EASTERN SNOW CONFERENCE

Report of the

COMMITTEE ON RESEARCH

February 1968

This report lists research reports relating to snow and ice as revealed by a poll of current members of the Conference.

The outline of the report is as follows:

SECTION I - SUMMARY OF CURRENT PROJECTS

A - Projects not reported in 1967

B - Projects reported in 1967

C - Research Projects Indirectly Related to Snow and Ice.

SECTION II - SUPPLEMENTAL INFORMATION

DATA SOURCES

Respectfully submitted,
Committee on Research, ESC

L. L. Cross, Jr., Chairman
Claude Triquet
Ray Falconer

SECTION I - CURRENT SNOW RESEARCH

GROUP A - NEW PROJECTS

68A1 ESTABLISHMENT OF SNOW COURSES IN THE ATTAWAPISKAT BASIN

Paul Jarvis; Gibb, Underwood & Mellelan and
John Silburn, Ontario Water Resources Commission,
801 Bay St., Toronto 5, Canada

To establish snow courses in the headwaters and at the mouth of the Attawapiskat River Basin with the object of relating snow melt to spring runoff. Two courses were set up, one at Pickle Lake and one at Attawapiskat, and local personnel were trained in taking snow measurements. Stream flow records have not yet been compiled and no relation has been made with snow melt.

Paper: Snow Course Data - January 1967 to May 1967. Attawapiskat Basin. Obtainable at the above address or Meteorological Branch, Dept. of Transport, Toronto 5, Canada.

68A2 INTERNATIONAL HYDROLOGICAL DECADE-REPRESENTATIVE BASIN STUDIES

D. Puccini, P. Eng. River Basin Research Branch,
Div. of Water Resources, Ontario Water Resources Commission,
801 Bay St., Toronto 5, Canada

Determination of snow melt runoff in the Wilmot Creek subbasin of the Bowmanville, Soper and Wilmot Creeks representative basin. Snow surveys are carried out regularly during the winter months and the data analyzed in conjunction with that from the climatological and hydrometric stations in the basin to assess the snowmelt runoff component of the winter water balance. Similar studies are contemplated for three other representative basins in southern Ontario.

Paper: "Wilmot Creek Snow Survey Report, 1966-67, Preliminary Data Report No. 67-1." Limited distribution only.

68A3 EVAPORATION OF INTERCEPTED SNOW IN A PINE PLANTATION AND A HARDWOOD STAND IN CENTRAL NEW YORK

Gordon Heisler, State University Water Resources Research Center,
S.U.N.Y. College of Forestry, Syracuse, N.Y. 13210

To determine area estimates of the amounts of intercepted snow which is evaporated in two forest stands, native hardwoods and a red pine plantation. Standard shielded rain gauges will be used to estimate amounts of snow intercepted. Radiant energy budgets will be computed from radiometer measurements to aid in estimating potential interception loss. Profiles of wind, temperature and vapor pressure will also be recorded. Data will be collected and analyzed on a storm basis. The project is scheduled to run two winters, 1967-68 and 1968-69.

68A4 LAKE EFFECT SNOWSTORMS

Dr. George E. McVehil, Cornell Aeronautical Laboratory, Inc., P. O. Box 235, Buffalo, N.Y., 14221

This research program consists of investigations of the Great Lakes snowstorms that occur when cold continental polar air is modified by the unfrozen lakes. Specific objectives include: 1) development of a mathematical model of the lake effect atmospheric circulations, 2) analyses of energy and water transfer between Lake Erie and the atmosphere, 3) development of a synoptic climatology of lake-effect situations, 4) observation of mesoscale storm characteristics, 5) analysis of physical properties of lake effect clouds, and 6) evaluation of the feasibility of modification of lake-effect snow systems.

Papers: (Obtainable from Cornell Aeronautical Laboratory, Inc.) Some studies of Lake Effect Snowfall from Lake Erie, by G.E. McVehil and R. L. Peace, Jr., Proceeding of Eighth Conference on Great Lakes Research, Publ. No. 13, Great Lakes Div., Univ. of Michigan, 1965 pp. 262-272.

A Study of Lake Effect Snowstorms, by G.E. McVehil and R.L. Peace, Jr., Report No. VC-2142-P-2, Cornell Aeronautical Lab., 1966.

Radar Characteristics of Lake Effect Snowstorms, by R.L. Peace, Jr., Proceedings of Twelfth Converence on Radar Meteorology, Am. Meteorology Soc., Boston, 1966, pp. 454-460.

