DOD OPERATIONS MANUAL

THE REFERENCE CLIMATOLOGICAL STATION (RCS) PROCESSING SYSTEM

Executive Summary

The Reference Climatological Station (RCS) program was initiated in the late 1960s to provide climatological data for the study of climate variability. Stations were selected in locations where changes in land use practices, new construction and site relocations were anticipated not to occur. Thus, data collected at these sites are not biased or contaminated by anthropogenic changes to the environment and fluctuations or trends in the data can be attributed to climate variability.

The RCS sites are part of the cooperative data network and are distinguished by the site selection criteria and because wind data are collected in addition to the standard elements; precipitation, air and soil temperature, evaporation and weather occurrence. Observations are made once each day at a time agreed to by NWS and station personnel. Some sites take observations in the morning, others in the afternoon.

The RCS data, with the exception of winds, are stored in the cooperative data files and published in Climatological Data Monthly Summary. A separate file containing all available data from the RCS sites is also archived. The period of record for some elements begins in the late 1800s. The RCS data are kept in a separate file to provide easier access for users. Data from other climatological stations have been stored in several different files depending on element type. The introduction of the element data base structure may eliminate the need for a separate RCS file.

In the mid-1980s, replacement of outdated recording methods and equipment at the RCS sites was begun. In 1984 and 1985 new wind equipment and automatic data recorders were installed at a few sites for testing. The data recorder, an OMNIDATA Polycorder, is a small computer that will collect data from automatic sensors, convert voltages to scientific units, calculate maximum, minimum, mean and resultant values, and store data in central memory. The recorder is programmable so that other statistics can be generated, sensor scanning intervals selected and messages generated to help observers.

Data are recorded on Erasable Programmable Read Only Memory (EPROM) microchips. The chips are mailed to NCDC and read into the mainframe computer for processing. Use of the Polycorder and EPROM chip eliminates the need and cost associated with manuscript forms and the transcription errors produced when writing data on the form and digitizing data from the form.

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I. FOREWORD

The purpose of this document is to provide enough information to users, maintenance programmers, and operators of the system to enable them to understand and use the data, improve and modify the system if necessary, and properly and completely process the data. The document is divided into sections, sub-sections and appendices, each presenting details on a particular aspect of the data file, its history and development. Some of the sections contain information important to all users, while other sections contain details pertinent to programmers or program operators. The document is designed so that individual sections can be selected to fulfill a particular purpose. For example, a data user might need Section II and Appendices A-D. An NCDC program operator might need only Appendices E and F.

Section II provides an overview and history of the RCS data file. Users, operators, and programmers will find background information and essential constants and equations used in processing the data set.

Appendices A-D may be beneficial for outside users. They describe the present data base structure of the RCS file, definitions of elements, the codes, flags and sorts used, the types of available products, station history information and history of errors or disrepancies in the data file. Appendix E defines procedures needed to run the system at NCDC. Appendix F describes the ECL and programs needed to run the system and provides a schedule of actions to complete processing. Appendix G decribes the operations and set up of the Polycorder data recording system. Appendix H describes the SEDECO wind system and I describes the techniques for reducing the wind data to scientific units.

II. Data Set Description.

II.1. Title (File Name and Aliases)

The NCDC file name is RCS data (TD3230). RCS is an acronym for Reference Climatological Station and refers to a network of specially selected cooperative stations that observe winds in addition to temperature, precipitation, and evaporation.

II.2. History of the File.

II.2.1 Background.

Initial efforts to establish a Reference Climatological Station (RCS) network began in 1954 by the NWS. A list of candidate stations was compiled based on the location, local environment, and the probability that the local environment would not change over time because of new construction or alterations in land use. The list was trimmed by selection of stations with the longest period of record and with the fewest relocations. With the help of State Climatologists and Climate Program Managers, sites were selected where the greatest interest and ability to maintain such a network appeared to exist. For this reason, most of the RSC sites are located at agricultural experiment stations that are extension centers of major universities.

The network became operational in 1966. Twenty-eight candidate sites were originally selected, but only 15 were provided with instrumentation. Additional stations were established through 1976 to bring the number of sites to its present level of 21.

In 1973 the RCS management was transferred from the Division of Climatology (NWS) to the EDIS Special Projects Office (now NESDIS) and in December 1980 the management functions were transferred to NCDC.

The rationale for maintaining a RCS network is to provide data which have not been influenced or biased by changes in the local environment for the purpose of determining climatic variability. The present NWS network of cooperative and principal weather stations is influenced by frequent changes in site and instrument locations and exposure and by encroachment of new construction or changes in land use practices. Consequently, series of climatic data are interupted and continuity of observations is compromised.

