

Report of the
EASTERN SNOW CONFERENCE
RESEARCH COMMITTEE

February 8, 1973

The results of our annual survey of the snow and ice research being conducted by members of the Conference is attached, as is a selected current bibliography you submitted. Both the research summary and bibliography are indexed as they have been in the past as follows:

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

Although this indexing scheme has apparently been satisfactory for a number of years, there have been an increasing number of instances in the last year or so when research projects and titles have not fit in any category. This serves as some indication of the changing interests of our members. We would welcome suggestions for modification of our indexing scheme, and serve notice that some research projects or reports may be classified in categories which may not reflect their primary emphasis. In addition, there are a number of articles from several symposia which were held or whose proceedings became available over the past year. It might be well for you to obtain a complete list of the papers from certain of these meetings if you have not already done so.

This year the first Student Award for Snow Research will be given as part of the program of this meeting.

D. V. Dunlap
R. B. Sykes
A. R. Eschner, Chairman

EASTERN SNOW CONFERENCE RESEARCH COMMITTEE

LIST OF STUDIES IN PROGRESS

1. PROPERTIES OF SNOW AND ICE

- 73-1 STUDY OF SNOW STRATIGRAPHY AND DISTRIBUTION IN THE PETERBOROUGH, ONTARIO AREA-- W. P. Adams; Trent University, Peterborough, Ontario

Objectives: To study the development of snow stratigraphy under various cover types. The objectives include the study of the relationships between snowcover and vegetation and to obtain useful area mean snowfall values.

Recent Reports: SNOW DISTRIBUTION, MELT AND RUN-OFF CHARACTERISTICS OF A SWALE TYPE, S. A. Mathewson (B.S. Honors Thesis, Trent University).

- 73-2 SEASONAL AND REGIONAL VARIATIONS IN SNOW, ICE AND CLIMATE IN COLD REGIONS-- Michael A. Bilello; U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, N.H.

Objectives: The objective is to provide a description of the snow and ice surfaces of the cold regions and establish techniques to predict this aspect of the environment using certain climatic and meteorological inputs. Several papers on ice thickness measurements were published as CRREL reports. Another paper on snowcover properties was presented at a Hydrology Symposium in Banff, and a lecture on Snow Hydrology in Engineering was given at a Corps of Engineering course in Portland, Oregon.

Recent Reports: (1) CRREL Special Report 43, Part VI, "Ice Thickness Observations, North American Arctic and Sub-Arctic 1968-69 and 1969-70."

(2) CRREL Special Report 160, "Air and Water Temperatures and Ice Conditions on the Connecticut River."

(3) Symposium Reprint, "Meso-Scale Measurement of Snowcover Properties." - M. Bilello - Author - Available at CRREL.

(4) CRREL Special Report 171, "Wastewater Management by Disposal on the Land." - M. Bilello - Contributor - Available at CRREL.

- 73-3 THE CLIMATE OF THE MARITIME PROVINCES-- A.D. Gates; Atmospheric Environment Service, Elmsdale, Nova Scotia

Objectives: This general study, on more or less classical outlines, will include new material on monthly and annual snowfall in Nova Scotia, New Brunswick, and Prince Edward

Island, including coefficients of variation, frequencies, probabilities, return period expectations for 24 hour amounts, monthly snow depths, seasonal maxims, computed greatest probable depths, median dates for beginning and end of snowcover season, and circulation effects. Some of this material has already been prepared in draft form for inclusion in a more specialized study on regional climate for tourism and outdoor recreation referred to separately. This general study on the climate of the Maritimes is expected to reach draft stage (for eventual publication) in the spring of 1973.

Recent Reports: See details under separate return for draft of "The Climate of the Maritime Provinces as it Affects Tourism and Outdoor Recreation."

- 73-4 THE CLIMATE OF THE MARITIME PROVINCES AS IT AFFECTS TOURISM AND OUTDOOR RECREATION-- A. D. Gates; Atmospheric Environment Service, Elmsdale, Nova Scotia

Objectives: This general study includes considerable new material on annual snowfall in Nova Scotia, New Brunswick, and Prince Edward Island, its variation, snowfall frequencies and probabilities, monthly snowcover charts, estimates of the beginning and end of the snowcover season, maximum annual snow depths, computed greatest probable snow depths. Much of this material may also be included in a more general "Climate of the Maritime Provinces," which is also under preparation. The present study has been submitted in draft form to AES headquarters in Toronto, where it is being examined with a view to publication.

