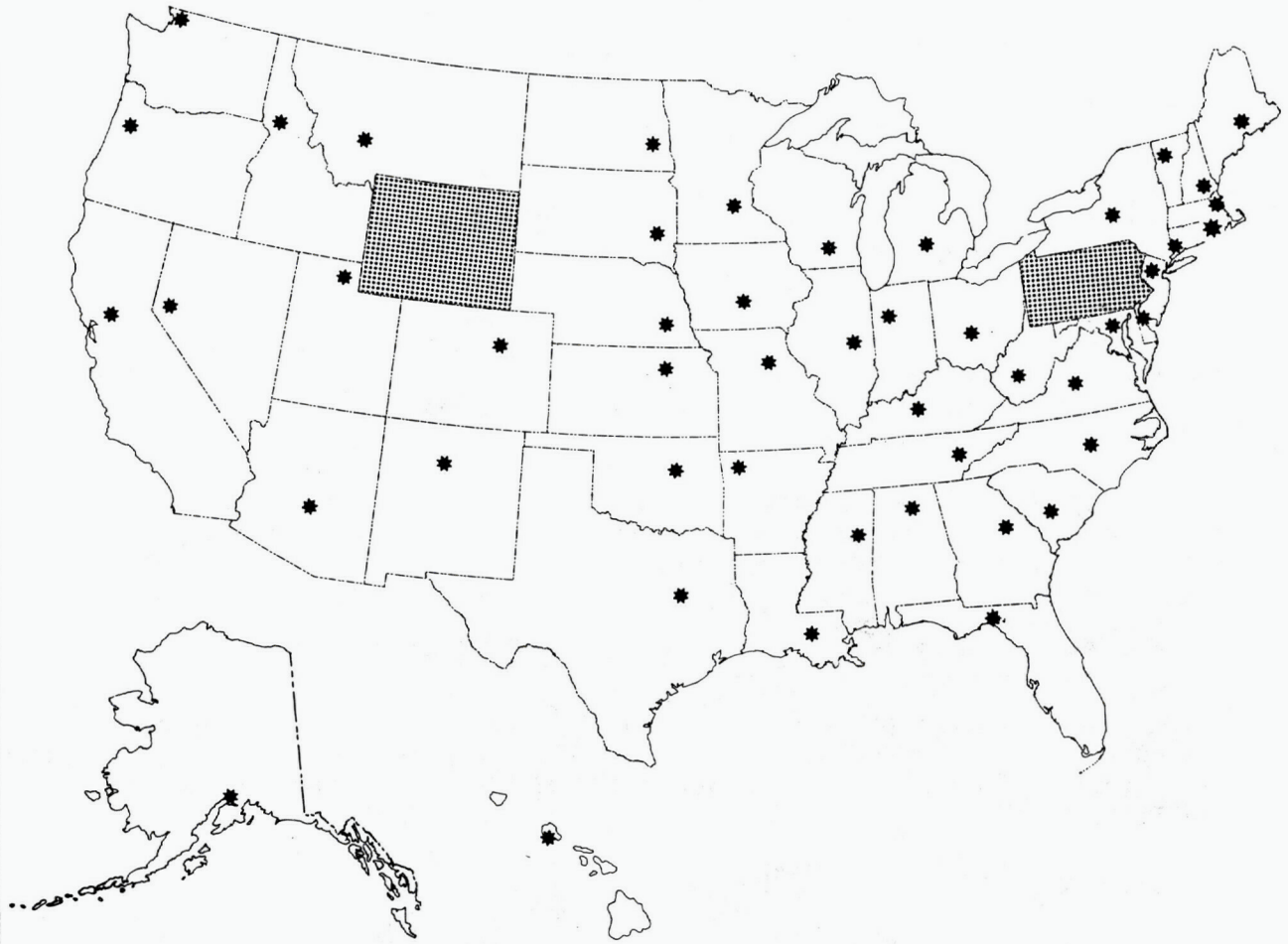
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE
NATIONAL CLIMATIC DATA CENTER

THE STATE CLIMATOLOGIST

IN COOPERATION WITH THE
AMERICAN ASSOCIATION OF STATE CLIMATOLOGISTS



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Data Processing Systems

In January 1984 the NCDC implemented two new, improved data processing systems. The new Surface Data Processing System and Hourly Precipitation Data Processing System culminate 18 months of work by members of the Program Development Staff in the Systems Integration and Planning Office of NCDC.

