

# Eastern Snow Conference

## PROCEEDINGS—VOLUME 4

THIRTEENTH MEETING  
HANOVER, NEW HAMPSHIRE  
FEB. 9 AND 10, 1956

FOURTEENTH MEETING  
SYRACUSE, NEW YORK  
FEB. 7 AND 8, 1957



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## FOREWORD

The publishing of this Fourth Volume of the proceedings of the Eastern Snow Conference is in part an attempt to live up to Article II of the Constitution which states that one of the objects of the organization is "the collection, dissemination and analysis of data relating to snow and ice".

It has been customary in previous proceedings to briefly outline the Conference, its aims and objects. However, since it is now 17 years since the first meeting in 1940 and copies of the Constitution are not readily available, your Executive felt that it would be appropriate to include the Constitution in its entirety in this volume of the proceedings.

This will be the second time that the proceedings of two meetings have been included in one volume - Volume 2 included the Tenth and Eleventh meetings held at Albany and Greenfield, and now this volume covers the Thirteenth and Fourteenth meetings which were held at Hanover and Syracuse. It is suggested by the Executive that a real attempt should be made by the Conference to produce a volume of the proceedings each year and as soon as possible after the annual meeting. The value of the papers given at the meeting somewhat diminishes by any extended lapse of time. The members are apt to forget the context of the papers and where a paper refers to methods or equipment, with the rapid advances in snow and ice research, these may quickly become obsolescent.

The organization responsible for publishing Volume 4 of the proceedings is the Ontario Hydro. Certain individuals require special mention: Mr. O. E. Johnston, Hydraulic Generation Engineer, Ontario Hydro, for approving the publication, and Mr. T. K. Allen, Superintendent of the Ontario Hydro Printing Department, for producing such a fine job. The publication committee, who are nameless, should also be thanked.

A capsule comment - and quote from Volume 2 of the proceedings:  
"We should all remember that the Eastern Snow Conference is an organization of participants and it can be no better than its group efforts. The informal atmosphere which we all prize so highly can be maintained while the Eastern Snow Conference becomes more effective and goes on to new gains."

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# EASTERN SNOW CONFERENCE CONSTITUTION

## ARTICLE I

### Name and Location

*Section 1.* The name of this organization shall be the "Eastern Snow Conference." The area to be included in this organization shall be the states lying east of the State of Ohio and the adjoining area in Canada.

## ARTICLE II

### Objects

*Section 1.* The objects to be attained by the organization are:

- (a) The collection, dissemination, and analysis of data relating to snow and ice.
- (b) The discovery and analysis of the physical laws pertaining to the formation of the snow mantle and the behavior and disposition of this mantle.

## ARTICLE III

### Membership

*Section 1.* Membership shall be open to all individuals and organizations interested in the work and objects of the organization. Application for membership shall not be required. A membership roll shall be made up of all individuals and organizations who are interested in the work or objects of the organization.

*Section 2.* Any member in attendance at a meeting may vote.

*Section 3.* Any individual whose name appears on the membership roll may hold office.

## ARTICLE I

### Affiliation with American Geophysical Union

*Section 1.* At the first opportunity the Eastern Snow Conference shall affiliate itself with the American Geophysical Union.

*Section 2.* Formal papers and reports presented before the Eastern Snow Conference shall be presented to the American Geophysical Union for publication after approval by the executive committee.

## ARTICLE II

### Duties of Officers

*Section 1.* The President shall have general supervision of the affairs of the organization and shall preside at all meetings of the organization and of the executive committee at which he may be present.

*Section 2.* The Vice-President shall, in the absence of the President or in the event of a vacancy in that office, discharge the duties of that office.

*Section 3.* The Secretary shall keep the records of all meetings of the organization and of the executive com-

## ARTICLE IV

### Officers

*Section 1.* The officers of the organization shall consist of a President, a Vice-President, a Secretary and three other members forming a total of six members who shall constitute the executive committee in which shall be vested the general government of the organization.

*Section 2.* All officers shall be elected in the manner determined by the President to be most suitable at the Annual Meeting, nominations having been previously made by a nominating committee appointed by the President at the annual meeting.

*Section 3.* The term of office of all officers shall begin at the close of the annual meeting at which they are elected and shall continue through the following annual meeting or until their successors are duly chosen.