Recent Reports: Copies of the draft (131 pages of text, 71 maps and diagrams are on file with G. A. McKay, Applications and Consultation Division, Central Services Directorate, Atmospheric Environment Service, Department of Environment, 4905 Dufferin St., Downsview, Ontario M3H 5T4

- 73-5 DEFORMATION OF ICE-- L. W. Gold; National Research Council Canada, Ottawa Ontario K1A 0R6.

Objectives: To establish the dependence of the deformation of ice on stress, temperature and time in conjunction with the studies of deformation behavior.

Recent Reports: Laboratory studies of deformation behavior of ice are continuing.

- 73-6 SNOWFALL CHARACTERISTICS-- James E. Juisto; Atmospheric Sciences Research Center of SUNY, Albany, N. Y.

Objectives: To study snowfall characteristics by the examination of an optical-attenuation method for measuring snowfall rate and accumulation and by photographic measure-

ment of snow crystal concentrations in the air (at ground level). The instruments required for the project will be used during the 1972-73 winter season.

Recent Reports: Kaplan, M. L., 1972: A MACROSCALE- MESO-SCALE NUMERICAL MODEL AND LAKE-EFFECT SNOWSTORMS. Ph.D. Thesis, Dept. of Atmospheric Science, State Univ. at Albany.

- 73-7 THE MAPPING OF SNOWFALL AND SNOWCOVER IN NORTH AMERICA-- G. A. McKay and H. A. Thompson; D.O.E./A.E.S., Downsview, Ontario.

Objectives: To improve data and topographical relationships by the use of zonation and height-dependency curves to improve the quality of maps, water and energy balance techniques, and computer mapping procedures.

Recent Reports: Presented at the International Symposia on the Role of Snow and Ice in Hydrology... Banff, September 1972.

The study will be published in the proceedings.

- 73-8 THE LINKING OF THE ATMOSPHERE'S MULTISCALED ENERGY SOURCES-- Dr. Douglas Pain; Division of Atmospheric Sciences, Cornell University, Ithaca, N. Y.

Objectives: Gravity wave phenomena provide a primary link between cumulus-scale energy sources and those atmospheric features characterized by medium and large-scale wavelengths. Using the Great Lakes as our laboratory, we have been able to diagnose and predict this coupling of energy sources that creates the severe snowsqualls most prominent during the early winter season.

Recent Reports: Reports have presently been submitted to ESC.

- 73-9 ICE CRYSTAL MULTIPLICATION IN CONVECTIVE ELEMENTS OF WINTER OROGRAPHIC STORMS-- Larry Vardiman; Colorado State Univ., Fort Collins, Colo.

Objectives: Observations of the ratio of ice nuclei₃ to ice crystals indicate multiplication ratios exceeding 10^3 at 15°C , reducing to unity near -30°C . Examination of crystals supports the notion of fracturing of dendrites that grow preferentially near -15°C .

Recent Reports: Atmospheric Science Paper No. 191, Dept. of Atmospheric Sciences, Colorado State Univ., Ft. Collins.

2. PRECIPITATION AND ACCUMULATION

- 73-10 THE EFFECT OF FORESTS ON SNOW ACCUMULATION AND MELT IN VARIOUS ELEVATION ZONES OF THE HESSIAN LOW MOUNTAINS--

H. M. Brechtel and A. R. Eschner; Hess Forst. Versuchsanstalt, D-351 Hann. Munden, W. Germany and SUNY College of Forestry, Syracuse, N. Y.

Objectives: To quantify the effect on snow accumulation and dissipation of aspect, elevation and vegetation in the low mountains of Hessen. 600+ snow survey lines have been established on north and south facing slopes, at 100 m. elevation intervals, under beech and spruce and on open land. Measurements started in the winter of 1971-1972, but results have been essentially negative because of the dearth of snow. Measurements are being made in the winter of 1972-73.

Recent Reports: Eschner, A. R., 1973. ESTABLISHING A SNOW SURVEY IN THE STATE OF HESSEN, W. GERMANY. Proc. ESC.

- 73-11 ESTIMATION OF SNOWFALL AMOUNTS IN AN ONSHORE FLOW IN NOVA SCOTIA-- B.D. Greer; Atmospheric Environment Service, Downsview, Ontario.

Objectives: Forecasting mean and maximum amounts of snow generated in Nova Scotia by the passage of cold air over the Bay of Fundy and the Gulf of St. Lawrence. This is an objective technique using eigen vectors and multiple linear regression. The technique is now undergoing tests in Atlantic Weather Central in Halifax, Nova Scotia.

Recent Reports: To date, no reports have been submitted to ESC.