Surface Data Processing

This system processes hourly data from nearly 400 National Weather Service First Order, FAA, and Navy stations. It is designed to run on the Digital Equipment Corporation VAX 11/780 computer and marks NCDC's entry into the world of interactive data processing on an operational basis.

The following is a list of system highlights:

° Increased efficiency, allowing the system to run using less than half the people as the old system.

° Design and implementation of more than 350 quality control algorithms which check the physical/climatological limits, internal and time consistency, and perform cross-checks of all input data.

° Creation and use of a Master Station Index (MSI) containing processing information for each reporting station. For example, the MSI stores climatological limits for data elements which are used in the quality control process.

° Design and implementation of an interactive editor which allows for corrections to be applied to the data at a computer terminal which highlights erroneous information. Each change made interactively, by the NCDC validator, is quality controlled immediately with the results instantaneously available.

Hourly Precipitation Data Processing

The new HPD system processes data from approximately 3,000 rain gauges scattered across the United States. It is also a highly interactive system which utilizes three computers, a Data General Eclipse S/140, the VAX 11/780, and the Sperry 1100/12.

Due to the nature of the input data media, paper tapes and charts, the new system is still a manually intensive one. However, the philosophy of the new system is to accomplish much of the work interactively, using the Eclipse computer, in the beginning stages of the monthly processing cycle. This approach reduces the amount of quality control required in the later stages of processing, thus reducing greatly the redundant examination of the original data media.

System highlights follow:

° 30 percent reduction in the personnel required to process the data.

° Interactive pre-analysis of data to discover problems and document them via an Inventory/Comment (I/C) file.

° Interactive translation and digitization of input data.

° Automatic detection and filtering of instrument problems.

° Creation of daily and monthly precipitation climatology information which is used in the quality control process.

° Creation and use of a Master Station Index containing processing information for each reporting station.

iques to edit/update the monthly processing files

° Development of techni interactively.

a major step forward for the NCDC operations.

These systems provide a

PUBLICATIONS

abilities. The NCDC has issued a new supplement to the States No. 81 series: "Monthly Precipitation obability Levels Derived From the 1951-1980 Normals." e by state, with the 10%, 50%, and 90% probability ecipitation data given for stations which have 1951-80 n data. Users of precipitation data have found that ecipitation are the best estimates to use in ns; for example, the 50% level precipitation amount is pated precipitation than the average precipitation

Precipitation Proba Climatography of the United Probabilities - Selected Pr The publication is available level monthly and annual pr normal monthly precipitatio probability estimates of pr economic-related applicatio a better estimate of anticip amount for the period.

Series 3-1. "Atlas of Mean Winter Departures From the tiguous United States, 1895-1983" presents maps which tion of winter season temperature departures, relative the contiguous United States for each of the 89 e a statistical measure of the unusualness of these ardized departures (the seasonal values minus the he standard deviation).

Historical Climatology Long-Term Mean Over the Con depict the spatial distribut to the long-term mean, over seasons. The maps also giv departures by showing standa long-term mean divided by t

hy Series 6-1. Climatographies for state-wide averages on, heating and cooling degree days, and for state-wide Palmer Drought Indices have been printed for the 48 iod of record for each state begins in the late 1800's with individual year/month values and ranking included. presented.

Historical Climatograp of temperature, precipitati and divisional averages of contiguous states. The per and continues through 1982 Time series plots are also

These publications may be purchased from the National Climatic Data Center. The Historical Climatology Series 3-1 is $4.00 the HCS 6-1 is $5.00 per state, and the Monthly Precipitation Probabilities is $1.00 per state. Orders may be placed by telephoning 704, 259-0682 or by writing the National Climatic Data Center, Federal Building - MC-05, Asheville, NC 28801-2696.

OTHER PUBLICATIONS FROM THE STATES

Climate Fluctuations in Illinois: 1901-80. This 73 page publication covers many different aspects of the Illinois Climate over the past 80 years. In addition to discussing changes in average precipitation and temperature the publication also covers other subjects as hail, droughts, length of growing season, snowfall, sunshine, visibility, and more. The publication was done by Stanley A. Changnon, Jr. and the Illinois State Water Survey.

Climate at the Northeast Research Station, St. Joseph, Louisiana 1931-80. This publication was done by Richard C. Thompson, Robert A. Muller, and Stephen H. Crawford through the Louisiana State Agriculture Experiment Station. The 39 page publication has both graphical and tabular presentations of agriculturally related climatic parameters.