*Section 4.* Any vacancy shall be filled by action of the remaining members of the executive committee.

## ARTICLE V

### Meetings

*Section 1.* The meetings of the organization shall consist of the annual meeting, the date for which shall be determined by the executive committee and any other meeting that may be called by the executive committee.

*Section 2.* A number of 10 members shall constitute a quorum for the transaction of business.

## ARTICLE VI

### Amendments

*Section 1.* The constitution may be amended at any annual meeting by an affirmative vote of a majority of the members present.

## BYLAWS

mittee and shall make reports of all meetings of the organization to the American Geophysical Union.

*Section 4.* The executive committee shall decide by majority vote all questions coming before it — three members constituting a quorum.

## ARTICLE III

### Committees

*Section 1.* Besides the executive committee the following standing committees of three members each shall be appointed annually by the president:

Committee on Research

Committee on Records

Committee on Equipment

## ARTICLE IV

### Amendments

*Section 1.* These Bylaws may be amended at any annual meeting by an affirmative vote of a majority of the members present and voting.

NOTE: This constitution has yet to be amended to include a section regarding dues.

**PAPERS NOT PUBLISHED IN THESE PROCEEDINGS**

**RADAR OBSERVATION OF SNOW FORMATION**

K. L. S. Gunn and R. H. Douglas, Stormy Weather  
Group, McGill University, Montreal, Canada.

Abstract included in Proceedings.

**ICE PRESSURE ON DAM**

Progress of the General Investigation

J. G. Willmot, Ontario Hydro, Toronto, Canada.

Read by J. A. S. Milne

**MICROCLIMATOLOGY**

Eleanor Hanlon, Syracuse University, Syracuse, N.Y.

## I N T E R I M   R E P O R T

## REPORT OF COMMITTEE ON SNOW STATISTICS

The original purpose of this committee composed of —

JOHN R. CRIPPEN, U.S. Geological Survey — Albany

GEORGE SCRUTON, Shawinigan Water & Power Company, Montreal, and

CARROLL F. MERRIAM, Chairman

was "for investigating the possibilities of the Eastern Snow Conference publishing a compilation of snow data", see Minutes 12th Annual Meeting, par. 12, but it has since been extended to include the study of snow statistics in general, and particularly their use primarily for increasing the effectiveness of snow surveys. Consequently there are two distinct phases, first the assembly of data, and second their analysis.

It is obvious that the publication of all past snow data assembled under a single cover, desirable as this may be, is a task beyond the capabilities of the Eastern Snow Conference without outside aid. Therefore appeal must be made first to appropriate government agencies, both in the United States and in Canada for cooperation similar to that presently rendered by the U.S. Weather Bureau in the publication of the Annual Snow Survey Summaries.

While there is considerable merit in this suggestion, it is felt that such a request for assistance should not be made without first careful study to determine the most economical procedure. Possibility of taking advantage of the trend toward use of business machine methods should be investigated, with the aim of keeping such a compilation up to date with the least cost as years go by. It is therefore recommended that while the Eastern Snow Conference acting as a whole should adopt a resolution to this effect addressed to the proper authorities, this request should at the same time express desire to assist in working out the most desirable plan of procedure and a willingness to do our part in the search for material and the preparation of the manuscript.

The committee believes that in the meantime consideration should be given to the possibilities of substitute measures whereby in effect the same ends might be accomplished at much less present cost, thus serving the needs until such time as it would be possible to make a more complete compilation of all past observations than can be done at present. Such proposal might take the form of an index for all snow courses where at one time or another observations had been taken. Such a listing, supplemented with references to published data, would at least be a guide by which the research worker would be able to obtain his source information. A suggested format for such an index is attached as Exhibit A. The compilation for such a listing has already been completed for all of the New England States, and it would be merely a continuation of work in progress to complete New York, New Jersey and Pennsylvania. From year to year any necessary additions or amplifications could be made either by holding the type set up as linotype slugs, or by opening up the master sheet from which plates could be made by photo-lithography.

It is furthermore recommended that the committee be asked to confer with those in the U.S. Weather Bureau responsible for the publication of the Annual Snow Survey Summaries, to see if an equally effective but more economical format could be adopted. The basic principle behind such change would be to see if space and effort might not be saved by separating what might be called the permanent information from the current. Specifically the cooperating agency, the elevation and geographic location could be incorporated in the index occupying one section of the publication, thus leaving only the current observations to be listed in a readily understood but shorthand form as illustrated by Exhibit B. It is believed that under this or some similar plan the information contained will be exactly as useful as at present, and there would be the additional advantage that the complete index of all known snow survey data would be reissued each year and thus be automatically brought up to date.

