

REPORT OF THE ESC RESEARCH COMMITTEE  
LIST OF STUDIES IN PROGRESS

1. PROPERTIES OF SNOW AND ICE

- 83-1 GLACIOLOGY--WATER, ICE, AND ENERGY BALANCE OF SNOW AND GLACIERS,  
AND SNOW AND ICE PHYSICS--Mark F. Meier, U.S.

U.S. Geological Survey, Water Resources Division,  
1201 Pacific Avenue, Suite 850  
Tacoma, Washington 98402.

Objectives

Obtain understanding of how meteorological processes determine snow accumulation and melt, and develop improved techniques for predicting snow mass, snow distribution, and snowmelt runoff. Determine how meteorological processes affect glacier mass balances, and how changes in mass balance affect glacier motion, variations, and runoff. Use this knowledge and glacier variation data to construct climatic histories. Measure and develop an understanding of the physics of water flow through ice and at the ice/rock interface. Use computer models and glacier data to obtain new understanding of glacier flow and sliding. Understand why certain glaciers behave in anomalous ways (surges, calving retreats) and use this knowledge to minimize economic hardship in dangerous glacier situations.

Recent reports:

Meier, M. F. and Post, Austin, 1980, G. K. Gilbert and the Great Iceberg-Calving Glaciers of Alaska, in Yochelson, Ellis L., ed., The Scientific ideas of G. K. Gilbert. Boulder, CO, Geological Society of America Special Paper 183, p. 115-123.

Meier, M. F., Carpenter, P. J., and Janda, R. J., 1981, Hydrologic Effects of Mount St. Helens' 1980 Eruptions. EOS, Transactions American Geophysical Union, v. 62, no. 33, p. 625-626.

Meier, M. F., Mayo, L. R., Trabant, D. C., and Krimmel, R. M., 1980, Comparison of Mass Balance and Runoff at Four Glaciers in the United States, 1966 to 1977. Proceedings of the International Symposium on the Computation and Prediction of Runoff from Glaciers and Glacierized Areas, Tbilisi, Georgia, U.S.S.R., September 3-11, 1978.

Meier, M. F., Rasmussen, L. A., Post, Austin, Brown, C.S., Sikonia, W. G., Bindschadler, R. A., Mayo, L. R., and Trabant, D. C., 1980. Predicted Timing of the Disintegration of the Lower Reach of Columbia Glacier Alaska. U.S. Geological Survey Open-File Report 80-582, 47 p. Translated into Chinese by Peoples Republic of China, October 1980.

Meier, M. F., Post, A., Rasmussen, L. A., Sikonia, W. G., and Mayo, L. R., 1980, Retreat of Columbia Glacier--A Preliminary Prediction. U.S. Geol. Survey Open-File Report, 9 p.

Brugman, Melinda M. and Meier, Mark F., 1981, Response of Glaciers to the Eruptions of Mount St. Helens, in Lipman, Peter W. and Mullineaux, Donald R., eds., The 1980 Eruptions of Mount St. Helens, Washington. U.S. Geol. Survey Professional Paper 1250, pp. 743-756.

Brugman, Melinda M. and Post, Austin, 1981, Effects of Volcanism on the Glaciers of Mount St. Helens. U.S. Geol. Survey Circular 850-D, 11 p.

Driedger, Carolyn L., 1981, Effect of Ash Thickness on Snow Ablation, in Lipman, Peter W. and Mullineaux, Donald R., eds., The 1980 Eruptions of Mount St. Helens, Washington. U.S. Geological Survey Professional Paper 1250, pp. 757-760.

Fountain, Andrew G., 1982, Columbia Glacier Photogrammetric Altitude and Velocity: Data Set (1957-1981). U.S. Geological Survey Open-File Report 82-756, 225 p.

Krimmel, Robert M., and Post, Austin, 1981, Oblique Aerial Photography, March-October 1980, in Lipman, Peter W. and Mullineaux, Donald R., eds., The 1980 Eruptions of Mount St. Helens, Washington. U.S. Geological Survey Professional Paper 1250, pp. 31-51.

Meier, M.F., and Poots, E.P., 1982, Snow and Ice, Climate, and Water Supply: Glaciological Programs of the IHP Relevant to Developing Countries. Unesco Bulletin, Nature and Resources, v. 18, no. 1.

- 83-2 WINTER BATTLEFIELD OBSCURATION RESEARCH PROGRAM, R. K. Redfield, H. O'Brien. U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, N.H.

Objectives: Determine effects of winter atmospheric conditions, mainly snowfall, on electromagnetic energy propagation.

Recent reports:

SNOW-ONE-A Data Report, USACRREL Special Report 82-8, G. N. Aitken, Editor, USACRREL, Hanover, N.H., May 82\*.

Snow Symposium I, Proceedings, Hanover, N.H., August, 81.\*

Snow Symposium II, Proceedings, CRREL Special Report 83-4, Hanover N.H., August, 82.\*

\* Reports available to U.S. government agencies, contractors and others with special permission. Contact CRREL/RG, 72 Lyne Rd, Hanover, N.H., 03755 for copies.

## 2. PRECIPITATION AND ACCUMULATION

- 83-3 ASSESSMENT OF TOPOGRAPHIC - SNOW COVER RELATIONSHIPS IN SOME CLEAR-CUTS IN CENTRAL NEW BRUNSWICK. D.A. Daugharty, R.B.B. Dickison, Dept. of Forest Resources, University of New Brunswick, Fredericton, N.B.

