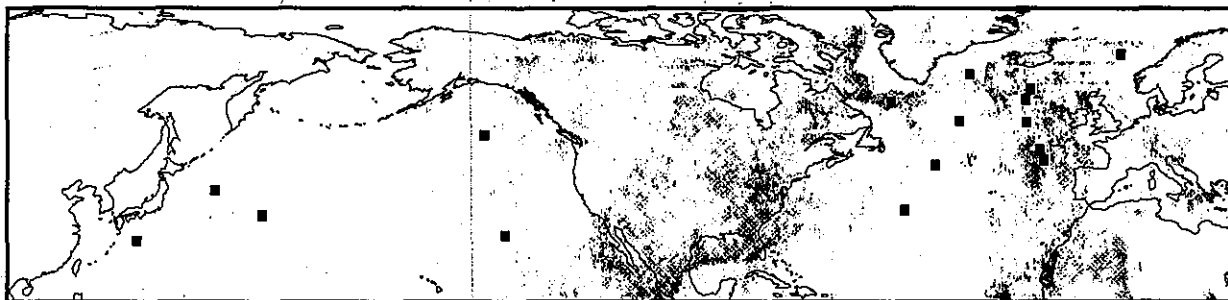




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Abstract

Surface and upper air climatological summaries for 16 Ocean Weather Stations (OWS) are presented. Periods of record for surface data vary from 7 years for OWS X to more than 30 years for OWS C, M, and P. OWS T operated primarily during the summer typhoon season (May to November). Valid upper air records are generally of equal or lesser duration than those taken at the surface. The interval of time covered extends from 1945 for the earliest starting OWS to 1982 for a few OWS, some of which are still operating. The purpose of this special report is to make available to the scientific community high-quality climatological data over generally fixed ocean areas for comparison with data from traveling merchant ships and for comparison with profiles derived from satellite observations. The basic data used for preparation of the summaries are available through either the National Center for Atmospheric Research in Boulder, Colorado or the National Climatic Data Center in Asheville, North Carolina.

1. Introduction

The value of meteorological observations from fixed locations at sea had become evident by the 1930s when France and Germany established specially outfitted ships to assist aviation over the Atlantic (Roll, 1965). In the United States during World War II, Coast Guard or Navy vessels were assigned to approximately fixed locations designated as Ocean Weather Stations (OWS) for weather reporting, as well as search and rescue (Crutcher and Whiting, 1956). Starting about 1945, international agreements were made to maintain a network of OWS in the Northern Hemisphere Atlantic and Pacific Oceans. Eventually, stations were identified by a letter (A, B, etc.), or by the corresponding phonetic code in use at any given time (Able, Baker),* initially such that the Atlantic stations were chosen from the first 13 letters of the alphabet (A-M) and the Pacific stations from the others (N-X). Other than shifts in location during the 1940s and 1950s, a relatively stable set of about 13 OWS continued to operate until the mid-1970s (National Climatic Data Center, 1978). Although two Atlantic stations were added in 1975 (L and R), advances in remote sensing, aircraft performance, and other technology have rendered the OWS less important for weather forecasting or for rescue work; furthermore, economics have led to closure of all but about four OWS operated by the USSR or European countries (Table 1).

Nevertheless, the weather observations (both surface and upper air) taken at these OWS comprise the best continuous records available over the world's oceans. They have been made by trained observers at essentially fixed locations, and they provide valuable climate information in regions where the only other data come from traveling ships, or, more recently, buoys (Hamilton, 1986). Although standard meteorological observations every 3 hours (surface) or twice a day (upper air), as well as some oceanographic data (e.g. from bathythermographs), have been used in numerous past studies for selected stations and weather variables (see Section 5), we lack a detailed summary of the meteorological conditions at each OWS over the available record.

* These are earlier codes than those shown to the right of station letters in the Contents. All are from Crutcher and Whiting (1956) or the U.S. Naval Oceanographic Office (1968).

Table 1. The 16 OWS used for this study*

OWS	Assigned location	Study Area	Surface reports	Period of record		Approximate nationality	Status
				Surface	Upper air		
A	62°00'N, 33°00'W	61.0°N-62.9°N, 33.9°W-32.0°W	67874	1945-73	1950-69	U.S./Netherlands/U.K.	
B	56°30'N, 51°00'W	55.5°N-57.4°N, 51.9°W-50.0°W	67593	1946-74	1950-74	U.S./Canada	
C	52°45'N, 35°30'W	51.8°N-53.7°N, 36.4°W-34.5°W	86486	1945-82	1950-73	U.S./USSR	X
D	44°00'N, 41°00'W	43.0°N-44.9°N, 41.9°W-40.0°W	65535	1945-73	1950-73	U.S.	
E	35°00'N, 48°00'W	34.0°N-35.9°N, 48.9°W-47.0°W	64451	1949-73	1950-73	U.S.	
I	59°00'N, 19°00'W	58.0°N-59.9°N, 19.9°W-18.0°W	59030	1950-75	1950-75	U.K.	
J	52°30'N, 20°00'W	51.5°N-53.4°N, 20.9°W-19.0°W	64233	1950-75	1950-75	U.K./Netherlands	
K	45°00'N, 18°00'W	44.0°N-45.9°N, 16.9°W-15.0°W	66519	1949-75	1950-75	Belgium/France/Netherlands	
L	57°00'N, 20°00'W	56.0°N-57.9°N, 20.9°W-19.0°W	18863	1975-82	1975-82	U.K.	X
M	66°00'N, 2°00'E	65.0°N-66.9°N, 1.0°E-2.9°E	80657	1949-82	1952-75	Norway/Sweden/Netherlands	X
N	30°00'N, 140°00'W	29.0°N-30.9°N, 140.9°W-139.0°W	66363	1946-74	1950-74	U.S.	
P	50°00'N, 145°00'W	49.0°N-50.9°N, 145.9°W-144.0°W	88330	1949-81	1950-81	U.S./Canada	
R	47°00'N, 17°00'W	46.0°N-47.9°N, 17.9°W-16.0°W	14478	1975-82	1975-82	France	X
T	29°00'N, 135°00'E	28.0°N-29.9°N, 134.0°E-135.9°E	36519	1948-81	1956-81	Japan	
V	34°00'N, 164°00'E	33.0°N-34.9°N, 163.0°E-164.9°E	47021	1955-71	1955-71	U.S.	
X	39°00'N, 153°00'E	38.0°N-39.9°N, 152.0°E-153.9°E	15623	1947-53	—	Japan	

* Each Study Area forms a 2° box centered, as nearly as possible, on the assigned location. The boundaries of each box, however, are governed by rules of inclusivity (see Appendix A) that effectively reduce the size of each Area by 0.1° of latitude and longitude. The number of surface reports and periods of record refer to the data available in the Study Area surrounding the assigned location. All of the stations except L, M, R, T, and X were subject to changes in assigned location (either within or outside the indicated period of record) from which, data were generally not used. Nationality of the operating country also changed for several OWS. See NCDC (1978) and Crutcher and Whiting (1956) for further details. The stations with *Status* marked (by an x) were operating recently (World Meteorological Organization, 1986).

This report presents climatic summaries of the annual and diurnal cycles, as well as the interannual variability, for 16 selected OWS operated during 1945-82 (Table 1).^{*} Other OWS were not selected (Table 2) because of short or discontinuous periods of record. The Study Areas (see also Figure 1) are the same size (although not necessarily at the exact location) as the boxes used in summarizing global ship data in the Comprehensive Ocean-Atmosphere Data Set (COADS; Woodruff *et al.*, 1987). Section 2 gives details of the data sets, and Section 3 describes the format and constituents of each summary data plot. Appendices incorporate processing notes and additional technical material. The summaries follow in alphabetical order by OWS letter.

Table 2. OWS excluded from this study[†]

OWS	Available data type	Reason for exclusion
F	All obs	Data only for 11 months, between 1945 and 1949
G	All obs	Data only for June and July 1949
H	On station	Spotty seasonal data for 1970-74; extant data are irregular
O	All obs	Data only for 8 months, Dec. 1949-July 1950
Q	All obs	Data only for 2 years, 1952-53
S	All obs	Data only for Sept. 1950-Dec. 1953
U	All obs	Data only for Dec. 1950-Dec. 1953
Z	All obs	Z was an unofficial OWS operated, apparently, by South Africa in the Southern Hemisphere, and thus was considered outside the scope of this report

[†] See Crutcher and Whiting (1956) for information on earlier OWS data and additional minor stations.

^{*} See Diaz *et al.* (1986) for preliminary summaries of station A.

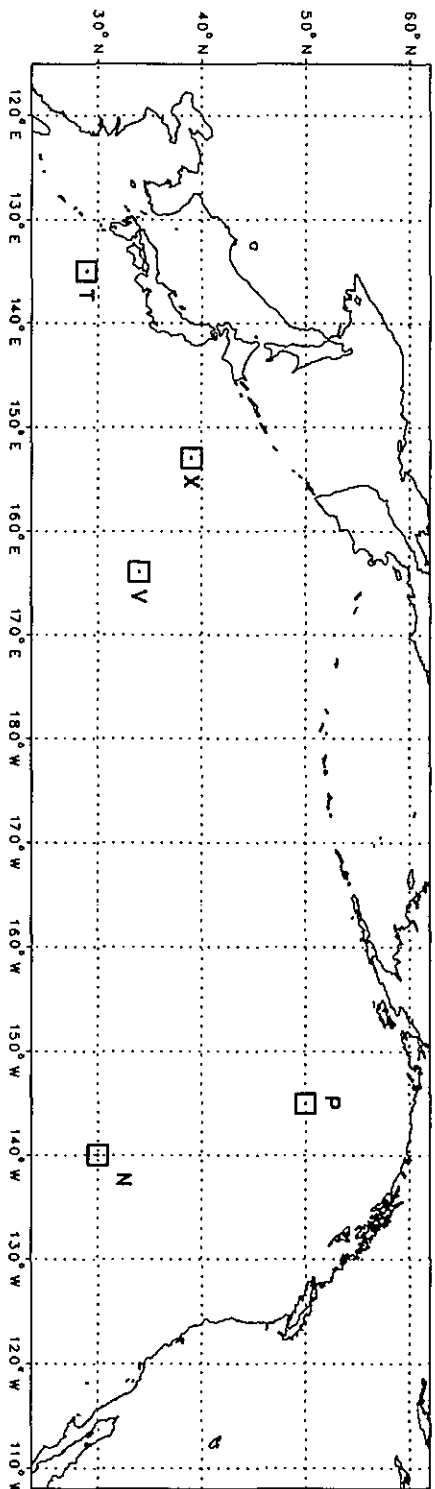
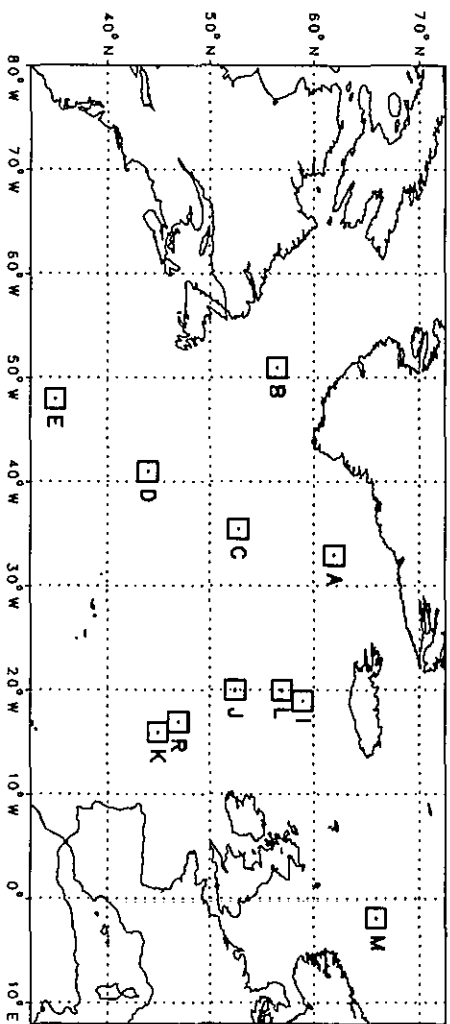


Figure 1. Ocean Weather Station Study Area Locations

2. Data

NOAA's National Climatic Data Center (NCDC) provided surface meteorological reports in its Ocean Station Vessel (OSV) upgrade (TD-1160), which combine all digital OSV ship reports already available at NCDC with data acquired specifically for TD-1160,* covering the period through 1982. TD-1160 is an edited version of these data from which most duplicate ship reports have been eliminated. The data set consists of two files:

On Station/Synoptic. This file is restricted to observations that were made "on station" and at standard 3-hourly synoptic times (00, 03, ..., 21 GMT). Generally, a report was said to be on station if it was within a 210 x 210 nautical mile box centered on the assigned OWS location (Crutcher and Whiting, 1956). The data from this file were found to be much cleaner than from the other file.

All Observations. This file contains all observations, whether taken on or off station and regardless of synoptic time. OSV could be off station when en route to and from the OWS location and when embarking on search and rescue missions. Stations T and X were found only in this file.

Appendix A details the procedures used to summarize the surface data.

NCAR's Data Support Section provided upper air data in the form of year-month summaries for the different stations. Two different data sets were combined in order to obtain the most complete coverage available at NCAR in year-month summaries. No upper air data were identified in either data set for station X.

Climats. The primary source was a set of world monthly mean rawinsonde data taken from "Climat temp" reports (Jenne and Crutcher, 1976). Quality con-

* According to NCDC, additional data from the U.K. Meteorological Office would be useful for filling gaps in stations C, L, M, and R. Also, some U.S. data for B, H, and N may be recoverable from original manuscripts.

trol flags that formed a part of the data set were used selectively to eliminate erroneous year-months.

NCAR Raobs. Gaps in Climats data were sometimes filled using this alternate set of primarily U.S. data assembled at NCAR (Spangler and Jenne, 1986). Separate year-month summaries for 00 GMT and 12 GMT were averaged together to obtain a combined mean for these few gaps. Dew point temperature is not available from this data set.

Appendix B details the procedures used to summarize the upper air data.

3. Description of summaries

For each OWS an introductory page gives the station location and the period of record for surface data. The following 17 pages show the frequency of surface observations, and the climatology and monthly anomalies for both surface and upper air data (Appendices A and B precisely define the plotted values). Isopleths (always referred to as contours) were added where appropriate.* The following describes each of the 17 summaries (pages), for each OWS:

No. 1: Frequency of Surface Observations. This gives the number of days per year-month with surface observations, as well as long-term monthly and annual sums. Since some ship reports were incomplete, the maximum and minimum frequency from among all the variables are plotted.

No. 2: Surface Climatology. These are period-of-record averages by (3-hourly) synoptic time (GMT on the left, local time on the right). The dashed lines separate nighttime from daytime hours. The upper left panel shows mean vector wind and contours of wind steadiness in percent (as defined in Appendix A). Sea level pressure is shown in the upper right panel, total cloudiness in the lower left, and percentage frequency of observations reporting precipitation in the lower right (contoured).

No. 3: Surface Climatology (continued). Plots similar to No. 2 show air temperature (AT), dew point depression with contours (dew point may be approximated by subtracting this from the corresponding value of mean AT), sea surface temperature (SST), and SST minus AT with contours.

No. 4: Anomalies of Surface Air Temperature. The anomalies of each year-month with respect to the period-of-record monthly long-term mean (LTM) are

* Contours were smoothed (by piece-wise application of a spline) to avoid jagged lines. Intervals may vary from station to station, depending on the magnitude of the variable gradients, in order to improve presentation of patterns. When patterns are incoherent, contours are not shown.

plotted, together with the corresponding long-term standard deviation (SD), and annual anomalies (Ann) calculated only if observations were made for at least 6 months in a given year.

No. 5: Anomalies of Surface Dew Point Depression. Similar to No. 4.

No. 6: Anomalies of Sea Surface Temperature. Similar to No. 4.

No. 7: Anomalies of Sea - Air Temperature Difference. Similar to No. 4.

No. 8: Anomalies of Surface Scalar Wind. Similar to No. 4.

No. 9: Anomalies of Sea Level Pressure. Similar to No. 4.

No. 10: Anomalies of Total Cloudiness. Similar to No. 4.

No. 11: Anomalies of Precipitation Frequency. Similar to No. 4.

No. 12: Upper Air Climatology. These are period-of-record means of the monthly means of twice-daily (generally) rawinsondes of wind, dew point temperature, air temperature, and pressure height. Values are plotted for selected pressure surfaces (left scales) at their mean geopotential height (right scales). The pressure labels on the left are positioned at the annual mean of the 12 monthly heights.

No. 13: Anomalies of Air Temperature: 700 mb. Similar to No. 4.

No. 14: Anomalies of Air Temperature: 500 mb. Similar to No. 4.

No. 15: Anomalies of Air Temperature: 200 mb. Similar to No. 4.

No. 16: Anomalies of Dew Point Temperature: 700 mb. Similar to No. 4.

No. 17: Anomalies of Dew Point Temperature: 500 mb. Similar to No. 4.

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Appendix A. Surface data

A1. Variables

Observations (or measurements) were generally made every 3 hours of wind (speed and direction), sea level pressure, total cloudiness, present weather, air temperature, dew point (or wet bulb) temperature, and sea surface temperature. Other variables such as wave and swell fields were also observed (see Slutz *et al.*, 1985; hereafter *Release 1*), but were not used in this report.

In initial processing, wind observations were separated into their eastward and northward vector components (u and v) and dew point was subtracted from air temperature to yield dew point depression. Further variables were derived as follows (where, e.g., $\bar{u}$ indicates the monthly mean of all observations of u):

Wind steadiness. For each year-month, wind steadiness is a percentage calculated as

$$\frac{\sqrt{\bar{u}^2 + \bar{v}^2}}{\bar{w}} \times 100,$$

where $\bar{w}$ is the mean scalar wind speed (with $w = \sqrt{u^2 + v^2}$). If $\bar{u}$ and $\bar{v}$ are missing or $\bar{w}$ is 0, wind steadiness is missing.

Total cloudiness. Individual observations of total cloud amount are estimated in oktas from 0-8; an additional value (stored as 9) denotes the sky was obscured or the cloud amount could not be estimated. The monthly mean is the mean of all observations between 0 and 8 oktas inclusive. Observations with a value of 9 are considered to be missing.

Precipitation frequency. For each year-month, the precipitation frequency is a percentage calculated from present weather as

$$\frac{\text{the number of reports of precipitation events}}{\text{the total number of reports of present weather}} \times 100,$$

where a precipitation event is defined as any precipitation occurring at the OWS at time of observation or within the hour preceding the observation.*

A2. Plotted quantities

Surface Climatology. For each synoptic hour and month, the mean $\bar{x}$ and standard deviation σ of all individual observations were plotted.

The sunrise/sunset lines on the climatology plots are based on the position of the sun at the middle of each month at the latitude and longitude of the center of the COADS 2° box nearest the center of each Study Area. Each synoptic hour was considered to be in either daylight or darkness. For graphic clarity, the sunrise/sunset line was always plotted midway between synoptic hours even though the actual time may differ. For the method of calculation used for determining local daylight and darkness, see *Release 1*.

Anomalies. For each of m months j , and n years i , the anomaly $\Delta\bar{x}_{ij}$ is plotted, where $\bar{x}_{ij}$ is the mean of all individual observations for all synoptic hours of a given year-month:

$$\Delta\bar{x}_{ij} = \bar{x}_{ij} - \bar{X}_j ,$$

where

$$\bar{X}_j = \frac{1}{n} \left(\sum_{i=1}^n \bar{x}_{ij} \right) .$$

* Present-weather codes of 20-29 and 50-99 inclusive were considered as precipitation; see *Release 1*.

Long-term monthly means $\bar{X}_j$ are plotted as the upper numbers (Roman) of each pair in the column labeled "LTM"; the "Ann" row of that column contains the following annual LTM (upper number):

$$\bar{X} = \frac{1}{m} \left(\sum_{j=1}^m \bar{X}_j \right)$$

Annual means of anomalies, $\overline{\Delta\bar{x}_i}$, are computed only if there are $m > 6$ months for a given year, as follows:

$$\overline{\Delta\bar{x}_i} = \frac{1}{m} \left(\sum_{j=1}^m \Delta\bar{x}_{ij} \right)$$

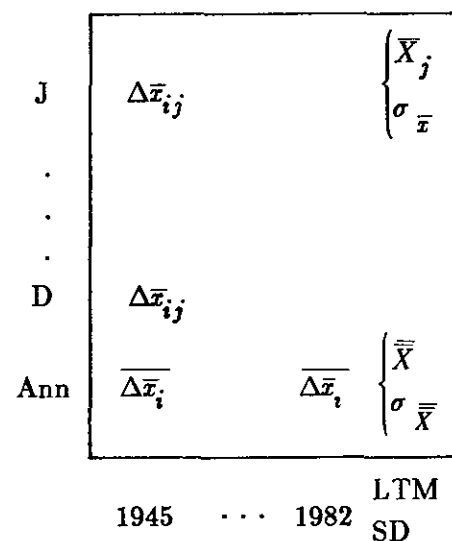
The standard deviation (SD) of the n $\bar{x}_{ij}$ about each $\bar{X}_j$ is

$$\sigma_{\bar{x}} = \sqrt{\frac{1}{n-1} \sum_{i=1}^n \Delta\bar{x}_{ij}^2},$$

and, letting N represent the number of $\overline{\Delta\bar{x}_i}$ (i.e., years with $m > 6$), a corresponding standard deviation about $\bar{X}$ is

$$\sigma_{\bar{X}} = \sqrt{\frac{1}{N-1} \sum_{i=1}^N \overline{\Delta\bar{x}_i}^2},$$

where $\sigma_{\bar{x}}$ and $\sigma_{\bar{X}}$ are plotted in italics beneath each $\bar{X}_j$ and $\bar{X}$, respectively. Thus, the layout is the following:



A3. Processing

Surface data were processed from individual reports supplied by NCDC in its 148-character TD-1129 format (NCDC, 1986). To reduce the volume of data, the data were converted to the COADS format for Compressed Marine Reports (CMR) as described in Woodruff and Lubker (1986).^{*} COADS trimming limits

^{*} The conversion for TD-1129 into CMR differed from that described, but only as follows: Only a blank bucket indicator (BI) was considered to represent missing. BI of B or 0 were considered to represent bucket, and any other character was accepted as unknown. Wind observations were rejected under two more stringent conditions: (1) if observations resulting in $u = v = 0$ had a direction indicator (DI) of "-", or (2) if wind direction in conjunction with DI had an undefined conversion according to Table F2-1 of *Release 1*. These more stringent tests for validity may have caused some calm wind observations to be rejected. Ship type (ST) was set to 3 or 2 depending only on whether the input file was On Station or All Observations, respectively (TD-1129 positions 91-97, instead of 146, were used for input inventory purposes).

derived from 1950-79 data were used to flag statistical outliers in each CMR of sea surface temperature, air temperature, wind, sea level pressure, and relative humidity. Each flag was set to 0, 1, or 2 depending on how an individual observation x compared with its limits*:

- 0 if $g - 2.8\sigma_1 \leq x \leq g + 2.8\sigma_5$ (narrow interval), or
- 1 if $g - 3.5\sigma_1 \leq x \leq g + 3.5\sigma_5$ (but not within the narrow interval), or
- 2 if $x < g - 3.5\sigma_1$ or $x > g + 3.5\sigma_5$,

where g is the smoothed median for the COADS 2° box and the month of x , and σ_1 and σ_5 are the corresponding smoothed (possibly asymmetric) estimates of the standard deviation derived from the first and fifth sextiles of the data distribution. If, however, the variable itself was missing or the smoothed limits were missing, the flag was set to missing. For the computation of the smoothed limits and the method of setting flags, see *Release 1*.

Each report in this initial flagged set of CMR data was then filtered by its geographic location for inclusion in a Study Area. Any report not located within a Study Area (Table 1) was rejected. A report on a boundary of a Study Area was included if its location is on the edge closest to either the Equator or the Prime Meridian (see *Release 1*). These edges are the inclusive edges of the Study Area. Reports located on the other two edges were not included. Specifically, the inclusive edges of Study Areas in the Eastern Hemisphere (M, T, X, and V) are the western and southern sides. For the Western Hemisphere (all other Study Areas) the inclusive edges are the eastern and southern sides.

Reports located within a Study Area but recorded during dates when a given OWS was not in existence (see Table 1) were excluded from the summaries. Similarly, reports thought to be spurious because the assigned location of the OWS at that time was not the center of the Study Area were usually excluded. In these cases, the final determination was based on the number of reports made during

* For wind, flagging was set at the maximum flag value found for separate tests of u and v . The relative humidity flag, dependent on both air and dew point temperatures, was used to later edit dew point values.

the questionable times: if only a few reports were made, all reports for those times were rejected. Table A1 lists the times and the number of reports rejected per OWS.

Table A1. Surface reports removed for periods when an OWS was not in operation or when the OWS was not assigned to the center of the Study Area

OWS	Reports removed		No. of reports removed
	Before	After	
A	Dec. 1945	Dec. 1973	236
I	Mar. 1950	Jun. 1975	757
J	Mar. 1950	—	36
K	—	Jun. 1975	8
L	Jul. 1975	—	8
P	Dec. 1949	—	1
R	Jul. 1975	—	25
V	—	Dec. 1971	112

In OWS T, 104 reports were excluded because they were not made on the usual synoptic hours 00, 03, 06, 12, 15, 18, or 21 GMT.

Some observations of present weather (Table A2) were subjectively removed from the data set. During early years some stations tended to record fewer present-weather observations, and the ones recorded were biased toward precipitation. As a result, precipitation frequency showed a sharp increase for these periods.

Table A2. Biased present-weather observations removed from surface reports

OWS	Present weather removed before	No. of reports changed
A	Jan. 1947	2317*
T	Jan. 1949	318†
X	Jan. 1949	2431

* Present weather was removed from these reports before entire reports made prior to December 1945 were removed for A (see Table A1).

† Present weather was removed from these reports before entire reports were removed from T because they were not made on 3-hourly intervals.

Duplicate reports were discovered and eliminated from five stations after the aforementioned processing (Table A3). Reports were considered duplicates if they had identical year, month, day, and hour. Latitude and longitude were ignored in this determination, but turned out to be equal in all duplicate matches except those for stations C, I, and J. Once two (or more) duplicates were identified, a single report was selected for retention as the best duplicate based on the following rules:

- a) The report with the lowest trimming code (sum of the trimming flag values, CMR fields 30-34) was retained, where a missing variable caused a 2 (equal to the value flagging data outside the 3.50 trimming limits) to be entered in place of the actual missing flag value in this calculation.
- b) In the event the trimming codes of duplicate reports were equal, the report from the preferred deck (see Table A3) was retained; or, if the the decks were also equal, the first report in sequence was retained.

Each flagged variable from a given report was used in the summaries only if its flag is 0 or 1. If its flag is 2, the variable was excluded from the summaries. Total cloudiness and present weather have no flag fields, so they were always accepted if legitimately coded. Table A4 shows the number of observations (NOBS) at each flag level for the five flagged variables for each Study Area. The percentage trimmed at the 3.50 level is

$$\frac{\text{NOBS with Flag} = 2}{(\text{NOBS with Flag} = 0) + (\text{NOBS with Flag} = 1) + (\text{NOBS with Flag} = 2)} \times 100.$$

Table A3. Duplicate elimination and deck structure*

INPUT			OUTPUT			
Deck	No. reports	Years	<u>Non-duplicates</u>		<u>Duplicates</u>	
			No. reports	Years	No. reports	Years
<u>OWS A</u>						
116	23692	1945-1955	23692	1945-1955	0	-
117	43	1952-1954	43	1952-1954	0	-
128	26622	1950-1971	26622	1950-1971	0	-
184	15318	1956-1961	15318	1956-1961	0	-
555	1197	1971-1973	1197	1971-1973	0	-
888	103	1973-1973	103	1973-1973	0	-
927	899	1972-1973	899	1972-1973	0	-
Total	67874		67874		0	

Table A3. Duplicate elimination and deck structure* (continued)

Deck	INPUT		OUTPUT			
	No. reports	Years	<u>Non-duplicates</u>		<u>Duplicates</u>	
			No. reports	Years	No. reports	Years
<u>OWS B</u>						
116	40166	1946-1963	40166	1946-1963	0	-
117	412	1952-1964	412	1952-1964	0	-
128	25937	1963-1972	25937	1963-1972	0	-
555	559	1973-1973	559	1973-1973	0	-
888	519	1973-1974	519	1973-1974	0	-
Total	67593		67593		0	
<u>OWS C</u>						
116	48282	1945-1963	48282	1945-1963	0	-
117	425	1952-1963	425	1952-1963	0	-
128	27644	1963-1973	27644	1963-1973	0	-
555	1	1972-1972	0	-	1	1972-1972
849	2587	1978-1979	2587	1978-1979	0	-
888	15	1980-1980	15	1980-1980	0	-
890	7533	1980-1982	7533	1980-1982	0	-
Total	86487		86486		1	

Table A3. Duplicate elimination and deck structure* (continued)

Deck	INPUT		OUTPUT			
	No. reports	Years	<u>Non-duplicates</u>		<u>Duplicates</u>	
			No. reports	Years	No. reports	Years
<u>OWS D</u>						
116	39369	1945-1963	39369	1945-1963	0	-
117	297	1952-1964	297	1952-1964	0	-
128	25422	1963-1972	25422	1963-1972	0	-
555	384	1971-1973	383	1973-1973	1	1971-1971
888	64	1973-1973	64	1973-1973	0	-
Total	65536		65535		1	
<u>OWS E</u>						
116	38541	1949-1963	38541	1949-1963	0	-
117	209	1952-1964	209	1952-1964	0	-
128	25701	1963-1973	25701	1963-1973	0	-
Total	64451		64451		0	
<u>OWS I</u>						
116	3346	1950-1951	3346	1950-1951	0	-
128	27047	1962-1971	27047	1962-1971	0	-
184	19969	1953-1961	19969	1953-1961	0	-
194	1954	1952-1952	1954	1952-1952	0	-
555	2223	1970-1973	2222	1972-1973	1	1970-1970
888	507	1973-1974	507	1973-1974	0	-
927	3985	1972-1975	3985	1972-1975	0	-
Total	59031		59030		1	

Table A3. Duplicate elimination and deck structure* (continued)

Deck	INPUT		OUTPUT			
	No. reports	Years	<u>Non-duplicates</u>		<u>Duplicates</u>	
			No. reports	Years	No. reports	Years
<u>OWS J</u>						
116	4346	1950-1951	4346	1950-1951	0	-
128	27062	1962-1971	27062	1962-1971	0	-
184	23084	1953-1961	23084	1953-1961	0	-
194	2055	1952-1952	2055	1952-1952	0	-
555	2621	1971-1973	2621	1971-1973	0	-
888	996	1973-1974	995	1973-1974	1	1974-1974
927	4070	1972-1975	4070	1972-1975	0	-
Total	64234		64233		1	
<u>OWS K</u>						
116	37231	1949-1962	37231	1949-1962	0	-
128	21125	1963-1970	21125	1963-1970	0	-
555	2886	1971-1973	2886	1971-1973	0	-
888	597	1973-1974	597	1973-1974	0	-
927	4680	1971-1975	4680	1971-1975	0	-
Total	66519		66519		0	
<u>OWS L</u>						
849	332	1978-1979	332	1978-1979	0	-
888	5111	1978-1981	5111	1978-1981	0	-
890	6712	1980-1982	6712	1980-1982	0	-
927	6708	1975-1979	6708	1975-1979	0	-
Total	18863		18863		0	

Table A3. Duplicate elimination and deck structure* (continued)

INPUT			OUTPUT			
Deck	No. reports	Years	<u>Non-duplicates</u>		<u>Duplicates</u>	
			No. reports	Years	No. reports	Years
<u>OWS M</u>						
116	27599	1949-1959	27599	1949-1959	0	-
128	30769	1959-1970	30769	1959-1970	0	-
555	2433	1971-1973	2433	1971-1973	0	-
849	188	1978-1979	188	1978-1979	0	-
888	7434	1973-1981	7434	1973-1981	0	-
890	5471	1980-1982	5471	1980-1982	0	-
927	6763	1971-1977	6763	1971-1977	0	-
Total	80657		80657		0	
<u>OWS N</u>						
116	39074	1946-1963	39074	1946-1963	0	-
117	486	1954-1964	486	1954-1964	0	-
128	25820	1963-1972	25820	1963-1972	0	-
555	598	1973-1973	598	1973-1973	0	-
888	385	1973-1974	385	1973-1974	0	-
Total	66363		66363		0	
<u>OWS P</u>						
116	36819	1949-1962	36819	1949-1962	0	-
128	31114	1963-1973	31114	1963-1973	0	-
926	20804	1974-1981	20196	1974-1981	608	1978-1980
927	203	1978-1979	201	1978-1979	2	1979-1979
Total	88940		88330		610	

Table A3. Duplicate elimination and deck structure* (continued)

Deck	INPUT		OUTPUT			
	No. reports	Years	<u>Non-duplicates</u>		<u>Duplicates</u>	
			No. reports	Years	No. reports	Years
<u>OWS R</u>						
849	213	1978-1979	213	1978-1979	0	-
888	6434	1978-1981	6434	1978-1981	0	-
890	6533	1980-1982	6533	1980-1982	0	-
927	1298	1975-1976	1298	1975-1976	0	-
Total	14478		14478		0	
<u>OWS T</u>						
116	21845	1948-1962	21845	1948-1962	0	-
119	246	1955-1959	246	1955-1959	0	-
128	9817	1963-1970	9817	1963-1970	0	-
849	506	1979-1979	506	1979-1979	0	-
888	2035	1978-1981	2035	1978-1981	0	-
890	2070	1980-1981	2070	1980-1981	0	-
Total	36519		36519		0	
<u>OWS V</u>						
116	23385	1955-1963	23385	1955-1963	0	-
117	343	1955-1964	343	1955-1964	0	-
128	23293	1963-1971	23293	1963-1971	0	-
Total	47021		47021		0	

Table A3. Duplicate elimination and deck structure* (continued)

Deck	INPUT		OUTPUT			
	No. reports	Years	<u>Non-duplicates</u>		<u>Duplicates</u>	
			No. reports	Years	No. reports	Years
<u>OWS X</u>						
116	15623	1947-1953	15623	1947-1953	0	-
Total	15623		15623		0	

* Source deck (CMR field 28) numbers were assigned as follows by NCDC (from *Release 1* Table F1-1, except for deck 890):

116	U.S. Merchant Marine
117	U.S. Navy Hourlies
119	Japanese Ships No. 2
128	International Marine (U.S. recruited ships punched in-house)
184	Great Britain Marine (194 Extension)
194	Great Britain Marine
555	Monterey Telecom.
849	FGGE (First GARP Global Experiment)
888	GWC (U.S. Air Force Global Weather Central)
890	NOAA National Meteorological Center
926	International Maritime Meteorological (IMM) Exchange
927	International Marine (U.S. recruited ships punched in-house)

Decks 555, 849, 888, and 890 were from the Global Telecommunication System (GTS). For duplicate elimination, the preferred deck had the highest non-GTS number; or, among strictly GTS reports, the highest number.

Table A4. Surface trimming performance*

	SST	AT	RH	WIND	SLP
<u>OWS A</u>					
Flag = 0 (within $\pm 2.8\sigma$):	66435	67460	58233	66695	67319
Flag = 1 (within $\pm 3.5\sigma$):	588	255	5979	947	456
Flag = 2 (outside $\pm 3.5\sigma$):	132	68	38	149	50
Missing variable:	719	91	3561	83	49
RH not valid:			63		
Percent trimmed at 3.5σ :	0.2%	0.1%	0.1%	0.2%	0.1%
<u>OWS B</u>					
Flag = 0 (within $\pm 2.8\sigma$):	66295	67126	59683	65351	66414
Flag = 1 (within $\pm 3.5\sigma$):	799	298	7160	1701	820
Flag = 2 (outside $\pm 3.5\sigma$):	294	103	52	387	247
Missing variable:	205	66	599	154	112
RH not valid:			99		
Percent trimmed at 3.5σ :	0.4%	0.2%	0.1%	0.6%	0.4%
<u>OWS C</u>					
Flag = 0 (within $\pm 2.8\sigma$):	85222	86139	76202	85147	85930
Flag = 1 (within $\pm 3.5\sigma$):	906	278	9952	978	437
Flag = 2 (outside $\pm 3.5\sigma$):	207	43	9	202	90
Missing variable:	151	26	284	159	29
RH not valid:			39		
Percent trimmed at 3.5σ :	0.2%	0.0%	0.0%	0.2%	0.1%

Table A4. Surface trimming performance* (continued)

	SST	AT	RH	WIND	SLP
<u>OWS D</u>					
Flag = 0 (within ∓ 2.80):	64535	65491	62634	64445	65309
Flag = 1 (within ∓ 3.50):	837	32	2870	809	187
Flag = 2 (outside ∓ 3.50):	105		3	142	32
Missing variable:	58	12	28	139	7
RH not valid:					
Percent trimmed at 3.50:	0.2%	0.0%	0.0%	0.2%	0.0%
<u>OWS E</u>					
Flag = 0 (within ∓ 2.80):	63794	64154	63314	63378	63989
Flag = 1 (within ∓ 3.50):	466	252	1042	805	391
Flag = 2 (outside ∓ 3.50):	89	33	3	156	66
Missing variable:	102	12	59	112	5
RH not valid:			33		
Percent trimmed at 3.50:	0.1%	0.1%	0.0%	0.2%	0.1%
<u>OWS I</u>					
Flag = 0 (within ∓ 2.80):	58791	58655	53867	58358	58663
Flag = 1 (within ∓ 3.50):	59	293	5020	539	284
Flag = 2 (outside ∓ 3.50):	15	59	3	75	62
Missing variable:	165	23	85	58	21
RH not valid:			55		
Percent trimmed at 3.50:	0.0%	0.1%	0.0%	0.1%	0.1%

Table A4. Surface trimming performance* (continued)

	SST	AT	RH	WIND	SLP
<u>OWS J</u>					
Flag = 0 (within ∓ 2.80):	63994	63868	56844	63555	63770
Flag = 1 (within ∓ 3.50):	174	263	6618	519	257
Flag = 2 (outside ∓ 3.50):	18	46	2	62	50
Missing variable:	47	56	726	97	156
RH not valid:			43		
Percent trimmed at 3.50:	0.0%	0.1%	0.0%	0.1%	0.1%
<u>OWS K</u>					
Flag = 0 (within ∓ 2.80):	63741	66117	60985	65253	66099
Flag = 1 (within ∓ 3.50):	93	275	4193	948	338
Flag = 2 (outside ∓ 3.50):	39	38	5	166	75
Missing variable:	2646	89	1299	152	7
RH not valid:			37		
Percent trimmed at 3.50:	0.1%	0.1%	0.0%	0.3%	0.1%
<u>OWS L</u>					
Flag = 0 (within ∓ 2.80):	18639	18733	[⊙] 16469	18649	18779
Flag = 1 (within ∓ 3.50):	2	94	1790	188	65
Flag = 2 (outside ∓ 3.50):	9	31	7	19	8
Missing variable:	213	5	575	7	11
RH not valid:			22		
Percent trimmed at 3.50:	0.0%	0.2%	0.0%	0.1%	0.0%

Table A4. Surface trimming performance* (continued)

	SST	AT	RH	WIND	SLP
<u>OWS_M</u>					
Flag = 0 (within ∓ 2.80):	79442	79630	72728	79680	79809
Flag = 1 (within ∓ 3.50):	771	439	3874	793	654
Flag = 2 (outside ∓ 3.50):	177	94	23	77	129
Missing variable:	267	494	3952	107	65
RH not valid:			80		
Percent trimmed at 3.50:	0.2%	0.1%	0.0%	0.1%	0.2%
<u>OWS_N</u>					
Flag = 0 (within ∓ 2.80):	65142	66246	65332	65436	66008
Flag = 1 (within ∓ 3.50):	134	85	867	626	282
Flag = 2 (outside ∓ 3.50):	39	18	6	142	53
Missing variable:	1048	14	141	159	20
RH not valid:			17		
Percent trimmed at 3.50:	0.1%	0.0%	0.0%	0.2%	0.1%
<u>OWS_P</u>					
Flag = 0 (within ∓ 2.80):	88245	88109	73921	86543	87469
Flag = 1 (within ∓ 3.50):	9	169	14043	1405	432
Flag = 2 (outside ∓ 3.50):	1	50	13	307	82
Missing variable:	75	2	303	75	347
RH not valid:			50		
Percent trimmed at 3.50:	0.0%	0.1%	0.0%	0.3%	0.1%

Table A4. Surface trimming performance* (continued)

	SST	AT	RH	WIND	SLP
<u>OWS R</u>					
Flag = 0 (within ∓ 2.80):	14380	14381	12486	14355	14371
Flag = 1 (within ∓ 3.50):	5	57	1597	104	82
Flag = 2 (outside ∓ 3.50):	14	37		12	20
Missing variable:	79	3	369	7	5
RH not valid:			26		
Percent trimmed at 3.50:	0.1%	0.3%	0.0%	0.1%	0.1%
<u>OWS T</u>					
Flag = 0 (within ∓ 2.80):	36388	36344	23824	35715	36243
Flag = 1 (within ∓ 3.50):	44	103	740	582	179
Flag = 2 (outside ∓ 3.50):	36	47	13	149	87
Missing variable:	51	25	11922	73	10
RH not valid:			20		
Percent trimmed at 3.50:	0.1%	0.1%	0.1%	0.4%	0.2%
<u>OWS V</u>					
Flag = 0 (within ∓ 2.80):	46823	47003	44863	46560	46826
Flag = 1 (within ∓ 3.50):	152	6	2017	229	157
Flag = 2 (outside ∓ 3.50):	6			34	34
Missing variable:	40	12	141	198	4
RH not valid:					
Percent trimmed at 3.50:	0.0%	0.0%	0.0%	0.1%	0.1%

Table A4. Surface trimming performance* (continued)

	SST	AT	RH	WIND	SLP
<u>OWS X</u>					
Flag = 0 (within ± 2.80):	15321	15565	5788	15230	15508
Flag = 1 (within ± 3.50):	122	13	635	314	75
Flag = 2 (outside ± 3.50):	57	7	4	70	35
Missing variable:	123	38	9192	9	5
RH not valid:			4		
Percent trimmed at 3.50:	0.4%	0.0%	0.1%	0.4%	0.2%

* The number of observations is shown for each of the five flagged variables (SST = sea surface temperature; AT = air temperature; RH = relative humidity; WIND = u , v , and derived w , jointly; SLP = sea level pressure) for each Study Area. Although relative humidity was not calculated, its flag was used to trim dew point depression. For relative humidity, the number for *Missing variable* is actually the number of missing dew point observations and the number for *RH not valid* is the number of reports with extant dew point and air temperature flagged as 2 (inadvertently included in the summaries).

Appendix B. Upper air data

B1. Variables

Upper air soundings of wind, humidity, temperature, and geopotential height were typically made twice daily (00 GMT and 12 GMT) at standard isobaric surfaces (1000 mb, 850 mb, 700 mb, 500 mb, 300 mb, 200 mb, 150 mb, and 100 mb). Both data sets used (see Section 2) contain already-calculated year-month summaries. Climats consists of year-month summaries from different countries for which, in general, the number and time of soundings constituting the year-month were not available. NCAR Raobs has separate summaries for 00 GMT and 12 GMT. Climats has summaries for dew point temperature whereas NCAR Raobs has mixing ratio (unused in this report). NCAR Raobs has summaries of the eastward and northward components of vector wind ($\bar{u}$ and $\bar{v}$) whereas Climats has summaries for vector mean speed and direction, which were converted back to $\bar{u}$ and $\bar{v}$.

B2. Plotted quantities

Upper Air Climatology. The quantities of the upper air climatology plot were calculated in the same way as the surface climatology plots (Appendix A). For each pressure surface and month, the period-of-record mean of each variable is plotted at the mean geopotential height for that pressure surface and month. The pressure labels on the left are plotted at the mean height across the 12 months.

Anomalies. The quantities of the upper air anomaly plots are calculated by the same method as the surface anomaly plots (see Appendix A).

B3. Processing

Climats contains some status codes (Jenne and Crutcher, 1976) to flag wild or inconsistent data. Report status codes from the hydrostatic check of height and temperature (applied by NCAR only through 1974) were checked. Any year-month reports with status codes of 9 or 11 had missing data substituted for all

variables. Some stations had two or more reports with identical dates. In all cases, only one of these duplicate reports had valid data and was retained; the remainder had a report status code of 10 and were eliminated. Report wind status codes were also checked, and any report with a status code of 3 had missing data substituted for the resultant $\bar{u}$ and $\bar{v}$ at all levels. The report hour code, which may indicate the hour or combination of hours used starting in 1967, was ignored.

Climats was the primary source of monthly means used in the summaries. NCAR Raobs was used to fill gaps in the Climats data. The merging of the data sets was done such that all the data for any year-month are entirely from one data set or the other. To help ensure against erroneous upper air data for times when the OWS moved outside the Study Area, etc., the merged upper air data were compared for time correspondence with the surface data, as shown in the Frequency of Observations plots (plot No. 1 for each OWS). Upper air data for year-months in which there were no surface data were rejected.

Climats was chosen to be the primary data set because of its longer period of record. Since NCAR Raobs consists of separate year-month summaries for the hours 00Z and 12Z, these hours were averaged to form a single year-month mean for each variable (except dew point temperature, which was not available from NCAR Raobs). The combined mean was then used to fill in the gaps in Climats where possible. Figure B1 shows the data set used for each year-month for each Study Area.

Early processing of the merged upper air data showed, however, that not all wild values were flagged in the Climats data. Also, flags were not available in NCAR Raobs. Hence, the new upper air data were trimmed in a manner similar (although not identical to) the surface data. For each OWS, the period of record median and sextiles (as defined in *Release 1*) were taken for each variable at each pressure (including the geopotential height of each pressure surface). The monthly data were then trimmed so that all remaining data met the condition

$$g - 3.5\sigma \leq \bar{x} \leq g + 3.5\sigma$$

where, here, g is the period-of-record median of a given variable at a given pressure, σ is the estimated standard deviation, and $\bar{x}$ is the monthly mean of the var-

iable at the pressure under consideration. The estimated standard deviation is computed as

$$\sigma = \frac{\sigma_5 - \sigma_1}{2}$$

where σ_5 and σ_1 are the fifth and first sextiles, respectively, of the data distribution. Thus the upper air data were trimmed using symmetric limits about g whereas the surface data were trimmed using possibly asymmetric limits.

Table B1 shows the number of year-months trimmed from the summaries (Trim) and the number used in the summaries (Rem, for remaining) for each Study Area. Since the upper air data consist only of monthly means, trimming resulted in the loss of entire year-months for the trimmed variables at individual pressure surfaces. All five variables—air temperature, dew point temperature, u and v wind, and pressure height—were subject to trimming at all pressure surfaces.

Period-of-record means were then made from the trimmed monthly data, and monthly anomalies of the trimmed data were made from these trimmed means. The trimmed means and anomalies constitute the data shown in all of the upper air summary plots.

Table B1. Upper air trimming performance*

Pressure surface	Air temp		Dew point		u-wind		v-wind		Height		Total		
	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	%Trim
OWS A													
100 mb	4	156		2	1	138	2	137	4	156	11	589	1.8%
150 mb	2	159		2	2	139	2	139	3	158	9	597	1.5%
200 mb	3	217		2	1	145	2	144	3	217	9	725	1.2%
300 mb		228		2	2	147	1	148		228	3	753	0.4%
500 mb	2	226	2	210	1	147	3	145		228	8	956	0.8%
700 mb	1	227	1	215	2	147	3	146		228	7	963	0.7%
850 mb	2	226	4	215	2	147	3	146	2	226	13	960	1.3%
1000 mb		2		2		1		1		2	0	8	0.0%
Total	14	1441	7	650	11	1011	16	1006	12	1443	60	5551	1.1%
Percent trimmed	1.0%		1.1%		1.1%		1.6%		0.8%				
OWS B													
100 mb		204			5	179	1	183	1	203	7	769	0.9%
150 mb	1	203			2	193	1	194	2	202	6	792	0.8%
200 mb		274			1	194	1	194	3	271	5	933	0.5%
300 mb	3	279		9		198		198		282	3	966	0.3%
500 mb	2	280		257	1	197	2	196	2	280	7	1210	0.6%
700 mb	2	280	1	275		198	2	196	2	280	7	1229	0.6%
850 mb	1	281	4	273	1	147	1	147	1	281	8	1129	0.7%
1000 mb		4		2		2		2		4	0	14	0.0%
Total	9	1805	5	816	10	1308	8	1310	11	1803	43	7042	0.6%
Percent trimmed	0.5%		0.6%		0.8%		0.6%		0.6%				

Table B1. Upper air trimming performance* (continued)

Pressure surface	Air temp		Dew point		u-wind		v-wind		Height		Trim	Total	
	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem		Rem	%Trim
OWS C													
100 mb	2	203			6	176	1	181		205	9	765	1.2%
150 mb	3	202			1	189	2	188		205	6	784	0.8%
200 mb	3	274				198	1	197		277	4	946	0.4%
300 mb	1	283		32		200	2	198	1	283	4	996	0.4%
500 mb	1	283		249		200	1	199	1	283	3	1214	0.2%
700 mb	1	283	1	279		201	2	199	2	282	6	1244	0.5%
850 mb	3	281		275		156	1	155	1	283	5	1150	0.4%
1000 mb		3		1		3		3		3	0	13	0.0%
Total	14	1812	1	836	7	1323	10	1320	5	1821	37	7112	0.5%
Percent trimmed	0.8%		0.1%		0.5%		0.8%		0.3%				
OWS D													
100 mb	1	198			1	168	2	167	2	197	6	730	0.8%
150 mb	1	198			1	185		186	2	197	4	766	0.5%
200 mb	1	269				191		191	1	269	2	920	0.2%
300 mb	2	276		71	3	191	1	193	1	277	7	1008	0.7%
500 mb	2	276		246	3	191	1	193	2	276	8	1182	0.7%
700 mb	4	274		270	1	193	1	193	1	277	7	1207	0.6%
850 mb	3	275		274		160		160	1	277	4	1146	0.3%
1000 mb		2				2		2		2	0	8	0.0%
Total	14	1768	0	861	9	1281	5	1285	10	1772	38	6967	0.5%
Percent trimmed	0.8%		0.0%		0.7%		0.4%		0.6%				

Table B1. Upper air trimming performance* (continued)

Pressure surface	Air temp		Dew point		u-wind		v-wind		Height		Total		
	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	%Trim
<u>OWS E</u>													
100 mb		196			1	167	3	165		196	4	724	0.5%
150 mb	3	194			1	184	1	184		197	5	759	0.7%
200 mb	2	267				188	1	187	1	268	4	910	0.4%
300 mb	2	274	1	107		191	1	190	1	275	5	1037	0.5%
500 mb		276		226	1	191		192	1	275	2	1160	0.2%
700 mb	2	274	3	262		192		192	3	273	8	1193	0.7%
850 mb	2	274	1	274	1	136	1	136	1	275	6	1095	0.5%
1000 mb											0	0	0.0%
Total	11	1755	5	869	4	1249	7	1246	7	1759	34	6878	0.5%
Percent trimmed	0.6%		0.6%		0.3%		0.6%		0.4%				
<u>OWS I</u>													
100 mb	2	224			4	196	2	198		226	8	844	0.9%
150 mb		226			1	203	1	203		226	2	858	0.2%
200 mb		284				208	2	206		284	2	982	0.2%
300 mb		285		4		212	1	211	1	284	2	996	0.2%
500 mb		285	3	271		212	1	211		285	4	1264	0.3%
700 mb	1	284	7	269		212	1	211		285	9	1261	0.7%
850 mb	2	283	2	275	1	211		212		285	5	1266	0.4%
1000 mb		1		1		1		1		1	0	5	0.0%
Total	5	1872	12	820	6	1455	8	1453	1	1876	32	7476	0.4%
Percent trimmed	0.3%		1.4%		0.4%		0.5%		0.1%				

Table B1. Upper air trimming performance* (continued)

Pressure surface	Air temp		Dew point		u-wind		v-wind		Height		Trim	Total		
	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem		Rem	%Trim	
<u>OWS J</u>														
100 mb	2	226			3	195		198		228	5	847	0.6%	
150 mb	1	228			4	198	2	200		229	7	855	0.8%	
200 mb	1	296			5	202	2	205	1	296	9	999	0.9%	
300 mb	1	296		6	3	207	1	209		297	5	1015	0.5%	
500 mb	1	297	4	290	3	209	1	211	1	297	10	1304	0.8%	
700 mb	2	296	4	289	3	209	1	211	1	297	11	1302	0.8%	
850 mb	1	297		292	2	210	3	209	1	297	7	1305	0.5%	
1000 mb		1		1						1	0	3	0.0%	
Total	9	1937	8	878	23	1430	10	1443	4	1942	54	7630	0.7%	
Percent trimmed	0.5%		0.9%		1.6%		0.7%		0.2%					
<u>OWS K</u>														
100 mb	3	205			1	133	2	132	1	207	7	677	1.0%	
150 mb		212			1	141	1	141	2	210	4	704	0.6%	
200 mb		275			2	141		143	3	272	5	831	0.6%	
300 mb	4	274	1	17	4	140		144	1	277	10	852	1.2%	
500 mb	2	276	3	272	2	143	1	144	1	277	9	1112	0.8%	
700 mb		278	2	273	4	141		145		278	6	1115	0.5%	
850 mb	1	277		276	3	142		145	1	277	5	1117	0.4%	
1000 mb		2		1		1		1		2	0	7	0.0%	
Total	10	1799	6	839	17	982	4	995	9	1800	46	6415	0.7%	
Percent trimmed	0.6%		0.7%		1.7%		0.4%		0.5%					

Table B1. Upper air trimming performance* (continued)

Pressure surface	Air temp		Dew point		u-wind		v-wind		Height		Trim	Total		
	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem		Trim	Rem	%Trim
<u>OWS L</u>														
100 mb		87			2	85	1	86	2	85	5	343	1.4%	
150 mb	2	85			1	86	1	86	1	86	5	343	1.4%	
200 mb	2	85			2	85	1	86	1	86	6	342	1.7%	
300 mb	2	85			2	85	2	85	1	86	7	341	2.0%	
500 mb	1	86		86	3	84	3	84	1	86	8	426	1.8%	
700 mb	2	85	1	85	4	83	3	84		87	10	424	2.3%	
850 mb	4	83	3	83	5	82	2	85	2	85	16	418	3.7%	
1000 mb		1		1							0	2	0.0%	
Total	13	597	4	255	19	590	13	596	8	601	57	2639	2.1%	
Percent trimmed	2.1%		1.5%		3.1%		2.1%		1.3%					
<u>OWS M</u>														
100 mb	2	213		3		158		158	1	214	3	746	0.4%	
150 mb	1	216		3		161	1	160	1	216	3	756	0.4%	
200 mb	4	247		3		163		163	2	249	6	825	0.7%	
300 mb	2	251		5		165	2	163	3	250	7	834	0.8%	
500 mb	2	251		244	1	164	1	164	3	250	7	1073	0.6%	
700 mb	1	252	2	250	1	164	4	161	2	251	10	1078	0.9%	
850 mb		253	2	250	1	164	4	161	2	251	9	1079	0.8%	
1000 mb		3		3		1		1		3	0	11	0.0%	
Total	12	1686	4	761	3	1140	12	1131	14	1684	45	6402	0.7%	
Percent trimmed	0.7%		0.5%		0.3%		1.0%		0.8%					

Table B1. Upper air trimming performance* (continued)

Pressure surface	Air temp		Dew point		u-wind		v-wind		Height		Trim	Total	
	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem		Trim	Rem
OWS N													
100 mb	1	204			1	174	4	171	1	204	7	753	0.9%
150 mb	1	205				196		196	1	205	2	802	0.2%
200 mb	1	238			1	199	2	198	1	238	5	873	0.6%
300 mb		247	1	97	1	201	1	201	2	245	5	991	0.5%
500 mb		247		158		202	2	200	2	245	4	1052	0.4%
700 mb	3	244	2	202	1	201	2	200		247	8	1094	0.7%
850 mb	1	246	3	239		162	2	160		247	6	1054	0.6%
1000 mb		2				2		2		2	0	8	0.0%
Total	7	1633	6	696	4	1337	13	1328	7	1633	37	6627	0.6%
Percent trimmed	0.4%		0.9%		0.3%		1.0%		0.4%				
OWS P													
100 mb	7	272				217	1	216	5	274	13	979	1.3%
150 mb	2	278			1	237		238	4	276	7	1029	0.7%
200 mb	1	346			2	243	1	244	2	345	6	1178	0.5%
300 mb	4	350		29	1	246	1	246		354	6	1225	0.5%
500 mb	2	352		332	3	245	3	245		354	8	1528	0.5%
700 mb	1	353		333	2	246	3	245		354	6	1531	0.4%
850 mb	3	351	3	330	2	243	1	244		354	9	1522	0.6%
1000 mb		21		3		20		20		21	0	85	0.0%
Total	20	2323	3	1027	11	1697	10	1698	11	2332	55	9077	0.6%
Percent trimmed	0.9%		0.3%		0.6%		0.6%		0.5%				

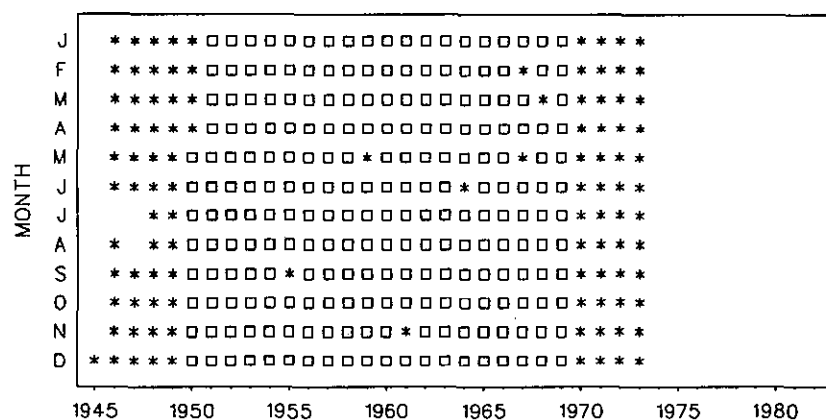
Table B1. Upper air trimming performance* (continued)

Pressure surface	Air temp		Dew point		u-wind		v-wind		Height		Trim	Total		
	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem		Rem	%Trim	
<u>OWS R</u>														
100 mb	1	72				61	1	60	1	72	3	265	1.1%	
150 mb		73				62		62	1	72	1	269	0.4%	
200 mb	1	71			1	62	1	62	1	72	4	267	1.5%	
300 mb	2	71				63		63	1	72	3	269	1.1%	
500 mb	3	70	2	68		63		63	1	72	6	336	1.8%	
700 mb		73	1	70		63	1	62	3	70	5	338	1.5%	
850 mb	2	71	1	70		63	1	62	1	72	5	338	1.5%	
1000 mb											0	0	0.0%	
Total	9	501	4	208	1	437	4	434	9	502	27	2082	1.3%	
Percent trimmed	1.8%		1.9%		0.2%		0.9%		1.8%					
<u>OWS T</u>														
100 mb		108				24		24		108	0	264	0.0%	
150 mb		108				24		24		108	0	264	0.0%	
200 mb		108				24		24		108	0	264	0.0%	
300 mb		108		54	2	22	2	22		108	4	314	1.3%	
500 mb	1	107	2	82	1	23	2	22		108	6	342	1.7%	
700 mb	1	107	1	82		24	1	23		108	3	344	0.9%	
850 mb	1	107	1	83	2	22		24	1	107	5	343	1.4%	
1000 mb		24				24		24	2	22	2	94	2.1%	
Total	3	777	4	301	5	187	5	187	3	777	20	2229	0.9%	
Percent trimmed	0.4%		1.3%		2.6%		2.6%		0.4%					

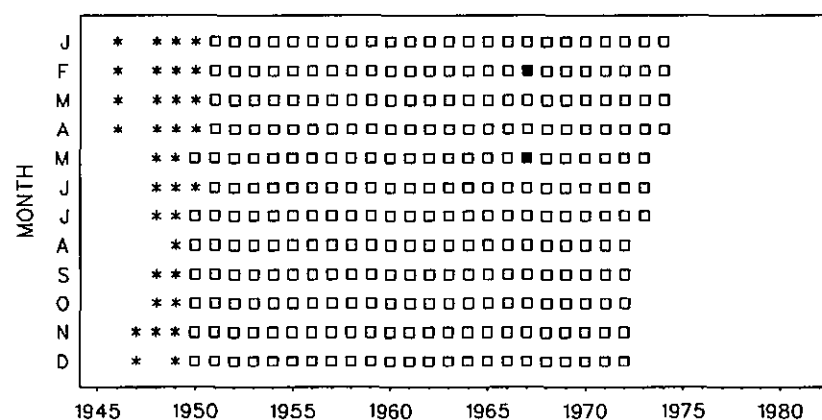
Table B1. Upper air trimming performance* (continued)

Pressure surface	Air temp		Dew point		u-wind		v-wind		Height		Total		
	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	Trim	Rem	%Trim
<u>QWS V</u>													
100 mb	2	140			1	102	1	102	2	140	6	484	1.2%
150 mb	3	139			1	120	6	115	1	141	11	515	2.1%
200 mb	2	195			1	129		130		197	3	651	0.5%
300 mb		198		107		135		135		198	0	773	0.0%
500 mb	1	197		157	1	135		136		198	2	823	0.2%
700 mb	2	196	2	176	1	134	1	134		198	6	838	0.7%
850 mb	1	197	8	179	1	128	4	125		198	14	827	1.7%
1000 mb											0	0	0.0%
Total	11	1262	10	619	6	883	12	877	3	1270	42	4911	0.8%
Percent trimmed	0.9%		1.6%		0.7%		1.3%		0.2%				

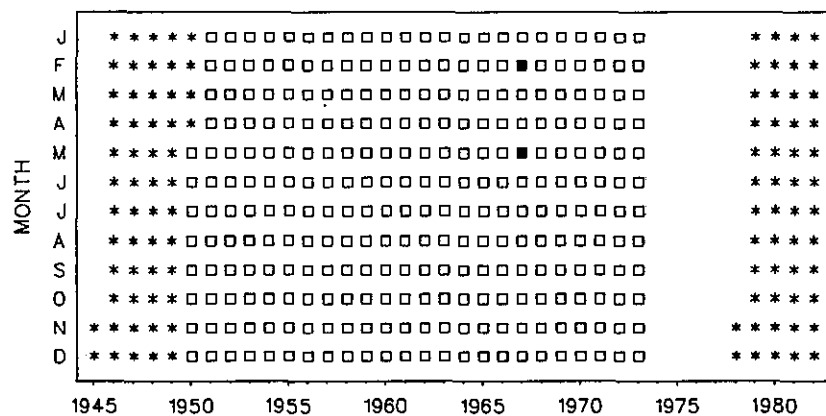
* The values shown for each of the five variables are the numbers of year-months trimmed from the summaries (Trim) and the numbers of year-months used in the summaries (Rem, for remaining).



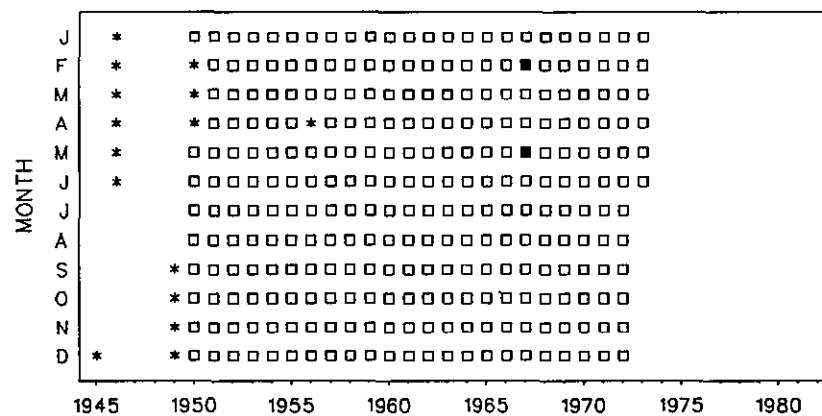
OWS A
year-months: 229 Climats, 0 NCAR, 105 surface data only



OWS B
year-months: 280 Climats, 2 NCAR, 33 surface data only



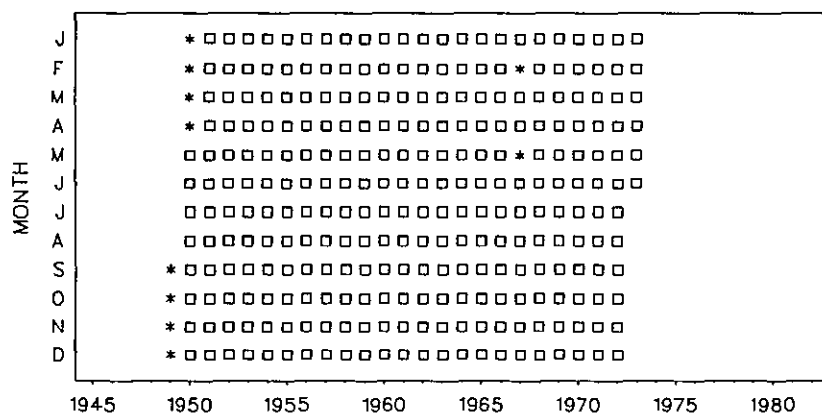
OWS C
year-months: 282 Climats, 2 NCAR, 104 surface data only



OWS D
year-months: 276 Climats, 2 NCAR, 15 surface data only

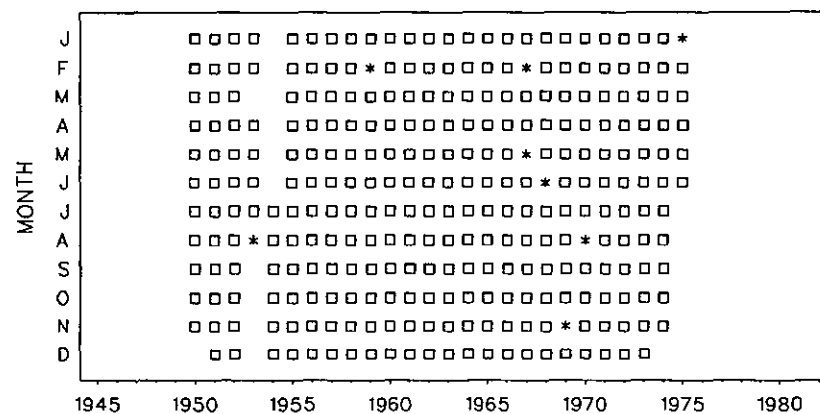
Figure B1. OWS Upper Air Data Sources

□ = Climats * = surface data only
■ = NCAR Raobs



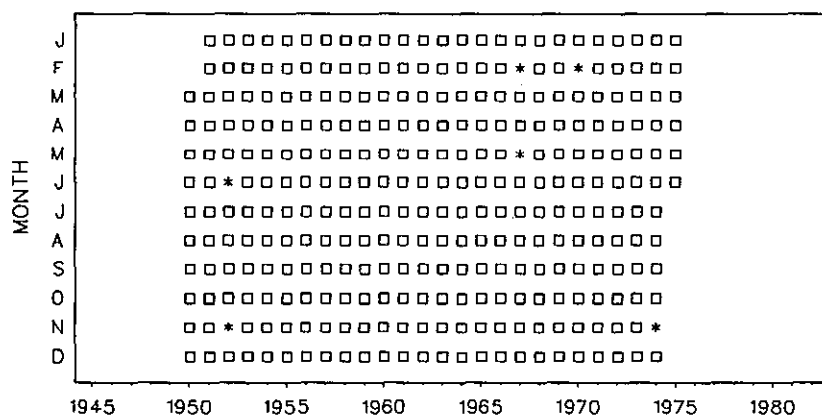
OWS E

year-months: 276 Climats, 0 NCAR, 10 surface data only



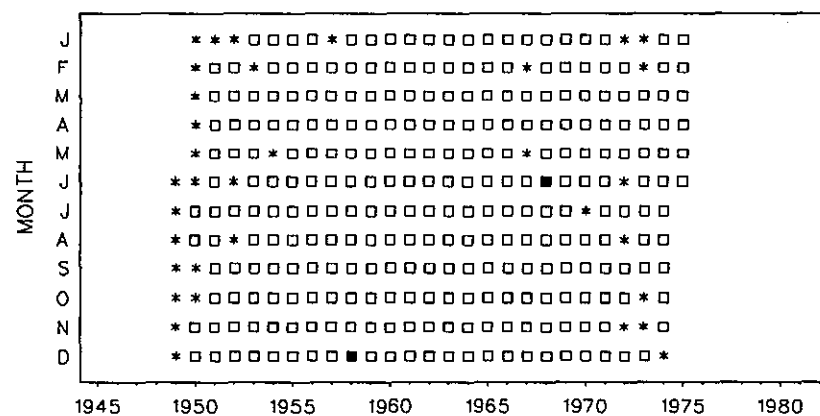
OWS I

year-months: 285 Climats, 0 NCAR, 8 surface data only



OWS J

year-months: 298 Climats, 0 NCAR, 6 surface data only



OWS K

year-months: 277 Climats, 2 NCAR, 34 surface data only

Figure B1 (continued). OWS Upper Air Data Sources

□ = Climats * = surface data only
 ■ = NCAR Raobs

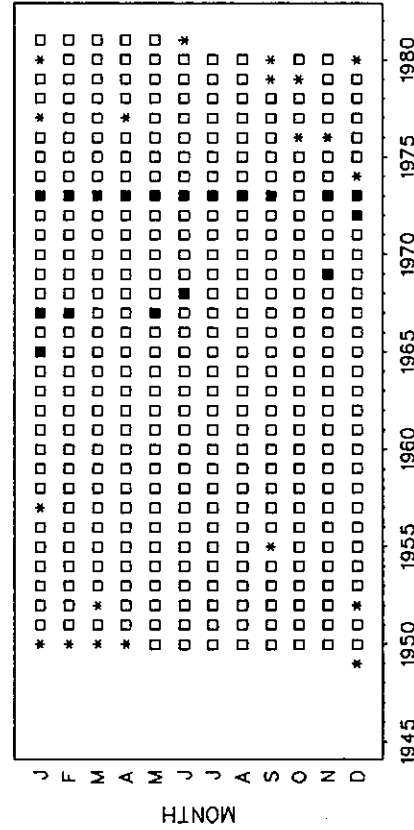
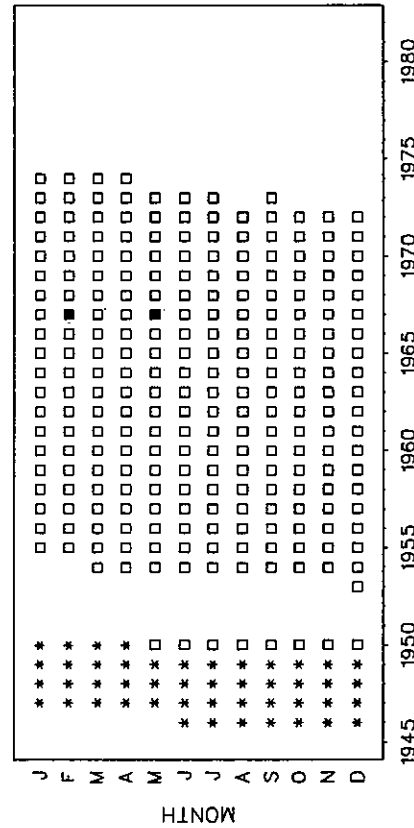
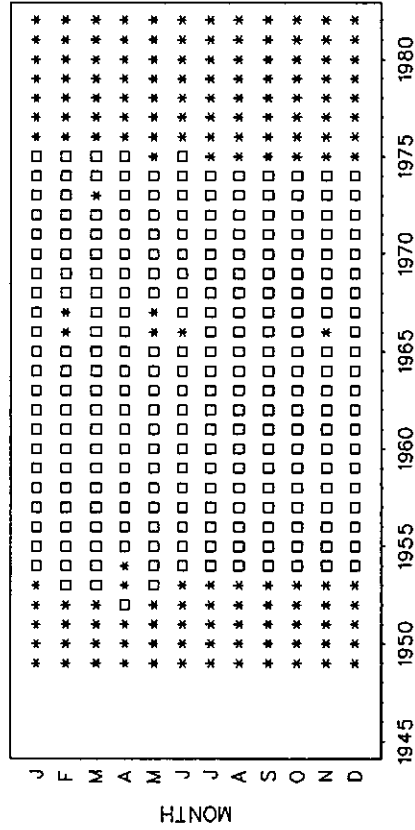
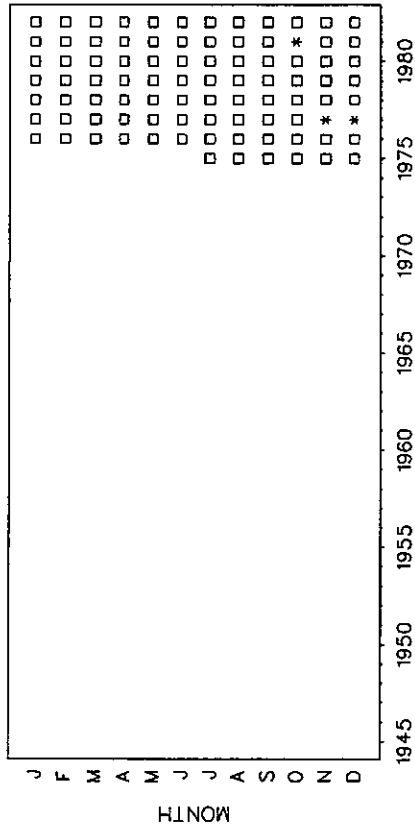
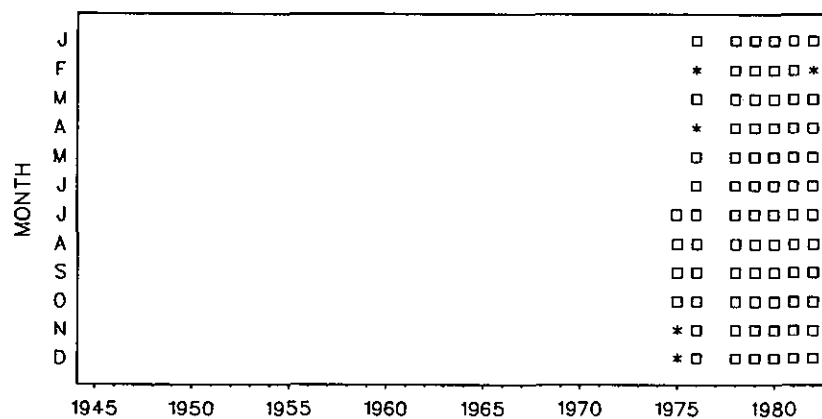
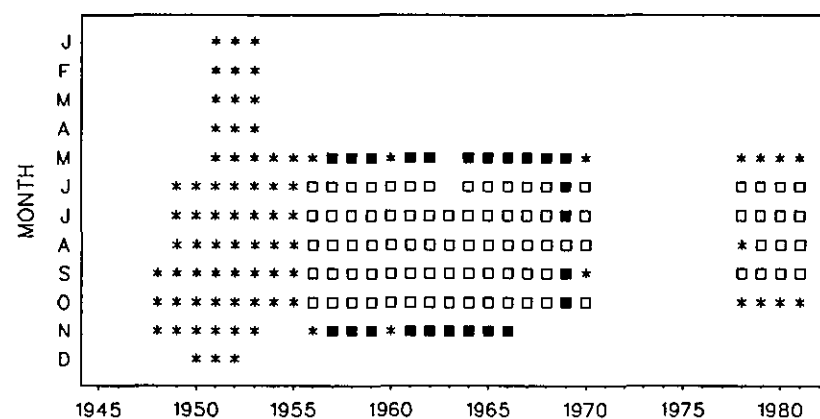


Figure B1 (continued). OWS Upper Air Data Sources

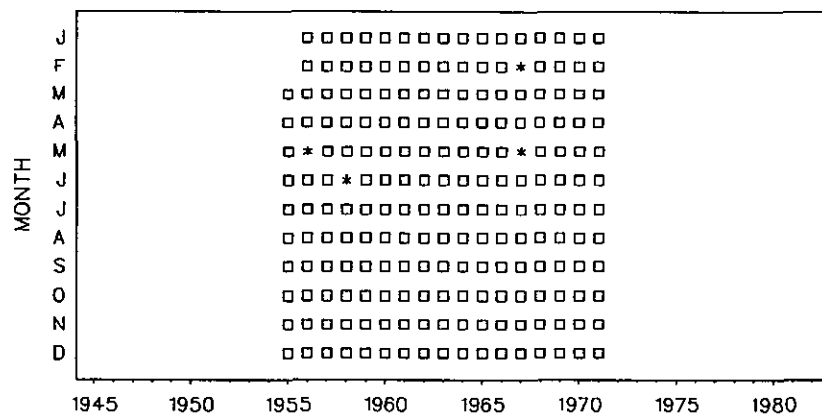
□ = Climats
■ = NCAR Raobs
* = surface data only



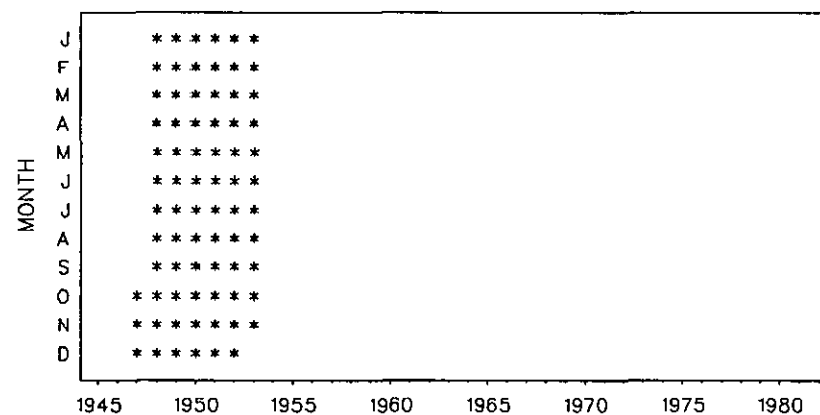
OWS R
year-months: 73 Climats, 0 NCAR, 5 surface data only



OWS T
year-months: 84 Climats, 24 NCAR, 78 surface data only



OWS V
year-months: 198 Climats, 0 NCAR, 4 surface data only

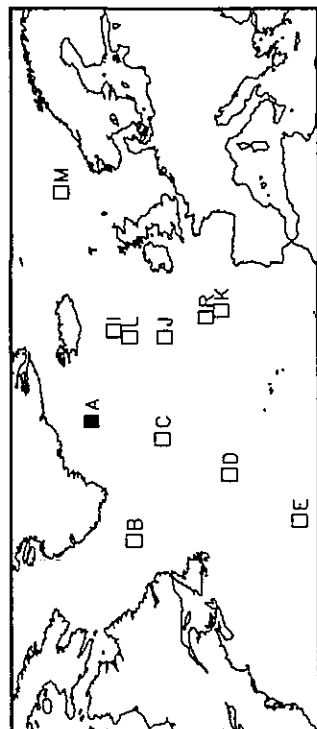


OWS X
year-months: 0 Climats, 0 NCAR, 74 surface data only

Figure B1 (continued). OWS Upper Air Data Sources

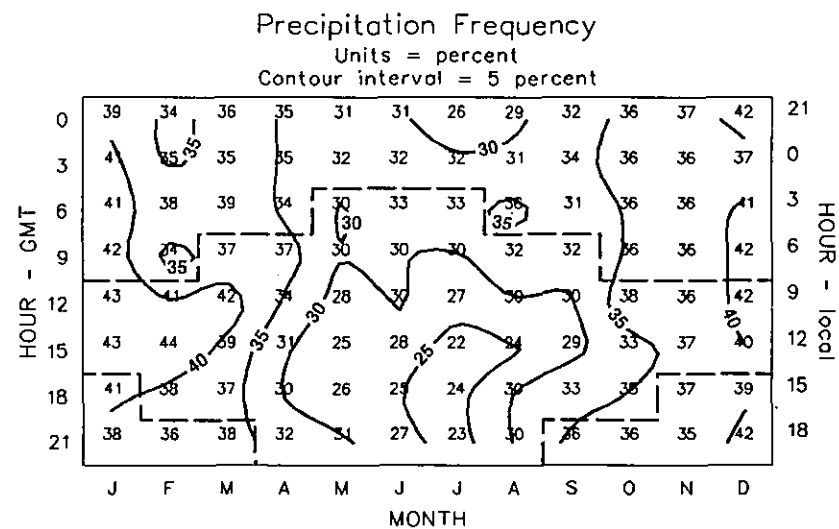
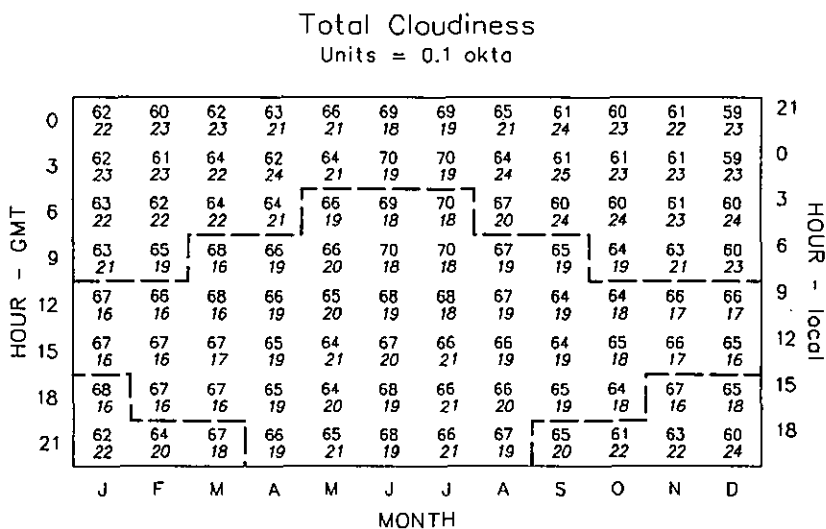
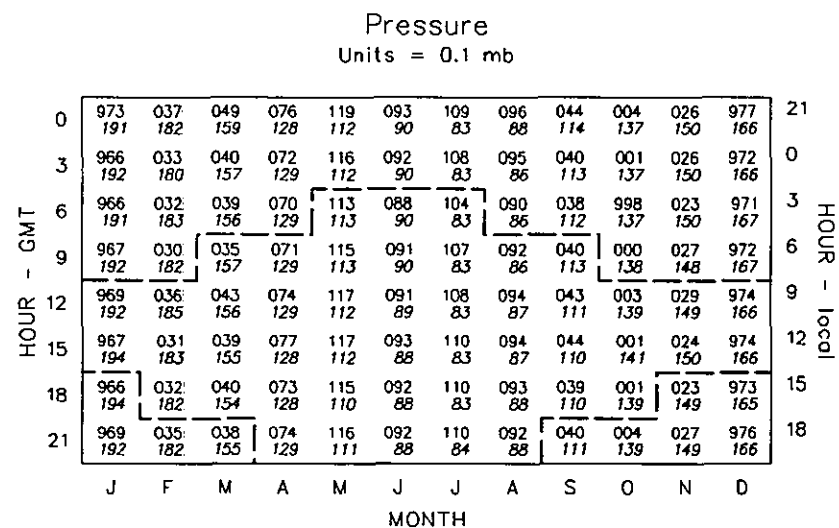
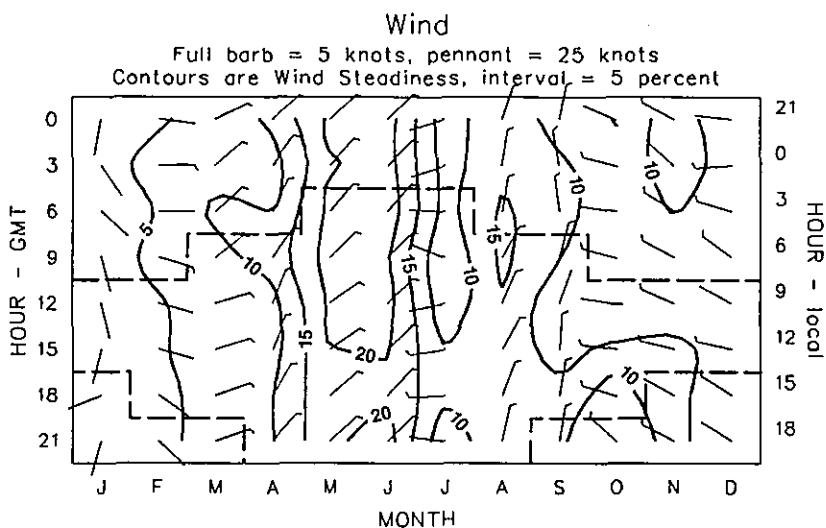
□ = Climats * = surface data only
■ = NCAR Raobs

Summaries



61.0°N – 62.9°N, 33.9°W – 32.0°W
1945 – 1973

OWS
A



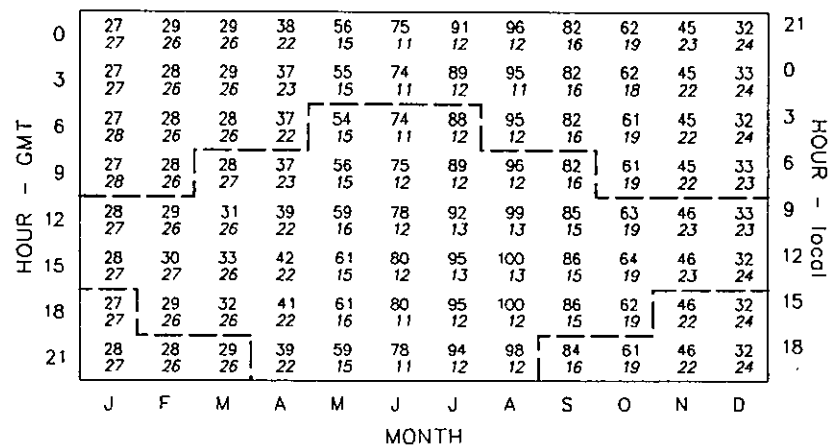
OWS Study Area A Surface Climatology

upper number = mean
lower number = standard deviation

———— data contours
- - - - - sunrise/sunset

Air Temperature

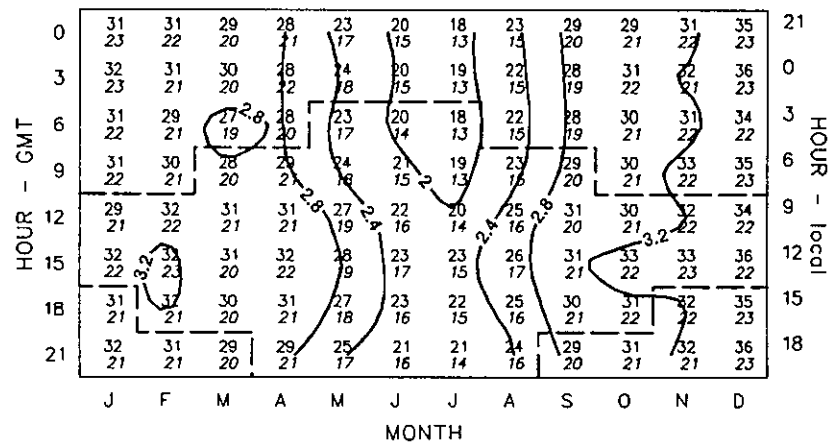
Units = 0.1 °C



Dew Point Depression

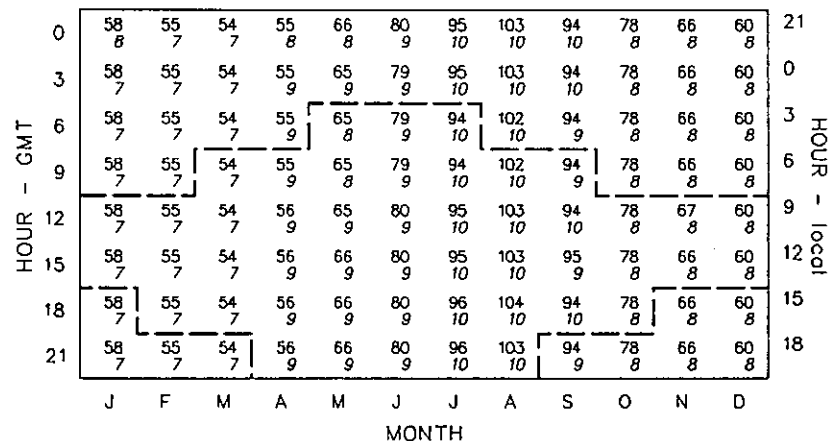
Units = 0.1 °C

Contour interval = 0.4 °C



Sea Surface Temperature

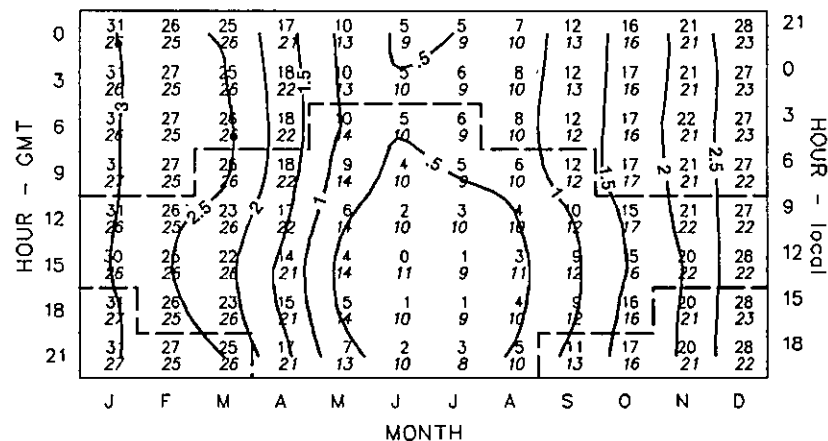
Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C

Contour interval = 0.5 °C



OWS Study Area A Surface Climatology

upper number = mean

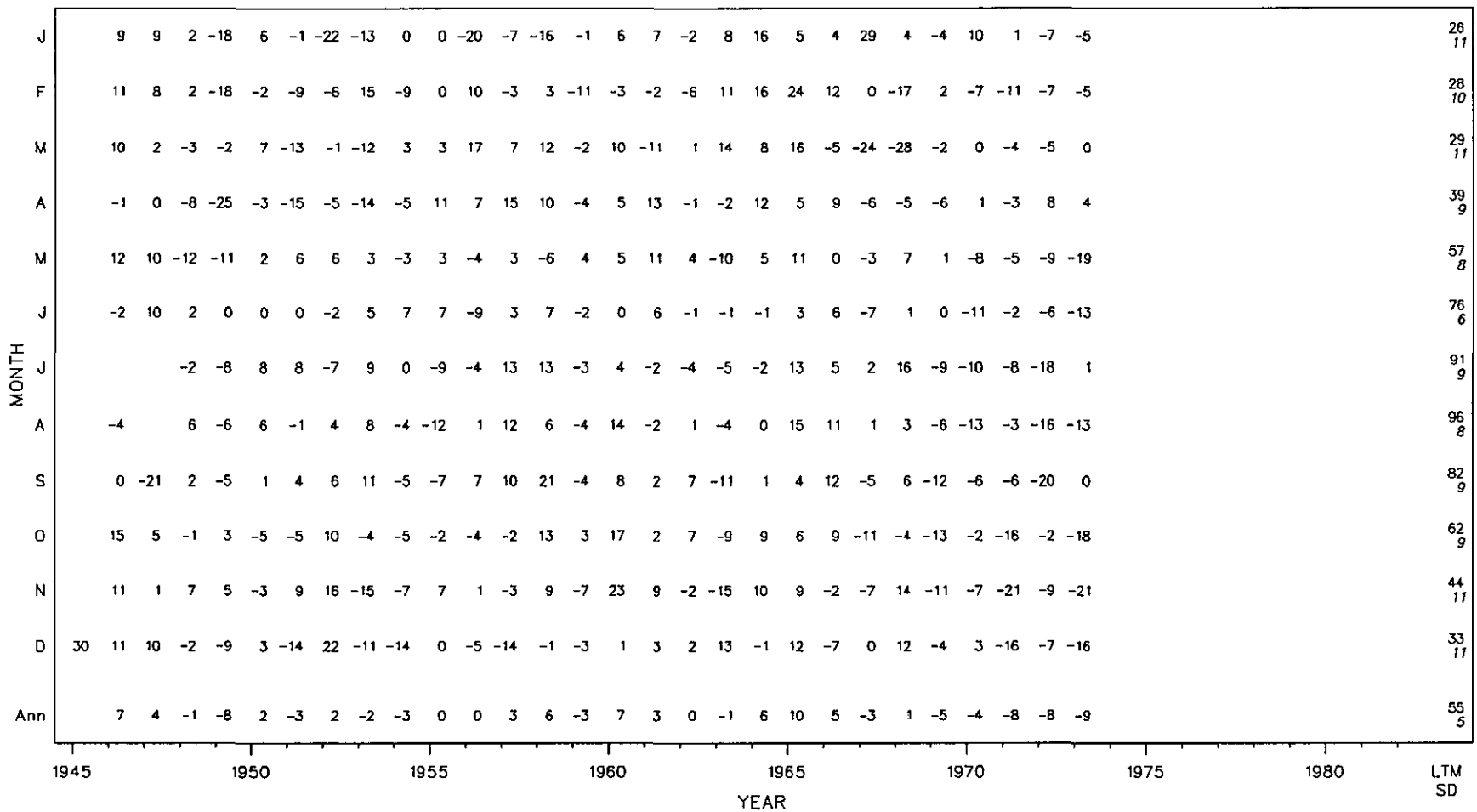
lower number = standard deviation

———— data contours

----- sunrise/sunset

Surface Air Temperature

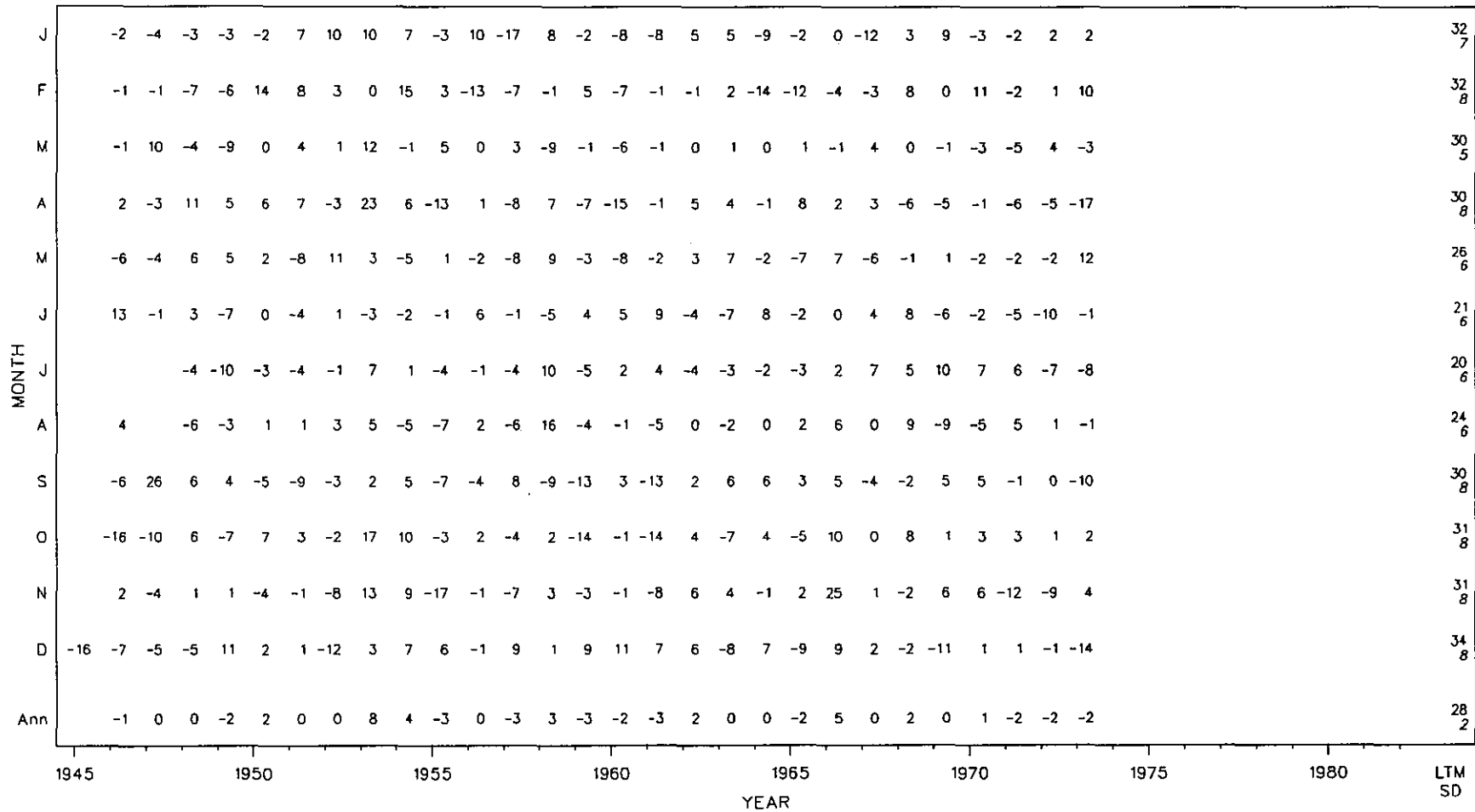
Units = 0.1 °C



OWS Study Area A Anomalies

Surface Dew Point Depression

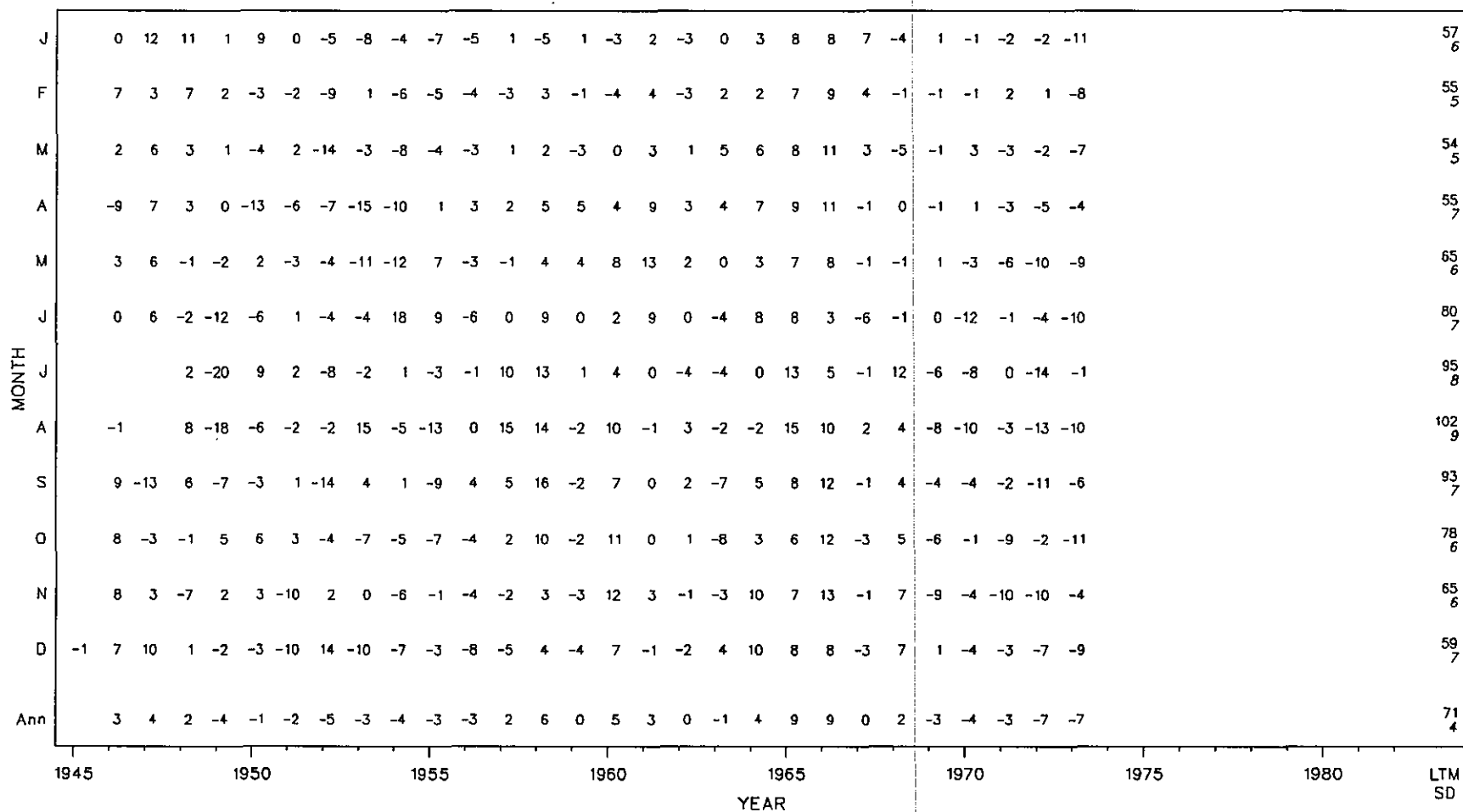
Units = 0.1 °C



OWS Study Area A Anomalies

Sea Surface Temperature

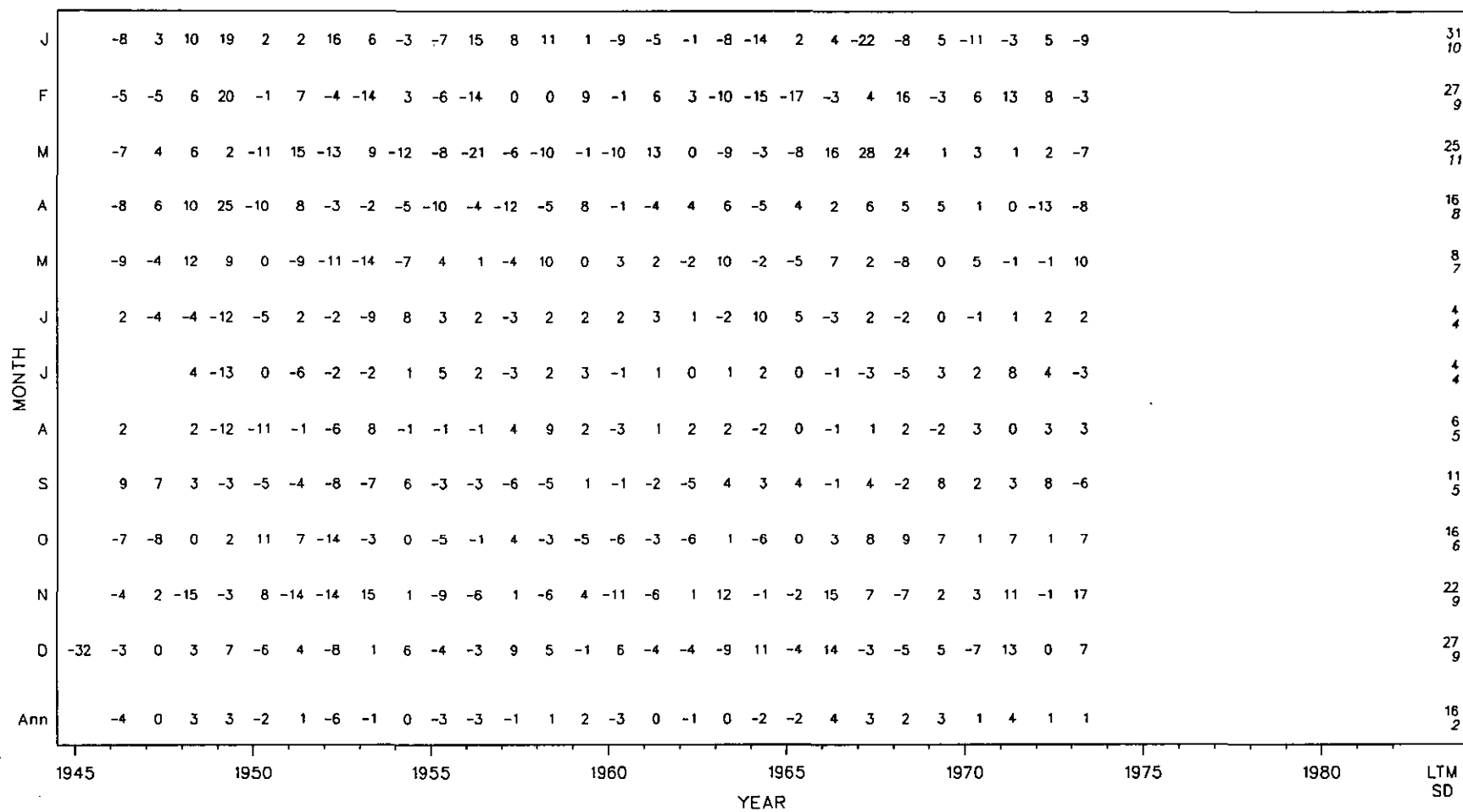
Units = 0.1 °C



OWS Study Area A Anomalies

Sea - Air Temperature Difference

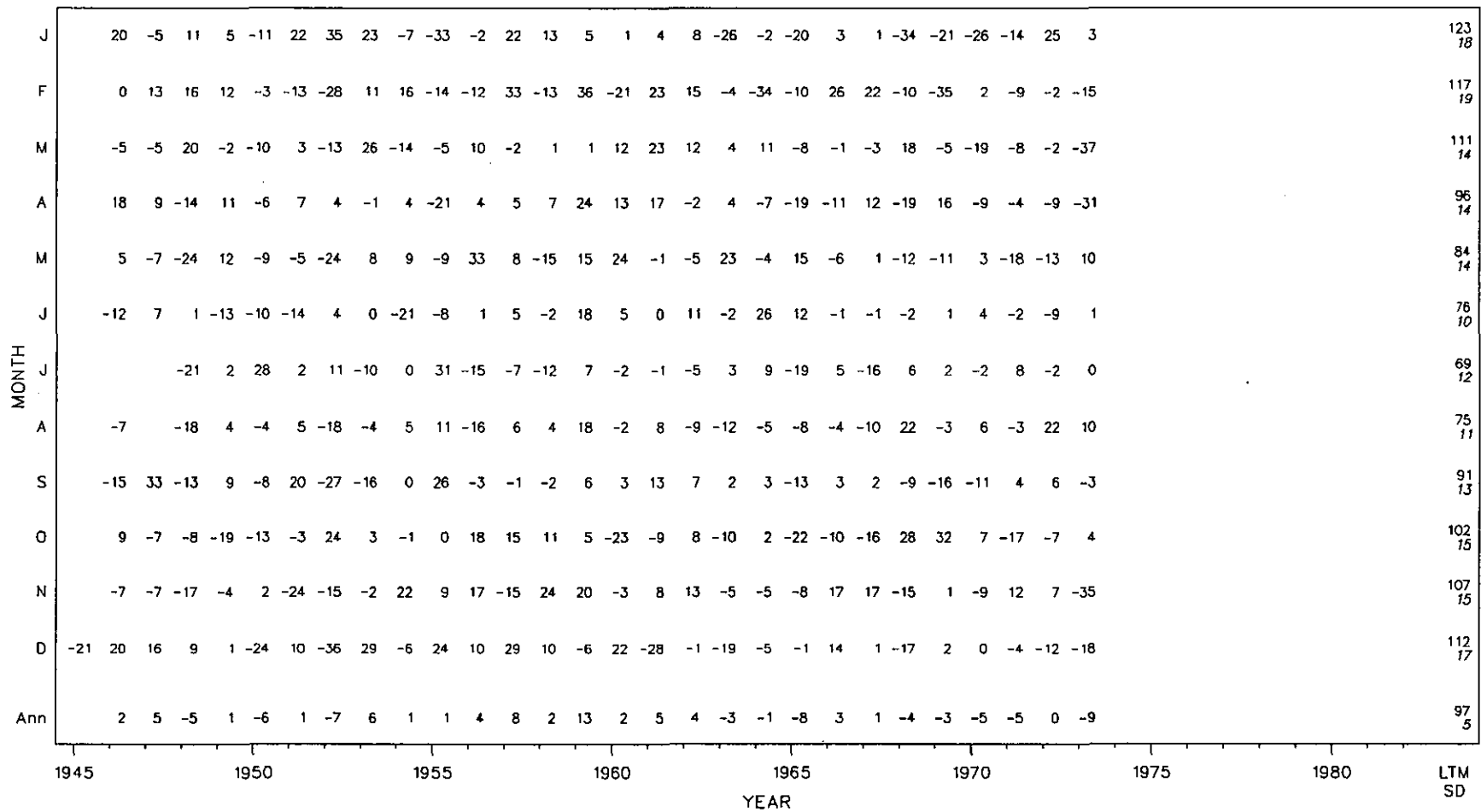
Units = 0.1 °C



OWS Study Area A Anomalies

Surface Scalar Wind

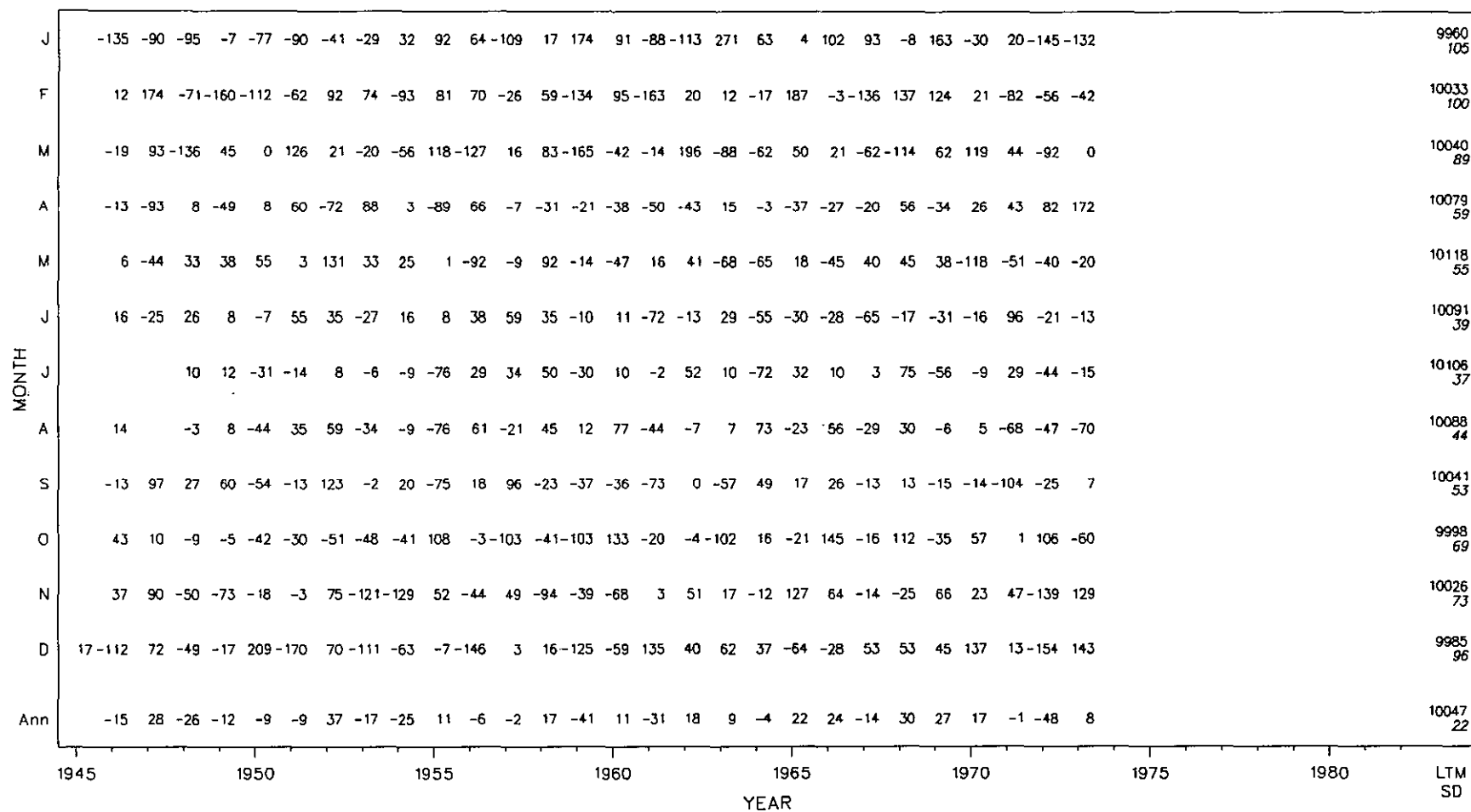
Units = 0.1 m/s



OWS Study Area A Anomalies

Sea Level Pressure

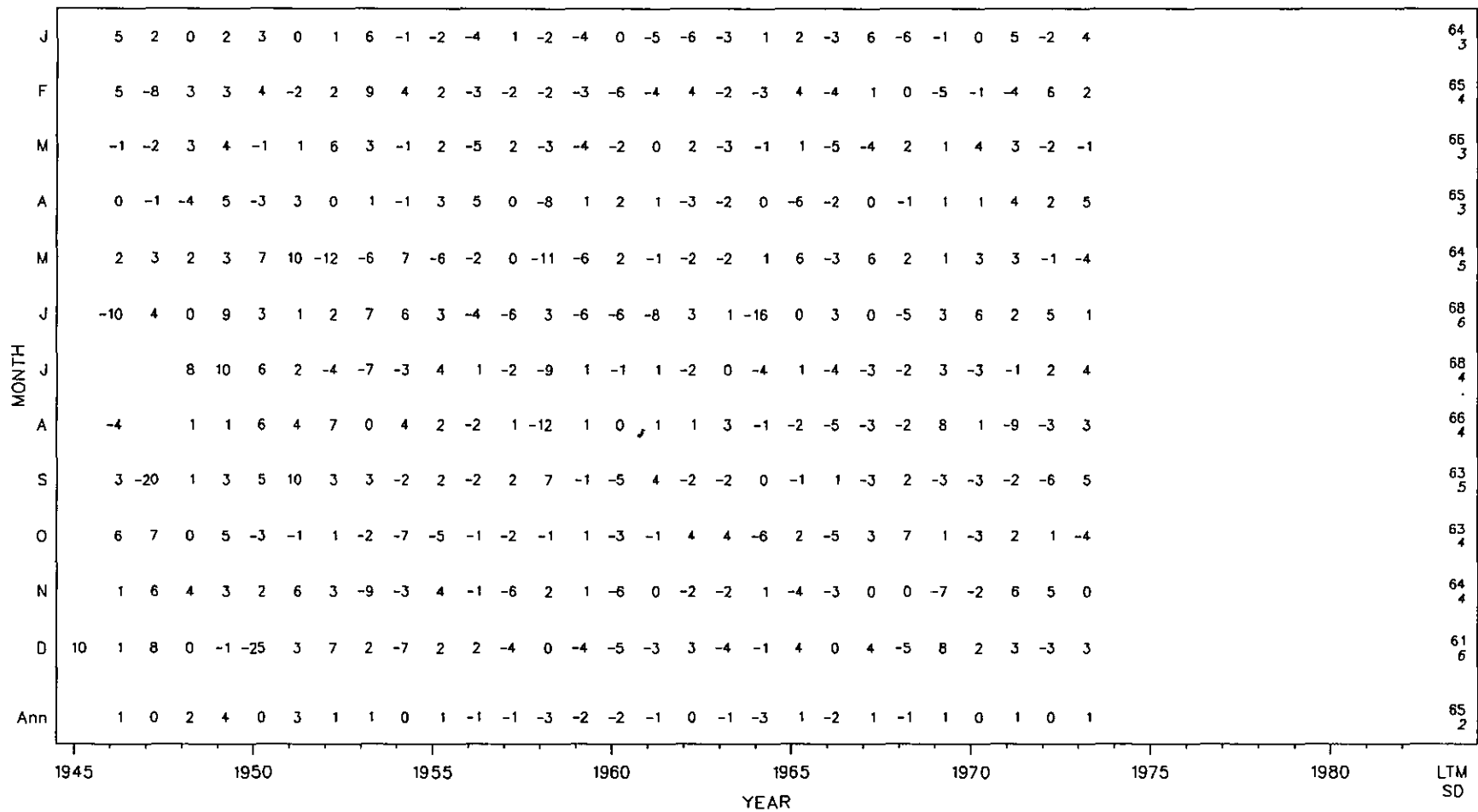
Units = 0.1 mb



OWS Study Area A Anomalies

Total Cloudiness

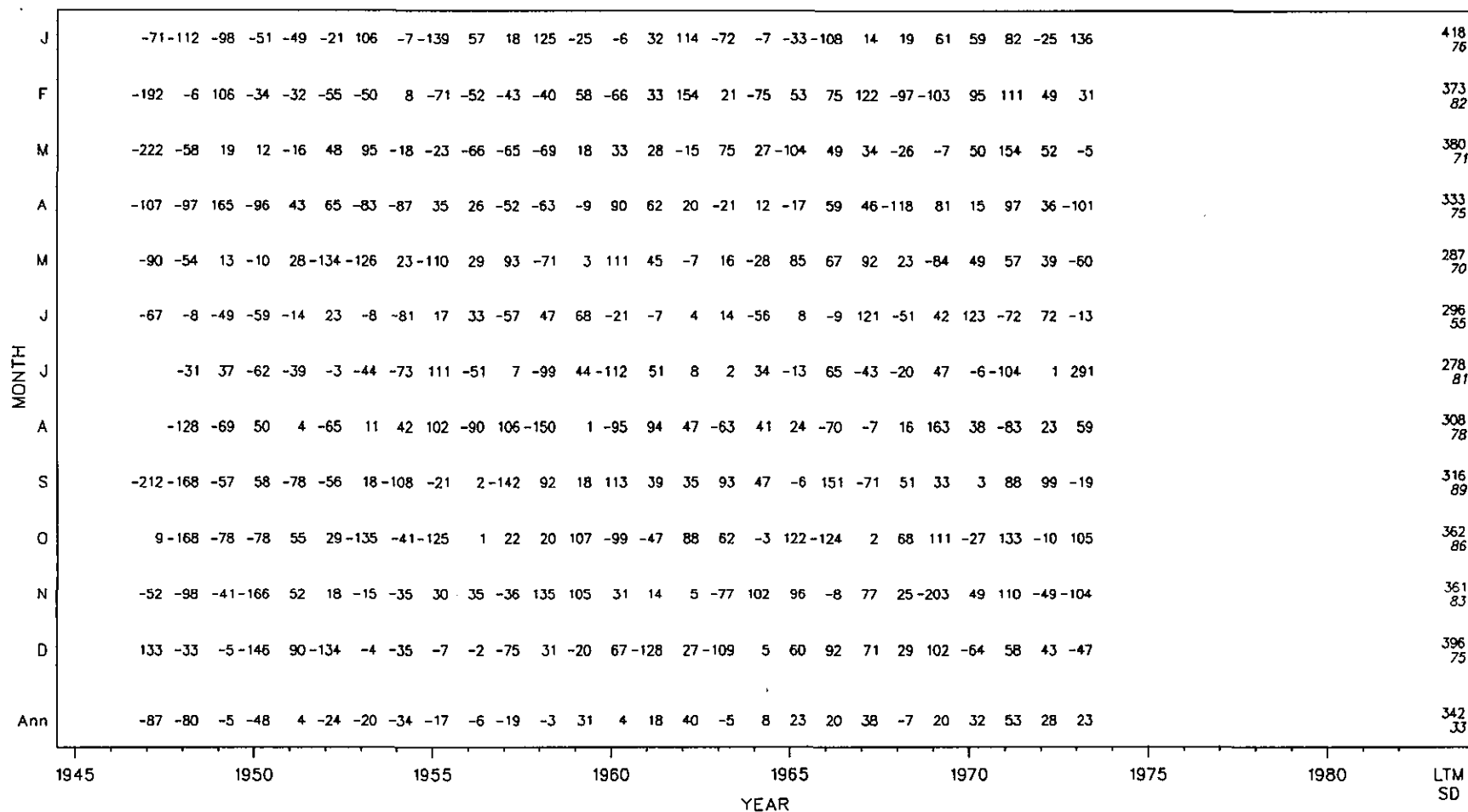
Units = 0.1 okta



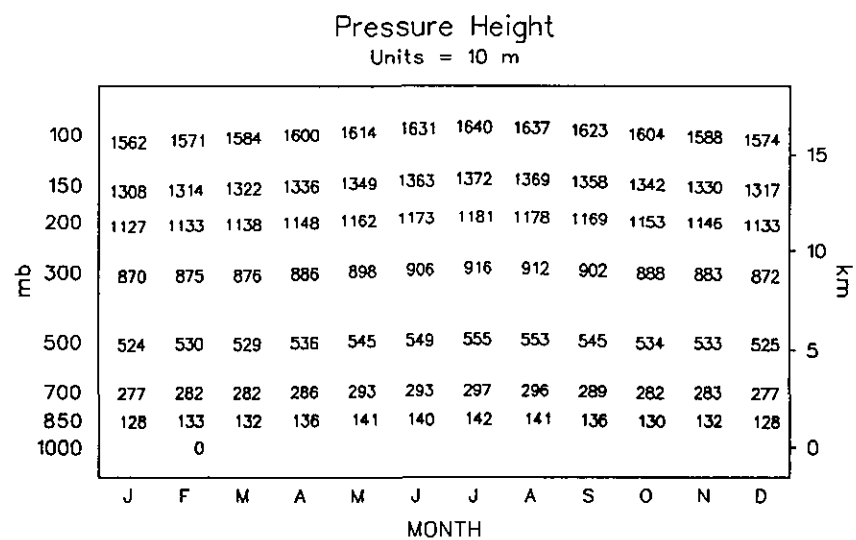
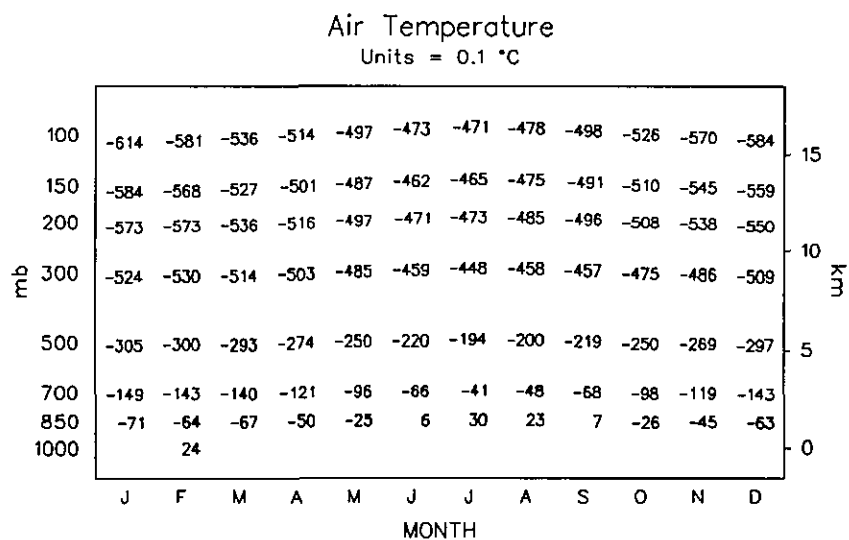
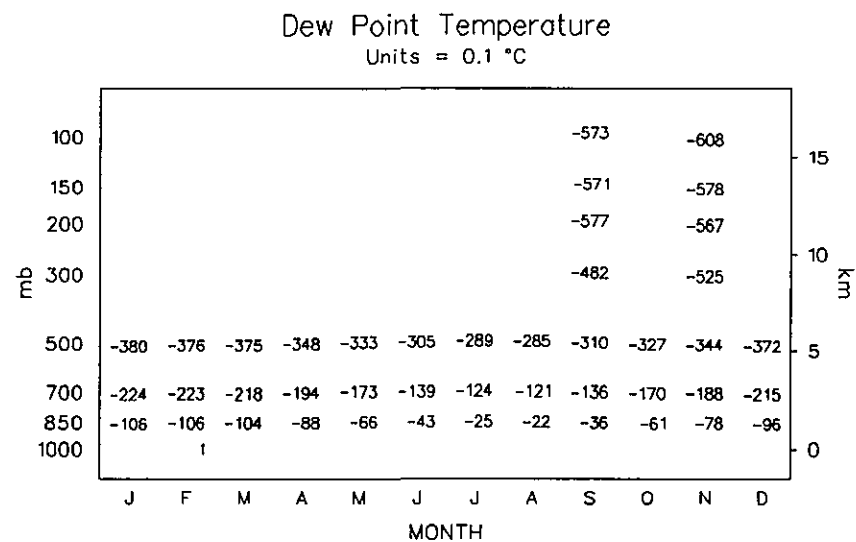
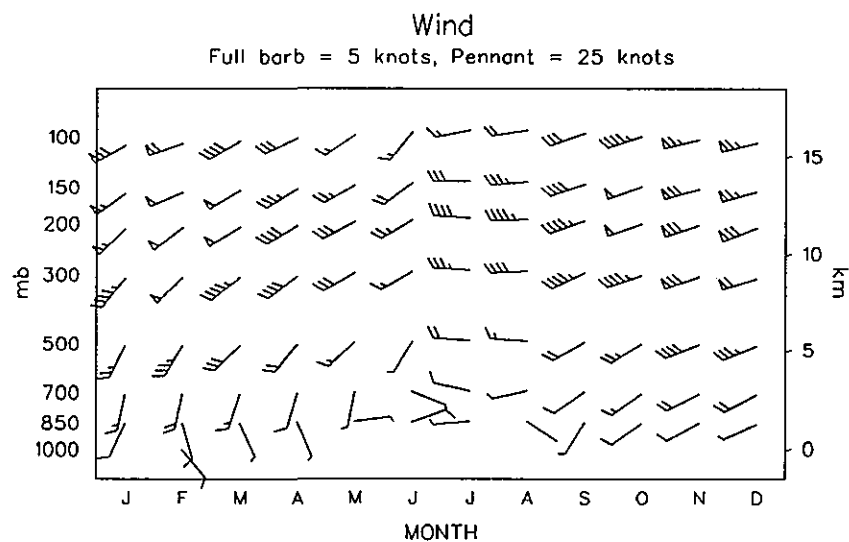
OWS Study Area A Anomalies

Precipitation Frequency

Units = 0.1 percent



OWS Study Area A Anomalies

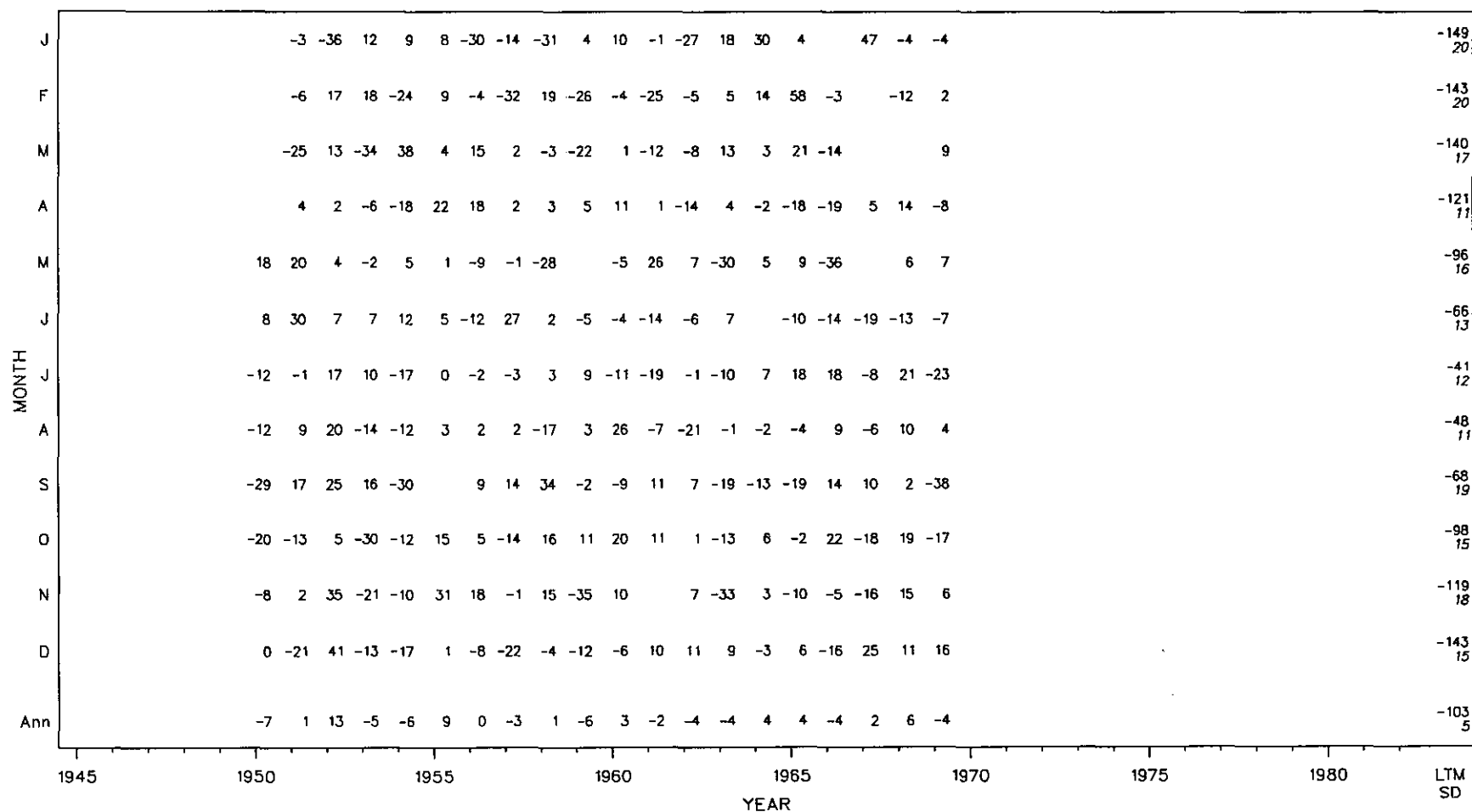


OWS Study Area A Upper Air Climatology

Mean plotted at actual height

Air Temperature: 700 mb

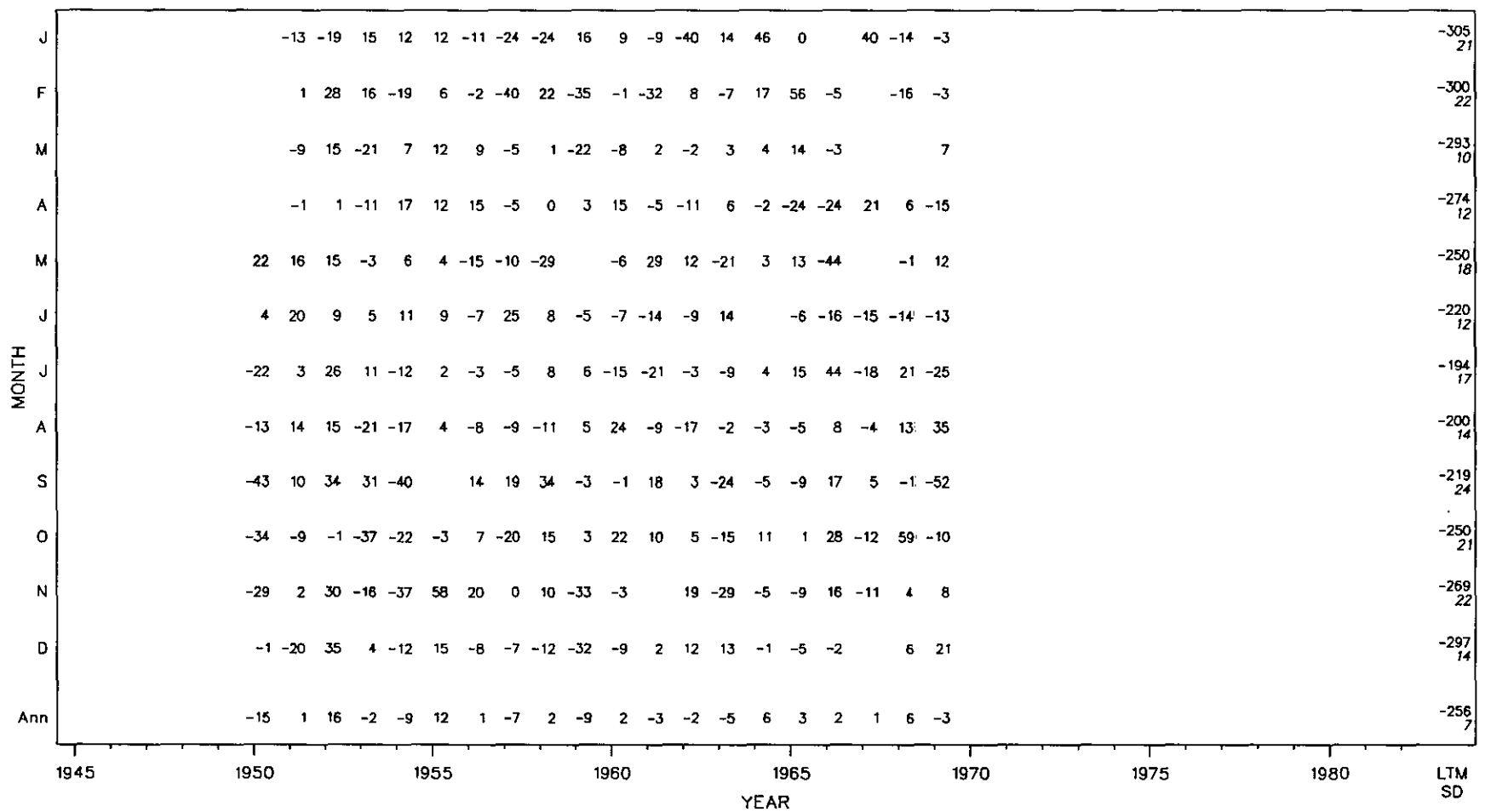
Units = 0.1 °C



OWS Study Area A Anomalies

Air Temperature: 500 mb

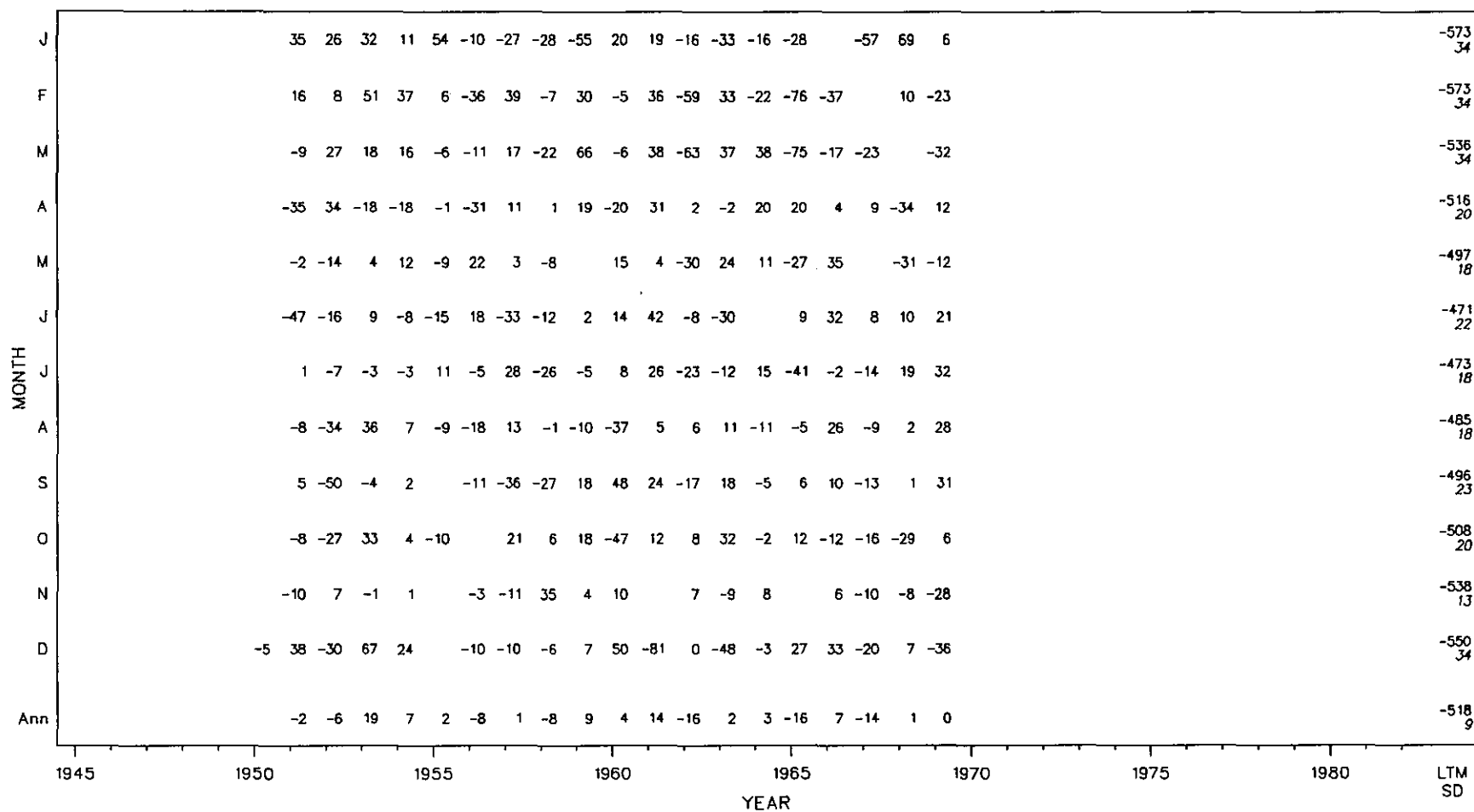
Units = 0.1 °C



OWS Study Area A Anomalies

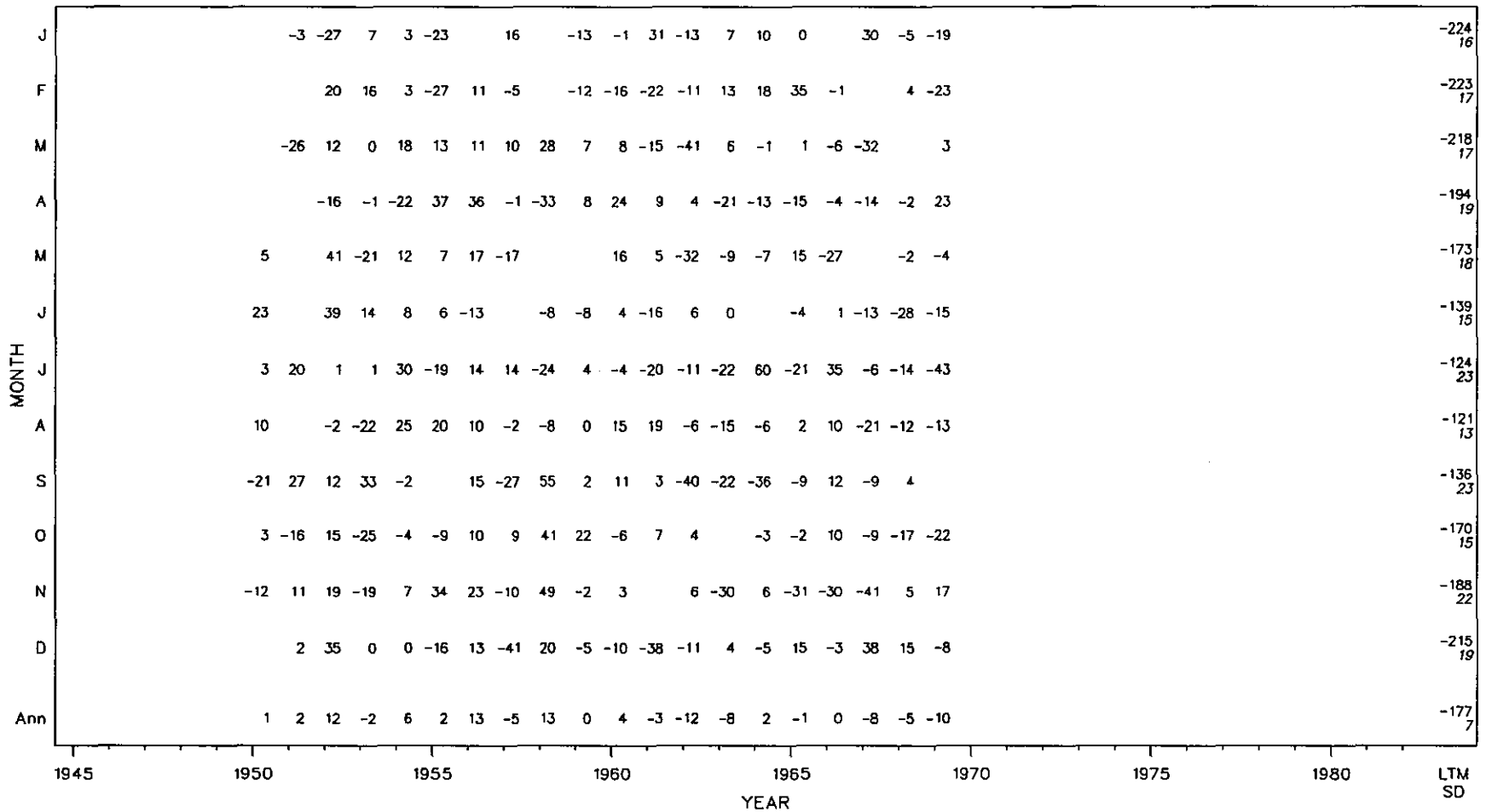
Air Temperature: 200 mb

Units = 0.1 °C



OWS Study Area A Anomalies

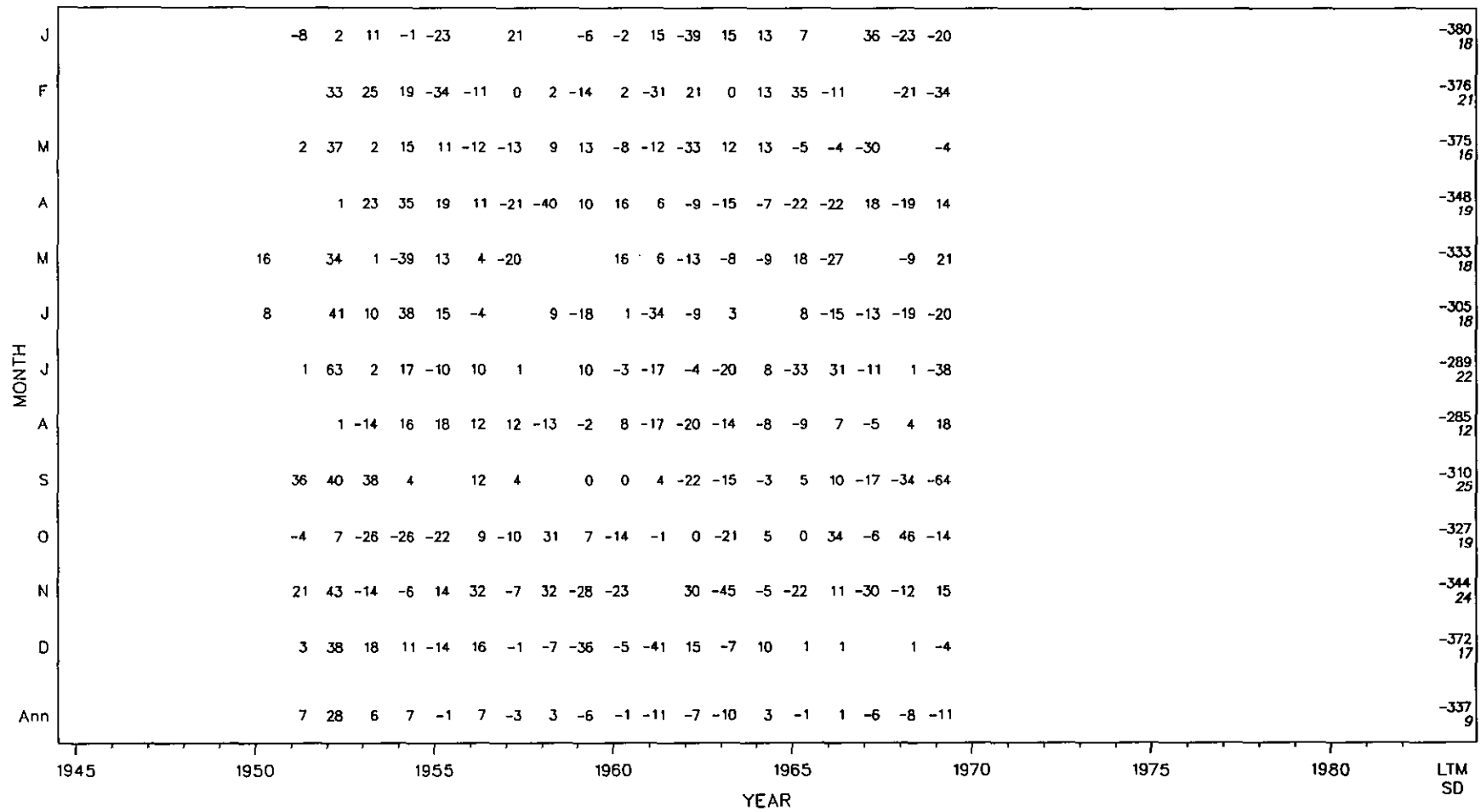
Dew Point Temperature: 700 mb
Units = 0.1 °C



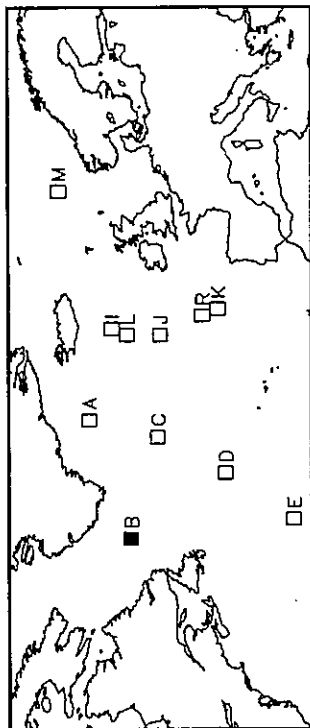
OWS Study Area A Anomalies

Dew Point Temperature: 500 mb

Units = 0.1 °C



OWS Study Area A Anomalies



55.5°N – 57.4°N, 51.9°W – 50.0°W
1946 – 1974

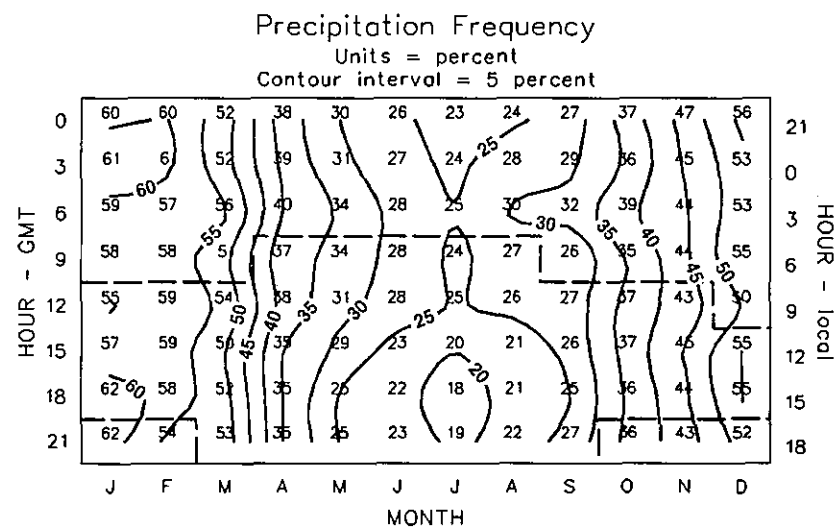
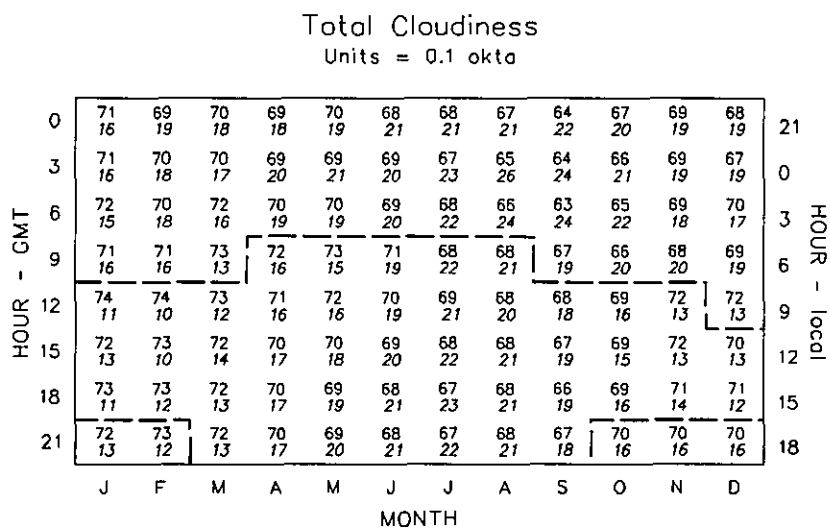
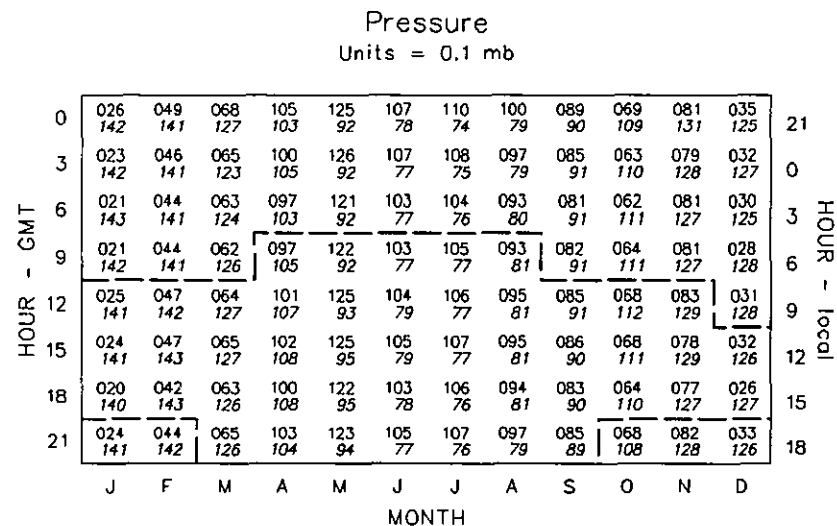
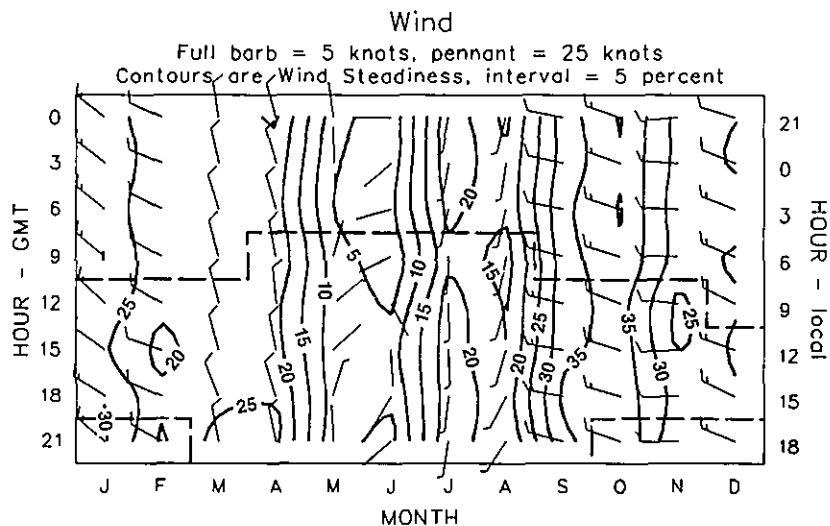
OWS
B

MONTH																																		Sum
	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	
J	31 29	16 15	31 31	26 26	29 29	18 18	8 8	27 26	31 31	31 30	31 31	31 31	24 24	31 31	31 25	30 30	31 31	31 31	31 31	31 31	30 30	31 31	31 31	31 31	30 30	31 31	31 31	25 25	16 14	22 22	767 754			
F	28 21	5 5	23 23	19 19	28 28	25 25	17 17	28 27	27 27	29 29	28 28	28 28	12 12	29 29	28 28	23 23	28 28	29 29	28 28	25 25	28 28	29 29	28 28	28 28	28 28	28 28	20 19	26 26			702 693			
M	31 30	3 2	25 24	27 27	31 31	30 30	26 26	31 30	25 25	31 31	31 31	31 31	30 26	31 31	31 31	31 31	31 31	31 31	31 31	31 31	27 27	29 29	31 31	31 31	31 31	12 12	29 28	27 27			786 777			
A	29 29	11 10	30 30	27 26	30 30	24 24	22 22	30 30	30 30	30 30	30 30	28 28	30 30	30 29	30 30	30 30	30 30	30 30	30 30	29 29	30 30	26 26	29 29	29 28	28 28	29 29	30 30	18 18			779 775			
M		12 11	26 26	31 30	31 31	16 15	31 31	31 31	31 31	31 31	31 31	29 29	28 28	31 31	31 31	31 31	31 31	31 31	29 29	26 25	31 31	31 30	31 31	31 31	31 31	31 30	21 20			745 737				
J		12 12	25 25	29 29	30 29	18 18	30 29	30 30	30 30	29 28	30 30	30 30	30 29	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 29	30 29	27 27	21 18			731 722				
J		16 16	30 30	26 26	31 31	25 24	31 30	28 28	31 31	31 31	31 31	31 29	31 31	31 31	31 31	31 31	31 31	31 31	31 31	29 28	31 31	31 30	31 31	31 31	31 31	30 30	20 20			762 752				
A			12 12	31 31	22 22	28 28	29 29	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 30	18 18			697 694				
S		9 9	30 29	25 25	22 22	22 21	21 30	30 29	30 30	30 30	30 30	25 25	30 30	30 30	30 30	30 30	30 30	30 30	30 30	29 29	30 30	30 30	30 29	30 30	29 29	29 29					690 688			
O		31 29	28 28	23 23	31 31	29 29	31 22	29 29	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	28 28					755 743			
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D		14 14		26 25	4 4	31 31	12 12	31 31	31 31	31 31	30 30	31 31	31 31	31 31	31 31	31 31	31 31	31 31	30 30	31 31	31 31	31 31	31 31	30 30	31 31	31 31	22 20					694 691		
Ann	119 109	19 19	145 139	316 313	298 296	345 344	283 282	301 290	359 353	354 354	366 365	363 361	363 362	334 328	363 360	365 363	359 353	364 361	364 364	364 363	358 357	353 352	347 344	364 362	363 359	360 358	307 303	157 149	93 93			8846 8756		
	1945		1950			1955			1960			1965			1970			1975			1980											Sum		

OWS Study Area B (56.5°N, 51.0°W)

Frequency of Surface Observations

Each of the 11 variables was observed on X days of each month.
The upper number is the maximum X from among all the variables.
The lower number is the minimum X from among all the variables.