It is furthermore recommended that in future issues of the Annual Snow Survey Summaries, a section be devoted to listing omissions in past issues as well as errors that have been noticed. It has been found that in a number of cases observations have been made but for some reason or other they missed being published.

While the Annual Snow Survey Summaries include snow observations between 1940-41 and 1954-55 for the United States, there appears to be no corresponding publication for this period of time for Canada. The Canadian Met. Service is publishing a summary for the winter of 1954-55, and it will be off the press in February, and hopes to continue such a summary annually. Mr. Scruton has undertaken the task of collecting unpublished material for Canada. He reports that there are about 150 active snow courses operated by about a half dozen agencies, and they together with the Canadian Met. Service are cooperating wholeheartedly in the collection of past data.

In regard to analysis, it is felt that the Eastern Snow Conference would be remiss to be content to play only the part of the archivist. The time has come to give more serious thought to the analysis of past records.

There have been many perplexing disappointments in snow surveying, and it is now apparent that it is practically hopeless to expect a correct evaluation of the average snow cover by taking the average of a relatively few observations at more or less random points. The primary reason for this is the complexity of the snow pattern as shown for example by Exhibit C which gives the normal water content on March 1st, for Vermont and New Hampshire. It will be appreciated that to obtain a reliable direct measurement of the average it would be necessary to have an enormous number of carefully selected courses, a condition that is practically impossible to fulfill.

The inability to get fully satisfactory results by direct measurement means that snow observations must be interpreted in the light of their relation to normal values, as has been done by the Union Water Power Co. having a background of 45 years experience in snow surveying. Although we now see that so and so many inches on such and such a date may have a little meaning taken alone, it does take on significance when we know what percentage this is of the normal for that date, or how many inches it is above or below the seasonal trend. In this way the influence of local conditions such as geographic position, altitude, exposure, relation to mountain ranges, etc. are automatically taken into consideration, and the result, or departure from normal, can be assumed to be representative over a considerable area. Experiments indicate that this concept of departure from normal has many interesting possibilities in increasing the effectiveness of snow observations.

To accomplish this end obviously necessitates statistical analysis of past data in order to establish the normals to which individual observations may be referred. It is believed that this analysis can be most economically carried out through the agency of the Eastern Snow Conference rather than individually by constituent organizations.

It has furthermore become apparent from the experimental efforts so far that these constituent organizations have much to gain by appliance with the Eastern Snow Conference.

NOTE: Exhibits referred to in this report are filed with the Secretary of the Conference.



I N T E R I M   R E P O R T

**MEMORANDUM**

*To:* All parties interested in Snow Survey Mapping Method proposed by Mr. CARROLL MERRIAM.

*From:* GORDON S. HAYES, District Engineer, U.S. Geological Survey, Augusta, Maine.

*Re:* Test of Method on March 2 at Augusta, Maine, using live data simultaneously with production of Maine Cooperative Snow Survey Map for 1956.

Attached is a copy of the informal report to me by Mr. Merriam, of the test of the new methods proposed by him for making maps of departure from normal and actual water content of snow cover. It should be noted that I have inserted a paragraph on page 3, giving my opinion as to the comparison of the map of water content prepared by Mr. Merriam as a test and that which was produced and distributed by this office as the Maine Cooperative Snow Survey Map of Water Equivalent on March 1, 1956.

Each year since 1941 this office has been the collection agency for data from all parties making snow surveys within the State of Maine and from this data we have prepared a Map of Water Equivalent of Snow Cover as of March 1st. This has been distributed to all individuals, industries, utilities, and governmental agencies who have requested it.

This year Mr. Merriam asked permission to use our collected data for a "live" test of his proposed methods and it was granted. At Mr. Merriam's request, several agencies outside the State, furnished data for his test and for such use as this office cared to make of it in the preparation of our conventional map.

Following is a list of contributors of base data used in the preparation of our conventional map and the test maps:

Great Northern Paper Company

New England Power Co. — Northern Div.

