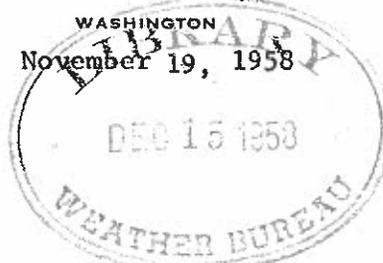


UNITED STATES DEPARTMENT OF COMMERCE  
WEATHER BUREAU

WASHINGTON  
November 19, 1958



IN REPLY, PLEASE ADDRESS  
CHIEF, U. S. WEATHER BUREAU  
WASHINGTON 25, D. C.  
AND REFER TO  
C-3.1

FILE: 922 MEMO

MEMORANDUM

TO : Area and State Climatologists, Substation Inspectors, Field Aides, WRPCs, River Forecasts Centers, River District Offices, and Area Engineers (with copies to Regional Offices for information)

FROM : Office of Climatology

SUBJECT : Climatological Services Memorandum No. 69

GENERAL

1. INFORMAL MINUTES OF THE SEVENTH MEETING OF ADVISORY COMMITTEE ON CLIMATOLOGY (NAS-NRC): The meeting of the Committee was held on 21 October 1958 at the School of Forestry, Yale University, New Haven, Connecticut. The full Committee was present: Dr. Longwell, Chairman, Dr. Benton, Dr. Church, Dr. Hewson, Dr. Reifsnyder. The Weather Bureau, Office of Climatology, was represented by Dr. H. E. Landsberg.

Dean George A. Garratt, of the Yale Forestry School welcomed the Committee.

Dr. Landsberg briefed the Committee on progress of work, covering nine projects. Comments of the Committee on the various projects follow:

- a. Climates of the States. In view of some "violations" in CLIMATE AND MAN, care should be taken that isolines match at state boundaries. Some way should be found to indicate where the 1931-1955 averages fall with respect to longer time series available for many stations. As sections are complete, announcement of the availability should be made (perhaps in Weekly Weather and Crop Bulletins, and the Bulletin of the American Meteorological Society).
- b. Climate of the St. Lawrence Seaway. The Committee suggested that water levels in various ports, as related to wind directions, be included. Data from car ferry logs should, if possible, be obtained from the operating companies. Water surface temperature data, aside from the Church study of Lake Michigan (University of Chicago Reports) might be available from Great Lakes Research Institute and Maj. Hunt (Corps of Engineers, Detroit). Summarization of weather data on the old forms (1210F), which contain bearings to fixed points, might be converted into coordinates by storing the point positions in the memory of an electronic computer. This should be attempted. If possible, the masters of the ships should be interviewed for significant weather information. Data on seiches, fog frequency, and ship icing should be included.

(Climatological Services Memorandum No. 69)

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- c. Climatic Charts for Mariners. The Committee hopes these can be completed at an early date. Several members desired copies of the Navy Marine Climatic Atlas.
- d. Climatic Charts for National Atlas. The Committee noted the new base map and hoped for wide distribution of completed charts.
- e. Northern Hemisphere Charts. The Committee was pleased to learn that all the gaps in the series will soon be filled. (This will accomplish the recommendation C-1, contained in the first general report of the Committee, April 1957, page 22).
- f. Training of Climatologists and Student Trainee Program. Committee members stressed the desirability of getting information on student trainee programs in the fall. The importance of personal interviews was also pointed out. Area or selected State Climatologists might talk to students about nature and scope of climatological jobs in the Weather Bureau. Among the problems are competition by industry, diversion of mathematics and physics majors to Bureau of Standards and similar installations. The Committee suggested that the scholarship program be revised to permit a small number of particularly well qualified individuals (20%?) to continue for a second year in order to get a well-rounded education.
- g. State Climatologist Program. The Committee voiced again its recommendation as stated in its first general report, D-1 (page 23).
- h. Bench Mark Station Program. The report of progress was noted.
- i. Crop Bulletin Cooperation. The Committee suggested that more information on forest fire weather conditions be reported in the Weekly Weather and Crop Bulletin.
- j. Fosdic. This item was added to the agenda. The prospectus of IBM for a Fosdic system was shown to the members of the Committee. Vigorous pursuit of this or a similar approach was urged.

