

Report of the
EASTERN SNOW CONFERENCE
RESEARCH COMMITTEE

February 12, 1970

As in the past, the committee has conducted a survey of the membership concerning research studies in progress. The list is attached. It is divided into 8 sections as follows:

1. Properties of snow and ice
2. Precipitation and accumulation
3. Snowpack measurement
4. Snowmelt
5. Streamflow
6. Lake and river ice
7. Highways and buildings
8. Soil water and frost

The selected bibliography initiated last year has also been continued and is attached.

The committee suggests to the Conference that it establish a student award to encourage student interest and research in problems related to snow and ice. An outline of the proposal is included in this report.

The committee is working on an index to all the Proceedings of the Eastern Snow Conference yet published. We hope to have this ready by next year. The Western Snow Conference is about to publish a similar index to their Proceedings.

We are also discussing the possibilities of compiling a review of research needs in snow and ice for northeastern North America. Several suggestions have been received, but we feel that a more representative committee is necessary to work successfully on this.

Submitted,

C.A. Federer, Chairman
R.B.B. Dickison
A.R. Eschner

EASTERN SNOW CONFERENCE RESEARCH COMMITTEE

List of Studies in Progress

1. PROPERTIES OF SNOW AND ICE

- 70-1 MECHANICAL PROPERTIES OF FRAZIL, SNOW AND COLUMNAR ICE FOR THE CASES OF UNIAXIAL AND BIAXIAL DEFORMATION -- Bernard Michel, Ice Mechanics Laboratory, Universite Laval, Civil Engineering Department, Quebec 10, P.Q., Canada.

The objects of this extensive research program is to find, for the ductile and fragile zones of deformation, the ultimate

strength of ice in compression and tension. The results are obtained for frazil, snow and columnar ice taking into account the temperature and the crystal orientation.

Three D.es.Sc. thesis are under preparation and most of the results will be published in 1970.

- 70-2 DEFORMATION BEHAVIOUR OF ICE --L.W. Gold, Snow and Ice Section, Division of Building Research, National Research Council of Canada, Ottawa, Ontario.

This is a continuing study of fracture of ice.

- 70-3 THERMAL CONVECTION AS A POSSIBLE MECHANISM CONTRIBUTING TO FLOW IN ICE CAPS --T. Hughes, O.S.U. Institute of Polar Studies, 125 South Oval Drive, Columbus, Ohio 43210.

This study investigates the criterion for convection in ice caps and the size and velocity of convection cells which may develop. The critical parameters are ice thickness, ice viscosity, and temperature gradients. Conditions for convection are presently satisfied in certain parts of the Greenland and Antarctic ice caps, and a mechanism is proposed whereby convection may lead to surges of ice caps. The study is nearly completed.

2. PRECIPITATION AND ACCUMULATION

- 70-4 SATELLITE APPLICATIONS TO SNOW HYDROLOGY -- Robert W. Popham, ESSA National Environmental Satellite Center, F.O.B. #4, Suitland, Md.

A review and summary of satellite applications to snow hydrology thru 1968 - prepared for WMO.

Popham, Robert W. 1968. Satellite applications to snow hydrology. World Meteorol. Org.--Int. Hydrol. Decade Report 7. WMO, Geneva, Switzerland.

- 70-5 FEBRUARY 1968 HEAVY SNOW PERIOD IN THE OSWEGO AREA -- Robert B. Sykes, Jr., Lake Ontario Environmental Laboratory, State University College, Oswego, New York 13126.

To isolate some of the local heavy snow situations in respect to atmospheric pressure and wind variations.

Report given at the 12th Great Lakes Conference in Ann Arbor, Michigan.

- 70-6 BOSTON'S HEAVIEST SNOWSTORM ON RECORD --Charles H. Pierce, ESSA Weather Bureau, Logan International Airport, East Boston, Mass.

To determine the synoptic meteorological features that produced Boston's heaviest snowstorm in 98 years of records. It was found that the three main ingredients that gave the 26.3-inch snowfall were: (1) the unusual motion of the middle level weather system with respect to the low level system; (2) the deceleration of the storm to the southeast of Boston; and (3) the long over-water trajectory of moist air for an extended period before reaching Boston.

