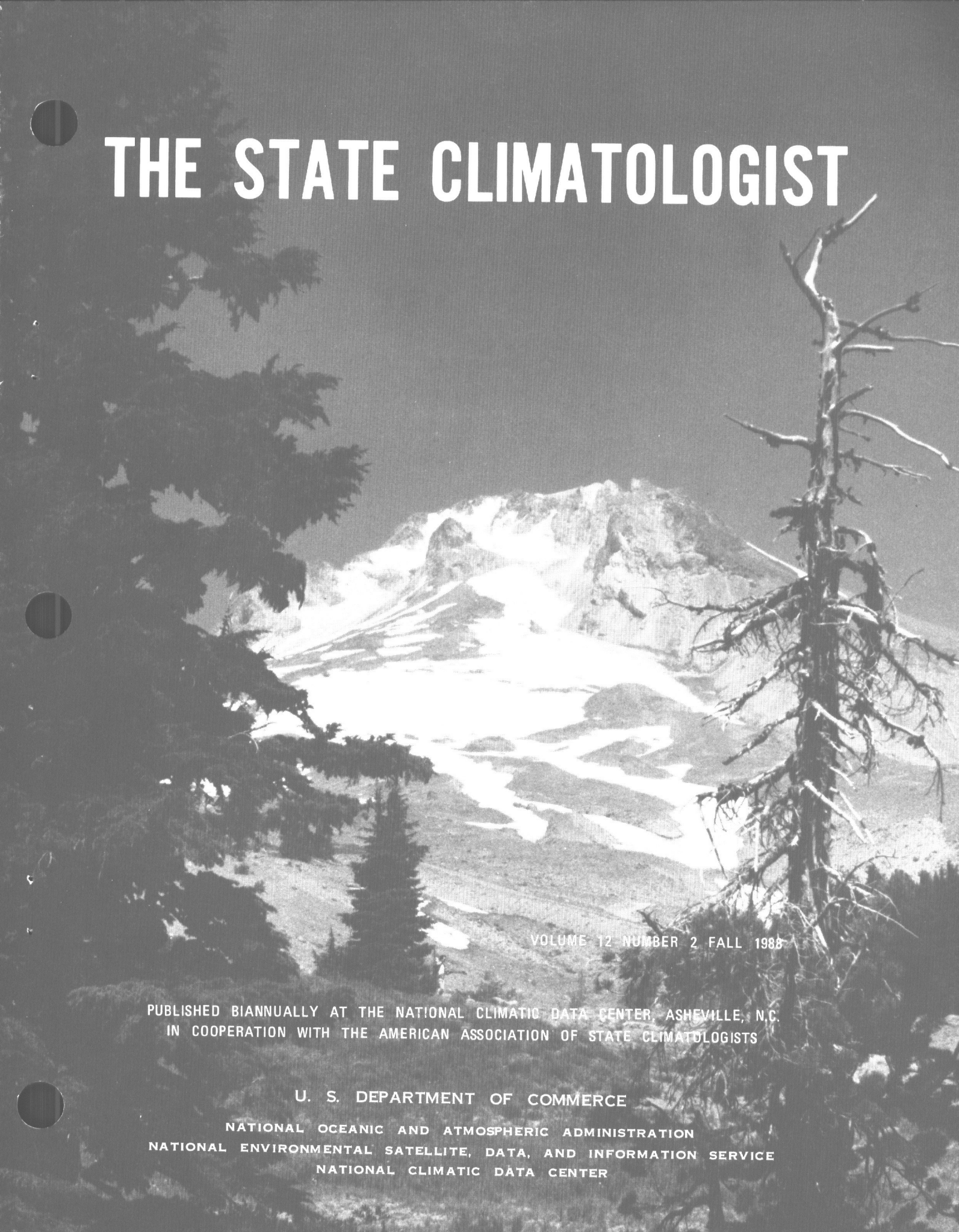
THE STATE CLIMATOLOGIST



VOLUME 12 NUMBER 2 FALL 1988

PUBLISHED BIANNUALLY AT THE NATIONAL CLIMATIC DATA CENTER, ASHEVILLE, N.C.
IN COOPERATION WITH THE AMERICAN ASSOCIATION OF STATE CLIMATOLOGISTS

U. S. DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE
NATIONAL CLIMATIC DATA CENTER

EDITOR'S NOTES

This issue is one of diversity. I hope you find the articles of interest. Perhaps a revelation or two will be discussed - the MMTS actually has less missing data than the CRS stations.

And then there are those articles that ask you to respond - see pages 15 and 25.

State Climatologist Exchange Program. The National Climatic Data Center and the National Climate Program Office will again sponsor the State Climatologist Exchange Program for 1989. By now, you should have received your announcement. There are several new faces among the State Climatologists, and some old ones who have not availed themselves of this opportunity. Deadline for applications is January 15, 1989.

John James, Nevada, has given the "Coat and T-Shirt Award" for August to Mountain City, Nevada. On August 22, 1988, they recorded a low of 20 degrees followed by a high of 86 degrees. Now that's climate change!

COVER PHOTOGRAPH: AASC's "unofficial" official photographer, Grant Goodge, certainly has captured the magnificence of Mt. Hood in this photo. Good shot, Grant. Just how do you ask a mountain to say cheese?

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ACTIVITIES OF THE NATIONAL CLIMATIC DATA CENTER'S "DROUGHT CENTRAL"

by

Richard Heim Jr.

The drought of 1988 certainly made its mark in the weather history books as one of the greatest weather events of the decade. Dry areas that were scattered across the west, north, and southeast at the beginning of the year came together during the spring to form an "inverted U" shaped pattern that covered roughly 40 percent of the nation at the drought's summer peak. Crops suffered as growing season rains failed, barge traffic came to a standstill as the Mississippi River and its tributaries reached record and near-record low levels, major forest fires burned out of control, and, in the northern Georgia mountains, thousands of century-old oaks, hickories, and other hardwood trees were dying.

A huge demand developed for current information on the drought and for information to put the drought into a historical perspective. This large demand prompted the National Climatic Data Center to establish a drought information response team. Team members were drawn from the DOD/Cooperative Data Branch, ISD/User Services Branch, Climatological Analysis Division, and SIP/Program Development Branch. An office (the Drought Information Center, also called "Drought Central") was opened in mid-June, into which the drought-related requests were funneled. The drought team disseminated information, performed historical analyses, and followed the development of the drought throughout the summer and fall.

Historical Comparisons

The current drought has been traced back to a period of dryness which developed in the southeast U.S. in 1984. The 1987-88 winter was unusually dry in the northern Plains and far West, and this dryness kept the national drought area statistics above ten percent. It was the dryness of spring and early summer 1988, however, which caused the most rapid expansion of the dry area (see Figure 1). The drought team examined precipitation averaged across the entire country and found that the April-June 1988 period was the driest for that period since at least 1895, the earliest year for which a national average can be reliably calculated (Figure 2). The April-June periods of 1934 and 1936 were second and third

driest.

The drought was accompanied by record-setting heat during the summer (June-August). When nationally-averaged temperatures were examined, the team discovered that the summer of 1988, based on preliminary data, tied for second hottest with 1934 (Figure 3). The hottest summer was 1936.

When the climate divisions were examined on an individual basis, it was found that fourteen percent of them recorded the driest ever April-June period in 1988 and about 13 percent had the hottest summer in 1988 (Figure 4). However, while much of the country was experiencing drought, about one percent of the climate divisions (basically parts of Louisiana and New Mexico) recorded the wettest summer in 1988.