Extreme Weather History and Climate Atlas For Alabama. Mr. E. A. Carter (former Alabama State Climatologist) and V. G. Seaquist have published a several hundred page book that covers not only extreme weather events that have occurred in the state of Alabama but tables of normal conditions for selected stations as well. Some of the significant events are documented through damage photographs, radar, and satellite imagery.

Persons interested in Nevada and Great Basin climate should be aware of two recent publications by the Geography Department, University of Nevada Reno. In December 1983 the Great Basin Climatological Station Index was released and sent to over 100 users in and out of the State. It is a compilation of the sources of all known current climate records in Nevada and some adjacent areas, including many previously unpublished (in fact unknown by most) sources. This was accomplished by field, phone, and mail surveys all over Nevada, in order to locate weather observers. This publication will be periodically updated to reflect changes.

In February 1984 the first of an annual series are released - Monthly Precipitation Data for a Portion of the Great Basin for the 1982-83 Season. This includes data for those weather stations that had information available for the past season. One interesting note about some data from this publication, at least for those that believe Nevada receives little precipitation - two stations in south-western Washoe County in the Carson Range between Lake Tahoe and Reno, had over 90 inches of precipitation during the 1982-83 season!

The Great Basin Project has been funded by the UNR Mountain and Desert Research Fund (major portion) and Department of Geography. If you would like copies of either of these publications please contact:

Prof. John W. James
Great Basin Climate Project Director
Department of Geography
University of Nevada
Reno, Nevada 89557

Monthly Narratives for the Climatological Data (CD) Bulletin

For many years NCDC has published the narrative summaries from the State Climatologist in the Monthly (CD) bulletins. These narratives enhance the utility of the publication and provide valuable documentation of contemporary climate, and our perceptions of it for future researchers. As is mentioned below, these narratives should be restricted to unusual or outstanding weather during the month.

Ideally, there should be only one monthly narrative for each state (no annual narratives are planned). If a state has no SC, SCs of adjacent states are encouraged to coordinate among themselves or a regional center and provide a single narrative. If multi-state narratives are submitted, please assure that they cover only those states published in a single CD issue.

Following are some guidelines for the preparation of a narrative for the CD publication:

1. Monthly narrative summaries may be prepared for inclusion in the Climatological Data bulletin whenever justified by occasions of unusual of outstanding weather during the month. The summaries should supplement the tabular data, but not repeat them except to stress some point, or to clarify the discussion.

2. Examples of events worthy of narration are floods, droughts, hurricanes, periods of significant departures from normal temperatures, outstanding freeze events resulting in heavy crop damage, unusual snowfalls, periods of storminess, etc. Storms and resulting damage need not be detailed as in the Storm Data reports, but only described in general terms.

3. The length of the narrative typically would be one page, and should not exceed two. Traditional composition style for a general audience is recommended. Please avoid using abbreviations, acronyms, or technical terms unless they are clearly defined. To assure publication, narratives must reach the National Climatic Data Center by 40 days after the end of the calendar month.

Your cooperation in this effort will be greatly appreciated. It will serve to emphasize and strengthen the goals of NCDC and the SC's and will provide a tangible example of SC-NCDC exchange.

* * * * * *

We are deeply saddened to report the passing on February 10th of Richard O. Gifford, from complications of leukemia, following a long sporadic bout with the disease. Dick had been Nevada State Climatologist since 1972, and was also a Professor of Plant, Soil and Water Science at the University of Nevada, Reno.

He was born in Newark, Delaware, July 11, 1932, received his B.S. from the University of Delaware in 1954, an M.S. from the University of Maryland in 1956, and the Ph.D., also from the University of Maryland, in 1960. He had been at UNR since 1959.

He is survived by his wife Dona, and three grown daughters, Beth Taylor and Mary of Reno, and Gwen of San Jose.

Dick was known as a fine teacher and an enthusiastic and diligent researcher.

He will be sorely missed by all those who know him.

A memorial is being established with the Clinical Cancer Research Fund, University of Nevada, Reno, School of Medicine, Reno, Nevada 89557.

John James

We also regret the passing of Mrs. Corrine Court (wife of Arnold Court) on February 10, 1984. Those of us who know Arnold offer our sincere condolences in his hour of loss. Mrs. Court was 69 years of age and died of a massive lung infection. We understand that the family is asking any monetary remembrances be contributed to the American Lung Association.

