

National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET 9645 (DSI-9645)

**World Weather Records - NCAR Surface
(World Monthly Surface Station Climatology)**

December 23, 2002

National Climatic Data Center
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1. **Abstract:** The [National Center for Atmospheric Research](#) (NCAR) has world monthly surface station climatological data for over 3900 different stations (2500 in more recent years) up through 1998. Data for some stations goes as far back as the mid-1700's. See Tables 5A - 5C for data availability by decade. Most of the data was obtained directly from the National Climatic Data Center (NCDC), Asheville, North Carolina. However, much of the data prior to 1951 came from John Wolbach of Harvard College Observatory, who contracted to have this data punched at NCDC. The first six months of 1961 were punched at NCAR. Sharon Nicholson, Florida State University, provided African precipitation data to extend the records of over 250 stations. (For any specific use of the African precipitation data, please credit Sharon Nicholson). Dennis Shea, NCAR, has been a valuable source for data obtained directly from various countries. See note 5 for data publications. The standard parameters available are sea level pressure, station pressure, temperature, and precipitation. After 1960, additional available parameters include moisture and percent sunshine.

There are several specialized sets in this same global format that are available separately, as follows:

Region	Approximate # of Stations	Parameters	Periods of Record
USA	3900	Temperature, Precipitation	1941 - 1980
Canada	3900	Temperature, Precipitation	Late 1800's - 1982
India	4000	Precipitation	1901 - 1970
Australia	14000	Precipitation	Late 1800's - 1982
Africa	1000	Precipitation	Late 1800's - 1973
China	90	Precipitation	1951 - 1980

The above Africa set is Sharon Nicholson's total set, excluding the stations having special flags which are not part of this format (her complete set with all flags is available in a separate format). The stations having WMO numbers have been added to the global set where they extended the period of record as indicated before. Also, approximately 400 stations with WMO numbers from the Australian set have been added to the global set.

The data has been reformatted and is available in either a packed binary or a character format. The missing codes and the biases put on the data (to keep all numbers positive integers) are the same in either format. After unpacking (or decoding), the true data value is obtained as follows:

$$\text{True value} = \text{unpacked (or decoded) value} - \text{bias}$$

Missing codes which are unique from actual data values have been chosen for missing parameters. The missing codes contained in the tables are after the bias has been subtracted.

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Most users receive the character format version which is described after the binary packed format. However, the packed binary format includes information about missing codes and biases, and comments about the data that are necessary for a complete understanding of the character format content. The specifics about bits and words may be ignored if the character format is being used.

2. Element Names and Definitions:

Character Format Received by Most Users

Information about missing codes and biases, and comments about the data are contained in the packed binary version section. Logical records are 50 characters in length. They are blocked together into physical records 5000 characters in length (100 logical records per physical record) except for the last physical record on each tape, which may have fewer than 100 logical records. The logical records are sorted in ascending order by WMO number, year, month, and record type. See notes 1 and 2. Logical records for which all parameters are missing have been eliminated.

There are eight types of logical records, 0 through 7. An explanation and character breakdown for each is given below.

Type 0 - primary identification record; this record occurs whenever there is a change in any one of the following parameters - source of data, source of identification, WMO#, latitude, longitude, elevation, 721#, 995#. See Table 1.

character	1,	type 0
characters	2-7,	WMO#
characters	8-11,	year
characters	12-13,	month (1-12)
character	14,	source of data
character	15,	ship indicator
character	16,	source of ID
characters	17-20,	latitude
characters	21-25,	longitude
characters	26-29,	elevation
characters	30-35,	721#
characters	36-44,	995#
characters	45-50,	blanks

Type 1 - secondary identification record; always occurs after Type 0.

character	1,	type 1
characters	2-13,	same as type 0
characters	14-43,	name
characters	44-50,	blanks

Types 2-5 - record of height parameters (Table 3). When they exist, these

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records will occur only once for each year. Types 3-5 occur only when there are additional heights associated with Sfc pressure, temperature, and precipitation; see text following Table 3.