The Hectic Telephone Schedule

As soon as its telephone number (704-259-0251) was released to the news media, Drought Central became deluged with requests for drought information. Numerous newspapers, including USA Today, the Washington Post, Washington Times, Los Angeles Times, Denver Post, and Kansas City Star, among many others, wanted to know the current status of the drought and how it compared to historical droughts. National media organizations, such as the North American Newspaper Syndicate, the Associated Press, U.S. News and World Report, ABC News Nightline, the Ophrah Winfrey Show, and the United Stations Radio Network, asked for data. The Natural History Magazine and the Encyclopedia Britannica needed maps and charts for special reports on the drought that they were preparing. Requests came in from the Illinois Power Company, the Illinois Department of Insurance, the New Jersey Department of Commerce, Energy, and Economic Development, the Pennsylvania Department of Community Affairs, several commodities trading companies, and even Blue Cross Blue Shield. Information requests are broken down by user type in Table 1.

Monthly precipitation and drought index values were needed by state and county Agricultural Stabilization Conservation Service (ASCS) offices and by the United States Congress for determining if and how drought disaster funds should be allocated. The Congressional Budget Office wanted to know how much rain was needed to end the drought and the probability of that occurring. The Senate Committee on the Environment and Public Works needed temperatures from several foreign cities to compile worldwide heatwave statistics.

Orders for climatic data were placed by university researchers and such organizations as IBM, Martin Marietta Aerospace, the Beefstake Tomato Growers Association, and Toro Company. The data ordered included tape dataset TD-9640, station COOP forms, the CLIMATOLOGICAL DATA publication, and

digital tapes containing county-to-climate division conversion tables and divisional mapping files.

Several requests originated from OUTSIDE the United States. Drought information was provided to a research agency in Hungary, a public broadcasting company in Japan, the University of Western Ontario, the BBC-London, and the Canadian Consulate General's office.

The greatest services-oriented impact upon NCDC operations came perhaps from requests from local attorneys, local farmers, the Illinois State Department of Insurance, and Chubb Insurance Group. Summer (June-August 1988) rainfall data for hundreds of COOP and HPD stations in a ten-state area in the Midwest were needed to settle drought insurance claims totaling into the millions of dollars.

Drought-related requests peaked in July (see Figure 5). The number of contacts dropped off as late summer rains fell and the drought waned. However, when the worst hurricane of the century, Gilbert, roared across the Carribean in September, NCDC became deluged with calls for historical hurricane information and the Drought Information Center became the Drought and Hurricane Information Center. There were many orders for diskette dataset TD-9697 and for the TROPICAL CYCLONES OF THE NORTH ATLANTIC OCEAN publication.

National and International Reports and Meetings

The drought team produced numerous time series charts, maps, and descriptive summaries to meet the demands placed upon it. Local, regional, and national temperature, precipitation, drought index, and hurricane statistics were summarized for the weekly Drought Advisory report edited by the Climate Analysis Center. Charts and summaries putting the drought and heatwave into a historical perspective were printed in the WEEKLY WEATHER AND CROP BULLETIN, WMO's CLIMATE SYSTEM MONITORING BULLETIN, and WEATHERWISE magazine ("About That Drought...").

Viewgraphs were made for NCDC staff attending numerous scientific meetings and workshops, including the Regional Fruit Growers Association Meeting, Water Management to Handle Drought: Government and Intergovernmental Responsibilities, Strategic Planning Seminar: The Drought of 1988 and Beyond, several regional agricultural group meetings, and many others. The drought team's limited staff was kept quite busy.

Computer Operations

Drought Central kept up with the current status of the drought by accessing the CAC's dial-in database every week via personal computer and modem. A FORTRAN program was written for

the PC that generated up-to-date weekly statistics on the drought, such as: 1) the weekly change in PDSI for each climatic division and an indicator showing if the division crossed into a new PDSI category that week, 2) the highest and lowest PDSI that week and their state and division, and 3) national statistics summarizing the number of divisions and areal percent of the U.S. i) having positive/negative/zero delta PDSI values and ii) currently in each PDSI category. The program proved so useful that CAC requested a copy of it.

The drought prompted the creation of an indexed file on mainframe disk containing the monthly temperature, precipitation, and drought index values for all 344 contiguous climatic divisions for the period 1895 to the present. The PDSI, PHDI, and Z index values were converted and downloaded to PC for operational real-time display. Maps showing the geographical extent of the drought for the U.S. or any region in a given month, and time series charts showing the temporal variation of the drought indices for a specific climatic division, were generated operationally by the PCMARS program and used to answer many requests.

Software was written to access the mainframe indexed file to 1) select all parameters for a specified division and year, 2) select all years for a specified division and parameter, 3) select all divisions for a specified year and parameter, and 4) produce demand-mode statistics that could be used to answer questions such as, which year had the hottest July for each division in the country, which year had the driest April through June for each division in the country, etc.

The mainframe indexed file was updated in three phases, in order to have current high quality monthly statistics. Preliminary divisional temperature and precipitation estimates were determined each month from the un-QC'd first and second order airport station data, obtained via modem from CAC. The Palmer drought program was run on this data to generate preliminary PDSI, PHDI, and Z index values for all 344 contiguous divisions. These first-guess values (NCDC AFOS) constituted the most current monthly statistics we could generate. The second update phase involved a first-look at the denser, but at this point un-QC'd, cooperative station network data. The cooperative network provides a better estimate of the divisional temperature and precipitation, but processing of the data takes several months. This second phase (NCDC prelim) allowed a preliminary look at the drought indices calculated from the cooperative data. The third update phase involved the final, validated cooperative station data. The "final" divisional drought values calculated from these data were considered to be the most accurate of the three sets.

The three sets of monthly values generated as specified above, plus the weekly PDSI values generated operationally on a real-time basis by CAC, were compared in a preliminary

examination to evaluate the accuracy of each set. The "final" COOP values were assumed to be the most accurate and were therefore used as the standard against which the others were evaluated. The "final" PDSI value for each division was subtracted from the corresponding value from each of the other sets. The mean of the magnitude of these differences is shown for each set in Table 2. Of the three estimates, NCDC preliminary comes closest to the "final" figures, NCDC AFOS is next closest, and CAC weekly has the greatest departure in mean absolute PDSI difference. Those CAC weekly divisions consistently having the greatest difference (3.0 points or more) are: California, division 3; Colorado, divisions 2, 5; Idaho, divisions 2, 4, 7; Kansas, division 9; Louisiana, divisions 8, 9; Oklahoma, division 4; Oregon, divisions 2, 5; and Washington, divisions 4, 6.

Table 2 also shows the areal percent of the country in severe and extreme drought for each set. The NCDC prelim and NCDC AFOS sets give the best estimates of the areal extent of the drought, each within two percent of the final value. The CAC estimates are 5 to 7 percent drier than the NCDC final values. These statistics reflect: 1) the importance of quality control of the data to minimize data and key entry errors, 2) the importance of a dense station network to more accurately measure convective precipitation, and 3) the difficulty of getting accurate climatic measures in mountainous regions.

Future Activities

During the cold season (late fall through early spring), evapotranspiration is at a minimum and soil moisture recharge is at a maximum; hence, droughts normally decrease in intensity during this period. The demand for information from NCDC's Drought Information Center will, likewise, diminish. But this is not necessarily the end of Drought Central.

Much has been accomplished by the drought team during the summer of 1988. The user contacts, new databases, and new software are the most apparent accomplishments. But more importantly, a structure has been established through which NCDC can respond to future climate anomalies. A generalized "historical perspectives information center" would be able to compare current heatwaves, coldwaves, snowy winters, and other climate extremes with records from the past so that we, as a nation, can better tell what HAS happened and how what IS happening fits into the overall historical picture.