Grant Goodge

* * * * * *

Leonard Perry, who has been acting as the Assistant State Climatologist, has recently been given the title of Vermont State Climatologist. In this new position, Dr. Perry will continue to serve as a resource person to anyone needing climate information for Vermont. Such requests may be as general as climate trends and temperature patterns for the state, or as specific as precipitation for a certain town over a given period. His office will also serve as a repository for climate publications such as Climatological Data for New England, monthly Vermont Climate summaries, Local Climatological Data for Burlington, Storm Data, and Precipitation Data for New England.

Dr. Perry is an Assistant Professor in the Department of Plant and Soil Science at the University of Vermont, as well as the Ornamental Horticulturalist Specialist with the Extension Service. He serves as a consultant for greenhouse and nursery professionals, landscapers, and garden center operators throughout Vermont. Home gardeners are assisted through his presentations, press releases in the Green Mountain Gardener, and radio and television appearances on Across the Fence.

In addition to his work with ornamental plants, and research with flower crops, he represents the University of Vermont on two Northeast Regional committees. One concerns the improvement of plant types through the use of germplasm. The other concerns the impact of climatic variability on agriculture. It is under this latter commitment that Dr. Perry has responsibility as State Climatologist as well as coordinating a program in lilac phenology. Each spring, 70 observers in Massachusetts, New Hampshire, and Vermont send in observations of when their lilacs came into bloom. This is then sent to a central computer where it is merged with similar recordings from the eastern United States Quebec. After 20 years of records, results are now being related to climatic information. Anyone interested in participating in this phenology program should contact Dr. Perry at the address on the front of this summary.

ASSISTANT DIRECTOR - NATIONAL CLIMATE PROGRAM OFFICE

The National Climate Program Office (NCPO), Rockville, Maryland invites application for a rotating position under the Intergovernmental Personnel Act (IPA). This IPA permits temporary assignment of employees between Federal agencies and State or local goverments, institutions of higher education, Indian tribal governments, the Trust Territory of the Pacific Islands, or other approved nonprofit organizations. Employees of a State or local government must be a permanent, career employee of that organization for at least 90 days prior to entering into a mobility assignment agreement with a Federal agency. Period of service is 1 year beginning October 1, 1984, with the option of a second year if mutually desirable.

The duties of the position are to review and help develop National and international Climate program plans; assist in planning, developing, and overseeing NCP project; and, advise in implementing climate related activities of the United States in bilateral projects and the World Climate Program (WCP) Candidates are sought with the following qualifications: (1) Ph.D in meterology or physical oceanography; (2) Experience in preparing and reviewing research plans; (3) Knowledge of activities of National Climate Program (NCP) and the World Climate Program (WCP) of the World Meteorological Organization (WMO); (4) Familiarity with applications of satellite data and technology to climate programs; and (5) Ability to communicate ideas through writing and oral presentations.

The NCPO under the IPA will negotiate salary, benefits and travel with the selectee's cooperating institution. A resume, three references and curriculum vitae should be submitted by May 1, 1984 to:

Dr. William A. Sprigg
NOAA/National Climate Program Office
Room 108, Rockwall Building
11400 Rockville Pike
Rockville, Maryland 20852

Telephone # - (301) 443-8981

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INVENTORY OF REQUESTS FOR CLIMATE INFORMATION IN COLORADO

by

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November 1983

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Fort Collins, Colorado 80523

INTRODUCTION

The Colorado Climate Center (CCC) has been in existence since 1974 with the purpose of providing information and expertise on Colorado's complex climate. The four major activities of the CCC are climate information services, data acquisition and archiving, climate monitoring, and applied research.

A detailed summary of requests for climate information has recently been completed. The project was initially undertaken to monitor the progress and growth of CCC's service activity, and to provide information on which to base program modifications. It has since proven invaluable in documenting the nature and importance of Federal-State interaction and cooperation in climate data collection and information dissemination.