The RCS network was established to collect climatological data in local environments which are anticipated to have minimal man-made changes. The network will effectively monitor the climate and enable the identification of climatic fluctuations, variability, and possibly the causes of climate change.

II.2.2. Period of Record.

The period of record of digitized data for individual stations is given in Table II-1 and a summary of station history including dates of RCS site establishment is given in Table II-2. The date of opening for temperature and precipitation in Table II-2 is the date that maximum and minimum thermometers mounted in Cotton Region shelters and standard 8" raingages were installed. Earlier temperature and precipitation measurements were made at many sites with different instrumentation.

Table II-1

DIGITAL DATA PERIOD OF RECORD

STATION	STATE	1984 CD#	SNOWFALL SNOWDEPTH	TEMPERATURE	SOIL TEMPERATURE	PRECIPITATION	EVAPORATION	DAYS WITH WEATHER	WIND
Crete	NE	2520209	1948	1948		1948	1972	1948	1972
Blue Hill	MA	1907362	1926	1926		1926		1926	1975
Calhoun	LA	1614112	1948	1948	1976	1948	1961	1948	1969
Jackson	TN	4045614	1900	1900	1967	1900	1966		1975
Bozeman	MT	2410472	1892	1892	1966	1892	1948	1955	1969
State University	NM	2985358	1892	1892	1976	1892	1959	1900	1969
Geneva	NY	3031840	1926	1926	1969	1926	1969	1926	1970
Wooster	OH	3393126	1900	1900	1967	1900	1979	1900	1969
Beeville	TX	4106397	1901	1901	1978	1901	1979	1901	1970
Chatham	MI	2014842	1901	1901	1967	1901		1901	1973
Davis	CA	0422942	1948	1917	1967	1917	1948	1948	1971
Cottonwood	SD	3919725	1909	1909	1976	1909	1953	1909	1969
Presque Isle	ME	1769371	1926	1926		1926		1926	1969
Goodwell	OK	3436281	1948	1948	1978	1948	1948	1948	1978
Union	OR	3587468	1928	1928	1974	1928	1974	1948	1974
Quincy	FL	0874291	1948	1896	1970	1896		1948	1977
Norfolk	CT	0654451	1942	1942		1942	1965	1942	1971
Grand Canyon	AZ	0235962	1957	1957		1957	1972	1957	1971
Arlington	WI	4703088	1962	1962		1962	1965		1976
Sterling	VA	4480844	1977	1977		1977		1977	1971
Logan	UT	4251943	1969	1969	1969	1969	1971	1969	1970

Table II-2

RCS NETWORK STATION HISTORY SUMMARY

STATION	STATE	#	CD#	LAT. DEG	LAT. MIN	LONG. DEG	LONG. MIN	OBSERVATION TIME	TEMP. & PRECIP. OPEN	NEARBY SITE CD#	NEARBY SITE OPEN	NUMBER OF SIG.MOVES	RCS ESTAB.	WIND BEGUN
Crete	NE	25	20209	40	37	96	57	5:00 PM	1881			2 - 1894 1952	5/66	3/72
Blue Hill	MA	19	07362	42	13	71	07	7:00 AM	1885			0	7/59	1/76
Calhoun	LA	16	14112	32	31	92	20	7:30 AM	1888			0	10/66	5/69
Jackson	TN	40	45614	35	37	88	50	8:00 AM	1891			0	3/74	6/75
Bozeman	MT	24	1044,10472	45	40	111	09	5:00 PM	1892			1 - 1966	6/66	7/69
State University	NM	29	85358	32	17	106	45	7:00 AM	1892			0	12/66	1/69
Geneva	NY	30	3177,31840	42	53	77	02	8:00 AM	1894			1 - 1968	6/67	1/71
Wooster	OH	33	93126	40	47	81	55	8:00 AM	1894			0	11/66	6/69
Beeville	TX	41	06397	28	27	97	42	8:00 AM	1895			1 - 1922	8/66	10/70
Chatham	MI	20	14842	46	21	86	56	4:30 PM	1900			0	8/73	11/73
Davis	CA	04	22942	38	32	121	46	8:00 AM	1908	2294	1871	0	8/66	3/71
Cottonwood	SD	39	19725	43	58	101	52	7:00 AM	1909			0	8/66	5/69
Presque Isle	ME	17	69371	46	39	68	00	5:00 PM	1909			1 - 1918	10/66	5/69
Goodwell	OK	34	36281	36	36	101	37	8:00 AM	1910			0	12/77	1/79
Union	OR	35	87468	45	13	117	53	8:00 AM	1912			0	8/73	8/74
Quincy	FL	08	7424,74291	30	36	84	33	8:00 AM	1916			0	7/76	3/77
Norfolk	CT	06	54451	41	58	73	13	7:00 AM	1932			0	1/64	2/71
Grand Canyon	AZ	02	3595,35962	36	03	112	09	7:15 AM	1957	3591	1903	1 - 1976	12/67	10/70
Arlington	WI	47	03088	43	18	89	21	5:00 PM	1959			0	10/73	6/75
Sterling	VA	44	80844	38	59	77	28	8:45 AM	1964			0	1/68	1/68
Logan	UT	42	51943	41	40	111	54	8:00 AM	1967	5186	1890	0	6/66	12/69