Table 1. Breakdown of information requests by user type, June 15-October 21, 1988.

User Category	Percent of Total
Individual	5.8
Attorney	2.5
Insurance Adjuster	2.5
University Research	4.9
Non-University Research	3.0
Engineer-Contractor	3.1
Consulting Meteorologist	1.3
Other Consultant	7.5
Manufacturer	3.8
Utility Company	1.7
Transportation	.2
Agriculture	5.3
Other Business	5.2
NOAA Agencies	6.6
Department of Defense	1.6
United States Congress	1.4
Other Federal Government Agency	6.9
State/Local Government	5.0
Foreign Government	.9
Other Foreign	1.6
United States News Media	27.3
Education	.3
State Climatologist	1.6

Total Number of Information Requests = 637

Table 2. Comparison of drought statistics generated from four datasets.

		June 1988*	July 1988**
Mean absolute difference in PDSI values			
	NCDC prelim	NA	.16
	NCDC AFOS	.35	.74
	CAC weekly	.75	.92
Percent area in severe/extreme drought			
	NCDC final	32.4%	37.0%
	NCDC prelim	NA	36.6%
	NCDC AFOS	32.9%	38.6%
	CAC weekly	39.8%	42.2%

PDSI's based on 1931-1960 calibration period.
*CAC weekly = week ending July 2
**CAC weekly = week ending July 30

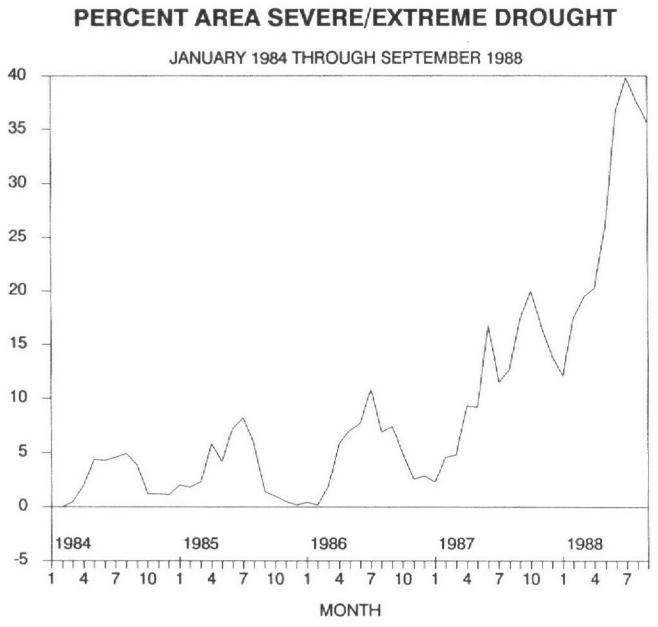

Fig. 1. Percent area of the United States experiencing severe and extreme drought, 1/1984-9/1988. Values are based on PDSI calibration period of 1895-1987. Values for August and September, 1988, are based on preliminary data.

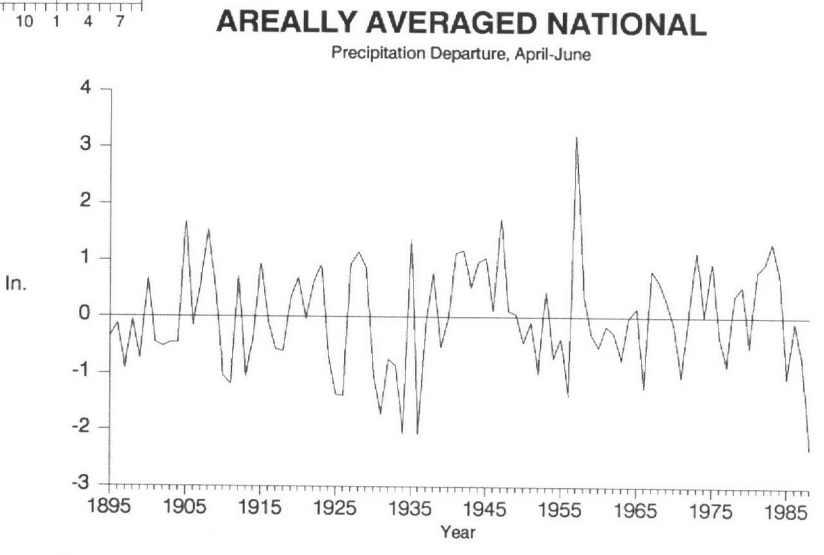

Fig. 2. Precipitation departure from the long-term mean, areally-averaged for the nation. April through June was the peak dry period in 1988.

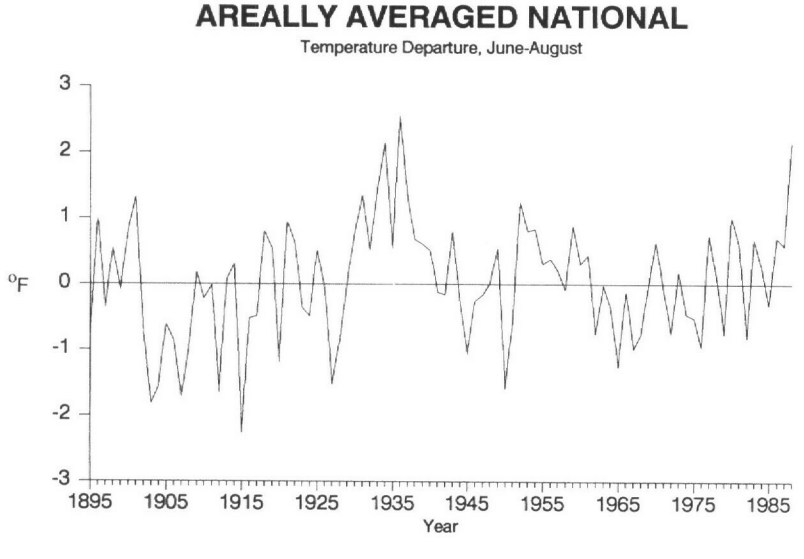

Fig. 3. Temperature departure from the long-term mean, areally-averaged for the nation. The heatwave of 1988 occurred during the June through August period.

