SUBSTATION PROGRAM ACTIVITIES

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Chairperson, Subcommittee
Volunteer Observer Networks

1. INTRODUCTION

The National Weather Service maintains a network of approximately 11,565 cooperative weather observation stations called substations, that provides weather data for climatology, hydrology, and local service programs. The distinctive feature of this program is that observations are taken by cooperative observers -- private citizens who perform the service for free or who are paid a small fee for their efforts. Equipment at substations varies. While a number of these substations are fully automated, most are manually operated.

The use of the information is for basic data and/or reporting purposes. The data usually are provided through published records and are used in climatic studies, hydrologic design, and other planning.

Reports serve operational purposes and are transmitted in accordance with specific criteria to meet the needs of hydrologic forecasting, agricultural advisories, hurricane and severe storm warnings, control of hydrologic structures, crop summaries etc.

Special cooperative projects are operated for other agencies to meet their particular needs when these are beyond those normally provided by NWS. A total of 51 Substation Network Specialists, supported by reimbursable, State, and NWS funds, inspect and maintain this network of almost 11,565 substations.

2. NETWORK CLASSIFICATIONS

All substations have a network classification to represent the basic purpose for which they are established:

"a" Network

The "a" Network includes only those temperature-precipitation substations required to provide an adequate sample of data for areal statistics on weather and climate. The network should ordinarily contain about one temperature-precipitation substation per 625 square miles.

"ab" Network

The "ab" Network includes all stations which serve the purpose of both the "a" and "b" Networks.

"b" Network

The "b" Network includes all stations serving a hydrologic purpose such as the following:

(1) Rainfall and River, Rainfall (river) and River reporting substations.

(2) Evaporation substations.

(3) All recording raingage substations, including those in networks such as FC-1, IRPN, etc.; and those published in HPD.

(4) Other precipitation and special observation substations such as soil moisture, hygrothermograph, etc. stations designed to meet the hydrologic needs of the National Weather Service or cooperative agencies.

"c" Network

The "c" Network includes three general classes of stations, as follows:

(1) Temperature and/or precipitation stations primarily for local public service purposes (Metropolitan networks, stations established at radio stations, newspapers, etc.);

(2) Temperature and/or precipitation stations which have a long record but are not included in the "a" or "b" networks. Generally, the period of record should be at least 50 years and the prospects should be good for continuing the station with little change in environment;

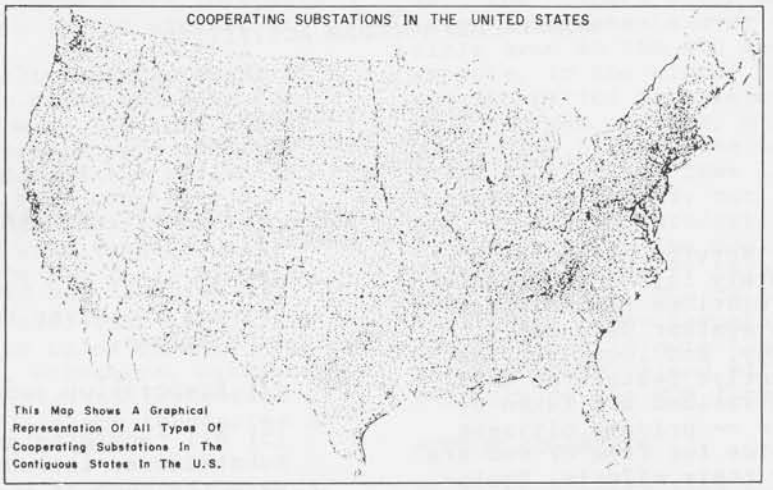
(3) Temperature and/or precipitation and special purpose stations at tower sites, experimental stations, research farms, etc.

"x" Network

The "x" Network includes substations having 30-year normals. A decision to continue these substations will be made in 1980.