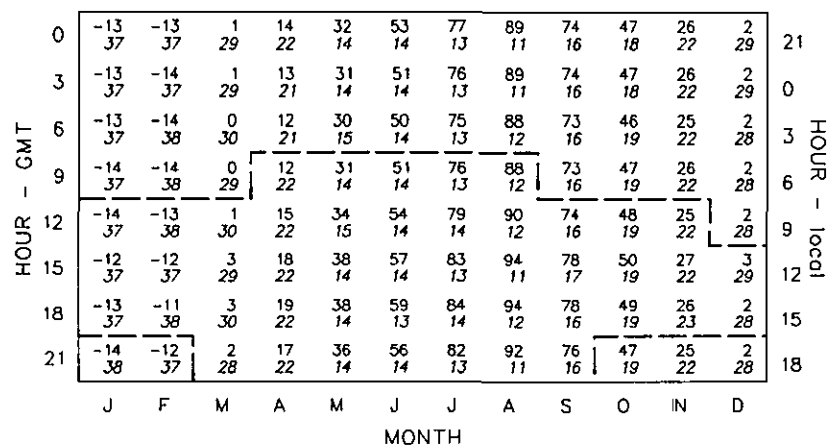
OWS Study Area B Surface Climatology

upper number = mean
lower number = standard deviation

———— data contours
----- sunrise/sunset

Air Temperature

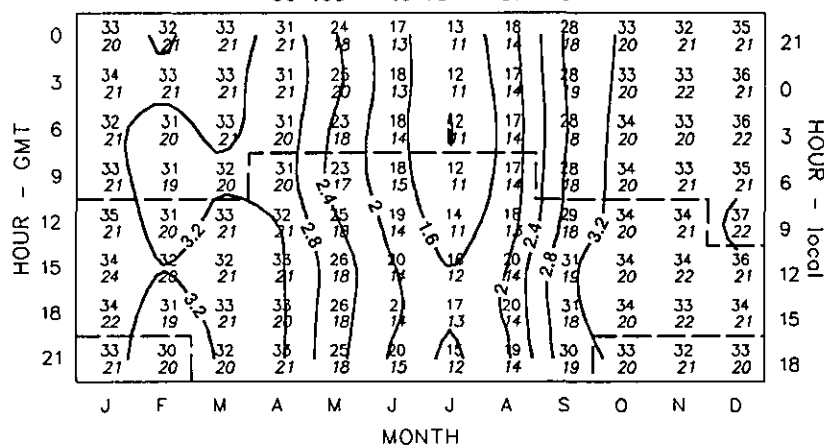
Units = 0.1 °C



Dew Point Depression

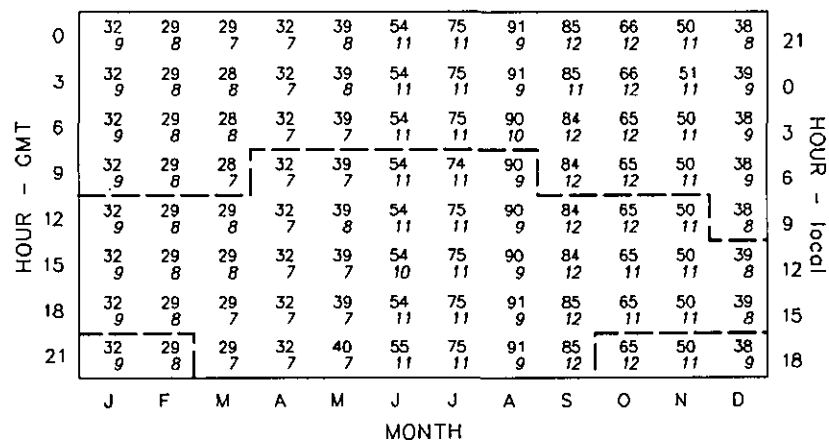
Units = 0.1 °C

Contour interval = 0.4 °C



Sea Surface Temperature

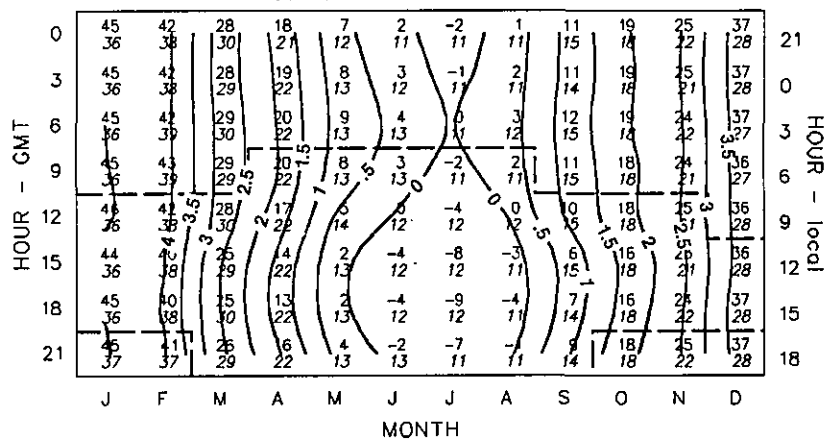
Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C

Contour interval = 0.5 °C



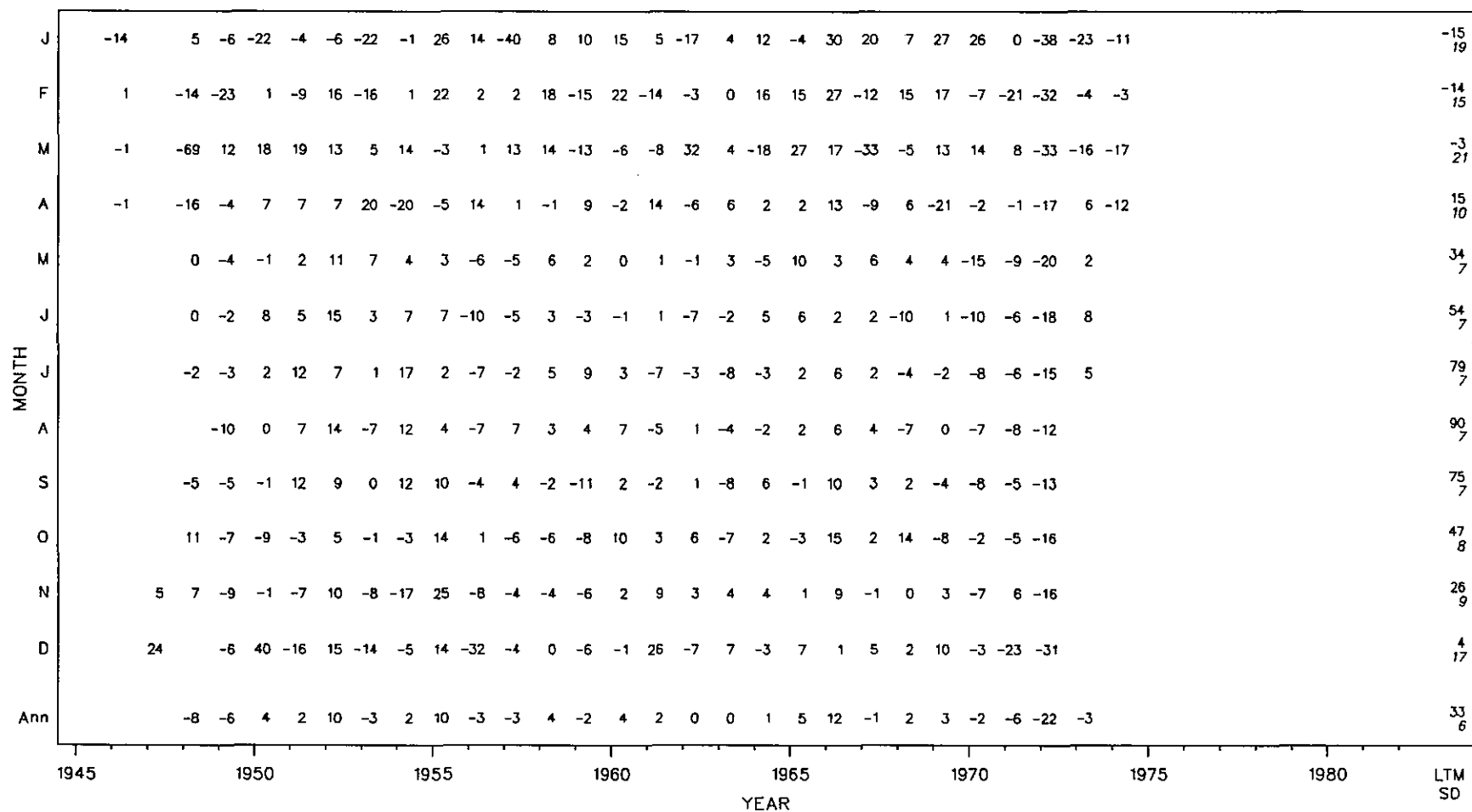
OWS Study Area B Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
- - - sunrise/sunset

Surface Air Temperature

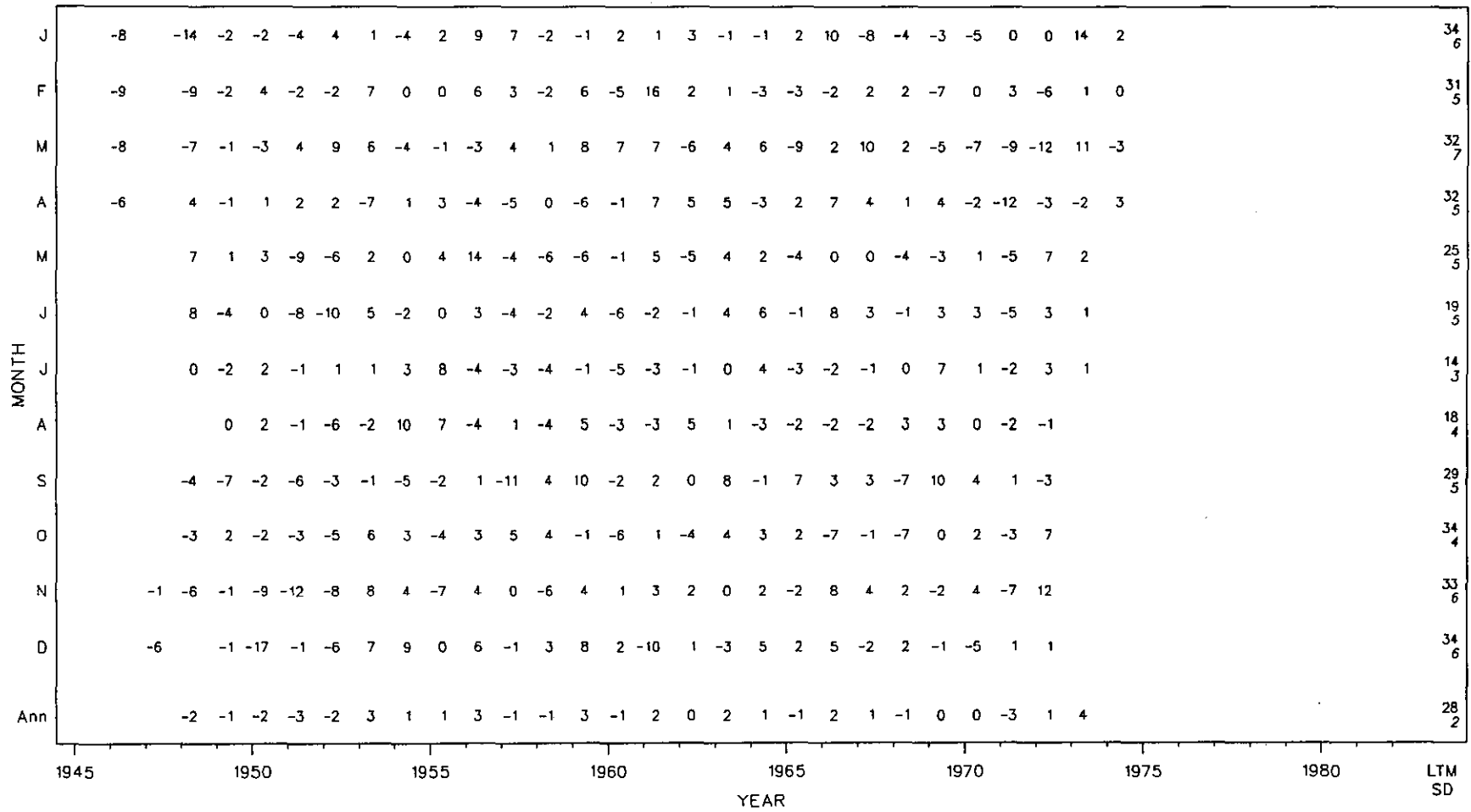
Units = 0.1 °C



OWS Study Area B Anomalies

Surface Dew Point Depression

Units = 0.1 °C



OWS Study Area B Anomalies

Sea Surface Temperature

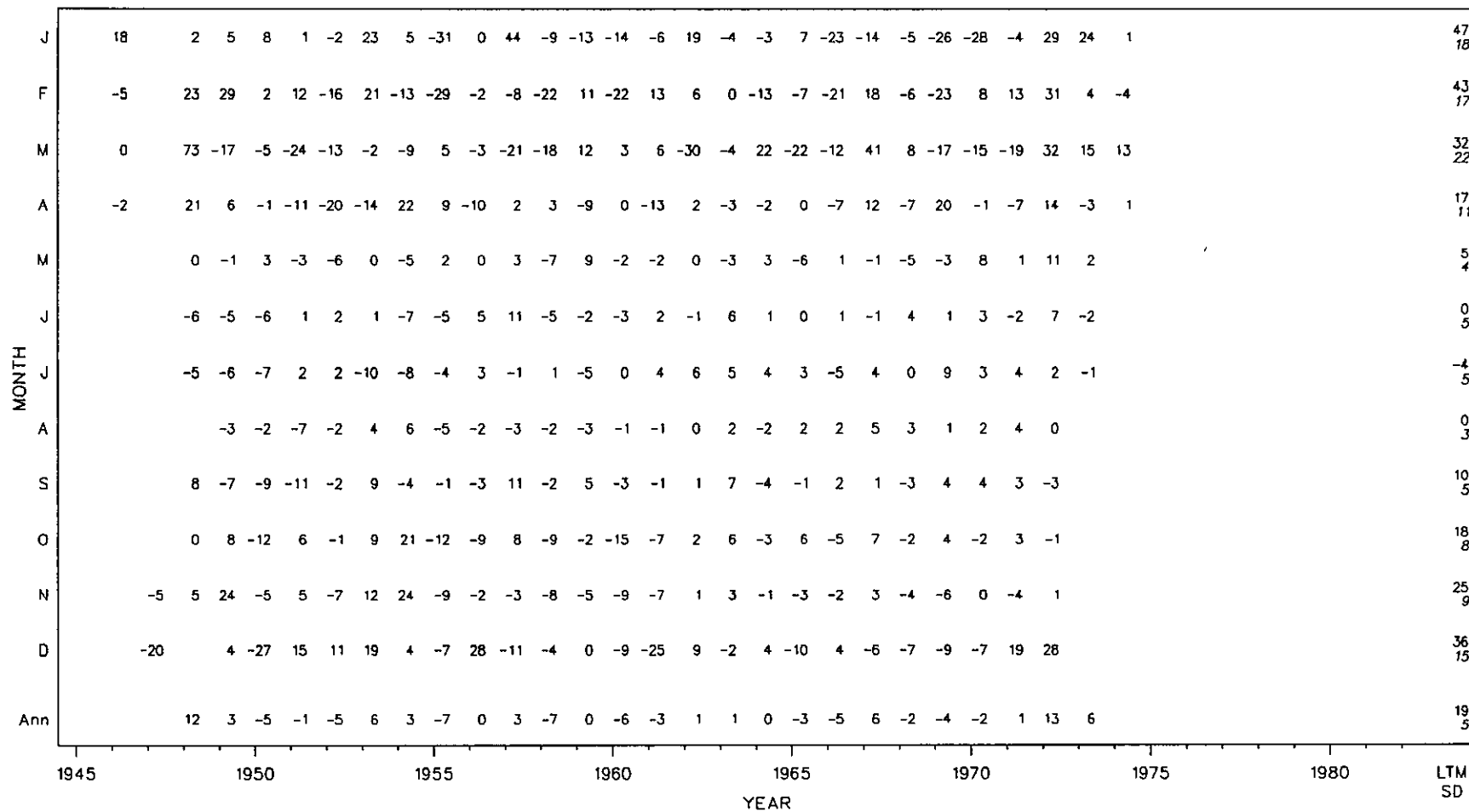
Units = 0.1 °C

MONTH																													LTM SD
	1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075	2080	
J	3	8	-1	-13	-4	-8	1	4	-5	14	4	-1	-2	2	-1	-1	0	9	2	7	6	2	1	-3	-4	-9	1	-10	31 6
F	-1	8	6	4	3	1	5	-12	-8	0	-6	-4	-5	0	-2	2	0	3	8	6	6	8	-7	1	-7	-2	0	-6	29 5
M	0	4	-6	13	-5	0	3	5	2	-2	-8	-4	-1	-3	-3	2	-1	4	5	5	8	3	-5	-1	-12	-1	0	-4	29 5
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J		-6	-7	2	5	18	4	-1	2	-3	6	-2	-5	-4	3	-8	4	7	7	3	1	-5	2	-7	-7	-11	4		54 6
J		-7	-9	-5	15	8	-10	9	-3	-4	-2	6	4	3	-4	2	-4	1	5	2	6	-4	7	-5	-2	-14	4		75 7
A		-13	-2	0	12	-3	18	-1	-10	5	1	1	5	-6	1	-2	-4	5	8	8	-4	1	-5	-4	-12				90 7
S		3	-12	-9	1	6	10	8	9	-7	15	-4	-6	-1	-4	2	-2	2	-2	11	4	-1	0	-5	-2	-16			85 7
O		11	1	-20	3	3	6	19	2	-8	2	-15	-10	-4	-3	8	-1	-1	3	11	9	12	-5	-4	-2	-17			65 9
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Ann		4	-3	-1	1	5	3	4	2	-3	-1	-3	-2	-2	-1	1	1	2	3	6	5	0	-1	-5	-5	-9	2		52 3

OWS Study Area B Anomalies

Sea - Air Temperature Difference

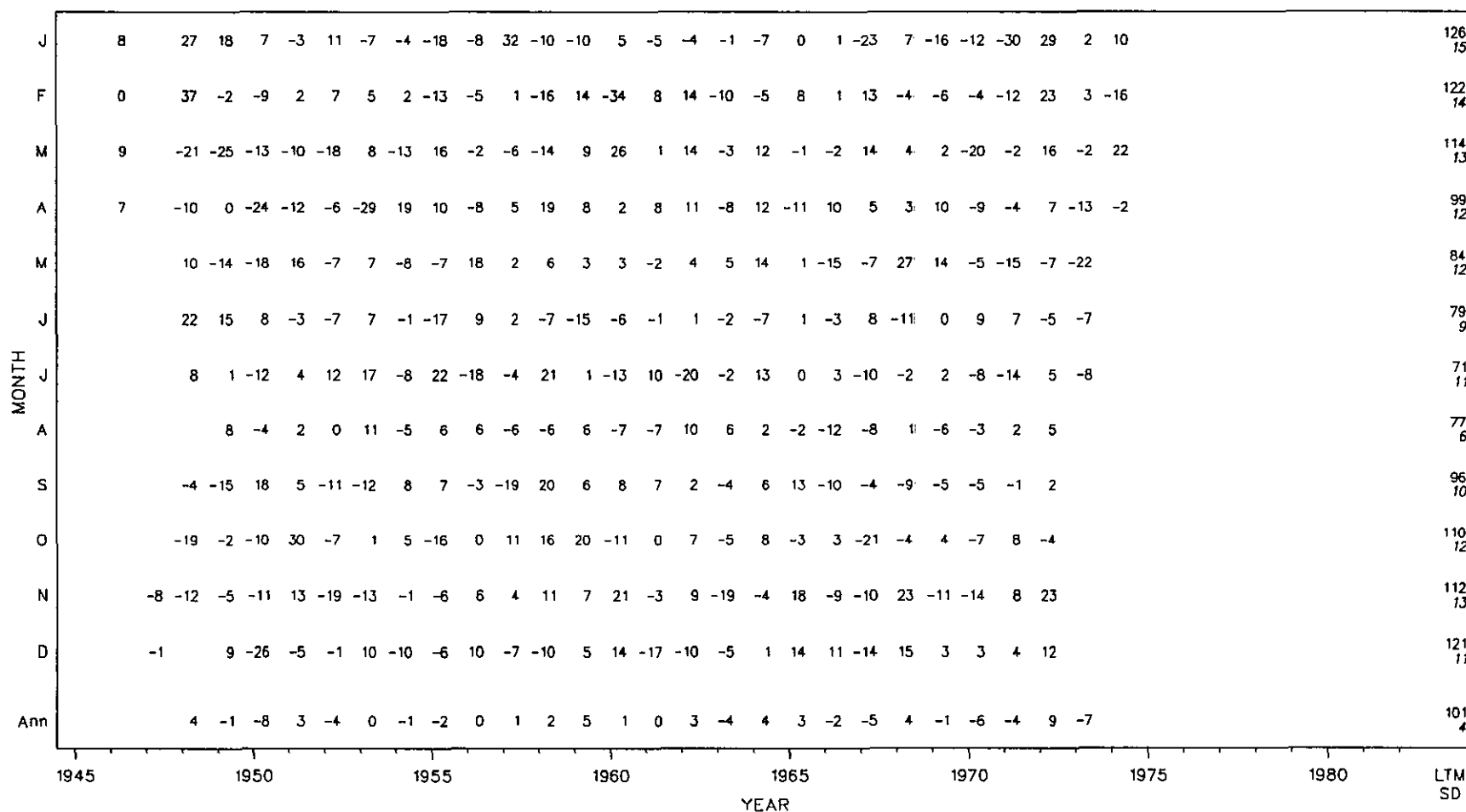
Units = 0.1 °C



OWS Study Area B Anomalies

Surface Scalar Wind

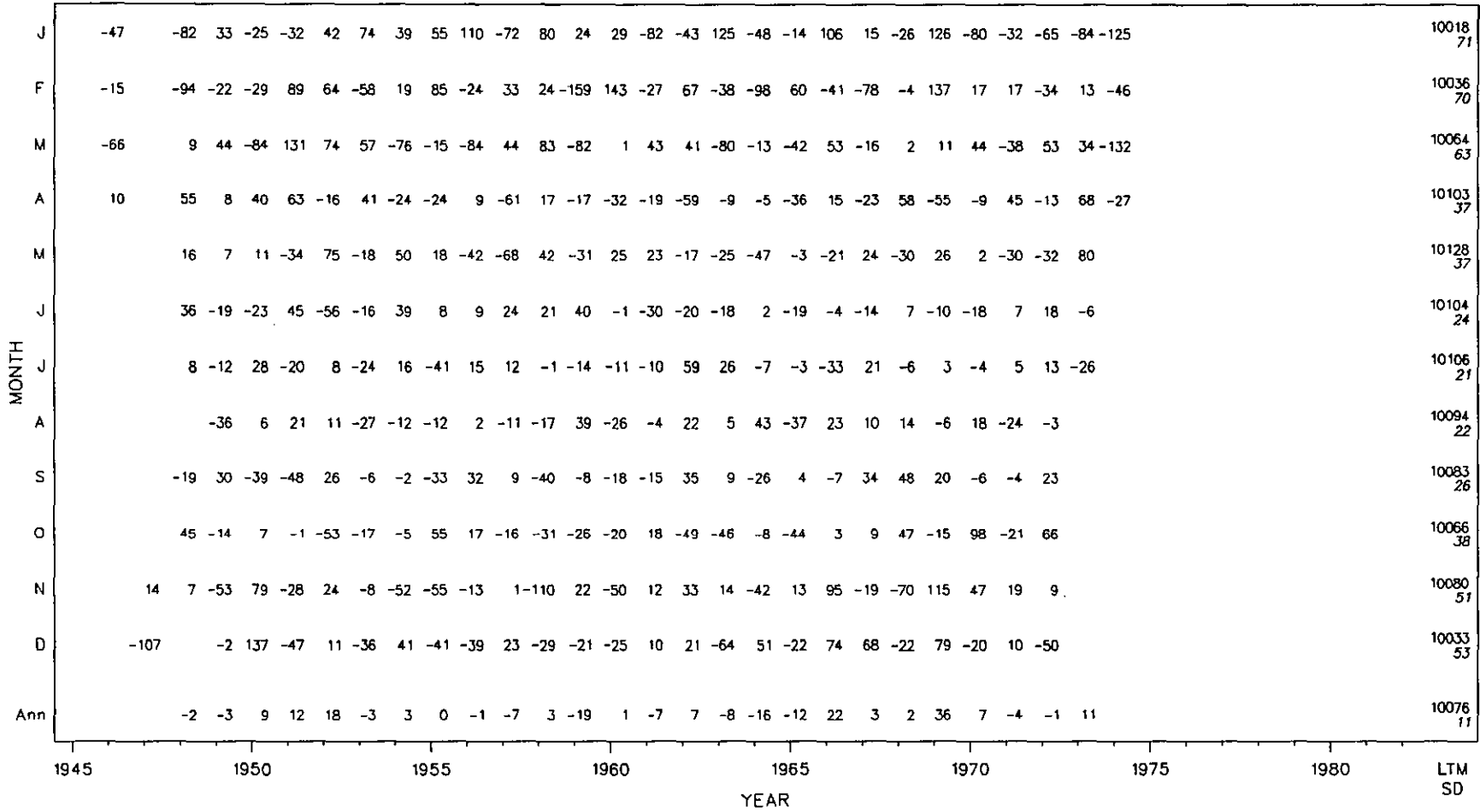
Units = 0.1 m/s



OWS Study Area B Anomalies

Sea Level Pressure

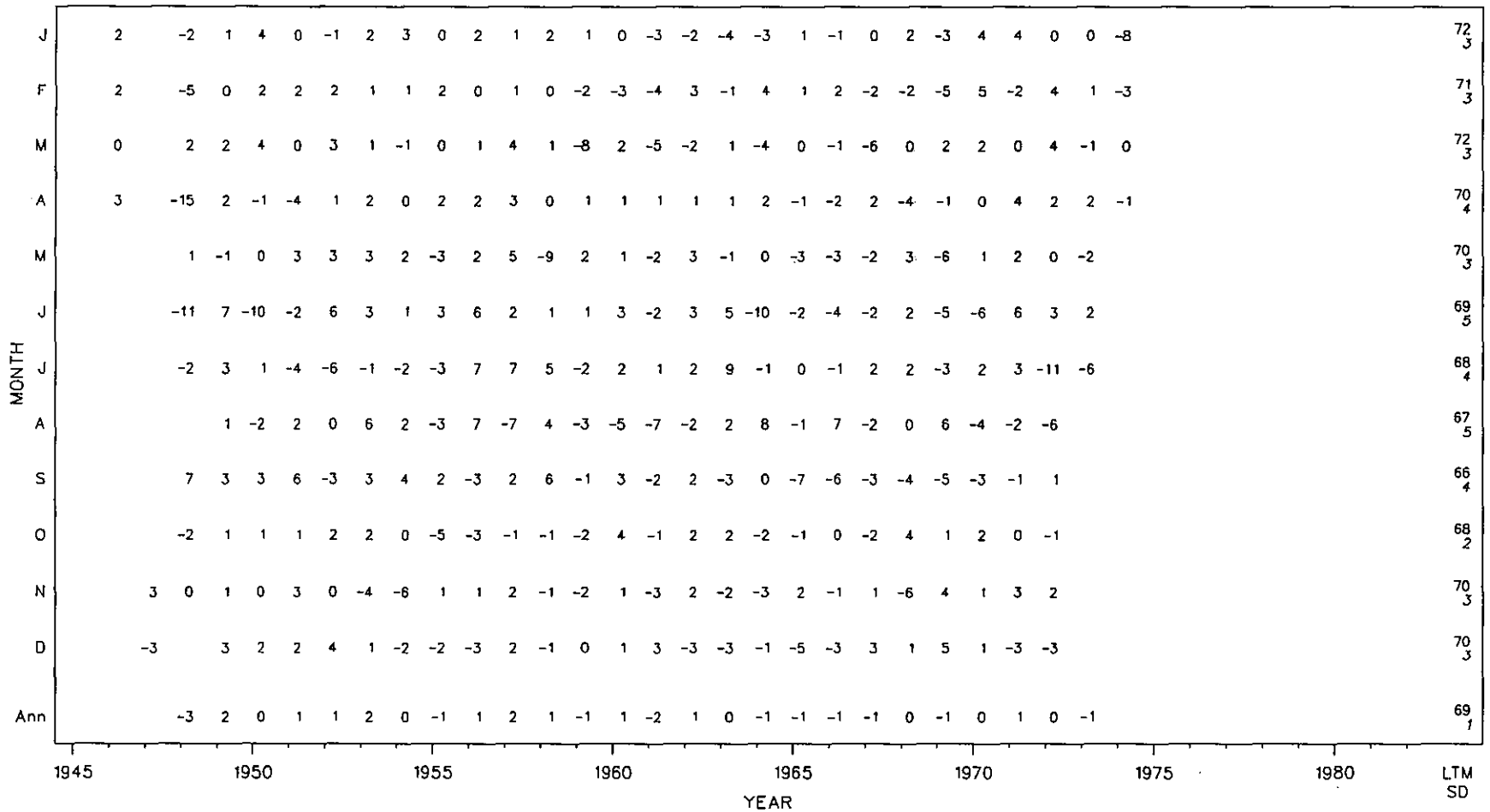
Units = 0.1 mb



OWS Study Area B Anomalies

Total Cloudiness

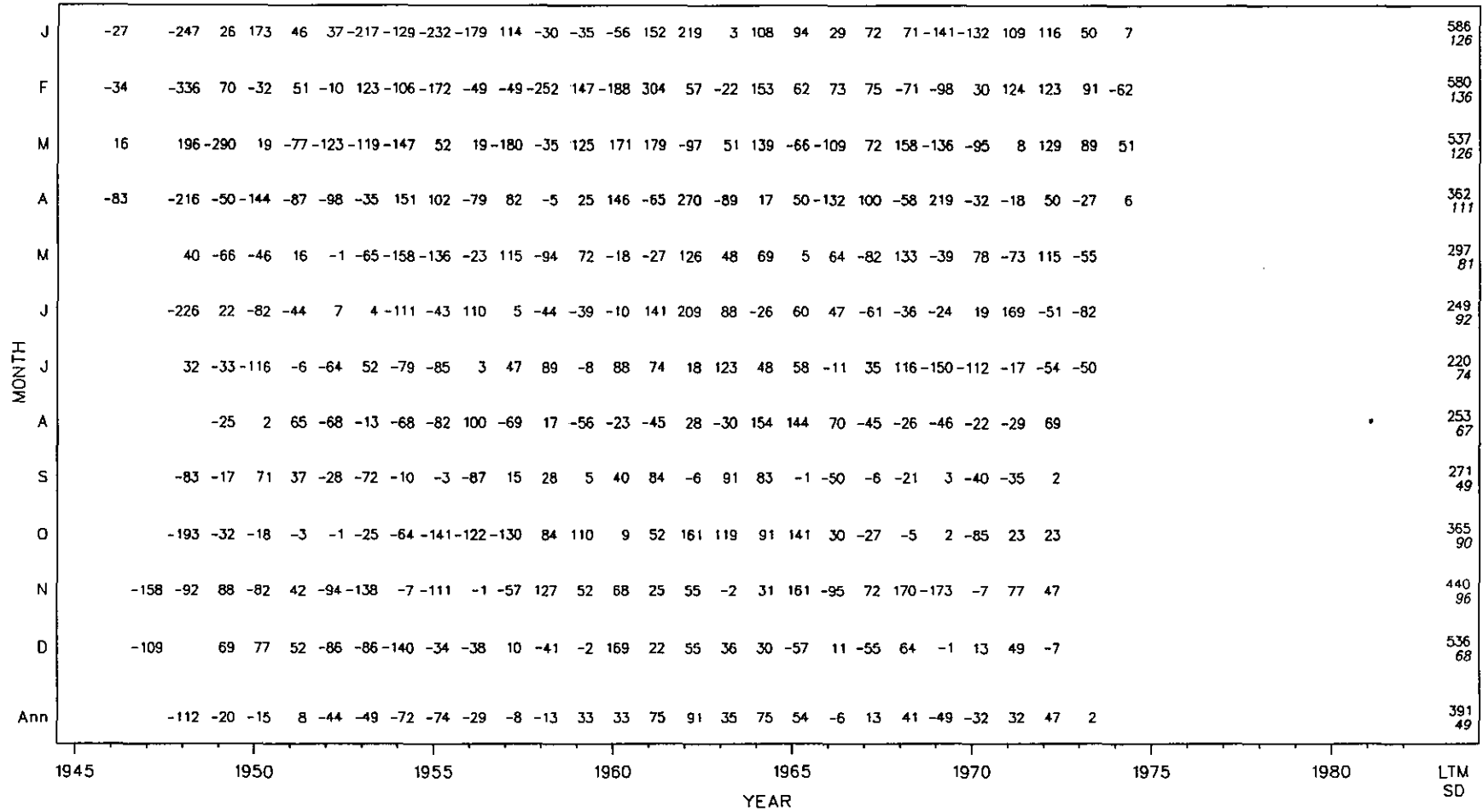
Units = 0.1 okta



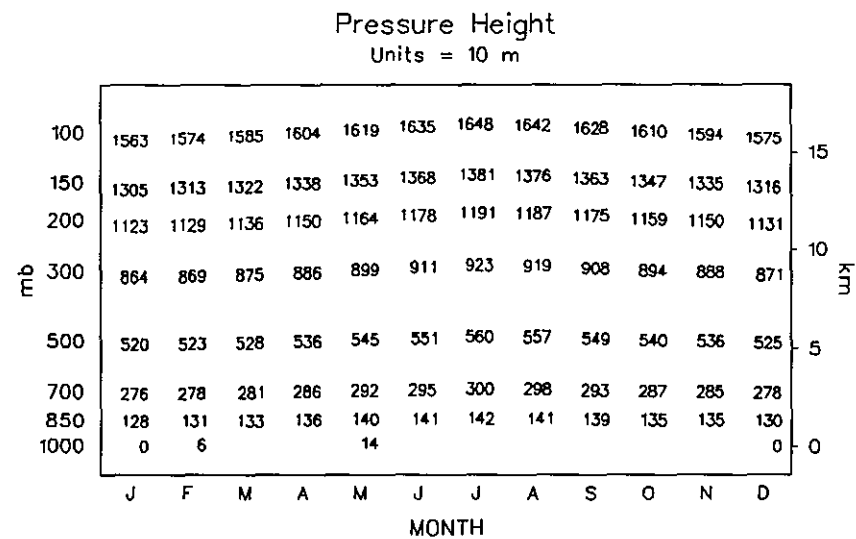
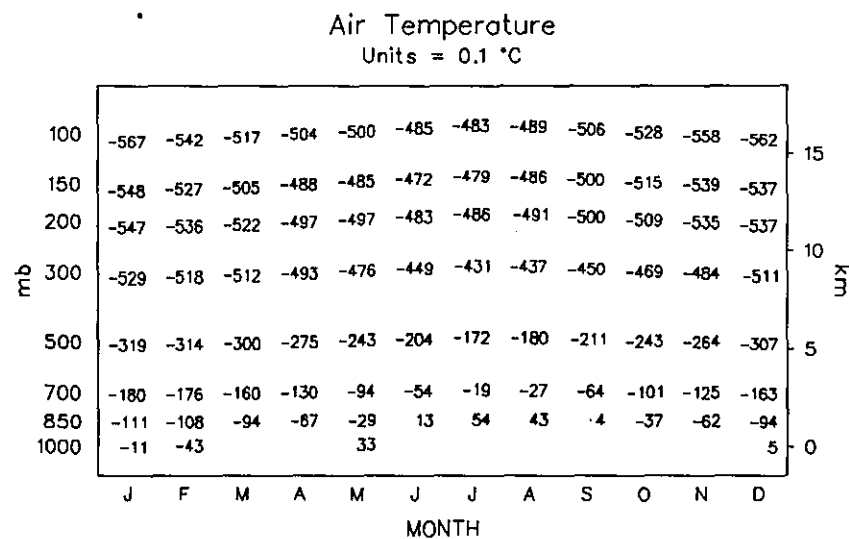
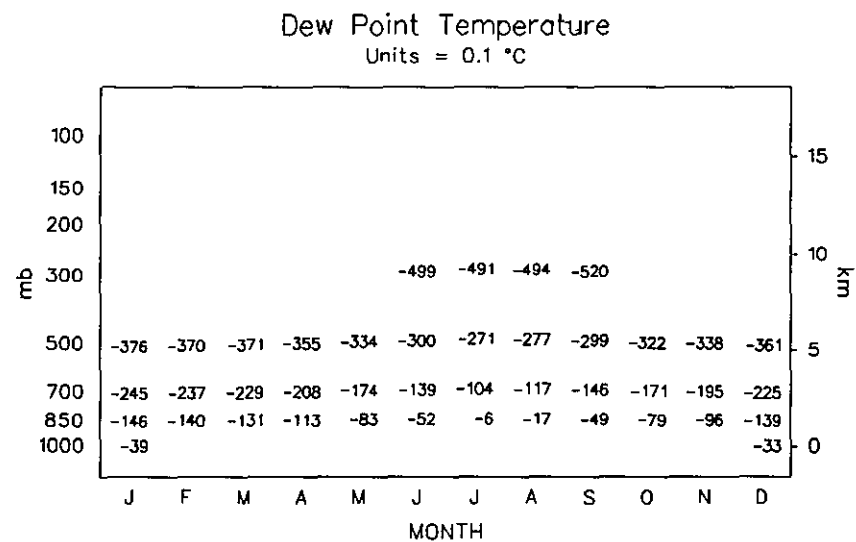
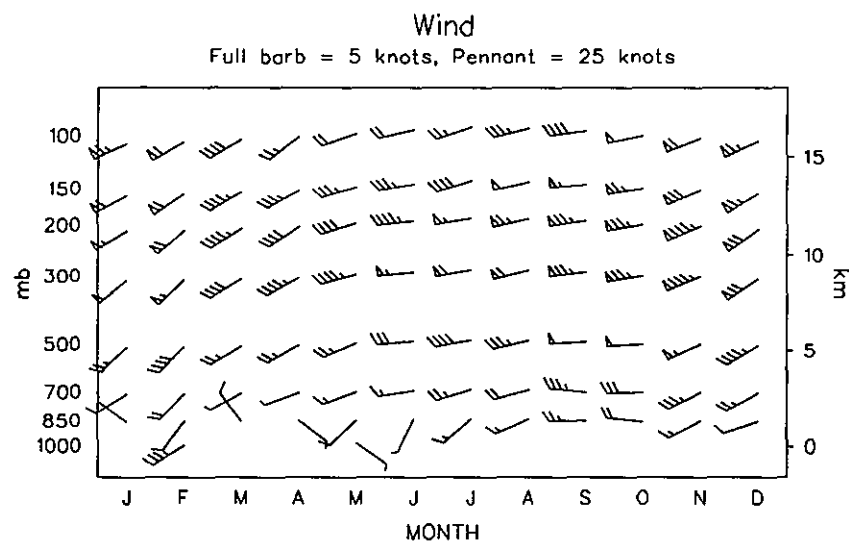
OWS Study Area B Anomalies

Precipitation Frequency

Units = 0.1 percent



OWS Study Area B Anomalies

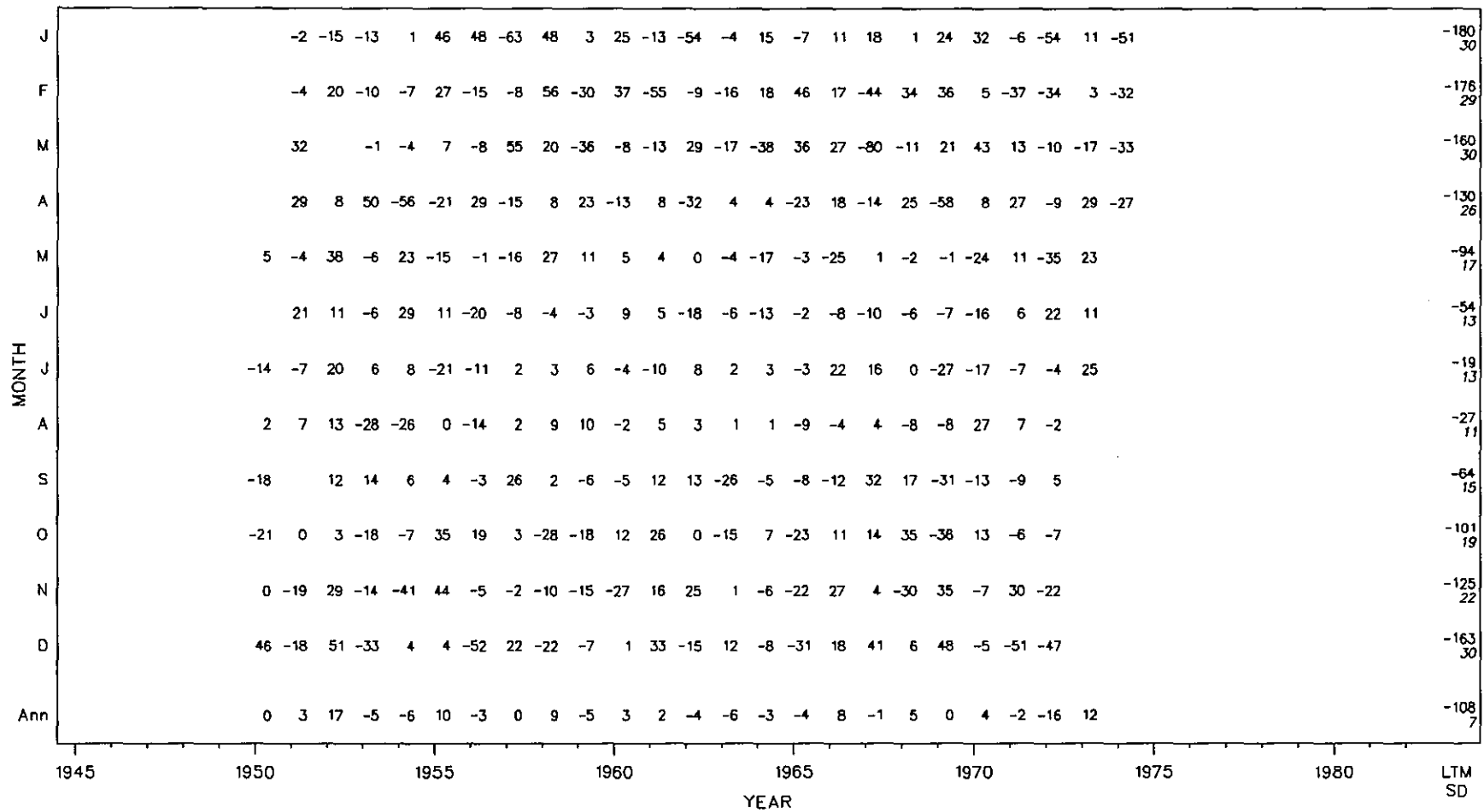


OWS Study Area B Upper Air Climatology

Mean plotted at actual height

Air Temperature: 700 mb

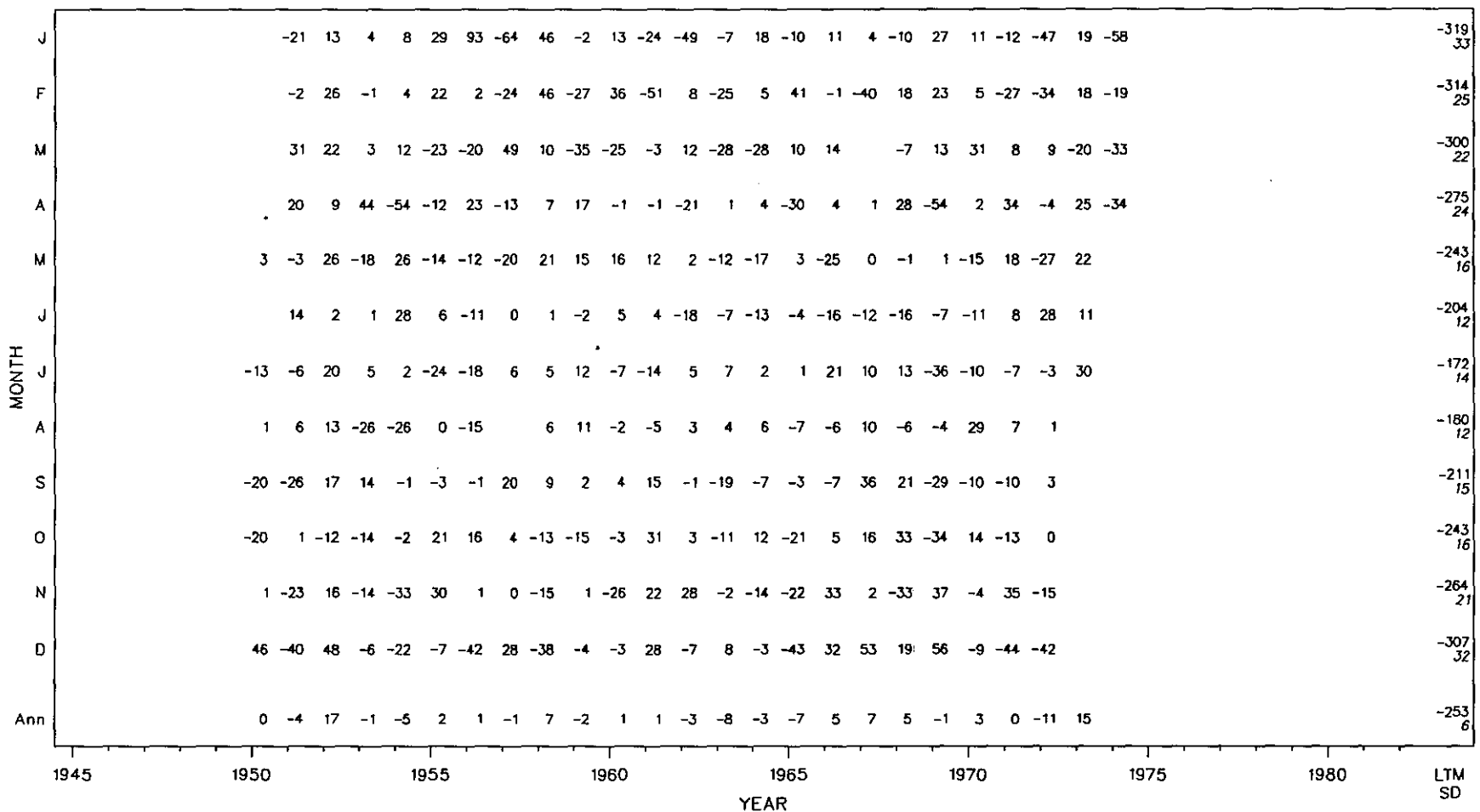
Units = 0.1 °C



OWS Study Area B Anomalies

Air Temperature: 500 mb

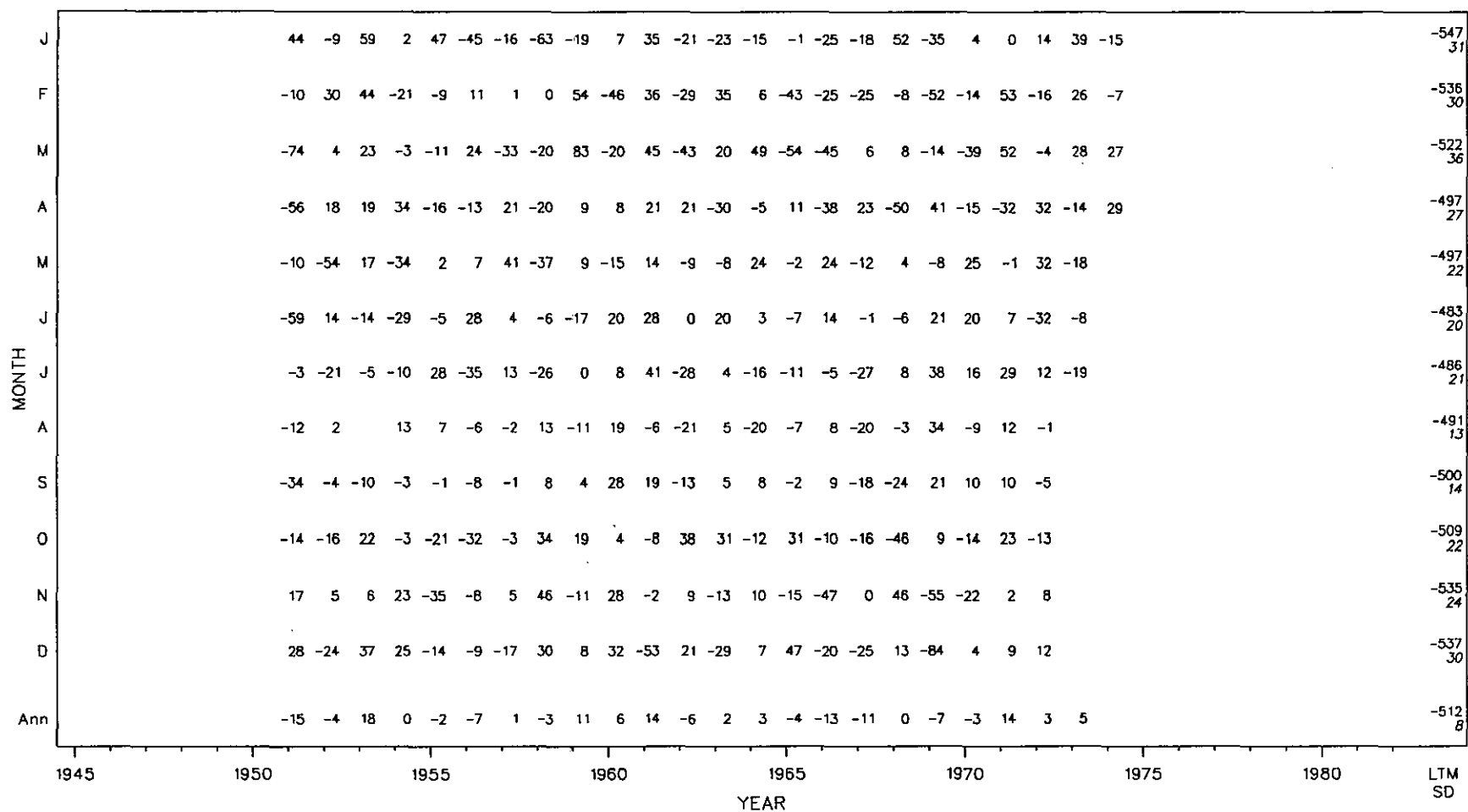
Units = 0.1 °C



OWS Study Area B Anomalies

Air Temperature: 200 mb

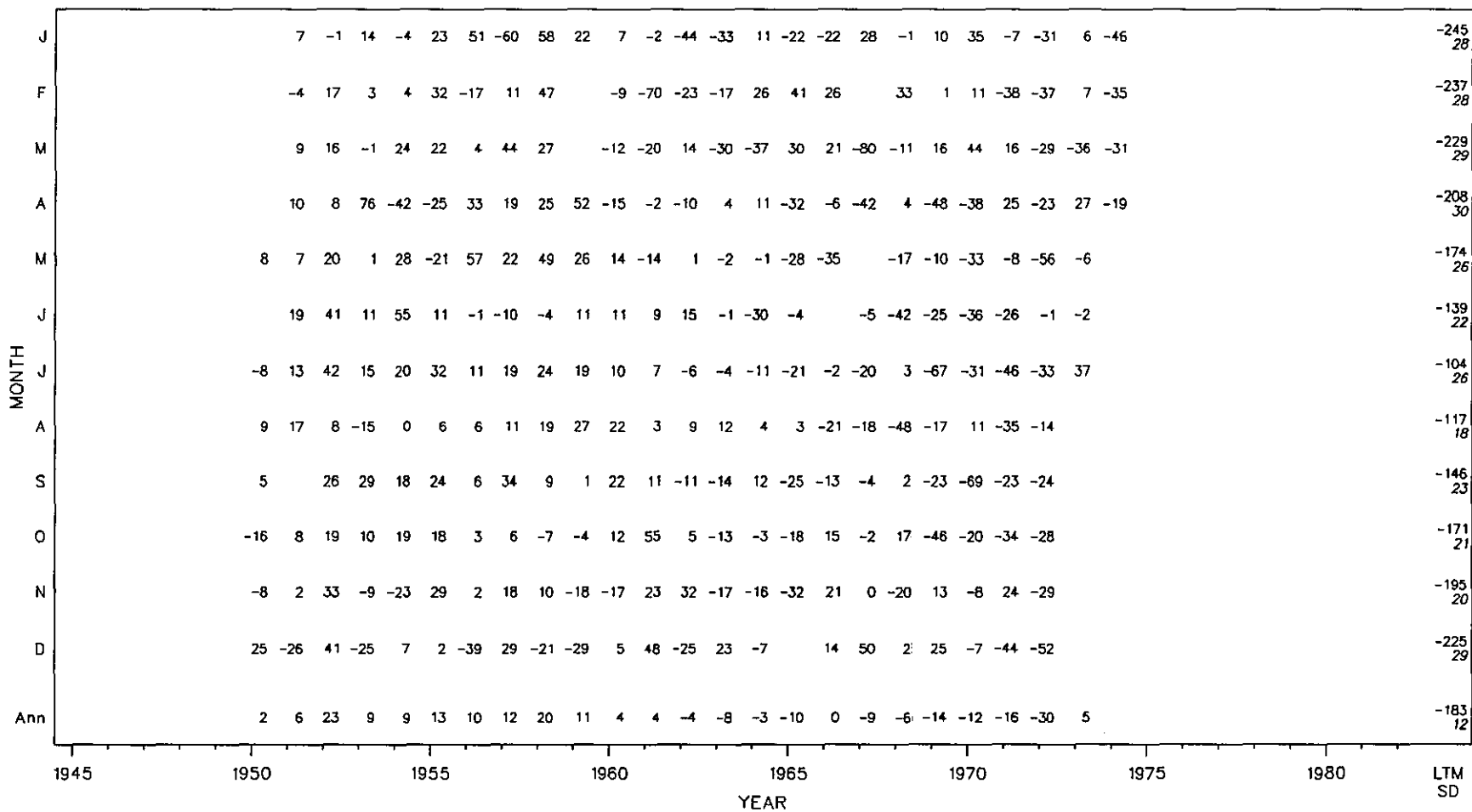
Units = 0.1 °C



OWS Study Area B Anomalies

Dew Point Temperature: 700 mb

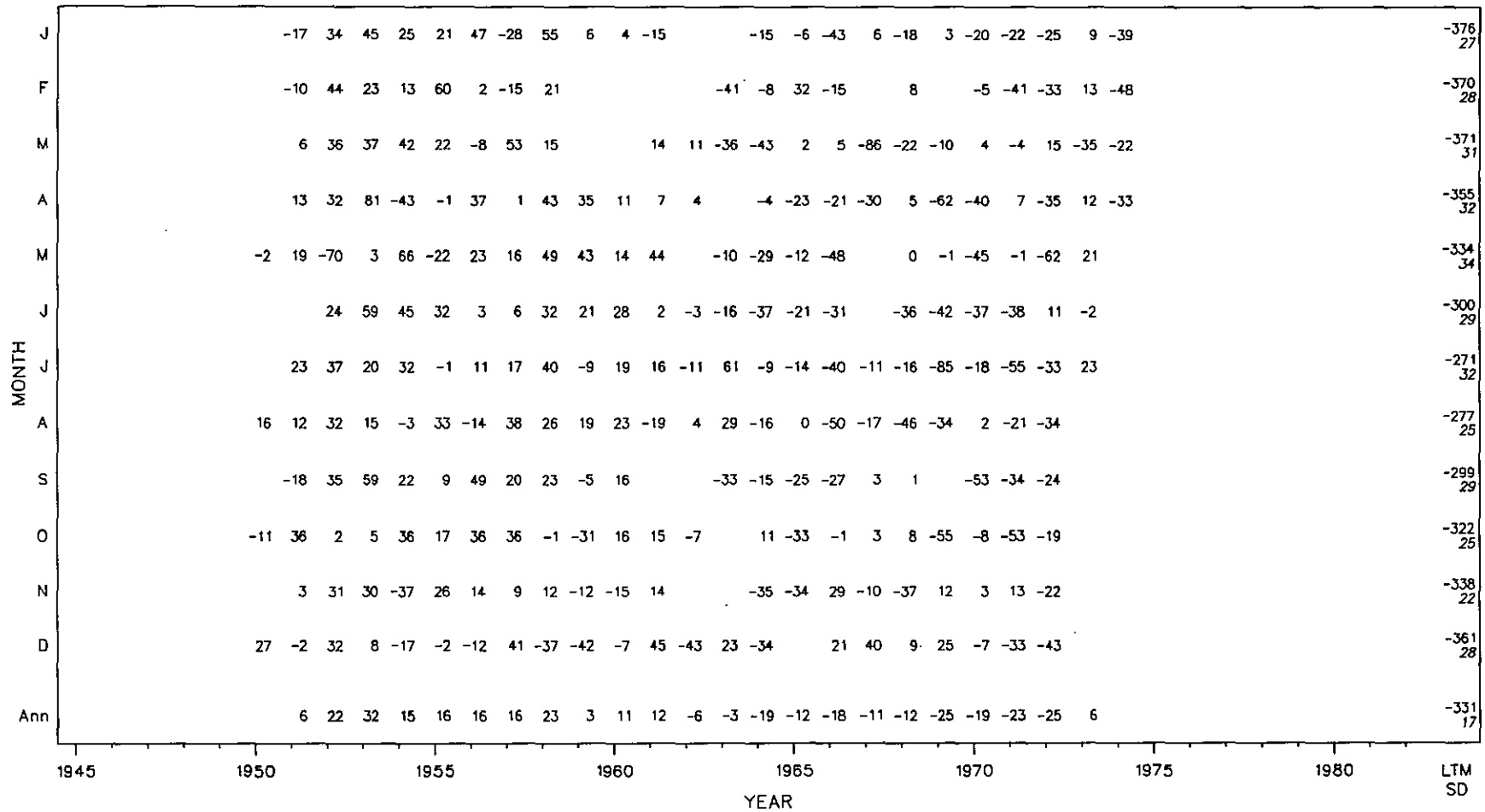
Units = 0.1 °C



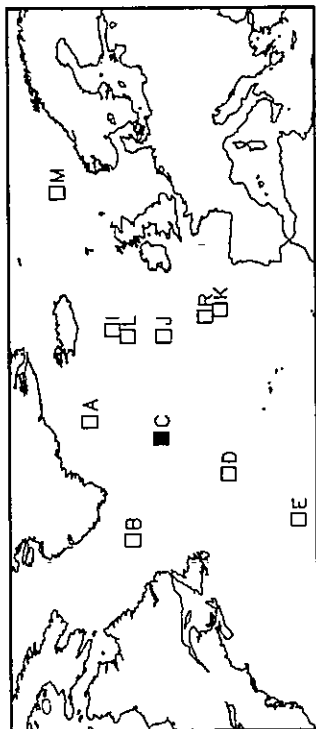
OWS Study Area B Anomalies

Dew Point Temperature: 500 mb

Units = 0.1 °C



OWS Study Area B Anomalies



51.8°N – 53.7°N, 36.4°W – 34.5°W
1945 – 1982

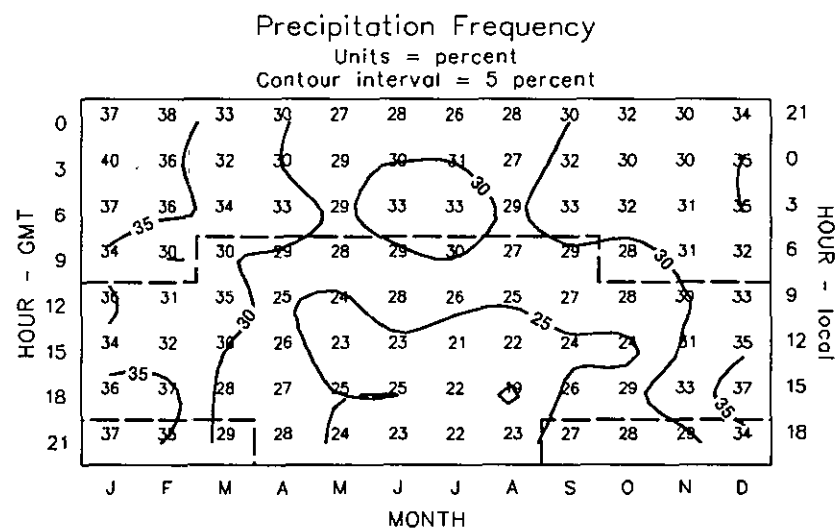
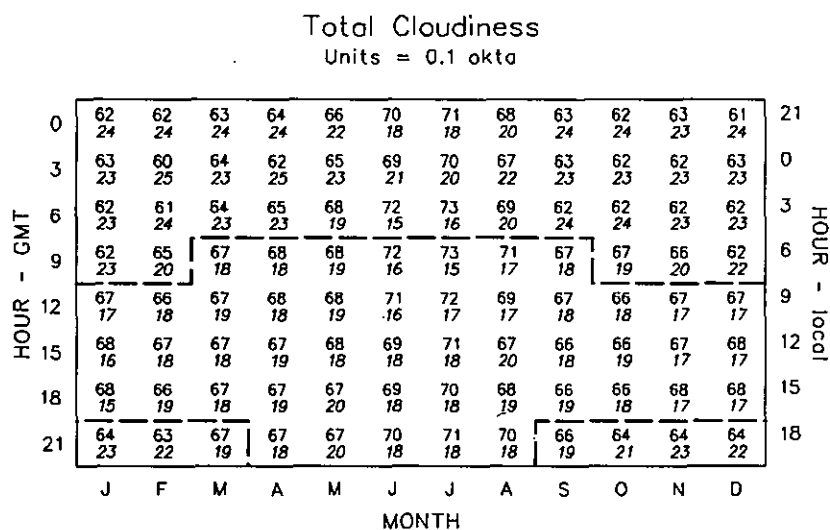
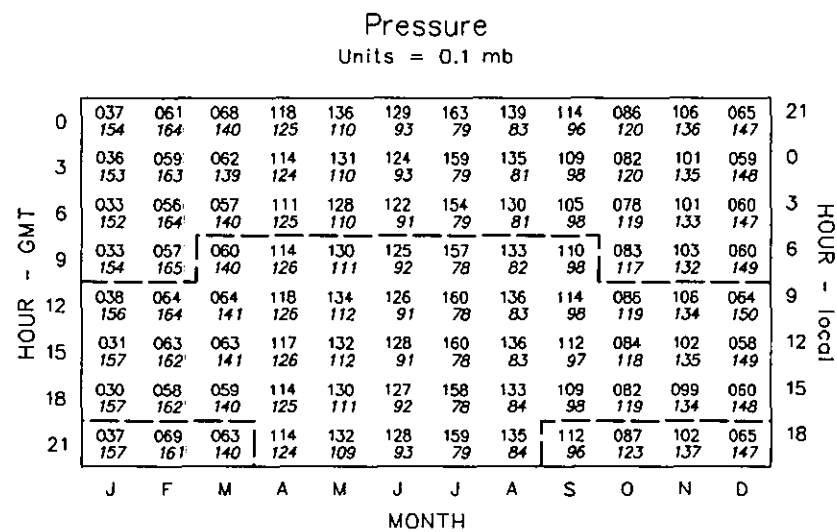
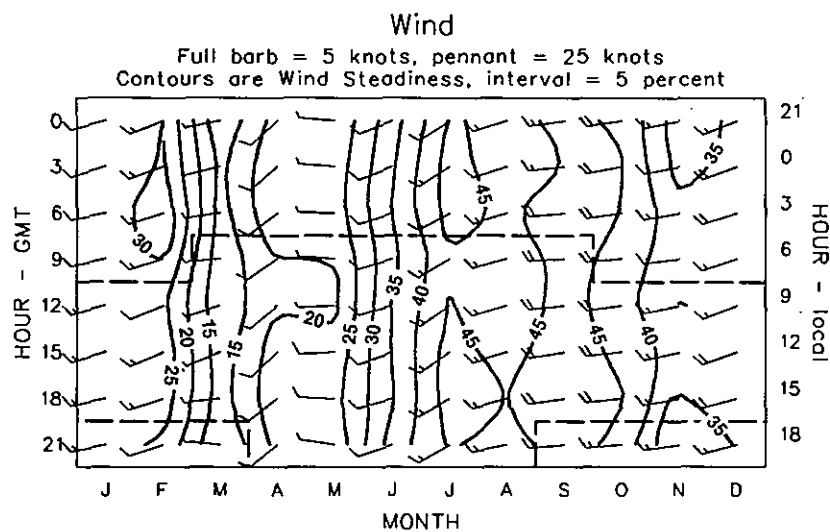
OWS
C

MONTH																																				Sum		
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J	31	31	30	27	28	31	27	31	29	29	31	25	31	27	31	30	30	31	31	28	31	28	31	31	30	31	26	26				31	4	31	31	920		
F	26	28	29	28	25	27	29	28	28	28	29	28	28	28	29	28	28	16	29	28	28	28	29	28	28	25	25	27				28	29	28	28	878		
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Ann	60	362	364	364	353	351	352	351	356	355	351	361	353	358	354	363	364	361	323	365	357	361	362	353	359	354	335	268	310				35	334	319	361	355	11284
	59	359	363	363	353	351	348	346	355	354	350	357	351	358	351	360	360	360	323	363	357	358	361	352	357	352	328	263	301				35	331	317	358	320	11174
	1945					1950									1955																							

OWS Study Area C (52.8°N, 35.5°W)

Frequency of Surface Observations

Each of the 11 variables was observed on X days of each month.
 The upper number is the maximum X from among all the variables.
 The lower number is the minimum X from among all the variables.



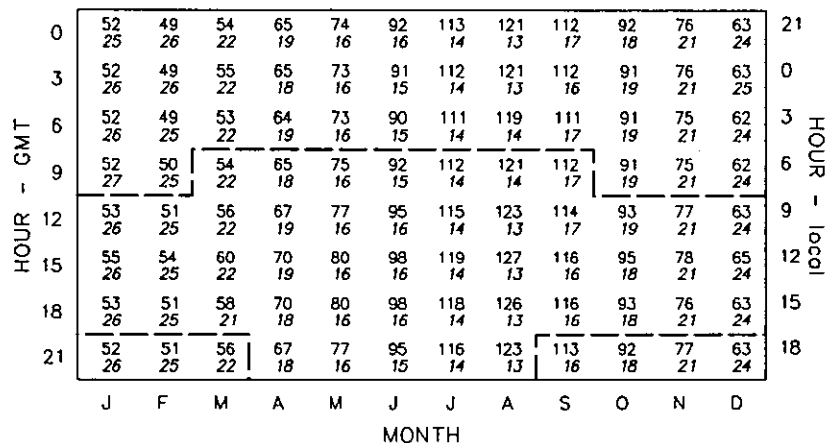
OWS Study Area C Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
--- sunrise/sunset

Air Temperature

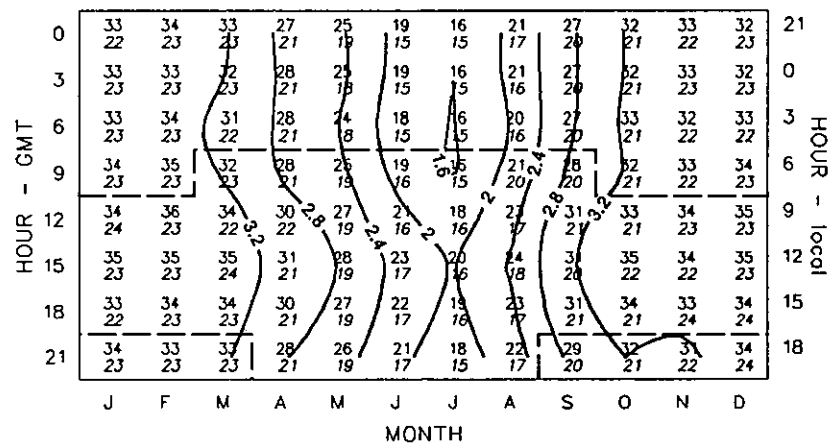
Units = 0.1 °C



Dew Point Depression

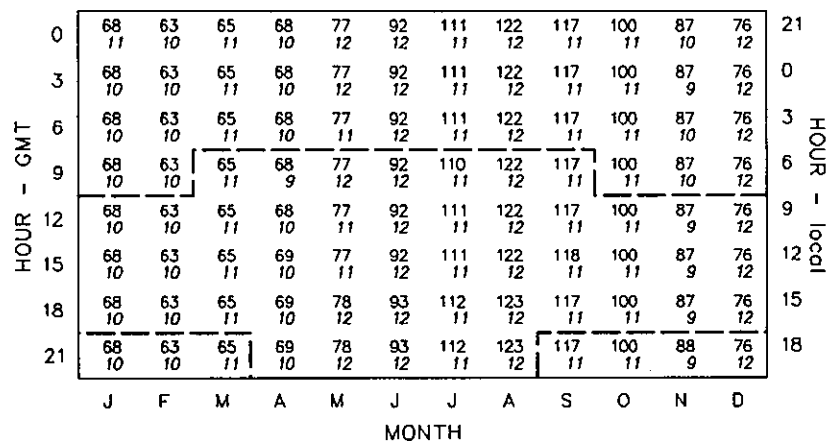
Units = 0.1 °C

Contour interval = 0.4 °C



Sea Surface Temperature

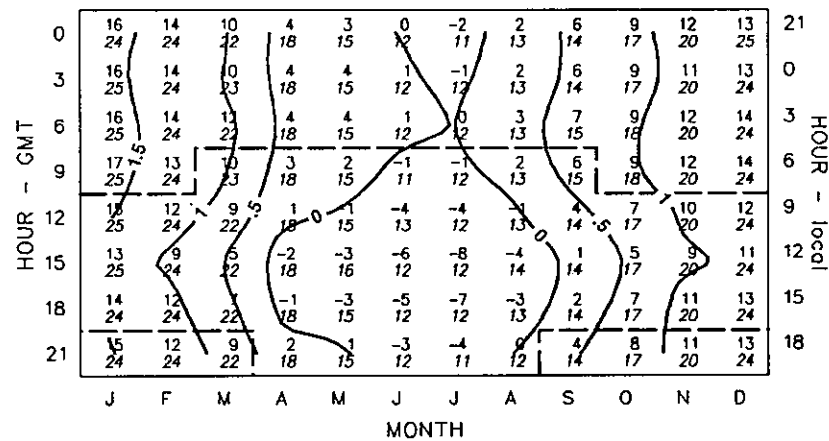
Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C

Contour interval = 0.5 °C



OWS Study Area C Surface Climatology

upper number = mean

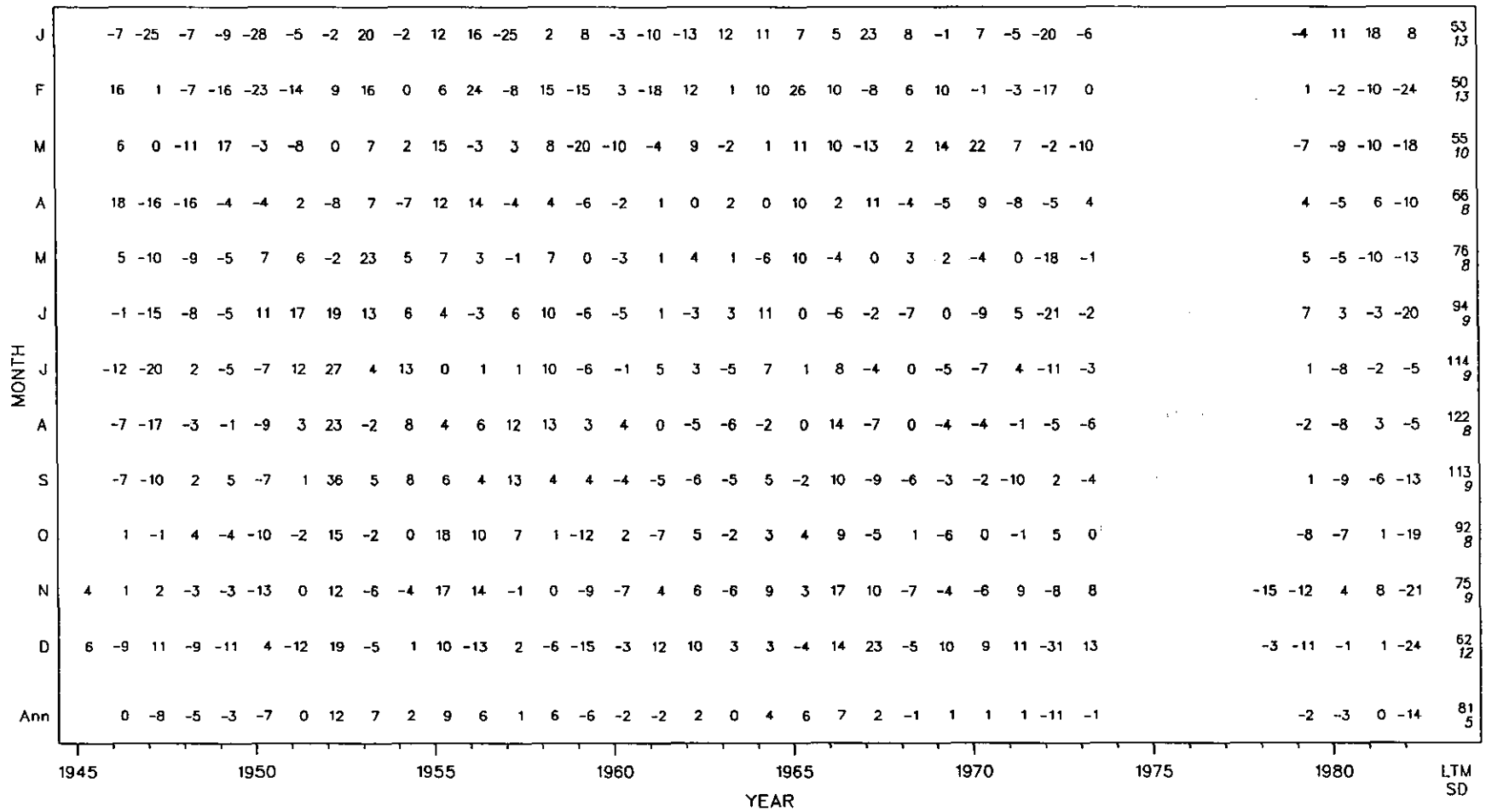
lower number = standard deviation

———— data contours

----- sunrise/sunset

Surface Air Temperature

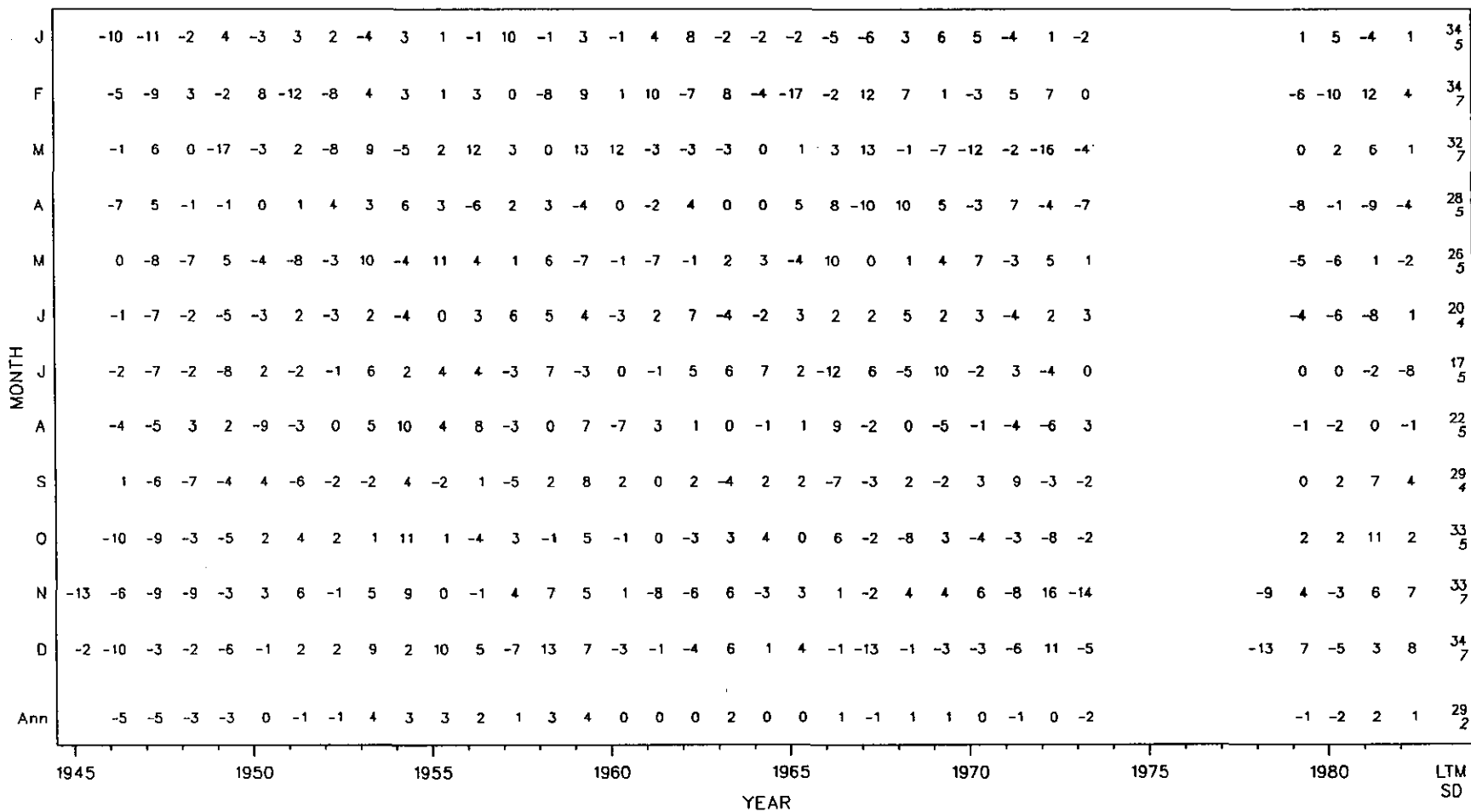
Units = 0.1 °C



OWS Study Area C Anomalies

Surface Dew Point Depression

Units = 0.1 °C



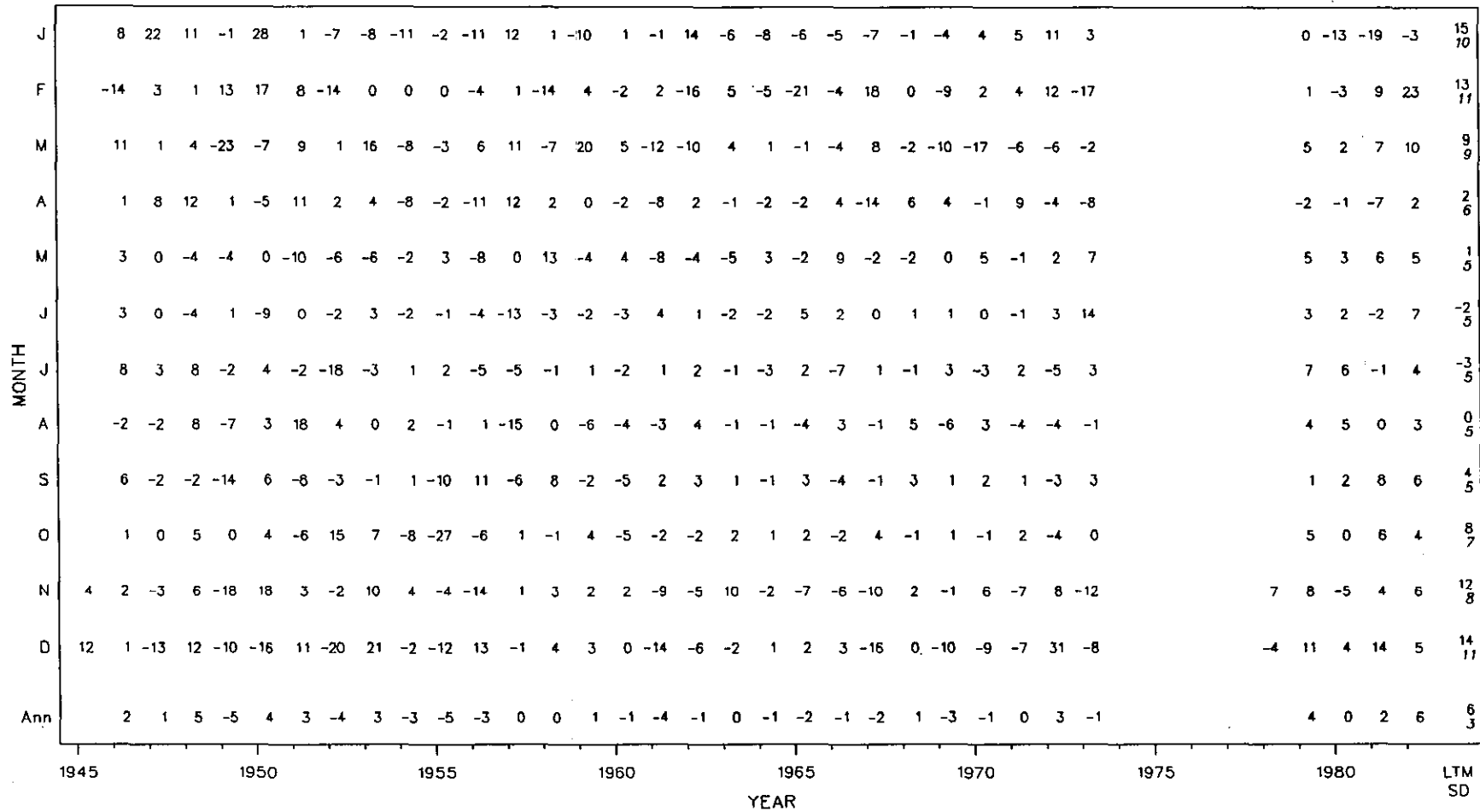
OWS Study Area C Anomalies

Units = 0.1 °C



Sea - Air Temperature Difference

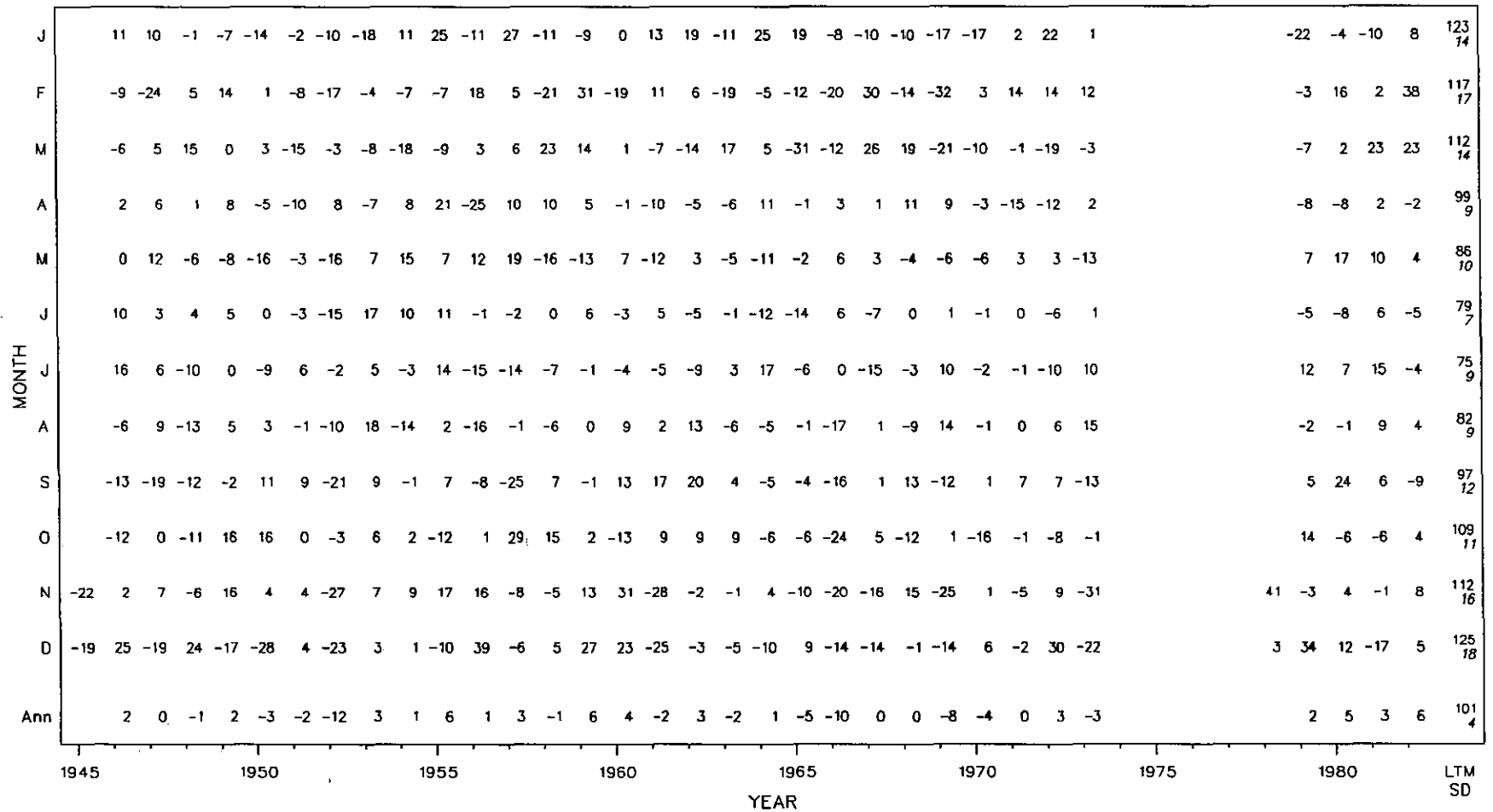
Units = 0.1 °C



OWS Study Area C Anomalies

Surface Scalar Wind

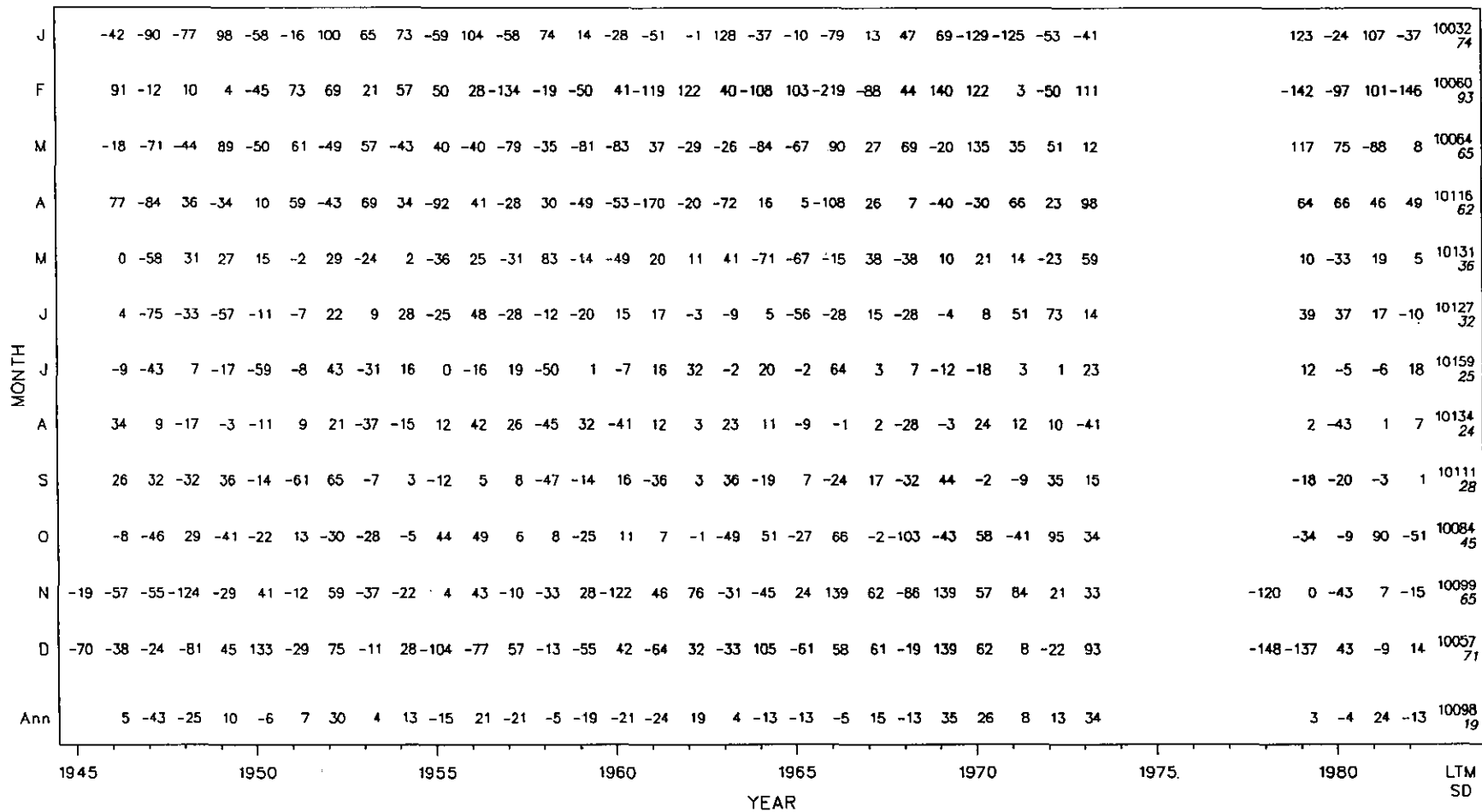
Units = 0.1 m/s



OWS Study Area C Anomalies

Sea Level Pressure

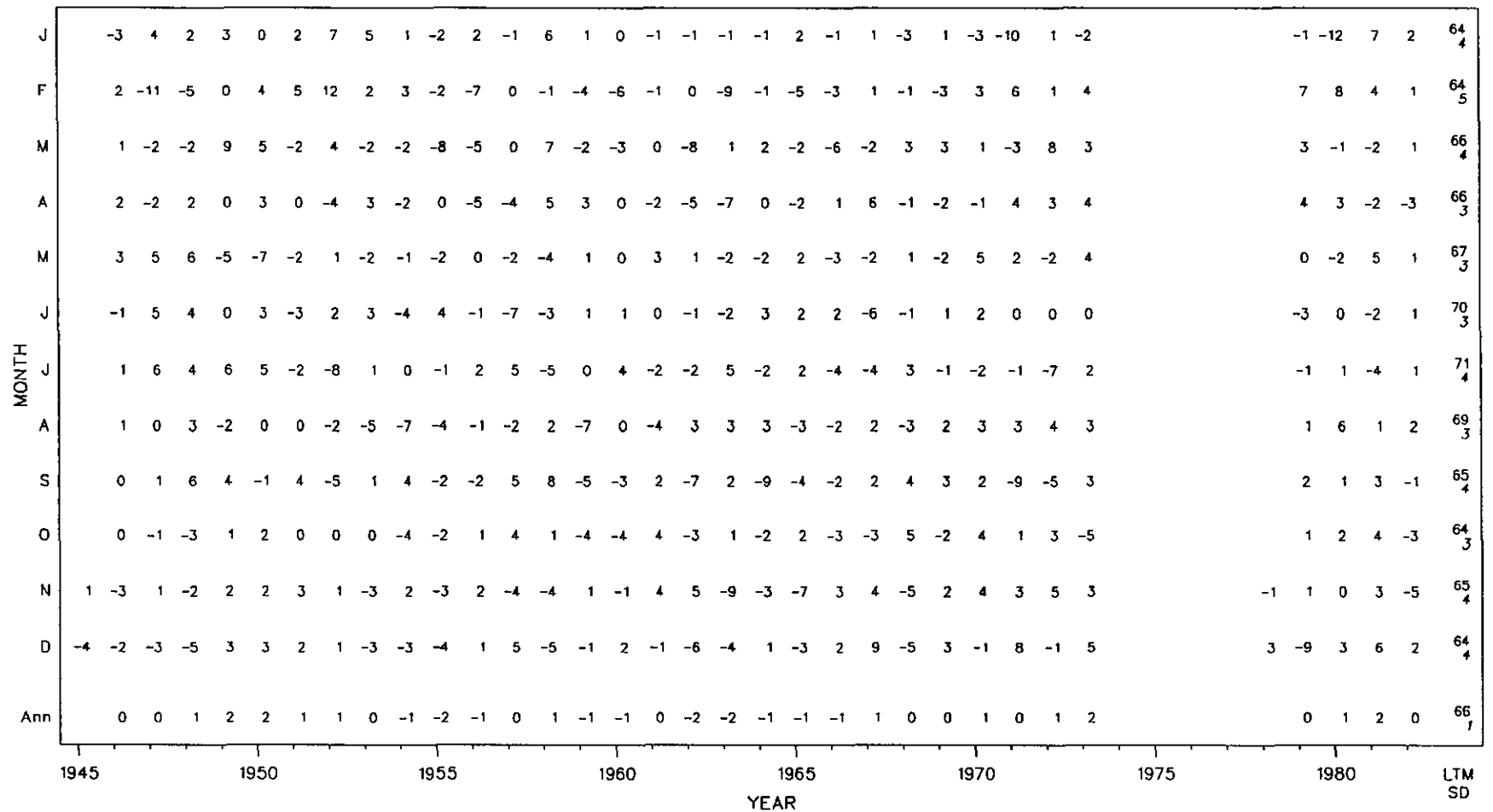
Units = 0.1 mb



OWS Study Area C Anomalies

Total Cloudiness

Units = 0.1 okta



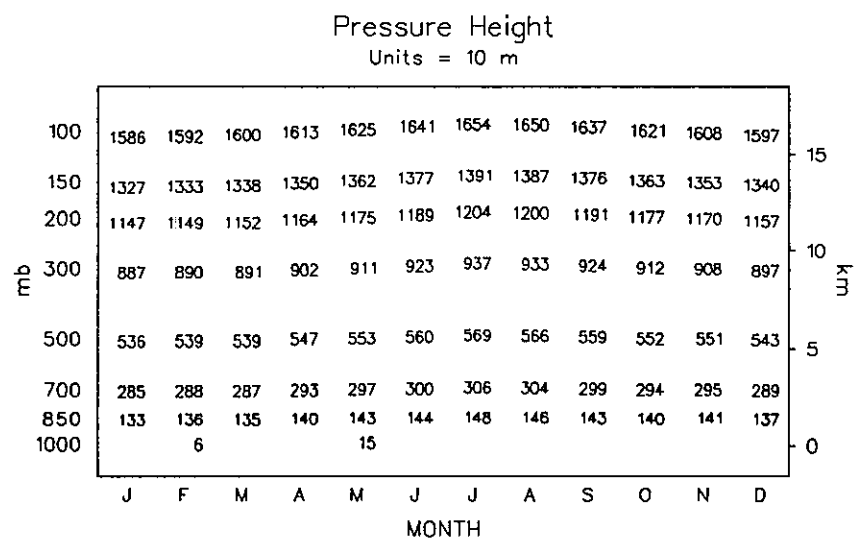
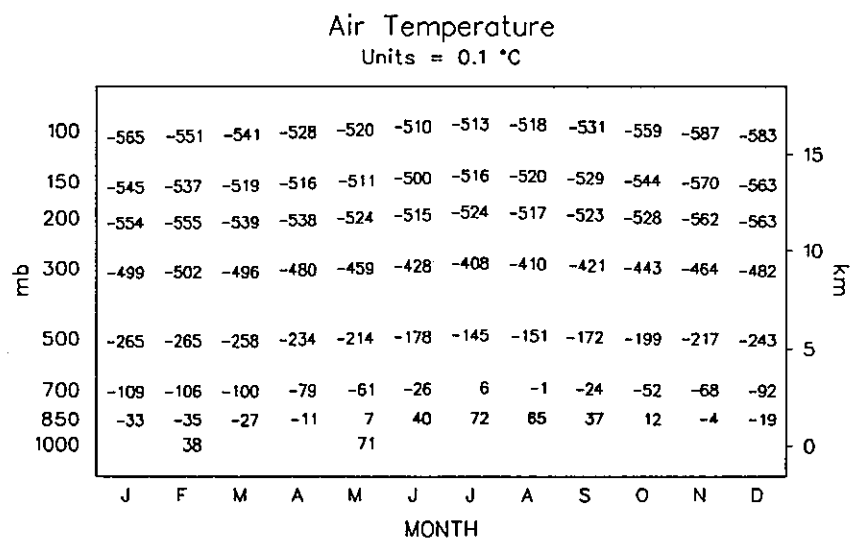
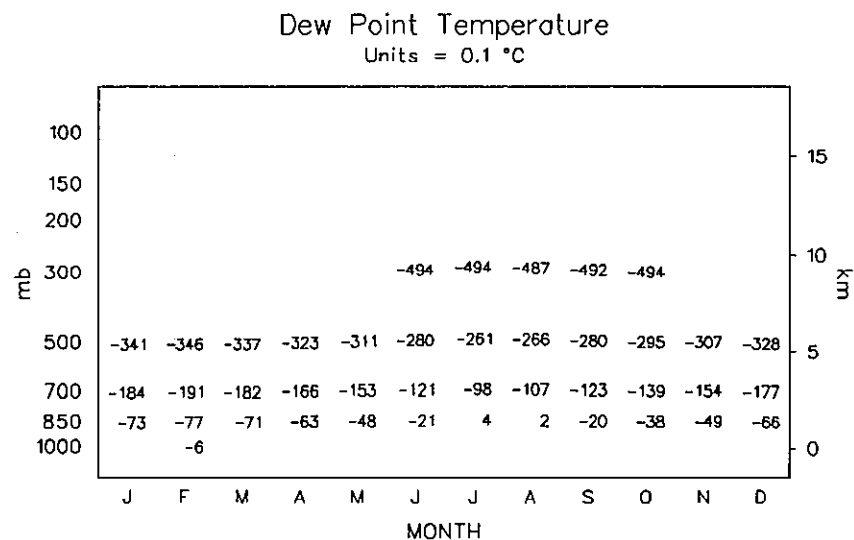
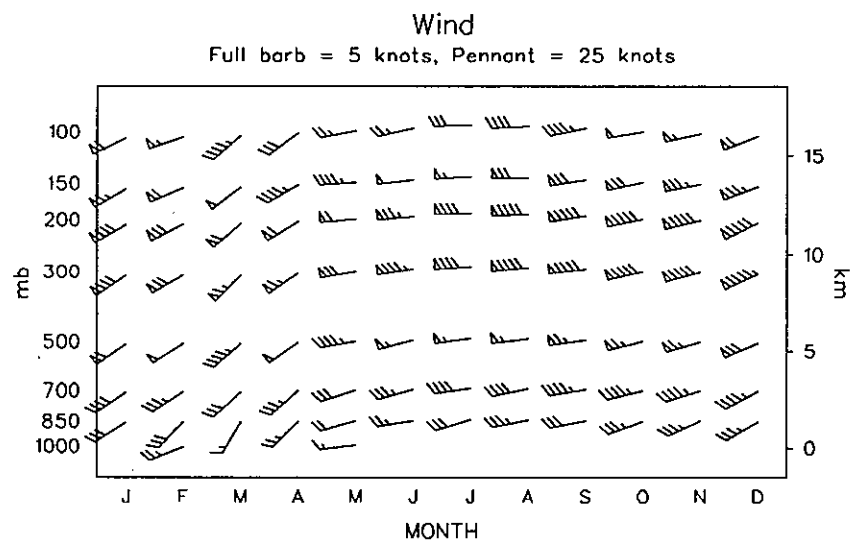
OWS Study Area C Anomalies

Precipitation Frequency

Units = 0.1 percent

MONTH																															LTM SD																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974		1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903	2904	2905	2906	2907	2908	2909	2910	2911	2912	2913	2914	2915	2916	2917	2918	2919	2920	2921	2922	2923	2924	2925	2926	2927	2928	2929	2930	2931	2932	2933	2934	2935	2936	2937	2938	2939	2940	2941	2942	2943	294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OWS Study Area C Anomalies

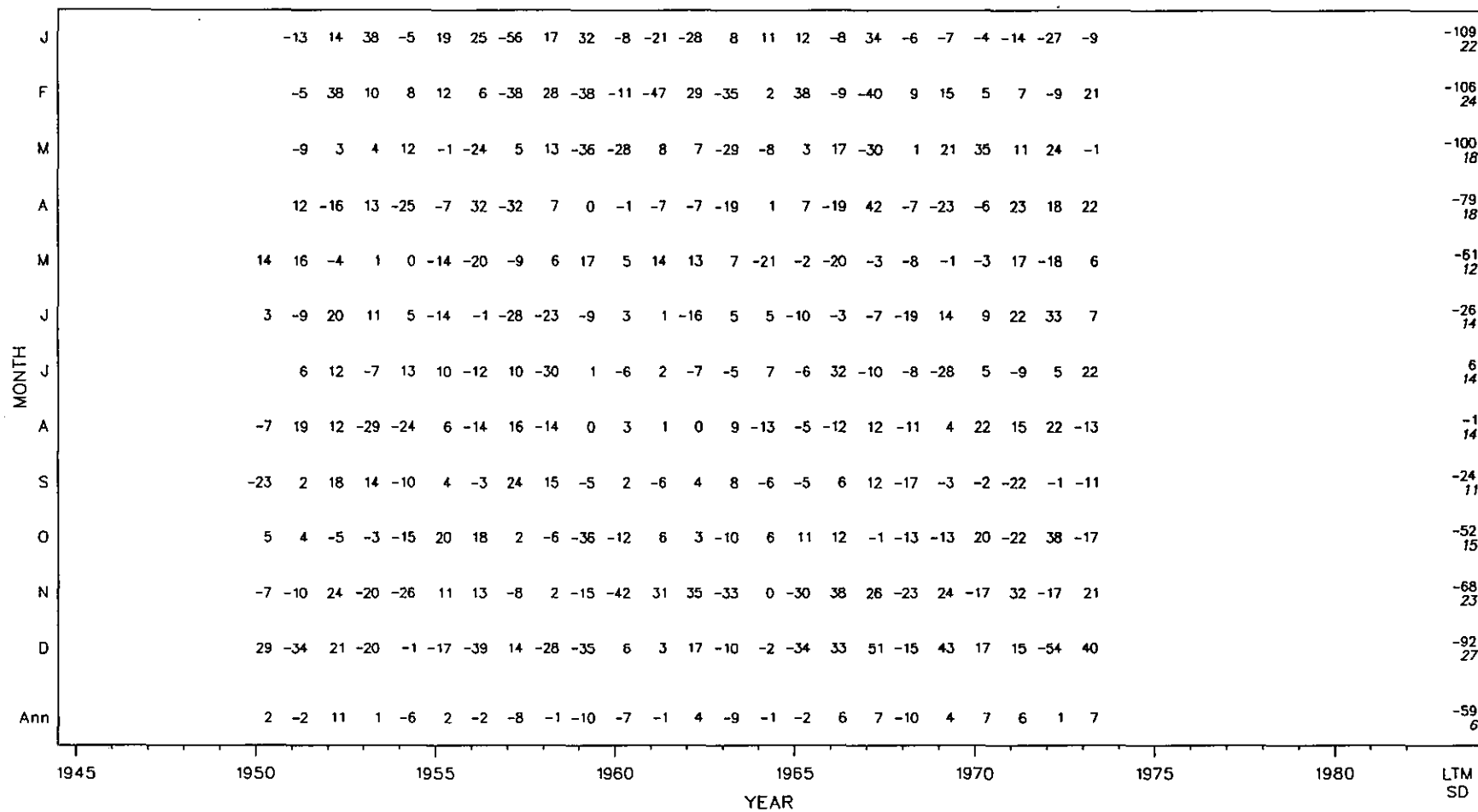


OWS Study Area C Upper Air Climatology

Mean plotted at actual height

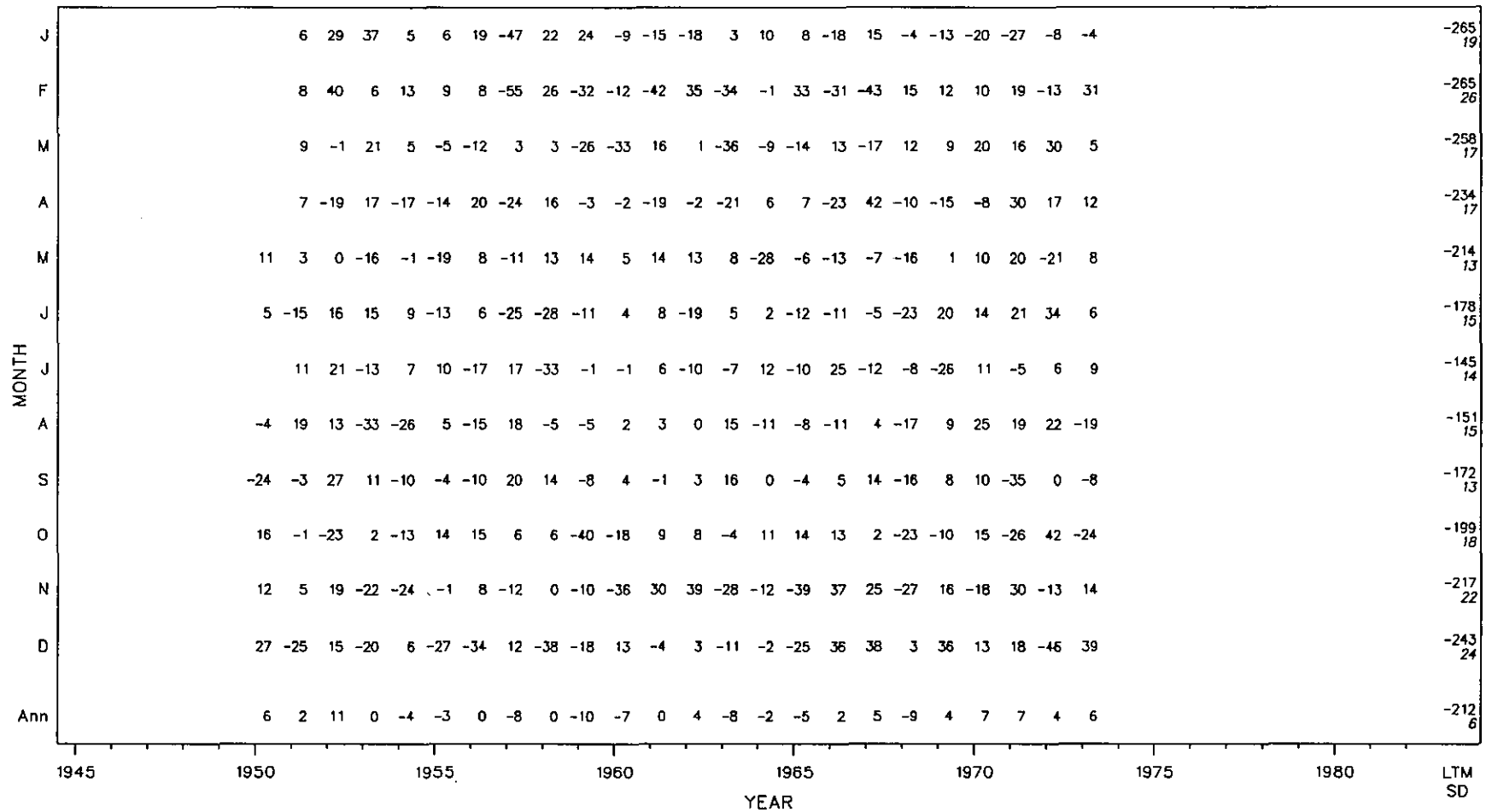
Air Temperature: 700 mb

Units = 0.1 °C



OWS Study Area C Anomalies

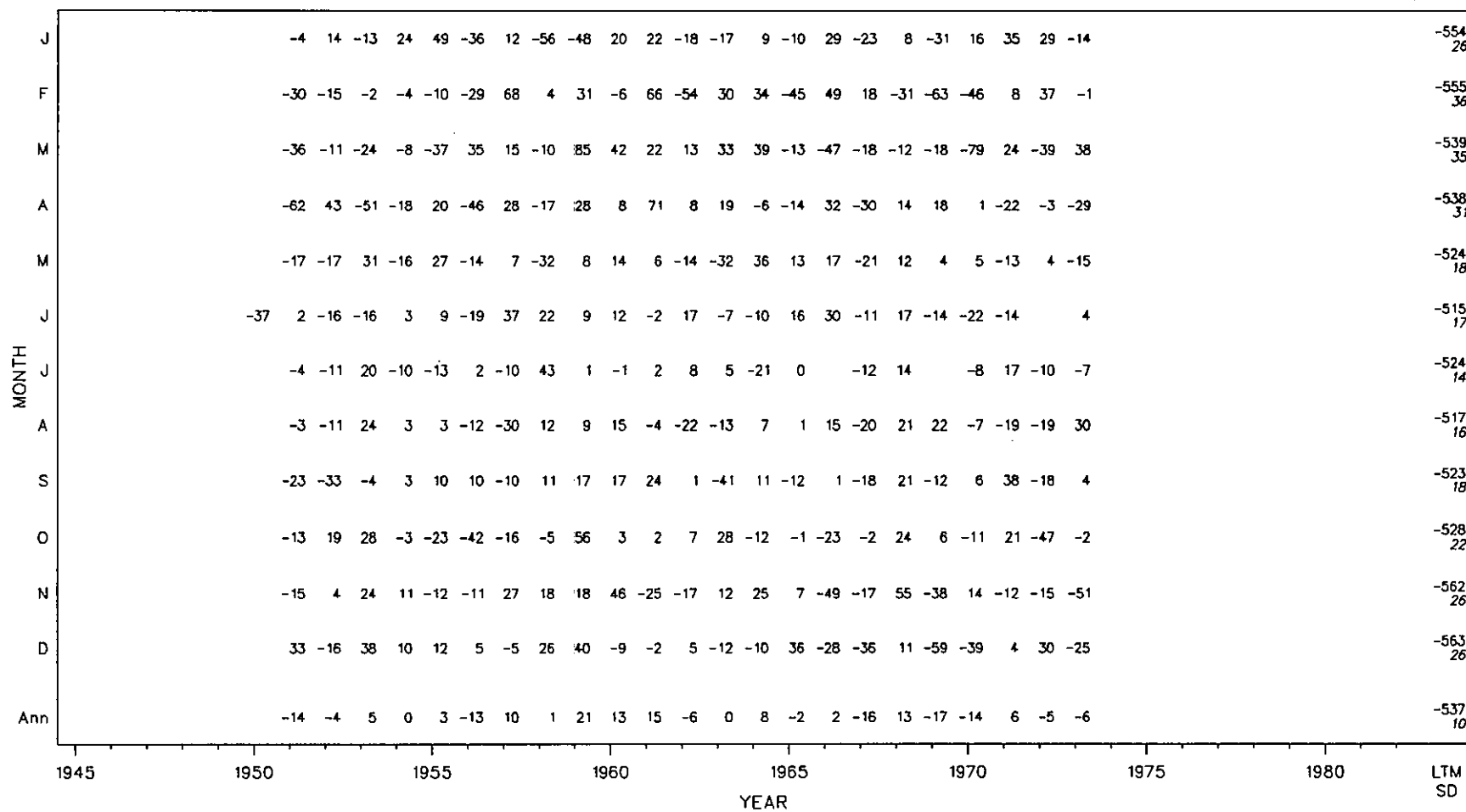
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Units = 0.1 °C



OWS Study Area C Anomalies

Air Temperature: 200 mb

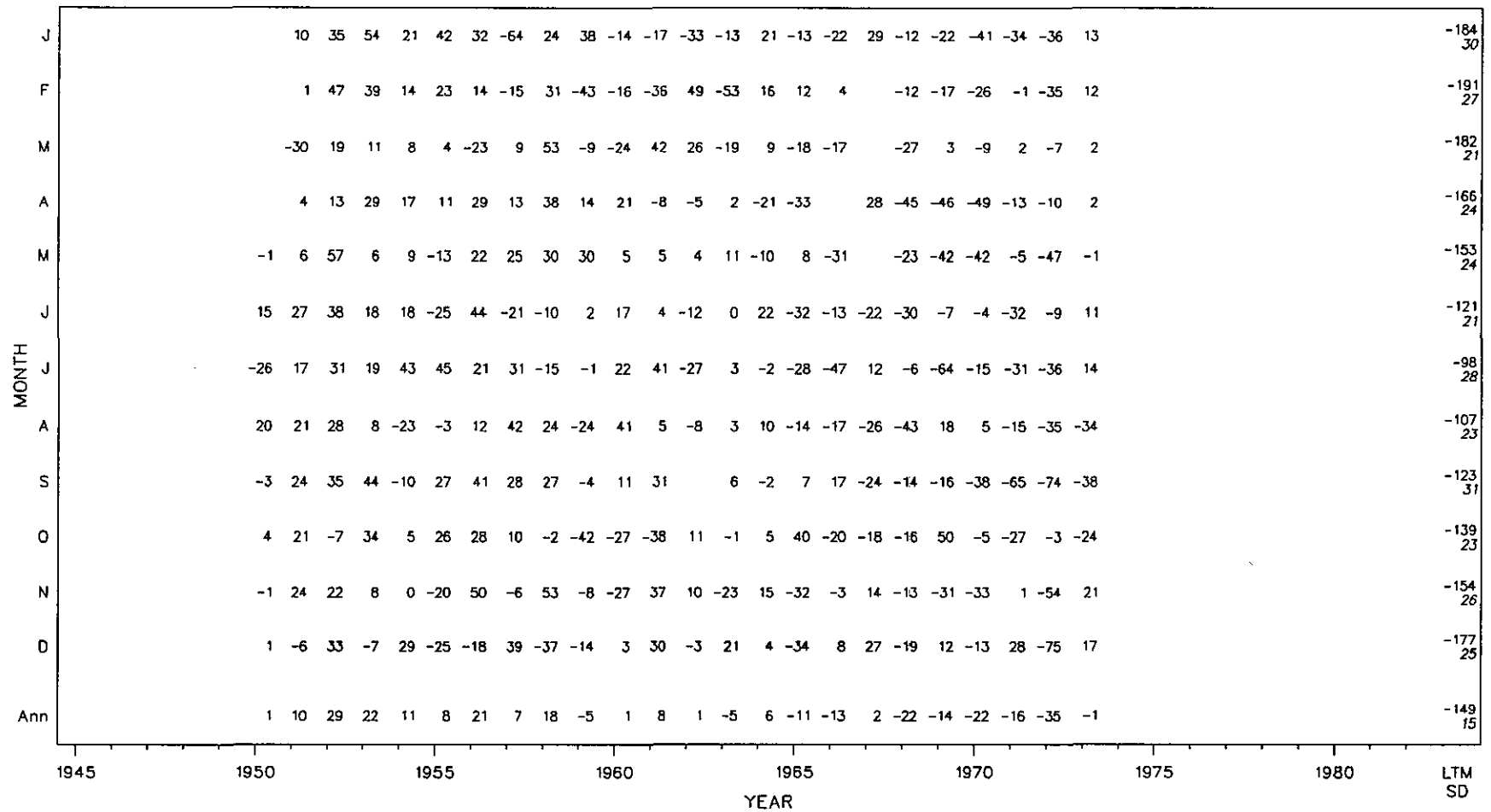
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OWS Study Area C Anomalies

Dew Point Temperature: 700 mb

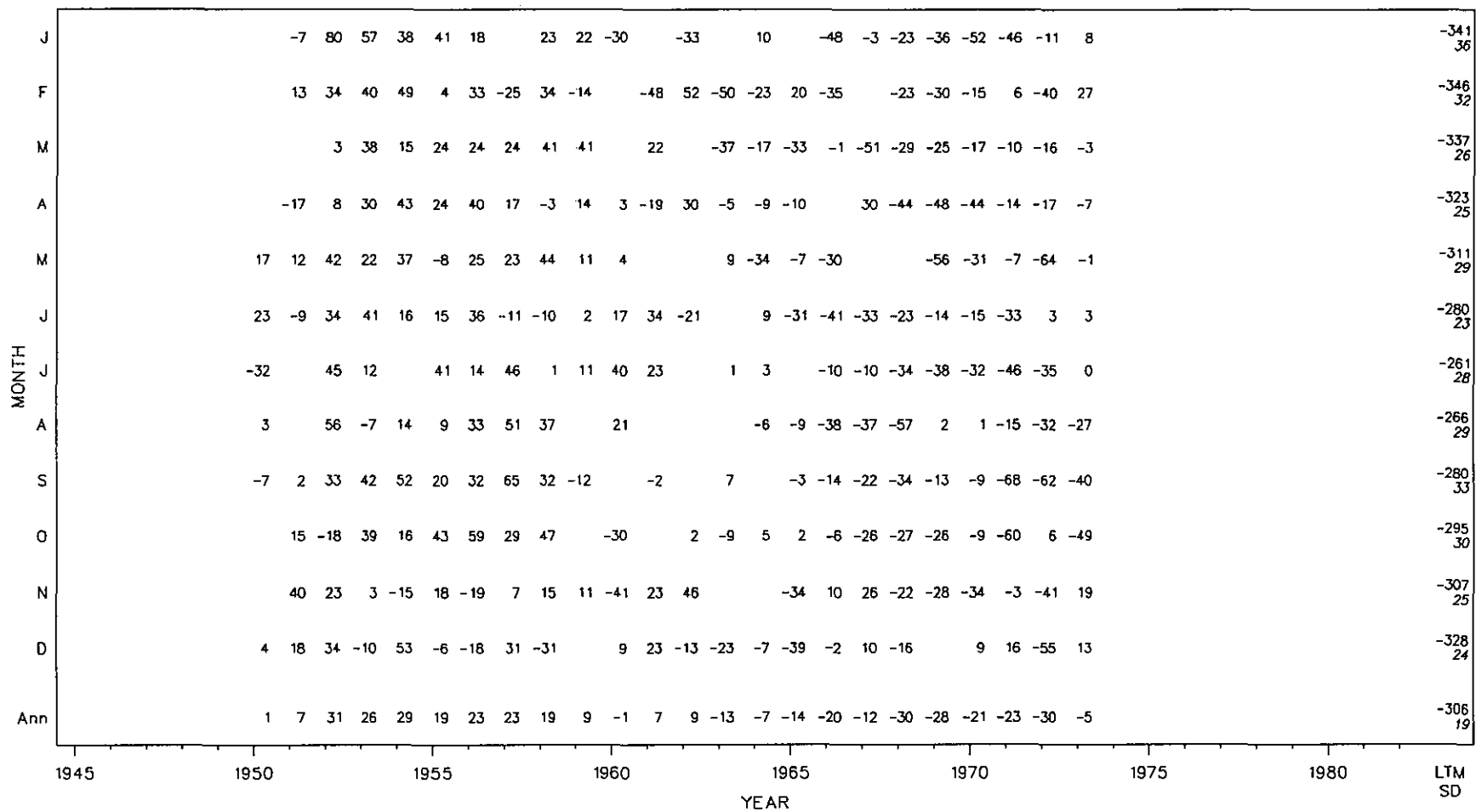
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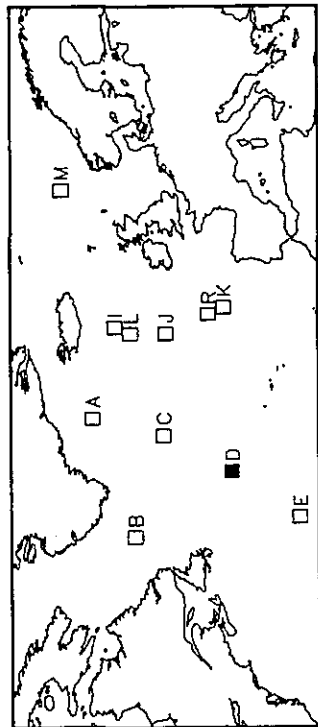
OWS Study Area C Anomalies

Dew Point Temperature: 500 mb

Units = 0.1 °C



OWS Study Area C Anomalies



43.0°N - 44.9°N, 41.9°W - 40.0°W
1945 - 1973

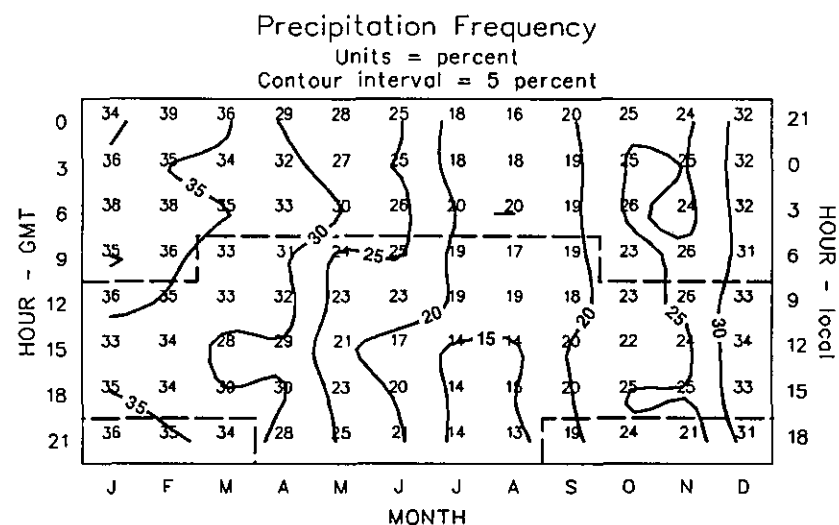
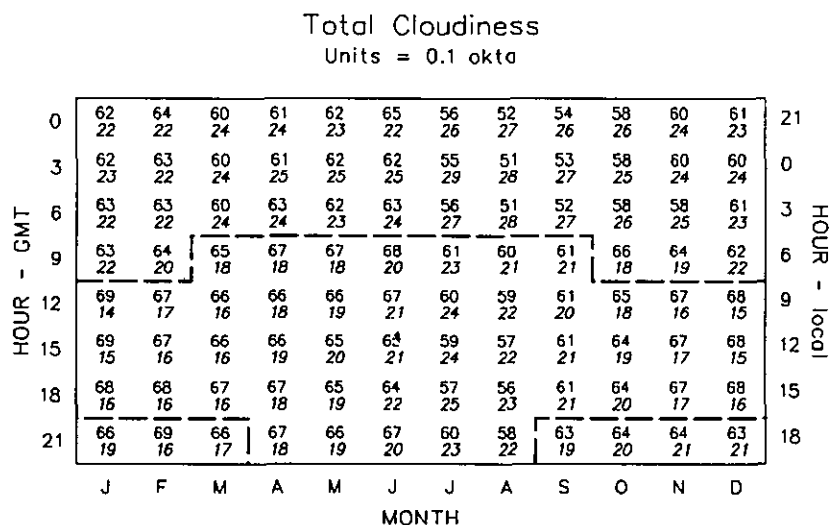
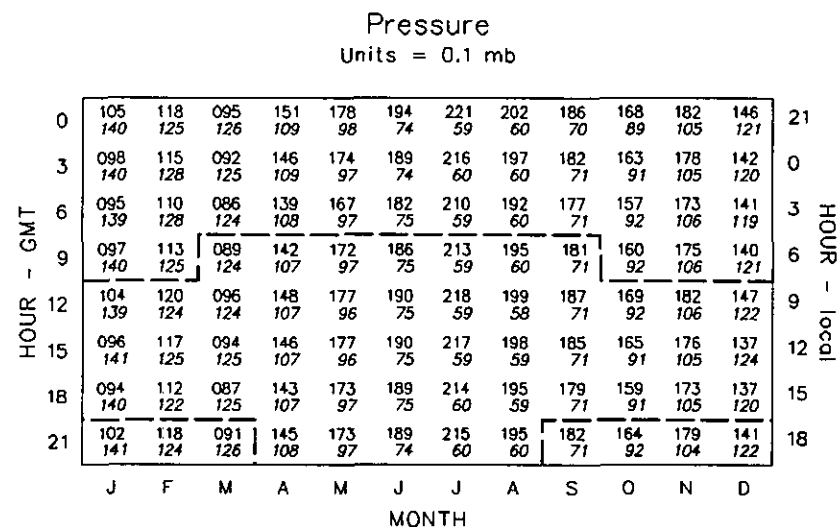
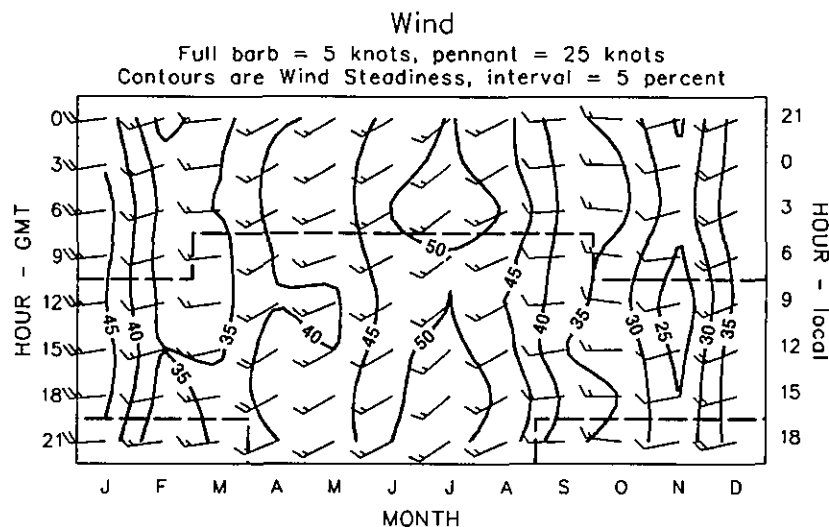
OWS
D

MONTH																									Sum		
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F	28 27	20 20	26 26	29 29	25 25	28 26	25 25	29 29	27 27	28 28	25 25	29 29	28 28	28 28	29 29	26 26	27 27	28 28	29 29	27 27	28 28	25 25	27 27	27 27	676 673		
M	31 31	28 28	29 29	25 25	26 26	31 31	31 31	31 31	31 31	31 31	30 30	30 30	31 31	31 31	31 31	31 31	26 26	31 31	31 31	31 31	23 22	31 31	31 31	29 29	12 12	723 722	
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J		31 31	31 31	28 28	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	28 27	31 31	31 31	31 31	31 31	31 31	29 29	17 17	691 688		
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S		26 26	29 29	30 30	23 23	28 28	30 30	30 30	28 28	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	23 23	27 27	26 26	690 690		
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Ann	1 149 1 148	118 118	344 344	353 353	341 340	352 352	357 354	360 360	353 350	363 363	363 363	360 359	365 365	364 364	364 364	364 362	366 365	355 354	363 363	363 363	349 349	346 344	350 349	348 346	280 280	105 103	8496 8476

OWS Study Area D (44.0°N, 41.0°W)

Frequency of Surface Observations

Each of the 11 variables was observed on X days of each month.
 The upper number is the maximum X from among all the variables.
 The lower number is the minimum X from among all the variables.