character 1,	type 2, 3, 4, or 5
characters 2-13,	same as Type 0
characters 14-19,	height of ground above mean sea level
characters 20-25,	height of barometer above mean sea level
characters 26-31,	height above MSL to which station pressure is reduced
characters 32-37,	height of thermometer above ground
characters 38-43,	height of thermometer above MSL
characters 44-49,	height of rim of precipitation gauge above ground
character 50,	blank

Type 6 - record of standard parameters for the month given (Table 2)

character 1,	type 6
characters 2-13,	same as type 0
character 14,	SLP indicator
characters 15-19,	SLP
character 20,	previous pressure indicator
characters 21-25,	station pressure
characters 26-29,	height
characters 30-33,	temperature
characters 34-39,	precipitation
characters 40-50,	blanks

Type 7 - record of additional data for the month given (Table 3a)

character 1,	type 7
characters 2-13,	same as type 0
characters 14-17,	temperature departure
character 18,	moisture indicator
characters 19-22,	relative humidity or vapor pressure
characters 23-26,	R.H. or V.P. departure
characters 27-28,	days of precipitation 1 mm.
characters 29-32,	precipitation departure
character 33,	quintile
characters 34-35,	# of observations/month
characters 36-38,	sunshine duration
characters 39-42,	sunshine % of average
characters 43-46,	sea temperature
characters 47-50,	sea temperature departure

NOTE 1: In most cases the units digit of the WMO number is 0, and the leftmost 5 digits are the normal WMO number obtained from the various sources indicated in Table 1. For some stations there was no WMO currently in use, so one was created from a non-zero units digit (usually 7), along with the actual WMO number of a nearby station. This is an arbitrary solution, but the resulting number was checked for uniqueness, and it facilitates sorting the data and

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guarantees a satisfactory ordering.

NOTE 2: This data set includes monthly means and annual means, 10-year monthly means and 10-year annual means, and 30-year monthly means and 30-year annual means. The value stored for the year determines which of the above three types the record is. The annual, 10-year and 30-year means have been dropped from the character version because of volume considerations.

For records containing the monthly means and annual means, the year is as normal, e.g. 1967.

For records containing the 10-year monthly means and 10-year annual means, the year is the last year of the 10 years plus 1000, e.g.,

1960		1000		
Last year	+	bias	=	2960
of 10 years				Packed yearly value

For records containing the 30-year monthly means and the 30-year annual means, the year is the last year of the 30 years plus 2000, e.g.,

1960		2000		
Last year	+	bias	=	3960
of 30 years				Packed yearly value

After 1960, Note 2 does not apply to the data, and all parameters in the thirteenth month (annual means) are set to missing.

NOTE 3 - (applies to binary packed format only): In general the month is 1, indicating the identification data is to be used for the entire year. However, some stations changed positions, numbering schemes or some other identifying parameter during the year. In these cases the month (not 1) identifier indicates the first month in this record for which the identification is to be used. The identification for months in this record prior to the month identifier is the same as in the previous year.

NOTE 4 - (applies to binary backed format only): The name is in Control Data Corporation (CDC) display code. Every 6 bits is one display code character, whose octal representation is given in the following Table 4.

3. **Start Date:** 17319999. See Tables 5A - 5C for data availability by decade
4. **Stop Date:** Ongoing. See Tables 5A - 5C for data availability by decade
5. **Coverage:** Global
 - a. Southernmost Latitude: 90S
 - b. Northernmost Latitude: 90N
 - c. Westernmost Longitude: 180W
 - d. Easternmost Longitude: 180E

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6. How to Order Data:

Ask NCDC's Climate Services about the cost of obtaining this data set.
Phone: 828-271-4800
FAX: 828-271-4876
E-mail: NCDC.Orders@noaa.gov

7. Archiving Data Center:

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Phone: (828) 271-4800.

8. Technical Contact:

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Phone: (828) 271-4800.

