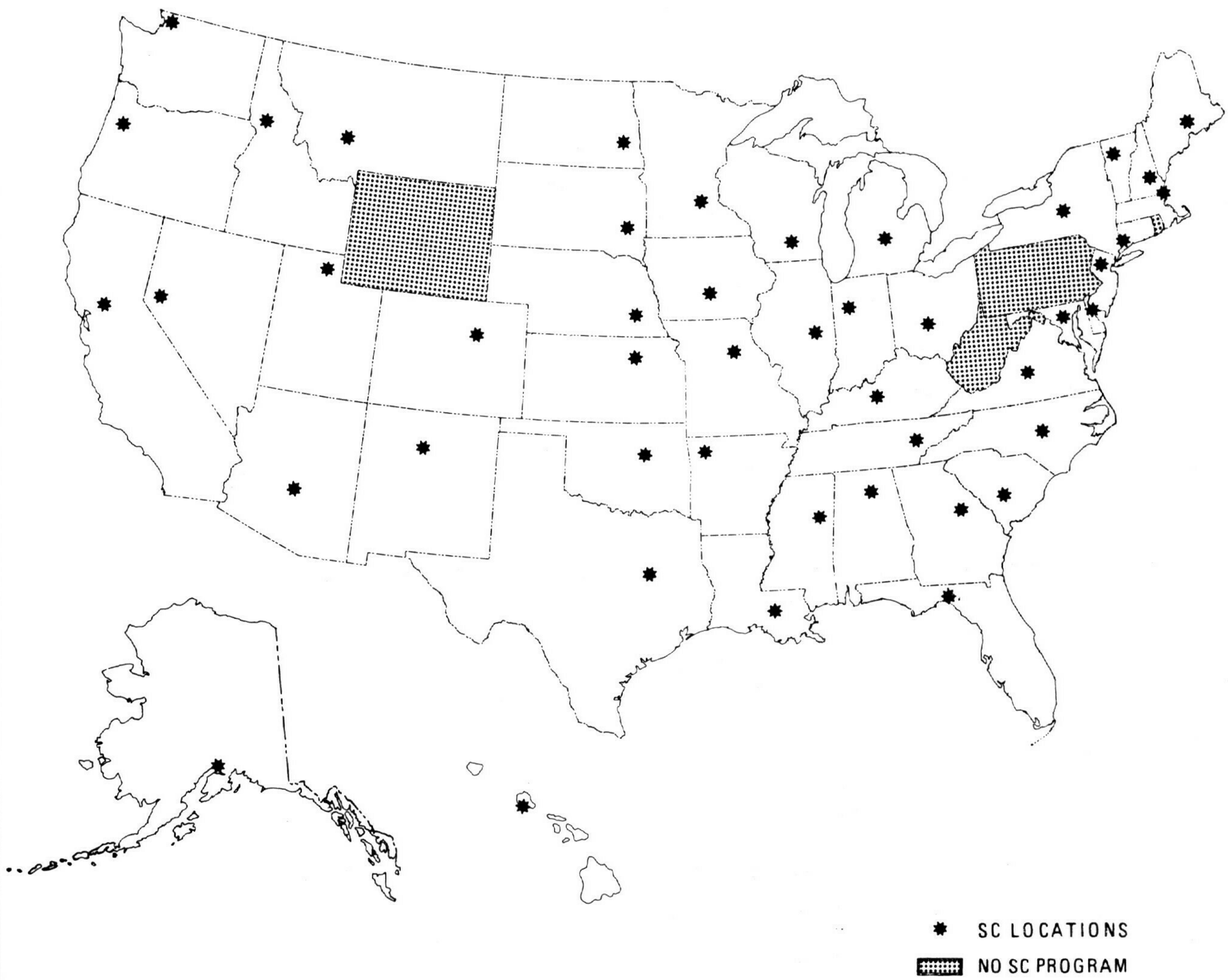
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE
NATIONAL CLIMATIC DATA CENTER

THE STATE CLIMATOLOGIST

IN COOPERATION WITH THE
AMERICAN ASSOCIATION OF STATE CLIMATOLOGISTS



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Degree Day Data. The NCDC has published Annual Degree Days to Selected Bases. The publication contains the 1951-80 annual heating and cooling degree day normals for seven base temperatures at over 3,000 locations in the United States. These data are used in building design standards and to estimate the energy required to heat and cool a wide variety of buildings. Energy conservation has resulted in the need for degree day data at base temperatures other than the historical 65°F (18.3°C). The publication advertises a monthly summary that is available on microfiche.

NCDC Marketing. A meteorologist in the Information Services Division has been assigned part-time to coordinate public information efforts of the NCDC during FY 1983. He is the point of contact to arrange for shipment of quantities of NCDC brochures and price lists for use at regional conferences of scientific groups. The contact is Mr. Cleo G. Hogan, telephone 704-258-2850, extension 682.

VAX 11/780. The National Climatic Data Center (NCDC) has developed a service for the State Climatologists where they are able to dial into a VAX 11/780 at NCDC and selectively obtain climatological data records for their use. This service will expedite the accessibility of this information for the climatologists and will provide a means for recording the selected data onto storage mediums rather than have to enter the values from manuscripts. The data are available from four different areas of climatic data files: (1) the Summary of the Day data, (2) the PRELIM data, (3) the Climatological Monthly data, and (4) the Local Climatological Data. Additional information about access methodology may be obtained from Larry Griffin or Doug Mason at (704) 258-2850, extension 205 (FTS 672-0205). Information about the data files may be obtained from the NCDC User Services Branch (704) 258-2850, extension 682, (704) CLI-MATE, or FTS 672-0682.

Estimating Missing Max and Min Temperatures. The cooperative data areal edit program can estimate up to eight missing max temperatures and eight missing min temperatures in one month's data. One to three nearby stations are selected to provide the estimate for the missing data. The nearby stations are from the same time of observation group (AM, PM, or MID) as the missing data, but are not restricted by division or state boundaries. Also, the nearby stations are within 60 miles and have less than 1000 feet elevation difference from the station with missing data.

The general approach involves finding the combination of one to three nearby stations whose temperatures for the month most closely fit the temperature pattern of the station with the missing data. Individual station effects such as elevation and exposure are roughly accounted for by using deviations from each monthly station average. The estimated temperature is derived by averaging the appropriate nearby station deviations occurring on the day with missing data. None of the calculations use any data that have been "flagged" as suspicious by previous internal consistency or three standard deviation screening tests.

The specific calculation is as follows: First the surrounding station data are converted to standardized Z values by subtracting from each its row (monthly) mean and dividing by its standard deviation. An error variance is computed for each possible combination of surrounding stations. This error variance is computed by first finding an average Z value from the combination of surrounding stations for each day of the month. Then, this average Z value is multiplied by the standard deviation (flagged points excluded) of the row containing the missing data to obtain a correction temperature in degrees F. Next, the row average is added to the correction temperature to produce a best guess for a particular day. This is repeated for all days that are not flagged or missing. The best guesses are then subtracted from the observed value on each day and the error variance associated with that combination of surrounding stations is computed and saved. This process is repeated for all combinations of surrounding stations. Finally, these error variances are sorted and the combination of surrounding stations associated with the lowest error variance is used to make the best guess for the missing values.