Mesoscale Study of a Lake Effect Snowstorm, by R.L. Peace, Jr., and R.B. Sykes, Jr., Monthly Weather Review, Vol. 94, No. 8, Aug. 1966, pp. 495-507.

A Study of Lake Effect Snowstorms, by G.E. McVehil, J.E. Jiusta, W.J. Eadie, R.L. Peace, Jr., R.A. Brown, Report No. VC-2355-P-2, Cornell Aeronautical Lab., 1967

68A5 BASIN SNOWMELT AND HYDROGRAPH SYNTHESIS FOR THE NORTH NASHWAKSIS STREAM BASIN, N.B., CANADA

Dr. K.S. Davar (Prof. D.I. Bray, Assisting Coordinator)
University of New Brunswick, Dept. of Civil Eng.
Fredericton, New Brunswick, Canada

This study is directed toward estimating basin, snowmelt from meteorological parameters by two alternative methods: a) Linear regression analysis and, b) Physical theory of snowmelt. The estimated basin snowmelt, after being adjusted for extent of cover, is routed to the basin outlet for synthesizing snowmelt hydrographs. A hydrologic budget for the snowmelt season is also being made.

Paper: To be reported in a Masters Thesis to be submitted to the Dept. of Civil Engineering, in Spring, 1968.

68A6 A MODEL STUDY OF INTERCEPTED SNOW

John R. Yager, State University Water Resources Research Center,
S.U.N.Y. College of Forestry, Syracuse, N.Y., 13210

Theoretical estimate of energy fluxes in the steady slate from a computerized mathematical model of intercepted snow, under varying climatic conditions, are calculated and evaluated.

68A7 GROUND WATER RESOURCES IN PRINCE EDWARD COUNTY

Prof. R.J. Kennedy, Dept. of Civil Engineering,
Queens University, Kingston, Ontario

The principle objective is an estimate of ground water resources for the area but the study necessarily includes an investigation of the geology and the water budget. In connection with the latter, four snow courses have been established and data is being collected.

68A8 A PRELIMINARY ESTIMATE OF THE ICE SEASON ENERGY BALANCE FOR THE NIAGARA RIVER.

H.L. Ferguson, Meteorological Branch, Dept. of Transport,
315 Bloor St., West, Toronto 5, Ontario, Canada

This is an original feasibility study for the joint Meteorological Branch-Ontario Hydro IHD study on Niagara River ice. Terms in the energy budget equation are estimated using climatological data for February and river temperature and flow data collected in February 1967. Principal objectives are to establish an optimum time scale for energy budget-ice forecasting purposes and to establish the relative magnitudes of energy budget terms.

Paper: To be published shortly. Copies will be available from the author.

68A9 CRITICAL METEOROLOGICAL CONDITIONS FOR MAXIMUM INFLOW, CHURCHILL FALLS POWER DEVELOPMENT, NEWFOUNDLAND

D.M. Sparrow, Meteorological Branch, Dept. of Transport, 315 Bloor Street, West, Toronto 5, Ontario, Canada

Estimates are made by two independent methods of the physical upper limit to seasonal snowfall in the high elevation portion of southwest Labrador. In addition, upper limits to melt season temperature sequences and maximum spring storm rainfall are studied.

Paper: Under preparation and approved for publication as a Meteorological Branch Technical Circular.

68A10 SNOW MELT COMPUTED FROM CLIMATOLOGICAL OBSERVATIONS

Dale O. Hackett, E.S.S.A. Weather Bureau River Forecast Center, Box 688, Hartford, Conn., 06101

To analyze snowmelt rates from climatological observations to determine thresholds, degree-day factors, optimum temperature functions, etc.

68A11 ICE PRESSURE AGAINST STRUCTURES

Snow and Ice Section, Division of Building Research, National Research Council, Ottawa, Ontario

A laboratory study has been initiated on the buckling of ice covers due to lateral load. A field study on ice pressure measurement using strain gauges has been initiated. Several members of the Section presented papers at a Conference on Ice Pressures held at Laval University, November 1966. The Proceedings of this conference should be available shortly. Copies may be obtained by writing to The Secretary, Associate Committee on Geotechnical Research, National Research Council, Ottawa.

Papers: Elastic and Strength Properties of Fresh Water Ice by L.W. Gold, presented to Conference on Ice Pressures against Structures, Tech. Memo. No. 92, National Research Council, Associate Committee on Geotechnical Research, Ottawa, November 1966.