Among the items of planned programs, the Committee discussed the 1951-1960 decadal census of climatic data. This should start in fiscal year 1961. The Committee members felt that such a census, on a regular basis, was highly desirable. It was suggested that it include more data than those contained in Bulletin W Supplement. Among elements suggested for inclusion (where available) were frost penetration, evaporation, sunshine, solar radiation intensity, water levels in wells (from U.S.G.S.). For agricultural purposes the use of weekly and certain areal summarizations were urged. The question of severe storm data in Climatic Data National Summary was discussed. The Committee agreed that the detail given is quite out of line with the purpose of a "summary". In this connection one member pointed out that in the last annual issue three pages were devoted to wind storms but 43 pages to tornadoes. It was suggested that tornadoes be treated in the same manner as wind storms. If the raw material is available for research, publication seems unjustified (see also top of page 12 of 1st general report of Committee).

Committee members then discussed the need to look ahead at climatological data which would be needed in the future by those practicing applied climatology. The observational program should not be entirely dictated by aviation and general weather forecasting requirements. In this connection it was suggested that the old Weather Bureau plan to equip certain TV towers with instruments (thermometers, anemometers) be revived. Such data would be useful for air pollution studies. Bench Mark stations should be equipped to measure the fall-out of solid pollutants, atmospheric chemistry, carbon dioxide, surface ozone, and ultraviolet radiation. First priority should still go to the installation of soil temperature devices and net radiometers. The purpose has to be data for further development of physical and dynamic climatology and the primary parameters of water and energy balance of the atmosphere.

The Committee then discussed the funding requirements for the climatological programs and the chairman reported on his conversation with the Chief of the Weather Bureau last spring.

The chairman also reported on the status of the proposed Climatic Laboratory, advocated by the Great Plains Council.

2. SECOND NATIONAL CONFERENCE ON AGRICULTURAL METEOROLOGY, OCTOBER 22-24, 1958 AT NEW HAVEN, CONNECTICUT: The New Haven meeting was an outstanding success. There is no doubt but that all meteorologists present profited by the contact with the agriculturalists and foresters, and it appeared that the exchange and stimulation was mutual.

These agriculturalists and foresters are a very "weather-wise" group. Many have had considerable meteorological training and are well aware of the possibilities and limitations of meteorology. It behooves all meteorologists to take cognizance of the fact that these people are concerned with such matters as radiation and heat budgets, evapotranspiration and water budgets, and wind movement near the air-earth interface. The above points are stressed because it is fairly evident that most meteorologists have a rather poor understanding of what it is that the agriculturalist needs from meteorology. For instance, agriculturalists need meteorological measurements that, in general, the Weather Bureau does not make. This does not mean detailed micro-measurements, but rather those which describe the general physical environment of crops and animals. They need climatological analyses designed to answer specific questions. They need probability forecasts which have been made by meteorologists who are thoroughly aware of present and pending agricultural activities and aware also of the weather problems associated with those activities.

Some instances of points made and questions raised during the meeting may be of interest.

- a. Dr. F. A. Brooks, University of California, suggested that the Weather Bureau compute and disseminate daily values of potential evapotranspiration. There was agreement that this should be done, but no agreement as to which method of computation should be used.
- b. Dr. E. W. Hewson, University of Michigan, made the point that climatology deserves far more attention and that agricultural climatology

is one of the foremost areas where progress can be made.

