1979

EASTERN SNOW CONFERENCE

RESULTS OF SNOW SURVEY SCHEDULE COMMITTEE QUESTIONNAIRE

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Introduction:

The Committee has prepared the results of the responses to the 1979 Questionnaire in the form of summarized answers listed after each question. This is followed by conclusions drawn on the five subject areas of the questionnaire.

Acknowledgement:

The thanks of the Committee goes to Secretary Ron Allen who kindly provided the mailing list and labels for this effort. Also thanks to those who responded to the questions.

Source Documents:

The original copies of the questionnaire received back by the Committee have been filed with the Secretary for safe keeping and reference by any interested Conference member.

Abbreviations:

The following abbreviated terms are used in the paper.

AES	- Atmospheric Environment Service, Canada
cm	- centimetre
ESC	- Eastern Snow Conference
NWS	- National Weather Service, United States
pt.	- point
SCS	- Soil Conservation Service, United States
USGS	- United States Geological Survey
W. Eq. or Water Eq.	- Water Equivalent of Snow
yr.	- year

EASTERN SNOW CONFERENCE '79 QUESTIONNAIRE RESULTS

NETWORKS

1. Q. How many snow survey stations does your Agency operate?

   A. 30 Networks reported operating from 38 respondents.

   Networks range in size = 1 to 145 stations.
   Five (5) networks operated by private companies.
   Twenty-five (25) networks operated by public agencies.
   The average size of network - 38 ± 1 stations.

   Total number of stations reported = 1164 (Not comprehensive total).

2. Q. Has the number of stations changed recently? If so, by how much?

   A. Fourteen (14) of 30 networks have changed, 16 have not.

   Increases = 7 ranging 1 to 10 courses.
   Decreases = 7 ranging 2 to 67 courses.

3. Q. Have you recently done a snow network evaluation? If so, what methods were used? (Please describe) Is a reference available?

   A. Five (5) Networks have been evaluated, two (2) are underway.

   Statistical averages/optimal interpolation/verbal interviews/vegetation effects are methods that have been used. Physiographic relations are under study.

4. Q. What standard of station operation do you follow?

   A. Station operation is done according to these standards.

   AES = 5 NWS = 2 USGS = 3 SCS = 2 ESC = 1
   5 pt. = 4 10 pt. = 5 31 pt. = 2 Unspecified = 14

DATA AND ANALYSES

5. Q. Do you observe (1) snow depth, (2) water equivalent, (3) density? In what ratio? What is your frequency of observation?

   A. Number of agencies observing these parameters.

   (a) Snow Depth - 34 Water Eq. - 33 Density - 18
   (b) Predominately, observers measure depth and water equivalent in a 1:1 ratio. Only two reported a reduction in W. Eq. observations, 3:1 and 10:1.

(c) Sampling/observation frequencies varied widely in the responses, but the bi-weekly and monthly frequencies predominated.

2 @ daily	1 @ 21 days
5 @ 7 days	7 @ 30 days
1 @ 10 days	6 quoted in terms of 1 to 7 times/yr.
13 @ 14 or 15 days	
	2 undefined in time units

6. Q. What accuracy is required for a single station observation?

A. Accuracy varies significantly in amount and in reference. Some respondents differentiated between depth and water content parameters citing different accuracy requirements.

Of 26 responses, seven quoted percentages, seventeen quoted linear dimensions of the snowpack, two used weight units and one indicated variable standards.

Accuracy standards of 1 cm or less in the expressed depth of the snowpack and water equivalent column were most frequently stated.

7. Q. What is the data used for? (reservoir storage, hydropower, flood forecasting, recreation, agriculture, research, water balance, wildlife, or other). Please specify in descending order of importance if there is more than one use.

A.

Number of Demands for Data	Relative Importance of Data to Demand
19 - Flood Forecasting	Research
17 - Reservoir Storage	Flood Forecast
14 - Hydropower	Reservoir Storage
7 - Water Balance	Hydropower
2 - Recreation	Recreation & Agriculture
1 & 1 - Agriculture and Wildlife	Wildlife

Other Priorities and Uses

Publication of Data
Climatology
Water Supply Forecasting
Student Training

8. Q. Is the data used operationally? Is snow data essential?

A. Operational Use

(a)	Yes	No	Sometimes
	23	11	1

Essential

(b)	Yes	No
	27	4

9. Q. Do you cooperate with others to exchange snow data or analyses? If so, in real-time or historic?

A.

Exchange Data and Analyses	Yes	No
	32	3

Real-time	Near real	Historic
18	4	18

10. Q. Do you use a standard data format; in exchanging? In archiving?

A.

Standard Format for Exchange	Yes	No
	17	16
For Archiving	Yes	No
	16	12

11. Q. What means of data exchange do you use? (telex, mail, etc.)

A. Means of Exchange in order from most popular:
mail
telephone
telex
telecopy
reports

12. Q. Is your data quality controlled? If so, how?

A.

Quality Control	Yes	No
	20	15

Methods vary but the most common quality control is a standard field procedure or an office procedure to screen the data at the initial stage. Some agencies carry out site inspection work and two reported calibration of instruments as a quality control method.

Two of the large network operators who responded to the questionnaire carry out combined field, office, site inspection and observer training programs.

However, much of the data is uncontrolled.

13. Q. What type(s) of analysis do you perform? (mapping, areal averaging, indexing, etc.)

A. Analysis Listed in descending order of frequency

Mapping of Snow	- 16	Several agencies carry
Areal Averaging	- 15	out more than one type
Means, historic comparison or indexing	- 10	of analysis on snow data
No analysis	- 8	
Terrain Correlation	- 3	
Hydrology Studies	- 2	
Water Balancing	- 1	

14. Q. Are your analyses automated?

A. Automation of analysis has not been widely reported in the responses to the questionnaire. Of those who did answer (23) twenty-three are not automated for snow data analysis. Six (6) agencies see themselves as automated while five (5) others are partly so.