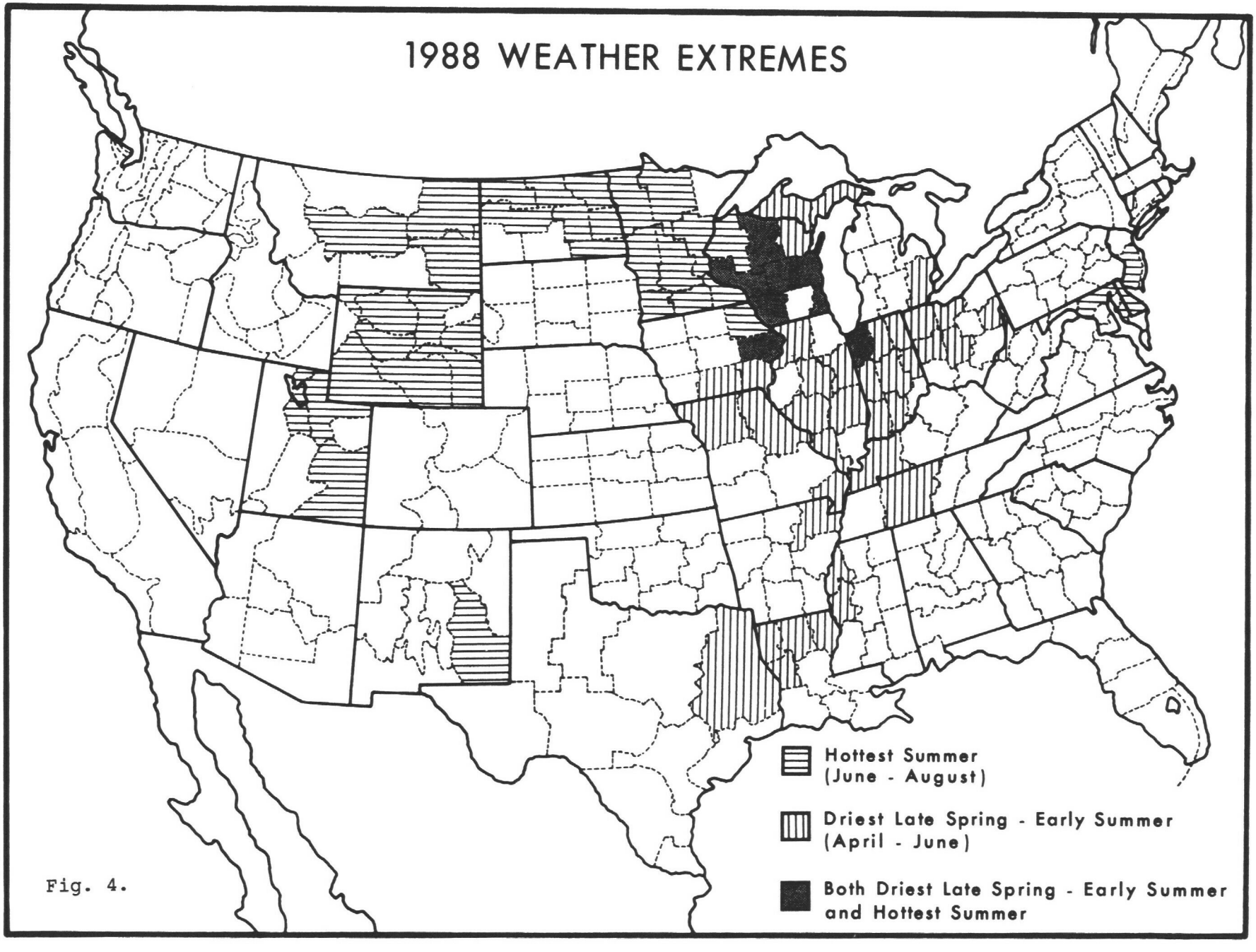
1988 WEATHER EXTREMES
Hottest Summer
(June - August)
Driest Late Spring - Early Summer
(April - June)
Both Driest Late Spring - Early Summer
and Hottest Summer

Fig. 4.

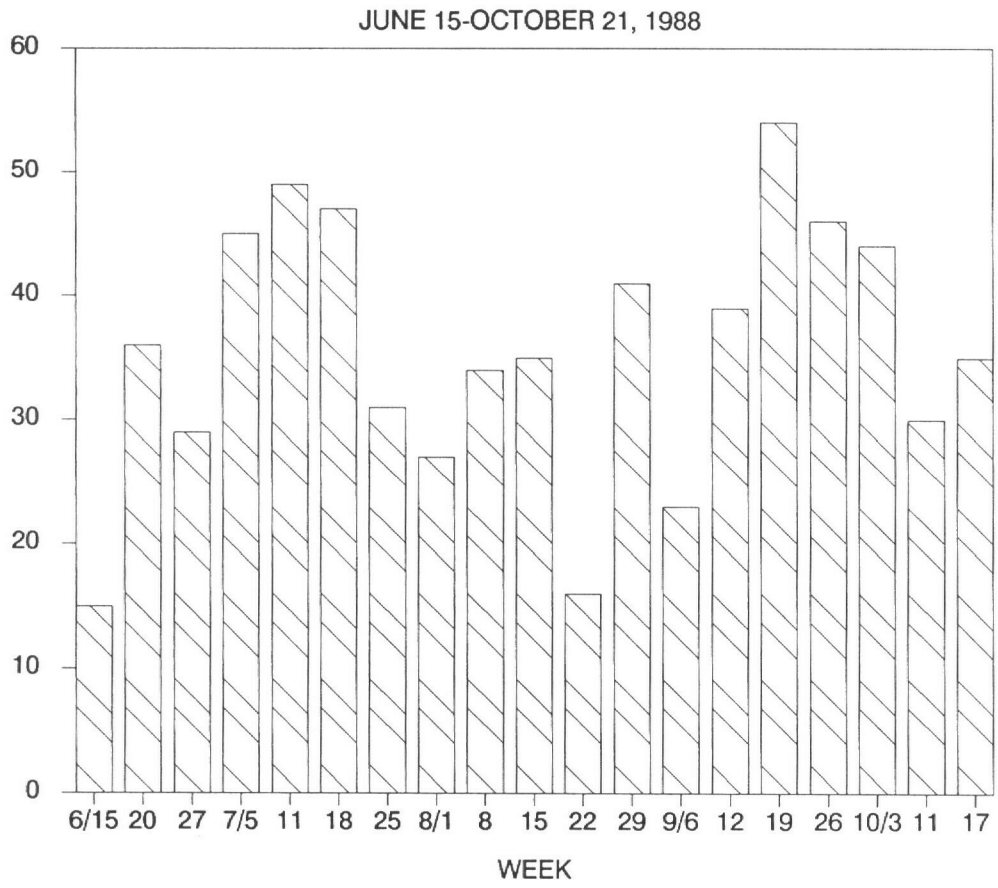
DROUGHT CENTRAL WEEKLY CONTACTS
JUNE 15-OCTOBER 21, 1988
60
50
40
30
20
10
0
6/15 20 27 7/5 11 18 25 8/1 8 15 22 29 9/6 12 19 26 10/3 11 17
WEEK

Fig. 5.

MMTS UPDATE

Rob Quayle, NCDC

The National Weather Service Cooperative Program Managers have been installing thermistor-type remote readout Maximum-Minimum Temperature Systems (MMTSs) since 1983. The new units replace Cotton Region Shelter (CRS) Liquid-in-Glass systems that were used for about a century. NWS Headquarters reports the following statistics, by Region, as of August 1988:

	MMTSs Installed	MMTS Failures
Eastern Region	418	429
Southern Region	761	640
Central Region	978	426
Western Region	581	246
Alaska Region	58	59
Pacific Region	43	31
National Total	2839	1831

The number of failures can be greater than the number of units installed when systems fail more than once. Despite the failure rate, CPM's are making repairs promptly and missing data rates are comparable to CRS installations, as will be shown below. The total number of MMTS units on hand for replacement and/or installation purposes is now about 1530, in addition to the 2839 already installed. The total number of Co-op Temperature Stations is 5636.

Of the stations for which we have adequate documentation, the following missing data rates were recorded for temperatures for April through August 1988:

2161 MMTS stations: 4.07% missing days.
1646 CRS stations: 4.20% missing days.

A missing max and/or a missing min was counted as a missing day. Highest missing data rates are during "vacation" months of July (MMTS = 5.53%) and August (CRS = 5.57%).

NCDC station history files do not specify temperature instrument type for about 1800 stations. NCDC is working with NWS to update station history information so that more comprehensive MMTS vs non-MMTS statistics can be prepared. Plans are being developed to compare temperature relationships between MMTS and non-MMTS stations for the MMTS and pre-MMTS eras. Those future studies should shed some light on the existence and magnitude of data biases, if any. Maxima, minima, means and variances will all be studied for various seasons and climates.

Co-Op Cutoff Question

At the behest of some cooperative program managers (CPMs), National Weather Service Headquarters and the National Climatic Data Center are considering an extension of the date when co-op forms can be mailed to NCDC. Presently, the cutoff date for receipt of data at NCDC is the 15th working day of the next month. After that date, monthly forms are considered late and data may not be published in the monthly Climatological Data (CD) publication. Delayed data are, however, keyed into the data base and included in the annual publication.