Objectives:

- To test the effect of aspect on the elevation - snow cover gradients in clearcuts.
- Current progress - study delayed until winter 1983-84 because of insufficient snow accumulation this season.

Recent reports:

Daugharty, D.A. and R.B.B. Dickison 1982. Snow cover distribution in forested and deforested landscapes in New Brunswick, Proceedings, 50th Western Snow Conference, Reno, Nevada.

Dickison, R.B.B. and D.A. Daugharty, 1982. A comparison of forest cover measures as estimators of snow cover and ablation. Proc. Can. Hyd. Symp: 82, Fredericton, N.B. 1982, 113-129.

83-4 SNOW DRIFT MODELING, Dr. James D. Iversen, Iowa State University, Ames, IA.

Objectives: To understand snow deposition physics and small-scale modeling.

Recent reports:

J. D. Iversen, "Drifting Snow Similitude - Drift Deposit Rate Correlation", Wind Engineering Proceedings of the Fifth International Conference, Ft. Collins, Colorado, Vol. 2, Pergamon Press, 1980, 1035-1047.

J. D. Iversen, "Wind-Tunnel Modeling of Snow Fences and Natural Snow-Drift Controls", 37th Eastern Snow Conference, Peterborough, Ontario, Canada, 1980, Proceedings, pp. 106-124.

J. D. Iversen, "Drifting Snow Similitude - Transport Rate and Roughness Modeling", Journal of Glaciology", 1980, vol. 26, 393-403.

J. D. Iversen, "Comparison of Wind Tunnel Model and Full-Scale Drifts", Journal of Industrial Aerodynamics and Wind Engineering, 1981, Vol. 8, 231-249.

J. D. Iversen, 1982. Small-Scale Modeling of Snow-Drift Phenomena. Wind Tunnel Modeling for Civil Engineering Applications. National Bureau of Standards, Washington, D.C., pp. 522-545.

J. D. Iversen, 1982. Development of Small-Scale Snowdrift Simulation. Western Snow Conference Proceedings, pp. 112-119.

J. D. Iversen, B. R. White, "Saltation Threshold on Earth, Mars, and Venus", Sedimentology 1982, Vol. 29, 111-119.

J. D. Iversen, 1982 "Photographic Determination of Transport Rate Effects in Blowing Sand and Snow", Flow Visualization II Hemisphere, pp. 509-513.

83-5 REGIONAL AND SEASONAL VARIATIONS IN SNOW-COVER DENSITY IN THE USSR, Michael A. Bilello, U.S. Army Cold Regions Research and Engineering Laboratory, (USACRREL), Hanover, N.H.

Objectives: An average snow-cover density chart was developed for the Soviet Union based on data obtained through the literature, and a relationship between seasonal wind speed and density. The study is nearing completion and will be published as a USA CRREL report.

Recent reports: See below.

83-6 FROZEN PRECIPITATION - ITS FREQUENCY AND CONCURRENT METEOROLOGICAL CONDITIONS FOR SELECTED LOCATIONS IN THE U.S. AND CENTRAL EUROPE., Michael A. Bilello, U.S. Army Cold Regions Research and Engineering Laboratory, (USACRREL), Hanover, N.H.

Objectives: An approach similar to that used in a previous statistical study on frozen precipitation for locations in the U.S. will be used for sites in central Europe. The results of the investigation for the U. S. stations are complete, and another for a site in Germany is in progress.

Recent reports:

Previous reports on the above two subjects are available and published as: USA CRREL Research Report 267 and Technical Report 162.

- 83-7 SNOW DISTRIBUTION AND STRATIGRAPHY IN THE PETERBOROUGH AREA. -- Peter Adams, Dept. of Geography, Watershed Ecosystems Program, Trent University, Peterborough, Ontario.

Recent reports: See below.

- 83-8 SPATIAL AND STRATIGRAPHIC DEVELOPMENT OF ICE AND SNOW ON LAKES IN ONTARIO AND LABRADOR. -- Peter Adams, Dept. of Geography, Watershed Ecosystems Program, Trent University, Peterborough, Ontario.

Recent reports:

Adams, W.P. 1980. Illustrations of biological roles of winter lake cover. Proc. Eastern Snow Conf., 37:1-18.

Adams, W.P. 1981a. Snow, Plants and Animals. In: Handbook of Snow (D.M. Gray and D.H. Male, Eds., Pergamon Press, Canada, 770pp.), 13-21.

Adams, W.P. 1981b. Snow and Ice on Lakes. In: Handbook of Snow (D.M. Gray and D.H. Male, Eds., Pergamon Press, Canada, 770pp.), 437-474.

Adams, W.P. 1981c. Comparison of Canadian and Soviet snow gauges. Proc. Eastern Snow Conf., 38, 113-118.

Adams, W.P. 1982. Spatial variability of snow and ice on lakes and a strategy for measurement based on three years' data from Elizabeth Lake, Labrador. Proc. Eastern Snow Conf., 39, 49-62.

Adams, W.P., J. Campbell, B.R. Wolfe and L.J. Woods, 1982. An atlas of spatial and temporal trends of winter cover for Lake St. George, 1976-1979. Report submitted to Ministry of the Environment, Ontario. 42p. plus maps.