- c. The interest in radiation prompted the suggestion that the Weather Bureau publish hourly radiation data, and that outgoing nighttime radiation be measured.
- d. There was an implication that some of the agricultural colleges were ready to install and operate general agro-meteorological observing stations, but they expect recommendations from the Weather Bureau as to instrumentation and procedures. It is apparent that Weather Bureau work on the development and testing of agro-meteorological instruments should be expanded and accelerated.
- e. Dr. Mather emphasized the point that potential evapotranspiration can best be considered as a climatic measure - an inverse of precipitation, and that it does not take account of advected energy.
- f. There was much concern with detailed measurements for determining the vertical transport of heat, water vapor and carbon dioxide. Instrumentation problems are formidable and evoked considerable discussion.
- g. A number of people were concerned with techniques for the modification of microclimate and with an evaluation of the effects of the modification.

The papers and discussions at this meeting emphasized the research aspects of agro-meteorological problems more than the observations and services required by the farmers. It seemed a little surprising that there was so little emphasis on the effects of various weather elements on various plants during the different phenological periods of the plant. The kind of weather a plant "wants" during each stage of its growth remains as one of the large gaps in our knowledge of agricultural meteorology.

This incomplete report of a very worthwhile meeting presents only a few impressions. Dr. Waggoner, Professor Havens and the responsible members of the Connecticut Agricultural Experiment Station and the Yale School of Forestry deserve credit for an excellent meeting.

3. WARSAW MEETING OF THE COMMISSION FOR AGRICULTURAL METEOROLOGY: The Second Session of the Commission for Agricultural Meteorology (CAGM) met in Warsaw, Poland from September 29 to October 17, 1958. The United States delegation was composed of Mr. Milton L. Blanc, Chief of the Climatological Investigations Branch, and Mr. William E. Hiatt, Chief of the Hydrologic Services Division.

The session was well organized, busy, and well attended. Thirty three nations had official delegates and there was a total of fifty delegates and experts taking part in the discussions. Compared with twenty nations represented at the First Session at Paris in 1953, this excellent attendance indicates the increased interest and activity in this important field. Nations as far extended as Argentina and Brazil in South America, Ethiopia, Rhodesia and Union

of South Africa in Africa, Canada in North America and the Ukraine and USSR in Asia, plus a large number from both Eastern and Western Europe were present.

A number of resolutions and recommendations concerning important items of technical progress in agricultural meteorology were adopted and twelve working groups were established to carry on the work of the commission between sessions. A more complete report on the work of the session and other items incidental to the meeting will be given in a later issue of CSM.

4. EVAPORATION MEASUREMENTS: The following discussion by Wayne C. Palmer, Chief of the Bioclimatology Section of the Office of Climatology, may be found useful as a "tentative viewpoint" for some individuals who are concerned with agricultural problems. It seems that much of the disagreement concerning evaporation arises from a neglect of the separate problems involved as well as from a neglect of the necessity for recognizing the purposes for which various measurements may be made.

There have been a number of questions regarding the black Bellani plate atmometer. The following paragraphs provide a brief sketch of the "status" of the work with that instrument. The latter portion of the discussion is intended to set forth a viewpoint which some people have found useful in approaching the whole problem of evaporation and evapotranspiration.

The Canadians (Holmes and Robertson) have searched for an evaporation measuring instrument that would respond to the meteorological elements the same as does a growing plant. They (and we) realize that such an instrument does not (and likely never will) exist. At any rate, they came to the conclusion that the Bellani black-plate atmometer was the best available. They propose that the measurements from this instrument be used as an estimate of potential evapotranspiration.

They say that these instruments actually measure only the drying power of the air, not potential evapotranspiration. They prefer to call this measurement "latent evaporation".

The black plate atmometer does seem to possess some useful characteristics. It is relatively inexpensive; it provides an integrated measure over various periods of time; variations of latent evaporation agree very closely with variations of potential evapotranspiration as calculated by Penman's equation; and it appears to integrate the influence of sunshine, wind, temperature and vapor pressure.

While the above characteristics are "all to the good", there are some aspects which are not so favorable. One of the most frequently expressed objections is that the instruments are rather fragile and quite "tricky" to operate - to the point, in fact, where it is generally agreed that three of the instruments should be exposed in order to determine when one of them has become unreliable. Some workers using the spherical type came to the conclusion that for reliable results the individual instruments should be recalibrated every two weeks.

