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EDUCATION **University of California Los Angeles** Los Angeles, California
Doctor of Philosophy in Civil Engineering 2012

- Minor in Atmospheric Sciences
- Emphasis in Hydrology & Water Resources
- NASA Earth System Science Fellowship Recipient

University of Arizona Tucson, Arizona
Master of Science in Hydrology & Water Resources 2006

- Emphasis in Surface Hydrology

University of Vermont Burlington, Vermont
Bachelor of Science in Geology 2003

- Emphasis in Surface Hydrology

PROFESSIONAL

EXPERIENCE

Institute of Arctic and Alpine Research Boulder, Colorado

University of Colorado Boulder

Research Assistant Professor, Fellow

October 2017 – Present (40 hrs/week)

- Lead Principal Investigator on multiple large, multidisciplinary National Science Foundation projects. Assess terrestrial hydrologic change in the Arctic and the potential impacts on rivers, fisheries, and Indigenous communities. Assess ecosystem response to climate change and population pressures in Colorado. Coordinate stakeholder engagement. Co-founded an Indigenous Advisory Council. Lead PI on a NOAA Climate Program Office project to assess projected future changes in snowpack, precipitation, soil moisture and flood risk.
- Analyze the agricultural water supply-demand imbalance during the California drought using novel NASA satellite data, snow models, lidar, and GPS data. Oversee operational snowpack reports to California DWR and stakeholders. Reanalysis of 2017 Oroville Dam flood disaster using diverse gridded historical weather, snowpack, and climate data. Supervise and mentor three graduate and three undergraduate students.
- Published two high impact papers in *Nature Climate Change* on future rain-on-snow flood risk and the use of winter snowmelt trends as an indicator of warming and risk to snow water resources across western North America.

National Center for Atmospheric Research Boulder, Colorado

Advanced Study Program Fellowship - Postdoctoral

October 2015 – October 2017 (40 hrs/week)

- Independently pursued research that collaboratively leveraged NCAR's world-class

climate modeling capacity and multidisciplinary hydrologic team expertise. Analyzed high-res RCM output and led a high-impact paper in *Nature Climate Change* that alters conventional thought of how water resources may respond to climate change.

- Advanced the capability of hydrologic models to simulate dominant cold region processes in Alaska. As a member of a collaborative team, built propensity for research techniques using a model to achieve the Mission's goal of advancing hydrological model capacity and uncertainty characterization.

University of Saskatchewan

Kananaskis, Alberta

Postdoctoral Fellow

October 2012 – October 2015 (40 Hours/Week)

- Developed new parsimonious model capacity of snow and forest hydrology to evaluate cold region process sensitivity to changes in land cover and climate. Creative use of technology (computational fluid dynamics, ray tracing) in solutions of challenging problems related to fine-scale numerical modeling of Earth System processes.
- Conducted and supervised a field campaign to evaluate how forest vegetation structure controls snowfall, melt, water and energy availability. Mentored and developed graduate students, student interns, and supervised two technicians.

University of California Los Angeles

Los Angeles, California

NASA Earth System Science Graduate Fellow

September 2008 – September 2012

- Conduct independent research using detailed field measurements and numerical modeling to analyze snow accumulation and melt dynamics in the Sierra Nevada.
- Designed and supervised ten basin-scale snow surveys with five or more researchers including undergraduate and graduate students in the remote Sierra Nevada, California.
- Build future capabilities leveraging state-of-the-art lidar technology to estimate high-resolution solar radiation beneath a forest canopy in Sequoia National Park with a novel approach that remains an example of technical excellence.

CLASSROOM

TEACHING EXPERIENCE

University of Colorado Boulder

Boulder, Colorado

Lecturer

Spring and Fall Semesters, 2019

- Lecture three days per week a class of 160 undergraduates in Geography course *Environmental Systems: Landscapes and Water*; plan field excursions, design lectures, homework, and exams. Supervise three teaching assistants who held weekly labs.

Lecturer

Spring Semester, 2022

- Lecture two days per week a mixed class of 22 undergraduate and six graduate students in Geography course *Snow Hydrology*; design lectures, homework, and exams. Supervise a teaching assistant who held weekly labs.

