

GB
652
.P76
1986

PROCEEDINGS

of the

Symposium: Cold Regions Hydrology

UNIVERSITY OF ALASKA-FAIRBANKS, FAIRBANKS, ALASKA

Edited by

DOUGLAS L. KANE

Water Research Center

Institute of Northern Engineering

University of Alaska-Fairbanks

Fairbanks, Alaska



ARLIS
Alaska Resources
Library & Information Services
Anchorage Alaska

3 3755 000 53999 9

Co-Sponsored by

UNIVERSITY OF ALASKA-FAIRBANKS
FAIRBANKS, ALASKA

AMERICAN SOCIETY OF CIVIL ENGINEERS
TECHNICAL COUNCIL ON COLD REGIONS ENGINEERING

NATIONAL SCIENCE FOUNDATION

STATE OF ALASKA, ALASKA POWER AUTHORITY

STATE OF ALASKA, DEPARTMENT OF NATURAL RESOURCES

U.S. ARMY, COLD REGIONS RESEARCH
AND ENGINEERING LABORATORY

Host Section

ALASKA SECTION OF THE AMERICAN WATER RESOURCES ASSOCIATION

The American Water Resources Association wishes to express appreciation to the U.S. Army, Cold Regions Research and Engineering Laboratory, the Alaska Department of Natural Resources, and the Alaska Power Authority for their co-sponsorship of the publication of the proceedings.

American Water Resources Association

5410 Grosvenor Lane, Suite 220
Bethesda, Maryland 20814

TABLE OF CONTENTS

RESERVOIR AND LAKE LEVEL PROCESSES

The Susitna Hydroelectric Project Simulation of Reservoir Operation	
— <i>Yaohuang Wu, Joel I. Feinstein, and Eugene J. Gemperline</i>	3
Reservoir Operations Planning in Snowmelt Runoff Regimes Based on Simple Rule Curves	
— <i>B. A. Shafer, P. E. Farnes, K. C. Jones, J. K. Marron, and F. D. Theurer</i>	13
Modelling Water Levels for a Lake in the Mackenzie Delta	
— <i>P. Marsh</i>	23
Short-Wave Heating of Lake Surface Water Under a Candelled Ice Cover	
— <i>J. P. Gosink and J. D. LaPerriere</i>	31
Hydrothermal Modeling of Reservoirs in Cold Regions: Status and Research Needs	
— <i>Donald R. F. Harleman</i>	39

WATER, SNOW AND ICE MANAGEMENT

Watershed Test of a Snow Fence to Increase Streamflow: Preliminary Results	
— <i>Ronald D. Tabler and David L. Sturges</i>	53
Survey of Experience in Operating Hydroelectric Projects in Cold Regions	
— <i>Eugene J. Gemperline, David S. Louie, and H. Wayne Coleman</i>	63
Hydrology and Hydraulic Studies for Licensing of the Susitna Hydroelectric Project	
— <i>Eugene J. Gemperline</i>	73
Ice Jam Flooding — Evolution of New York State's Involvement	
— <i>Russell E. Wege</i>	87
Hydrological and Ecological Processes in a Colorado, Rocky Mountain Wetland: Case Study	
— <i>Edward W. Rovey, Catherine Kraeger-Rovey, and David J. Cooper</i>	93
Seasonal Snow and Aufeis in Alaska's Taiga	
— <i>C. W. Slaughter and C. S. Benson</i>	101

INSTRUMENTATION AND DATA COLLECTION

Water Redistribution in Partially Frozen Soil by Thermal Neutron Radiography	
— <i>Michael A. Clark, Dr. Roger J. Kettle, and Giles D'Souza</i>	113
The Development and Use of "Hot-Wire" and Conductivity Type Ice Measurement Gauges for Determination of Ice Thickness in Arctic Rivers	
— <i>David A. Sherstone, Terry D. Prowse, and Harry Gross</i>	121

Recent Developments in Hydrologic Instrumentation	
— <i>Vito J. Latkovich and James C. Futrell II</i>	131
Problems Encountered and Methods Used in the U.S. Geological Survey for the Collection of Streamflow Data Under Ice Cover	
— <i>Ernest D. Cobb and Bruce Parks</i>	135
Simplified Method of Measuring Stream Slope	
— <i>Jacqueline D. LaPerriere and Donald C. Martin</i>	143