Once the minimum-error-variance-producing combination of nearby stations is found, it is used to provide the best guess estimate for the missing data. An average Z value from the optimum nearby station combination is found for the missing day. This tells how many standard deviations above or below the monthly mean one would expect the temperature to be on the missing day. This then is converted to a temperature departure from the mean by multiplying by the missing station's monthly standard deviation. The best guess is then computed by simply adding this departure from the mean to the monthly mean. After all calculations are complete, the estimated values are automatically checked for internal consistency. Finally, each estimate is checked by a meteorological technician to insure the value is reasonable.

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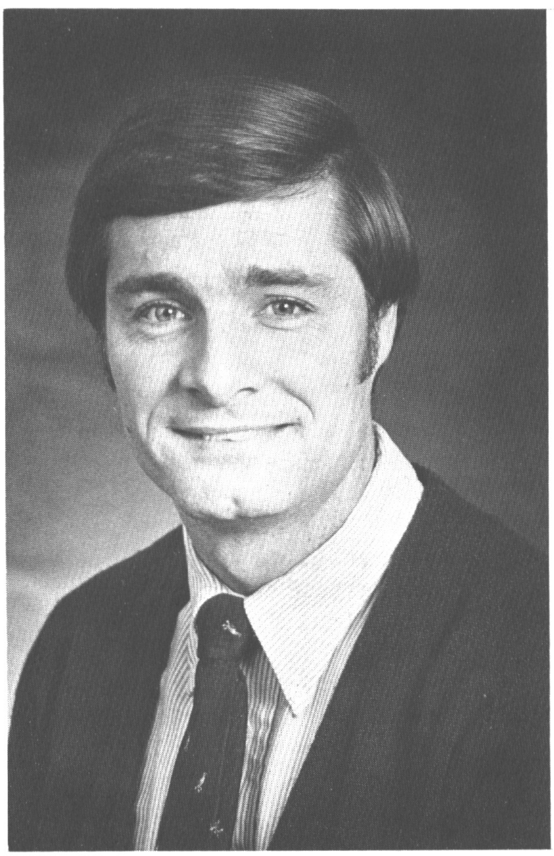


DR. CHARLES L. WAX

The National Climatic Data Center and the American Association of State Climatologists would like to welcome Dr. Charles L. Wax. Dr. Wax is the newly appointed State Climatologist for the State of Mississippi. This Mississippi native has been an assistant professor of geography at Mississippi State University for the past six years. Prior to assuming his duties at MSU, Dr. Wax served as a Graduate Research Assistant, Center for Wetland Resources, Louisiana State University. Dr. Wax is very excited and enthusiastic about the State Climatologist Program in Mississippi and says his goal is "to develop a climatology program and provide information on a voluntary basis to anyone who requests it. I'll be seeking ways to make the program work." Because of Mississippi's agricultural lean, Wax said he hopes the services will be most beneficial to farmers and foresters.

TEXAS A&M UNIVERSITY
COLLEGE OF GEOSCIENCES
OFFICE OF THE STATE CLIMATOLOGIST

THE QUEST FOR CLIMATE REFERENCE STATIONS

by
John F. Griffiths
Texas State Climatologist

It stands to reason that in any climatological study, whether theoretical or applied, the investigator needs to use the most reliable and representative information available. Therefore it comes somewhat of a surprise to read, in a classical paper concerning climatic change, that the researcher simply used those stations whose "data are readily accessible." There was absolutely no indication of a discriminating approach to the selection of stations for the study. Unfortunately, this aspect again was missing in other later, but similar, landmark papers in the 1960s and 1970s. This is a surprising omission since Mitchell (1953) had pointed out how climatic change could embody two components (REAL and APPARENT). The role of these components is shown in Fig. 1, a simplified version of one of Mitchell's figures. In CLIMATE (1957), a publication dealing with the earlier benchmark stations some very germane comments were made.

> "The longest climatological series in the United States are not homogeneous and no exact statistical methods exist for making them so. These long series, widely published in the past without qualifying notes, must therefore be used with discrimination."

> "The longest series...have exclusively come from stations within slowly expanding cities.---Also, the occasional need to move stations to new locations with their slightly different climates has blemished their combined record with discontinuities."

> "Virtually all 'first-order' Weather Bureau stations have been located (and relocated) in cities until recent times when many more transferred to nearby airports. Resulting discontinuities in their records can rarely be corrected for..."

> "----the records of the larger variety of elements at first-order stations are irretrievably blemished by the effects of many station moves, changes in observational routines, and local city growth. Historical series based on such records must always be suspected."

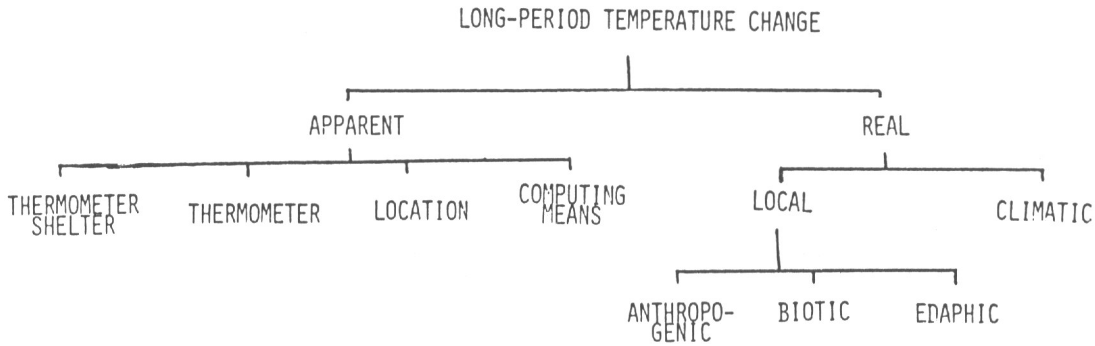


Figure 1. Possible components of a long-period temperature change [adapted from Mitchell (1953)].

It is unfortunate for our science that 25 years later the same comments need to be made.

There is clearly a need for the identification of climatic reference stations since, due to certain influences, such as relocation, urbanization, observation schedule changes, among others, the measurements for most stations may well include an APPARENT impact large enough to mask the REAL facet.

Texas State Climatologist John Griffiths discusses project with Senior Student Assistant Dawn Zak.

During the past couple of years we have been pursuing the problem of identifying likely candidates as climatic reference stations - a task undertaken with the assistance of N.S.F. and N.C.D.C., and guidance from J. Murray Mitchell and Henry Diaz. There are two ways (partially independent) of arriving at a selection of stations - through station histories, and by statistical analyses.