II.2.3 Time Resolution of Data.

The RCS sites are cooperative stations. Data are collected once each day at specified observation times. (See Table II-2).

II.2.4 Frequency and Type of File Updates.

A RCS data file was established in 1985. Data are processed monthly in cooperative data processing systems. Annual and period of record updates to cooperative files are completed according to CD system schedules. RCS station data are selected from the monthly CD files and merged into 3230 . The 3230 RCS data is merged into the period of record archive file annually.

II.2.5 Historical Summary of Data Quality.

The RCS data have been processed in various CD processing systems except for wind data. See the Cooperative Data Operations Manual for details. Manual correction of wind data was in practice until 1982 when comptuer programs were written to more accurately edit winds. The wind data for the entire period of record have been re-edited with the new processing programs before adding them to the RCS file.

II.2.6 Data Recording System.

RCS data are recorded once daily at the specified observation time on manuscript forms E-22 and F-10B (figures II-1 and II-2). The forms are sent to NCDC once monthly, keyed, and entered into the various processing systems. Wind data are recorded on form F-10B as counts of winds passage in four cardinal directions and total passage.

The wind recording system, SEDECO Wind Accumulator, is a mechanical counting device much like the odometer in an automobile. Counters are activated each time the anemometer registers the passage of one-fifth of a nautical mile of air. The total passage counter advances one unit and one or two direction counters advance by increments of ten units or less depending on the wind direction. The observer writes the dial readings on F-10B once daily. Winds are calculated from the difference between the counts from one day to the next. (See Appendix I).

The SEDECO Wind Accumulator and spare parts are no longer manufactured. The units have been prone to frequent break down. In 1981, invegstigation of new recording equipment to replace these obsolete units was begun. In 1984, four new data recording units, Ommidata Polycorders, were purchased to replace the SEDECO equipment and to provide a means to digitally record and update the other RCS data elements. (See Appendices E and G). New wind sensors, the R. M. Young Wind Monitor, were also purchased to replace the obsolete F-104E wind speed transmitter and F012 wind vane. To date, new wind equipment and Polycorder data recorders have been installed at RCS sites at Steling, VA and NM State University, Las Cruces, NM.