- 73-12 DEVELOPMENT OF TIME-SPACE MODELS OF SNOW ACCUMULATION, MELT AND WATER INPUT OVER NEW ENGLAND-- Robert L. Hendrick; New England Watershed Research Center, S. Burlington, Vt.

Objectives: Elevation and thermal latitude models are now being tested. It appears that snow water content at any mountain elevation can be predicted with about + 10% accuracy for ordinary temperature and precipitation data at valley stations.

Recent Reports: To date, no reports have been submitted to ESC.

- 73-13 GROUND TRUTH PRECIPITATION STUDIES-- Lee W. Larson and Eugene Peck; Office of Hydrology, Hydrologic Research Lab, Silver Spring, Md.

Objectives: The general objective is to improve precipitation measurements, especially for solid precipitations, by various analytical and physical techniques.

Recent Reports: (1) Larson, L.W., 1971. AN APPLICATION OF THE DUAL-GAGE APPROACH FOR CALCULATING "TRUE" SOLID PRECIPITATION. 53rd Annual Meeting, American Geophysical Union, Washington, D. C., April, 1972.

(2) Rechar, Paul A., 1971. ARE EXISTING MEASUREMENTS OF PRECIPITATION INPUT TO WATERSHEDS ADEQUATE FOR MANAGEMENT DECISIONS?, AWRA Symposium, Watersheds in Transition, CSU, Ft. Collins, Colo., June, 1972.

- 73-14 AIR BORNE GAMMA-RAY SNOW SURVEY-- Dr. H. S. Loijens; Dept. of the Environment, Ottawa, Canada, K2A OE7.

Objectives: To measure the 1972-1973 snowfall in Southern Ontario by the airborne natural gamma method. Ontario Hydro is one of the participating organizations in providing ground truth in the form of conventional snow surveys and soil moisture content.

Recent Reports: To date, no reports have been submitted to ESC.

- 73-15 PROJET VERGLAS (PROJECT ICING)-- Bernard A. Power; Weather Engineering Corporation of Canada, Ltd., Dorval 780 Que.

Objectives: To clarify the fundamental processes of ice and snow accretion on overhead electric power transmission and distribution lines, the vertical profile in the boundary layer of cloud-liquid water content, typical values of liquid water and drop sizes in supercooled stratus and strato-cumulus in Quebec province and to verify the fundamental accretion equations against actual observations of glaze and rime ice.

Recent Reports: Rapport Final, PROJET VERGLAS, Saison: octobre 1970-avril 1971, Prepare pour l'Hydro-Quebec. Genie Meteo Cie, Montreal, mai, 1971. (in French only).

- 73-16 FORECASTING TYPE OF PRECIPITATION-- Stanley Wasserman; National Weather Service, Garden City, N. Y.

Objectives: A continuation of the study reported in NOAA Technical Memorandum NWSEP-45. This study is being repeated and refined based on the availability of additional data.

Recent Reports: A report has been submitted to ESC.

3. SNOWPACK MEASUREMENT

- 73-17 MONITORING OF SNOW WATER EQUIVALENT BY RADIOLOGICAL SYSTEMS-- Vern C. Bissell and Eugene L. Peck; National Weather Service, Silver Springs, Md.

Objectives: The objective is to develop techniques for the remote measurement of the water equivalent of the snowcover. Three years of research have resulted in the development of techniques which are considered of suitable for operational use. The techniques are being used to measure the water equivalent of the snowcover for the Lake Ontario IFYGL

program. A portable gamma ray detector has been tested for measurement by a ground based unit.

Recent Reports: (1) Bissell, V. C. & Peck, E. L., 1972. UNMANNED MEASUREMENT OF SNOW WATER EQUIVALENT USING NATURAL SOIL RADIOACTIVITY, Presented at the 53rd Annual AGU Meeting (submitted for publication in WRR).

(2) Burson, Z. G. & Fritzsche, A. E., 1972. AERIAL SNOW GAGING USING NATURAL TERRESTRIAL GAMMA RADIATION, EEG 1183-1557, August.

- 73-18 CHEMISTRY OF THE SNOWPACK AT HUBBARD BROOK EXPERIMENTAL FOREST-- James Hornbeck & Gene Likens; USFS & Cornell Univ. 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: To date, no reports have been submitted to ESC.

- 73-19 METAMORPHOSIS OF THE SNOWPACK and FLOW OF WATER IN THE SNOWPACK-- E. J. Langham; INRS/EAU, Univ. of Quebec, Canada.

Objectives: To study the metamorphosis of the snowpack and to study the flow of water in the snowpack.

Recent Reports: Langham, E. J. 1972. UN MODELE DE LA NEIGE RELIE A SA MESO-STRUCTURE. (submitted to the Bulletin of IAHS.)