3. REFERENCE CLIMATOLOGICAL STATION NETWORK

Reference Climatological Stations (formerly known as Climatological Bench Mark Stations) are stations or substations selected by the



STATUS OF SUBSTATION NETWORKS

Eastern Region

	Networks as of Jan. 1, 1979						Networks as of July 1, 1979						Net Changes						Planned Network (a) Not Implemented
	a	ab	b	c	x	Total	a	ab	b	c	x	Total	a	ab	b	c	x	Total	
Connecticut	8	5	36	0	2	51	7	5	36	0	2	50	-1	0	0	0	0	-1	1
Delaware	4	2	2	2	1	11	4	2	2	2	1	11	0	0	0	0	0	0	0
Maine	29	18	34	0	1	80	28	17	36	0	1	82	-1	+1	+2	0	0	+2	7 (5)
Maryland & D.C.	21	8	22	23	7	81	21	7	22	23	7	80	0	-1	0	0	0	-1	0
Massachusetts	17	14	68	0	0	100	16	16	68	0	0	100	-1	+2	-1	0	0	0	1
New Hampshire	8	18	53	1	0	80	7	19	52	1	0	79	-1	+1	-1	0	0	-1	1
New Jersey	7	13	61	7	6	94	7	13	55	8	8	91	0	0	-6	+1	+2	-3	0
New York	33	56	197	5	31	322	33	54	184	8	38	318	0	-2	-13	+3	+8	-4	10
North Carolina	48	45	103	10	6	210	47	44	103	10	6	210	+1	-1	0	0	0	0	1
Ohio	15	56	170	9	7	257	15	56	167	13	0	251	0	0	-3	+4	+7	-8	1
Pennsylvania	12	72	234	10	9	337	13	71	237	8	8	337	+1	-1	+3	-2	-1	0	7 (1)
Rhode Island	1	3	3	0	0	7	4	2	2	2	1	11	+1	+2	+2	0	0	+4	0
South Carolina	24	34	53	21	1	133	25	34	52	23	0	134	+1	0	-1	+2	-1	+1	0
Vermont	6	10	56	0	0	72	6	10	53	3	0	72	0	0	-3	+3	0	0	0
Virginia	33	43	130	5	6	217	34	42	130	5	6	217	+1	-1	0	0	0	0	1
West Virginia	16	46	94	1	3	160	16	45	96	1	2	160	0	-1	+2	0	-1	0	0
Totals	280	441	1317	94	80	2212	283	437	1295	107	81	2203	+3	-4	-22	+13	+1	-9	30 (6)

Southern Region

Alabama	34	46	80	3	0	163	32	46	78	3	0	159	-2	0	-2	0	0	-4	2
Arkansas	20	67	136	1	0	224	20	67	133	1	0	221	0	0	-3	0	0	-3	2
Florida	65	37	42	8	0	152	65	35	42	8	0	150	0	-2	0	0	0	-2	4
Georgia	37	47	123	6	0	223	37	48	121	7	0	223	0	+1	-2	+1	0	0	3
Louisiana	30	39	101	3	0	173	27	38	102	3	0	171	-3	0	+1	0	0	-2	6 (1)
Mississippi	25	54	107	3	0	189	24	55	104	3	0	186	-1	+1	-3	0	0	-3	2 (1)
New Mexico	67	73	67	5	0	212	65	76	61	6	0	208	-2	+3	-6	+1	0	-4	49 (21)
Oklahoma	15	94	217	1	0	327	14	94	217	1	0	326	-1	0	0	0	0	-1	1
Tennessee	43	33	59	5	0	140	42	34	59	5	0	140	-1	+1	0	0	0	0	0
Texas	98	232	520	14	0	864	97	234	514	17	0	862	-1	+2	-6	+3	0	-2	51 (36)
Puerto Rico	3	21	69	0	0	93	4	20	68	1	0	93	+1	-1	-1	+1	0	0	0
Virgin Islands	0	6	21	3	0	30	0	6	19	2	0	27	0	0	-2	-1	0	-3	0
Totals	437	749	1552	52	0	2790	427	755	1527	57	0	2766	-10	+6	-25	+5	0	-24	120 (59)

Central Region

Colorado	9	129	135	0	1	274	9	130	132	4	1	276	0	+1	-3	+4	0	+2	55 (37)
Illinois	32	63	167	0	0	262	32	64	165	1	0	262	0	+1	-2	+1	0	0	0
Indiana	24	52	101	12	2	191	23	51	97	14	2	187	-1	-1	-4	+2	0	-4	0
Iowa	9	85	190	1	0	295	9	85	188	2	0	294	0	0	-2	+1	0	-1	0
Kansas	9	106	316	0	0	441	9	107	322	1	0	439	0	+1	-4	+1	0	-2	0
Kentucky	26	49	130	10	0	215	28	49	125	11	0	213	+2	0	-5	+1	0	-2	0
Michigan	47	63	151	29	6	296	48	62	148	32	6	296	+1	-1	-3	+3	0	0	0
Minnesota	16	112	108	9	2	247	16	114	105	10	2	247	0	+2	-3	+1	0	0	1
Missouri	8	110	187	5	0	310	8	110	184	7	0	309	0	0	-3	+2	0	-1	2
Nebraska	5	114	230	0	0	349	5	115	222	3	0	345	0	+1	-8	+3	0	-4	2 (1)
North Dakota	1	104	115	0	1	221	0	105	114	4	1	224	-1	+1	-1	+4	0	+3	1
South Dakota	12	91	72	1	1	177	12	93	70	3	0	178	0	+2	-2	+2	-1	+1	11
Wisconsin	4	101	107	6	0	218	7	102	101	9	0	219	+3	+1	-6	+3	0	+1	0
Wyoming	22	109	54	1	0	186	20	103	48	4	0	176	-2	-6	-5	+3	0	-10	52 (36)
Totals	224	1298	2073	74	13	3682	226	1300	2022	105	12	3665	+2	+2	-51	+31	-1	-17	124 (74)