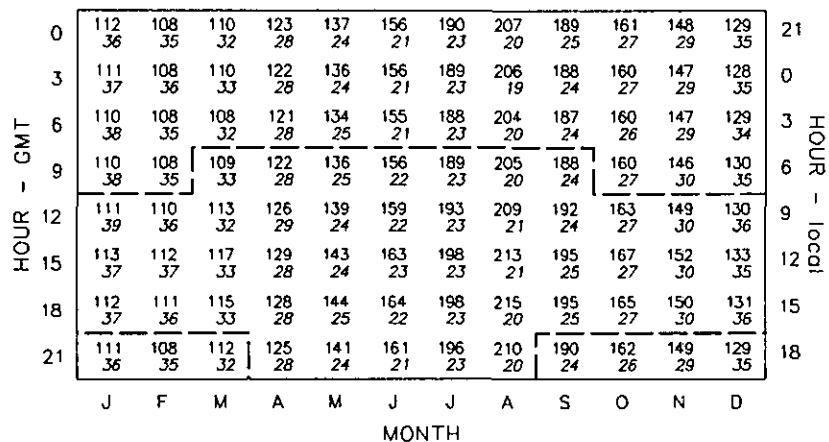
OWS Study Area D Surface Climatology

upper number = mean
lower number = standard deviation

———— data contours
----- sunrise/sunset

Air Temperature

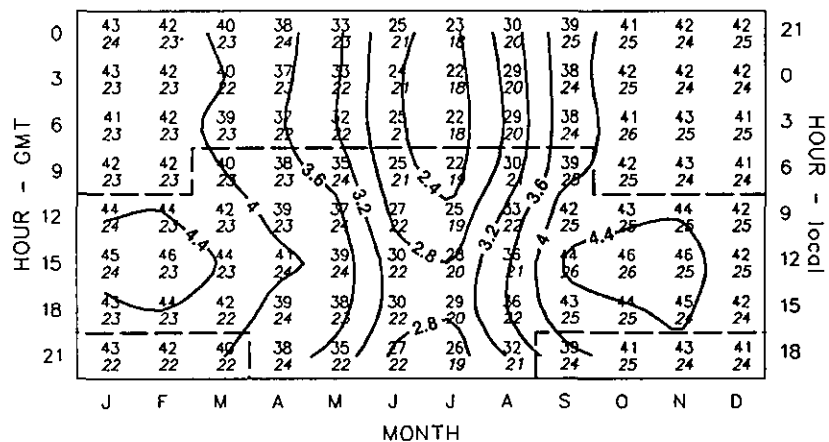
Units = 0.1 °C



Dew Point Depression

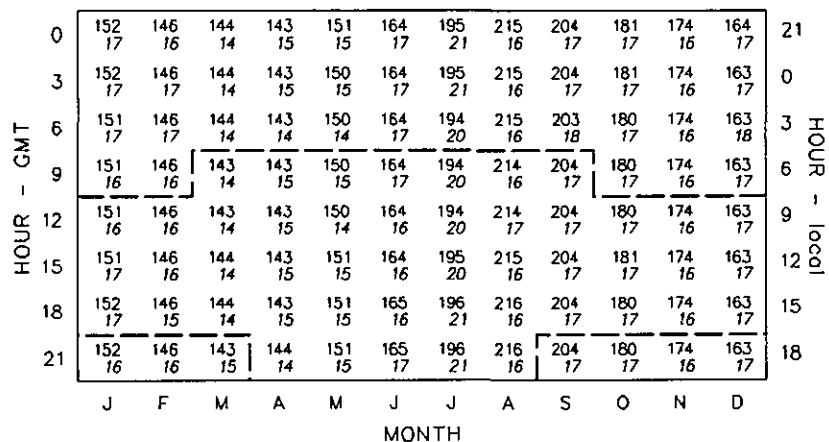
Units = 0.1 °C

Contour interval = 0.4 °C



Sea Surface Temperature

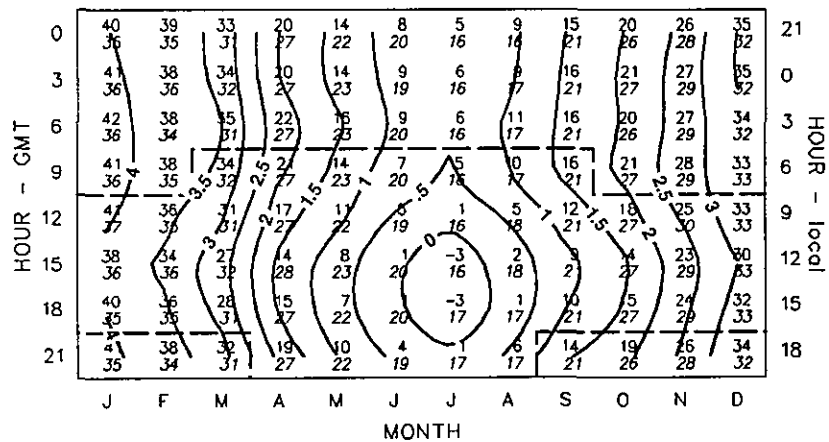
Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C

Contour interval = 0.5 °C



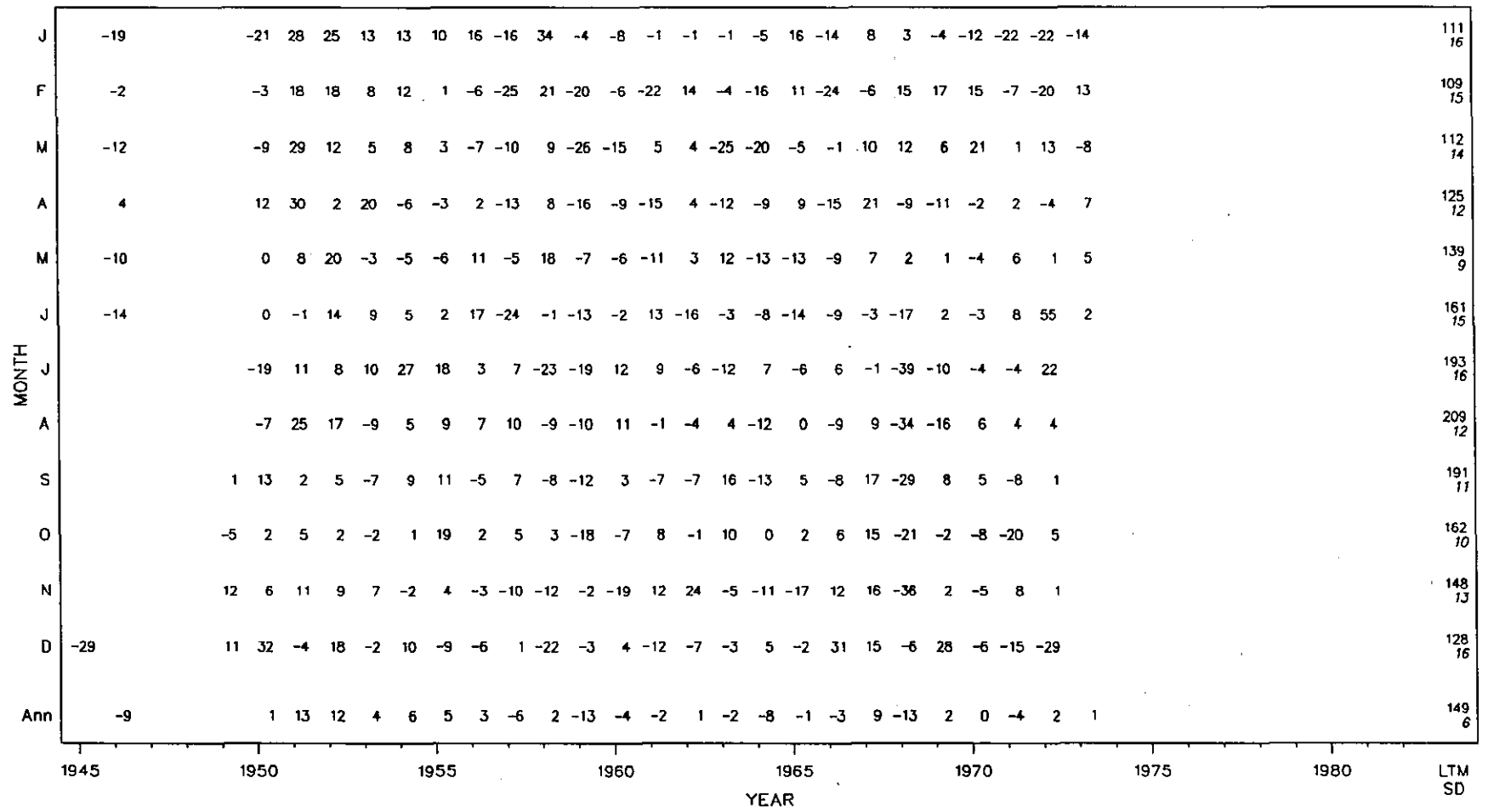
OWS Study Area D Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
--- sunrise/sunset

Surface Air Temperature

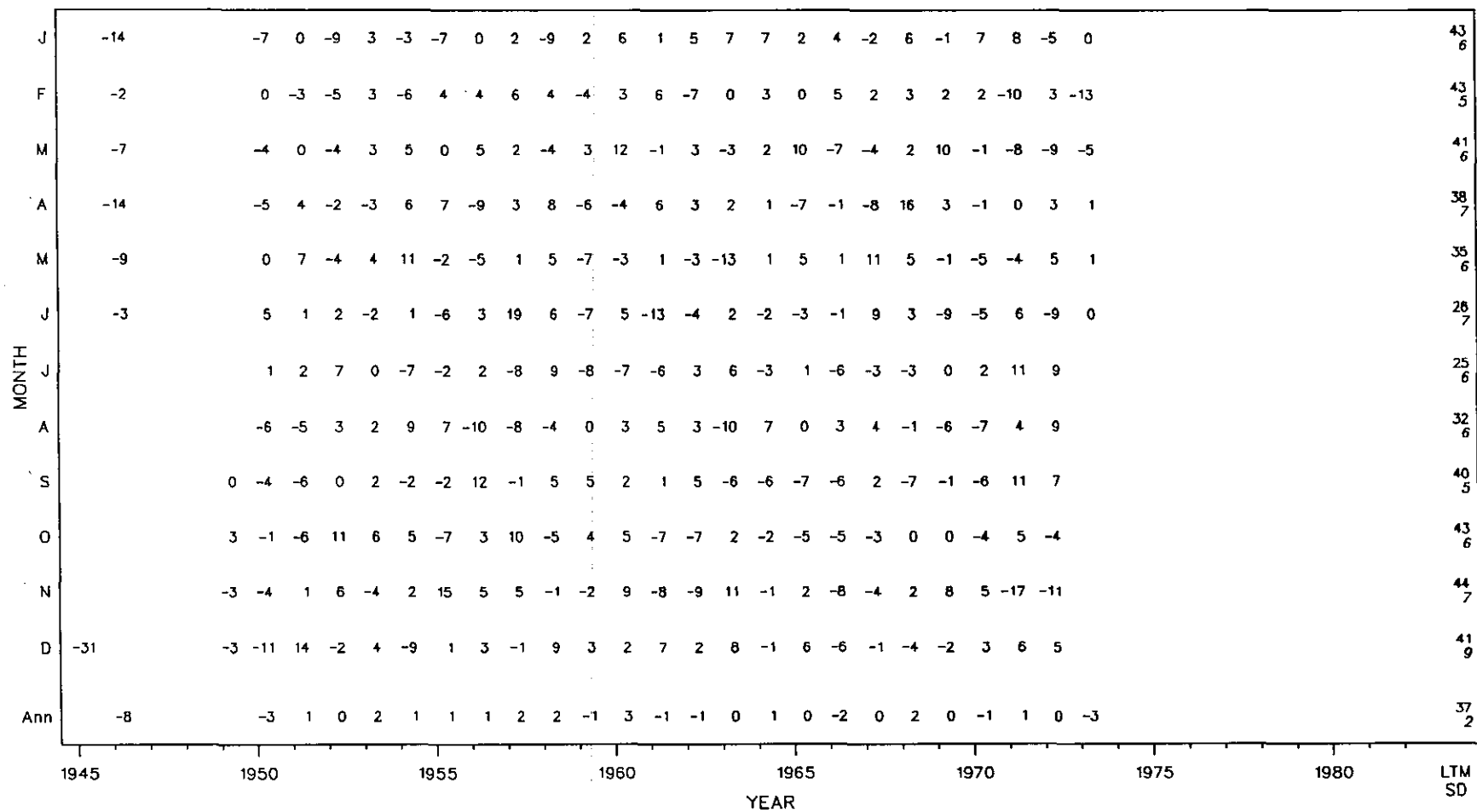
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OWS Study Area D Anomalies

Surface Dew Point Depression

Units = 0.1 °C



OWS Study Area D Anomalies

Sea Surface Temperature

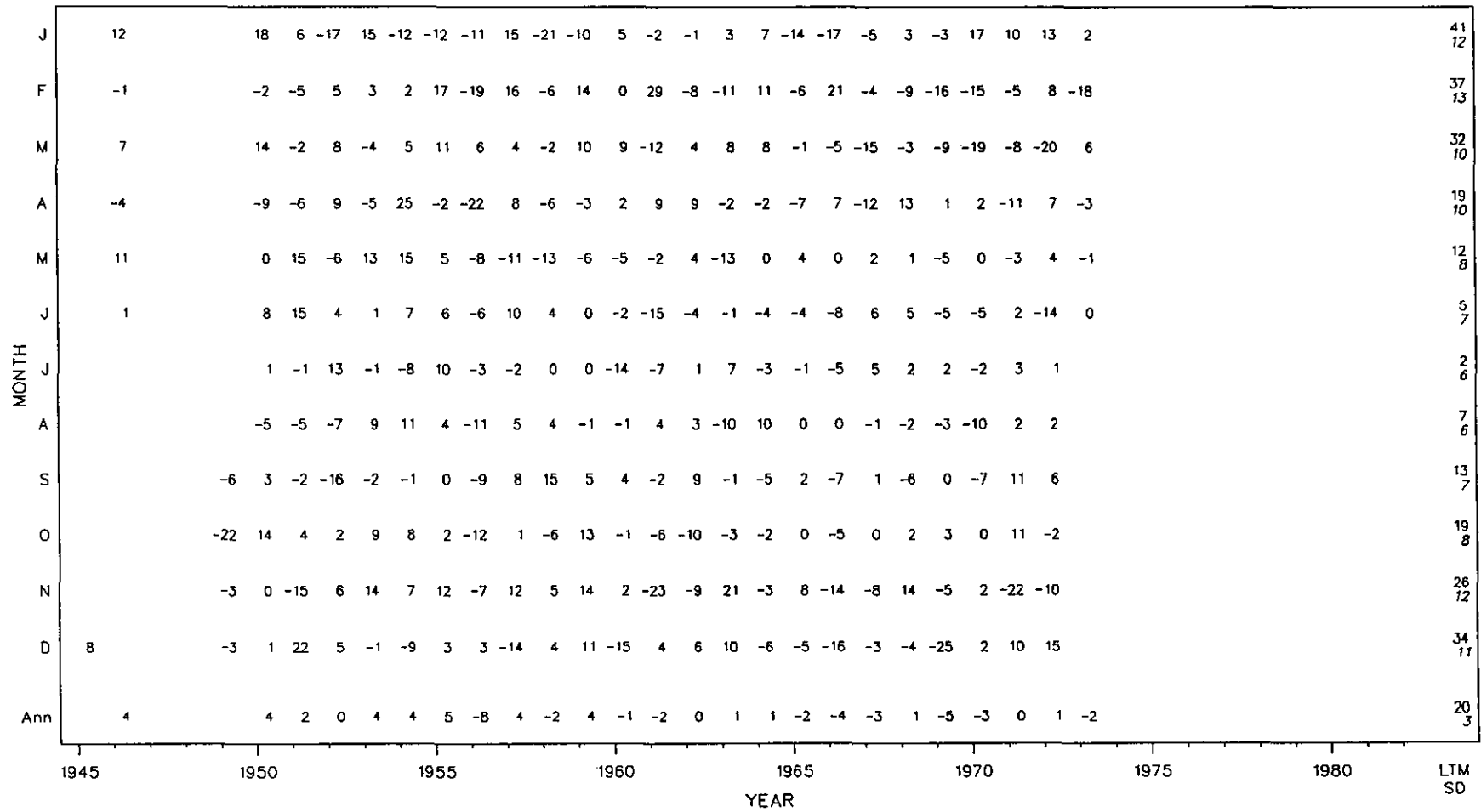
Units = 0.1 °C

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F	-3	-4	12	23	11	11	18	-25	-10	15	-6	-6	7	6	-15	-5	6	-3	-10	5	1	-1	-11	-12	-5				146 11
M	-5	5	27	20	2	13	14	0	-6	7	-15	-6	-7	8	-18	-12	-6	-7	-5	9	-3	2	-7	-7	-3				144 11
A	0	4	25	11	15	19	-5	-20	-4	2	-18	-7	-6	13	-13	-12	1	-7	10	4	-10	1	-9	3	3				143 11
M	1	0	23	14	10	10	-1	3	-17	5	-13	-10	-13	7	-1	-13	-8	-9	8	3	-4	-4	3	4	4				151 10
J	-13	8	14	17	10	12	7	11	-14	3	-14	-4	-2	-20	-5	-12	-18	-17	3	-11	-4	-7	10	41	2				166 14
J		-18	9	22	9	19	28	0	5	-23	-19	-1	2	-5	-5	4	-6	2	5	-37	-8	-6	-1	24					196 15
A		-11	20	10	0	16	13	-4	15	-5	-11	10	3	-1	-6	-2	-1	-9	9	-35	-18	-4	6	5					215 12
S		-6	16	1	-11	-8	8	12	-14	14	7	-7	7	-8	2	15	-19	7	-15	18	-35	9	-2	3	7				204 13
O		-27	15	9	3	8	9	21	-10	5	-3	-5	-9	2	-10	7	-2	2	1	15	-18	1	-8	-8	3				181 11
N		9	6	-3	15	20	5	17	-10	2	-7	12	-17	-11	15	17	-14	-9	-2	8	-23	-3	-4	-13	-8				173 12
D	-22	8	32	18	23	-3	1	-6	-3	-14	-18	8	-11	-7	-1	7	-1	-7	15	12	-10	3	-4	-5	-15				162 13
Ann	-4	4	16	13	8	10	10	-5	-2	0	-8	-5	-4	1	-1	-7	-3	-7	6	-12	-4	-3	-4	3	-2				169 7

OWS Study Area D Anomalies

Sea - Air Temperature Difference

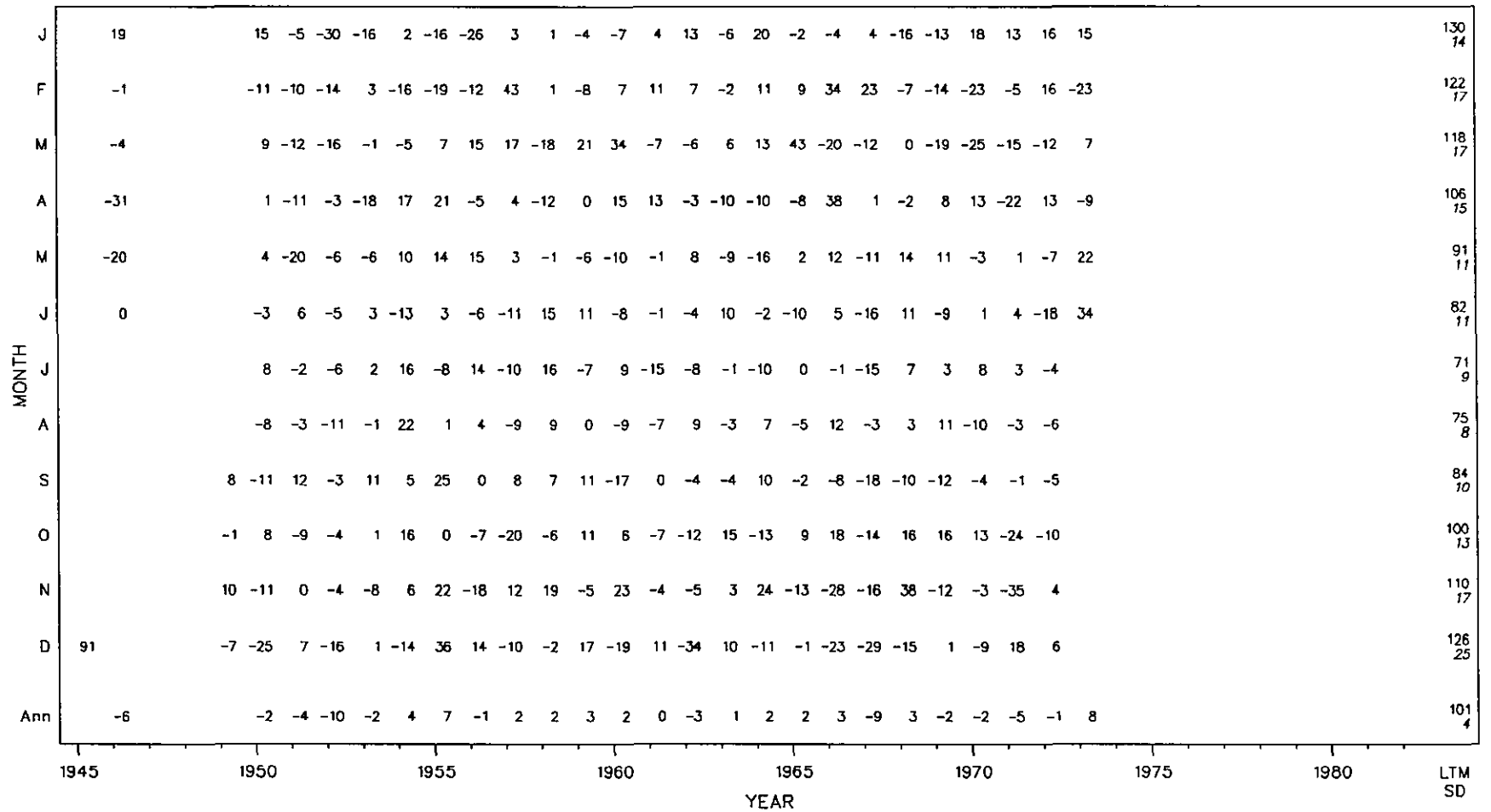
Units = 0.1 °C



OWS Study Area D Anomalies

Surface Scalar Wind

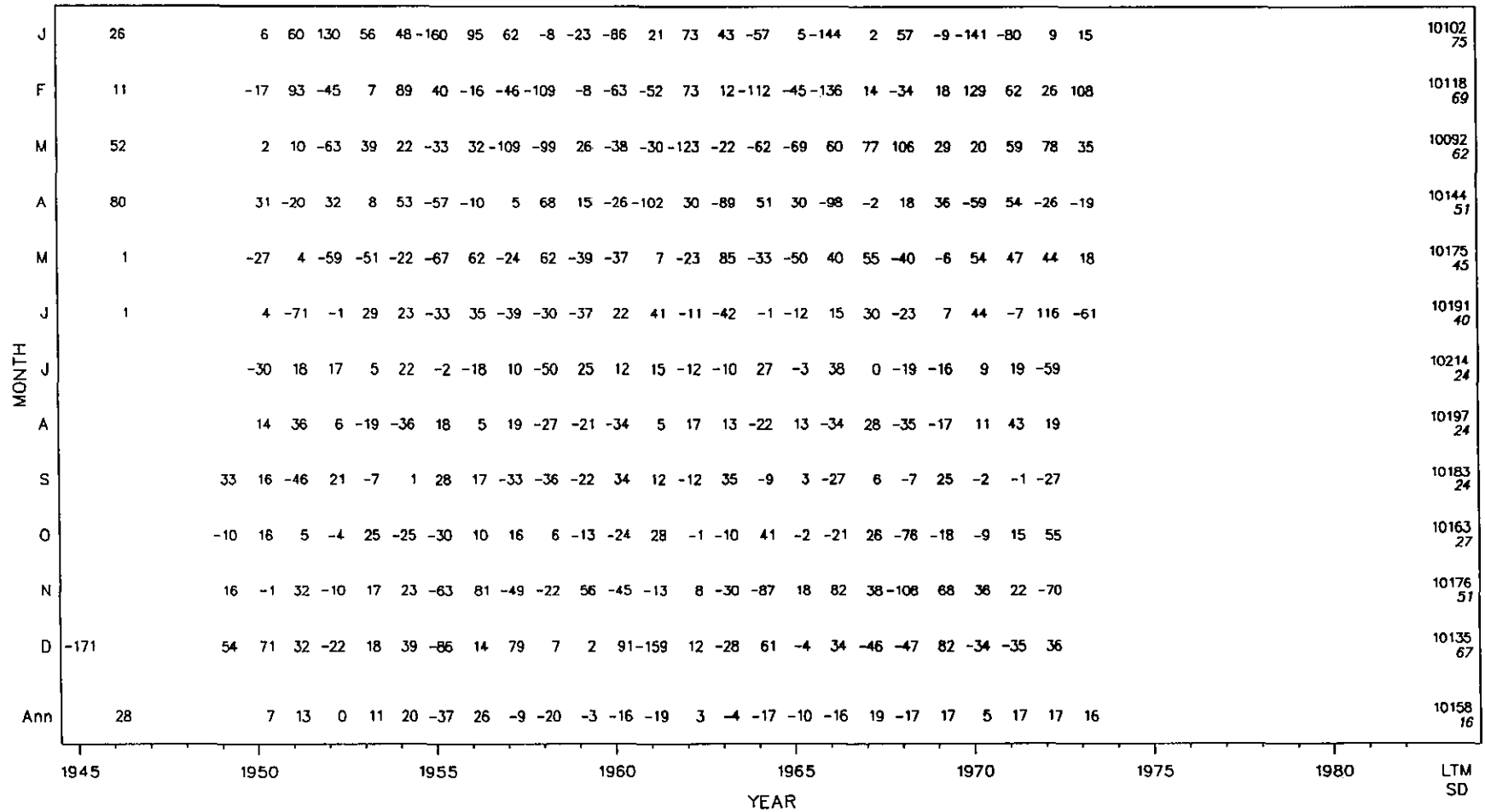
Units = 0.1 m/s



OWS Study Area D Anomalies

Sea Level Pressure

Units = 0.1 mb



OWS Study Area D Anomalies

Total Cloudiness

Units = 0.1 okta

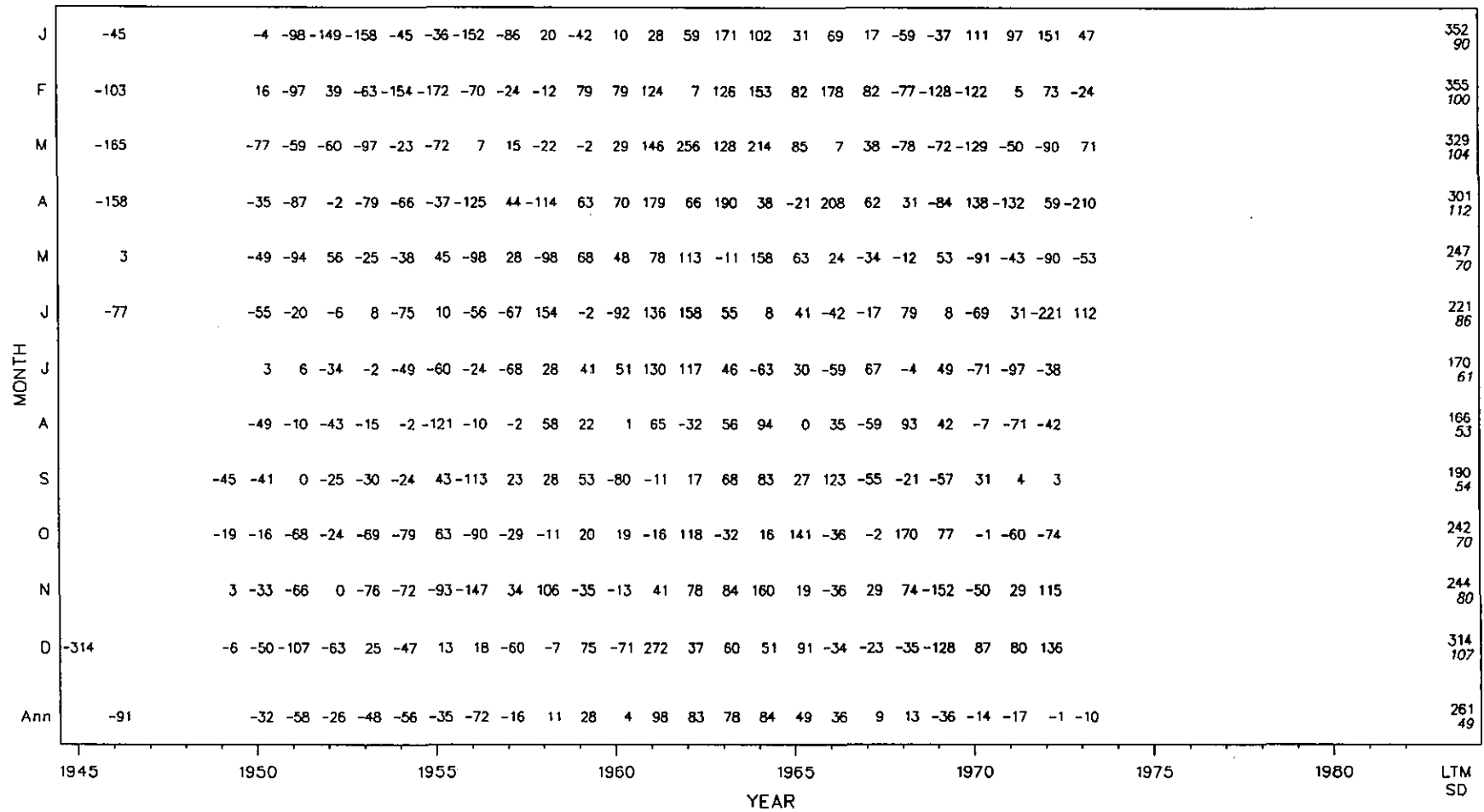
MONTH																										
	1945	1950	1955	1960	1965	1970	1975	1980	LTM	SD																
J	5	2	0	2	2	-4	-5	-8	5	8	2	-4	-4	2	1	0	-1	-7	0	-4	0	2	-2	-1	5	65
F	-1	1	8	-2	2	0	-5	-3	2	-2	2	-3	2	-6	-5	2	-1	0	1	0	-4	0	4	4	3	66
M	2	4	-3	-4	-2	0	1	2	4	-6	4	-1	0	-2	1	2	1	-5	7	-1	-5	-3	1	1	4	64
A	-3	-1	-10	3	3	-1	4	0	3	-8	7	2	4	-4	-2	-3	-1	-2	2	-2	5	1	-2	4	3	65
M	2	3	-4	-3	-2	-8	2	1	3	-3	1	0	-1	2	3	1	2	3	-6	-4	4	1	-4	0	5	65
J	6	-1	7	1	2	0	8	5	2	7	5	-11	-1	2	-3	-8	-2	-3	1	5	6	-2	3	-29	0	64
J		5	7	-2	0	-9	-9	1	-2	2	4	5	1	10	7	-10	-1	-3	5	6	7	-7	-7	-10		58
A		-10	-8	-5	3	0	-12	7	1	7	0	-3	0	1	7	7	-1	-2	-2	9	6	0	-2	-3		55
S		-3	3	6	-3	-2	-1	7	-3	2	1	3	-4	-7	0	-2	3	3	2	-5	-1	-2	-1	8	-2	58
O		3	1	3	0	-3	-1	-6	-4	2	0	8	-1	-2	-1	-8	-6	4	0	-1	3	6	7	-5	4	62
N		2	-6	-3	-1	-3	2	1	-9	3	2	0	3	-5	0	0	2	1	4	1	-3	1	1	3	4	63
D	13	0	-2	3	-3	4	-10	5	2	-1	0	5	2	-3	0	-2	-1	0	-5	-5	-2	-5	1	1	1	64
Ann	2	0	0	-1	0	-3	-1	-1	2	1	3	-1	-1	0	0	-1	0	-1	0	1	2	0	0	-2	3	62

OWS Study Area D Anomalies

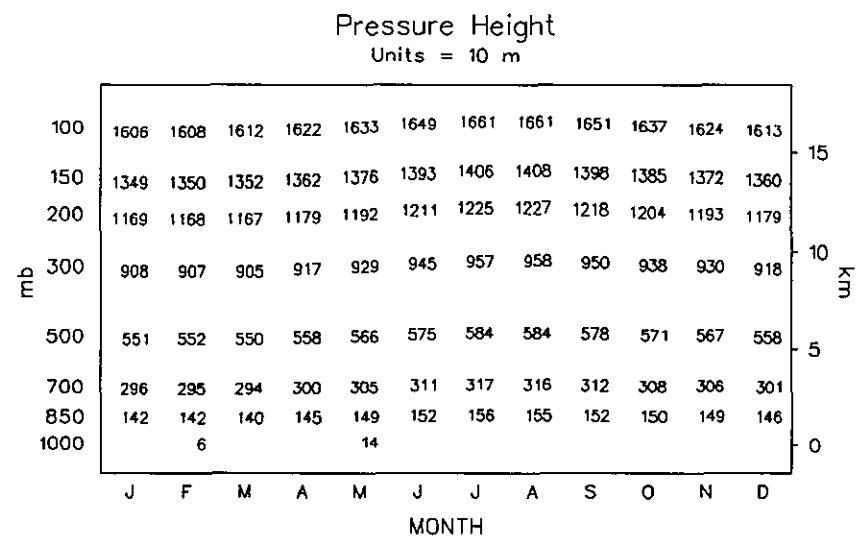
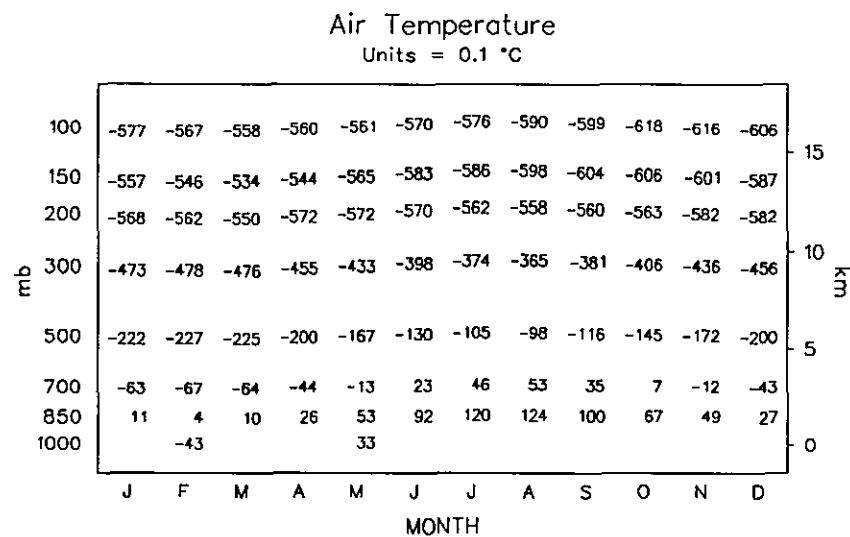
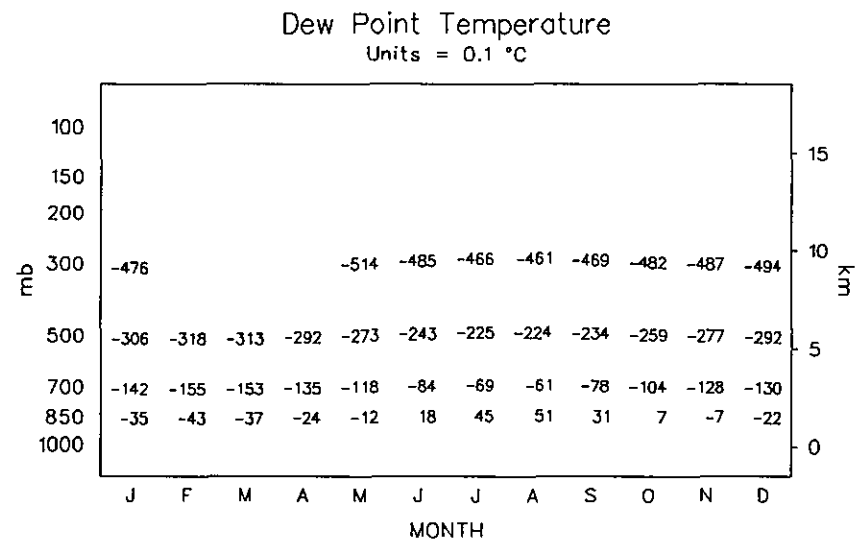
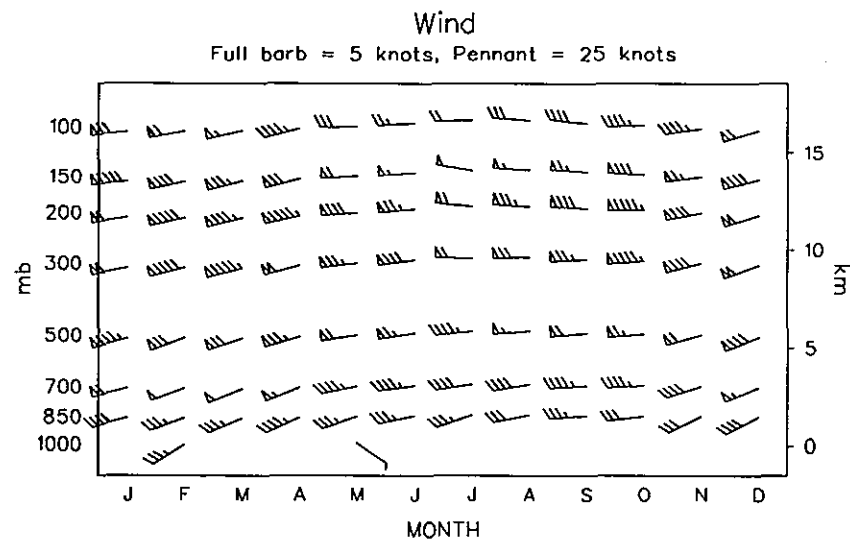
D10

Precipitation Frequency

Units = 0.1 percent



OWS Study Area D Anomalies

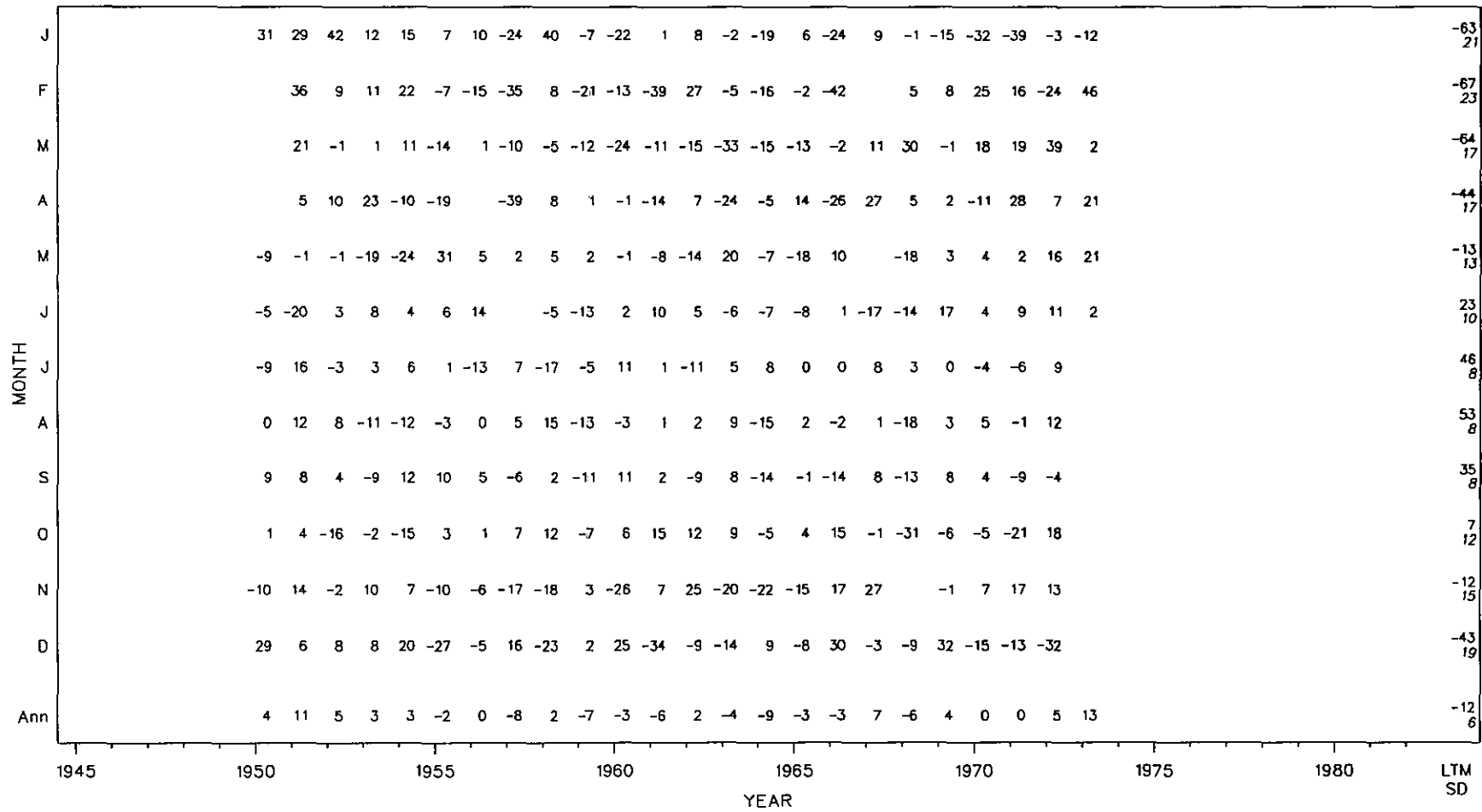


OWS Study Area D Upper Air Climatology

Mean plotted at actual height

Air Temperature: 700 mb

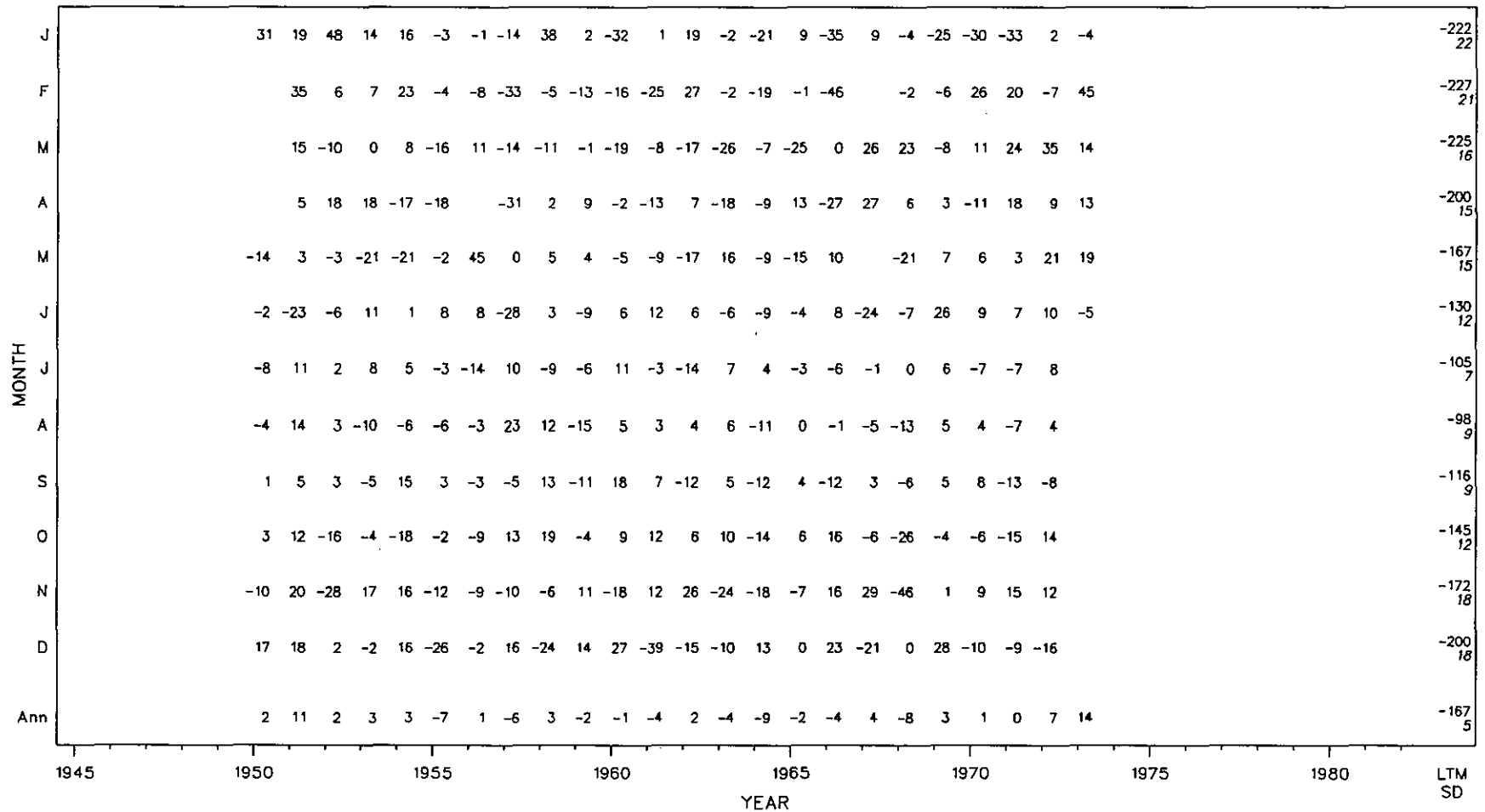
Units = 0.1 °C



OWS Study Area D Anomalies

Air Temperature: 500 mb

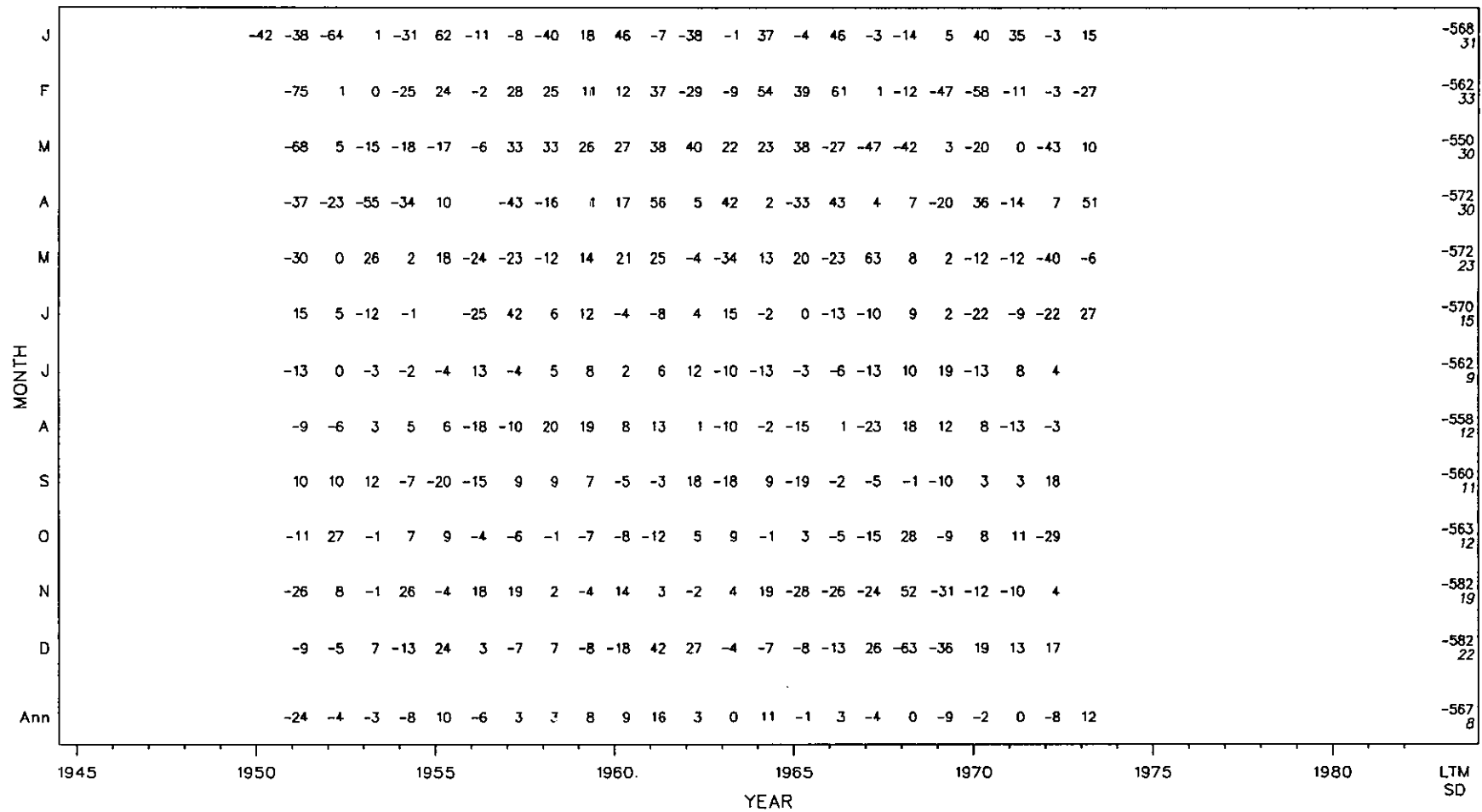
Units = 0.1 °C



OWS Study Area D Anomalies

Air Temperature: 200 mb

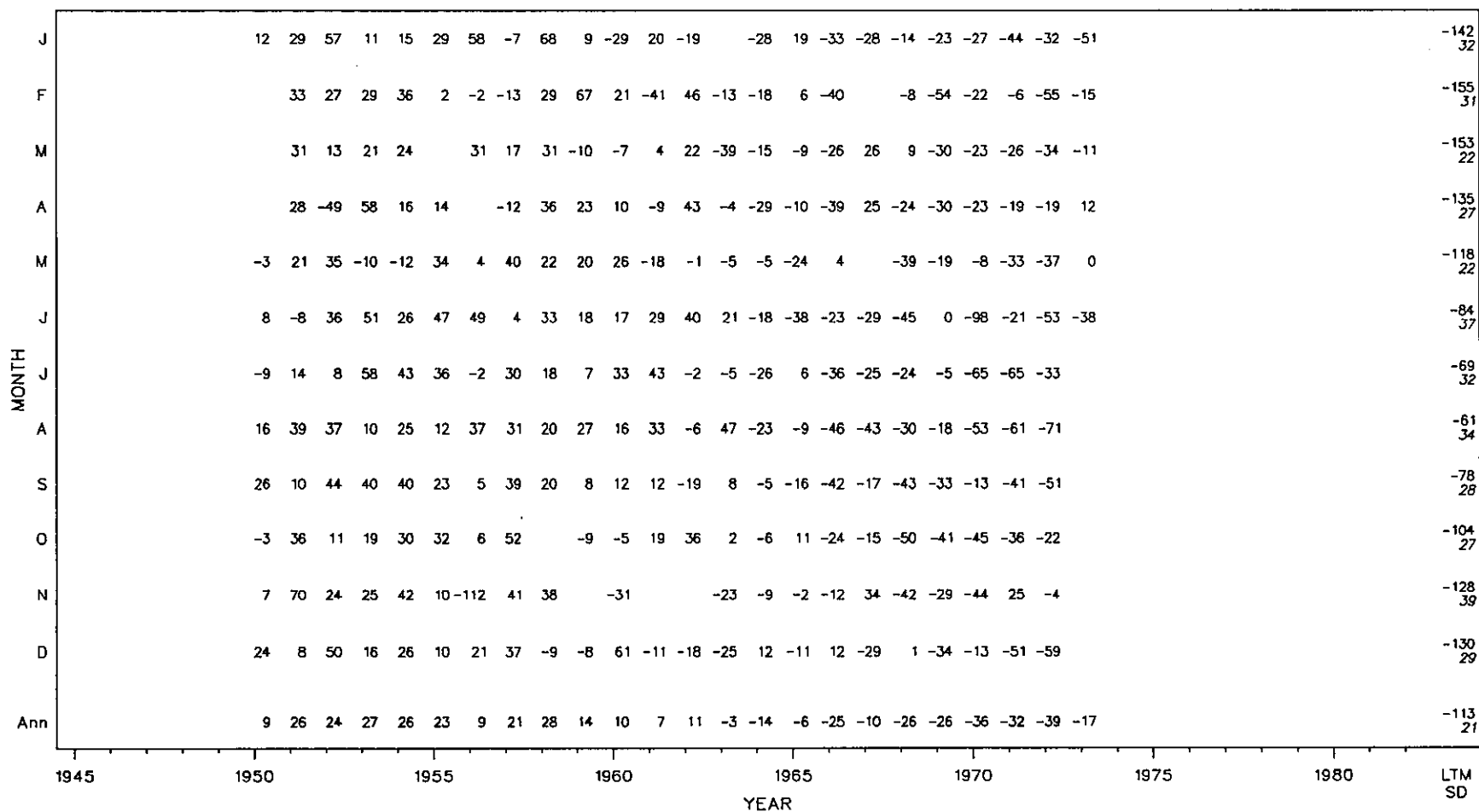
Units = 0.1 °C



OWS Study Area D Anomalies

Dew Point Temperature: 700 mb

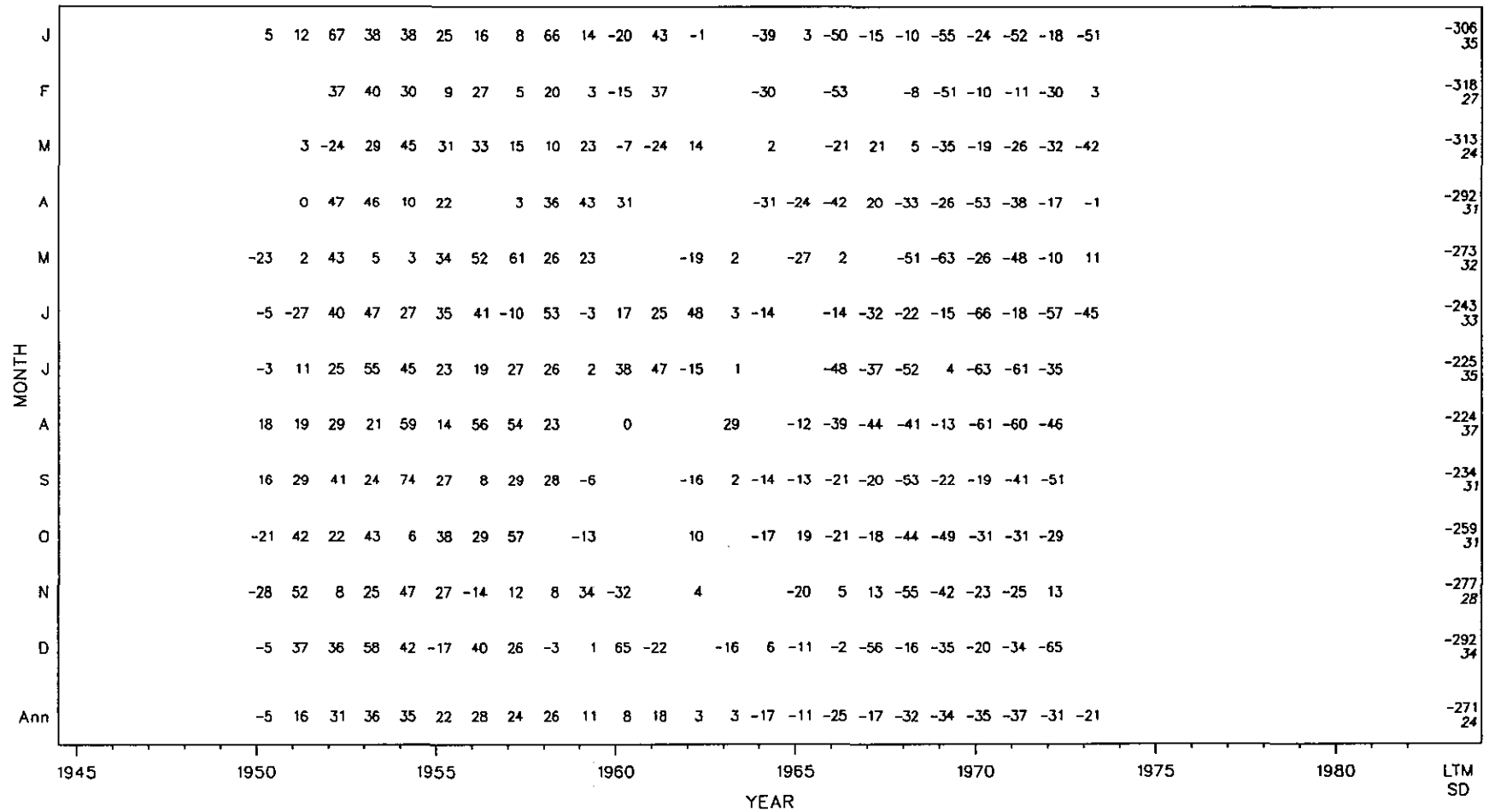
Units = 0.1 °C



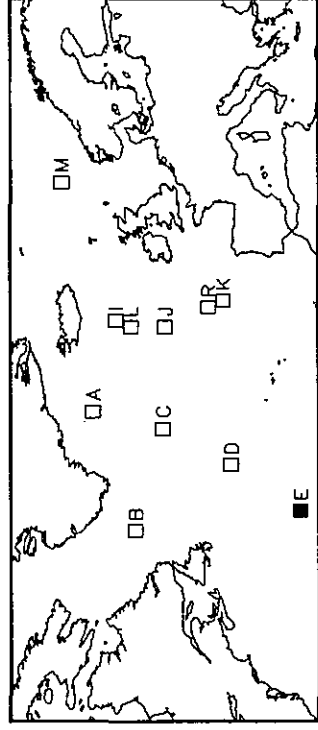
OWS Study Area D Anomalies

Dew Point Temperature: 500 mb

Units = 0.1 °C



OWS Study Area D Anomalies



34.0°N – 35.9°N, 48.9°W – 47.0°W
1949 – 1973

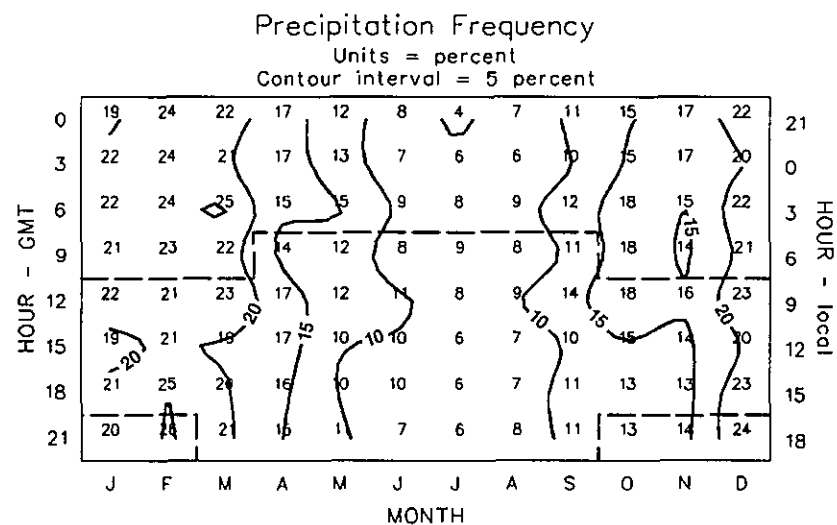
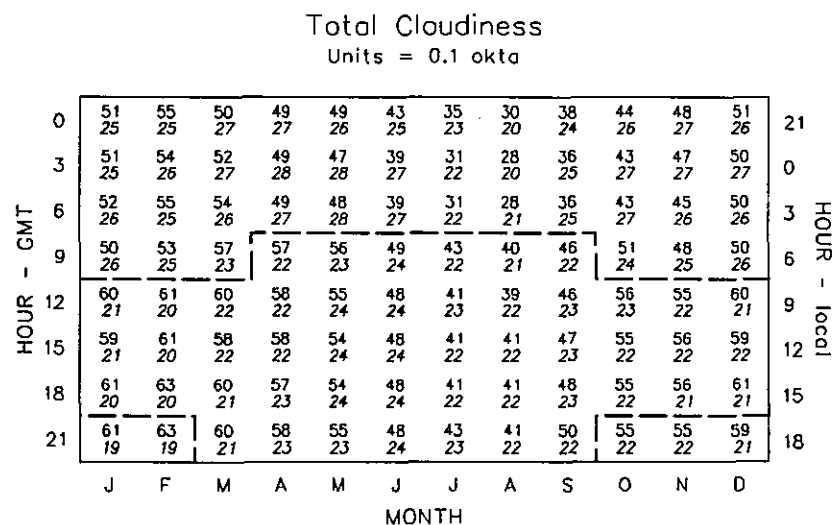
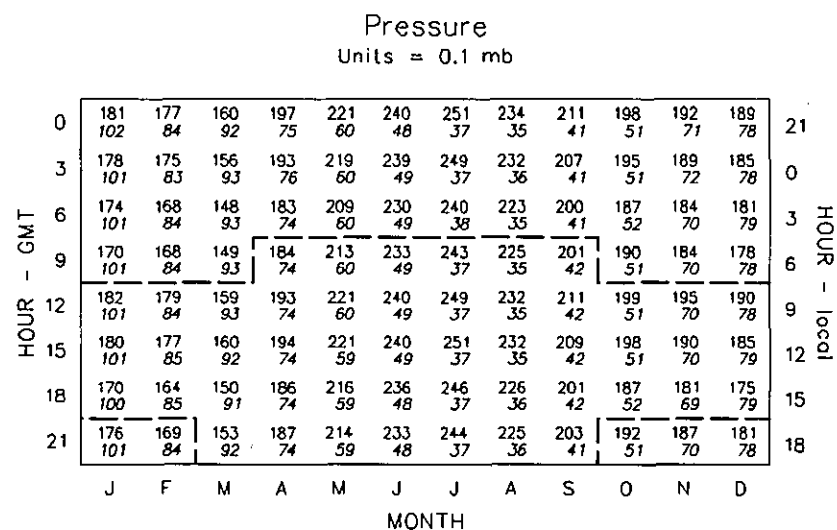
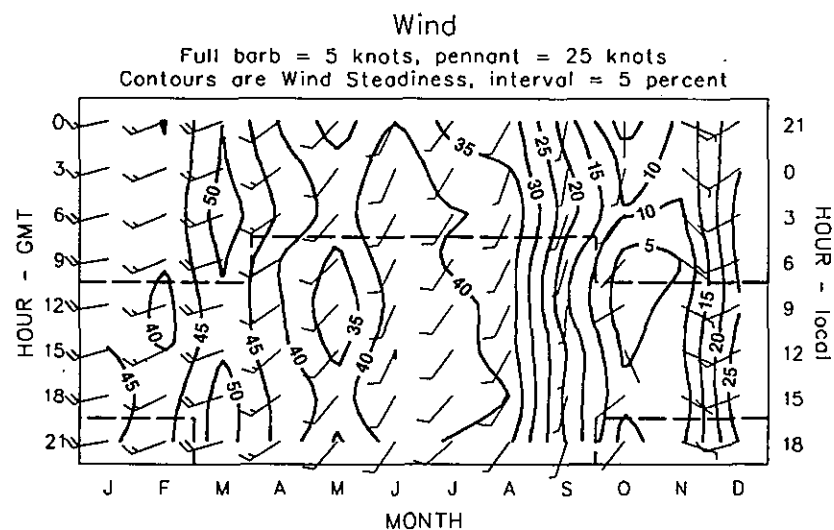
OWS
E

MONTH																													Sum		
	1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075	2080	2085	2090	2095
J	31 31	31 31	28 27	31 31	31 27	31 27	31 29	29 31	31 31	31 31	31 26	31 31	31 31	30 30	31 28	30 30	21 21	31 31	22 22	20 20	695 694										
F	28 28	28 28	29 29	26 26	28 28	28 28	29 29	28 28	28 28	29 29	28 28	28 28	29 29	28 28	28 28	27 27	28 28	26 26	23 23	19 19	24 24	653 653									
M	31 31	31 31	31 31	26 26	31 31	30 30	30 30	31 31	31 31	29 29	31 31	31 31	30 30	28 28	31 31	31 31	26 26	31 29	28 28	29 29	30 30	31 31	718 718								
A	30 30	30 30	30 30	30 30	30 30	27 27	30 30	30 30	30 30	29 29	30 30	30 30	26 26	30 30	28 28	30 30	23 23	25 25	26 26	29 29	29 25	687 686									
M	31 31	28 28	31 31	31 31	29 29	31 31	31 30	29 29	26 26	31 31	30 30	31 31	30 30	29 29	31 31	31 31	24 24	29 29	30 30	27 27	30 29	710 710									
J	30 30	29 29	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	29 29	29 29	30 30	20 20	23 23	30 30	26 26	29 21	686 686									
J	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	30 30	31 31	31 31	31 30	31 31	31 31	31 31	31 31	31 31	31 31	31 31	30 30	21 21	701 700									
A	31 31	31 31	28 28	30 30	31 31	31 31	31 31	31 31	30 30	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	30 30	29 29	31 31	26 26	700 700								
S	28 28	30 30	21 21	30 30	30 30	30 30	30 30	22 21	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	29 29	30 28	21 21	25 25	29 28	24 24	679 675								
O	31 31	23 23	20 19	31 31	30 30	31 31	31 31	31 31	31 31	30 30	31 31	31 31	31 31	31 31	29 29	31 31	31 31	31 31	26 26	31 31	13 13	698 697									
N	30 30	30 30	30 30	26 26	26 26	24 24	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	29 29	29 29	28 28	29 29	30 30	7 7	678 678								
D	31 31	31 31	31 31	31 30	25 25	27 24	26 26	31 31	31 31	31 31	31 31	31 31	31 31	27 27	31 31	29 29	31 31	31 31	24 24	26 26	31 31	26 26	705 702								
Ann	120 120	357 357	341 340	356 355	351 351	351 350	353 360	354 360	361 361	357 356	365 365	364 363	359 359	362 362	357 357	360 360	359 359	358 334	336 324	324 332	347 346	276 276	150 150	8310 8299							

OWS Study Area E (35.0°N, 48.0°W)

Frequency of Surface Observations

Each of the 11 variables was observed on X days of each month.
The upper number is the maximum X from among all the variables.
The lower number is the minimum X from among all the variables.

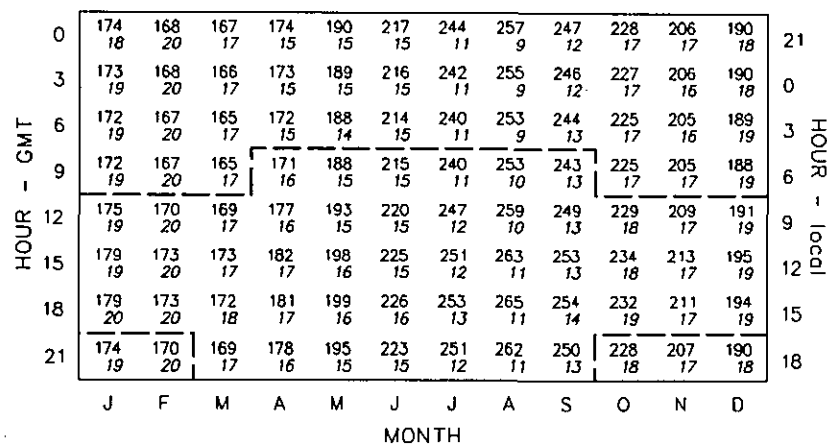


OWS Study Area E Surface Climatology

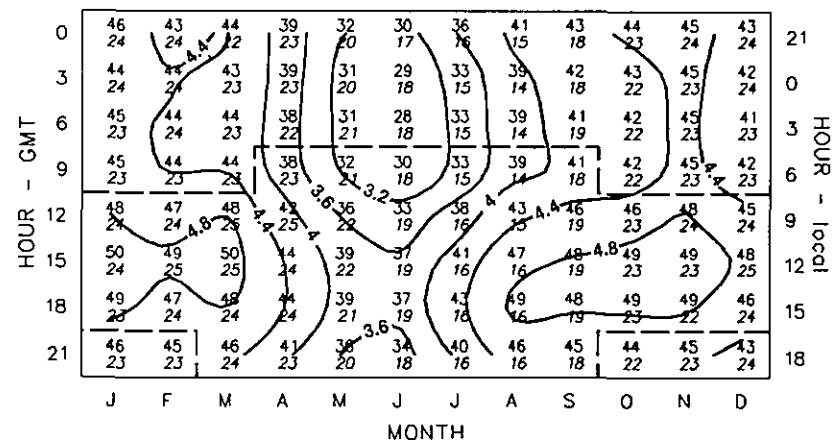
upper number = mean
lower number = standard deviation

— data contours
--- sunrise/sunset

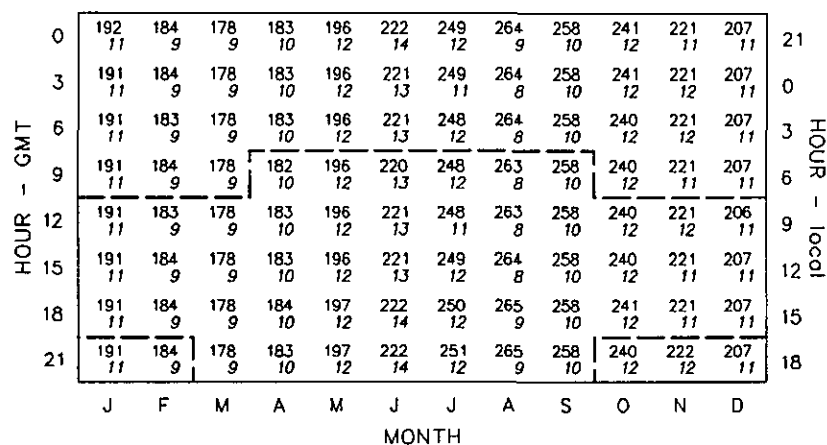
Air Temperature
Units = 0.1 °C



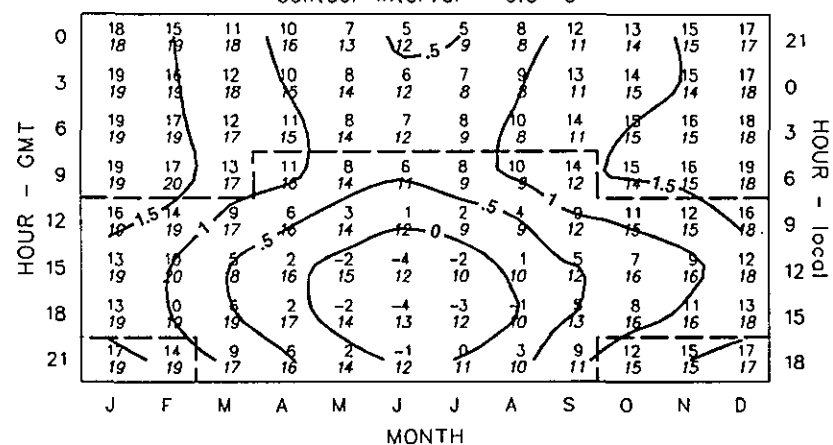
Dew Point Depression
Units = 0.1 °C
Contour interval = 0.4 °C



Sea Surface Temperature
Units = 0.1 °C



Sea - Air Temperature Difference
Units = 0.1 °C
Contour interval = 0.5 °C



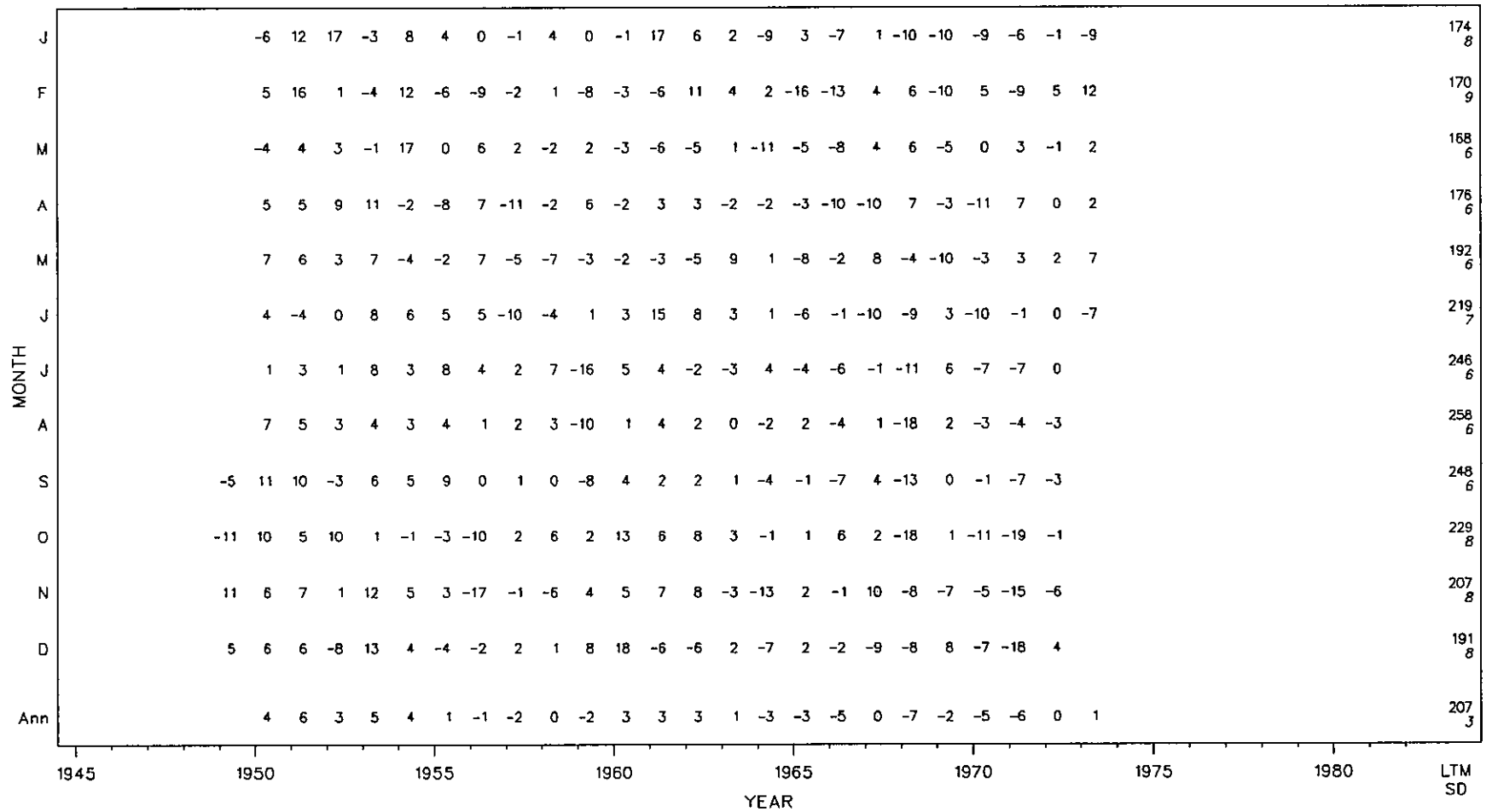
OWS Study Area E Surface Climatology

upper number = mean
lower number = standard deviation

———— data contours
----- sunrise/sunset

Surface Air Temperature

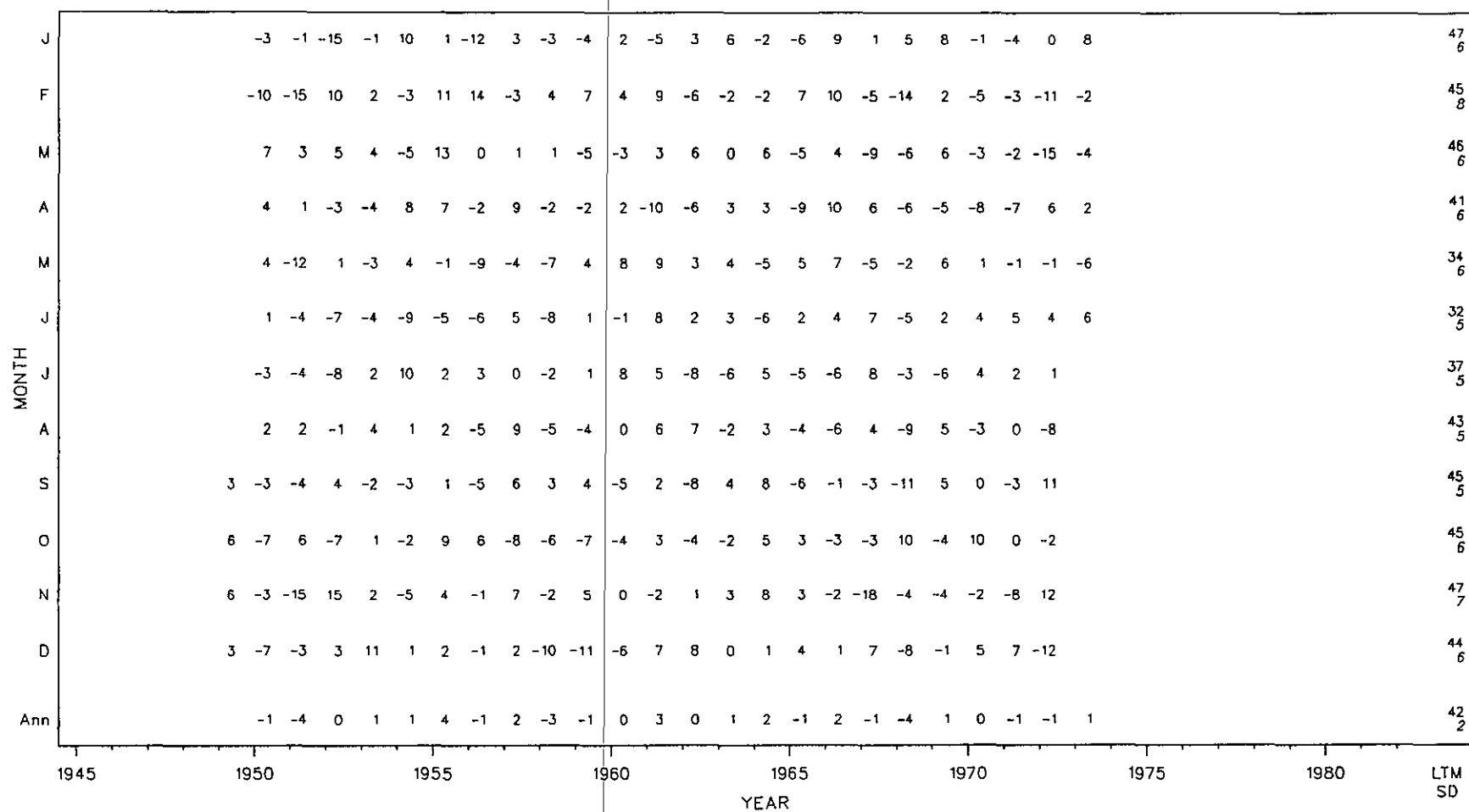
Units = 0.1 °C



OWS Study Area E Anomalies

Surface Dew Point Depression

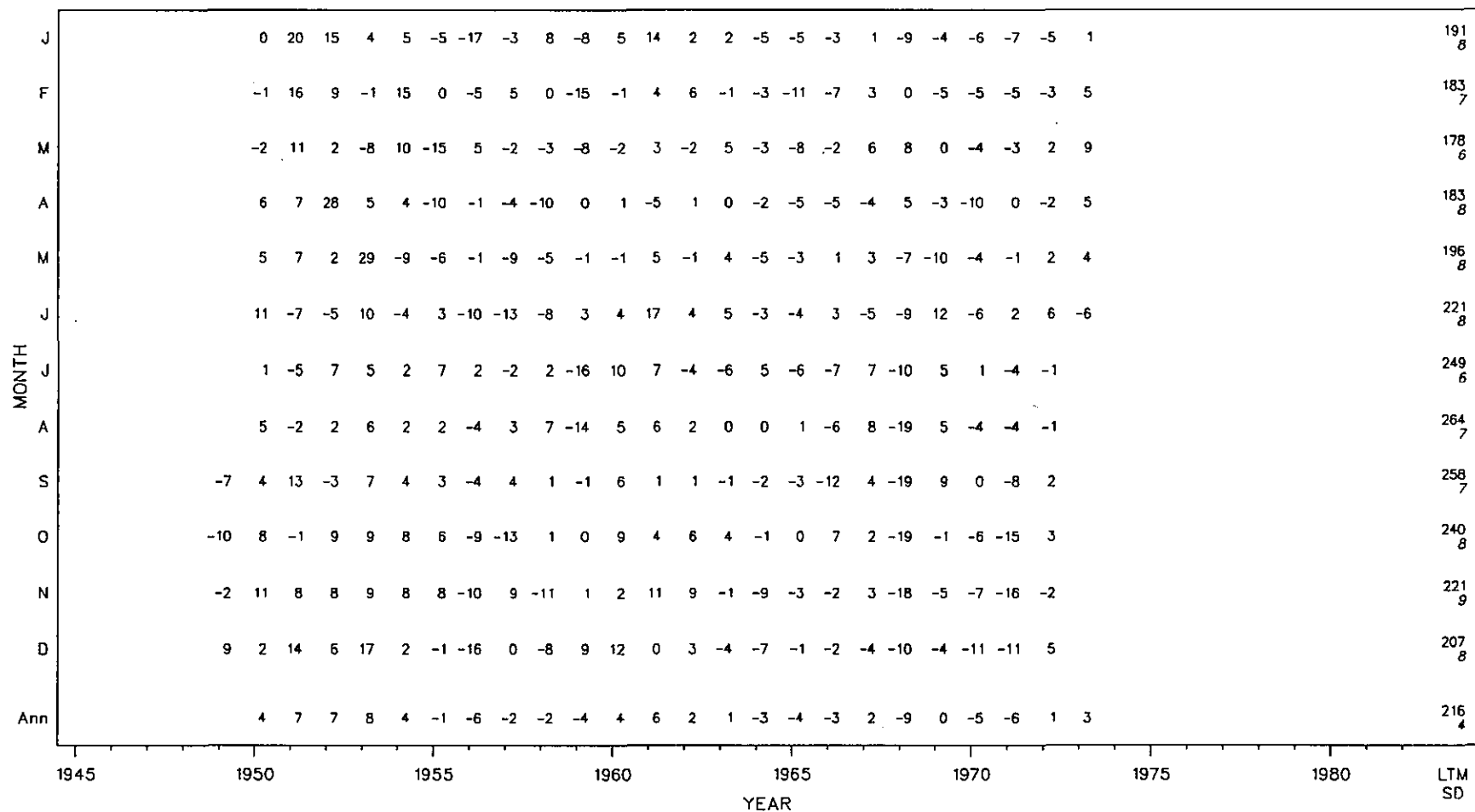
Units = 0.1 °C



OWS Study Area E Anomalies

Sea Surface Temperature

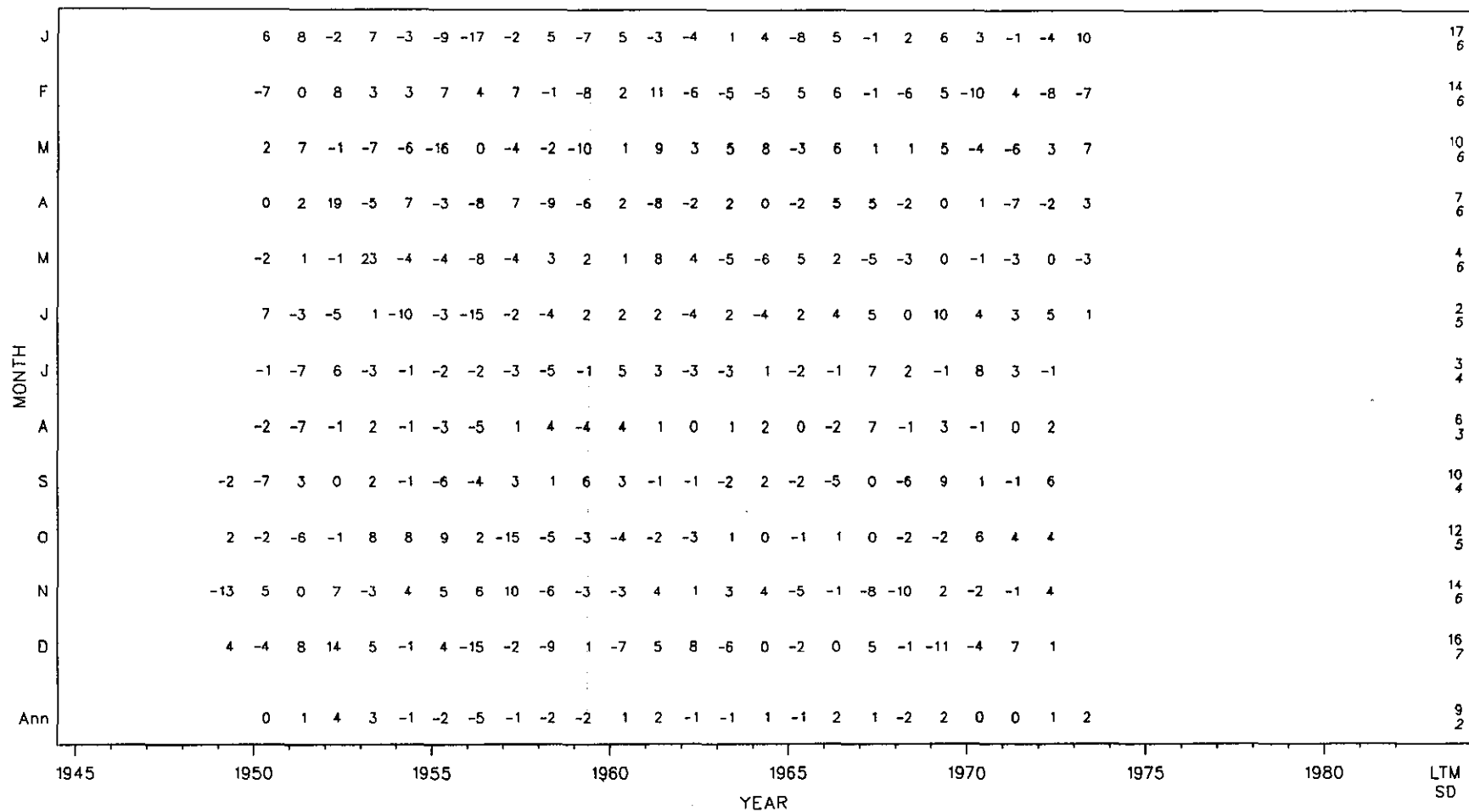
Units = 0.1 °C



OWS Study Area E Anomalies

Sea - Air Temperature Difference

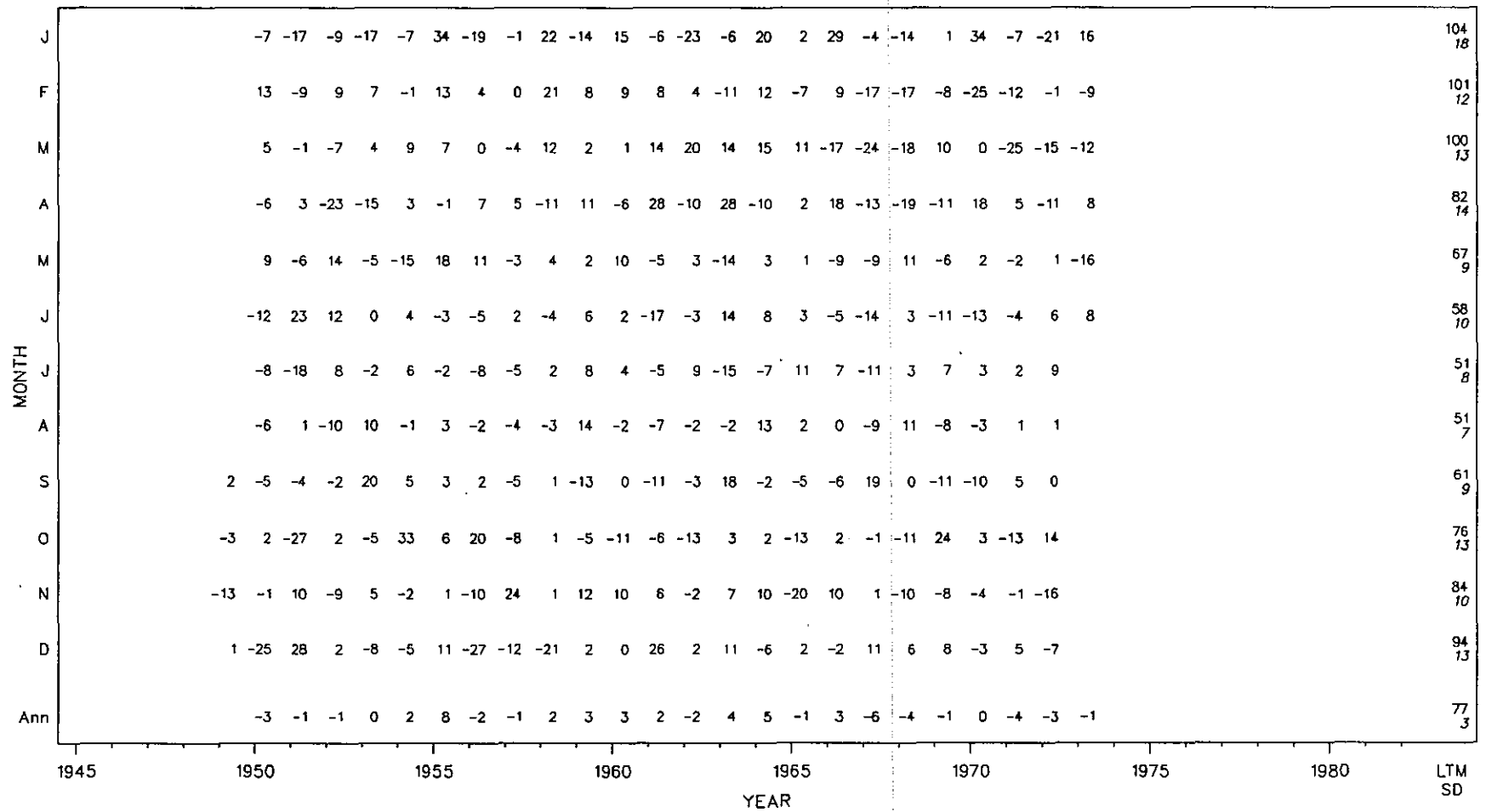
Units = 0.1 °C



OWS Study Area E Anomalies

Surface Scalar Wind

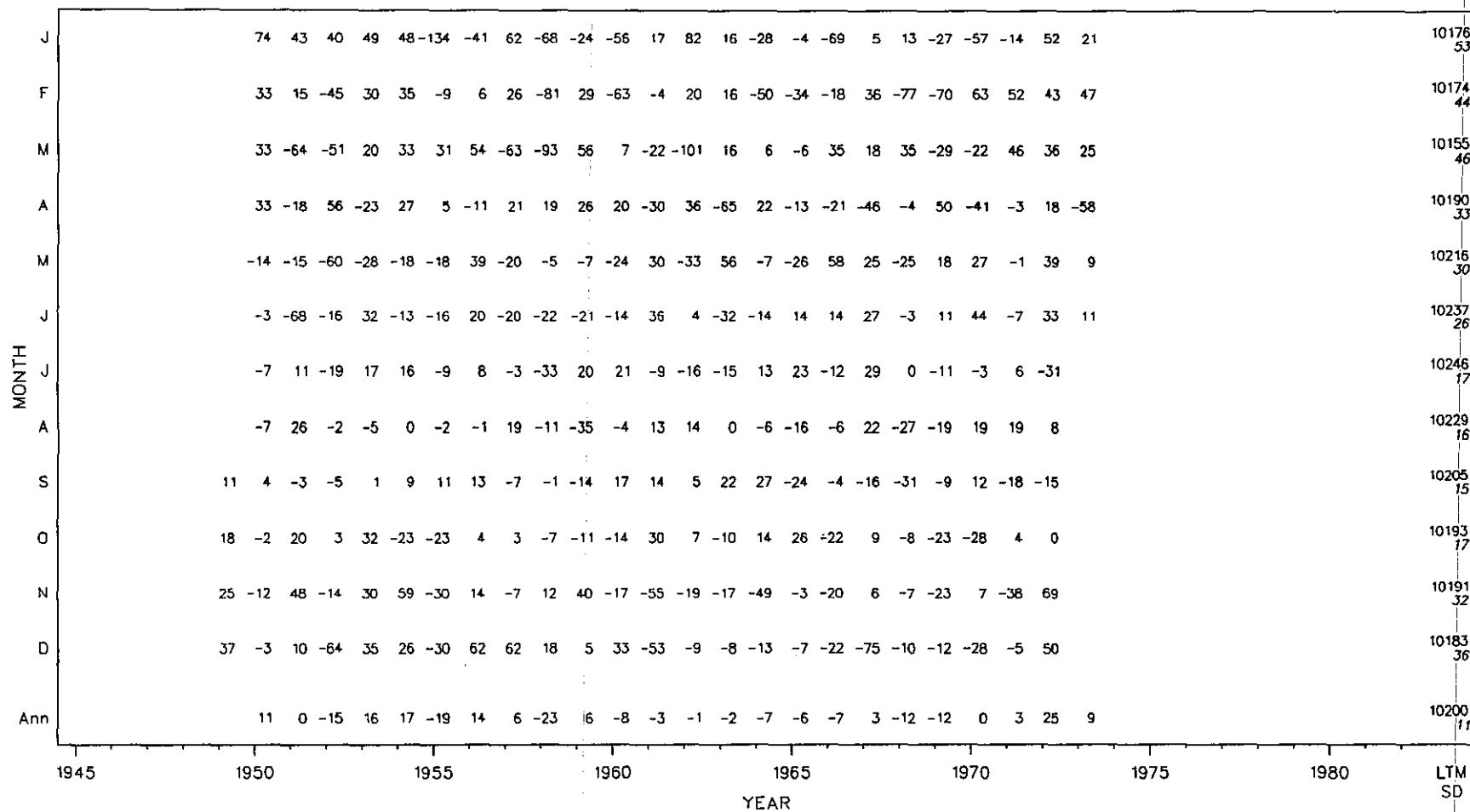
Units = 0.1 m/s



OWS Study Area E Anomalies

Sea Level Pressure

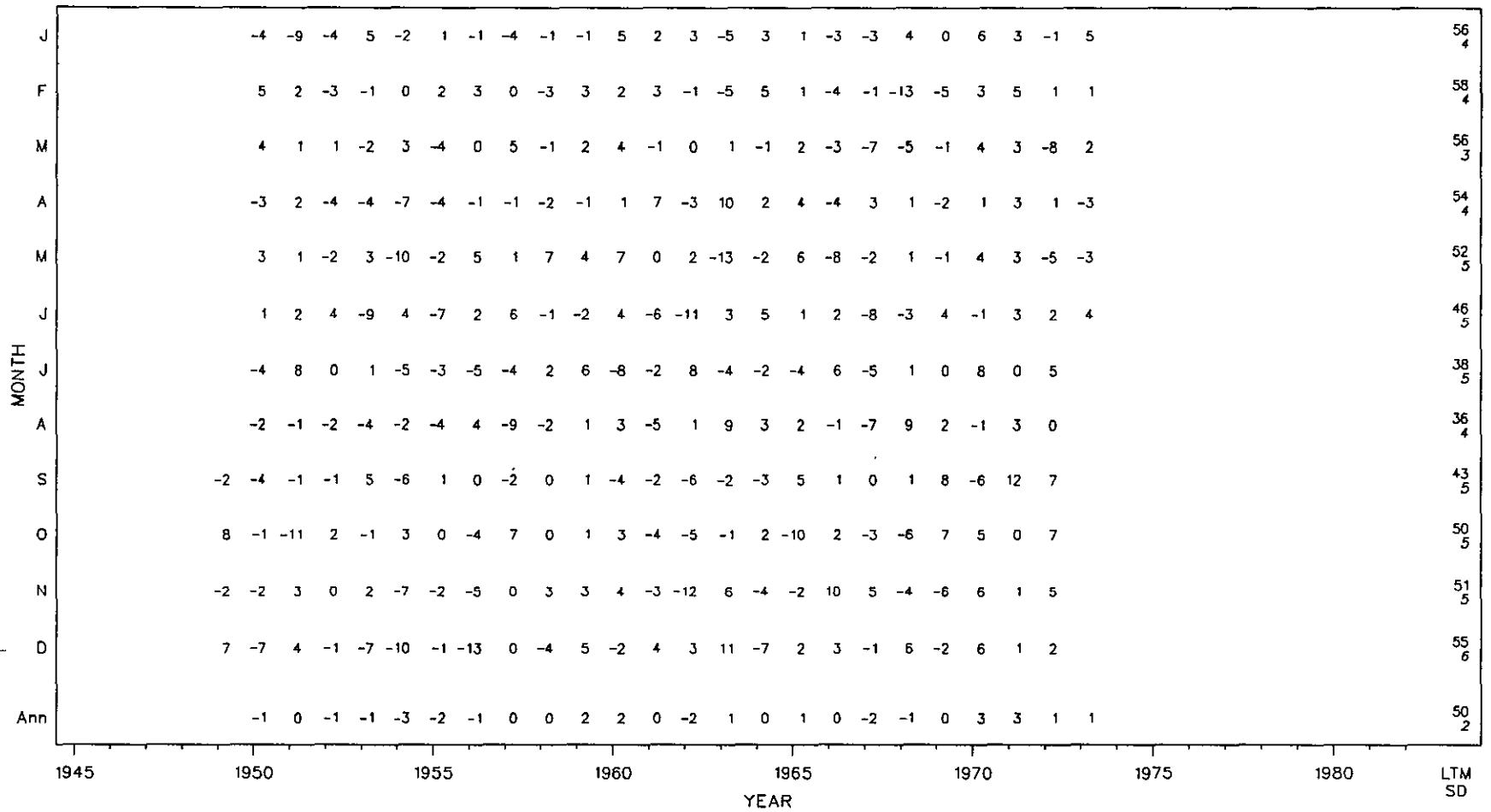
Units = 0.1 mb



OWS Study Area E Anomalies

Total Cloudiness

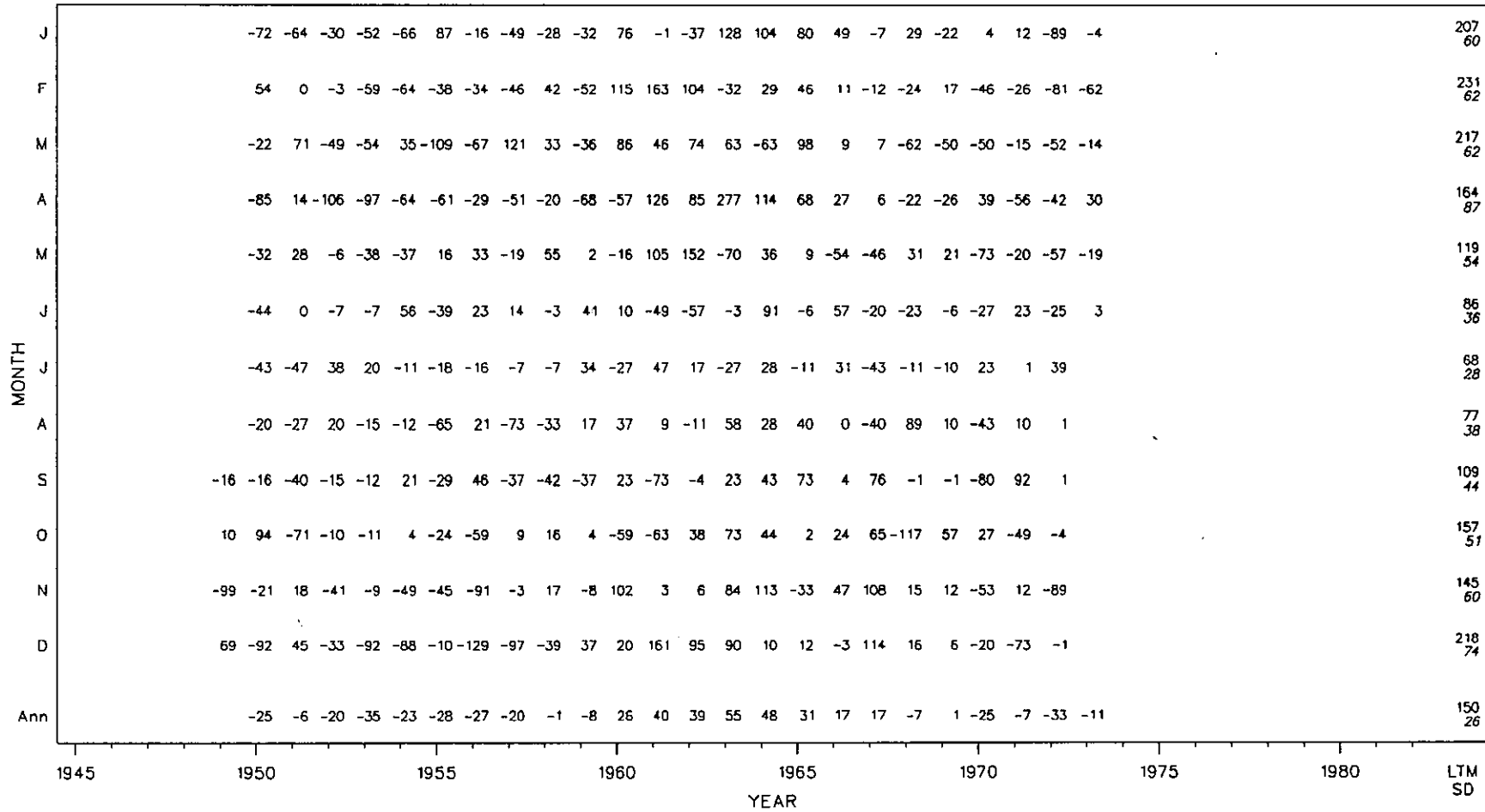
Units = 0.1 okta



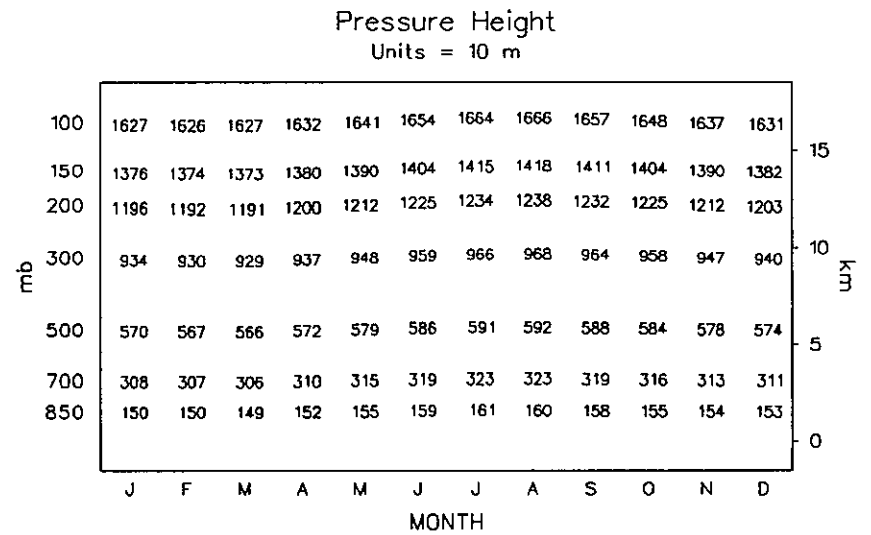
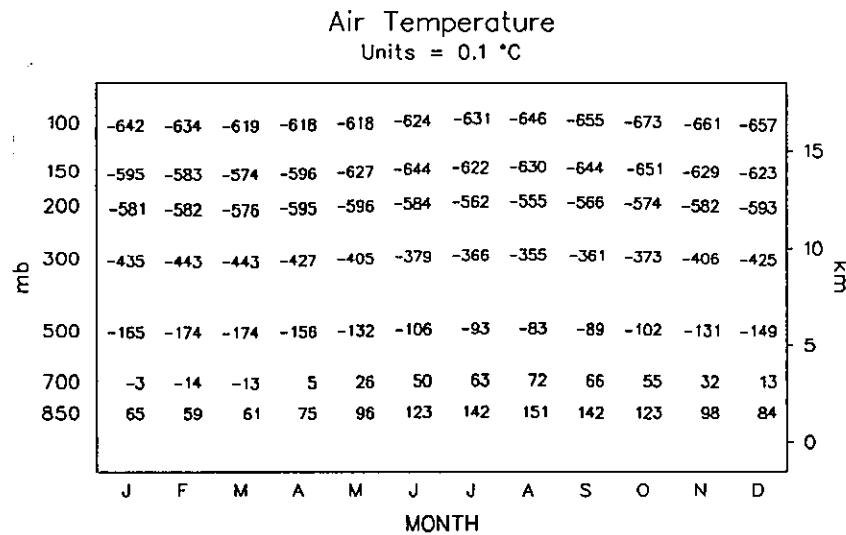
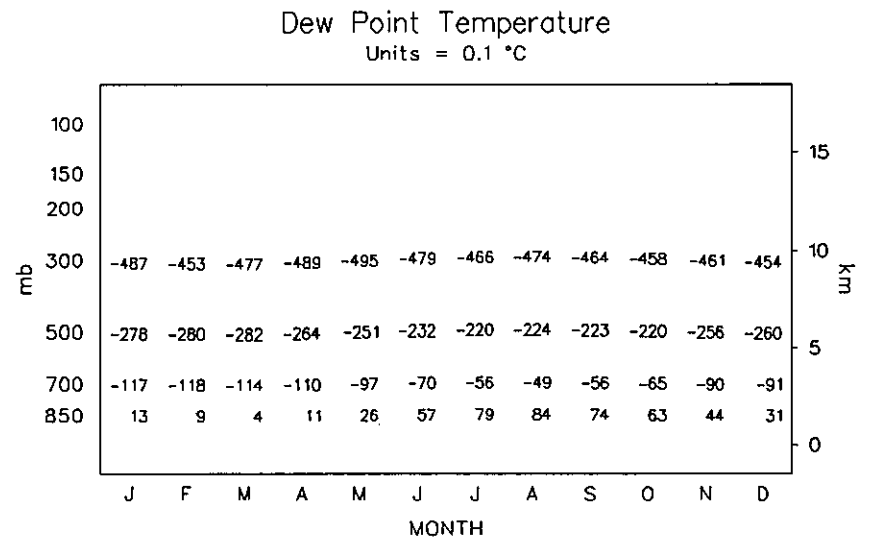
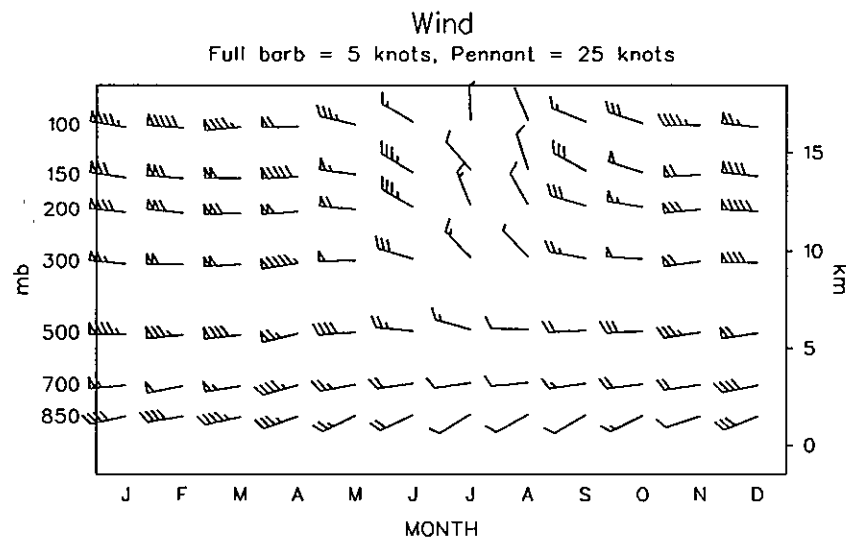
OWS Study Area E Anomalies

Precipitation Frequency

Units = 0.1 percent



OWS Study Area E Anomalies

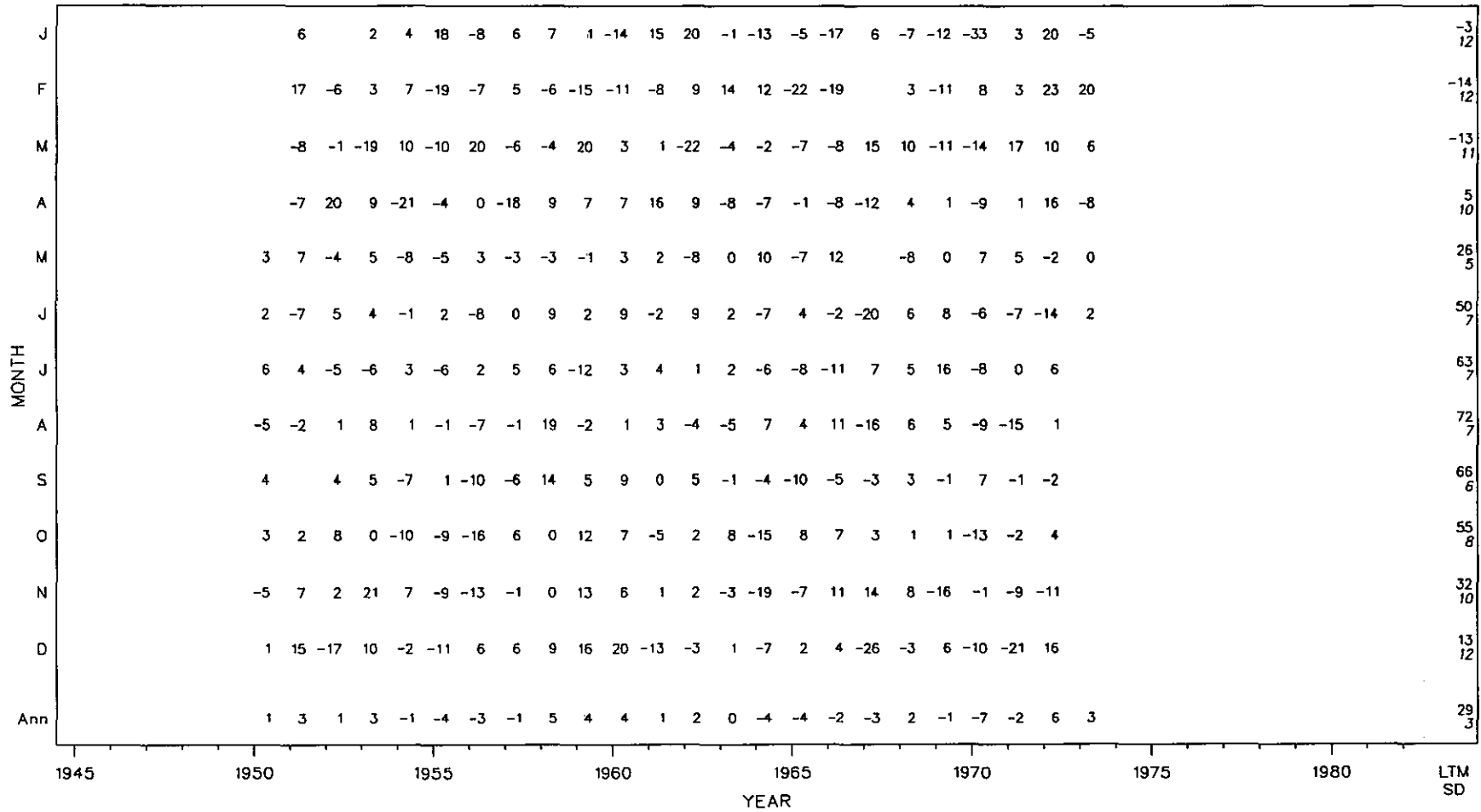


OWS Study Area E Upper Air Climatology

Mean plotted at actual height

Air Temperature: 700 mb

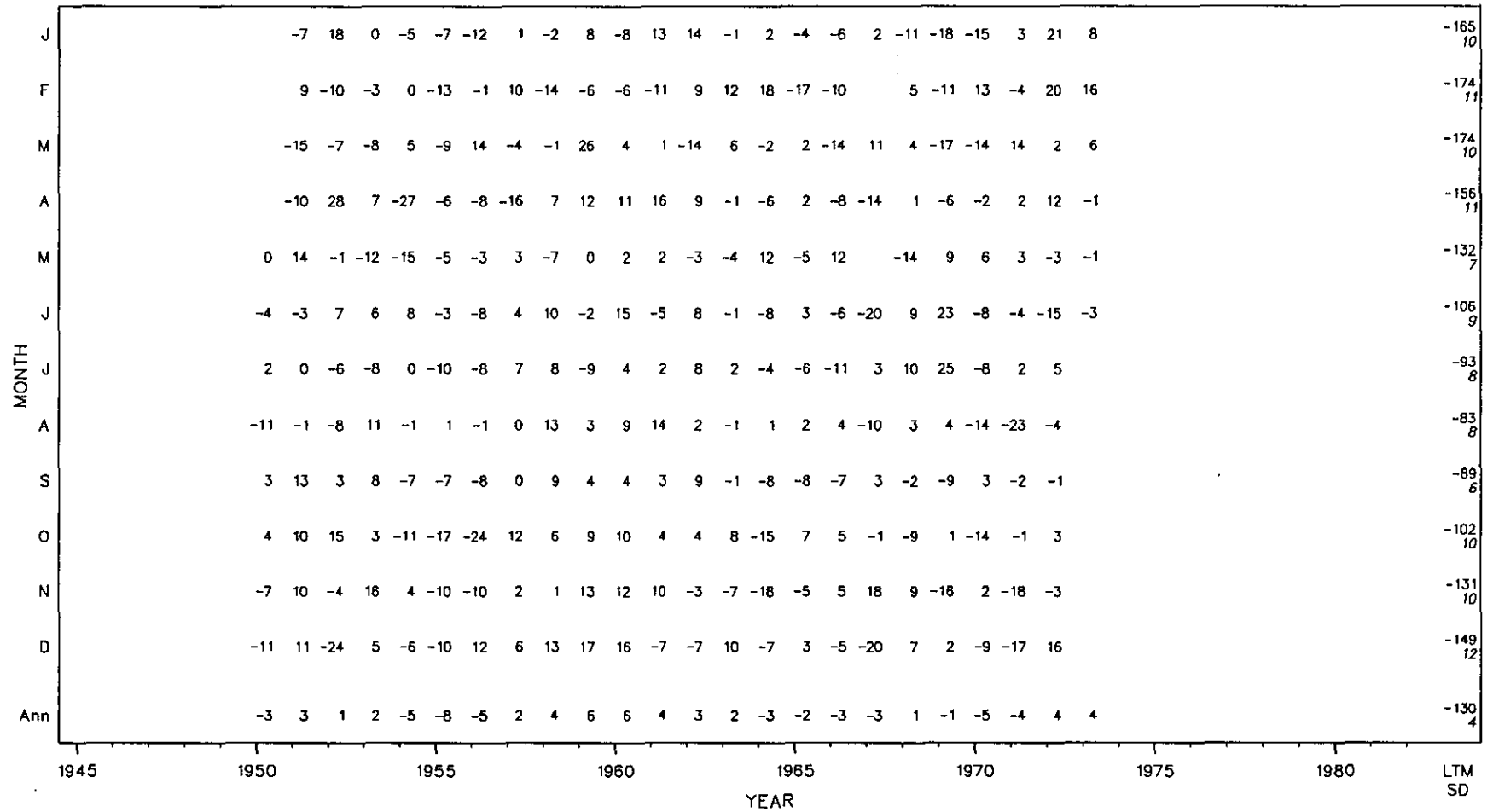
Units = 0.1 °C



OWS Study Area E Anomalies

Air Temperature: 500 mb

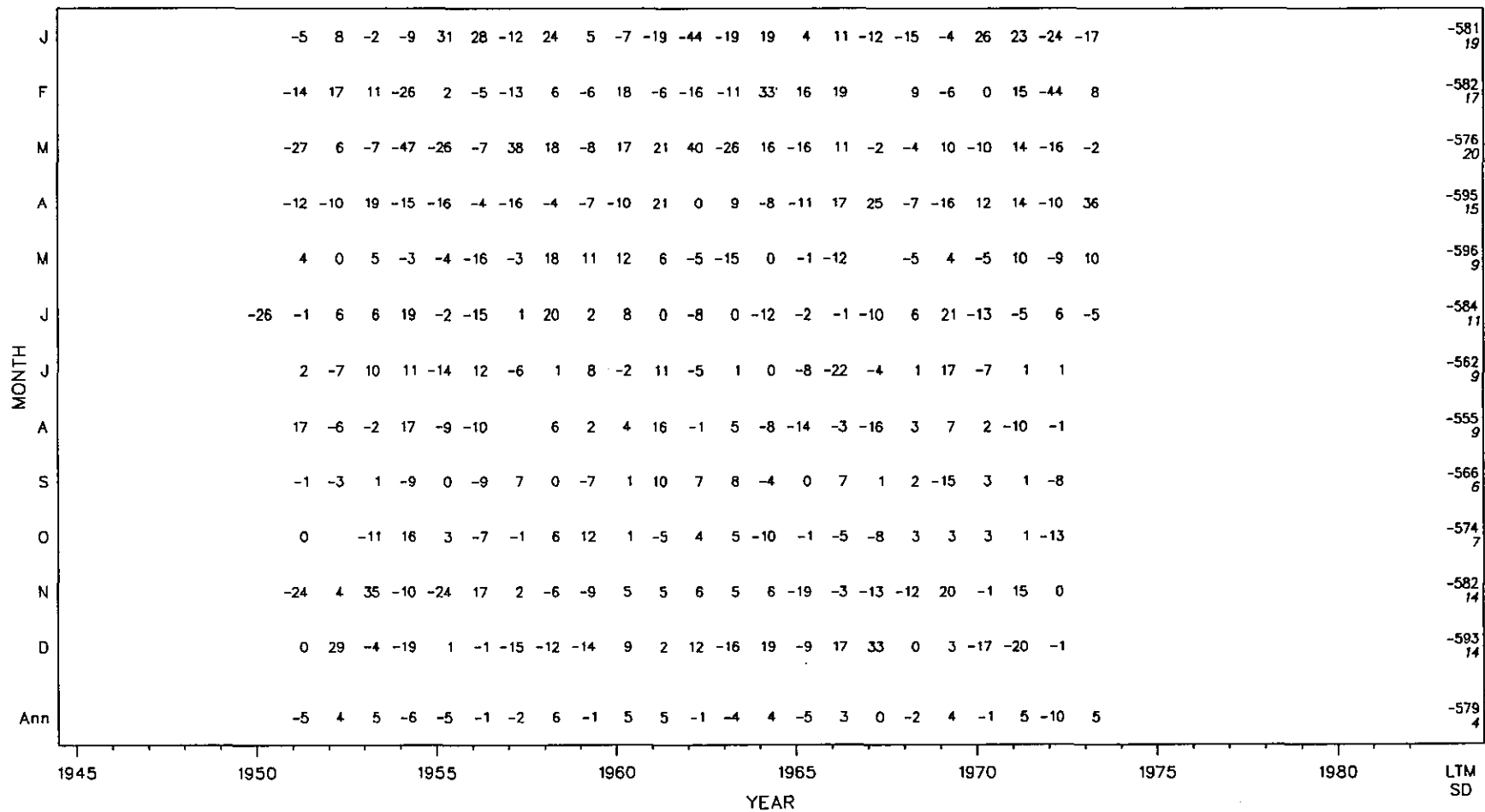
Units = 0.1 °C



OWS Study Area E Anomalies

Air Temperature: 200 mb

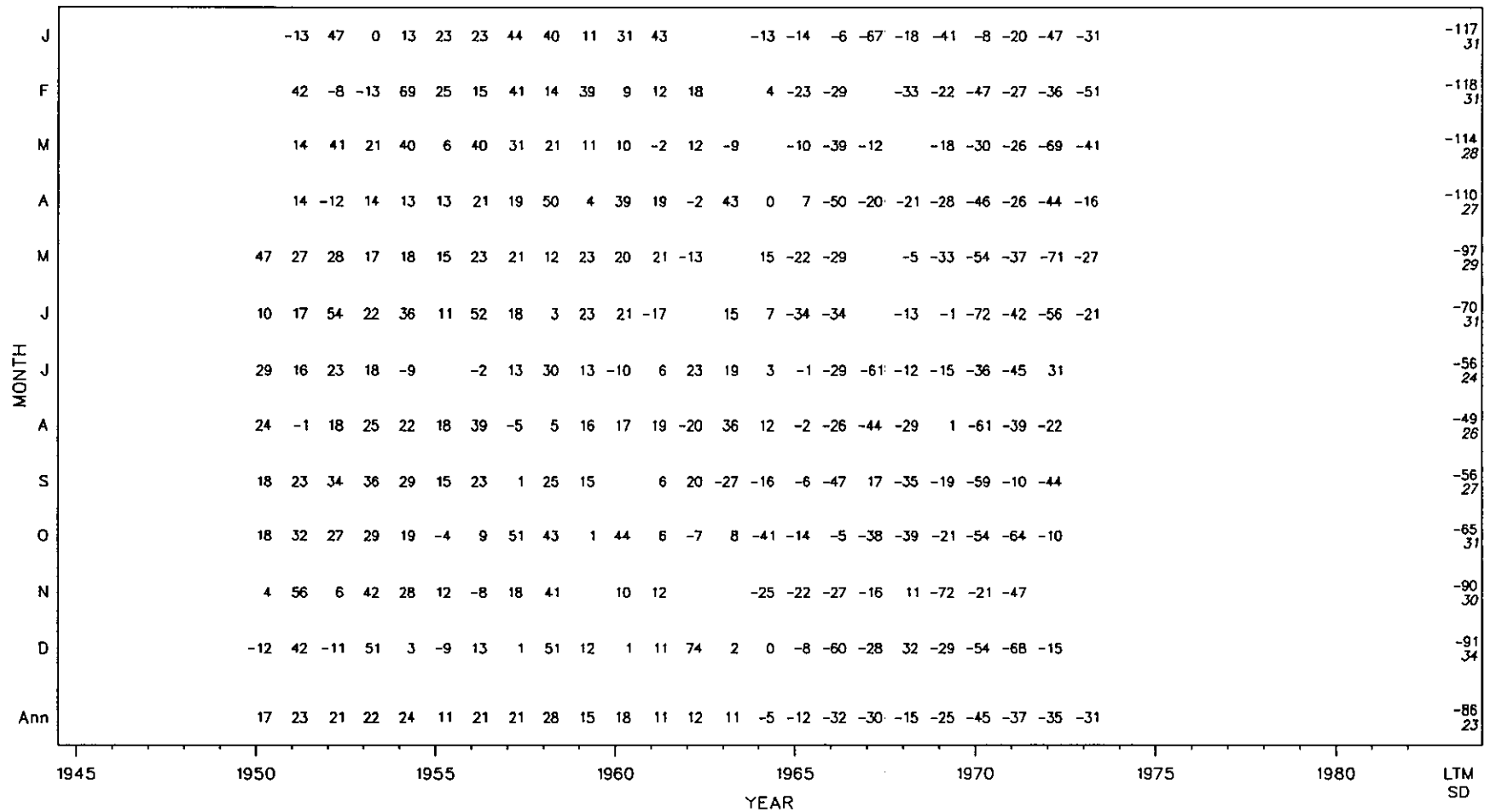
Units = 0.1 °C



OWS Study Area E Anomalies

Dew Point Temperature: 700 mb

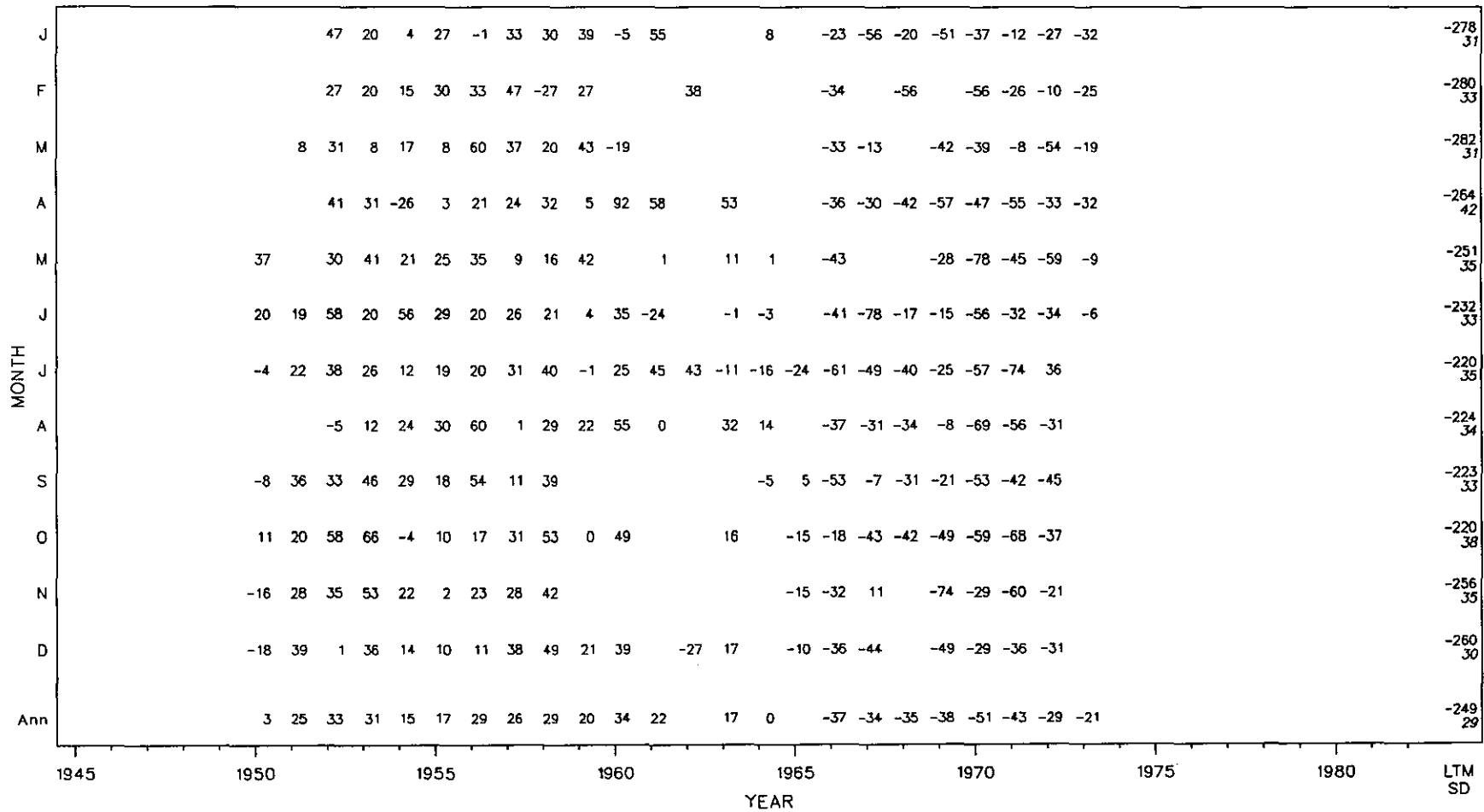
Units = 0.1 °C



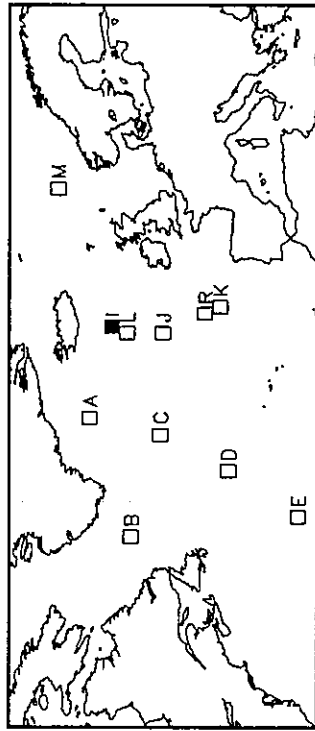
OWS Study Area E Anomalies

Dew Point Temperature: 500 mb

Units = 0.1 °C



OWS Study Area E Anomalies



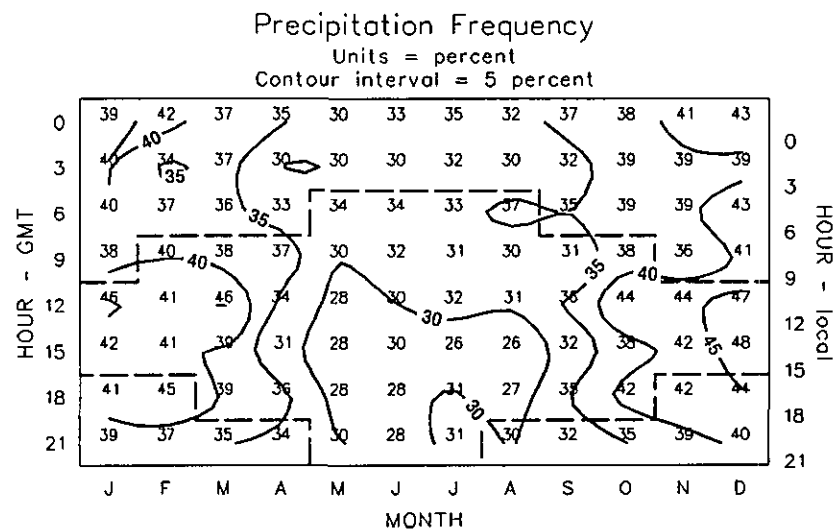
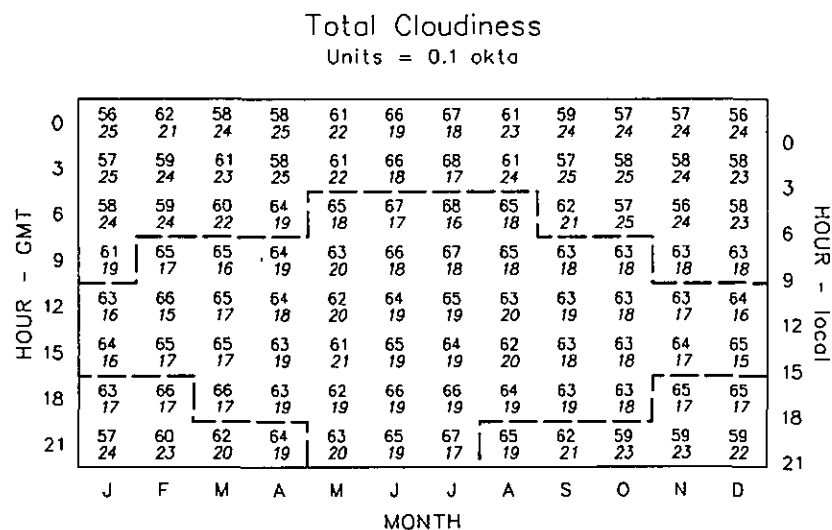
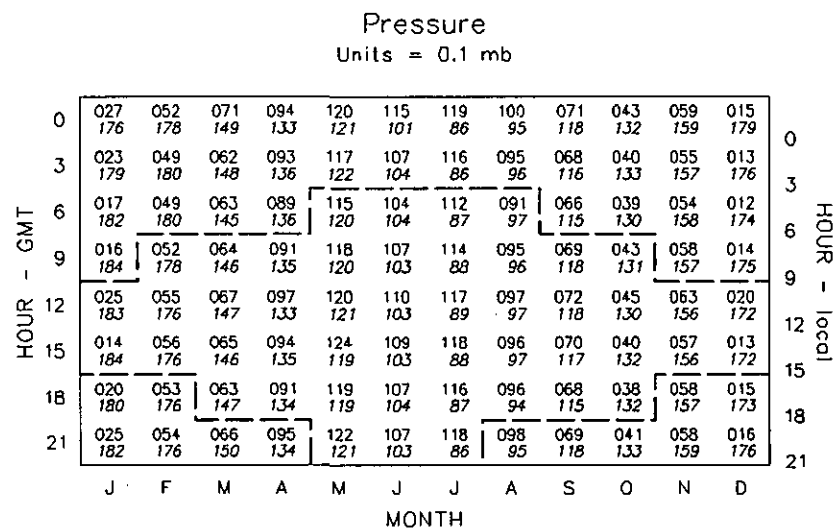
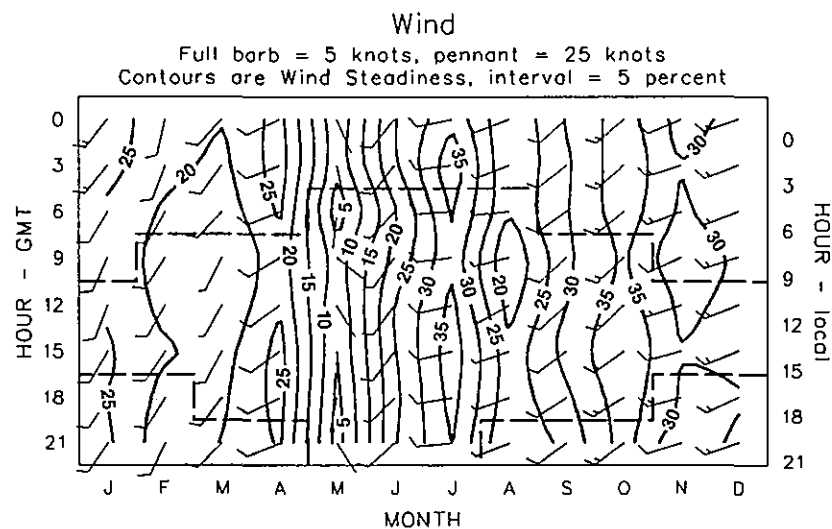
58.0°N – 59.9°N, 19.9°W – 18.0°W
1950 – 1975

OWS

MONTH																												
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J	20 20	15 15	1 1	31 31	29 29	26 26	31 31	22 22	31 31	31 31	30 30	28 28	31 31	9 9	30 30	31 31	31 31	30 30	31 31	29 29	28 28	16 16	654 654					
F	16 16	26 26	17 17	9 9	28 28	17 9	21 21	27 27	16 16	29 29	27 27	28 28	28 28	29 28	28 26	24 24	29 29	27 27	28 28	27 29	27 27	23 23	28 28	614 606				
M	18 18	28 28	29 29		30 30	29 23	31 31	31 31	22 22	30 30	31 31	31 31	31 31	31 31	29 29	31 31	31 31	31 31	30 30	31 31	30 30	30 30	707 701					
A	30 29	30 30	30 30	11 11	30 30	30 30	30 30	30 30	20 20	30 30	30 30	28 28	30 29	30 30	30 30	29 29	29 29	27 27	30 30	30 30	30 30	26 26	29 29	709 707				
M	31 31	28 28	12 12	17 17	30 30	29 29	31 31	31 31	25 25	31 31	31 31	31 31	30 30	31 31	31 31	31 31	30 30	30 30	28 28	30 31	31 31	26 26	31 31	718 718				
J	30 30	29 29	14 14	29 29	30 30	30 30	27 27	27 27	28 28	28 28	30 30	30 30	29 29	30 30	30 30	30 30	30 30	30 30	30 30	29 29	29 29	26 26	30 30	715 715				
J	21 21	27 27	31 31	22 22	21 21	31 31	29 29	31 31	31 31	31 31	31 31	27 28	28 31	31 31	31 31	28 28	31 31	28 31	31 31	29 30	29 29	30 30		724 723				
A	31 31	7 7	31 31	5 4	30 30	28 28	31 31	24 24	25 25	31 31	31 31	31 31	31 31	29 29	31 31	31 31	29 29	26 26	31 31	31 31	30 30	21 21	688 686					
S	20 20	11 11	28 28		30 30	29 29	30 30	30 30	27 27	30 30	25 25	28 28	30 30	29 29	30 30	28 28	30 30	30 30	28 28	30 30	25 25	29 29	667 667					
O	4 4	26 26	19 19		31 31	30 30	31 31	31 31	31 31	30 30	31 31	31 31	31 31	31 31	31 31	31 31	30 30	31 31	31 31	31 31	31 31	22 22	688 688					
N	12 12	1 1	30 30		28 28	30 30	27 27	27 27	28 28	29 29	30 30	28 28	29 29	30 30	30 30	30 30	30 30	20 20	30 30	30 30	28 26	29 29	27 27	642 640				
D		11 11	11 11		27 27	27 27	23 23	28 28	30 30	27 27	31 31	28 28	31 31	30 30	31 31	31 31	31 31	30 30	27 27	31 31	31 31	28 27	606 605					
Ann	233 232	239 239	253 253	124 123	167 167	352 352	332 318	342 342	340 340	321 321	357 357	356 356	355 355	360 359	362 362	341 341	362 362	353 353	363 362	340 340	356 356	361 361	362 359	349 348	288 288	164 164	8132 8110	

OWS Study Area I (59.0°N, 19.0°W) Frequency of Surface Observations

Each of the 11 variables was observed on X days of each month.
The upper number is the maximum X from among all the variables.
The lower number is the minimum X from among all the variables.