Adams, W.P., J.R. Glew, K.C. Outerbridge and N. Strickland, 1982. Evolution of snowcover at meadow and bush sites; an illustration of techniques of measurement and display. Ecology Bulletin, Dept. of Biology, Trent University, 6(1): 27-35. Reprinted 1982, The Monograph, 33(1): 6-12.

Adams W.P. and D.C. Lasenby, 1982. Lake ice growth and conductivity. Proc. Eastern Snow Conf., 39, 184-188.

Adams, W.P. and T.D. Prowse, 1980. Observations on the use of a mechanical device for measuring the thickness of lake ice. Proc. Eastern Snow Conference, 37: 189-192.

Adams, W.P. and T.D. Prowse, 1981. Evolution and magnitude of spatial patterns in the winter cover of temperate lakes. Fennia, 159 (2): 343-359.

Adams, W.P. and N.T. Roulet, 1980. Illustration of the role of snow in the evolution of the winter cover of a lake. Arctic, 31,1,100-116.

- Adams, W.P. and N.T. Roulet, 1982. Areal differentiation of land and lake snowcover in a small subarctic drainage basin. Nordic Hydrology, 13, 139-156.
- Campbell, J. and L.J. Woods, 1982. An introduction to the importance of winter lake cover to the ecology of Lake St. George. Report submitted to Ministry of the Environment, Ontario. 65p.
- De Bryn, E.R. 1980. On the Diurnal Variability of Phytoplankton Primary Production Under Ice Cover in a Temperate Lake. Honours Thesis, Biology Thesis, Trent University.
- Jackson, M. 1980. Winter oxygen loss in three southern Ontario lakes. In: Studies in Snow and Ice, Trent Student Geographer, No. 8: 149-159.
- Jackson, M. and D. Lasenby, 1982. A method for predicting winter oxygen profiles in ice-covered Ontario lakes. Can. Jour. Fish. Aquat. Sci., (in press).
- Jones, R. and D.B. Orr, 1980. Freeze-out of nutrients from lake ice. Proc. Eastern Snow Conf., 37: 193-195.
- Linsey, G.A., 1981. Spatial and temporal variation of factors influencing oxygen loss in a temperate lake. M.Sc. Thesis, Watershed Ecosystems Program, Trent University.
- Mathers, T.J., 1980. The role of vegetation in the disposition of snowfall on a mixed forest watershed in the Kawartha Lakes Region of east central Ontario. In: Studies in Snow and Ice, Trent Student Geographer, No. 8: 36-50.
- Orr, Daniel, 1980. The influence of a snow and ice cover on the major cation concentrations of Dummer Lake, Ontario. Honours Thesis, Biology-Geography Dept., Trent University.
- Outerbridge, K., 1981. Transmission of light through a snowcover. Honours Thesis, Dept. of Geography, Trent University.
- Outerbridge, K.C., N.T. Roulet and W.P. Adams, 1981. Light transmission through natural snowcovers. Proc. Eastern Snow Conf., 38, 117-118.
- Pearson, Matthew, 1980. Pollutant analyses of winter lake cover. Honours Thesis, Biology Dept., Trent University.
- Pierson, D.C. and C.H. Taylor, 1981. The influences of snow on the input and movement of cations within a small watershed: Methods and preliminary results. Proc. of the Eastern Snow Conf., 38: 182-184.
- Price, J.S., 1980. A comparative study of ice regimes during the freeze-up period on the Indian River, near Peterborough, Ontario. In: Studies in Snow and Ice, Trent Student Geographer, No. 8: 110-120.
- Roulet, N.T., 1980a. Use of a computer mapping package in displaying areal representations of snowcover. Proc. Eastern Snow Conf., 38: 118-120.
- Roulet, N.T., (Ed.), 1980b. Studies in snow and ice. Trent Student Geographer, No. 8. Trent University, Peterborough, 193 p.

Roulet, N.T., 1981. Significant error in the stake approach of measuring white ice growth. Proc. of the Eastern Snow Conf., 38: 106-109.

Roulet, N.T., 1981. Variability of the quality and quantity of light penetrating a winter lake cover. M.Sc. Thesis, Watershed Ecosystems, Trent University, Peterborough, Ontario.

Strickland, N., 1981. Factors affecting the albedo of snowcover. Honours Thesis, Dept. of Geography, Trent University.

Strickland, N., 1982. Factors affecting temporal variations in the albedo of snowcover. Proc. Eastern Snow Conf., 39.

Taylor, C.H. and D.C. Pierson, 1981. The influence of snow on the input and movement of cations within a small watershed. Proc. Eastern Snow Conf., 37: 182-184.

Taylor, C.H. 1982. The hydrology of a small wetland catchment near Peterborough, Ontario. In: Bardekci, M.J. (Ed.), Wetlands Research in Ontario, Occasional Paper, Dept. of Applied Geography, Ryerson Polytechnical Institute, 105-139.

Taylor, C.H., 1982. The effect on storm runoff response of seasonal variations in contributing zones in small watersheds. Nordic Hydrology (in press).

Winter, Malcolm, 1980. A test of the Jackson Model for predicting oxygen deficits in temperate ice-covered lakes. Honours Thesis, Dept. of Geology, Trent University.