INSTRUMENTS

15. Q. What type(s) of instruments do you use? (Please identify the main stay).

A. The vast majority of respondents are using the familiar tube type snow sampling equipment with the Mt. Rose model being the clear favorite.

16. Q. Has your instrumentation changed recently? If so, why? Describe the change: (metric, technology, etc.).

A. Snow sampling equipment has not changed significantly in the Eastern area of North America. The small number of changes reported in the questionnaires involved improvement to the research facility operated by Dr. B. Michel and a compatibility change in the tube sampler used on one network; both in Quebec.

17. Q. Do you have any new technology snow instrumentation in operation? If yes, please describe.

A. A number of devices are under test by agencies associated with the Eastern Snow Conference.

The following list was reported to this questionnaire.
- a portable gamma - spectrometer
- a laser-optical snow particle imaging system
- snow samplers in metric sizes
- Wyoming Snow gauges
- a Tretyakov snow gauge
- a snow melt recording device and DCP
- a lysimeter in a research facility
- NYERPIC and IDAHO gamma measuring snow pack gauges
- snow pillows

VALUE

18. The responses to the questions on value indicate a real problem in attempting to assess the value of snow pack data.

Paulin's (1) study of data value in Quebec and neighbouring regions put the total dollar value very conservatively at $700,000/yr against an operating cost of $50,000/yr for a C/B ratio of 1:14 over a 50% sample response of 70 users of the data.

This questionnaire received the following. Of 137 agencies/conference members contacted by mail, 36 replied with answers to some of the questions. That is, we had a 26% response rate. Two other responses indicated no snow data activities by those agencies in our Conference area. Three responses were received advising of research and design use of snow climatological data, four were received back undelivered and one response from the SCS in the Western Snow Conference indicated a willingness to share WSC experience with the ESC to help strengthen our snow survey activity.

The specific replies given to the four parts of the question are presented as follows:

Q. Estimate the value of snow data to your Agency or operations by quoting dollar values - if possible - for the following topics:

Capital per annum - snow measurements:

A. No answer - 14
Inseparable costs - 3 respondents
Separable total costs - $10,600, 19 respondents
Average cost per station/yr - $558
Range of costs - zero to $5,000

Operating and maintenance per annum - snow network:

A. No answer - 16
Inseparable costs - 4 respondents
Separable total costs - $226,680, 16 respondents
Average cost per station/yr. - $425.

Operations supported (as noted in Question 7) per annum:

A. Almost no information was given on this point
No answer - 25
Inseparable costs - 5 respondents
Total declared - ranged $3,000 to $500,000
In three cases there was a clear indication that the question was not understood.
In two cases indirect replies were stated.

B/C ratios for operations supported:

A. Almost no estimates were given.
No answer - 27
C/B answers - 1.2:1, 1:5, 1:14, 1:250, from 4 respondents
Indirect answers - 4

PUBLIC INFORMATION

19. Q. In addition to Question 7, are your data and analyses used for public information purposes? If yes, please specify:

A.		Specified Information - Use and Frequency Among Respondents
Yes	24	General news - 14 Co-op snow survey reports - 3 Data publication - 2
No	8	Advise project operators - 2 Research reports - 2 Snow survey report - 1 Water Resource Review - 1

Q. Is this a mandate of your Agency or State Government?

A. Mandate -	Yes	No	No Answer
	7	18	7

CONCLUSIONS:

1. Networks
   - There is a sizable number of snow survey stations in the Eastern Snow Conference Area run as networks by some 30 or more agencies. About half the networks have had some change in size recently, the most notable being a 75% reduction in the State of Maine.
   - Despite some concern over changes in network size, very few have been evaluated recently to see if they are performing well and efficiently. Also the way networks are operated is highly variable which must reflect in the quality and comparability of data obtained across the region.

2. Data and Analyses
   - Snow depth and water equivalent are measured in all networks on a 1:1 ratio of observation. Most often 15 and 30 day observation cycles are used.
   - Accuracy of observation varies significantly but a majority of opinion holds that 1 cm of depth and water equivalent should be the minimum acceptable accuracy.
   - Snow data are essential in an operational mode for five (5) purposes which were chosen as highest priorities marked as follows:
     Flood Forecasting
     Research and Reservoir Storage
     Hydropower
     Water Balance
   - A wide exchange of data and analysis takes place within the region. About half of the exchange is real-time and half historically. This verifies the operational need for the information; however, about half of the data exchange and archiving takes place in non-standard format. Also many of the agencies do not quality control their snow data in contrast to the larger network operators who take pains in this regard.
   - The most popular analyses are mapping and areal averaging. Most analysis is unautomated.

3. Equipment
   - Conventional tube type sampling kits (several models) are almost universally used and this has not changed recently.
   - New technology equipment is in use only on a test basis and not widely.

4. Value
   - In contrast to the clear acknowledgement of the essentialness of snow data it has been shown difficult to put a monetary value on it. (The values which were quoted were high). The high priority uses of snow information have an integral connection with snow in this ESC region and it may well be almost meaningless to attempt to put quantitative values to the data.

     Suffice it to say that flood forecasts, reservoir filling estimates and water balances could not be done in the snow belt without this data. These activities are widely practiced in this region.

5. Public Information
   - Snow information is finding a wide public market as indicated by the response, however, only a few agencies as yet have a clear mandate to provide these data.

REFERENCES:

Paulin, M. G., (1979): Description, Evaluation et Perspective de Developpement du Réseau Nivométrique du Quebec, Publication au Service de la Meteorologie, Richesses Naturelles, Quebec.