

LIST OF STUDIES IN PROGRESS

1. PROPERTIES OF SNOW AND ICE

- 76-1 HYDROLOGIC STUDIES AT BOOT CREEK AND PETER LAKE BASINS, N.W.T.--J.C. Anderson; J.N. Jasper, Glaciology Division, Dept. of the Environment, Ottawa, Ontario.

Objectives: To study seasonal regimes of the water balance components at a taiga (Boot Creek) and a tundra (Peter Lake) watershed in the Mackenzie Delta region. To study inter-relationships between the water balance components. Analysis of 1975 summer field season data is in progress, and it is hoped that the study will continue in 1976.

Recent Reports: Anderson, J.C. (1974). "Hydrologic Studies at Boot Creek and Peter Lake Basins during 1974." pp.25-59 in, Further Hydrologic Studies in the Mackenzie Valley, Canada, Environmental-Social Committee, Northern Pipelines, Task Force on Northern Oil Development, Report No. 74-35. Information Canada, Cat. No. R57-4/1975.

- 76-2 WATER MOVEMENT THROUGH SNOW, -- S.C. Colbeck, CRREL

Objectives: This is an ongoing study investigation on the physics of water movement through snow as a porous medium. Various fundamental and applied aspects of water flow are being studied. These include capillary and layering effects, water runoff forecasting and wet snow loads on roofs.

Recent Reports: (1) Colbeck, S.C., 1974. Water flow through snow overlying an impermeable boundary, Water Resources Research, Vol. 10, No. 1, p.119-123.

(2) Colbeck, S.C. 1974. The capillary effects of water percolation in homogeneous snow, Journal of Glaciology, Vol. 13, No. 67, p.85-98.

(3) Colbeck, S.C. 1974. On predicting water runoff from a snow cover, Symposium on the Advanced Concepts and Techniques in the Study of Snow and Ice Resources, 2-6 Dec. 1973 (compiled by H.S. Santeford and J.L. Smith, National Academy of Sciences, Wash. DC), p.55-66.

(4) Sweeny, Bruce D. and S.C. Colbeck. 1974. Measurements of the dielectric properties of wet snow using a microwave technique, CRREL Research Report 325.

(5) Colbeck, S.C. 1975. Water flow through a layered snowpack, Water Res. Res., Vol. 11, No. 2, p.261-266.

(6) Colbeck, S.C. On the use of tensiometers in snow hydrology, in press, Journal of Glaciology.

(7) Colbeck, S.C. Tracer movement through snow. In press 1975. General Assembly of IUGG, Grenoble, France.

(8) Colbeck, S.C. 1975. Analysis of hydrological response of rain-on-snow. CRREL Research Report 340.

(9) Dunne, T., A.G. Price and S.C. Colbeck. The generation of runoff from subarctic snowpacks, submitted. Water Res. Res.

(10) Colbeck, S.C. An analysis of water flow into dry snow. Submitted for journal publication.

(11) Colbeck, S.C. Effects of radiation penetration on snowmelt hydrographs, CRREL Research Report, in press.

(12) Colbeck, S.C. Wet snow loads on roofs. In preparation.

76-3 THERMODYNAMICS AND DEFORMATION OF WET SNOW-- S.C. Colbeck, CRREL

Objectives: The object is to understand the phase equilibrium in wet snow. Wet snow metamorphism and deformation are being investigated both theoretically and experimentally using the thermodynamics of phase equilibrium.

Recent Reports: Colbeck, S.C. Grain and bond growth in wet snow, Symposium on Snow Mechanics, Grindelwald, Switzerland, April 1974. In press.

76-4 SNOWCRYSTAL GROWTH AND ICE NUCLEATION--Helmut, K., Weickmann and Farn P. Parungo, Atmospheric Physics and Chemistry Laboratory, ERL-NOAA, Boulder, Colo.

Objectives: To study the initiation and growth process of snowcrystal in the atmosphere. We have conducted both laboratory and field experiments on snowcrystals. Scanning and transmission electron microscopes are used to examine snowcrystals' structure; an X-ray energy Spectrometer is used to analyze the chemical composition of the individual particles which are acquired in the snowcrystal.