AIR TEMPERATURE °F								PRECIPITATION							WIND		EVAPORATION (Inches & hundredths)			WATER TEMP. °F		ADDITIONAL DATA REMARKS
24 Hours Ending at Observation		At Observation			Supplemental Readings at 4 PM			Time of	Time of	Time of	Time of	24 Hour Amounts		At Obsn.	Anemometer Dial Reading	24 Hour Movement	Gage Reading or Amount Added	Reading When Tank Filled or Amount Removed	Amount of Evaporation	24 Hours Ending at Observation		
Max.	Min.	Dry-bulb	Wet-bulb	Dew Point	Dry-bulb	Wet bulb	Dew Point	beginning	ending	beginning	ending	Rain, Melted snow, etc. (in. & hundredths)	Snow, Ice Pellets, Hail (in. & tenths)	Snow, Ice Pellets, Hail, Ice on ground (in.)	(Miles) 5626		+	−		Max.	Min.	
81	61	66	63		62	52		7:40P	—			.18	0	0	5633	7	0	.16	.02	46	36	Int. Sprinkles E morning; Calm at night; [illegible]
62	49	67	47		58	53		—	2:50P			.65	0	0	5656	23	0	.52	.13	67	46	[illegible] early
59	49	53	51		59	55		12:10P	2:00P			.18	0	0	5671	15	0	.13	.05	51	41	Int. Sprinkles.
66	49	58	58		75	59						.01	0	0	5676	5	.05	0	.06	67	45	—
75	48	58	53		71	62						0	0	0	5684	8	.15	0	.15	80	52	Ex. T. Shwr.
60	55	71	65		75	68		3:35P	3:50P	9:25P	DNP	0	0	0	5688	4	.16	0	.16	81	50	—
81	61	68	68		80	72						.11	0	0	5692	4	0	.03	.08	77	51	—
84	62	[illegible]	[illegible]		[illegible]	[illegible]						0	0	0	5695	3	.14	0	.14	85	59	—
90	68	76	70		83	74						0	0	0	5705	10	.23	0	.23	90	62	—
87	67	77	71		84	72						0	0	0	5715	10	.22	0	.22	90	63	Rec. [illegible]
89	68	75	69		82	69						0	0	0	[illegible]	9	.21	0	.21	91	63	T-storm [illegible]
87	56	57	55		80	65						0	0	0	5739	15	.26	0	.26	90	53	T. Shwr. [illegible]
81	57	71	66		81	74		3:30P	4:15P			0	0	0	5751	12	.18	0	.18	84	67	TE [illegible]
83	64	65	64.5		78	70		6:10A	7:15A	4:10P	4:45P	.11	0	0	5763	12	.06	0	.17	87	61	—
79	50	51	48		65	53						.04	0	0	5779	16	.15	0	.19	81	51	—
66	60	50	45		63	55						0	0	0	5790	11	X	0	.14	57	44	—
69	50	55	54		63	60						0	0	0	5800	10	.15	0	.15	65	50	Fog [illegible]
67	58	59	58.5		65	64		8:00A	DNP			0	0	0	5810	10	.08	0	.38	61	53	[illegible]
66	59	66	66		77	68		8:00A	8:20A			.14	0	0	5821	11	0	.14	.00	67	58	[illegible]
79	56	64	60		75	61						T	0	0	5831	10	.15	0	.15	84	54	—
75	47	57	50		73	59						0	0	0	5838	7	.23	0	.23	85	50	—
75	51	55	52		75	58						0	0	0	5845	7	.19	0	.19	83	50	—
76	51	58	56		76	66						0	0	0	5853	8	.23	0	.23	86	53	Fog [illegible]
79	58	58	57		64	63		7:25A				0	0	0	5863	10	.17	0	.17	83	56	—
65	56	61	60.5		75	65		—	6:15A			.35	0	0	5886	23	0	.32	.03	56	53	—
77	50	56	52		70	59						0	0	0	5892	6	.18	0	.18	83	51	—
72	47	53	52		78	63						0	0	0	5901	9	.18	0	.18	81	50	—
78	53	66	63		76	68		6:40A	8:25A			T	0	0	5915	14	.20	0	.20	61	56	Sprinkles. [illegible] Fog
78	62	65	63		74	69						T	0	0	5925	10	.15	0	.15	56	60	[illegible] rain.
70	60	62	61		67	66		6:45A	—			T	0	0	5934	9	.13	0	.13	78	59	—
												(1.77)										
[illegible]	[illegible]	1850	1737.5		2204	1911						E	0	0		308	4.03	1.30	4.56	2299	1579	
											Greatest	65	0	0			Adjusted Total		2.73	74.1	52.5	
[illegible]	57.9	61.0	57.9		73.5	63.7																

FORM F-32 (7-81)

U.S. DEPARTMENT OF COMMERCE
NOAA
NATIONAL WEATHER SERVICE

OBSERVER: Edward C. Childs 5[illegible]

STATION NUMBER: Norfolk 2 SW. [illegible]