"Boston's Heaviest Snowstorm on Record" Weatherwise - December 1969.

- 70-7 INTERACTION BETWEEN THE GREAT LAKES AND THE ATMOSPHERE -- William J. Eadie, Cornell Aeronautical Laboratory, Inc., P.O. Box 235, Buffalo, New York 14221.

The objectives are a better understanding of the dynamics and cloud physics of lake-effect snowstorms, and the determination of the feasibility of their artificial modification.

The Structure and Dynamics of Lake-Effect Snowstorms, by G.E. McVehil, C.W.C. Rogers, and W.J. Eadie, Report No. VC-2559-P-1, Cornell Aeronautical Laboratory, Inc., 1968.

- 70-8 SNOWCOVER IN THE VICINITY OF PETERBOROUGH, ONTARIO --W.P. Adams, Trent University, Peterborough, Ontario.

To increase knowledge of snowcover in the Peterborough area in connection with a study of river development in the catchment of Jackson's Creek which includes the downtown part of the city.

"Making Use of Snow," presented to the O.U.T.A. Fall Conference, 1st December.

- 70-9 THE INADVERTENT MODIFICATION OF THE ATMOSPHERE BY AIR POLLUTION -- Dr. Vincent J. Schaefer, Atmospheric Sciences Research Center--SUNYA, 130 Saratoga Road, Scotia, New York 12302.

Schaefer, V.J. 1969. The inadvertent modification of the atmosphere by air pollution. Bull. Am. Meteorol. Soc. 50: 199-206.

- 70-10 AVALANCHE RESEARCH -- P.A. Schaerer, Snow and Ice Section, Division of Building Research, National Research Council of Canada, Ottawa, Ontario.

Observations are continuing on the properties of avalanches and their dependence on weather and the characteristics of the avalanche site.

3. SNOWPACK MEASUREMENT

- 70-11 SATELLITE SURVEILLANCE OF MOUNTAIN SNOW IN THE WESTERN UNITED STATES --James C. Barnes, Allied Research Associates, Inc., Virginia Road, Concord, Massachusetts 01742.

To develop techniques for using satellite photography to map snow distributions in regions of mountainous terrain.

Barnes, J.C. and C.J. Bowley, 1969. Satellite Surveillance of Mountain Snow in the Western United States, Final Report, Contract No. E-196-68, Allied Research Associates, Inc.

- 70-12 MONITORING OF SNOW WATER EQUIVALENT BY AERIAL RADIOLOGICAL SYSTEM -- Eugene Peck, ESSA, Weather Bureau, W232, Silver Spring, Md. 20910; Bruce Jones, E G and G, Inc., P.O. Box 1022, Boulder, Colo., 80302; Charles Anderson, E G and G, Inc., 680 East Sunset Road, Las Vegas, Nevada 89101.

To determine the accuracy with which the water equivalent of the snowpack can be ascertained by utilizing airborne measurements of natural radiation. Tests are being conducted during the 1969-70 winter season over a 10-mile, non-forested area near Luverne, Minn. Total and energy spectrum gamma ray radiation data from different flight heights and extensive ground measurements of soil moisture

and water equivalent of the snow are being collected.

4. SNOWMELT

- 70-13 ALBEDO OF VEGETATED SURFACES -- Raymond E. Leonard, Northeastern Forest Experiment Station, c/o State University College of Forestry, Syracuse, New York 13210.

Obtain temporal and spatial values of albedo for various cover types in the North East. Six aerial tramways have been constructed in stands of Red Pine, Northern Hardwoods, and Norway Spruce. These measuring systems have been operated for periods of one to two years since 1966.

Albedo of intercepted snow. Leonard, R.E. and A.R. Eschner. 1968. Water Resources Research, Vol. 4, No. 5, pp. 931-935.

- 70-14 COOPERATIVE SNOW HYDROLOGY PROJECT - ESSA WEATHER BUREAU AND ARS SLEEPERS RIVER WATERSHED --Eric Anderson, Office of Hydrology W232, Room 530 W232, 8060-13th St., Silver Spring, Md. 20910 or Project Leader, Sleepers River Watershed, USDA Agricultural Research Service, Danville, Vermont 05828.