University of California Los Angeles

Los Angeles, California

Teaching Assistant (TA)

Fall Semester, 2009

- Lead weekly discussion sessions, designed homework and held office hours for class of 100+ in Civil Engineering course 150 *Introduction to Hydrology*. Prof. S. Margulis

WORKSHOPS &

FIELD COURSES UCB Science Discovery, Family Engineering Day; 1000+ attendees (2020)
TAUGHT NSF-funded workshop LiDAR Applications in Critical Zone Sciences (2014)
TA for *Advanced Field Methods in Snow Science*, Prof. Noah Molotch (2011)
TA for *Snow Hydrology and Field Camp*, Prof. Paul Brooks (2006)

FUNDING

- (Planned) **Bureau of Reclamation, Science and Technology** 2022-2025
“Assessing historical and projected future flood mechanisms for headwater basins of the western U.S.”
(role: **PI**, \$200k)
- (Pending) **NSF, Hydrological Sciences** 2022-2025
“Estimating the “time of emergence” of the anthropogenic warming signal in snow water resource metrics for western US headwaters” (role: **PI**, \$700K)
- (Pending) **Department of Energy, Earth & Environ. Systems Sciences** 2022-2025
“Consequences of winter perturbations on hydro-biogeochemical connectivity in contrasting ecosystems” (role: **co-PI**, \$225K; total \$1M)
- (Pending) **NOAA, Office of Education, Environmental Literacy** 2022-2025
“Increasing climate resilience to extreme heat in Denver public schools through education and community outreach” (role: **PI**, \$499K)
- (Pending) **NASA, Water Resources** 2022-2025
“Advancing domestic and international water management capabilities with a global daily snow cover and albedo product” (role: **co-PI**, \$777K; total \$1.3M)
- (Awarded) **NSF, Growing Convergence Research** 2021-2026
“Collaborative Research: GCR: Co-defining climate refugia to inform the management of mountain headwater systems” (role: **PI**, \$3.6M)
- (Awarded) **CU Boulder, Office of Outreach & Engagement** 2021-2022
Microgrant – “Facilitating Co-production and Indigenous Community Engagement” (role: **PI**, \$1K)
- (Awarded) **NSF, Navigating the New Arctic Program, supplemental funding** 2021
Supplemental – Research Experience for Undergraduates (REU) (role: **PI**, \$9K)
- (Awarded) **National Park Service, CESU** 2021-2023
“Alaska Glacier Status and Trends 2.0; Hydrologic Modeling” (role: **PI**, \$67K)
- (Awarded) **NASA, Applied Sciences** 2021-2022
“Satellite-based Snowpack Information: COVID-19 impacts on water resources” (role: **co-PI**, \$21K)
- (Awarded) **NSF, Navigating the New Arctic Program** 2020-2024
“The climate impacts on Alaskan and Yukon rivers, fish, and communities as told through co-produced scenarios” (role: **PI**, \$3M)
- (Awarded) **NOAA, Climate Program Office** 2019-2021
“Assessing the predictability and probability of 21st century rain-on-snow flood risk for the conterminous U.S.” (role: **PI**, \$200K)
- (Past Award) **NASA, GEO, supplemental funding** 2019

“Optimizing the Indus Basin Irrigation System and reservoir operations using remotely sensed snow surface properties in the ParBal model” (role: co-I, \$22K)

- (Past Award) **National Science Foundation, Hydrologic Sciences** 2018-2020
“Extending the vadose zone: characterizing the role of snow for liquid water storage and transmission in streamflow generation” (role: co-PI, \$142K)
- (Past Award) **University of Colorado Outreach Award** 2019-2020
“Past, Present, Future: Exploring Boulder’s Natural Environment” (role: co-I, \$24K)
- (Past Award) **NCAR Advanced Study Program Fellowship** 2015-2017
“Slower snowmelt in a warmer world” (\$136K)
- (Past Award) **NASA Earth and Space Science Fellowship Program** 2008-2012
“Remote Sensing and Ground Data Assimilation Using A Basin-Scale Snow Water Equivalent Reconstruction Method” (\$90K)

STUDENT

MENTORSHIP **Graduate Student co-Advisor**

Dylan Blaskey, Ph.D. Student, Civil Engineering, CU Boulder

Ph.D. Committee Member

Kehan Yang, University of Colorado, Boulder

Hamideh Safa, University of Nevada, Reno

Dylan Blaskey, University of Colorado, Boulder

Katherine Hale, University of Colorado, Boulder

John Bryan Curtis, University of Colorado, Boulder

Masters Committee Member

Eric Kennedy, University of Colorado, Boulder

Natasha Harvey, University of Colorado, Boulder

Undergraduate Research Mentor

Siobhan Ciafone (Honor Thesis), University of Colorado, Boulder

Ella Hall, University of Colorado, Boulder

Allyson Fitts, University of Colorado, Boulder

Haley Nolde, University of Nebraska, Lincoln

AWARDS

RECEIVED

Outstanding Mentor Award

Undergraduate Research Opportunities Program

2021

University of Colorado, Boulder

Best Presentation

Western Snow Conference Annual Meeting, Reno, NV

2019

Best Student Poster Presentation

Eastern Snow Conference Annual Meeting, Montreal, Quebec

2010

Graduate College Fellowship Award (merit-based)