06-5445-1

U.S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
WEATHER BUREAU

RECORD OF REFERENCE

CLIMATOLOGICAL STATION OBSERVATIONS

STATION: NORFOLK 2SW

COUNTY: LITCHFIELD

STATE: CONNECTICUT

LOCAL TIME OF OBSERVATION: 7 AM

IF AT DIFFERENT TIMES: TEMP. | PRECIP. | WIND

MONTH: JUNE

STANDARD TIME IN USE: EASTERN

DATE	TEMPERATURE °F 24-HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION DATE OF OCCURRENCE	24-HR. AMOUNTS RAIN, MELTED SNOW, ETC. (Ins. & hundredths)	SNOW, ICE PELLETS, HAIL (Ins. & tenths)	AT OBSN. SNOW, ICE PELLETS, HAIL, ICE ON GND (Inches)	WEATHER FOG	ICE PELLETS	GLAZE	THUNDER	HAIL	DAMAGING WIND	WIND COMPONENTS (Fifths of a nautical mile) WEST	EAST	SOUTH	NORTH	TOTAL PASSAGE (Fifths of a nautical mile)	TIME OF OBSN. IF DIFFERENT FROM THE ABOVE	REMARKS
1			43											002862	000829	000000	007899	879	7:40	
2			47											008062	000759	000007	017766	2130		[illegible] rain
3			53											011732	001771	000231	024570	3136		
4			58											016026	001285	000929	028448	3981		
5			59											022162	001294	000970	034912	4981		
6			71											027128	001302	002202	036902	5882	7:40	
7			68											030149	001306	002584	037995	6986		[illegible]
8			73											035152	001339	003866	038928	7177		
9			76											042790	001343	006042	040465	8186		
10			77											047882	001349	006591	042607	9103		
11			75											053952	001369	008471	045898	9925		
12			57											059036	001495	008978	050007	10971		Comp. [illegible]
13			71											064572	001610	010921	050340	11890		
14			65											070637	001610	011897	052871	12987		
15			58											078255	001640	012208	052900	14068		
16			50											082412	002032	013208	064184	14867		
17			55											085771	002434	014113	064371	15452		
18			54											088012	002636	016795	064351	16059		[illegible]
19			66											093201	002439	020551	064355	16909		
20			64											098393	002497	020571	071390	17889		
21			57											101158	002960	020581	076702	18500		
22			55											105039	002896	023540	081273	19155		
23			58											108067	003111	021006	083452	19698		
24			58											111361	004001	022229	086190	20595		[illegible]
25			61											118586	005000	024326	086205	21357		
26			56											117750	005152	024304	089442	22026		
27			73											120834	005238	026411	094867	22840		
28			66											126896	005238	028151	095015	23706		
29			65											130926	005248	030117	095170	23355		[illegible]
30			62											132169	005833	030830	095230	24756		[illegible]
31																				

WIND TEST, LAST DAY OF MONTH AFTER REGULAR READ.: W [illegible] E [illegible] S [illegible] N [illegible] PASSAGE 16

OBSERVER

Check ☐ when additional sheet is used for remarks

II.3 Coverage.

II.3.1 Geographical, Number of Stations.

The Reference Climatological Network consists of 21 cooperative stations. Figure II-3 shows the location of each site. Table II-2 gives latitude, longitude and station number.

II.3.2 Division of Stations by Network, Controlling Agency, etc.

The RCS stations are part of the NWS cooperative data network. Responsibility for management and maintenance of the network is divided between NCDC and NWS and is defined in NESDIS Policy and Guidance Manual, Chapter 10, Section 2.

The NCDC responsibilities are:

1. To provide technical leadership to the program.
2. Monitor the operation and progress of the RCS.
3. Set up an annual schedule of site visits to maintain siting citeria and liaison with station and university personnel, NWS CPM's and Regional Headquarters.
4. Furnish an annual status report to the NESDIS Director.
5. Process, quality control and archive RCS data.
6. Evaluate station records and cooperative observers.
7. Acquire and provide new or spare equipment and services needed to maintain the network.

The NWS responsibiliteis are:

1. To provide recording forms.
2. To maintain equipment and install new equipment.
3. To provide a focal point for station needs and services through the CPM.

II.4 Equations and Elements.

II.4.1 Equations Used In Data Processing.

Equations used in processing cooperative data may be found in the Operations Manual for that system.

Equations for processing RCS wind data from the SEDECO wind system are given in Appendix I, Computational Aids for Deriving Daily Average Wind Statistics.