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH
Scientific Computing Division
Data Support Section
P. O. Box 3000
Boulder, CO 80307

9. Known Uncorrected Problems: In the cases where 6 height values are given for each of 4 parameters, it was discovered that the values given for a particular height were different for the different parameters, i.e., height of barometer above mean sea level associated with standard pressure = 17.7 m, but height of barometer above mean sea level associated with temperature = 78.9 m. This discrepancy has currently not been resolved, and all the height values are carried along.

Therefore, records prior to 1961, with additional data will be either:

23 words long (1410 bits of data and 62 unused bits, indicator = 0) or
27 words long (1716 bits of data and 12 unused bits, indicator = 1).

10. Quality Statement: The data through 1973 was scanned for gross format errors in card punching, and several hundred errors were corrected. Extreme values were inspected on the basis of being 4 or 5 standard deviations from the long period monthly mean. Many such deviations are real; but some were obviously the result of card-punching or publication errors, and some values were so extreme they were set to missing. Some of the data received on tape from NCDC overlaps that received on earlier tapes. These overlaps are considered to be updates and are merged with or replace the data previously received. NCAR has an available list of all changes and corrections made. We would appreciate receiving any additions or corrections from users in the form of station number, year, month, old value, and new value.

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There are gaps in a number of the station records that should be filled. NCDC estimates that half of these are available from published sources in the USA, but that it would require considerable expenditure to search for and enter this data.

11. Essential Companion Datasets: None. There are however, several sources:

World Weather Records,* "--1920", Smithsonian Miscellaneous Collections, Vol. 79, 1927, Smithsonian Institution, Washington, D.C.

World Weather Records,* 1921-1930, Smithsonian Miscellaneous Collections, Vol. 90, 1934, Smithsonian Institution, Washington, D.C.

World Weather Records,* 1931-1940, Smithsonian Miscellaneous Collections, Vol. 105, 1947, Smithsonian Institution, Washington, D.C.

World Weather Records, 1941-1950, U.S. Weather Bureau, 1959, U.S. Department of Commerce, Washington, D.C.

World Weather Records, 1951-1960 (6 volumes), Environmental Data Services, 1966, U.S. Department of Commerce, Washington, D.C.

World Weather Records, 1961-1970 (4 volumes), Environmental Data and Information Service, 1981-1983, U.S. Department of Commerce, Washington, D.C. (Asia and Africa currently being prepared and not available.)

12. References: No information provided with original documentation.

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TABLE 1. Identification Format.
(First 332 bits of every logical record)

Parameter	# of Bits	# of Bits Preceding This Parameter	Missing Code	Bias	Comments
Word count used by RPTIN*	12	0	NA	NA	The number of 64-bit words in this logical record
Reserved	4	12	NA	NA	
Format #	6	16	NA	NA	0
Source of data	2	22	NA	NA	0 - NCDC 1 - Wolbach, MIT(from NCDC) 2 - from individuals 3 - from country
Indicator (ship)	1	24	NA	NA	0 - non-ship 1 - ship
Source of Identification	2	25	NA	NA	0 - missing 1 - library tape from NCDC 2 - from data source 2 3 - World Weather Records (51-60), (61-70) publications; and ETAC compiled, Navy published World Index; Clayton's Weather Records
WMO #	21	27	NA	NA	6-digit WMO; see Note 1
Year	12	48	NA	NA	Four digits; see Note 2
Month	4	60	NA	NA	First month to which identification applies; see Note 3
Latitude	11	64	-999	1000	1/10's of degrees, north positive, south negative
Longitude	12	75	-1999	2000	1/10's of degrees, west positive, east negative
Elevation	14	87	-999	1000	meters
Name	180	101	Blanks	NA	Display code (CDC);
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see Note 4

Card deck 721 stn #	20	281	0	NA	NCDC numbering scheme for monthly publication
Card deck 995 stn #	30	301	0	NA	NCDC numbering scheme for World Weather Records
Additional data indicator	1	331	NA	NA	0 - no additional data 1 - record has additional data

*RPTIN is the NCAR unblocking routine, the counterpart of RPTOUT.