Western Region

Arizona	41	120	59	1	1	222	41	120	61	1	1	224	0	0	+2	0	0	+2	39 (9)
California	136	129	415	15	8	703	134	128	395	16	16	689	-2	0	-20	+1	+8	-13	15
Idaho	37	79	55	10	0	181	35	81	51	9	2	178	-2	+2	-4	-1	+2	-3	32 (18)
Montana	40	172	162	7	0	381	38	174	157	7	4	380	-2	+2	-5	0	+4	-1	24 (8)
Nevada	41	62	12	1	0	116	42	61	12	1	0	116	+1	-1	0	0	0	0	75 (54)
Oregon	12	157	184	14	1	368	11	158	177	14	7	367	-1	+1	-7	0	+6	-1	11 (2)
Utah	42	86	67	8	0	201	44	85	65	5	0	199	+2	-1	-2	-1	0	-2	32 (21)
Washington	52	75	129	4	0	260	52	73	125	4	2	256	0	-2	-4	0	+2	-4	7
Totals	401	879	1083	58	10	2431	397	880	1043	57	32	2409	-4	+1	-40	-1	+22	-22	235 (112)

Alaska Region

Alaska	124	32	48	2	0	206	120	30	48	2	0	200	-4	-2	0	0	0	-6	0

Pacific Region

Hawaii & Pacific Islands	0	53	254	21	0	328	0	51	251	20	0	322	0	-2	-3	-1	0	-6	0
GRAND TOTALS	1448	3452	6327	301	103	11649	1453	3453	6186	348	125	11565	-13	+1	-141	+47	+22	-84	539 (251)

The figures in parenthesis beside the planned (a) network indicate the number of locations approved for that type of substation which cannot be established at this time due to location in an uninhabited or remote area.

Also included in this table are 578 first- and second-order stations with network designations.

Alaska has no definite number of stations in the planned network due to circumstances peculiar to that area.

Environmental Data Service as meeting the World Meteorological Organization (WMO) standards for such stations where homogeneous series of observations over a period, not less than 30 years, have been made or are expected to be made. They are sited with an adequate and unchanged exposure where the observations can be made in representative conditions. The surroundings of the station should not alter in time to such an extent as to affect the homogeneity of the series of observations. The "surroundings of the

station" have been defined by the Environmental Data Service (EDS) as the area within 100 feet of the station, plus the space over 20 feet above the surface to a distance of one-fourth mile from the station, and in general the space which subtends an angle of 10 degrees above the horizon from the observation site. Although Reference Climatological Stations are selected without regard to network classification, most of them are "a" or "b" Network substations.

4. RESOURCES AUTHORIZED

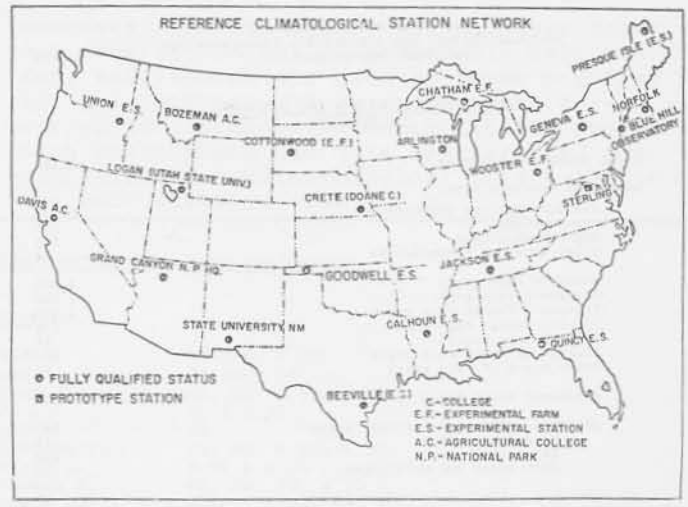
The Organic Act (33 U.S.C. 706) of October 1, 1890 provides the basic authority for the substation program. Section 313 sets forth the statutory requirements of the program; i.e., report temperature and rainfall conditions, and take such meteorological observations as may be necessary to establish and record the climatic conditions of the United States.