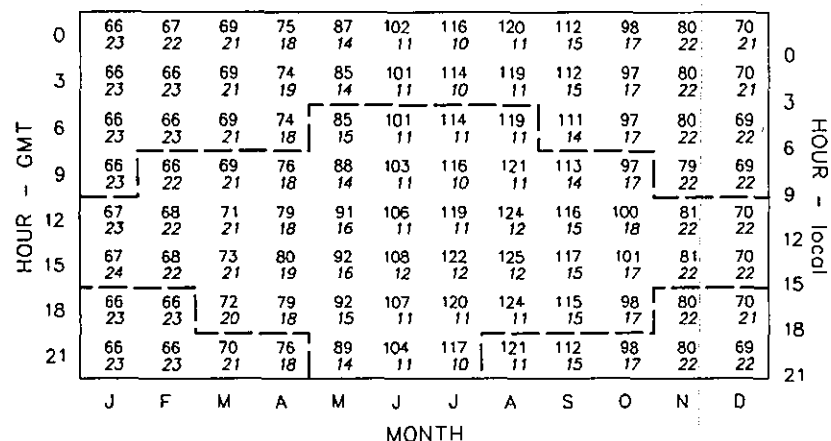
OWS Study Area I Surface Climatology

upper number = mean
lower number = standard deviation

———— data contours
----- sunrise/sunset

Air Temperature

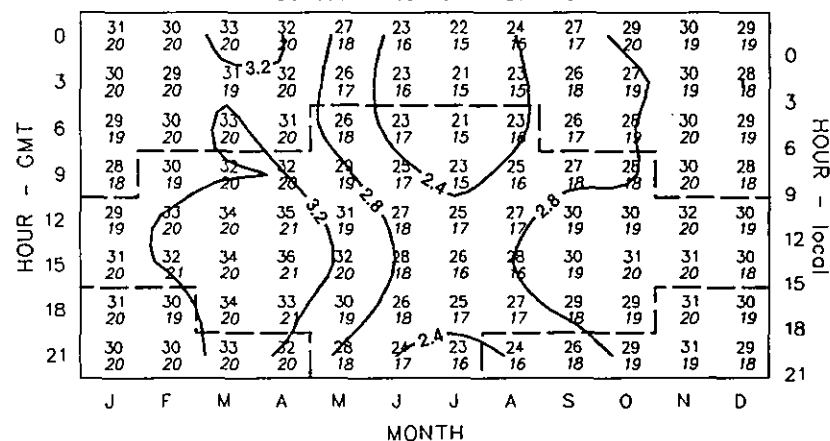
Units = 0.1 °C



Dew Point Depression

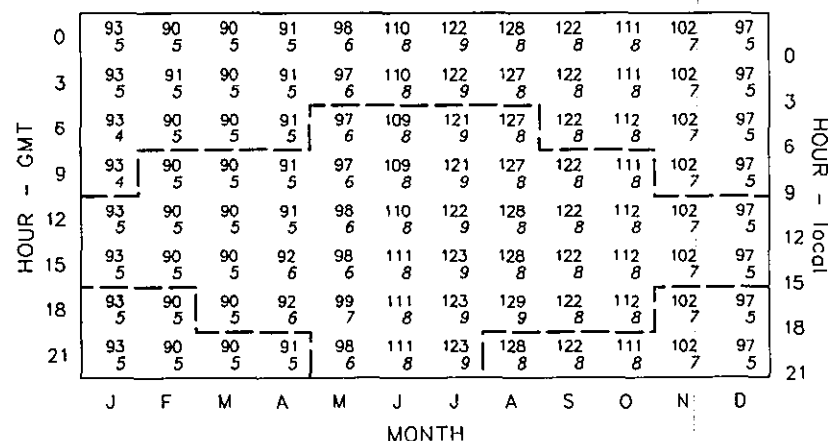
Units = 0.1 °C

Contour interval = 0.4 °C



Sea Surface Temperature

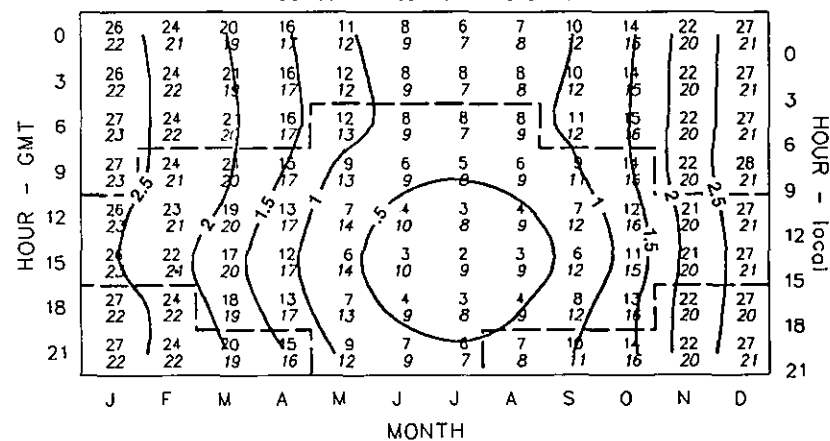
Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C

Contour interval = 0.5 °C



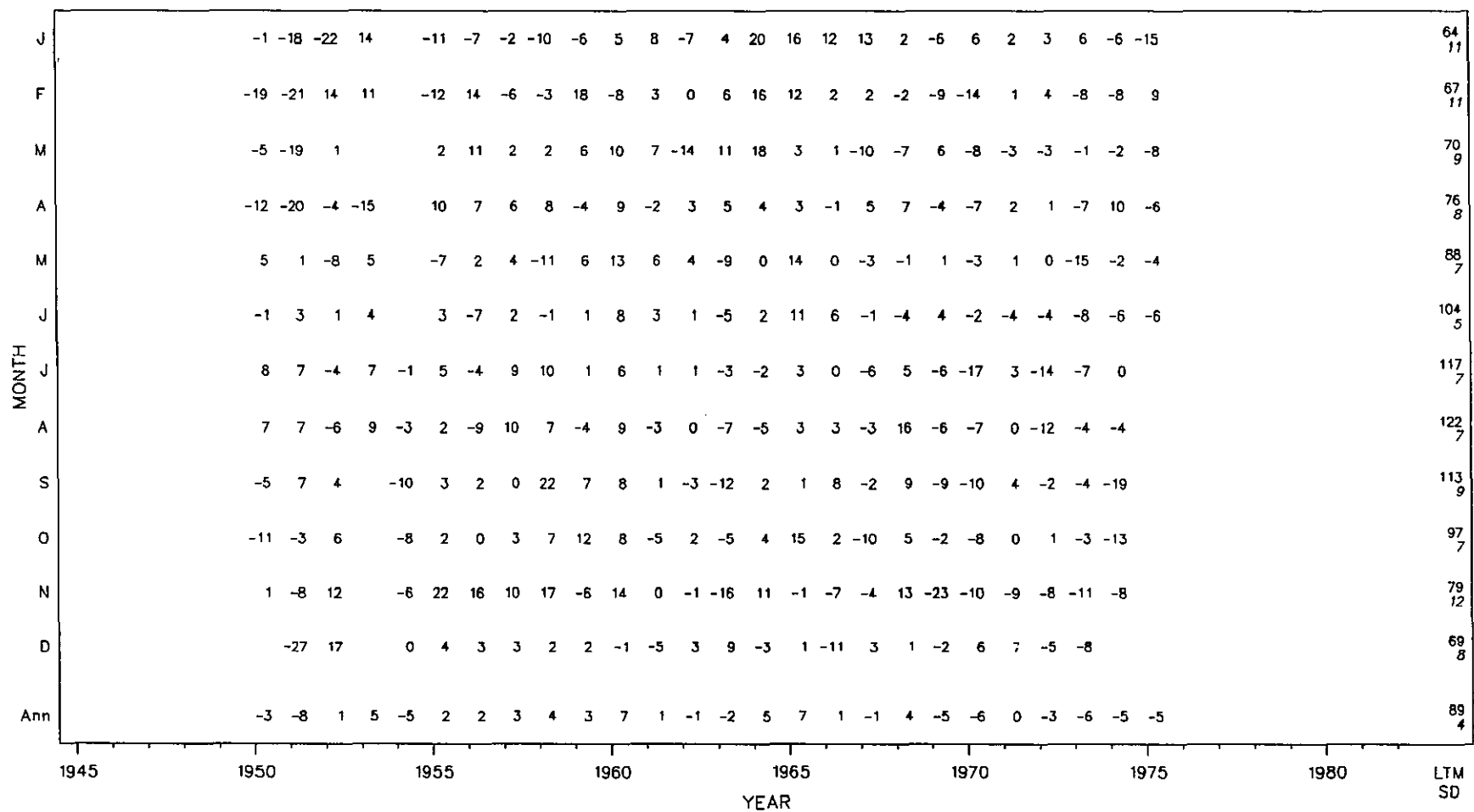
OWS Study Area I Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
--- sunrise/sunset

Surface Air Temperature

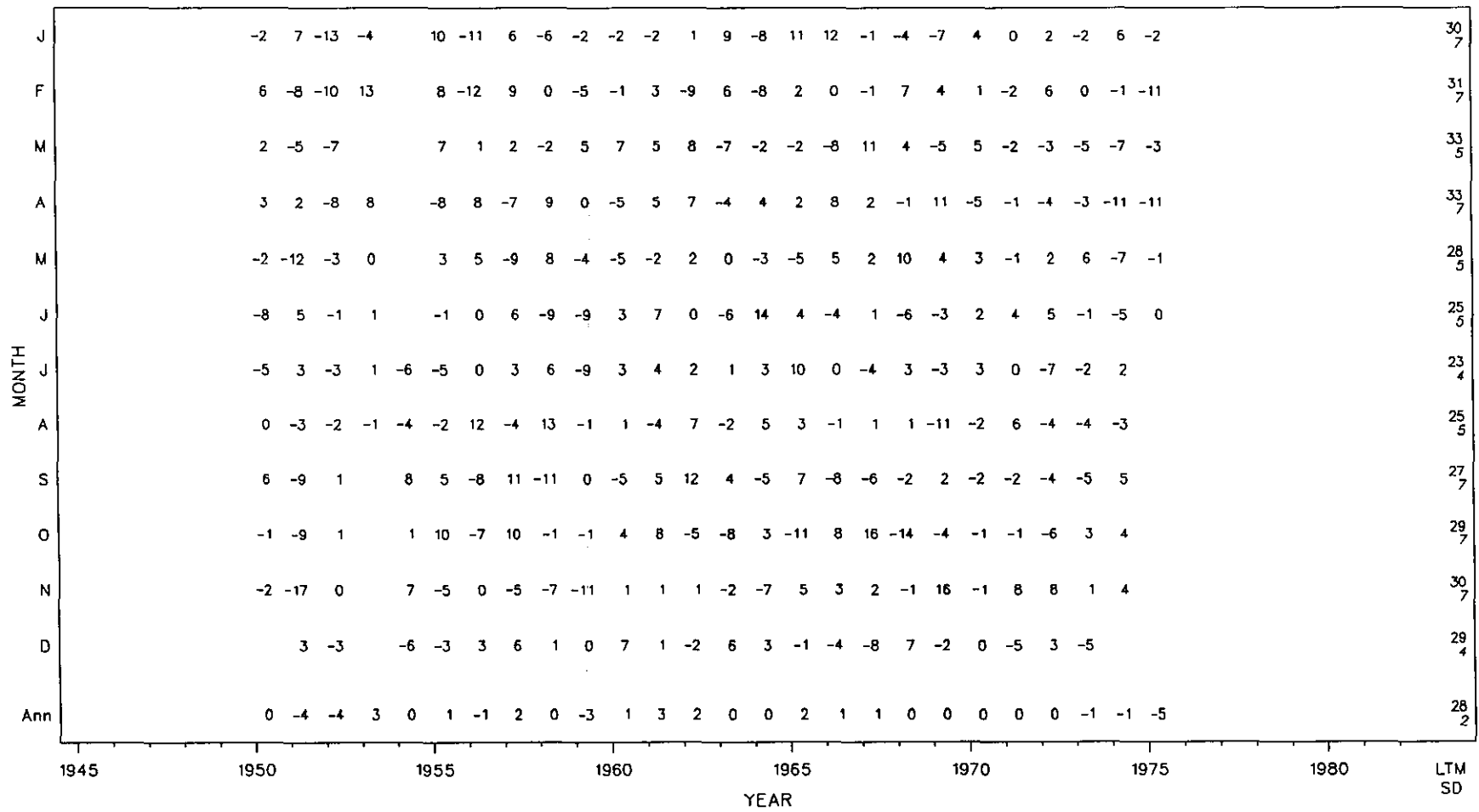
Units = 0.1 °C



OWS Study Area I Anomalies

Surface Dew Point Depression

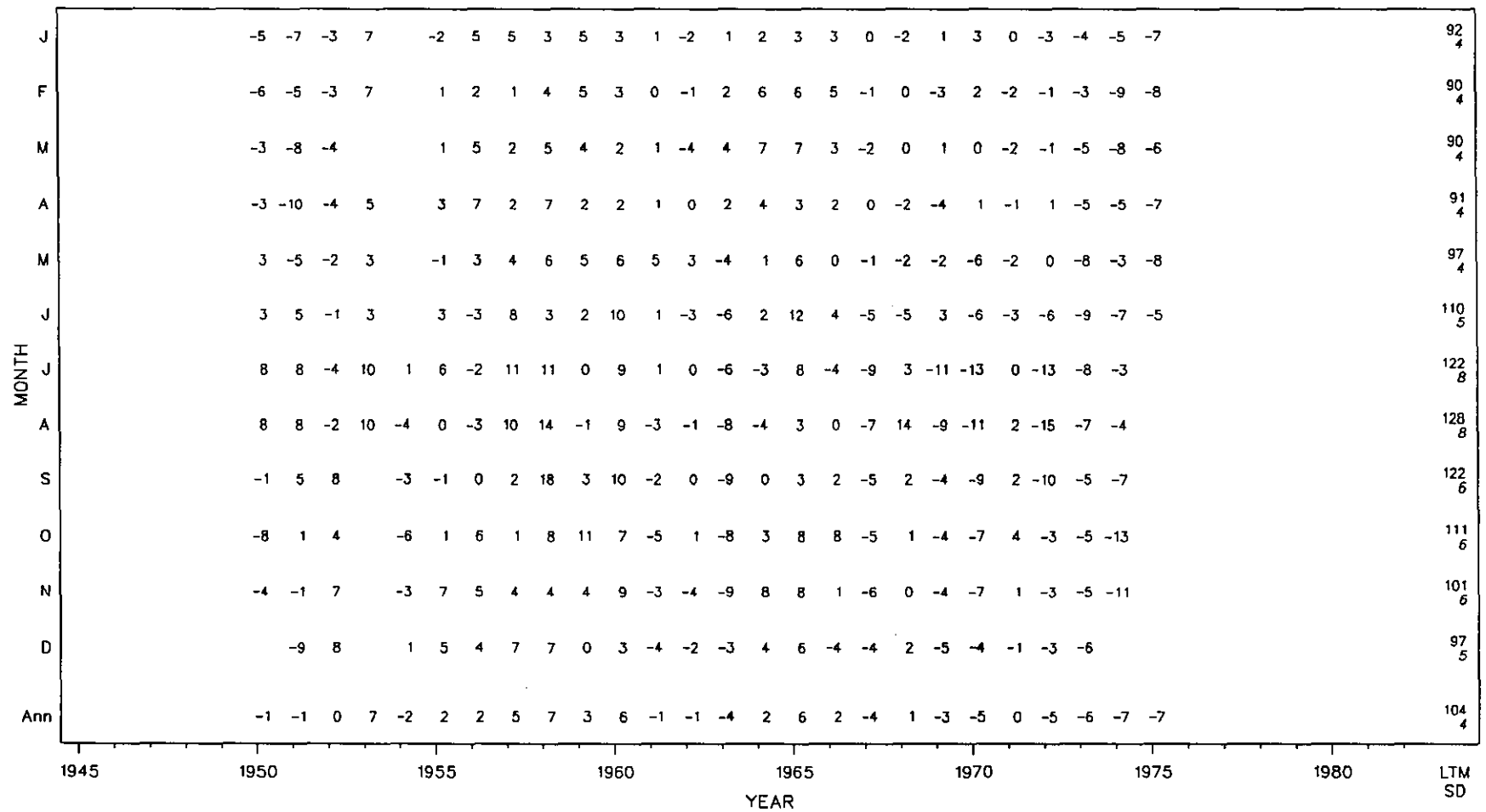
Units = 0.1 °C



OWS Study Area I Anomalies

Sea Surface Temperature

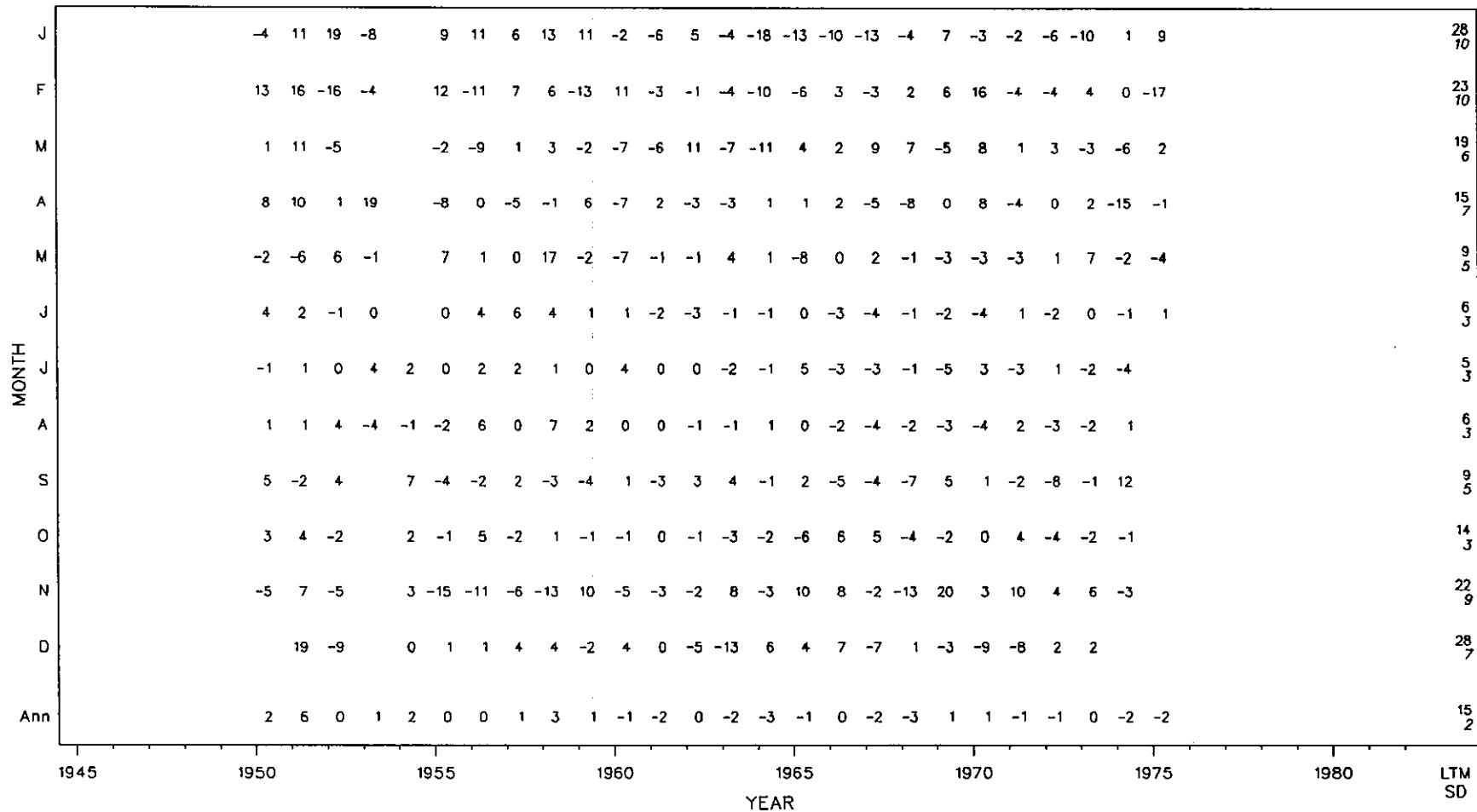
Units = 0.1 °C



OWS Study Area I Anomalies

Sea - Air Temperature Difference

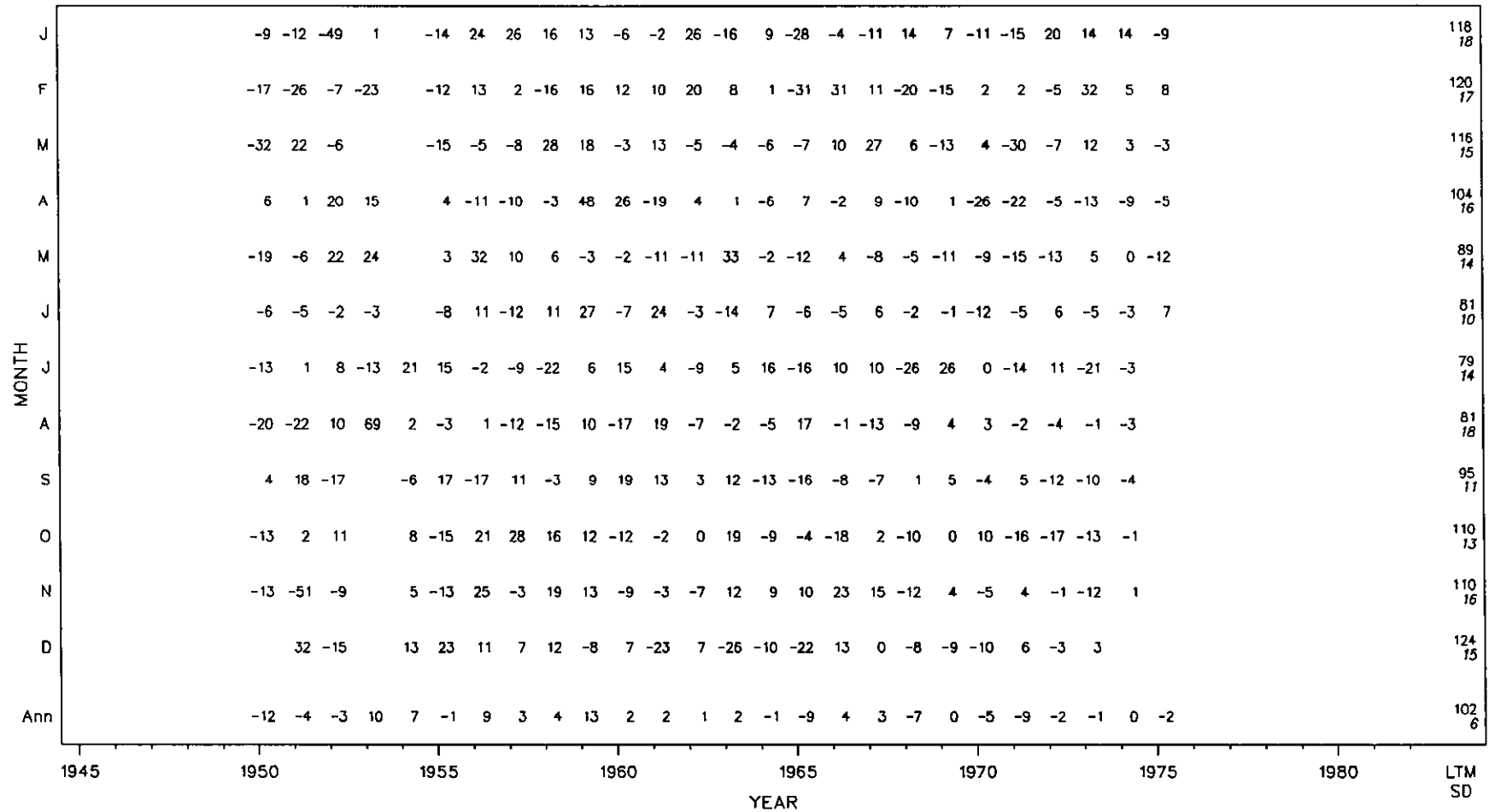
Units = 0.1 °C



OWS Study Area 1 Anomalies

Surface Scalar Wind

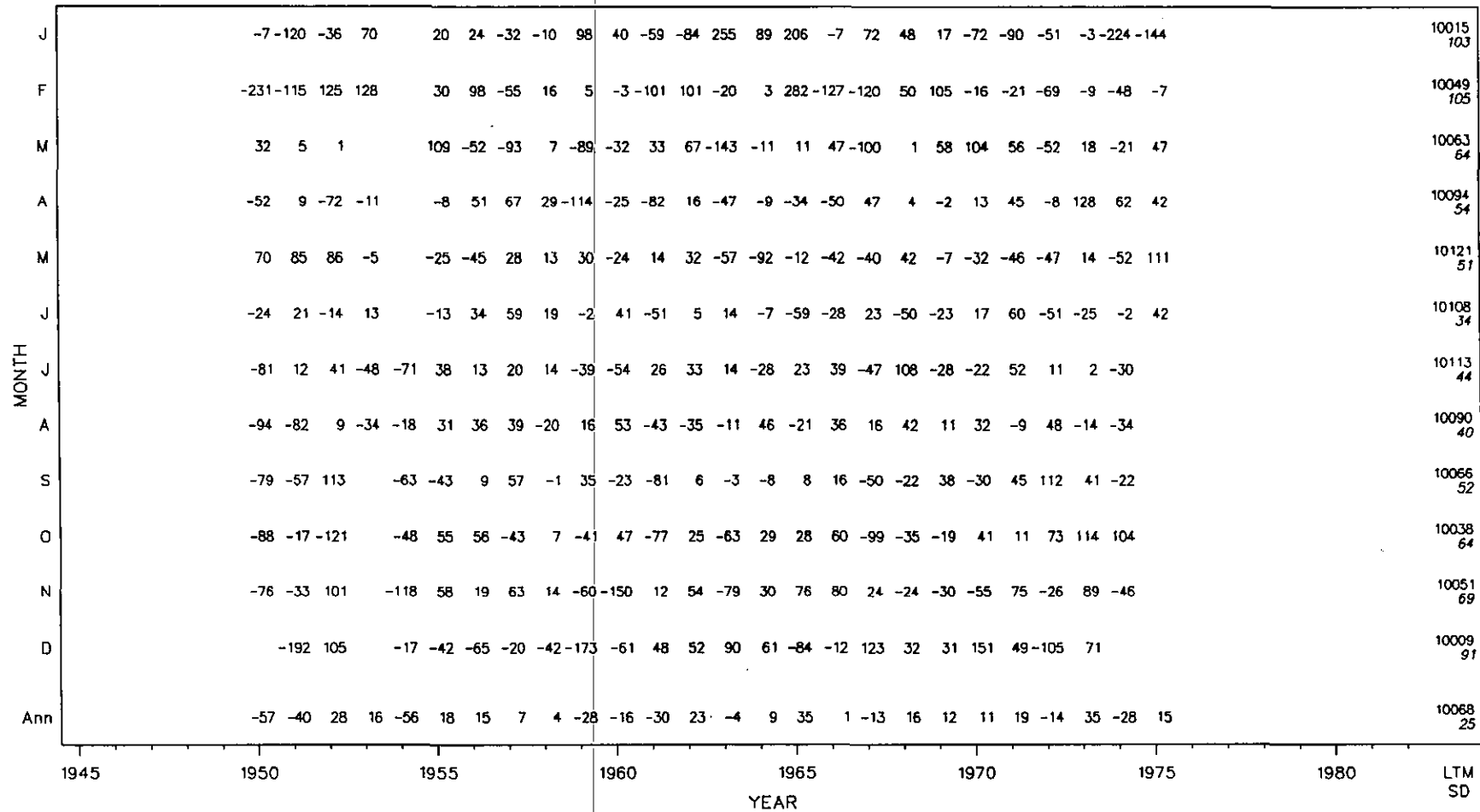
Units = 0.1 m/s



OWS Study Area I Anomalies

Sea Level Pressure

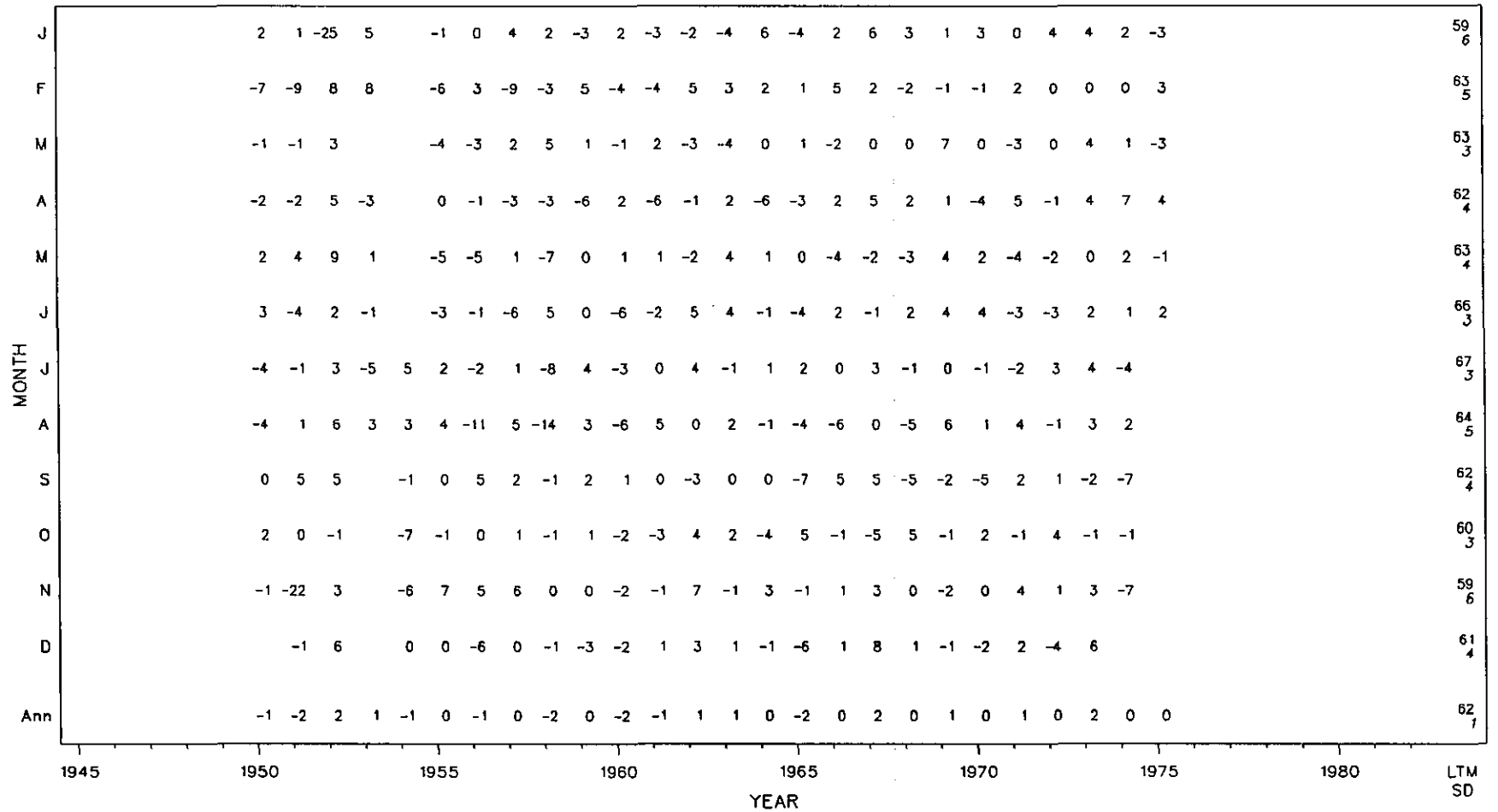
Units = 0.1 mb



OWS Study Area I Anomalies

Total Cloudiness

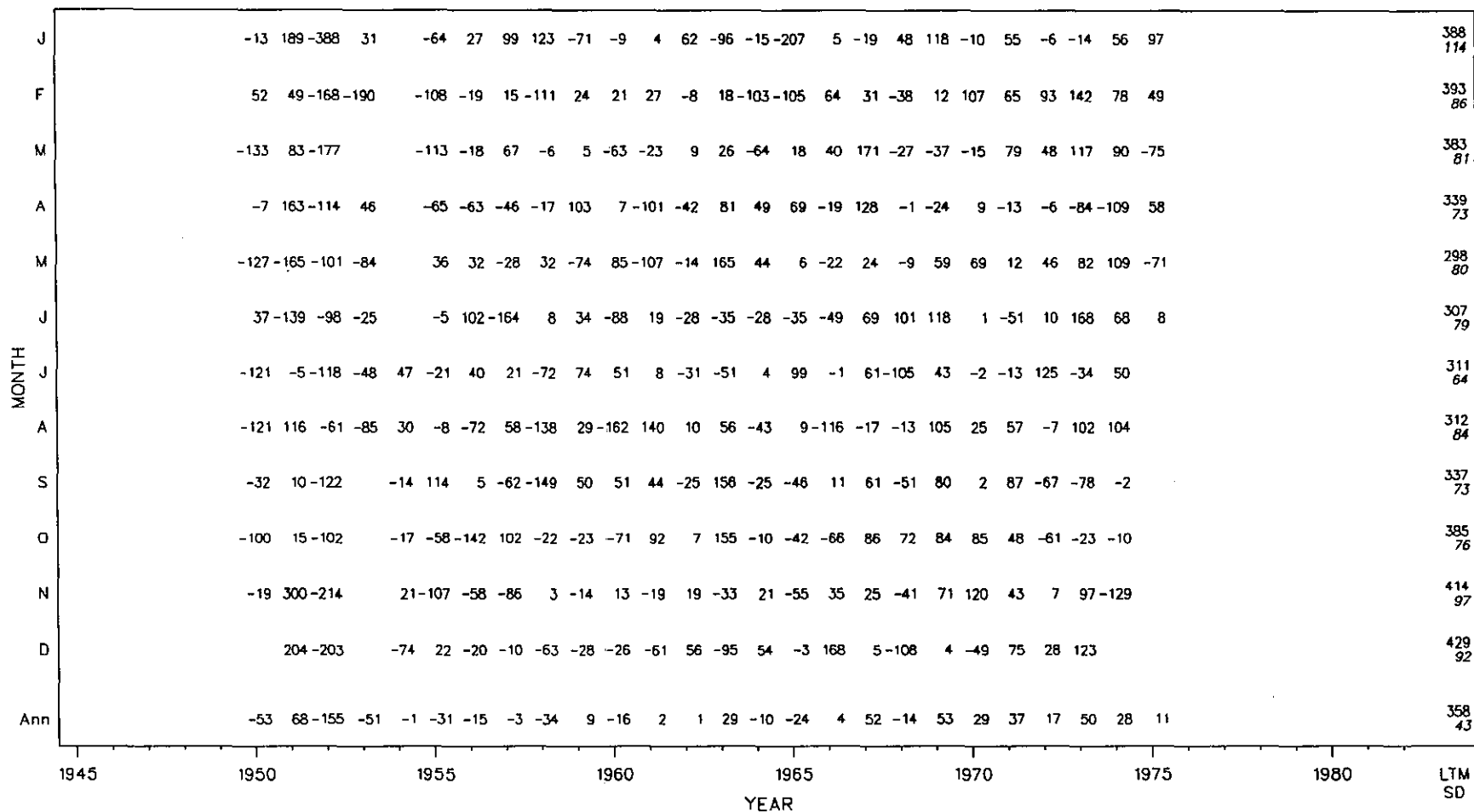
Units = 0.1 okta



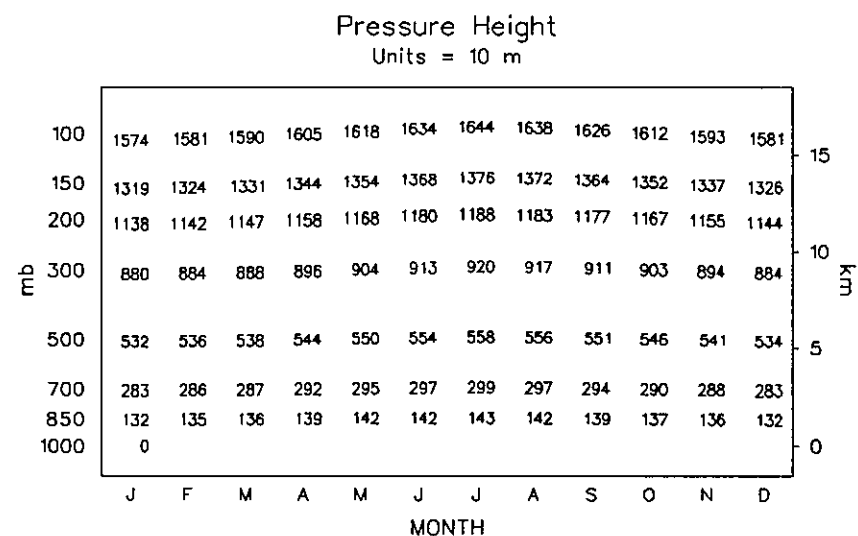
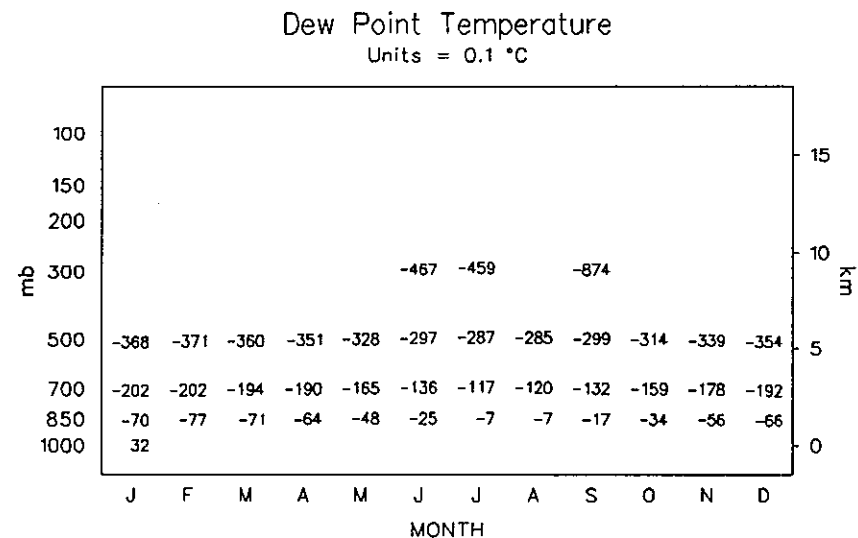
OWS Study Area I Anomalies

Precipitation Frequency

Units = 0.1 percent



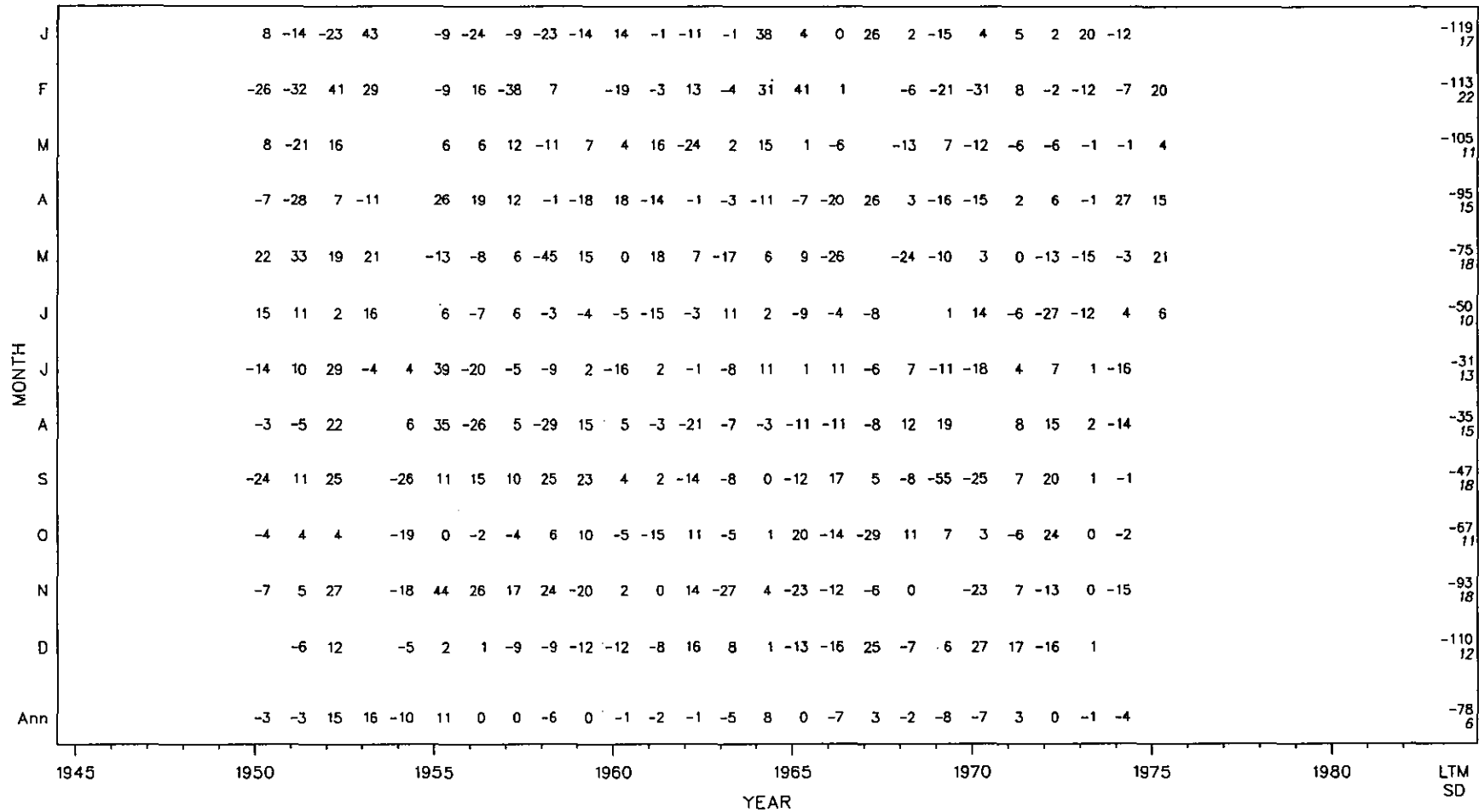
OWS Study Area I Anomalies



Mean plotted at actual height

Air Temperature: 700 mb

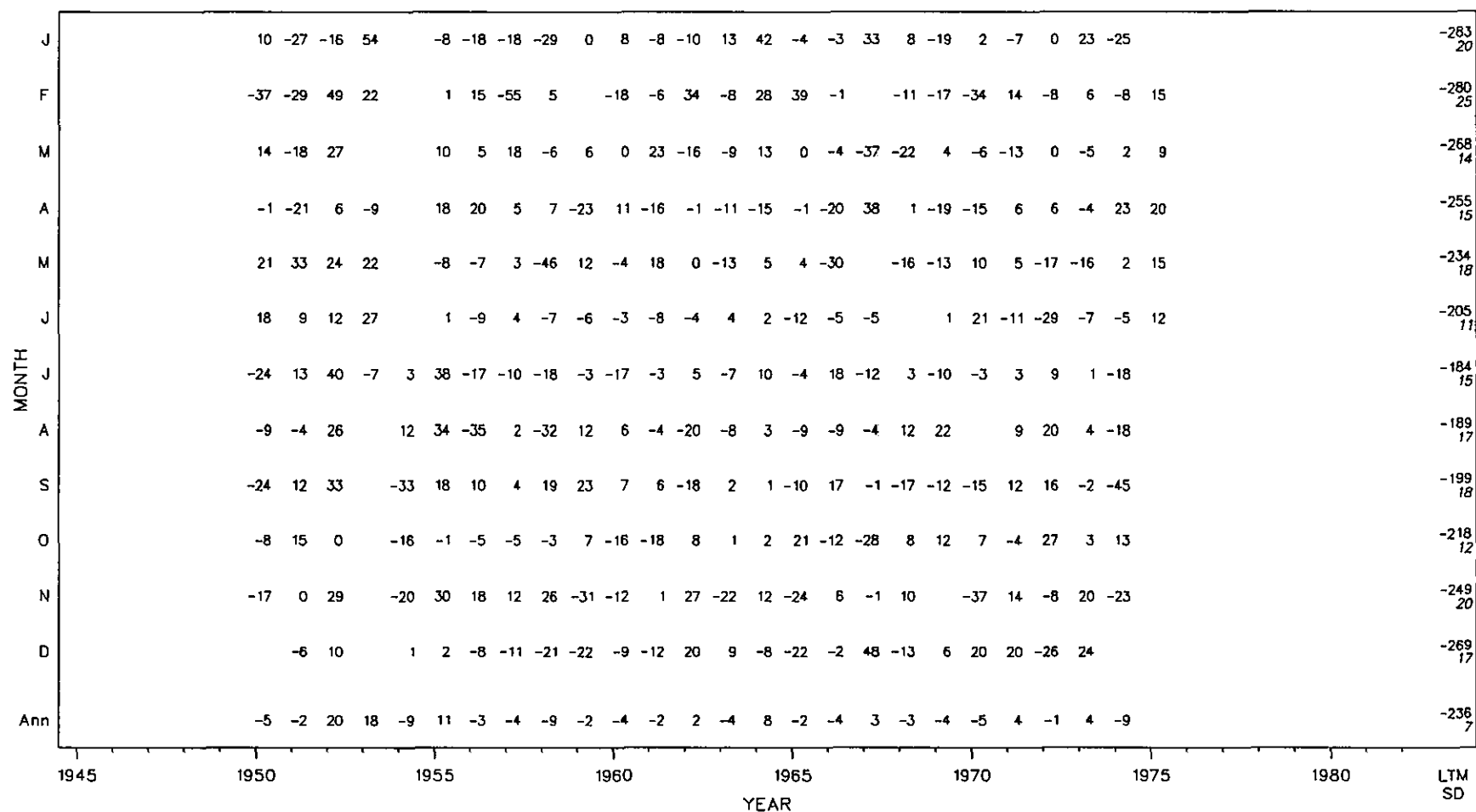
Units = 0.1 °C



OWS Study Area I Anomalies

Air Temperature: 500 mb

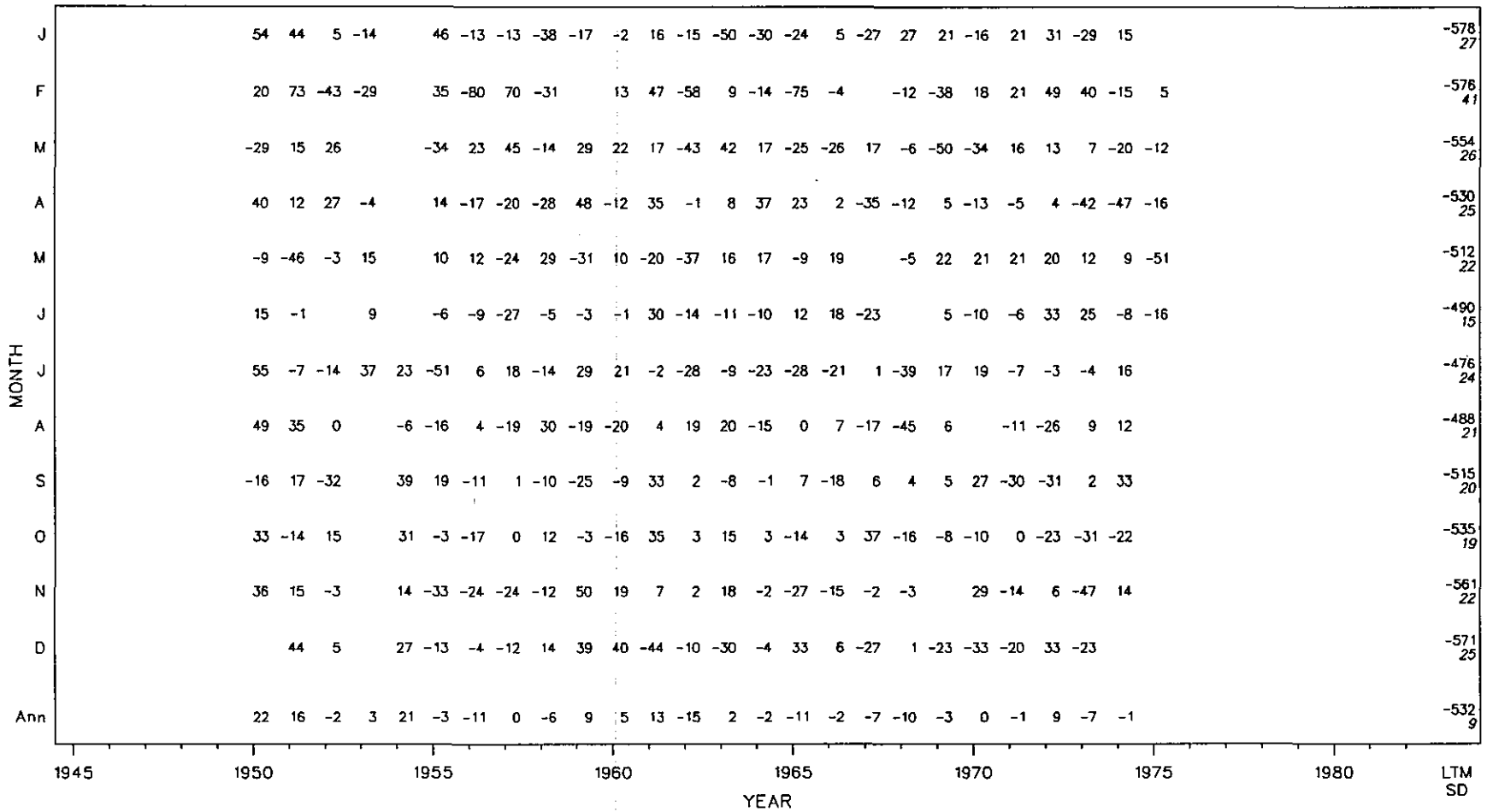
Units = 0.1 °C



OWS Study Area I Anomalies

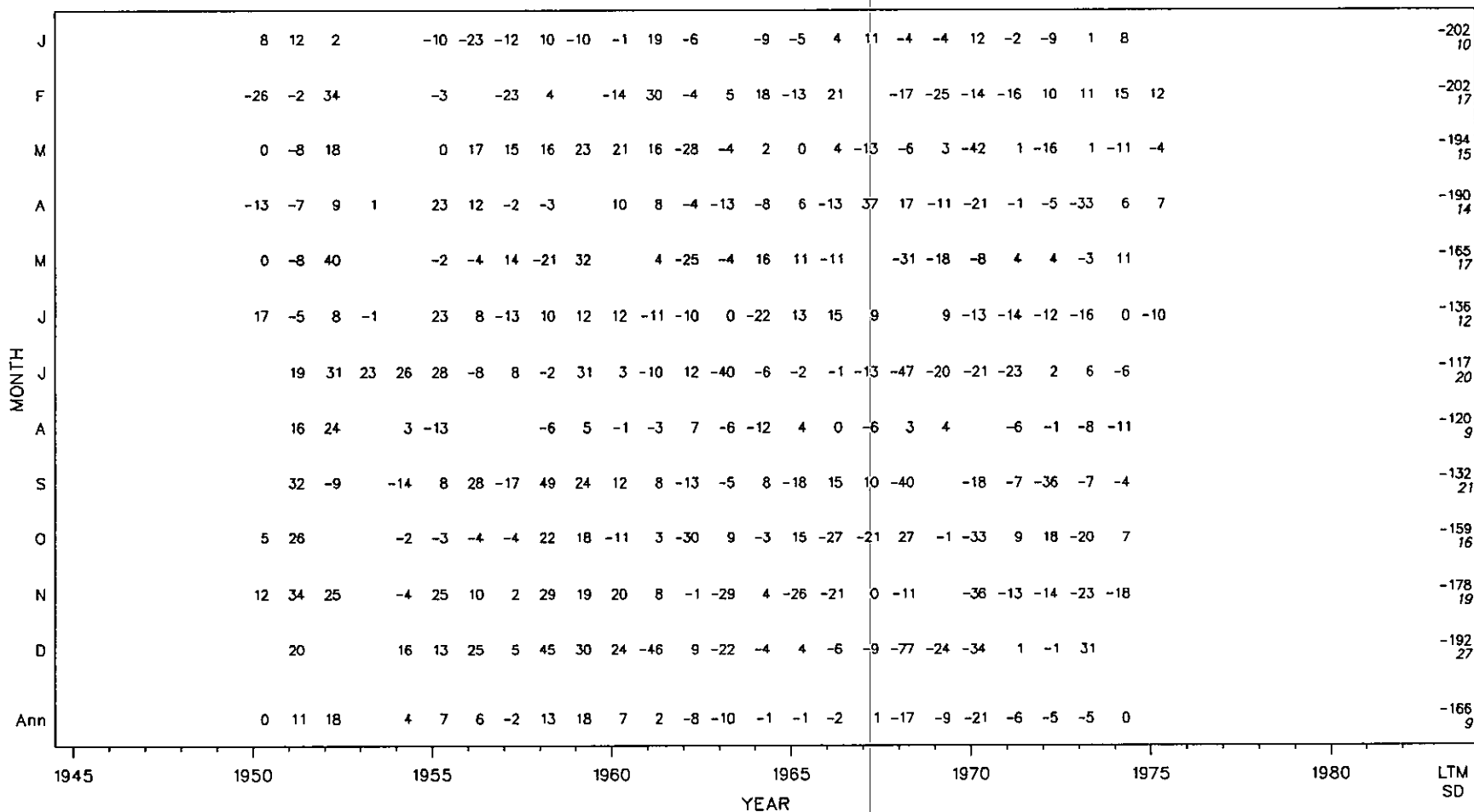
Air Temperature: 200 mb

Units = 0.1 °C



OWS Study Area I Anomalies

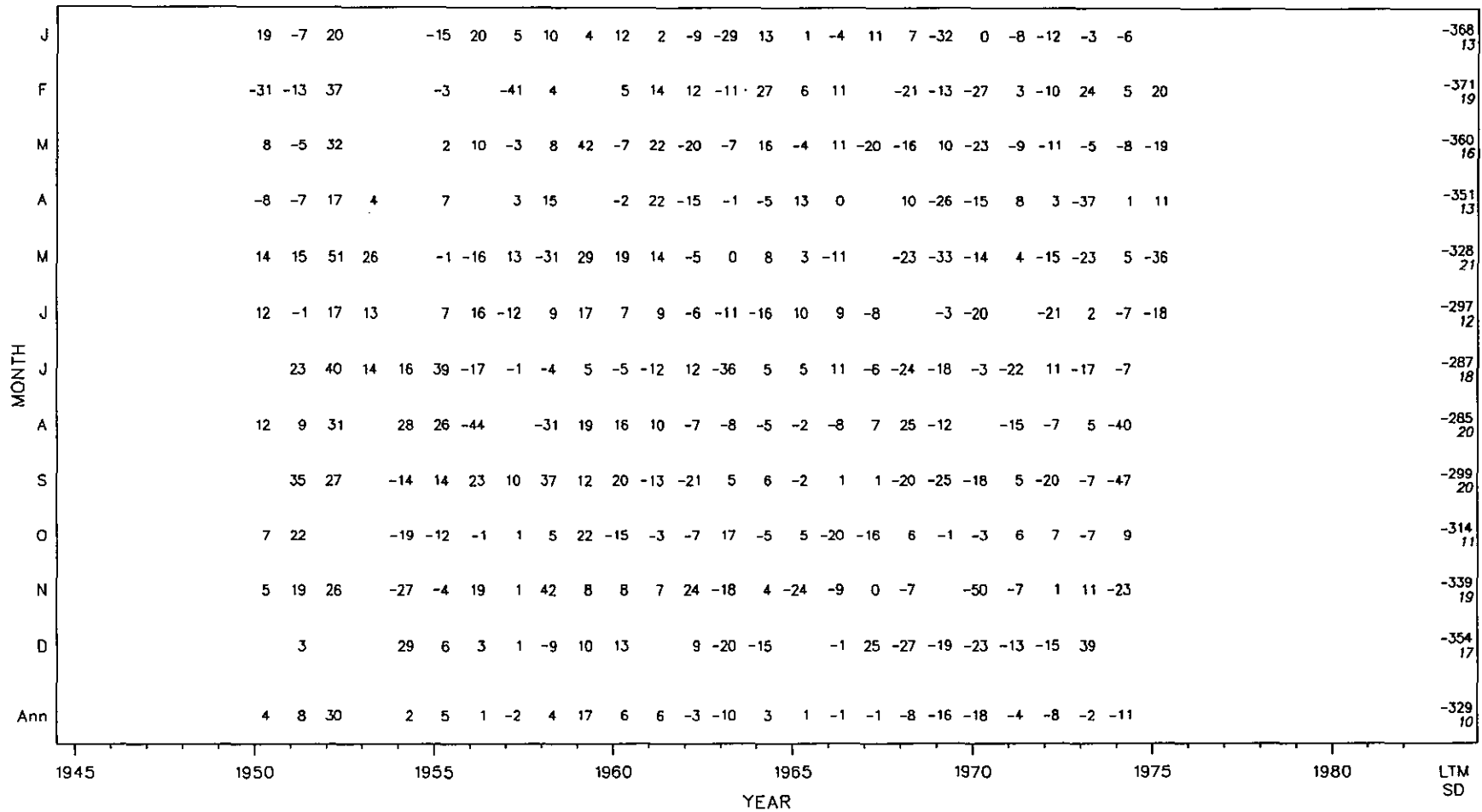
Dew Point Temperature: 700 mb
Units = 0.1 °C



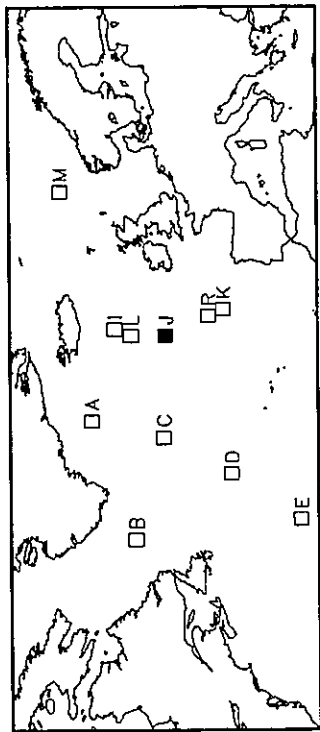
OWS Study Area I Anomalies

Dew Point Temperature: 500 mb

Units = 0.1 °C



OWS Study Area | Anomalies



51.5°N – 53.4°N, 20.9°W – 19.0°W
1950 – 1975

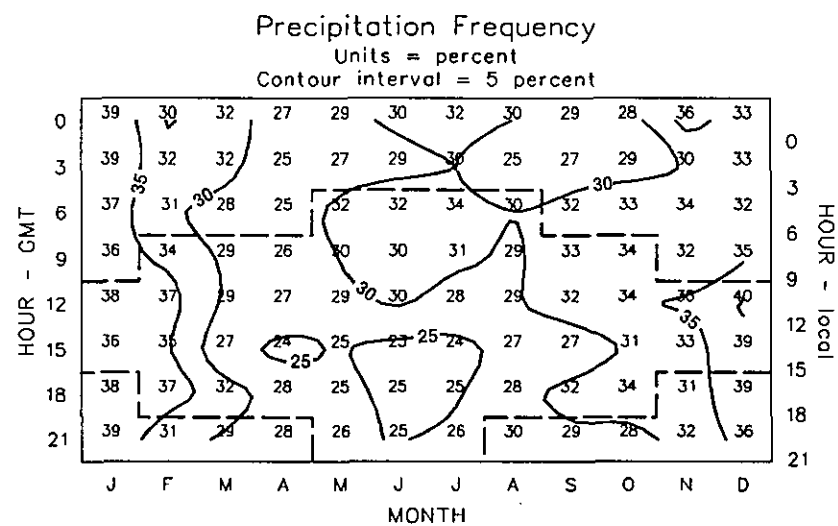
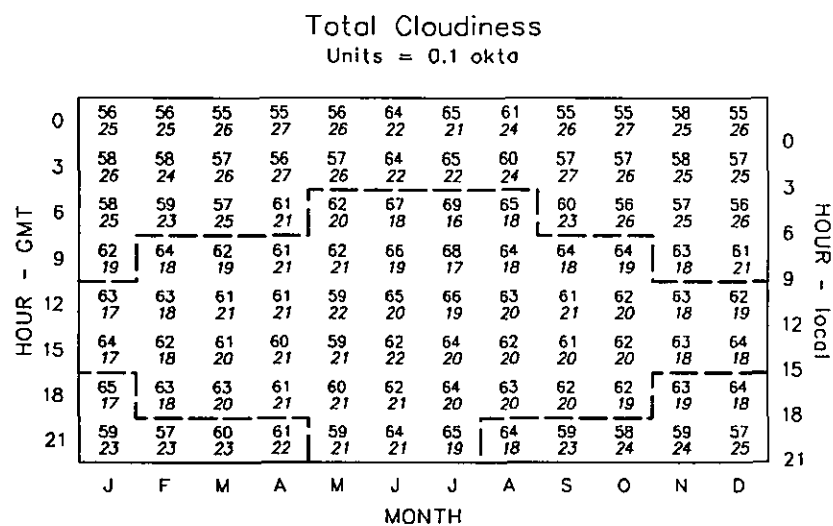
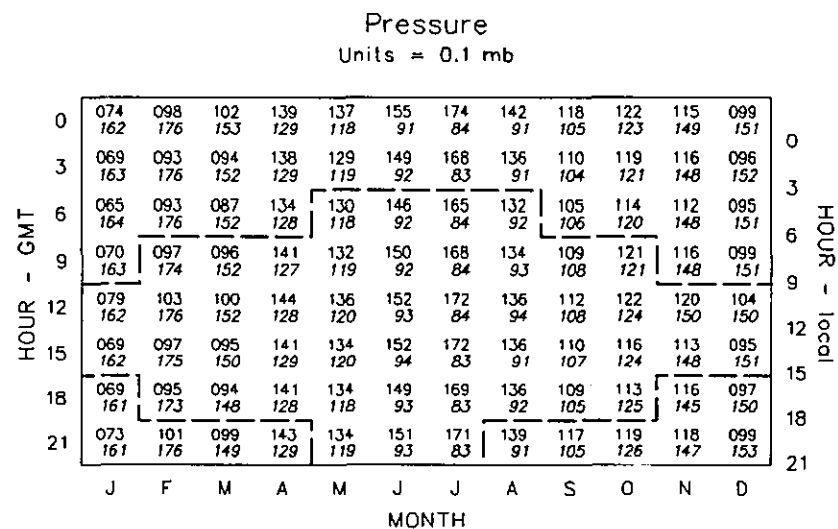
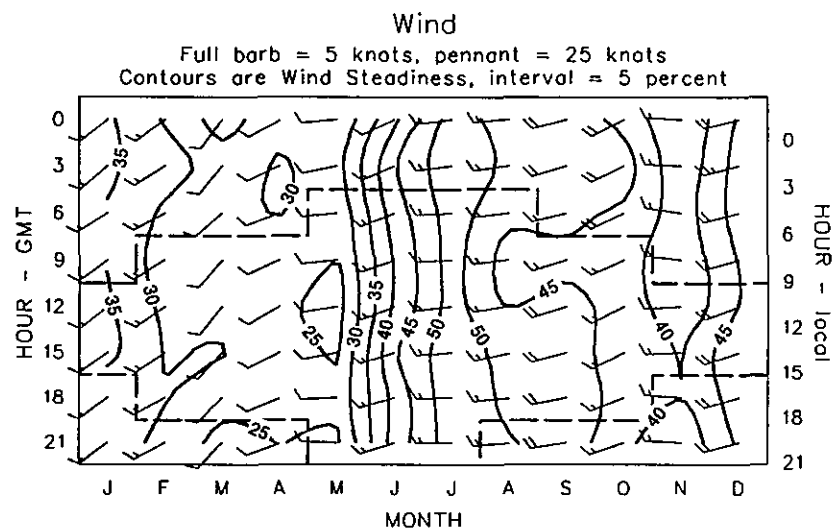
OWS
J

MONTH																															Sum			
	1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075	2080	2085	2090		2095	2100	
J		30 30	28 28	31 31	31 31	29 29	27 27	31 31	30 30	30 30	30 28	30 30	31 31	31 31	30 30	31 31	31 31	30 30	31 31	31 31	31 31	31 31	30 30	31 31	31 31	31 31	31 31	30 30	28 28	30 30		751 751		
F		27 27	29 29	27 27	28 28	24 24	29 29	27 27	28 28	24 24	29 27	27 27	23 23	29 29	28 28	28 28	27 27	28 28	27 27	23 23	26 26	29 29	28 28	28 28	28 28	28 28	28 28	28 28	28 28	28 28		678 678		
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J		27 27	31 31	19 19	31 31	31 30	29 29	31 31	31 31	30 30	31 31	31 31	31 31	31 31	31 31	29 29	30 30	31 31	31 30	30 30	31 31	31 31	31 31	30 30	31 31	31 31	31 31	31 31	30 30		750 749			
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O		28 28	29 29	8 8	31 31	30 31	24 24	15 15	31 31	31 31	29 29	31 31	31 31	29 29	31 31	31 31	30 30	28 28	29 29	31 31	31 30	31 31	31 31	27 27								709 708		
N		29 29	27 27	29 29	17 17	29 29	30 30	30 30	30 30	30 30	25 25	29 29	25 25	29 29	29 29	25 25	30 30	30 30	30 30	29 29	30 30	30 30	29 29	4 4								684 684		
D		31 31	22 22	29 29	31 31	24 24	29 29	24 24	31 31	28 28	28 28	27 27	30 30	31 31	31 31	31 31	31 31	31 31	31 31	30 30	31 31	27 27	31 31	29 29								730 730		
Ann		250 248	330 329	273 273	351 351	354 354	351 336	337 345	355 355	337 337	350 350	352 352	350 349	353 353	356 356	358 358	360 360	358 358	357 357	358 357	349 349	351 349	350 349	353 353	323 323	166 165							8727 8717	
		1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075	2080	2085	2090	2095	2100	Sum

OWS Study Area J (52.5°N, 20.0°W)

Frequency of Surface Observations

Each of the 11 variables was observed on X days of each month.
The upper number is the maximum X from among all the variables.
The lower number is the minimum X from among all the variables.



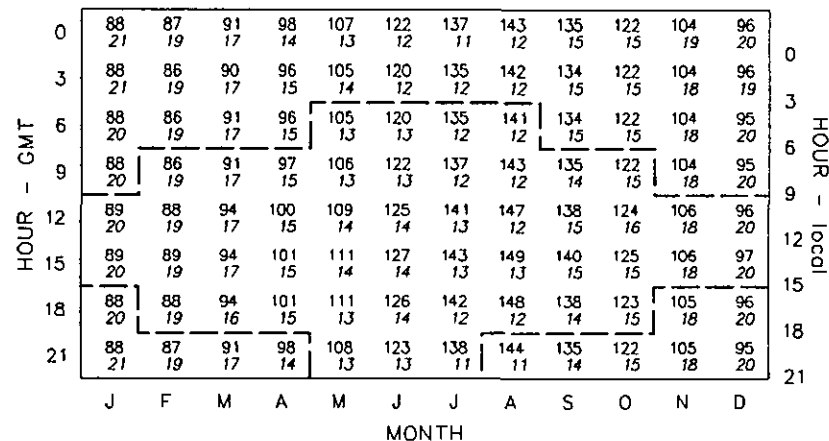
OWS Study Area J Surface Climatology

upper number = mean
lower number = standard deviation

———— data contours
----- sunrise/sunset

Air Temperature

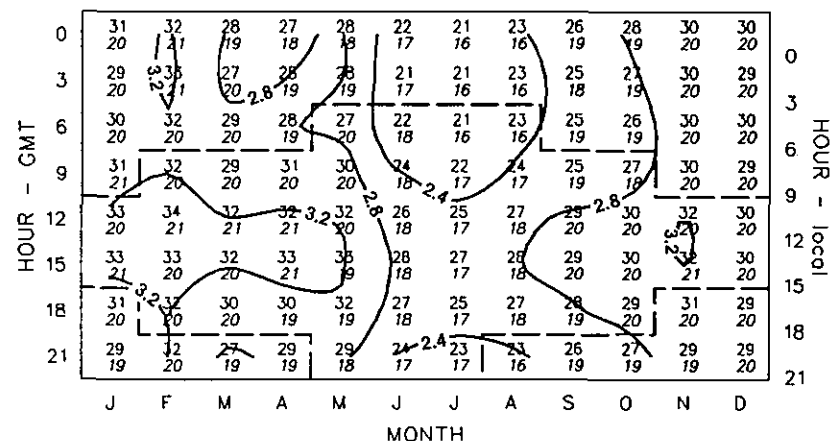
Units = 0.1 °C



Dew Point Depression

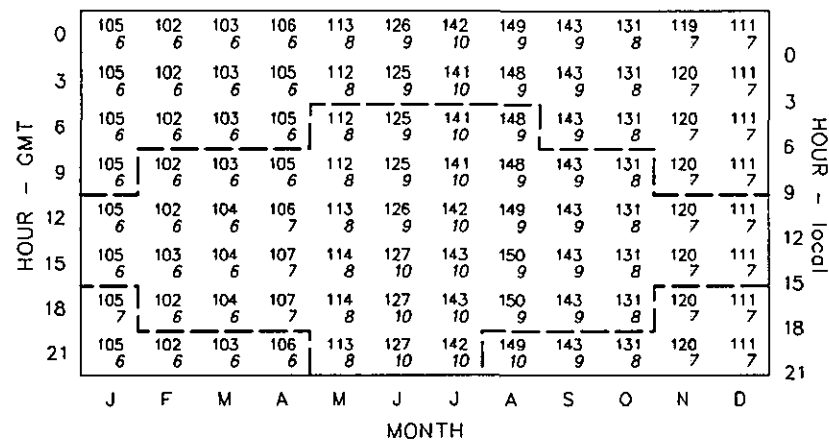
Units = 0.1 °C

Contour interval = 0.4 °C



Sea Surface Temperature

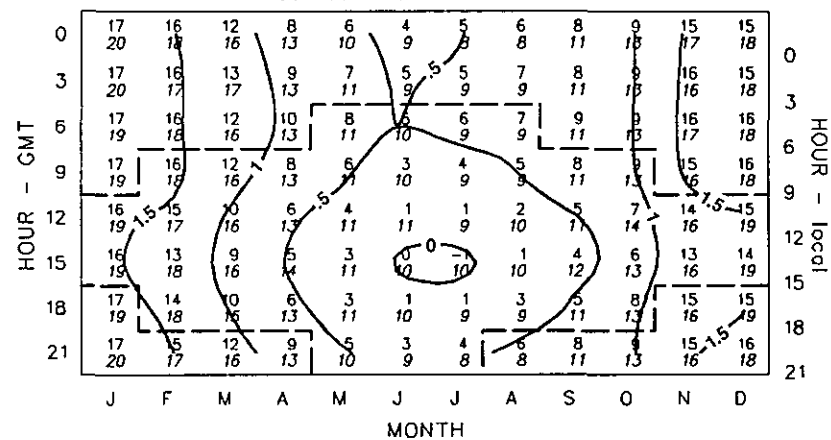
Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C

Contour interval = 0.5 °C



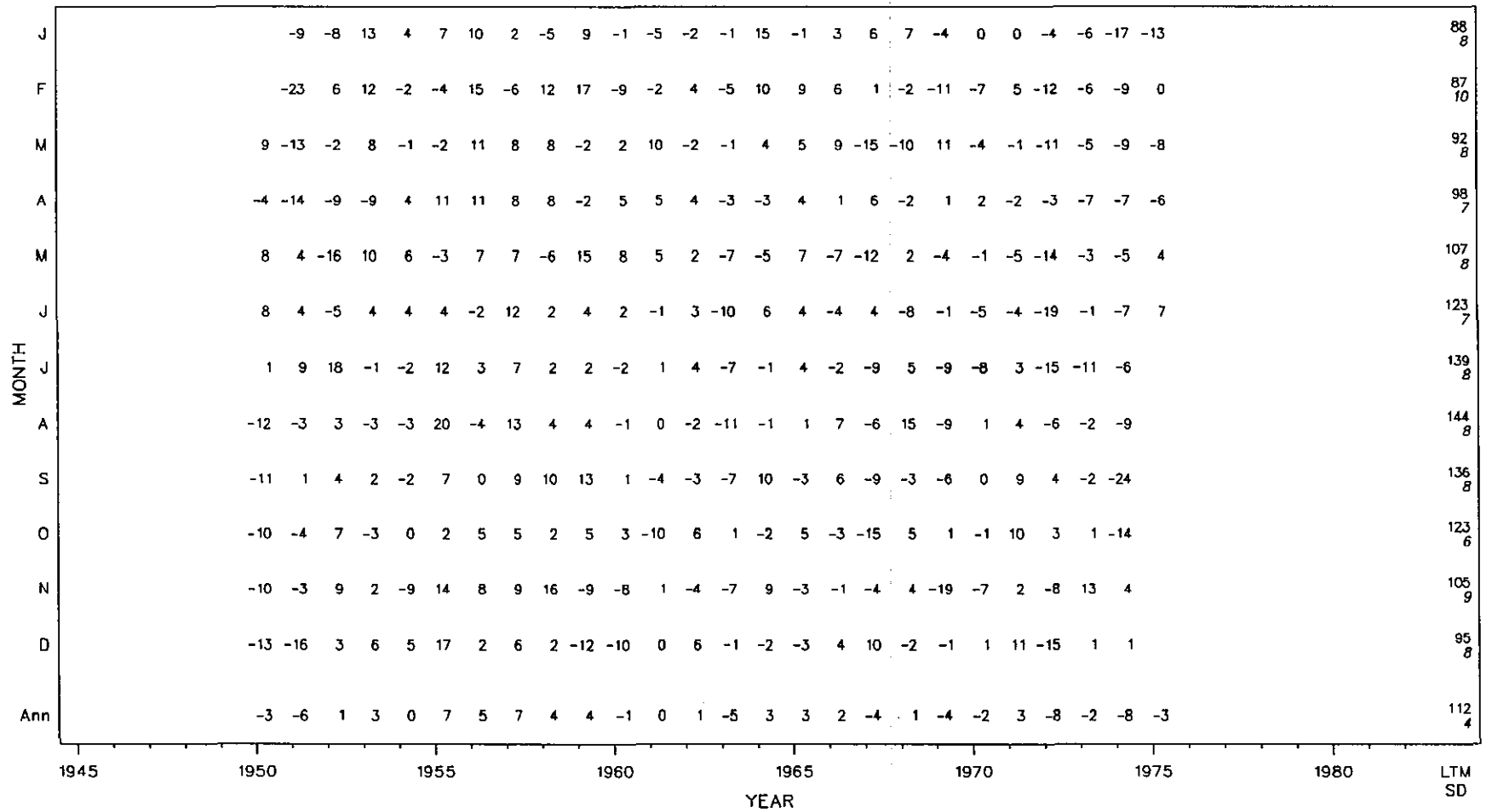
OWS Study Area J Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
- - - sunrise/sunset

Surface Air Temperature

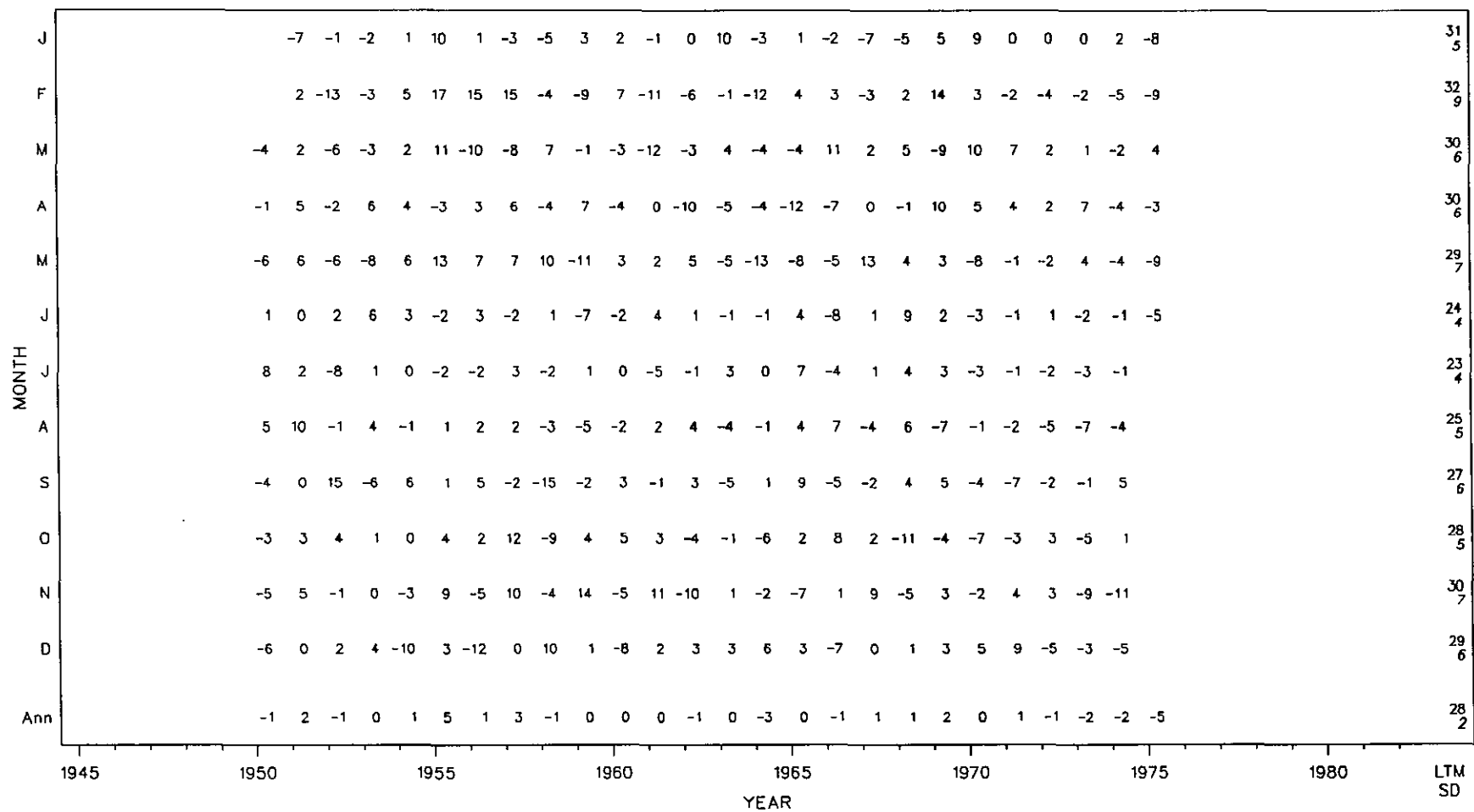
Units = 0.1 °C



OWS Study Area J Anomalies

Surface Dew Point Depression

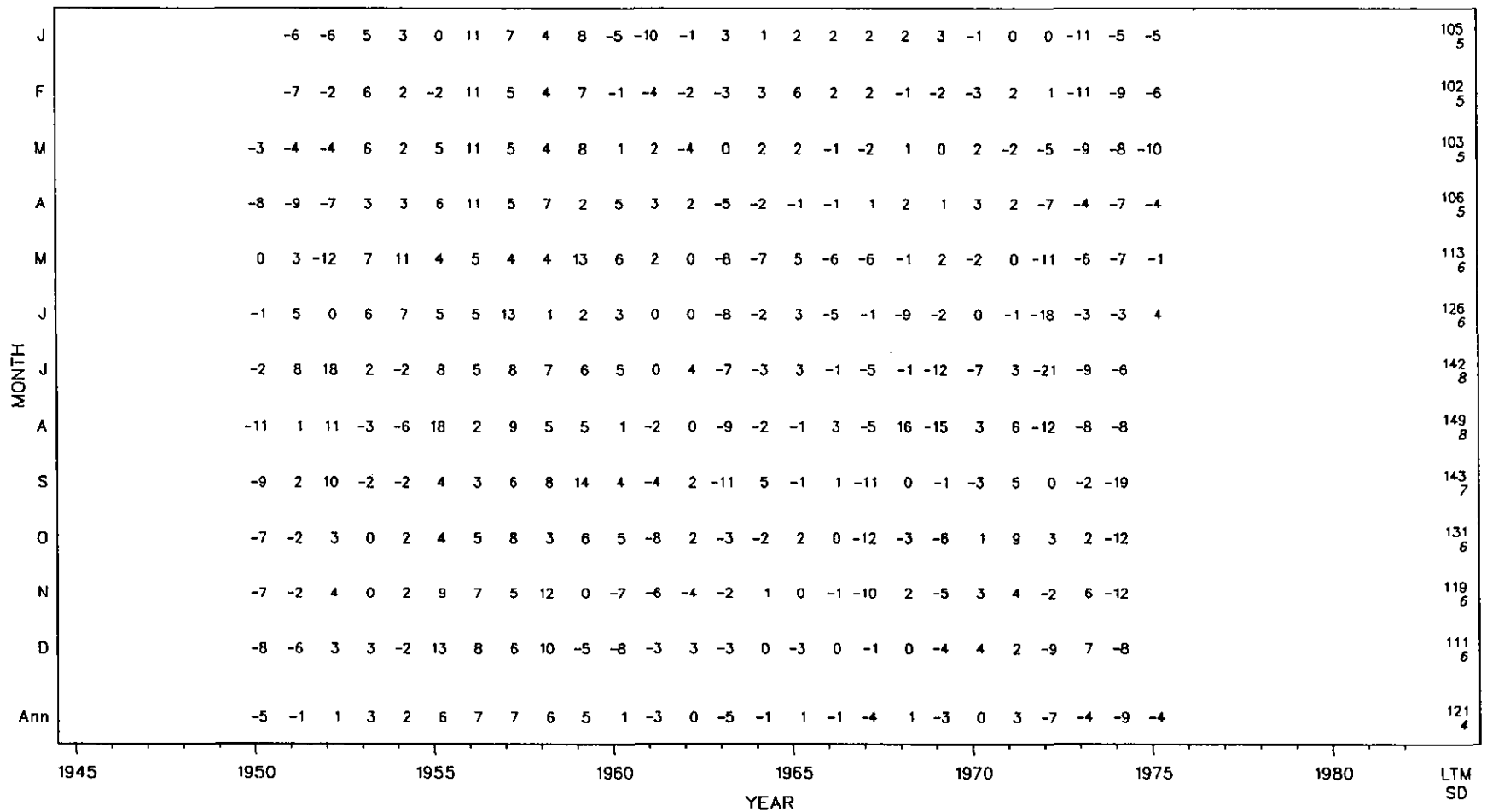
Units = 0.1 °C



OWS Study Area J Anomalies

Sea Surface Temperature

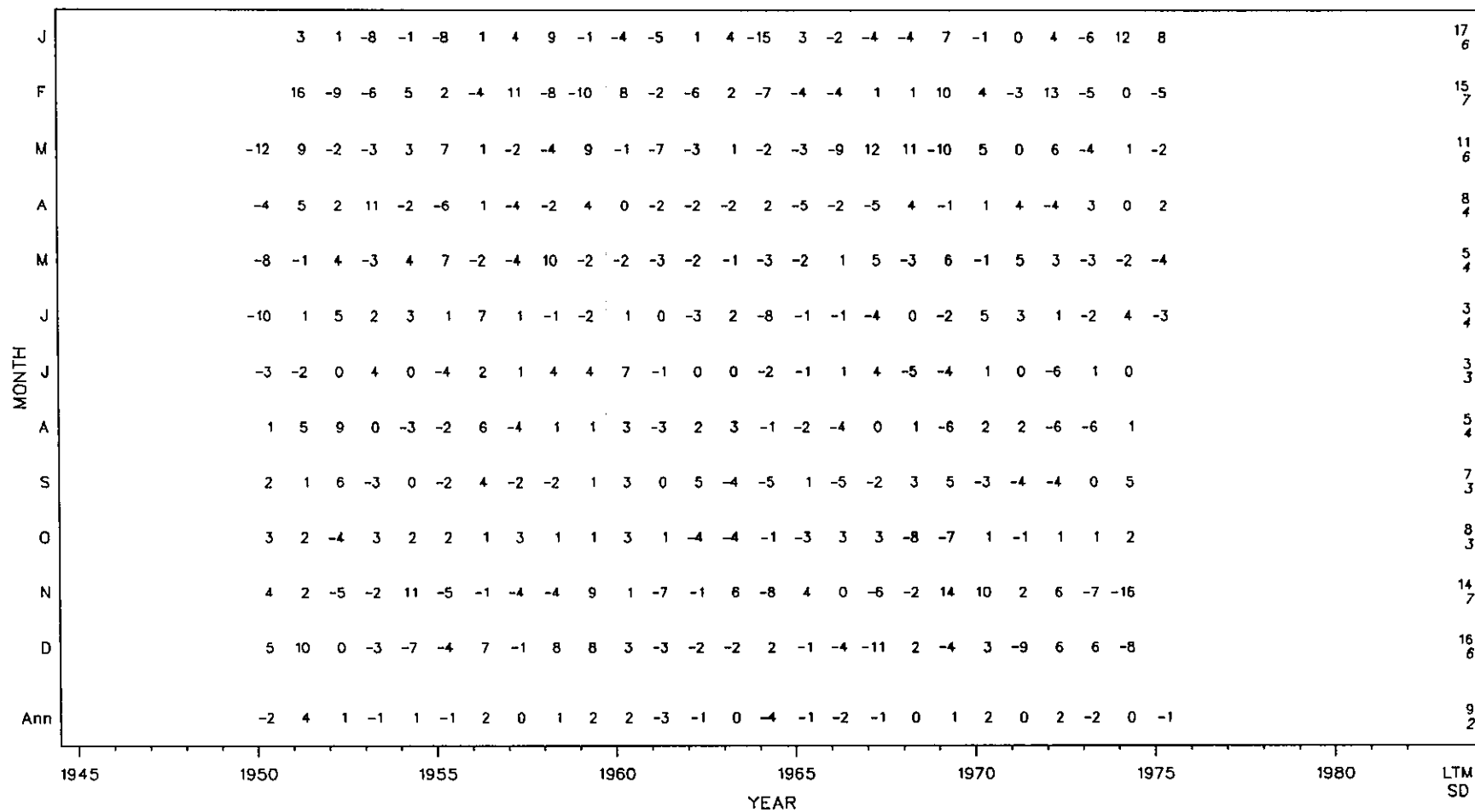
Units = 0.1 °C



OWS Study Area J Anomalies

Sea - Air Temperature Difference

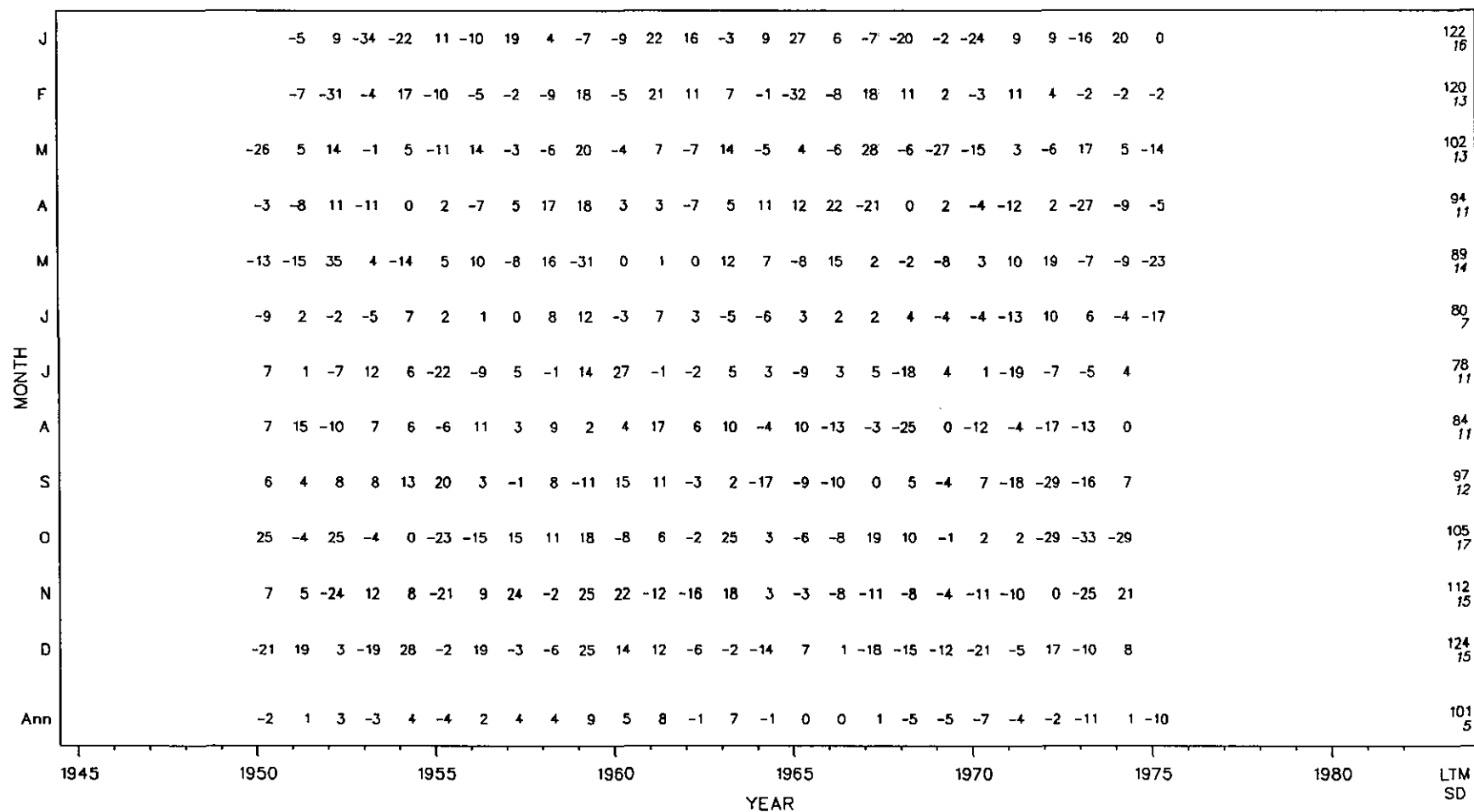
Units = 0.1 °C



OWS Study Area J Anomalies

Surface Scalar Wind

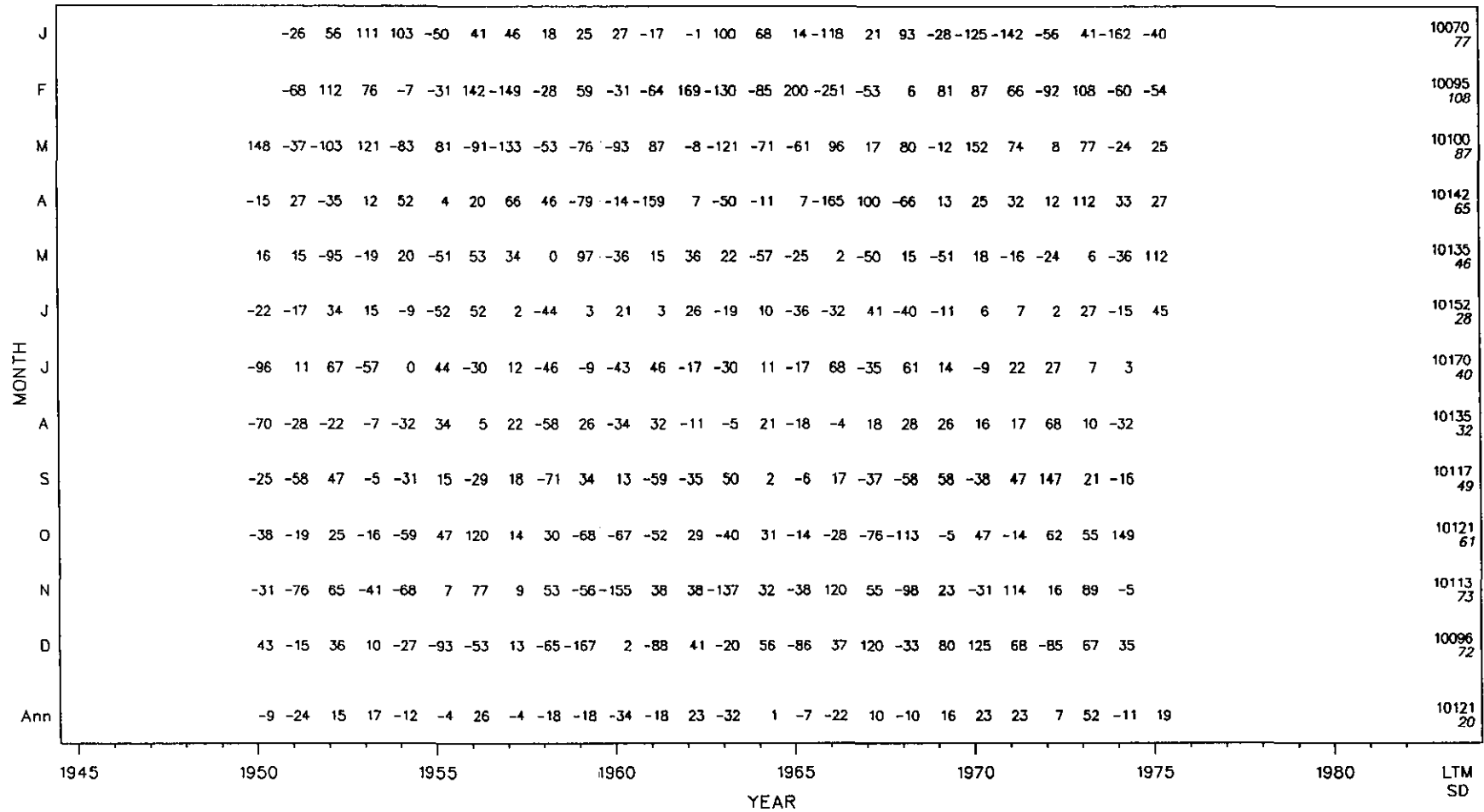
Units = 0.1 m/s



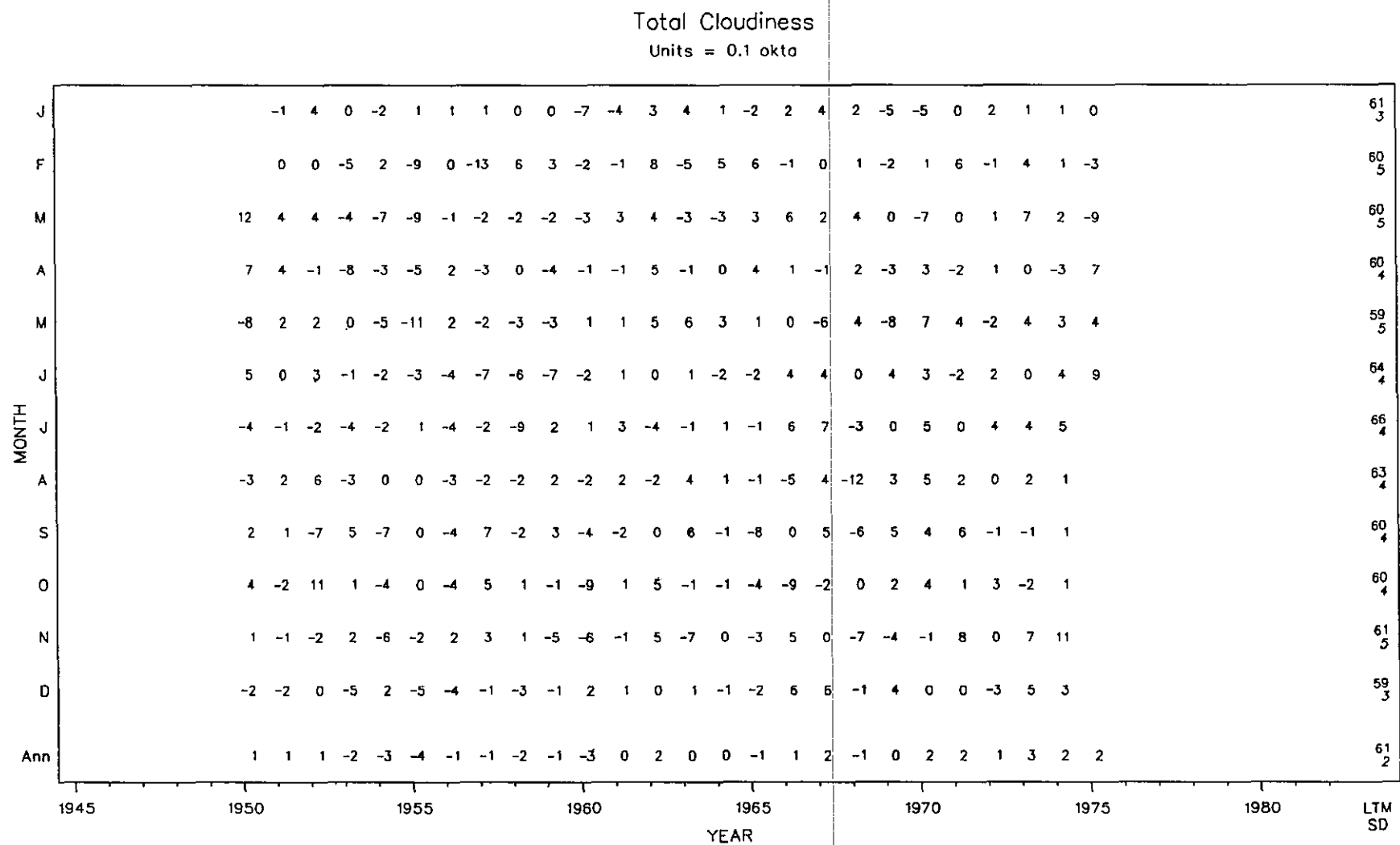
OWS Study Area J Anomalies

Sea Level Pressure

Units = 0.1 mb



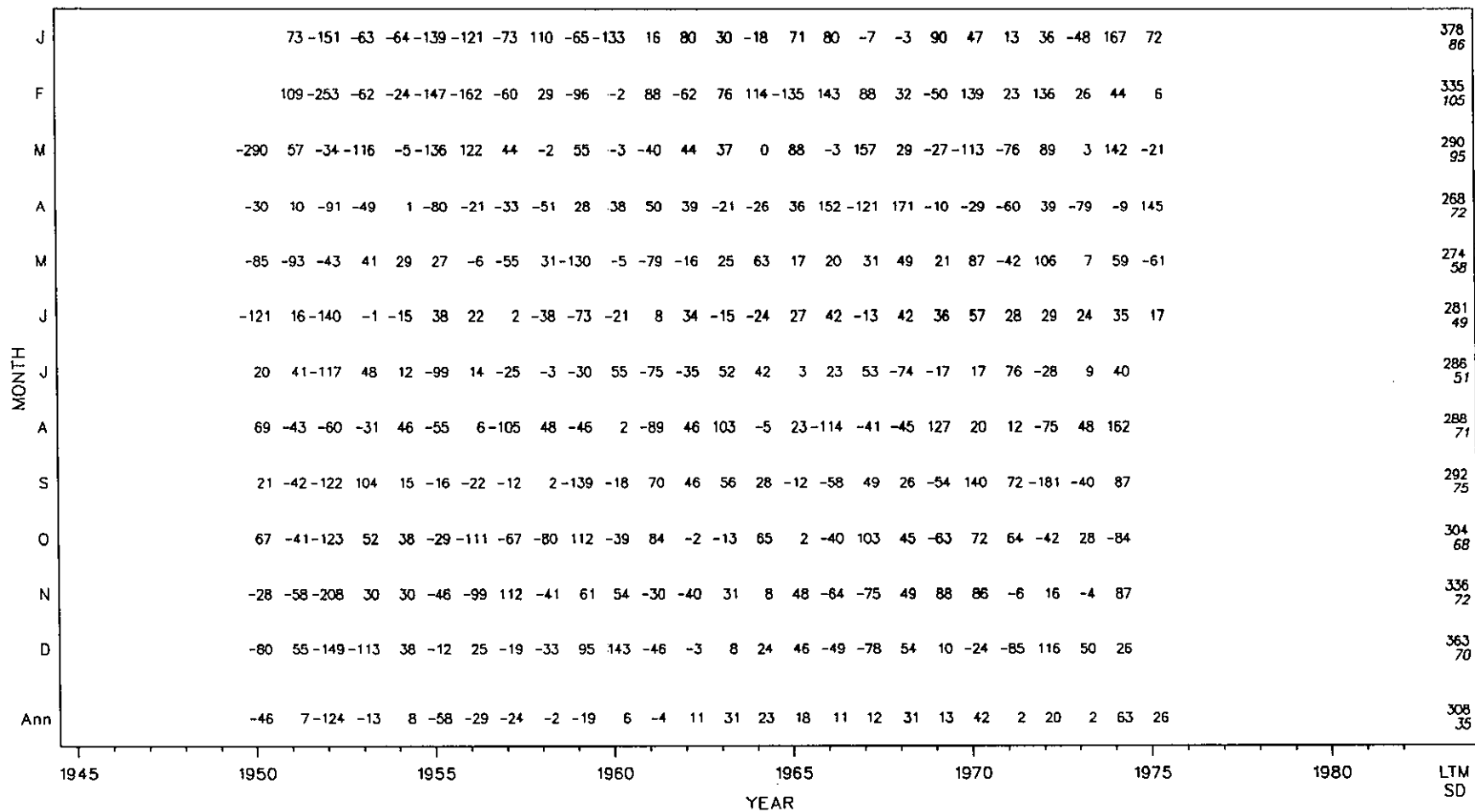
OWS Study Area J Anomalies



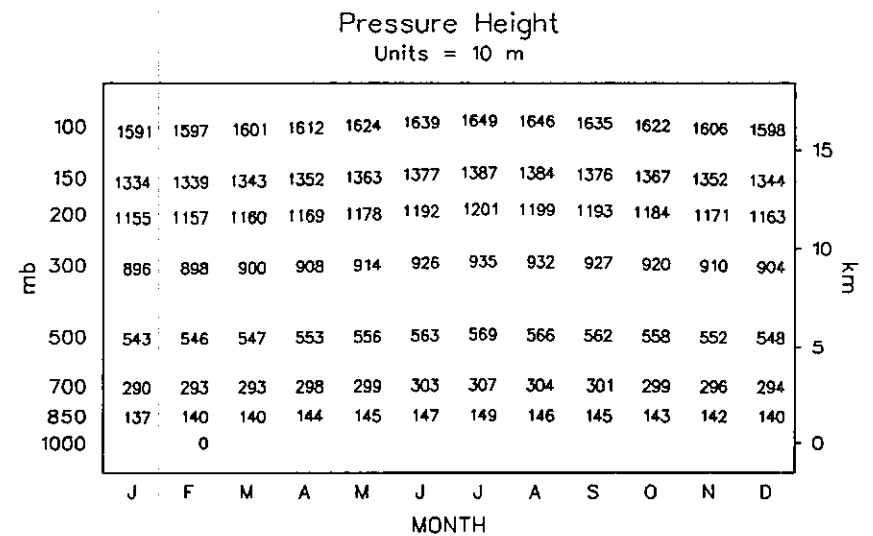
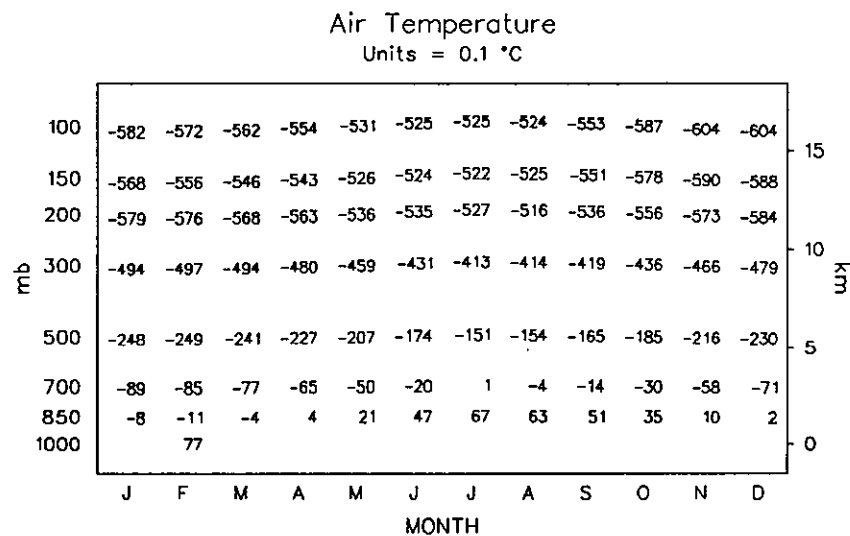
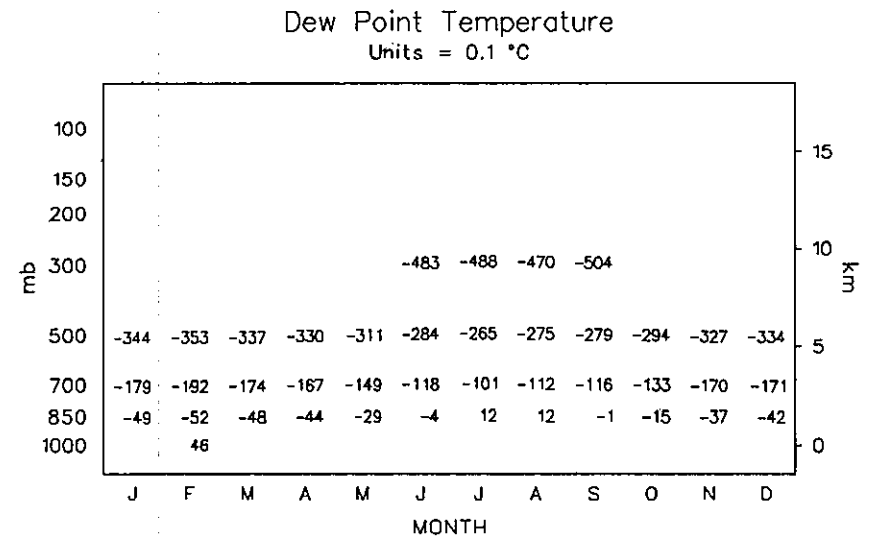
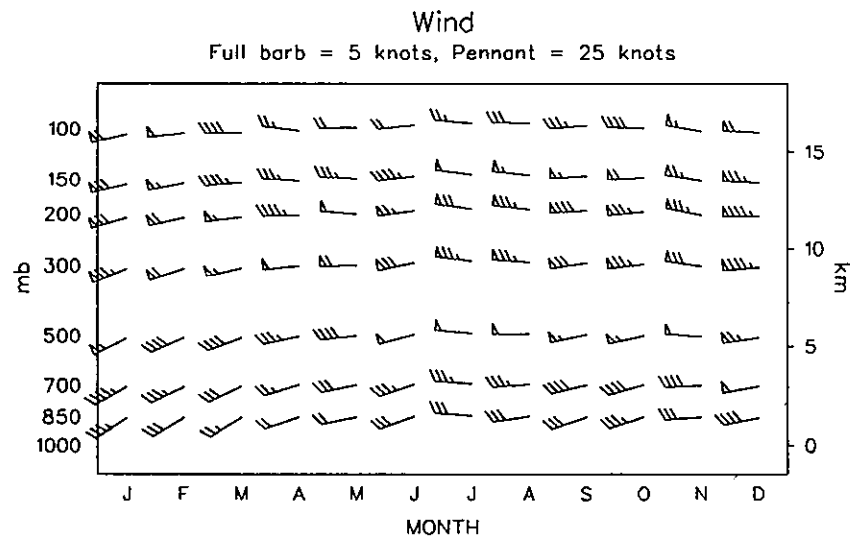
OWS Study Area J Anomalies

Precipitation Frequency

Units = 0.1 percent



OWS Study Area J Anomalies

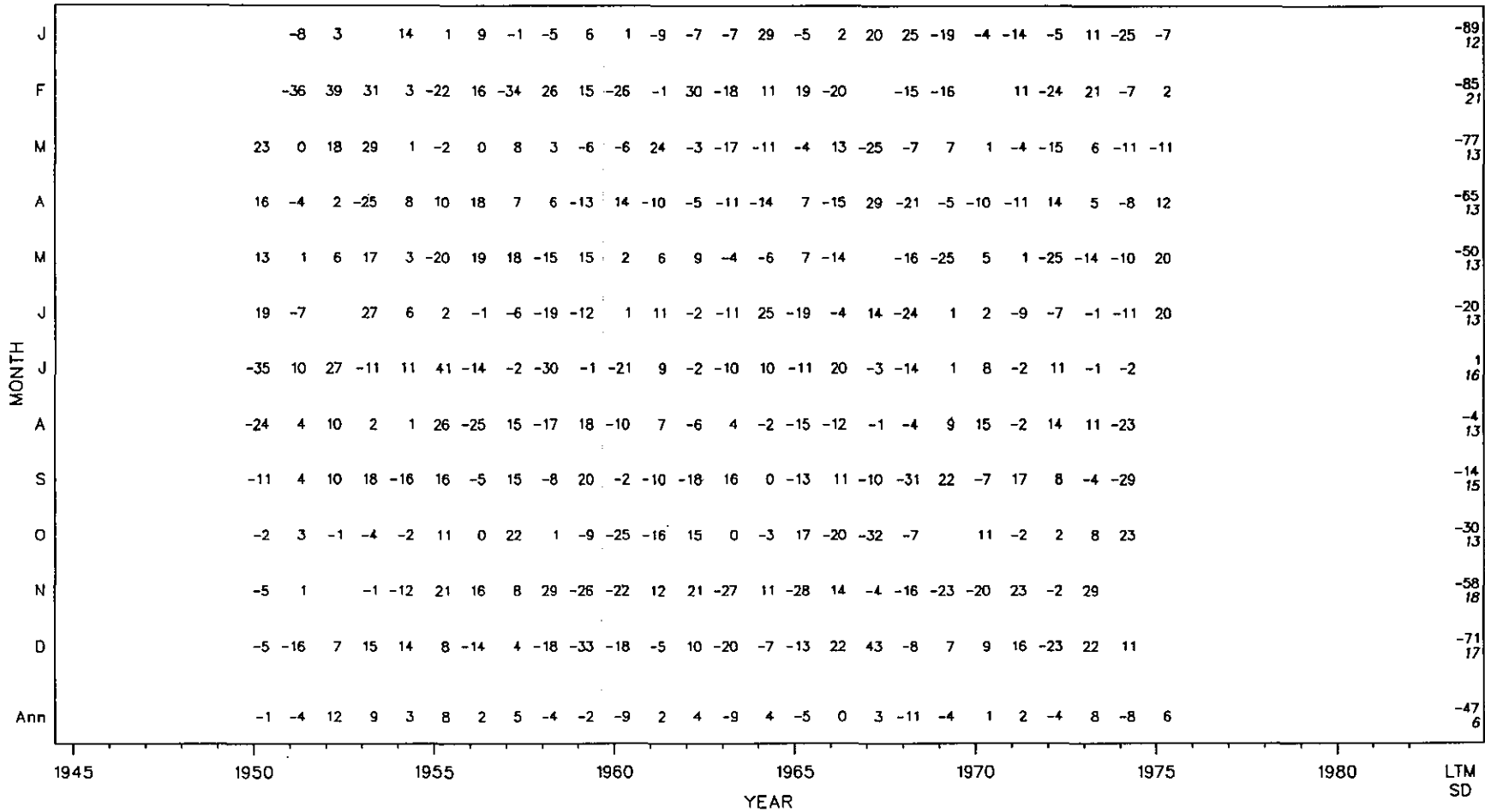


OWS Study Area J Upper Air Climatology

Mean plotted at actual height

Air Temperature: 700 mb

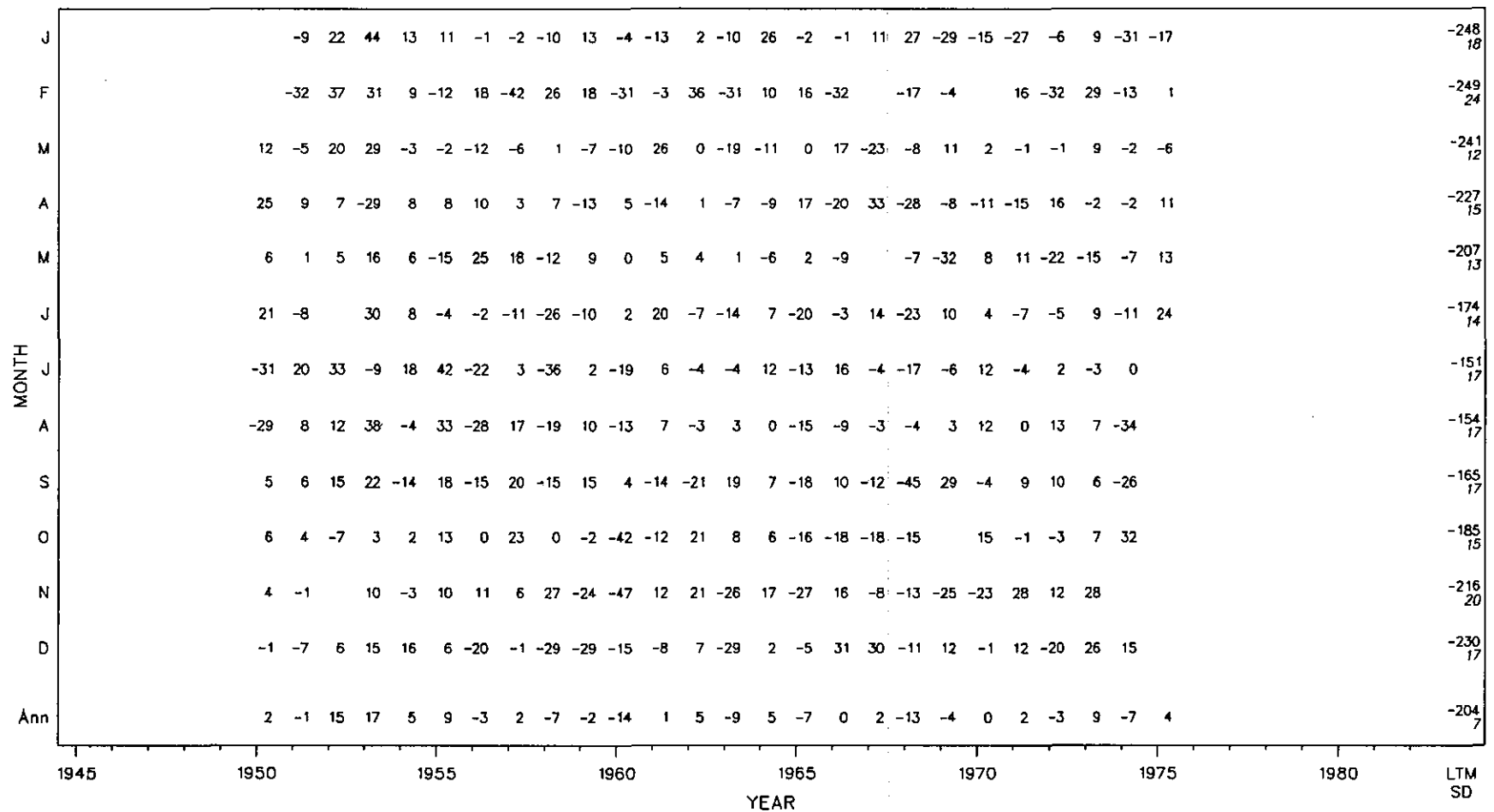
Units = 0.1 °C



OWS Study Area J Anomalies

Air Temperature: 500 mb

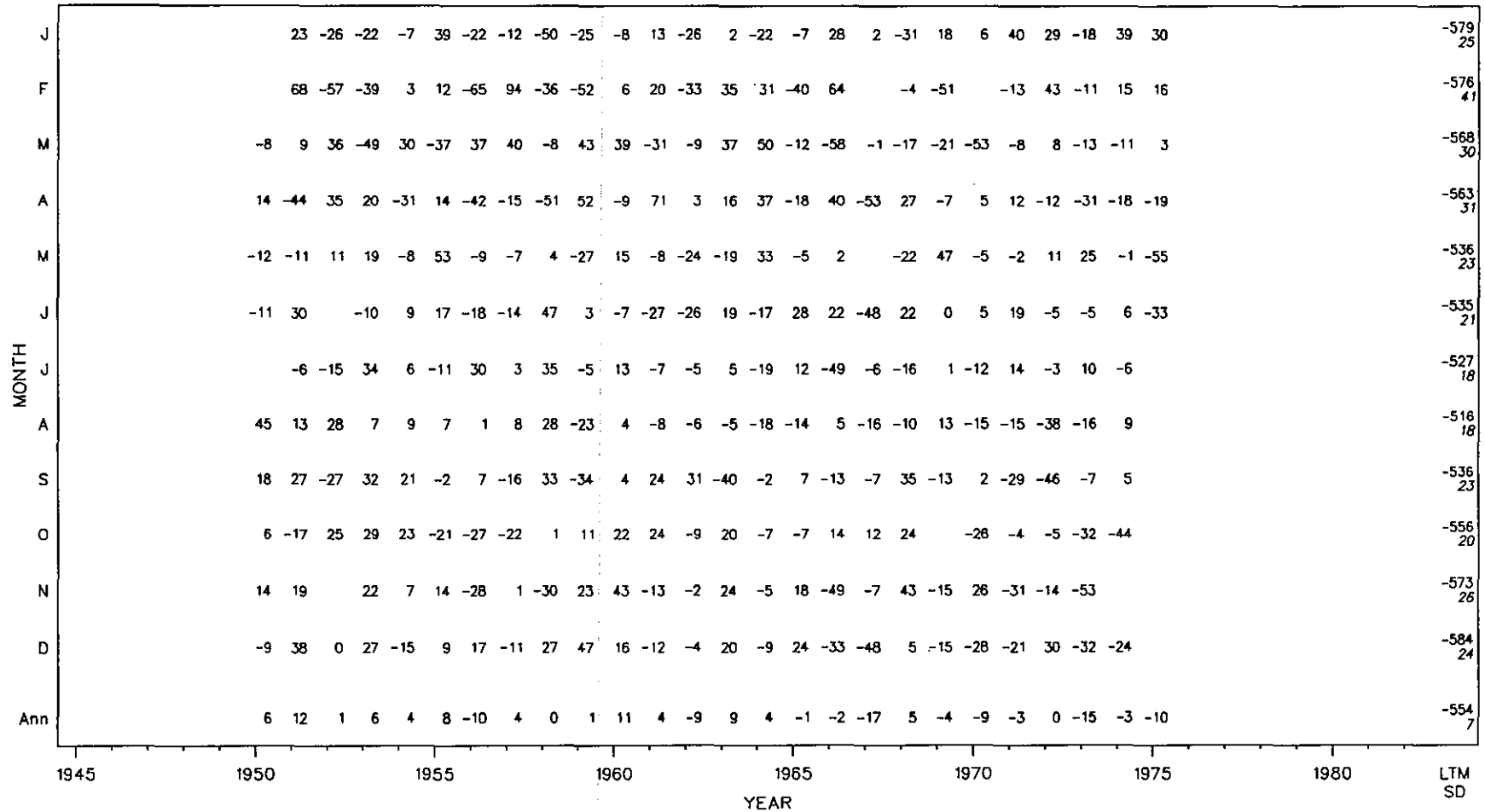
Units = 0.1 °C



OWS Study Area J Anomalies

Air Temperature: 200 mb

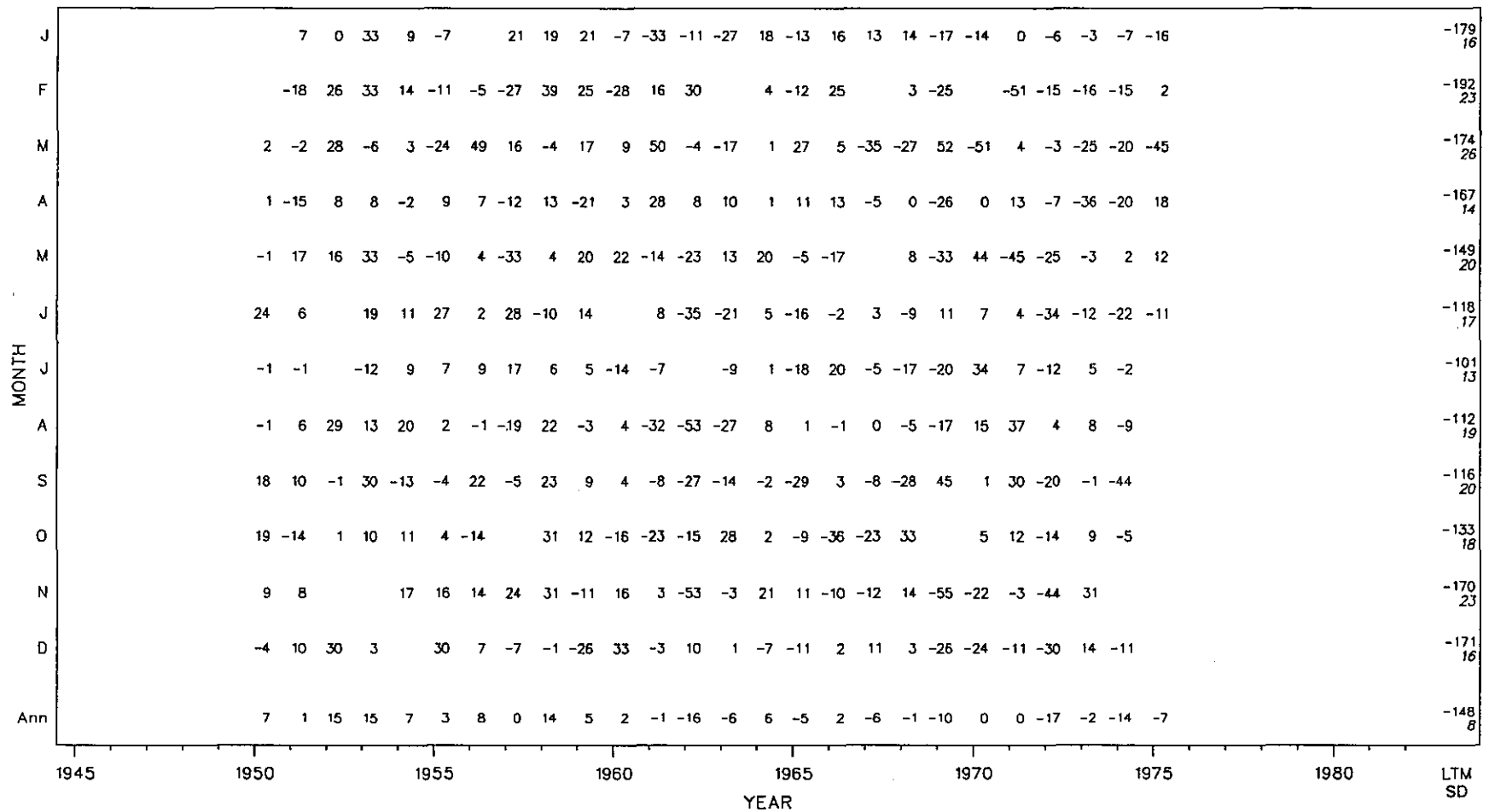
Units = 0.1 °C



OWS Study Area J Anomalies

Dew Point Temperature: 700 mb

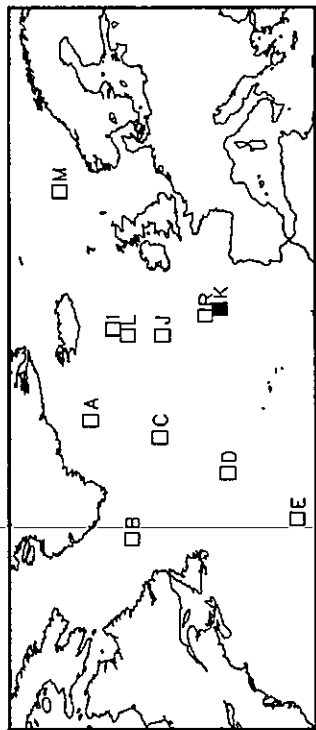
Units = 0.1 °C



OWS Study Area J Anomalies

Units = 0.1 °C





44.0°N – 45.9°N, 16.9°W – 15.0°W
1949 – 1975

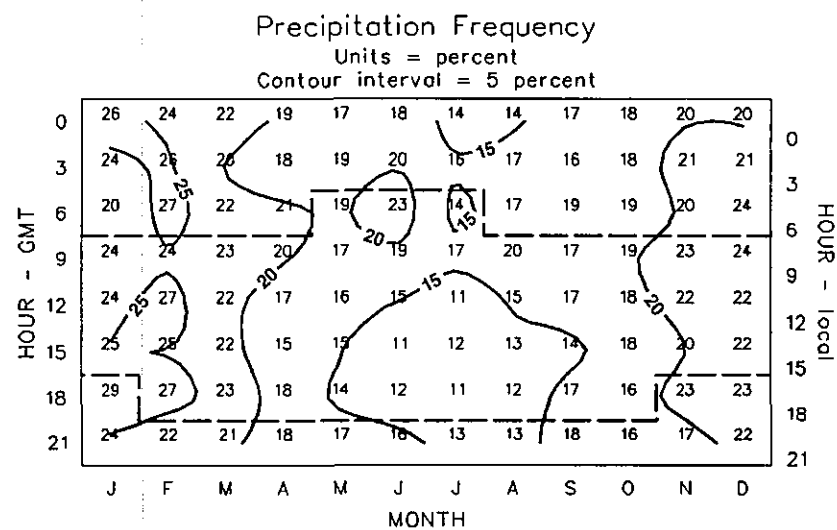
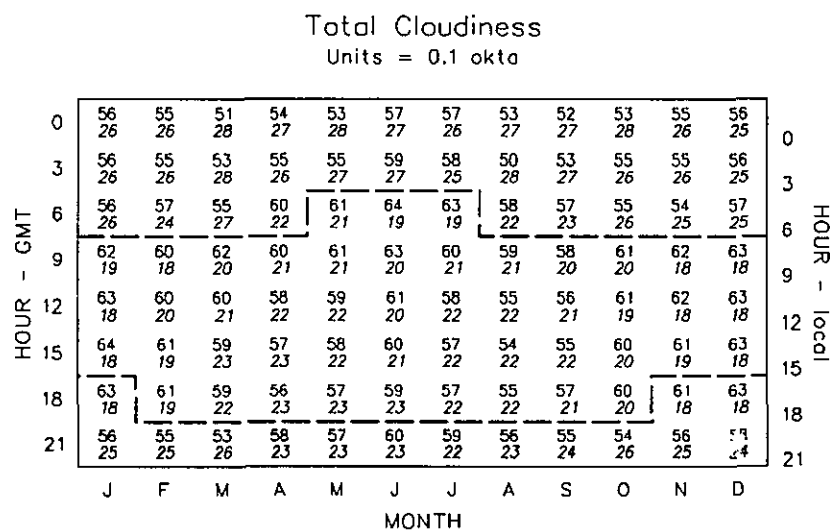
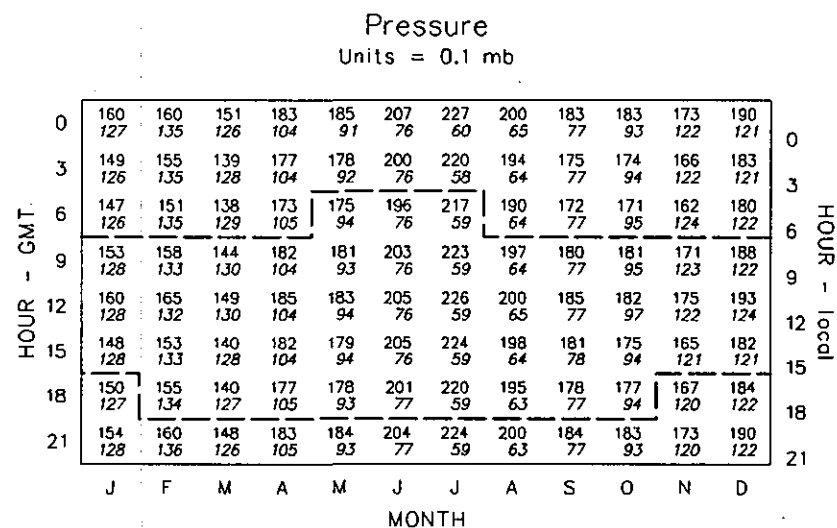
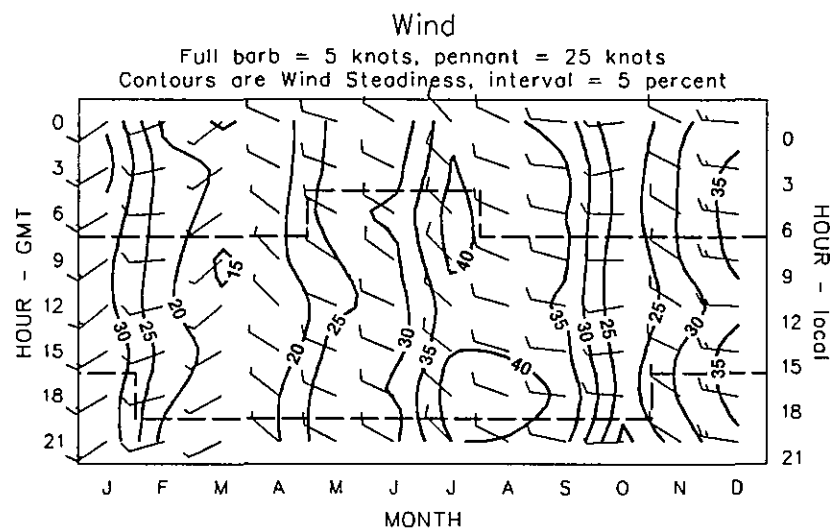
OWS
K

MONTH																													Sum																												
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J	30 30	31 31	31 29	31 29	31 31	31 31	25 25	31 31	22 22	30 30	31 29	30 30	31 31	31 31	31 31	31 31	29 29	31 31	30 30	30 30	29 29	29 29	30 30	26 26															774 768																		
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J	6 6	30 30	30 30	12 12	30 30	24 24	24 23	30 30	30 0	27 26	29 29	30 30	30 30	29 29	27 27	29 29	30 30	25 25	5 5	29 29	30 30	28 27	30 30	29 27															708 675																		
J	31 25	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 0	30 30	30 30	31 30	30 30	30 29	31 31	23 23	28 28	26 26	29 29	30 30	27 27	31 31	28 30	30 30															773 735																		
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S	30 30	30 17	30 30	26 26	30 30	30 8	30 8	30 30	30 0	30 30	30 30	29 29	27 27	29 29	30 30	29 29	30 30	27 27	29 29	29 29	29 29	24 24	28 28															733 690																			
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D	31 31	30 30	31 31	31 31	31 31	27 27	31 31	31 31	24 24	25 0	28 28	31 31	30 30	29 29	29 28	31 31	30 30	25 25	29 29	29 29	26 26	24 24	30 30	21 21															742 717																		
Ann	190 154	363 342	365 365	341 339	365 363	332 332	335 333	364 363	351 351	359 106	341 340	357 356	362 358	358 349	349 353	353 354	337 337	350 350	316 315	354 354	347 347	343 341	351 350	328 319	320 152													9037 8709																			
																													1945	1950	1955	1960	1965	1970	1975	1980																					Sum

OWS Study Area K (45.0°N, 16.0°W)

Frequency of Surface Observations

Each of the 11 variables was observed on X days of each month.
The upper number is the maximum X from among all the variables.
The lower number is the minimum X from among all the variables.