The change under consideration would still request that CPMs have data at NCDC by the 15th working day of the month following the data month. However, data would not be considered formally late and would be published if forms were received by the last working day of the month.

The advantages of the proposed system are that CPMs, who now have less staff support and more duties than in the past, would have a more flexible schedule. By extending the cutoff, more data would be published in monthly bulletins and placed in the current month's data base. The obvious disadvantage is the potential for further delaying publications and data base products.

If you have an opinion regarding this issue, you are welcome to submit it (before the Christmas Holidays, 1988) to:

Mr. Thomas Blackburn, W/OSO141x4
National Cooperative Program Manager
National Weather Service
Silver Spring, MD 20910

U. S. CLICOM

FALL 1988

INTRODUCTION

CLICOM has continued to grow and improve during the year since our last article in The State Climatologist. There are now 38 CLICOM sites within the United States and almost that many more throughout the world.

CLICOM VERSION 2.0

Clicom Version 2.0 was completed and distributed this spring. Some of the new features include: two new data sets (15 minute and 10 day data), the ability to derive 10 day data from daily data, two interactive tutorials, and an automatic CLICOM installation program. Enhancements to existing facilities include: redesigned indexed manuals, the ability to generate moisture variables, improved menus, and the support of the Microsoft mouse in the area QC program. Anyone still using Version 1.1A should consider upgrading. As of July 1, 1988 the CLICOM staff at NCDC no longer maintains a Version 1.1A on line. Support for this version has been terminated.

TRAINING

In July we held a 3 day CLICOM training session at the University of Illinois in Champaign. Eleven members of the Midwestern Regional Climate Center attended the class. Three CLICOM systems were set up for training and all participants were afforded an opportunity for "hands-on" experience. This on-site training had the added benefit of bringing together the regional users to discuss cooperative uses of the system with a CLICOM "expert" present to answer specific questions about the system. Our special thanks to Mr. Carl Lonnquist for all his efforts in arranging this session, and in making us feel welcome in Champaign. Contacts with Carl since the session have reinforced our feeling that the training was quite successful.

DATA AVAILABILITY

As a result of some new hardware acquisitions at NCDC, CLICOM formatted data is now available on the following six media:

1. 5.25" Floppy diskettes
2. 3.5" Diskettes
3. IBM 3363 Optical disk's
4. ISI 525WG Optical disk's
5. 1600 bpi tapes
6. 6250 bpi tapes

DATA COSTS

We are trying to keep these costs to a minimum so as not to restrict use of the CLICOM system by "small" users. Costs will vary depending on number of tapes accessed, number of diskettes produced, etc. We'll be glad to calculate specific costs for any data set/element/period-of-record you identify.

MORE INFORMATION

For more information on CLICOM contact:

Roger Bissinger or Wayne Brazille
Data Base Administration
National Climatic Data Center
Federal Building
Asheville, NC 28801

or call (704)-259-0387
or
FTS 672-0387

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AMERICAN ASSOCIATION OF STATE CLIMATOLOGISTS
MINUTES OF ANNUAL MEETING
TIMBERLINE, OREGON
AUGUST 2-4, 1988

The 13th annual meeting of the American Association of State Climatologists was called to order by President Pat Michaels (VA) at 0800. Approximately 60 attendees were present, including 29 state climatologists or assistants.

After a few words of welcome to the slopes of Mount Hood by Kelly Redmond (OR), Ken Kunkel (MRCC, IL) began the presentations, discussing issues relating to the use of "normals" and the best ways of communicating measures of central tendency and dispersion of climate data to users.

Peter Robinson (NC) spoke on approaches to strengthen state climate programs. Peter advocated a strategy somewhat like the development of a business plan. Ideally, in each state, mention of "climate" should automatically inspire an image of the state climate office. The usual spirited discussion engendered by both the speaker and the topic ensued, and a wide variety of viewpoints propagated through the air.

Howard Hill reviewed events of the past year at NCPO, noting in passing that "climate is on a lot of lips this year." Four regional centers covering 30 states have been funded, a fifth is in the works, and efforts are being expended to create a sixth and final center in the south central states. Alaska and Hawaii are not included in any of the present or prospective RCC's. Howard outlined the broad funding picture as well.

Dave Miller (CT) told about what's new in the Northeast. Bernie Dethier has retired from New York and is attempting to acquire a Maine accent as that state's new SC. Other topics included CLICOM and quality control, a way to disseminate climate data and information via an ARCINFO GIS, a new program to help community planners and local government officials, and a new Senate bill to establish Regional Marine Research Centers. Dave suggested that the AASC urge that existing climate units provide the climatological services these centers will need.

In his customary energetic manner, John Purvis (the SC SC), pointed out that coastal issues are a common thread of concern in the southeast region. The budding southeast center is assessing needs to guide future growth of the center. He stressed that the RCC's should act as conduits both from the local level up and from the top down.

Ken Kunkel discussed the Midwest RCC from a month's perspective. All states in the region are expected to have CLICOM by the end of the year. Ken spoke of the demand for fresh data brought on by the year's unprecedented drought. The

development of a computerized climate dissemination service directed primarily toward agriculture ("Agriclims") was his final subject.

Ken Hubbard (NE) talked about 1) AGNET, the realtime data acquisition system 2) AGRIPOD, a near-real time weather information system 3) AWDN, the Automated Weather Data Network 4) CLICOM 5) the use of optical disks, sold by US West and 6) UNIDATA. A set of slides drawn from the AWDN showed how the drought evolved in this state.

Bob Muller (LA) noted the trials and tribulations involved with obtaining the funding to establish the remaining regional center. Bob then reminded the audience, with a set of slides, of the intermingling of comedy and tragedy that characterizes certain data measurements.

Dick Reinhardt (WRCC) covered several goals of the Western RCC, among them 1) improved dissemination of climatic data, 2) interaction with federal agencies, 3) acquisition of other data sets and 4) development of climatic products. A Climatic Data Service Facility has been established to help access data validated by the states, as well as data from other observing programs.

Kelly Redmond (OR) described the procedure, currently operational in the 11 westernmost states, for injecting local expertise into the NCDC quality control path for temperatures. The philosophy, motivation and need for the approach taken were also covered. The minimal attention paid on the national scale to the vital area of quality control of climate data, and the importance of renewed commitment in this area, were stressed.

Myron Molnau (ID) followed with a discussion of the more difficult topic of quality control of cooperative precipitation data.

Grant Goodge (NCDC) described the frustrations of attemptimg to maintain a quality national database in the face of severe budgetary and manpower cutbacks. Grant conveyed a sense that these chronic problems will not improve without the influence of AASC and other users of climatic information.

Steve Doty (NCDC), substituting for director Ken Hadeen, continued by describing the dismal financial circumstances besetting NCDC. A budget shortfall of 15 percent of a $10 million budget was projected, and a staffing level of 230 one year ago was now reduced to 180-190. Busy signals for incoming callers have become much more frequent. Steve mentioned several other topics: the frost/freeze publications, CLIMAIL, the need to use the on-line data bases, the Historical Climatology Network, and the state climatologist exchange program.

Steve noted that nine states have new state climatologists, and that Wyoming had finally appointed someone to this position.

Only Pennsylvania remains without.

Howard Hill spoke for the audience in expressing thanks for the efforts of those operating within the difficult situation at NCDC.

As distant Mount Jefferson absorbed the remaining red rays of a setting sun, Allan Murphy spoke on "Climate Services in the 1990's". Thoughts occasionally drifted back to a dinner featuring what must have been the World's Best Chicken Ever.