The Hydroclimatic Network, known as the FC-1, was approved by Congress on June 28, 1938, and established under Public Law 761 as a means of providing rainfall information for use in civil works activities of the Corps of Engineers (COE). This network had been operated by the National Weather Service in cooperation with the Corps of Engineers on a reimbursable basis. With the organization of the National Oceanic and Atmospheric Administration (NOAA), the Hydrologic Network (FC-1) was transferred from the support of the Corps of Engineers to direct NOAA funding, effective October 18, 1970. Approximately $850,000 and 29 Substation Network Specialists' positions were transferred as S&E funds to NWS.

The National Weather Service has cooperated with the Corps of Engineers since 1937 in establishing and operating networks of river and rainfall reporting stations. Reports from these stations supplement those stations maintained by the NWS and are made available to the Corps of Engineers for flood control operations and flood forecasting. Today, there are 41 reporting networks with stations reporting systematically or in accordance with the established criteria.

The Bureau of Reclamation Networks (USBR) are based upon a Memorandum of Understanding between the two agencies, dated February 13, 1948, and provide for the NWS to establish and operate networks of meteorological substations to meet the needs of USBR. Installations are varied and include recording, storage, and standard 8-inch precipitation gages, temperature, evaporation, solar radiation, and other equipment. Both basic and reporting data substations are included.

The Bonneville Power Administration (BPA) Network is based upon the Memorandum of Understanding executed November 26, 1957. Annual adjustments are made in accordance



with current need and costs. The tasks call for the operation and maintenance of temperature and precipitation substations for basic data and/or reporting services and for developing forecasting procedures for streamflow in the Pacific Northwest.

The Cold Regions Research and Engineering Laboratory (CREEL) project began in FY1962 in cooperation with the U.S. Army in connection with its soil thaw, snow, and ice measurements.

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service 7/1/79

COUNT OF SUBSTATIONS AND SERVICES
ALL NETWORKS

SUBSTATIONS

Number of substations by network: A 1453 AB 3453 B 6186 C 348 x 125	11,565
Number of stations with paid services	6,151
Number of stations without paid services	4,098
Number of stations having associate services	738
First and second order stations	578

SUBSTATION SERVICES

Number of stations having the following services:	
Both temperature and non-recording precipitation	5,912
Non-recording precipitation without temperature	3,214
Storage gage	36
FC-1 precip (recording and/or non-recording) stations	2,864
Hourly precipitation stations (recording precipitation)	
Sponsored by S&E	417
Sponsored by S&E (FC-1)	2,526
Sponsored by other government agencies	127
Associate stations	136
Substations with both daily (or storage) and hourly precipitation services	1,933
Crop reporting stations	473
River and/or rainfall reporting stations	5,409
River stage reports only	929
Rainfall reports only	3,462
River stage and rainfall reports	1,018
Evaporation stations	454
Telemetered stations (Includes AHOS, BDT, Telemark, VHF)	1,248
Automated Hydrological Observing System (AHOS)	461
AHOS/T	415
AHOS/S	46
Special Reporting Stations	196
Miscellaneous (snow density, special meteorological)	376
Number of publishing stations that have these services:	
Temperature	5,744
Daily (or storage) precipitation	8,392
Hourly precipitation	3,107
Evaporation	445
Soil temperature	256
TOTAL NUMBER OF STATIONS PUBLISHED	9,620