WATER QUALITY

Water Quality-Discharge Relationships in the Yukon River Basin, Canada	
— <i>Paul H. Whitfield and W. G. Whitley</i>	149
The Role of Snowcover on Diurnal Nitrate Concentration Patterns in Streamflow from a Forested Watershed in the Sierra Nevada, Nevada, USA	
— <i>Jonathan J. Rhodes, C. M. Skau, and D. L. Greenlee</i>	157
Reservoir Water Quality Simulation in Cold Regions	
— <i>C. Y. Wei and P. F. Hamblin</i>	167
Trophic Level Responses to Glacial Meltwater Intrusion in Alaskan Lakes	
— <i>J. P. Koenings, R. D. Burkett, Gary B. Kyle, Jim A. Edmundson, and John M. Edmundson</i>	179
Deep-Lying Chlorophyll Maxima at Big Lake: Implications for Trophic State Classification of Alaskan Lakes	
— <i>Paul F. Woods</i>	195
Factors Influencing the Quality of Snow Precipitation and Snow Throughfall at a Sierra Nevada Site	
— <i>Sheri Woo and Neil Berg</i>	201

POSTER SESSION

Primary Production, Chlorophyll, and Nutrients in Horseshoe Lake, Point MacKenzie, Alaska	
— <i>Paul F. Woods and Timothy G. Rowe</i>	213
Water Quality of Abandoned Mine Runoff: A Case Study of Alaskan Sites	
— <i>David B. Pott, Robert E. Lindsay, and Nicholas Pansic</i>	221
Thawing of Ground Frost on a Drained and Undrained Boreal Wetland Site	
— <i>L. E. Swanson and R. L. Rothwell</i>	231
Probability Distributions of Rain on Seasonally Frozen Soils	
— <i>John F. Zuzel</i>	237
Evidence of Groundwater Recharge Through Frozen Soils at Anchorage, Alaska	
— <i>James A. Munter</i>	245
Residential Well Development of a Low Permeability Bedrock Flow System	
— <i>William A. Petrik</i>	253
Hydrologic Monitoring of Subsurface Flow and Groundwater Recharge in a Mountain Watershed	
— <i>Michael E. Campana and Richard L. Boone</i>	263
Discharge Under an Ice Cover	
— <i>Henry S. Santeford and George R. Alger</i>	275

Hydrology of Two Subarctic Watersheds	
— <i>Robert E. Gieck, Jr. and Douglas L. Kane</i>	283
The Water Balance of the Upper Kolyma Basin	
— <i>V. K. Panfilova</i>	293
Water Balance and Runoff Analysis at a Small Watershed During the Snow-Melting Season	
— <i>H. Motoyama, D. Kobayashi, and K. Kojima</i>	297
Estimations of Snowmelting Rate in a Small Experimental Site	
— <i>N. Ishikawa, H. Motoyama, and K. Kojima</i>	305
A Methodology for Estimating Design Peak Flows for Yukon Territory	
— <i>J. Richard Janowicz</i>	313
Effects of Seasonally Frozen Ground in Snowmelt Modeling	
— <i>Knut Sand and Douglas L. Kane</i>	321
Some Aspects of Glacier Hydrology in the Upper Susitna and Maclaren River Basins, Alaska	
— <i>Theodore S. Clarke, Douglas Johnson, and William D. Harrison</i>	329
Regional Distribution of Stream Icings in Alaska	
— <i>K. G. Dean</i>	339
Estimation of Glacier Meltwater Hydrographs	
— <i>David Bjerklie and Robert Carlson</i>	345

PRECIPITATION — SNOW PACK — SOIL PROCESSES

Snow Surface Strength and the Efficiency of Relocation by Wind	
— <i>R. A. Schmidt</i>	355
Water Flow Rates, Porosity, and Permeability in Snowpacks in the Central Sierra Nevada	
— <i>Bruce J. McGurk and Richard C. Kattelmann</i>	359
In Situ Electrical Measurements of Snow Wetness in a Deep Snowpack in the Sierra Nevada Snow Zone of California	
— <i>James A. Bergman</i>	367
Measurements of Snow Layer Water Retention	
— <i>Richard Kattelmann</i>	377
Precipitation Measured by Dual Gages, Wyoming-Shielded Gages, and in a Forest Opening	
— <i>David L. Sturges</i>	387
The Mass Balance of Snow Cover in the Accumulation and Ablation Periods	
— <i>Esko Kuusisto</i>	397