Recent Reports:(1)Parungo, F.P. and H.K. Weickmann: Growth of ice crystals from frozen cloud droplets, Beitrage zur Physik der Atmos. 46, 289-304. 1973.

(2) Parungo, F.P. and H.K. Weickmann: Ice nucleation and crystal growth studies by electron microscope. Proc. VIII International Conf. on nucleation. Leningrad, USSR, Sept. 1973.

(3) Parungo, F.P. and R.F. Pueschel: Elemental identification of particles in snow crystals, Science, 180, 1057. 1973.

76-5 GLACIER MAPPING--W.E.S. Henoch, Glaciology Division, Dept. of the Environment, Ottawa, Ontario.

Objectives: On-going project.

Recent Reports: Peyto Glacier Map. Scale: 1:10,000. Eight colours, 10m contour intervals on ice and terrain. Three dimensional relief depiction in shaded relief and hatched bedrock portrayal. Mines and Resources, Ottawa, 1975. Distributed by: Canada Map Office, Dept. of Energy, Mines and Resources, 615 Booth St., Ottawa, Ontario.

76-6 CHEMISTRY OF THE SNOWPACK AT HUBBARD BROOK EXPERIMENTAL FOREST-- James W. Hornbeck and Gene E. Likens, U.S. Forest Service and Cornell University, Durham, N.H.

Objectives: The chemical characteristics of the snowpack are being measured routinely during accumulation and melt. The findings will be related to other components of the biogeochemical cycle being studied at Hubbard Brook. This study was initiated in December 1972.

Recent Reports: Hornbeck, J.W. and G.E. Likens. The ecosystem concept for determining the importance of chemical composition of snow, 1974. In: Advanced Concepts and Techniques in the Study of Snow and Ice Resources. National Academy of Sciences, Monterey, California, pp. 139-151.

76-7 CONVECTIVE HEAT TRANSFER AT THE SNOW AIR INTERFACE--J.J.C. Picot and A.A. Ross, University of New Brunswick Chem. Eng. Dept., Fredericton, N.B.

Objectives: Terminated. Gives correlation of convected heat flux as function of wind speed and temperature.

Recent Reports: Picot, J.J.C and A.A. Ross. Convective heat transfer at the snow air interface.

76-8 HETEROGENEOUS NUCLEATION OF ICE ON ELECTRICALLY CHARGED SUBSTRATES-- Bernard A. Power, Weather Engineering Corporation of Canada, Ltd., Dorval, Quebec.

Objectives: To derive quantitative expressions for the freezing of super-cooled water or the sublimation of water vapor on electrically charged nuclei. A modification of H.H. Fletcher's expression for uncharged spherical nuclei has been made which indicates that electrical charges greatly lower the supercooling at which nucleation takes place. The mechanism is through the enhancement of surface water adsorption. The model is being extended to charged plane nucleating surfaces.

Recent Reports: None.

76-9 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. Avalanche impact pressures have been measured for both flowing and powder avalanches. Observations on avalanche mass and run out distance continue to be made.

Recent Reports: Nil.

2. PRECIPITATION AND ACCUMULATION

76-10 CONDITIONAL PROBABILITY OF FROZEN PRECIPITATION (POFP(F)) (THROUGH MODEL OUTPUT STATISTICS)--Dr. H.R. Glahn and Mr. Joseph Bocchieri, Techniques Development Laboratory, National Weather Service, Silver Spring, Md.

Objectives: To provide a better objective forecast of POFP(P), we enlarged the development data sample of PE forecast variables from three to five years and rederived the operational logit equations. 1000-850 mb thickness was added to the list of predictors.

To provide a more timely product to NWS forecasters, a new system based on LFM model output only was developed. It will become operational in early 1976. The Technical Procedure Bulletin referenced describes the development of this product.

Recent Reports: Technical Procedure Bulletin No. 146: "Operational Probability of Frozen Precipitation Forecasts Based on Model Output Statistics." August 28, 1975, Technical Procedures Branch, National Weather Service, Silver Spring, Md. 20910.

