LIST OF STUDIES IN PROGRESS

1. **PROPERTIES OF SNOW AND ICE**

80-1

**PROPERTIES OF SNOW--S.C. Colbeck** U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH.

Objectives: Investigate the mechanical properties of wet snow; investigate the grain structure and grain growth in snow; make water measurements and investigate water flow in snow; review articles books and conference proceedings.


(4) Colbeck, S.C. "Snow Metamorphism Due to Radius of Curvature". *J. Glaciology* in press.


80-2

**THE ROLE OF THE SNOWPACK IN THE NUTRIENT BUDGET OF A SUBARCTIC ECOSYSTEM--Michael English**, Department of Geography McGill University, Montréal, Québec.

Objectives: To study the interaction of melt water from the snowpack and underlying vegetation - To quantitatively define nutrient interaction between the snowpack - Vegetation/litter layer and soil - To determine the behaviour of this meltwater once it enters the lake system; does it flush out of the system or is it incorporated within the aquatic system - The study is currently in progress.

Recent Reports: Reports to the Arctic Institute of North America and to the Centre for Northern Studies and Research at McGill University, the funding agencies of this research.

80-3

**SHORTWAVE RADIATION INVESTIGATIONS FOR GLACIATED BASINS--D.S. Munro**, Department of Geography, University of Toronto, Toronto, Ontario.

Objectives: A model for the distribution of net shortwave radiation in a glaciated basin has been completed. The findings have been submitted in a report to the Snow and Ice Division, National Hydrology Research Institute, Environment Canada. Further work is contemplated with Dr. G.J. Young of the Snow and Ice Division.


80-4

**METEOROLOGICAL INFORMATION IN SKIFIELD PLANNING--Terry D. Prowse, I.F. Owens**, Department of Geography, University of Canterbury, New Zealand.

Objectives: Assessment of Meteorological information in ski-field planning and management. Feasibility studies were conducted for a proposed ski-field and research is continuing on establishing relationships between meteorological parameters, snow properties and avalanche occurrence in the Canterbury High Country, N. N.Z.


Objectives: To chronicle avalanche fatalities and the meteorological conditions which caused the avalanche releases. Work on the historical aspects has been concluded.


AVALANCHE ENGINEERING--P.A. Schaerer, Division of Building Research, National Research Council of Canada, Ottawa, Ontario.

Objectives: To determine the characteristics of snow avalanches in motion, the amount of snow moved by avalanches, and the feasibility of measures for avalanche protection. Impact pressures and seismic signals of avalanches were recorded at Rogers Pass. Analysis showed the impact pressures to be greater than previously assumed.

Recent Reports: (1) Schaerer, P.A. Avalanche design criteria for Denny Creek Bridge. Submitted for publication in Ac International, American Concrete Institute.


GLACIER HYDROLOGY; ROCKY MOUNTAINS, ALBERTA/BFITTISH COLUMBIA--G.J. Young, National Hydrology Research Institute, Snow and Ice Division, Environment Canada, Ottawa.


RUNOFF PROCESSES AND REGIMES IN SMALL, HIGH ARCTIC BASINS, NORTHWEST DEVON ISLAND. --M.K. Woo and P. Marsh, Department of Geography, McMaster University, Ontario.

Objectives: The overall objective is to study the runoff generating processes in glacierized and non-glacierized, permafrost areas, to enable a numerical prediction of streamflow regimes in small basins of the Arctic Islands. Field work was carried out near Eidsabotn Fiord on Devon Island during the summer of 1979. Further field work is planned for the summer of 1980.

2. PRECIPITATION AND ACCUMULATION


Objectives: Provide a description of seasonal snow and ice cover conditions in Arctic and Subarctic regions, and establish techniques to predict these conditions using climatic and meteorological information. Analogs and maps to depict various aspects of the winter environment throughout North America, Europe, and Asia have been and are being developed.

Recent reports: (1) Bilello, M.A. (1978). "Ice decay patterns on a lake, a river, and a coastal bay in Canada." Paper presented at the 26th Annual Meeting of the Canadian Association of Geographers at the University of Regina, Saskatchewan, Canada.


80-10

NASHWAAC EXPERIMENTAL WATERSHED PROJECT-HYDROMETEOROLOGICAL STUDIES—R.B.B. Dickison and D.A. Daugharty, University of New-Brunswick, Fredericton, N.B.