Wolfe, J.D., 1980. Nutrient export from two source watersheds. M.Sc. Thesis, Biology-Geography Watershed Ecosystems Program, Trent University.

83-09 GLOBAL SNOW COVER - ATMOSPHERIC CIRCULATION INTERACTIONS -- K. F. Dewey, University of Nebraska, Lincoln, NE.

Objectives: To digitize and create a global snow cover data archive and compare these data to the variations in atmospheric circulation. The Northern Hemisphere Digitized Snow Cover archive is completed for the period 1966 through 1982, and the Southern Hemisphere archive is half completed for the same time period.

Recent reports:

Two NOAA/NESS Technical Reports are available from the author, K. F. Dewey, at the University of Nebraska, Lincoln, NE 68588-0135 "Satellite Observations of Variations in Northern Hemisphere Seasonal Snow Cover". NOAA/NESS Technical Report, 42 p. (Dec. 1981).

"Satellite Observations of Variations in Southern Hemisphere Snow Cover". NOAA/NESS Technical Report, 33 p. (Spring, 1983).

83-10 ACCURACY OF CANADIAN SNOW GAUGE MEASUREMENTS -- B. E. Goodison, Atmospheric Environment Service, Downsview, Ontario.

Objectives: Projects are continuing to assess the accuracy of Canadian snow gauge measurements, particularly in low snowfall regions; to develop a Canadian shield for recording gauges, similar to the MSC Nipher shield, and, to improve the measurement of fresh snowfall at Canadian climate stations.

Recent reports:

Goodison, B.E., 1981: Compatibility of Canadian Snowfall and Snow Cover Data. Water Resources Research, Vol. 17, No. 4, pp. 893-900.

Goodison, B.E., H.L. Ferguson, G.A. McKay, 1981: Snowfall and Snow Cover Measurement and Data Analysis, Chapter 6, Handbook of Snow - Principles, Processes, Management and Use (ed. D.M. Gray and D.H. Male), Pergamon Press, Toronto, p. 191-274.

Goodison, B.E. and J.R. Metcalfe, 1980. AES Nipher Shields for Recording Precipitation Gauges: An Assessment. Proc. Eastern Snow Conference, Peterborough, Ontario, June 5-6, 1980, 196-198.

Goodison, B.E., Metcalfe, J.R., 1981: An Experiment to Measure Fresh Snowfall Water Equivalent at Canadian Climate Stations, Proceedings Eastern Snow Conference, Syracuse, New York, June 4-5, 1981, p. 110-112.

Goodison, B.E. and J.R. Metcalfe, 1982: Canadian Snow Gauge Experiment: Recent Results. Proceedings, Eastern Snow Conference, Vol. 27, p. 192-195 (also in Proc. Western Snow Conference, 50, p. 192-195).

Goodison, B.E., V.R. Turner, and J.R. Metcalfe, 1983: A Nipher-Type Shield for Recording Precipitation Gauges. Proceedings, AMS Conference on Meteorological Instrumentation and Observations, April 11-15, 1983, Toronto, p. 21-26.

Goodison, B.E. and Metcalfe, J.R., 1981: Nipher-Type Shield for Recording Precipitation Gauges: Field Trails. Paper presented at the 15th Annual CMOS Congress, Saskatoon, Saskatchewan, May 27-29, 1981.

- 83-11 SNOW SAMPLER RE-DESIGN -- B.E. Goodison, AES; R.P. Richards, B.C. Ministry of Environment; P.E. Farnes, USDA-SCS; N. Peterson, California Water Resources.

Objectives: The Western Snow Conference Working Group on Metrication completed its assessment of new metric snow samplers for deep and shallow snowpacks, including recommendations for metric conversion and standardization. A report will be available in early 1983.

Recent reports;

Farnes, P.E., B.E. Goodison, N.R. Peterson, R.P. Richards, 1980: Proposed Metric Snow Samplers by Western Snow Conference Metrication Committee. Proc. Western Snow Conference, Laramie, Wyoming, April 15-17, 1980, 107-119.

Farnes, Phillip E., Ned R. Peterson, Barry E. Goodison, and Robert P. Richards, 1982: Metrication of Manual Snow Sampling Equipment, Proceedings, Western Snow Conference, Reno, Nevada, April 20-23, 1982, p. 120-132 (also in Proc. Eastern Snow Conf., 39, p. 120-132).

3. SNOWMELT AND STREAMFLOW

- 83-12 NOAA-NWS SNOW RESEARCH PROJECT -- Dr. Eric Anderson, Hydrologic Research Laboratory, NOAA-National Weather Service.

Objectives: To develop improved snowmelt runoff models for use in river forecasting. The study site is the W-3 watershed and NOAA Snow Research Station located near Danville, Vermont. This was one of the six test basins used in the WMO project on "Intercomparison of Models of Snowmelt Runoff". Collection and analysis of data continue.

Recent reports:

Colbeck, S.C., and Anderson, E.A., "The Permeability of a Melting Snow Cover", Water Resources Research, Vol. 18, No. 4, August 1982, pp. 904-908.