SUMMARY OF INVENTORY

A. Number of Requests

Figure 1 shows a time series of monthly and annual requests. In 1977, the CCC answered 373 requests. The 1983 total will be more than

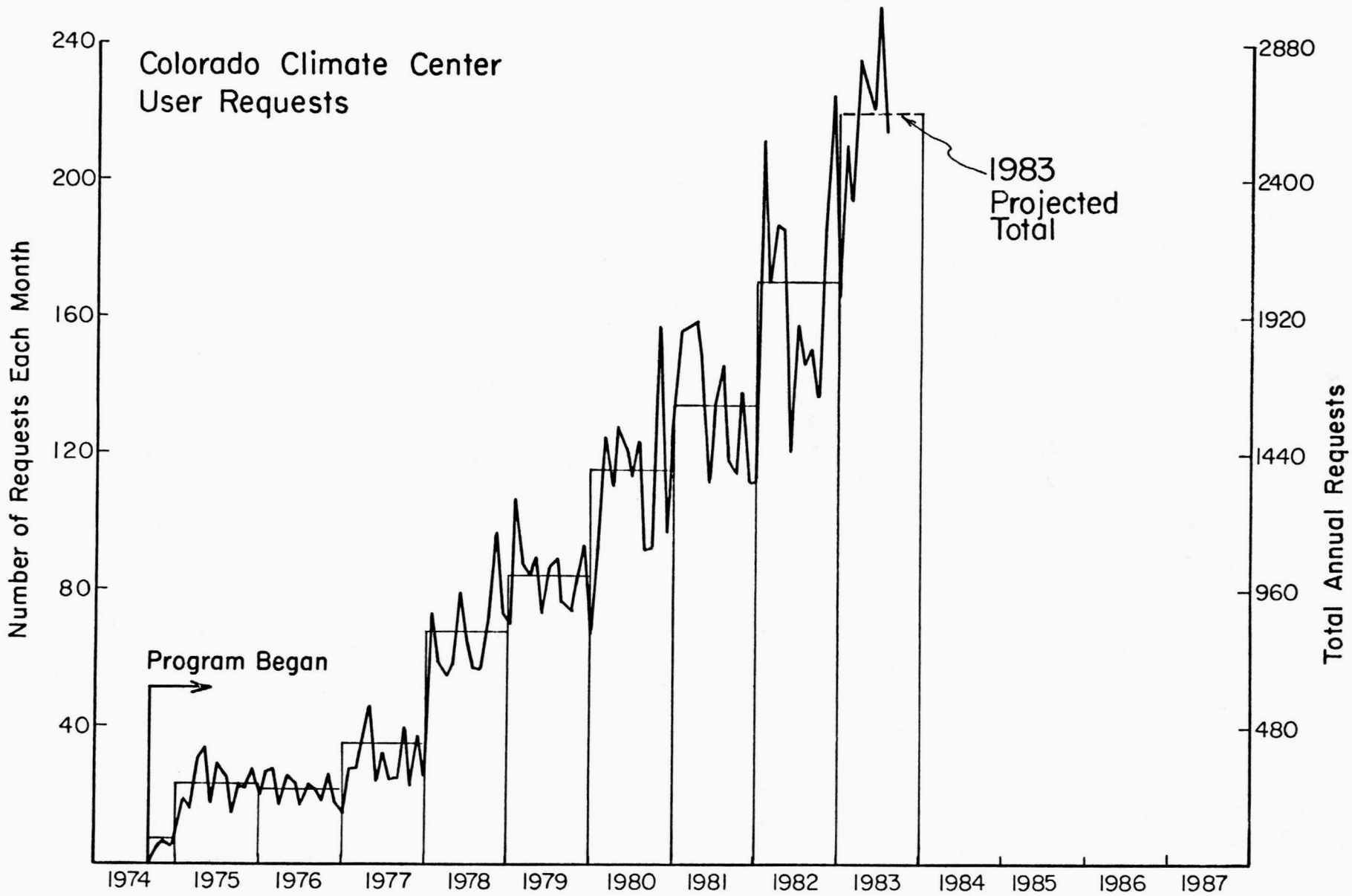
Colorado Climate Center
User Requests
Number of Requests Each Month
Total Annual Requests
240
200
160
120
80
40
2880
2400
1920
1440
960
480
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1983
Projected
Total
Program Began

Figure 1.

2600. There are several reasons for this tremendous growth. Colorado's population increased by 31% from 1970 to 1980 (based on 1980 census figures) and the growth has not stopped. At the same time, increased use of climate information has become a national pattern initiated in the 1970s by greater environmental regulations and also by skyrocketing energy prices. Completion of several publications, involvement in State climate monitoring activities, media interaction and the development of close ties with the National Weather Service and other Federal agencies have all worked together to greatly increase the visibility of the CCC.

