

Douglas M. Hultstrand

Senior Hydrometeorologist

dmhultst@metstat.com

720.771.5840

EDUCATION

Ph.D. Candidate Earth Sciences

Colorado State University

Fort Collins, CO

M.S. Watershed Science, Hydrology

August 2006

Colorado State University

Fort Collins, CO

Thesis: "Geostatistical Methods for Estimating Snowmelt Contribution to the Annual Water Balance in an Alpine Watershed"

B.A. Physical Geography (*Hydrology Certificate*)

May 2003

University of Colorado

Boulder, CO

RELATED SKILLS

Physical Science Techniques

- Water Balance
- Discharge Measurements
- Meteorological Measurement & Analysis
- Spatial Modeling
- Water Quality Sampling
- Snow Survey and Sampling Methods
- Data Analysis
- Watershed Modeling
- Snow & Ground Energy Balance Computations
- Storm Analysis
- Dew Point Analysis
- Areal Reduction Factor (ARF) Calculations
- Error Analysis/QC
- Eddy Covariance
- Snowmelt & Snowpack Sublimation Analysis
- Proposal Writing
- Regional L-moments
- Turbulent Flux Modeling (Latent and Sensible)

Computer Skills

- ArcView
- ArcGIS
- ArcInfo
- MATLAB
- MS Word
- MS Excel
- MS Access
- MS Power Point
- SPLUS/R
- IDL
- HEC-HMS
- Lecia Software
- PRMS
- GIS Weasel
- ERDAS
- Solar Analyst
- GRASS GIS
- Linux/Unix
- HTML
- RAOB
- Perl
- GrADS
- IPW Toporad
- DNR Garmin
- Python
- GPS Interface
- WATFLOOD
- AWK/GWAK

WORK EXPERIENCE

Senior Hydrometeorologist

Windsor, CO

Metstat, Inc.

2006 - Present

- Conducted in-depth analysis of extreme precipitation events for probable maximum precipitation studies.
- Conducted meteorological data analysis and modeling for hydrometeorological studies.
- Co-developed GIS/R code for real-time gauge adjusted radar estimates for hydrologic applications.
- Co-developed PERL and R code for real-time software to convert radar estimated precipitation into an average recurrence interval.
- Co-developed methodology and code (PERL, R, GRASS GIS) to determine temporal distribution of PMP rainfall as a function of area size.
- Conducted vertical temperature and wind speed analysis for Mt Baker region, integrated surface measurements, MM5 model estimates, and balloon sonde data.

- Co-developed PERL and R code for implementation of real-time precipitation quality control measures on MADIS hourly data, quality control included statistical outliers, default ZR relationship outliers, and spatial outliers for the continental United States.
- Created PERL and R code that integrated surface temperature measurements and balloon sonde temperature measurements; data were used to calculate hourly vertical temperature profiles and lapse rates for a period of 144-hours during several extreme precipitation events (Lewis River basin, WA and Brasses River basin, ME).
- Computed site-specific and regional L-moment statistics for frequency analysis of streamflow, snowfall, snow load, and wind speed.
- Created PERL and R code to calculate L-moment statistics for dew point temperature frequency analysis for Arizona statewide study, southeastern United States and northeastern United States projects.
- Researched precipitation areal reduction factor (ARF) methodology, and developed GRASS GIS code to derive storm-based ARFs concept to aid the U.S Weather Service Hydrologic Design Studies Center (HDSC) study to update ARFs for the United States.
- Created cartographic precipitation frequency maps for the U.S Weather Service Hydrologic Design Studies Center (HDSC) NOAA Atlas 14 Precipitation Frequency Data Server: Ohio River Basin and Semi-Arid Southwest.
- Delivered high spatial and temporal gridded precipitation estimates for use in hydrologic model calibration and verification studies.
- Presented research and results to scientific and general public communities.