83-13 PEYTO/YOHO GLACIER HYDROLOGY -- John M. Power, National Hydrology Research Institute, Environment Canada, Ottawa, Ontario

Objectives: The assessment of the role of glaciers in the hydrologic cycle and of the contribution of glacier melt to streamflow. The project was started in 1965 and is continuing in the future as an index of glacier activity, and to provide a base for detailed studies on glacier processes.

Recent reports:

Power, J.M., Merry, C.J., Trivett, N.B.A., and Waterman, S.E. (1980). Snowpack estimation in the St. John River basin. In: Fourteenth International Symposium on Remote Sensing of Environment, San José.

Young, G.J., 1980. The impact of floods from glacier-dammed lakes, Yukon, Canada. Materialy Glyatsiologicheskikh Issledovaniy. Khronika. Obsuzhdeniya, 39, 101-107. Paper presented at the International Symposium on the Computation and Prediction of Runoff from Glaciers and Glacierized areas, Tbilisi, Georgian S.S.R. 3-11, September 1978.

Young, G.J., 1980. Streamflow formation in a glacierized watershed in the Rocky Mountains, Canada. Materialy Glyatsiologicheskikh Issledovaniy. Khronika. Obsuzhdeniya, 39, 55-62. Paper presented at the International Symposium on the Computation and Prediction of Runoff from Glaciers and Glacierized Areas, Tbilisi, Georgian S.S.R. 3-11, September 1978.

Munro, D.S. and Young, G.J., 1980. A net shortwave radiation model for glacierized basins. Proceedings of Eastern Snow Conference.

Young, G.J., 1980. Monitoring Glacier Outburst Floods. Nordic Hydrology, Vol. II, No. 5, 285-300.

Nakawo, M. and Young, G.J., 1981. Field Experiments to Determine the Effect of a Debris Layer on Ablation of Glacier Ice. Annals of Glaciology, 2, p. 85-91.

Young, G.J., 1981. The Mass Balance of Peyto Glacier, Alberta, Canada, 1965-1978. Arctic and Alpine Research, Vol. 13, No. 3, p. 307-318.

Young, G.J., 1981. Glacier contribution to streamflow in the Himalayan Region. Report submitted to the International Development Research Centre, Ottawa in fulfillment of a Professional Development Award. 40 p.

Collins, D.N. and Young, G.J., 1981. Meltwater hydrology and hydro-chemistry in snow - and ice - covered mountain catchments. Nordic Hydrology, 12, pp. 319-334.

Stenning, A.J., Banfield, C.E. and Young, G.J., 1981. Synoptic controls over katabatic layer characteristics above a melting glacier. Journal of Climatology, Vol. 1, pp. 309-324.

Nakawo, M. and Young, G.J., 1982. Estimate of Glacier Ablation under a Debris Layer from Surface Temperature and Meteorological Variables. Journal of Glaciology, Vol. 28, No. 98, pp. 29-34.

Munro, D.S. and Young, G.J., 1982. An Operational Net Shortwave Radiation Model for Glacier Basins. Water Resources Research, Vol. 18, No. 2, pp. 220-230.

Young, G.J. (ed.), 1982. Bibliography on the Hydrology of Glacierized Areas. In "Glacial Hydrology", Report GD-12, Glaciological Data, pp. 1-118. World Data Center A for Glaciology, March 1982.

Young, G.J., 1982. Hydrological Relationships in a Glacierized Mountain Basin. Proc. of Symposium on Hydrological Aspects of Alpine and High Mountain Areas. IAHS Publ. No. 138, p. 51-59.

#### 4. LAKE AND RIVER ICE

- 83-14 ICE DETERIORATION -- Dr. George D. Ashton, USA Cold Regions Research and Engineering Laboratory, Hanover, NH.

Objectives: Analysis of the deterioration process of ice covers in spring; First-generation model completed; field experiments planned for March-April 1983.

Recent reports: Manuscripts under preparation.

- 83-15 ICE MECHANICS -- Bernard Michel, Dept. of Civil Engineering, Laval University, Ste-Foy, Québec, Canada.

Objectives: Engineering of cold regions, ice and snow, Arctic ice and St. Lawrence.

Recent reports:

"Ice Mechanics" Les Presses de l'Université Laval, C.P. 2447, Ste-Foy, Québec, Canada G1K 7P4.

- 83-16 ICE THICKNESS, BREAK-UP AND FREEZE-UP DATA FOR SELECTED ONTARIO STREAMS -- L.J. Kamp-Chief; P.J. McCurry - A/Data Control Eng., Environment Canada, Water Resources Branch, Ontario Region, Guelph, Ontario.

Objectives: To compile and publish data on ice thickness and freeze up/break up dates for selected rivers. Presently all research is complete, tables done, ice thickness vs time plots done. All that remains is to put information into publishable format. Projected timetable is fall 1983 for issuing publication.

Recent reports: To be issued in fall 1983.

- 83-17 HYDRAULIC EFFECT OF THE ST. LAWRENCE RIVER ICE COVER -- Hung Tao Shen, Clarkson College of Technology, Department of Civil and Environmental Engineering, Clarkson college, Potsdam, N.Y.

Objectives: A hydraulic transient computer model is developed for simulating the flow and ice conditions in the upper St. Lawrence River during winter time.

Recent reports:

Shen, H.T., VanDeValk, W.A., Batson, G.B., and Maytin, I.L., "Field Investigation of a Hanging Dam in the St. Lawrence River," Report No. DTSL55-82-C-C0198A, U.S. Department of Transportation, Washington, D.C., Aug. 1982.