Objectives: The evaluate the effects of forest clearcutting on water balance, stream regional, energy balance and snow cover, on a small watershed in central New-Brunswick. Calibration period 1971-78; treatment carried out in 1978-79.


80-11

SPECIAL CHARACTERISTICS OF LAKE SNOWCOVER—Terry D. Prowse, Department of Geography, University of Canterbury, Christchurch, New Zealand, W.F. Adams, Department of Geography, Trent University, Peterborough, Ontario, Canada.

Objectives: To assess the special characteristics of lake snowcover (e.g. depth, density, water equivalent, stratigraphy) especially as they differ from land snowcover, work has been concluded.


80-12

SPATIAL DISTRIBUTION OF SNOWFALL AND SNOW COVER—R.M. Thompson, P.J. Pilon, S. Bouchard, Power Operations, Quebec, Alcan Smelters and Chemicals Ltd., Arvida, Quebec, Canada.

Objectives: Improve knowledge of spatial distribution of snowfall and snow cover for use in runoff forecasting for the operational management of Alcan's multi-reservoir hydroelectric system.


(4) Thompson, R.M., and R. Bergeron. "Spatial averaging of daily meteorological data - practical results from a hydrometeorological information system". To be presented at the Fourth Atlantic Region CSCE Hydrotechnical Conference, St. John's, Newfoundland, June 4-5, 1980. Copies will be available from the authors.

Objectives: To evaluate the snow course network with respect to cover type and to develop objective techniques to calculate areal averages of snow water equivalent for each subbasin from snow course data. Currently evaluating objective techniques.

3. SNOWPACK MEASUREMENT

80-14 SNOWFALL AND SNOWCOVER IN EAST CENTRAL ONTARIO--W.P. Adams, Trent University, Peterborough, Ontario.

Objectives: Studies of the performance of Canadian and Soviet snow gauges and study of the evolution of snow cover on land and on lakes.


80-15 SNOW AND ICE SURVEY – ELIZABETH LAKE BASIN--Douglas R. Barr, McGill Subarctic Research Station, Schefferville, Québec, Canada.

Objectives: Conducted intensive (600 point) snow and ice survey of Elizabeth Lake Basin, Labrador (5 km SW of Schefferville) in Late February, 1979, (in conjunction with Trent University, Ontario).


80-16 SCHEFFERVILLE REGION SNOW SURVEYS--Douglas R. Barr, McGill Subarctic Research Station, Schefferville, Québec, Canada.

Objectives: Winter 1978/1979, maintained two outlying 10 point snowcourses (approximately once per month January-May) at Greenbrush and Kivivic (north of Schefferville).

80-17 SCHEFFERVILLE SNOW SURVEYS--Douglas R. Barr, McGill Subarctic Research Station, Schefferville, Québec, Canada.

Objectives: Winter 1978/1979 maintained (October-June) weekly program along 10 point snowcourse and monitored snow stratigraphy at one site (in conjunction with Trent University, Ontario). This was the 20th year of McGill's snowcourse measurements in this area.

80-18 EXPERIENCE DANS L'AUTOMATISATION DES MESURES NIVÉOMÉTRIQUES A LA STATION DE DUCHÈSNAY--André Fréchette, Service de la Météorologie, Québec.

Objectives: Evaluer le fonctionnement de différents capteurs nivémétriques.


Objectives: Field investigations in different regions of Canada are used to assess the accuracy and comparability of Canadian methods of snowfall measurement and the influence of trace amounts, retention losses and blowing snow on Nipher gauge measurements at selected stations. Field assessment of Nipher type shields for F & P and Universal gauges has been initiated at selected stations. An experiment to measure fresh snowfall water equivalent using the type-D rain gauge
was initiated in all regions.


80-20

**SNOW MEASUREMENT PROGRAM--B.E. Goodison, Atmospheric Environment Service, Downsview, Ontario.**

Objectives: As a member of the Western Snow Conference Working Group on Snow Sampler Metrification, the committee (P. Farnes, N. Peterson, R.P. Richards) has designed, tested and analyzed the results of metric snow samplers for North America, both large (ESC-50) and small (WSC-10) diameters. Recommendations on new designs are being prepared and a final report is being prepared for the ESC/WSC meeting in 1982.