Bangor Hydro-Electric Company

Shawinigan Water & Power Company

Kennebec Water Power Company

U.S. Engineers — Boston District

Union Water Power Company

U.S. Weather Bureau — Portland Office

Public Service Company of N.H.

This office is much interested in Mr. Merriam's proposed methods of snow mapping and will continue to cooperate with him in furthering the studies in such ways as may be feasible. I am sending out this report on the first test run for your information and will appreciate any comments which you may care to make.

GORDON S. HAYES,  
*District Engineer*

## Report on Test of March 2nd, 1956

In the routine preparation of snow maps considerable skill has been developed through experience. This skill cannot be reduced to specified procedure, and care must always be taken not to disturb, by any new proposal, what has already been gained during the past but rather to supplement it by such innovations as may on trial prove their merit. These should be adopted only as opportunity presents itself, and not as a sweeping program of new technique. In this regard this test has shown that consideration may well be given to the possibilities of the following suggestions:

*Fringe Data:* This test as well as other experiments have demonstrated the desirability of receiving data from nearby regions outside of the area of immediate concern. Such information permits the drawing of lines of equal values with confidence to the limits of the map through knowledge of what lies just beyond. It is consequently suggested that zones be established between the provinces of the various data collecting offices, and that reports from these zones be transmitted to not one but two or more such offices as may be able to make use of the data. Specifically, it would appear advantageous if the office at Augusta could receive reports from —

- (1) Northern Division of the New England Company.
- (2) Winnepessaukee Area of the Public Service of New Hampshire.
- (3) U.S. Engineers — Boston Office data covering Northern New Hampshire and possibly Northern Vermont.
- (4) Department of Hydraulic Resources — Province of Quebec.
- (5) U.S. Geological Survey — Boston office.

With further development of snow observing program in New Brunswick, these data would undoubtedly assist in improving the map for Eastern Maine. From the point of view of other collecting offices, it may be advantageous to them to have reports from bordering sections of Maine.

*Definition of Geographic Location:* This test demonstrated the advantage of having prepared in advance a means of quickly plotting the locations at which snow observations were made. Plotting was accomplished by use of a blank sheet of transparent paper laid over a matrix on which only the locations of the courses had been inscribed. It would have been possible to have designated these by names, but it was found quicker to use the coordinates, which had been noted on the data sheet when the departure from normal had been determined by reference to the index cards. Once the data had been entered at the proper locations, the exact spot being the decimal point, everything else could be eliminated by inserting a sheet of white paper. In this way the "contouring" could proceed without the confusion of map features such as names, watershed boundaries, rivers, etc.

*Normal Maps:* A map showing the seasonal normal value for each snow course which had been observed for a sufficient length of time, could be constructed for any desired date in advance. Inasmuch as the only requirement is sufficient length of record to determine a satisfactory average, data could be used for courses no longer observed. In many situations these abandoned courses were useful in defining certain characteristics as influenced primarily by topography. These characteristics may be expected still to be reflected in maps of current distribution of snow, and it is possible that by having maps showing normal distribution for various dates, such maps may be of use in guiding the placing of the lines of equal values. These might thus bring into the picture the accumulated knowledge gained from past records. Such would remain unutilized if maps were to be plotted from current observations alone.

To some extent the same is actually accomplished through the skill that develops after years of experience, but this skill is difficult to pass along from one person to another. It is hardly a scientific approach when there may be a more definite way of improving on the results.

*Topography:* Of the many factors affecting the amount of snow accumulation, altitude seems to play the dominant part, and it has been customary to shape the lines of equal values in a manner that runs in general up the river valleys. This taken into account only the influence of the hollows, while it is possible that the distribution is governed fully as much if not more by the crests. To consider the influence of the uplands, it is possible to use topographic maps either pantographed up from the 1:2,000,000 jet navigation charts of the Coast and Geodetic Survey, or else down from the 1:500,000 aeronautical charts to bring them to the plotting scale for the snow maps at 1:1,000,000. The contour interval may be either 500 ft. or 1,000 ft. depending upon which map was used as a source. These copies were tinted to bring out the general land form more distinctly than possible from the contours alone. The maps actually used for this test did not include the drainage in blue, but in the future the rivers can be added. When drawing the maps for normal distribution it was surprising to see how closely the water content actually did conform with the topography. It should be distinctly understood, however, that it was not assumed that because a place had such an elevation, then the normal had to comply with an established formula or relationship. The maps were drawn primarily from the plotted data, the topo maps being used merely as a guide in filling in the lines of equal values where their trend was not clearly defined by the data. Whether the topo maps would prove as useful in making maps of actual current snow cover as they are in the case of normal distribution is a question, but at least it will be worthwhile to experiment further.