- 76-11 SNOWFALL MEASUREMENT PROGRAM,--B.E. Goodison, Atmospheric Environment Service, Downsview, Ontario.

Objectives: Studies have been in progress for two years and will continue. The objectives are as follows: (a) to compare the gauge catch of different snow gauges used in Canada and to compare the catch to fresh snowfall on the ground; (b) to investigate the relation between gauge catch, wind speed, gauge type, and crystal characteristics for shielded and unshielded gauges; (c) to study the densification of freshly fallen snow and to attempt an assessment of the importance of various meteorological parameters on this process.

Recent Reports: Goodison, B.E., 1975. Snow Studies at Cold Creek: Testing and Evaluation of Gauges Used in Canada for Fresh Snowfall Measurement. Proc. Canadian Hydrology Symposium, Winnipeg, Aug. 11-14, 1975.

- 76-12 GAMMA RADIATION--H.L. Ferguson and S. Lapczak, Atmospheric Environment Service, Downsview, Ontario.

Objectives: Using a portable gamma spectrometer, the overall objective is to investigate the feasibility of using this instrument for basin surveys of soil moisture and snowpack water content. At present the equipment is installed on a tower. Testing and comparison with conventional "ground truth" measurement of the snowpack and soil moisture changes is in progress. Using lead shields the effect of cosmic rays and atmospheric constituents is being studied as is the operation of an automatic camera system which will allow unattended operation.

Recent Reports: No recent report titles provided.

- 76-13 A CLASSIC LAKE EFFECT SNOWSTORM AT BUFFALO, NEW YORK, NOVEMBER 15, 1974--Gregory C. Dietz and Benjamin Kolker, NOAA, National Weather Service Office, Buffalo, N.Y.

Objectives: Paper completed September 1975 and accepted by "WEATHERWISE" for printing in October 1975 issue.

Recent Reports: See above on paper printed.

- 76-14 HYDROLOGIC RECONNAISSANCE: SOMERSET ISLAND, DISTRICT OF FRANKLIN--B.J. Grey, Glaciology Division, Dept. of the Environment, Ottawa, Ontario.

Objectives: Observe general hydrological conditions on Somerset Island and more detailed work on one basin. Observe character and distribution of semi-permanent snowbanks and monitor one snowbank in some detail. Provide ground truthing for study of snow disappearance on Somerset Island and

Boothia Peninsula using LANDSAT (ERTS) Imagery. The ERTS study is currently incomplete; the remainder has been compiled in a report.

Recent Reports: "Hydrological Reconnaissance: Somerset Island, 1975"
Internal Report to Glaciology Division, Dept. of the Environment, Ottawa.

- 76-15 FREEZING RAIN IN THE MONTREAL AREA--Margaret Leech, M.Sc. candidate,
McGill University, Dept. of Meteorology.

Objectives: Using the records from synoptic stations in the Montreal area, a climatology of freezing rain will be developed. Surface and upper air synoptic charts, and upper air soundings will be used to determine the synoptic conditions attendant to the occurrence of freezing rain. Some of the physical aspects of freezing rain will be documented and possibly analyzed. Low level temperature profile in Montreal during freezing rain, drop-size measurements and radar data on bright-band and melting level will yield information on the history of freezing rain drops reaching the ground.

Recent Reports: Nil

3. SNOWPACK MEASUREMENT

- 76-16 SNOW DISTRIBUTION AND STRATIGRAPHY IN THE PETERBOROUGH AREA AND STUDIES OF ICE AND SNOW COVER OF LAKES--W.P. Adams, Trent University, Peterborough, Ontario.

Objectives:

Recent Reports: (1) Adams, W.P. and D.R. Barr 1974a. The study of snow. Occasional Paper No. 2, Dept. of Geography, Trent University, 44-76.
(2) Adams, W.P. and D.R. Barr 1974b. Techniques and equipment for measurement of snow cover including stratigraphy. Occasional Paper No. 3. Dept. of Geography, Trent University, 11-26.
(3) Adams, W.P. and A.G. Brunge, 1975. Variation in the quality and thickness of ice on a subarctic lake. Rev. de Geog. de Montreal, XXIX, 4.