The next day featured several invited speakers from other agencies. Harry Lins (USGS-Reston) spoke about new initiatives within the Survey pertaining to climate, the wish for stronger ties with state climatologists, and the "105" grants program. Roger Tucker (USFS-Washington (DC)) described the expanding appreciation of the role of weather and climate in Forest Service activities. Bruce Parks (USGS-Reston) talked about the National Water Data Exchange and the Master Water Data Index, among other subjects. Stan Fox (SCS Snow Survey-Oregon) described the SNOTEL system, an nearby example of which was later visited by many attendees. Ben Domenico (UCAR) reviewed the Unidata Program and demonstrated PC-McIDAS with a remote hookup to Boulder. US West displayed the operation of its optically based hydrologic and climatic data systems.

Pat Michaels (VA) spoke on climate variability and impacts, sharing his perspective on current climate anomalies and their interpretation.

Steve Doty (NCDC) emphasized that the Climatological Information Retrieval System at NCDC needs more use by SC's to remain in operation. Steve also asked for input regarding whether to institute a formal program to honor observers and stations with century-long records. Many (over 500) are near or beyond this point at the present time.

Claude Duchon (OK) talked about a network of 107 automated stations to be deployed in that state, and invited applications to fill the vacant position of OSC director.

Joe Caprio (MT) showed examples of his recently developed MAPS system for the state of Montana.

Tom Blackburn (NWS-Washington DC), in a superb display of comedic talent, told the assembly what he'd like to say, and followed that with what he had to say. A number of significant problems plague the MMTS program, the long-awaited observer handbook, and the recording rainguage network. The outlook for rapid resolution of these problems is not promising.

Jim Laver (CAC) reviewed activities at the Climate Analysis Center, with emphasis on the spring drought.

At 1430 the business meeting was called to order.

President Pat Michaels (VA) quit.

President Wayne Wendland (IL) began.

Wayne acknowledged the presence of several former SC's, including Joe Moyer, Jim Goodridge, Bernie Dethier (both a present and a former), Howard Critchfield, and Arnold Court.

The minutes of the 1987 meeting, printed in the Fall 1987 edition of The State Climatologist, were approved.

Kelly Redmond (OR), treasurer, reported a balance of $6485.73 on July 31 in the organization's account.

Dave Miller (CT) proposed a motion to the effect that the AASC take steps to prevent the further deterioration of quality control of the nation's cooperative climate database. An animated discussion followed. The general tone of the comments was quite sympathetic to NCDC, as the subject has been of longstanding and widespread interest to the membership.

After further discussion, the motion was amended to read as follows: The AASC executive board exercise pressure to reestablish quality control measures to the cooperative data at NCDC, including the possibility of legal action against NCDC.

President Wayne took pains to assure NCDC representatives that the AASC is taking these actions as a supportive measure, not as an adversary.

The motion passed unanimously.

Dave Miller (CT) offered a second motion:

The AASC executive board carry out whatever steps are necessary to insure that the Senate bill on establishment of regional marine centers include wording to insure that regional climate centers and state climate centers be funded to provide climate services for these marine centers.

The motion passed unanimously.

Peter Robinson (NC) moved that: The AASC appoint a task force to support and encourage festivities to mark the occasion of the centennial of the cooperative climate observer program.

Bernie Dethier (ME) offered an amendment that we support and encourage NC-94's efforts in this regard. The amendment passed with two nays.

The motion was then passed.

President Wayne then moved that: The statement on normals presented at the meeting (by Ken Kunkel) be re-drafted in the light of comments make here today and be given for publication in The State Climatologist, that comments be invited until the 1st of February, and that we seek dissemination in an AMS publication.

The motion passed unanimously after a short discussion.

Pat Michaels (VA) proposed a constitutional amendment to expand the definition of a voting member, as underlined:

IV. Membership

2. Any person who is currently recognized by the Director of the National Climatic Data Center and a state agency as an official State Climatologist, or director of a Regional Climate Center, shall become a Voting Member upon voluntary registration of his or her name and address with the Secretary of the Association, and payment of dues.

Of the 23 state climatologists in the room, 21 voted yes, and the amendment passed.

Jim Zandlo (MN) moved that: The Data Availability and Quality Committee be charged with preparation of a statement giving measures to insure that the quality of climate data be maintained and improved.

The motion passed. Nolan Doesken (CO) volunteered to participate in this endeavor.

Dave Miller and Bernie Dethier each boasted of their state's glories to woo the AASC for the next annual meeting. 16 voters swooned over Maine, 3 liked Connecticut, and the rest watched with bated breath.

The following associate members were nominated:

Mark Janzaruk	NV	Mork/Molnau
Sandra Brazel	AZ	Muller/ Miller
Townsend, Tom	MO	Wendland/Doesken
Vernon Meentemeyer	GA	Brazel/Michaels
Philip Suckling	GA	Brazel/Michaels
Caryl Silberman	NY	Eggleston/Hubbard
Charles Feris	OR	Redmond/Michaels
Phil Buffinton	IL	Redmond/Wendland
Thomas Schwein	MO	Redmond/Wendland
Paul W. Dailey	MO	Redmond/Wendland

The slate passed.

Nominations for next year's officers were presented:

Kelly Redmond (OR) - President
James Zandlo (MN) - Secretary/Treasurer

Both were approved unanimously. The room remained quiet.

A note of appreciation was sounded for the organizational efforts.

The meeting was adjourned, and members trooped off to reflect on the handiwork of both man and Nature, or catch a plane.

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MEMORANDUM FOR: State Climatologists

FROM: Ken Kunkel, Chairman, Instrumentation and Data Standards Committee

SUBJECT: Draft Statement on "Climatic Means and Normals"

Based on our discussion at the annual meeting at Mt. Hood, Arnold Court and I have revised the draft statement on "Climatic Means and Normals". Please review this revised draft and send me any comments by February 15, 1988. I will attempt to corporate all suggested changes. I will then submit the draft for publication to the Bulletin of the American Meteorological Society.

CLIMATIC MEANS AND NORMALS

1. Introduction

The members of the American Association of State Climatologists (AASC) work daily at the interface between the meteorological/climatological profession and the many climate-sensitive aspects of our society. As a result, we are keenly aware of the limitations of standard climatic information in truly addressing societal needs. Blind use of such information may be misleading for certain applications. Analysis of the situation by the applied climatologist will usually avoid such misuse. However, it is also useful to periodically review the suitability of standard climatic information for general use. The AASC recently conducted a review of work concerning the applicability of climatic averages. As a result of this review, the AASC made a number of recommendations to the National Climatic Data Center (NCDC) regarding possible changes to publications of climatic statistics. These recommendations address the following questions:

1) Are climatic means with averaging periods other than the traditional 30 years more appropriate for general use?

2) Is the use of the word "normal" when used to describe 30-year means inappropriate and misleading to non-climatologists?

3) What is the relative importance of other climatic descriptors, such as the median, standard deviation, percentiles, etc?

Although the following statement is directed primarily to NCDC, we hope that other AMS members involved in applied climatological activities will find it informative.

2. Statement

The term "normal" applied to climatic statistics has developed a specific meaning to climatologists: a 30-year mean beginning in the first year of a decade (e.g., 1951-1980). However, to many others, the term "normal" may imply that climate is stable and unchanging and that when considering a long enough period, temperature and precipitation values will be evenly distributed about the normal. The "normal" in this case represents a standard toward which climate statistics ought to converge.

Since a time series of climate variables can be dynamic and non-stationary, there is no basis in such an expectation. Indeed, a 100-year time series of temperature for the hemisphere, or portions of the U.S., usually shows a warming during the first 50 or so years, followed by a cooling trend thereafter.