*Departure Map:* The primary purpose of this test was to demonstrate the practicability of constructing maps of departure from normal. All of the data currently observed could not be used for the reason that on this map we were limited to those courses for which there had been a sufficient number of years of observations to have established reasonably reliable normals. Fortunately this was not serious because the number of such courses in Maine is quite large. In fact practically all of the data could be used. The amount of departure both above and below normal was first determined from the index cards on which all previous observations had been plotted. These values were then entered on a blank sheet of transparent paper laid over the matrix showing the locations of the courses. The data were

then inked, those above normal in black, and those below in red. These contrasting colors showed at once the general areas of surplus and deficiency, so that the neutral line or division between the plus and negative values could first be drawn. Other lines of equal values were then plotted in the usual manner their general form apparently not being affected by topography. It was readily apparent that many of the observations were definitely out of line with their neighbouring courses, and such discrepancies which had to be allowed for were brought out much more clearly than in the conventional plot of the raw data as observed. When the map was completed these lines showed distinctly the outstanding characteristics, in this case a pronounced sink from the White Mountains to the mid basin of the Androscoggin, with less pronounced extension running northeastward through the middle of the province of New Brunswick, together with a fringe of high along the coast. The points which do fall in line with the vast majority of the others, show that the surface thus presented is on the whole much less broken up by sudden changes than the conventional map of actual measurements. Because it is smoother, it is believed that it can be more accurately depicted by the available data, or in other words, more points would be necessary when plotting in the usual way to give a desired degree of definition.

*Indirect Method of Plotting of Snow Cover:* Although the authorized scope of this test extended only to the construction of a map of departure from normal, attempt was subsequently made to see if it would be possible and practical to derive a map of snow cover by combining the map of departures with the map of normals. This may be considered the indirect method as compared with the conventional, but actually the observed data are used in the same manner as before but supplemented by estimated values derived by the intersections of the lines of equal values on the two superposed maps. The test showed several weaknesses which may be attributed to lack of previous experience so that several days later a new start was made with much better results.

Although completed too late to be of immediate value, this has been submitted for comparison with the map drawn by the conventional procedure.

(Opinion as to comparison to be inserted here by Mr. Hayes.)

NOTE: Mr. Hayes submitted the following statement regarding comparison of the two maps. "In general the two maps showed similar characteristics as might be expected. The areas of high water content were centered in approximately the same spots but the lines of equal water content took slightly varied shapes. Shapes of areas of low water equivalent varied to a greater degree but in general the variation was not excessive. The map prepared by the test method has lines running in smoother curves showing the effect of discarding some observations which appear to be out of line, and using the "departure from normal map" as a guide, in drawing the final "snow cover" map.

"It is believed that if both maps could have been prepared using entirely identical data the lines showing water content would have had even more similarity since many of the discrepancies appear in the areas where data was used in one method but not the other."

It should be observed that the two maps were not prepared from strictly comparable basic information. In the first place there were a number of additional observations at newly established courses which could be used on the official map, but for these courses it was impossible to know what the normal values were from which the observations departed. Against this there were a number of special observations taken as courses which had not been observed for a dozen years in the past, and there was no ready means of locating them on the official map without undue delay. In addition other agencies outside of the state cooperated generously, and as the precise locations of these courses had been previously entered on the base map, and as the normal for these had already been determined, these points could be used in the test. There is, of course, no reason why they could not have been used on the official map except that they had not been previously entered on the base map, and to do so would have caused delay which under the circumstances could not have been afforded. It is furthermore believed that even though the indirect method is definitely more laborious, nevertheless it does give effect to a large amount of effort that has been expended in snow observations in the past. Whether the results warrant the additional labour is a question to be solved.

*Conclusions:* It is obvious that there are a number of suggestions for further improvement of snow plotting technique which should be considered, and if found practical should be adopted as circumstances permit.

CARROLL F. MERRIAM

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SNOW CONFERENCE

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J. A. WEST, PHOENIX, ARIZONA

February, 1956

The Western Snow Conference through its General Chairman, Walter E. Johnson, has delegated me to extend greeting from the Western Snow Conference to the Eastern Snow Conference.