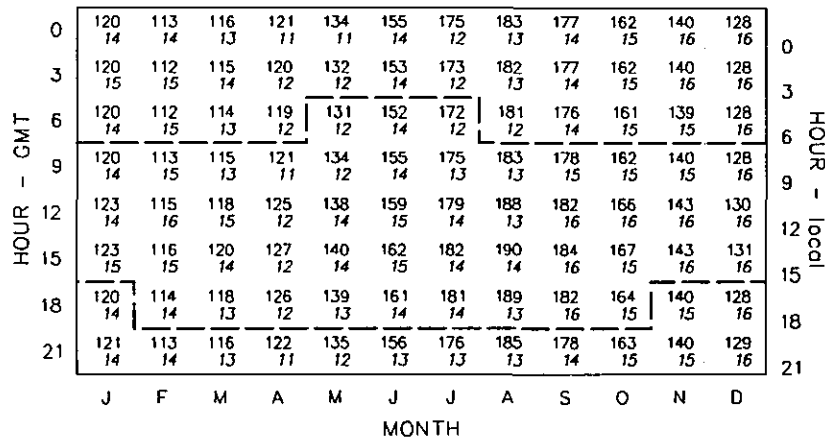
OWS Study Area K Surface Climatology

upper number = mean
lower number = standard deviation

———— data contours
- - - - sunrise/sunset

Air Temperature

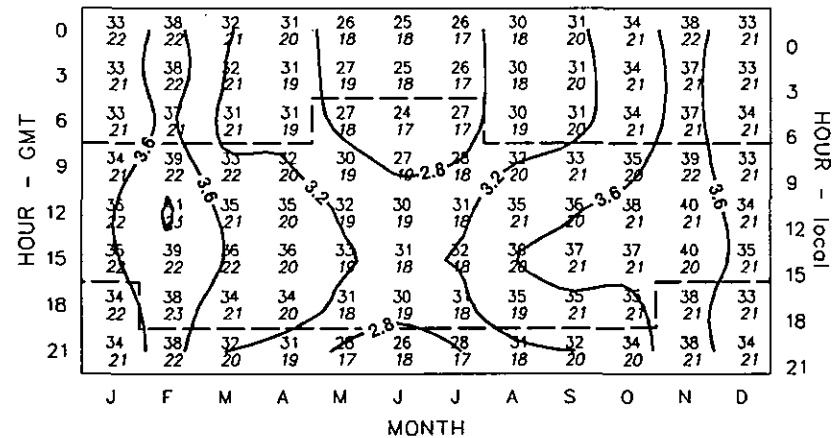
Units = 0.1 °C



Dew Point Depression

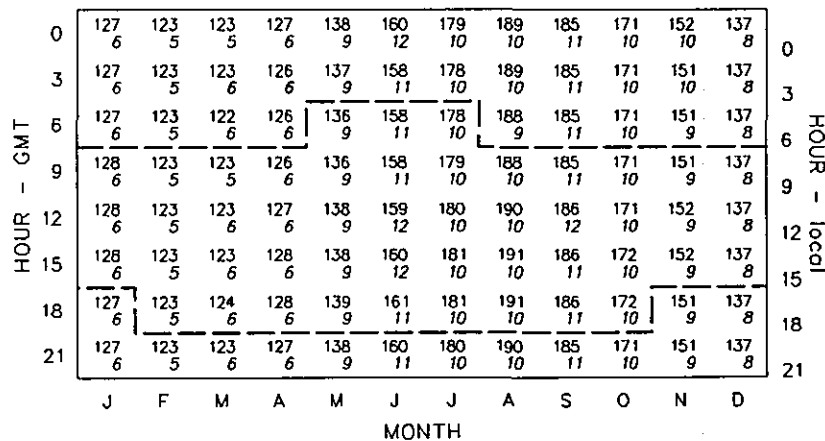
Units = 0.1 °C

Contour interval = 0.4 °C



Sea Surface Temperature

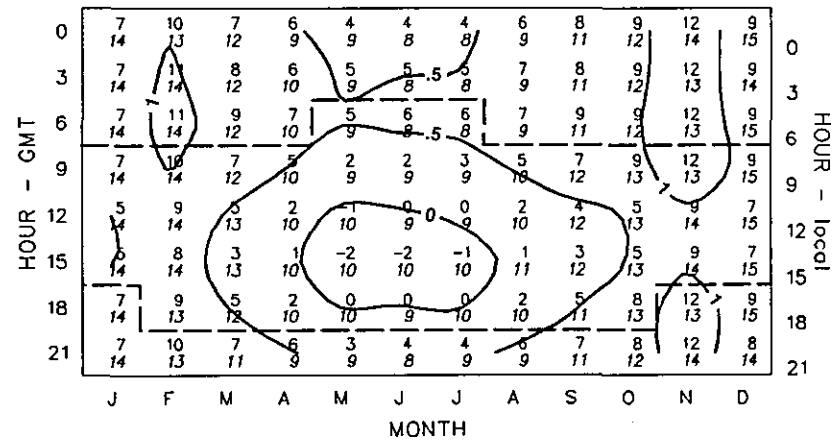
Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C

Contour interval = 0.5 °C



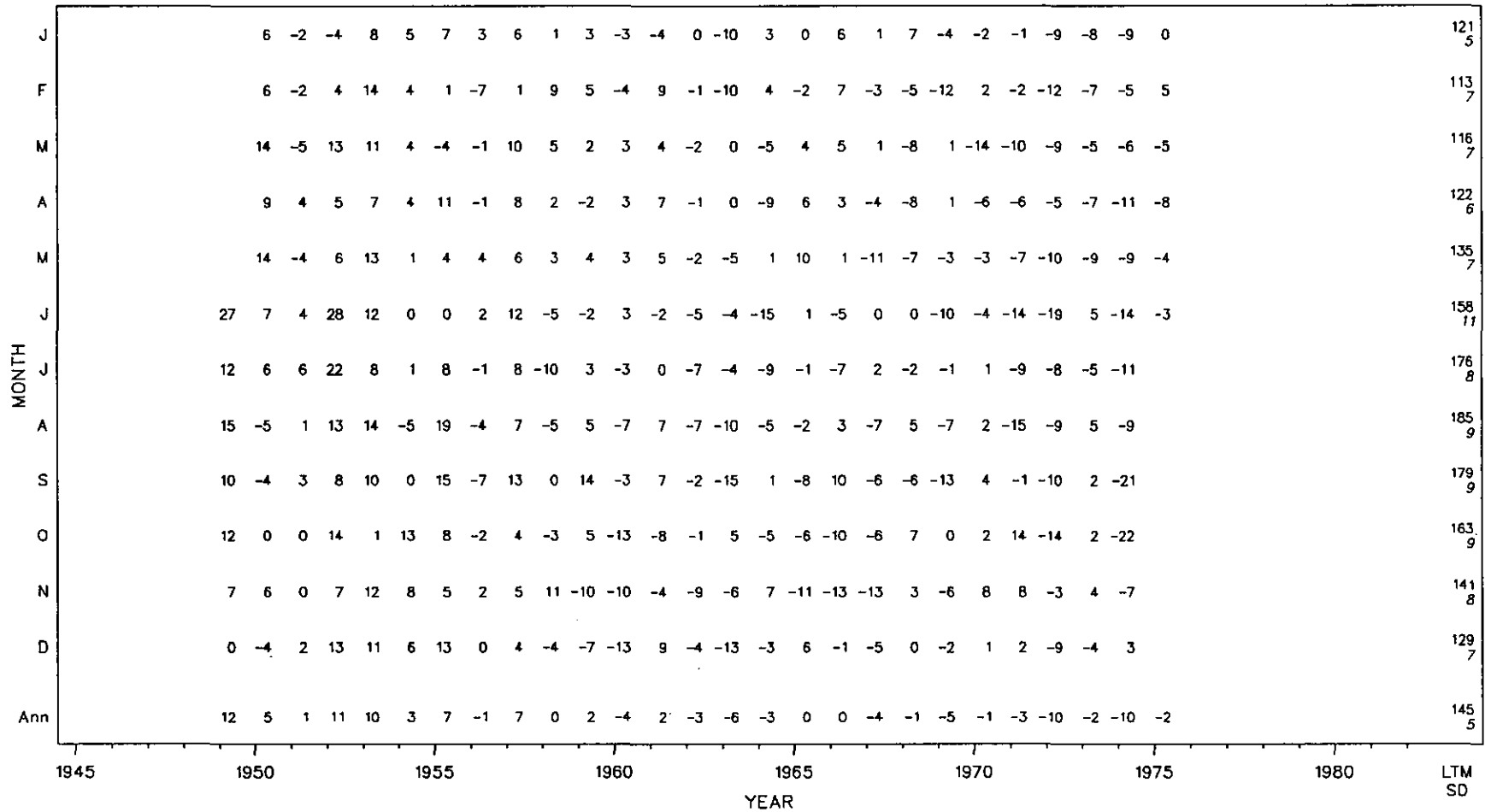
OWS Study Area K Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
--- sunrise/sunset

Surface Air Temperature

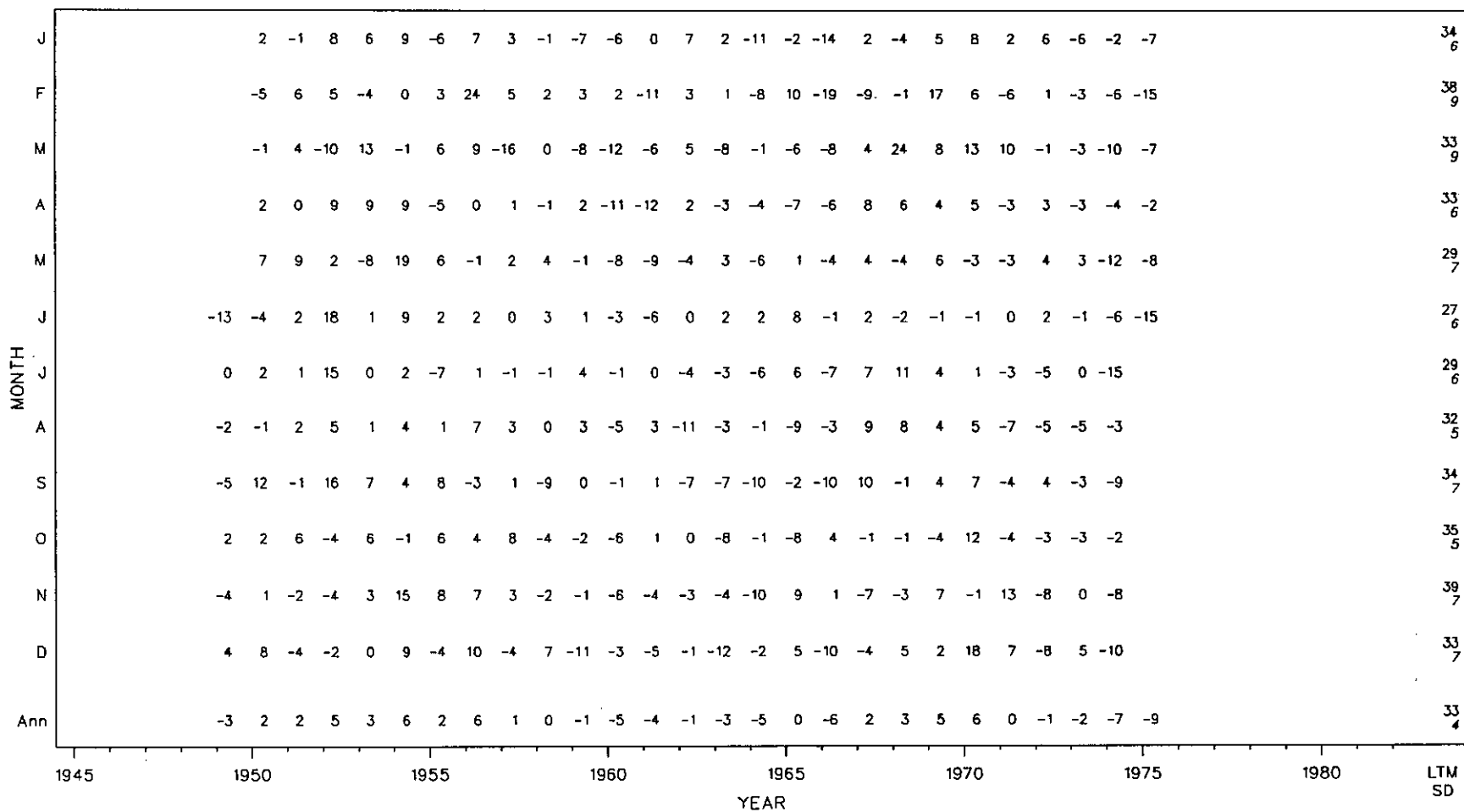
Units = 0.1 °C



OWS Study Area K Anomalies

Surface Dew Point Depression

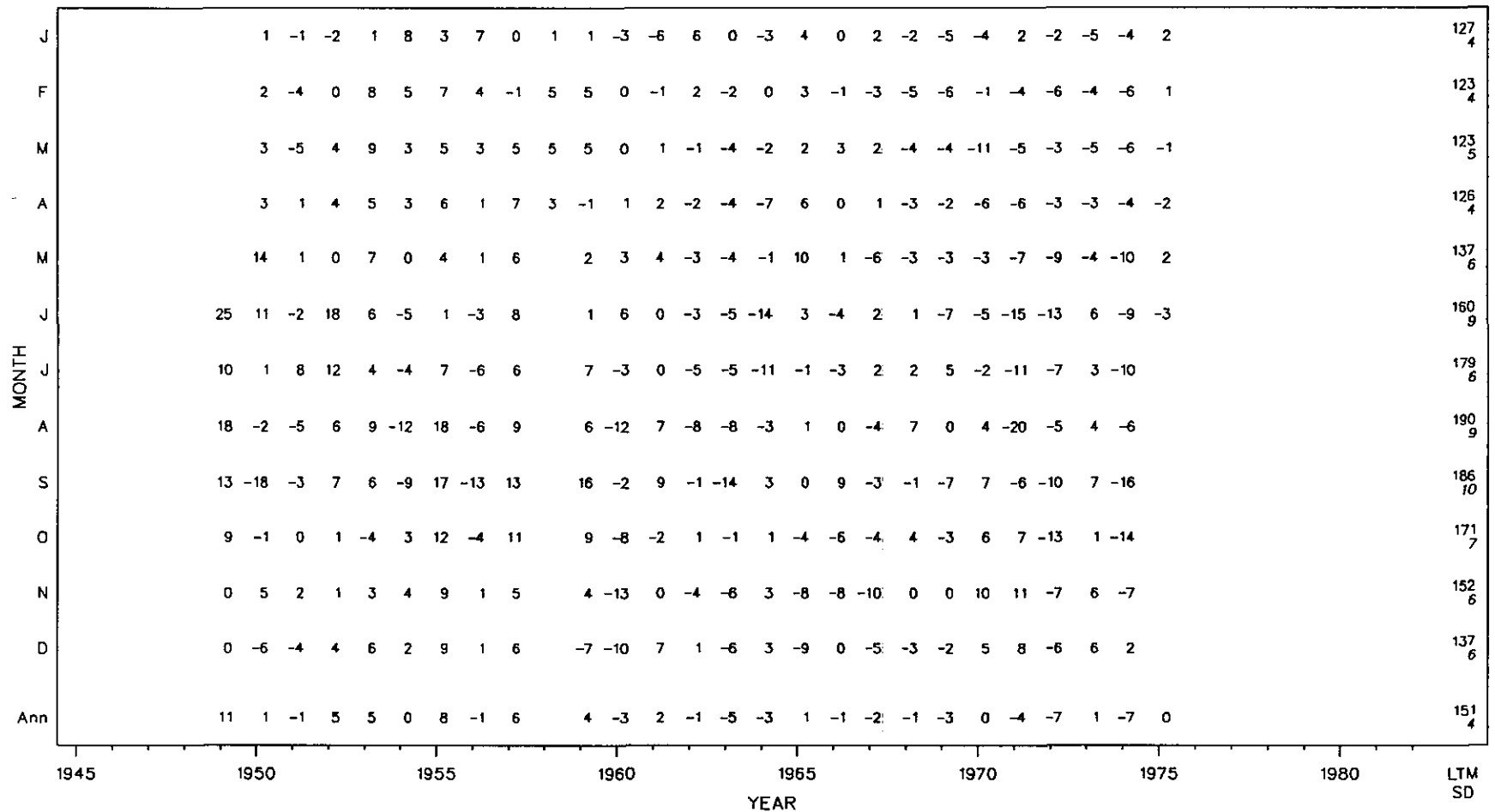
Units = 0.1 °C



OWS Study Area K Anomalies

Sea Surface Temperature

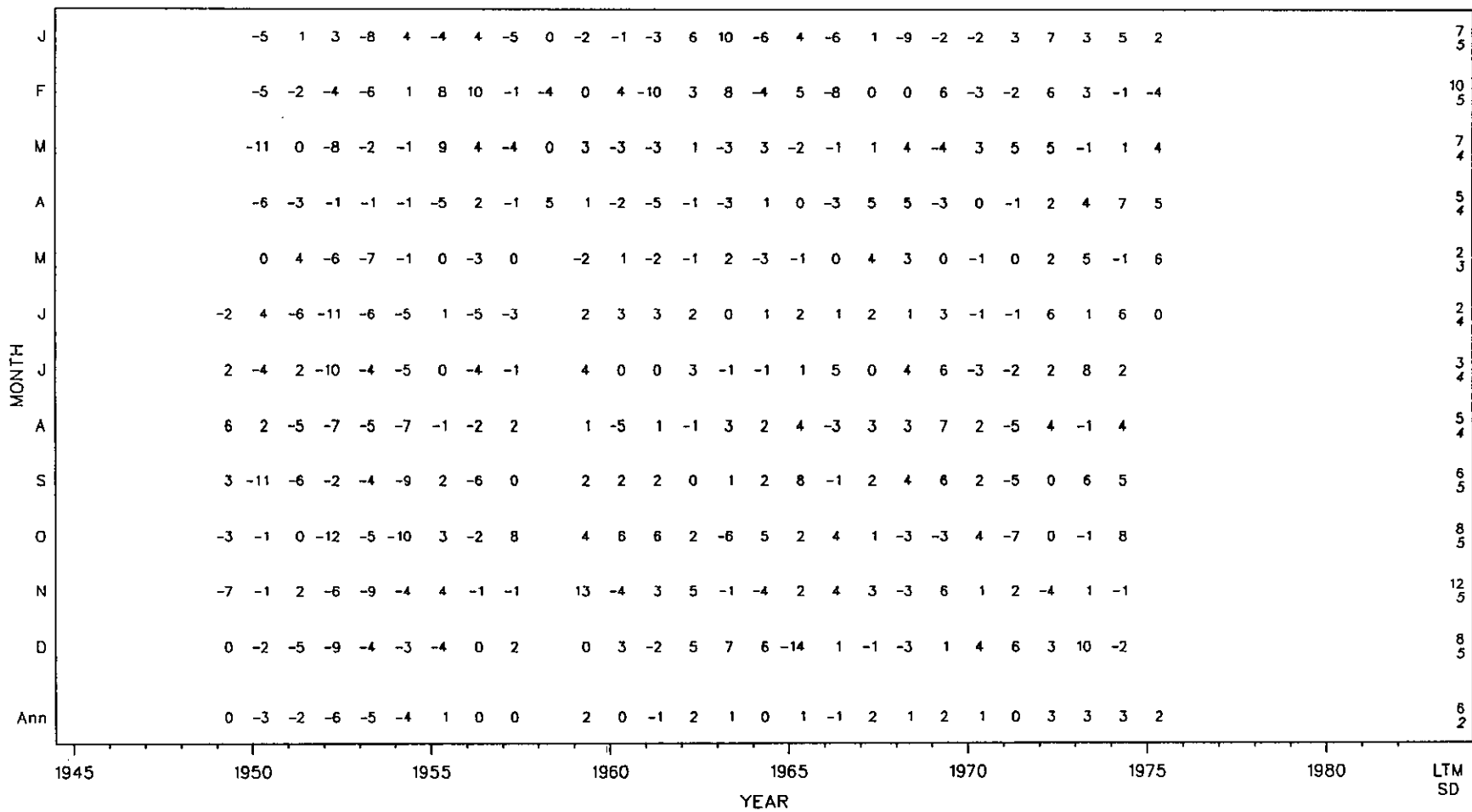
Units = 0.1 °C



OWS Study Area K Anomalies

Sea - Air Temperature Difference

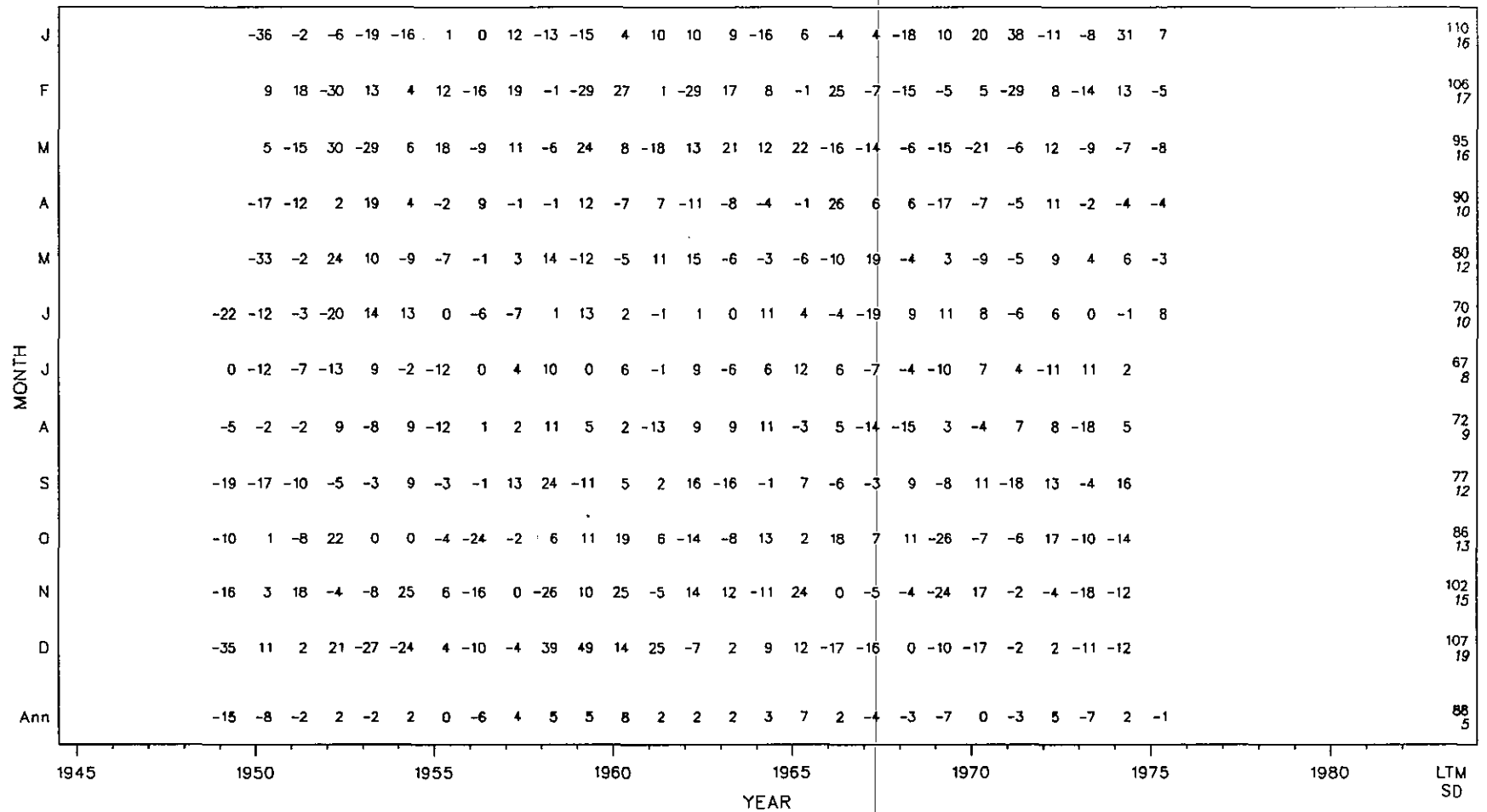
Units = 0.1 °C



OWS Study Area K Anomalies

Surface Scalar Wind

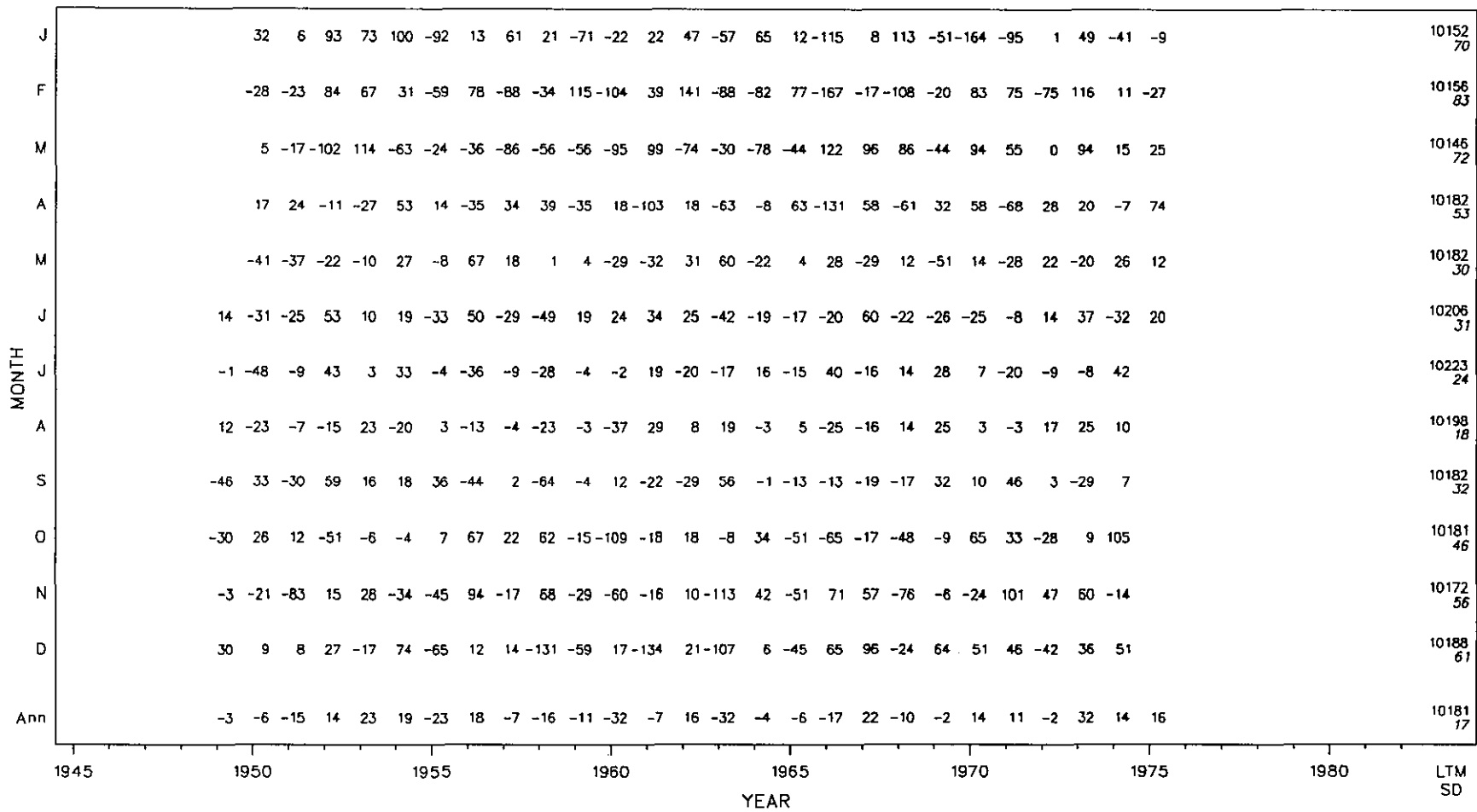
Units = 0.1 m/s



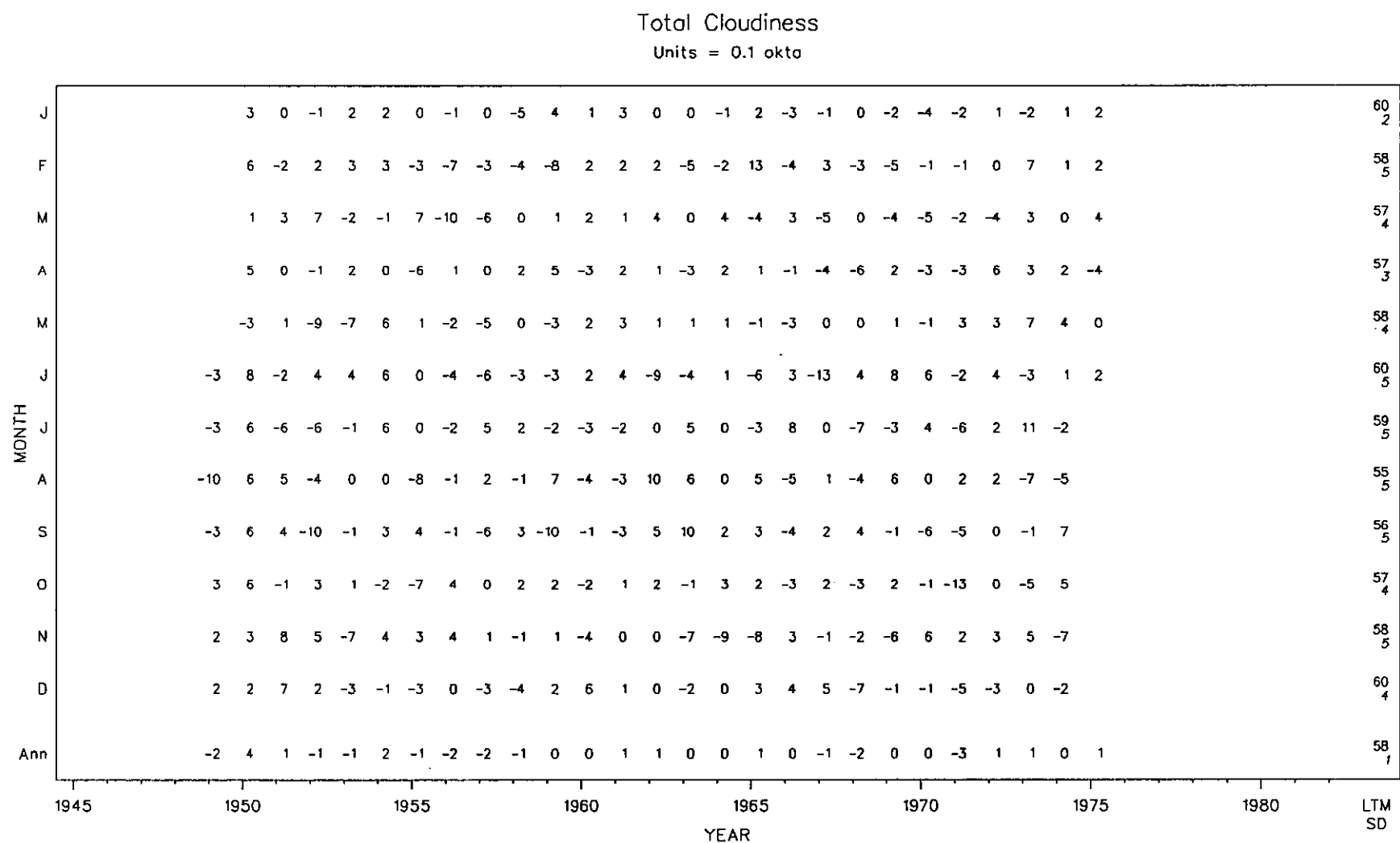
OWS Study Area K Anomalies

Sea Level Pressure

Units = 0.1 mb



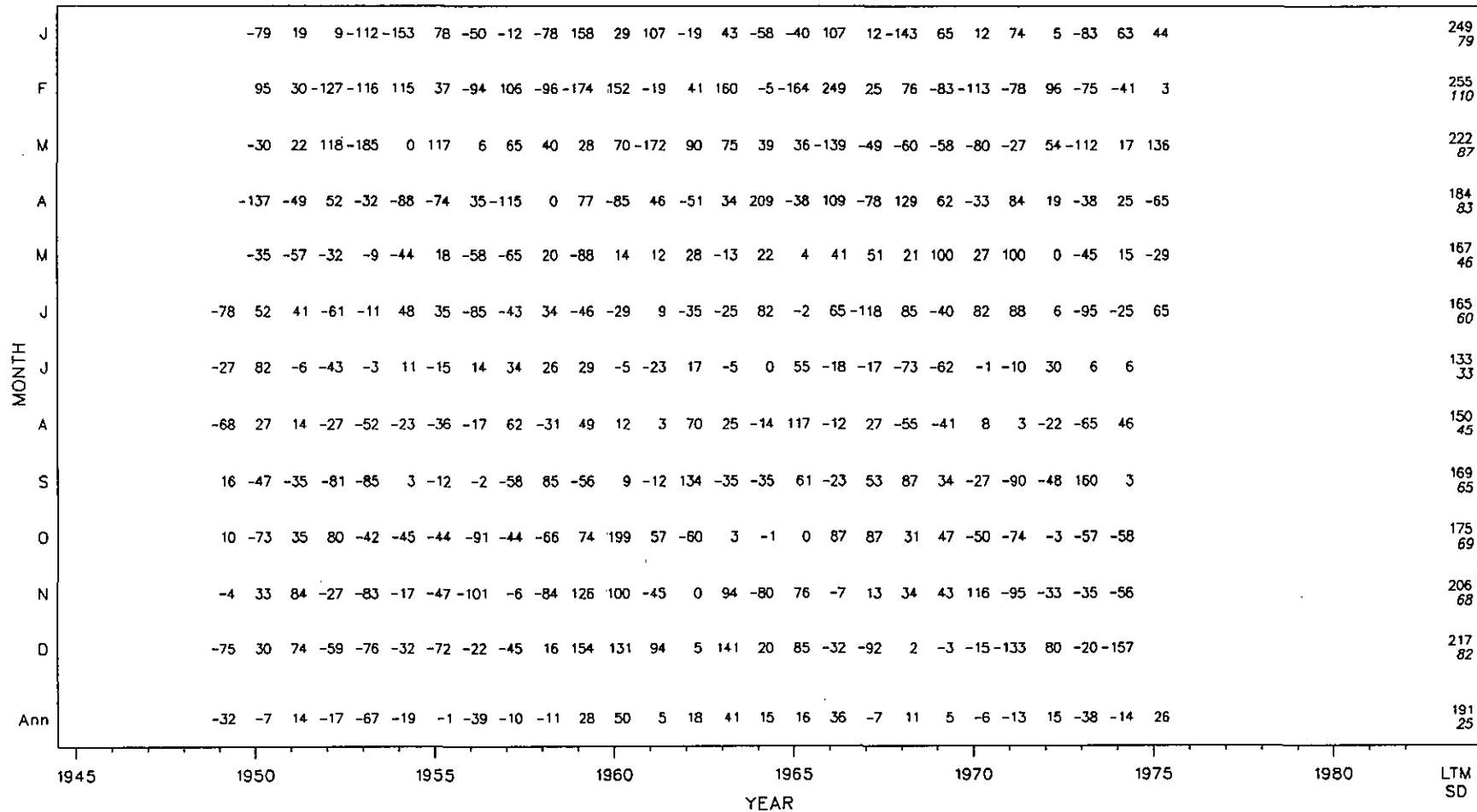
OWS Study Area K Anomalies



OWS Study Area K Anomalies

Precipitation Frequency

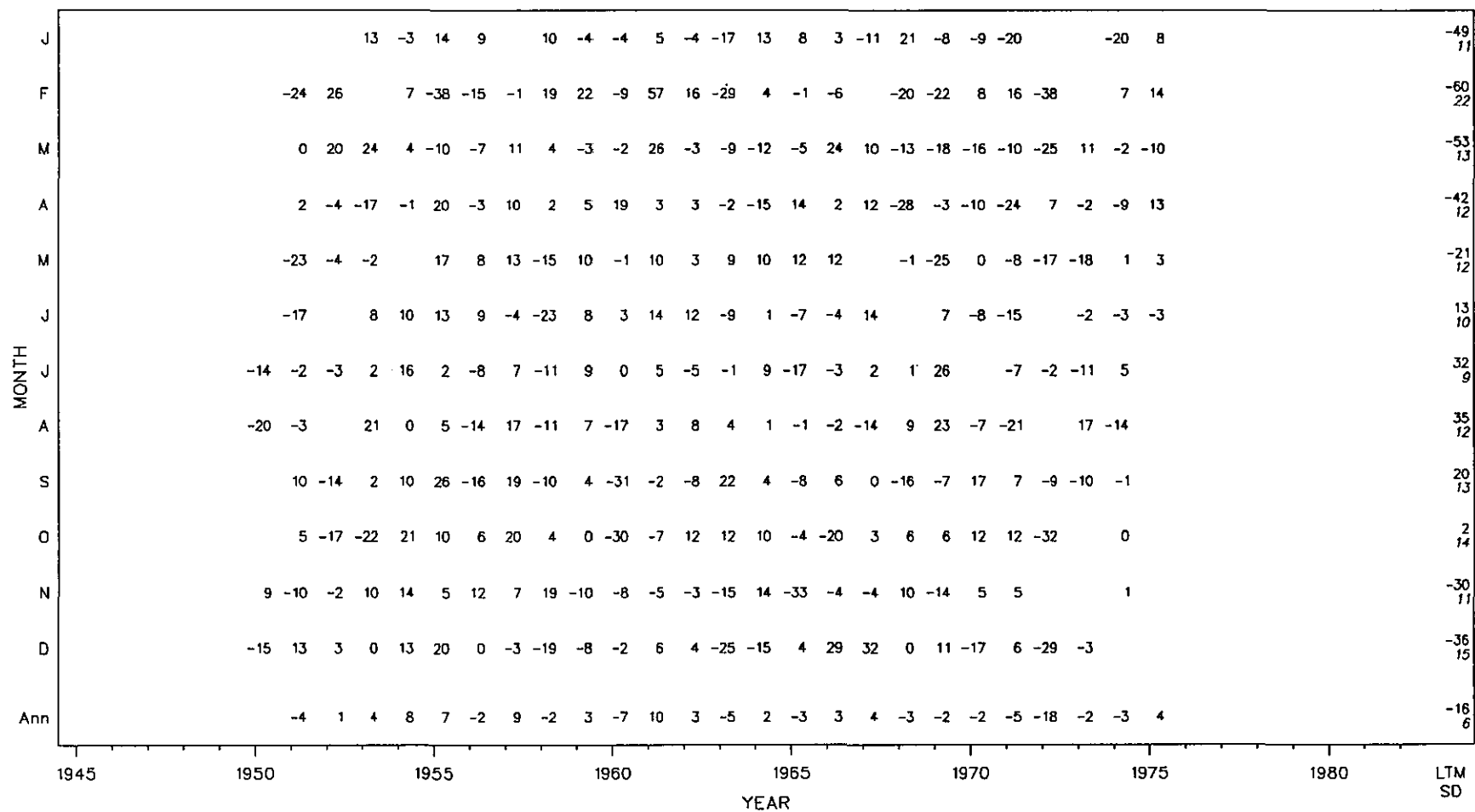
Units = 0.1 percent



OWS Study Area K Anomalies

Air Temperature: 700 mb

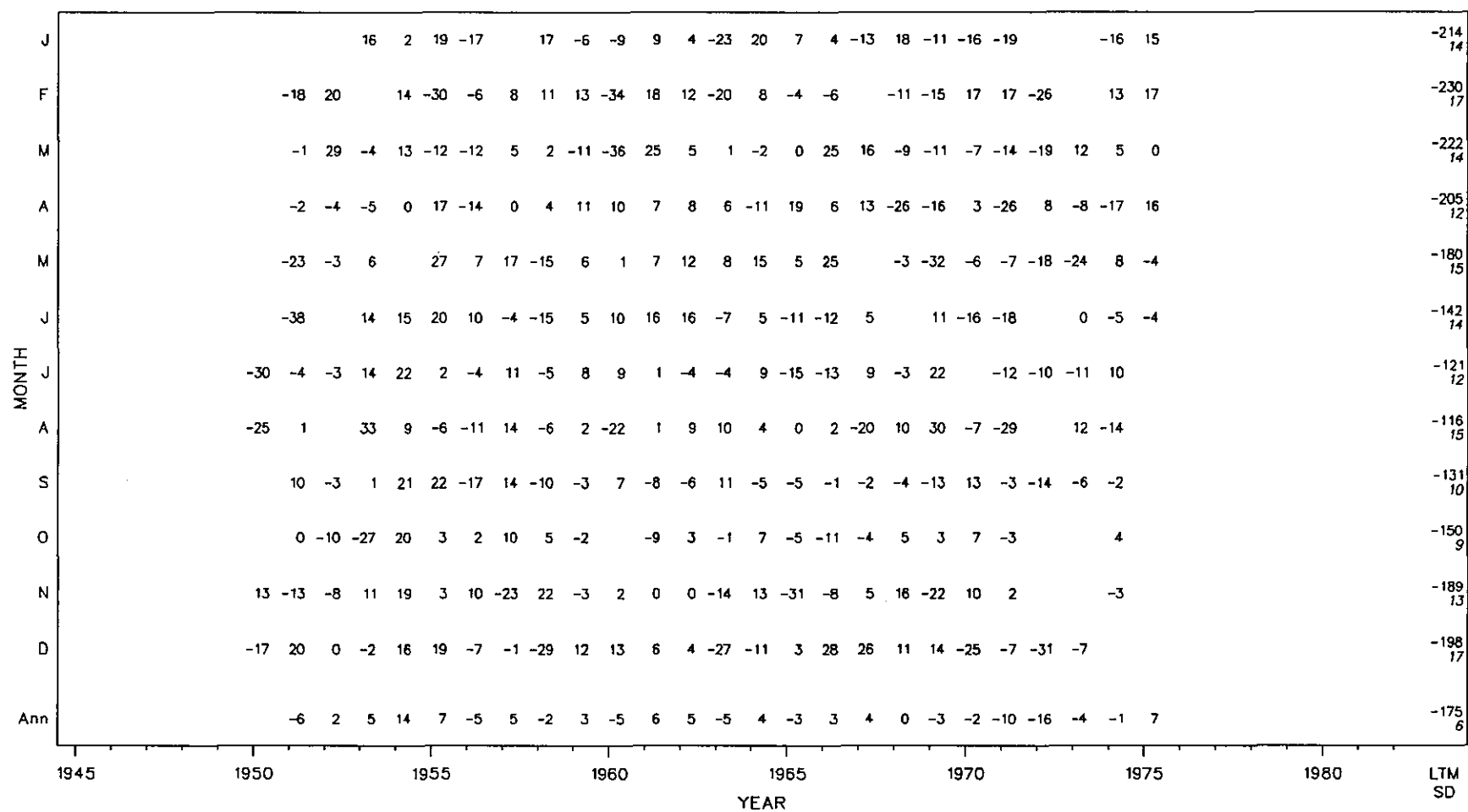
Units = 0.1 °C



OWS Study Area K Anomalies

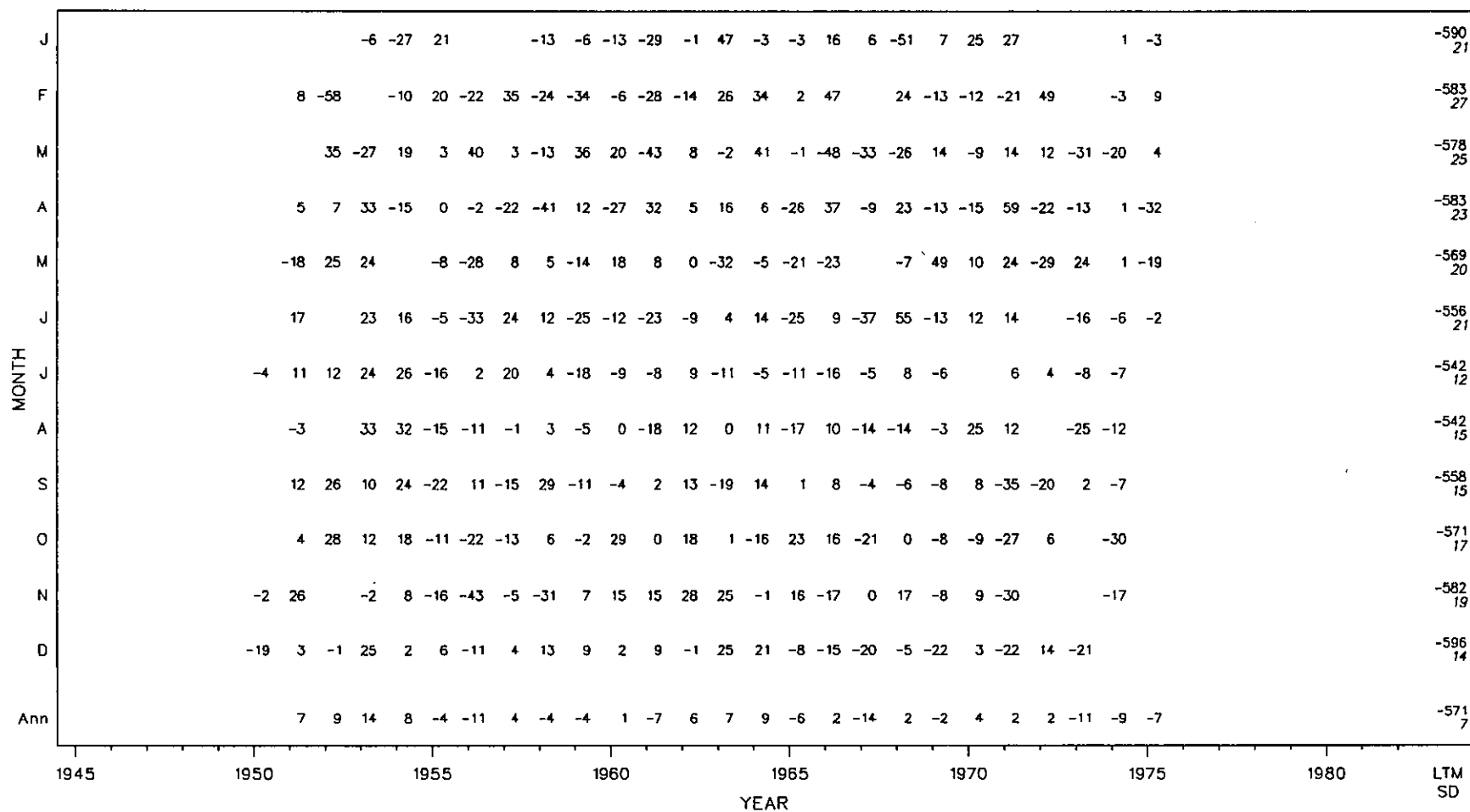
Air Temperature: 500 mb

Units = 0.1 °C



OWS Study Area K Anomalies

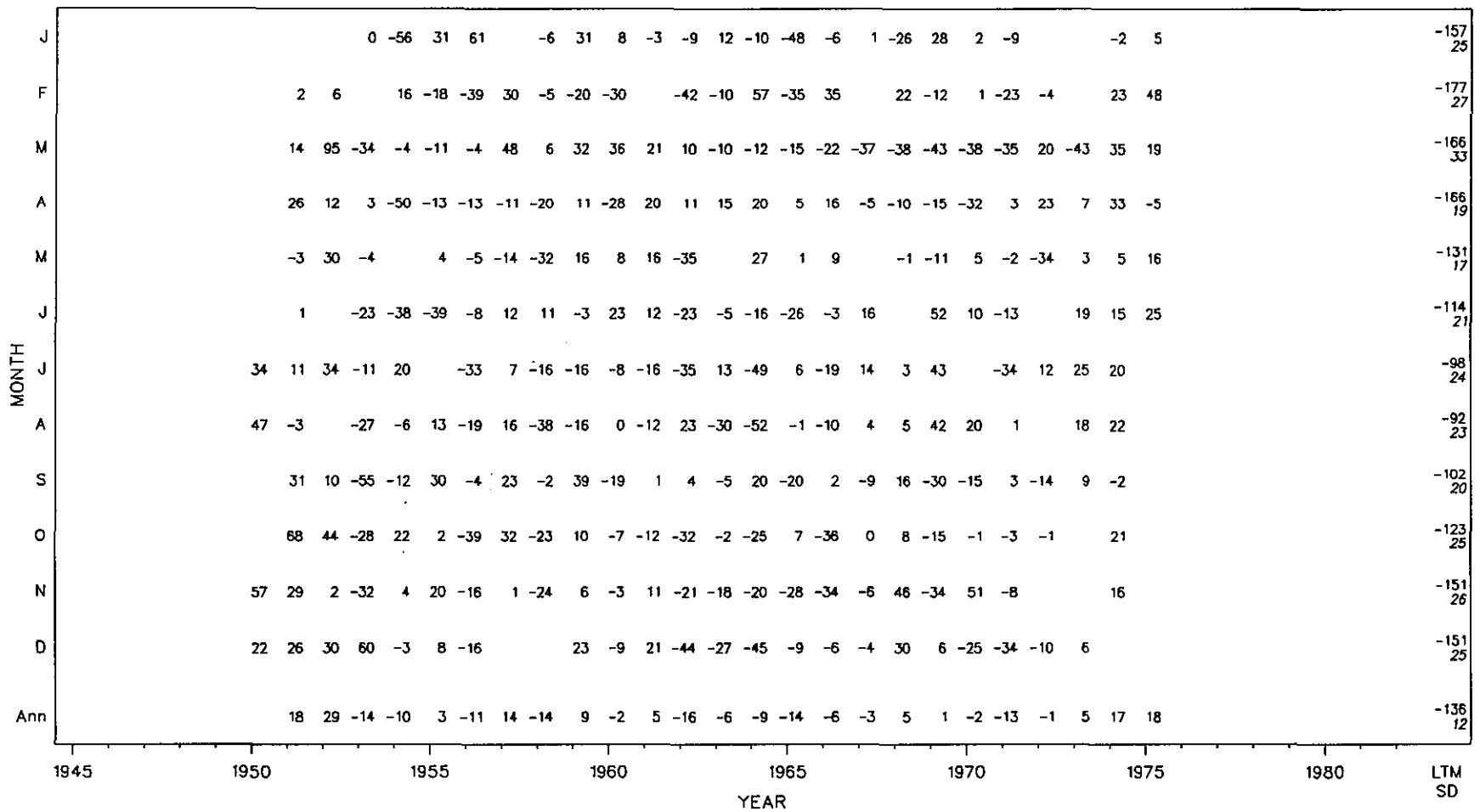
Units = 0.1 °C



OWS Study Area K Anomalies

Dew Point Temperature: 700 mb

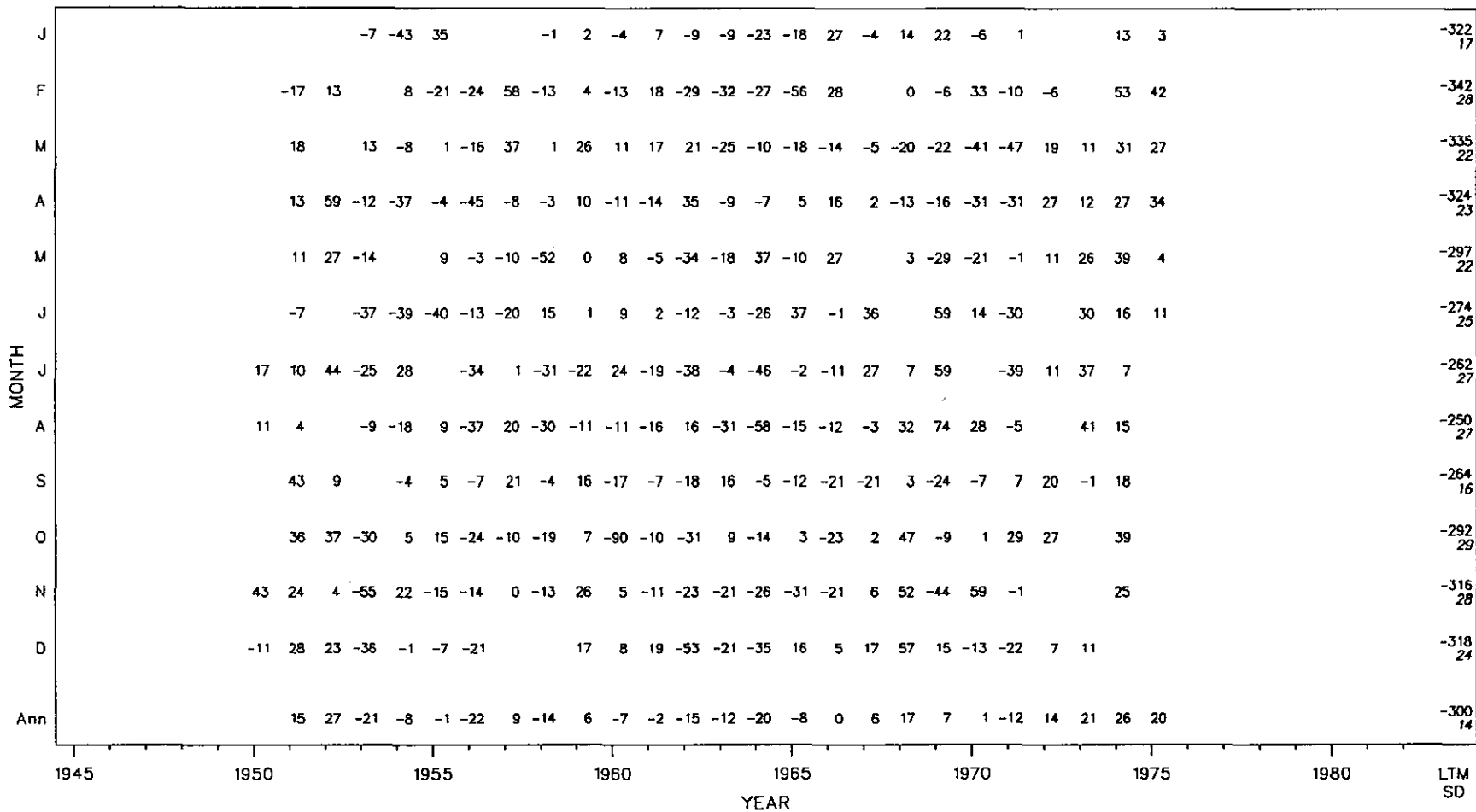
Units = 0.1 °C



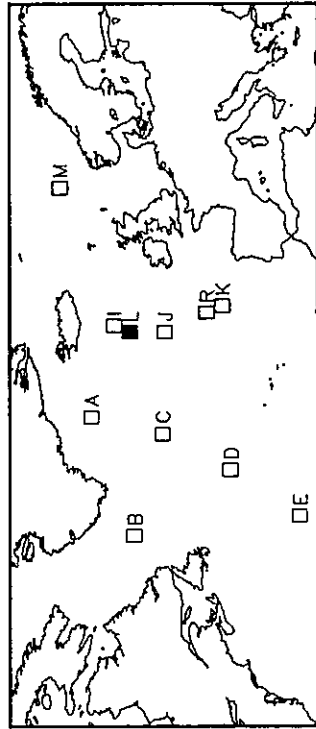
OWS Study Area K Anomalies

Dew Point Temperature: 500 mb

Units = 0.1 °C

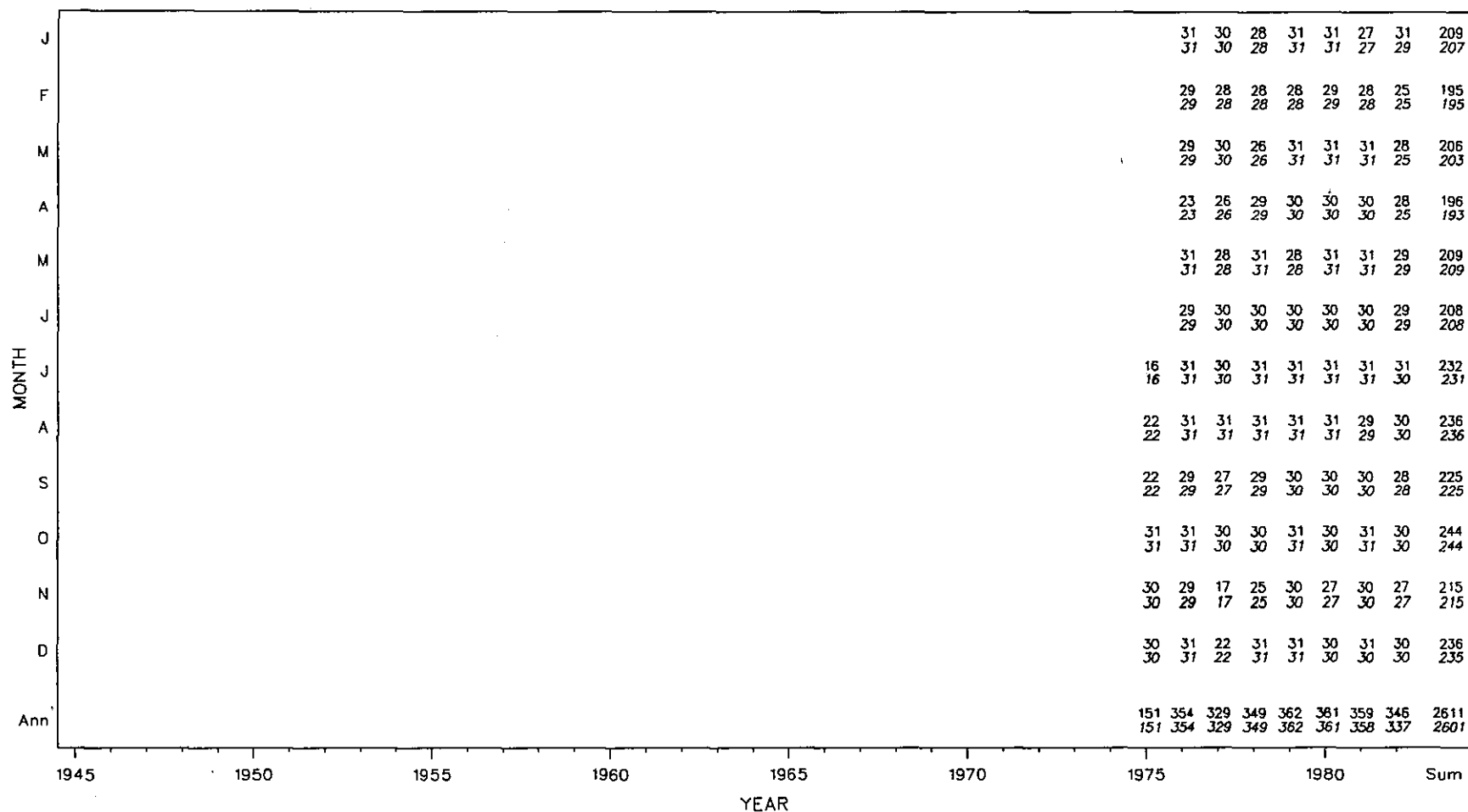


OWS Study Area K Anomalies



56.0°N – 57.9°N, 20.9°W – 19.0°W
1975 – 1982

OWS
L

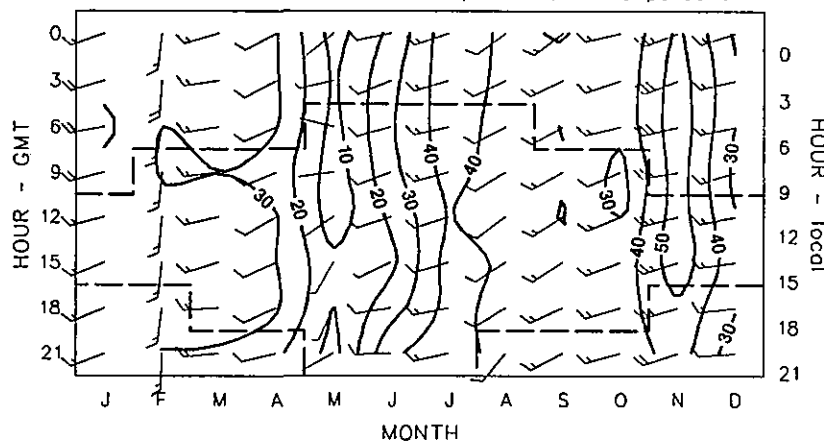


OWS Study Area L (57.0°N, 20.0°W) Frequency of Surface Observations

Each of the 11 variables was observed on X days of each month.
The upper number is the maximum X from among all the variables.
The lower number is the minimum X from among all the variables.

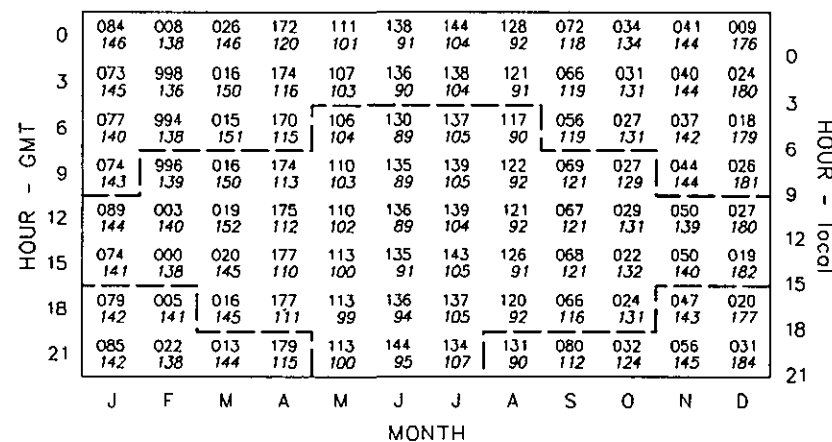
Wind

Full barb = 5 knots, pennant = 25 knots
Contours are Wind Steadiness, interval = 10 percent



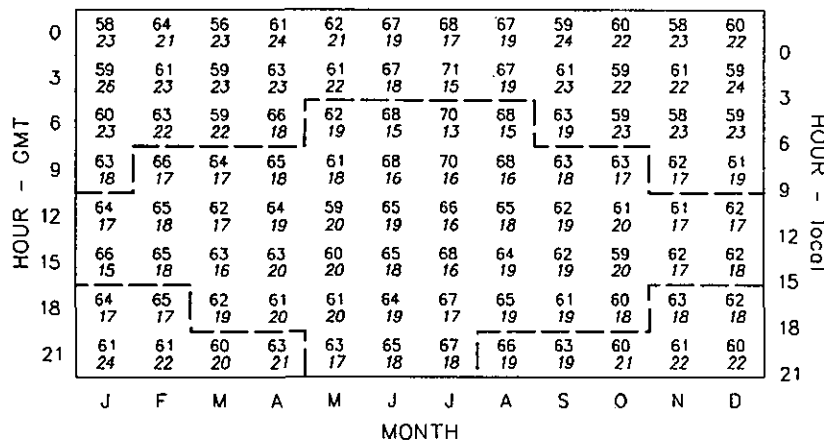
Pressure

Units = 0.1 mb



Total Cloudiness

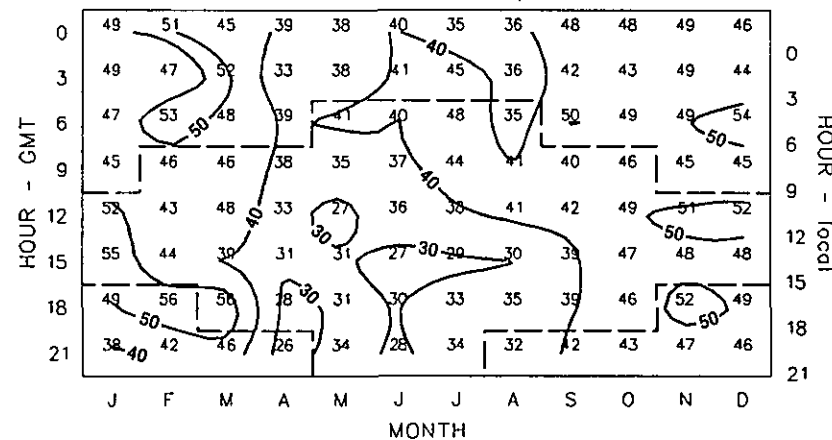
Units = 0.1 okta



Precipitation Frequency

Units = percent

Contour interval = 10 percent



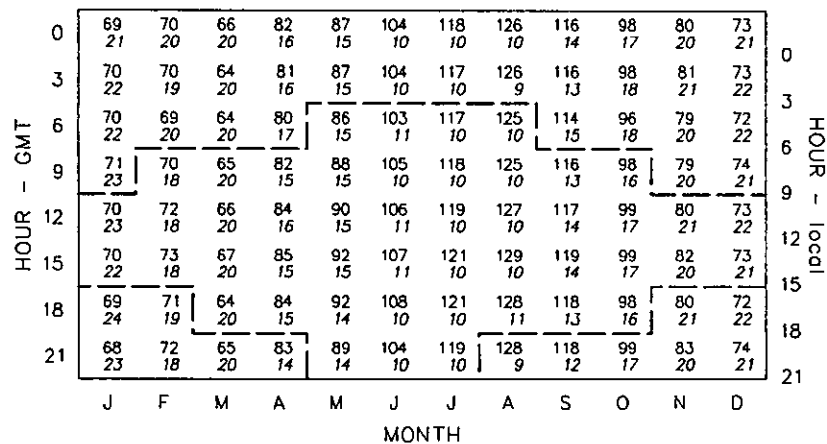
OWS Study Area L Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
--- sunrise/sunset

Air Temperature

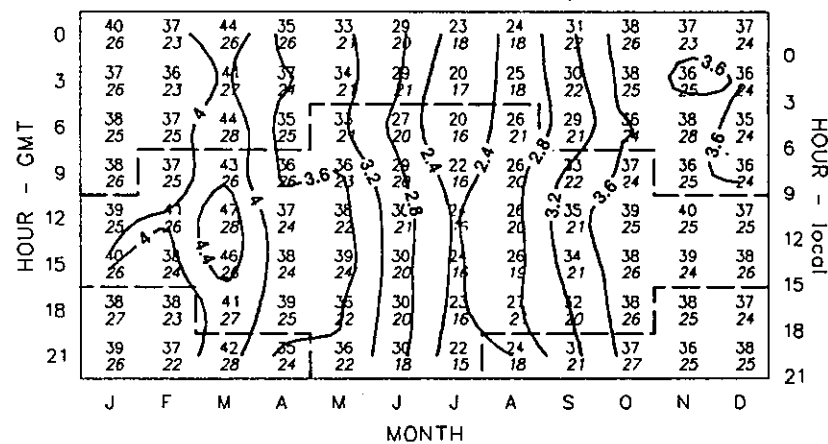
Units = 0.1 °C



Dew Point Depression

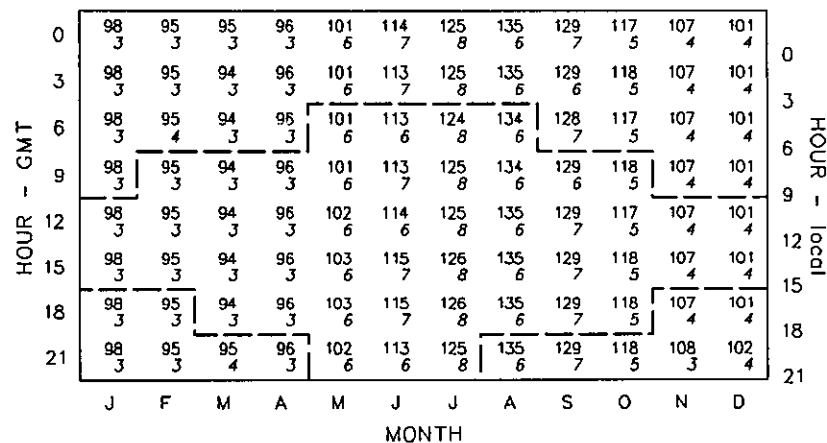
Units = 0.1 °C

Contour interval = 0.4 °C



Sea Surface Temperature

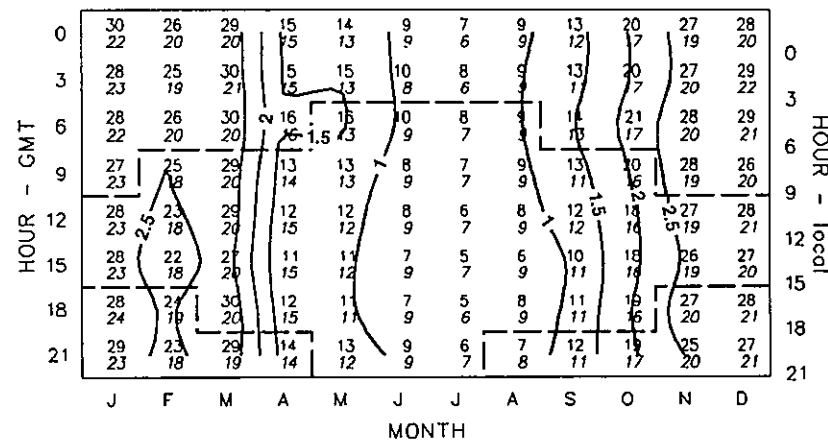
Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C

Contour interval = 0.5 °C



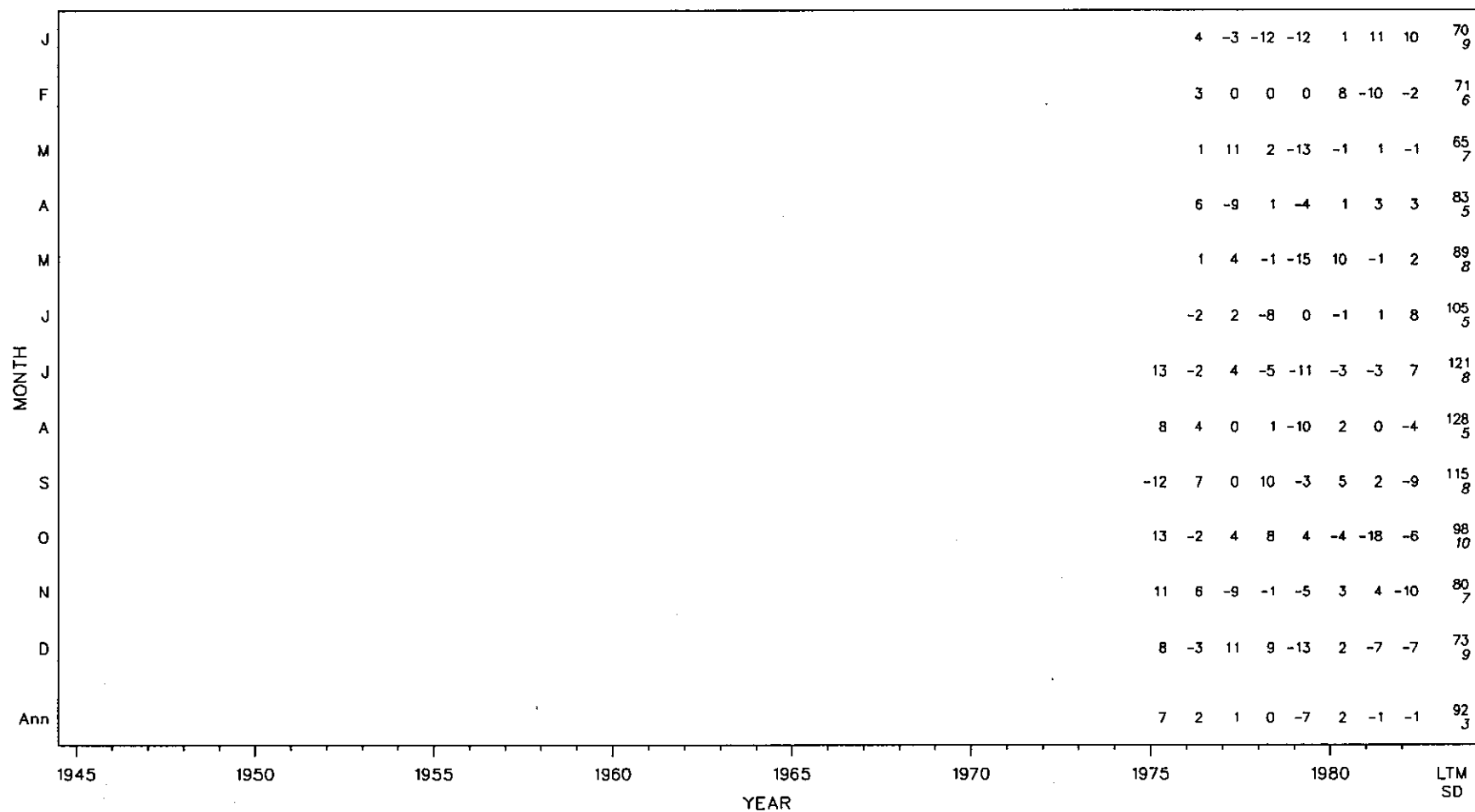
OWS Study Area L Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
--- sunrise/sunset

Surface Air Temperature

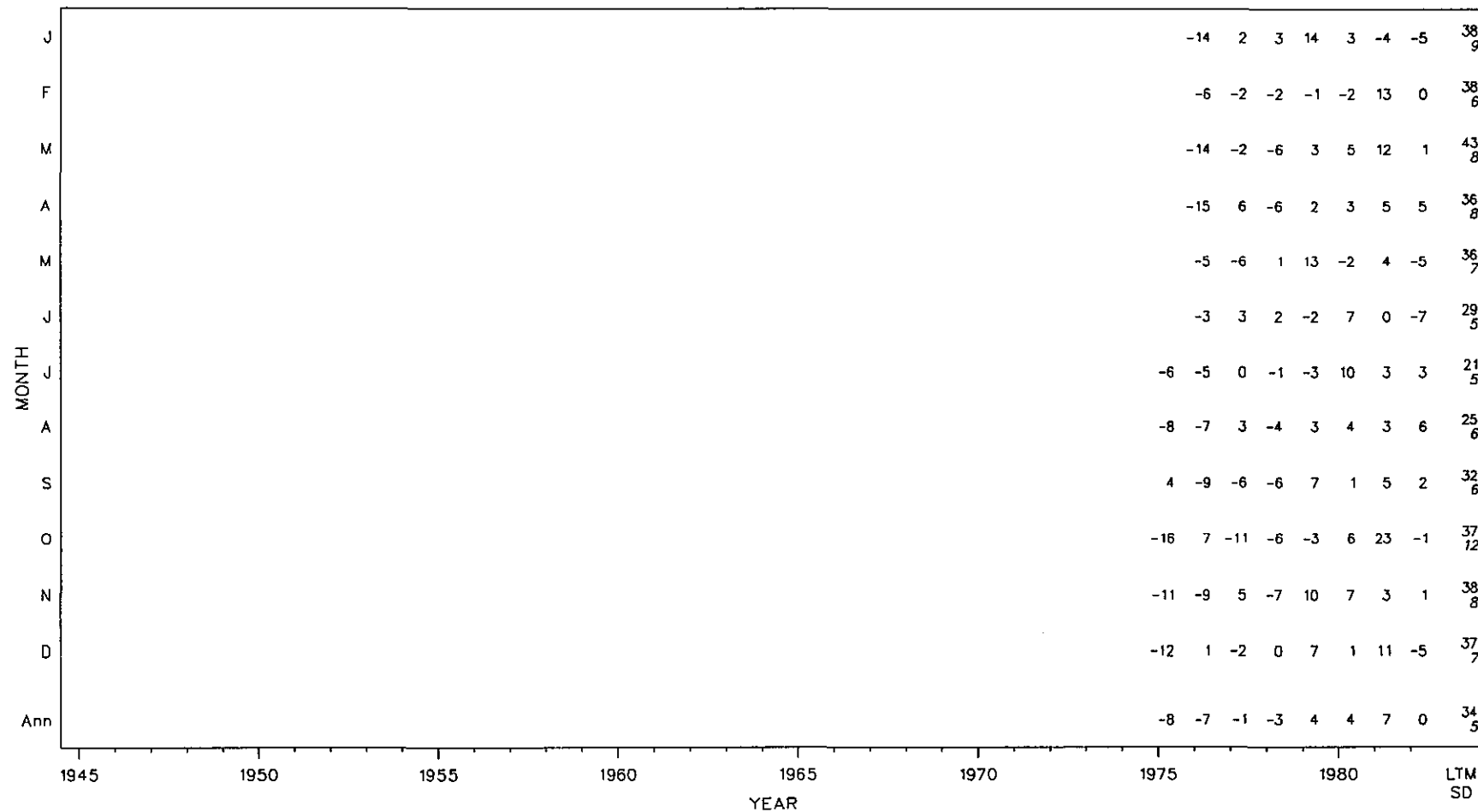
Units = 0.1 °C



OWS Study Area L Anomalies

Surface Dew Point Depression

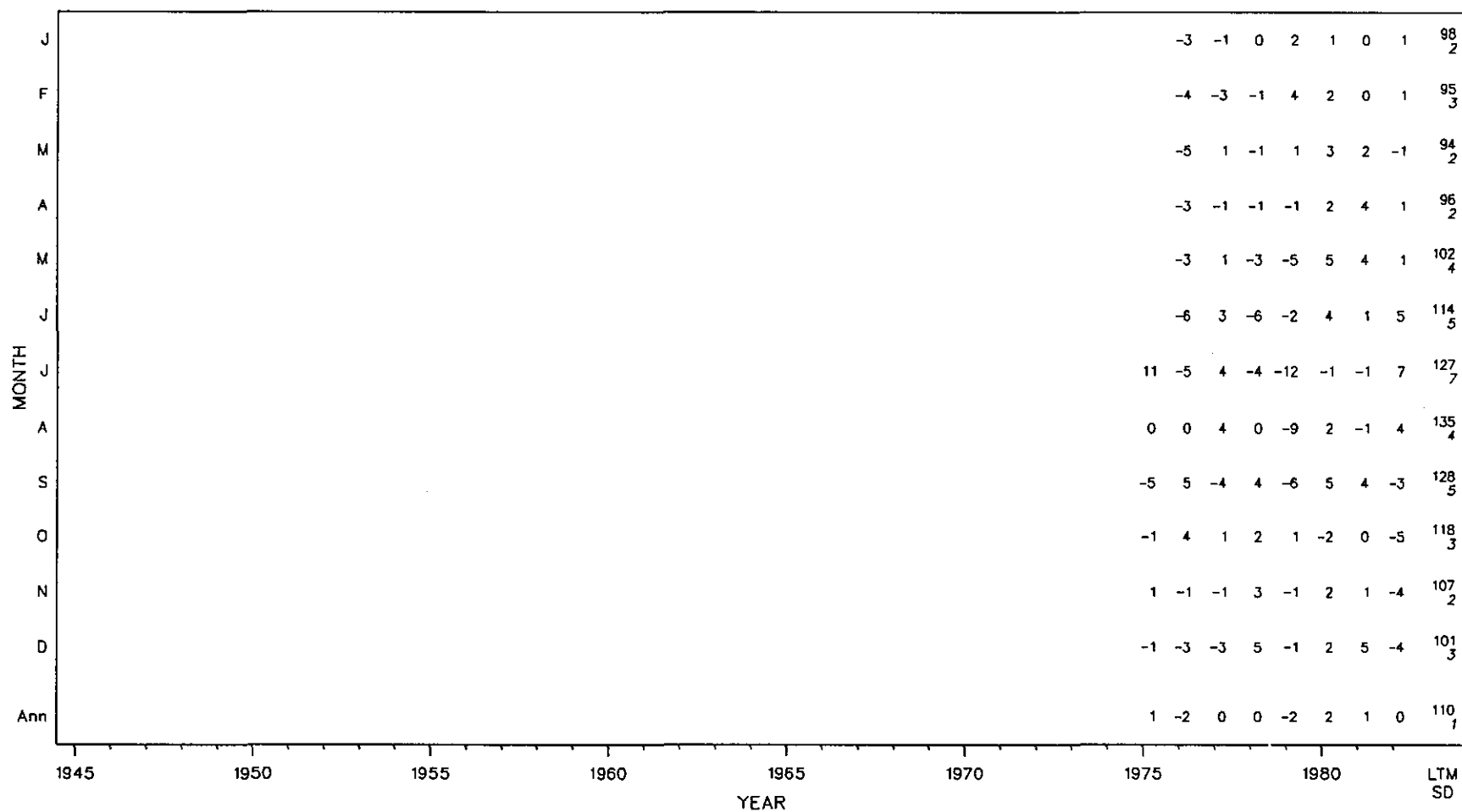
Units = 0.1 °C



OWS Study Area L Anomalies

Sea Surface Temperature

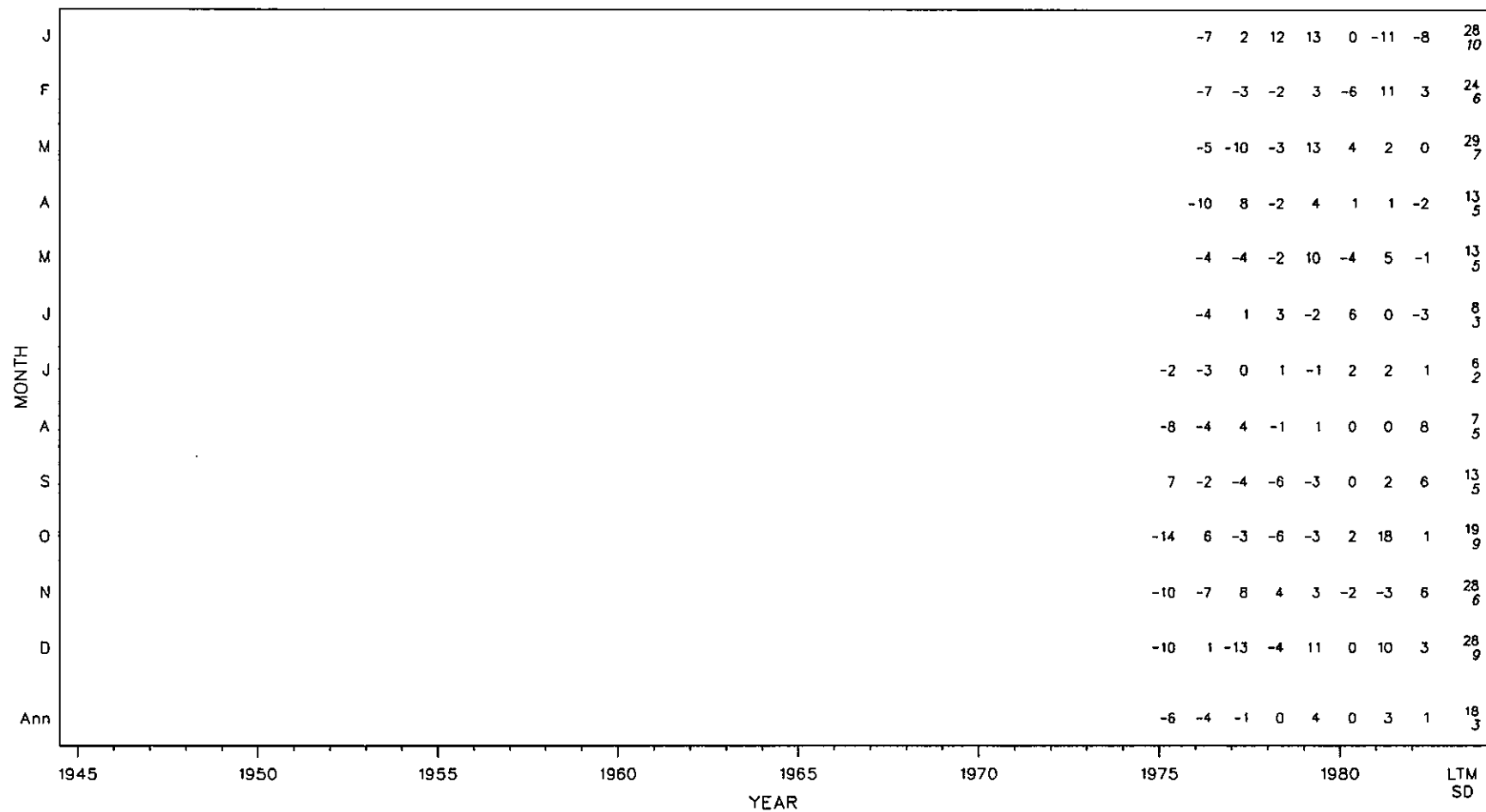
Units = 0.1 °C



OWS Study Area L Anomalies

Sea - Air Temperature Difference

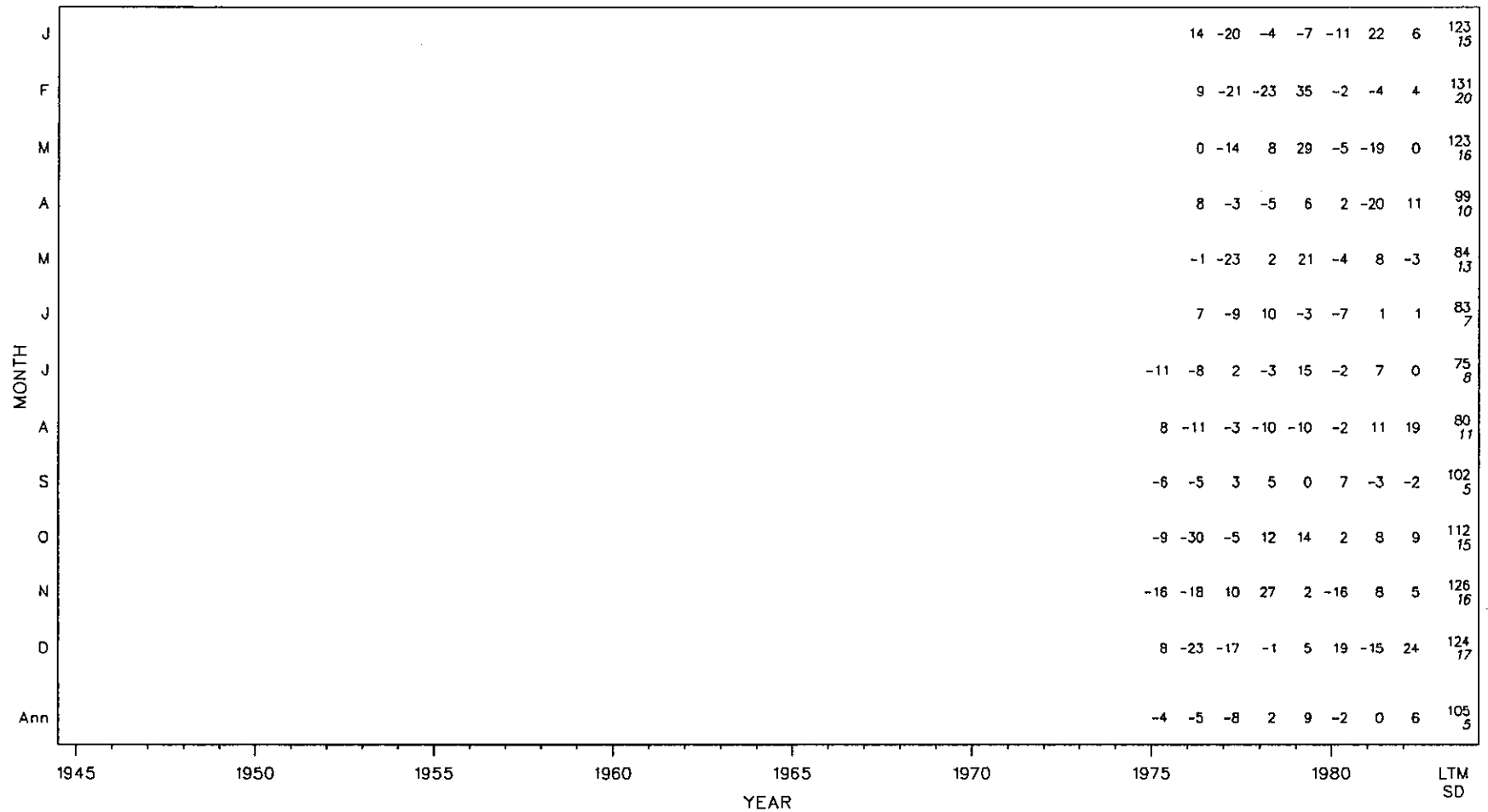
Units = 0.1 °C



OWS Study Area L Anomalies

Surface Scalar Wind

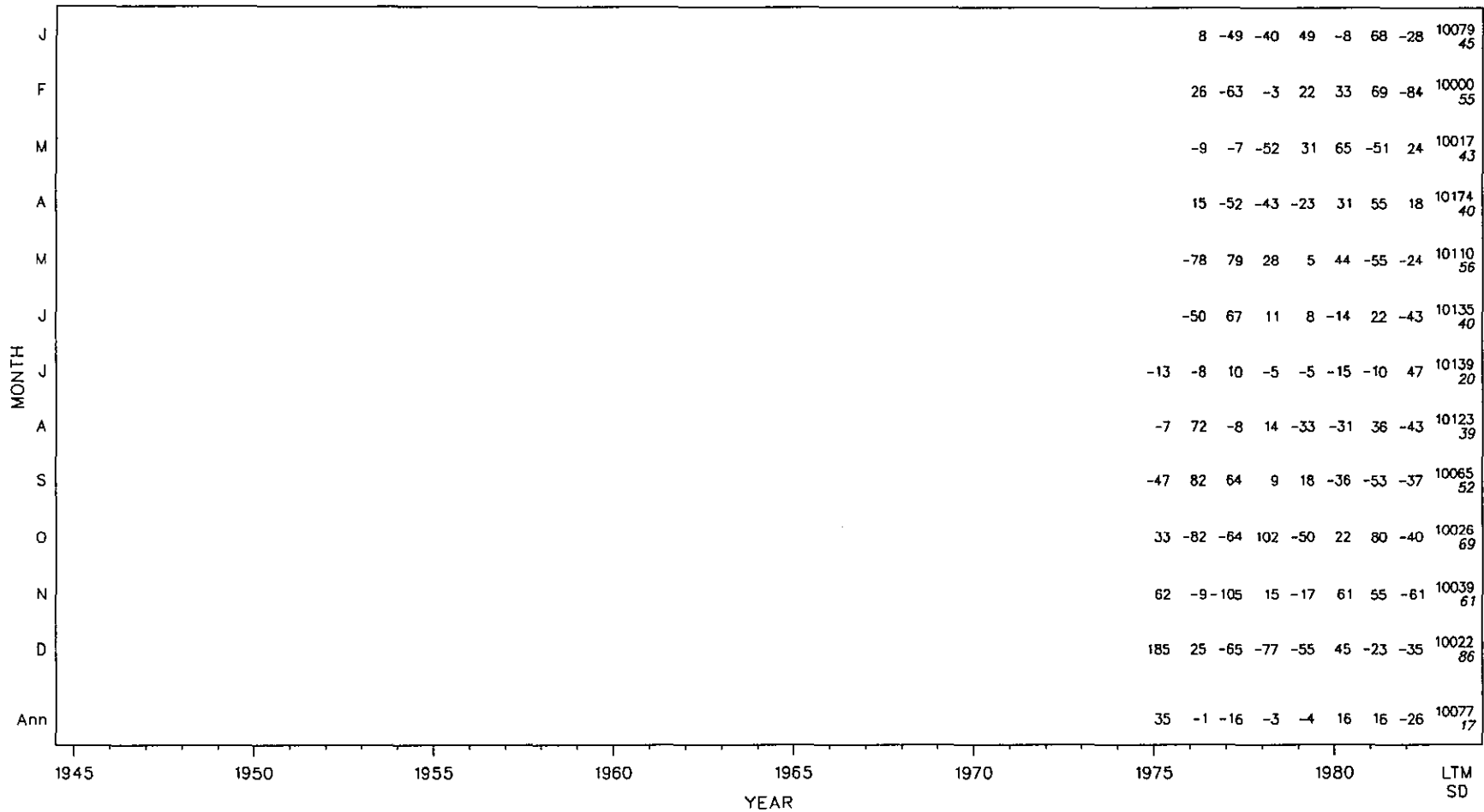
Units = 0.1 m/s



OWS Study Area L Anomalies

Sea Level Pressure

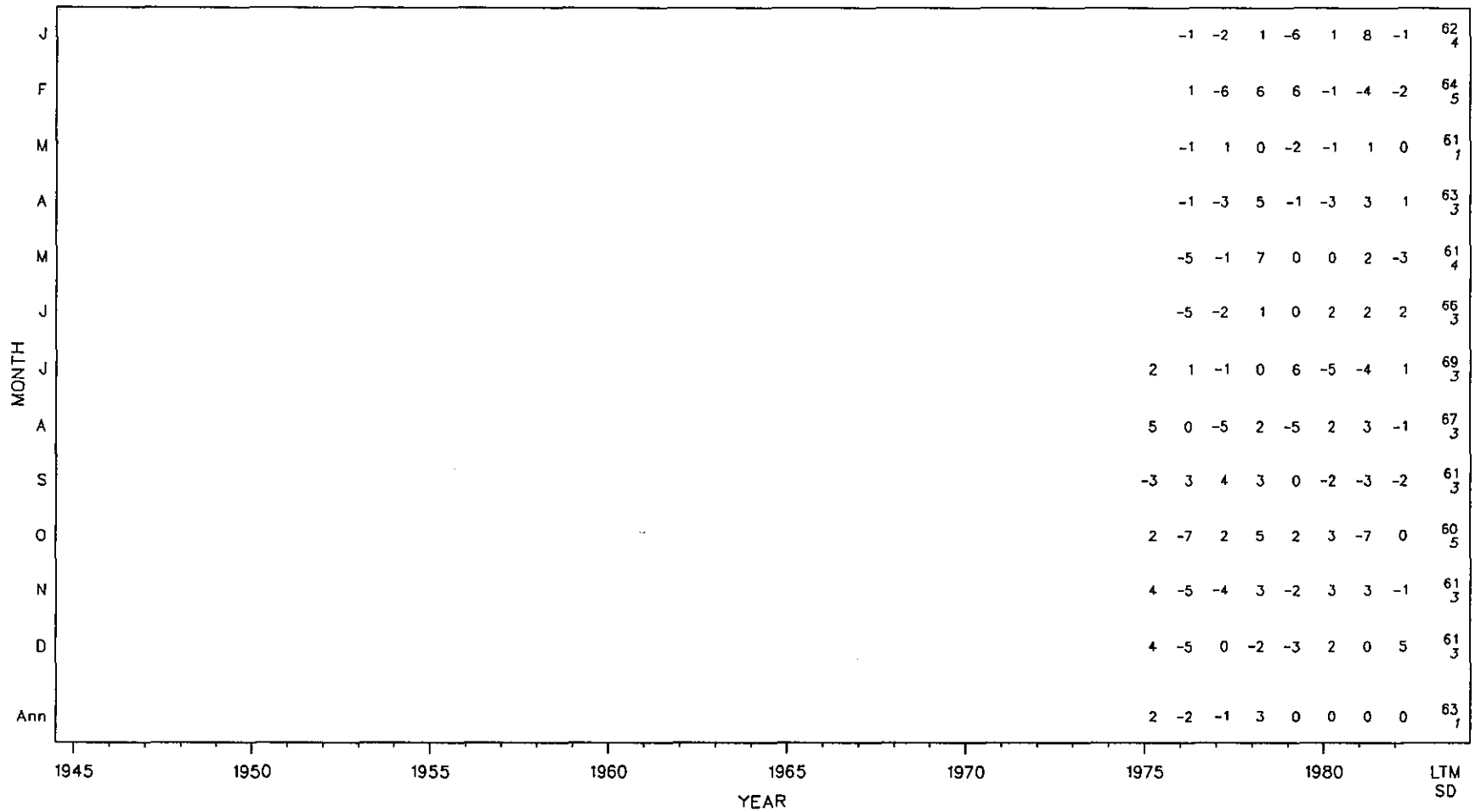
Units = 0.1 mb



OWS Study Area L Anomalies

Total Cloudiness

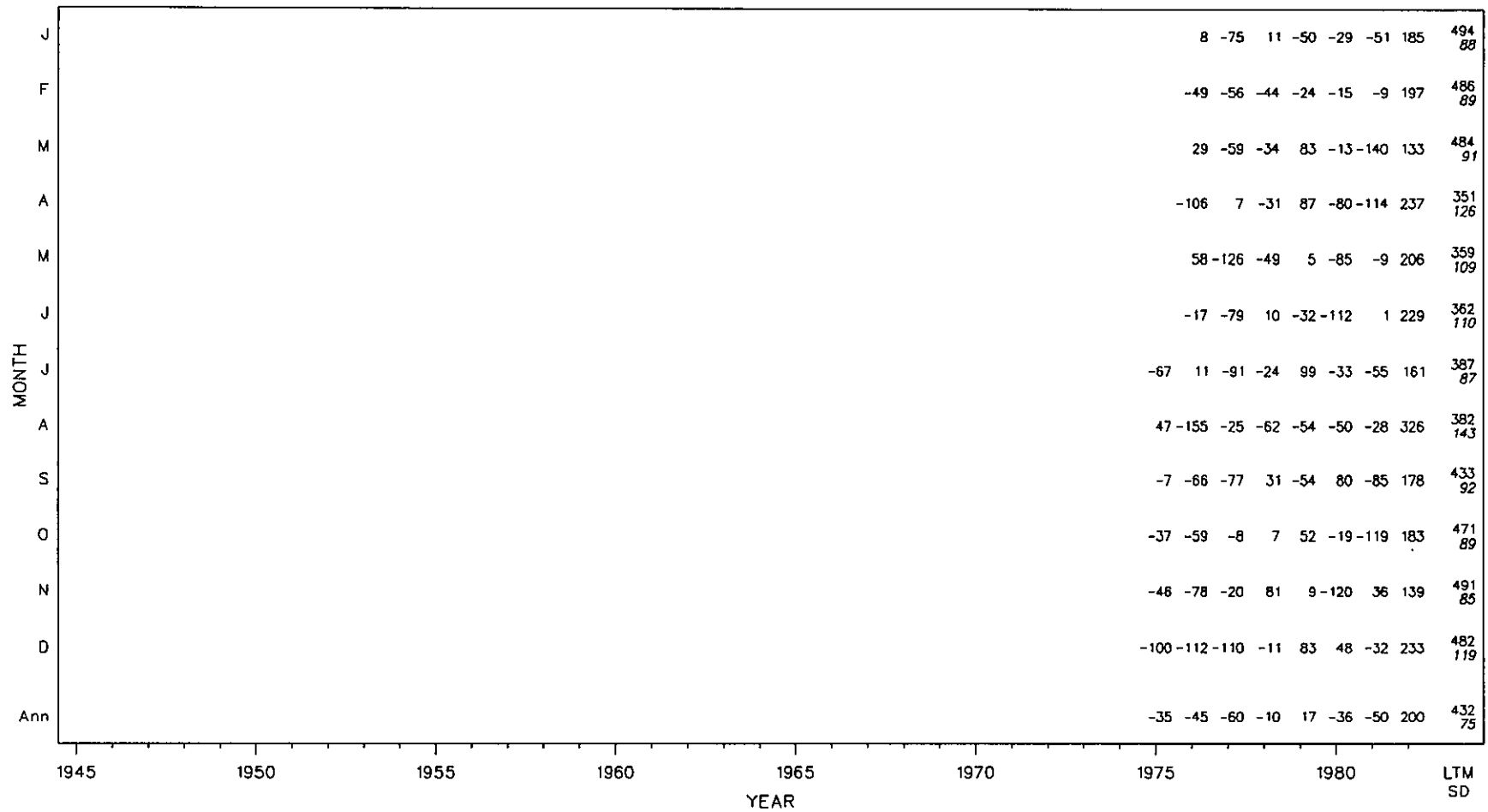
Units = 0.1 okta



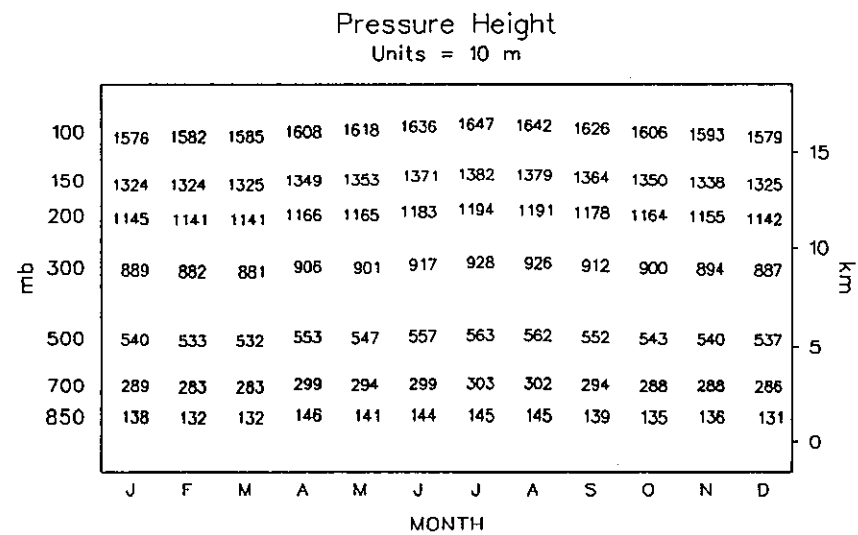
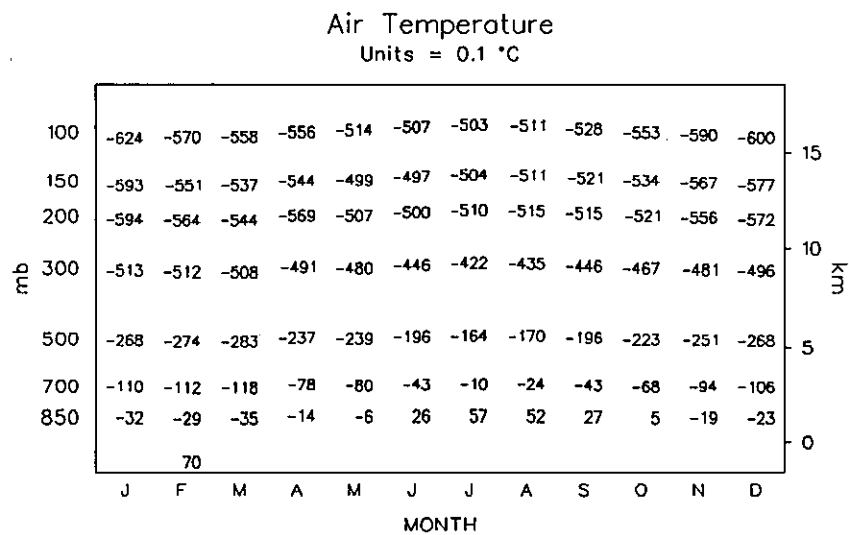
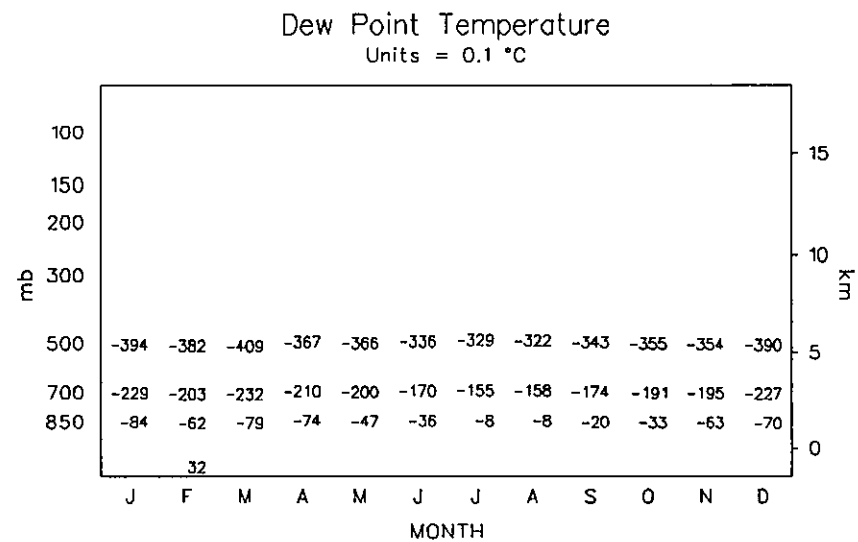
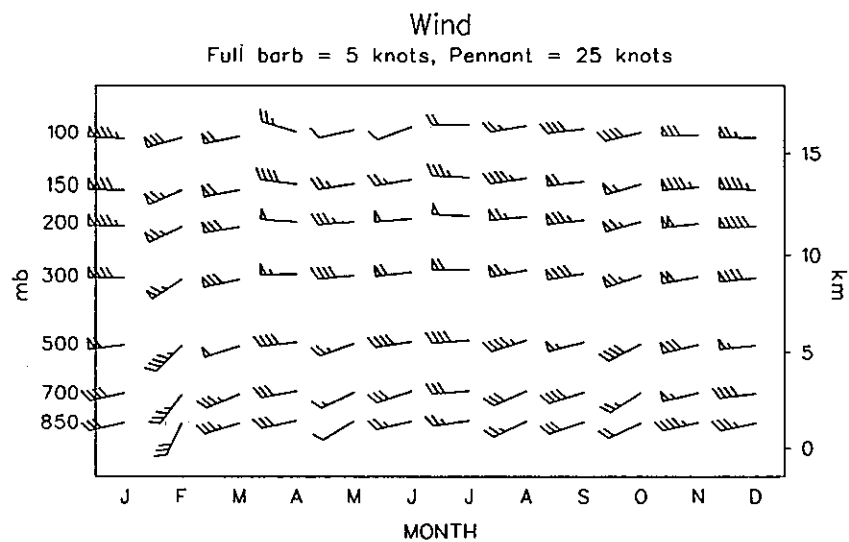
OWS Study Area L Anomalies

Precipitation Frequency

Units = 0.1 percent



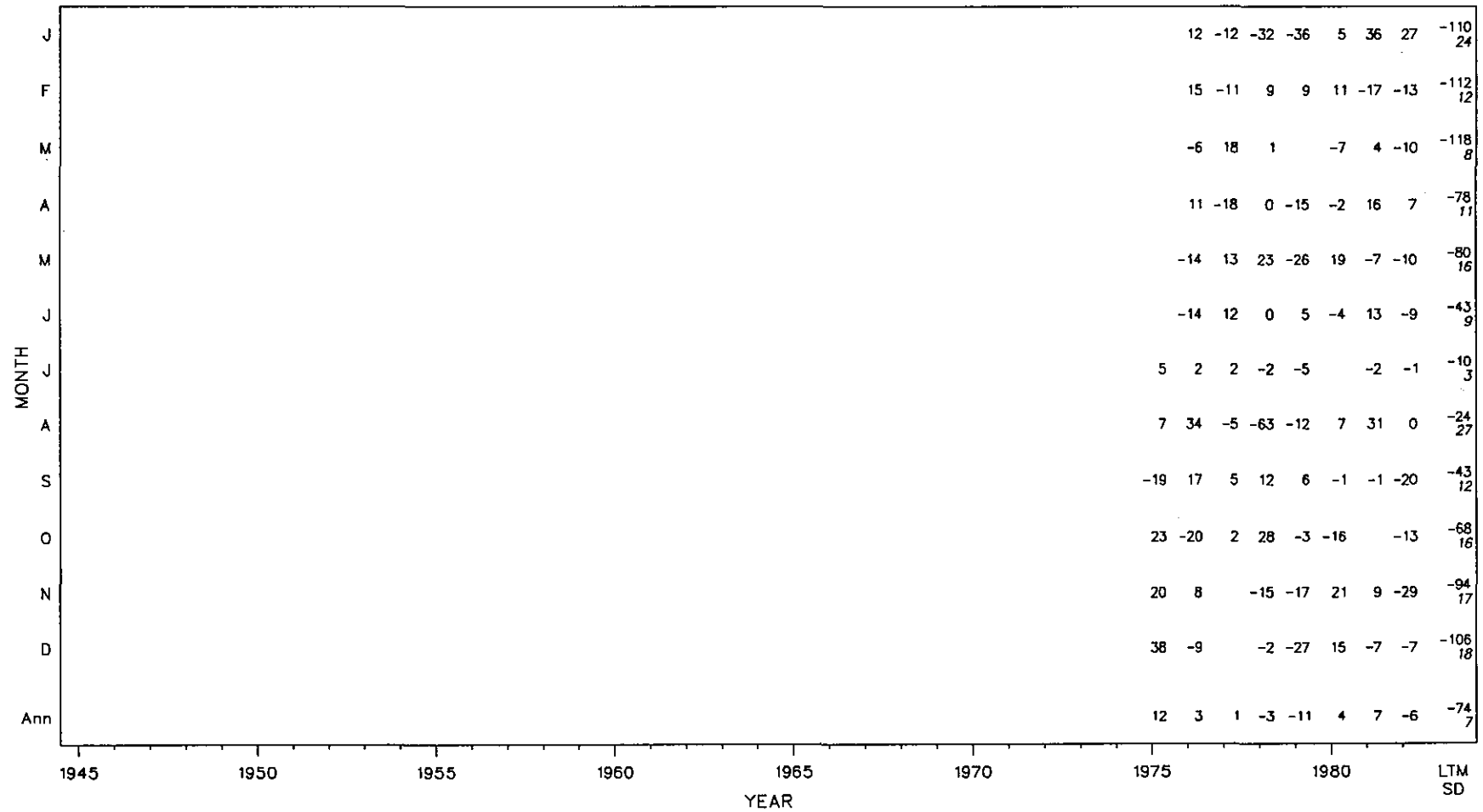
OWS Study Area L Anomalies



OWS Study Area L Upper Air Climatology

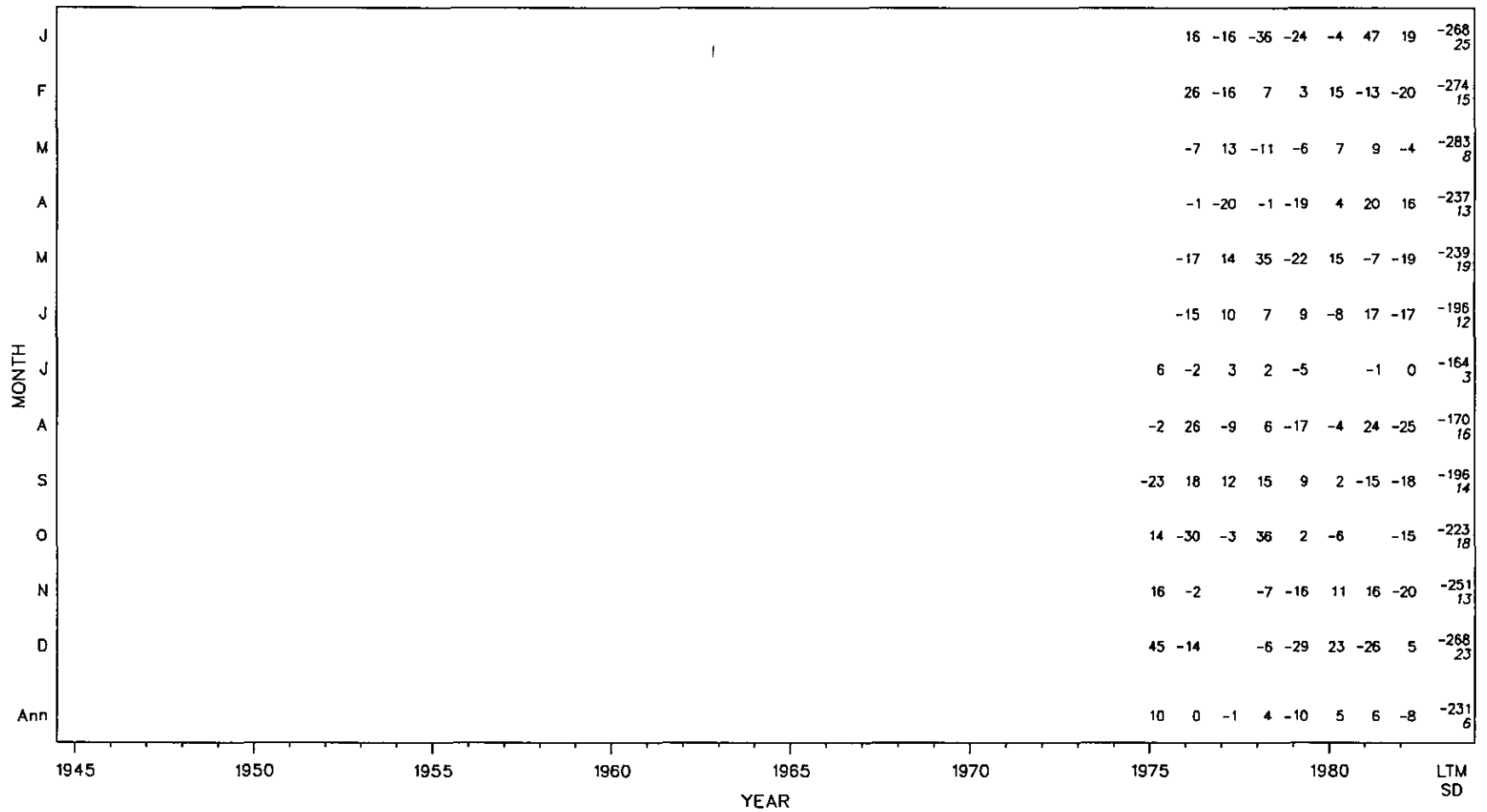
Mean plotted at actual height

Air Temperature: 700 mb
Units = 0.1 °C



OWS Study Area L Anomalies

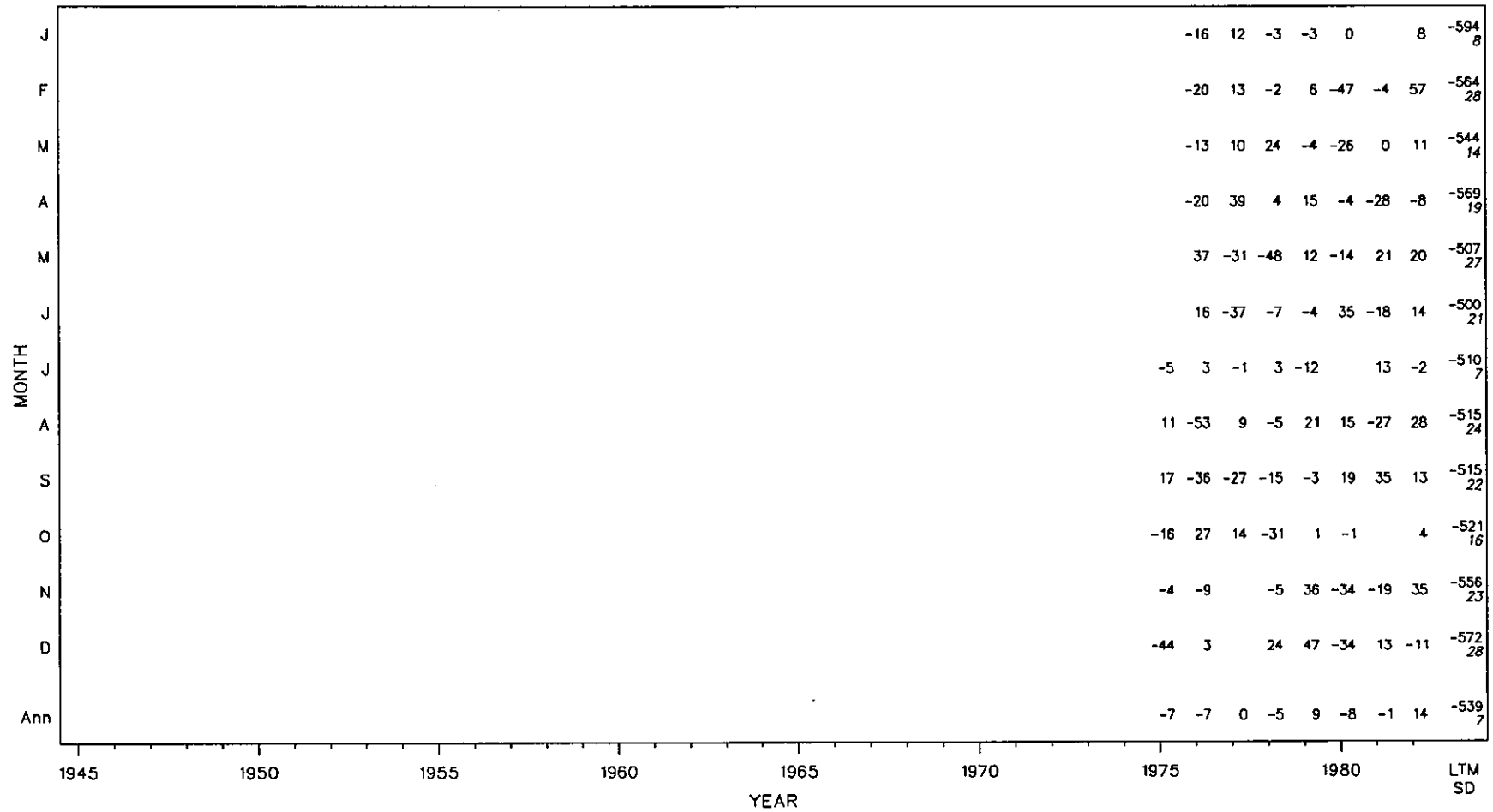
Air Temperature: 500 mb
Units = 0.1 °C



OWS Study Area L Anomalies

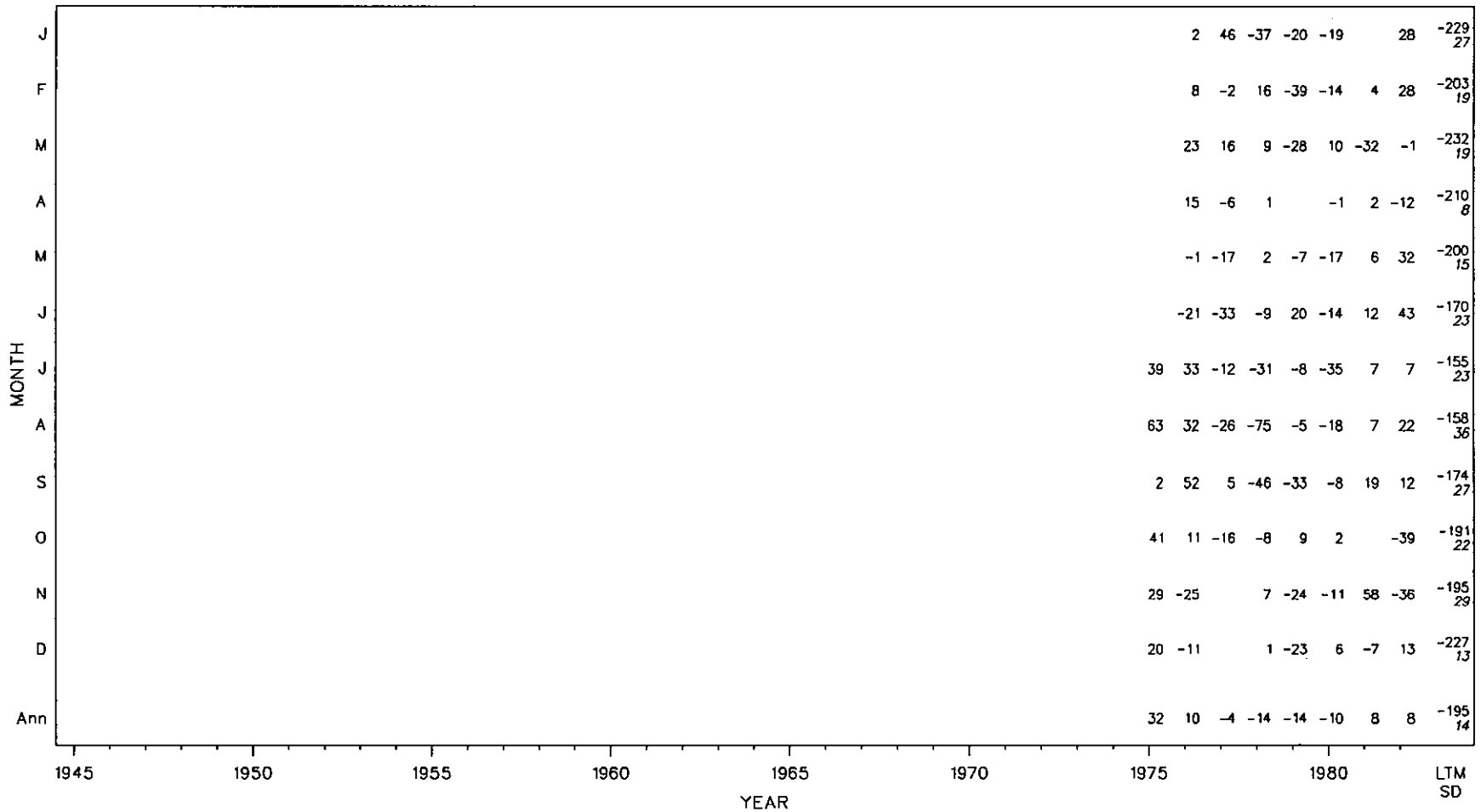
Air Temperature: 200 mb

Units = 0.1 °C



OWS Study Area L Anomalies

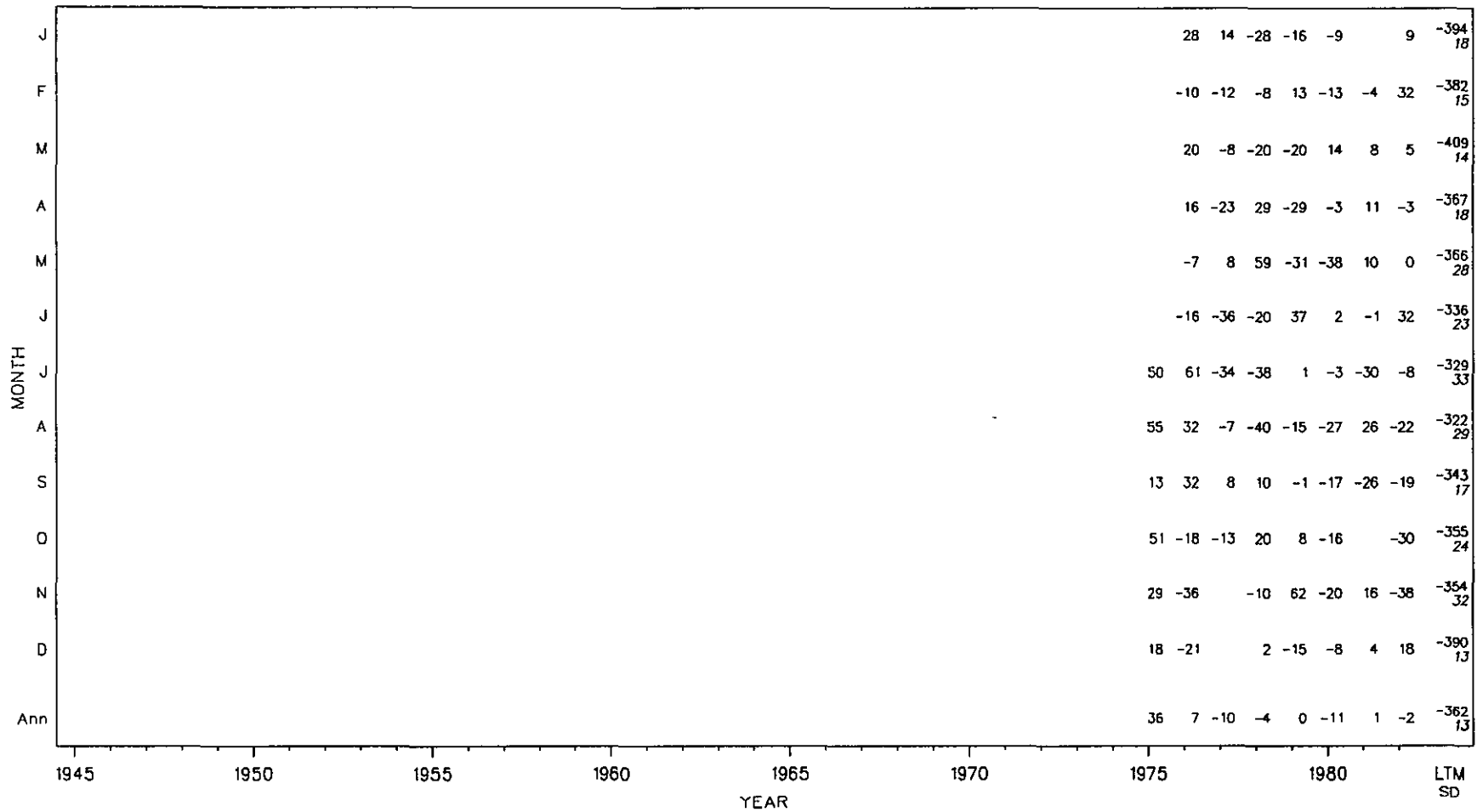
Dew Point Temperature: 700 mb
Units = 0.1 °C



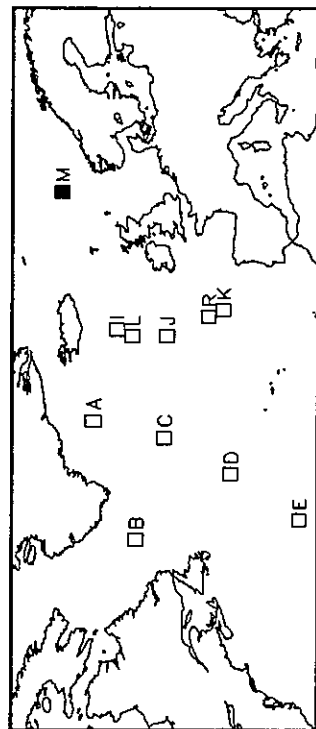
OWS Study Area L Anomalies

Dew Point Temperature: 500 mb

Units = 0.1 °C



OWS Study Area L Anomalies

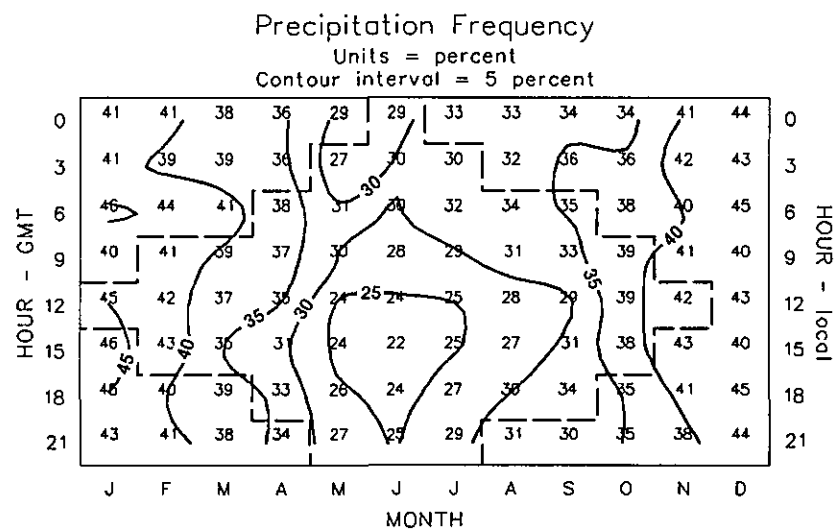
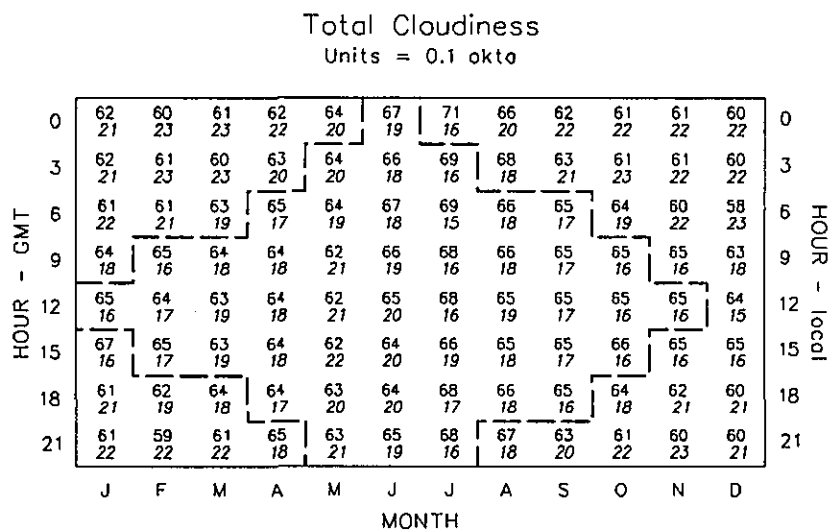
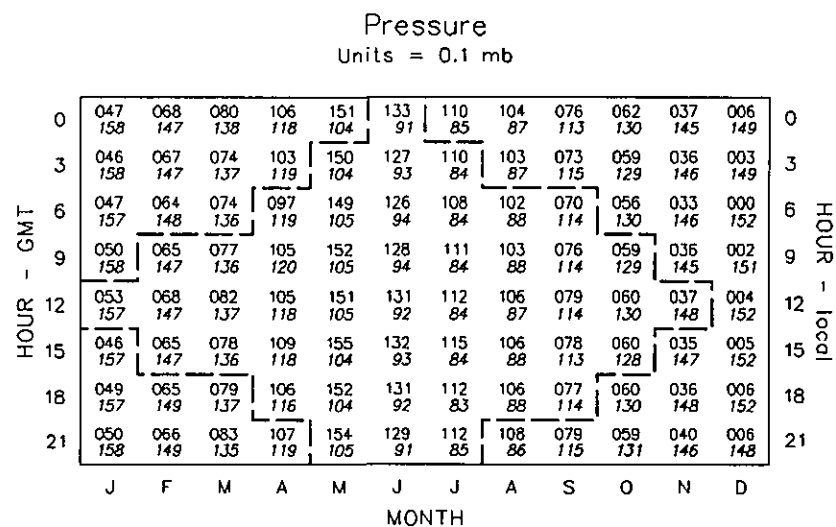
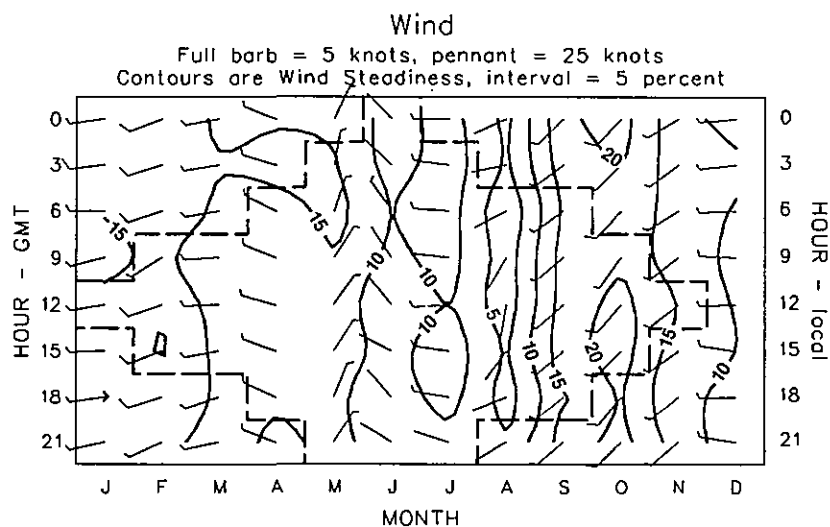


65.0°N – 66.9°N, 1.0°E – 2.9°E
1949 – 1982

OWS
M

MONTH	YEAR																																Sum		
	1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075	2080	2085	2090	2095				
J	24 0	31 31	30 30	31 31	30 30	31 31	31 31	31 31	27 27	31 30	31 31	31 31	31 31	31 31	30 30	31 31	31 31	31 31	27 27	30 30	14 14	27 22	13 13	30 30	31 31	14 14	18 15	21 18	31 31	31 31	31 31	31 31	28 28	952 916	
F	20 0	25 25	27 27	29 29	28 28	28 26	28 27	29 29	28 28	28 28	28 28	29 29	28 28	28 28	29 29	28 28	25 25	28 28	19 19	28 28	15 15	26 26	6 6	25 25	28 28	20 19	19 18	23 21	27 27	28 28	29 29	28 28	25 24	867 839	
M	31 0	29 29	31 31	29 29	31 31	31 31	31 31	31 31	29 29	31 31	31 31	31 30	31 31	31 31	31 31	31 31	31 31	31 31	22 21	27 27	29 29	30 30	22 22	12 11	17 17	12 12	26 25	27 22	31 31	31 31	31 31	31 31	30 28	96 918	
A	28 0	30 30	30 30	29 29	30 30	27 26	29 29	30 30	30 30	30 30	30 30	30 30	29 29	30 30	30 30	30 30	30 30	30 30	28 27	24 24	28 28	30 30	13 13	21 20	26 24	17 14	21 17	27 20	30 30	30 30	28 28	30 30	28 28	943 896	
M	31 0	31 31	31 31	30 29	31 30	31 31	31 31	31 31	31 31	31 31	31 31	31 29	31 31	31 31	31 31	31 31	31 31	31 31	31 31	30 30	26 26	29 29	31 31	13 12	27 27	27 27	17 17	22 21	30 30	31 31	31 31	31 30	31 31	30 26	994 952
J	30 0	30 30	30 30	28 28	30 26	30 30	30 30	30 30	30 29	30 30	30 30	30 29	30 30	30 30	30 30	30 30	30 30	30 30	30 30	26 25	30 30	22 22	13 13	30 30	30 30	17 17	18 17	26 26	30 30	30 29	30 30	30 30	29 23	959 914	
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O	29 29	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 30	31 30	31 31	31 31	31 31	31 31	31 31	31 31	31 31	29 29	31 31	31 31	10 10	27 27	28 28	20 20	31 31	20 20	23 23	25 25	24 24	31 31	31 31	26 26	30 27	972 967	
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D	31 31	30 30	30 30	31 31	26 26	29 29	31 31	31 31	31 31	31 31	31 31	31 31	31 31	20 20	30 30	31 31	31 31	31 31	31 31	28 28	28 28	27 27	24 24	19 19	28 25	30 28	25 16	30 25	20 20	31 31	31 31	31 31	30 25	977 956	
Ann	346 151	356 356	361 361	357 356	354 349	358 355	363 362	364 364	359 359	354 351	365 363	365 361	364 364	354 354	363 363	365 365	364 364	359 359	345 343	335 333	310 309	313 312	305 299	204 203	320 310	288 284	211 196	277 257	294 272	364 364	365 364	358 357	362 362	343 316	11465 11138

Each of the 11 variables was observed on X days of each month. The upper number is the maximum X from among all the variables. The lower number is the minimum X from among all the variables.



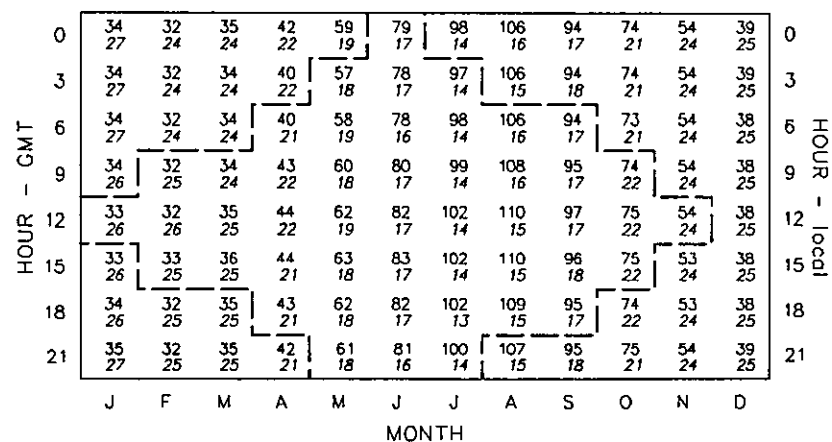
OWS Study Area M Surface Climatology

upper number = mean
lower number = standard deviation

———— data contours
- - - - - sunrise/sunset

Air Temperature

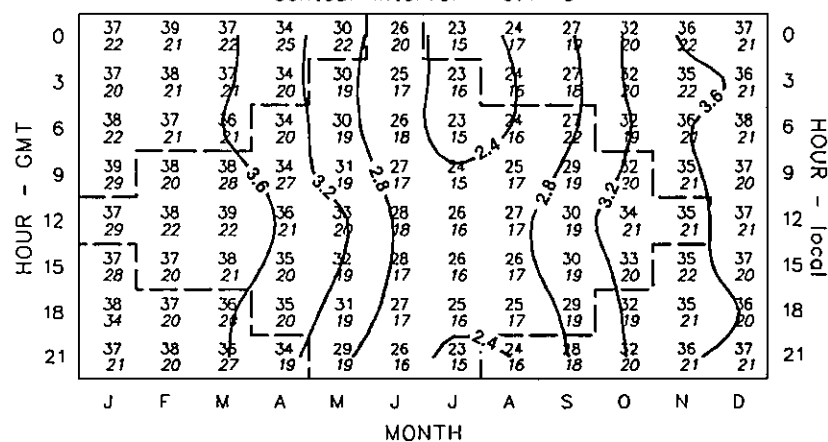
Units = 0.1 °C



Dew Point Depression

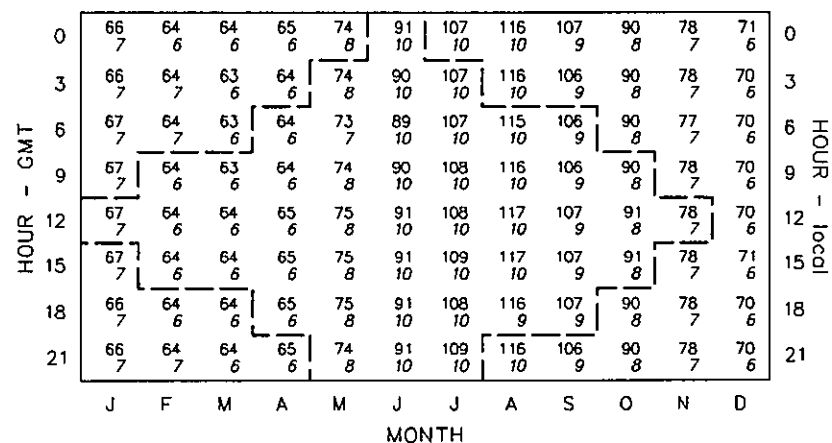
Units = 0.1 °C

Contour interval = 0.4 °C



Sea Surface Temperature

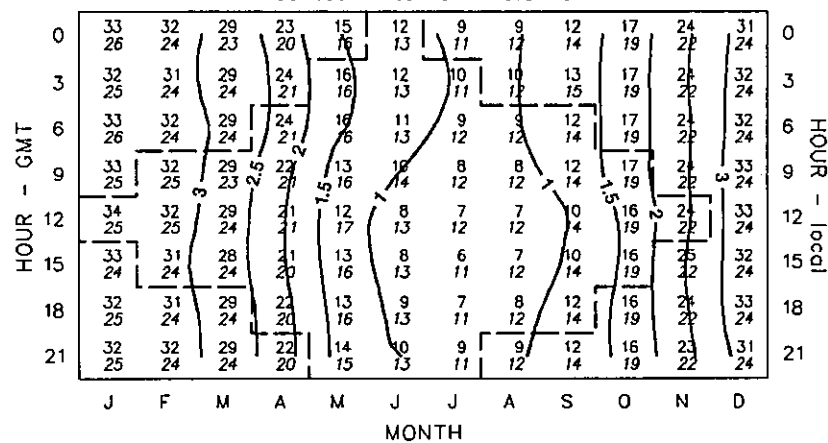
Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C

Contour interval = 0.5 °C



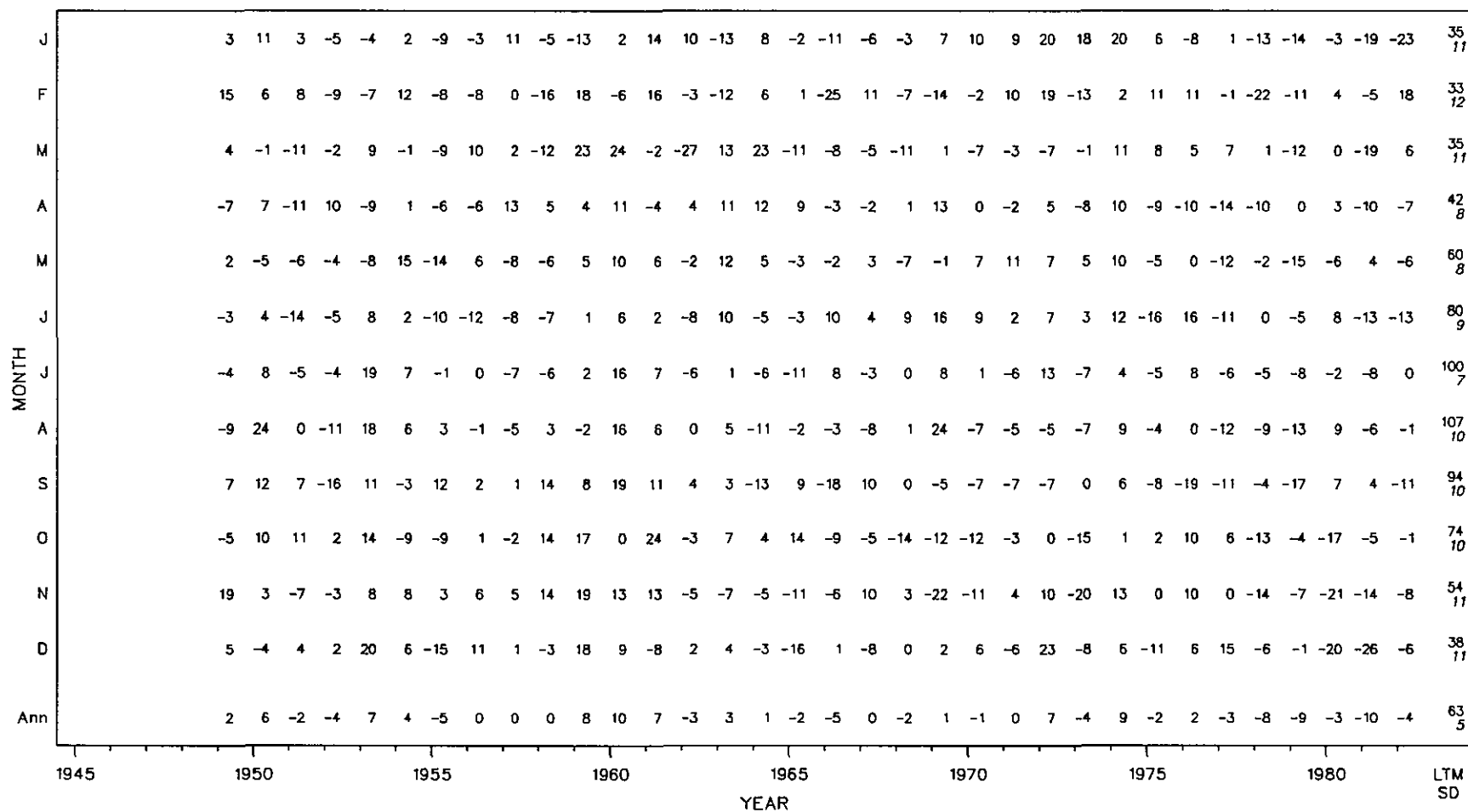
OWS Study Area M Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
--- sunrise/sunset

Surface Air Temperature

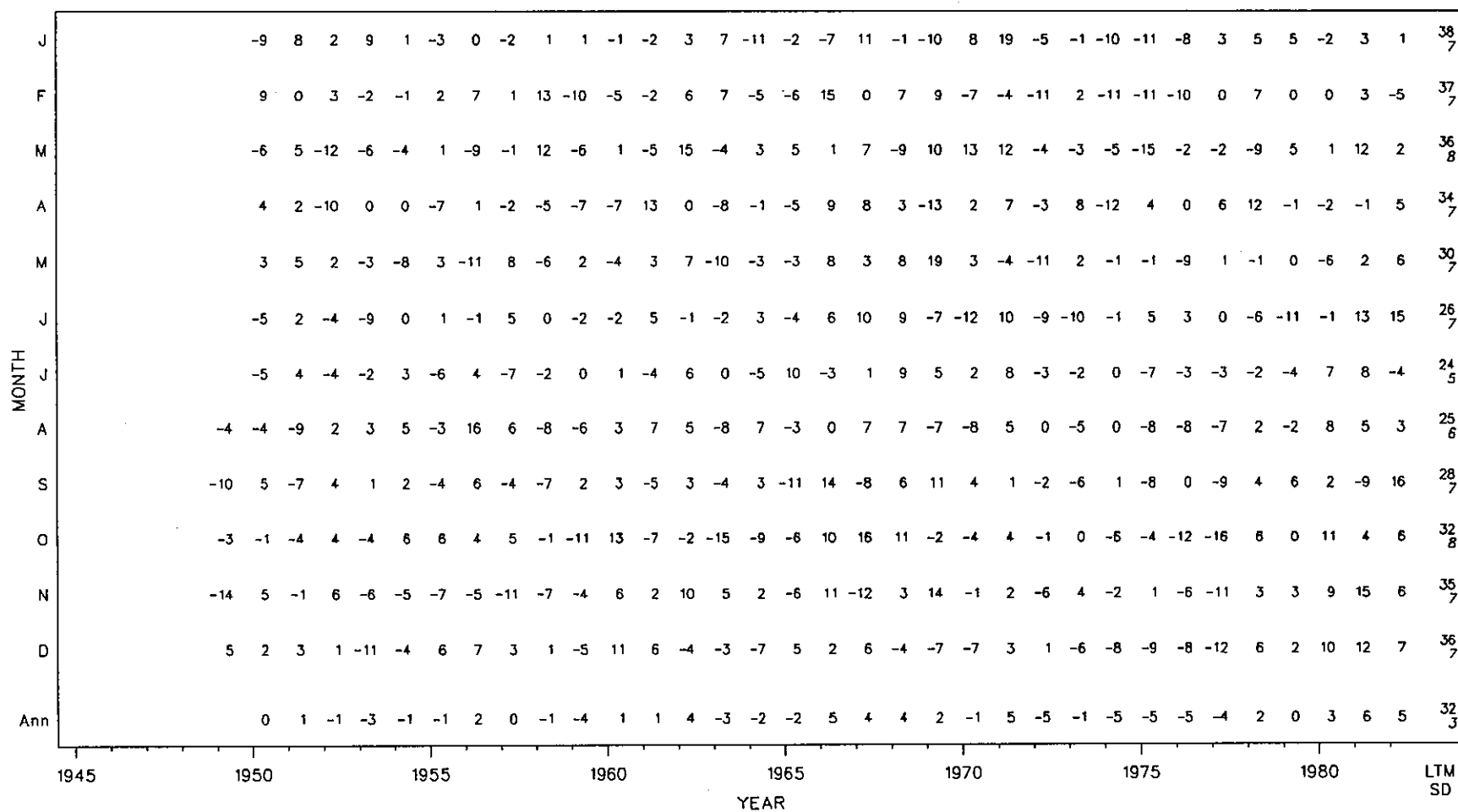
Units = 0.1 °C



OWS Study Area M Anomalies

Surface Dew Point Depression

Units = 0.1 °C

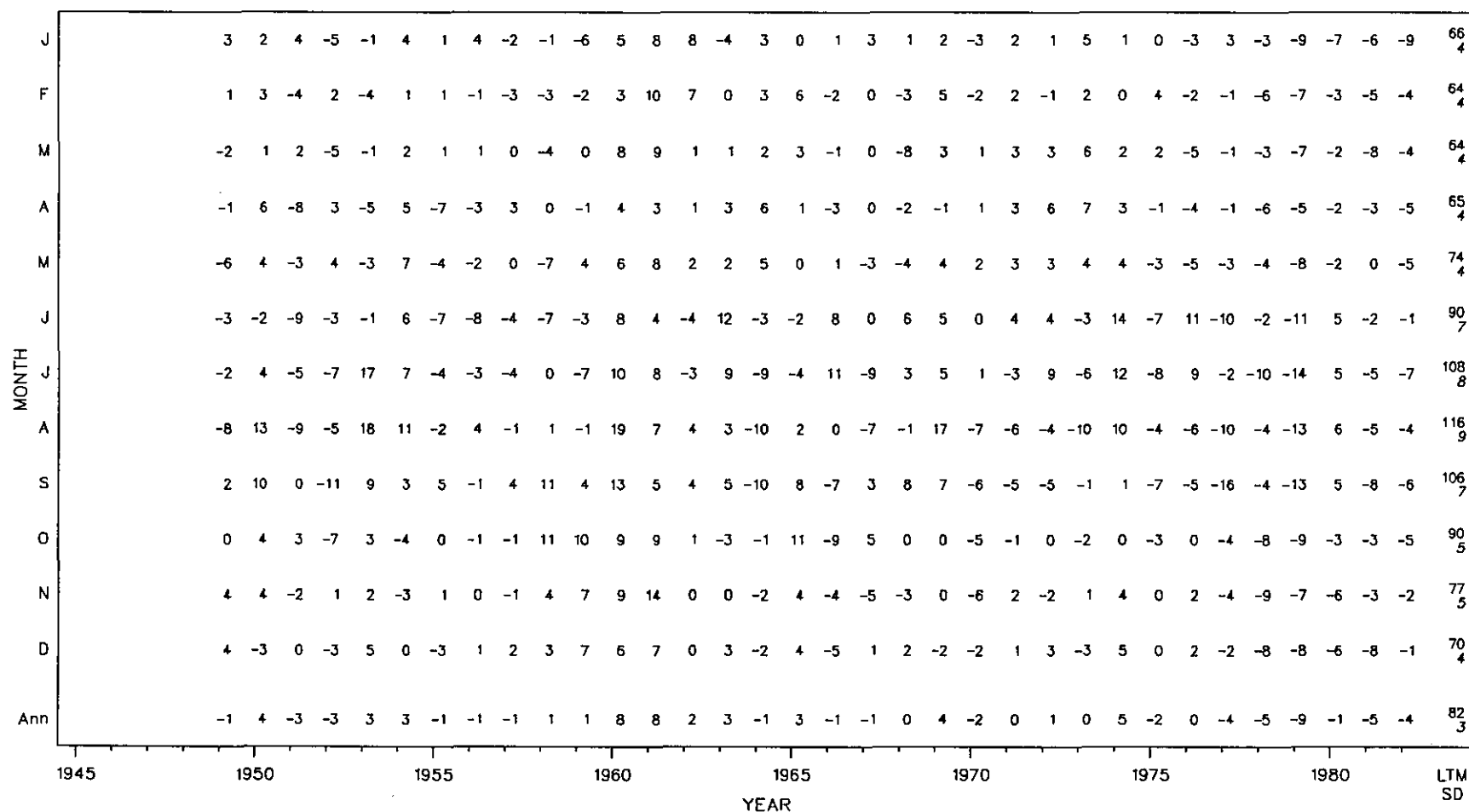


OWS Study Area M Anomalies

M5

Sea Surface Temperature

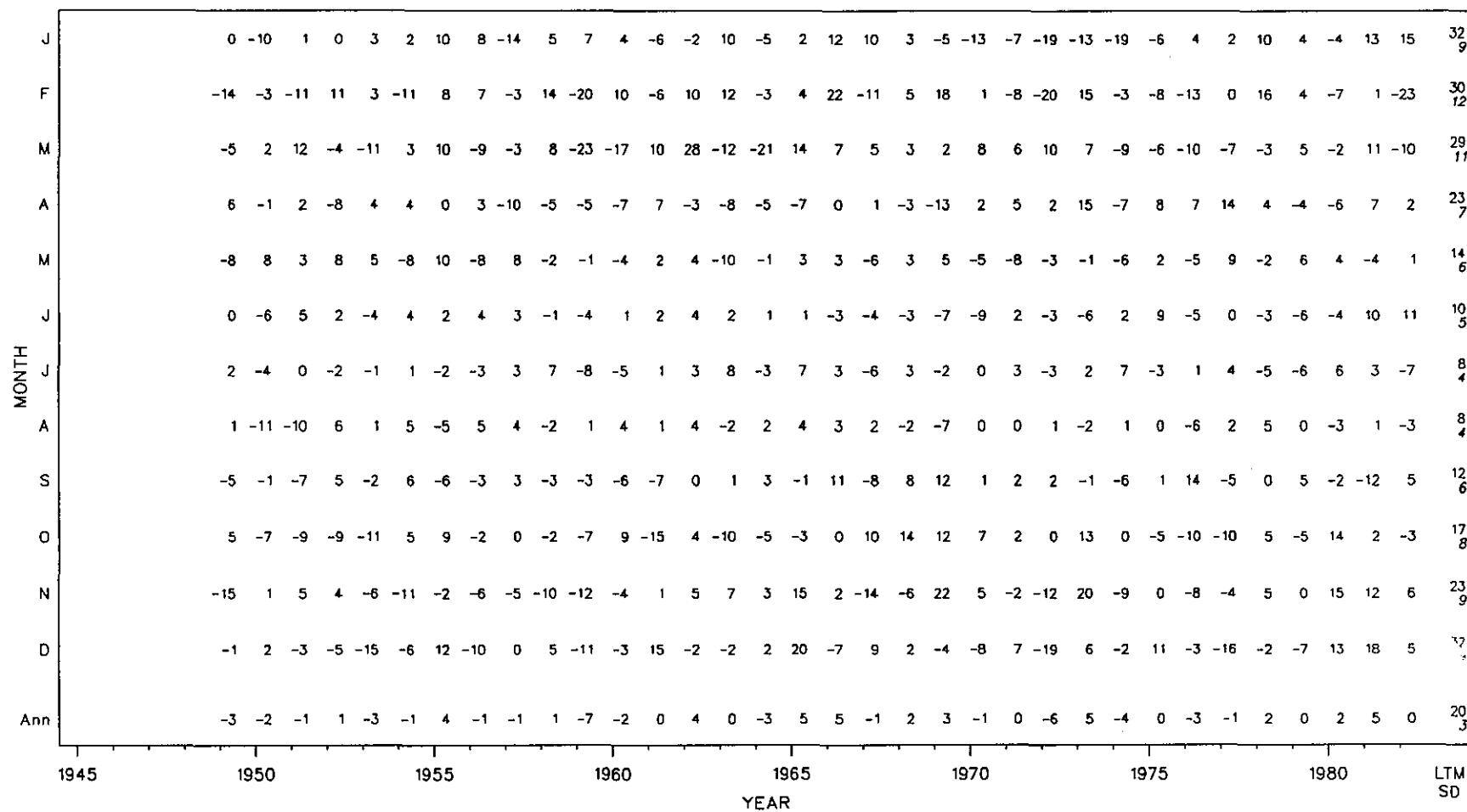
Units = 0.1 °C



OWS Study Area M Anomalies

Sea - Air Temperature Difference

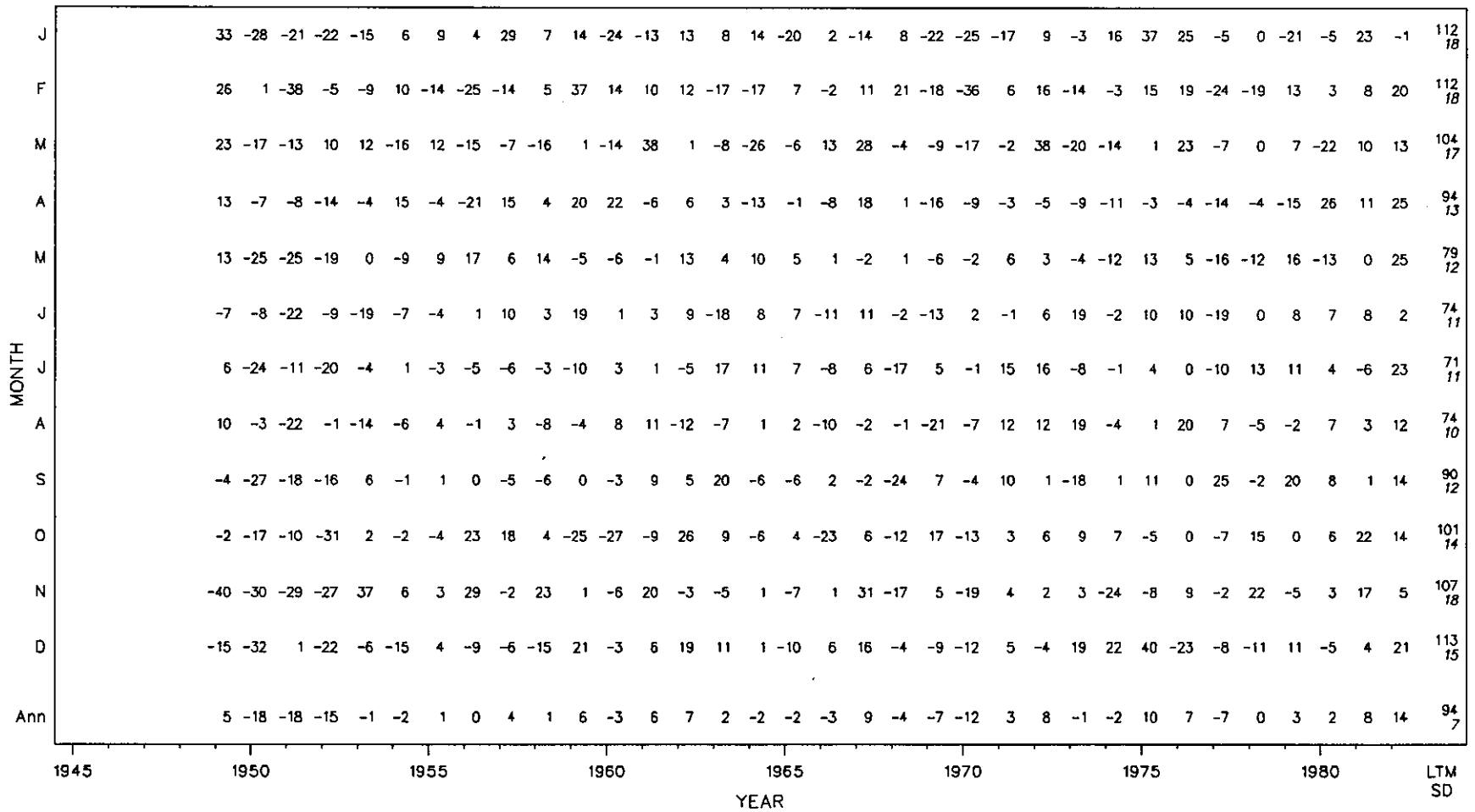
Units = 0.1 °C



OWS Study Area M Anomalies

Surface Sclar Wind

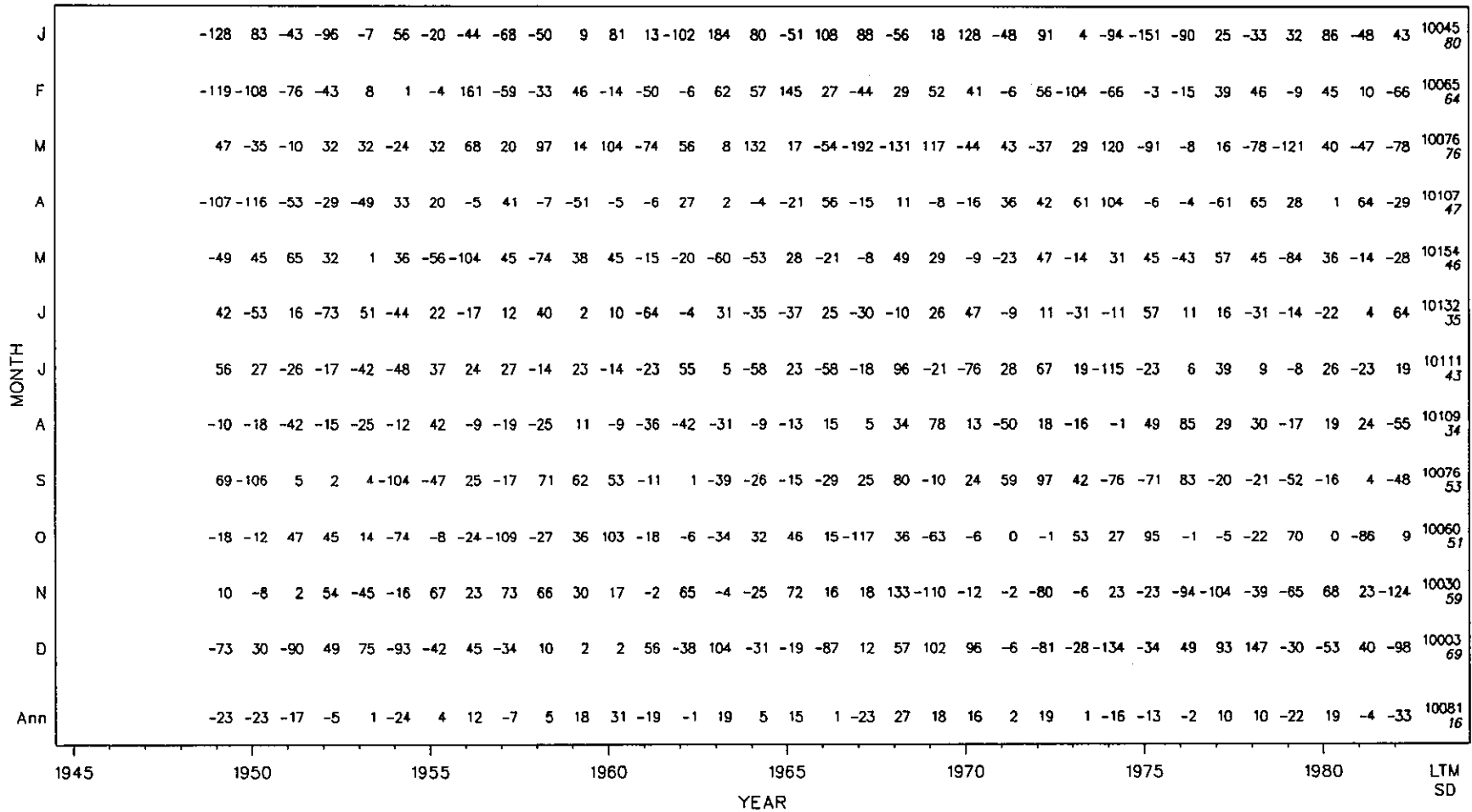
Units = 0.1 m/s



OWS Study Area M Anomalies

Sea Level Pressure

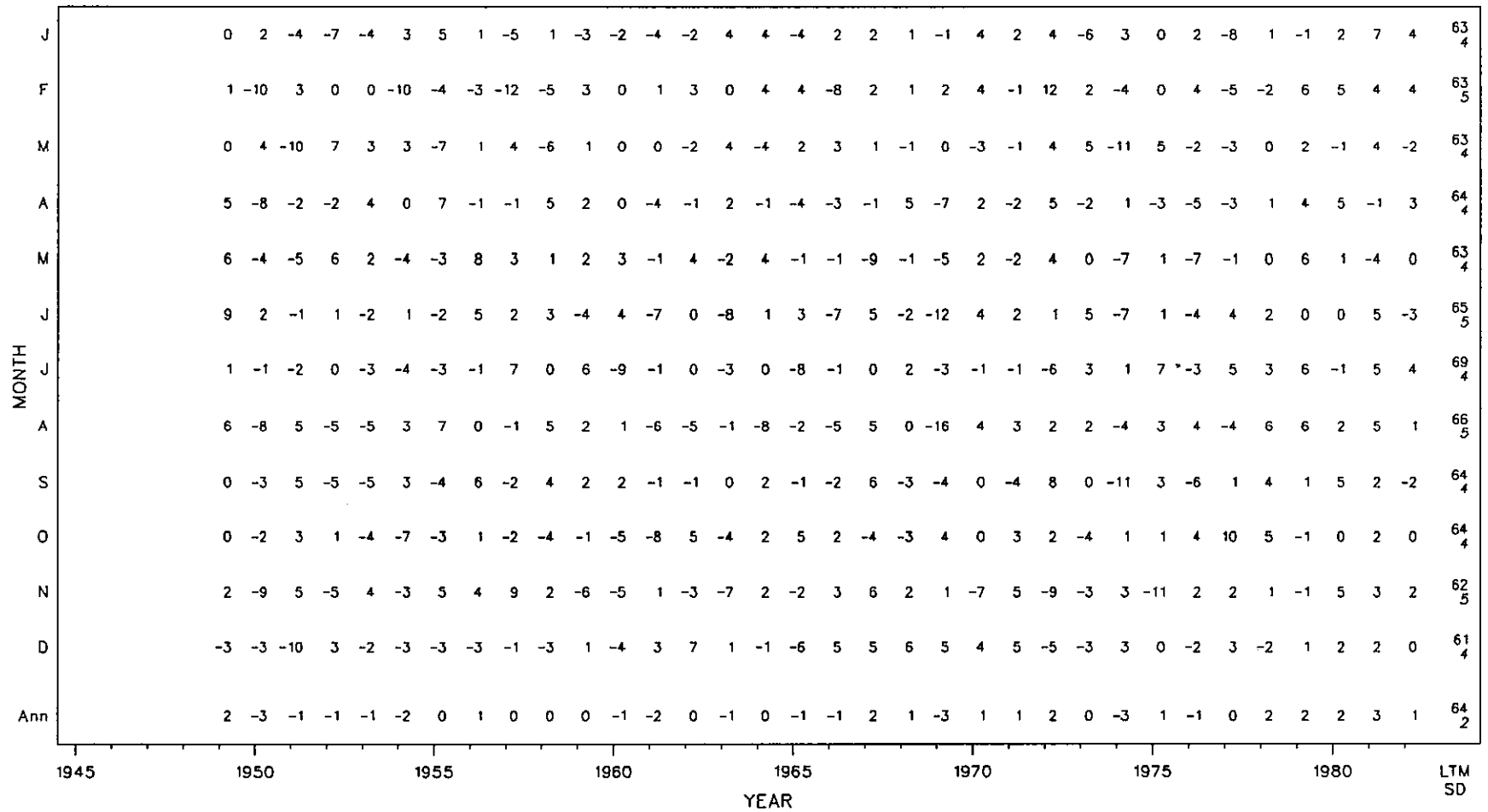
Units = 0.1 mb



OWS Study Area M Anomalies

Total Cloudiness

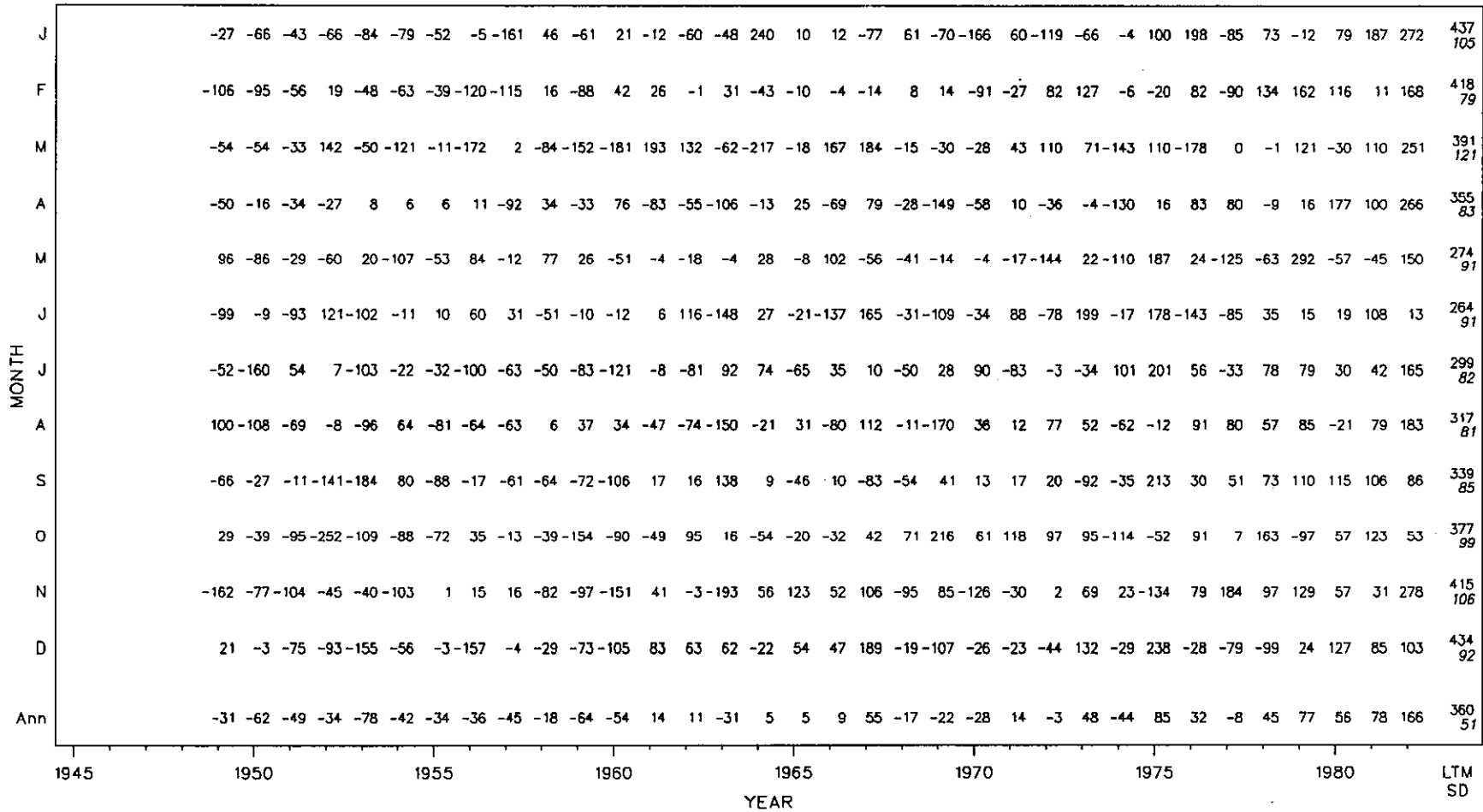
Units = 0.1 okta



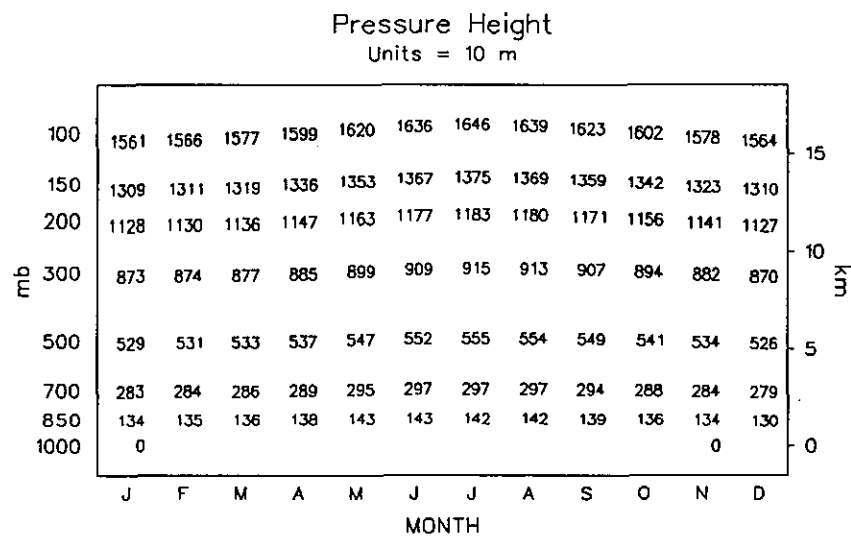
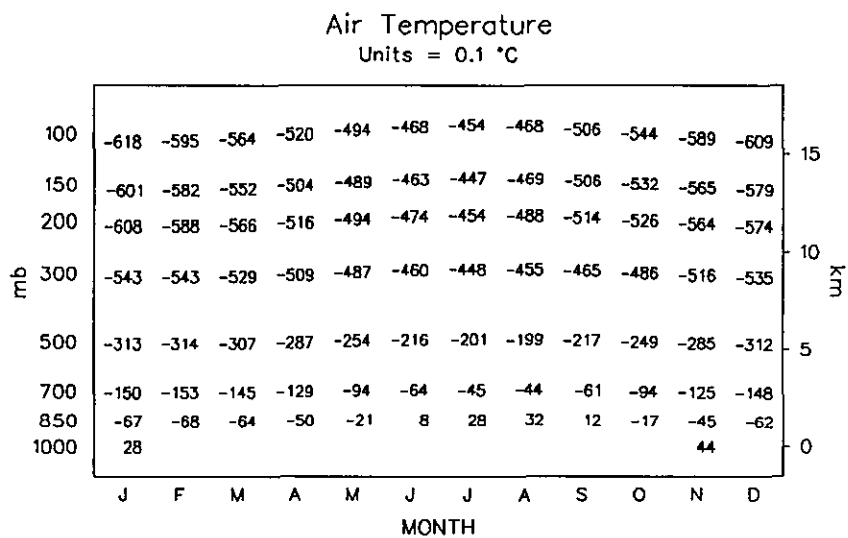
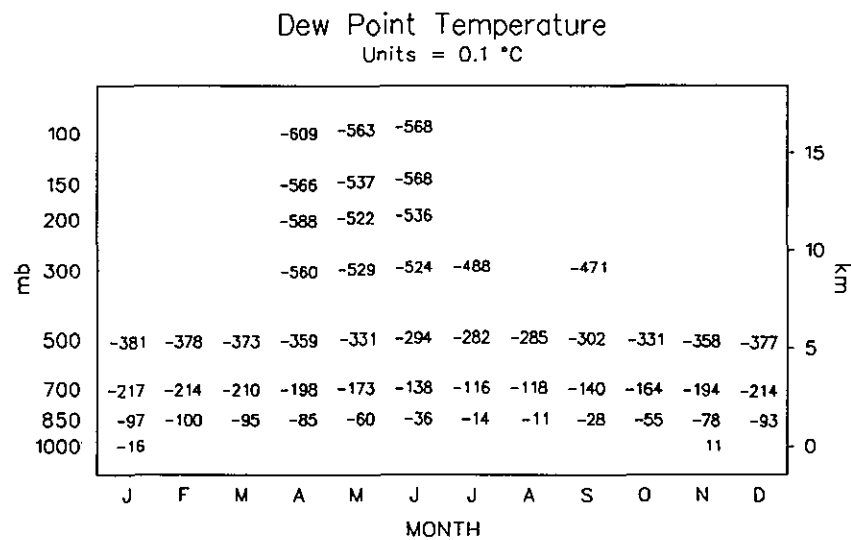
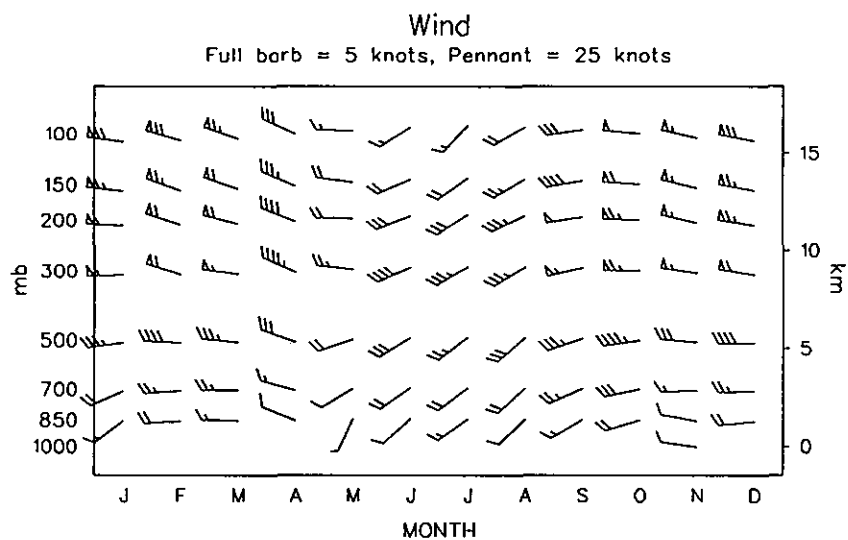
OWS Study Area M Anomalies