- 76-17 SNOW AND ICE PREDICTION IN WINTER ENVIRONMENTS--Michael A. Bilello, U.S. Army - Corps of Engineers - CRREL, Hanover, NH.

Objectives: Provide a description of the snow and ice conditions and establish predictive techniques using climatic and meteorological information. The seventh in a series of reports on ice thickness measurements in the North American arctic and subarctic was published and distributed. A study on the winter environment of the upper Susitna River Basin, Alaska; and a preliminary analysis on the average number of days with snow on the ground for selected areas in central Europe were completed.

Recent Reports: (1) "A Survey of the Urban and Suburban Climate in Southeast Michigan, U.S.A."
(2) "Snow, Ice and Winter Temperatures in the Libby Dam, Montana, Drainage Basin"
(3) "Air Masses, Fronts and Winter Precipitation in Central Alaska"
(4) "Ice Thickness Observations along the Coasts of Eastern Canada and Southern Greenland"
(5) "Summer Climate at Selected Sites on the Ross Ice Shelf and the Greenland Ice Sheet"
(6) "Ice Thickness Observations, North American Arctic and Subarctic, 1970-71 and 1971-72"
(7) "Snow and Ice Cover Conditions in the Susitna River Basin, Alaska"

76-18 SQUARE GRID ANALYSIS AND MAPPING OF SNOW WATER EQUIVALENT--SAINT JOHN RIVER BASIN--P.L. Hansen, Surface Water Section, Water Res. Branch, Environment, N.B., Fredericton, N.B.

Objectives: Test and apply the following; (a) square grid analysis of std. snow course data and physio-graphic parameters, (b) generate and map a matrix of W.E. values based on (a) by machine, (c) apply (b) to operational flood forecasting and user data progress: techniques tested and mapped in hindsight for 1 year of data, awaiting 2nd year for 1st operational test.

Recent Reports: Hansen, P.L., "Experiences in snow cover mapping in the Saint John River Basin", available with proceedings of the 3rd Canadian Symposium on Remote Sensing; contact C.C.R.S. 2464 Sheffield Rd., Ottawa (Attn. Miss F. Macdonnell).

76-19 SNOW ACCUMULATION, MELT AND WATER INPUT-A NEW ENGLAND MODEL--Robert L. Hendrick and Rojer J. DeAngelis, USDA-ARS. Northeast Watershed Research Center, University Park, Pa.

Objectives: A model utilizing only temperature and precipitation data from National Weather Service Weather Network stations is developed to predict snow water equivalent, melt and water input (snowmelt and rainfall) at any point or over any area up to 50 miles distance from the observing station. The effects of elevation and latitude on spatial variation of temperature and precipitation are critical to the predictions. Outputs include 10-day values of individual seasons and long term climatic averages for any un-gaged point or over any un-gaged watershed.

Recent Reports: Publication accepted by Journal of Applied Meteorology but will be delayed until refinements at precipitation-elevation function are completed. Preliminary draft available from authors.

76-20 SNOWPACK MEASUREMENT PROGRAM--B.E. Goodison, Atmospheric Environment Service Headquarters, Downsview, Ontario

Objectives: Project 3. Snowpack measurement program. (a) Standardization of Snow Course Data. Attempts are proceeding on developing a standardized procedure for reporting and publishing snow cover data in the United States and Canada. The proposals include provisions for metric conversion. This study is being done as a member of the Research Committee of the Eastern Snow Conference. (b) Snow Cutter Testing. Field studies are being conducted to compare the accuracy of various snow samplers used in Eastern Canada where shallow snowpacks are characterized by crusts and ice layers within the pack and at the ground surface.

Recent Reports: Ferguson, H.L. and B.E. Goodison, 1974. Mean Snowpack Water Equivalent Maps and Snow Course Data Problems over Southern Ontario Proc. Eastern Snow Conf. 1974 p91-111.

Goodison, B.E. 1975. Standardization of Snow Course Data: Reporting and Publishing. Proc. Eastern Snow. Conf. 1975.

76-21 BASIN SNOW ACCUMULATION-ABLATION ANALYSIS--B.E. Goodison, Atmospheric Environment Service, Downsview, Ontario.