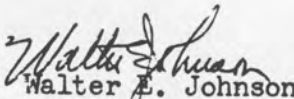
His Message Reads:--

Once again we wish to extend greetings from the Membership of the Western Snow Conference to those affiliated with your group. It is gratifying indeed to recognize the efforts, and appreciate the contributions of others who labor in our common field of endeavor.

While snow, as a natural resource, occupies a position of considerable economic importance everywhere, it is a critical element in the industrial life of our region, and we accordingly welcome the assistance of all who are engaged in the study of its occurrence, and the development of improvements in methods of measurement and potential evaluation.

We wish you a successful and profitable meeting, and will look forward to receiving and benefiting by the results of your discussions.

The Western Snow Conference will hold its next annual meeting in Penticton, British Columbia, April 18-20 inclusive, 1956. A chartered bus will leave Spokane, Washington, in the afternoon of April 17 and return on the 21st. Inspection stops at Grand Coulee and Chief Joseph Dams, on the Columbia River, will be made enroute. We cordially invite all who can to join us for this meeting.

  
Walter E. Johnson,  
General Chairman

WEJ:ejr

1957  
PROCEEDINGS

**To the Executive Committee of the Eastern Snow Conference**  
**Meeting at Hotel Onondaga, Syracuse, New York**  
**February 6th, 1957**

Your Secretary has asked me for a few thoughts regarding the processing of snow data. Your attention is called particularly to the report by Mr. Hayes concerning the experiment of March 1st, 1956. There is little that I can add from practical experience beyond this, but a few suggestions, which may be entirely impractical to consider at present, may be recorded for future reference.

It is essential to take into account the basic difference between snow data and other meteorological and hydrologic observations. These later even though to some extent "samples" are nevertheless made on a continuing basis at specified intervals. The records are in general complete as far as missing observations are concerned. Snow, on the other hand, might be considered a very sketchy sampling of samples. The labour involved per observation is as a rule far greater than for daily recording of river flow for example. Consequently the responsibility on our part for getting the most out of the data is far greater. Conventional methods of averaging are not sufficient and can be very misleading.

The probable accuracy of any one snow measurement is certainly not very high because of the extreme variability of conditions from one point to another. Reports carried beyond a tenth of an inch hardly seem justified, but are not objectionable if derived from an average of a large number of observations. However, when recording in published form the dropping of hundredths may save considerable space and effort without appreciable loss.

Because of the spasmodic nature of the times at which snow observations are made, the results can best be summarized in graphic form. The enclosed record card appears to be very satisfactory for conditions in the region of the Eastern Snow Conference. A supply sufficient for at least the present needs of the Conference is available, while the plate for reprinting is on deposit with the J. W. Boarman Co. in Baltimore. So far only a few of the very high altitude stations have required vertical scale exceeding 14 inches, while those that do use a second card for observations 10 to 24 inches.

After a relatively few years the points plotted regardless of year of observation begin to make clear a rather well defined characteristic curve in spite of considerable scatter in the points themselves. Experience has shown that even though the scatter seems great the probability of reliable results is high because curves drawn for individual stations have been found to "nest" together very satisfactorily.

So far it has seemed unnecessary to indicate on the plot the year of observation, or to try to connect the points for each individual year, unless there should be great inequality between the number of observations in each year. In this case too much weight would be given to the years having the greatest number. If plotted in detail the curve for any one season would be very jagged because of storms and thaws. For this reason observations from time to time are essentially random samples which may strike by chance on peaks or valleys. I should strongly recommend preservation of the actual reading and the date, rather than reduction to a standard date, such as the first or fifteenth, of the month, based on knowledge of intervening storms. There is no objection to making this reduction as long as the original record is kept, and in fact the estimated figure, noted as such, can well be added to the graph as having at least some significance. If the effect of the storms can be estimated no bit of information should be neglected.

On many of the chronological plots there is a distinct "arching", or envelope of minimum values. This indicates that at such stations some snow on the ground is always to be expected between definite dates. The others show that bare ground may be expected at any time throughout the season. Information of this kind might be interesting to those concerned with recreation or highway maintenance.