The initial step was to set up a set of criteria to make the selection process more objective than subjective. The personal choice was for stations that

(1) have records of <u>both</u> temperature and precipitations since, at least, January 1900;

(2) these records should be complete (although some missing data have to be tolerated, but gaps of 2 or more years are not accepted);

(3) the station should function until at least 1960;

(4) the station should be in a rural setting (maximum population allowed-5000);

(5) ideally the station should be at its original site but relocations are tolerated if these have been adjudged to be minor and to be compatible sites;

(6) there should have been no climatologically significant changes at the site(s) (such as interference from trees or buildings);

(7) observer standard should be very good.

It is clear that (1) through (4) can be objective criteria but (5) through (7) depend on subjectivity. To help reduce this subjectivity to a minimum all State Climatologists and Cooperative Program Managers in the 48 conterminous states were contacted and asked to suggest stations that, from their experience, would satisfy the criteria. There has been magnificent cooperation from my colleagues and we take this opportunity to thank all who have made our task easier. It is realized that, in some instances, our requests have put quite a burden on individuals - we apologize for this and trust we have not worn out too many friendships.

Our results, which are not yet finalized, show a total of 272 stations meeting the criteria given (see Table 1), with 29 stations being categorized as Class 1, or outstanding (see Table 2). Remember that this larger number is only about 1 in 40 of all cooperative stations.

On a grading system that gave 5 points maximum in each of four categories--continuity of record; number and distance of relocations; number of observers; size of community where station located--the first seven stations scored 20, the next eight 19, and the others 18. Of the 272 stations all but 13 received 10 or more points, while we are still trying to obtain the station histories of 12 others.

What are our present conclusions and recommendations at this stage?

1) We understand why this work has not been undertaken in this manner before (we would be loathe to repeat the experience).

2) It is unfortunate that complete station history data are not readily available for all states through 1980.

3) Let us hope every attempt will be made to ensure that all the 272 stations identified will be allowed to continue. Many superior stations are noted to have been closed since the 1950s.

TABLE 1

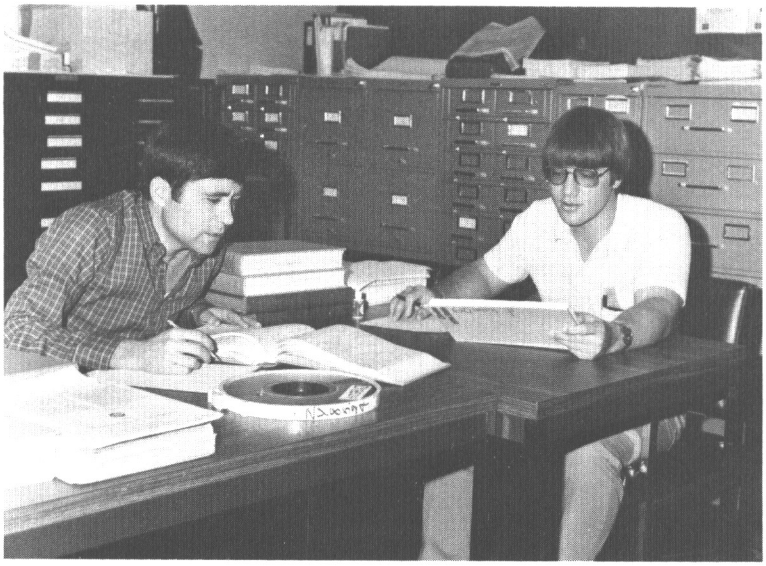
LISTING OF SUGGESTED CLIMATE REFERENCE STATIONS

STATE	TOTAL	STATION	TOTAL
Alabama	4	Nebraska	32
Arizona	7	Nevada	2
Arkansas	6	New Hampshire	2
California	7	New Jersey	5
Colorado	4	New Mexico	4
Connecticut	0	New York	5
Delaware	0	North Carolina	5
Florida	5	North Dakota	8
Georgia	10	Ohio	7
Idaho	4	Oklahoma	9
Illinois	11	Oregon	4
Indiana	4	Pennsylvania	1
Iowa	7	Rhode Island	0
Kansas	6	South Carolina	4
Kentucky	6	South Dakota	11
Louisiana	5	Tennessee	4
Maine	2	Texas	8
Maryland	2	Utah	8
Massachusetts	0	Vermont	4
Michigan	2	Virginia	6
Minnesota	13	Washington	3
Mississippi	8	West Virginia	6
Missouri	9	Wisconsin	5
Montana	4	Wyoming	3

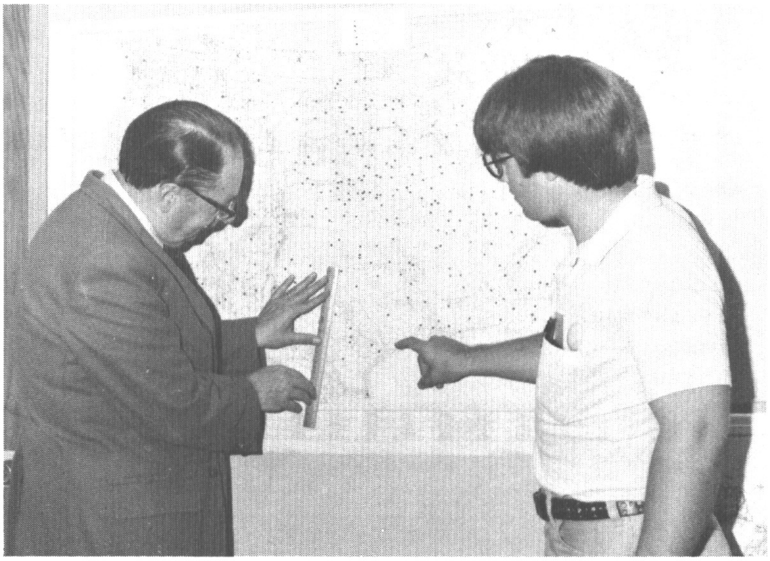
TABLE 2

LIST OF CLASS 1 STATIONS

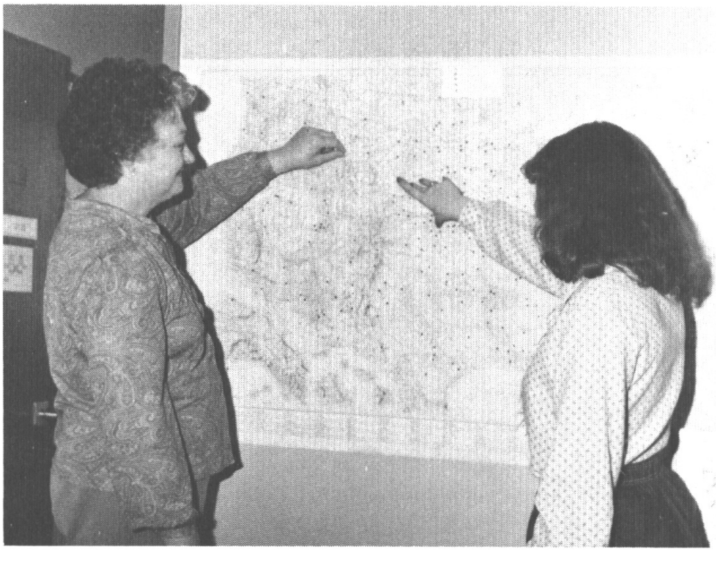
STATE	STATION	STATE	STATION
Minnesota	Farmington	Florida	St. Leo
North Carolina	Waldon	Idaho	Porthill
South Carolina	Yemmassee	Illinois	Walnut
South Dakota	Mellette	Iowa	Logan
Texas	Danevang	Kentucky	Irvington
Washington	Olga	Minnesota	Milan
Washington	Tatoosh Island	Nebraska	Geneva
		Nebraska	Kimball
		Nebraska	St. Paul
Indiana	Whitestown	Nevada	Flemington
Kansas	Columbus	Texas	Blanco
New Hampshire	Bethlehem	Utah	Fillmore
New York	Mohank Lake		
Ohio	Millport		
Ohio	Philo		
South Dakota	Forestburg		
Virginia	Columbia		