Holmes and Robertson have worked out a factor for converting latent evaporation (expressed in cubic centimeters of water) to potential evapotranspiration (expressed in inches). This factor is about .0034 inch per cubic centimeter.

The Weather Bureau has bought some of the various types of porous atmometers. The white spheres, the black spheres and the black plates are being installed at Silver Hill for testing. (They have had some difficulty in getting the instruments to function properly due to air leaks, leaky mercury valves, etc.)

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It seems apparent that there is some confusion among the various workers who are concerned with the whole problem of evaporation, transpiration, meteorological effects and measurements in general. There are 3 separate aspects of the problem and they are often overlooked.

The evaporation producing power of the atmosphere depends on the energy available (by radiation, advection and conduction) for the production of evaporation. Strictly speaking, this has never been measured because any measurements are dependent on the evaporating surface used.

Another aspect of the problem seems to concern the evaporation suppressing power of the atmosphere (actually of the space above the evaporating surface). This depends on the difference between the vapor pressure of the space and the vapor pressure of the evaporating surface.

These two aspects cover what is generally referred to as the "evaporative power of the atmosphere"; i.e., the rate at which the atmosphere will produce and retain moisture. This is strictly meteorological and the fact that a given evaporating surface may or may not release enough moisture to satisfy this demand is incidental. These two properties of the environment comprise the aspect some people have in mind when they refer to potential evapotranspiration. It is apparent that this quantity is extremely difficult, if not impossible, to measure directly because any measurement depends in part on the characteristics of the measuring device.

The third aspect is not meteorological, but it is deeply interwoven in our "meteorological measurements of evaporation". This item is the ability of the evaporating surface to release water molecules. It is a function of the shape and characteristics of the surface itself. It is independent of the environment except that its temperature is determined by the environment and in some cases its shape and exposure may be determined by the wind. The different "instruments" such as pan, atmometer, alfalfa field, lysimeter, etc., all seem to possess different "abilities". This is most important in that the various instruments respond differently to the various individual meteorological elements.

The above "hair-splitting" does not necessarily imply that an absolute measure of potential evapotranspiration be obtained, but rather it suggests that any measurement used must be regarded as an index - an index which may be nearly as dependent on the characteristics of the evaporating surface as on

the meteorological environment.

5. TIME OF CLIMATOLOGICAL OBSERVATIONS: Reference CSM 3, Item 3; CSM 4, Item 4; CSM 7, Item 7; CSM 18, Item 5 and Circular B, Paragraph 1210. We are concerned to note that in at least one state the number of temperature stations taking an a.m. climatological observation has increased considerably during the past five years while the number of stations in that state taking a p.m. observation has decreased during that period. We wish to reiterate the importance of taking climatological observations in the p.m.

There are several things to be considered in regard to this problem. We need these data for publication purposes and afternoon temperatures most frequently reflect the proper maximum and minimum for that calendar day. On the other hand, morning observations, if taken consistently at the same time, would more nearly resemble the midnight temperatures published for the previous day for first-order stations. (The matter of setting temperatures back as we did years ago results in a time consuming job if it is to be done properly.)

A recent study in this office has shown that evening observations are apt to be more homogeneous than morning observations; also that a minor change of one hour in observation time in the morning or evening, respectively, can have a remarkably large effect on mean temperature in some regions and seasons, with the largest effects occurring in the first few hours after sunrise. (See article by J. Murray Mitchell, Jr., in the February 1958 Bulletin of the American Meteorological Society.)

In spite of the foregoing, special conditions may make it necessary to select an a.m. observation time. Among these would be the continuance of a long series of good quality observations if these could no longer be furnished in the p.m. Another would be the establishment of a new "a" network station if it is impossible to secure a reliable observer who can furnish p.m. observations. Each case must be examined critically on its individual merits, and professional judgment must be used.

