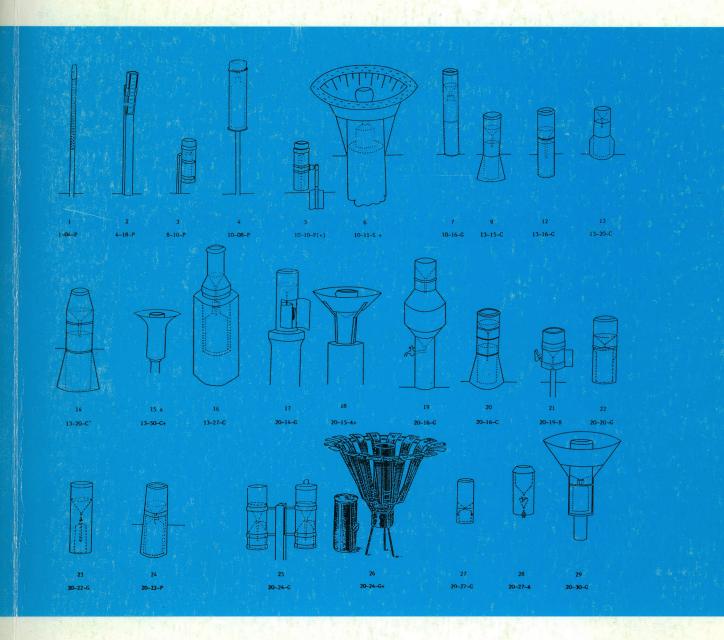
SWISS FEDERAL INSTITUTE OF TECHNOLOGY

ETH Zentrum CH-8092 Zurich Switzerland



B. Sevruk (ed.)

PRECIPITATION MEASUREMENT

WMO/IAHS/ETH Workshop on Precipitation Measurement St. Moritz, 3-7 December 1989

SWISS FEDERAL INSTITUTE OF TECHNOLOGY

ETH Zentrum CH-8092 Zurich Switzerland

266/3337 INSTITUT FUR METEOROLOGIE U. KLIMATOLOGIE

UNIVERSITAT HANNOVER

HERRENHAUSER STR. 2 - 3000 HANNOVER 21

551, 57 551, 508,77

B. Sevruk (ed.)

PRECIPITATION MEASUREMENT

WMO/IAHS/ETH Workshop on Precipitation Measurement St. Moritz, 3-7 December 1989

Table of Contents Prince Additional State of Contents of State of Contents of State of Contents of State of Sta

Reliability of Precipitation Measurement B. Sevruk 13
Part of I mercific die anomytensk intense en of
Results of Precipitation Intercomparison Measurements by Various at the Period 1975-1988 101 Fortguation Gauges on Polygon Branislava - Koliba for Period 1975-1988 101 H. South and O. Petaeka, Concards to 1907 Company Contaction Colleges
ERRORS AND INHOMOGENEITIES
Rainfall Records Affected by Raingauge Installation Heights and its Surrounding Conditions Cheng Zhi-Bing and Tong Yun-Tiao 25
About "Correction Coefficient" for Raingauges C. Cosandey
Automation of Winter Precipitation Measurements in Canada B.E. Goodison and J.R. Metcalfe
The Accuracy of Precipitation Measurement in the Balquhidder Experimental Basins R.C. Johnson 41
An Attempt at Determining the Lower Limit of Solid Precipitation Measurement Errors at Black Summit L. Kristev 45
The Homogenization of the Series of Monthly Totals of Rainfall in Brussels-Uccle (1833-1988) and the Assessment of Climate Change R. Sneyers, M. Vandiepenbeeck, G. Demaree and R. Vanlierde
eritiony of Slovakia
DATA COLLECTION AND CONTROL
Computer Processing of Pluviograms, an Example from Kenya L. Bärring 55
Survey of Data Collection Systems in Operational Hydrology A.F. Flanders
Pluviograph Digitisation: Method, Accuracy and Applications J. Sansom 65
Precipitation Measurement Research and Analysis for Verifying Space Observations of Rain O.W. Thiele