To better understand the physical processes involved in the metamorphosis and melting of a snowpack. Project began 1966. Data collection continues. The first complete winter of data was obtained during the 1968-1969 snow season.

Martin L. Johnson and Anderson, Eric. "The Cooperative Snow Hydrology Project - ESSA Weather Bureau and ARS Sleepers River Watershed", Proceedings Eastern Snow Conference 1968, pp. 13-23.

- 70-15 THE ENERGY BALANCE OF SNOWMELT IN NORTHERN HARDWOODS -- C.A. Federer, USDA-Forest Service, Northeastern Forest Experiment Station, P.O. Box 640, Durham, New Hampshire 03824.

Study of the influence of the winter hardwood forest canopy on the heat sources required for snowmelt. A mathematical model for solar radiation absorption and reflection by the canopy has been developed. Increase of downward thermal radiation by the canopy and reduction of wind speed under the canopy are also being studied.

- 70-16 MOISTURE FLUX IN THE SNOW PACK - SOIL SYSTEM -- L. Derikx, Hydrologic Sciences Div., Inland Waters Branch, Dept. of Energy, Mines and Resources, 558 Booth St., Ottawa, Ontario.

To study the moisture flux in the snow pack - soil system during the period of snow cover, and to develop a physical model of the processes involved.

- 70-17 A MASS AND ENERGY BALANCE MODEL FOR A SNOWPACK IN THE OPEN -- Michael R. Provart, School of Ag. Engineering, University of Guelph, Guelph, Ontario.

To develop a mathematical model of snowpack accretion and ablation processes in open areas. To test this model against data from the open terrain of Blue Springs Basin, Southern Ontario. To evaluate the snow measurement techniques used in the Blue Springs Basin and recommend modifications.

Will be published in M.Sc. Thesis - Jan. 1970.

- 70-18 MODELING THE SNOW ACCUMULATION AND ABLATION PROCESS - Eric Anderson, Office of Hydrology W232, ESSA-Weather Bureau, Silver Spring, Md. 20910.

To develop the best model of the snow accumulation and ablation process given various data inputs and geographical situations. Testing of models is currently underway for watersheds in the western mountain, north central and northeastern regions of the United States.

E.A. Anderson, "Development and Testing of Snow Pack Energy Balance Equations", Water Resources Research, Vol. 4, No. 1, February 1968, p. 19-37.

- 70-19 PARAMETRIC HYDROLOGY PEYTO GLACIER BASIN -- I. Derikx, Hydrologic Sciences Div., Inland Waters Branch, Dept. of Energy, Mines and Resources, 558 Booth St., Ottawa, Ontario

To establish a simple, flexible and adequate mathematical prediction model for the runoff of the glacier by determining quantitative and generally applicable relationships between meteorological parameters and runoff.

Derikx, I., 1969. Glacier Discharge Simulation. Paper presented at Symposium of American Water Resources Association, Banff, Alberta.

5. STREAMFLOW

- 70-20 PLANNING OF A HYDROMETRIC NETWORK FOR THE PROVINCE OF ONTARIO -- S.T. Solomon, Shawinigan Engineering Co., Ltd., 620 Dorchester Blvd., W., Montreal, P. Q., Canada.

To define the objectives and organization of a hydrometric network for Canadian conditions and to explore various techniques for the development of a preliminary network plan for the Province of Ontario. Problems of ice and snow are covered in a general way only.

Planning of a Hydrometric Network for the Province of Ontario. Obtainable from Water Survey of Canada, Department of Energy, Mines and Resources, Ottawa, (limited distribution).

- 70-21 THE EFFECT OF FOREST CLEARING ON SNOWMELT RUNOFF IN NEW ENGLAND -- Robert S. Pierce, USDA-Forest Service, Northeastern Forest Experiment Station, P.O. Box 640, Durham, New Hampshire 03824.

Small gauged watersheds are being used to study the effects of forest practices on snowmelt runoff. Streamflow data for 4 melt seasons following a complete forest clearing have been analyzed for changes in timing, volume, and peak flows. A less drastic east-west-oriented strip cutting is the next treatment planned for a Hubbard Brook Watershed.