Graduate Student Jim Love and Kevin Vining



John Griffiths with Kevin Vining



Dorothy Lorenz, State Climatologist Office Secretary with Student Assistant Dawn Zak.

Our next task is to assemble the data for these stations so as to begin statistical analyses. A subject that may be the theme of another article in a year or so.

BIBLIOGRAPHY

Climate, 1957: Chapter J in Historical Statistics of the United States, Colonial Times to 1957, Bureau of the Census, 241-255.

Mitchell, J. Murray, Jr., 1953: On the causes of instrumentally observed secular temperature trends, Jour. of Meteorology, 10, 244-261.

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NOAA POLICIES REGARDING THE FURNISHING OF RECORDS IN LITIGATION AND EMPLOYEE TESTIMONY

by Catherine M. Hess

1. GUIDELINES CONCERNING RECORDS AND DATA

NOAA, which collects, checks, publishes, and archives official weather records for the United States, receives hundreds of requests per year for these records for use in legal proceedings. It is the policy of NOAA to provide such records to non-federal litigants to the same extent that they are available to the general public. Most of these requests show a lack of familiarity with the kinds and forms of information available, and what NOAA can be reasonably expected to do to fill the request. These guidelines are for the enlightenment of parties wishing to use weather records in legal proceedings not involving the United States.

There are several thousand stations throughout the country making official observations. The location of these stations may be obtained from the local National Weather Service office or the National Climatic Data Center in Asheville, NC.

The most common kinds of information gathered at a weather station are precipitation measurements and daily high and low temperatures. About 300 offices record other information, such as wind, temperature, humidity, type of weather, atmospheric pressure, visibility, or the presence of clouds. This type of information may also be gotten from the FAA, airline observers, the military, or private meteorologists. The National Climatic Data Center has the originals of all types of data from these weather stations. This information is also published in Climatological Data and Hourly Precipitation Data for state information, and in Local Climatological Data for each station. These publications may be ordered directly from the National Climatic Data Center, at a charge.

Other weather records available from the National Climatic Data Center files are solar radiation data, upper air data, accounts of major storms, photographs of radar scope imagery, satellite cloud pictures, weather maps, observations from ships and aircraft, a variety of summaries of weather conditions, and climatological publications from foreign countries. Costs for these other records vary according to the amount of time it takes to locate them and how many copies are desired.

If an attorney feels that printed information is not satisfactory (because of the way it is presented or because more data is desired) copies of the original records may be available from the National Climatic Data Center at a small charge. If these are still not satisfactory the attorney can request specific information to be extracted or rephrased in plain language if necessary, which would involve a substantially higher charge. The attorney also has the option of using a private meteorologist.

If the data do not have a preprinted certification on them, then the records may be certified upon request, either individually or with an attachment. Individual certification is stamped on each sheet of information with a charge for each signature. A less costly option is have a certifying statement attached with a grommet to the documents certified (group certification). In addition, U.S. Department of Commerce authentication (blue ribbon and seal) can be requested. In some courts, records must be authenticated to be admissible. In most circumstances, authenticated records will obviate the need for a NOAA employee to appear in court for authentication purposes.

If the data are at slightly different times or locations than what is applicable to the case, a good thing to do is to ask for the help of a private meteorologist who can render an opinion on whether the data are applicable to the case. Addresses of private consulting meteorologists may be obtained from the American Meteorological Society at 45 Beacon Street, Boston, MA 02180.

If you are a NOAA employee and you are served with a subpoena duces tecum or a similar request for records, you should let the NOAA Office of General Counsel know immediately. The records may be provided only when they have been authorized according to the NOAA freedom of information regulations. For the guidelines pertaining to answering requests for this information, see the NOAA freedom of information regulations (15 CFR Part 903), and the Department of Commerce privacy regulations (15 CFR Part 4B), and 15 U.S.C. 1525.

Data as to the time of a sunrise, sunset, moonrise, or moonset are not official records of NOAA. Such information is provided by the Nautical Almanac Office (U.S. Naval Observatory, Mass. Avenue and 34th Street, N.W., Washington, D.C. 20390) and may be examined at local National Weather Service offices. If moon or sun data is required, it may be obtained upon request from the Nautical Almanac Office. That office will prepare a certification statement for specified locations of moon and sun data. The observatory will also prepare a certification statement regarding the moon phase on specified dates.

2. GUIDELINES CONCERNING TESTIMONY

If you are a NOAA employee and you are asked to give official testimony in any case involving the United States, you must let the NOAA Office of General Counsel know, as well as the appropriate NOAA organizational element. You may not testify as a witness for the side opposing the United States; in other words, if the United States is the plaintiff you may not testify for the defendant and vice versa. When you are testifying for the United States, a NOAA Staff Attorney should, when at all possible, be present at all meetings regarding your testimony.

Requests for testimony from a NOAA employee in private litigation not involving the United States should be addressed in writing to the NOAA Office of General Counsel, along with description of the testimony needed and an explanation as to why the information would not be available from another source. NOAA policy is generally not to allow its employees to testify so as to maintain strict impartially among non-federal litigants. However, the NOAA Office of General Counsel will authorize the testimony if the party making the request shows satisfactorily that the information would not be available elsewhere, that no records could be introduced in evidence in substitution for the testimony, and that the other conditions of the NOAA Directives Manual are met. Even if all of these conditions are not met, the Office of General Counsel may allow the employee to testify if NOAA has a significant interest in the litigation, and the outcome of the case would affect present or future policies of NOAA, or it is necessary to provide such information in the public interest. If testimony is authorized, the NOAA Office of General Counsel may arrange for the testimony to be given by a deposition or an affidavit at cost to the requesting party.

NOAA's policy is that any employee authorized to testify for private individuals should give only impartial testimony, that is, strictly factual information. An employee may not appear as an expert witness except when authorization has been given by the NOAA Office of General Counsel. If necessary, the NOAA Office of General Counsel may request the Department of Justice (Local U.S. Attorney) to intervene in the matter to represent the interests of the Federal Government.