4. **SNOWMELT**

80-21

**SNOW MELTING IN THE INTERFACIAL ENERGY BUDGET--David Miller, Department of Geological Sciences, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin.**

Objectives: Have just finished a three-year program on the interface study noted above, and the result, "Energy at the surface of the Earth" has gone into production for a late-1980 publication date. Chapter 14 deals with snow-melting.

Recent reports: "Water at the surface of the Earth", published by Academic Press, deals with snowfall in chapter 6 (and especially snowfall interception), and with snow cover in chapter 7.

80-22

**APPLICATION OF SATELLITE SNOWMELT MODELS IN THE SOUTH ISLAND HIGH COUNTRY--Terry D. Prowse, I.F. Owens, Department of Geography, University of Canterbury, Christchurch, New Zealand.**

Objectives: To assess the applicability of satellite snowmelt models in New Zealand. Field testing of the models is still in progress.


80-23

**SNOWMELT INFILTRATION AND RUNOFF--Anthony Wankiewicz, National Hydrology Research Institute, Environment Canada, Ottawa, Ontario.**

Objectives: To provide an improved understanding of (a) transmission of liquid water within the snowpack, at or along the snow/soil interface and within the saturated and unsaturated zones, (b) the influence of these phenomena on the generation of snow cover runoff.
5. STREAMFLOW

80-24 HUBBARD BROOK ECOSYSTEM STUDY—Robert S. Pierce, U.S. Forest Service, Northeastern Forest Experiment Station, Durham, N.H.

Objectives: Chemistry of winter precipitation and streamflow are being monitored routinely on several small (about 20 ha) watersheds in hardwood forest. Snow and frost are monitored at 4 snow courses. There is no active snow or ice research.


Objectives: Provide daily hydrological forecasts for use in the operational management of Alcan’s multi-reservoir hydroelectric system.

Recent reports: Only internal documentation has been prepared to date.

80-26 HYDROLOGIC RISK AND RELIABILITY IN THE OPERATION OF A MULTI-RESERVOIR WATER RESOURCES SYSTEM SUBJECTED TO SNOW-MELT RUNOFF—R.M. Thompstone, Power Operations, Quebec, Alcan Smelters and Chemicals Ltd, Arvida, Quebec, Canada.

Objectives: Improved measures of risk and reliability for use in the operational management of Alcan’s multi-reservoir hydroelectric system.


Objectives: Improve hydrologic forecasts for use in the operational management of Alcan's multi-reservoir hydroelectric system.


(3) Thompstone, R.M., and R. Bergeron. "Prévision hydrologique interactive dans un système d'information hydrométéorologique". To be presented at the Second Quebec Region CSCE Hydrotechnical Conference, Særbrooke, Quebec, May 22-23, 1980. Copies will be available from the authors.

Objectives: Adaptation of a new approach to forecasting spring floods which makes use of a "proper" combination of the input hydrometeorological data and the known discharge in the river. Results are encouraging and reports being prepared.

6. LAKE AND RIVER ICE


Objectives: Study of the major components of the ice and snowcover of lakes in Ontario and in Northern Quebec-Labrador with particular reference to the roles of these components in such things as the lake oxygen and light regimes, nutrient loading and other aspects of cryo-chemistry.


THEORETICAL STUDY OF ICE SUPPRESSION POSSIBILITIES—George O. Ashton, U.S.A. CRREL, Hanover, NH.

Objectives: Construct a simulation model for ice suppression resulting from discharge of warm water into rivers. Construct a simulation model of point source bubbler systems to melt ice.

Recent reports: (1) CRREL Report 79-30 Suppression of River Ice by Thermal Effluents.

(2) CRREL Report 79-12 Point source Bubbler Systems to Suppress Ice.

ICE SURVEYS - SCHEFFERVILLE—Douglas R. Barr, McGill Subarctic Research Station, Schefferville, Québec, Canada.

Objectives: Maintained weekly ice surveys (snow, ice) on Knob Lake (3 sites) and Maryjo (1 site)(data submitted to A.E.S.). Sporadic snow and ice data for other lakes also available.

GENERAL ASSISTANCE - SNOW AND ICE STUDIES—Douglas R. Barr, McGill Subarctic Research Station, Schefferville, Québec, Canada.

Objectives: The station provides back-up for a major year-round Limnology Project conducted by Dr. F. Rigler, Biology Department, McGill University and a variety of snow studies including, for example, the study of ground temperatures/snowpack relationships being conducted by the University of Montreal.
THERMAL REGIMES AS DISTURBED BY MAN—Roy E. Bates and George D. Ashton, USA CRREL, Hanover, N.H.