Objectives: In selected research basins in Canada (with special emphasis on Cold Creek Basin near Bolton, Ontario) studies are being conducted on land use snow cover relations, snowmelt from shallow snowpacks, snowmelt runoff processes, snowmelt at a point, snowfall-snow cover relations. Cold Creek Basin is characteristic of the margins of the continental

accumulation zone where ablation may occur often during the winter. Data collection and analysis is continuing.

Recent Reports: No recent report titles provided.

- 76-22 PHYSICAL CHARACTERISTICS OF SNOWBEDS IN THE RICHARDSON MOUNTAINS, N.W.T.--N.J.K. Peterson, Land Use Section, Dept. of Indian and Northern Affairs, Yellowknife, N.W.T.

Objectives: To examine the impact of semi-permanent snowbeds upon biological elements and other physical processes in and adjacent to snowbeds. Snowbeds are examined, along with other factors, as they influence active layer development, ground temperature regime and slope stability. The project has been completed.

Recent Reports: Peterson, N.J.K. (1974). "Physical Characteristics of Snowbeds in the Richardson Mountains, Northwest Territories". pp.109-201 in Hydrological Aspects of Northern Pipeline Development, Canada, Environmental Social Committee, Northern Pipelines, Task Force on Northern Oil Development, Report No. 74-12. Information Canada, Cat. No. R57-1/1974.

4. SNOWMELT

- 76-23 SNOW SURVEY INVESTIGATION AND SNOWMELT MODELLING--L.A. Logan, Ministry of the Environment, 135 St. Clair Ave. W., Toronto, Ontario.

Objectives: Development and Application of snowmelt models in complement to comprehensive watershed models. Completed snow accumulation and melt model, with simulation option depending on availability of input data.

Recent Reports: Logan, L.A. 1975 A Computer-Aided Snowmelt Model for Augmenting Winter Streamflow Simulation in a Southern Ontario Drainage Basin.

5. STREAMFLOW

- 76-24 WINTER DISTRIBUTION OF FLOW IN THE MACKENZIE DELTA, N.W.T.--J.C. Anderson; R.J. Anderson; D.K. MacKay, Glaciology Division, Dept. of the Environment, Ottawa, Ontario.

Objectives: To determine the discharge and late winter distribution of flow through the major distributaries of the Mackenzie Delta. Ice thickness data were also obtained and were related to temperature and snow cover conditions in each of the winters 1971-72 through 1973-74. Since then, the study has been undertaken by the Calgary District Office of Water Survey of Canada.

Recent Reports: Anderson, J.C. and R.J. Anderson (1974). "Progress Report on Winter Distribution of Flow in the Mackenzie Delta, N.W.T." pp. 231-254 in, Hydrologic Aspects of Northern Pipeline Development, Canada, Environmental-Social Committee, Northern Pipelines, Task Force on Northern Oil Development, Report No. 74-12. Information Canada, Cat. No. R57-1/1974.

- 76-25 MATHEMATICAL MODEL OF A MOUNTAINOUS WATERSHED CHARACTERIZED BY MAXIMUM RUNOFF IN SPRING AND AUTUMN--Raymond Charbonneau, INRS-Eau, Universite du Quebec, Case Postale 7500, Ste-Foy, Quebec.

Objectives: To develop a deterministic mathematical model that can use at least two different approaches regarding the processes of evapotranspiration, infiltration and snow melt. Emphasis has been put on snow melt problems due to the characteristics of the basin located in the French Alps.

Recent Reports: Doctorat Thesis: Modele mathematique en hydrologie. Cas d'un bassin versant, montagneux a regime nivo-pluvial: la Durance a Serre-Poncon.

- 76-26 DETERMINATION OF THE PRESENCE/ABSENCE OF STREAMFLOW IN SLUSH HORIZONS--
R.A. Halliday, Applied Hydrology Division, Dept. of the Environment,
Place Vincent Massey, Ottawa, Ontario.

