

EASTERN SNOW CONFERENCE

Report of the

COMMITTEE ON RESEARCH

February 1969

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

Respectfully submitted,

Committee on Research, ESC

Raymond E. Falconer, Chairman
Claud Triquet
C. Anthony Federer

RESEARCH STUDIES LIST - 1969

69A1 HYDROLOGIC ANALYSIS METHODS

Henry W. Anderson
Pacific Southwest Forest and Range Experiment Station
P.O. Box 245, Berkeley, California 94701

Paper: "Snow accumulation as related to meteorological, topographic, and forest variables in Central Sierra Nevada, California. Int. Assoc. Sci. Hydrol. Publ. No. 78, pp. 215-224, 1967.

69A2 FRAZIL ICE - THE INVESTIGATION OF THE OCCURRENCE AND PREVENTION OF THE FORMATION OF FRAZIL ICE IN WATER INTAKES
Division of Research and Division of Sanitary Engineering
Ontario Water Resources Commission
District Engineers Branch
801 Bay Street, Toronto 5, Ontario

The purpose of this project is to study the problems associated with the blockage or partial blockage of water intakes caused by frazil, anchor and slush ice. This study is being conducted to enable the Commission to advise the water authorities in Ontario on what action should be taken to alleviate these problems and to aid in the review of new intakes.

Paper: Project continuing. To be completed in 1969.

69A3 INTERNATIONAL HYDROLOGICAL DECADE REPRESENTATIVE BASIN STUDIES
River Basin Research Branch
Ontario Water Resources Commission
Division of Water Resources
801 Bay Street, Toronto 5, Ontario

Please see 1967 report. In addition, eight courses in the East and Middle Oakville Creeks representative basin were established and snow depth, density and water equivalent were measured.

Paper: No reports have been published on the 1967-68 data.

69A4 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 gaged watersheds are being used to study the effects of forest clearing on snowmelt runoff. After an eight-year calibration period, all timber was cut and left in place on Hubbard Brook Experimental Forest Watershed 2 (39 acres). Streamflow data for 3 melt seasons since cutting have been analyzed for changes in timing, volume and peak flows.

69A4 Paper: Changes in snowmelt runoff following forest
(cont.) clearing on a New England Watershed. J.W. Hornbeck and
Robert S. Pierce 1969. Eastern Snow Conference 1969
Annual Meeting.

69A5 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 is being developed. Increase of downward thermal radiation by the canopy and reduction of wind speed under the canopy are also being studied.

69A6 SOIL MOISTURE CONDITIONS OF THE LAKE ONTARIO WATERSHED
IN NEW YORK STATE
Gordon R. Ayer, United States Geological Survey
P.O. Box 948, Albany, New York 12201

Soil-moisture conditions in the Lake Ontario Watershed will be sampled at frequent intervals at selected sites by means of a neutron-scattering probe. These data will be related to the snow-pack during the winter months and to other parameters in order to estimate the amount of runoff that can be expected. As of January 1, 1969, open-hole sampling of the soil profile had been completed, observation wells driven and access pipes for the soil moisture probe had been placed at selected sites in several small basins in the Black River basin which comprises about 15 per cent of the Lake Ontario drainage in New York.

Paper: No reports or published papers have been prepared to date.

69A7 SURVEY OF FROZEN PRECIPITATION IN URBAN AREAS AS RELATED TO
CLIMATIC CONDITIONS
Michael A. Bilello
U.S. Army-Terrestrial Sciences Center
Box 282, Hanover, New Hampshire 03755

Detailed study of winter precipitation types in large cities in conjunction with concurrent weather conditions. Investigation deals with climatic summaries, rather than individual storms.

Paper: Technical Report 162 (Same author and address as above.)

69A8 CONTROL OF SNOW AND ICE
L. D. Minsk, Army Materiel Command /US/
Cold Regions Research and Engineering Labs
Army /US/

Techniques are being developed for applying electromagnetic energy, using high intensity radiation, to break the ice pavement bond. Discrete Wavelengths will pass through the ice without dissipation of energy by melting. An instrumented rotary plow will be used to measure the energy absorbing processes in snow removal. This data will provide rational design of rotary snow removal equipment. The possibility of applying an electric current to a thin electrical conductive asphalt overlay containing graphite to melt snow is being studied.