Shen, H.T., and Yapa, P.N.D.D., "Simulation of Undersurface Roughness Coefficient of River Ice Cover", Technical Report No. 82-6, Department of Civil and Environmental Engineering, Clarkson College of Technology, July 1982.

Shen, H.T., et al., "Winter Flow, Ice, and Weather Conditions of the Upper St. Lawrence River, 1971-81, Vols. I-IV, "Technical Report 82-1 to 82-5, Department of Civil and Environmental Engineering, Clarkson College of Technology, July 1982.

5. HYDRAULICS AND SNOW LOADS

- 83-18 SNOW LOADS FOR THE DESIGN OF NUCLEAR POWER PLANT STRUCTURES -- B. Ellingwood, J.R. Harris, National Bureau of Standards, Center for Building Technology, National Bureau of Standards, Washington, D.C.

Objectives: To gather data for characterization of snow loads on roofs of nuclear power plant structures and develop recommendations for design of such structures under both operating basis and extreme environmental loads. Project completed and report published.

Recent reports:

Snow Loads For the Design of Nuclear Power Plant Structures, NUREG/CR-2638, Nuclear Regulatory Commission, April 1982, (obtain from Division of Health, Siting and Waste Management, Office of Nuclear Regulatory Research, NRC, Washington, D.C. 20555).

- 83-19 WIND, EARTHQUAKE, SNOW, AND HAIL LOADS ON SOLAR COLLECTORS, J.R. Harris, National Bureau of Standards, Center for Building Technology, National Bureau of Standards, Washington, D.C. 20234.

Objectives: Take results of prior studies of snow loads on flat plate solar collectors and develop information, guidelines, and criteria for design of flat plate collectors and systems.

Recent reports:

Wind, Earthquake, Snow, and Hail Loads on Solar Collectors, By L. Cattaneo, J.R. Harris, T.A. Reinhold, E. Simiu, and C.W.C. Yancey, NBSIR 81-2199, National Bureau of Standards, Washington, D.C. 20234.

- 83-20 STRUCTURAL ENGINEERING ASPECTS OF SNOW LOADS ON STRUCTURES --  
Prof. Michael J. O'Rourke, Rensselaer Polytechnic Institute, Dept.  
of Civil Engr., R.P.I., Troy, N.Y.

Objectives: The object of this effort is to develop design relations for both uniform snow loads as well as drifting snow loads on buildings. The live load combination of snow and earthquakes is also being investigated.

Recent reports:

Uniform Snow Loads on Structures, by O'Rourke, Redfield, Van Bradsky, J. Struct. Div., ASCE, Dec. 1982, p. 2781-2798.

Analysis of Roof Snow Load Case Studies by O'Rourke, Koch, Redfield, U.S. Army Cold Regions Research & Engineering Lab Dept., 1983, p. 42.

Snow Loads on Long Span Roofs by O'Rourke, Michon, Proc. Sym. on Long Span Roof Structures, ASCE, Oct. 1981, p. 49-61.

Roof Snow Loads for Structure Design by O'Rourke, Stiefel, accepted for publication J. Struct. Engr. ASCE.

- 83-21 SNOW LOADS ON ONE AND TWO-LEVEL FLAT ROOFS IN CANADA -- D.A. Taylor  
Division of Building Research, National Research Council of Canada,  
Ottawa, Ontario.

Objectives: To study the density, depth and snow loads on multi-level flat roofs to improve the requirements in the National Building Code of Canada. Progress - field measurements completed.

Recent reports:

None yet. One paper on densities and one on loads in preparation for submission to the Canadian Journal of Civil Engineering.

- 83-22 RE-ANALYSIS OF THE 30 YEAR RETURN GROUND SNOW LOADS -- D.A. Taylor,  
National Research Council of Canada, Ottawa, Ontario and M. Newark,  
Atmospheric Environment Service, Downsview, Ontario.

Objectives: To greatly expand the number of stations for which the 30 year ground snow loads are given; to base these loads on the measured depths and (for the first time) measured densities and corresponding winter rainfalls; to report the weight of winter rain as a separate item. Progress - work just starting.

Recent reports: None.

- 83-23 SNOW DEPTHS AND DENSITIES ON ROOFS IN BRITISH COLUMBIA AND THE NORTH  
-- D.A. Taylor, Division of Building Research, National Research  
Council of Canada, Ottawa, Ontario.

Objectives: To obtain better design snow loads for locations in the mountains and valleys of British Columbia and in the Yukon and Northwest Territories. Progress - third winter of observations just completed.

Recent reports: None

- 83-24 SNOW LOADS AT SOLAR COLLECTORS ON FLAT ROOFS -- D.A. Taylor, National Research Council of Canada, Division of Building Research, Ottawa, Ontario and D. Nixon, Public Works Canada, Ottawa, Ontario.

Objectives: To study the accumulation of snow around solar collectors on flat roofs in order to assist designers with design loads for the roof and the collectors, and with the placement and height of the collectors above roofs to prevent snow from shading them. Progress - two years of observations completed.

Recent reports: Report in progress.

- 83-25 MODEL STUDIES OF SNOW DRIFTING ON ROOFS -- F. da Matha Sant'Anna and D.A. Taylor, Division of Building Research, National Research Council of Canada, Ottawa, Ontario.