Objectives: The question of whether or not streamflow takes place in a slush layer has always aroused controversy among those persons who routinely take winter discharge measurements. The objective is to resolve this problem by direct measurement of velocity in the slush by electromagnetic or fluorometric techniques. Work is done as funds permit with the last field program being conducted in 1973.

Recent Reports: Fast, E.J., Winter Discharge Measurements, Nelson River at Bladder Rapids, January 1973. Report dated March, 1973.

6. LAKE AND RIVER ICE

- 76-27 BREAK-UP OF RIVER ICE--Bernard Michel, Dr. Eng., Ice Mechanics Laboratory,
Dept. Civil Eng., Universite Laval, Quebec.

Objectives: Research is being completed on the stability of a solid ice under increasing river discharge at break-up. A model study is being undertaken on the equilibrium of unconsolidated ice covers in meandering rivers.

Recent Reports: Abdelnour R, Michel B. (1975) "Rapture a la debacle d'un couvert de glace continue". Rapport No GCS-75-10-06, Dpt. Genie Civil, Universite Laval, 121 pages.

- 76-28 ICE FORMATION--Bernard Michel, Dr. Eng., Ice Mechanics Laboratory, Dpt.
Civil Eng., Universite Laval, Quebec.

Objectives: Studies are continuing on the mechanism of nucleation of frazil. A small nucleator is used to study nucleation in various cases and particularly to ascertain or reject various nucleation theories.

Recent Reports: (1) Michel, B. (1972) "Properties and Process of River and Lake Ice", Proc. Int. Symposia on the Role of Snow and Ice in Hydrology, Banff, Vol. I, pp.454-482.

(2) Michel, B., Berenger, D. (1972) "L'hiver glaciologique le long du fleuve St-Laurent". Proc. Int. Symposia of the Role of Snow and Ice in Hydrology, Banff, Vol.2 pp. 1251-1283.

(3) Michel, B. (1972) "Static Growth of Black Ice in Cold Regions", Proc. I.A.H.R. Symposium, Ice and Its action on Hydraulic Structures, Leningrad, pp. 163-171.

(4) Michel, B., T.O'D. Hanley (1975) "Mechanisms of ice growth at the air-water-air interface in a laboratory tank". Seminar on Thermal Regime of river ice, NRC Technical Memorandum No. 114, pp. 96-104.

- 76-29 STUDY OF CHANNEL ICE EFFECTS AND SURFACE WATER VELOCITIES, MACKENZIE RIVER, N.W.T.--D.K. MacKay; D.E. Sherstone; K.C. Arnold, Glaciology Division, Department of the Environment, Ottawa, Ontario

Objectives: To monitor channel ice effects and map surface water velocities, using aerial surveillance and photography. To apply the results of this research to problems encountered in river navigation, highway and pipeline crossings, settlement location, etc. Field studies are continuing toward that end.

Recent Reports: MacKay, D.K., D.A. Sherstone and K.C. Arnold (1974). "Channel Ice Effects and Surface Water Velocities from Aerial Photography of Mackenzie River Break-up." pp. 71-107 in, Hydrological Aspects of Northern Pipeline Development, Canada, Environmental-Social Committee, Northern Pipelines, Task Force on Northern Oil Development, Report No. 74-12. Information Canada, Cat. No. R57-1/1974.

- 76-30 RHEOLOGY AND STRENGTH OF SALINE ICE--N.K. Sinha, Division of Building Research, National Research Council of Canada, Ottawa, Ontario

Objectives: To investigate the structural, rheological and mechanical properties of saline ice. New project.

Recent Reports: Nil.

- 76-31 DEFORMATION AND FAILURE OF FRESH WATER ICE--N.K. Sinha, Division of Building Research, National Research Council of Canada, Ottawa, Ontario.

Objectives: To investigate the rheological and mechanical properties of river and lake ice. Preliminary investigations of stress relaxation have been made in the laboratory. The scanning electron microscope has been successfully used to examine deformation mechanisms in columnar grained ice.

Recent Reports: (1) Gold, L.W. and A. Traetteberg. 1974. Young's modulus of ice and ice engineering problems. Presented to Second Symposium on Applications of Solid Mechanics, Dept. of Mechanical Engineering, McMaster University.