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service 7/1/79

COUNT OF SUBSTATIONS AND EQUIPMENT
ALL NETWORKS

Total number of stations	11,565
Number of stations with:	
Standard max/min thermometers	5,738
Thermographs	263
Hygrothermographs	261
Other types of thermometers	98
Standard rain gages	8,950
Universal rain gages	1,308
Fischer & Porter rain gages	1,999
Tipping Bucket rain gages	239
Storage rain gages	37
Plastic or wedge rain gages	102
Other types of rain gages	38
NWS-Owned river gages	634
AHOS/T's - River and/or rain gages	415
River gages only	121
Rain gages only	238
Both river and rain gages	56
AHOS/S's - River and/or rain gages	46
River gages only	5
Rain gages only	29
Both river and rain gages	12
BDT's - River and/or rain gages	267
River gages only	142
Rain gages only	119
Both river and rain gages	6
Telemarks - River and/or rain gages	426
River gages only	369
Rain gages only	48
Both river and rain gages	9
VHF - River and/or rain gages	52
River gages only	18
Rain gages only	19
Both river and rain gages	15
Other types of telemetry - River and/or rain gages	29
River gages only	10
Rain gages only	19
Both river and rain gages	0
Snow stakes	183
Green (Adirondack) snow density kits	40
Federal (Mount Rose) snow samplers	11
Other snow equipment	118
Palmer soil thermometers	221
Other (or unspecified) soil equipment	95
Evaporation equipment	542
Other miscellaneous equipment	384

The United States Geological Survey (USGS) is provided with river and precipitation data.

In order to arrive at separate cost figures of the "a", "ab", "b", "c", and "x" Networks, it becomes necessary to define the areas of accounting responsibility assigned to each. This is very complex in the case of the operation and maintenance of these networks because of the multiple-purpose nature of many of the stations. Since multiple services are provided at many substations, the plan provides, insofar as practicable, for an equitable grouping of inspection services under a single network classification. Salary, per diem, and vehicle costs for the Substation Network Specialists will be charged to the number for the activity served.

5. MANPOWER ALLOCATIONS

The Weather Service Headquarters

The Weather Service Headquarters determines policy and provides guidelines for substation management as the program relates in common to the several regions. The staffing of the headquarters follows:

Substation Program Manager
Substation Program Specialist
Meteorologist
Secretary

Regional Headquarters

The regional headquarters implement technical and administrative policy and guidelines as delineated by National Weather Service Headquarters. The staffing at the several regions follows:

Eastern Region
Chief, Regional Substation Management Staff
Administrative Aide

Southern Region
Chief, Regional Substation Management Branch
Substation Program Specialist
Quality Control Specialist
Clerk-Typist

Central Region
Chief, Regional Substation Management Branch
Quality Control Specialist
Clerk-Steno

Western Region
Chief, Regional Substation Management Section
Quality Control Specialist
Clerk-Steno

Alaska Region
Substation Program Specialist

Pacific Region
Chief, Regional Substation Management Section
Clerk-Steno

Substation Network Specialist (SNS)

This position is usually located at a Weather Service Forecast Office or Weather Service Office as a base of operations in order to make maximum utilization of the total number of SNS positions in the region. An SNS is primarily responsible for the maintenance and efficient operation of several cooperative observational networks in an assigned geographical area, which is usually confined to a state. The SNS travels to Cooperative Weather Observing stations manned by people who perform their services without pay or receive only token compensation. There are 51 SNS's supported by National Weather Service and reimbursable funds, who inspect and maintain equipment, recruit and train cooperative observers, and maintain liaison with the approximately 11,565 substations. A criterion of one specialist for 335 periodic substation visits per year, plus visits for special purposes (post-flood studies, snow-sampling surveys, etc.) is recognized. Annual visits are required to all substations, and twice-yearly visits are required for recording precipitation and evaporation substations.

The Cooperative Weather Observer

Cooperative weather observers are selected to take observations at predetermined locations in order to define the climate of the area. While cooperative observers may take several different kinds of observations, they usually make daily readings of maximum and minimum temperature and precipitation. Observers are usually selected from permanent residents in a community who have an interest in observing weather, so that a long record can be assured. Observations must be taken seven days a week throughout the year. The value of data is enhanced to a great extent by the records extending over a number of years. Most cooperative observers have served from 25 to 50 years.

A cooperative station represents an area of approximately 625 square miles. This distribution of stations varies somewhat in accordance with the topographic features of the country.

Where a cooperative station is needed, the Weather Service provides the shelter, thermometers, and rain gage. The observer takes one observation daily, preferably near sunset, and records the data on forms provided for this purpose. These records are forwarded to a processing center at the end of each month where the data are verified and published in a Climatological Data bulletin for each state or area.