Graduate Research Assistant

Colorado State University

Fort Collins, CO

2008 – Present

- Computed spatial distribution of snow depth and density based on ground surveyed data, compared ground survey derived snow distribution (depth, density and snow water equivalent) to the National Operational Hydrologic Remote Sensing Center's SNOW Data Assimilation System (SNODAS) modeled snow depth, snow density, and snow water equivalent.
- Conducted research comparisons between a snow energy balance model and temperature index model to quantify the spatial and temporal snowmelt contribution and stream runoff to alpine watersheds.
- Analyzed streamflow sensitivity to varying scales of temporal and spatial precipitation estimates as input to physically-based runoff model (WATFLOOD) for the November 2006 precipitation event along the Oregon coastal range.
- Computed snowpack sublimation rates at multiple high elevation regions using several methods: bulk aerodynamic profile method, aerodynamic profile method, and the eddy covariance method.
- Evaluated, designed and optimized sampling schemes for alpine snow surveys based on computed physiographic terrain parameters.
- Designed and coordinated field based snow sampling in a remote alpine watersheds (2005-2010).
- Organized, maintained, and created documentation for six years of snow depth and snow density observations.
- Applied snowpack energy balance to simulate and forecast mountain snowpack processes.
- Created lecture notes, field notes and instructed WR 575 - Snow Hydrology Field Methods.
- Contributed as lead author and co-author for journal publications.
- Presented research and results to scientific and general public communities.
- Developed Python/GIS code to derive terrain based parameters of wind shelter and wind drift regions in alpine regions.

Graduate Teaching Assistant

Colorado State University, Dept. of FRWS

Fort Collins, CO

2004 – 2006

- Taught and advised students in WR 440 - Watershed Problem Analysis
- Taught and advised students in WR 474/574 - Snow Hydrology
- Instructed students on procedures to compute and analyze streamflow, to model snowmelt, and to perform synthetic unit hydrograph analysis.
- Instructed students on methods to collect water quality samples and stream discharge samples.
- Instructed students on procedures to collect, analyze, and disseminate water resources data.
- Instructed students on HEC-HMS modeling procedures that accounted for streamflow, reservoir storage, snowmelt, and channel routing.
- Presented bi-weekly lectures to students and advised students with questions.
- Planned, designed and coordinated weekly field based snow sampling in remote alpine watersheds.

Graduate Research Assistant

Colorado State University

Fort Collins, CO

2005 – 2006

- Performed weekly meteorologic and hydrologic sampling at the Glacier Lakes Ecosystems Experiments Site, a US Forest Service Rocky Mountain Research Station site located in the Wyoming Snowy Range Mountains.
- Performed meteorological maintenance on the AmeriFlux station "GLEES" and the National Atmospheric Deposition Program (NADP) station "WY00".
- Analyzed sixteen years of meteorologic and hydrologic data for the USFS Rocky Mountain Research Station.
- Modeled the spatial and temporal snowmelt runoff in West Glacier lake watershed.
- Gathered satellite derived snow covered area data for computation of snow covered area depletion curve used in snowmelt modeling.
- Incorporated surface station data, satellite data, modeled data, terrain derived physiographic data, and ground-based survey data to determine the spatial distribution of snow depth, snow water equivalence, and snow cover area.
- Analyzed hourly streamflow data for stochastic modeling of short range streamflow forecasts.
- Analyzed aircraft Lidar snow depth data and compared to ground based snow survey data applied to geostatistical methods to estimate snow depth distribution data.
- Conducted weekly water quality sampling and stream discharge sampling in two alpine watersheds.
- Conducted stream discharge measurements and updated stage-discharge relationships for three remote alpine streams.
- Maintained remote meteorological stations, downloaded data, uploaded new data logger programs, and repaired/replaced sensors.
- Installed, constructed, disassembled, and maintained remote stream gauges.
- Collected discharge measurements on frozen lakes and streams.
- Conducted water quality sampling and discharge sampling in remote alpine regions.
- Organized, maintained, and created documentation of historical meteorologic and hydrologic measurement station records for the Glacier Lakes Ecosystems Experiments Sites.
- Used hand tools to maintain, update, and build remote meteorologic and hydrologic monitoring stations.

Hydrologic Technician

USGS Alpine Hydrology Research Group (AHRG)

Lakewood, CO

2002 – 2005

- Performed quality control methods on fifteen years of meteorologic data and loaded into Microsoft Access database.
- Conducted weekly samples of snow depth, snow density, and snow chemistry for remote alpine regions in Rocky Mountain National Park.
- Conducted water quality sampling and discharge sampling in remote alpine regions.
- Analyzed the 2001-2005 Rocky Mountain snow chemistry data.
- Maintained remote hydrologic stations, downloaded data, uploaded new data logger programs, repaired/replaced sensors.
- Conducted stream discharge measurements and updated stage-discharge relationships for remote alpine streams. Updated stage-discharge rating curve coefficients to improve streamflow estimates.
- Conducted lake core samples and lake water quality samples from inflatable boat in alpine regions.
- Filed water quality and streamflow data on to the National Water Information System (NWIS) database.
- Constructed, disassembled, and maintained remote stream gauges.
- Provided inspection reports on hydrologic and meteorologic instrumentation operation and performance.
- Collected discharge measurements on frozen lakes and streams.
- Collected stream discharge measurements with wading rods measurements, bridge measurements, boat measurements, ice measurements, Parshall Flume measurements, volumetric measurements, indirect measurements (weir, flumes, and gated structures).
- Organized, maintained, and created documentation of historical meteorologic and hydrologic measurement records in Loch Vale watershed, Colorado.
- Used hand tools to maintain, update, and build remote meteorologic and hydrologic monitoring stations.