B. Climate Information Users

The major categories of climate information users, and percentages of requests in each category over the past 5 years, are shown in Table 1. Five user categories account for nearly 2/3 of all requests. These are: 1) consultants and engineers, 2) universities, 3) federal users, 4) state and local government, and 5) individuals. Some interesting trends appear. For example, requests from individuals have shown a steady increase each year from 8.7% in 1979 to 12.6% in 1983. University requests, while growing at a slow rate numerically, have shown a marked percentage decline since 1979. This is apparently because university users became aware of the program early in CCC's lifetime and have already hit a plateau.

C. Information Use

The single greatest use of climate information in Colorado (and the fastest growing category) is for any of a vast assortment of operations and short-term planning activities (Table 2). A good example is the use of heating degree days for monitoring home, business, or public institution energy consumption. Although there are many exceptions,

TABLE 1.

Users of Climate Information in Colorado.
(based on climate requests received at the
Colorado Climate Center)

User class	Percent of total requests					
	1979[1]	1980	1981	1982	1983[2]	All
Business and Industry						
Agri-business	1.4	2.2	2.0	2.2	2.3	2.1
Architecture	1.4	1.0	2.2	1.7	0.6	1.4
Attorneys	2.1	3.0	2.9	3.6	3.1	3.1
Construction	3.1	4.0	2.6	4.2	11.7	5.3
Consulting and Engineering	16.0	18.8	20.1	17.4	13.3	17.2
Health	0.0	0.1	0.1	0.4	0.5	0.3
Individuals	8.7	9.9	10.3	10.8	12.6	10.7
Insurance	1.7	2.2	1.5	2.0	2.2	2.0
Manufacturing	1.2	1.1	0.9	1.2	1.3	1.1
Marketing	1.0	1.0	1.4	1.5	1.3	1.3
Media	3.7	8.5	7.1	5.0	4.1	5.8
Recreation	0.2	0.3	0.2	0.5	0.4	0.4
Transportation	0.0	0.2	0.4	0.4	0.6	0.4
Utilities	4.4	4.7	6.5	5.5	5.5	5.5
Mining	--	--	--	1.2	1.6	--
Other	1.4	2.5	2.6	2.6	3.9	3.9
Public and Government						
Federal	10.8	10.6	10.1	10.7	6.5	9.6
State and Local	10.4	7.8	6.5	10.9	11.0	9.3
Universities	31.3	20.9	20.9	15.7	15.4	18.7
Schools	1.2	1.1	1.6	2.0	1.0	1.5
Libraries	0.0	0.1	0.1	0.5	1.2	0.4
Total Percent	100.0	100.0	100.0	100.0	100.0	100.0
Total Number	482	1395	1609	2047	1557	7090

[1] based on July-December.

[2] based on January-July.

TABLE 2.

Uses and Applications of Climatic Data and Information Requested From the Colorado Climate Center.

	Percent of annual request					
	1979[1]	1980	1981	1982	1983[2]	All
Type of information use						
Policy making and long-range planning	8.5%	7.4%	10.7%	7.3%	5.5%	7.8%
Operations and short-range planning	32.8%	36.6%	32.9%	41.2%	50.0%	39.7%
Research	27.2%	18.7%	20.3%	14.6%	12.7%	17.1%
Design	6.8%	5.7%	8.9%	7.4%	5.9%	7.0%
Education	7.3%	5.1%	4.2%	5.0%	4.1%	4.8%
Documenting past record	7.9%	8.7%	6.3%	8.7%	8.1%	8.0%
General information	8.3%	14.6%	14.7%	14.0%	11.5%	13.3%
Other	1.2%	3.2%	2.0%	1.8%	2.2%	2.3%
Total percent	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total number in sample	482	1395	1609	2047	1557	7090
Application of information						
Energy consumption, conservation, and development	27.2%	24.5%	28.1%	28.1%	23.0%	26.2%
Water resources	18.0%	13.8%	16.2%	14.4%	16.1%	15.3%
Food and fiber	12.9%	9.3%	9.0%	7.4%	7.9%	8.6%
and use	11.2%	11.2%	9.0%	8.8%	7.9%	9.3%
ir quality	--	--	1.9%	2.4%	1.5%	--
ther	30.7%	41.1%	35.8%	38.9%	43.6%	40.6%
Total percent	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

[1] based on July-December, [2] based on January-July.

there tends to be a direct relationship between the user class and the type of information use.