Thus, climatologists may question whether the term "normal" should remain in our terminology. Has the term been overused and misused in the past, does it imply stationarity to the uninformed user, and has it therefore lost its specificity and credibility? There is no <u>a priori</u> reason why a 30-year mean is a standard of any particular physical significance.

On the other hand, use of the word "normal" is deeply ingrained in the language of the users of climatic data (e.g., "departure from normal"). Replacement of the use of the word "normal" will almost certainly bring about confusion among United States users and the general public. The cost of changing may not be worth the gain in linguistic accuracy. Therefore, a cautious approach is to retain the word "normal" for the present.

On a related point, 30-year means are certainly not optimum for all applications. Climate fluctuations occur on all time scales and 30-year means have no inherent stability.

Until well into the twentieth century, most climatic summaries were simple arithmetic averages for an entire period of record ("POR"), regardless of when that occurred. More attention was given to the length of record ("LOR"): the longer the better. All observations, from whatever instruments and averaged by any method, from varying exposures and locations around a given place, were averaged to describe its climate.

Growing realization that climate varies over scales from millions of years down to centuries and decades led the International Meteorological Organization to adopt the recommendation of its climatology commission meeting in Warsaw in 1933, that such phenomena be studied as changes in successive 30-year climatic "normals". These were defined as arithmetic averages over 30-year periods beginning in the first year of a decade (1901-1930, 1911-1940, etc.). Member nations were urged to compute and publish such "normals" for all climatic elements, and use the entire record only for extremes: wettest hour, day, year; coldest and hottest temperatures; longest period without direct sunshine, etc. During the ensuing half-century such "normals" were adopted by most meteorological services, although the United States computes them only for temperature, rainfall, and pressure, and retains inappropriate POR values for cloudiness, windspeed, thunderstorms, etc.

The 30-year period was a compromise estimate of the duration of reliable human memory, and of the LOR available for enough places worldwise. Some members wanted 11 years (solar cycle) or 20 or 25, because more stations could have such "normals." Others urged the 35-year "Bruckner cycle", still others a 50-year period. The 30-year averaging period was adopted primarily to monitor climatic change. However, in many applications, these averages are in essence used as predictors of the future climate. For this, the adopted 30-year averages have been found to have no special predictive properties. In fact, to predict the coming year's climate, 30-year means have been found to have less predictive skill than shorter-period means (Court, 1967, 1968; Lamb and Changnon, 1981). Any legal status they have attained, such as in utility rate making, should be withdrawn.

One difficulty, perhaps insuperable, in assessing the predictive abilities of various climate means is the lack of any truly objective measure of superiority or utility. Minimizing the mean square error is widely used but it may not be related to the actual economic loss from a bad prediction. For example, an error of 2 degrees does not generally result in four times the economic loss of an error of 1 degree. Until economic loss functions for climatic prediction errors are developed, comparison of the predictive abilities of various climatic averages will remain theoretical.

The choice of an alternate averaging period for use as a predictor is complicated by differences in published results. Court (1968) suggests the use of a period in the range of 7-15 years. Lamb and Changnon (1981) suggest a 5-year average, although their results were based only on Illinois data and only on averaging periods of 5, 10, 15, 20, 25 and 30 years. Dixon and Shulman (1984) found widely varying results depending on what criterion was used to judge the skill of an average. To further complicate this situation, Easterling and Angel (1988, unpublished) found that an 11-year average was preferable for use as a predictor of the coming year's climate, but that a 19-year average was a preferable predictor for 2, 3, 4, 5 years ahead. This study was also limited to Illinois but considered more stations than the Lamb and Changnon study.

These differences create a problem since a base period other than 30 years requires a clear rationale. Yet, published results agree only that a base period shorter than 30 years is optimum, but do not agree on the length of that base period. An important operational consideration is that publications which include climatic averages are likely to be updated only occasionally and will be used for several years after publication. Short-term averages (e.g., 5 years) would be inappropriate as predictors other than one or two years immediately following the averaging period. Therefore, the realities of the use of climatic publications probably preclude the inclusion of such short-term averages and favor the use of a somewhat longer averaging period.

A final point related to 30-year "normals" is that the mean in many cases is not the best measure of the central tendency, especially when the probability distribution is asymmetric. In dry climates the monthly or annual means of precipitation are inordinately influenced by a few wet years. For instance, in California during July less than 25% of all years are above the mean (Slusser, 1968). This goes against the popular perception that half of all years should be less than average, the other half more than average. This suggests that in many instances the median is a superior measure of central tendency since it is exactly the middle value of a group of numbers. However, the uncertainty of the estimate of the median is greater than that of the mean for the same time series. Therefore, the median may be desirable only for asymmetric time series.

In addition to the central tendency, an essential element of descriptive climatology is the variability about the central tendency. In fact, the year-to-year variability is usually much larger than long-term changes in the mean or median. There are several possible measures of this variability. For symmetric distributions, the standard deviation is a common measure. For asymmetric distributions, the mean absolute deviation is often used. Of greater detail, and therefore more utility, are values at several points on the cumulative probability curve. This has been done for precipitation in at least one publication (Houghton, 1985) where the 10 and 90 percentiles for precipitation are presented. These percentile values also represent the National Weather Service's thresholds for "much below" and "much above" categories.

Based on the above discussion, the AASC makes the following recommendations regarding future publications of climate statistics:

1. The term "normal" should be retained to describe the 30-year climatic means, for continuity and to comply with WMO standards for monthly and annual climate descriptions.

2. For averaging periods other than 30 years, the median should be adopted as a better measure of central tendency for certain climatic variables which in many locations exhibit an asymmetric distribution (e.g., total precipitation, total snowfall, etc.). The mean should be used for other climatic variables such as temperature whose distribution is usually symmetric, although maxima are skewed to the right and minima to the left.

3. The 30-year mean should be retained to describe climate for all variables for the sake of historical continuity. However, additional averaging periods should be included in published statistics to provide the climatologist flexibility in responding to climatic needs. The AASC suggests inclusion of 10-year and 20-year periods in published statistics.

4. A measure of variability should be included along with the mean and/or median. The 10 and 90 percentiles are suggested for skewed climatic data distributions. The standard deviation is suggested for symmetric distributions.

5. For all climatic elements a measure of variability is of greater priority than is the presentation of various interval means.

6. With regard to extremes of climatic variables, the entire period of record should be used for calculation for stations where instrument siting and exposure are constant.

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STRENGTHENING STATE CLIMATE PROGRAMS*

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* Based on a report of The Committee on State Climate Programs presented at the Annual Meeting, American Association of State Climatologists, Timberline Lodge, Oregon, August 3, 1988. The author acknowledges the active participation of the Committee in preparation of the report, and the valuable discussion following the presentation. The opinions expressed herein, however, are entirely those of the author.

A State Climate Program can be characterized as a program which provides climate data and information for the benefit of the State and its citizens. An ideal program would meet all the needs of, and thus provide maximum benefit to, all individuals and institutions in the State. The strength of an individual program can therefore be judged by how close it comes to meeting this ideal. Strength cannot be directly equated with personnel or financial resources, since needs vary from state to state. Indeed, although some programs are obviously stronger than others, none is ideal in this sense, and all are capable of being expanded and strengthened. This paper outlines a framework to assist in this process, whatever the current strength in a particular state.