If a Government Attorney is not present at your testimony, you should have with you a copy of the NOAA Directives Manual. If you are asked to testify as an expert witness, or on other matters which you do not have authorization, you should decline and explain that you are not allowed to do so, showing the pertinent NOAA Directives Manual Section. If the court orders you to testify, then comply, but first you should ask the court for an opportunity to seek the advice of the Office of General Counsel.

Requests for certified copies of these types of information should be referred to the following offices:

Weather and Climatological records:

National Climatic Data Center
Information Services Division
Federal Building
Asheville, NC 28801-2696

Weather Forecasts and Warnings (including Public, Marine and Aviation):

National Weather Service Headquarters, NOAA
GRAMAX Building
8060 13th Street
Silver Spring, MD 20910
Attn: W/OM 13x3

Aeronautical Charts:

Assistant Administrator for National
  Ocean Services
Aeronautical Chart Division
6001 Executive Boulevard
Rockville, MD 20852

Other:

Office of the General Counsel, NOAA
U.S. Department of Commerce
14th and Constitution Avenue, N.W.
Washington, D.C. 20230

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NORTHEAST REGIONAL CLIMATE PROGRAM

Prior to 1973, Cornell University had participated in a regional program, "The Climate of the Northeast," and was given the responsibility of working with NWRC (now NCDC) in assembling and analyzing a regional data base. With the elimination of the State Climatologist Program, Cornell was fortunate to have had a part-time state climatologist supported by the College of Agriculture. It became imperative that the regional data base be updated and expanded to produce climate information essential to the private and public sectors involved with climate and weather problems. It also became apparent that a regional climate program was needed for the northeast region. In 1980, a state climate program began in Connecticut funded by NCPO. In 1981, Maine and Vermont Agricultural Experiment Stations joined Cornell University in a cooperative project to demonstrate the need for and feasibility of a regional climate program with a regional climate office funded by NCPO. The program is designed to assist in the publication and dissemination of climate summaries and analyses, supply guidance for developing state climate programs, supply regional climate data, and inventory climatological data sets in the northeast for inclusion into the NEDRES of NESDIS. The Northeast Regional Climate Office (NRCO) at Cornell University manages the overall program.

Real-time data collected via teletype and data from cooperative networks are entered into the NRCO computer. All participating states have an interactive link with this computer. Historical data bases for New York and New England had been updated through 1980, using tapes from NCDC. Inventory of climatological data sets for NEDRES were completed for New York, Vermont, Maine, New Hampshire, and Connecticut in 1982. Total inventory for the remaining northeast states will be completed in 1983.

Climate summaries for Maine, New Hampshire, New York and Vermont are printed and mailed monthly under this program to over 3800 users and include all county agents and appropriate state and federal agencies. These summaries include information and maps for temperature, precipitation, weekly climate descriptions, degree days, monthly and seasonal weather outlooks, and pertinent articles on climate and past weather events. The state cooperative extension service is the user focal point in Maine and Vermont and, in New York, subsidizes the maintenance of two answering telephones which give local and regional weather information and forecasts to over 100,000 inquiries per year.

In 1982, a preliminary survey was made of users of the monthly climate summaries and the results showed state and federal agencies comprised 26% of the respondents followed by 14% for extension agents, 13% for business and, 12% for educational users. The greatest non-personal use was by agricultural interests (41%), followed by natural resource users (17%), and energy interests (13%).

A key factor in the Northeast Regional Climate Program is the acquisition and dissemination of climatic data and information. Since most states in the region had no climate office, there was no effective means by which data and information could pass from the federal level to the general user. The establishment of the NRCO provided this mechanism, increased the user pool, and decreased the request load on NCDC. The Northeast Climate Program provides climate information, products and services thereby stimulating productivity, economic recovery, and growth of the region.

GRAPEFRUIT AND TOYOTAS

SOME ASPECTS OF APPLIED MARITIME CLIMATOLOGY

Howard J. Critchfield
Washington State Climatologist

Twenty-four of the fifty United States border on an ocean and eight abut one or more of the Great Lakes. Yet the typical state climate service deals primarily with applications of data from continental stations to economic activities on land. An increasing number of requests for information on the marine environment, especially in connection with commercial fisheries and ocean shipping, led to an opportunity for the Washington State Climatologist to sample maritime climatology first-hand during the winter of 1982-83. The following account of a specific shipping operation between the U. S. coast and Japan suggests the scope and variety of applied problems.

The Ship and Equipment

M. V. SUNBELT DIXIE is a 12,000-tonne vessel built and outfitted in Japan to carry automobiles on eight of its ten cargo decks. Two mid-level decks are equipped for refrigeration and especially designed for transport of citrus fruit. Starboard hold covers and portable ramps accommodate loading and unloading of cars; citrus is handled through the port side. Ordinarily, the ship carries grapefruit from Florida to Japan and returns with motor vehicles. The overall design permits a fast turnaround in port while offering the economic advantages of a paying return haul.

Navigation equipment includes an OMEGA Navigation System for continuous position readings, an electromagnetic log for speed and distance, depth finder, radar, and magnetic compasses. Standard meteorological instruments facilitate regular observations of wind, dry and wet bulb temperatures, and barometric pressure. The barograph is corrected for the bridge height of 22 meters above sea level. Sea surface temperature is measured at the engine cooler intake at a depth of about 8 meters. Weather reports, forecasts, and facsimile maps are available by radio, but the ship does not receive satellite photos.

Climatology in Port

Operations of the Sunbelt Dixie in port are subject to the same kinds of weather vagaries that affect all ships, but the nature of the cargo introduces distinctive circumstances. Availability of citrus at a prearranged port and date depends on previous weather in the producing areas, in this case Florida, where a hard freeze could initiate a chain of events that culminate in a reduced or alternate cargo and possibly a different sailing schedule. Prior conditions in the market area influence the demand, for example, when quantities of locally produced competing fruit fluctuate significantly. Thus, climate sets the broad pattern for long range scheduling.

Rapid transfer of grapefruit to or from the ship is desirable not only for economy of turnaround but also to reduce the time of exposure between warehouse and the ship's holds. Sustained freezing temperatures endanger the fruit; high temperatures and low relative humidity speed deterioration. Heavy precipitation can weaken the cardboard cartons, causing collapse. It also slows activity on the wharf as special precautions become necesssary to insure protection and safety for workers and equipment. Unloading of grapefruit from Sunbelt Dixie at Tokyo on 18 January 1983 was extended several hours because of prolonged rain showers in the wake of a cold front.

Automobiles are generally less weather-vulnerable at port facilities, although violent winds, heavy rain or snow, and extreme temperatures can delay a schedule. An anticyclone that moved off the Asian continent following the cold front noted above brought fair weather, but on the morning of 23 January the vehicles awaiting loading at Nagoya were covered by a thick coat of frost, necessitating the diversion of an employee to scrape windshields.

Climatology Enroute

The primary objectives of a ship such as the Sunbelt Dixie are (1) a smooth, safe voyage, (2) energy efficiency, and (3) maintenance of arrival and departure schedules. All have direct economic implications. Rough seas induce jostling of grapefruit and, if violent, they can cause failure of securing cables on the car decks. At their worst they can damage the ship itself. It is therefore desirable to avoid the high waves and strong swell that are generated by vigorous storms and propagated for some distance on the open sea. Reduction of speed can help to offset potential damage if rough seas are encountered.