Use	Major User
Operations and planning (40%)	All users except architects and attorneys.
Research (17%)	Universities, federal labs, and large industries.
General Information (13%)	Individuals.
Policy making and long-range planning (8%)	Federal, state and local government.
Documenting past record (8%)	Attorneys and insurance.
Design (7%)	Architects and engineers.
Education (5%)	Universities, schools and libraries.
Other (2%)	

D. Applications

Application categories (Table 2) were selected to try to distinguish between uses affecting or affected by major natural resources of Colorado. Energy is by far the largest resource application followed, in order, by water resources, land use, food and fiber, and air quality. Many requests do not fit well into these categories.

E. Climate Elements

Nearly 60% of all data-related requests are concerned with temperature and precipitation (rain and snow). Wind, solar radiation and cloud cover, soil temperature, and evaporation each account for about 9%. Hail, lightning, severe storms and other miscellaneous requests account for the remaining 5%.

F. Data Sources

The data source most often used by the CCC to answer requests is the National Weather Service (NWS) cooperative observer network. More than half (57%) of all requests make use of data and/or summaries from this source. NWS first-order stations are the second most frequently used data sources (37%) followed closely by the second-order/aviation network (36%). Other data sources include: other federal sources (10%), private data sources (8%), national solar radiation network (5%), upper air network (2%), satellite and radar (<1%). Seven percent of all requests are answered without the use of data. These percentages add up to much more than 100% because several sources are frequently used to help answer a single request.

G. No Data Available

Out of 1557 user requests from January through July 1983, no data at all were available to answer a request in only 111 instances (7%). The majority of these were requesting solar radiation, wind, or soil temperature data or were looking for specific data for remote mountainous areas.

Seven percent is an impressive but somewhat misleading statistic. Realistically, the ideal data or information to best answer a request was available less than half the time. Many requestors accept information although their preferred element(s) and/or location(s) are not available. Another common problem is that raw data frequently exist that could be used to answer requests, but in raw form they cannot be used. The cost of summarization is far beyond the resources of the individual user. Wind data, for example, frequently sit unused in chart form although the demand for that data in a summarized form may be very high.

H. Products Used to Answer Requests

The materials most often used by CCC personnel in answering requests are locally produced and unpublished computer summaries of climatological data. This is a distinct change from just a few years ago when NCDC publications were primarily used. Original records are the second most frequently used information source followed by NCDC publications, CCC publications, the CCC computer data base, and other publications. Use of the CCC computer data base for individual request answering has actually decreased over the past 2 years. This is a result of the fact that beginning in 1982 direct user access to the data base was permitted. To date there are no statistics on how frequently users are being served in this fashion.

I. Requests From/For Locations Outside Colorado

Of the 1557 requests answered by CCC in the first 7 months of 1983, 91.7% originated in Colorado seeking Colorado information. Three percent originated in Colorado seeking non-Colorado information. A total of 5.3% of the requests came from other states -- 4.4% seeking Colorado information. The remaining 0.9% originated outside of Colorado seeking non-Colorado information.

J. Service Charge

The CCC charges for services which require significant amounts of employee time and/or require use of facilities such as copy machines, computers, or microfiche printers. Consistent with our State mandate, user fees are kept as low as possible. Originally very few users were charged for services. This increased to 10.4% of the 1979 requests and now stands at 27% of the 1983 total. Income from user fees remains very small.

K. Referrals

The best way to answer requests is often to refer users to the most qualified individuals or agencies. During the first 7 months of 1983 10% (157) of all requests were referred to other sources. Of these 157 referrals, 4% were referred to the U.S. Forest Service, 5% to consulting meteorologists, 6% to the USDA Soil Conservation Service, 7% to NCDC, 8% to other State Climatologists and 29% to the NWS and other NOAA groups. The remaining 41% included referrals to the Colorado State University (CSU) extension service, other university personnel, the CSU weather station, and a wide variety of other sources.

L. Near Real Time

A large and growing number of requests are seeking raw data or summaries a few days or weeks after the data were collected. Table 3 shows the results of this inventory. This tremendous demand suggests a great need for data acquisition and dissemination systems designed to keep pace with industry information systems.

Table 3. Percentage frequency of requests requiring near real time data/information

Year	Total Number of Requests	Near Real Time	Percentage
1979	1010	313	31%
1980	1395	442	32%
1981	1609	576	36%
1982	2047	689	34%
1983*	1557	709	45%

* based on January-July.