The next 975 bits are always present and contain the standard parameters included for each month.

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TABLE 2.
The Standard Monthly Parameters

Parameter	# of Bits	Missing Code	Bias	Comments
Sea level pressure indicator #1	1	NA	NA	0 - actual SLP 1 - estimated SLP
Sea level pressure	15	20000	0	1/10's of mb, SLP unless indicated otherwise by SLP indicator #2
Sea level pressure indicator #2	2	NA	NA	0 - sea level pressure 1 - P at constant Z 2 - Z at constant P when indicator is 0, height is set to missing
Station Pressure	15	20000	0	Pressure in 1/10's of mb
Height	13	5000	0	Geopotential meters
Temperature	11	990	1000	1/10's of degree C
Precipitation	18	200,000	0	1/10's of mm., trace is indicated by 150,000

The above 75 bits are repeated 13 times (975 total) once for each of the 12 months of the year and 1 more time for an annual mean (precipitation value is annual total).

If the last bit in the identification section is 0, then this concludes the record which is 21 words long (1307 bits of data and 37 unused bits).

If the last bit in the identification section is 1, then the record contains additional data which is one of two formats. Prior to 1961 additional data may consist of 103 or 409 bits, according to Table 3. From 1961 additional data consists of 1209 bits, according to Table 3a.

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TABLE 3A. (prior to 1961)

Parameter	# of Bits	Missing Code	Bias	Comments
Additional data format indicator	1	NA	NA	0 - one set of heights for all parameters 1 - one set of heights for each parameter
Height of ground above mean sea level	17	100000	10000	
Height of barometer above mean sea level	17	100000	10000	Tenths of meters. If the above indicator is 1, there is a set
Height above MSL which station pressure reduced	17	100000	10000	of these 6 heights for each parameter in order - SLP, sfc pressure,
Height of thermometer above ground	17	100000	10000	temperature, and precipitation.
Height of thermometer above MSL	17	100000	10000	
Height of rim of precip. gauge above ground	17	100000	10000	

This height data was received from Wolbach at MIT (punched at NCDC). In the cases where 6 height values are given for each of 4 parameters, it was discovered that the values given for a particular height were different for the different parameters, i.e., height of barometer above mean sea level associated with standard pressure = 17.7 m, but height of barometer above mean sea level associated with temperature = 78.9 m. This discrepancy has currently not been resolved, and all the height values are carried along.

Therefore, records prior to 1961, with additional data will be either;

23 words long (1410 bits of data and 62 unused bits, indicator = 0) or
27 words long (1716 bits of data and 12 unused bits, indicator = 1).

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TABLE 3B. (From 1961)

Parameter	# of Bits	Missing Code	Bias	Comments
Temperature departure from normal	11	990	1000	1/10's degree C
Moisture indicator	1	NA	NA	Following 2 parameters are, 0 - Relative humidity 1 - Vapor pressure
Relative humidity or Vapor pressure	11	127 1000	0 0	Whole % 1/10's of mb
Relative humidity departure from normal or Vapor pressure departure from normal	11	200 1000	100 1000	Whole % 1/10's of mb
# days with precipitation 1 mm.	6	63	0	
Precipitation Departure from normal	12	2000	2000	Whole mm.
Quintile of precipitation occurrence in 30-year period	3	7	0	0 - smaller than any other value in 30-year period 1 - occurred 1-6 times 2 - occurred 7-12 times 3 - occurred 13-18 times 4 - occurred 20-24 times 5 - occurred 25 or more 6 - larger than any other value in 30-year period
Number of observations per month	6	63	0	
Sunshine duration	10	999	0	hours
Sunshine % of average	10	1000	0	whole percent
Sea temperature**	11	990	1000	1/10's of degree C
Sea temperature from departure normal**	11	990	1000	1/10's of degree C

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** Usually present only for ships, but occurs on occasion with some coastal stations.