University of Arizona

2005 and 2006

David Hawley Undergraduate Research Scholarship

University of Vermont

2003

REFEREED

PUBLICATIONS 29+ Peer-reviewed publications | *H*-index of 20+

In Review | In Press

Wieder, W.R., D. Kennedy, F. Lehner, **K.N. Musselman**, K.B. Rogers, N. Rosenbloom, I.R. Simpson, and R. Yamaguchi, Pervasive alterations to snow-dominated ecosystem functions under climate change. In Review, Proceedings of the National Academy of Sciences.

Seybold, E.C., R. Dwivedi, **K.N. Musselman**, D.W. Kincaid, A.W. Schroth, J.N. Perdrial, A.T. Classen, and E.C. Adair, Changing winter dynamics pose emerging risks to water quality. In Review, Environmental Research Letters.

Webb, R.W., **K.N. Musselman**, S. Ciafone, K.E. Hale, and N.P. Molotch, Extending the vadose zone: Characterizing the role of snow for liquid water storage and transmission in streamflow generation. In Review, Advances in Water Resources.

Yang, K., K. Rittger, **K.N. Musselman**, E.H. Bair, J. Dozier, D.J. Gochis, S.A. Margulis, T.H. Painter, and N.P. Molotch, Inter-comparison of snow water equivalent data product accuracy in the Sierra Nevada California using Airborne Snow Observatory data. Submitted to Water Resources Research.

Published

[29] Hale, K., A. Wlostowski, A.M. Badger, **K.N. Musselman**, B. Livneh, and N.P. Molotch, 2022. Modeling streamflow sensitivity to climate warming and surface water inputs in a montane catchment. *Journal of Hydrology: Regional Studies*, 39, p.100976.

[28] Yang, K., **K.N. Musselman**, K. Rittger, S. Margulis, T.H. Painter, and N.P. Molotch, 2021. Combining ground-based and remotely sensed snow data in a linear regression model for real-time estimation of snow water equivalent. *Advances in Water Resources*, p.104075.

[27] **Musselman, K.N.**, N. Addor, J.A. Vano, and N.P. Molotch, (2021), Winter melt trends portend widespread declines in snow water resources. *Nature Climate Change* 11, 418–424.

[26] Ikeda, K., R. Rasmussen, C. Liu, A. Newman, F. Chen, M. Barlage, E. Gutmann, J. Dudhia, A. Dai, C. Luce and **K.N. Musselman** (2021). Snowfall and snowpack in the Western US as captured by convection permitting climate simulations: current climate and pseudo global warming future climate. *Climate Dynamics*, pp.1-25.

[25] Mendoza, P.A., T.E. Shaw, J. McPhee, **K.N. Musselman**, J.R. Revuelto, and S. MacDonell (2020), Seasonal and annual variability of snow depth fractal behavior in a sub-alpine catchment. *Water Resources Research*. 56(7), e2020WR027343

[24] Ueher, T.M., S.D. Kaspari, **K.N. Musselman** and S.M. Skiles (2020), The post-wildfire impact of burn severity and age on black carbon snow deposition and implications for snow water resources, Cascade Range, Washington, USA. *Journal of Hydrometeorology*. 21(8), 1777-1792.

[23] Henn, B., **K.N. Musselman**, L. Lestak, F.M. Ralph, and N.P. Molotch (2020), Extreme runoff generation from atmospheric river driven snowmelt during the 2017 Oroville Dam spillways incident. *Geophysical Research Letters*, 47(14).

[22] Mendoza, P.A., **K.N. Musselman**, J.S. Deems, J.R. Revuelto, I. Lopez-Moreno, and J. McPhee (2020), Seasonal and annual variability of snow depth fractal behavior in a sub-alpine catchment. *Water Resources Research*, 55(7).

[21] Giroto, M., **Musselman, K.N.**, and Essery, R.L. (2020), Data Assimilation Improves Estimates of Climate-Sensitive Seasonal Snow. *Current Climate Change Reports*, 6, 81–94.

[20] **Musselman, K.N.**, F. Lehner, K. Ikeda, M.P. Clark, A.F. Prein, C. Liu, M. Barlage and R. Rasmussen (2018), Projected increases and shifts in rain-on-snow flood risk over western North America. *Nature Climate Change*, 8, 808-812.