- 73-20 CONTINUING PROGRAM OF SNOWCOVER INVESTIGATION IN TWO IHD REPRESENTATIVE DRAINAGE BASINS-- L. A. Logan; Ministry of the Environment, Toronto 195, Ontario.

Objectives: To determine reliable estimates of basin-wide snowpack conditions (measured indices--depth, water equivalent, core length, density, albedo, etc.) for use in evaluating snowpack storage and yield, time delays to snowmelt runoff, and for general snowmelt hydrograph synthesis. To study continuing statistical evaluation of snow survey data from two sampling networks, relative to sampling accuracy, areal distribution of snowpack conditions. To study the development of empirical relationships between snowpack density and depth and certain meteorological parameters for use in estimating basin-wide water equivalents.

Recent Reports: Logan, L. A., 1972. BASIN-WIDE WATER EQUIVALENT ESTIMATION FROM SNOWPACK DEPTH MEASUREMENTS. UNESCO/WMO/IAHS, Presented at the International Symposia on the Role of Snow & Ice in Hydrology, Banff, Alberta, Canada.

(2) Logan, L. A., 1973. SNOW SURVEY REPORT -- WILMOT CREEK BASIN: 1968-69 TO 1971-72 SNOW SEASON. (In preparation)

(3) Logan, L. A., 1973. SNOW SURVEY REPORT -- EAST & MIDDLE JAKVILLE CREEKS BASIN: 1969-70 TO 1971-72 SNOW SEASON. (In preparation)

4. SNOWMELT

- 73-21 COOPERATIVE SNOW HYDROLOGY PROJECT -- Eric Anderson & Ron Whipkey; National Weather Service & ARS New England Watershed Research Center, Silver Springs, Md. & S. Burlington, Vt.

Objectives: To better understand the physical processes involved in the metamorphosis and melting of a snowpack. The Project began in 1966. Data collection continues. Analysis is underway on the four years of continuous data so far collected (1969-1972).

Recent Reports: To date, no reports have been submitted to ESC.

- 73-22 NASHWAAK EXPERIMENTAL WATERSHED PROJECT -- WATERSHED PRECIPITATION SURVEY-- R. B. B. Dickison; Univ. of New Brunswick, Fredericton, Canada.

Objectives: The objectives of the overall project include determination of the effects of large scale clear-cutting and forest species regroup of experimental watersheds located in the headwaters of the Nashwaak River. Evaluation of the effects may be based on comparative streamflow measurements from "paired" --one treatment versus one control --watersheds. The basic climatological network established in 1971 consists of two main stations where several parameters are being measured, and 10 satellite locations where storage precipitation gages are used. An intensive study of snowpack variation is planned for the winter of 1972-73. Removal of the first cover is anticipated for about 1975, after which snowcover-topograph relationship will again be surveyed.

Recent Reports: To date, no reports have been submitted to ESC.

- 73-23 SNOW HYDROLOGY--SOIL MOISTURE-- W. N. Embree; U.S. Geological Survey, Albany, N. Y.

Objectives: To obtain an estimate of changes in quantity of water stored in the unsaturated zone, and to better define the contribution of snowmelt to soil moisture through the use of neutron-scattering soil-moisture equipment.

Recent Reports: Monthly soil-moisture logs at 11 sites in the Black River Basin are being analyzed to determine

monthly changes. Work is progressing on (1) working this data into a hydrologic budget, for the Black River Basin, and (2) extending these data to other areas in the Lake Ontario Basin.

- 73-24 ANNUAL SPRING SNOW SURVEY AND SPRING FLOOD FORECAST 1972--
W. R. Haynes; Newfoundland & Labrador Power Comm., Bishop's Falls, Nfld.

Objectives: Forecasting the spring run-off for the months of April, May and June in the five watersheds of Central Newfoundland for the operation of the Commission's Hydro Plants. This is only the second year of the annual survey. Error was reduced from 25% to 10%

Recent Reports: To date, no reports have been submitted to ESC.

- 73-25 LYSIMETER SNOWMELT ON FORESTED AND CLEARED WATERSHEDS--
James Hornbeck & C. Wayne Martin; U.S.F.S., Durham, N.H.

Objectives: Four Haupt lysimeters are being used to measure snowmelt on cleared and hardwood forested watersheds on the Hubbard Brook Experimental Forest.

Recent Reports: Hornbeck, J. W. & Martin, C. W., 1972. LYSIMETER SNOWMELT AND STREAMFLOW ON FORESTED AND CLEARED SITES. Presented at the ESC Proc. 1972:111-118.