FIELD INTERCOMPARISONS

Test of a Trigonometrical Model of Slope Rainfall in the Small Ringelbach Catchement (High Vosges, France) B. Ambroise and J. Adjizian-Gerard 81
A Study on Observation Errors of Precipitation Measurements at Different Heights by Wind Tunnel Cheng Zhi Bind and Fu Yao Xian
Rain Meteorology: Influence of Sensors on Measurement Capacity F. Cernesson and J. Lavabre
Point Snowfall Measurements with Different Methods R. Lemmelä 97
Results of Precipitation Intercomparison Measurements by Various Precipitation Gauges on Polygon Bratislava - Koliba for Period 1975-1988 M. Lapin and O. Priadka
Winter Precipitation in an Alpine Region: Comparisons Between Storage Gauges and Water Equivalent of Snowcover J. Ries, L.N. Braun and H. Siegenthaler
Precipitation Measurement Errors as a Function of the Degree of Gauge Site Exposure to Wind V. Sokollek, H. Haamann and A. Meuser
Some Precipitation Measurements in a Semi-Arid Area, Central Jordan 117 K. Wirth
WMO INTERCOMPARISONS
Canadian Participation in the WMO Solid Precipitation Measurement Intercomparison: Preliminary Results B.E. Goodison and J.R. Metcalfe
anjamic was to be seen a
Wind Related Errors in Different Methods of Solid Precipitation Measurement
Wind Related Errors in Different Methods of Solid Precipitation Measurement Th. Günther and B. Graf
Wind Related Errors in Different Methods of Solid Precipitation Measurement Th. Günther and B. Graf Results of the Solid Precipitation Measurements Intercomparison on the Territory of Slovakia M. Lapin M. Lapin
Wind Related Errors in Different Methods of Solid Precipitation Measurement Th. Günther and B. Graf Results of the Solid Precipitation Measurements Intercomparison on the Territory of Slovakia 135
Wind Related Errors in Different Methods of Solid Precipitation Measurement Th. Günther and B. Graf Results of the Solid Precipitation Measurements Intercomparison on the Territory of Slovakia M. Lapin Preliminary Results from the WMO Solid Precipitation Measurements Intercomparison 141
Wind Related Errors in Different Methods of Solid Precipitation Measurement Th. Günther and B. Graf Results of the Solid Precipitation Measurements Intercomparison on the Territory of Slovakia M. Lapin Preliminary Results from the WMO Solid Precipitation Measurements Intercomparison H. Madsen and NHP Working Group on Precipitation Preliminary Results of the WMO Field Intercomparison in Yugoslavia 145

District Description District Market Description	
Ralationship Between Rainfall and Hydrologiacal Analysis - Representativeness and Errors O. Bonacci	159
A. D. Sough	
Snowmelt Simulations With- and Without Precipitation Corrections Using NWSRFS Models J. Buchtele	165
Study of Rendall over the Sahah anakanab Time Shana Dense	
Research on Analysis and Correction of Systematic Errors in Precipitation Measurement in Wulumqi River Basin, Tianshan Yand Daqing, Shi Yafeng, Kang Eris and Zhang Yinsheng	173
Correction of Precipitation Measurements for Wind Induced Losses: A Case Study T.V. Gronowski	181
1.V. Gronowski	
Correction of the Annual Precipitation Norm Ek. Koleva and N. Petkova	183
Methodics of Corrections of Systematic Errors of Atmospheric Precipitation Measurements in CSSR M. Lapin and F. Samaj	187
Precipitation Measurement and Corrections in Mountainous Areas L. Molnar and M. Trizna	193
Wind Induced Measurement Error for High-Intensity Rains B. Sevruk	199
INSTRUMENTS AND NEW MEASUREMENT TECHNIQUES	
A Recently Developed Rainfall Recorder J. Gayer, L. Pálos and T. Környei	207
Introducing "Electronic Impact Sizing" as a New, Cost-Effective Technique for the On-Line Evaluation of Precipitation V. Genrich	211
10 Years of Snow Depth Measurement D. Lecorps and M. Sudul	217
Heavy Rain Characteristics and Ground Measurement Comparisons W. Edward Melson Jr.	221
Types of Standard Precipitation Gauges B. Sevruk and S. Klemm	227
The water of TT	
Part II	
Areal Precipitation	
Special control is mentioned of the temperature of the state of the st	
AREAL PRECIPITATION AND REPRESENTATIVENESS	

237

Precipitation Field and Area-Averaged Precipitation Amounts T. Faragó and M. Vértessy

Relating Point Rainfall and Area Average Rainfall over the Sahel I.D. Flitcroft, G. Dugdale and J.R. Milford	245
EPSAT-Niger: A Pilot Experiment for Rainfall Estimation over West Africa	
EPSAT: Study of Rainfall over the Sahel at Small Time Steps Using a Dense Network of Recording Raingauges of the state of	259
Measuring the Accuracy of Areal Precipitation Estimates P.D. Jones	267
Accuracy of Mean Areal Precipitation Estimates Ek. Koleva	271
Basin Precipitation as Residual in Alpine Water Balances M. Kuhn and F. Pellet	
INTERPOLATION AND DISTRIBUTION	
Investigations of the Spatial and Dynamic Precipitation Variability through on- Line Data Acquisition H. Bergmann and T. Zeyringer	281
Spatial Dependence of Daily Rainfall - A Case Study in Tunisia R. Berndtsson	285
Rainfall Distribution and Trend Analysis of Sitanadi Basin in Dakshina Kannada District of the West Coast of India M.R. Gajendragad, C. Naganna, K.N. Lokesh, G. Ranganna, G. Chandrakantha, Ananth Kumar Ars, K. Harshendra and B. Malatesh	293
Comparison Over France of Two Methods of Monthly Rainfalls Assessment O. Le Breton	299
NETWORK OPTIMIZATION	
Taking Topography Into Account for Network Optimization in Mountainous Areas P. Benichou	307
Attempt at a Rationalization of Precipitation Stations Network in an Orographically Complex Terrain of Slovakia B. Gajar	313
Application of Polynominal Surface Fitting Technique and Analysis of Variance for Raingauge Network Design in Kerala (India) E.J. James, K.E. Sreedharan, E.J. John, G. Ranganna and K. Sudheer	317
Design of Rainguage Network for Bharathapuzha and Periyar River Basins (India) Using Gamma Distribution E.J. James and K.E. Sreedharan	325
Rainfall Network Optimization	331