COMPARISON WITH NCDC REQUEST INVENTORY

Through 1981, NCDC has kept thorough request statistics. Categories are not identical to the CCC inventory, so precise comparisons can not be made. Some general comments are in order, however.

NCDC has also experienced increasing numbers of requests. The annual number reached 64,313 in 1978 and continued to rise to 75,164 requests in 1981. Higher user fees and reduced budgets have, along with a sour national economy, now caused NCDC's request load to level off while Colorado's continues to rise.

The major users of NCDC's services are individuals (18% in 1981), engineers and consultants (14%), businesses (12%), Federal users (11%), and attorneys (9%). These account for nearly 2/3 of their requests. Engineers and consultants, Federal users and individuals are also in the top 5 in the CCC inventory. Beyond that, there are significant differences. There is not a user class "business" on the CCC inventory so that comparison is impossible. Attorneys and insurance requests form a much higher percentage of NCDC's request than at the state level. At the same time, CCC sees many more requests from universities, state and local governments, and utilities. Media only seldom make use of NCDC while media requests at the state level are common. Requests from agricultural concerns make up only a very small percentage of total requests both at NCDC and at CCC.

A few changes are also occurring. While still the number one user class at NCDC, request from individuals have begun to decrease. At CCC the reverse is true. Individuals account for a higher percentage of the request total each year.

The primary data sources used in request answering at NCDC are the synoptic/airways network (29% in 1981), first-order station data (24%) and the cooperative network (17%). These are also the primary sources at CCC but in the reverse order. Solar radiation data are only used to answer about 1% of NCDC's request. A much larger portion of requests received at the state level are solar related. The CCC uses data from other sources outside of NOAA with greater frequency than NCDC. NCDC is much different from CCC and most other state programs in that they also deal with many extensive sources such as radar, marine, and satellite data.

Further numerical comparisons are difficult to make due to incompatibility in the types of information inventoried. It is nevertheless apparent that there are marked differences between user services supplied by NCDC and CCC (and presumably other states). It can be implied that the roles of each organization are considerably more complementary than redundant.

CONCLUSIONS

The CCC request inventory provides excellent insight into the users and uses of climate information, the adequacy of present data, and the available products most often used to answer requests. For example, this inventory clearly documents the tremendous reliance on the NWS cooperative network. It also points out the need to collect more solar, wind, and soil temperature data and to work towards collecting and delivering data to users in more timely and effective ways.

This inventory must be kept in perspective. It is not a total survey of users and climate information needs -- only of those who made

the effort to contact the CCC. It did not address the multitude of users of published climate data and information who never contact NCDC or CCC. It also overlooks the growing number of major climate information users who are choosing to collect their own data and prepare their own information products. Finally, this inventory misses completely the "could be"/"should be" users who simply are not aware of available information and do not recognize a benefit of incorporating climate information into their activities. To complete the view of climate information users and needs in Colorado and the U.S. all of these groups must be considered.

IMPLICATIONS FOR THE NATIONAL CLIMATE PROGRAM

In the National Climate Program, NOAA has been given the responsibility to provide leadership in developing a nationwide program to improve dissemination and use of climate information. This inventory for Colorado has several important implications for such a program. While revealing specific changes and expansion in information use, differences between services at the State and Federal levels and complementary activities, it also suggests three broad general points which must be central to a national program:

- High quality consistent data are essential,
- Local climate expertise is effective,
- Technological advances are inevitable.

The cornerstone of any effective program to enhance the use of existing information is access to high quality data. The single most relied upon data source from our State's perspective and the source offering extremely great future potential is the NWS cooperative

network. Technological advances can and should be applied to this network as well as to the more elegant data gathering networks. Non-NOAA data sources also need to be incorporated into the national program.

Experience in Colorado indicates that a local contact with local expertise in climate is very important to users. Coupling this with the degree to which federal agencies use state information services is a clear sign that a cooperative effort between states and the federal government would be mutually beneficial and effective.

Finally, any national program must recognize the effects of technological change. These changes will affect data collection, data processing, and information dissemination and services. An effective program must be flexible enough to accommodate and encourage these changes. Right now the technology-related change which could benefit the most users is a system which reduces the time between data collection and user access to the data.

ACKNOWLEDGMENTS

This summary was made possible by a grant to the Colorado Climate Center from the National Climate Program Office of the National Oceanic and Atmospheric Administration, Grant No. NA 80AA-D-00118 and by the