	0	0	1	0	0	0
1925-1926	1	0	0	0	3	0	0	0
1926-1927	0	0	0	0	4	0	0	0
1927-1928	4	0	0	0	8	1	0	0
1928-1929	0	0	0	0	1	0	0	0
1929-1930	0	0	0	0	2	0	0	0

[a] U.S. Department of Commerce, Weather Bureau. 1933. Climatic summary of the United States, Section 105, Southern Florida. Washington, D.C.

Table III-3. Dates of temperature of 32°F (0°C) and below at Merritt Island and Titusville from the beginning of record up to 1930.[a]

Year	Merritt Island	Titusville
1887	[b]	Nov 21, 32°F
1888	[b]	Dec 21, 32°F
1889	[b]	None
1890	[b]	None
1891	[b]	Apr 7, 7[c]
1892	None	None
1893	None	Jan 14, 29°F; Jan 17, 30°F
1894	Dec 29, 22°F; Dec 30, 32°F	Dec 29, 18°F; Dec 30, 28°F
1895	Feb 8, 22°F; Feb 9, 26°F	Feb 8, 19°F; Feb 9, 22°F; Feb 10, 30°F
1896	None	[b]
1897	Jan 28, 29°F; Jan 29, 31°F	[b]
1898	Jan 2, 28°F; Jan 3, 30°F; Jan 4, 32°F	[b]
1899	Feb 9, 32°F; Feb 13, 29°F; Feb 14, 24°F	[b]
1900	Jan 3, 32°F; Feb 18, 30°F; Feb 19, 32°F	[b]
1901	Dec 21, 30°F; Dec 22, 31°F	Feb 24, 30°F; Feb 25, 28°F; Dec 18, 32°F; Dec 19, 28°F; Dec 20, 32°F; Dec 21, 25°F
1902	None	Jan 14, 26°F; Jan 23, 31°F; Feb 11, 30°F; Feb 12, 31°F; Feb 19, 31°F

Table III-3. (continued).

Year	Merritt Island	Titusville
1903	None	Jan[b]; Feb 18, 30°F; Nov[b]; Dec[b]
1904	None	Jan[b], Feb[b]; Dec 21, 29°F; Dec 22, 30°F
1905	Jan 26, 24°F; Jan 27, 31°F	Jan 8, 31°F; Jan 26, 19°F; Jan 27, 26°F; Jan 28, 27°F; Jan 29, 28°F; Feb 16, 32°F
1906	Dec 24, 30°F; Dec 25, 29°F	Nov[b]; Dec[b]
1907	None	Jan[b]; Feb[b]
1908	None	Jan 25, 32°F, Feb 3, 31°F; Feb 29, 32°F
1909	Jan 31, 31°F; Feb 1, 33°F Dec 30, 28°F; Dec 31, 32°F	Jan 31, 29°F; Feb 1, 30°F; Feb 4, 27°F; Dec 27, 28°F; Dec 30, 24°F; Dec 31, 27°F
1910	Jan 1, 31°F; Jan 23, 32°F	Jan 1, 28°F; Jan 23, 28°F; Jan 30, 32°F; Dec 2, 29°F
1911	None	Jan 5, 32°F
1912	None	Jan 16, 32°F
1913	None	Nov 10, 32°F
1914	None	Nov 21, 30°F
1915	None	None
1916	None	Dec 17, 30°F
1917	Feb 3, 26°F; Feb 4, 32°F Feb 6, 31°F	Feb 3, 23°F; Feb 4, 23°F; Feb 6, 28°F; Dec 9, 31°F; Dec 31, 28°F
1918	Jan 2, 31°F; Jan 5, 32°F	Jan 1, 28°F; Jan 2, 24°F; Jan 4, 30°F; Jan 5, 27°F; Jan 13, 30°F; Jan 14, 30°F; Jan 19, 32°F, Jan 24, 29°F
1919	None	Jan 6, 31°F

Table III-3. (continued).

Year	Merritt Island	Titusville
1920	None	Jan 4, 32°F; Feb 16, 32°F; Mar 1, 32°F; Mar 2, 31°F
1921	None	None
1922	None	Jan 13, 30°F; Feb 8, 32°F
1923	None	None
1924	None	None
1925	Feb 13, 31°F	Feb 13, 31°F; Nov 24, 32°F
1926	Jan 15, 32°F	Jan 15, 31°F; Feb 11, 32°F
1927	None	Jan 11, 26°F; Jan 12, 31°F; Jan 16, 27°F; Mar 3, 32°F; Dec 20, 31°F; Dec 21, 30°F
1928	Jan 3, 30°F; Jan 4, 32°F Jan 29, 32°F; Feb 19, 32°F	Jan 2, 32°F; Jan 3, 24°F; Jan 4, 28°F; Jan 29, 27°F; Jan 30, 32°F; Feb 19, 29°F; Nov 22, 32°F
1929	None	Dec 24, 31°F; Dec 25, 32°F
1930	None	None

[a] U.S. Department of Commerce, Weather Bureau. 1933. Climatic summary of the United States, Section 105, Southern Florida. Washington, D.C.
[b] No record.
[c] Probably freezing near ground.

Table III-4. Records of frosts for Merritt Island and Titusville from the beginning of record up to 1930.[a]

Station	Length of record (years)	Number of years with no killing frost in spring	Number of years with no killing frost in fall	Latest killing frost of record in spring	Earliest killing frost of record in fall
Merritt Island	44	29	39	Mar 5, 1916	Dec 21, 1901
Titusville	38	13	18	Apr 7, 1891	Nov 10, 1913

[a] U.S. Department of Commerce, Weather Bureau. 1933. Climatic summary of the United States, Section 105, Southern Florida. Washington, D.C.

NASA
National Aeronautics and Space Administration

Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle
Climate of the Kennedy Space Center and Vicinity

5. Report Date
June 1990

6. Performing Organization Code
BIO-2

7. Author(s)
Joseph L. Mailander

8. Performing Organization Report No.

10. Work Unit No.

9. Performing Organization Name and Address
The Bionetics Corporation
Mail Code BIO-2
Kennedy Space Center, Florida 32899

11. Contract or Grant No.
NAS10-11624

13. Type of Report and Period Covered

12. Sponsoring Agency Name and Address
NASA/John F. Kennedy Space Center, FL 32899

14. Sponsoring Agency Code
MD

15. Supplementary Notes

16. Abstract

Climate plays a large role in determining the biota of a region. Summary data are presented for climate variables of ecological importance including precipitation, temperature, evapotranspiration, wind, insolation, lightning, and humidity. The John F. Kennedy Space Center, Cape Canaveral Air Force Station, and surrounding area are sampled intensively for climatic conditions; data are presented for the barrier island, Merritt Island, and the mainland, which represents the range of conditions in the local area. Climatic figures, database listings, and historic data (pre-1931) are presented in the appendix.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Climate, KSC, precipitation, temperature, evapotranspiration, insolation	Unlimited, NTIS

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of pages	22. Price
Unclassified	Unclassified	62	