Objectives: To determine if adequate simulations of snow drifting on roofs can be obtained in a wind tunnel. Progress - tunnel testing in progress.

Recent reports: One in progress (in French).

- 83-26 SNOW AND ICE LOADS ON SLOPING GABLE AND SHED ROOFS -- D.A. Taylor, Division of Building Research, National Research Council of Canada, Ottawa, Ontario.

Objectives: To study factors affecting the accumulation of snow and ice loads on gable and shed roofs of various slopes and surface roughnesses. Progress - Nine years of pilot study on experimental roofs at NRC completed - observations continue.

Recent reports:

Draft paper prepared for submission to the Canadian Journal of Civil Engineering - "Snow Loads on Sloping Roofs: A Pilot Study", by D.A. Taylor.

- 83-27 SNOW AND ICE LOADS ON SLOPING GABLE AND SHED ROOFS -- D.A. Taylor, Division of Building Research, National Research Council of Canada, Ottawa, Ontario.

Objectives: To study factors affecting the accumulation of snow and ice loads on gable and shed roofs of various slopes and surface roughnesses.

Progress - Nine years of pilot study on experimental roofs at NRC completed - observations continue.

Recent reports:

Draft paper prepared for submission to the Canadian Journal of Civil Engineering - "Snow Loads on Sloping Roofs: A pilot Study", by D.A. Taylor.

## 6. SOIL AND WATER FROST

- 83-28 SNOW AND PERMAFROST HYDROLOGY IN A HIGH ARCTIC ENVIRONMENT -- Mingo Woo, Department of Geography, McMaster University, Hamilton, Ontario.

Objectives: The objectives are: study the hydrological processes related to snow accumulation and melt, the movement of melt-water through cold snowpacks, the effects of snow jams on stream-flow and the hydrology of drainage basins as influenced by snowmelt and the occurrence of permafrost. Most of these objectives have been accomplished and the results are published in the references listed.

Recent reports:

Woo, M.K. and Sauriol, J. 1980. Channel development in snow-filled valleys, Resolute, N.W.T., Canada. Geografiska Annaler, 62A, 37-56.

Woo, M.K. 1980. Hydrology of a small lake in the Canadian High Arctic. Arctic and Alpine Research 12, 227-235.

Marsh, P., Rouse, W.R. and Woo, M.K. 1981. Evaporation at a High Arctic site. Journal of Applied Meteorology 20, 713-716.

Woo, M.K. and Heron, R. 1981. Occurrence of ice layers at the base of High Arctic snowpacks. Arctic and Alpine Research 12, 225-230.

Woo, M.K., Heron, R. and Steer, P. 1981. Catchment hydrology of a High Arctic lake. Cold Regions Science and Technology 5, 29-41.

Woo, M.K. and Sauriol, J. 1981. Effects of snow jams on fluvial activities in the High Arctic. Physical Geography 2, 269-274.

Woo, M.K. 1982. Upward flux of vapor from frozen materials in the High Arctic. Cold Regions Science and Technology 5, 269-274.

Woo, M.K. and Steer, P. 1982. Occurrence of surface flow on Arctic slopes, southwestern Cornwallis Island. Canadian Journal of Earth Sciences 19, 2368-2377.

7. REMOTE SENSING.

83-29 POLAR ICE REMOTE SENSING -- Campbell, William J., U.S. Geological Survey, Water Resources Division, Tacoma, Washington.

Objectives:

1. To numerically model the arctic and antarctic sea-ice covers and ice sheets for a variety of different rheological assumptions.
2. To acquire data to test the numerical models of the arctic and the antarctic ice sheets and ice packs by directly participating in remote-sensing and surface-truth experiments and from remote-sensing polar-orbiting satellites.
3. To investigate the dynamics and thermodynamics of the upper ocean and their relation to the ice thickness, the results to be applied to the sea-ice cover models.
4. To construct multidimensional time-dependent models of glacier flow and ice-sheet flow and to test them with observations of glaciers.

Recent reports:

Ling, C.H., Rasmussen, L.A., and Campbell, W.J., 1980, A continuum sea ice model for a global climate model. Proceedings of the Symposium on Sea Ice Processes and Models, Seattle, September 1977, p. 187-196.

Campbell, W.J., Gloersen, P., Ramseier, R.O., and Zwally, H.J., 1980, Arctic sea ice variations from time-lapse microwave imagery. Boundary Layer Meteorology, v. 18, p. 99-106.

Campbell, W.J., Cheney, R.E., Marsh, J.G., and Mognard, N.M., 1980, Ocean eddy structure by satellite radar altimetry required for iceberg towing. Cold Regions Science and Technology, v. 1, p. 211-221.

Campbell, W.J. (The Polar Group), 1980, Polar Atmosphere-Ice-Ocean Processes: A review of Polar Problems in climate research. Reviews of Geophysics and space Physics v. 18, no. 2, p. 525-543.

Campbell, W.J., Gloersen, P., Zwally, H.J., Ramseier, R.O., and Elachi, C., 1980. Simultaneous passive and active microwave observations of near-shore Beaufort Sea Ice. Journal of Petroleum Technology, v. 21, no. 6, p. 1105-1112.