69A9 EVALUATION OF ICE DETECTION EQUIPMENT
C. L. Richard
Michigan Department State Highways

Reliability of frost and ice detection equipment and disappearing legend warning signs on freeway overpass bridges is being evaluated. Recording test equipment connected to ice detector system records frost and ice conditions and is compared to U.S. Weather Bureau conditions, accident reports, and visual observations.

69A10 DEVELOP IMPROVED SNOW REMOVAL AND ICE CONTROL
TECHNIQUES AT INTERCHANGES
L. G. Byrd, Bureau of Public Roads /US/
American Association of State Highway Officials
Tallamy, Bertram D & Associates

This project is designed to develop improved snow removal and ice control techniques at interchanges. At several selected urban and rural interchanges snow removal procedures and equipment will be observed, and factors influencing and reducing efficiency will be determined. Consideration will be given to new and potential developments in the equipment and chemical field. Procedures and techniques to overcome inefficient methods and equipment will then be determined and tested. If necessary, design innovations of interchanges which would enhance snow and ice removal will be recommended.

69A11 ICY ROAD WARNINGS
P. J. Williamson
Ministry of Transport, London /UK/
International Road Federation

Devices are being developed to warn highway authorities of the onset of ice-forming conditions. At present, such devices depend on the road temperature and the presence of moisture upon it and automatic telephone apparatus is being developed for use with such detectors. Attempts will be made to render the warning more reliable by modifying the sensing equipment.

69A11 Further studies will be made of the weather conditions
(cont.) leading to ice formation to assist in developing equipment
of greater reliability.

Paper: Experimental Ice-Warning System, P.J. Williamson,
Traffic Engineering and Control, Vol. 15, No. 8, pp. 447-479,
and p. 497. 1963.

69A12 FROST HEAVE CORRECTIONS USING STYROFOAM
P. A. Jensen
Minnesota Department of Highways

Two perennial frost heaves were treated by excavating
the roadbed to a depth of 19", placing a 2" layer of styro-
foam over the subgrade, backfilling over the insulating layer
with granular base material and resurfacing with bituminous
materials. Both installations were instrumented with thermo-
couples above and below the styrofoam at various depths and
positions with respect to the centerline to study the degree
of frost penetration. Thermocouples were also installed in
similar positions in an adjacent uninsulated roadbed.

69A13 SOIL FREEZING AND FROST HEAVING
R. D. Miller
Cold Regions Research and Engineering Labs, Army /US/
Cornell University, Ithaca, New York

The immediate objectives of this study concern water
movement in frozen soils. One aspect deals with macroscopic
translocations of water within frozen soils. A second aspect
concerns microscopic movement in unfrozen films between soil
particles in an adjoining ice phase, such as a growing ice
lens. Both aspects will be laboratory studies. Both seek a
rational model for quantitative evaluation of the parameters that
influence the velocity of water movement.

69A14 SATELLITE SNOW SURVEILLANCE IN REGIONS OF MOUNTAINOUS TERRAIN
James C. Barnes
Allied Research Associates, Inc
Virginia Road, Concord, Mass. 01742

To study the application of satellite snow mapping
techniques, developed for flat terrain, to the mountainous
terrain of the western United States. In addition to
meteorological satellite data, high resolution color photo-
graphs from the Gemini spaceflights are being examined.
Study will be completed in mid-1969.

69A15 SATELLITE SNOW SURVEILLANCE IN REGIONS OF FLAT TERRAIN
James C. Barnes,
Allied Research Associates, Inc
Virginia Road, Concord, Mass. 01742

- 69A15 (cont.) To study the use of satellite photography for operational mapping of snow cover in the Missouri-Upper Mississippi River Basins region. Study completed in May 1968.

Papers: Operational Guide For Mapping Snow Cover From Satellite Photography, J. Barnes and C. Bowley, 1968. Final Report under Contract E-162-67(N), Allied Research Associates, Inc.

"Snow Cover Distribution As Mapped From Satellite Photography", J. Barnes and C. Bowley, 1968. Water Resources Research, 4(2), pp. 257-272.

- 69A16 SURVEILLANCE OF ARCTIC SEA ICE USING INFRARED SATELLITE DATA
James C. Barnes
Allied Research Associates, Inc
Virginia Road, Concord, Mass. 01742

To study the use of High Resolution Infrared Data from the Nimbus meteorological satellites for surveillance of Arctic Sea Ice. Study will be completed in mid-1969.