- 70-22 WINTER STREAMFLOW MEASUREMENT CONDITIONS, PROBLEMS AND TECHNIQUES AT GAUGING STATIONS ON SMALL STREAMS -- River Basin Research Branch, Division of Water Resources, Ontario Water Resources Commission, 135 St. Clair Ave. W., Toronto 195, Ontario.

A critical review is being made of winter conditions and the problems associated with them for the obtaining of accurate stage-discharge relationships at gauging stations on small streams. From this review, it is anticipated that techniques can be developed

and improved to aid in winter streamflow data collection. Initial results have led to experimentation on the use of heating cables, observers, etc.

- 70-23 INSTALLATION OF HEATING CABLES IN CONCRETE WEIRS --River Basin Research Branch, Division of Water Resources, Ontario Water Resources Commission, 135 St. Clair Ave. W., Toronto 195, Ontario.

It is anticipated that the installation and operation of heating cables in small artificial weirs will prevent significant ice buildup on the weirs, thereby enabling the obtaining of more accurate stage-discharge relationships during the winter months. Initial results at one streamflow station were encouraging and a second installation is in operation for the first time this winter.

6. LAKE AND RIVER ICE

- 70-24 PRIORITIES IN ICE RESEARCH --Canada Inland Waters Branch, Dept. of Energy, Mines and Resources, Ottawa. Consultant: H.G. Acres, Ltd., 1259 Dorchester Rd., Niagara Falls, Ontario.

The purpose of the study is to evaluate research related to ice on rivers and lakes by: reporting on the economic impact of ice in these areas, reviewing the present state of knowledge, and recommending research priorities according to economic advantages. The work has been undertaken in the form of a series of studies with progress reports being issued at the end of each of six studies. The six reports will be assembled to form a final report.

Requests for copies of the reports should be directed to: Dr. J.D. Keys, Chairman, Inland Water Branch Ice and Snow Research Committee, Dept. of Energy, Mines and Resources, No. 8 Building, Ottawa 1, Ontario.

- 70-25 SNOW AND ICE COVER OBSERVATIONS THROUGHOUT NORTH AMERICA -- Michael A. Bilello, U.S. Army CRREL, P.O. Box 282, Hanover, N.H. 03755.

Weekly measurements of snow-cover properties, and ice thickness and conditions on lake, river and land-fast sea ice are being taken at several networks of stations in Alaska, Canada, and northern U.S. Research and analysis of the data collected at these locations continues.

(1) U.S.A. CRREL Research Report 213 "Water temperatures in a shallow lake during ice formation, growth and decay" by M. Bilello.
(2) U.S.A. CRREL Special Report 121 "Ice conditions and prediction of freeze-over on streams in the vicinity of Ft. Greely, Alaska" by Bates, Saboe and Bilello. (3) U.S.A. CRREL Special Report 127 "Surface measurements of snow and ice for correlation with aircraft and satellite observations" by M. Bilello.

- 70-26 USE OF SATELLITE HIGH RESOLUTION INFRARED IMAGERY TO MAP ARCTIC SEA ICE -- James C. Barnes, Allied Research Associates, Inc., Virginia Road, Concord, Massachusetts 01742.

To study the use of data from the Nimbus High Resolution Infrared Radiometer for mapping sea ice distributions. A continuation of this work, using Nimbus III data, is in progress.

Barnes, J.D., D.T. Change and J.H. Willand, 1969: Use of Satellite High Resolution Infrared Imagery to Map Arctic Sea Ice, Final Report, Contract No. N62306-68-C-0276, Allied Research

Associates, Inc.

- 70-27 GREAT LAKES ICE ATLAS -- D.R. Rondy, Great Lakes Research Center, U.S. Lake Survey, 630 Federal Bldg., Detroit, Michigan 48226.

Publication (April 1969) illustrates ice cover on Great Lakes during winters classified as mild, normal, and severe.

- 70-28 MELTING OF LAKE ICE -- G.P. Williams, Geotechnical Section, Division of Building Research, National Research Council, Ottawa 7, Ontario.