These 103 bits are repeated 13 times (1339 total), once for each of the 12 months and one more time for the annual mean. Therefore, records from 1961 on, with additional data, are 42 words (2646 bits of data and 42 unused bits).

TABLE 4. Display Code Character Set and Octal Equivalent

Character	Octal Equivalent
A thru Z	01 thru 32
0 thru 9	33 thru 44
+	45
-	46
*	47
/	50
(51
)	52
\$	53
=	54
blank	55
,	56
.	57

Table 5A: Area - North America (12n-90n,40w-170w)

The following table indicates the data coverage by decade

explanation of symbols

- recs - no. of logical records in the decade (station/years)
- s - no.of stations in the decade
- sslp - no.of stations in the decade with sea level pressures
- mssl - no.of months of slp in the decade
- sp - no.of stations in the decade with pressures
- mp - no.of months of pressure in the decade
- st - no. of stations in the decade with temperatures
- mt - no.of months of temperature
- sr - no. of stations in the decade with precipitation
- mr - no.of months of precipitation

decade	recs	s	sslp	mssl	sp	mp	st	mt	sr	mr
1991-1998	2252	351	349	22890	348	18043	350	23689	344	23630
1981-1990	2235	310	294	21572	294	21518	310	23919	308	23731
1971-1980	2075	232	191	19122	185	18093	231	23001	226	22243
1961-1970	4287	446	272	28357	216	23908	390	43173	439	49523
1951-1960	3958	409	223	25039	190	21924	363	40822	391	44718
1941-1950	2596	280	165	16818	147	15816	262	28257	271	29785
1931-1940	2127	230	95	9374	138	14734	206	22500	226	24723
1921-1930	1929	199	65	7290	121	13979	174	19880	196	22382
1911-1920	1708	179	35	3965	114	13108	154	17308	176	19776
1901-1910	1550	165	31	3449	106	11892	142	15520	161	17855
1891-1900	1232	137	25	2814	93	10007	122	12967	133	14137
1881-1890	1032	114	24	2623	75	7653	100	10338	110	11651
1871-1880	682	91	18	1220	53	3966	74	6070	84	7285
1861-1870	265	33	1	120	1	56	20	1924	28	2654
1851-1860	254	29	1	36	0	0	17	1610	23	2384
1841-1850	194	23	0	0	0	0	14	1335	17	1658
1831-1840	125	17	0	0	0	0	11	945	12	946
1821-1830	87	10	0	0	0	0	7	751	6	441
1811-1820	28	8	0	0	0	0	6	239	3	168
1801-1810	10	1	0	0	0	0	1	120	1	83
1791-1800	12	2	0	0	0	0	2	125	0	0
1781-1790	18	3	0	0	0	0	2	131	1	72
1771-1780	7	1	0	0	0	0	1	69	0	0
1761-1770	7	2	0	0	0	0	1	12	1	60
1751-1760	10	1	0	0	0	0	0	0	1	120
1741-1750	10	1	0	0	0	0	0	0	1	120
1731-1740	3	1	0	0	0	0	0	0	1	36
total data coverage	28693	678	465	164689	452	194697	605	294705	665	320181

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Table 5B: Area - northern hemisphere, excluding North America

The following table indicates the data coverage by decade

explanation of symbols

- recs - no. of logical records in the decade (station/years)
- s - no.of stations in the decade
- sslp - no.of stations in the decade with sea level pressures
- mslp - no.of months of slp in the decade
- sp - no.of stations in the decade with pressures
- mp - no.of months of pressure in the decade
- st - no. of stations in the decade with temperatures
- mt - no.of months of temperature
- sr - no. of stations in the decade with precipitation
- mr - no.of months of precipitation