BASE STATION (Mail Address)	SUBSTATION NETWORK SPECIALIST	AREA ASSIGNMENT
	EASTERN REGION	
Albany, NY (WSFO)	Quick, Donald L.	NY (Ex. S.NY)
Allentown, PA (WSO)	Karlock, John K.	Eastern PA
Baltimore, MD (WSO)	Snider, Arthur J.	MD, DE, N.VA, E.WV
Columbia, SC (WSFO)	Rampey, Earl L.	SC & W.NC
Columbus, OH (WSO)	Seidel, Lloyd B.	OH
New York, NY (ERH)	Nunziata, Vincent J.	CT, NJ, S.NY, & RI
Pittsburgh,PA (WSFO)	Willson, Donald L.	W.WV & W.PA
Portland, ME (WSFO)	Jennings, Thomas R.	ME, MA, NH, & VT
Raleigh, NC (WSFO)	Daniels, Robert E.	E.NC & S.VA
	SOUTHERN REGION	
Albuquerque, NM (WSFO)	Snyder, Richard A.	NM, W. of 104 deg.
Baton Rouge, LA (WSO)	Moreau, Malcolm B.	LA, TX, E. of 94 deg 30'W
Fort Worth, TX (SRH)	Manning, Robert S.	OK & TX bet. 32 deg 30' & 34 deg 34'N & 94"30' & 101 deg.
Jackson, MS (WSFO)	Brown, Maxie R.	MS
Lakeland, FL (WS)	Clarke, Thomas P.	FL
Little Rock, AR (WSFO)	Currence, Elwood E.	AR
Lubbock, TX (WSFO)	Megee, Charles M.	NM, E. of 104 deg, TX, W of 101 deg & N. of 34 deg 30'N
Macon, GA (WSO)	Funderburk, Ralph S.	GA
Montgomery, AL (WSO)	Ferguson, Ronald E.	AL
Memphis, TN (WSFO)	Arnold, Larry	TN, AR, E. of 91 deg 31'W
Oklahoma Cy, OK (WSFO)	Lambert, John R.	OK, N. of 34 deg 30'
San Antonio, TX (WSFO)	Hutchison, Harold E.	TX, S. of 30 deg N & bet. 90 deg 30' & 101 deg W
San Juan, PR (NWS)	Noboa, Carlos E.	PR & VI
Waco, TX (WSO)	Starnes, Allen R.	TX, S. of 32 deg 30' to 30 deg N & bet. 94 deg 31' & 101 deg W
	CENTRAL REGION	
Ann Arbor, MI (WSFO)	Graves, Donald	MI
Bismarck, ND (WSFO)	Chamberlain, Clarence C.	ND
Cheyenne, WY (WSFO)	Simpson, Clinton	WY
Denver, CO (WSFO)	Tate, William H.	W. CO
Des Moines, IA (WSFO)	Farmer, Homer D.	IA
Fargo, ND (WSO)	Behrens, Leo W.	MN
Goodland, KS (WSO)	Elias, Michael G.	E. CO, W. KS, NE, W. of 100 deg W
Indianapolis, IN (WSFO)	Hennek, John P.	IN
Louisville, KY (WSFO)	Tellez, Pete	KY
Minneapolis, MN (WSFO)	Thurston, Thomas R.	WI
St. Louis, MO (WSFO) (St. Charles address)	Loveless, John R., Jr.	MO
Omaha, NE (WSFO)	Marechale, Allen	NE, E. of 100 deg W
Sioux Falls, SD (WSFO)	Johnson, Robert D.	SD
Springfield, IL (WSO)	Wolfe, Jerry F.	IL
Topeka, KS (WSFO)	Hall, Wilbur	E. KS
	WESTERN REGION	
Boise, ID (WSFO)	Ingve, Olson	ID & W. MT
Great Falls, MT (WSFO)	McPhee, Maynard	MT (exc. W. MT)
Phoenix, AZ (WSFO)	Parlier, Jerold	AZ
Portland, OR (WSFO)	Howick, Sidney O.	OR
Reno, NV (WSFO)	Soileau, James B.	NV & NE. CA
Sacramento, CA (WSO)	O'Shaughnessy, Arthur G.	N. CA (exc. NE.)
Salt Lake Cy, UT (WSFO)	Hirschi, Dean C.	UT
San Diego, CA (WSO)	Freeman, Carl W.	S. CA
Seattle, WA (WSFO)	Pickering, Earl R.	WA
	PACIFIC REGION	
Hilo, HI (WSO)	Taboniar, John	HI, Maui, Lanai, Molokai
Honolulu, HI (PRH)	Ho, Roland	Oahu, Kauai, American
	Chun, Robert	Samoa, Guam
	ALASKA REGION	
Anchorage, AK	Misiewicz, Edward M.	AK