- 73-26 SNOWMELT RUNOFF FROM FORESTED WATERSHEDS IN NEW ENGLAND--
R.S. Pierce; U.S.F.S., Durham, N. H.

Objectives: Small gaged watersheds are being used to study the effects of aspect and forest practices on snowmelt run-off. Experimental treatments include a complete forest clearing and a strip cutting. Snow course data are being collected to supplement stream flow records.

Recent Reports: Hornbeck, J.W., Federer, C.A. & Pierce, R.S., 1972. SNOW MANAGEMENT SEEMS UNLIKELY IN THE NORTHEAST. National Sym. on Watersheds in Transition, Am Water Res. Assoc. Proc Series No. 14, p.212- 219.

- 73-27 SNOW MELTING SYSTEMS-- G.P. Williams; National Research Council, Ottawa, Ontario

Objectives: To establish design criteria for embedded snow melting systems.

Recent Reports: To date, no reports have been submitted to ESC.

- 73-28 DETERMINATION OF MONTHLY WATER LOSS FROM MESO-SCALE AND MACRO-SCALE WATERSHEDS-- D.C. Woodman; Penn. State Univ. University Park, P.A.

Objectives: The objective of the study was to determine a method for estimating water loss, using commonly measured or known parameters, from large scale watersheds. An exact energy balance expression was examined for the nature of functional dependencies. On this basis parameters were successfully combined to yield a new expression for monthly water loss.

Recent Reports: To date, no reports have been submitted to ESC.

5. STREAMFLOW

- 73-29 MEASUREMENTS OF SUBDRAIN FLOWS-- R.S. Broughton; McGill University, Canada

Objectives: To measure subdrain outflow to determine peak drainage rates and annual outflow volumes for two soil sheds. An attempt will be made to determine the proportion of snowmelt which passes through the soil to subdrain flow on flatland soils. Samples of outflow water are taken to measure nitrogen leached through the soil profile.

Recent Reports: To date, no reports have been submitted to ESC.

6. LAKE AND RIVER ICE

- 73-30 MEASUREMENT OF ICE FORCES AGAINST A LIGHT PIER-- C.H. Atkinson; Acres Consulting Services, Ottawa, Ontario.

Objectives: The objective of the investigation is to collect a statistical sample of ice forces exerted against a single light pier located in Lake St. Peter. Instrumentation is now being installed and measurements are scheduled in the coming winter, 1972-73.

Recent Reports: Atkinson, C.H., 1971. MEASUREMENT OF ICE FORCES AGAINST A LIGHT PIER. Presented at the Conference on Port and Ocean Engineering under Arctic Conditions, Technical University of Norway, August, 1971.

- 73-31 STUDY OF NIAGARA RIVER ICE-- J.B. Bryce; Ontario Hydro, Ontario Canada.

Objectives: A ten-year program to study the formation, movement, and dissipation of ice in the Niagara River between Ft. Eric and Grass Island Pool. Grass Island Pool is formed by the Niagara River Control Structure, which is located immediately above the Canadian Falls. This project has been previously reported. Field work is considered to be completed. In 1973, a final report should be completed.

Recent Reports: A report has been sent to ESC.

73-32 FRICTION COEFFICIENT OF RIVER ICE COVER-- G. Tsang; Canada Center for Inland Waters, Burlington, Ontario, Canada.

Objectives: To relate winter flow resistance to summer flow characteristics. The Grand River has been chosen as the research river. About a dozen sites have been chosen and a field program is underway.

Recent Reports: Tsang, G. & Szues, L., 1972. FIELD EXPERIMENTS OF WINTER FLOW IN NATURAL RIVERS. Proc., International Symposium on the role of Snow and Ice in Hydrology.

7. HIGHWAYS AND BUILDINGS

73-33 SURVEY OF ICING LOADS ON STRUCTURES-- D.W. Boyd; National Research Council, Ottawa, Ontario.

Objectives: Surveying of icing occurrences to obtain information needed for design icing loads.

Recent Reports: To date, no reports have been submitted to ESC.

73-34 UPLIFT FORCES ON PILES AND FOUNDATIONS-- R.M.W. Frederking; National Research Council, Ottawa, Ontario.

Objectives: To study uplift forces on piles and foundations. Equipment has been completed for preliminary tests.

Recent Reports: To date, no reports have been submitted to ESC.

73-35 AVALANCHE INVESTIGATIONS-- P.A. Schaerer; National Research Council, Ottawa, Ontario.

Objectives: Observations on avalanche pressures are continuing at Rogers Pass, British Columbia.

Recent Reports: To date, no reports have been submitted to ESC.