CHANNEL HYDRAULICS AND MORPHOLOGY

Erosion Control for Placer Mining	
— <i>Larry A. Rundquist and N. Elizabeth Bradley</i>	407
Riverbank Erosion Processes of the Yukon River at Galena, Alaska	
— <i>William S. Ashton and Stephen R. Bredthauer</i>	415

SNOWMELT RUNOFF

Modelling Snowmelt Infiltration and Runoff in a Prairie Environment	
— <i>D. M. Gray, R. J. Granger, and P. G. Landine</i>	427
Using Real-Time (SNOTEL) Data in the NWSRFS Model	
— <i>Keith R. Cooley</i>	439
Theoretical Basis and Performance Evaluation of Current Snowmelt-Runoff Simulation Models	
— <i>T. W. Tesche</i>	449
Recent Developments in Snowmelt-Runoff Simulation	
— <i>Sten Bergström</i>	461

GLACIER HYDROLOGY

The Role of Glacierized Basins in Alaskan Hydrology	
— <i>C. Benson, W. Harrison, J. Gosink, S. Bowling, L. Mayo, and D. Trabant</i>	471
Glacier-Climate Research for Planning Hydropower in Greenland	
— <i>Roger J. Braithwaite and Ole B. Olesen</i>	485
A Forecast Procedure for Jokulhlaups on Snow River in Southcentral Alaska	
— <i>David L. Chapman</i>	491
Suspended Sediment Budget of a Glacier-Fed Lake — Eklutna Lake, Alaska	
— <i>Jeffrey H. Coffin and William S. Ashton</i>	501
Annual Runoff Rate from Glaciers in Alaska; A Model Using the Altitude of Glacier Mass Balance Equilibrium	
— <i>Lawrence R. Mayo</i>	509

REMOTE SENSING

Seasonal and Interannual Observations and Modeling of the Snowpack on the Arctic Coastal Plain of Alaska Using Satellite Data	
— <i>Dorothy K. Hall, Alfred T. C. Chang, and James L. Foster</i>	521
Operational Demonstration of Monitoring Snowpack Conditions Utilizing Digital Geostationary Satellite Data on an Interactive Computer System	
— <i>Milan W. Allen and Frederick R. Mosher</i>	531
Applying a Snowmelt-Runoff Model Which Utilizes Landsat Data in Utah's Wasatch Mountains	
— <i>Woodruff Miller</i>	541
Initiation of Spring Snowmelt Over Arctic Lands	
— <i>David A. Robinson</i>	547

RIVER ICE HYDRAULICS

Forecasting the Effects on River Ice Due to the Proposed Susitna Hydroelectric Project	
— <i>Ned W. Paschke and H. W. Coleman</i>	557

A Structure to Control Ice Formation and Ice Jam Flooding on Cazenovia Creek, New York	
— <i>Steven R. Predmore</i>	565
Freezeup Processes Along the Susitna River, Alaska	
— <i>Stephen R. Bredthauer and G. Carl Schoch</i>	573
Growth and Decay of River Ice Covers	
— <i>Hung Tao Shen and A. M. Wasantha Lal</i>	583
Ice Jams in Regulated Rivers in Norway, Experiences and Predictions	
— <i>Randi Pytte Asvall</i>	593
Hydrologic Aspects of Ice Jams	
— <i>Darryl Calkins</i>	603
Author Index	611

A Structure to Control Ice Formation and Ice Jam Flooding on Cazenovia Creek, New York	
— <i>Steven R. Predmore</i>	565
Freezeup Processes Along the Susitna River, Alaska	
— <i>Stephen R. Bredthauer and G. Carl Schoch</i>	573
Growth and Decay of River Ice Covers	
— <i>Hung Tao Shen and A. M. Wasantha Lal</i>	583
Ice Jams in Regulated Rivers in Norway, Experiences and Predictions	
— <i>Randi Pytte Asvall</i>	593
Hydrologic Aspects of Ice Jams	
— <i>Darryl Calkins</i>	603
Author Index	611