- 69A17 A GEOGRAPHICAL STUDY OF RIVER DEVELOPMENT IN THE JACKSON CREEK WATERSHED, PETERBOROUGH, ONTARIO. CANADA.
W. P. Adams and F. M. Helleiner
Trent University, Peterborough, Ontario

A detailed study and inventory of the watershed, with some emphasis on snow, as a basis for regional planning.

Paper: New Project.

- 69A18 STATIC ICE FORCES
Samuel S. Lazier
Queen's University
Kingston, Ontario. Canada

To provide up-to-date design data on the forces which static ice may exert on marine structures.

This study is just getting under way and it is hoped that this winter measurements of the temperature gradient across an ice sheet in Kingston Harbor will be made.

- 69A19 ICE PRESSURE AGAINST STRUCTURES [previously Project 68A11]
L. W. Gold, Snow and Ice Section
Division of Building Research
National Research Council

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

Paper: Proceedings of Conference on Ice Pressure Against Structures Tech. Memo No. 92, NRC Assoc. Committee on Geotechnical Research, NRC No. 9851, 247 pp. March 1968, Ottawa.

69A20 DEFORMATION BEHAVIOUR OF ICE [previously Project 68B4]
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 which has been previously reported.

Paper: Time to Formation of First Cracks in Ice, L.W. Gold. Proceedings of the Int. Conference on Low Temp. Science, 1966, Sapporo, Japan. Vol. 1, Part 1, 1967, pp. 359-370.

Surface Features Observed During Thermal Etching of Ice, A.S. Krausz and L.W. Gold. Journal of Colloid and Interface Science, Vol. 25, No. 2, Act 1967, pp. 255-262.

69A21 MELTING OF LAKE ICE [previously Project 68A12]
G. P. Williams, Snow and Ice section
Division of Building Research
National Research Council of Canada, Ottawa, Ontario.

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

69A22 AVALANCHE RESEARCH [previously Project 68B6]
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.

69A23 GROUND THERMAL REGIME [previously Project 67C1]
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.

Paper: Thermal Regime of a Sphagnum Peat Bog, G.P. Williams. Presented to the Third International Peat Congress, Quebec City, August 1968.

69A24 ICING ON ENGINEERING STRUCTURES [previously Project 68B3]
Donald W. Boyd
Division of Building Research
National Research Council of Canada, Ottawa, Ontario.

69A24 (cont.) To determine the geographical distribution, frequency and thickness of ice accumulations on wires, towers and other structures.

Paper: Atmospheric Icing of Structures, D.W. Boyd and G.P. Williams. Tech. Paper No. 275, D.B.R. Nat. Res. Council, May 1968 .

69A25 DEFORMATION BEHAVIOUR OF ICE [previously Project 68B7]
A. S. Krausz, Snow and Ice Section
Division of Building Research,
National Research Council of Canada, Ottawa, Ontario

An investigation of the Rate Theory of Deformation Mobility was completed and the results reported.

Paper: A Rate Theory of Dislocation Mobility, A.S. Krausz. Acta Metallurgica, Vol. 16, No. 7, July 1968, pp. 897-902.

69A26 GREAT LAKES WEATHER MODIFICATION PROGRAM
G. E. McVehil
Cornell Aeronautical Laboratory, Inc
P.O. Box 235, Buffalo, New York 14221

The Cornell Aeronautical Laboratory, under sponsorship of the Atmospheric Physics and Chemistry Laboratory of ESSA, has been conducting studies of lake-effect snowstorms for the past three years. These studies, which have concentrated on the physical structure and dynamics of lake-effect precipitation systems, have had as their ultimate goal an assessment of the feasibility of weather modification in lake-effect snowstorms. The mesoscale convective circulations produced when cold air passes across the relatively warm Great Lakes leads to organized cloud systems which often produce heavy snow. Studies to date indicate that these cloud systems are amenable to modification by silver iodide or dry ice seeding. Ice nucleation resulting from seeding is expected to alter the natural evolution of cloud and precipitation elements and result in a redistribution of the normal snowfall.

Modification experiments were carried out over eastern Lake Erie in November and December, 1968. Lake-effect clouds were seeded in 16 experiments. Seeding in some cases was done from above the clouds, using dry ice as seeding agent; in other situations seeding was done with silver iodide from aircraft flying below cloud base. Data were collected by radar, aircraft, and surface snow observers. These data are now being analyzed. The program is a joint study being carried out by CAL, ESSA, Penn State University, and the State University of New York

Papers: Project Lake Effect, A study of Lake Effect Snowstorms, G.E. McVehil, J.E. Jiusto, R.A. Brown, and R.L. Peace, Jr. 1967. Final Report on Contract No. E22-49-67-N, CAL Rep. No. VC-2355-P-2, 31 October, 1967, 80 pages.