The basic thesis presented here is that a State Climate Program can usefully be considered as similar to a small business enterprise and that strategies must be developed to expand and strengthen it using the same approach as would be taken in a small business. Currently most state programs are located in public sector institutions. The professionals involved are driven by the traditional public sector business practices and reward structures. This frequently implies that the program tries to help everyone equally, whatever the source or nature of the request and the effort required to provide a response. This all too often involves the stretching of available resources too thinly with the result that no-one is served well. Further, the approach generally leads to a "passive" program, which spends almost all its time responding to requests for information, rather than an "active" one which is developing new information and seeking opportunities to disseminate it. Only when operating in the active mode can a program hope to increase in strength and value. The most obvious way to enhance the active component is to identify a single potential "client group" and concentrate on providing exemplary service to it. Successful provision of such service, involving the development of appropriate information

products and delivery systems, creates both a group of satisfied clients demonstrating the value of the program and program personnel increasingly skilled in producing valuable, needed, products. This establishes a solid base. New client groups can then be identified and served, and the overall program strengthened.

This view emphasizes an approach which is more akin to that associated with private sector enterprises than to our normal public sector viewpoint. Indeed, anyone involved with a State Climate Program must already have something of this view since, expressed crassly, we have a product, climate information, which we believe is valuable. However, at present we tend to spend a great deal of time and effort producing that product and then virtually giving it away. While our situations may make it impossible, or undesirable, for us to profit personally, we must think in terms of "selling" the product for the benefit of both the program and the user. In commercial terms, we must embark on a market survey, match our product to the market, advertise it, sell it, and continually seek to develop new, improved versions of our product. A successful business means a strong program.

Adoption of the concept of climate information as a product and a State Climate Program as a small business does not require the wholesale abandonment of current practices or expertise. Rather, it must be seen as a framework for development, allowing us to build upon our current structures and exploit the current mixture of our users.

The traditional structure of state programs contains four elements: database management, research, service, and education. All remain vital. However, the small business framework emphasi a focussed approach to their development. Once a major group of users, and their needs, are identified, we can plan rational strategies. The users may need, for example, information which requires timely data from other state, regional, or federal centers, indicating that a flexible, compatible, and upgradable computer communication system is the vital portion of the database function which must be established. Similarly, the user group may have a vital need for pieces of information which are currently unavailable, but which can be provided after a specially designed research project has been undertaken.

Most State Climate Programs at present have a great mixture of users with a great variety of needs. Virtually all programs are committed to continuing to serve these users, and thus continuing to operate, at least to some extent, in a passive mode. The transition to a more active mode, as implied by the small business strategy, must be approached with care. A review of types of people who request services will, in many states, allow definition of already existing "client groups" with similar, if by no means identical, needs. Appropriate contacts with these people, exploring their range of interests, can reveal common needs, indicating opportunities for information production and the beginnings of an active role for the program. Indeed, such an approach is highly advantageous. By dealing right from

the start with representatives of several organizations from a single economic sector, it emphasizes a fundamental distinction between a true small business and a state program. The State Program, still in the public sector even if the viewpoint is changed, is presumably dedicated to the open flow of information, not the development of a competitive advantage for a single client. Indeed, the emphasis throughout should be on constituencies consisting of all representatives of a particular economic activity rather than on individual clients.

One group which needs to be considered especially is the private sector consultants. An active program can easily be seen as undermining their position. If the program emphasizes its role as a creator of information which is equally available to all, however, the presence of an active program can be legitimately presented as a major benefit to the consultants. The new information generated should give them the opportunity to provide better value-added services to their particular clients. Consequently it is advantageous to regard consultants as a constituency rather like any other, but probably being rather more concerned with explicitly acquainting them with, and seeking their active involvement in, program plans and developments.

The focus of the small business approach is the development of a business plan, a strategy to discover an unmet need and to provide the product which fills that need. The following sections outline such a business plan in terms appropriate for a State Climate Program.

(1) Choose Primary Constituency

The primary constituency which is chosen must be one where there is currently an unmet need for information that the program has the capabilities, or potential, for providing. Hence two factors must be considered:

(a) **Current administrative location and funding source:**
Some programs are administratively located or funded by groups, such as an Agricultural Experiment Station or a Water Resources Agency, who provide a natural constituency. In these cases some refinement may be needed to identify those within the field with major unmet needs. For other programs the constituency will not be self-evident, and a broader range of options are available.

(b) **Assessment of needs, opportunities and capabilities:**
For a constituency to provide viable support for the program, it must need climate information on a continuing basis. A single research project may provide useful short-term support, and may possibly lead to a long-term commitment, but hoping for a string of single projects is less satisfactory than developing a constituency with ongoing, often routine, needs. In addition, these needs must be for information which is more valuable than that currently available. This could include new types of

information, more spatial or temporal detail, or more timely provision. An obvious final consideration is whether the program is currently or potentially capable of providing the required information.

(2) Develop the Primary Constituency

Once the constituency is identified and the needs and opportunities assessed, links with the constituency must be developed with the objective of producing information, and hence a program, which is indispensable. This development has three components:

(a) **Provide Policy Input**

Interaction with policy or decision makers is vital. Without the active participation of these leaders, no information, however potentially useful, is likely to get used, let alone be seen as vital. In virtually all cases, the information required here is for future conditions pertaining to the operations and plans of the company or agency. This may include, of course, reviews of past conditions relating to future actions, and almost certainly the information itself will be based largely on historical records and analysis.

With the current widespread concern with the potential impacts of climatic change, many policy makers are actively seeking the kind of expert guidance that a State Climate Program can give. Hence there is, at present, a great opportunity which must not be missed.

(b) **Provide Regular Information**

While the regular provision of information to the primary constituency is a vital part of program building, the wider distribution of products derived from this information provides an opportunity for creating and maintaining a broad awareness of the program. While this information could include the monthly climate summaries produced by many state programs, it need not be on a routine basis, nor in a formal published form. However, this information constitutes a form of advertising, and as such must come fairly often, and it must be useful and interesting to the recipient. Information is not necessarily to be equated with numbers. Discussion of the impacts on a state of ozone holes, acid rain or El Nino can provide useful information, indeed, some rational statements about these are not only sorely needed, but can provide a great deal of publicity and credibility to a program. Certainly no unusual event should pass without comment from the State Program.

(c) **Develop New Products**

No strong business can rest on its laurels. Changes in climate itself, in our understanding of climate and climate analysis techniques, in technology or in society will continually occur. Program personnel must keep abreast of such changes,

interacting with users in general and in the primary constituency in particular, to identify opportunities to develop new, improved products. The State Climate Program must be in a position to seize these opportunities.

Here there is certainly no reason for an individual state program to work in isolation. The regional climate centers, and the American Association of State Climatologists itself, provides a pool of resources. Joint actions, or individual actions on behalf of all, addressing key developments in all aspects of the diverse fields covered by state programs are likely to be beneficial to all.

(3) Build New Constituencies

Throughout the previous step the emphasis was placed on the production of information which the primary constituency regarded as vital. Indeed, the more a program is seen as being indispensable, and capable of producing ever better products, the more it will be provided with the resources required to continues improving. However, while providing the services to the prime constituency, information will be generated which is of interest to a wider or different audience. This therefore provides an opportunity for expansion. The steps required to develop a new constituency are essentially the same as those indicated above, although the solid base built by serving the prime constituency may make this step rather more straightforward.

This step can be repeated many times, adding new constituencies as the program develops and increases in strength. Eventually the program will begin to resemble the ideal one, where all constituencies in the State are provided with the level of service which provides maximum benefit.

This analysis strongly suggests that a framework built upon the concept of a small business is valid and worthy of further consideration. Application of the concept to the particular needs and aspirations of an individual state could usefully be explored in cooperation with the Business School at the local University or with the state agency responsible for small business development. As presented here it provides only a very general outline for a strategy for strengthening State Climate Programs.

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