Conservation of fuel is accomplished by reducing ship speed, by avoiding rough seas, and by choosing a course to take maximum advantage of tailwinds and ocean surface currents. Maintenance of sailing schedules may come into conflict with the other considerations if an attempt is made to increase speed. Reduction of speed becomes a questionable procedure when it results in interception by a storm.

The crude fundamentals of ship routing have been applied since before recorded history. Matthew Fontaine Maury's pioneering efforts in mapping prevailing winds in the 19th century were the forerunners of today's sailing charts, which form the basic climatology for sea route planning. The combination of observations at sea and modern radio communication supplies the essential information for forecasts and short range adjustments of the ship's course. A review of Sunbelt Dixie's 1982-83 turnaround voyage confirms the blending of time scales in practical ship routing.

Sunbelt Dixie departed from Port Canaveral, Florida, on 23 December 1982 after loading 264,000 cases of grapefruit. Islands and reefs on the route from east-coast Florida to Panama limit the choices, except that winds and currents favor a course between Cuba ahd Haiti. From the Panama Canal the ship followed a tropical path with tailing trade winds and generally benign seas through the Hawaiian Islands and then northwestward to Japan. A strong extratropical cyclone off Japan moved fortuitously eastward in time to allow a genial approach and arrival at Tokyo on 17 January. After discharging grapefruit at Tokyo and Sakai (Osaka), the ship moved to Nagoya to take on 3,020 Toyotas and depart on 23 January. Skirting the succession of low pressure centers that plague North Pacific shipping in winter, Sunbelt Dixie headed eastward along the 35th parallel until it became expedient to seek a lower latitude and avoid heavy swell emanating from an extensive storm. This deviation added approximately 100 nautical miles to the Pacific crossing, which had already forsaken the great circle; it did not save the vessel from three days of continuous rolling. From a point northeast of Hawaii the route followed a great circle along the coasts of Mexico and Central America to Panama, experiencing a short period of roughness generated by a misplaced "Tehuantepecer" south of Costa Rica.

Overall, the trans-Pacific routes were compatible with the climatic averages of winds and currents. As would be expected, departures of air and sea temperatures from sailing chart means were greater near the continents and at the high latitudes.

Climate had a different kind of influence on return passage through the Panama Canal. Owing to a drier than usual winter in the normally winter-dry climate of Panama, the water level of Gatun Lake, which serves as the reservoir for lock chambers, was low. Combined with the routine repairs performed annually in the dry season, the need to ration water led to restricted canal traffic, including a maximum limit on ship draft. Sunbelt Dixie incurred a 36-hour delay while awaiting entry to the canal. To the extent that effective routing at sea can gain an advantage in the queue it can make a complete voyage more economical. Voluntary advance booking for Panama Canal transit, which was scheduled to begin in April 1983, should reinforce the economic feasibility of weather routing to and from the canal.

The last leg of the voyage--Panama Canal to Baltimore--was subjected to uncertainty similar to that off the coast of Japan a month earlier. An intense extratropical cyclone dropped 60 cm of snow on the upper Chesapeake Bay area on the weekend of 11-12 February, threatening to present difficulties in port. A subsequent slow-moving storm center off Cape Hatteras gradually shifted eastward to allow a relatively easy approach and timely arrival at Baltimore on 17 February. Given the lack of reliable forecasts a month in advance, it appears that the element of chance (luck?) must be factored into the routing equation--at least in this case.

Controlled Climate in the Holds

The maximum survival time between harvest of grapefruit in Florida and retail disposal in Japan is approximately two months, of which transport at sea accounts for nearly four weeks. Refrigeration maintains the temperature at the 11-12°C optimum in the ship's citrus holds. In order to slow desiccation relative humidity is kept at 85-90%; mist is sprayed into the holds if it falls below 80%. Recording panels on the bridge register temperatures at 80 thermistor sites and relative humidity at 8 hygristors. Other panels monitor carbon dioxide released by the fruit. The cardboard citrus containers are specially designed with narrow slots on top and sides to allow freedom of air movement. Fans circulate air in the holds to maintain homogeneous conditions and expel excess carbon dioxide and other organic gases. During loading and unloading electric cranes and battery powered forklifts are used to move stacks of citrus cases within the ship, thus avoiding the introduction of exhaust fumes.

The main consideration on the car decks is fire prevention. Fans expel vapors from fuel and exhaust continuously during loading or unloading of motor vehicles and can be activated in transit if necessary. Panels on the bridge monitor gas concentrations throughout the car holds. A carbon dioxide infusion system provides fire control capability.

Conclusion

The Marine Observations Program and the various reporting networks on land complement one another to form the basis for global weather and climate services. Recognizing the importance of weather reports and climatic records to shipping, the bridge officers of Sunbelt Dixie make regular 6-hourly observations while at sea. When communications services permit, these observations are radioed to shore stations to assist preparation of ocean forecasts and maps. During 48 days actually at sea on its 1982-83 winter turnaround the ship's radio D5BU scored 31 hits on the Northern Hemisphere Surface Weather Charts issued by the National Weather Service. Complete records of the ship's observations are provided to the Japanese Meteorological Agency and the U. S. National Climatic Data Center for archiving and climatological analyses. Sea surface temperatures and data on waves and swell are especially valuable for research on ocean-atmosphere interactions and the improvement of state-of-the-sea forecasts.

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SEED GERMINATION

by
E. Arlo Richardson
State Climatologist

As the recession intensifies and money for food becomes more difficult to obtain, the number of people who try to stretch their limited food dollar by gardening increases. The new gardener finds that there is much more to productive gardening than just putting a few seeds in the soil and watching the sun and the rain do their job. There is an art to gardening which is based on a knowledge of the environmental factors which influence the growth and development of each type of plant species from the time the seed is planted in the soil until time for replanting the harvested seeds the following spring.

Let's look at a few of the problems associated with seed germination. In reference to the vegetative growth of plants, each seed species also has a specific set of cardinal temperatures. These cardinal temperatures consist of a base temperature below which the seed will not germinate even if other environmental conditions are optimal; the optimum temperature, the temperature at which the maximum rate of growth or development will occur; and the critical temperature, the temperature above which little or no growth will occur.

Onions, endive and parsnips, for example, will begin to germinate whenever soil temperatures at the planting depth rise above 35 degrees F. Their maximum rate of growth occurs when soil temperatures climb to about 70 to 75 degrees. Broccoli, cabbage, kohlrabi, peas, beets, carrots, cauliflower, parsley and celery require soil temperatures of 40 degrees F or higher before germination will occur. The optimum temperature for germination is quite variable ranging from only 70 degrees F for celery and 75 degrees F for peas to between 80 and 85 degrees for the other species in this group.