Undergraduate Research Assistant

Institute of Arctic and Alpine Research (INSTAAR),

University of Colorado

Boulder, CO

2002 – 2003

- Collected and analyzed alpine hydrological and meteorologic data on Niwot Ridge, CO.

- Analyzed weather balloon data collected at Summit, Greenland, created IDL code to filter and plot balloon sonde data.
- Computed diurnal transfer rate of chemicals from the atmosphere to the snowpack and snowpack to the atmosphere and its dependence on different atmospheric conditions.
- Conducted literature review of air quality and ozone interactions with seasonal snowpacks.
- Conducted weekly snow sampling of depth, density, and water quality at Niwot Ridge LTER site for Dr. Mark Williams.

AWARDS & HONORS

- Executive Program Committee Member (hydrology, data analysis and modeling) National Hydrologic Warning Council (NHWC).
- Colorado Water Resources Research Institute (CWRRI) Grant, 2008-2009
- Graduate Research Funds, 2005
- USGS STAR Award, 2003, 2004, and 2005
- Albert W. Smith Geography Scholarship, 2002
- Dean's List, 1999, 2000, 2001, and 2002
- The National Society of Collegiate Scholars, 2001
- Phi Beta Kappa, 2001

PROFESSIONAL AFFILIATION

- American Geophysical Union (AGU)
- American Meteorological Society (AMS)
- Western Snow Conference (WSC)
- Association of State Dam Safety Officials (ASDSO)
- National Hydrologic Warning Council (NHWC)
- American Water Resources Association (AWRA)

PUBLICATIONS & REPORTS

- **Hultstrand, D.M.**, J.D. Stednick, and S.R. Fassnacht. Geostatistical Methods for Estimating Snowmelt Contribution to the annual Water Balance of an Alpine Watershed, Wyoming, USA. *Hydrological Processes*. (submitted).
- Fassnacht, S.R., R. Bales, K. Dressler, and **D.M. Hultstrand**. Inconsistency in the Large-scale Physiographic Drivers for Snow Accumulation across the Colorado River Basin. *Proceedings of the Eastern Snow Conference*, Ontario, Canada, June 9-11, 2010 (submitted).
- **Hultstrand, D.M.**, T.W. Parzybok, E.M. Tomlinson and W.B. Kappel, 2009. Advanced Spatial and Temporal Rainfall Analyses for Use in Watershed Models. In *U.S. Geological Survey Scientific Investigations Report: Proceedings of the Third Interagency Conference on Research in the Watersheds*, Estes Park, CO, Sept. 2008.
- Tomlinson, E.M., W.B. Kappel, P.J. Diederich, T.W. Parzybok, and **D.M. Hultstrand**, 2008. Nebraska Statewide Probable Maximum Precipitation (PMP) Study.
- Tomlinson, E.M., W.B. Kappel, T.W. Parzybok, **D.M. Hultstrand**, and G. Muhlestein, 2008. Site-Specific Probable Maximum Precipitation (PMP) Study for the Magma Drainage Basin, AZ.
- Tomlinson, E.M., W.B. Kappel, T.W. Parzybok, **D.M. Hultstrand**, and G. Muhlestein, 2008. Site-Specific Probable Maximum Precipitation (PMP) Study for Blenheim-Gilboa Drainage Basin, NY.
- Fassnacht, S.R., **D.M. Hultstrand**, and R.C. Bales, 2007. Physiographic Variables to Describe Basin Scale Snow Water Equivalent. *EOS Trans.*, AGU, Fall Meet. Suppl., 88(52): C21B-0456.
- Ingersoll, G.P., A.M. Mast, L. Nanus, H. Handran, D.J. Manthorne, and **D.M. Hultstrand**, 2007, Rocky Mountain snowpack chemistry at selected sites, 2004: *U.S. Geological Survey Open-File Report 2007-1045*, 15 p.
- **Hultstrand, D.M.**, S.R. Fassnacht, and J.D. Stednick, 2006. Geostatistical Methods for Estimating Snowmelt Contribution to an Alpine Water Balance. *Proceedings of the Western Snow Conference*, Las Cruces, NM, April 17-20 2006.
- **Hultstrand, D.M.**, 2006. *Geostatistical Methods for Estimating Snowmelt Contribution to the Seasonal Water Balance in an Alpine Watershed*. Master of Science Thesis, Watershed Science Program, Colorado State University, 130 pp.