Precipitation Frequency

Units = 0.1 percent



OWS Study Area M Anomalies

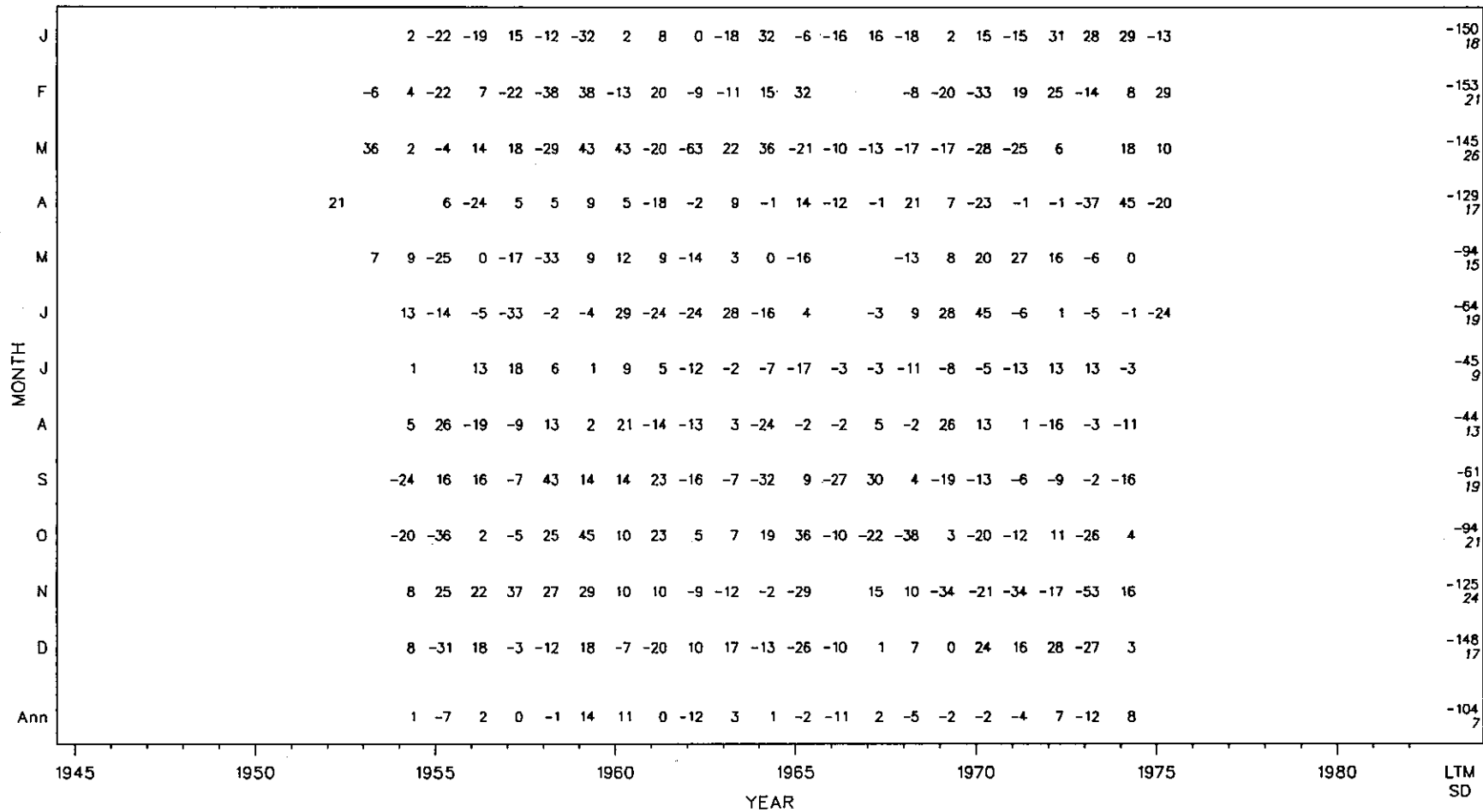


OWS Study Area M Upper Air Climatology

Mean plotted at actual height

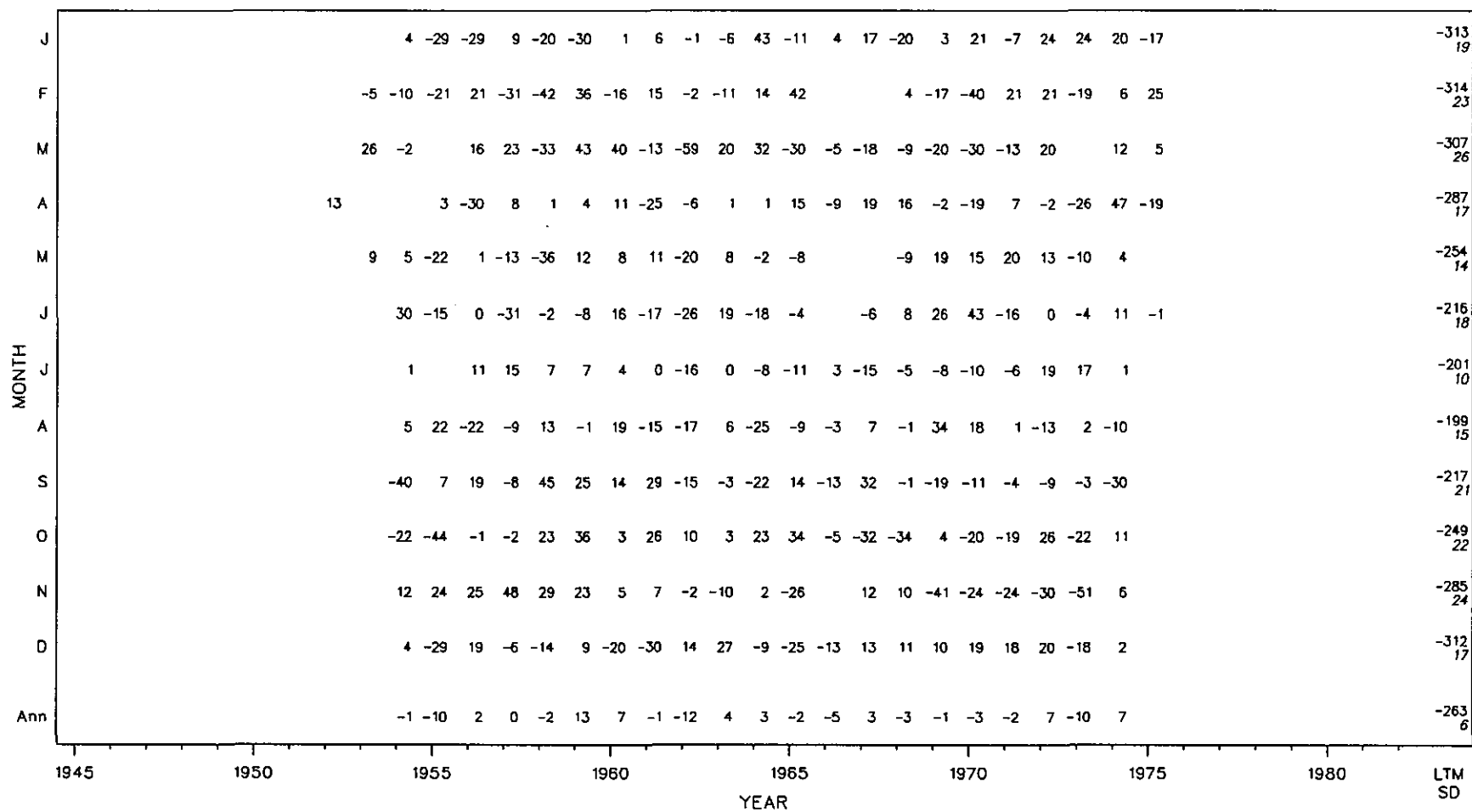
Air Temperature: 700 mb

Units = 0.1 °C



OWS Study Area M Anomalies

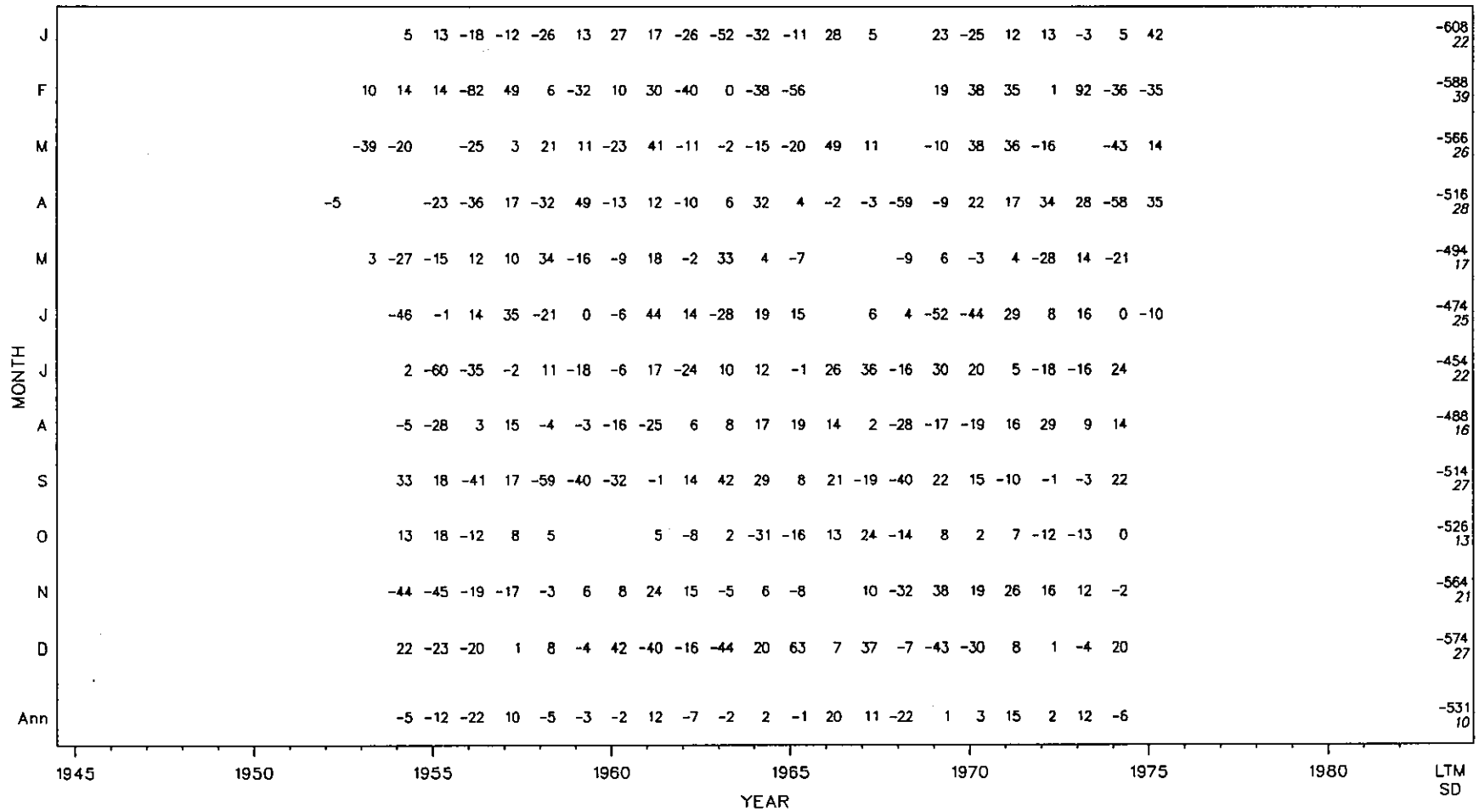
Units = 0.1 °C



OWS Study Area M Anomalies

Air Temperature: 200 mb

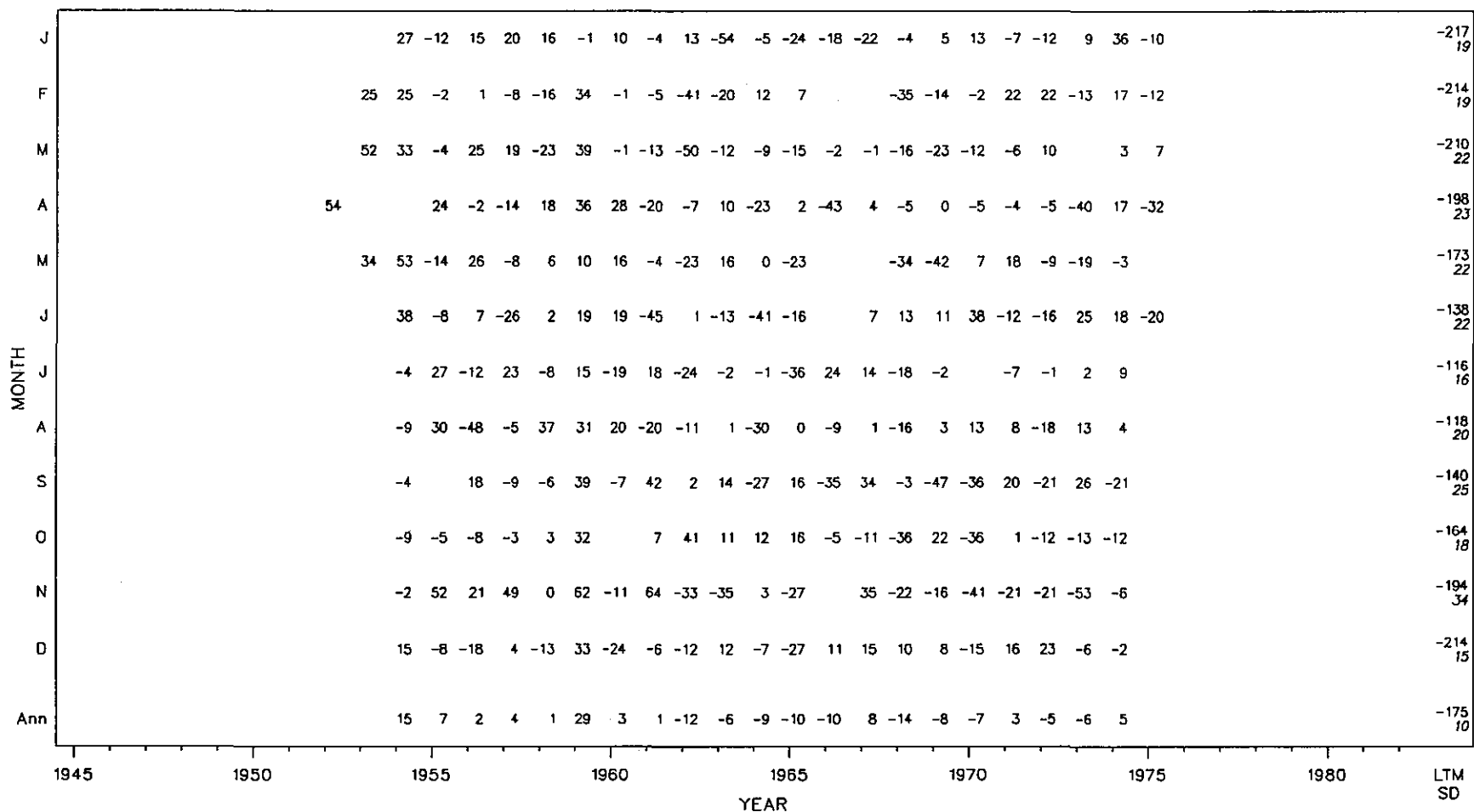
Units = 0.1 °C



OWS Study Area M Anomalies

Dew Point Temperature: 700 mb

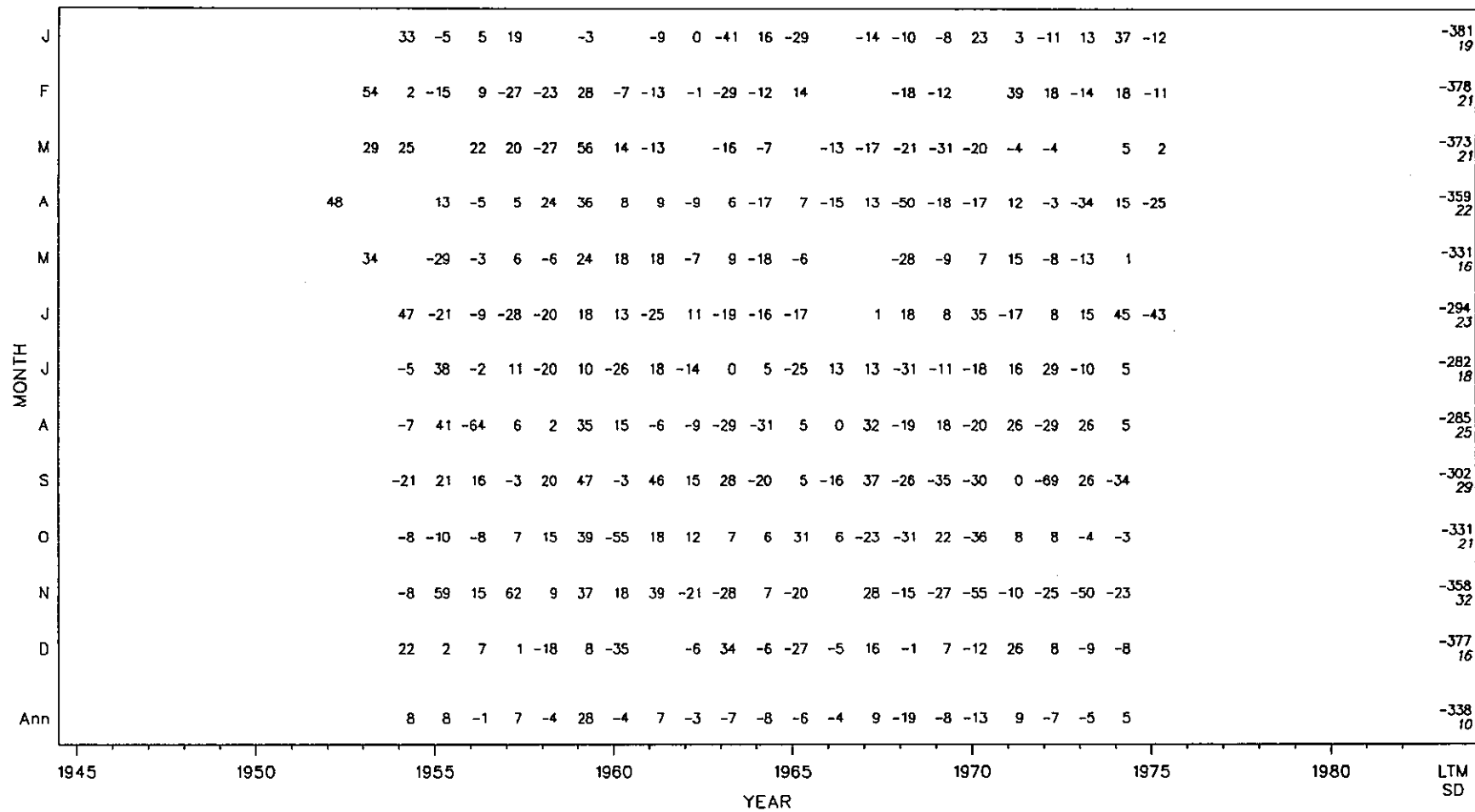
Units = 0.1 °C



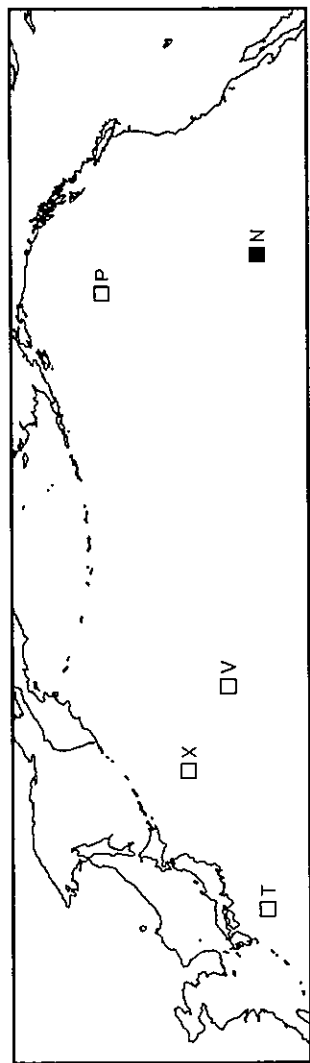
OWS Study Area M Anomalies

Dew Point Temperature: 500 mb

Units = 0.1 °C



OWS Study Area M Anomalies



29.0°N — 30.9°N, 140.9°W — 139.0°W
1946 — 1974

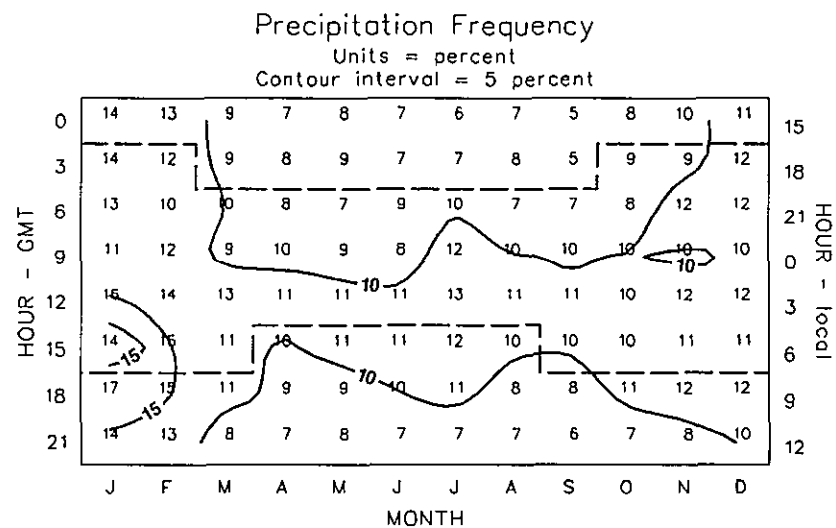
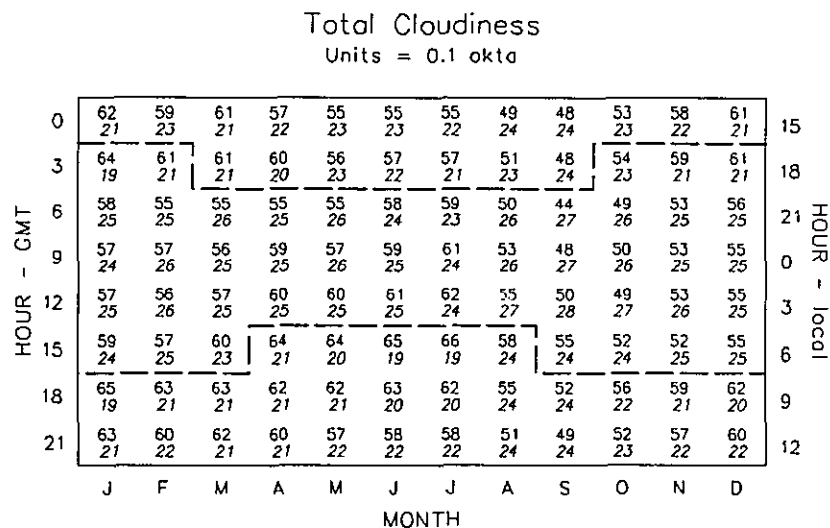
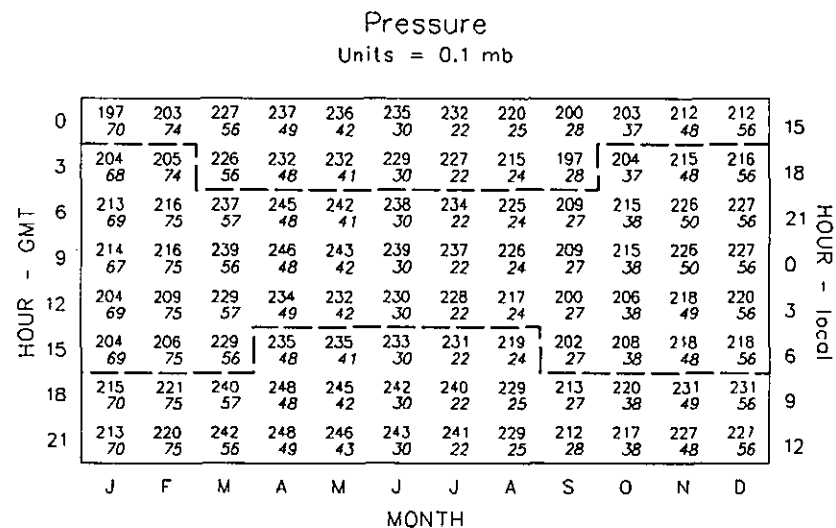
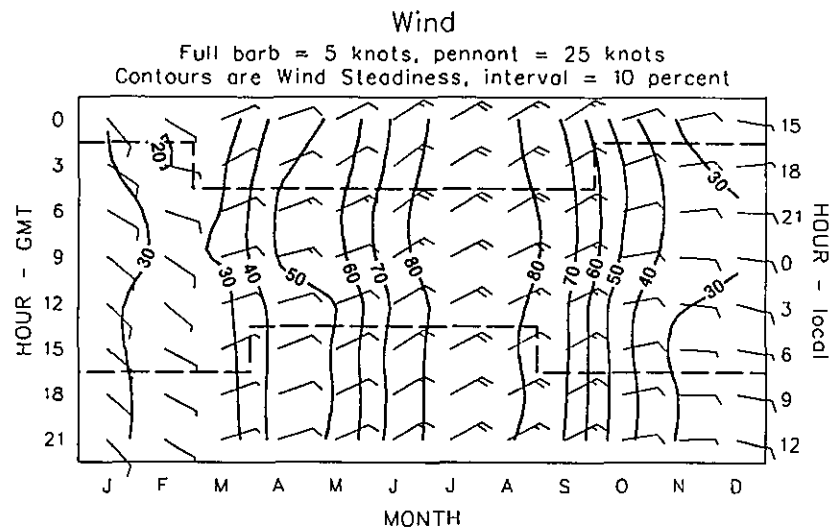
OWS
N

MONTH	YEAR																															Sum					
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J		31 30	31 31	30 30	31 31						31 31	31 31	31 31	31 30	31 31	31 31	31 31	31 31	31 31	31 31	30 30	31 31	31 31	28 28	31 31	29 29	31 31	31 31	24 24	21 21						720 718	
F		28 28	27 27	28 28	28 28						28 28	29 29	28 28	28 28	28 28	29 29	28 28	28 28	28 28	28 28	28 28	28 28	28 28	27 27	22 22	28 28	27 27	13 13	11 11								634 634
M		31 31	31 31	31 31	31 31						22 22	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	28 28	31 31	31 31	31 31	31 31	28 28	30 30	29 29	30 30	31 31	30 30						755 755
A		30 28	30 30	30 30	30 30						30 30	30 30	30 26	30 30	30 30	30 30	30 30	30 30	30 30	30 30	27 27	30 30	30 30	28 28	27 27	30 30	30 30	30 30	22 22	30 30	12 11						716 709
M		30 30	31 31	31 31	31 31						31 31	27 27	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	29 29	31 31	31 31	31 31	30 30	28 28	22 22							724 724
J		8 8	30 30	30 30	30 30						30 30	30 30	30 25	30 30	30 30	30 29	30 30	30 30	30 30	30 30	30 30	30 30	30 30	29 29	30 30	28 28	30 30	30 30	29 29	4 4							698 692
J		31 31	31 31	31 31	31 31						31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	26 26	30 30	30 30	27 27	26 26	21 21							749 749
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S		30 30	30 30	30 30	30 30						30 30	30 30	29 29	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	25 25	29 29	28 28	30 30	29 29	1 0							711 710
O		31 31	31 31	31 31	31 31						31 31	31 31	29 29	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	27 27	31 31	26 26	22 22	30 30	29 29	24 24							714 714
N		30 29	30 30	30 30	30 30						30 30	30 30	24 24	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	29 29	29 29	30 30							712 711
D		31 31	27 27	31 31	31 31	10 10					1 1	31 31	31 31	27 27	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	29 29								713 713
Ann	192 172	360 357	364 364	364 364	344 343		1 1	297 297	361 361	364 360	354 349	365 364	365 365	366 365	365 365	365 365	365 365	365 365	365 365	357 357	363 363	358 358	360 360	339 339	344 344	349 349	355 355	333 333	146 145	74 73							8570 8533

OWS Study Area N (30.0°N, 140.0°W)

Frequency of Surface Observations

Each of the 11 variables was observed on X days of each month.
The upper number is the maximum X from among all the variables.
The lower number is the minimum X from among all the variables.



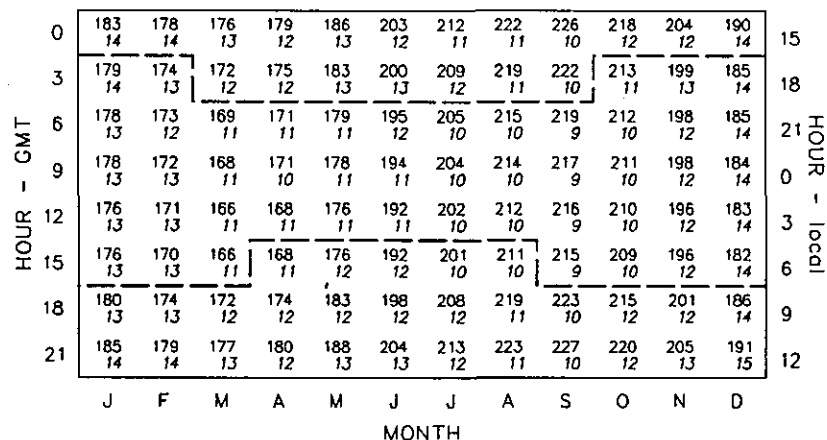
OWS Study Area N Surface Climatology

upper number = mean
lower number = standard deviation

———— data contours
- - - - sunrise/sunset

Air Temperature

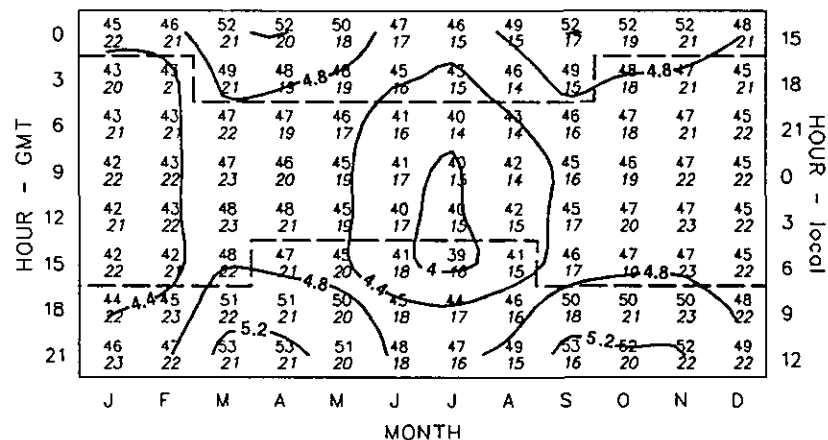
Units = 0.1 °C



Dew Point Depression

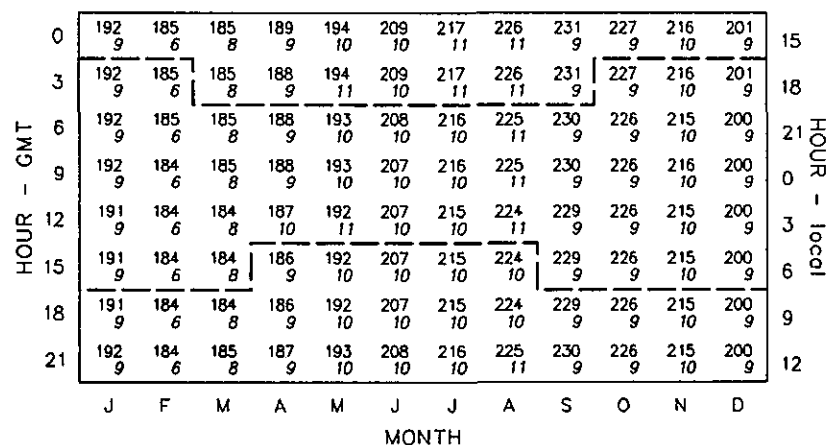
Units = 0.1 °C

Contour interval = 0.4 °C



Sea Surface Temperature

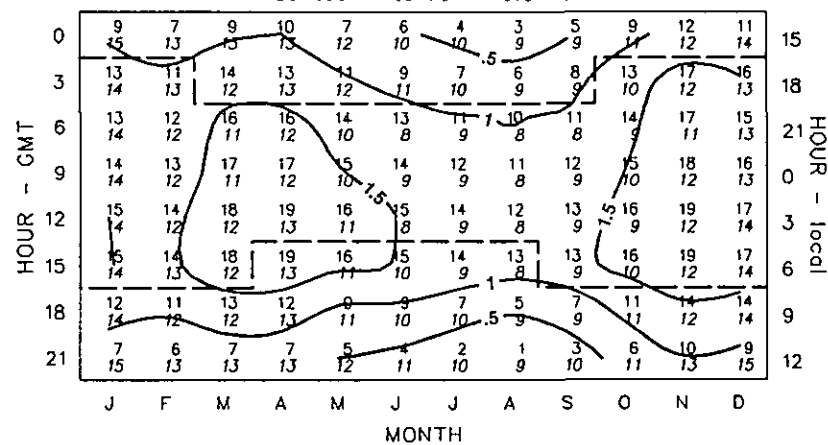
Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C

Contour interval = 0.5 °C



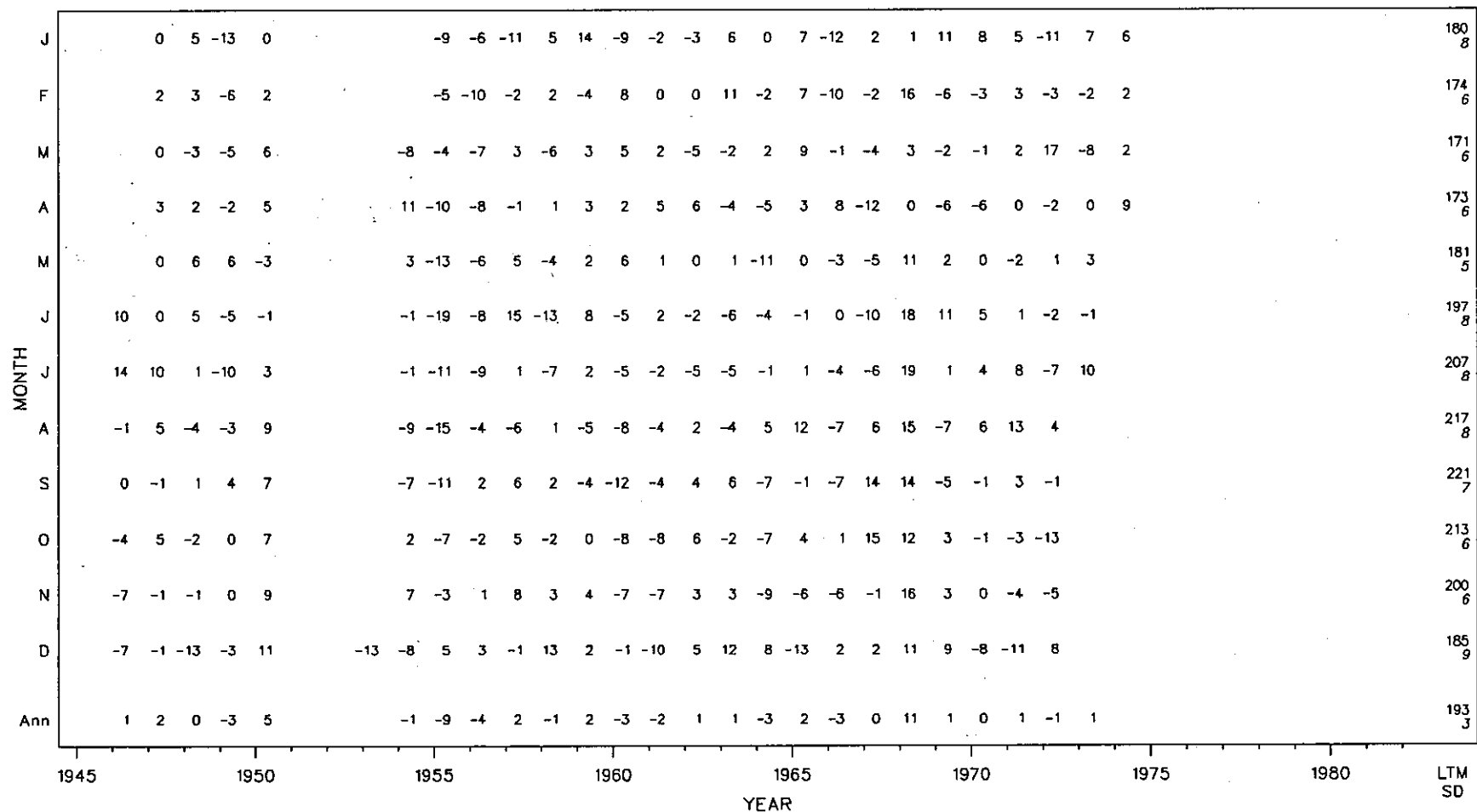
OWS Study Area N Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
--- sunrise/sunset

Surface Air Temperature

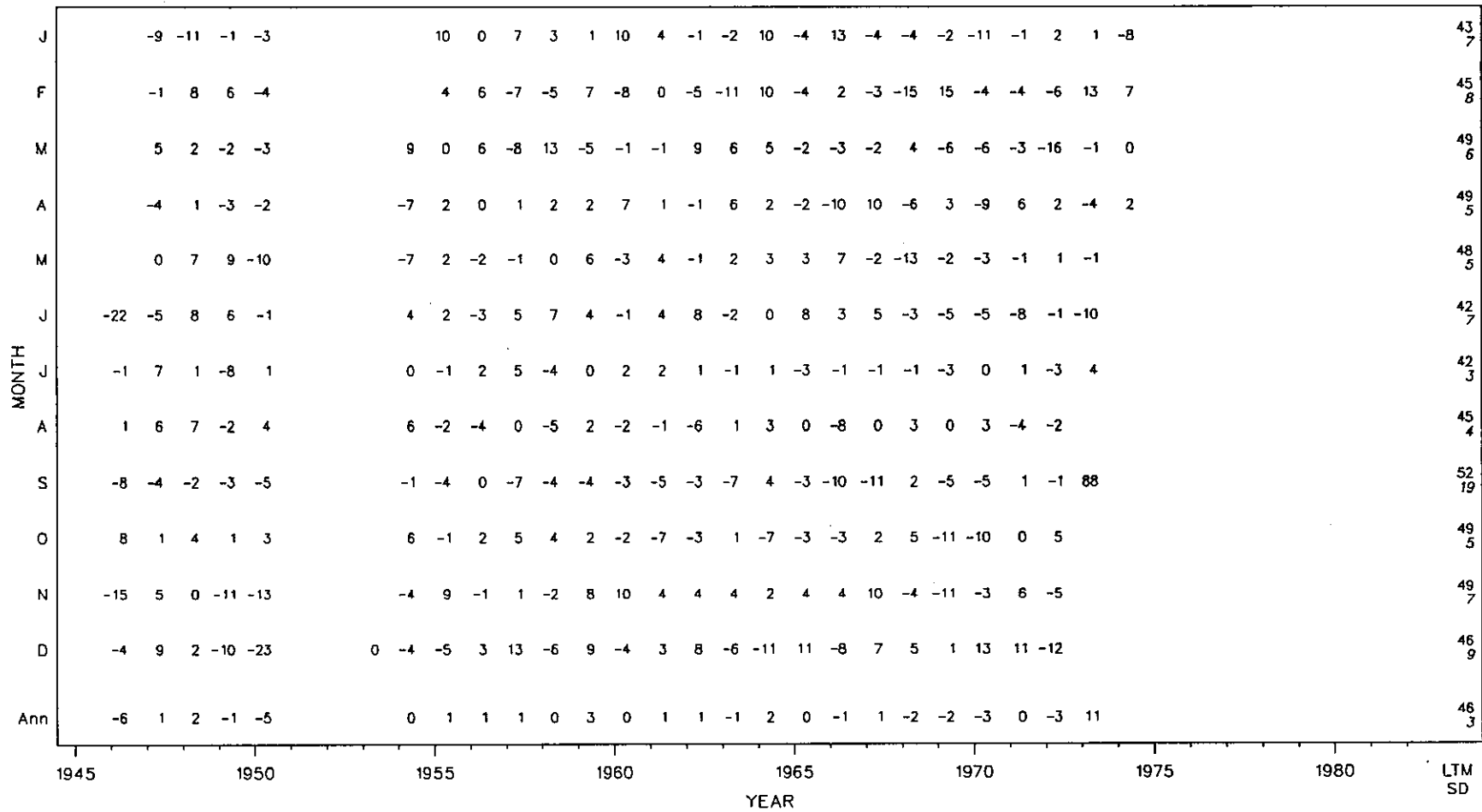
Units = 0.1 °C



OWS Study Area N Anomalies

Surface Dew Point Depression

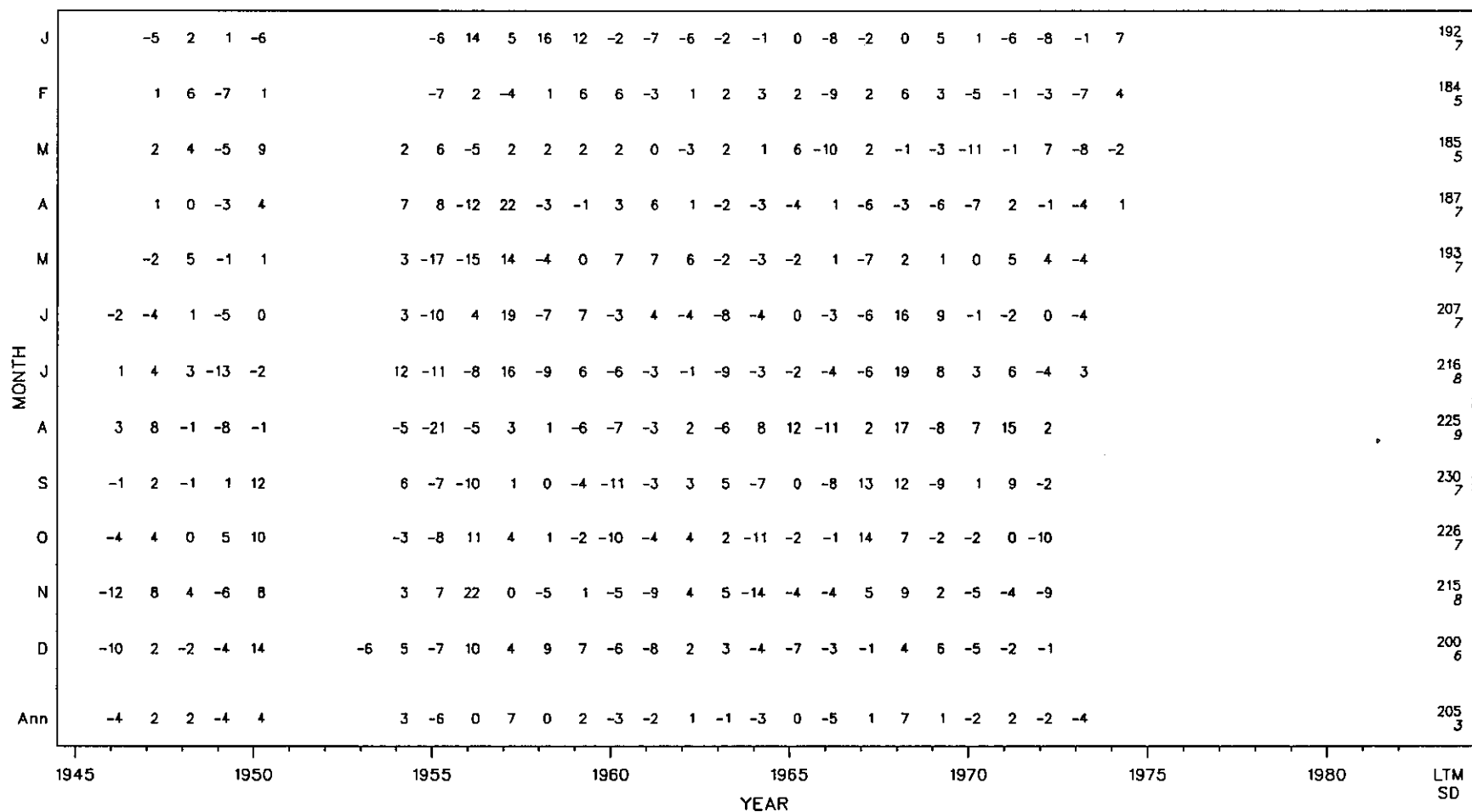
Units = 0.1 °C



OWS Study Area N Anomalies

Sea Surface Temperature

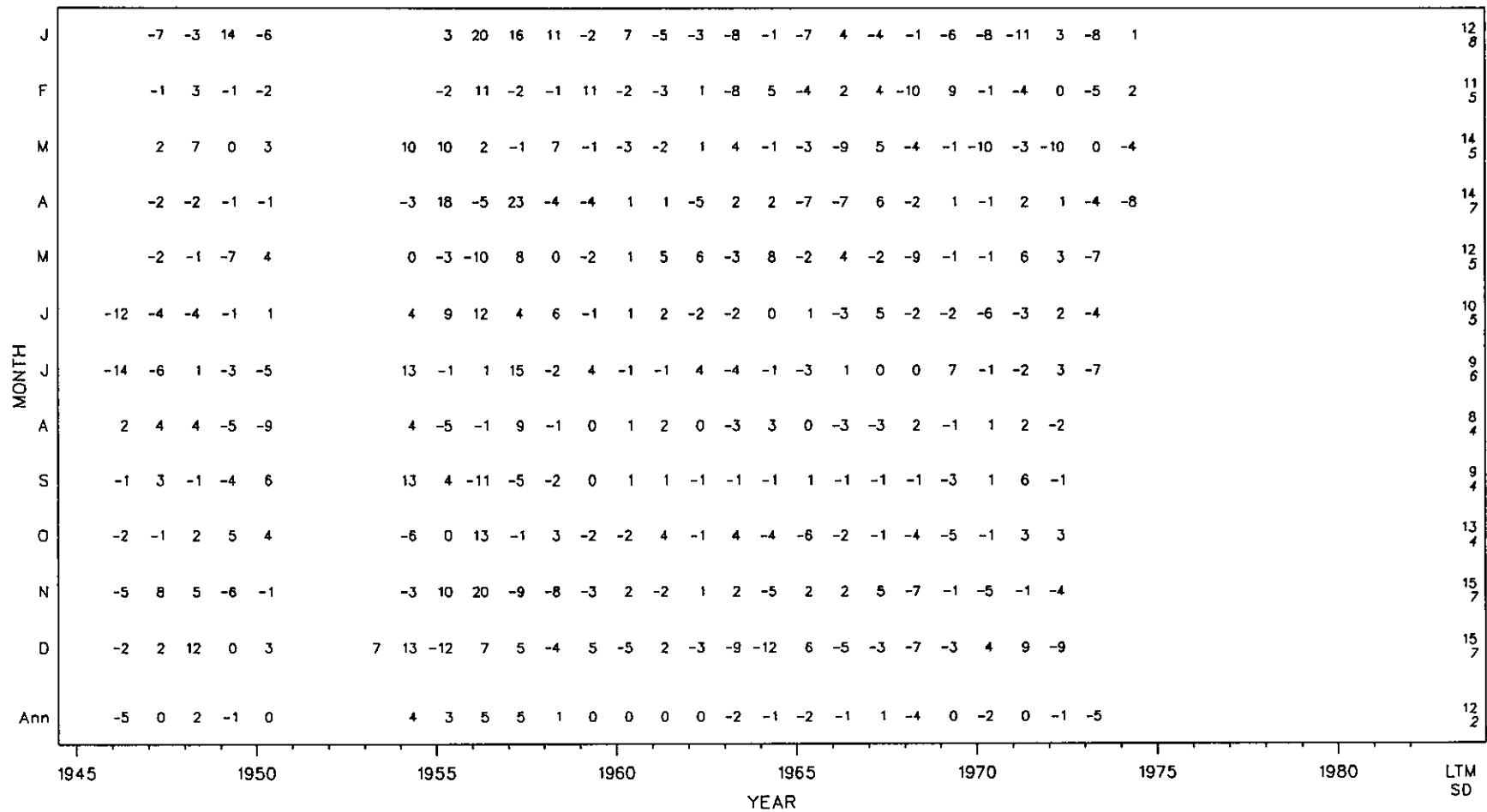
Units = 0.1 °C



OWS Study Area N Anomalies

Sea - Air Temperature Difference

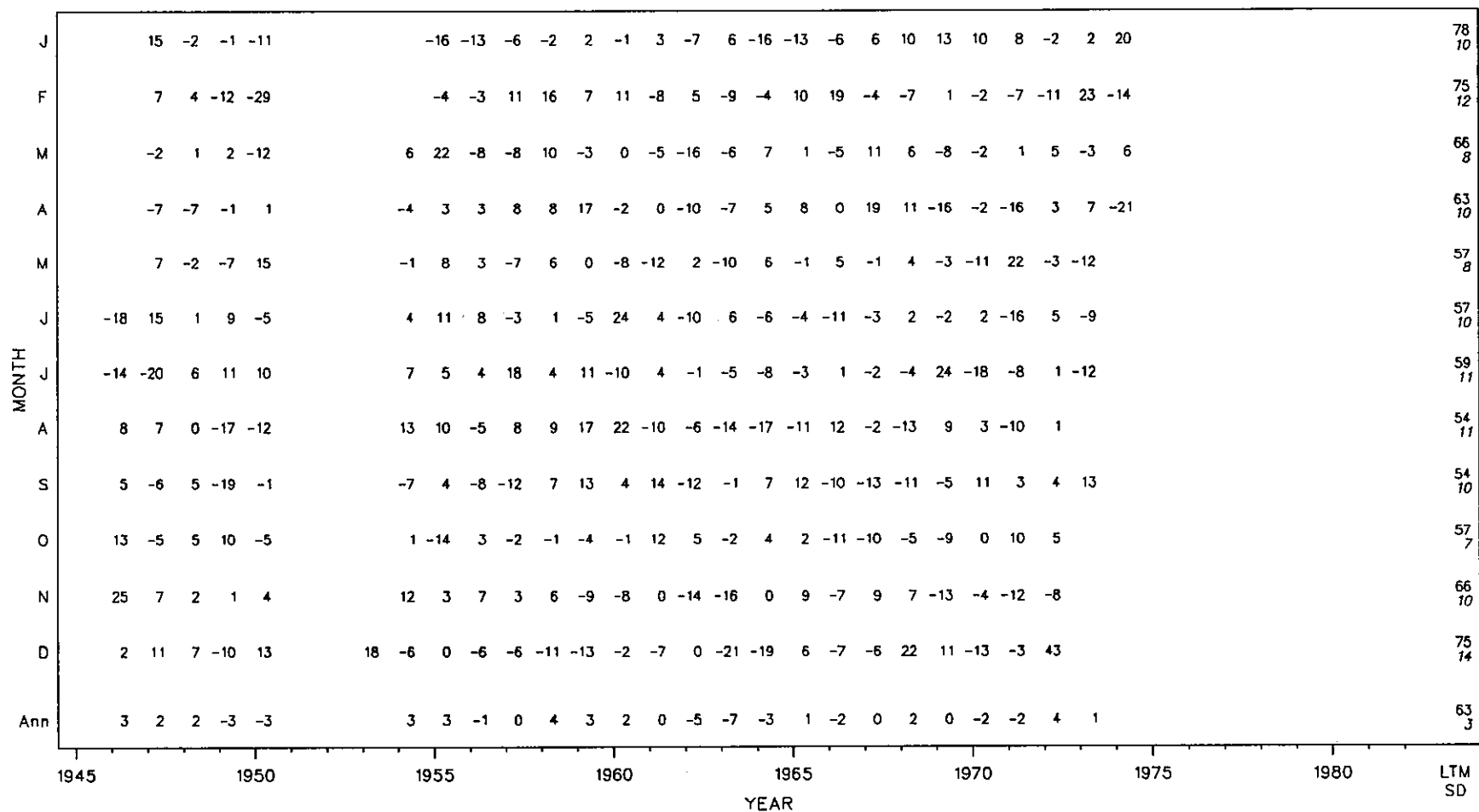
Units = 0.1 °C



OWS Study Area N Anomalies

Surface Scalar Wind

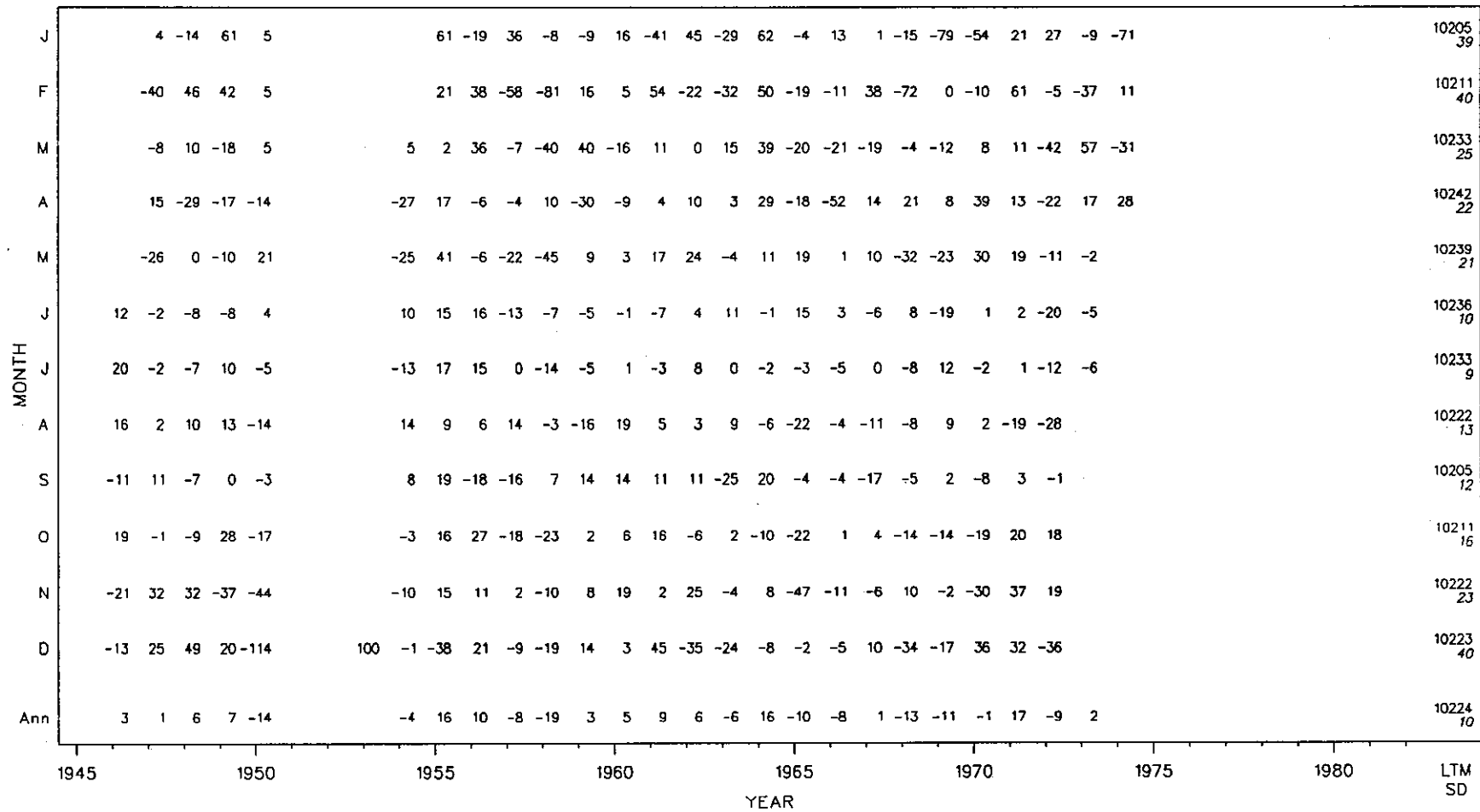
Units = 0.1 m/s



OWS Study Area N Anomalies

Sea Level Pressure

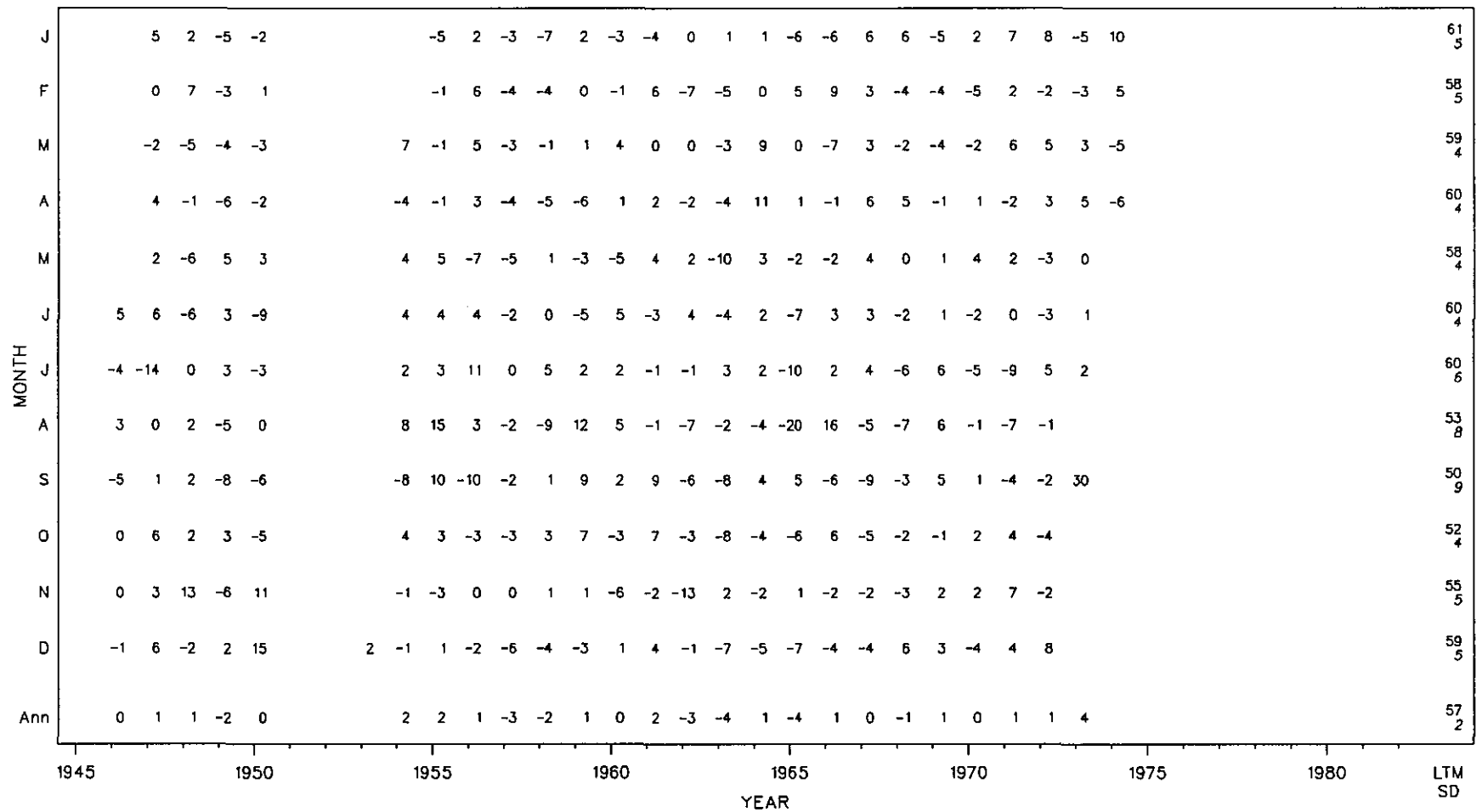
Units = 0.1 mb



OWS Study Area N Anomalies

Total Cloudiness

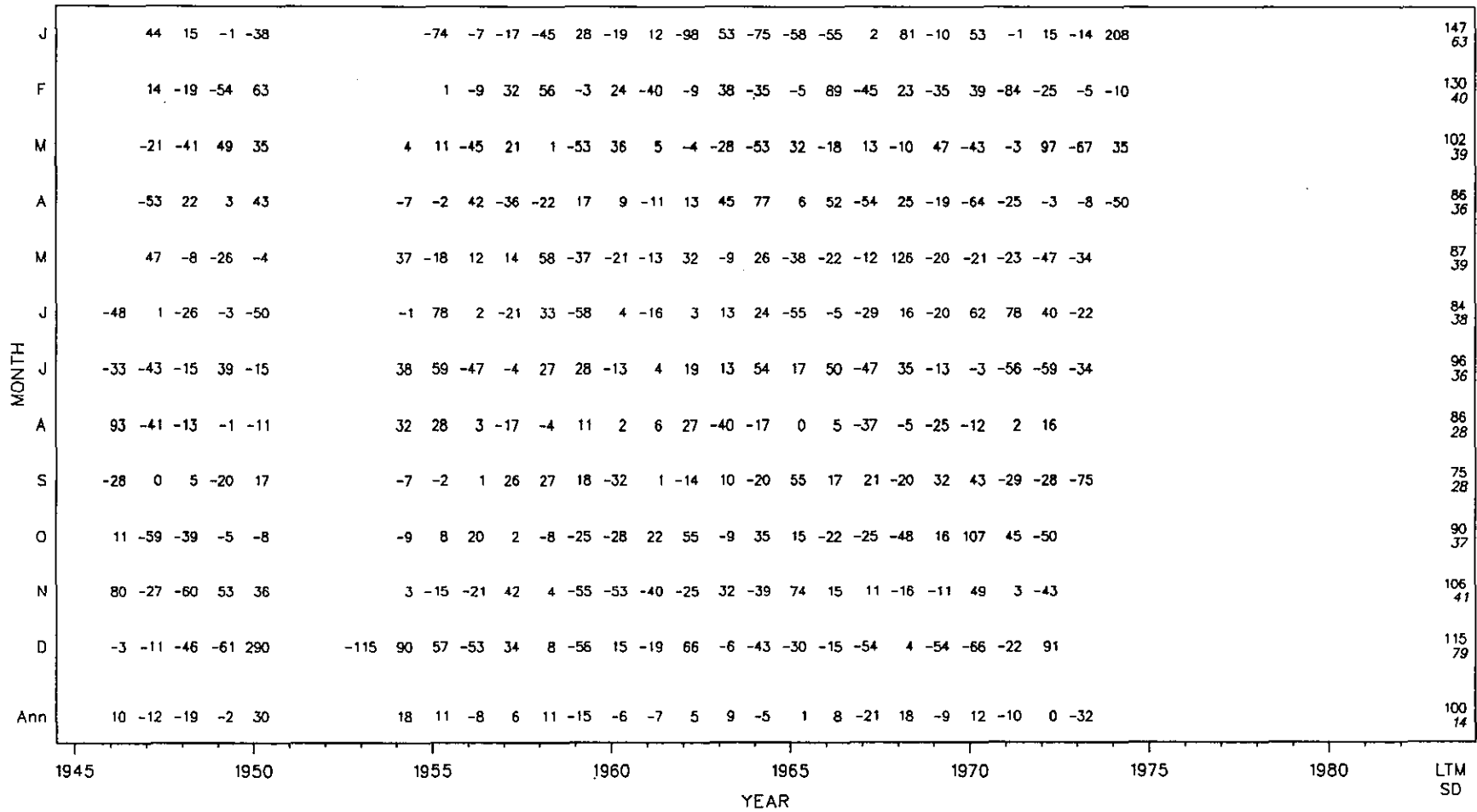
Units = 0.1 okta



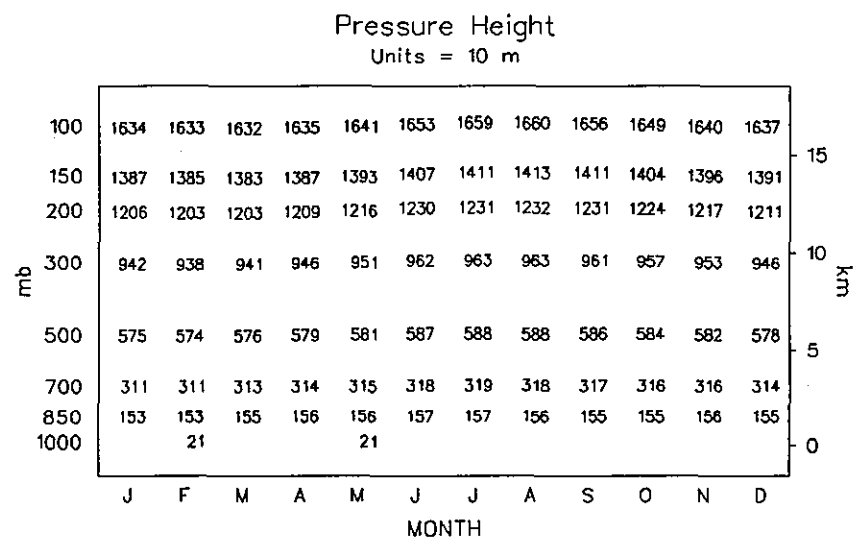
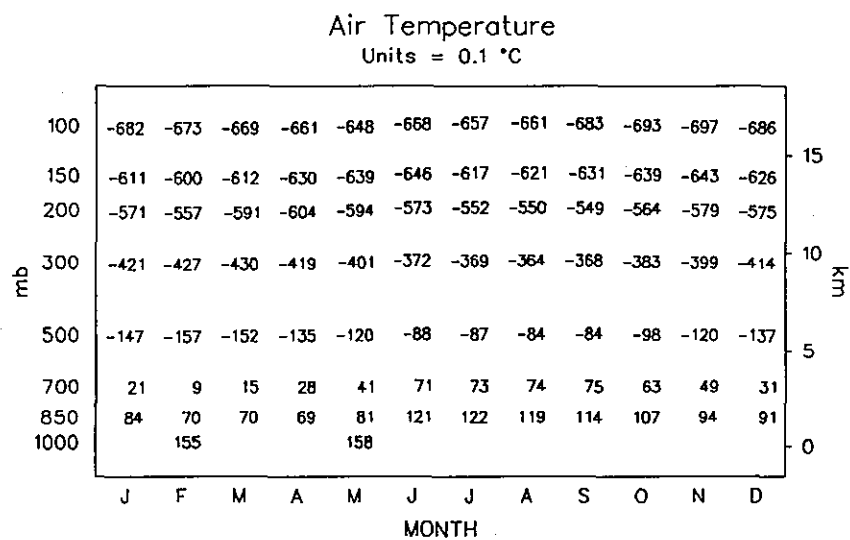
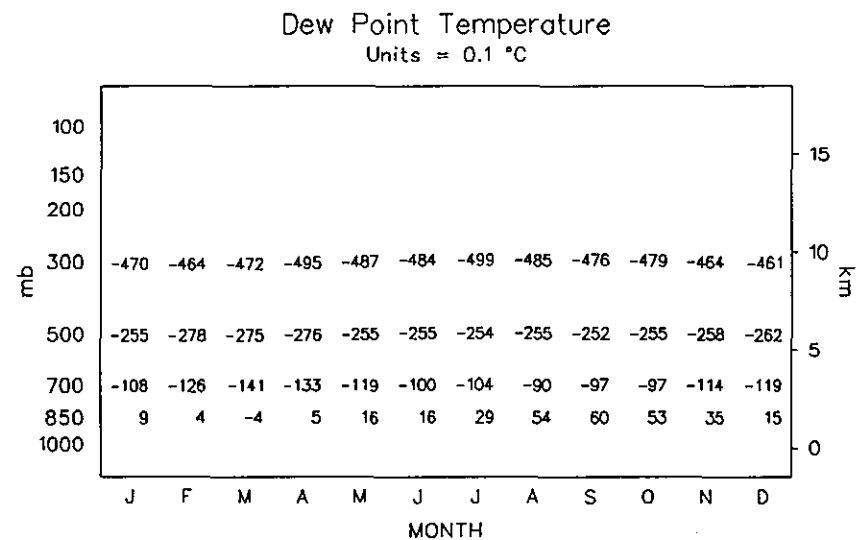
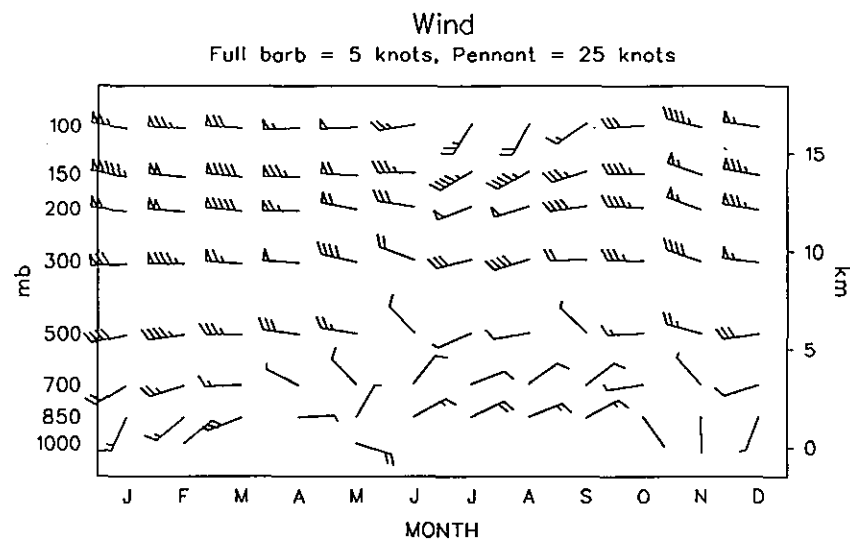
OWS Study Area N Anomalies

Precipitation Frequency

Units = 0.1 percent



OWS Study Area N Anomalies

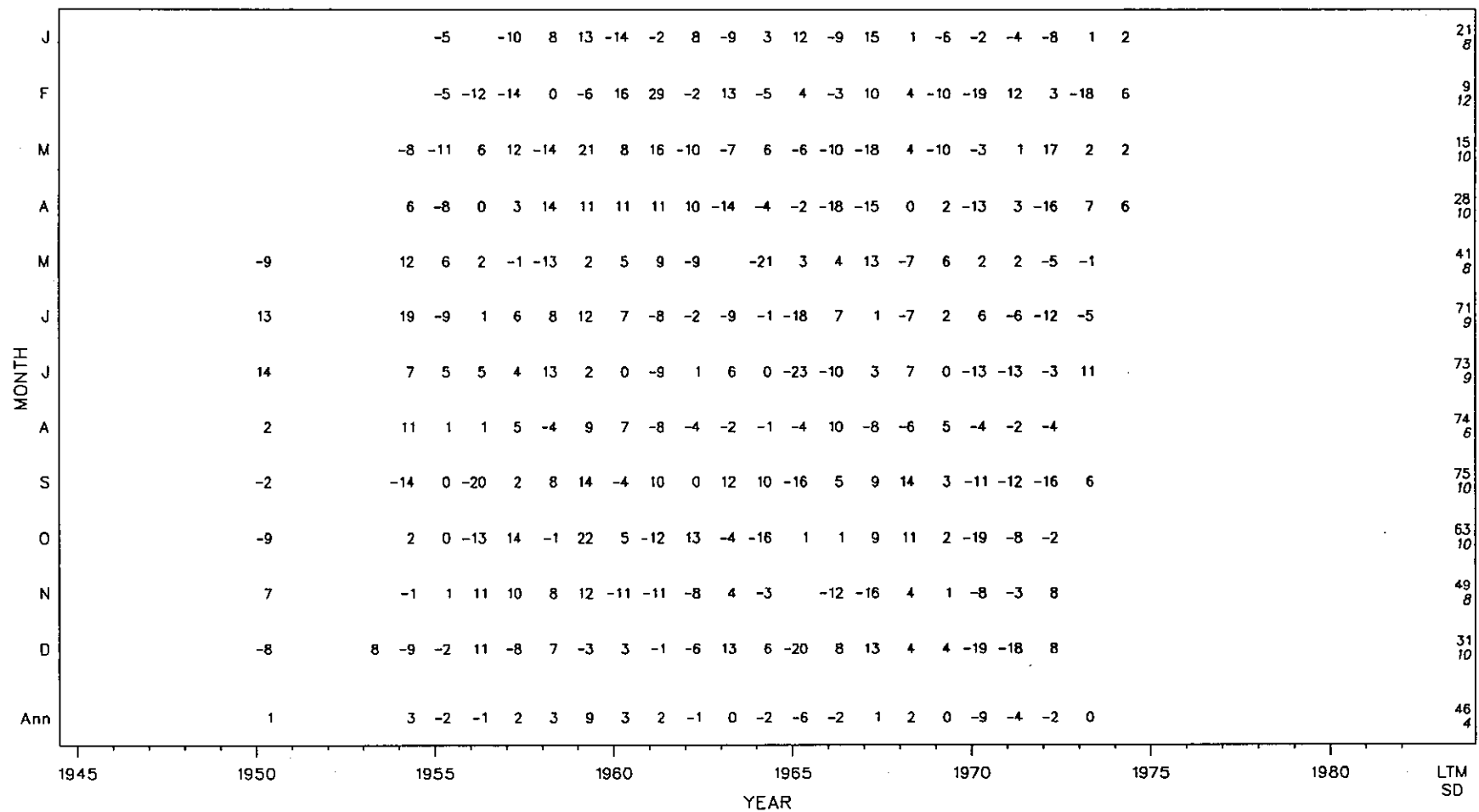


OWS Study Area N Upper Air Climatology

Mean plotted at actual height

Air Temperature: 700 mb

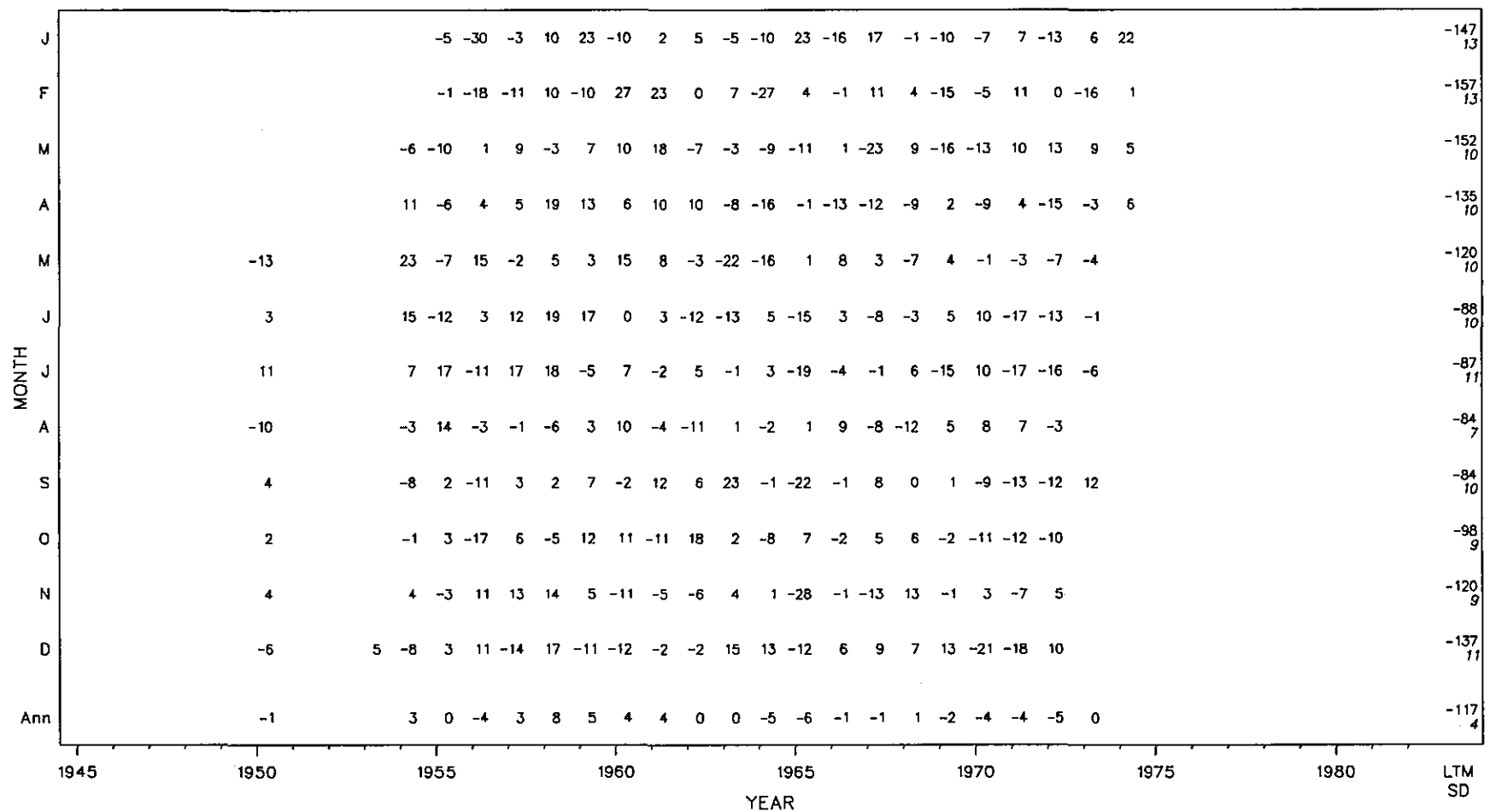
Units = 0.1 °C



OWS Study Area N Anomalies

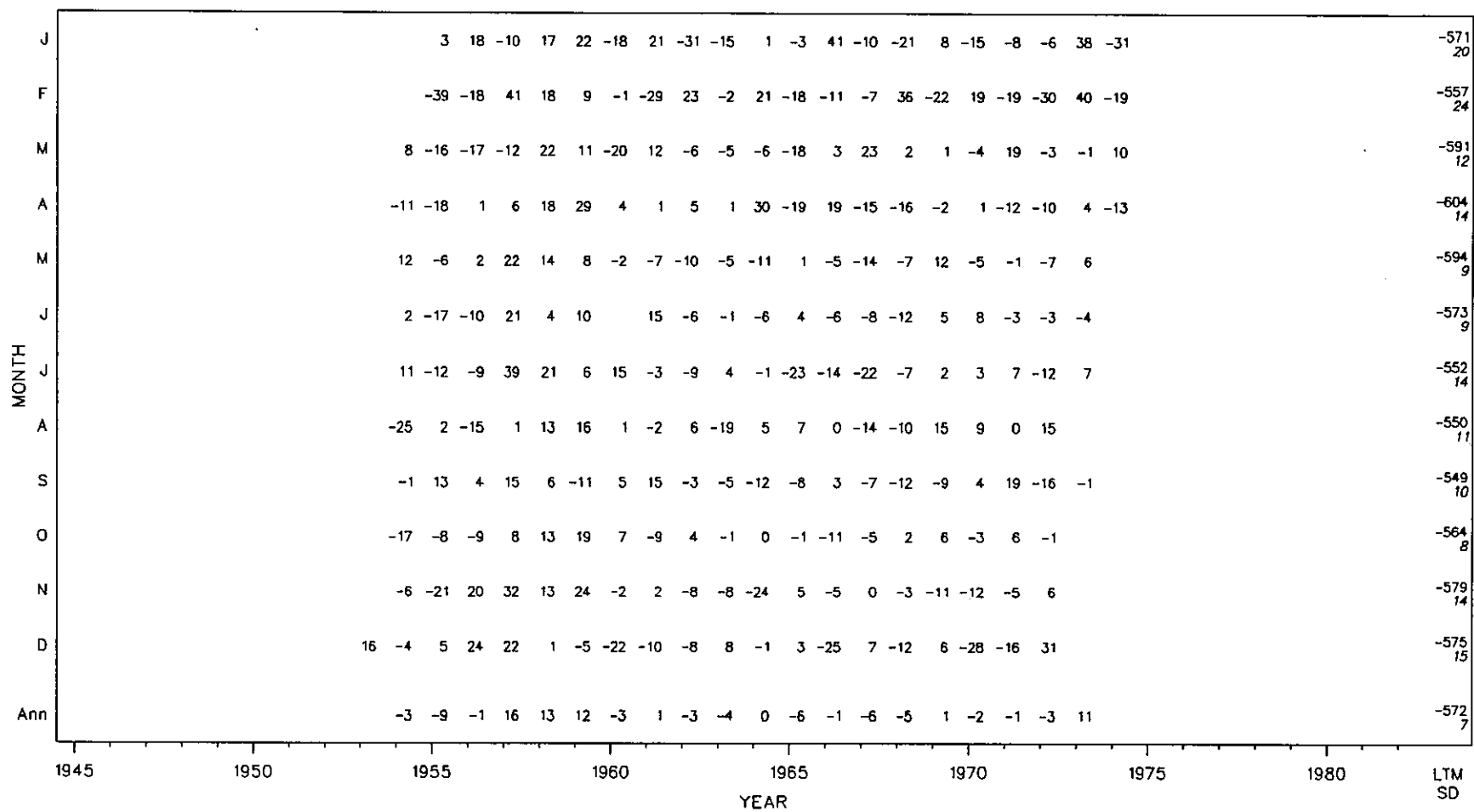
Air Temperature: 500 mb

Units = 0.1 °C



OWS Study Area N Anomalies

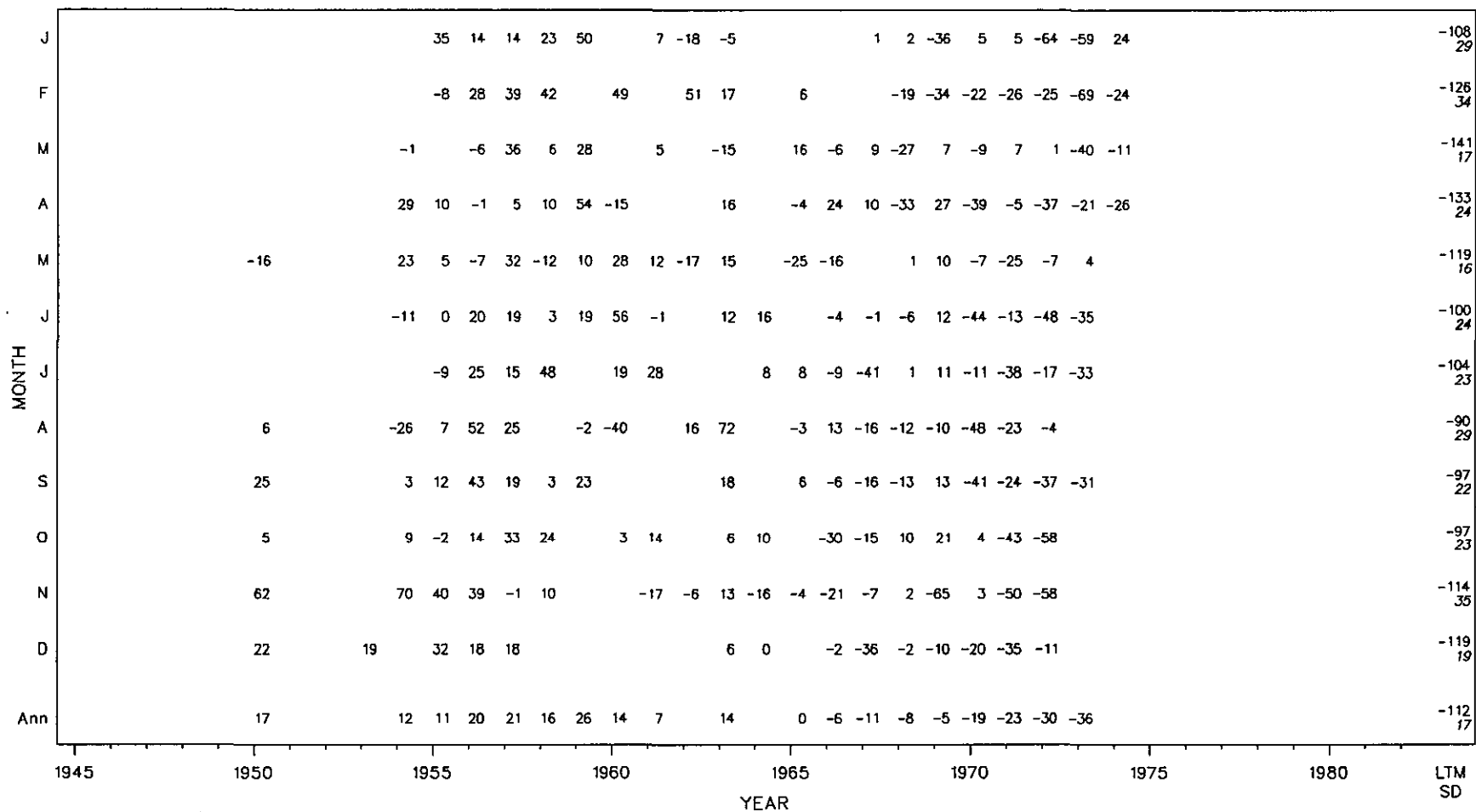
Units = 0.1 °C



OWS Study Area N Anomalies

Dew Point Temperature: 700 mb

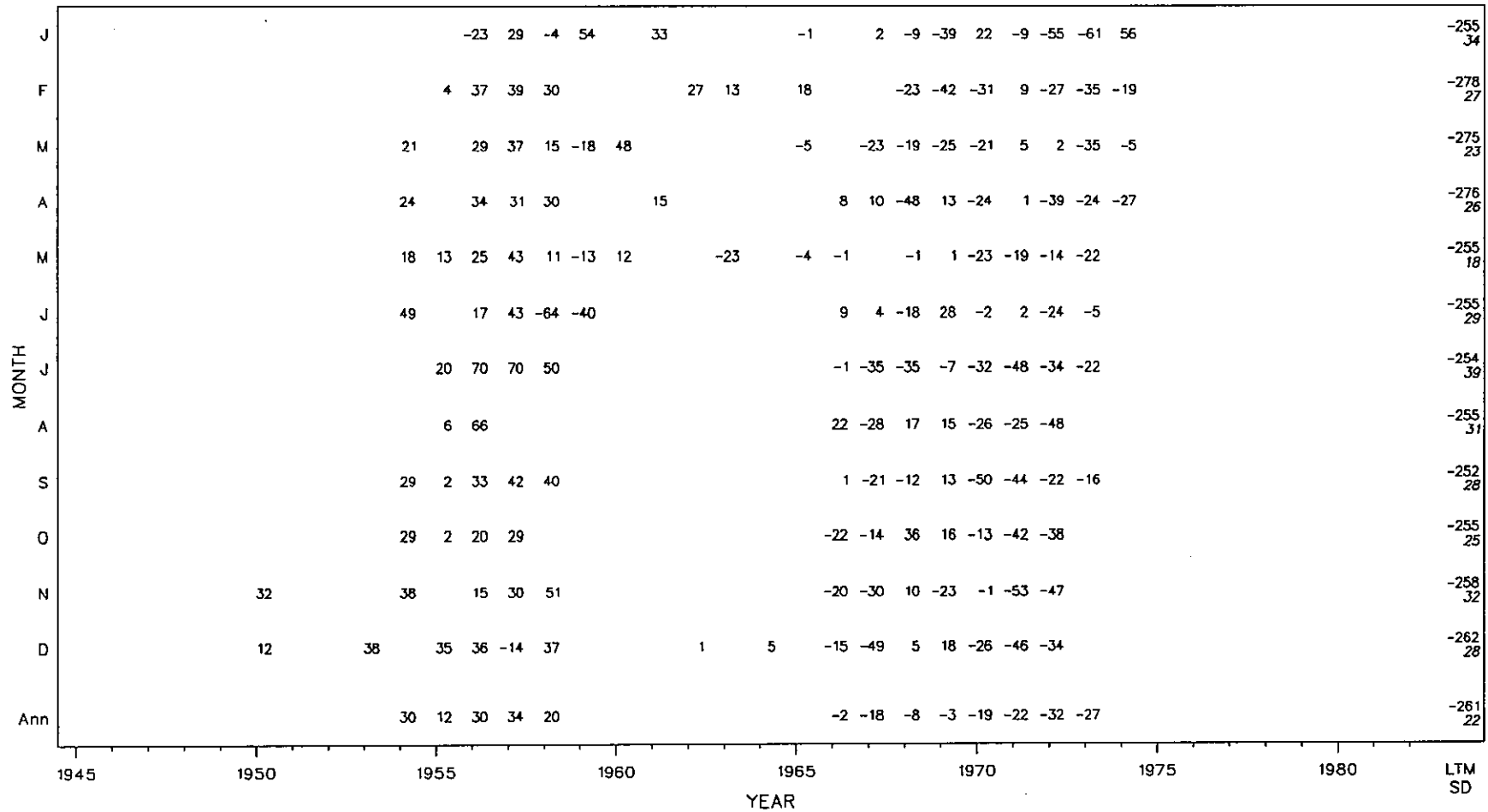
Units = 0.1 °C



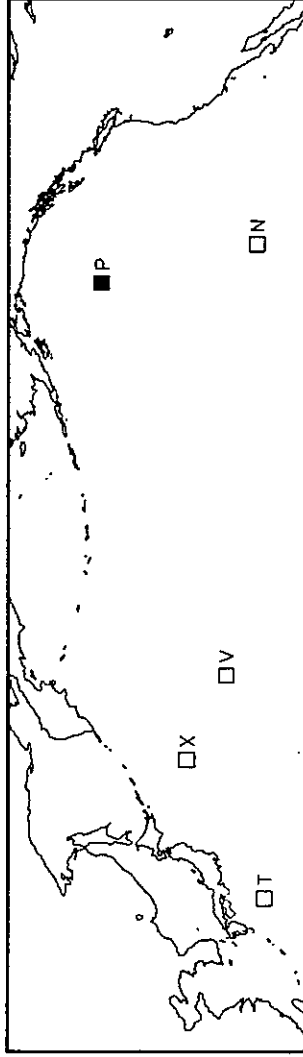
OWS Study Area N Anomalies

Dew Point Temperature: 500 mb

Units = 0.1 °C



OWS Study Area N Anomalies

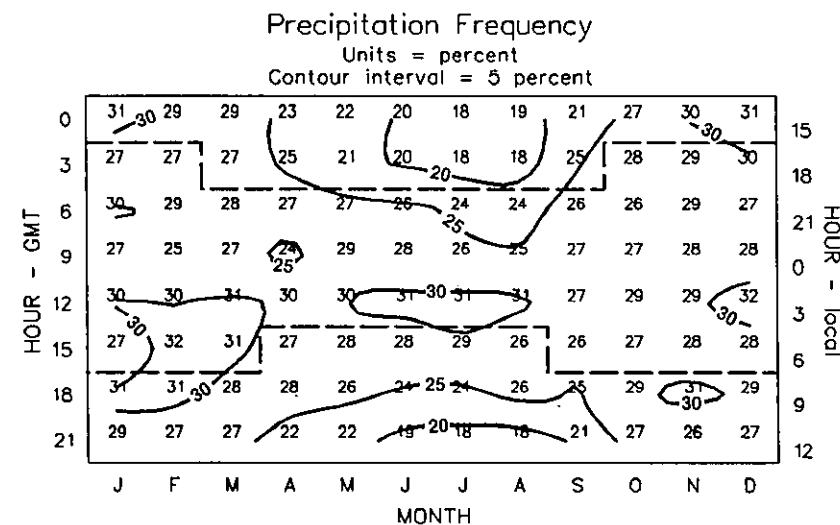
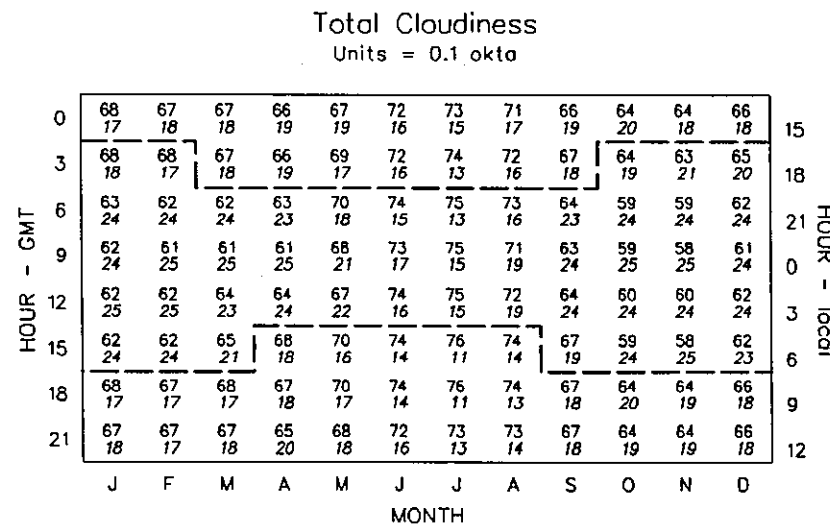
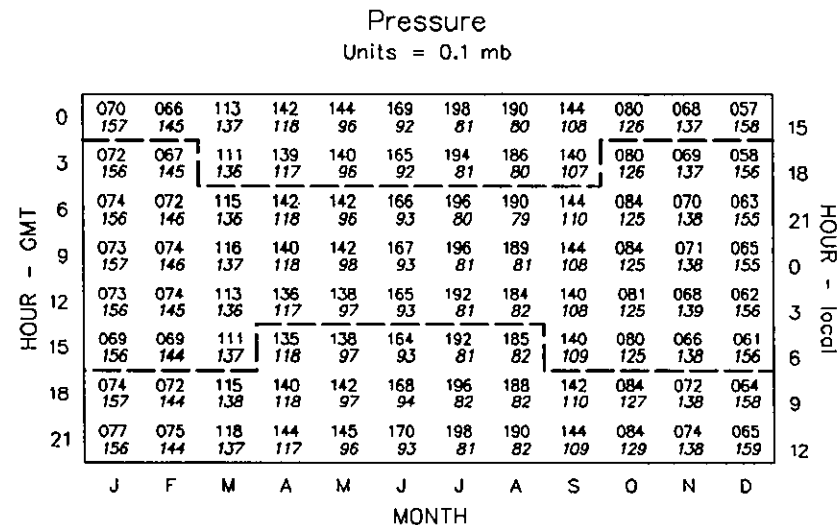
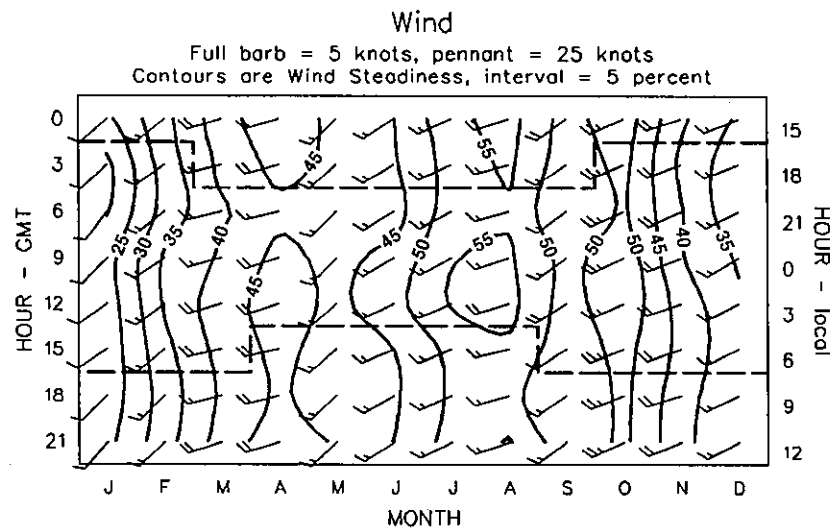


49.0°N – 50.9°N, 145.9°W – 144.0°W
1949 – 1981

OWS
P

MONTH																																		
	1945	1950	1955	1960	1965	1970	1975	1980	Sum																									
J	30	31	20	31	30	31	31	31	31	30	31	31	31	31	25	30	23	31	31	31	31	31	28	31	28	27	31	31	31	18	26	935		
F	28	28	29	28	28	28	29	28	28	28	29	28	28	28	29	28	28	29	28	28	28	28	26	28	28	27	27	27	27	29	27	895		
M	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	26	31	29	24	30	31	31	30	976			
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J	31	31	31	31	31	31	31	31	31	31	31	30	31	31	31	31	31	31	31	31	31	31	31	31	31	31	27	31	31	31		956		
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S	30	30	30	30	30	30	28	30	30	30	30	30	30	30	29	30	30	30	30	30	30	30	28	30	27	29	30	30	30	26		917		
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Ann	12	364	365	340	365	362	364	362	365	357	362	366	363	359	364	362	346	363	352	366	365	365	363	358	351	352	359	345	343	357	359	341	164	11281
	12	364	363	340	365	362	361	345	338	356	361	366	363	358	306	360	346	363	352	366	365	365	358	358	351	349	358	343	342	357	358	337	164	11152

Each of the 11 variables was observed on X days of each month. The upper number is the maximum X from among all the variables. The lower number is the minimum X from among all the variables.



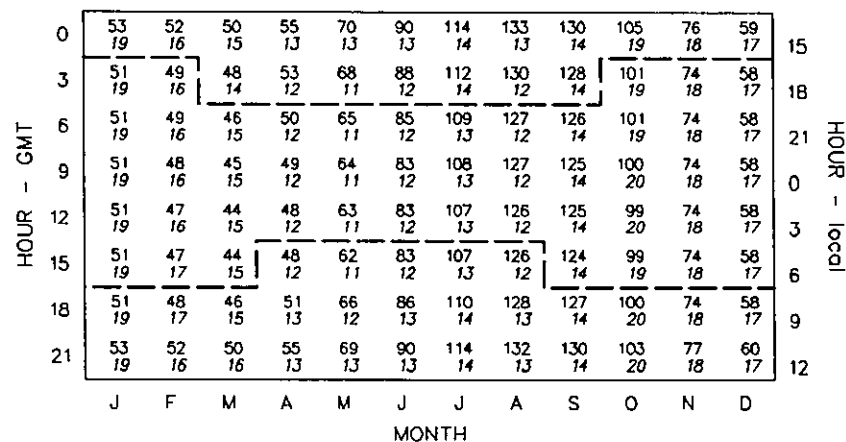
OWS Study Area P Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
--- sunrise/sunset

Air Temperature

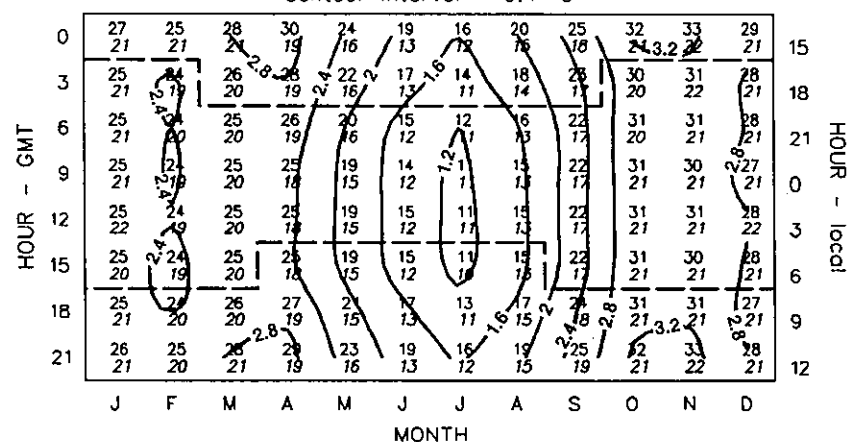
Units = 0.1 °C



Dew Point Depression

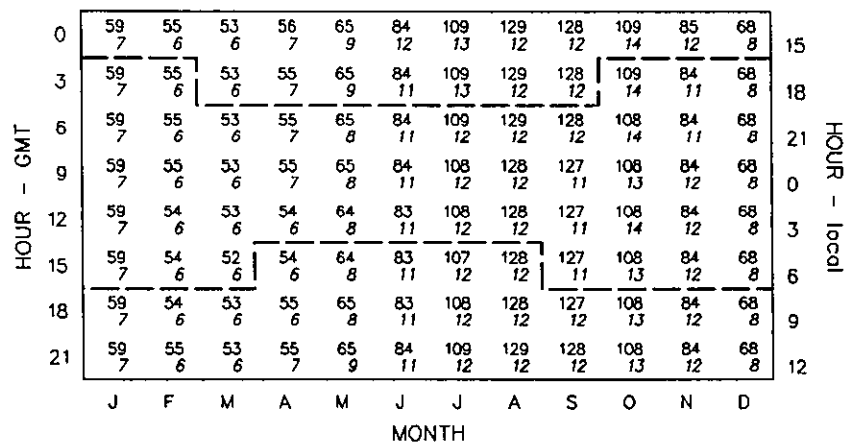
Units = 0.1 °C

Contour interval = 0.4 °C



Sea Surface Temperature

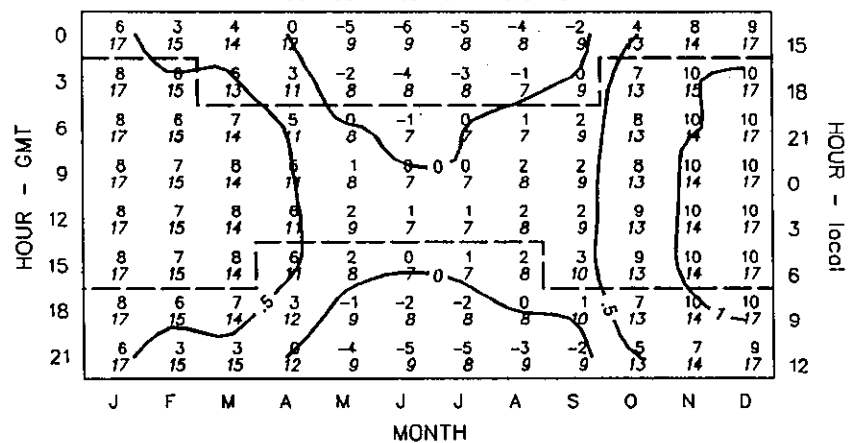
Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C

Contour interval = 0.5 °C



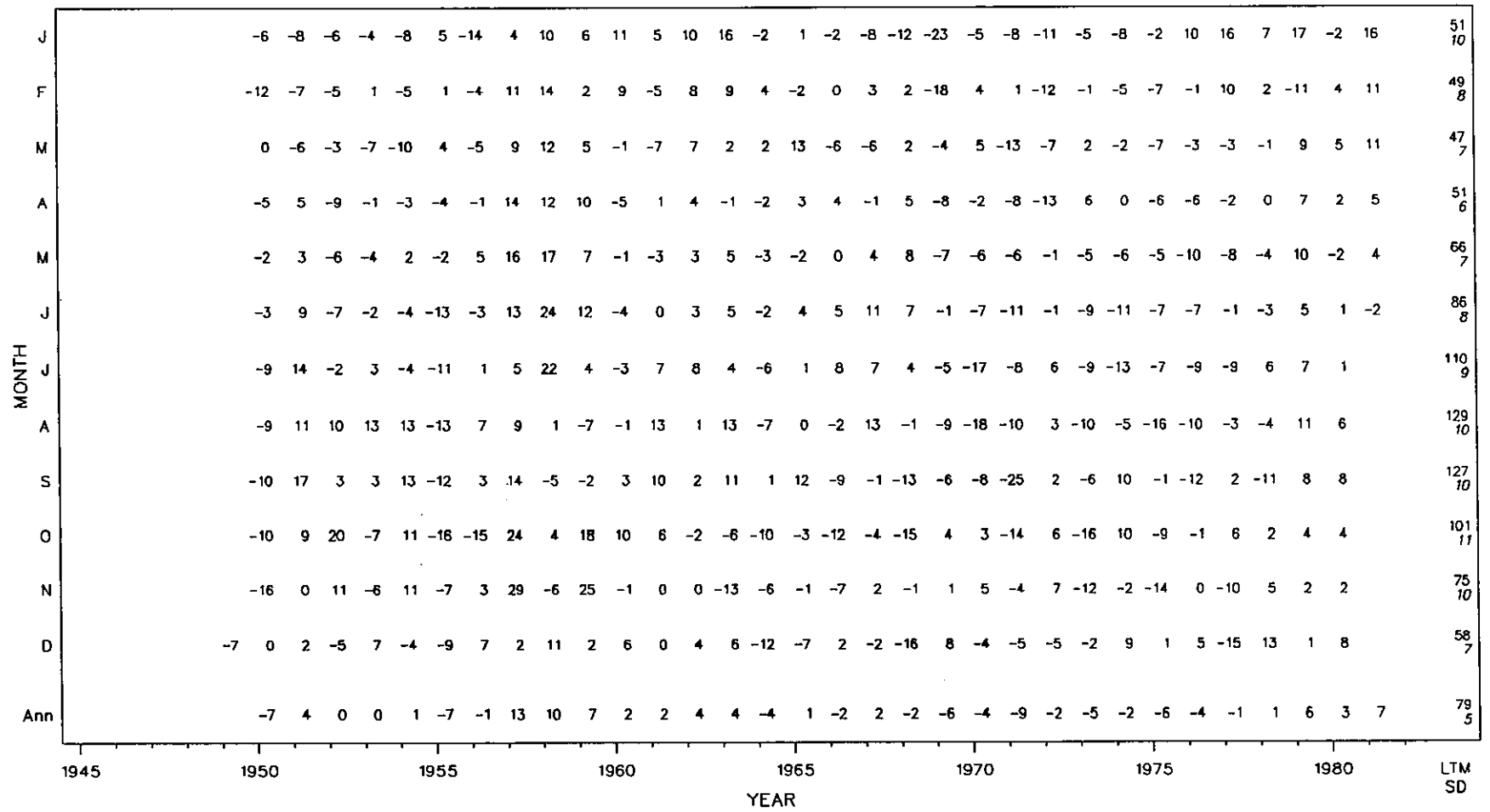
OWS Study Area P Surface Climatology

upper number = mean
lower number = standard deviation

———— data contours
- - - - - sunrise/sunset

Surface Air Temperature

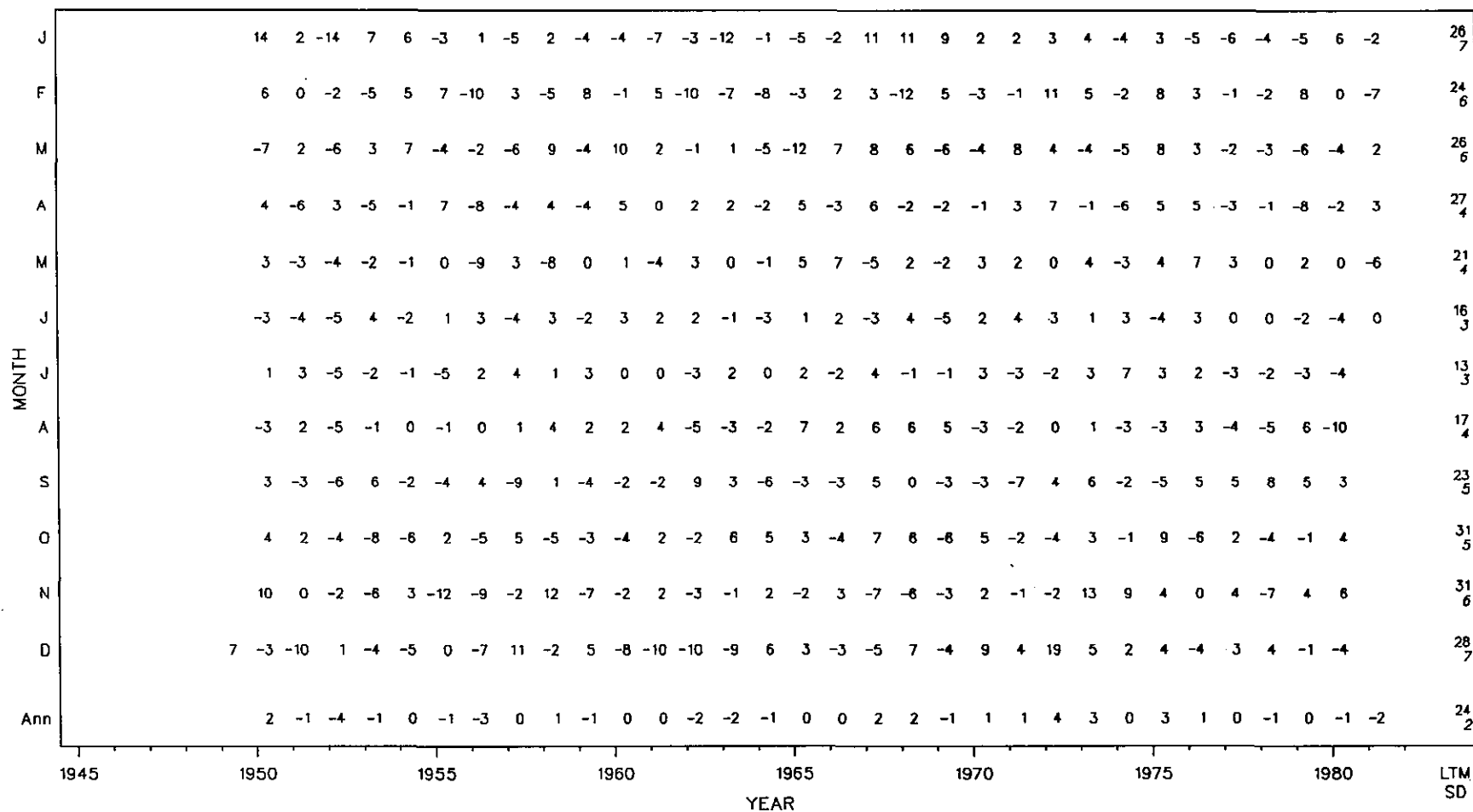
Units = 0.1 °C



OWS Study Area P Anomalies

Surface Dew Point Depression

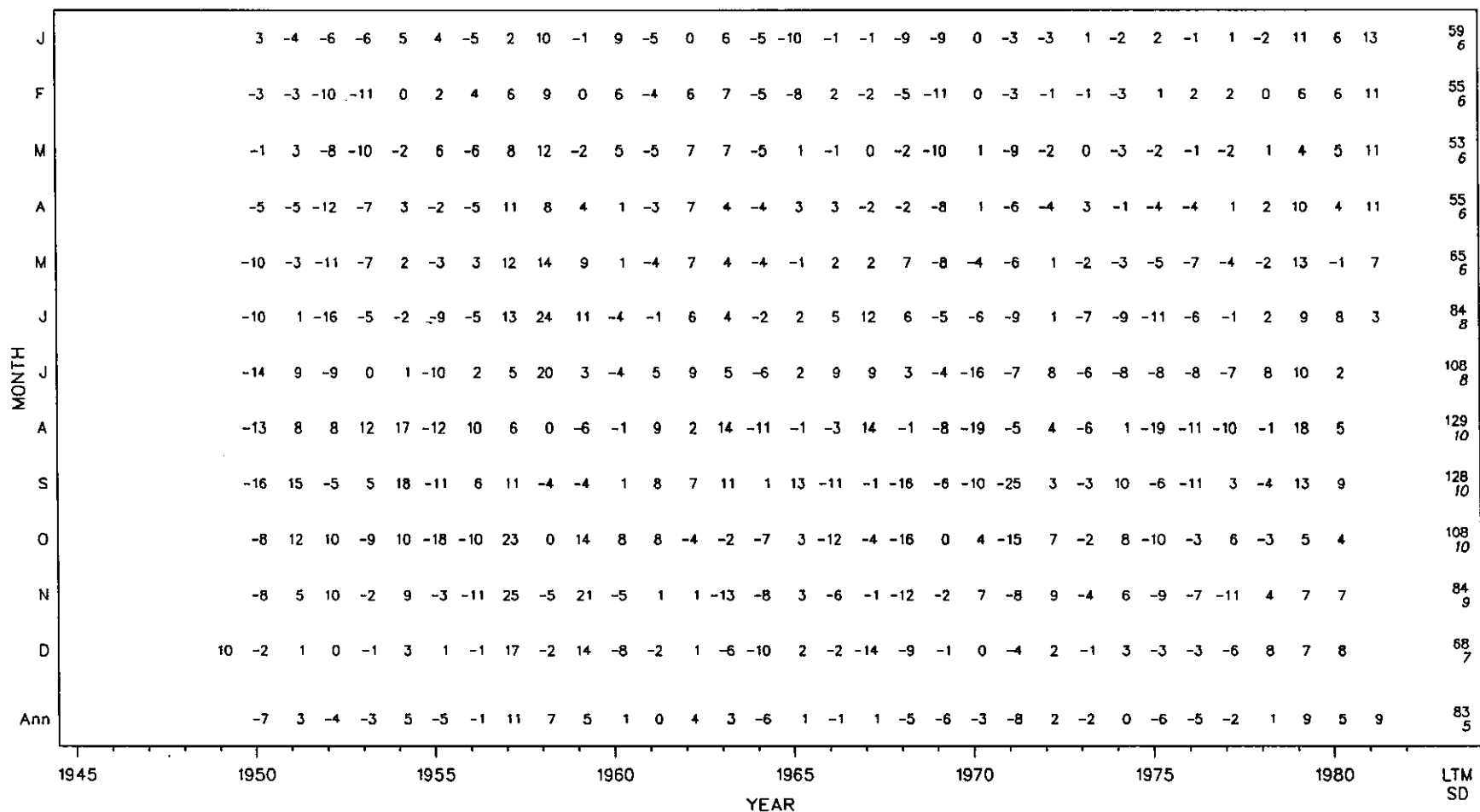
Units = 0.1 °C



OWS Study Area P Anomalies

Sea Surface Temperature

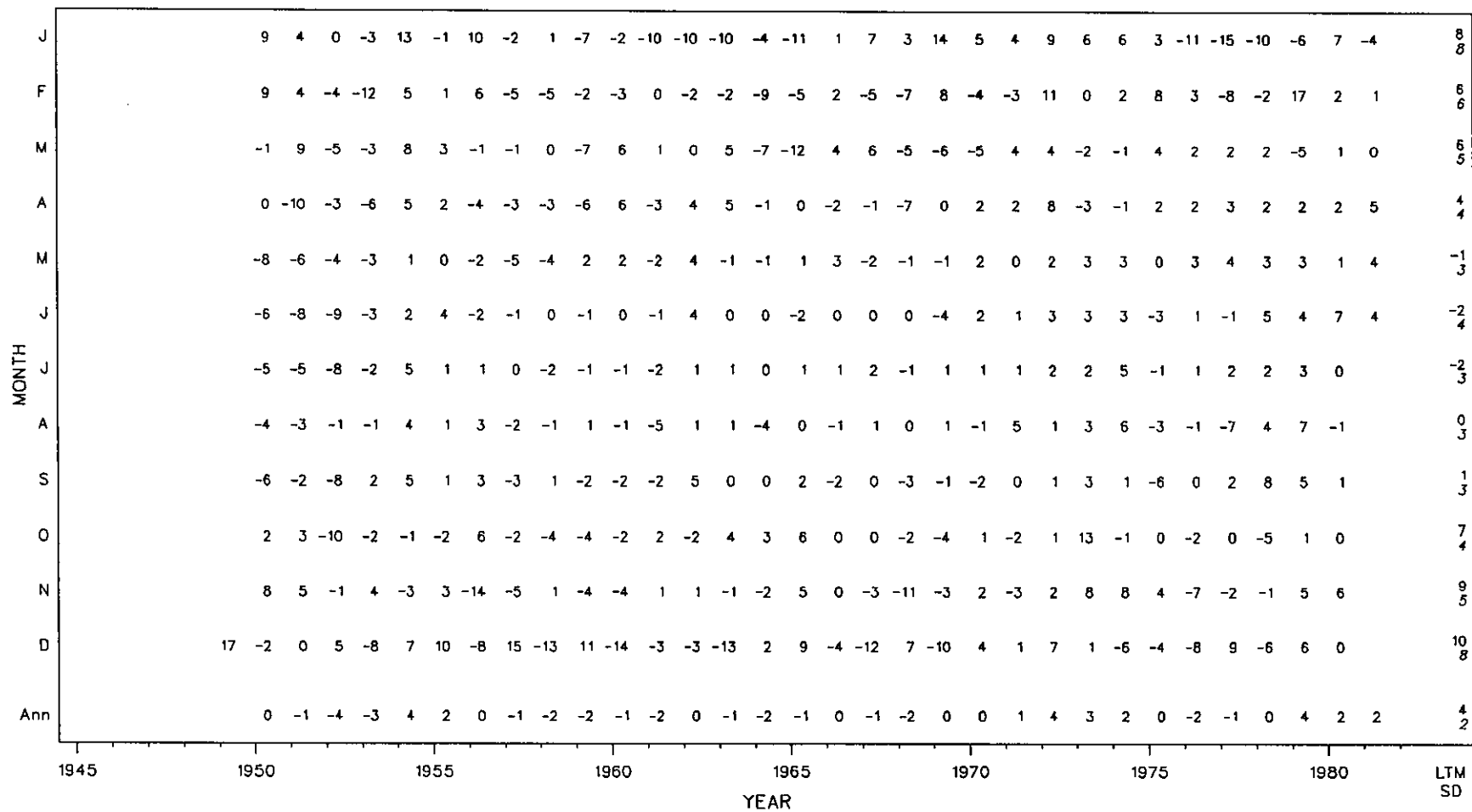
Units = 0.1 °C



OWS Study Area P Anomalies

Sea - Air Temperature Difference

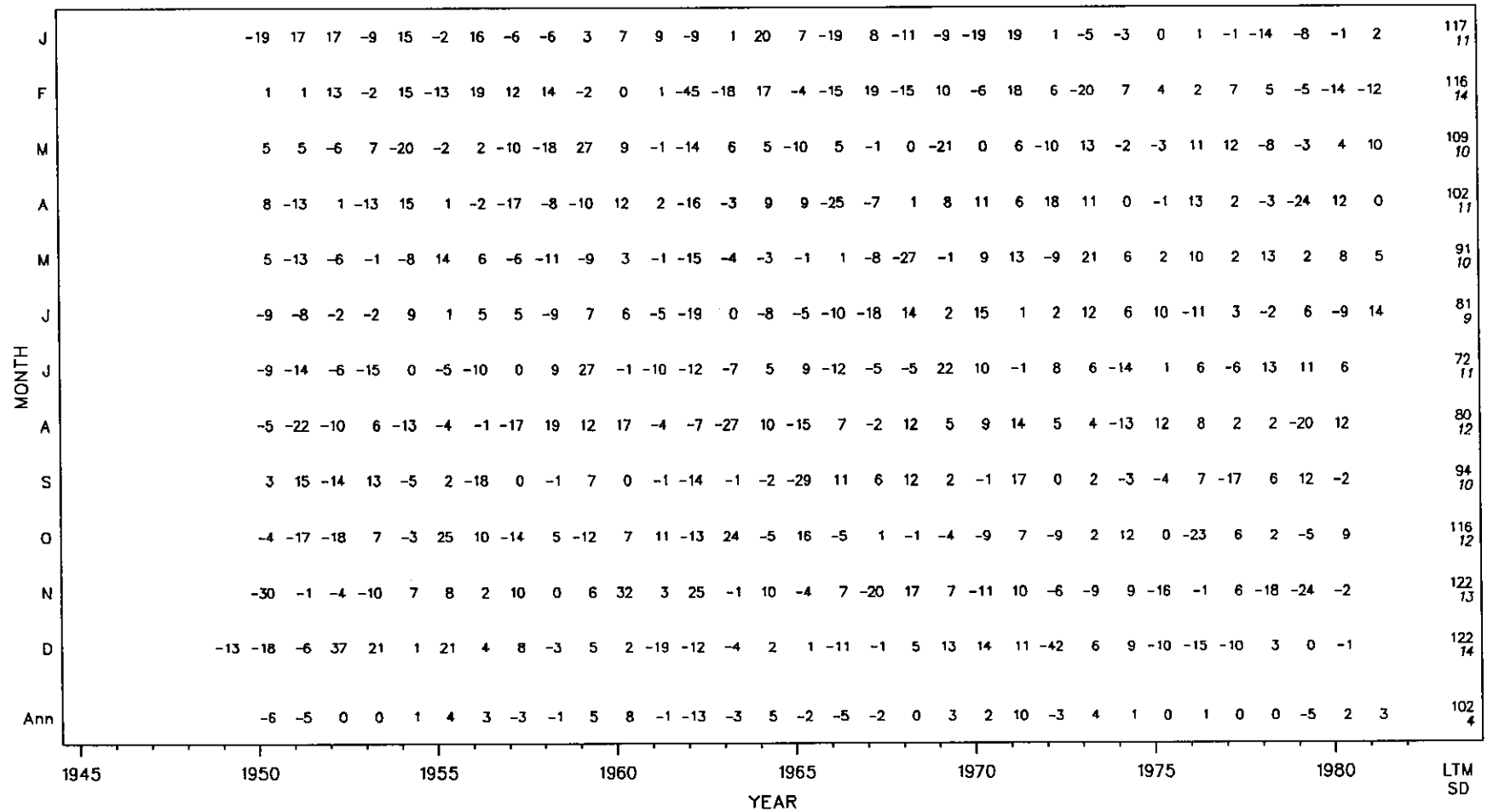
Units = 0.1 °C



OWS Study Area P Anomalies

Surface Scalar Wind

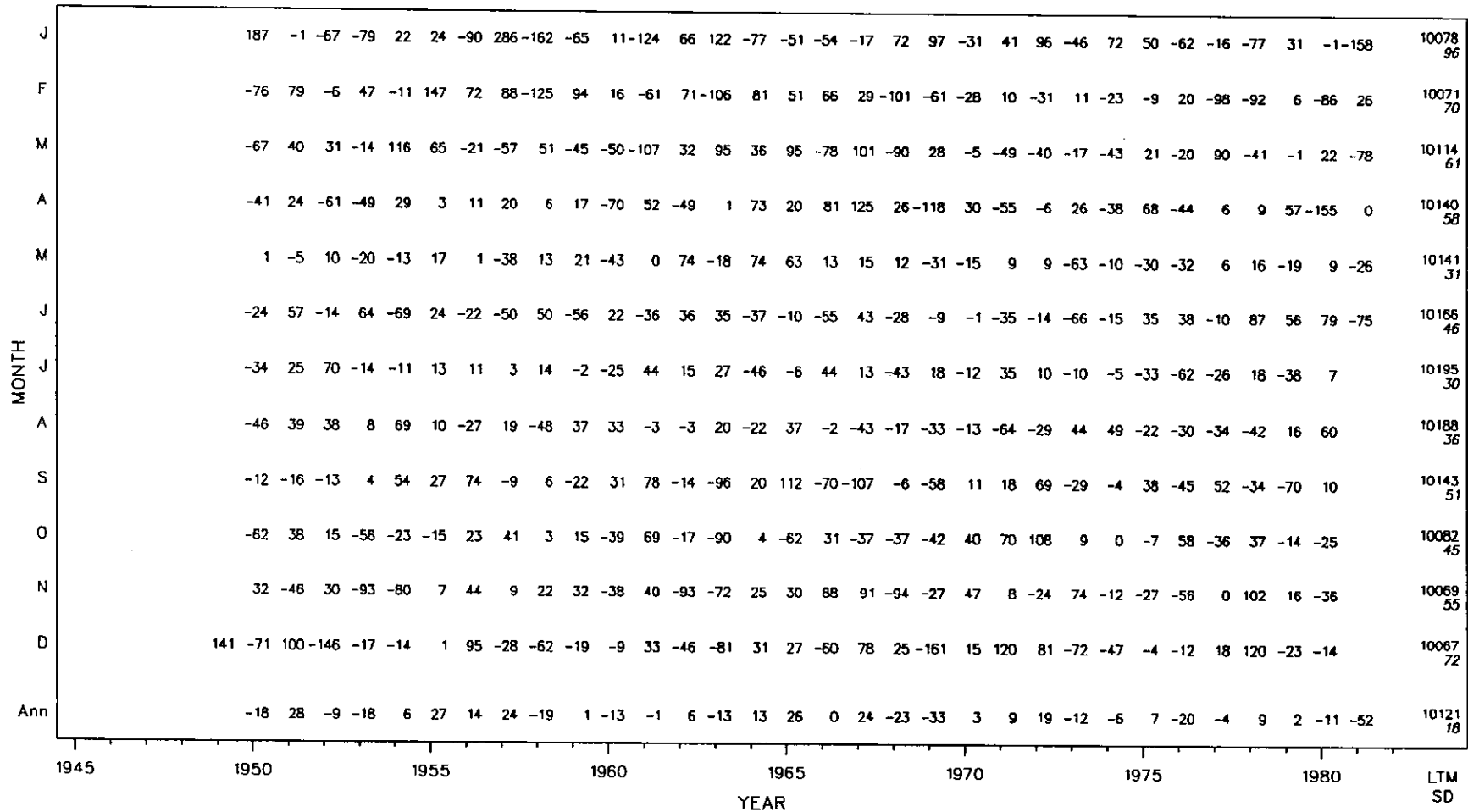
Units = 0.1 m/s



OWS Study Area P Anomalies

Sea Level Pressure

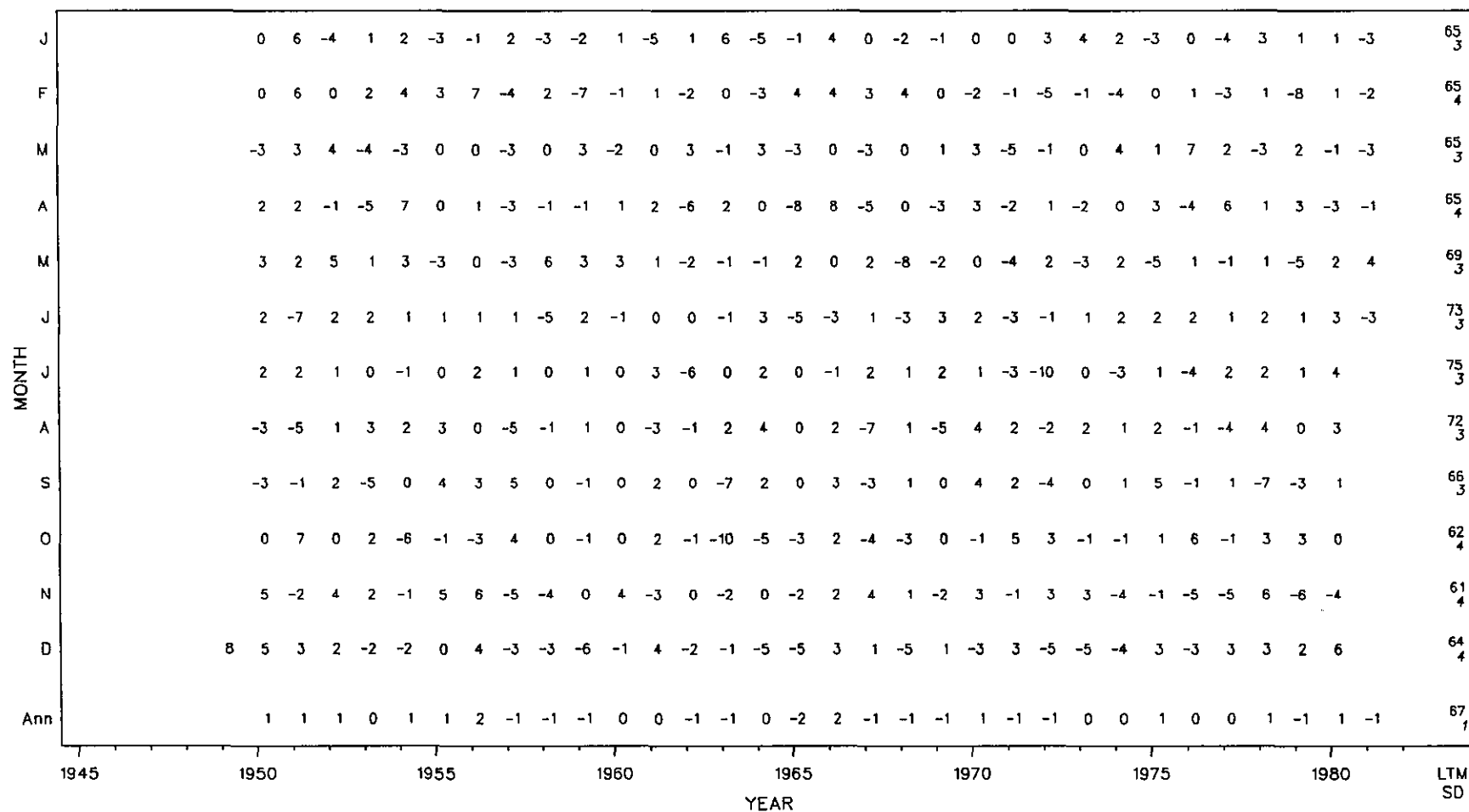
Units = 0.1 mb



OWS Study Area P Anomalies

Total Cloudiness

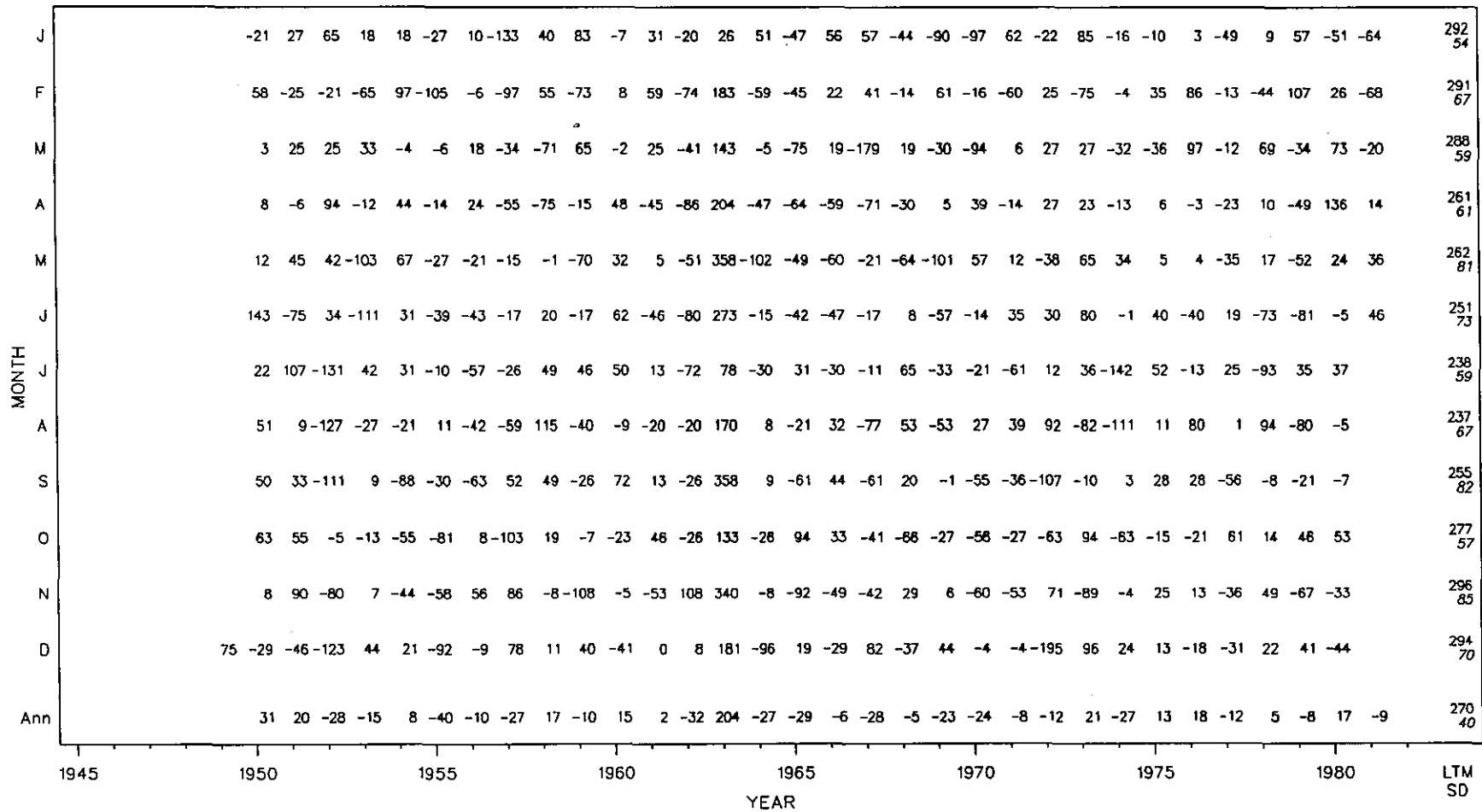
Units = 0.1 okta



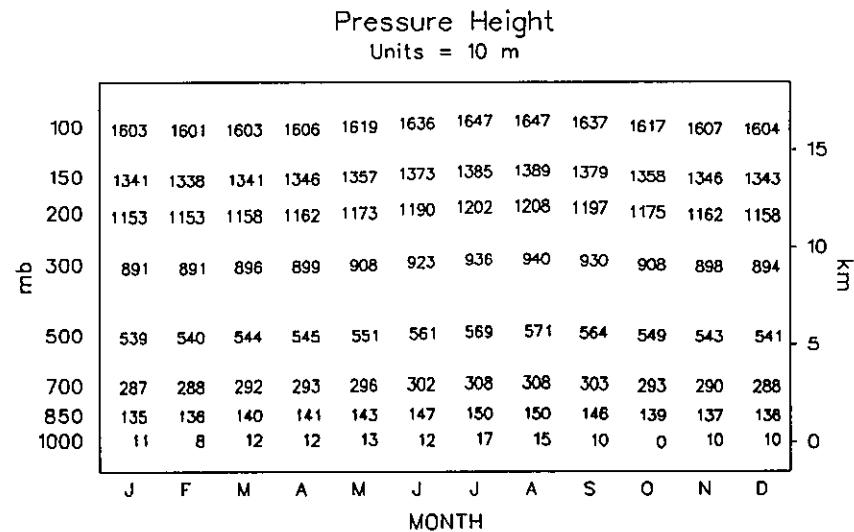
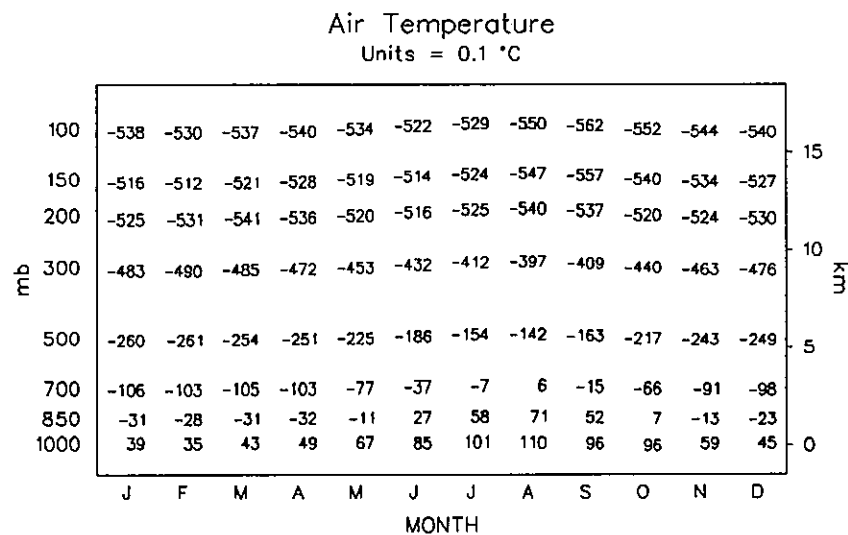
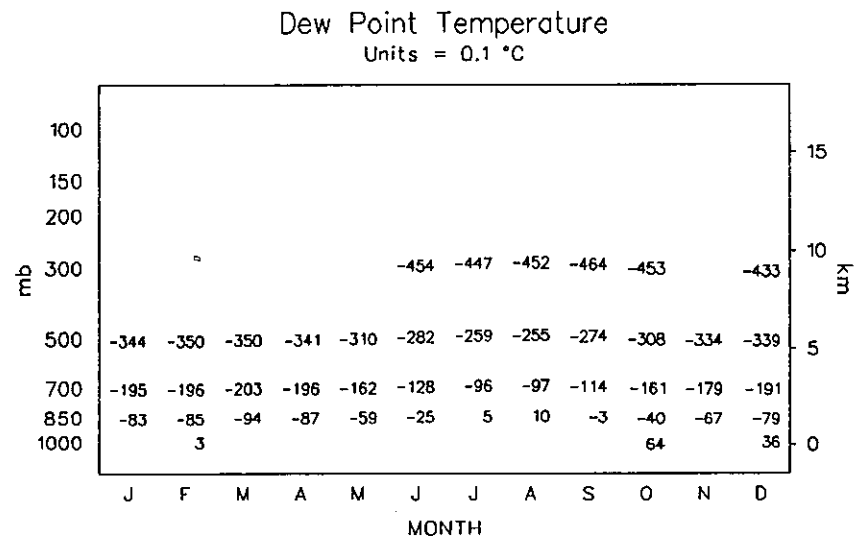
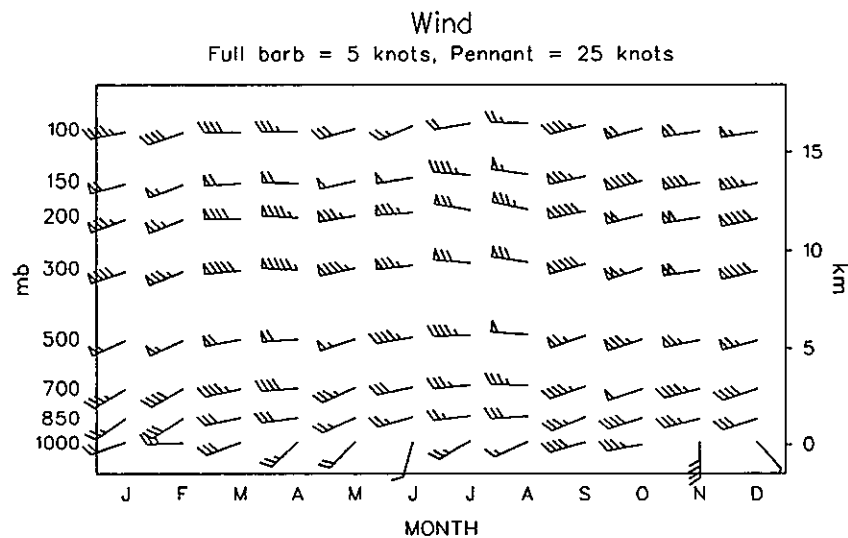
OWS Study Area P Anomalies