Objectives: The objective of this study is to determine the influence of ice covers on the disposition of added heat to water bodies. Work has started on a summary of thermal structures, Ice conditions and meteorological conditions on Lake Champlain.

Recent reports: (1) USA CRREL Report 79-26 by Roy E. Bates and Mary Lynn Brown "Lake Champlain ice formation and ice free dates and predictions from meteorological indicators".

(2) USA CRREL Report 80-2 by Roy E. Bates "Winter thermal structure, ice conditions and climate of Lake Champlain."

FUNDAMENTAL MECHANICS OF ICE JAMS—Darryl Calkins and Roy Bates, USA CRREL, Hanover, N.H.

Objectives: Verification of current theories relating to ice jam initiation as they predict ice thickness, water levels and discharge for shallow streams. Field data has been collected on ice jam thickness, water levels and the usual meteorological condition. Field data will be used to calibrate physical models of this river.


ICE MANAGEMENT IN LAC ST. PIERRE, QUEBEC—J.V. Danys, Transport Canada, Canadian Coast Guard, Marine Aid Division, Ottawa.

Objectives: To study and control the behaviour of ice in the St. Lawrence Seaway. Further work in progress.

Recent reports: Obtainable from Canadian Journal of Civil Engineering.

RESEARCH ON FRESH WATER ICE—Bernard Michel, Université Laval, Département de Génie civil, Québec.

Objectives: The following projects are underway: frazil ice studies; mechanical properties of fresh water ice; ice impact on structures; internal stresses in lake ice; ice and micro-climate.


80-37

WINTER COVER ON TEMPERATURE LAKES--Terry D. Prowse, Department of Geography, University of Canterbury, Christchurch, New Zealand, W.P. Adams, Department of Geography, Trent University, Peterborough, Ontario, Canada.

Objectives: To assess both the temporal and spatial variation of snow, white ice and black ice on temperate lakes. Work has been concluded.


80-38


Objectives: To assess the role of snow, white and black ice on controlling winter lacustrine radiation receipts and their impact on the winter oxygen deficit.


The Relationship between Winter Lake Cover, Radiation Receipts and the Oxygen Deficit in Temperate Lakes.

THE ESTIMATION OF LIGHT TRANSMISSION THROUGH A MULTI-LAYERED SNOW AND ICE LAKE COVER IN SUBARCTIC QUEBEC--Nigel T. Roulet (Grad. Student) Dr. W.P. Adams (Advisor) Dept. of Geog., Trent University, Peterborough, Ontario.

Objectives: The basic objective of this work is to provide a simple model for the transmission of light through snow and ice covers of a lake, using gross measurements of these parameters. It is hoped that through this work the spatial significance of the lake cover as a 'filter' of light will be recognised - we are now in the final data collection stage of the research.

80-40

LIARD RIVER SPRING FLOOD -- ICE JAM STUDY--David A. Sherstone: Snow & Ice Div., National Hydrology Research Institute, Environment Canada, Ottawa.

Objectives: (1) Study of locations, frequency and severity of river ice jams during spring break-up. (2) Study of processes responsible for ice jam creation and destruction and resultant channel bank and bed modification by ice action. (3) sediment production by ice during break-up.


Objectives: To investigate the rheological and mechanical properties of river and lake ice. Further investigations have been carried out on the rate sensitivity of compressive strength of S-2 ice. A numerical method of predicting strain history from stress history has been developed.


ICE COVER BREAK-UP ON A SMALL HIGH ARCTIC LAKE—M.K. Woo & R. Heron, Department of Geography, McMaster University, Hamilton, Ontario.

Objectives: The objective of this project is to obtain an understanding of, and to model, the break-up processes of the ice cover of a typical small lake in the High Arctic. Field work was carried out near Resolute Bay, N.W.T. during the summer of 1979. A further field season is planned for the summer of 1980.

7. HIGHWAYS AND BUILDINGS

HYDROLOGIC STUDIES, MACKENZIE DELTA REGION, N.W.T.—J.C. Anderson; A.W. Gell, Snow & Ice Division, Environment Canada, Ottawa.