- Korfmacher, J.L. and **D.M. Hultstrand**, 2006. Glacier Lakes Ecosystem Experiments Site (GLEES) NADP (WY00) hourly meteorological tower data: 1991-2005. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Korfmacher, J.L. and **D.M. Hultstrand**, 2006. Glacier Lakes Ecosystem Experiments Site (GLEES) hourly meteorological tower data: 1989-2005. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Ingersoll, G.P., M.A. Mast, L. Nanus, D.J. Manthorne, H.H. Handran, **D.M. Hultstrand**, and J. Winterringer, 2005. Rocky Mountain Snowpack Chemistry at Selected Sites, 2003: *U.S. Geological Survey Open-File Report 2005-1332*, 17 p.

PRESENTATIONS

- 2010, Presentation, Average Recurrence Interval of Event Precipitation in Real-Time. ASDSO Conference, Seattle, Washington.
- 2010, Presentation, Inconsistency in the Large-Scale Physiographic Drivers for Snow Accumulation across the Colorado River Basin. Eastern Snow Conference, Ontario, Canada.
- 2010, Speaker, Estimating Hydrologic Uncertainties in Water Balance Studies. Seminar, Fort Collins, Colorado.
- 2009, Presentation, Snow Depth Measurement Variability Across Two Study Domains. American Geophysical Union, San Francisco, California.
- 2009, Presentation, Improving Hydrologic Calibration and Validation Analyses with Radar-Estimated Precipitation from the Storm Precipitation Analysis System. Northeast Regional ASDSO, State College, Pennsylvania.
- 2009, Speaker, Incorporating Advanced Spatial and Temporal Rainfall Data into Hydrologic Models. Waterpower XVI, Spokane, Washington.
- 2009, Presentation, Improving Hydrologic Analysis and Applications through the Use of Near Real-Time Storm Precipitation Analysis System (SPAS). Waterpower XVI, Spokane, Washington.
- 2009, Presentation, How six Extreme Pacific Northwest Storms Compare to Historical Storms in HMR 57. Western Regional ASDSO, Couer d'Alene, Idaho.
- 2009, Presentation, Arizona Statewide Probable Maximum Precipitation (PMP), Improving HMR 49. Western Regional ASDSO, Couer d'Alene, Idaho.
- 2009, Speaker, Improving Hydrologic Analysis and Applications through the Use of Quality Controlled Radar Data and the Storm Precipitation Analysis System. National Hydrologic Warning Council, Vail, Colorado.
- 2009, Speaker, Accuracy of Spatial Precipitation Estimates for Hydrologic Modeling. 29th Annual American Geophysical Union (AGU) Hydrology Days, Fort Collins, Colorado.
- 2008, Presentation, High-Resolution Storm Rainfall Analysis for Use in Hydrologic Modeling: Storm Precipitation Analysis System (SPAS) and NEXRAD Weather Radar, Hydrovision, Sacramento, CA.
- 2008, Poster, Advanced Spatial and Temporal Rainfall Analysis for Use in Watershed Models, Third Interagency Conference on Research in the Watersheds, Estes Park, CO.
- 2008, Speaker, Estimating Errors Associated with Calculated Sublimation from Seasonally Snow-Covered Environments, Colorado Water Resources Research Institute, Fort Collins, CO.
- 2007, Presentation, Detailed Storm Rainfall Analysis for Hurricane Ivan Flooding in Georgia Using the Storm Precipitation Analysis System (SPAS) and NEXRAD Weather Radar, Hydropower, Knoxville, TN.
- 2006, Speaker, Glacier Lakes Ecosystems Experiments Site (GLEES), Rocky Mountain Research Station (RMRS) Project Review.
- 2006, Speaker, Geostatistical Methods for Estimating Snowmelt Contribution to the Annual Water Balance in an Alpine Watershed. 26th Annual American Geophysical Union Hydrology Days, Fort Collins, Colorado.
- 2005, Speaker, 60th Annual Meeting of the Rocky Mountain Hydrologic Research Center, Fort Collins, Colorado.