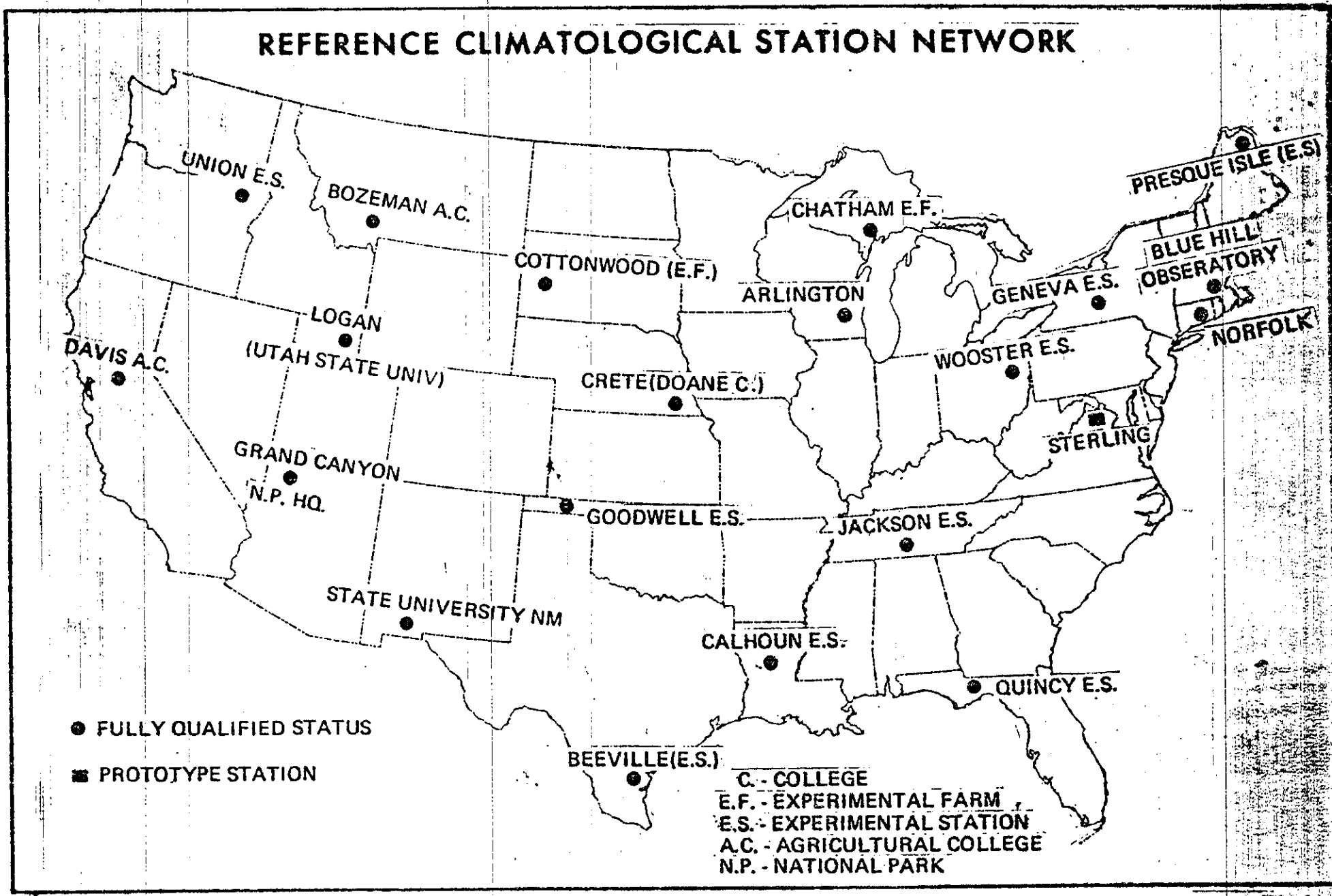

REFERENCE CLIMATOLOGICAL STATION NETWORK
UNION E.S.
BOZEMAN A.C.
COTTONWOOD (E.F.)
CHATHAM E.F.
PRESQUE ISLE (E.S)
BLUE HILL OBSERATORY
ARLINGTON
GENEVA E.S.
LOGAN (UTAH STATE UNIV)
DAVIS A.C.
NORFOLK
WOOSTER E.S.
CRETE(DOANE C.)
STERLING
GRAND CANYON N.P. HQ.
GOODWELL E.S.
JACKSON E.S.
STATE UNIVERSITY NM
CALHOUN E.S.
QUINCY E.S.
BEEVILLE(E.S.)
FULLY QUALIFIED STATUS
PROTOTYPE STATION
C. - COLLEGE
E.F. - EXPERIMENTAL FARM
E.S. - EXPERIMENTAL STATION
A.C. - AGRICULTURAL COLLEGE
N.P. - NATIONAL PARK

Figure II-3

The Polycorder data recording system uses several equations to reduce input voltage to scientific units and to calculate daily mean and resultant values. The Polycorder collects data automatically from temperature and wind sensors approximately every eight seconds.

Voltages from the air and soil temperature systems are reduced to degrees Centigrade by:

$$T = \frac{1}{A + B\ (\ln R_T) + C\ (\ln R_T)^3}$$

where: T is the absolute temperature (^oK)

R_T is the change is resistance output by the sensor

$A = 9.724449.10^{-4}$

$B = 2.324948.10^{-4}$

$C = 8.127207.10^{-8}$

$R_T = \frac{V}{I}$

where: V is the sensor output voltage

I is the current, equal to $\frac{E-V}{20000}$

E is the excitation voltage

T - 273.16 = Centigrade temperature = C
Fahrenheit temperature = F = 9/5 C +32

Wind speed and direction voltages pass through a signal conditioning box provided by R. M. Young. The output from the signal conditioner is an analog voltage directly proportional to speed and direction.