69A27 ICE FORCES ON BRIDGE PIERS
C.R. Neill
Research Council of Alberta
301 Civil Engineering Bldg.
University of Alberta, Edmonton, Canada

To collaborate with Alberta Dept. of Highways in measurement of ice forces on actual bridge piers and piles. Spring break-up observations and measurements made 1967 and 1968 on special load-measuring pier in North Alberta.

Papers: "Ice pressure measurements at Honds Bridge, Spring 1967". Highways Division, Research Council of Alberta. Unpublished preliminary report.

"Determination of actual forces on bridge piers due to moving ice", E.J. Sanden and C.R. Neill. Paper presented at 49th Annual Convention, Canadian Good Roads Association, Toronto, October 1968. To be published in convention proceedings.

69A28 ICE ADHESION STUDIES
L. David Minsk
U.S. Army-Terrestrial Sciences Center
Hanover, New Hampshire 03755

Investigate the mechanism of the ice-substrate bond and develop methods for its control. Pull tests have been made on a large number of metals, plastics, and coated metals. Excellent short-term reduction of adhesional force has been achieved using pristane, a natural oil. An ice adhesion lab is being established to carry out fundamental studies on adhesion.

69A29 SNOW CATCH RELATIONSHIP OF DIFFERENTLY EXPOSED RAIN GAGE CANS PLUS COMPARISON OF CAN DEPTH WITH SNOW BOARD
L. Lansing
ASRC-SUNY Field Station
Boonville, New York

The winter of 1968-69 is the first year of the study. The objective is to come up with a recommendation of the best location to measure snow both in the solid and the liquid state.

69A30 PRESSURE PILLOW INVESTIGATIONS
Dr. Lloyd M. Cox
Agricultural Research Service
306 North 5th Street, Boise, Idaho

To complete basic research on steel, fiberglass, butyl, and other pressure pillow types.

69A31

STUDY OF RIVER AND LAKE ICE

[I.H.D. Project No. C.6.7. Niagara River]

J. B. Bryce, Ontario Hydro

(In co-operation with the Meteorological Branch of the
Department of Transport - Canada)

620 University Avenue, Toronto 2, Ontario

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.)

This will be the third year of a planned eight to ten-year program of ice observations. The first year, 1966-67, was of a reconnaissance and exploratory nature. In the second year, 1967-68, emphasis shifted to determining the extent of the formation of anchor ice and the mechanics of its formation. This will continue in 1968-69 with more intensive concentration on some parts of the program.

Briefly the program consists of continual ice observations utilizing helicopters, aerial photographs, ground observations, and on occasion, river observations from the ice breaker "Niagara Queen". Underwater cameras are also utilized for still shots, and conventional movie cameras for standard and time lapse movie sequences. The formation of anchor and frazil ice is examined at first hand using ice trays suspended near the bed of the river.

Instrumentation has been installed to measure precipitation, air and water temperatures, wind direction and speed, net radiation, water levels, and velocities.

Papers: A preliminary estimate of the ice seas on energy balance for the Niagara River, H.L. Ferguson, Hydrometeorology Section, Meteorological Service of Canada. Published in the bulletin of the I.A.S.H. Annee No. 3 1968, pp. 41-58.

Instrumentation for study of the ice formation on the Niagara River, H.F. Cork and R.G. Chapil. I.H.D. Report No. 1, Department of Transport Meteorological Branch, Technical Services, T.E.C.-627. 1966, 11pp.

Copies of these papers can be obtained from the Meteorological Branch, Department of Transport, 315 Bloor Street West, Toronto, Ontario.

69A32

SNOWMELT AT INDEX PLOTS

Dr. K. S. Davar, University of New Brunswick
Department of Civil Engineering
Fredericton, New Brunswick, Canada

To obtain correlations between actual snowmelt measured at index plots and meteorological parameters, in an open environment and in a forest environment. Such techniques would improve reliability of estimates for actual snowmelt from drainage basins and synthesizing of basin outflow hydrographs used in reservoir operations and river regulations.

Paper: Snowmelt at an index plot, D.W. Pysklywec, K.S. Davar, and D.I. Bray. Water Resources Research, Vol. 4, No. 5, Oct. 1968.