Another group of vegetables among which are the asparagus, sweet corn and tomatoes requires temperatures of 50 degrees or higher for germination and their optimum temperatures range from only 75 for tomatoes and asparagus to 85 for corn. Most of the warmer temperature crops such as cucumbers, squash, cantaloupe, peppers and watermelons all require soil temperatures of 60 degrees or higher for germination with optimum temperatures ranging from 75 for cucumbers and lima beans to 85 for peppers and 95 for squash and watermelons.

The importance of having soil temperatures warm enough for good germination before planting cannot be overemphasized. Frequently, when seeds are planted in soils which have soil temperatures at or below the minimums required for germination, the seeds will lie dormant and may even rot before the temperatures warm up enough for them to germinate.

Additional information on the temperature requirements for germination can be found in most garden books.

There are many things that can be done to speed up the warming of the soil in the spring. First, fall plowing will allow frost to condition the soil and will enable the gardener to prepare the soil without having to turn over the soil and bring the cooler soil to the surface after the original surface layer has been warmed. Second, sprinkling ashes, dry soil or furnace cinders over the snow that may remain in the late spring to speed up melting and, consequently, more rapid warming. Third, by use of reflectors to increase the amount of energy reaching the soil and plastic mulches to help reduce the radiative losses from the soil at night.

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STATUS OF COOPERATIVE STATION NETWORKS

EASTERN REGION

	Networks as of 1-1-82						Networks as of 1-1-83						Net Change						Planned Network (a)
	a	ab	b	c	x	Total	a	ab	b	c	x	Total	a	ab	b	c	x	Total	Not Implemented
Connecticut	7	5	38	0	0	50	7	5	37	0	0	49	0	0	-1	0	0	-1	1
Delaware	4	2	3	3	0	12	4	2	3	3	0	12	0	0	0	0	0	0	0
Maine	32	15	41	0	0	88	32	16	41	0	0	89	0	+1	0	0	0	+1	6
Maryland & DC	22	7	22	26	0	77	22	7	22	26	0	77	0	0	0	0	0	0	0
Massachusetts	16	16	68	0	0	100	16	16	67	0	0	99	0	0	-1	0	0	-1	1
New Hampshire	8	19	54	1	0	82	8	19	53	1	0	81	0	0	-1	0	0	-1	1
New Jersey	7	13	60	12	0	92	6	14	59	12	0	91	-1	+1	-1	0	0	-1	0
New York	36	55	195	25	0	311	35	56	197	24	0	312	-1	+1	+2	-1	0	+1	7
North Carolina	46	44	99	14	0	203	44	46	98	14	0	202	-2	+2	-1	0	0	-1	1
Ohio	15	55	166	16	0	252	14	58	164	15	0	251	-1	+3	-2	-1	0	-1	1
Pennsylvania	12	74	237	11	0	334	13	75	235	11	0	334	+1	+1	-2	0	0	0	7
Rhode Island	1	3	3	0	0	7	1	3	3	0	0	7	0	0	0	0	0	0	0
South Carolina	28	31	55	20	0	134	28	31	56	19	0	134	0	0	+1	-1	0	0	0
Vermont	6	10	52	3	0	71	6	10	51	4	0	71	0	0	-1	+1	0	0	1
Virginia	34	42	124	8	0	208	34	42	123	9	0	208	0	0	-1	+1	0	0	1
West Virginia	14	48	97	1	0	160	13	49	97	1	0	160	-1	+1	0	0	0	0	0
TOTALS	288	439	1314	140	0	2181	283	449	1306	139	0	2177	-5	+10	-8	-1	0	-4	27

SOUTHERN REGION

	a	ab	b	c	x	Total	a	ab	b	c	x	Total	a	ab	b	c	x	Total	Planned
Alabama	29	50	86	5	0	170	27	50	90	5	0	172	-2	0	+4	0	0	+2	7
Arkansas	21	67	133	1	0	222	19	70	123	1	0	213	-2	+3	-10	0	0	-9	2
Florida	63	35	39	7	0	144	64	35	39	7	0	145	+1	0	0	0	0	-1	7
Georgia	36	49	125	7	0	217	36	50	124	7	0	217	0	+1	-1	0	0	0	3
Louisiana	25	41	119	3	0	188	26	42	118	3	0	189	+1	+1	-1	0	0	+1	8
Mississippi	22	58	122	4	0	206	20	61	121	4	0	206	-2	+3	-1	0	0	0	2
New Mexico	59	82	57	5	0	203	56	86	50	5	0	197	-3	+4	-7	0	0	-6	18
Oklahoma	13	96	203	2	0	314	13	98	200	2	0	313	0	+2	-3	0	0	-1	11
Tennessee	42	34	46	5	0	127	36	41	46	5	0	128	-6	+7	0	0	0	+1	0
Texas	106	235	512	29	0	882	104	239	501	26	0	870	-2	+4	-11	-3	0	-12	52
Puerto Rico	6	21	65	1	0	93	8	20	66	1	0	95	+2	-1	+1	0	0	+2	1
Virgin Islands	0	6	20	2	0	28	1	5	20	2	0	28	+1	-1	0	0	0	0	0
TOTALS	422	774	1527	71	0	2794	410	797	1498	68	0	2773	-12	+23	-29	-3	0	-21	111

CENTRAL REGION

	a	ab	b	c	x	Total	a	ab	b	c	x	Total	a	ab	b	c	x	Total	Planned
Colorado	15	138	125	6	0	284	18	142	122	6	0	288	+3	+4	-3	0	0	+4	56
Illinois	31	69	161	8	0	269	30	70	161	8	0	269	-1	+1	0	0	0	0	0
Indiana	24	51	92	13	0	180	26	52	95	12	0	185	+2	+1	+3	-1	0	+5	3
Iowa	12	94	197	4	0	307	11	94	200	4	0	309	-1	0	+3	0	0	+2	0
Kansas	9	105	320	4	0	438	9	105	319	3	0	436	0	0	-1	-1	0	-2	0
Kentucky	27	53	139	10	0	229	27	54	142	10	0	233	0	+1	+3	0	0	+4	0
Michigan	53	61	145	38	0	297	53	61	148	38	0	300	0	0	+3	0	0	+3	0
Minnesota	16	112	103	13	0	244	16	112	104	13	0	245	0	0	+1	0	0	+1	4
Missouri	9	109	183	9	0	310	10	110	184	10	0	314	+1	+1	+1	+1	0	+4	3
Nebraska	6	115	225	3	0	349	8	115	225	3	0	351	+2	0	0	0	0	+2	2
North Dakota	3	101	121	6	0	231	3	99	122	7	0	231	0	-2	+1	+1	0	0	4
South Dakota	12	94	75	3	0	184	11	95	75	3	0	184	-1	+1	0	0	0	10	11
Wisconsin	7	101	101	9	0	218	7	101	102	9	0	219	0	0	+1	0	0	+1	0
Wyoming	20	104	46	4	0	174	19	105	43	4	0	171	-1	+1	-3	0	0	-3	50
TOTALS	244	1307	2033	130	0	3714	248	1315	2042	130	0	3735	+4	+8	+9	0	0	+21	133