6. ADDITIONAL INFORMATIVE DATA FOR CLIMATOLOGICAL SUBSTATION SUMMARIES: Several State Climatologists have included in their textual material in these substation summaries statements indicating values of meteorological elements not usually recorded at the substations. These indicated values were derived from nearby first-order stations. An example of such statements is quoted herewith:

"Long-term sunshine and humidity records are not available at (substation), but records at (W. B. station) and (W. B. station), which should be similar, are representative of conditions at (substation). These records indicate that November - January sunshine is about 30% of the possible, while in the June - August period, sunshine is about 70% of the possible. Relative humidity measurements at the above mentioned locations indicate early morning averages of 78% to 85% and early afternoon averages of 50% to 75%. The lower values are applicable to the summer season and the higher values to the winter season."

If, in the professional judgment of the State Climatologist, data from a near-

by first-order station(s) is considered reasonably comparable to that which might be expected at the substation, such statements may be included. They should, of course, explain the source of the data from which the indicated values were obtained. These values need not be limited to sunshine and relative humidity, but may include any surface data of local interest so long as location factors are deemed reasonably comparable.

7. STORM DAMAGE REPORT: The State Climatologist for Oregon has arranged with the General Adjustment Bureau's Regional Office in San Francisco to have their twelve branch offices in Oregon supply him with a fairly close estimate of wind and hail damage in any area where they handle fifty or more insurance claims as the result of one storm. Reports are made on a special card designed and reproduced by the State Climatologist and this arrangement seems to be working very well.

A questionnaire form such as this requires Budget Bureau approval, and this has been obtained for the Oregon card. If other State Climatologists plan to use a similar form, they should submit the proposed questionnaire to us, along with four completed copies of Standard Form 83, for clearance.

8. EVAPOTRANSPIRATION DATA: As a part of our contribution to the International Geophysical Year, we have been asked to supply daily and monthly evaporation and evapotranspiration data for a network of about a dozen stations over the United States. In addition, we are planning to furnish monthly evaporation (pan) data for approximately 100 stations. The latter are readily available. However, evapotranspiration data have not previously been collected in any systematic manner. Therefore, we are now asking each State and Territorial Climatologist to help us in locating suitable material. Some description of the station as well as the type of evapotranspirimeter and operational techniques is requested.

Priority will be given to those stations meeting the following criteria:

- a. The evapotranspiration data are available for all or nearly all of the IGY (July 1957 - December 1958) period.
- b. The observer is willing (1) to copy the data on IGY forms; or (2) to send the data to Asheville for copying.
- c. Evaporation data are also available at the same or a nearby location.

9. COPIES OF SUBSTATION NETWORK MAPS ARE AVAILABLE: Negative photocopies of Substation Network Maps are retained in the Substation Unit, O&SF Division, for use in making additional copies for offices having need for them. When maps were first reproduced, copies were distributed on a restricted basis; copies of later approved maps were distributed more generously to Area Hydrologic Engineers and Substation Inspectors as well as State Climatologists and WRPC's.

From time to time additional copies of specific maps have been made for offices requiring them. Most Inspectors now have copies for their respective states. Offices having need of these maps, showing the planned networks at

time of their approval, may obtain copies by requesting them from the O&SF Division. Maps should not be requested for casual use as they are rather large in size and expensive to reproduce.

10. COLLECTION OF CROP INFORMATION IN THE WINTER SEASON: Reference Item 2 of our memo of October 1, 1957 to all State and Area Climatologists and RAOs. As outlined in the above cited reference, the Agricultural Marketing Service is now responsible for collection of crop information in the non-growing, as well as during the crop season. State Climatologists who have collected winter crop information in the past should (if this has not already been done) arrange with the AMS statistician for him to do this job. Any difficulty in accomplishing this should be reported to this office.

11. REPORTING OF PAPERS PREPARED OR COLLEGE WORK COMPLETED: All concerned should be impressed with the importance of reporting to the Personnel Management Division any technical or scientific papers prepared or publications issued (using WB Form 5010) and also of reporting, by copy of transcripts, any additional college credit earned. Both of these items are frequently overlooked.