Objectives: To provide hydrologic information (snow cover; summer rainfall; runoff; river ice conditions; icings) relevant to the design and construction of northern highways; to determine mean water balance component magnitudes in tundra and taiga environments.


ICE ENGINEERING—R. Frederking, Division of Building Research, National Research Council of Canada, Ottawa.

Objectives: To establish the criteria required for the design of structures subject to forces due to river, lake or sea ice, and for the assessment of the load carrying capacity of ice covers. The ice behaviour around the dock at Nanisivik, N.W.T., has been studied and a qualitative model of ice behaviour formulated.

Recent reports: (1) Frederking, R. Laboratory tests on downdrag loads developed by floating ice covers on vertical piles. Proceedings POAC '79, The Fifth Int. Conf. on Port and Ocean Engineering under Arctic Conditions, Aug. 13-18, Trondheim, pp. 1097-1110.


SNOW LOADS ON ROOFS IN CANADA—D.A. Taylor, National Research Council Canada, Division of Building Research, Ottawa.

Objectives: In general, to provide information for the improvement of the Commentary on Snow Loads in the National Building Code of Canada and to help designers with snow load problems. In particular (1) to collect data on the density of snow on roofs across Canada in order that depth measurements can be reliably converted to loads; (2) to survey snow loads on flat and multi-level flat roofs and on drifts.
where the roofs change levels; (3) to study the effect of slope and roof texture on the accumulation of snow on sloping roofs; (4) to collect data for improvement of the unbalanced snow distributions used for the design of cylindrical arch-shaped roofs; (5) to survey snow on arena-type roofs in Canada; (6) to study snow loads on mobile homes and; (7) to prepare general papers to assist designers and the construction industry with roof snow load problems.


8. SOIL AND WATER FROST

80-46 PREDICTION DU GEL SAISONNIER DANS LE TERRITOIRE DE LA BAIE JAMES—Bhawan Singh et James T. Gray, Université de Montréal, Département de Géographie, Montréal.

Objectives: To be able to predict the depth and duration of seasonal frost from measurable components of the radiation and energy balances.

Recent reports: (1) CINEP special publication March, 1980.

(2) To be submitted to Journal Canadien de la Science de la Terre.

9. REMOTE SENSING


Recent reports: report expected in 1980.


Objectives: Prepare Handbook as one of the final products of NASA Applications Systems Verification Test on Operational Applications of Satellite Snowcover Observations.

Recent reports: Handbook is currently in printing by NASA.


Objectives: Conduct research related to soil moisture and snow water equivalent calculation using natural terrestrial gamma radiation attenuation techniques. Establish optimum flight line network for operational airborne snow survey program.

Recent reports: Airborne Snow Survey using Natural Gamma Radiation.

80-50 REMOTE SENSING OF SNOW COVER: SRSAT SNOW EXPERIMENT—B.E. Goodison; S. Waterman; A. Wankiewicz; E. Langham; J. Metcalfe, Environment Canada.

Objectives: Overflights by a Convair 580 to obtain synthetic aperture radar and scatterometer data were done at intervals during the 1978-1979 winter. An extensive simultaneous ground based data collection program was carried out in March 1979 for one of the flights. Evaluation of the X and L band data continues, but X band gives more information on snowpack conditions than L band. A report is in preparation.


Objectives: Development of operational, semi-automated techniques for estimating snow cover extent on a sub-basin on grid square basis using polar orbiting meteorological satellite data. Operational maps of the Saint John Basin are being provided for the 1980 season.


80-52 SNOW COVER ANALYSIS USING LANDSAT DIGITAL DATA—Carolyn J. Merry, Harlan L. McKim, U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH.

Objectives: To map snow/cover vegetation categories from Landsat digital data for correlation to groundtruth data on water equivalent. These data serve as input to the SSARR (Streamflow Synthesis and Reservoir Regulation) model for predictions of spring runoff.


Objectives: To classify snowcover and its areal extent with the use of landsat digital data. Work has been concluded.


80-54 MODELLING OF SHORTWAVE RADIATION FOR SNOW COVERED TERRAIN -- S.E. Waterman, Hydrometeorology Division, Atmospheric Environment Service, Canada.

Objectives: Model spectral flux of diffuse and direct solar radiation incident on snow covered surfaces for various atmospheric and topographic conditions. Simulations of the response of various remote sensors to changing snowpack conditions and evaluation of multispectral remote sensing techniques for snowcover monitoring.