Precipitation Frequency

Units = 0.1 percent



OWS Study Area P Anomalies

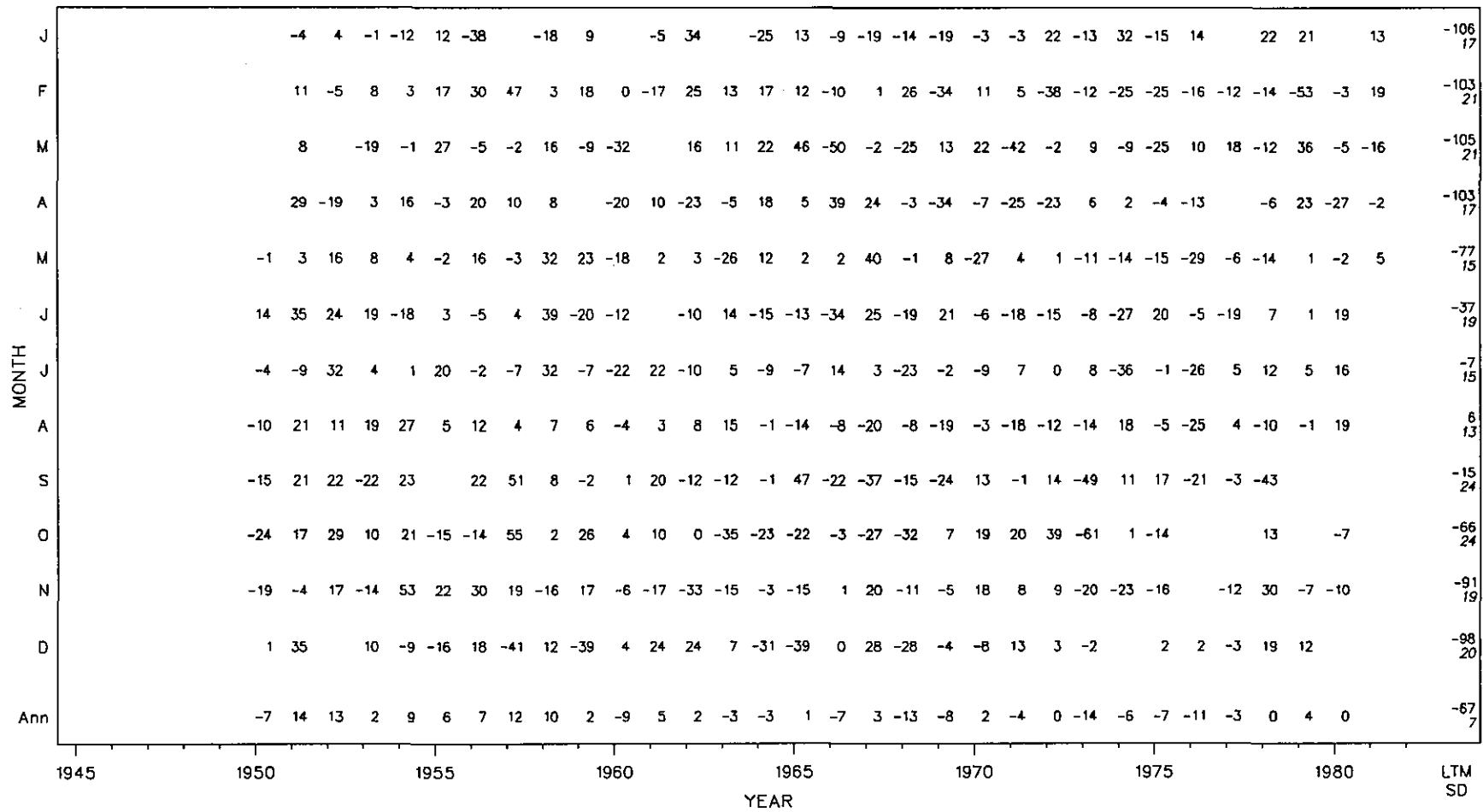


OWS Study Area P Upper Air Climatology

Mean plotted at actual height

Air Temperature: 700 mb

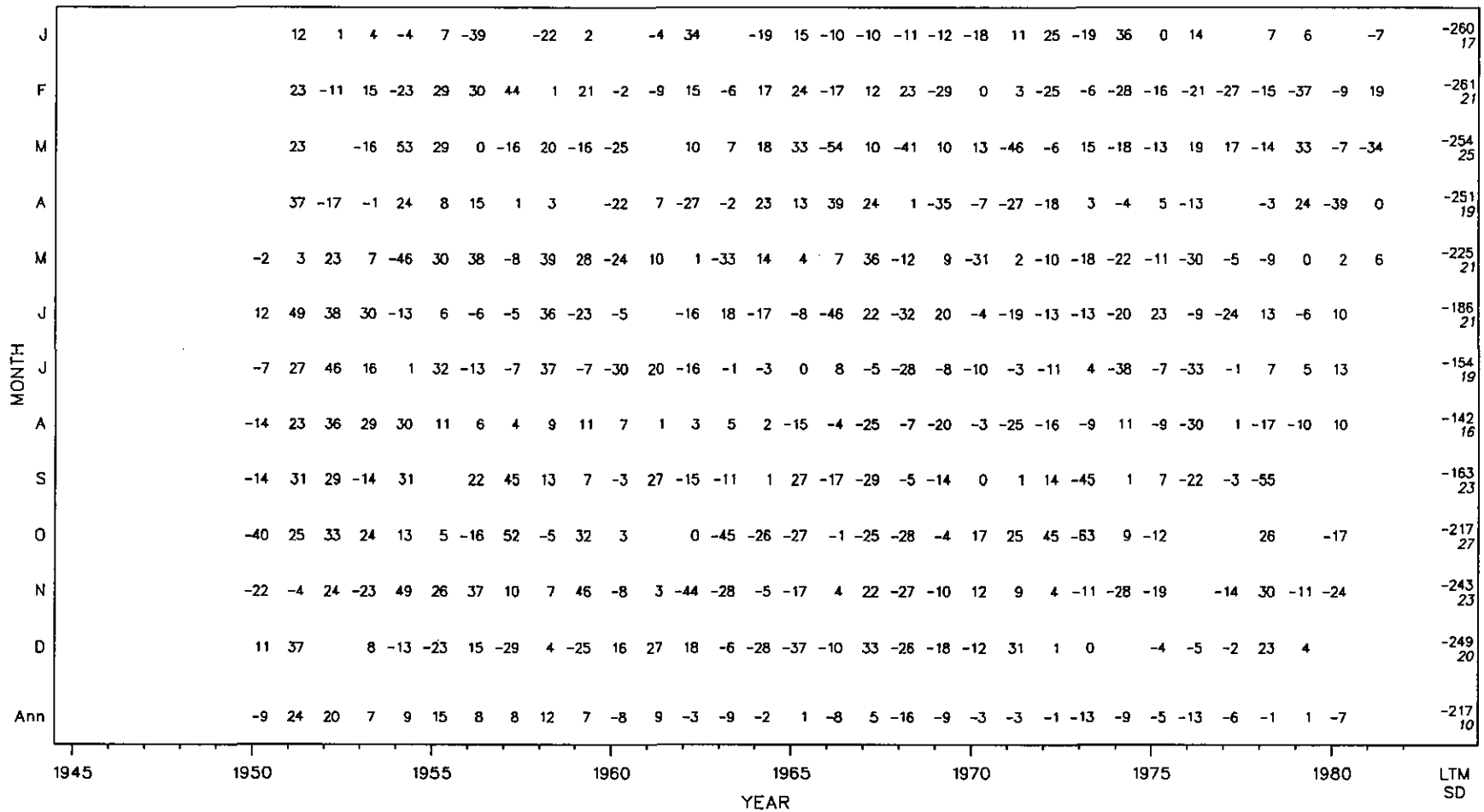
Units = 0.1 °C



OWS Study Area P Anomalies

Air Temperature: 500 mb

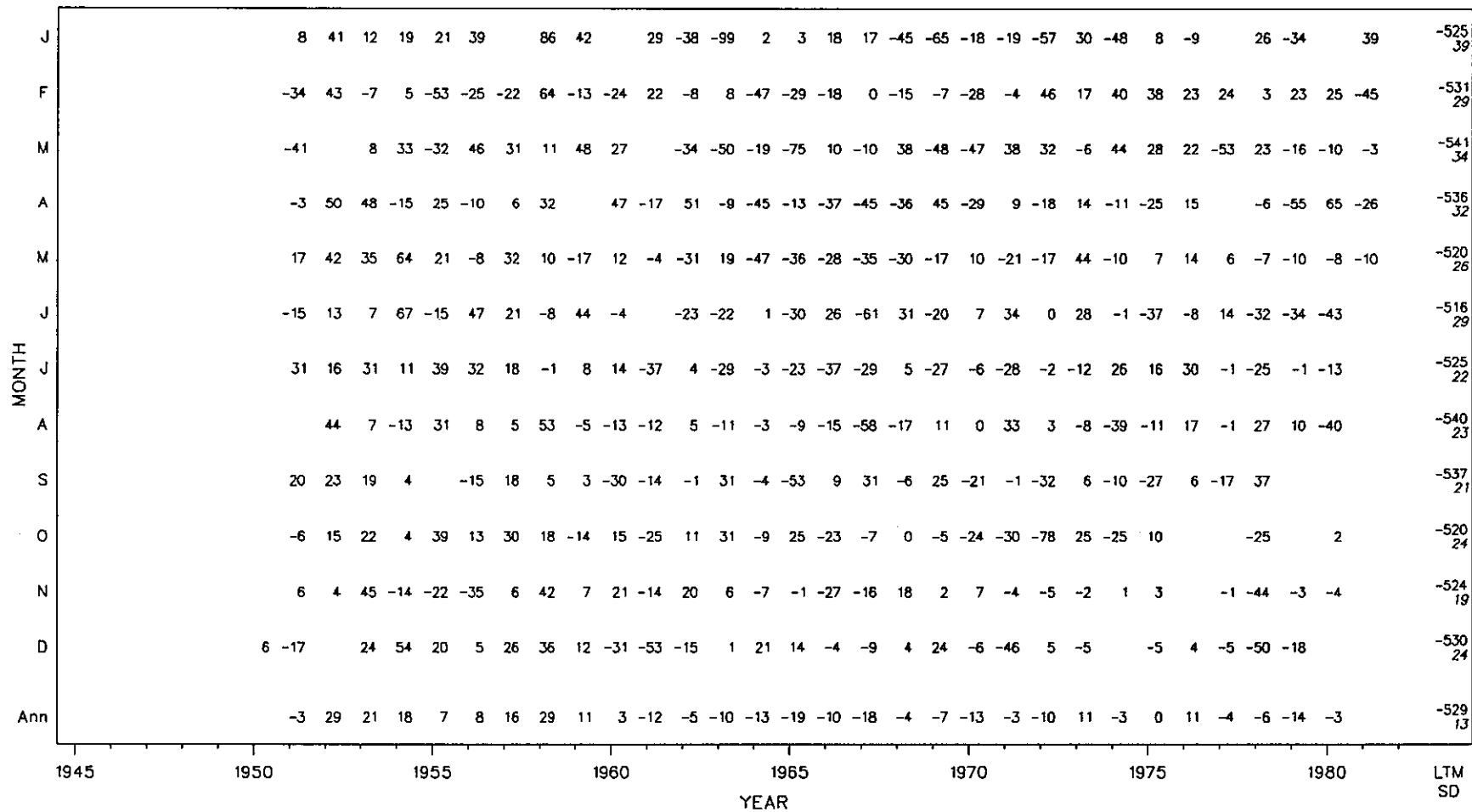
Units = 0.1 °C



OWS Study Area P Anomalies

Air Temperature: 200 mb

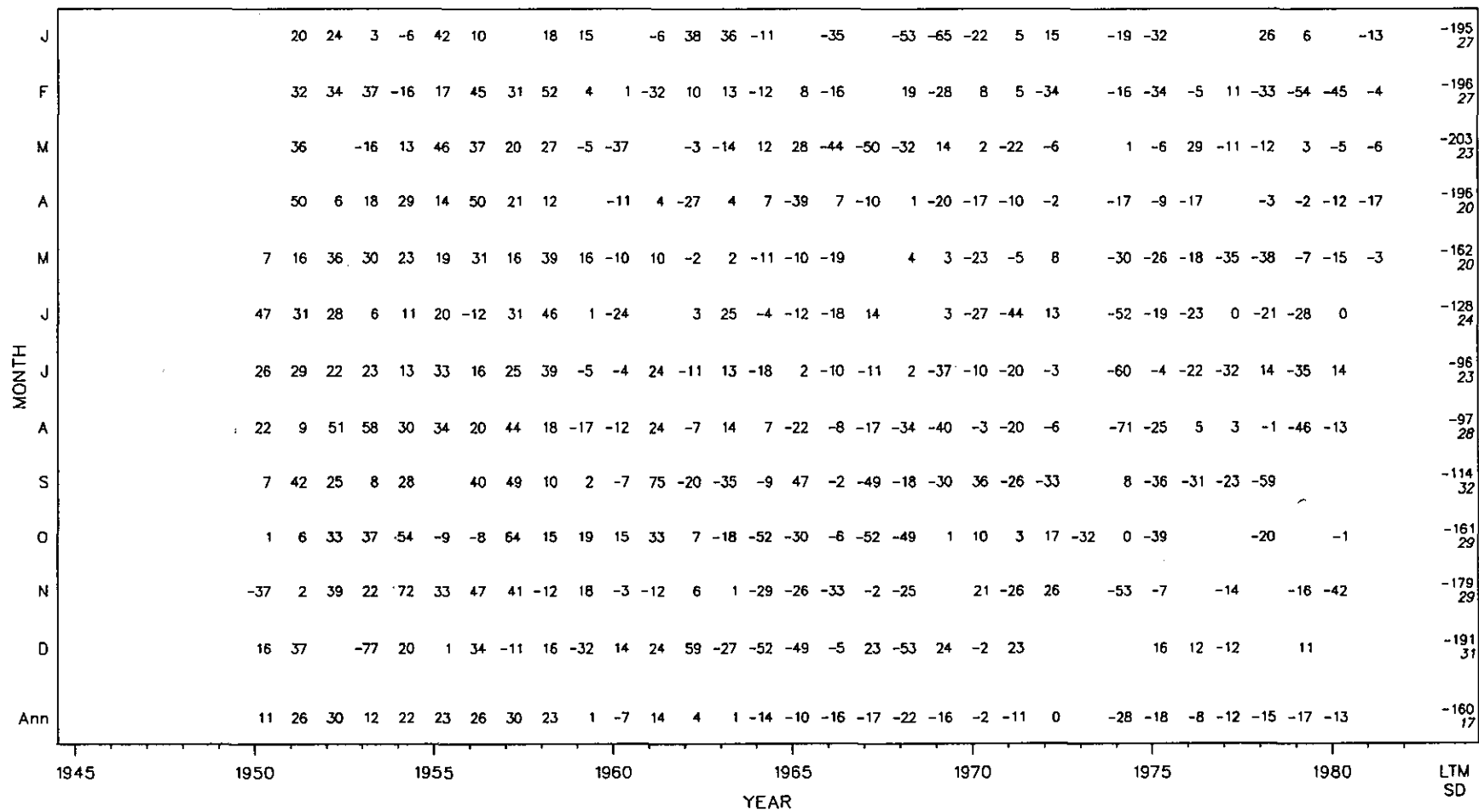
Units = 0.1 °C



OWS Study Area P Anomalies

Dew Point Temperature: 700 mb

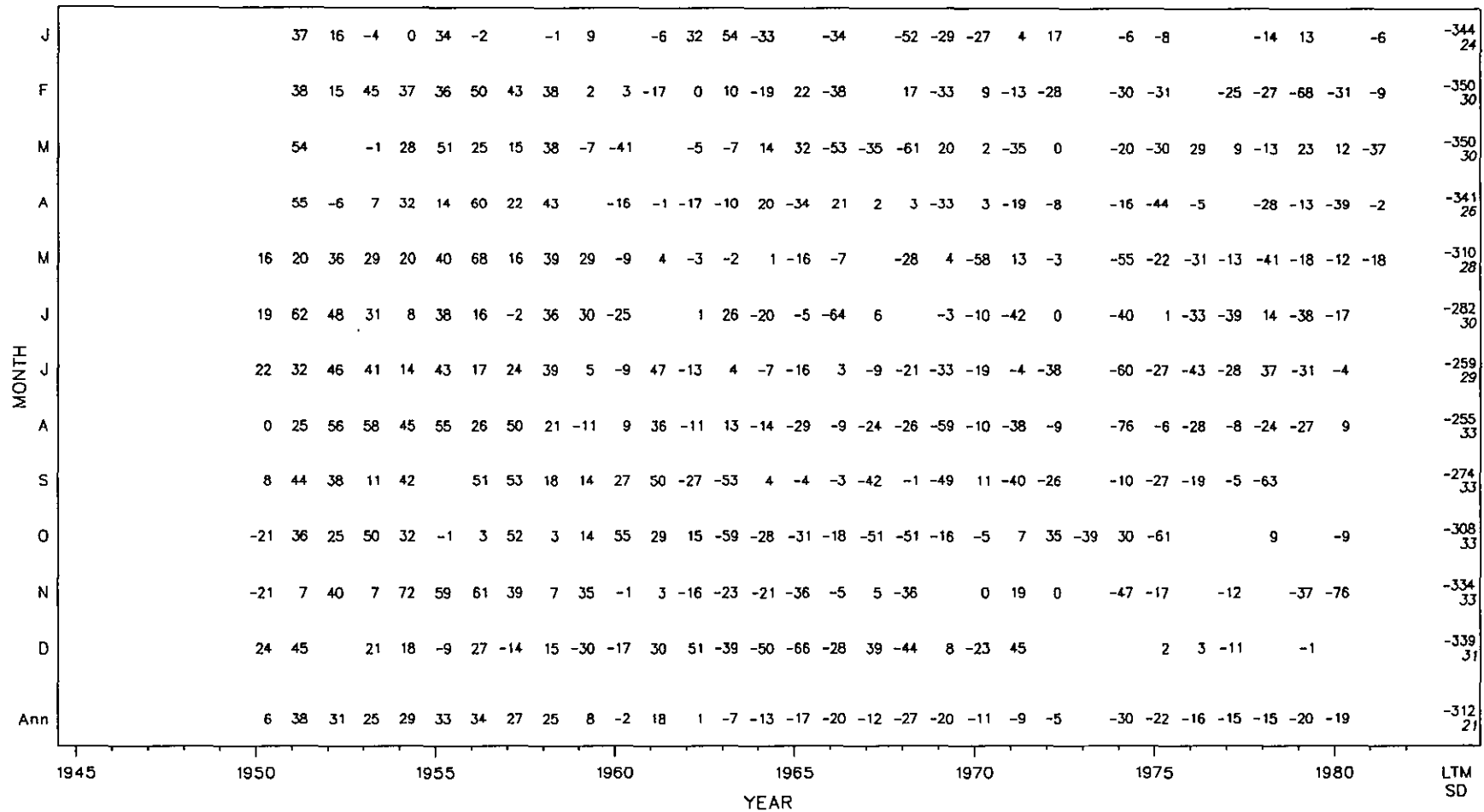
Units = 0.1 °C



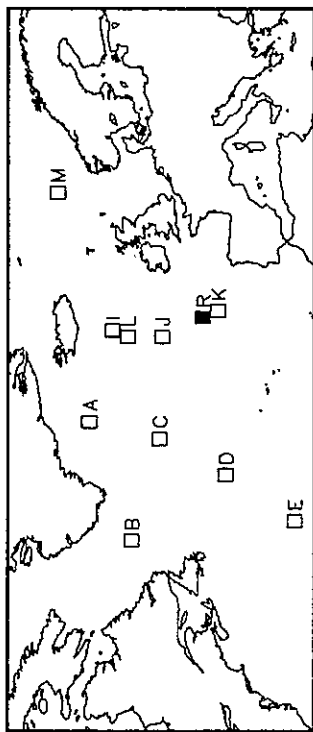
OWS Study Area P Anomalies

Dew Point Temperature: 500 mb

Units = 0.1 °C

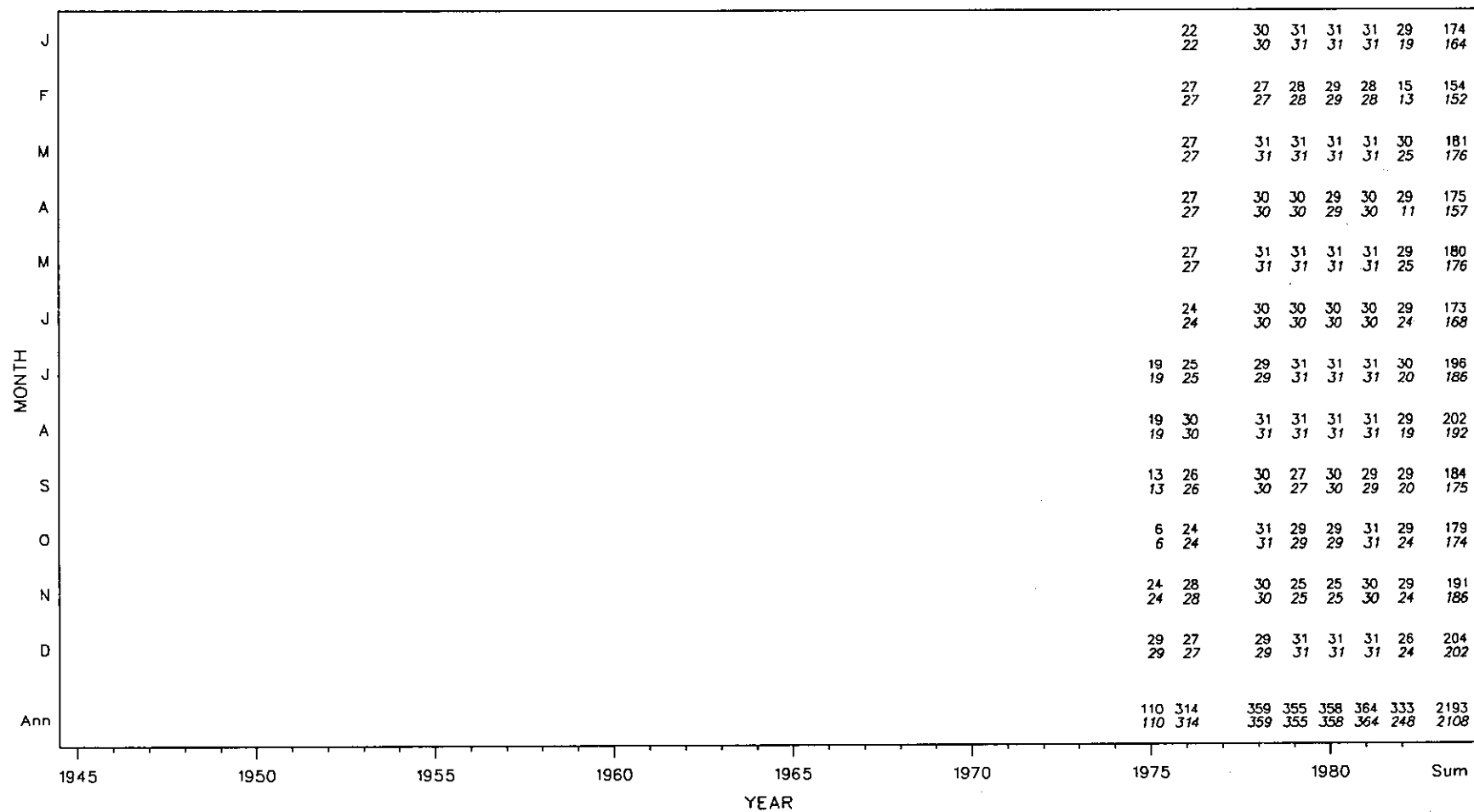


OWS Study Area P Anomalies



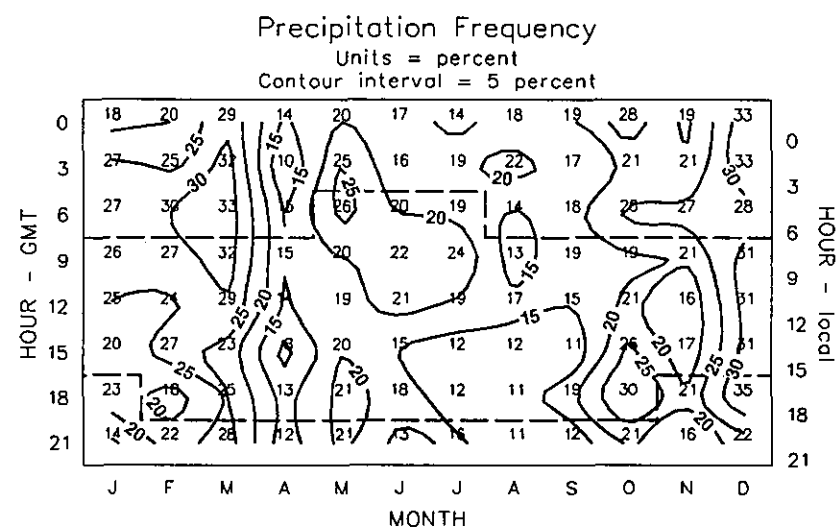
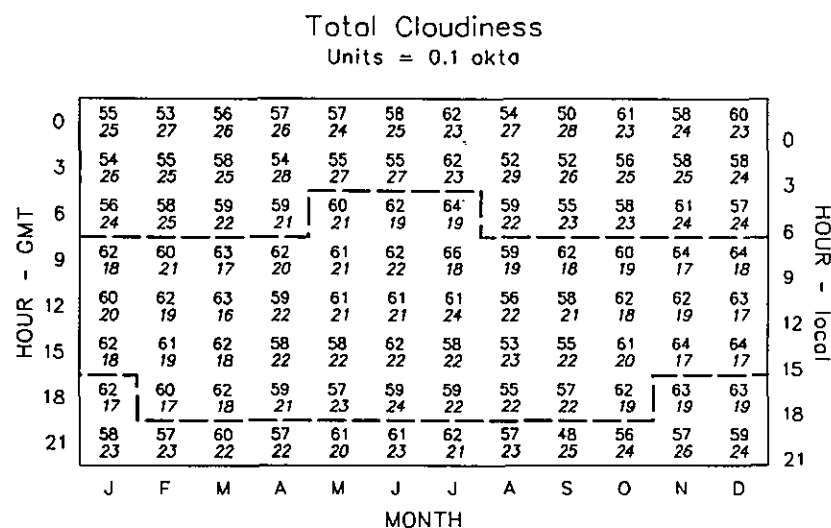
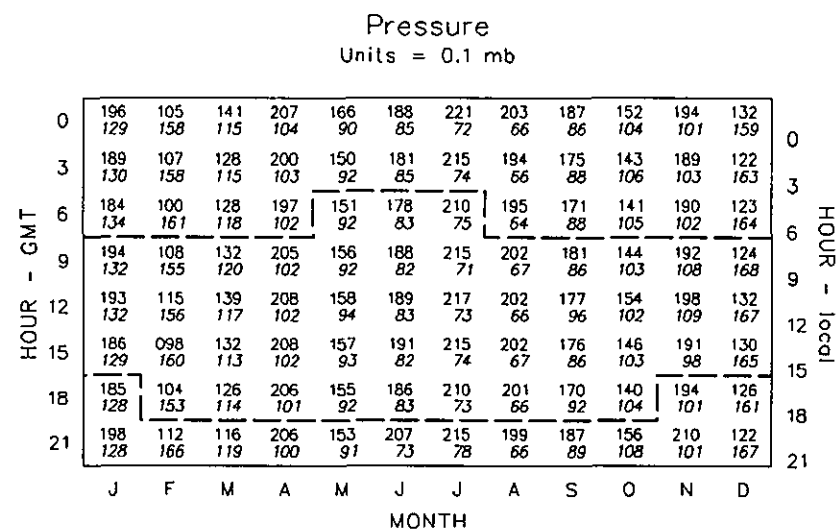
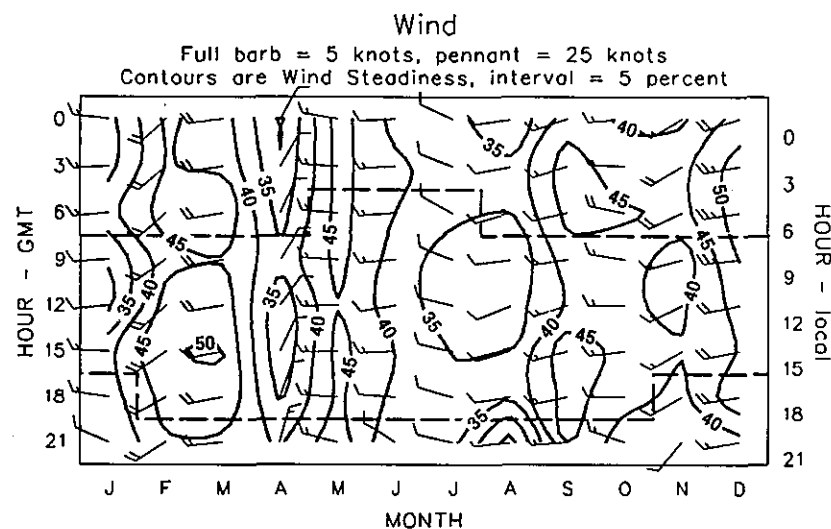
46.0°N - 47.9°N, 17.9°W - 16.0°W
1975 - 1982

OWS
R



OWS Study Area R (47.0°N, 17.0°W) Frequency of Surface Observations

Each of the 11 variables was observed on X days of each month.
The upper number is the maximum X from among all the variables.
The lower number is the minimum X from among all the variables.



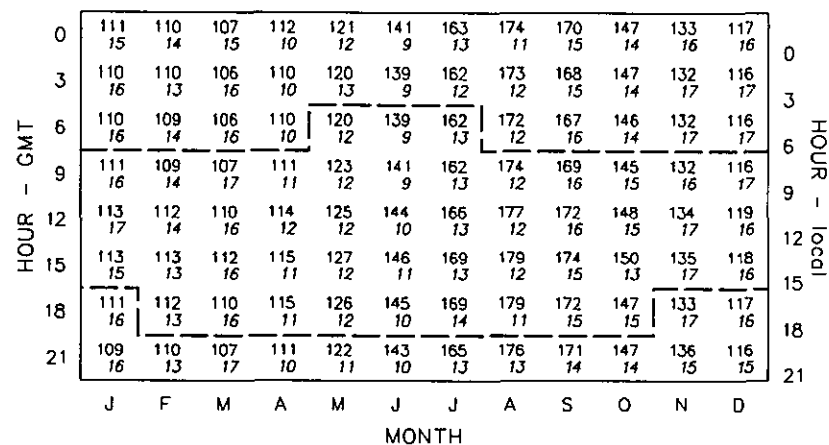
OWS Study Area R Surface Climatology

upper number = mean
lower number = standard deviation

———— data contours
- - - - - sunrise/sunset

Air Temperature

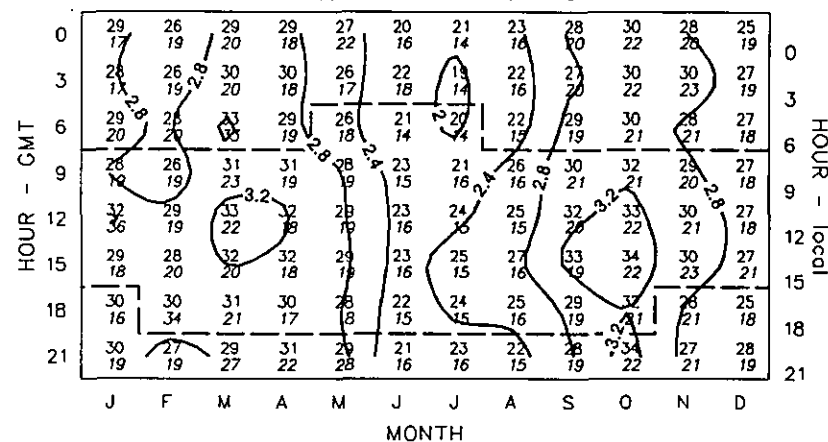
Units = 0.1 °C



Dew Point Depression

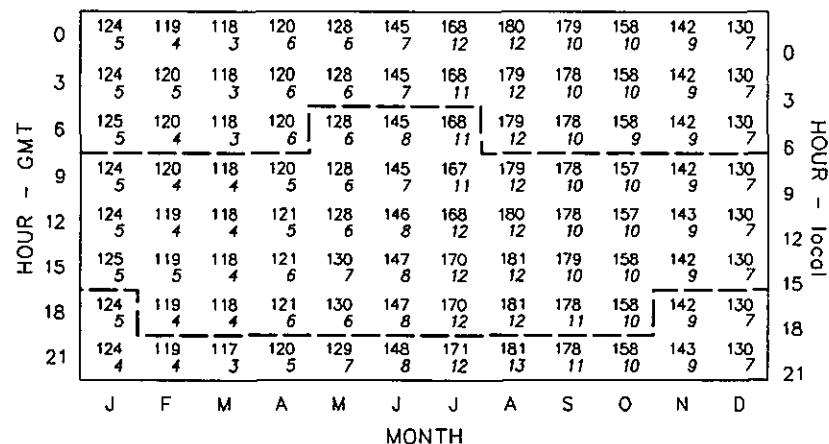
Units = 0.1 °C

Contour interval = 0.4 °C



Sea Surface Temperature

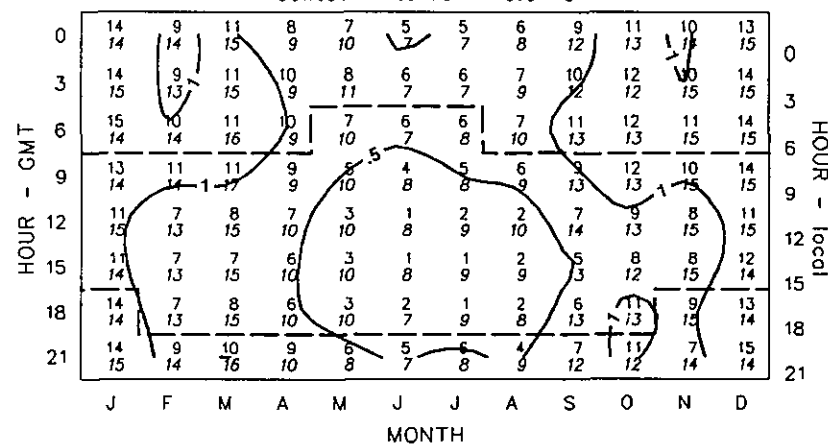
Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C

Contour interval = 0.5 °C

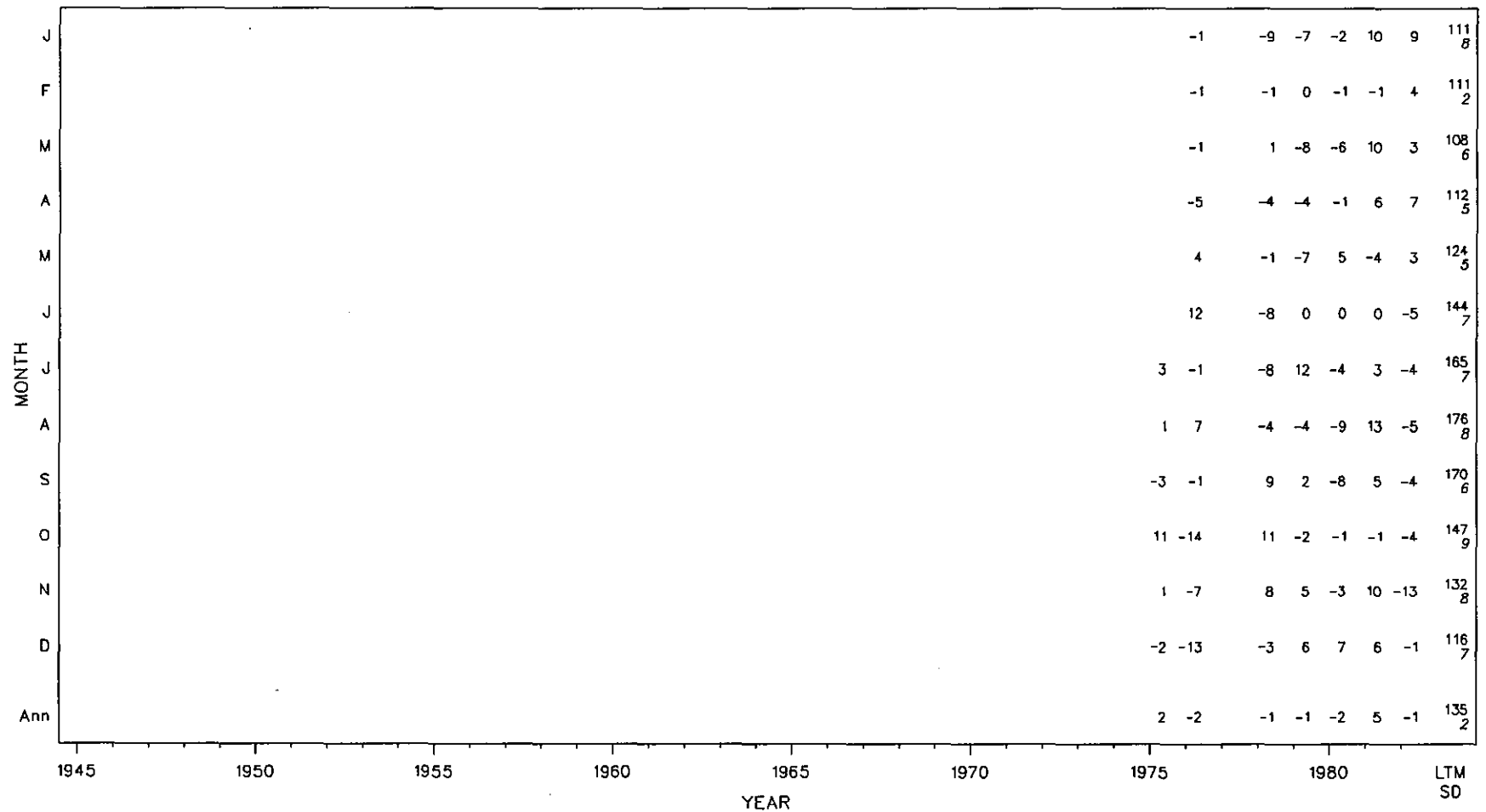


OWS Study Area R Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
--- sunrise/sunset

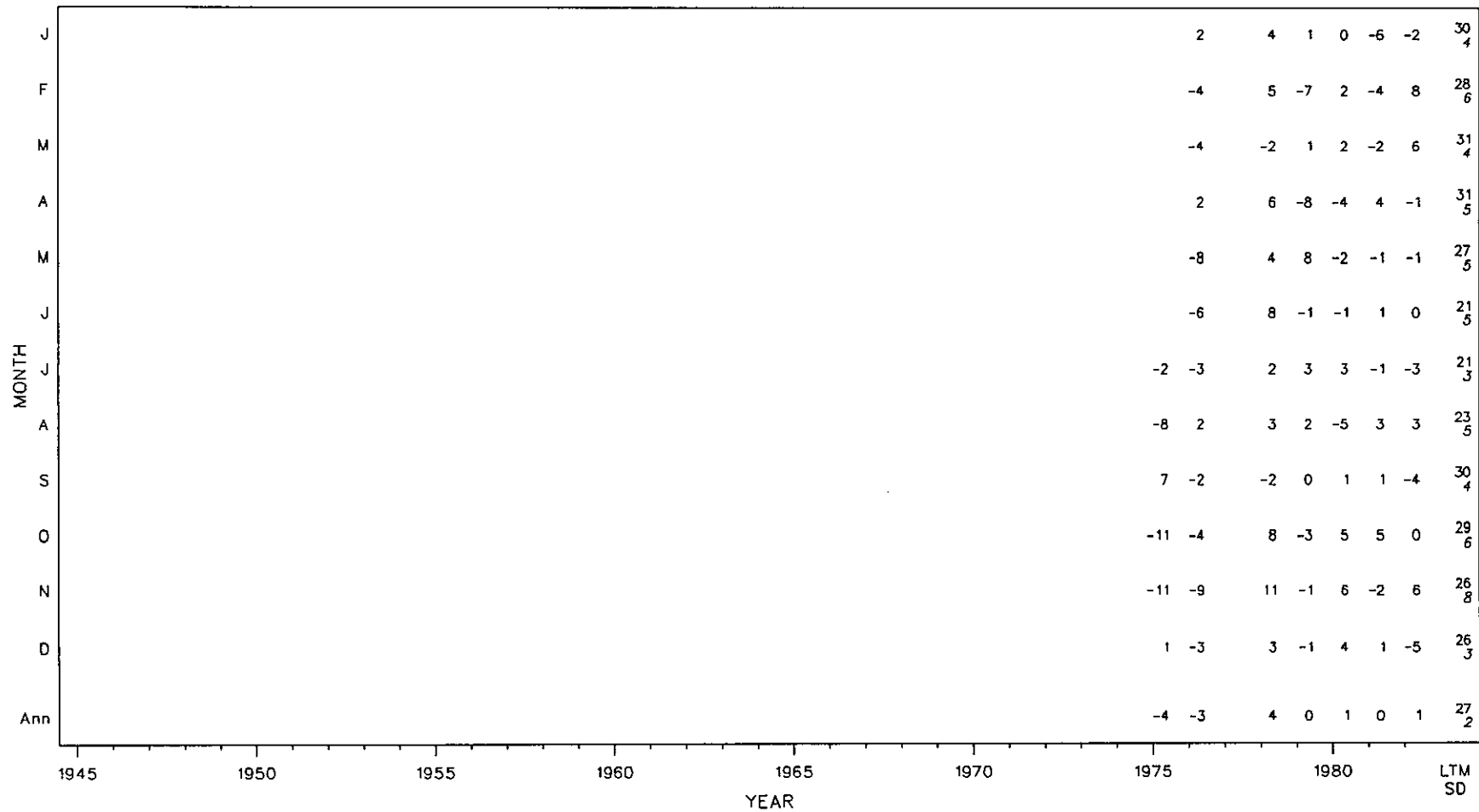
Surface Air Temperature Units = 0.1 °C



OWS Study Area R Anomalies

Surface Dew Point Depression

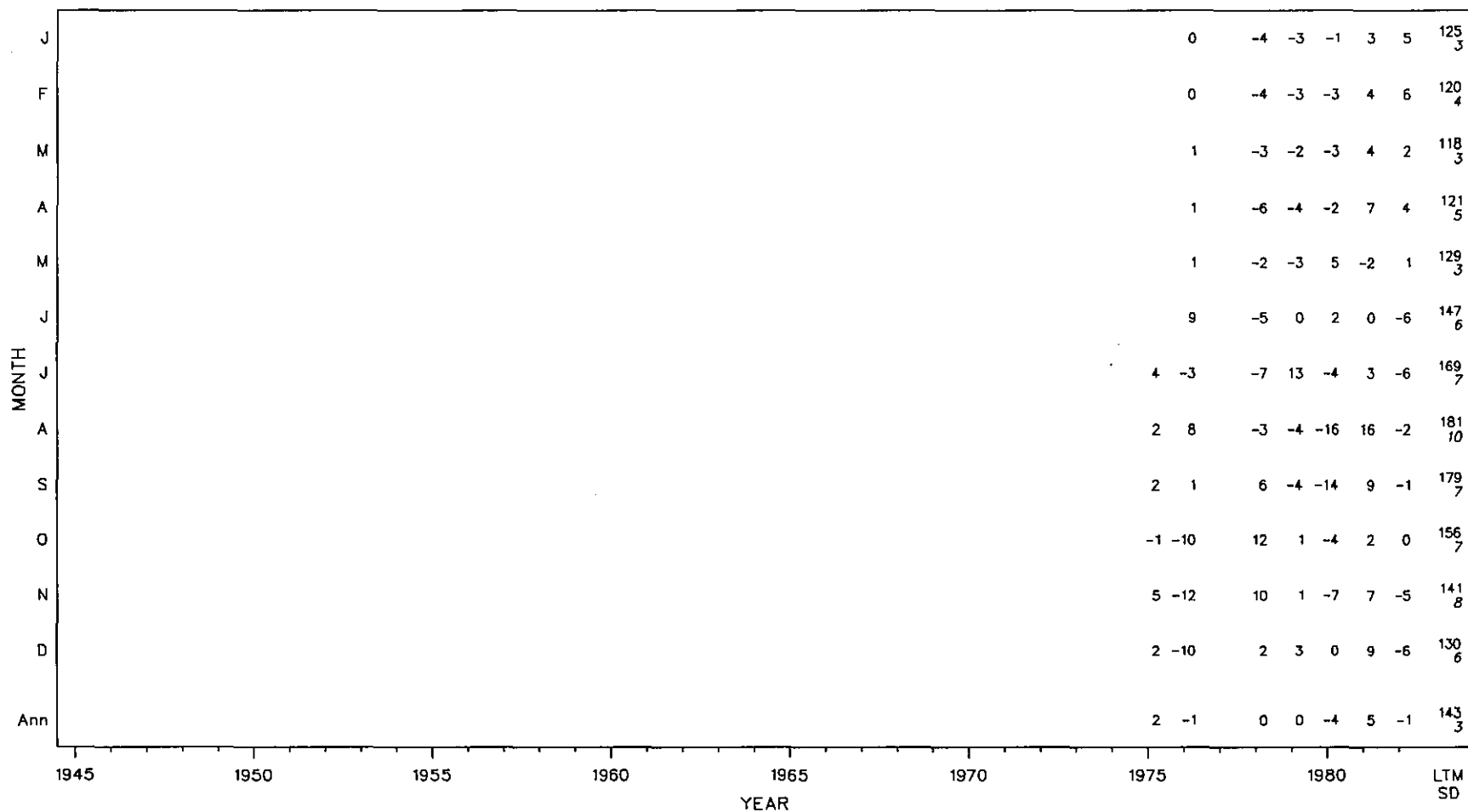
Units = 0.1 °C



OWS Study Area R Anomalies

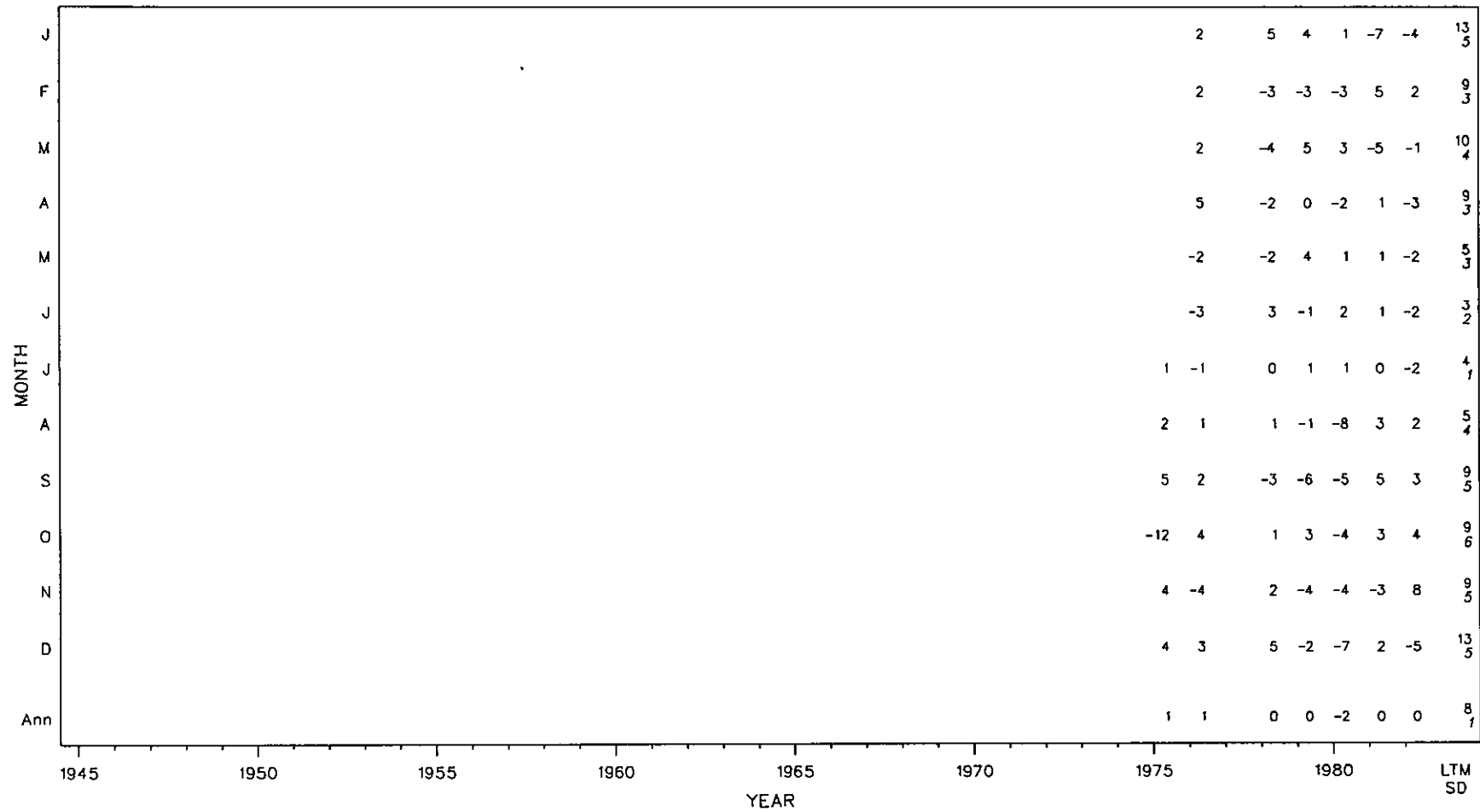
Sea Surface Temperature

Units = 0.1 °C



OWS Study Area R Anomalies

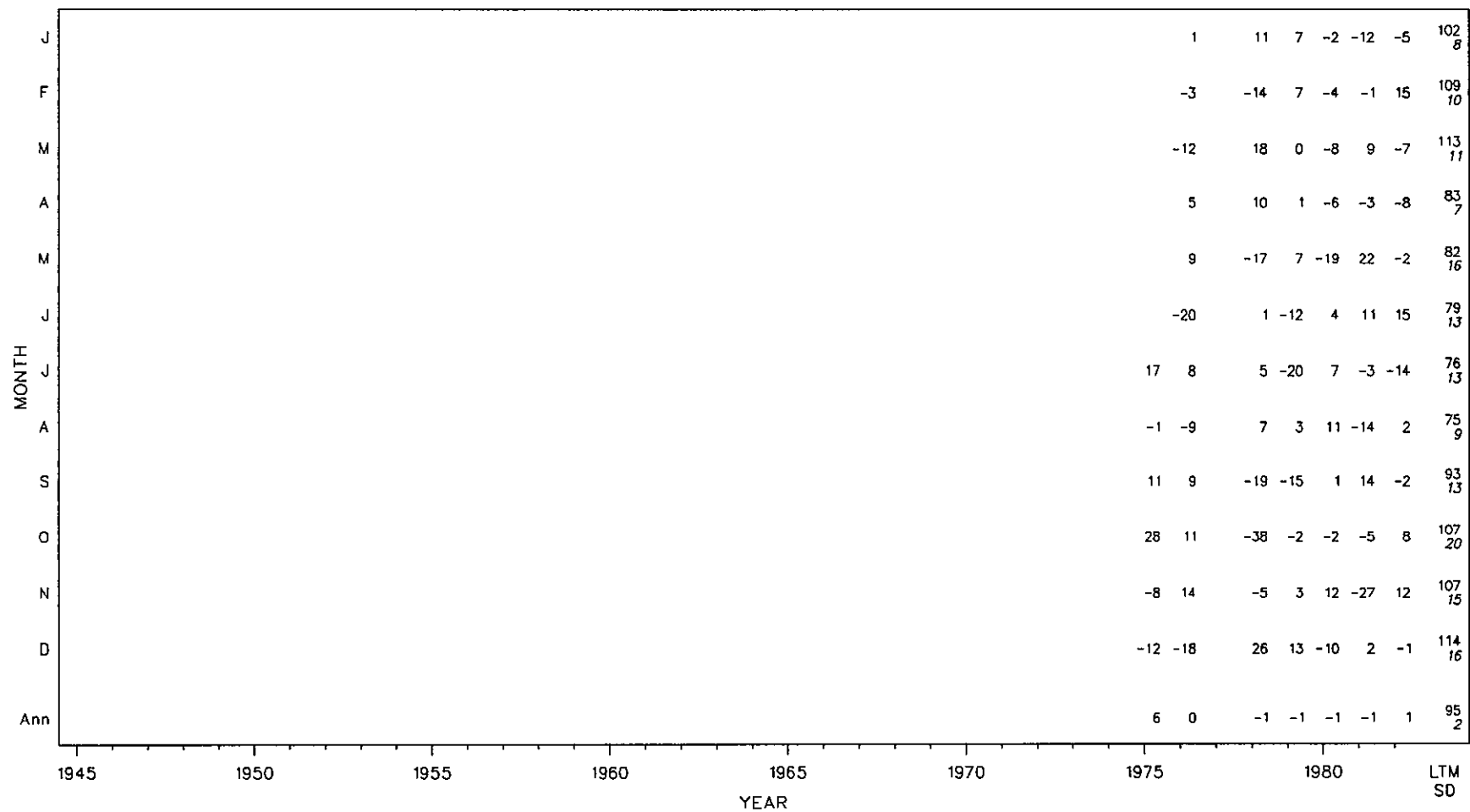
Sea - Air Temperature Difference
Units = 0.1 °C



OWS Study Area R Anomalies

Surface Scalar Wind

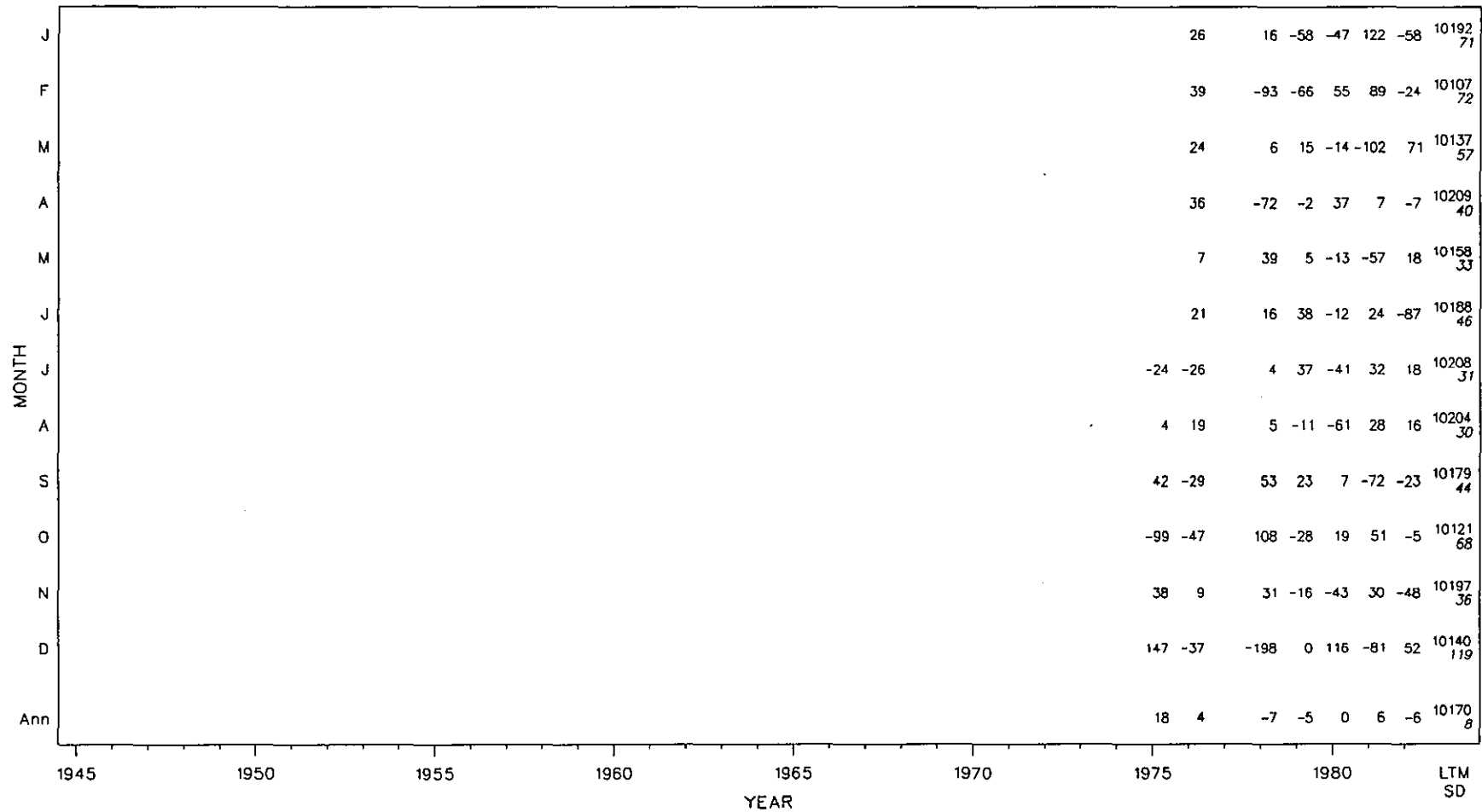
Units = 0.1 m/s



OWS Study Area R Anomalies

Sea Level Pressure

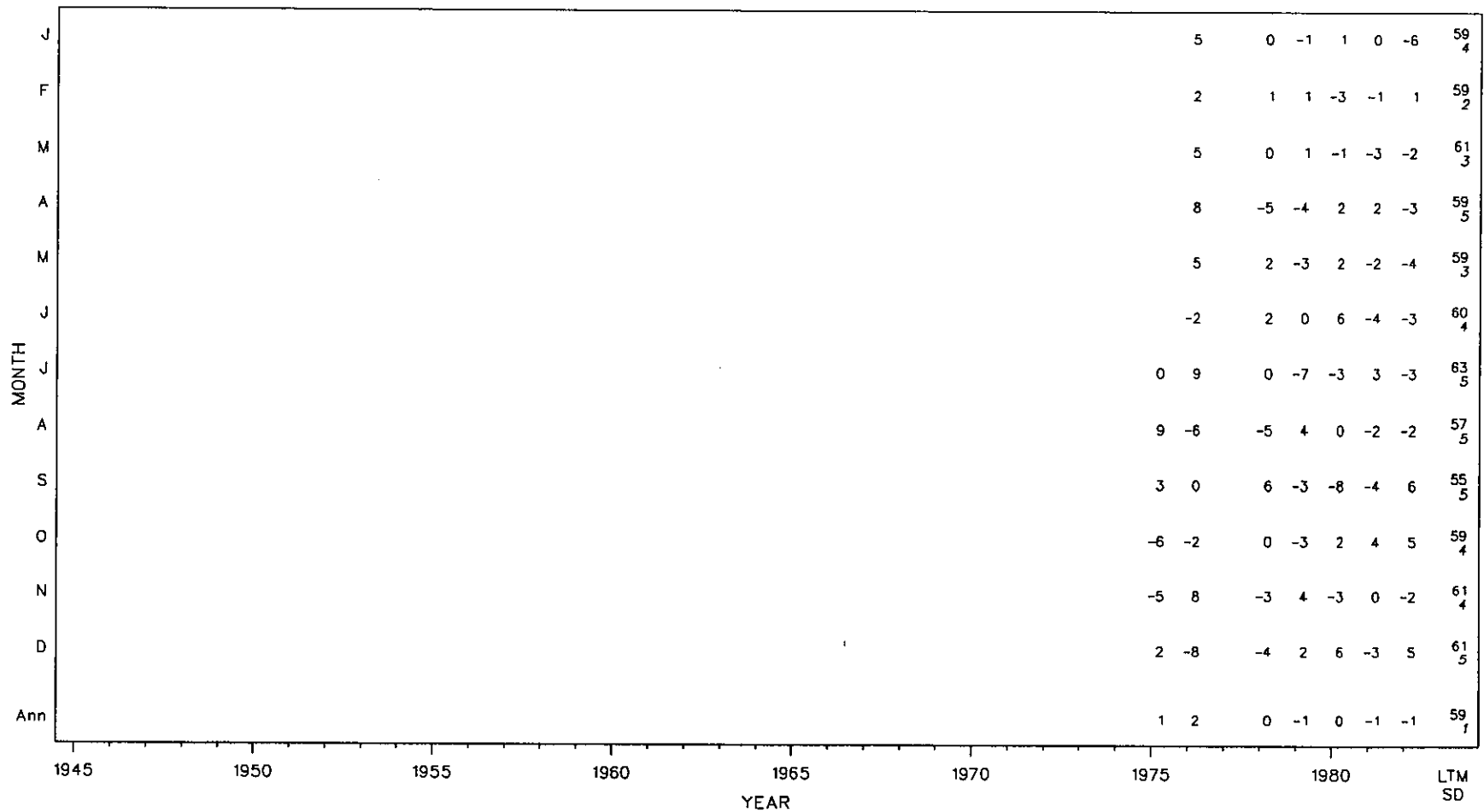
Units = 0.1 mb



OWS Study Area R Anomalies

Total Cloudiness

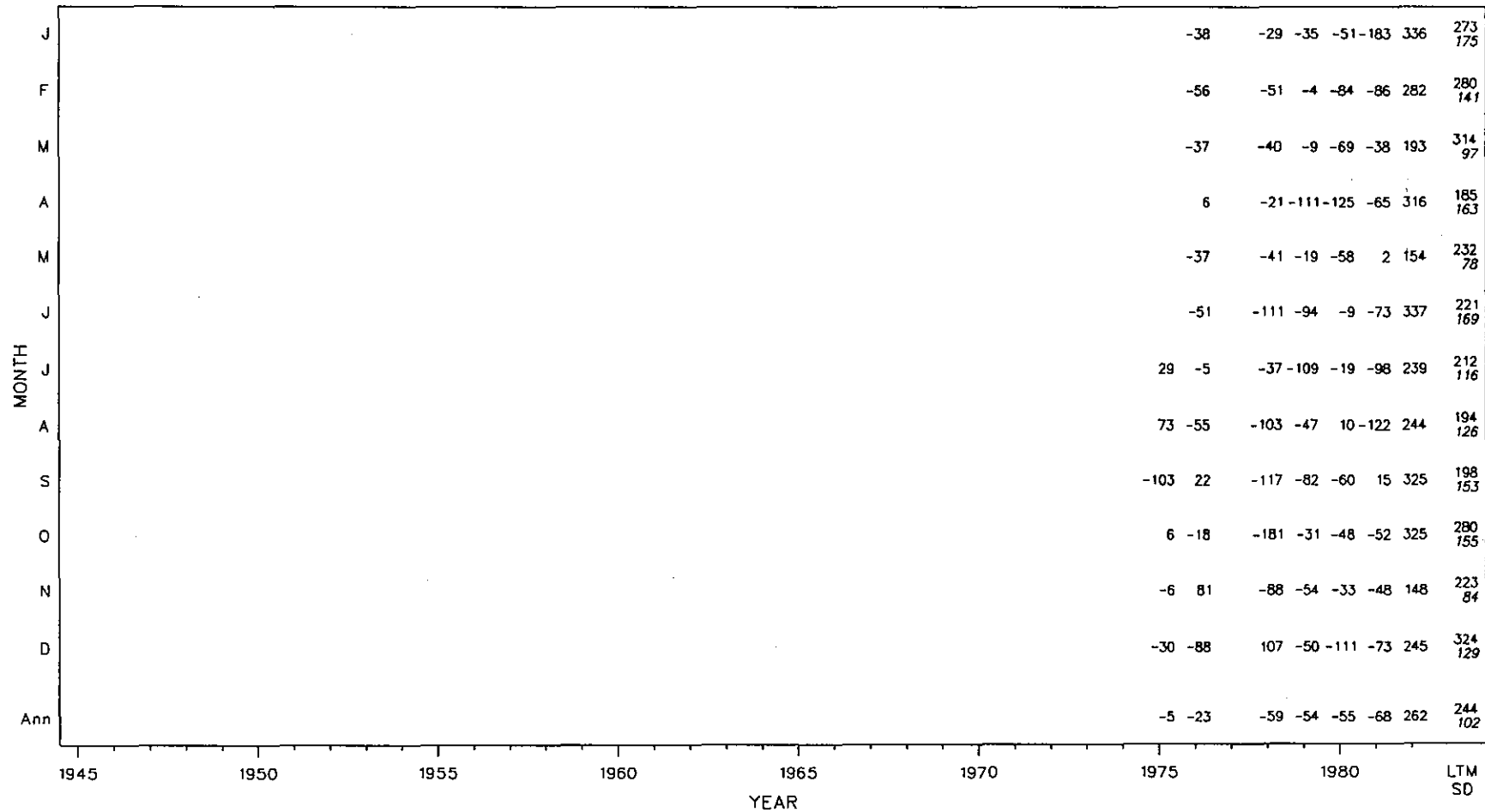
Units = 0.1 okta



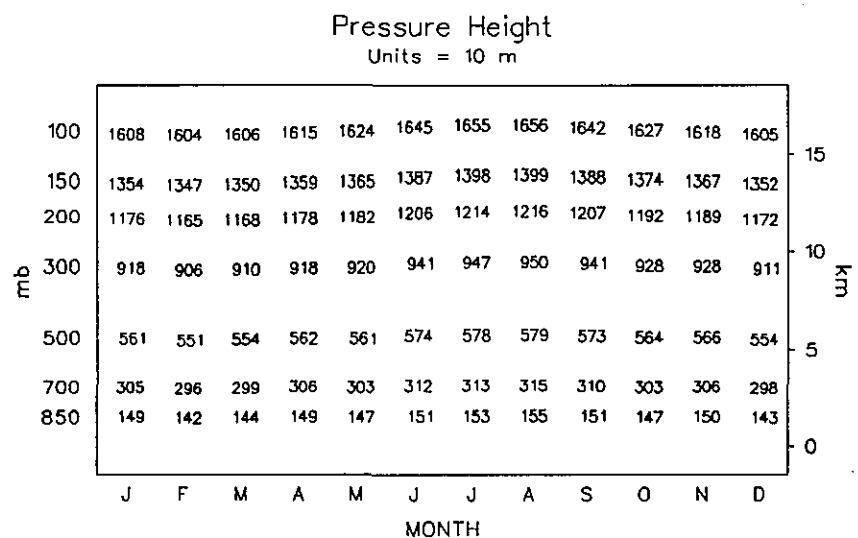
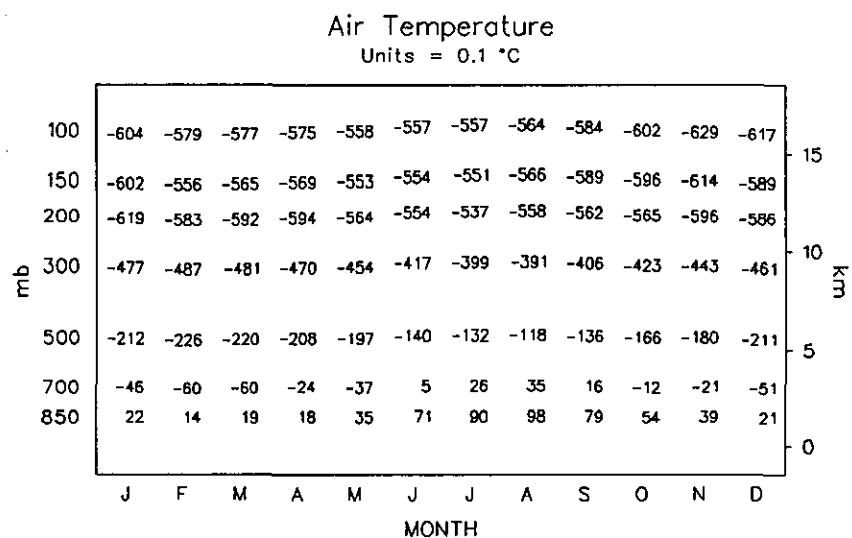
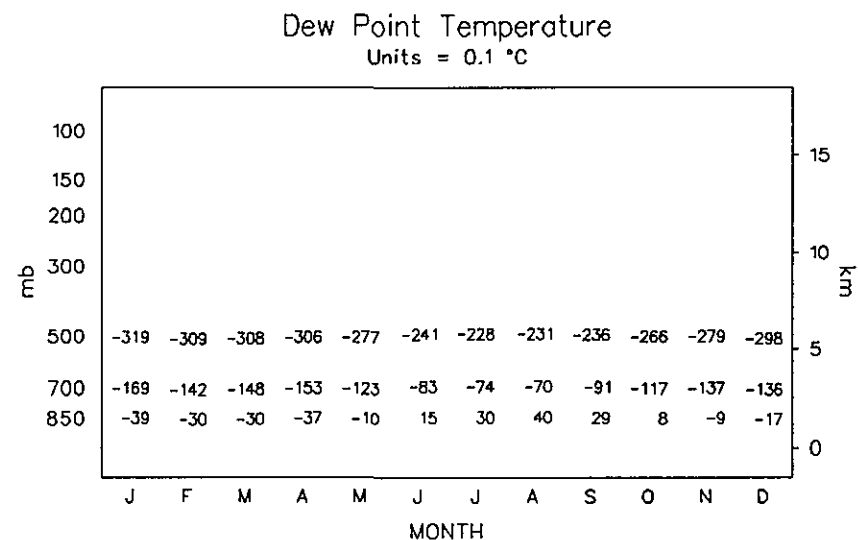
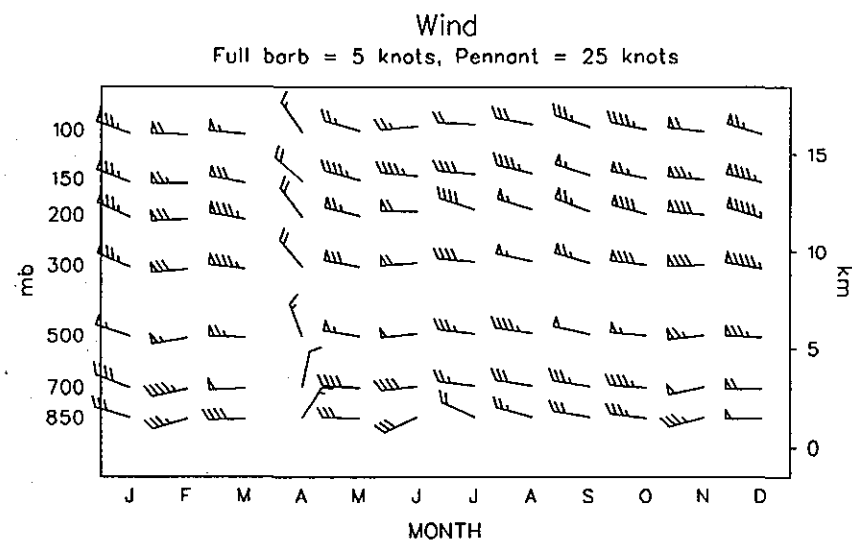
OWS Study Area R Anomalies

Precipitation Frequency

Units = 0.1 percent



OWS Study Area R Anomalies

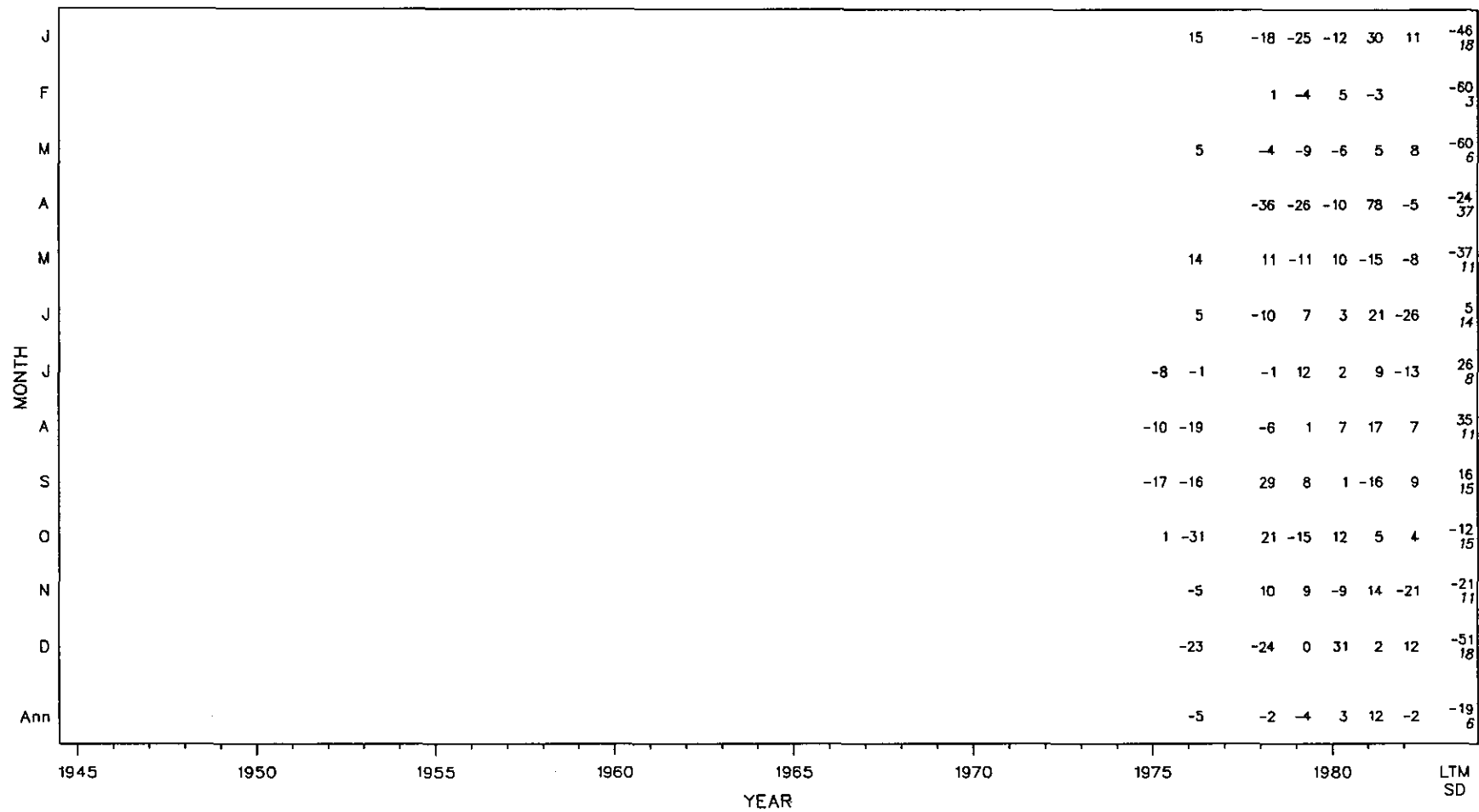


OWS Study Area R Upper Air Climatology

Mean plotted at actual height

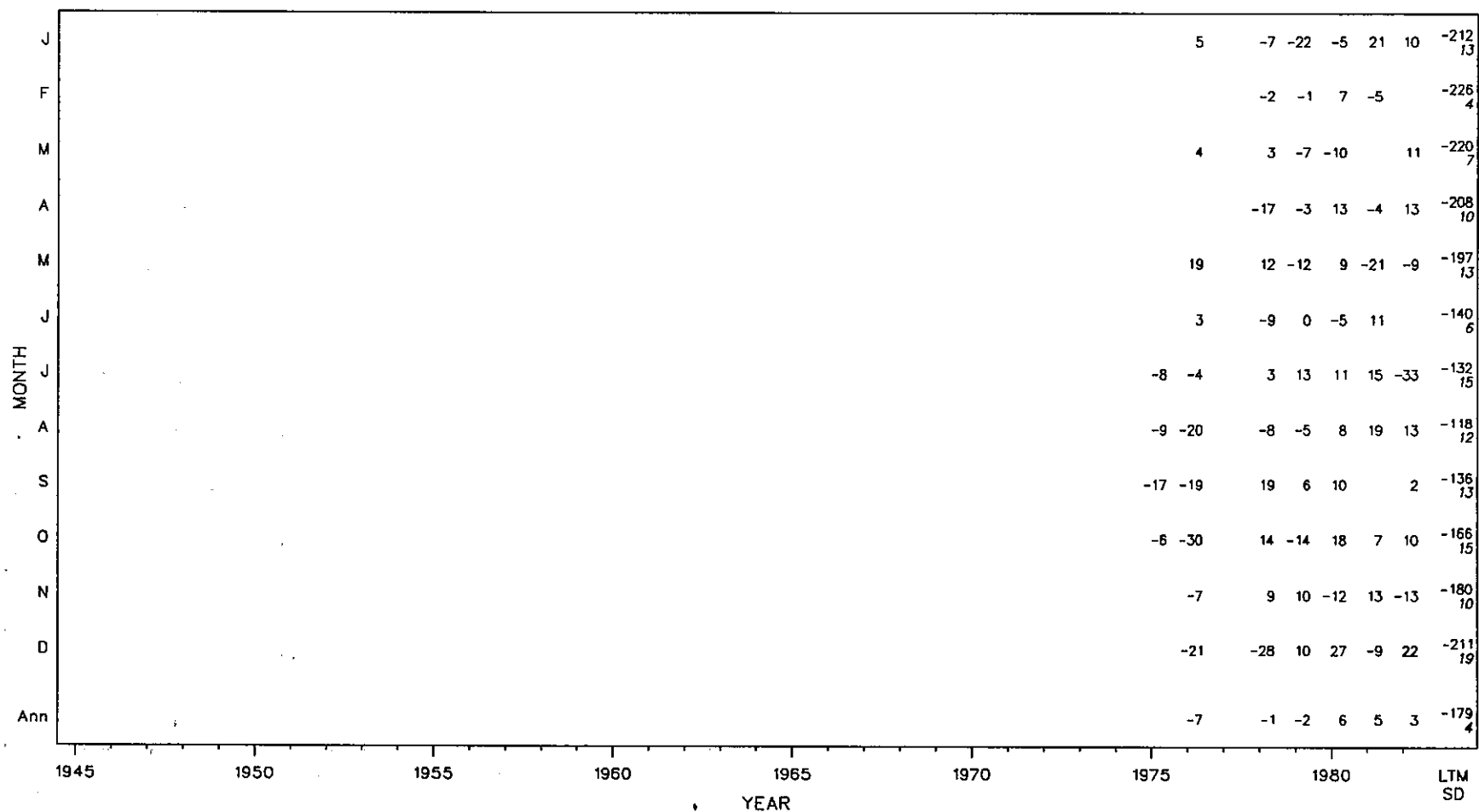
Air Temperature: 700 mb

Units = 0.1 °C



OWS Study Area R Anomalies

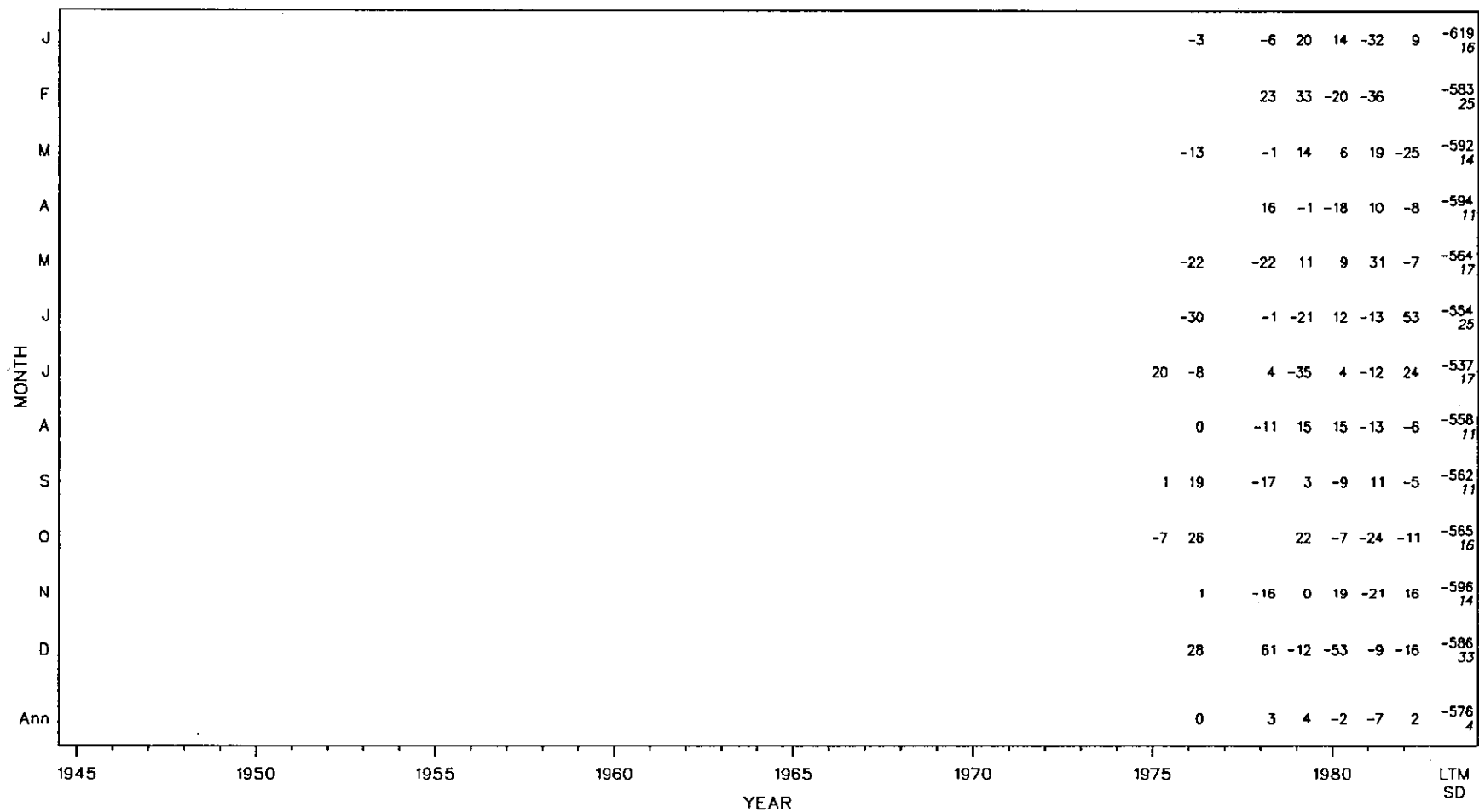
Air Temperature: 500 mb
Units = 0.1 °C



OWS Study Area R Anomalies

Air Temperature: 200 mb

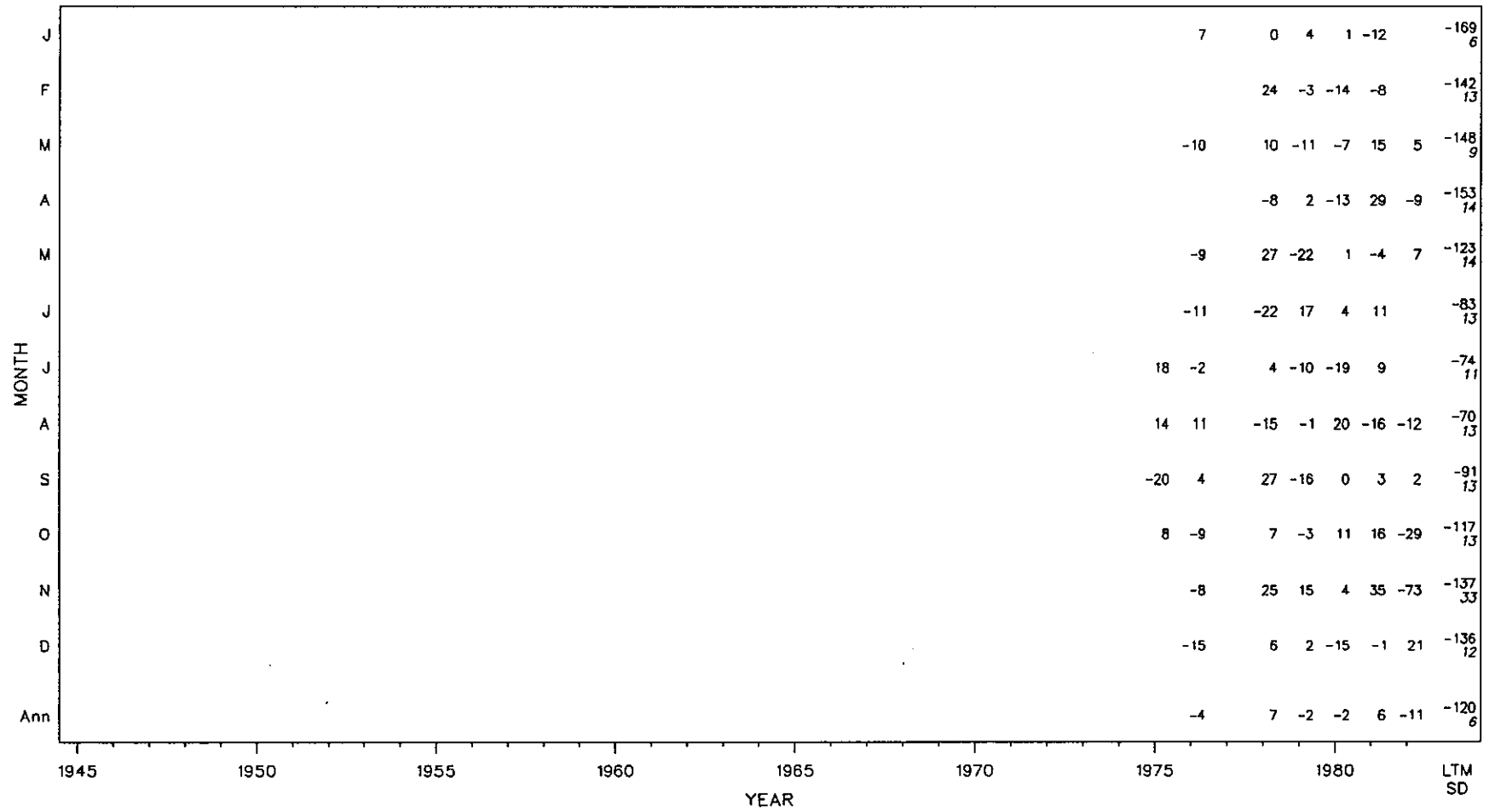
Units = 0.1 °C



OWS Study Area R Anomalies

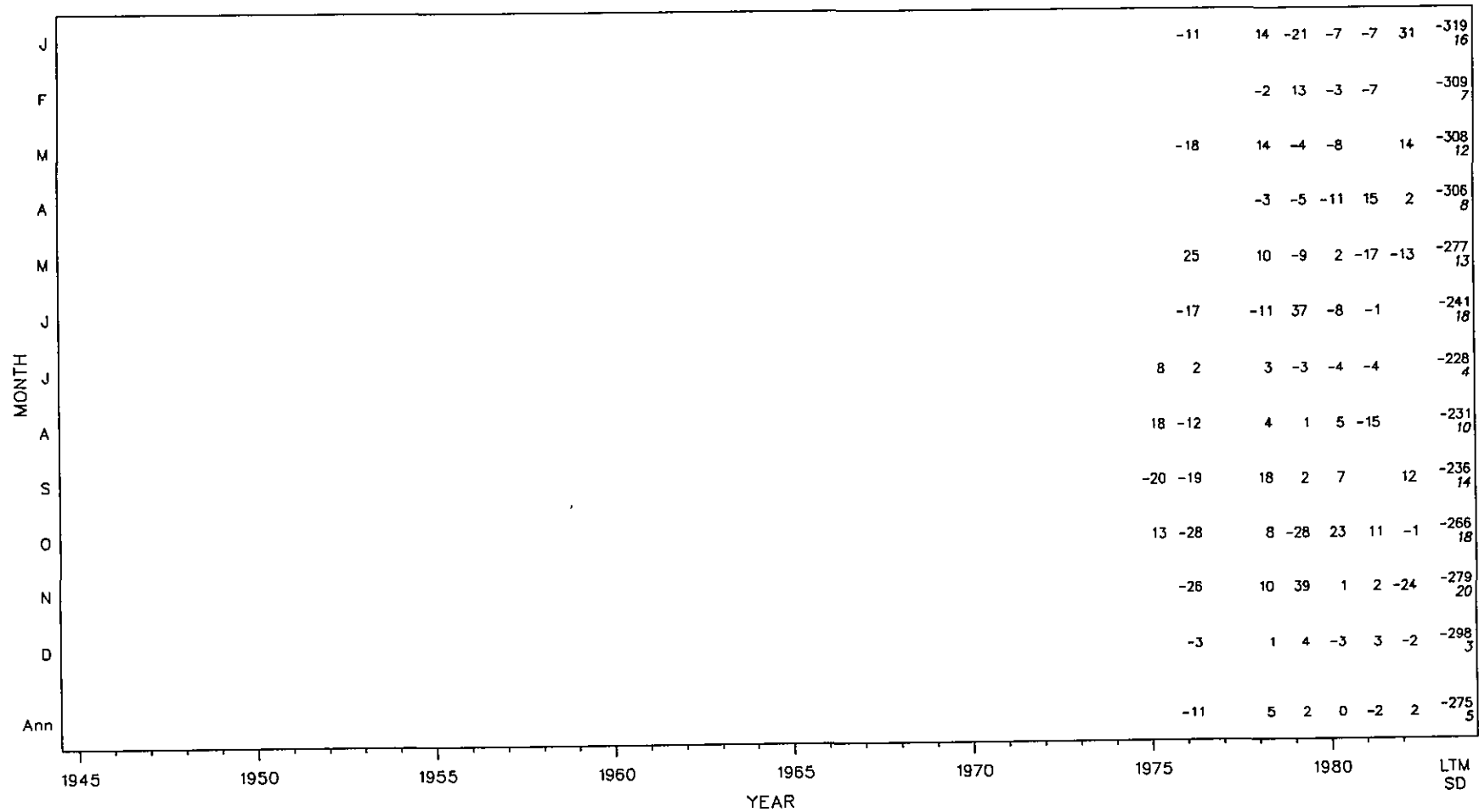
Dew Point Temperature: 700 mb

Units = 0.1 °C

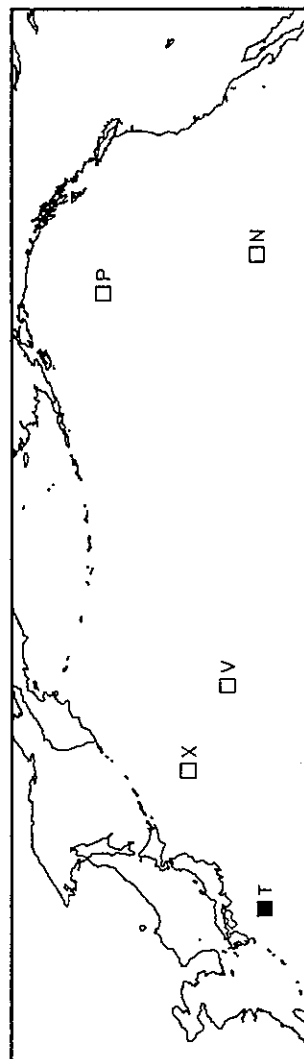


OWS Study Area R Anomalies

Dew Point Temperature: 500 mb
Units = 0.1 °C



OWS Study Area R Anomalies



28.0°N – 29.9°N, 134.0°E – 135.9°E
1948 – 1981

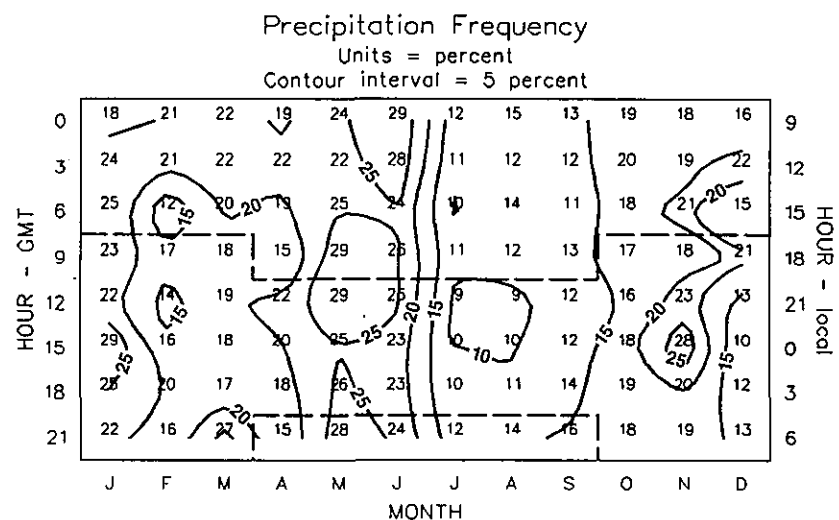
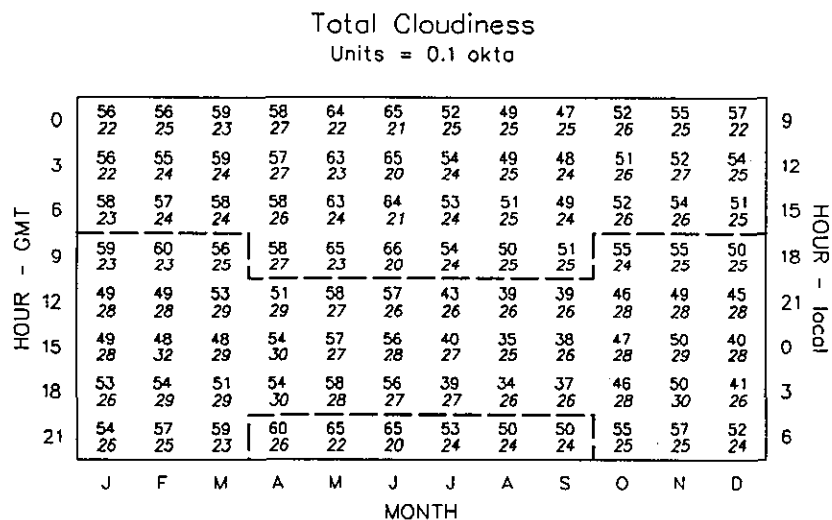
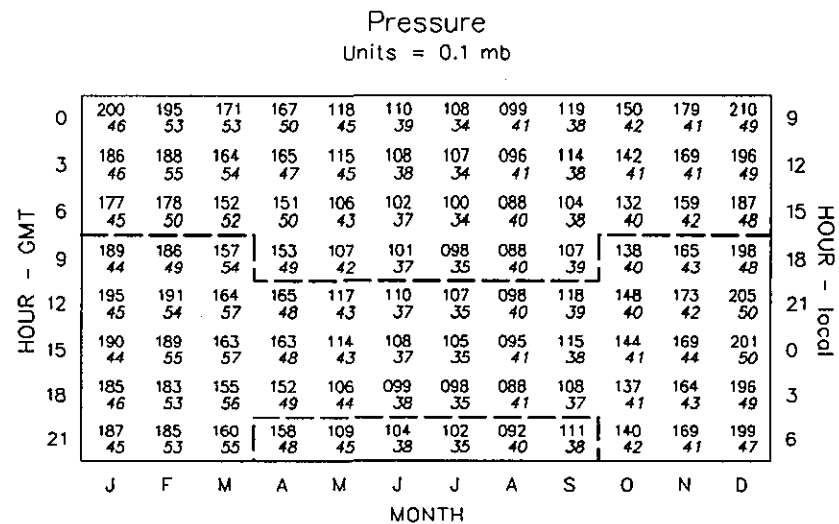
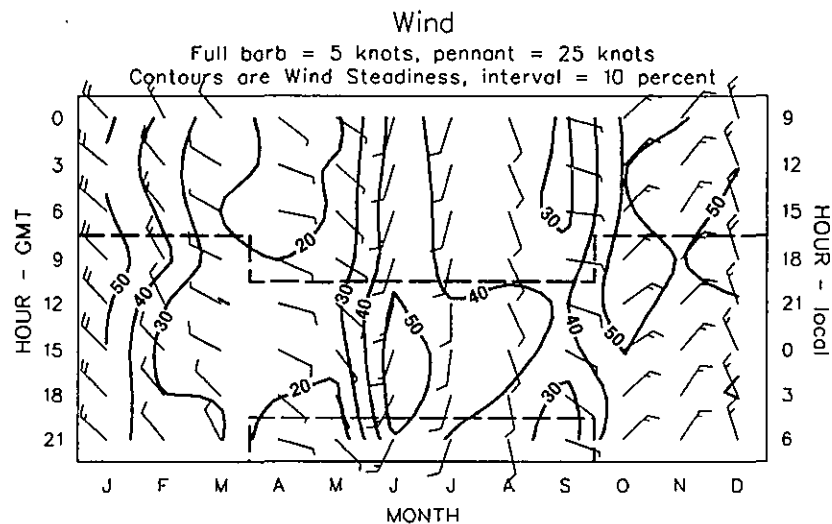
OWS
T

MONTH																																		Sum		
	1945	1950	1955	1960	1965	1970	1975	1980																												
J			31 31	31 31	31 31																											93 93				
F			28 28	29 29	26 26																												83 83			
M			31 31	31 31	31 31																												93 93			
A			30 30	30 18	29 29																												89 77			
M			31 31	31 0	31 17	17 16	16 11	11 8	9 6	6 8	8 6	7 7	7 7		8 8	9 9	8 8	11 11	11 11	12 12	11 11												299 267			
J		16 16	30 30	30 0	29 29	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30		30 30	30 30	30 30	30 30	30 30	30 30	30 30												735 705			
J		31 31	31 31	31 1	31 31	31 30	31 31	31 30	29 29	31 31	31 30	30 31	31 31	23 23	31 31	31 31	31 31	31 31	29 29	31 31	31 31												790 759			
A		29 29	22 22	30 30	30 0	31 31	31 31	31 31	31 31	31 30	30 30	29 29	31 31	31 31	29 29	30 31	31 31	31 31	31 31	31 31	31 31												780 747			
S	12 5	29 29	21 20	30 30	28 1	28 28	25 25	30 29	30 30	27 27	27 25	30 30	30 30	30 26	30 30	30 30	28 28	26 26	30 30	30 30													758 716			
O	28 6	30 30	31 31	31 0	30 30	24 24	22 21	31 31	31 30	31 29	30 31	29 28	29 29	30 30	31 31	31 31	31 31	28 28	28 28	30 30	31 31												752 695			
N	1 0	2 2	29 29	30 30	24 0	25 25		3 3	3 3	3 3	2 2	2 2	4 4	3 3	3 3	3 3	2 2	3 3															142 117			
D		31 31	31 31	31 7																													93 69			
Ann	41 11	137 137	195 194	364 364	357 118	322 322	158 158	159 157	167 167	162 160	157 153	161 160	159 159	161 156	161 161	115 115	163 162	164 164	162 162	157 157	159 159	164 164	164 164										4707 4421			
	1945	1950	1955	1960	1965	1970	1975	1980																												Sum

OWS Study Area T (29.0°N, 135.0°E)

Frequency of Surface Observations

Each of the 11 variables was observed on X days of each month.
The upper number is the maximum X from among all the variables.
The lower number is the minimum X from among all the variables.



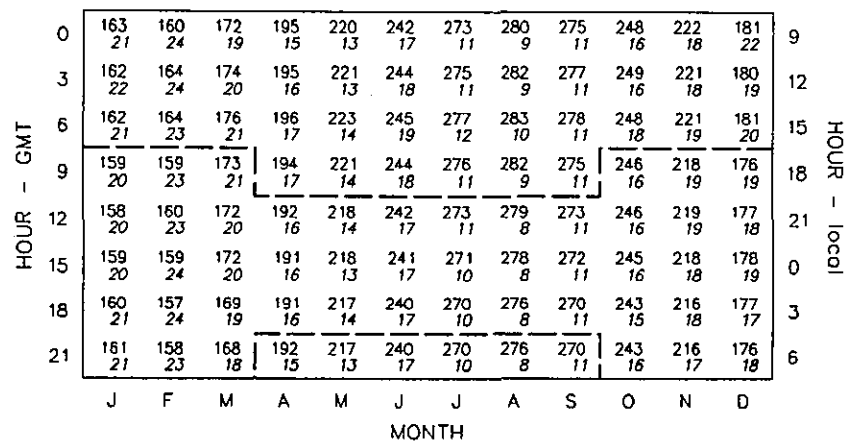
OWS Study Area T Surface Climatology

upper number = mean
lower number = standard deviation

———— data contours
----- sunrise/sunset

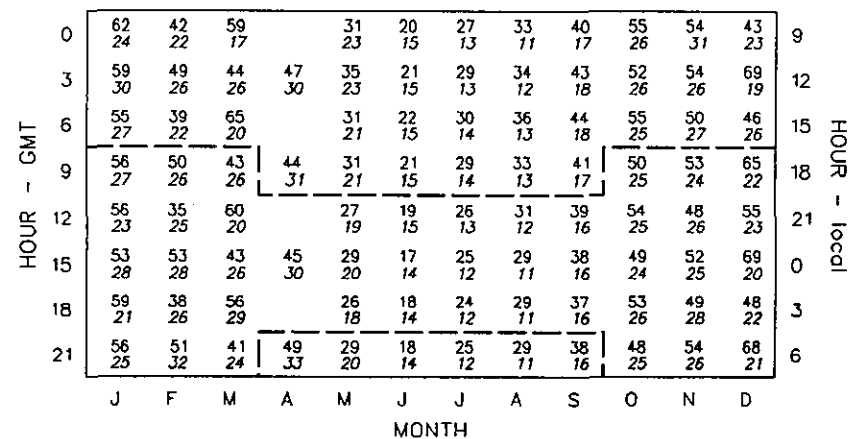
Air Temperature

Units = 0.1 °C



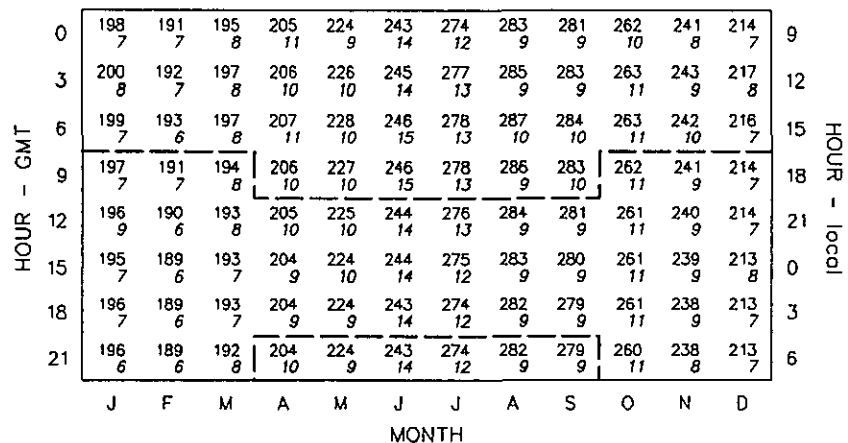
Dew Point Depression

Units = 0.1 °C



Sea Surface Temperature

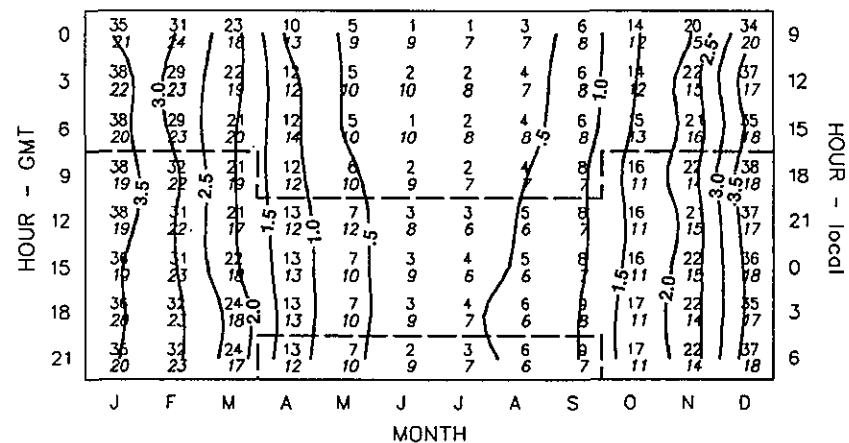
Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C

Contour interval = 0.5 °C



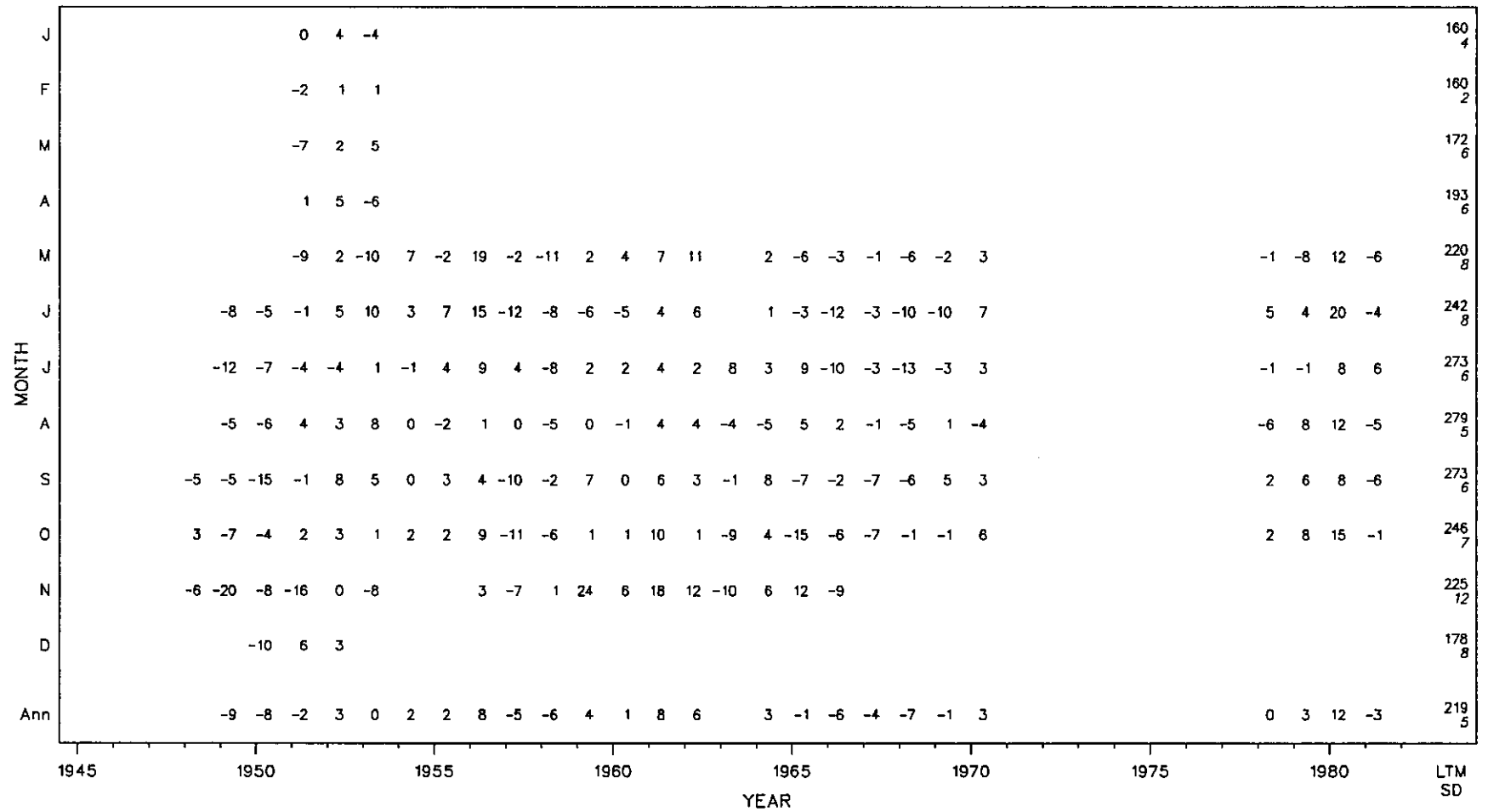
OWS Study Area T Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
--- sunrise/sunset

Surface Air Temperature

Units = 0.1 °C

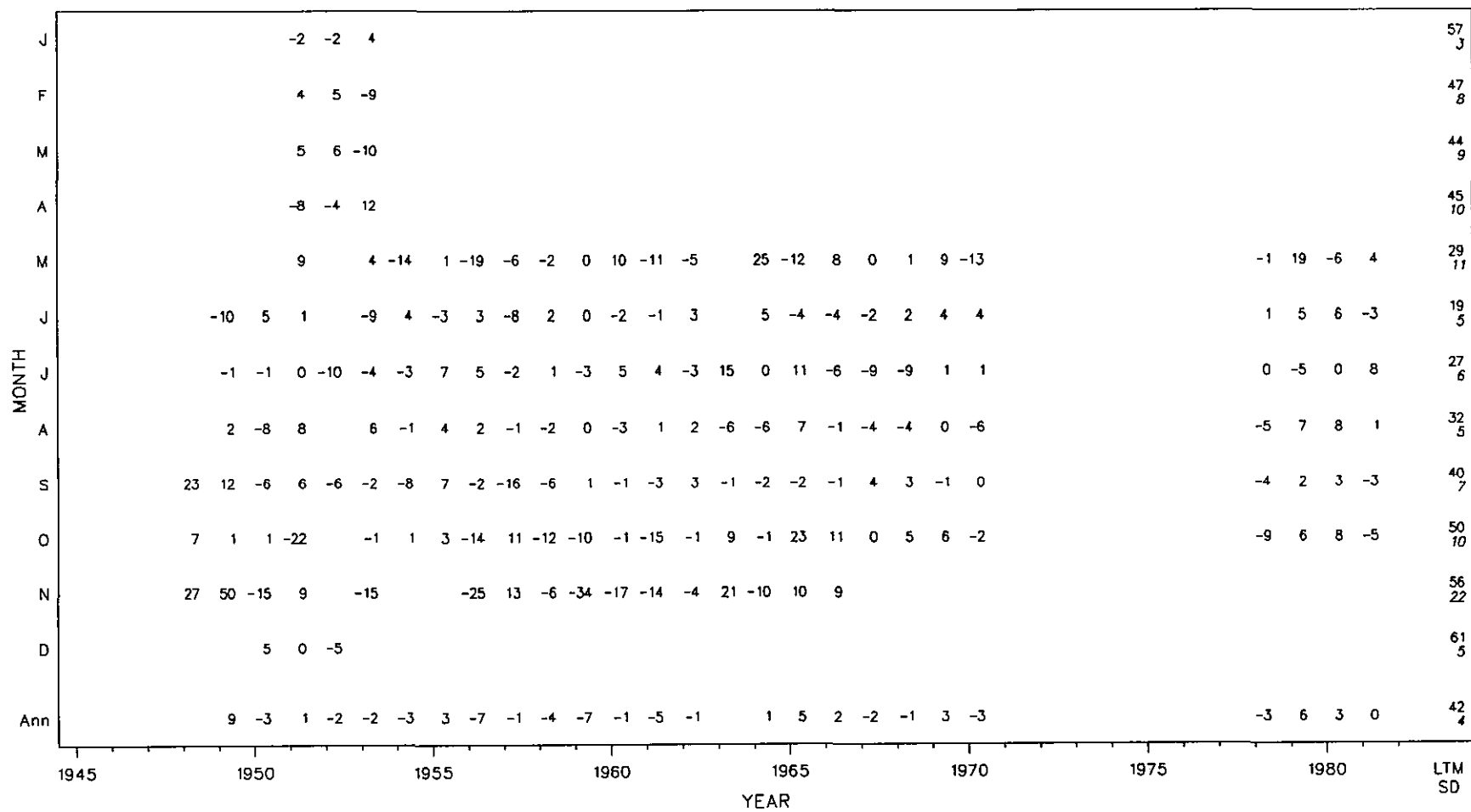


OWS Study Area T Anomalies

T4

Surface Dew Point Depression

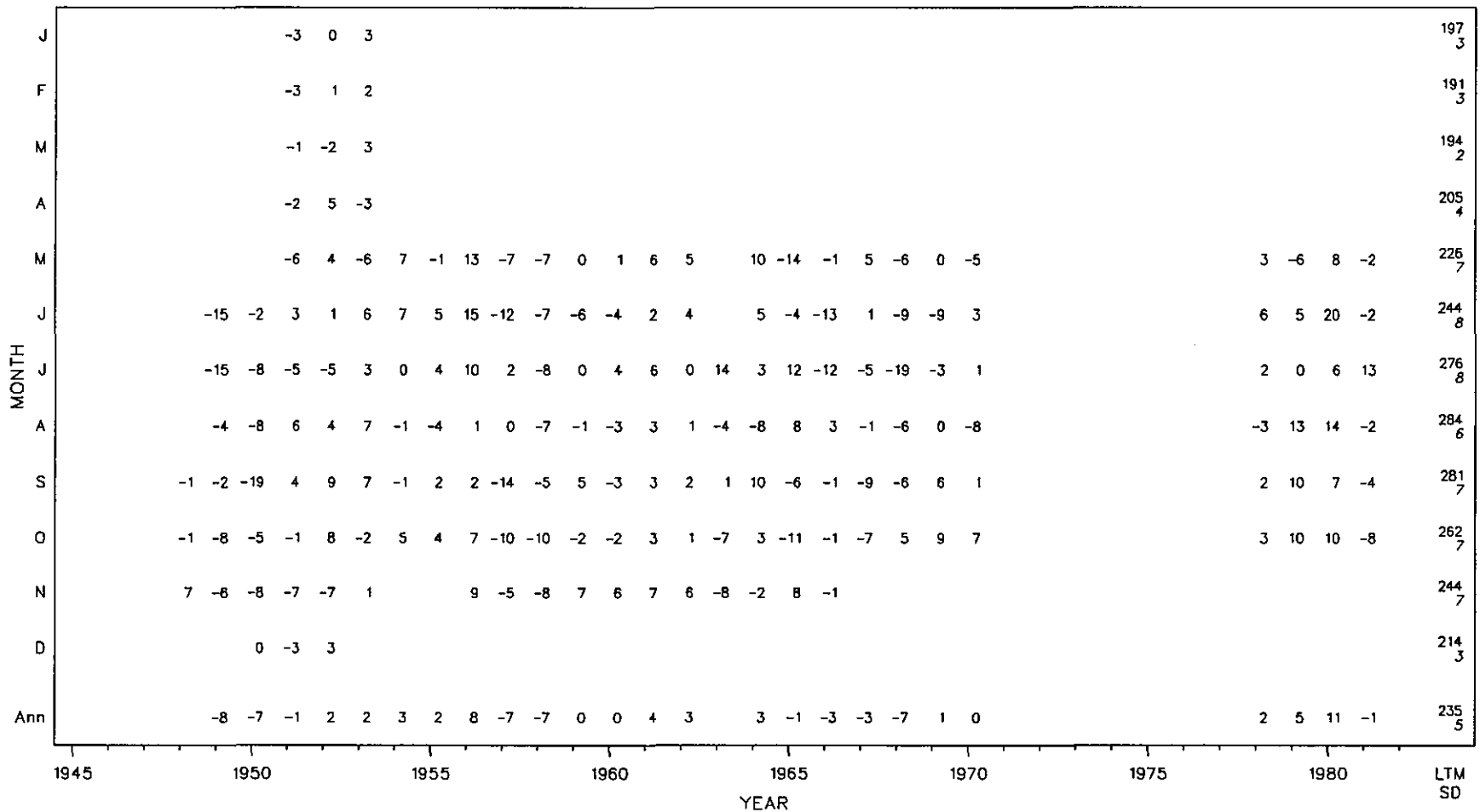
Units = 0.1 °C



OWS Study Area T Anomalies

Sea Surface Temperature

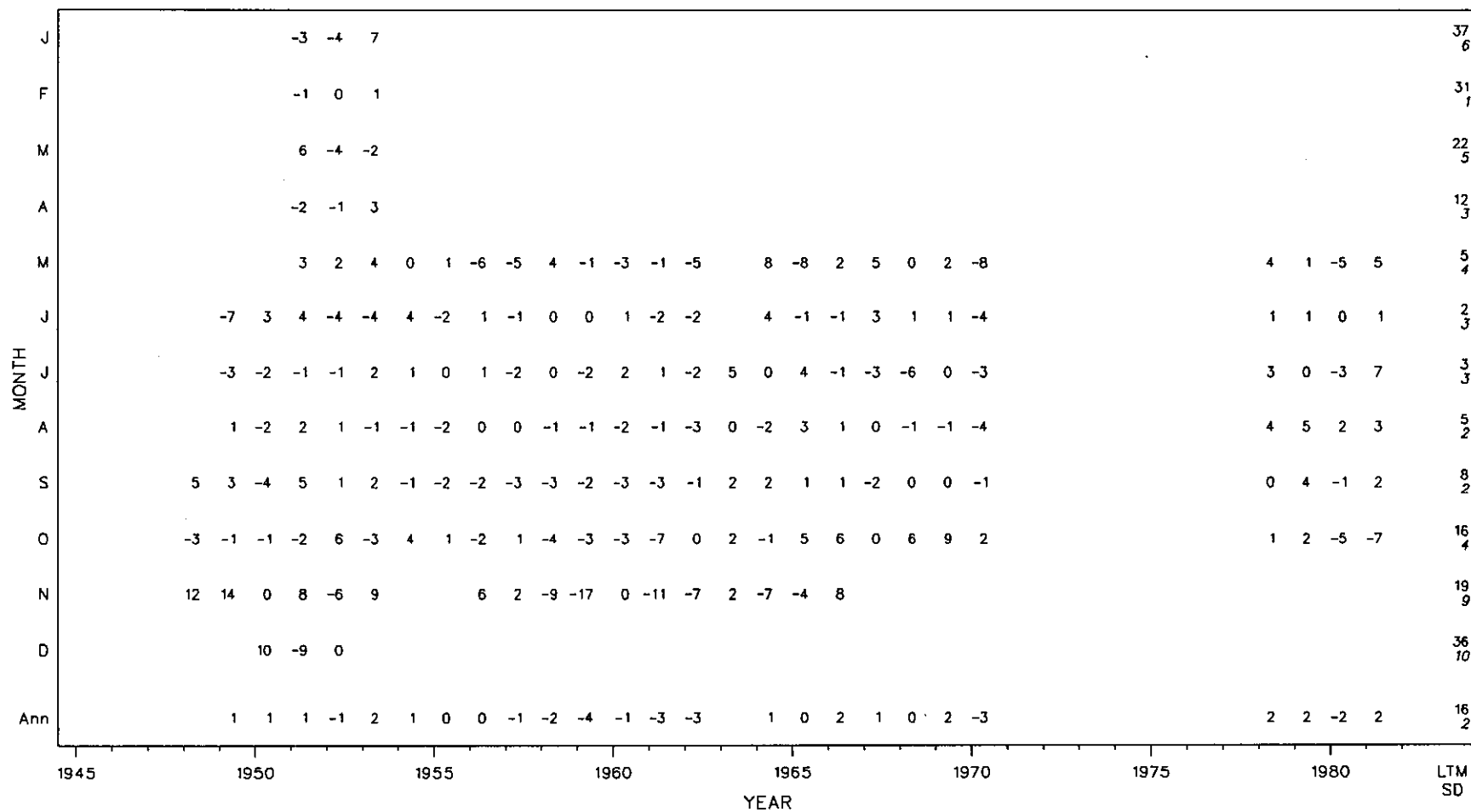
Units = 0.1 °C



OWS Study Area T Anomalies

Sea - Air Temperature Difference

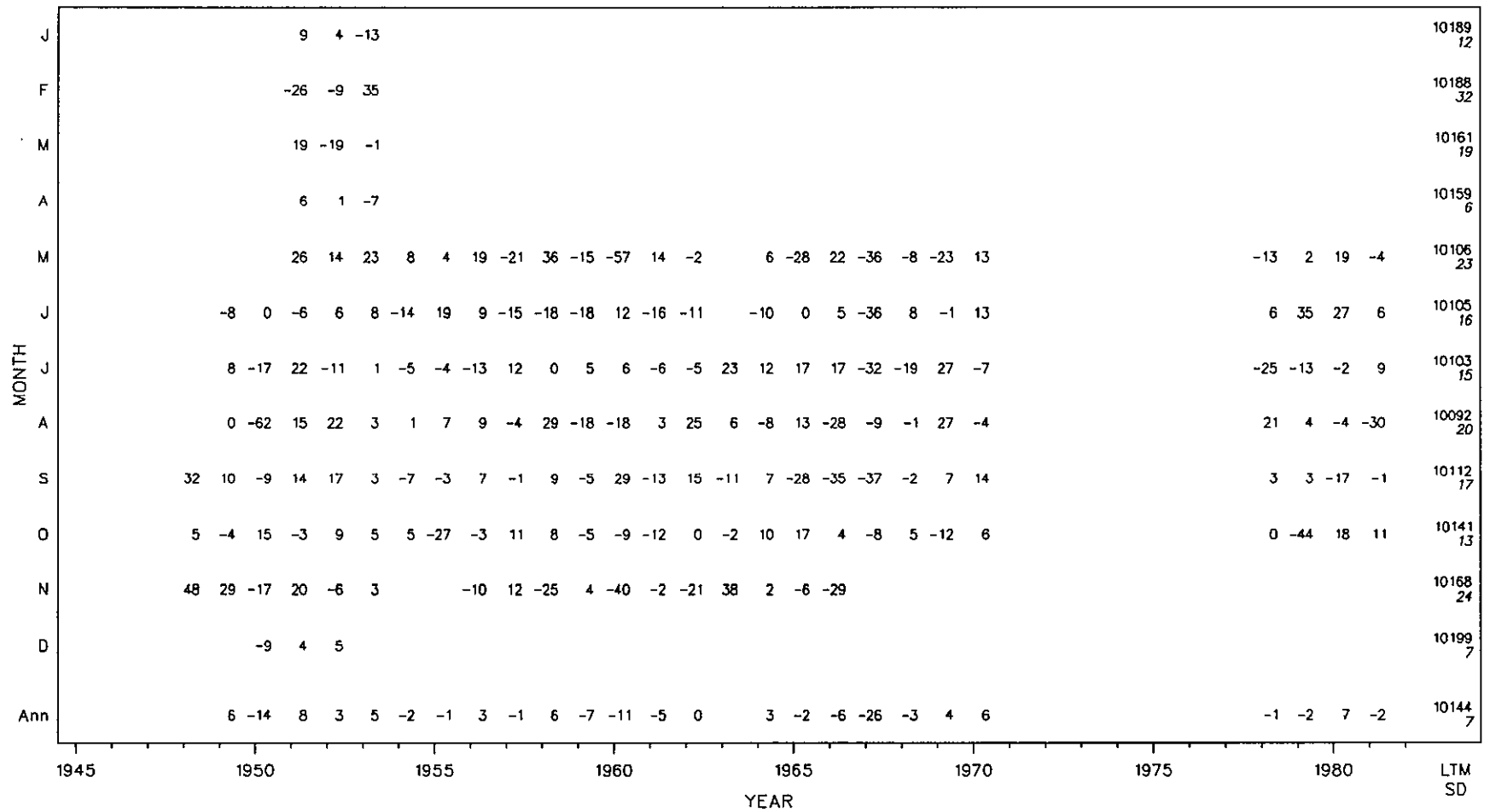
Units = 0.1 °C



OWS Study Area T Anomalies

Sea Level Pressure

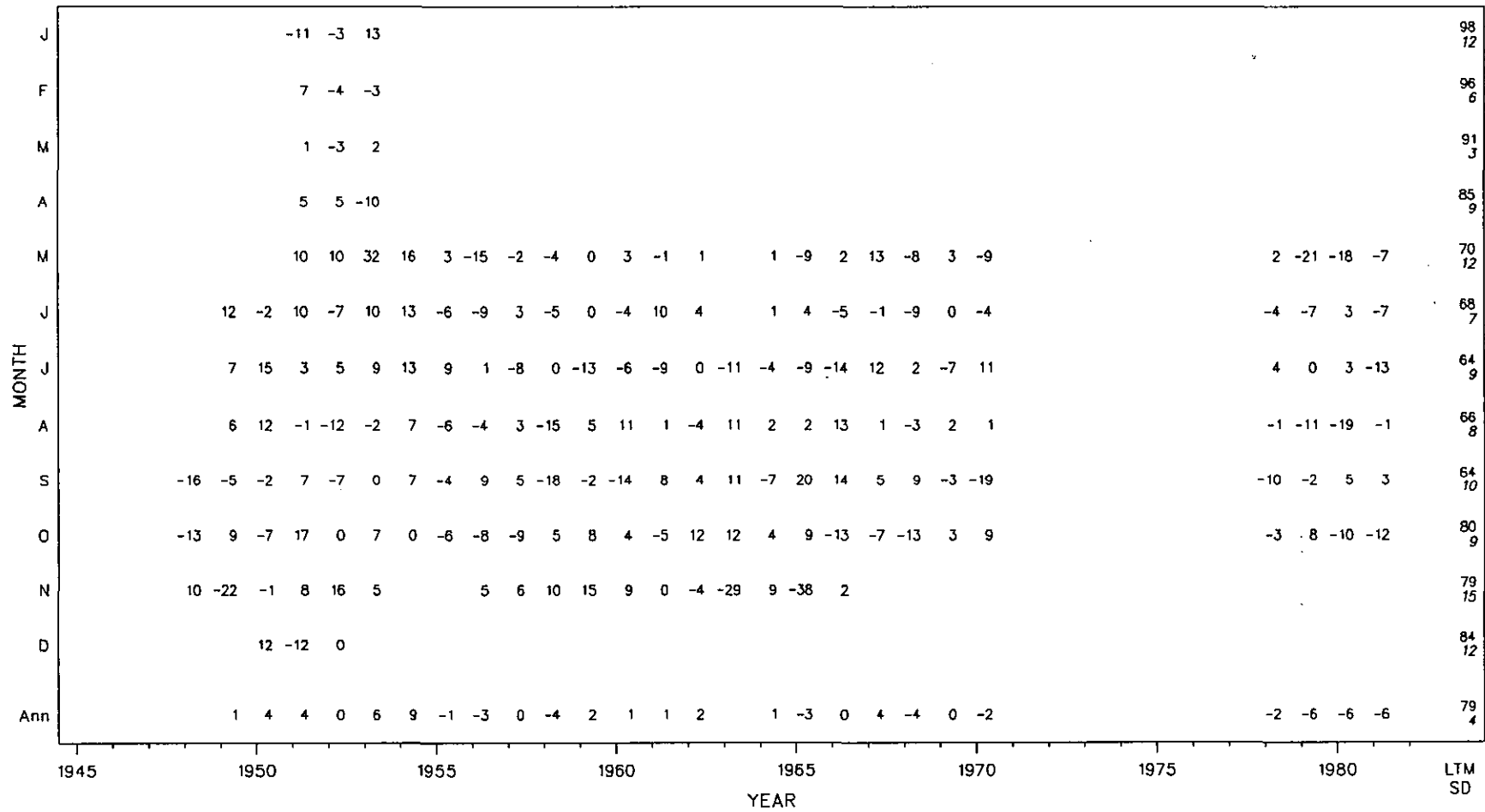
Units = 0.1 mb



OWS Study Area T Anomalies

Surface Scalar Wind

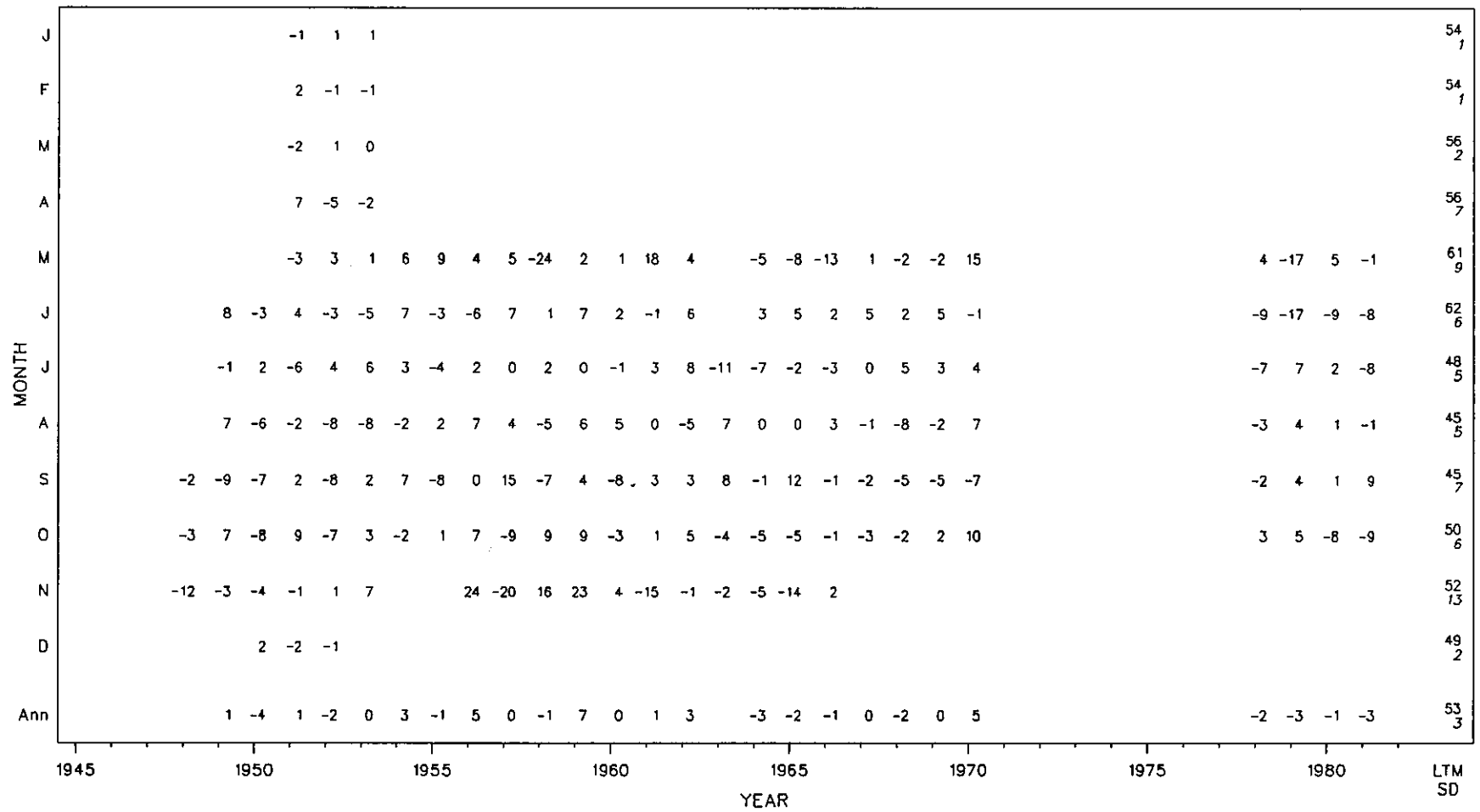
Units = 0.1 m/s



OWS Study Area T Anomalies

Total Cloudiness

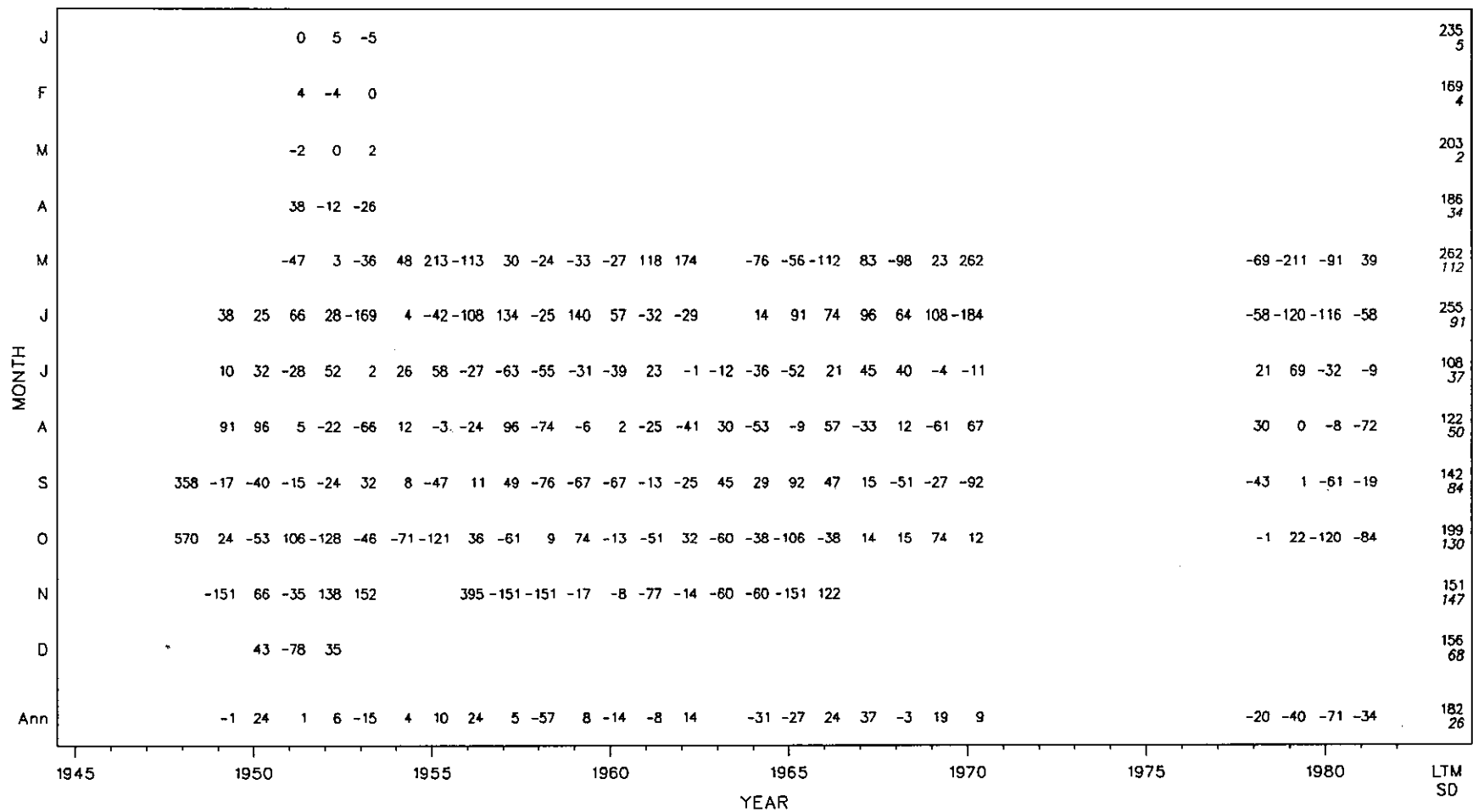
Units = 0.1 okta



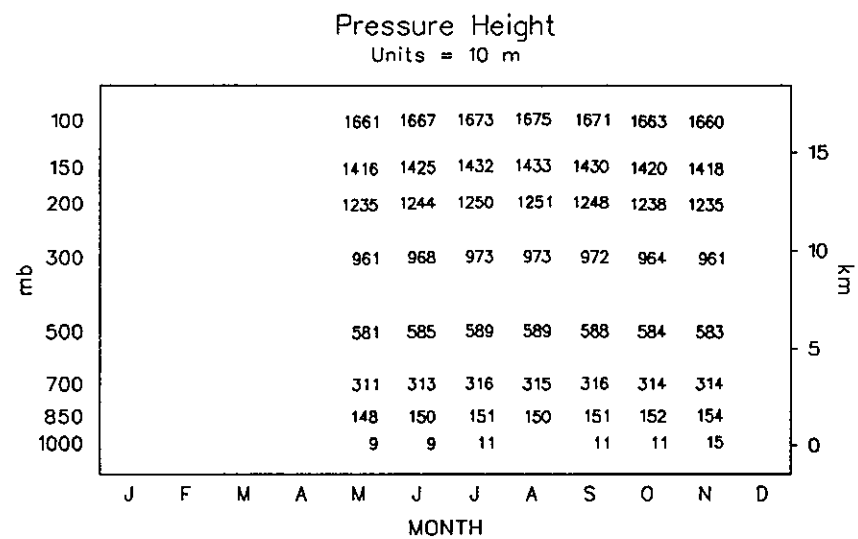
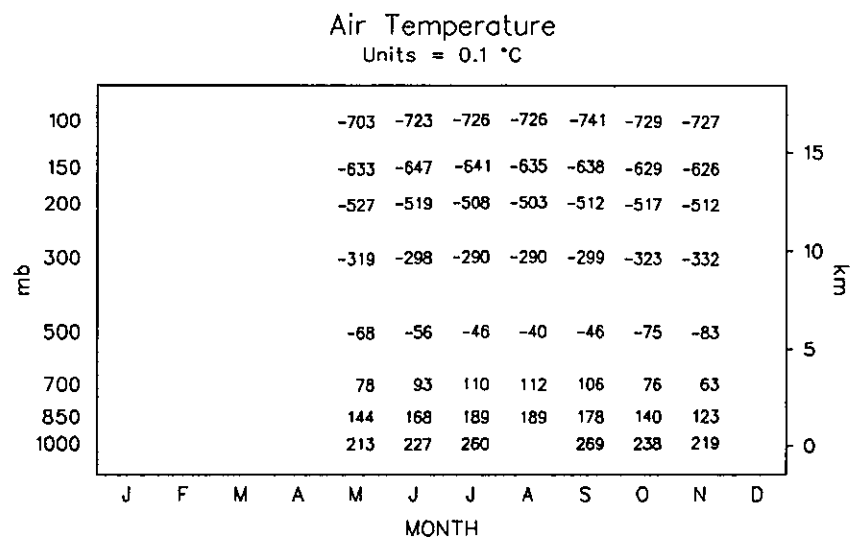
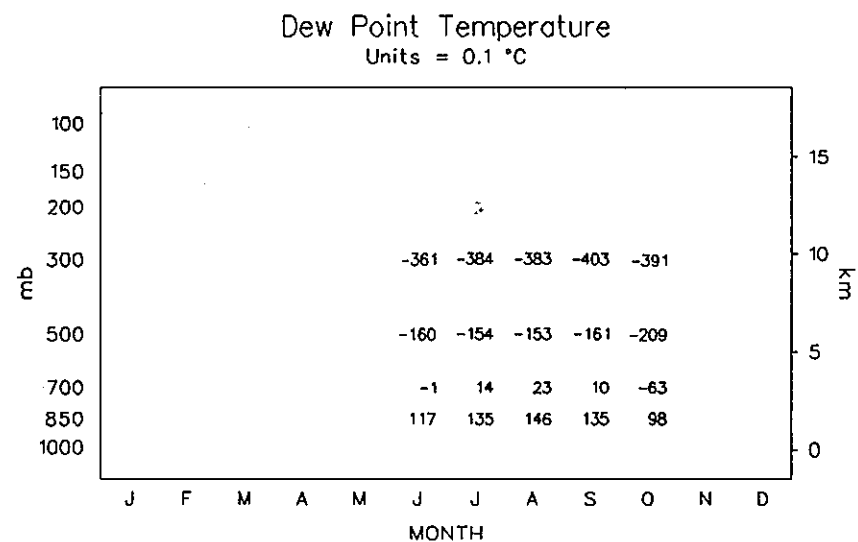
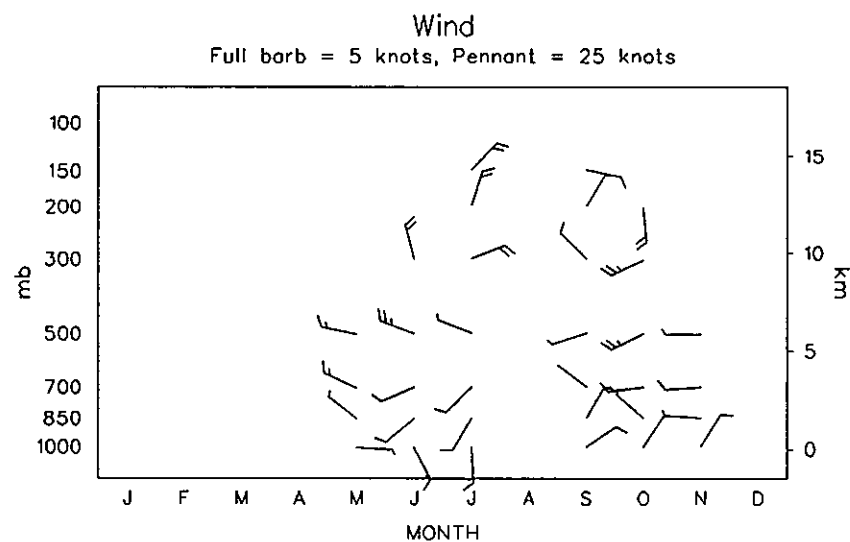
OWS Study Area T Anomalies