(2) Traetteberg, A., L.W. Gold and R. Frederking. 1975. The strain rate and temperature dependence of Young's modulus of ice. Presented IAHR Symposium on Ice Problems, Hanover, N.H.

7. HIGHWAYS AND BUILDINGS

- 76-32 WIND AND ICE LOADING ON STRUCTURES--Anderson, Robert; Leech, Margaret, Meteorology Research International Ltd., 809 Sun Life Bldg., Montreal, Quebec.

Objectives: The project is to research extreme winds and ice accumulation on structures. A number of climatic stations have been established to measure, wind, temperature and icing in Labrador and Northern Quebec. Similar studies have been carried out in Newfoundland and Iran.

Recent Reports: Report prepared for client.

- 76-33 ICE ENGINEERING--R. Frederking, Division of Building Research, National Research Council of Canada, Ottawa, Ontario.

Objectives: To establish the criteria required for the design and structures subject to forces due to river, lake or sea ice, and for the assessment of the load carrying capacity of ice covers. Laboratory measurements of the vertical loads developed on small diameter piles by a floating ice cover are underway. A study on the edge loading of ice plates has been completed.

Recent Reports: (1) Frederking, R., and L.W. Gold. 1974. Experimental study of edge loading of ice covers. Presented to 27th Canadian Geotechnical Conference, Edmonton. To be published in Canadian Geotechnical Journal, Vol. XII, No. 4.

(2) Frederking, R. 1975. Mechanical properties of ice and their application to Arctic ice platforms. Presented to Ice Tech 75, Society of Naval Architects and Marine Engineers, Montreal.

8. SOIL AND WATER FROST

No submissions.

9. REMOTE SENSING

- 76-34 DETERMINING THE EXTENT OF SNOW COVER IN HEAVILY FORESTED MOUNTAINS WITH NOAA-4 IMAGERY--A.R. Eschner, S.U.N.Y. College of Env. Sci. & Forestry, Syracuse, N.Y.

Objectives: To determine the areal variation in snow depth and water equivalent. To develop for various vegetation cover types empirical relationships between in situ reflectances and signals received by satellite radiometers.

Recent Reports: None.

- 76-35 SNOW STUDIES BY SATELLITE--H.L. Ferguson and S. Lapczak, Atmospheric Environment Service Headquarters, Downsview, Ontario.

Objectives: As part of the WMO international study of the application of satellites to the analysis of snow cover, Canada and the United States selected four large international basins for joint study - the Saint John, Lake of the Woods, Souris and Columbia. Most of the AES effort is on the Saint John and Souris basins. NOAA/VHRR imagery for January to May 1975 has been examined and 13 relatively cloud free images were selected for closer study in conjunctions with applicable LANDSAT images. Mapping of the continuous snow line and areas of patchy snow was carried out for the available imagery. To develop techniques for interpreting remotely sensed data, ground truth data has been acquired from the co-operative agencies. The project is continuing during the 1976 season.

Recent Reports: No recent report titles provided.

- 76-36 REMOTE SENSING OF SNOW COVER FROM AIRBORNE AND SPACEBORNE PLATFORMS--P.J. Howarth and M-K Woo, Dept. of Geography, McMaster University, Hamilton, Ontario

Objectives: To determine the information on snow extent and snow depth that can be obtained from low altitude photography, high altitude/small scale photography and from satellite data.

To understand the factors influencing reflectance values recorded from snow covered terrain by the LANDSAT satellites.

Progress - First stage completed; studies are continuing.

Recent Reports: Howarth, P.J. and M-K Woo, 1973. A preliminary evaluation of ERTS-1 (LANDSAT-1) imagery for the interpretation of snow cover in southern Ontario. Contract Report for Inland Waters Directorate, Environment Canada, 167 pp.

Howarth, P.J. and M-K Woo, 1975. The influence of scale in remote sensing of snow cover. Proceedings 32nd Annual Meeting of the Eastern Snow Conference, 18pp.

76-37 SATELLITE SNOW SURVEYS-VISIBLE AND NEAR-IR--Donald R. Wiesnet, David F. McGinnis, and Michael McMillan, NOAA/National Environmental Satellite Service, ESG/S33/Stop D, Washington, D.C.