WESTERN REGION

	a	ab	b	c	x	Total	a	ab	b	c	x	Total	a	ab	b	c	x	Total	Planned
Arizona	39	110	54	5	0	208	34	108	52	12	0	206	-5	-2	-2	+7	0	-2	56
California	134	127	385	20	0	666	135	127	376	21	0	659	+1	0	-9	+1	0	-7	18
Idaho	34	81	49	14	0	178	33	81	48	15	0	177	-1	0	-1	+1	0	-1	39
Montana	36	174	156	6	0	372	34	175	155	6	0	370	-2	+1	-1	0	0	-2	53
Nevada	40	60	13	1	0	114	40	60	13	1	0	114	0	0	0	0	0	0	78
Oregon	10	159	178	12	0	359	11	157	175	10	0	353	+1	-2	-3	-2	0	-6	12
Utah	43	85	78	7	0	213	43	86	75	8	0	212	0	+1	-3	+1	0	-1	30
Washington	51	70	146	5	0	272	48	69	143	5	0	265	-3	-1	-3	0	0	-7	16
TOTALS	387	866	1059	70	0	2382	378	863	1037	78	0	2356	-9	-3	-22	+8	0	-26	302

ALASKA REGION

	a	ab	b	c	x	Total	a	ab	b	c	x	Total	a	ab	b	c	x	Total	Planned
Alaska	123	31	53	2	0	209	124	28	55	2	0	209	+1	-3	+2	0	0	0	62

PACIFIC REGION

	a	ab	b	c	x	Total	a	ab	b	c	x	Total	a	ab	b	c	x	Total	Planned
Hawaii & Pacific Islands	0	52	267	16	0	335	0	53	280	4	0	337	0	+1	+13	-12	0	+2	2
Grand Totals	1465	3469	6252	429	0	11615	1442	3505	6219	421	0	11587	-23	+36	-33	-8	0	-28	637

(Also included in this table are 577 first-and second-order stations with network designations)

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*****EQUIPMENT COUNT*****

ALL REGION — 1/11/1983

TOTAL NUMBER OF STATIONS.	11587
NUMBER OF STATIONS WITH:	
STANDARD MAX/MIN THERMOMETERS	5101
THERMOGRAPHS	303
HYGROTHERMOGRAPHS	254
OTHER TYPES OF THERMOMETERS	214
STANDARD RAIN GAGES	8953
UNIVERSAL RAIN GAGES	1087
FISCHER & PORTER RAIN GAGES	2201
TIPPING BUCKET RAIN GAGES	165
STORAGE RAIN GAGES	25
PLASTIC OR WEDGE RAIN GAGES	132
OTHER TYPES OF RAIN GAGES	53
NWS-OWNED RIVER GAGES	1539
AHOS/T'S -- RIVER AND/OR RAIN GAGES	485
RIVER GAGES ONLY	167
RAIN GAGES ONLY	258
BOTH RIVER AND RAIN GAGES	60
AHOS/S'S -- RIVER AND/OR RAIN GAGES	68
RIVER GAGES ONLY	13
RAIN GAGES ONLY	37
BOTH RIVER AND RAIN GAGES	18
BOT'S -- RIVER AND/OR RAIN GAGES	367
RIVER GAGES ONLY	205
RAIN GAGES ONLY	148
BOTH RIVER AND RAIN GAGES	14
TELEMARKS -- RIVER AND/OR RAIN GAGES	366
RIVER GAGES ONLY	359
RAIN GAGES ONLY	7
BOTH RIVER AND RAIN GAGES	0
VHF -- RIVER AND/OR RAIN GAGES	65
RIVER GAGES ONLY	19
RAIN GAGES ONLY	33
BOTH RIVER AND RAIN GAGES	13
OTHER TYPES OF TELEMETRY -- RIVER AND/OR RAIN GAGES	50
RIVER GAGES ONLY	26
RAIN GAGES ONLY	24
BOTH RIVER AND RAIN GAGES	0
SNOW STAKES	206
GREEN (ADIRONDACK) SNOW DENSITY KITS	45
FEDERAL (MOUNT ROSE) SNOW SAMPLERS	13
OTHER SNOW EQUIPMENT	141
PALMER SOIL THERMOMETERS	271
OTHER (OR UNSPECIFIED) SOIL EQUIPMENT	117
EVAPORATION EQUIPMENT	447
OTHER MISCELLANEOUS EQUIPMENT	588

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COUNT OF SUBSTATIONS AND SERVICES
ALL NETWORKS

ALL REGIONS 1/10/1983

SUBSTATIONS

NUMBER OF SUBSTATIONS BY NETWORK: A-1442 AB-3505 B-6219 C-421 X-0	11587
NUMBER OF STATIONS WITH PAID SERVICES	4137
NUMBER OF STATIONS WITHOUT PAID SERVICES	7450
NUMBER OF STATIONS HAVING ASSOCIATE SERVICES	806
FIRST AND SECOND ORDER STATIONS	577

SUBSTATION SERVICES

NUMBER OF STATIONS HAVING THE FOLLOWING SERVICES:

BOTH TEMPERATURE AND NON-RECORDING PRECIPITATION	5572
NON-RECORDING PRECIPITATION WITHOUT TEMPERATURE	3201
STORAGE GAGE	32
FC-1 PRECIPITATION (RECORDING AND/OR NON-RECORDING) STATIONS	2866
HOURLY PRECIPITATION STATIONS (RECORDING PRECIPITATION)	3199
SPONSORED BY SSE	390
SPONSORED BY SSE (FC-1)	2545
SPONSORED BY OTHER GOVERNMENT AGENCIES	144
ASSOCIATE STATIONS	120
SUBSTATIONS WITH BOTH DAILY AND HOURLY PRECIPITATION SERVICES	1981
CROP REPORTING STATIONS	563
RIVER AND/OR RAINFALL REPORTING STATIONS	5700
RIVER STAGE REPORTS ONLY	1008
RAINFALL REPORTS ONLY	3641
RIVER STAGE AND RAINFALL REPORTS	1051
EVAPORATION STATIONS	447
TELEMETERED STATIONS	1370
AUTOMATED HYDROLOGICAL OBSERVING SYSTEM (AHOS)	552
AHOS/T	485
AHOS/S	68
SPECIAL REPORTING STATIONS	294
MISCELLANEOUS (SNOW DENSITY, SPECIAL METEOROLOGICAL)	439
NUMBER OF PUBLISHING STATIONS THAT HAVE THESE SERVICES:	
TEMPERATURE	5324
DAILY (OR STORAGE) PRECIPITATION	8184
HOURLY PRECIPITATION	3021
EVAPORATION	426
SOIL TEMPERATURE	308
TOTAL NUMBER OF STATIONS PUBLISHED	9359

USCOMM-NOAA-ASHEVILLE, N.C. 4/83/450

DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
ENVIRONMENTAL DATA AND INFORMATION SERVICE
NATIONAL CLIMATIC CENTER
FEDERAL BUILDING
ASHEVILLE, N.C. 28801