Precipitation Frequency

Units = 0.1 percent



OWS Study Area T Anomalies

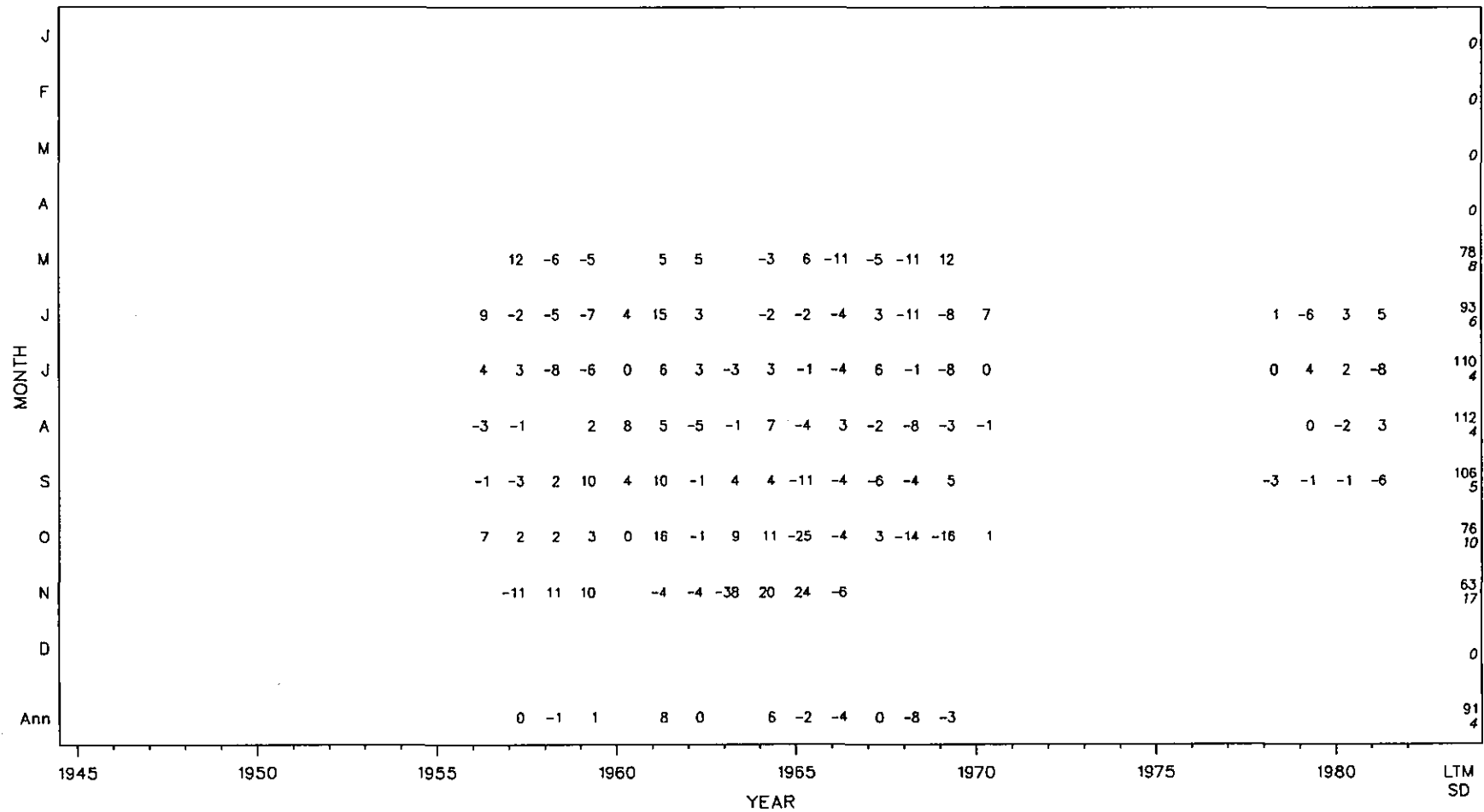


OWS Study Area T Upper Air Climatology

Mean plotted at actual height

Air Temperature: 700 mb

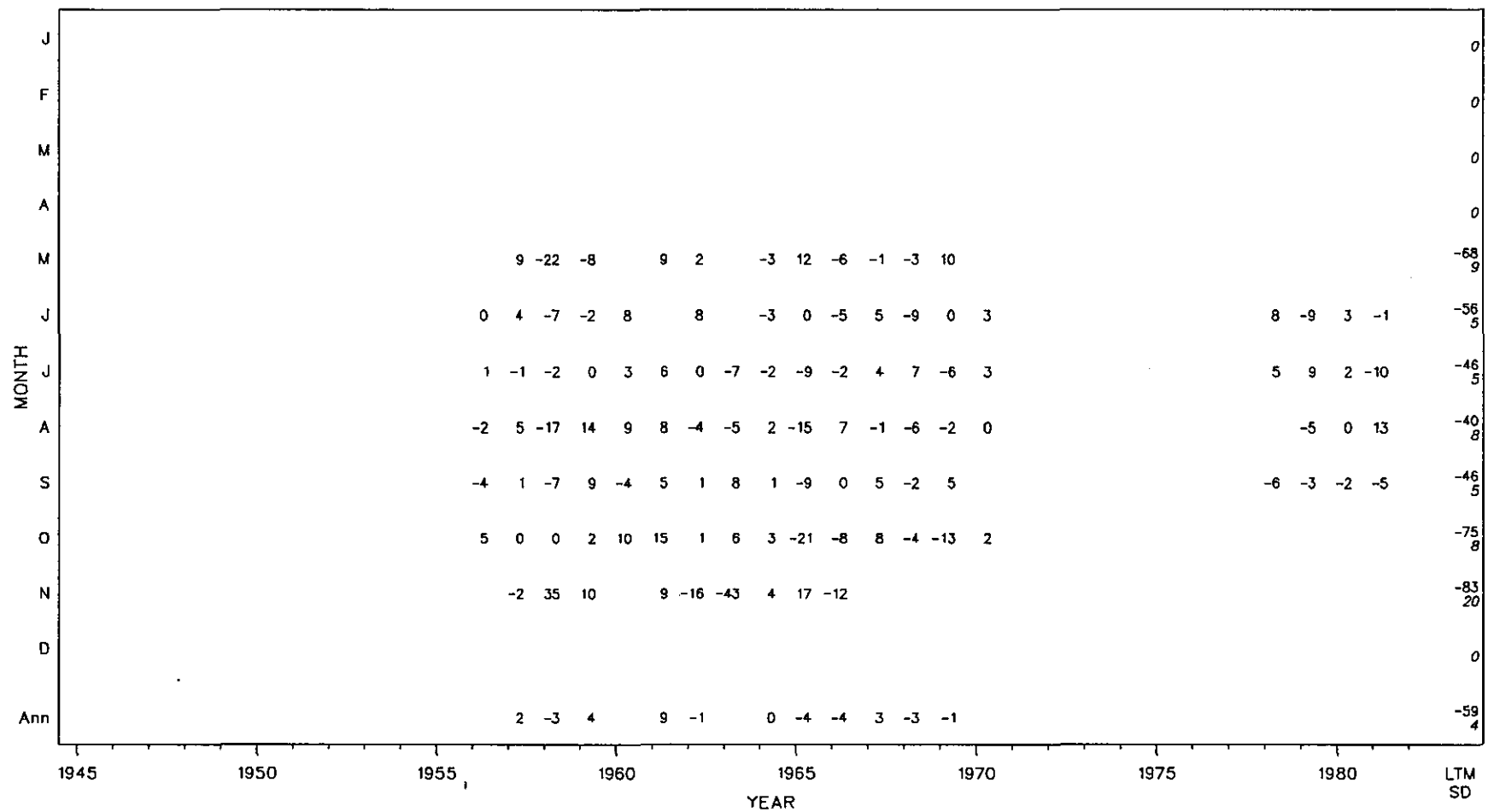
Units = 0.1 °C



OWS Study Area T Anomalies

Air Temperature: 500 mb

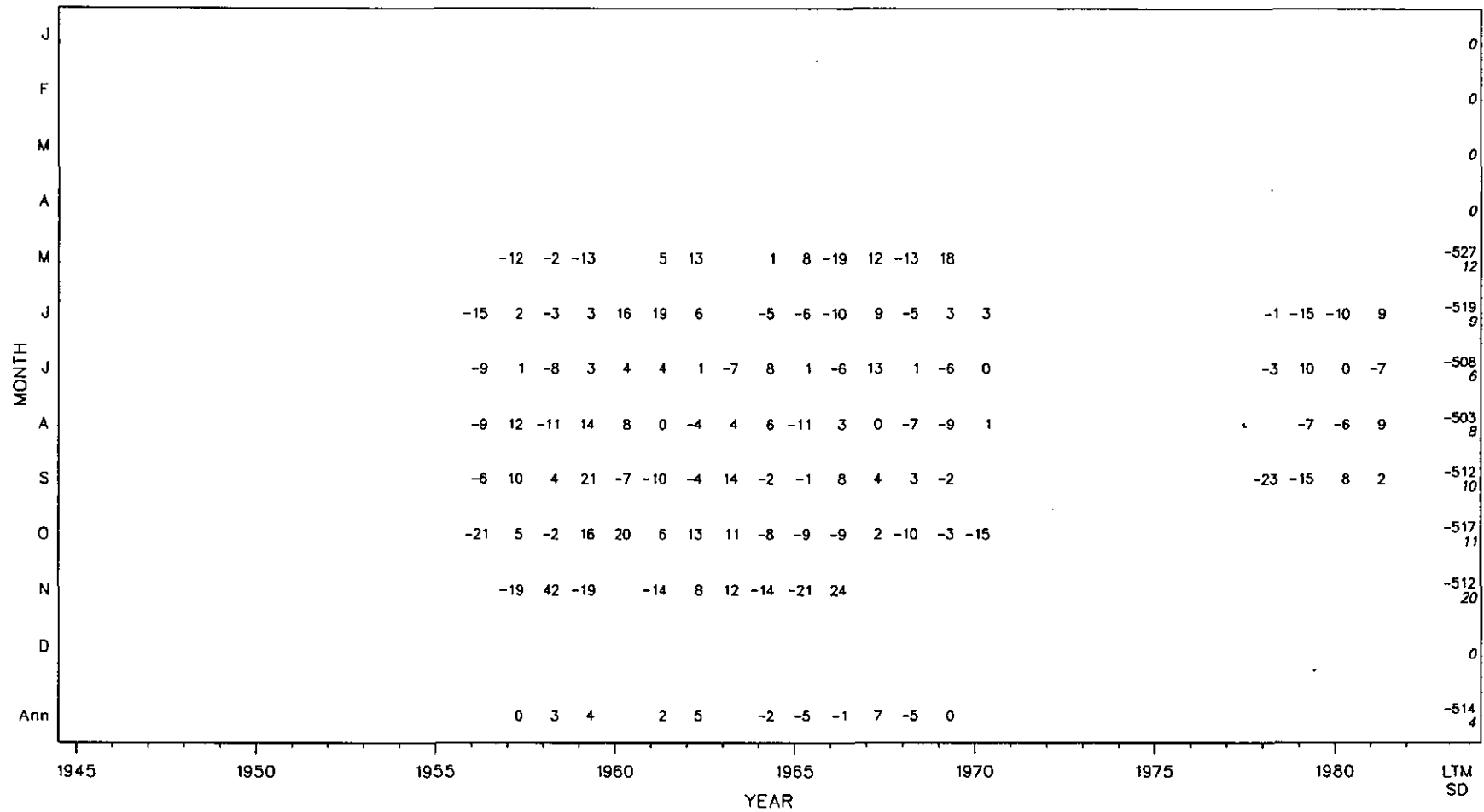
Units = 0.1 °C



OWS Study Area T Anomalies

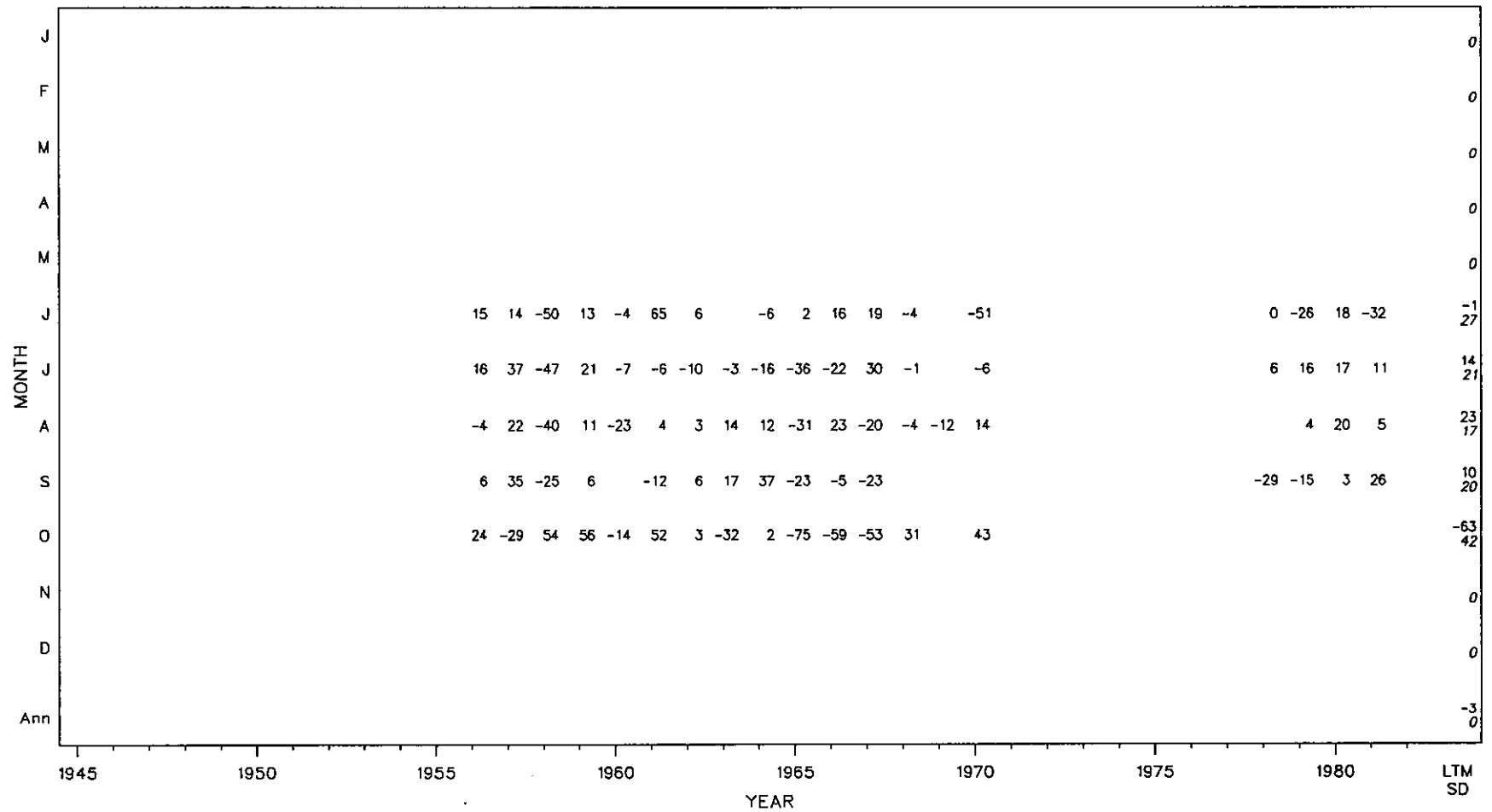
Air Temperature: 200 mb

Units = 0.1 °C



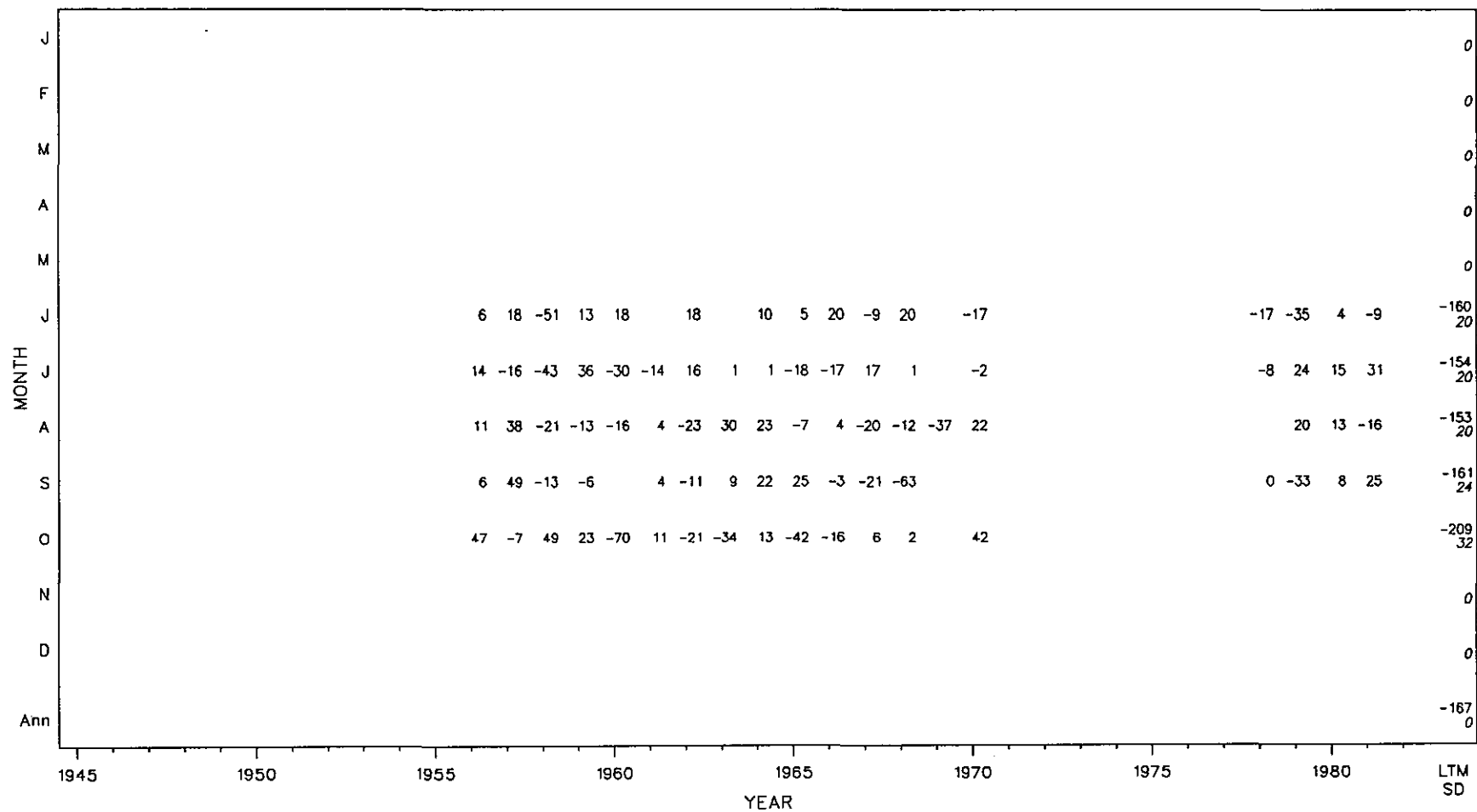
OWS Study Area T Anomalies

Dew Point Temperature: 700 mb
Units = 0.1 °C

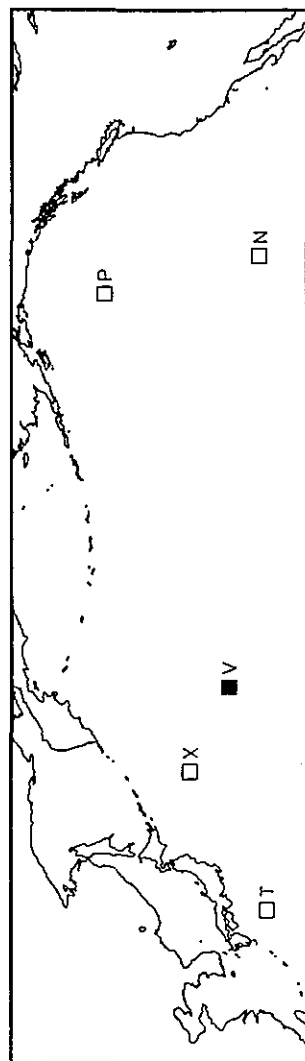


OWS Study Area T Anomalies

Dew Point Temperature: 500 mb
Units = 0.1 °C



OWS Study Area T Anomalies .



33.0°N – 34.9°N, 163.0°E – 164.9°E
1955 – 1971

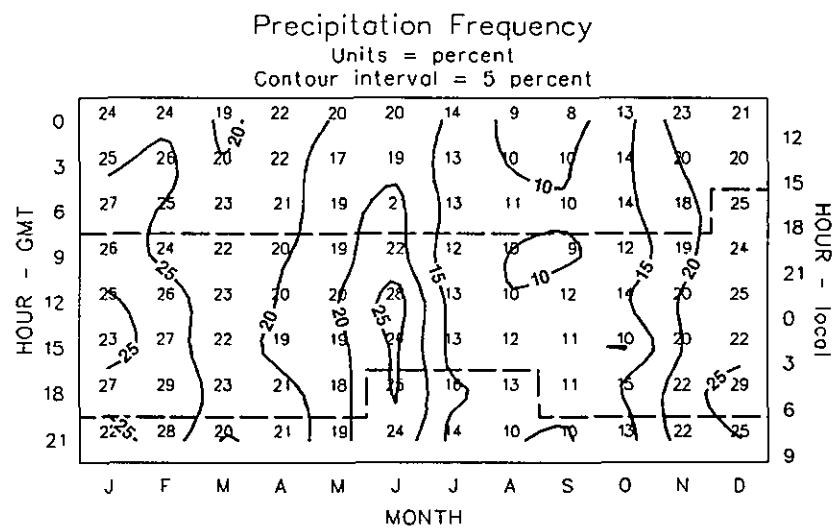
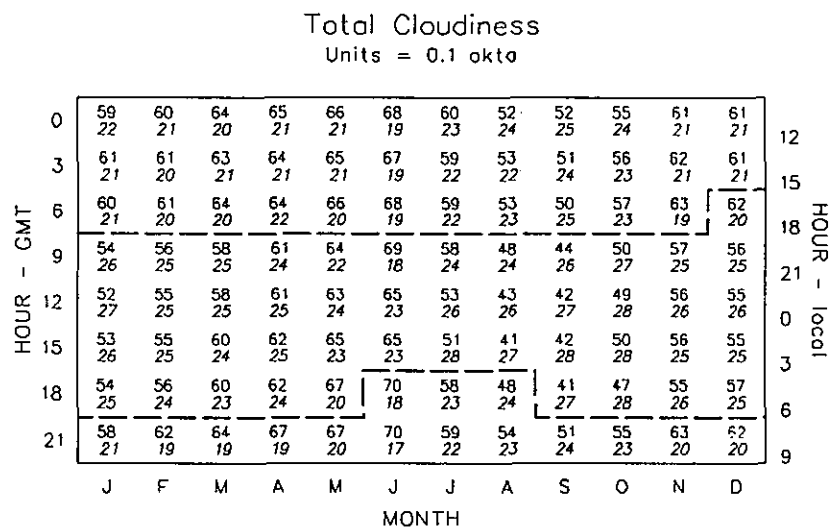
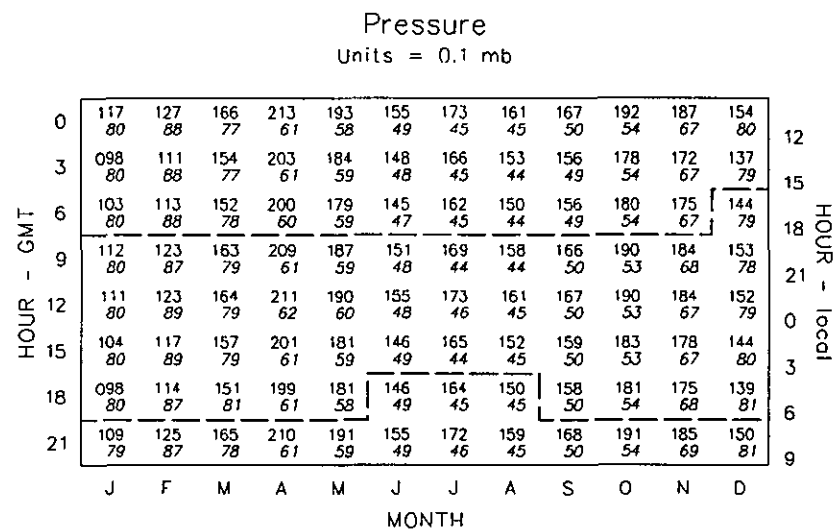
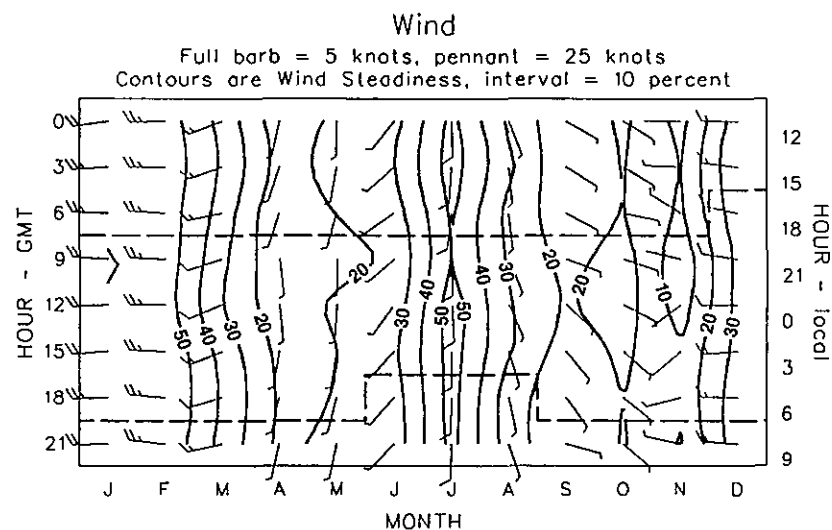
OWS
V

MONTH																													Sum
	1945	1950	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	
J				31 30	31 31	24 24	31 31	31 31	31 31	31 31	31 31	30 30	27 27	31 31	31 31	31 31	31 31	25 25	30 30									477 476	
F				29 29	28 28	27 27	28 28	29 29	28 28	28 28	28 28	24 24	13 13	28 28	28 28	28 28	28 28	22 22	28 28									424 424	
M				19 19	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	24 24	31 31	31 31	31 31	31 31	25 25	30 30									501 501	
A				30 30	30 30	30 30	26 26	30 29	30 30	30 30	30 30	30 30	30 30	30 30	30 30	29 29	30 30	30 30										505 504	
M				27 26	31 31	31 31	31 30	31 31	31 31	31 31	31 31	30 30	31 31	31 31	31 31	31 31	31 31	18 18	31 31									508 507	
J				30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	29 29	30 30	30 30	30 30	30 30										509 509	
J				31 31	31 31	31 31	31 31	31 30	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	31 31	30 30	31 31									526 525	
A				31 31	31 31	31 31	31 31	31 30	31 31	31 31	30 30	31 31	31 31	31 31	31 31	31 31	31 31	28 28	31 31									523 522	
S				30 30	30 30	28 28	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 29	30 30									508 507	
O				31 31	31 31	31 31	31 31	31 31	26 26	30 30	27 27	30 30	31 31	31 31	30 30	31 31	28 28	31 31										512 512	
N				30 30	27 25	30 30	30 30	30 30	30 30	30 30	27 27	30 30	30 30	30 30	30 30	30 30	30 30	30 30										504 502	
D				31 31	31 31	31 31	31 31	29 29	31 31	30 30	29 29	31 31	31 31	31 31	30 30	20 20	26 26	18 18										492 492	
Ann	290 289	363 360	363 363	357 357	360 360	366 364	363 362	360 360	359 359	353 353	338 338	364 364	365 365	362 362	354 354	322 321	350 350											5989 5981	

OWS Study Area V (34.0°N, 164.0°E)

Frequency of Surface Observations

Each of the 11 variables was observed on X days of each month.
The upper number is the maximum X from among all the variables.
The lower number is the minimum X from among all the variables.

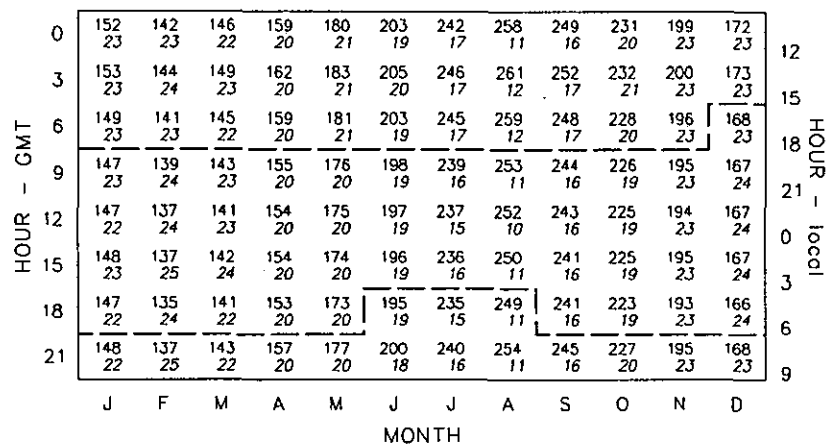


OWS Study Area V Surface Climatology

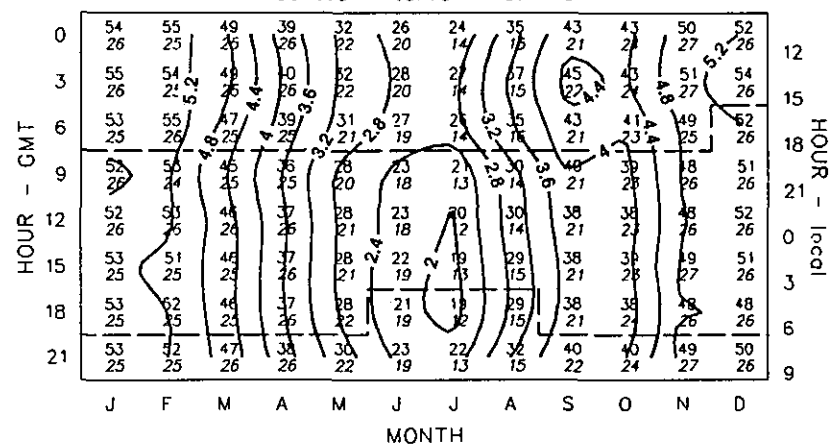
upper number = mean
lower number = standard deviation

———— data contours
----- sunrise/sunset

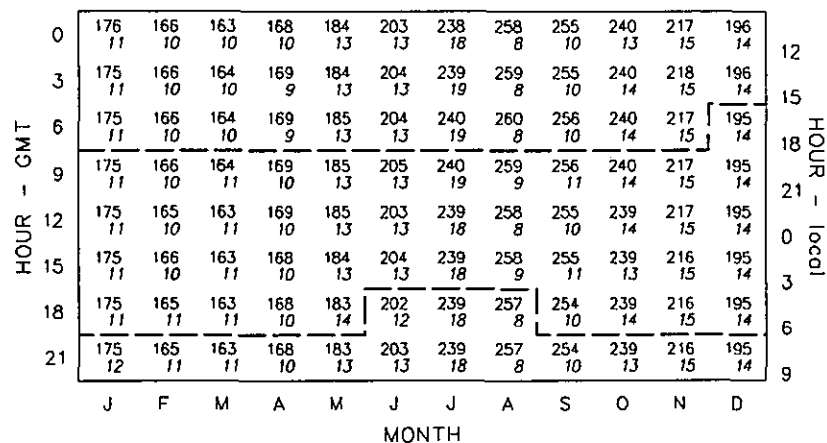
Air Temperature
Units = 0.1 °C



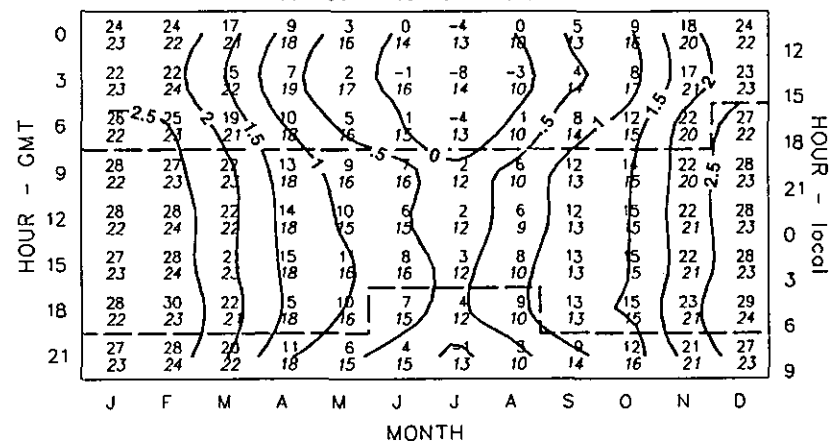
Dew Point Depression
Units = 0.1 °C
Contour interval = 0.4 °C



Sea Surface Temperature
Units = 0.1 °C



Sea - Air Temperature Difference
Units = 0.1 °C
Contour interval = 0.5 °C



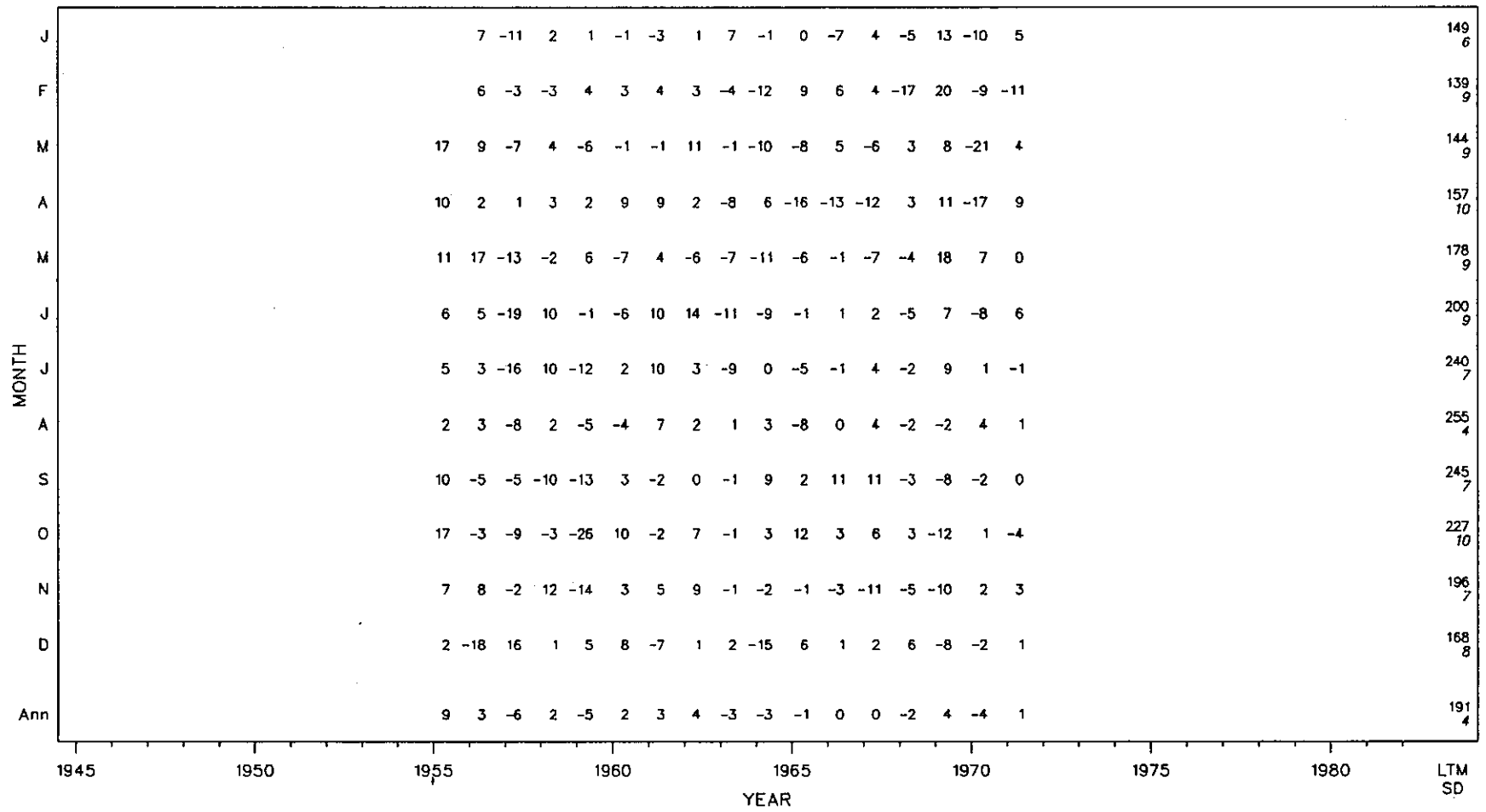
OWS Study Area V Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
--- sunrise/sunset

Surface Air Temperature

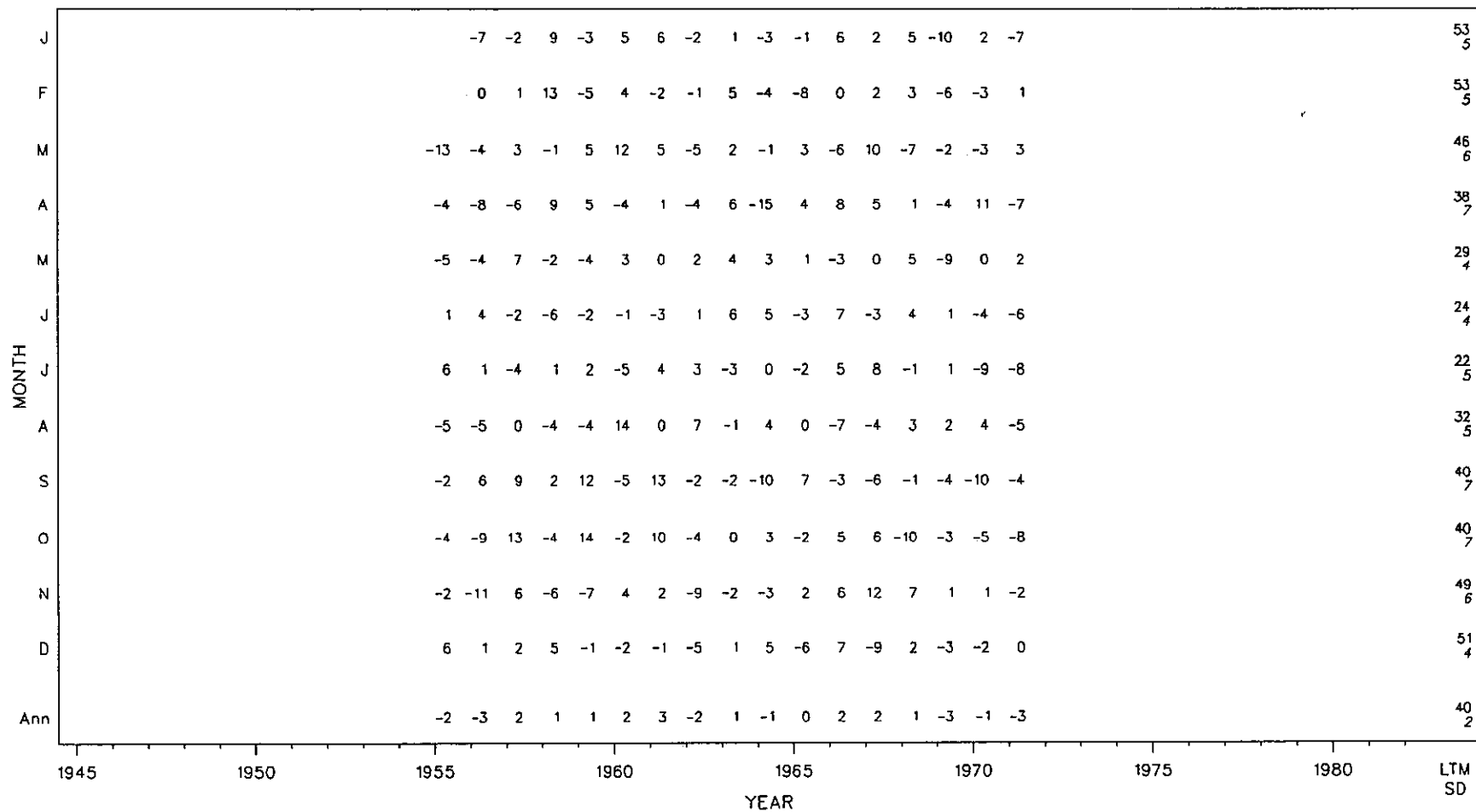
Units = 0.1 °C



OWS Study Area V Anomalies

Surface Dew Point Depression

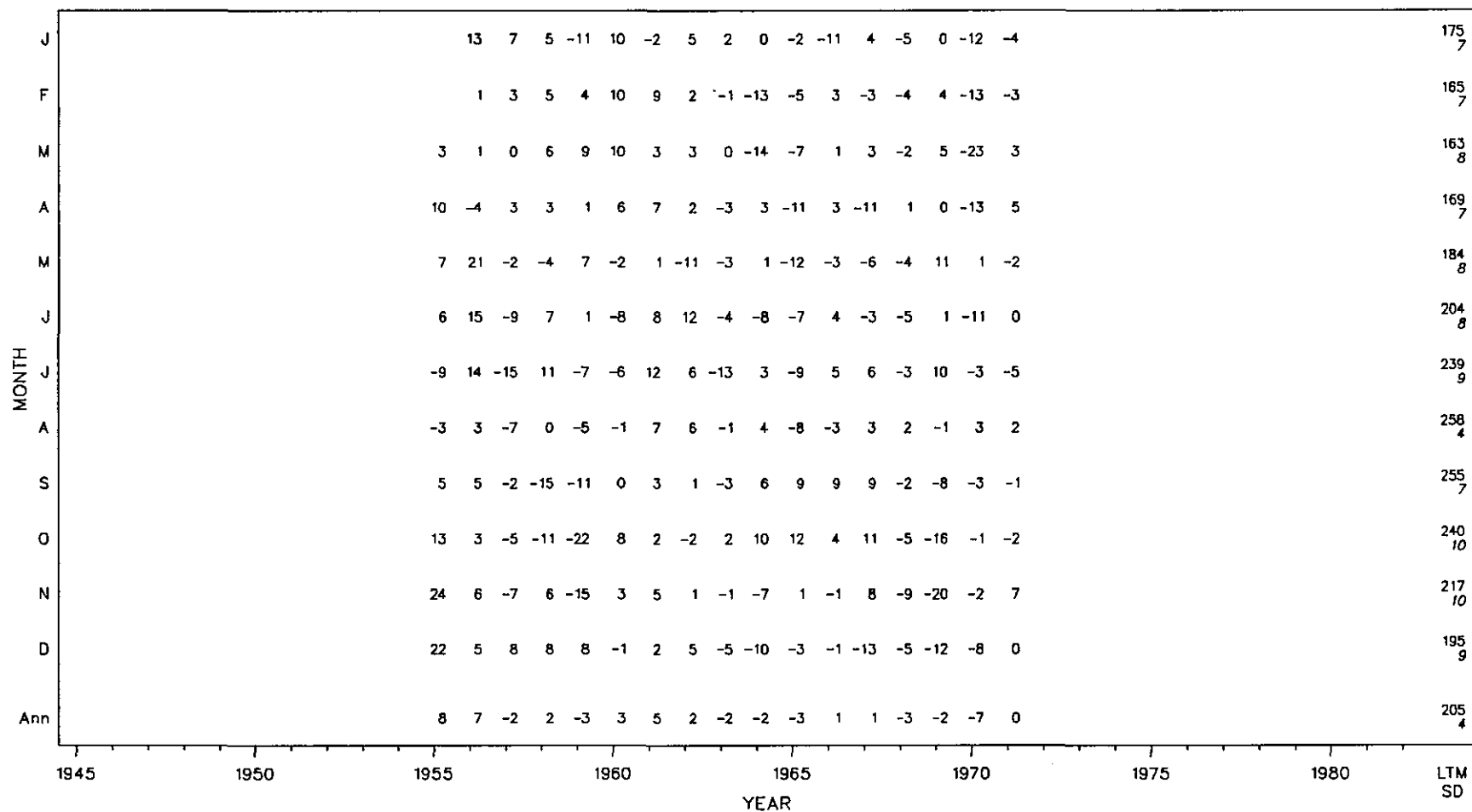
Units = 0.1 °C



OWS Study Area V Anomalies

Sea Surface Temperature

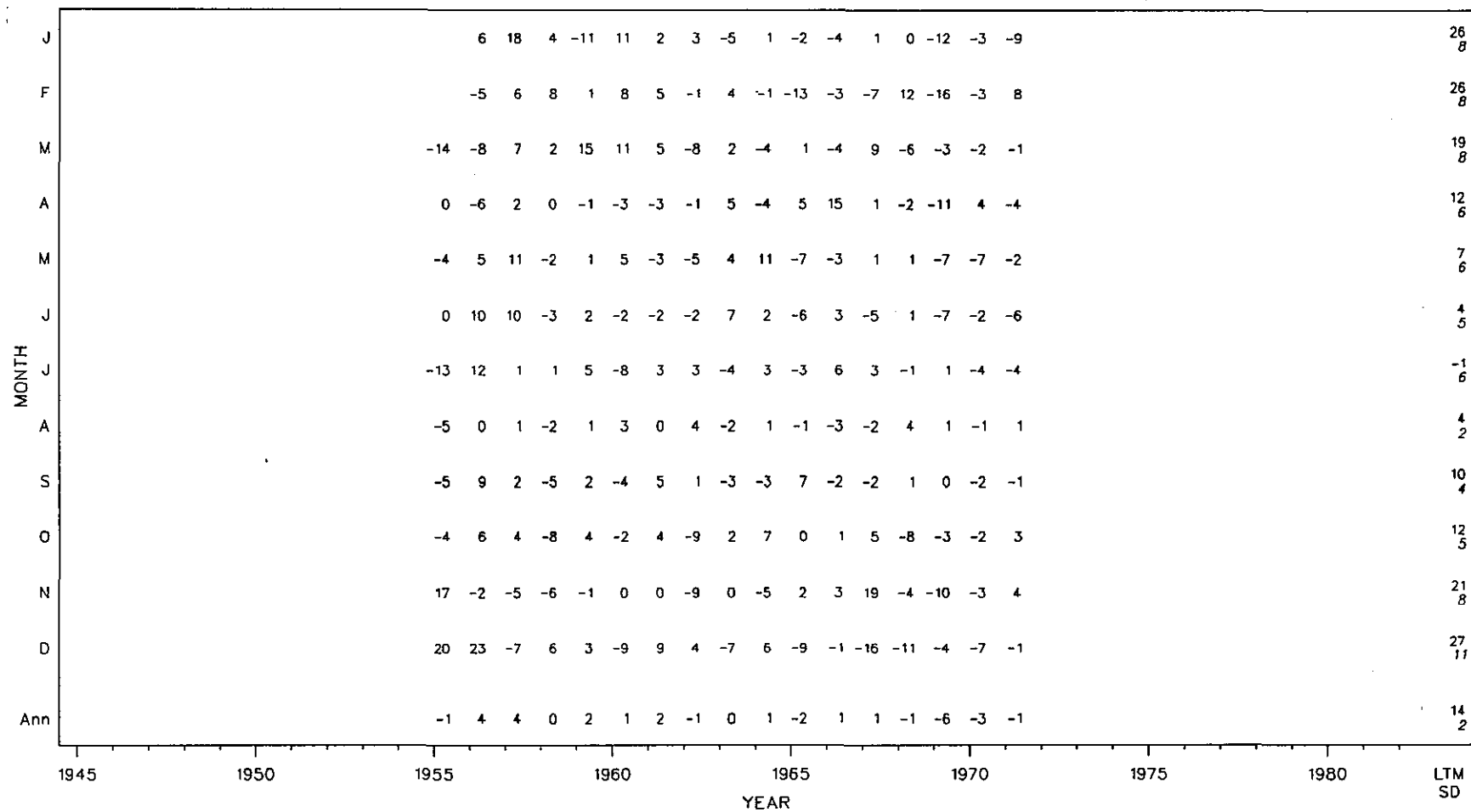
Units = 0.1 °C



OWS Study Area V Anomalies

Sea - Air Temperature Difference

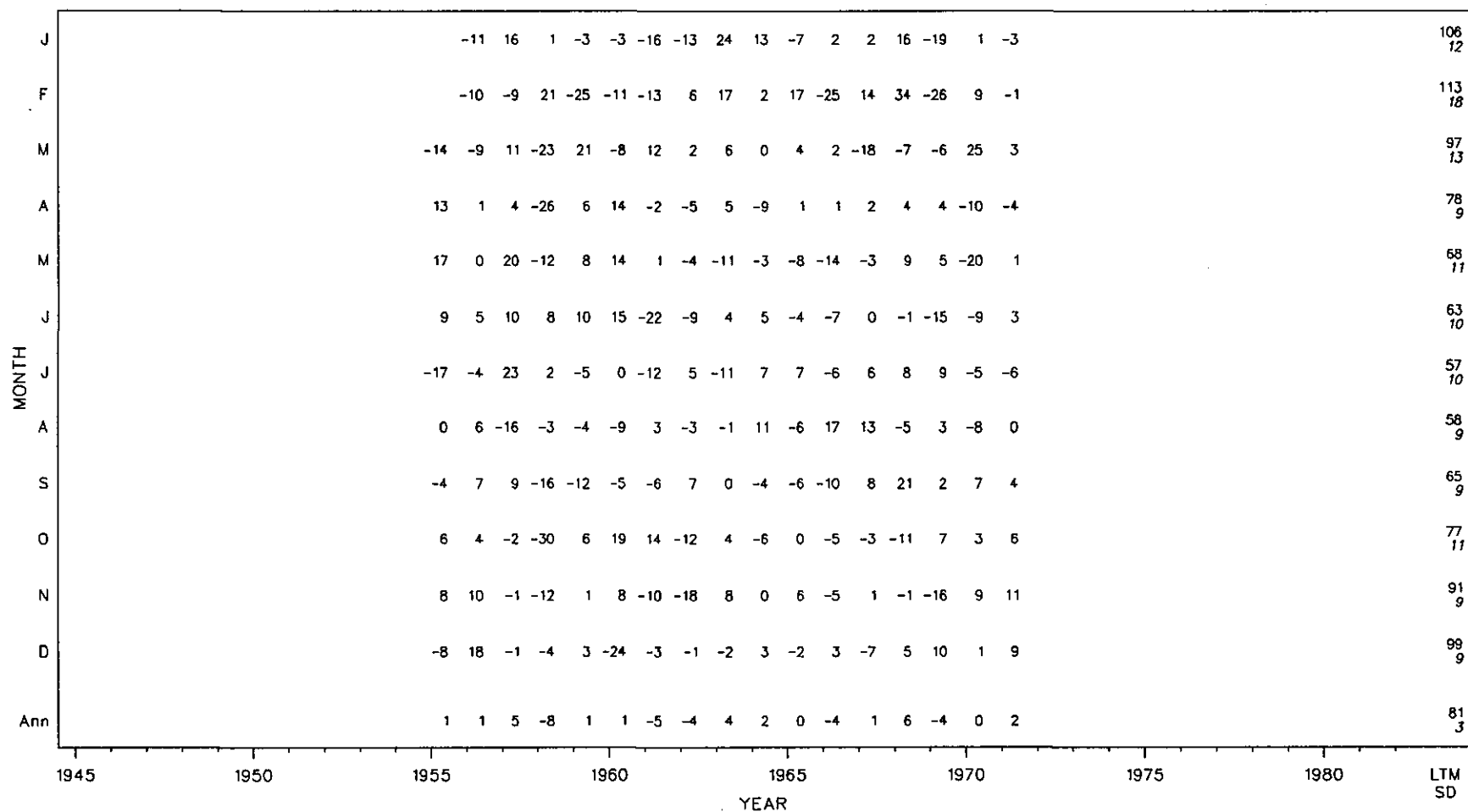
Units = 0.1 °C



OWS Study Area V Anomalies

Surface Scalar Wind

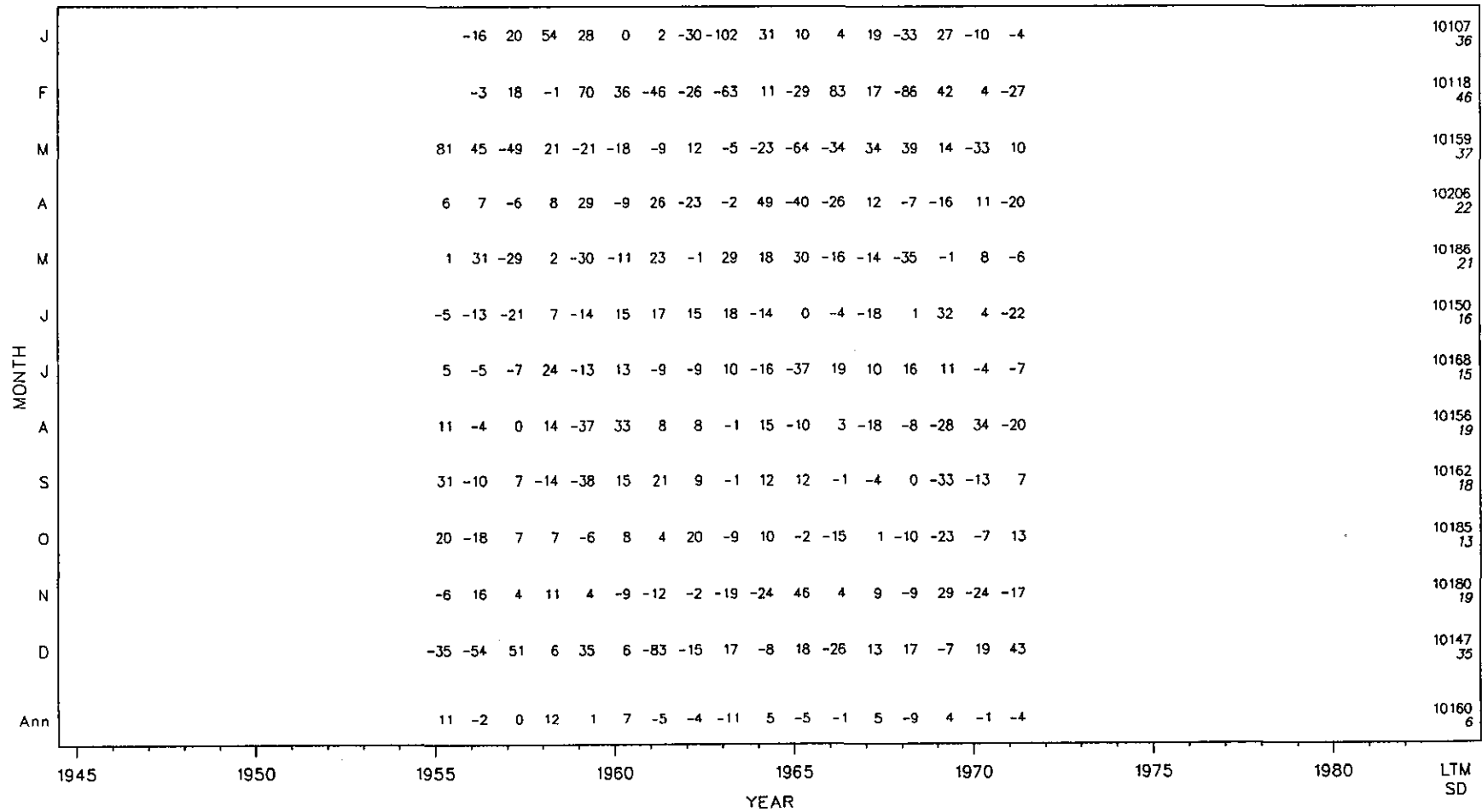
Units = 0.1 m/s



OWS Study Area V Anomalies

Sea Level Pressure

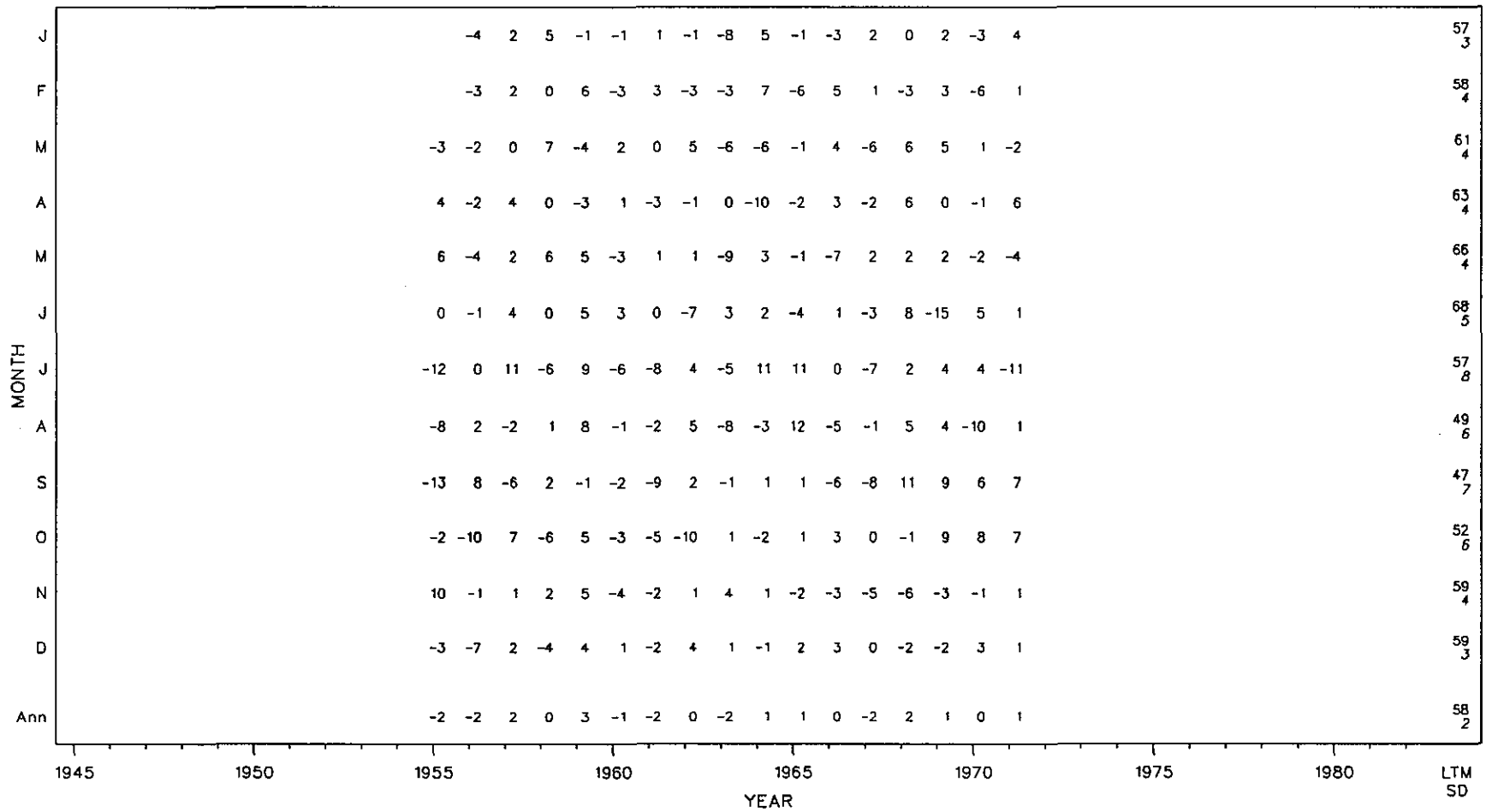
Units = 0.1 mb



OWS Study Area V Anomalies

Total Cloudiness

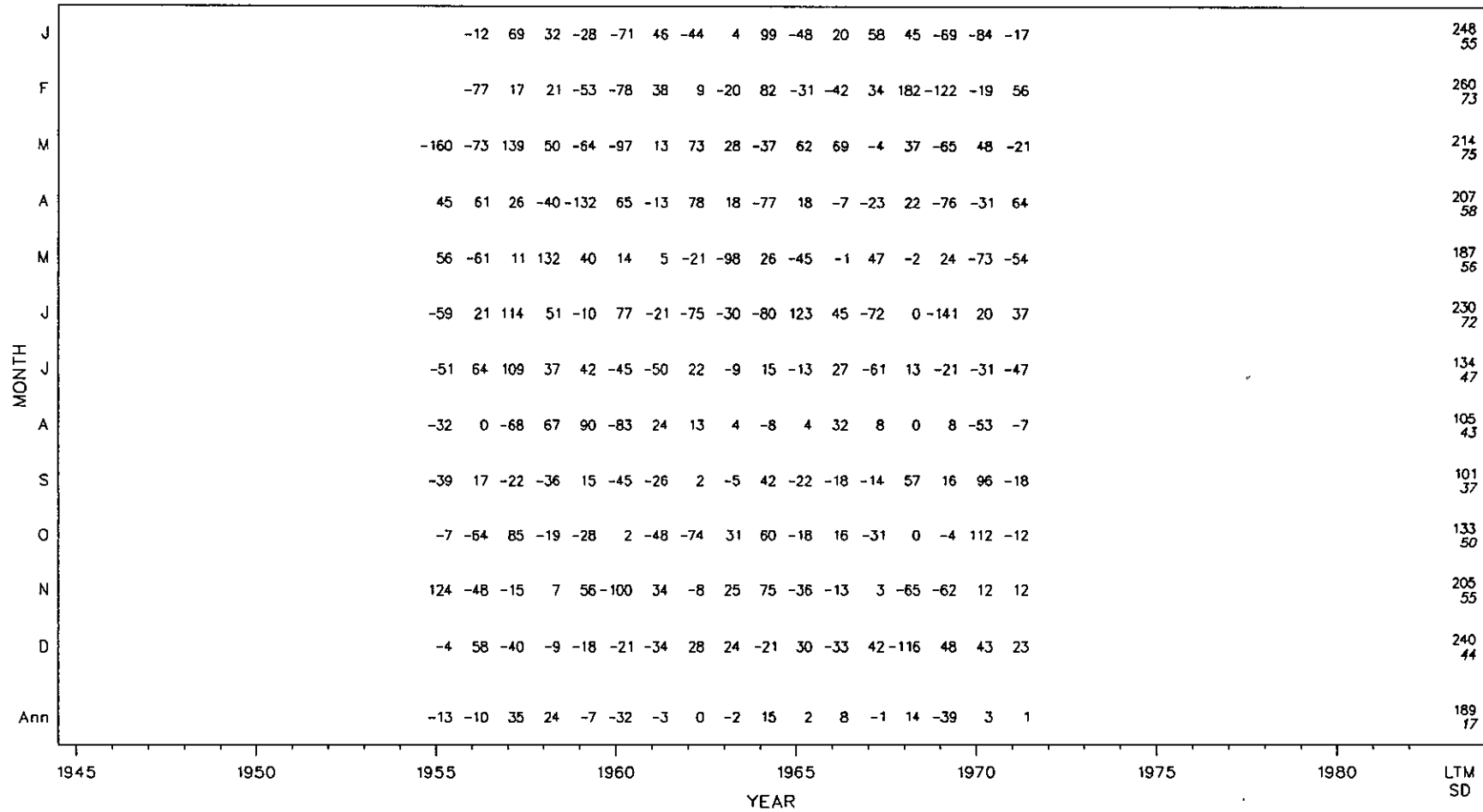
Units = 0.1 okta



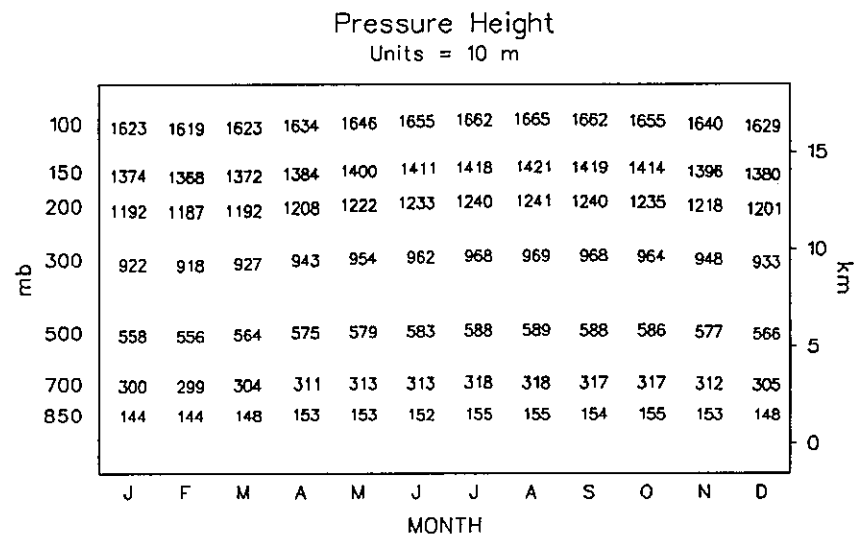
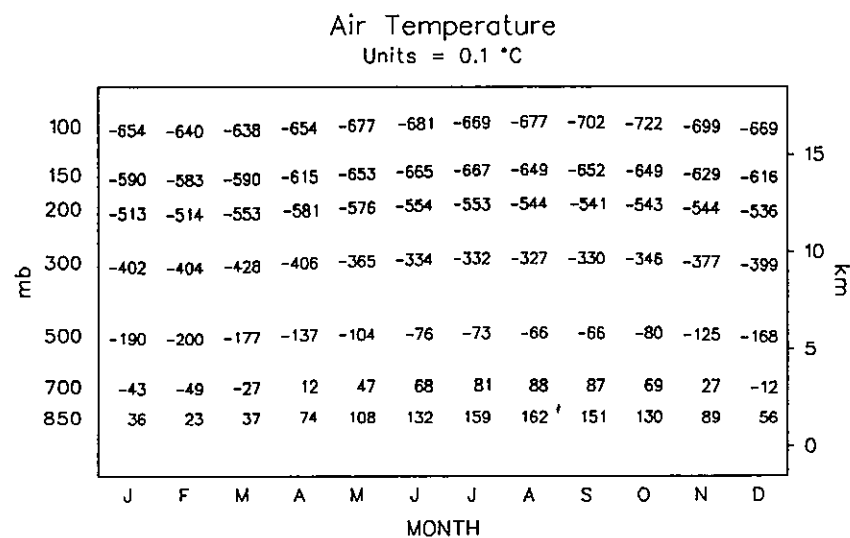
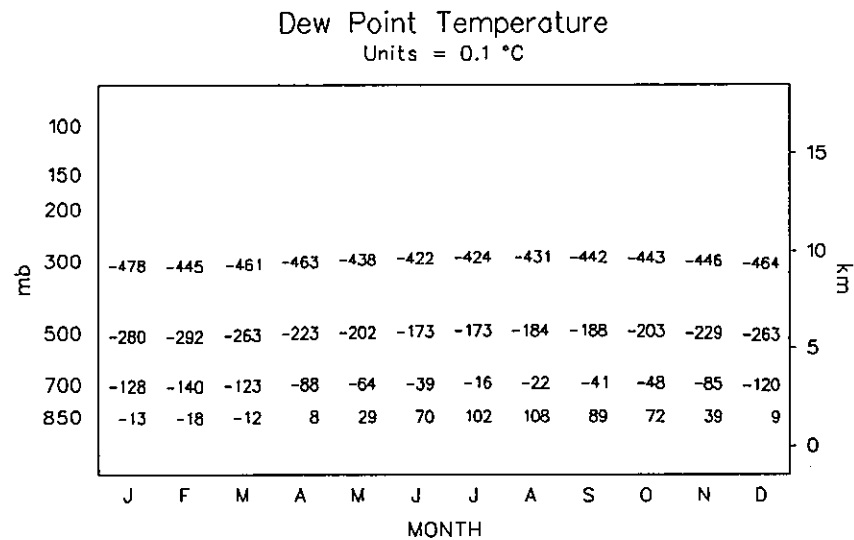
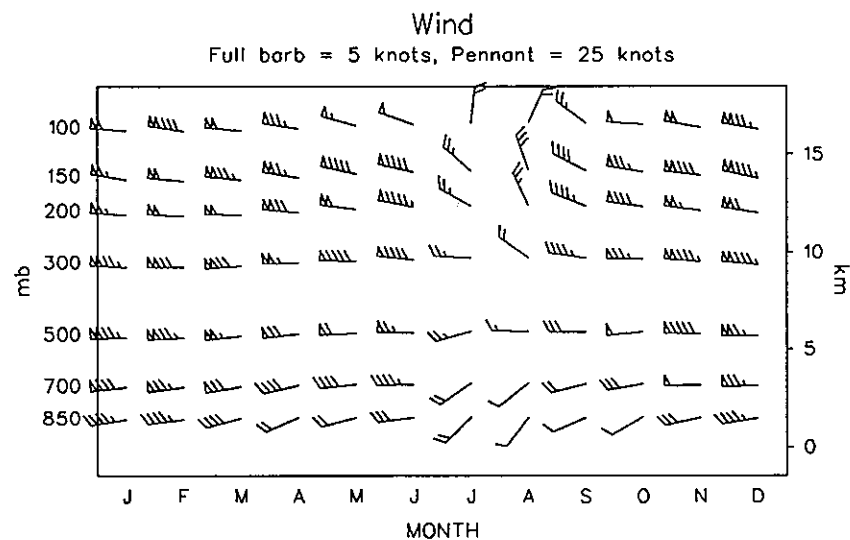
OWS Study Area V Anomalies

Precipitation Frequency

Units = 0.1 percent



OWS Study Area V Anomalies

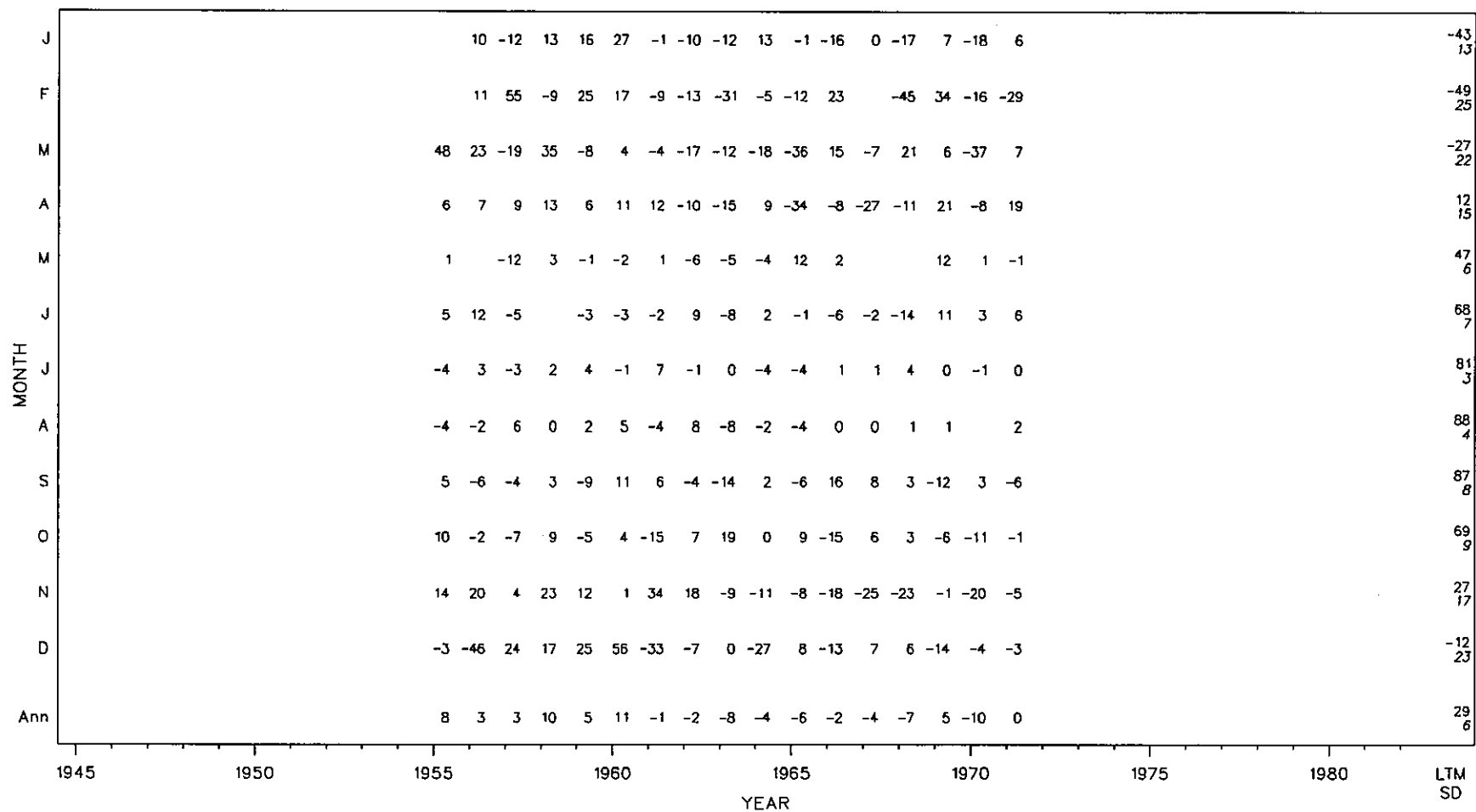


OWS Study Area V Upper Air Climatology

Mean plotted at actual height

Air Temperature: 700 mb

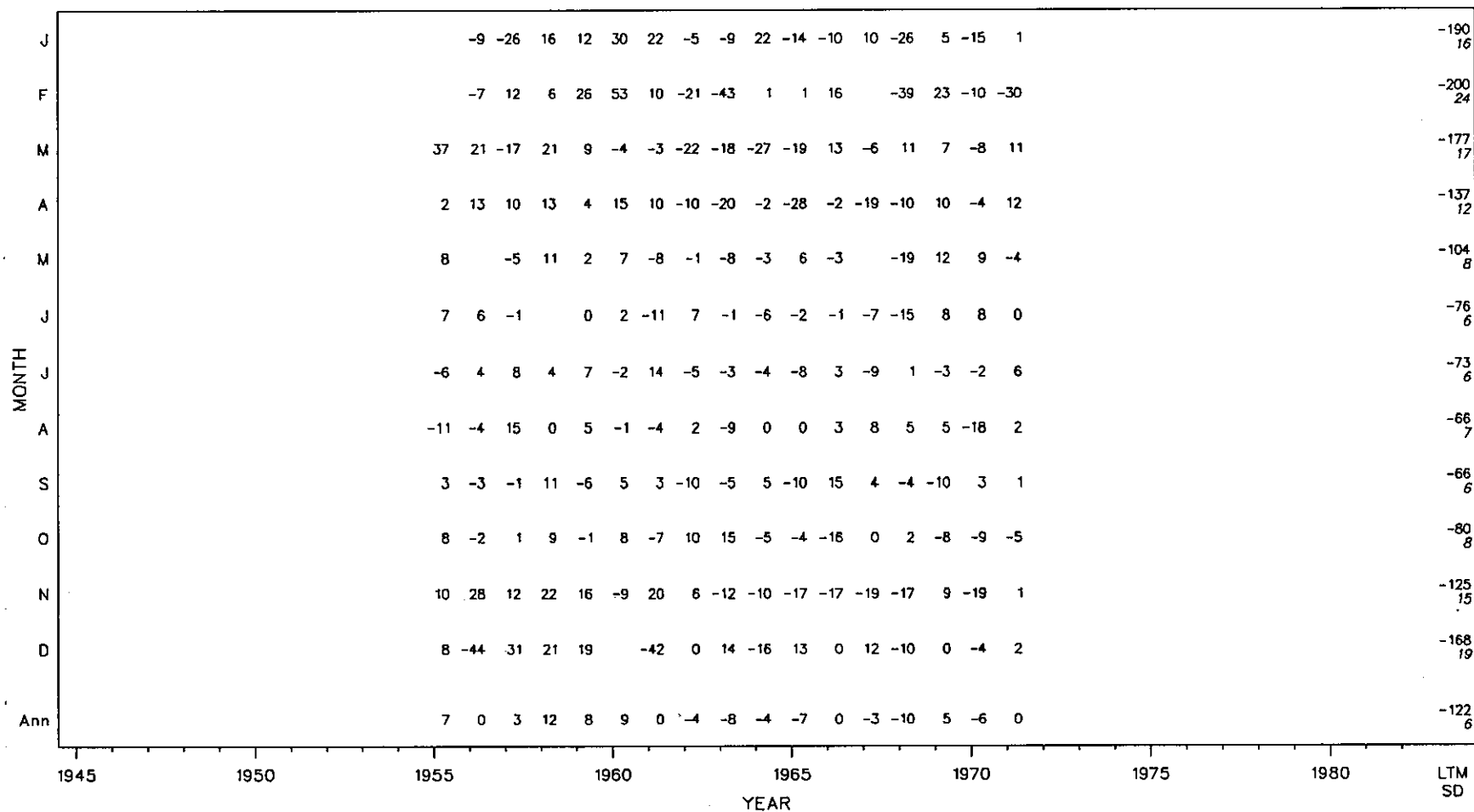
Units = 0.1 °C



OWS Study Area V Anomalies

Air Temperature: 500 mb

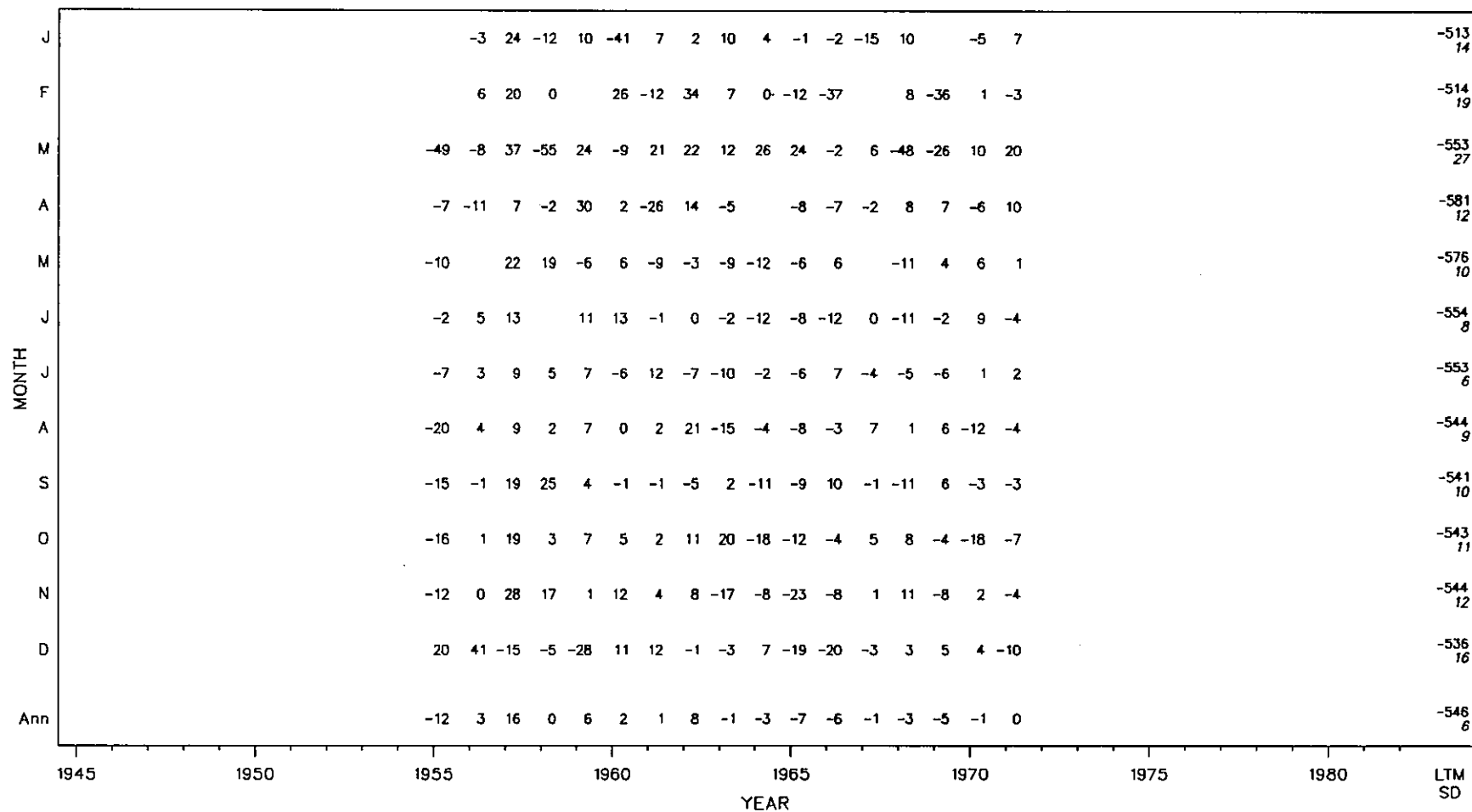
Units = 0.1 °C



OWS Study Area V Anomalies

Air Temperature: 200 mb

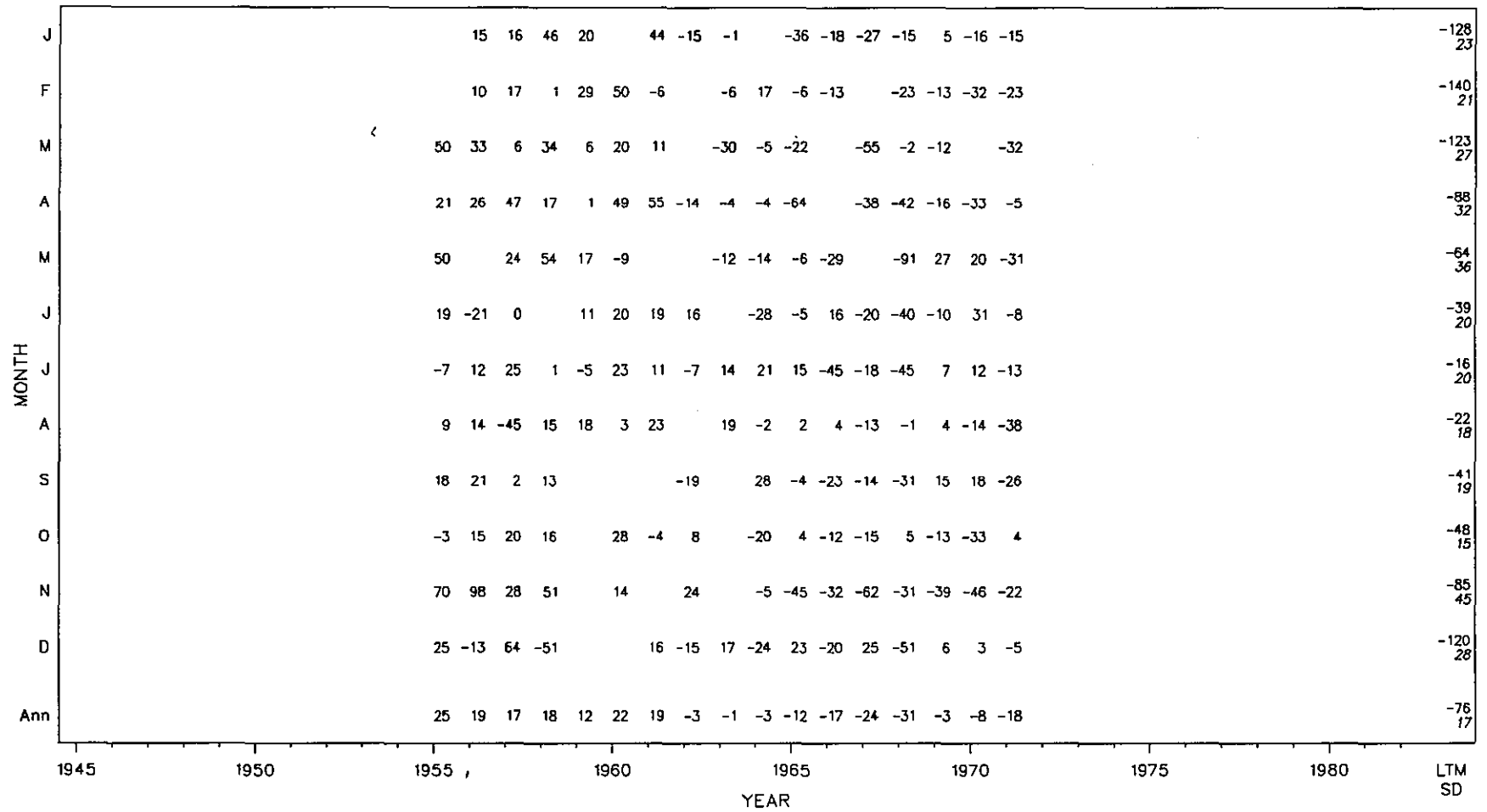
Units = 0.1 °C



OWS Study Area V Anomalies

Dew Point Temperature: 700 mb

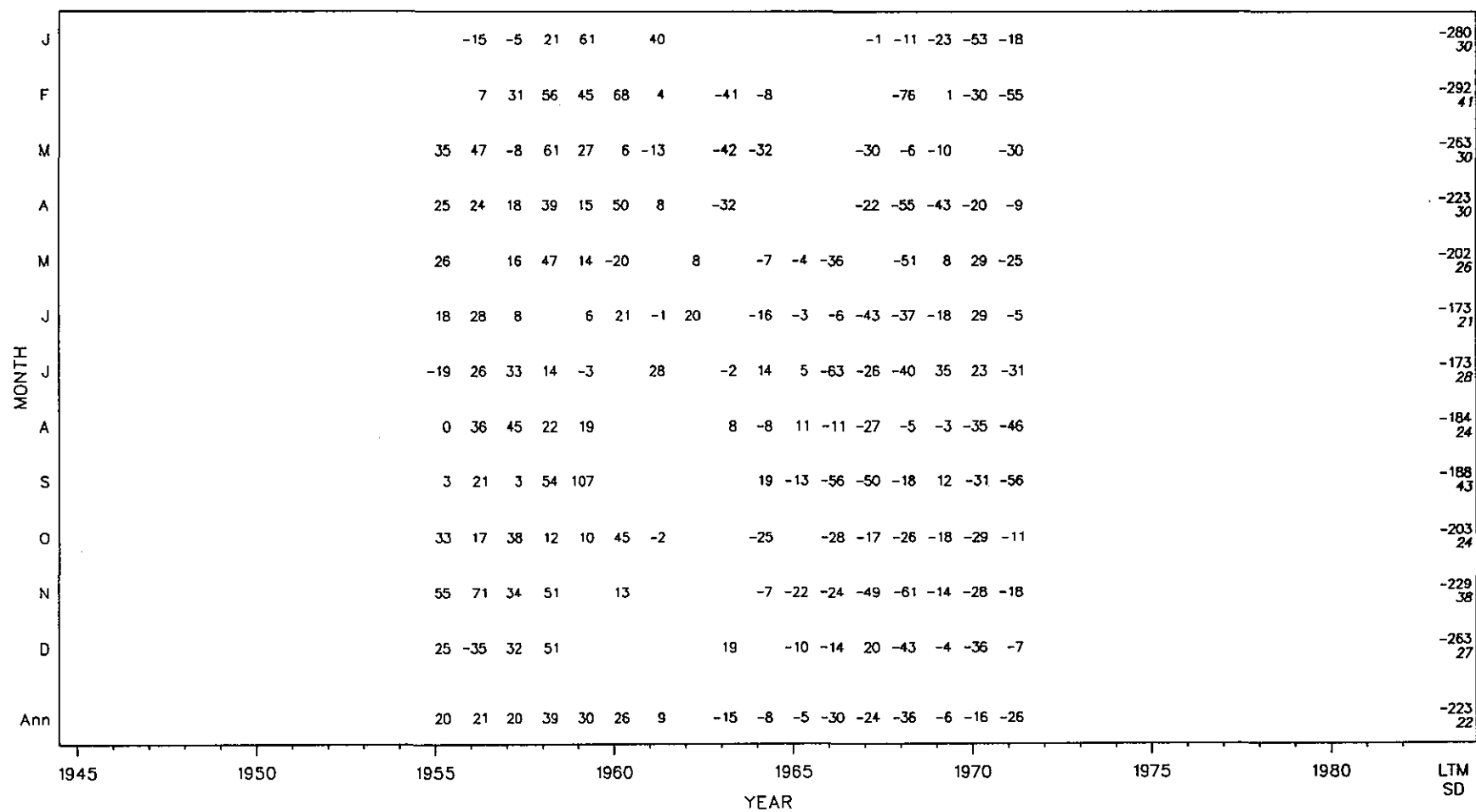
Units = 0.1 °C



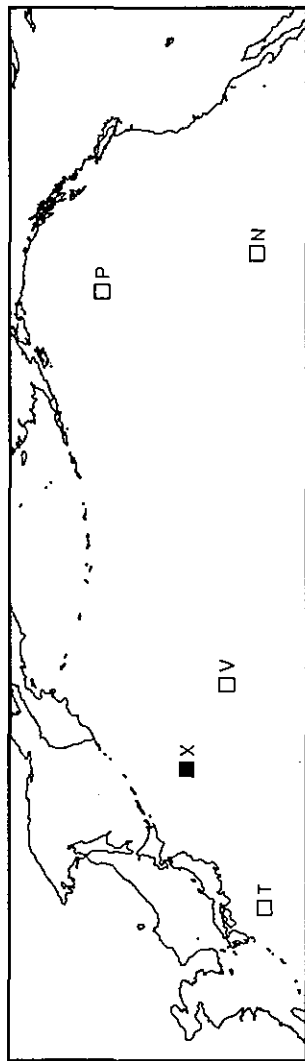
OWS Study Area V Anomalies

Dew Point Temperature: 500 mb

Units = 0.1 °C



OWS Study Area V Anomalies



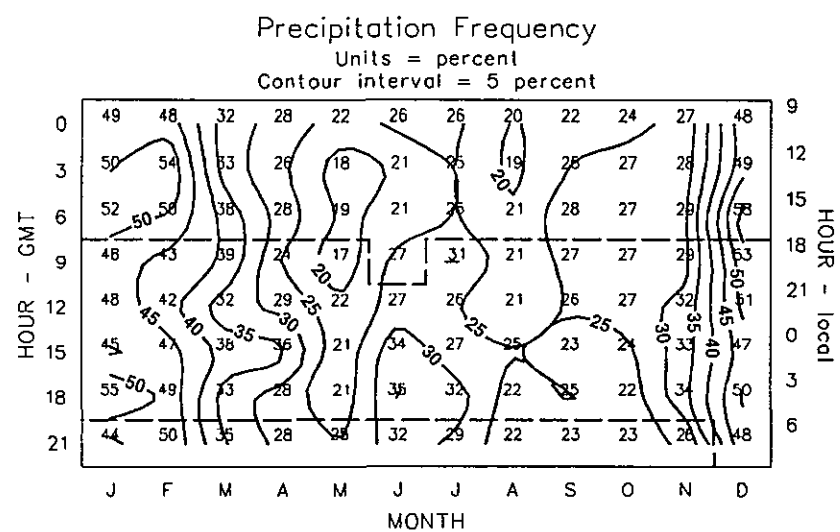
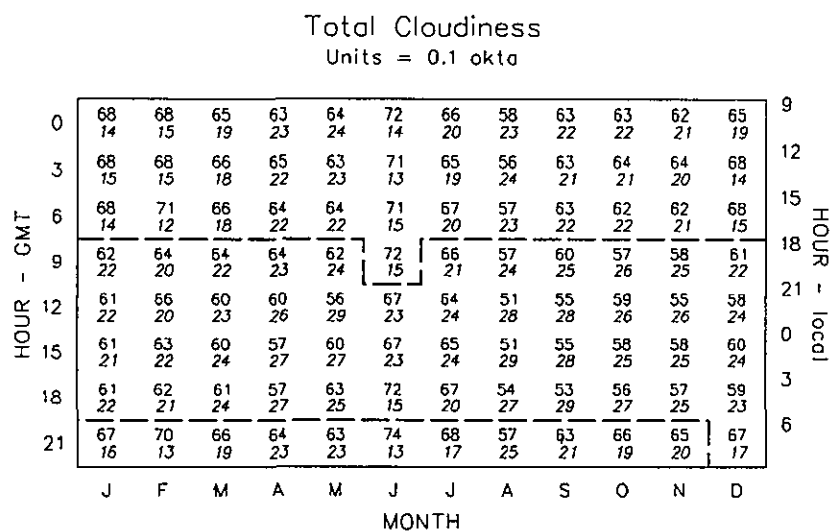
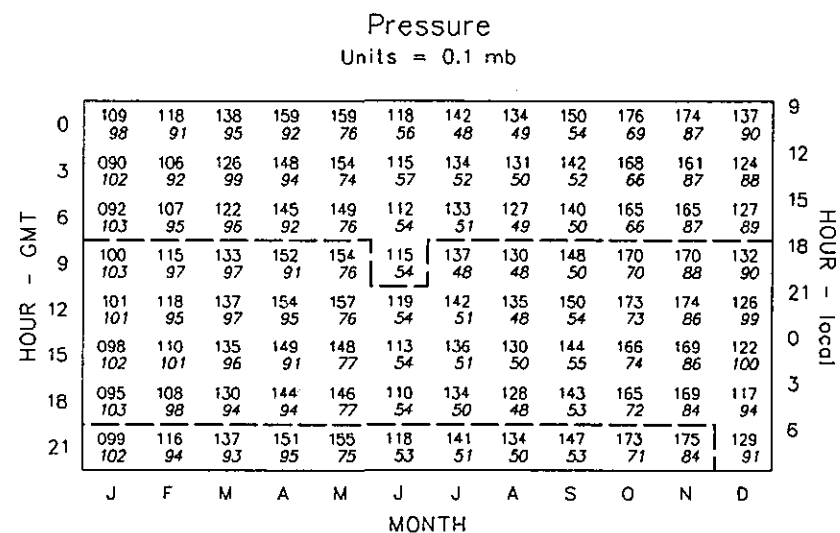
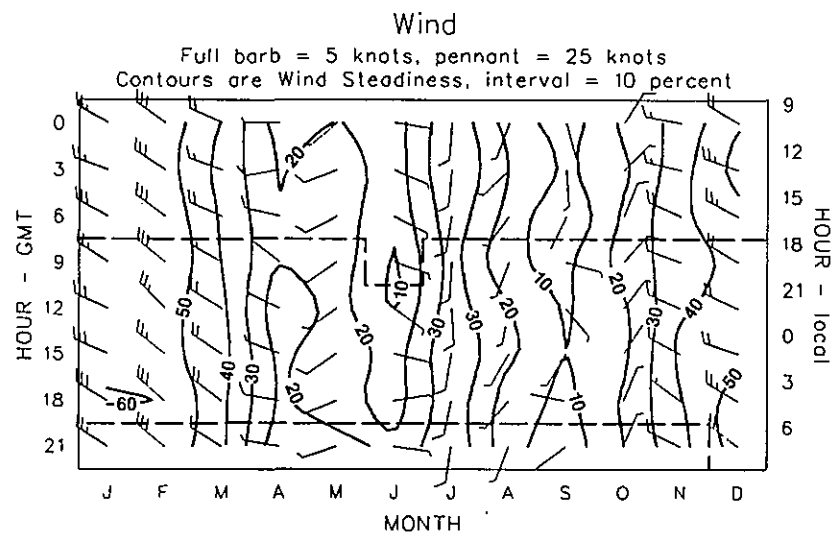
38.0°N - 39.9°N, 152.0°E - 153.9°E
1947 - 1953

OWS
X

MONTH								Sum
	1945	1950	1955	1960	1965	1970	1975	
J	12 9	31 31	30 30	31 31	30 16	31 31		165 148
F	19 4	15 15	28 27	28 28	25 13	28 28		143 115
M	28 19	31 31	31 31	31 31	30 0	31 31		182 143
A	30 16	30 30	30 30	30 30	30 0	30 30		180 136
M	31 17	31 31	31 31	31 31	29 0	30 29		183 139
J	27 18	30 29	5 5	30 30	30 0	30 30		152 112
J	30 20	31 31	29 29	31 31	31 0	31 31		183 142
A	24 10	31 31	31 31	31 31	31 0	31 31		179 134
S	7 5	27 26	30 30	30 30	30 0	30 30		154 121
O	11 5	15 10	30 30	31 31	31 31	30 0	30 30	178 137
N	18 10	28 22	30 30	25 25	30 30	30 0	26 24	187 141
D	20 17	30 26	31 31	31 31	31 30	31 7		174 142
Ann	49 32	281 176	348 346	332 331	365 364	357 36	328 325	2060 1610

OWS Study Area X (39.0°N, 153.0°E) Frequency of Surface Observations

Each of the 11 variables was observed on X days of each month.
The upper number is the maximum X from among all the variables.
The lower number is the minimum X from among all the variables.



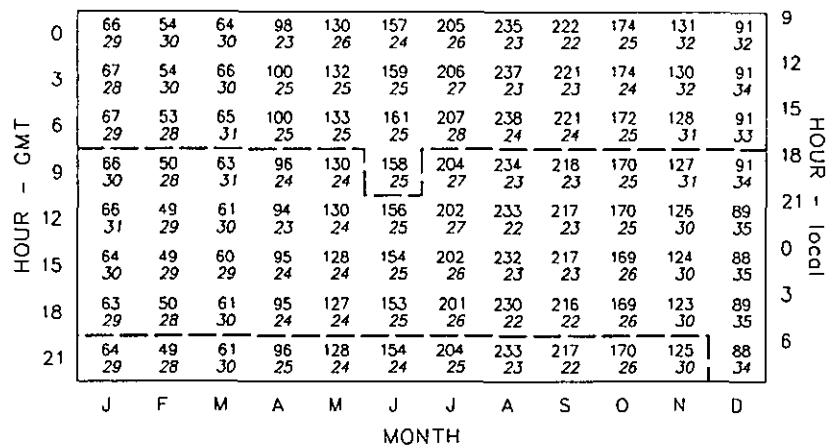
OWS Study Area X Surface Climatology

upper number = mean
lower number = standard deviation

———— data contours
----- sunrise/sunset

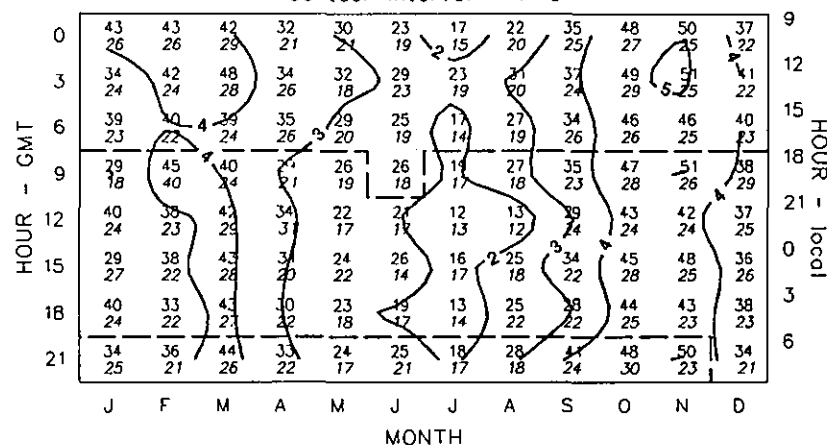
Air Temperature

Units = 0.1 °C



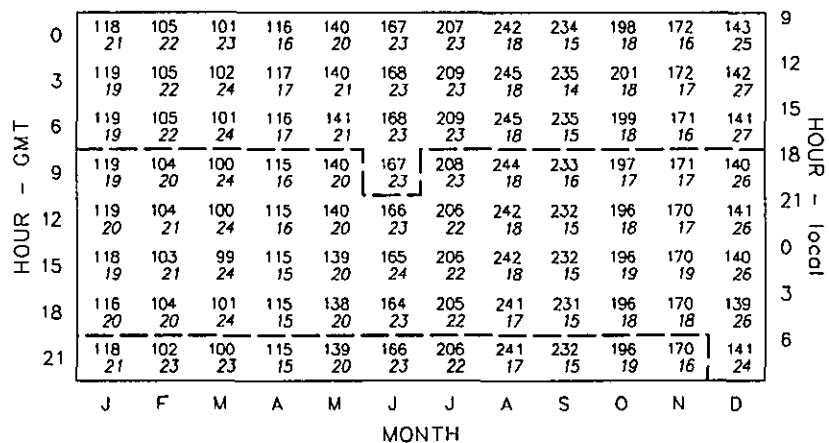
Dew Point Depression

Units = 0.1 °C
Contour interval = 1 °C



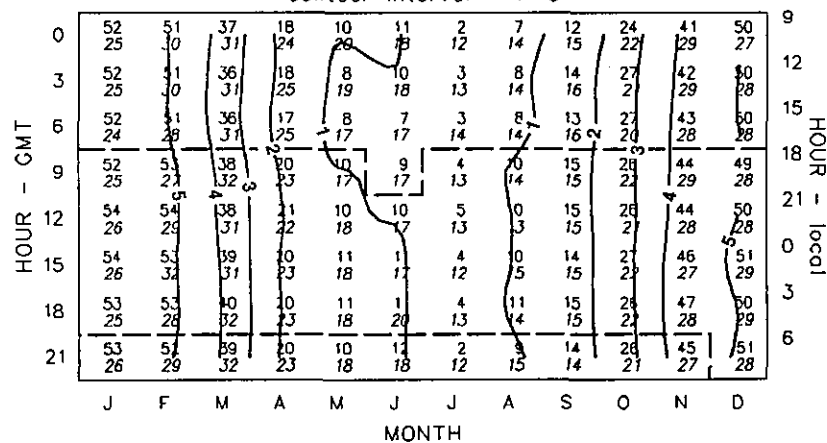
Sea Surface Temperature

Units = 0.1 °C



Sea - Air Temperature Difference

Units = 0.1 °C
Contour interval = 1 °C



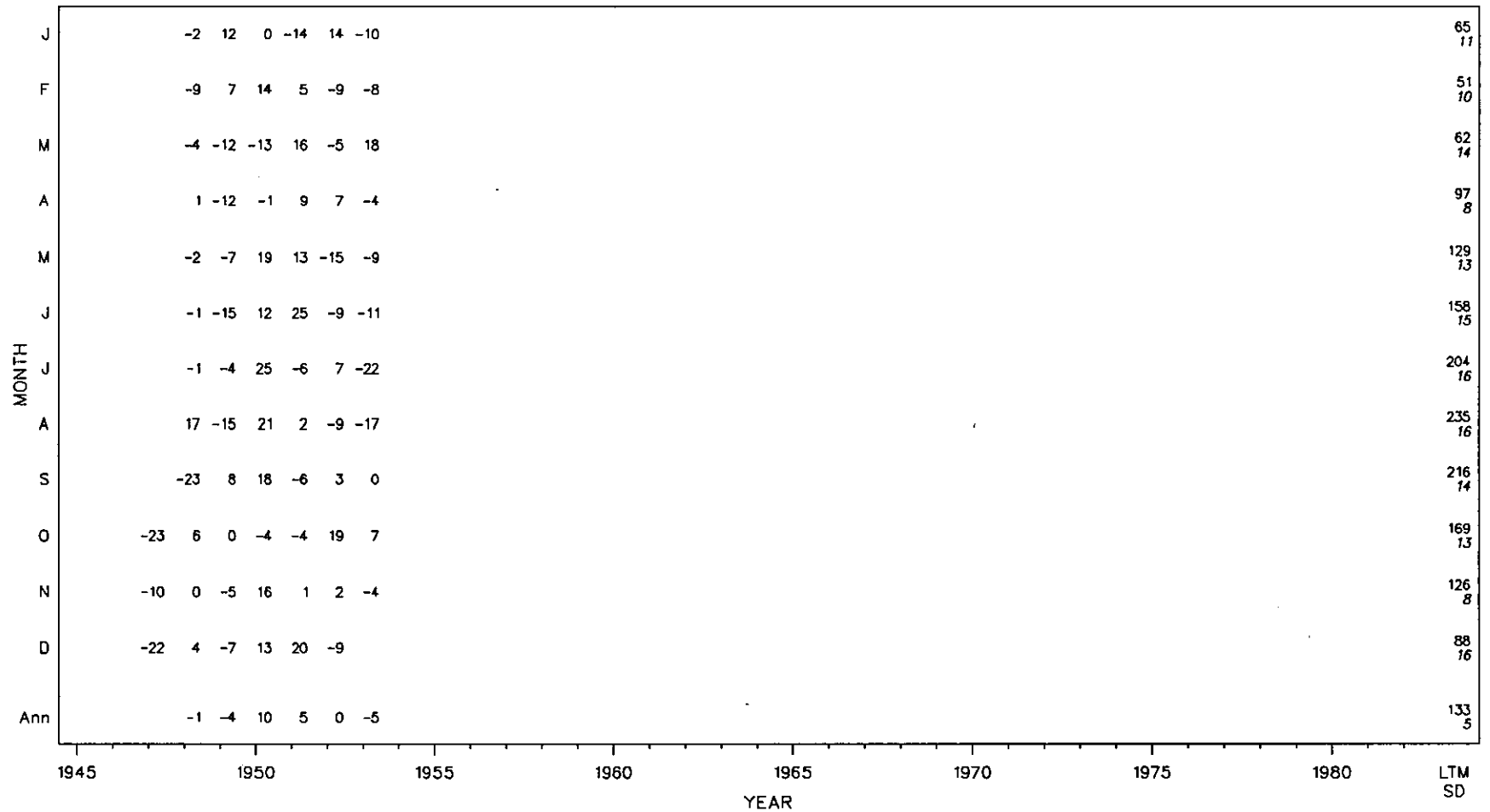
OWS Study Area X Surface Climatology

upper number = mean
lower number = standard deviation

— data contours
- - - sunrise/sunset

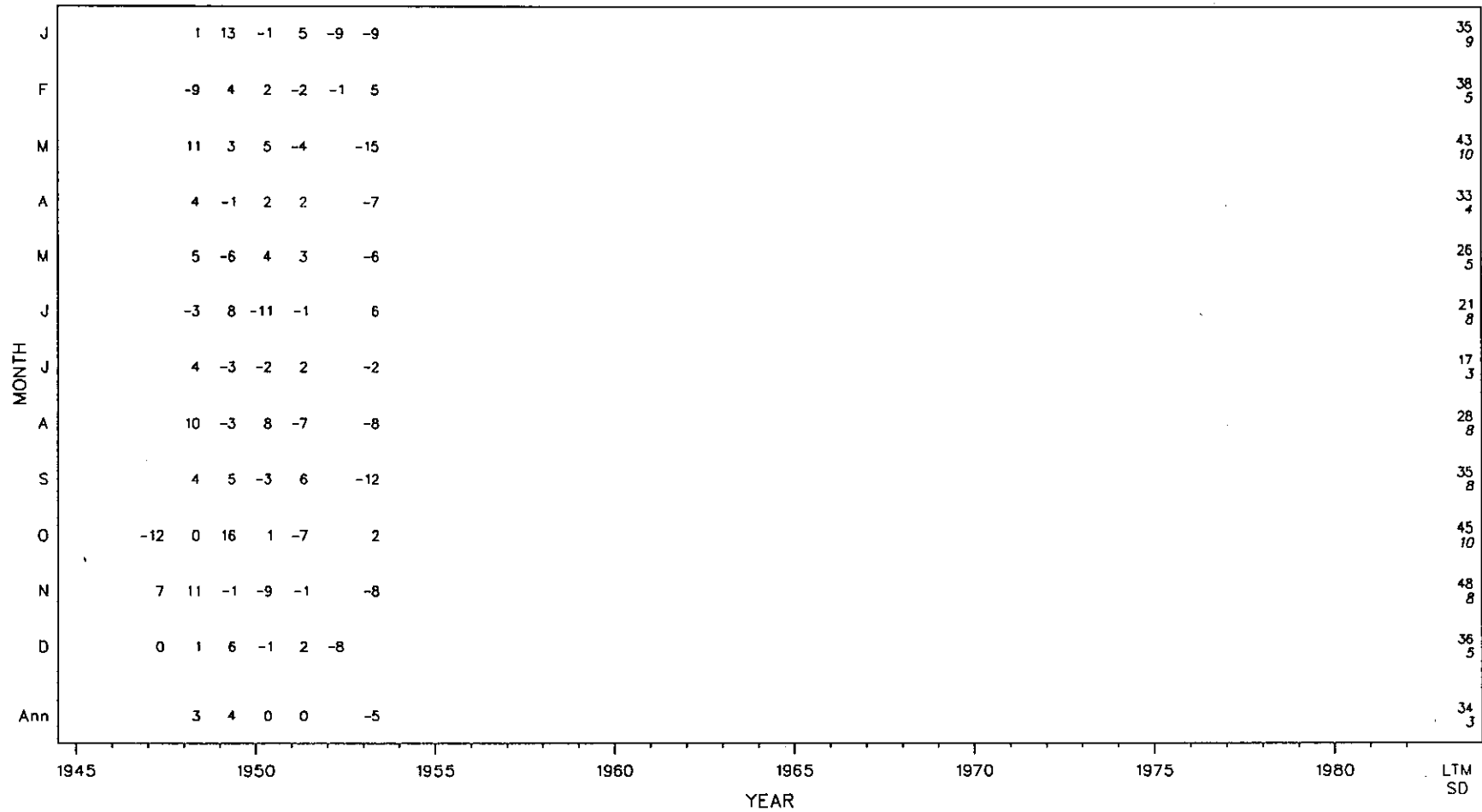
Surface Air Temperature

Units = 0.1 °C



OWS Study Area X Anomalies

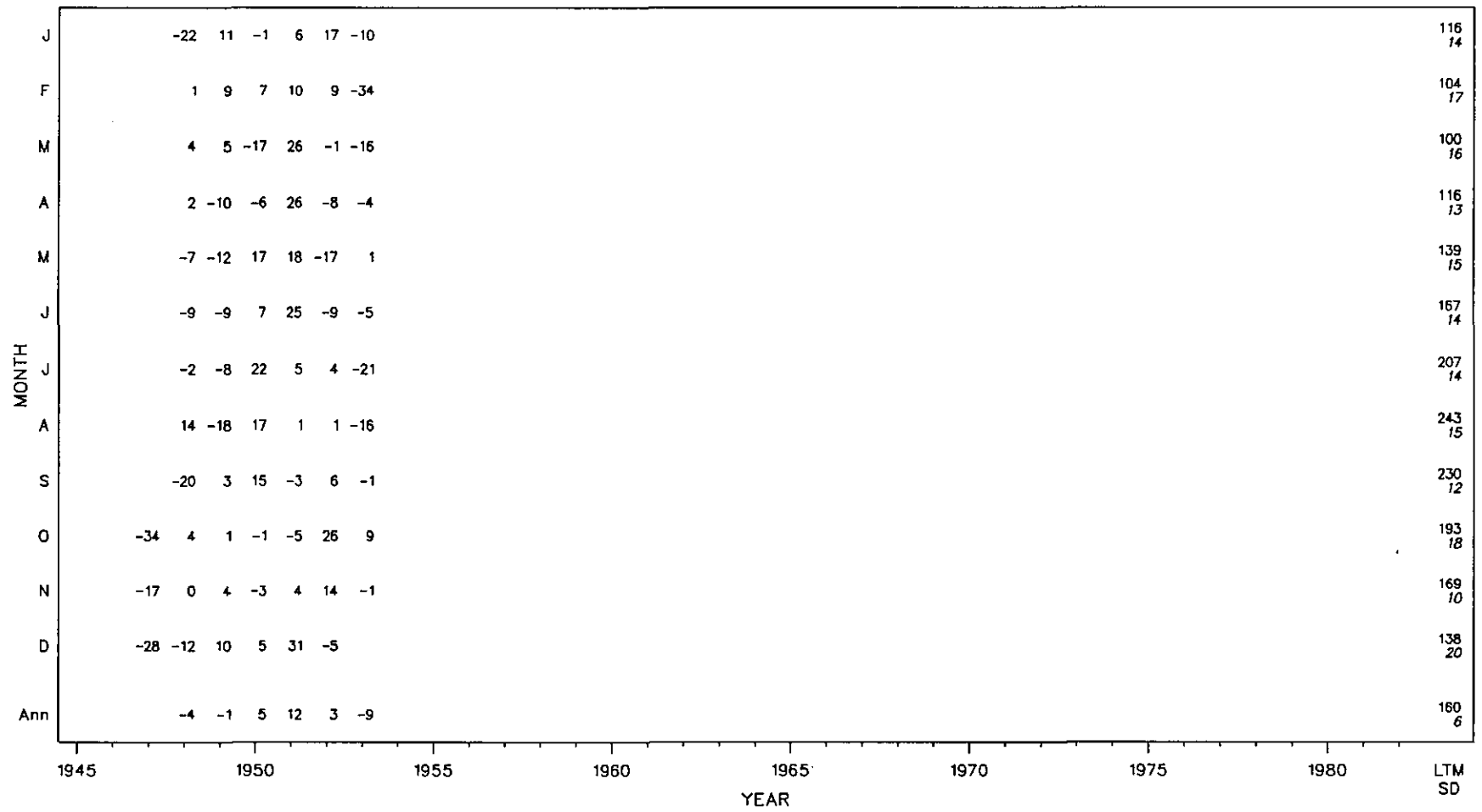
Surface Dew Point Depression
Units = 0.1 °C



OWS Study Area X Anomalies

Sea Surface Temperature

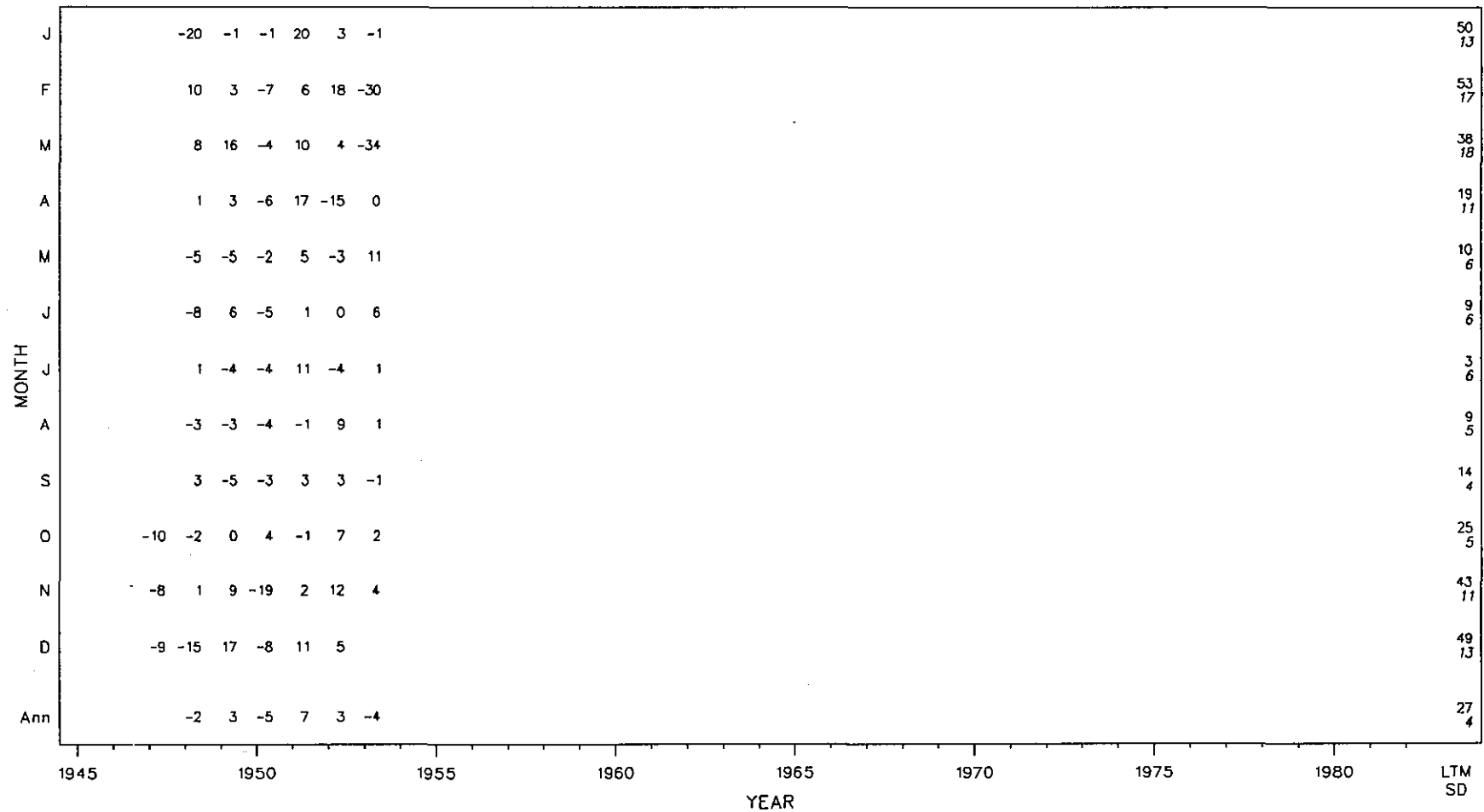
Units = 0.1 °C



OWS Study Area X Anomalies

Sea - Air Temperature Difference

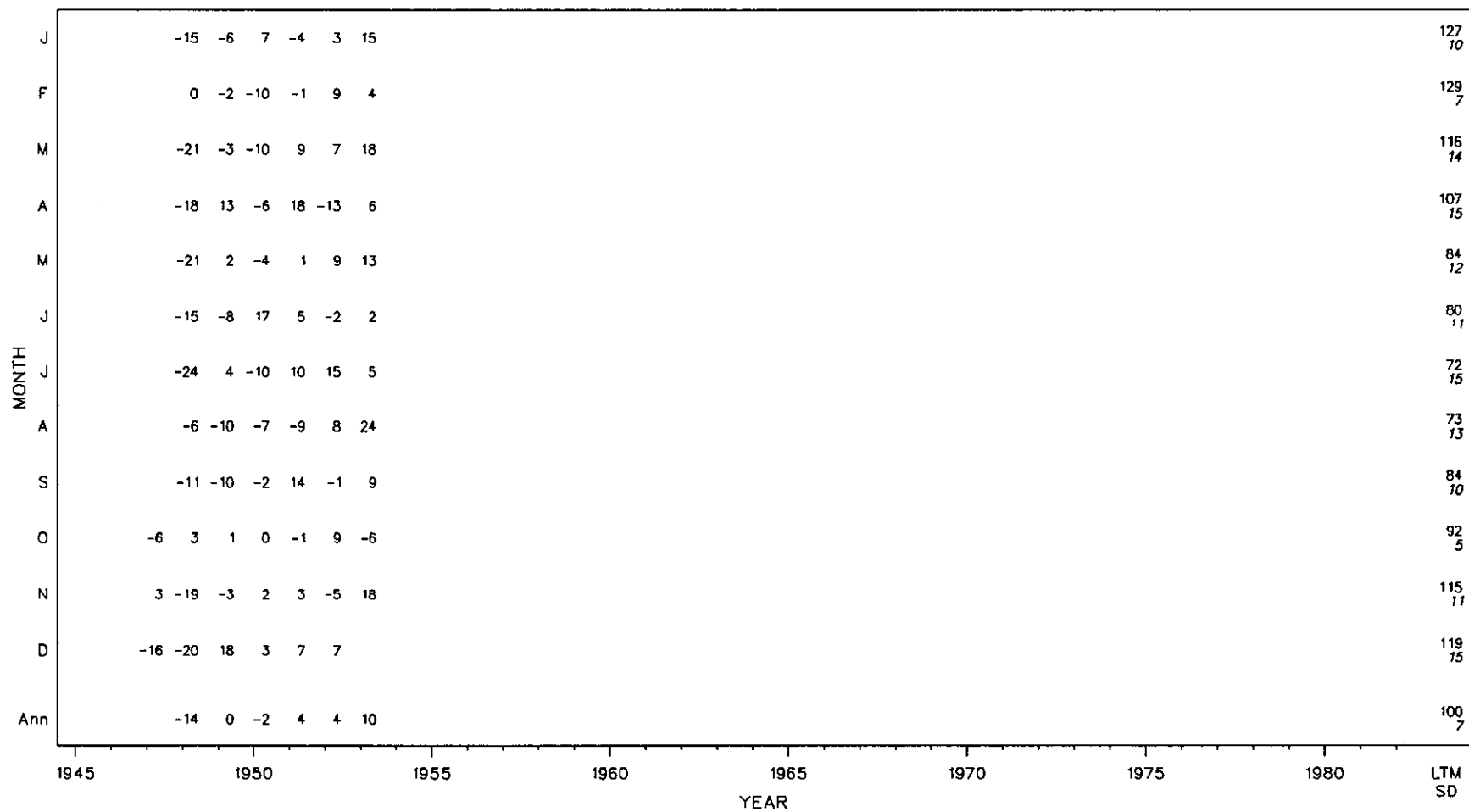
Units = 0.1 °C



OWS Study Area X Anomalies

Surface Scalar Wind

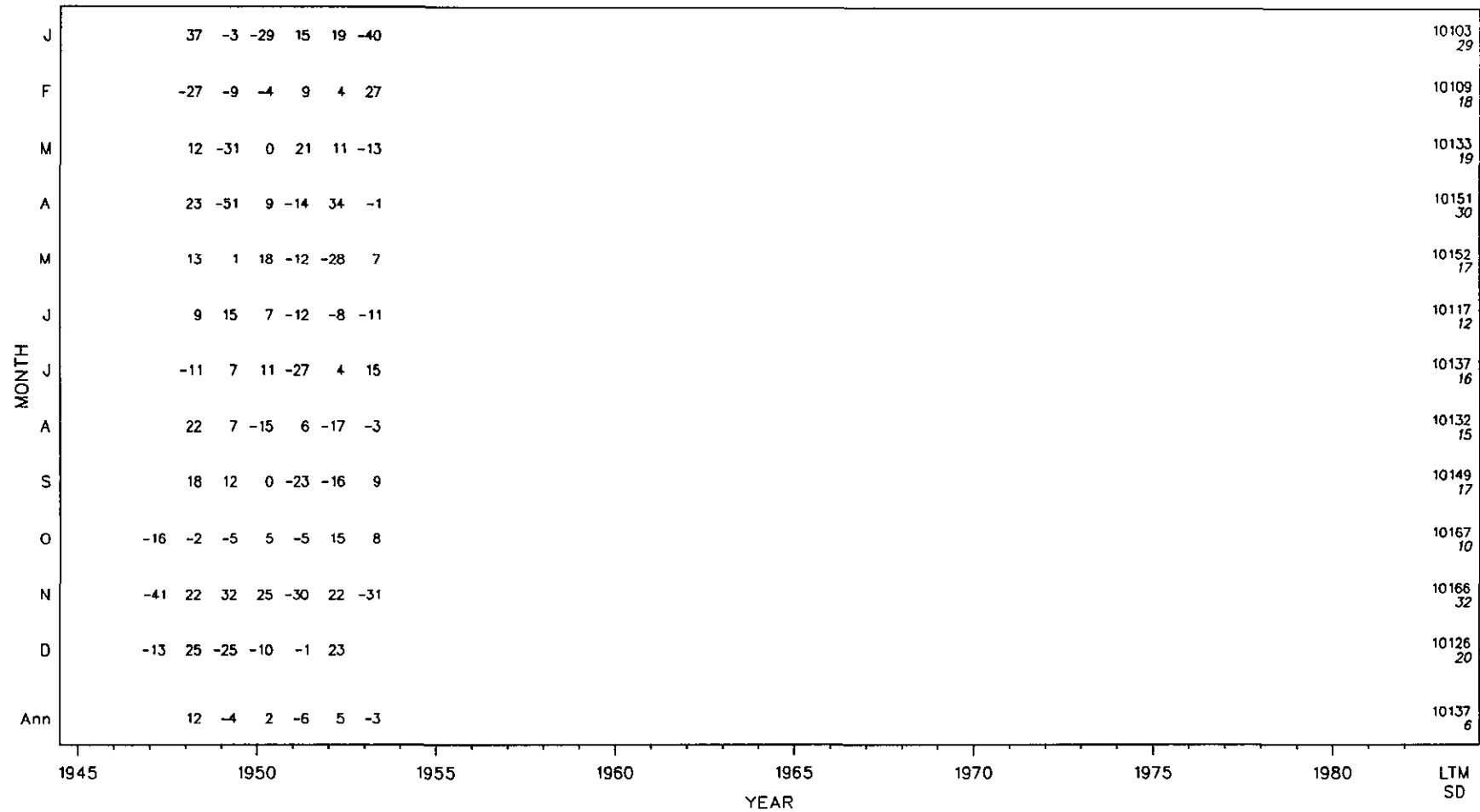
Units = 0.1 m/s



OWS Study Area X Anomalies

Sea Level Pressure

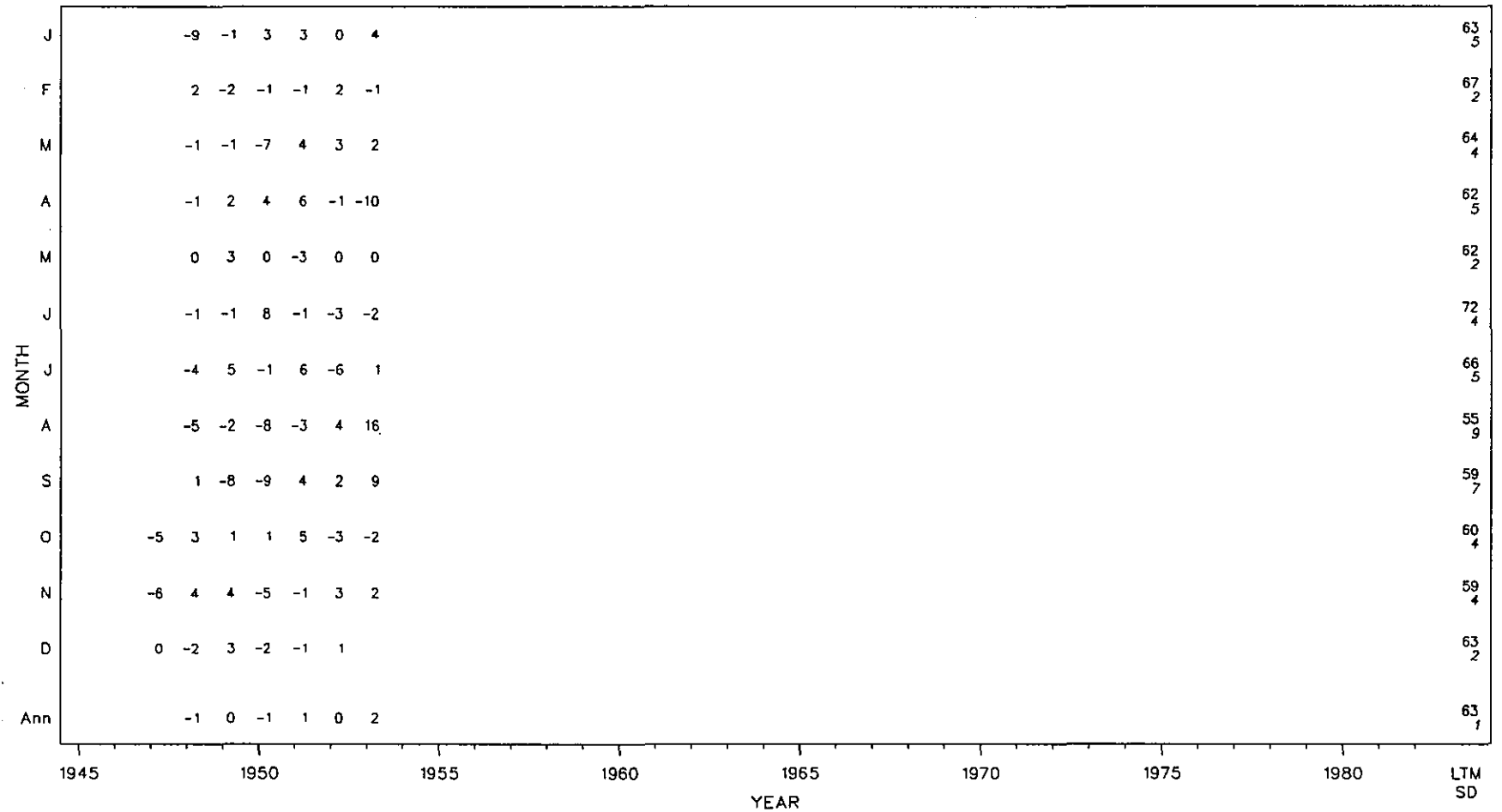
Units = 0.1 mb



OWS Study Area X Anomalies

Total Cloudiness

Units = 0.1 okta

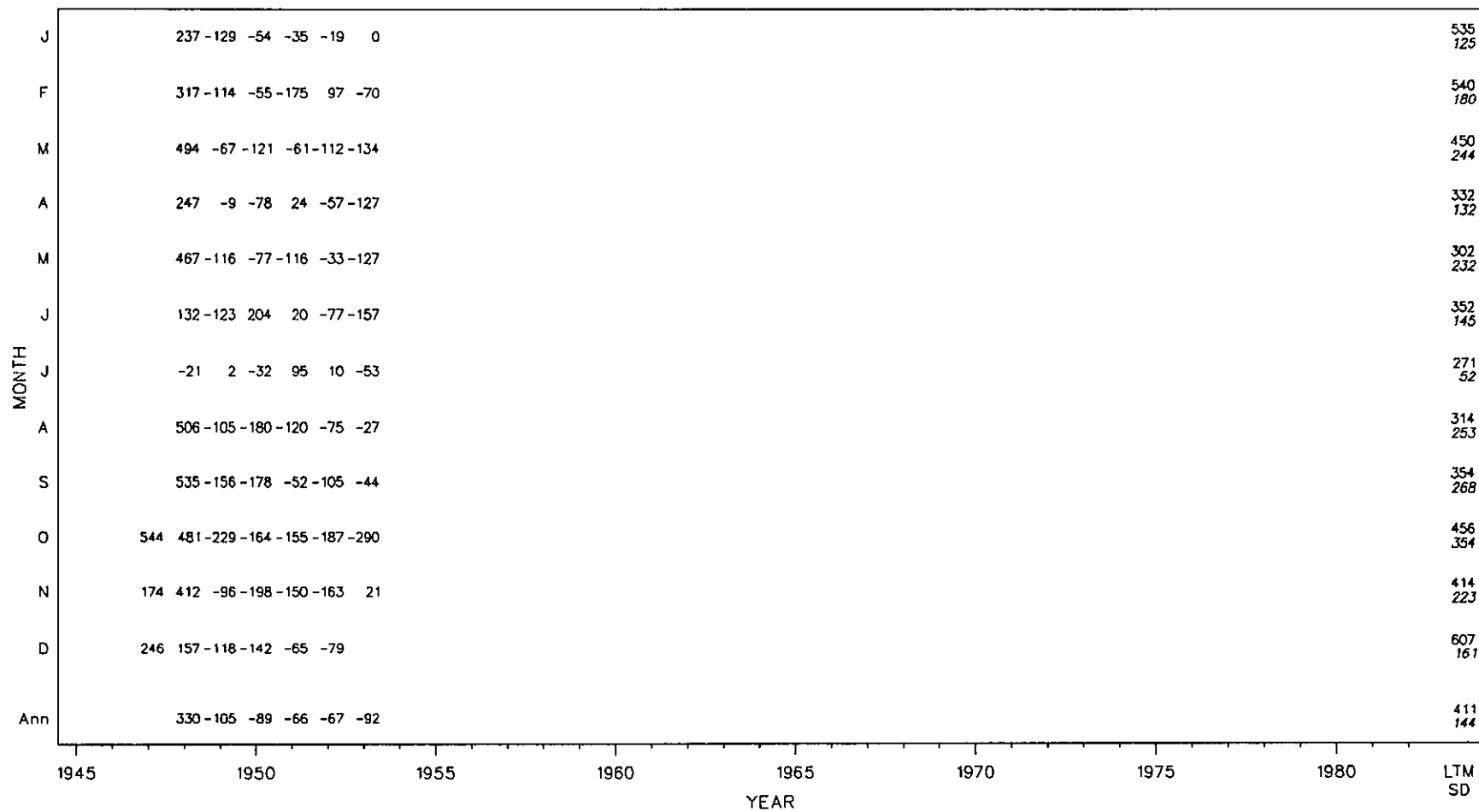


OWS Study Area X Anomalies

X10

Precipitation Frequency

Units = 0.1 percent



OWS Study Area X Anomalies