Plastic Deformation of Fresh Water Ice by A.S. Krausz, presented to Conference on Ice Pressures against Structures, Tech. Memo. No. 92, National Research Council, Associate Committee on Geotechnical Research, Ottawa, November 1966.

Model Study of Ice Pressures by J. Nuttall and L.W. Gold, presented to Conference on Ice Pressures against Structures, Tech. Memo. No. 92, National Research Council, Associate Committee on Geotechnical Research, Ottawa, November 1966.

Freeze-up and Break-up of Fresh Water Lakes by G.P. Williams, presented to Conference on Ice Pressures against Structures, Tech. Memo. No. 92, National Research Council, Associate Committee on Geotechnical Research, Ottawa, November 1966.

68A12 MELTING OF LAKE ICE

G.P. Williams, Division of Building Research, National Research Council, Ottawa, Ontario.

To study physical process of ice-melting and correlate rate of lake ice melt with meteorological conditions. Assess usefulness of dusts for increasing ice-melting rate.

Paper: Ice-Dusting Experiments to Increase the Rate of Melting of Ice by G.P. Williams, Technical Paper No. 239 of the Division of Building Research, National Research Council, January 1967.

GROUP B - PROJECTS LISTED PREVIOUSLY

68B1 SNOW AND ICE COVER INVESTIGATIONS
Michael A. Billelo, U.S. Army CRREL, Hanover, New Hampshire 03755

Regional variations in snow cover properties; formation, growth and decay of lake, river and sea ice in the Arctic and Subarctic. Seasonal and areal distribution and development of forecast schemes.

Paper: Relationships between Climate and Regional Variations in Snow Cover Density in North America. Proceedings of the International Conference on Low Temperature Science, Sapporo, Japan.

68B2 FLOOD RUNOFF AND WATER YIELD IMPROVEMENT FROM THE GLACIATED MOUNTAIN AREAS OF NEW ENGLAND
R.S. Pierce, Northeastern Forest Experiment Station, P. O. Box 640, Durham, N.H., 03824

The quantitative influence of forest environment and associated climate features on stream flow are being investigated. Reduction of high snowmelt runoff and increases in summer stream flow by suitable watershed treatments are the goals of the project.

Papers: Papers on stream gaging, snow accumulation and melt, and soil frost available from above address.

68B3 ICING ON ENGINEERING STRUCTURES
Donald W. Boyd, Division of Building Research, National Research Council, Ottawa, Ontario.

To determine the geographical distribution, frequency and thickness of ice accumulations on wires, towers and other structures. The Canadian Standards Association and many electric power and communication organizations are cooperating by reporting serious icing storms.

Paper: Icing Observations 1965-66, Second Progress Report by Donald W. Boyd, Division of Building Research, Technical Note 479, February 1967.

68B4 FRACTURE OF ICE
L.W. Gold, Division of Building Research, National Research Council, Ottawa, Ontario.

To determine the dependence of crack formation in ice, and the occurrence of failure on stress, temperature and time.

Papers: Dependence of Crack Formation on Crystallographic Orientation for Ice by L.W. Gold, Canadian Journal of Physics, Vol. 44, Nov., 1966, pp 2757-2764. (DBR Research Paper No. 290)

68B5 THERMAL REGIME OF RIVER ICE

G.P. Williams, Division of Building Research, National Research Council, Ottawa, Ontario.

To study ice formation in rivers, particularly supercooling and the relation of ice formation to meteorological variables. Progress includes continuation of special observations on supercooling in rivers and commencement of review of the literature on river ice.

Paper: Adhesion of Ice to Underwater Structures by G.P. Williams to be presented to 1967 Annual Meeting of Eastern Snow Conference.

68B6 AVALANCHE RESEARCH

P.A. Schaerer, Division of Building Research, National Research Council, Ottawa, Ontario.

Observations are being continued at Rogers Pass, B.C., on the properties of avalanches and their dependence on the characteristics of the avalanche site. One of the objectives is to determine the dependence of the size of avalanches at a given site, and the amount of snow brought down each winter, on the size of the accumulation zone and amount of snowfall.

Papers: A Study of the Amount of Snow Deposited at Avalanche Sites by P. A. Schaerer, presented to Int. Conf. on Low Temperature Science, Sapporo, Japan, 1966.

Snowshed Location and Design by P.A. Schaerer, Journal of the Highway Division, ASCE, Vol. 92, No. HW2, October 1966, pp 21-33. (DBR Technical Paper No. 252)

68B7 PLASTIC DEFORMATION OF ICE

A.S. Krausz, Division of Building Research, National Research Council, Ottawa, Ontario.