decade	recs	s	sslp	mslp	sp	mp	st	mt	sr	mr
1991-1998	9038	1522	1471	80775	1491	80779	1521	83569	1517	82499
1981-1990	8378	1063	988	77768	998	79018	1058	82381	1058	81328
1971-1980	9083	1207	1052	81177	1060	80806	1157	94020	1191	95790
1961-1970	12338	1340	1060	107000	375	38762	1291	134114	1329	139004
1951-1960	11072	1144	804	90581	650	71297	1069	121258	1134	128742
1941-1950	5461	632	328	31301	325	32064	470	46643	621	63342
1931-1940	5041	556	167	16830	222	23874	345	36545	550	58878
1921-1930	4195	462	123	14114	210	23479	287	31538	459	49190
1911-1920	3350	380	72	8092	185	20627	251	28394	349	35958
1901-1910	2915	337	65	6818	179	19432	235	25327	306	31145
1891-1900	2175	245	45	4619	146	16186	188	20530	217	22645
1881-1890	1708	191	22	2229	117	12043	154	16158	167	18094
1871-1880	1071	128	15	1560	63	5605	89	8192	119	11806
1861-1870	669	91	9	960	31	2729	50	4267	81	6884
1851-1860	432	51	7	756	18	1615	30	3062	42	4036
1841-1850	273	33	5	432	7	766	19	2118	24	2110
1831-1840	210	23	2	240	5	600	16	1793	13	1195
1821-1830	184	20	2	240	5	600	14	1584	10	974
1811-1820	162	18	2	240	5	479	13	1440	7	605
1801-1810	124	14	2	240	3	264	11	1186	4	420
1791-1800	113	12	2	240	2	240	10	1116	3	360
1781-1790	109	11	2	240	2	240	9	1079	3	300
1771-1780	68	9	3	252	2	240	7	684	1	120
1761-1770	39	6	2	132	2	156	5	379	1	82
1751-1760	15	2	1	72	1	72	2	180	0	0
total data coverage	78223	2283	2004	526908	1960	511973	2242	747557	2273	835507

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Table 5C: Area - southern hemisphere plus 0-12n,40w-170w

the following table indicates the data coverage by decade

explanation of symbols

- recs - no. of logical records in the decade (station/years)
- s - no.of stations in the decade
- sslp - no.of stations in the decade with sea level pressures
- mslp - no.of months of slp in the decade
- sp - no.of stations in the decade with pressures
- mp - no.of months of pressure in the decade
- st - no. of stations in the decade with temperatures
- mt - no.of months of temperature
- sr - no. of stations in the decade with precipitation
- mr - no.of months of precipitation

decade	recs	s	sslp	mslp	sp	mp	st	mt	sr	mr
1991-1998	4345	803	747	32315	760	32728	785	34265	789	33848
1981-1990	5702	1090	604	40516	667	42914	698	46539	1038	53493
1971-1980	8788	1094	578	43212	594	42909	654	49561	1071	94950
1961-1970	9623	1106	587	51296	337	31645	696	64082	1089	107136
1951-1960	9106	973	307	31903	313	31760	526	55086	943	105883
1941-1950	6659	727	112	11959	109	11944	256	27312	718	77900
1931-1940	6005	648	63	6628	74	8039	196	21079	642	70618
1921-1930	4139	451	48	5286	49	5391	96	10901	446	48567
1911-1920	3788	412	38	4271	46	5116	89	9768	407	44277
1901-1910	3326	366	31	3013	41	4297	77	7966	361	38765
1891-1900	2607	297	20	1873	25	2365	48	4625	294	30595
1881-1890	1754	217	14	1216	14	1133	30	2780	213	20091
1871-1880	879	127	9	1014	7	743	20	2058	123	9998
1861-1870	355	63	8	753	5	540	15	1437	61	3909
1851-1860	113	23	3	192	3	168	7	344	21	1159
1841-1850	62	7	1	117	0	0	1	119	6	598
1831-1840	5	4	0	0	0	0	0	0	4	53
total data coverage	67256	1803	1062	235564	1094	221692	1272	337922	1721	741840

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