Campbell, W.J., and Gudmansen, Preben, 1981. The Application of Microwave Sensing for Snow and Ice Research. U.S. Geological Survey Open-File Report 81-547.

Campbell, W.J., Ramseier, R.O., Zwally, H.J., and Gloersen, P., 1981. Structure and Variability of Bering and Okhotsk Sea-Ice Cover by Satellite Microwave Imagery in Energy Resources of the Pacific Region, Studies in Geology, No. 12, p. 343-354.

Josberger, Edward G., and Martin, Seelye, 1981. A Laboratory and Theoretical Study of the Boundary Layer Adjacent to a Vertical Melting Ice Wall in Saltwater. Journal of Fluid Mechanics, v. 111, pp. 439-473.

Mognard, Nelly M., Campbell, W.J., Cheney, B.E., Marsh, J.G., and Poss, D.B., 1981. Southern Ocean Waves and Winds Derived from Seasat Altimeter Measurements. In IUCR Symposium on Wave Dynamics and Radio Probing. 12 p.

Josberger, Edward G., 1982. One Peculiar Ice-Melt Pattern Explained, Another Peculiar Observed: Journal of Glaciology, v. 28, no. 99, pp. 391-393.

Josberger, Edward G., 1982. The Oceanographic Impact of Melting Icebergs and Marine Ice Shelves. Iceberg Research, No. 1, pp. 4-9.

Mognard, Nelly M., Campbell, William J., Cheney, Robert E., Marsh, James G., Ross, Duncan B., 1982, Iceberg Research, No. 1m. pp. 24-29.

- 83-30 AIRBORNE SNOW WATER EQUIVALENT MEASUREMENTS USING NATURAL TERRESTRIAL GAMMA RADIATION -- Dr. Thomas R. Carroll, Office of Hydrology, National Weather Service, NOAA, National Weather Service, Minneapolis, MN.

Objectives: The National Weather Service maintains an operational Airborne Gamma Radiation Snow Survey Program to make real-time airborne snow water equivalent and soil moisture measurements over the upper Midwest. The ongoing research is related to assessing the capabilities and limitations of the airborne technique to make airborne snow water equivalent and soil moisture measurements.

Recent reports:

A number of recent publications are available from the above address which describe the current status and capability of the airborne technique used to make snow water equivalent measurements with natural terrestrial gamma radiation.

- 83-31 PRAIRIE SNOW COVER RUNOFF STUDY: Multi-Stage Remote Sensing Snow Cover Experiment -- B.E. Goodison, AES, T. Carroll, U.S. National Weather Service; J. Glynn, NHRI; A. Banga, Saskatchewan Environment; R.A. Halliday, WRB; E. Langham, EMR.

Objectives:

Over ten Canadian and United States agencies are cooperating in a study to develop the capability of mapping areal snow cover (areal extent, depth, water equivalent) over the Canadian Prairies. In February 1982 a major airborne/ground snow survey experiment was conducted over Southern Saskatchewan. Gamma airborne surveys (using Canadian and American aircraft), NASA airborne passive microwave transects and coincident ground surveys were conducted. NOAA satellite and Nimbus 7 passive microwave data were collected. The data are being analyzed and compared.

- 83-32 SYNTHETIC APERTURE RADAR FOR THE DISCRIMINATION OF SNOW COVER PROPERTIES -- B.E. Goodison, Coordinator for RADARSAT Snow Study Team, Atmospheric Environment Service, Downsview, Ontario.

Objectives:

An experiment was planned for 1981-82 to assess the feasibility of using C and X band SAR data for the determination of snow depth, state of the ground and snowmelt and to determine the effect of land cover, terrain roughness and diurnal and seasonal variations on measurement capabilities. Only limited data were obtained. Future work through the Radarsat Program is planned.

Recent reports:

Goodison, B.E., S.E. Waterman, E.J. Langham, 1980: Application of Synthetic Aperture Radar Data to Snow cover Monitoring. Proc., Sixth Canadian Symposium on Remote Sensing, May 21-23, 1980, Halifax, N.S., p. 263-271.

Goodison, B.E. and S.E. Waterman, 1980: SAR Snow Experiment: Summary of Preliminary Results and Recommendations. Report presented at SURSAT Project Final Meeting, Ottawa, January 22-24, 1980, 5 pp.

83-33 ANALYSIS OF MICROWAVE RESPONSE TO SNOW -- Dr. Dorothy K. Hall,  
Hydrological Sciences Branch Code 924, NASA/GSFC, Greenbelt, MD.

Objectives: We are currently working on the microwave response  
of snowpacks beneath vegetation using SMMR satellite data.

Recent reports:

Measurement and Modeling of Microwave Emission from Forested  
Snowfields in Michigan, 1983, D.K. Hall, J.L. Foster and A.T.C.  
Chang, NORDIC HYDROLOGY, v. 13, pp. 129-138.

SELECTED BIBLIOGRAPHY - 1983

A very large number of references were submitted to the Research Committee.  
Unfortunately, the listing is too long for us to publish. Instead the Committee has  
submitted the list to the World Data Center - A for Glaciology for incorporation into  
their records. Further information on the snow and ice bibliographic material may be  
obtained from:

World Data Center - A: Glaciology  
Cooperative Institute for Research in  
Environmental Sciences  
University of Colorado  
Boulder, Colorado  
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