Special care should be taken in evaluating past records in regions where snow is so unusual that observations are stimulated only by unusual circumstances. In order to get a true average it is just as important to report "no snow on ground" in the open years as it is to measure only when there is an unusual amount. Unless this is done it is impossible to distinguish between years when there was actually no snow and those when observations were neglected. The effect is always to give too high an average.

The chronological plots in file for New England have found some use in normalizing short records by reference to stations nearby with long established records. Although this is an approximation, it may be useful in regions where programs of observations are being expanded but in which at present the records are mainly of limited length.

A strong point in Mr. Hayes' report is the desirability of overlap between regions reporting to respective collecting agencies. I believe that it is amply demonstrated that maps for specific areas cannot be reliably drawn without some knowledge of what lies beyond. It is urged that agreements be reached by which available data may be dispatched to the offices which have immediate need.

Studies have shown definitely that the prime variable influencing the accumulation of snow as of any given date is altitude. It is therefore suggested that much more complete and detailed maps of normal snow cover may be compiled by taking into account the generalized topography as shown on maps with 500 ft. contours. The lines of equal snow are still drawn consistently with the given data, but are shaped with reference to the topography.

Mr. Hayes' report discusses the results of experiments using the "differential method", which frankly is still in the development stage. Assuming Mr. Hayes' willingness to continue with another experiment on this coming March 1st and providing that we can have assurance of cooperation on the part of agencies adjacent to Maine, I should be glad to see if this method could be brought another step toward practicability. In principle it is based on the observation that "departure from normal" is far more uniform from a real standpoint than the raw data. Consequently if a map can first be drawn representing the distribution of "departure", it can then be matched with a map of normal for the date, with the result that a far more detailed and reliable map of actual cover can be constructed than would be possible from the observations alone. In effect it makes available for present use all of the effort that has been expended in snow observations in the past. Otherwise this would be neglected if the map were to be drawn strictly from the current data.

I believe that it would be desirable to collect all the snow data available in a single cover, particularly if data hidden away in such places as the Maine Public Utility Commission Reports, the files of the Kennebec Water Power Co., the Union Water Power Company, to mention only those that I know of, could be brought to light. On the other hand, I should not advise this being done until some plan could be worked out by which machine equipment could be used for setting up the data. I believe that a plan could be worked out so that the records could be automatically assembled without the task of retabulation and checking. The format by which such data could be presented could be advantageously condensed.

I still believe that we should look forward to the time when some coordinated system of referencing the location of snow observation points will be needed by the Conference as a whole, with provision for possible extension to the Middle West. The mathematical elements of such a system have already been developed and have been tested for accuracy. So far there appears to be a lack of appreciation of the problem of providing for a continuous map of this entire area, and the difficulties that will arise if attempt is made to join present maps of the various sections together. Preservation of standard map scales and the convenience of rectangular plotting are important considerations. I should strongly advise against closing the door to further consideration even though it may not be the time at present to proceed.

A word from me would hardly be complete without still another often repeated plea for attention to be given to ground water. Snow data are extensively used in estimating future river flow in terms of storage. Ground water plays a similar part and the effectiveness of one is impaired if the other is neglected. Results from a program of ground water observations are not to be expected for many years because they cannot be resolved directly into terms of acre-feet, but must wait a considerable period to build up a historical background. It is not too early to look forward to the time when ground water may become an important adjunct to snow surveys.

Respectfully submitted

CARROLL F. MERRIAM

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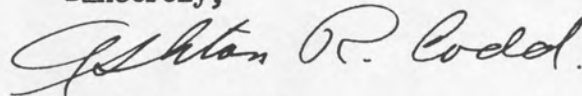
The Western Snow Conference wishes to extend Greetings  
and best wishes to you for a successful Conference at  
Syracuse, New York, February 7-8, 1957.

We are fortunate to have Mr. Homer J. Stockwell, one of  
our past General Chairman and Life Member of the Western Snow  
Conference, represent us at your Conference. We are sure  
that Homer will give a good account of, "The Use of Snow  
Surveys in the West."

We enjoyed the presentation by Mr. Gayno Williams,  
Ottawa, Canada at our Conference last April in Penticton, Canada.

I wish to extend an invitation to you folk for a  
representation at the Western Snow Conference, April 17-19, 1957  
at Santa Barbara, California. Headquarters will be at the  
Mar Monte Hotel in that city.

Sincerely,



Ashton R. Codd  
General Chairman