To obtain information on the mechanism of plastic deformation. The plastic behavior of ice is studied using the rate process theory and the Gilman-Johnston model. Attention is focused on the initial stage. It was established that in ice single crystals the dislocation multiplication process is the rate controlling mechanism in the initial stage.

Paper: A Method for Growing Tubular Ice Crystals by A.S. Krausz, B. Harron and G. G. Litvan, Nature, Vol. 215, No. 5098, July, 1967, pp 271-273. (DBR Research Paper No. 330).

GROUP C - RESEARCH INDIRECTLY RELATED TO SNOW AND ICE

67C1 SOIL FREEZING AND THAWING

G.P. Williams, National Research Council Conducted at University of Guelph, Guelph, Ontario

To determine whether or not the type of cultivation in the fall affected the workability of an organic soil in the spring. It was found that depth of freezing and rate of thawing were independent of method of cultivation. Snow cover reduced the depth of frost penetration and shortened the period of spring thaw.

Paper: Soil Freezing and Thawing, by G.P. Williams, Univ. of Guelph Eng. Tech. Publication 14, 1966.

67C2 EVAPORATION FROM LAKE ERIE

Roger A. Brown, R. L. Peace, Jr., G.E. McVehil, Cornell Aeronautical Laboratory, Inc., P.O. Box 235, Buffalo, N.Y., 14221

To conduct a study of the hydrologic and energy budgets of Lake Erie, with emphasis on evaporation measurement. Specific objectives were to review available data on these lake characteristics, to survey possible approaches to more precise determination of the relevant lake properties, and to suggest ways in which new research would most effectively contribute to better knowledge of Lake Erie physical properties.

Paper: A Study of Hydrologic and Energy Budgets of Lake Erie with Emphasis on Evaporation Measurement by R. A. Brown, R.L. Peace, Jr., G.E. McVehil. Report No. RM-2342-0-3, Cornell Aeronautical Laboratory, 1967.

(1) Snow courses should be selected, laid out and maintained during the summer or fall. The value also of the courses should be assessed during the winter season under snow cover. Courses should be marked clearly. Possibly USGS, as coordinating agency, could supply markers.

(2) A sufficient number of snow-depth and water-content samples up to ten should be taken at each snow course to obtain a representative average.

(3) Soil conditions under the snowpack should be noted at the time of each measurement.

(4) Snow Surveys should be conducted during the first week of January, February and March and the third week of February and March. Additional snow surveys should be made in April at high elevations and in more northern areas and in other sections, if necessary.

(5) Snow surveys should be coordinated with adjoining states in relation to dates of collection and data to be collected.

(6) One snow course, preferably of long duration, should be selected as an index course in each basin and measurements at this course continued indefinitely.

(7) Snow surveying equipment should be standardized so that all cooperators use comparable equipment and the same techniques.

(8) The use of a standard 8-inch rain gage to measure snow would be acceptable provided the user is instructed in how to get representative depths of snow and reliable values of water content.

A definite separation should be made between new snow and snow on the ground from previous storms. There is a problem of terminology with considerable confusion on this subject and amongst meteorologists themselves. Suggest that new snow should be listed as snow that has fallen in the past 24 hrs. or past 6 hrs. etc., and snow on the ground should be defined as snow cover i.e. the total snow that remains on the ground from all previous snow, including the present storm.

A snow stake, either in a fixed or variable location could be used for measuring snow cover. These readings could be coordinated with a nearby snow course and water content could be estimated in this manner.

The Equipment Committee also suggests that a meeting of snow pluggers from each cooperating agency should be held early during the snow season for purposes of training. Possibly this could be coordinated with all the agencies in the northeast so more uniform methods of data collection and reporting could be obtained.

A bibliography of references should be compiled of available literature relative to methods and procedures of snow surveying.

Develope a base map showing all snow reporting stations as in the Western Snow Surveys upon which snow water equivalent lines can be drawn - a picture is worth a thousand words.

Signed: Livingston Lansing, Chairman
G. P. Williams
Joseph W. Lalley

Note: This report was developed by Joseph Lalley and G. P. Williams in association with Ray Falconer, and revised slightly by L. Lansing, Chairman.

A question developed on how often new snowfall depth readings should be made i.e. every 6 hrs. as at first order Weather Bureau Stations or every 24 hrs. as at Cooperative Weather Bureau Stations - the frequency of the measurement has a proportional relationship to the total depth of new snow recorded from any given storm.