To study physical process of ice-melting and correlate rate of lake ice melt with meteorological conditions.

Williams, G.P. "Water Temperature During the Melting of Lake Ice". Water Resources Research, Vol. 5, No. 5, October 1969.

- 70-29 STUDY OF RIVER AND LAKE ICE -- J.B. Bryce, Ontario Hydro, 620 University Avenue, Toronto 2, Ontario.

A ten-year program to study the formation, movement, and dissipation of ice in the Niagara River between Fort Erie and Grass Island Pool. (Grass Island Pool is formed by the Niagara River Control Structure, which is located immediately above the Canadian Falls.)

- 70-30 TEMPERATURE GRADIENTS THROUGH ICE SHEETS -- S.S. Lazier, Dept. Civil Engineering, Queen's University, Kingston, Ontario, Canada.

Measurements of temperatures at close intervals in the ice sheet at the eastern end of Lake Ontario are being taken with a view to relating these to meteorology conditions. The ultimate aim is to provide field data on the problem of the forces exerted by the thermal expansion of ice sheets. Preliminary measurements were taken in 1969, and plans are well advanced to make continuous records during 1970. This work is a thesis topic of one of the investigator's graduate students.

See publication under study 70-31.

- 70-31 MOVEMENTS IN CONTINUOUS ICE SHEETS -- S.S. Lazier, Dept. of Civil Engineering, Queen's University, Kingston, Ontario, Canada.

"Pressure Ridges" are a common phenomenon on large continuous ice sheets, and it is the purpose of this study to examine the conditions which promote the formation of such "ridges". As part of the study, measurements are being taken of the movements of the ice sheet on either side of pressure ridges. Readings have been taken for three winters on such movements in the ice sheet at the eastern end of Lake Ontario. Movements of up to ten feet have been recorded, and these must surely be caused by thermal expansion alone. This work is continuing as a thesis topic for one of the investigator's graduate students.

Lazier, S.S., MacLachlan, F.A., "Movements in Continuous Ice Sheets and Temperature Gradients in an Ice Sheet". Proceedings, National Research Council, Sixth Conference on Snow and Ice, October 1969 (in press).

- 70-32 BORDER ICE FORMATION -- Bernard Michel, Ice Mechanics Laboratory, Universite Laval, Civil Engineering Dept., Quebec 10, P.Q., Canada.

The objects of this research are to find the mechanisms, the laws and the characteristics of the border ice. The knowledge of the following factors and others is major for a better understanding of the winter inundations, scientific localization of water intakes and nordic river hydrology: static formation of plate ice; dynamic formation by accumulation of ice floes and slush; formation by accretion of frazil and air inclusions on the edge of shore ice.

Michel, B. and R.O. Ramseier, 1969 - "Classification of River and Lake Ice Based on its Genesis, Structure and Texture. Report s-15, Dept. Genie Civil, Universite Laval, 40 pages. Michel, B., 1969 - "Ice Covers in Rivers". Proc. Conf. "Ice Pressures Against Structures", N.R.C. Tech. Mem. No. 92, p. 231-247.

- 70-33 DYNAMICS OF FREE-FLOATING AND SHORE-FAST BAY ICE -- P.F. Cooper, Jr., Polar Continental Shelf Project, Department of Energy, Mines and Resources, 588 Booth St., Ottawa, Ontario.

To study the movement and deformation of the ice in Kugmallit Bay N.W.T. and to relate this to the stresses applied by wind, current, and resistance of land-fast ice.

- 70-34 ICE FORCES ON BRIDGE PIERS -- C.R. Neill, Research Council of Alberta, 87 Ave. and 114 St., Edmonton, Alberta, Canada.

To carry out field measurements and other studies on action and forces of ice against bridge piers in river break-up conditions. Measurements have been obtained at one large bridge for 3 seasons and at another during 1 season. Movie films of dynamic action have been obtained, as well as continuous force recordings.

"Determination of actual forces on bridge piers due to moving ice," by E.J. Sanden and C.R. Neill. Proceedings of 1968 Convention, Canadian Good Roads Association. (Available from Res. Council as Contribution No. 423.) "Alberta studies of ice pressure on bridge piers," prepared for inclusion in Proceedings of National Research Council Conference on Snow and Ice, Calgary, 1969. (Will be available from Res. Council as Contribution No. 465.)