Objectives: To apply satellite data in the visible and near-IR spectrum to the study of snow, its distribution, depth and its physical properties, and to determine the applicability of these data to operational hydrology. Surveys of 2 river basins, the American River in California and the San Juan River in Arizona are on an operational basis. About 20 basins are currently mapped on a quasioperational basis using photo-optical interpretations from NOAA-4 data. Empirical relations between "albedo" and average snowpack density have been noted. Under certain conditions snow brightness can be related to snow depth.

Recent Reports: See recent references.

76-38 SNOW HYDROLOGY--H.S. Loijens, Hydrologist, Glaciology Division, Water Resources Branch, Inland Waters Directorate, Department of the Environment, Ottawa, Ontario

Objectives: Measurement of snow water equivalent by natural gamma radiation; mapping of snow extent by satellite imagery; snow measurement and distribution; snow melt modelling and watershed hydrology.

Recent Reports: Nil

LIST OF STUDIES IN PROGRESS

1. PROPERTIES OF SNOW AND ICE

- 76-39 LARGE-SCALE SNOW MAPPING FOR PERMAFROST PREDICTION--Dr. Frank H. Nicholson, McGill Sub-Arctic Research Laboratory, P.O. Box 790, Schefferville, P.Q.

Objectives: Use of (a) 5 large snow courses (100 points or more over several square kilometres each) and (b) sequential aerial photography through the snow-melt period. The aim is to produce maps of the average winter snow fall, which controls permafrost distribution, which in the Schefferville area specifically is a major problem in iron ore mining.

Recent Reports: Nicholson, F.H. 1975. Snow depth mapping from aerial photographs for use in permafrost prediction. Proc. Eastern Snow Conference 1975.

7. HIGHWAYS AND BUILDINGS

- 76-40 ROOF SNOW LOADS AND THEIR DEPENDENCE ON THE CLIMATOLOGY OF SNOWFALL, WIND, TEMPERATURE AND OTHER METEOROLOGICAL VARIABLES--Dr. N. Isyumov, University of Western Ontario, Faculty of Engineering Science, London, Ontario.

Objectives: The main objective of this study is to provide improved definitions of roof snow loads. Meteorological records for some 30 Canadian stations have been studied in order to provide statistical descriptions of the snowfall, other winter precipitation, wind and temperature climates. Both marginal and joint statistics have been studied. The dependence of roof snow loads on the statistical properties of the local climate is examined using Monte Carlo simulation techniques. Snow deposition and depletion models used in these simulations have been arrived at using physical modelling techniques. Results indicate a strong dependence of roof snow loads on the exposure to wind action and consequently local wind conditions. Work is continuing using improved statistical data and simulation techniques to provide information on the variability of roof snow loads in relation to ground snow load. Work is also continuing in the area of physical modelling of snow deposition and depletion and snow drifting in general. Comparisons with full scale case studies are planned.

Recent Reports: Isyumov, N. and A.G. Davenport, 1974, "A Probabilistic Approach to the Prediction of Snow Loads", Canadian Journal of Civil Engineering, Vol. 1, Number 1, pp. 28-49.

SELECTED BIBLIOGRAPHY - 1976

2. PRECIPITATION AND ACCUMULATION

Mikitiuk, M., 1975, "A Statistical Description of the Canadian Snow Climate", Bachelor's Thesis, University of Western Ontario, March, 1975.

7. HIGHWAYS AND BUILDINGS

Ghiocel, D. and D. Lungu, 1975, "Wind, Snow and Temperature Effects on Structures Based on Probability", ABACUS Press. Tunbridge Wells, Kent, England.

Isyumov, N. and A.G. Davenport, 1974. "A Probabilistic Approach to the Definition of Snow Loads", Can. Jour. Civil Eng. Vol. 1, No. 1, pp. 28-49.

Kind, R.J., 1974, "A critical examination of the requirements for model simulation of wind-induced ground-drift or erosion phenomena in wind tunnels with particular emphasis on snow drifting", NRC National Aeronautical Establishment Tech. Report LTR-LA-167.