For speed, 1 volt output = 100 mph, output voltage is multiplied by 100 to obtain miles per hour. The conditioner has an offset voltage equivalent to .7 mph and when the conditioner is connected to the Polycorder, the .7 mph offset is added to the true wind speed. The program in the Polycorder subtracts the .7 mph and converts the results to knots.

Wind speed (kts) = ((Voltage x 100)-.7) x .868391

The conditioner provided by R. M. Young displays the speed and direction in mph. When the conditioner and the Polycorder are connected, the display shows the speed as .7 mph higher than the actual speed because of the offset difference. The wind direction display is not affected.

Wind direction output from the conditioner is also an analog voltage where 1 volt = 360°.

Ommidata has developed a small unit interface which permits direct connection of the R. M. Young wind sensor to the Polycorder. The conditioner is not necessary. Additional programs are needed to record the wind data in this manner (see appendix G).

The eight-second samples are accumulated in the Polycorder throughout the day. After 24 hours the sums are divided by the number of samples to calculate daily mean values. Daily values of mean and resultant winds are saved.

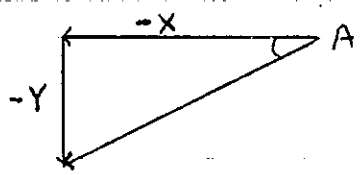
The resultant wind speed and direction are the vector means, the sum of the components of the individual wind samples divided by the number of samples.

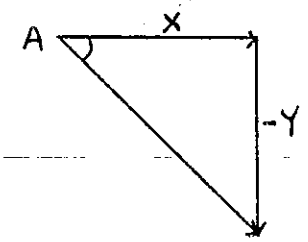
(E-W) x component = cos (direction) x speed
(N-S) y component = sin (direction) x speed

The resultant speed is the square root of the sum of the squares of the components.

$$\vec{V} = \sqrt{x^2 + y^2}$$

The resultant direction is calculated from the arctangent of the mean y component divided by the mean x component, which is the angle (A) between the horizontal and the resultant vector (V). eg.





The true wind direction is determined by adding or subtracting angle A from 270° or 90° depending on the sign of the component winds.

Sign of x Component	Sign of y Component	True Resultant Wind Direction
-	-	270 - A
-	+	270 + A
+	-	90 + A
+	+	90 - A

II.4.2 Data Elements.

The standard data elements in the RCS program are air and soil temperature, precipitation, wind, occurrence of weather, snowfall and depth, and evaporation. Values are observed once each day and written on forms E-22 and F-10B (Figures II-1a and II-2).

Input data from the Polycorder are received on EPROM microchips and are in the format specified in Table II-3. Each logical record contains two physical records in the EPROM chip format. This is done because transfer of data to the mainframe computer from the Polycorder is limited to 132 characters or less. Table II-3 shows the physical record number, field number, character length and decimal places, and the element recorded. An (0) indictes that the element is taken at the observation time or is for the 24-hour period ending at the observation time. A (M) indicates that the value is for the 24-hour period ending at midnight.

The archive data file (3230) element and unit codes are given in Table II-4. Each record contains 31 days of data for the specified element. The structure of each record is:

Field	Length	Parameter
1	3	Record Type, RCS = Daily
2	8	Station ID
3	4	Element Type (see Table II-4)
4	2	Units Code (see Table II-4)
5	4	Year
6	2	Month
7	4	A blank field
8	3	Number of days in the record
9	2	Day
10	2	Hour
11	1	Sign of data element (Positive=blank)
12	5	Value of the data element
13	1	Data Management Flag (See Table II-4)
14	1	Data Quality Flag (see Table II-4)

Fields 9-14 are repeated up to 31 times to produce the monthly record for each element.

II.5 Other NCDC Files or Projects Including or Using This File.

At present, those data listed in Table II-4 that are taken at the observation time of the station are included in the Cooperative Data (CD) files TD3200 (Summary of the Day) and TD3220 (Summary of the Month). Elements include maximum, minimum and at obervation temperature, maximum and minimum soil temperature, precipitation, snowfall, snowdepth, weather and evaporation.

II.6 Publication of Data.

The data stored in the CD files are published in Climatological Data Monthly Summary.