- 70-35 MEASUREMENT OF ICE FORCES ON LIGHT PIERS -- J.V. Danys, Marine Service Branch, D.O.T., H.G. Acres Ltd., (Consultant), 1259 Dorchester Rd., Niagara Falls, Ontario.

To design an instrument capable of measuring ice forces on light piers. The measured forces will then be used to check assumptions made with respect to ice strength, shape factors, and safety factors in designing light piers. Detailed design, component specification, and cost estimates are currently in progress.

Phase I Report (Sept. 1969) outlines the instrument concepts selected for detailed study. Requests for copies should be made to J.V. Danys, Aids to Navigation, Dept. of Transport, Hunter Bldg., Ottawa, Canada.

- 70-36 ICE PRESSURE AGAINST STRUCTURES -- L.W. Gold, Snow and Ice Section, Division of Building Research, National Research Council, Ottawa, Ont.

This is a continuing field study on ice pressure measurements using strain gauges.

7. HIGHWAYS AND BUILDINGS

70-37 ICING ON ENGINEERING STRUCTURES -- Donald W. Boyd, Division of Building Research, National Research Council of Canada, Ottawa, Ontario, Canada.

To determine the geographical distribution, frequency and thickness of ice accumulations on wires, towers and other structures.

8. SOIL WATER AND FROST

GROUND THERMAL REGIME -- G.P. Williams, Snow and Ice Section, Division of Building Research, National Research Council of Canada, Ottawa, Ontario.

Field study on the rate of freezing of a peat bog, influence of snow cover and thermal properties of the soil. Continuation of a study on air and ground temperatures at a specific peat bog.

E.S.C. Selected Bibliography - 1970

Categories:

1. Properties of snow and ice
2. Precipitation and accumulation
3. Snowpack measurement
4. Snowmelt
5. Streamflow
6. Lake and river ice
7. Highways and buildings
8. Soil water and frost

1. PROPERTIES OF SNOW AND ICE

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J. Electro-Chem. Soc., January 1968, pp. 174-177.

Cross, J.D. 1969. Study of the surface of ice with a scanning electron microscope. Proceedings of the International Symposium on Physics of Ice, Munich, Germany, September 1968.
Physics of Ice, Plenum Press, pp. 81-95.

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2. PRECIPITATION AND ACCUMULATION

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3. SNOWPACK MEASUREMENT

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5. STREAMFLOW

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6. LAKE AND RIVER ICE

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7. HIGHWAYS AND BUILDINGS

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8. SOIL WATER AND FROST

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Eastern Snow Conference

Student's Prize for Snow Research - Proposed Criteria

1. The Research Committee of the Eastern Snow Conference proposes that the Conference make available an annual award for student research related to snow. Proposed criteria for selecting the winning entry and presenting the award are outlined below.
2. Unless otherwise decided at an annual meeting of the Conference, the award shall be entitled "The Eastern Snow Conference Student's Prize for Snow Research."
3. For the purpose of this award, a student shall be defined as (a) one who was enrolled as a full-time graduate or undergraduate student at a recognized university during the academic year immediately prior to the selection of the award winner, and (b) one who has not reached his 30th birthday on December 31st of the year the award winner is selected.
4. The award shall consist of a cash prize of twenty-five dollars (U.S.) together with one year's membership in the Eastern Snow Conference and an appropriate certificate.
5. Entries are to be post-marked not later than September 30th and addressed to the Chairman of the Research Committee of the Eastern Snow Conference.
6. The award winning entry will be selected by the Research Committee, with the stipulation that the Committee may judge that no entry merits the award in a particular year. The winner will be announced prior to December 31st with formal presentation made at the ensuing annual meeting.
7. The award winning entry, at the discretion of the Program Committee, will constitute the basis of a presentation at the ensuing annual meeting. An abstract of the entry and the paper if presented at the annual meeting will be contained in the Annual Proceedings of the Eastern Snow Conference.

Research Committee
Eastern Snow Conference
February 1970