Raingauge Network Design and its Optimization Case Study: Daily Storm of Ankara Basin, Turkey A.U. Sorman	337
The A.U. Sorman control of the Delta	
DESIGN STORM DATA	
Spatial Distribution of Short Duration Precipitation on Norhern Italy V. Anselmo, L. Marchi, P.R. Tecca and V. Villi	347
Application of Point and Areal Estimates of Rainfall for Storm Water Management Studies D. Consuegra and A. Musy	353
Extreme Precipitation Characteristics /// WOYZ IVA WOYZ T. Faragó and I. Wantuch	361
Synthesis of Point Rainfall Data for Urban Runoff Design R. Garcia-Bartual and J. Marco	365
Urban Hydrologists Need Meteorologists! W. Krejci and W. Schilling	371
On the Rainfall Data for Urban Hydrological Applications J. Niemczynowicz	377
Requirements of Precipitation Data for Urbanized Watersheds J. Turcan and J. Turi Nagy	385
RADAR	
Rainfall Modelling Using Radar and Raingauge Observations K. Adamowski and J. Muir	395
Dynamics of Rain Event Morphology from Radar Imagery P. Burlando, R. Rosso, A. Pawlina and C. Capsoni	401
The Infleunce of Signal Quantisation of Radar Precipitation Estimates on Real- Time Flood Forecasting I.D. Cluckie, K.A. Tilford and D. Han	409
Rain Rate Measurement by Two Radars with Different Wave Length Masatoshi Shidawara and Fumio Yoshino	419
Hemispheric and Global Scale Precipitation Measurements and all the many common	
esolution Climatology of Gage-Contention Precipitation	
An Hierarchy of Techniques for Satellite-Improved Monitoring of Rainfall, with Special Reference to the Role of Passive Microwave Satellite Imagery E.C. Barrett	425
Statistical Studies for a Satelite-Based Tropical Rainfall Measuring Mission	
T.L. Bell	431

Daily Catchment Rainfall Estimated From Meteosat G. Dugdale, S. Hardy and J.R. Milford 433
Linear Relationships for Rain Rate Estimation from Space B. Kedem and D.A. Short
Potential Accuracy of Rainfall Estimates From Meteosat for Zimbabwe and Neighbouring Countries A. Makarau 447
Rainbearing Weather Systems and their Movement Monitored by Satellite 455
A.M. Martingly made yell Helmak by estamates land but into the noneuring A.E.C. world Stampgamate Station of the conference of the confere
SNOW AND SNOW COVER (1981) AND
On Problems of Measurements and Indirect Evaluation of Snowpack Water Equivalent in West Carpathians G. Babiaková and E. Simo 461
Snow Monitoring in the United Kingdom Using NOAA AVHRR Satellite Imagery 469
R.M. Lucas, A.R. Harrison and E.C. Barrett
Determination of the Transition Air Temperature from Snow to Rain and Intensity of Precipitation M. Rohrer 475
Different Types of Precipitation in Climatic Zones T.A. Shwer 483
GLOBAL AND REGIONAL PRECIPITATION
The Global Precipitation Climatology Project P.A. Arkin 491
Continental Scale Precipitation Variations in the 20 th Century R.S. Bradley and P.Ya. Groisman
Analysis of Regional Scale Precipitation Fluctuations on Decadal Time Scales H.F. Diaz
Regional, Hemispheric and Global Scale Precipitation Measurements P.D. Jones 513
A High-Resolution Climatology of Gage-Corrected, Global Precipitation 519 D.R. Legates
Precipitation Maps in the "Hydrological Atlas of Switzerland": Historical Survey and Actual Significance R. Weingartner 527

List of Abstracts Abstracts of full papers and posters

Errors and inhomogeneities	532
Data collection and control	533
Field intercomparisons	533
WMO intercomparisons	535
Corrections	536
Instruments and new measurement techniques	538
Areal precipitation and representativeness	539
Interpolation and distribution	540
Network optimization	541
Design storm data	542
Radar	543
Satellite	544
Snow and snow cover	545
Global and regional precipitation	546

Abstracts of "Works in Progress" (to be presented during the Workshop - only Abstracts available)

Late Papers

Precipitation Distribution in an Urbanized Area I. Auer	553
The Global Precipitation Climatology Centre H. E. Fleer, M. Boguslawski, H. Hauschild, U. Schneider	555
Ground Clutter Reduction During Rain Measurements by a Noncoherent Radar System J. J. van Gorp	563
Local Variations of Incident Rainfall as Affected by Topographical Scale, an Empirical Model D. Sharon and A. Margalit	573
Estimates of Wind Speed Statistics for Places without Wind Observations I. Sládek	579
Preliminary Results of Solid Precipitation Measurements	583