12. SEPARATES (REPRINTS) OF SECTIONS OF ANNUAL SUMMARY OF CDNS: The following sections of the annual issue of the Climatological Data, National Summary are reprinted every year. Copies may be obtained upon request to the National Weather Records Center.

- a. General Summary of River and Flood Conditions
- b. North Atlantic Tropical Storms
- c. General Summary of Tornadoes
- d. Normals, Means and Extremes

However, if any office plans to ask for more than a few copies of any one separate for 1958, we should be advised within the next few months so that the number of copies of separates to be printed can be adjusted.

13. SPECIAL TABULATIONS, SUMMARIES, OR PUBLICATIONS: State Climatologists are urged to keep us advised when planning any extensive tabulation, study, etc., that would likely result in a Weather Bureau publication. Department of Commerce clearance is now required for such publications, and in some cases duplication of work might be avoided if this office knew in advance of plans for a particular job.

14. ILLINOIS STATE CLIMATOLOGIST HONORED: Mr. L. A. Joos, State Climatologist for Illinois has been appointed Associate Professor of Climatology, Department of Horticulture, College of Agriculture and Agricultural Experiment Station of the University of Illinois.

15. TRAVEL TO SCIENTIFIC MEETINGS FOR PRESENTATION OF PAPERS: Reference COMEMO on above subject, file R-3, dated July 9, 1958. The referenced memorandum points out Weather Bureau policy concerning travel to scientific

meetings for presentation of papers. All Area and State Climatologists should have received a copy of it; if not, please inform this office.

16. CLIMATES OF THE STATES: Reference CSM 68, Item 4. As plans for the "Climates of the States" develop we find that two changes are desirable.

The first one is to publish mean maximum and mean minimum January and July temperature charts in each issue, rather than mean temperature and mean range, as originally planned. We find that the proposed mean range maps do not present much information.

The second change was recommended by the Advisory Committee for Climatology, and is an attempt to relate the 25 year (1931-1955) period used for the Mean Temperature and Precipitation Table to earlier time series of data. Details on this will be worked out and announced later.

17. NEW CENTRAL AREA CLIMATOLOGIST: Mr. Robert F. Dale, California State Climatologist, has been selected as Central Area Climatologist to succeed Dr. G. L. Barger. Mr. Dale plans to enter on his new job in early November.

18. ACTIVITIES OF STATE CLIMATOLOGISTS: The Oregon State Climatologist is working with the Northwestern Area Climatologist and Oregon State College to develop a scheme for forecasting (in late winter or early spring) the amount of feed that can be expected on a given amount of grazing land, based on the weather experienced from September 1 to the time of the forecast.

The Iowa State Climatologist has furnished local farm papers with maps showing the percentage probability of minimum temperatures of 32°F occurring on or before various dates in the fall.

The Wisconsin State Climatologist prepared a map on "Outstanding Tornadoes in Wisconsin". This map and related information will be used in Wisconsin to guide school building programs in the area of greatest tornado frequency.

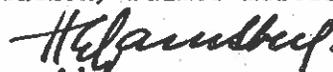
19. PUBLICATIONS DISTRIBUTED TO STATE AND AREA CLIMATOLOGISTS AND WRPC's SINCE CSM 68: "A Graphical Technique for Determining Evapotranspiration by the Thornthwaite Method" by Wayne C. Palmer and A. Vaughn Havens. Reprinted from April 1958 "Monthly Weather Review".

20. NARRATIVE STORIES FOR CLIMATES OF THE STATES: Reference CSM 65, Item 2. Most of these texts have been received here, but some have not. All concerned are asked to give priority to this job.

FOR WRPCs

21. AMENDMENT TO PROCEDURES: Paragraph 1009.6375: Add the following to the paragraph regarding soil type and cover:

"A note should also be carried showing the type of soil thermometers in use at each station. An example is: (Station) Palmer mercury in steel."



H. E. Landsberg  
Director, Office of Climatology

GUIDE TO CLIMATOLOGICAL SERVICES MEMORANDUM NO. 69

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