Table II-3

Polycorder Data Format

Physical Record	Field	Length	Element
1	1	5.2	Day
1	2	3	Month
1	3	5.2	Hour of Manual Observation
1	4	5.2	Minute of Manual Observation
1	5	5.1	Maximum Temperature - Manual, (0)
1	6	5.1	Minimum Temperature - Manual, (0)
1	7	5.1	At Ob Temperature - Manual, (0)
1	8	6.2	Rainfall Dates (0)
1	9	7.3	Rainfall, (0)
1	10	8.3	Snowfall, (0)
1	11	7.3	Snowdepth, (0)
1	12	5.1	Fog, (0)
1	13	5.1	Ice Pellets, (0)
1	14	5.1	Glaze, (0)
1	15	5.1	Thunder, (0)
1	16	5.1	Hail, (0)
1	17	5.1	Wind Damage, (0)
			(Mean Wind Direction, (0) - Sterling Only)
1	18	7	Evaporation Wind, (0)
			(Mean Wind Speed, (0) - Sterling Only)
2	1	5.2	Evaporation, (0)
			(Resultant Direction, (0) - Sterling Only)
2	2	3	Maximum Pan Temperature, (0)
			(Resultant Speed, (0) - Sterling Only)
2	3	5.2	Minimum Pan Temperature, (0)
2	4	5.2	Mean Wind Speed, (M)
2	5	5.1	Mean Direction, (M)
2	6	5.1	Resultant Speed, (M)
2	7	5.1	Resultant Direction, (M)
2	8	6.2	Maximum Gust, (M)
2	9	7.3	Gust Direction, (M)
2	10	8.3	Gust Time, (M)
2	11	7.3	Soil Temperature Maximum, (M)
2	12	5.1	Soil Temperature Minimum, (M)
2	13	5.1	At Ob Temperature - Automatic, (0)
2	14	5.1	Maximum Temperature, (M)
2	15	5.1	Minimum Temperature, (M)
2	16	5.1	Maximum Temperature, (0)
2	17	5.1	Minimum Temperature, (0)
2	18	7	Station ID Number

Table II-4

RCS Archive File Codes

Element	Ob Time	Element Code	Units Code
Maximum Temperature - Manual	0	TMAX	F (whole degrees F)
Minimum Temperature - Manual	0	TMIN	F
At Observation Temperature - Manual	0	TOBS	F
Maximum Temperature - MMTS	M	ATMX	TF (10ths of degrees F)
Minimum Temperature - MMTS	M	ATMN	TF
Maximum Temperature - MMTS	0	ATMX	TF
Minimum Temperature - MMTS	0	ATMN	TF
At Observation Temperature - MMTS	0	ATOB	TF
Soil Temperature Maximum - MMTS	M	SXYZ	TF
Soil Temperature Minimum - MMTS	M	SNYZ	TF

Code - Y:
1 = Grass
2 = Fallow
3 = Bare Ground
4 = Brome Grass
5 = Sod
6 = Straw Mulch
7 = Grass Muck
8 = Bare Muck
0 = Unknown

		inches	centimeters
Code Z:	1 =	2	5
	2 =	4	10
	3 =	8	20
	4 =	20	50
	5 =	40	100

Rainfall	0	PRCP	HI (100ths of inches)
Snowfall	0	SNOW	TI (10ths of inches)
Snowdepth	0	SNWD	I (inches)
Occurrence of Weather	0	DYSW	Code - 1 = Fog 2 = Ice Pellets 3 = Glaze 4 = Thunder 5 = Hail 6 = Damaging Wind If 2 or more types of weather occur on the same day the codes are listed left-justified in the 5 digit field.
Evaporation - Wind Movement	0	WDMV	M (miles)
Evaporation	0	EVAP	HI
Maximum Pan Temperature	0	MXPN	F

Table II-4 (continued)

Element	Ob Time	Element Code	Units Code
Minimum Pan Temperature	0	MNPN	F
Mean Wind Speed	M	MSPD	~~TK~~ K (whole knots)
Mean Wind Direction	M	MDIR	WD (whole degrees 0=north)
Resultant Wind Speed	M	RSPD	~~TK~~ K
Resultant Wind Direction	M	RDIR	WD
Maximum Gust	M	GTMX	~~TK~~
Gust Direction	M	GTDR	WD
Gust Time	M	PGTM	HR (hours and minutes)

Observation Time Code:
- 0 = At the station observation time or for the 24-hour period ending at the observation time
- M = For the 24-hour period ending at midnight

Data Management Flag:
- A = Accumulated amount since last measurement
- B = Accumulated amount includes estimated values (since last measurement)
- E = Estimated
- T = Trace (Data value = 00000 for a trace)
- Blank = Flag is unnecessary

Data Quality Flag:
- 0 = Valid data element
- 2 = Invalid data element (subsequent value replaces original value)

II.7 References.

_____.(1970): Weather Bureau Observing Handbook No. 2, Substation Observations. U. S. Dept. of Commerce. Office of Meteorological Operations.