- [19] Isabelle, P.E., D.F. Nadeau, M.H. Asselin, R. Harvey, **K.N. Musselman**, A.N. Rousseau, F. Anctil (2018), Solar radiation transmittance of a boreal balsam fir canopy: Spatiotemporal variability and impacts on growing season hydrology, *Agricultural and Forest Meteorology*, 263, 1-14.
- [18] **Musselman, K.N.**, M. P. Clark, C. Liu, K. Ikeda and R. Rasmussen (2017), Slower snowmelt in a warmer world. *Nature Climate Change*, 7(3), 214-219.
- [17] **Musselman, K.N.**, N.P. Molotch, and S.A. Margulis, Snowmelt response to simulated warming across a large elevation gradient, southern Sierra Nevada, California. (2017) *The Cryosphere*, 11(6) 2847-2866.
- [16] López-Moreno, I., S. Gascoin, J. Herrero, E. Spoles, M. Pons, E. Alonso, J. Sickman, **K.N. Musselman**, A. Boudhar, L. Hanich, N. Molotch, J. Pomeroy (2017), Different sensitivities of snowpack to warming in Mediterranean climate mountain areas. *Env. Research Letters*, 12(7), 074006.
- [15] **Musselman, K.N.** and J.W. Pomeroy (2017), Estimation of needleleaf canopy and trunk temperatures and longwave contribution to melting snow. *Journal of Hydrometeorology*. 18, 555-572.
- [14] **Musselman, K.N.**, J.W. Pomeroy, R. Essery, and N. Leroux (2015), Impact of windflow calculations on simulations of alpine snow accumulation, redistribution and ablation. *Hydrological Processes*, 29(18), 3983-3999.
- [13] **Musselman, K.N.**, J.W. Pomeroy, and T.E. Link (2015), Variability in shortwave irradiance caused by forest gaps: Measurements, modelling, and implications for snow energetics. *Agricultural and Forest Meteorology*, 207, 69:82.
- [12] Harpold, A.A., J.A. Marshall, S.W. Lyon, T.B. Barnhart, B. Fisher, M. Donovan, K.M. Brubaker, C.J. Crosby, N.F. Glenn, C.L. Glennie, P.B. Kirchner, N. Lam, K.D. Mankoff, J.L. McCreight, N.P. Molotch, **K.N. Musselman**, J. Pelletier, T. Russo, H. Sangireddy, Y. Sjöberg, T. Swetnam, and N. West (2015), Laser Vision: LiDAR as a Transformative Tool to Advance Critical Zone Science. *Hydrology and Earth System Sciences*. 19, 2881–2897.
- [11] Meromy, L., N.P. Molotch, M. Williams, **K.N. Musselman**, and L. Kueppers (2015), Snowpack-climate manipulation using infrared heaters in subalpine forests of the Southern Rocky Mountains, USA. *Agricultural and Forest Meteorology*, 203, 142-157.
- [10] Harpold, A.A., N.P. Molotch, **K.N. Musselman**, R.C. Bales, P.B. Kirchner, M. Litvak, and P.D. Brooks (2015), Snowmelt infiltration in mixed conifer subalpine forests. *Hydrological Processes*, 29(12), 2782-2798.
- [9] Harpold, A.A., Q. Guo., N. Molotch, P.D. Brooks, R. Bales, J.C. Fernandez- Diaz, **K.N. Musselman**, T.L Swetnam, P. Kirchner, M. Meadows, J. Flanagan, and R. Lucas (2014), LiDAR-derived snowpack datasets from mixed conifer forests across the Western U.S., *Water Resources Research*. 50(3), 2749-2755.
- [8] Perrot, D.O., N.P. Molotch, **K.N. Musselman**, and E.T. Pugh (2014), Modeling the effects of the Mountain Pine Beetle on snowmelt rates in a subalpine forest. *Ecohydrology*. 7(2), 226-241.
- [7] **Musselman, K.N.**, S.A. Margulis, and N.P. Molotch (2013), Estimation of solar direct beam transmittance of conifer canopies from airborne LiDAR. *Remote Sensing of Env.* 136, 402-415.
- [6] Huang, C., S.A. Margulis, M.T. Durand, and **K.N. Musselman** (2012), Assessment of snow grain-size model and stratigraphy representation impacts on snow radiance assimilation: Forward Modeling Evaluation, *IEEE Transactions on Geoscience and Remote Sensing*. 50(11) 4551 – 4564.
- [5] López-Moreno, J.I., S.R. Fassnacht, J.T. Heath, **K.N. Musselman**, J. Revuelto, J. Latron, E. Morán-Tejeda, T. Jonas (2012), Small scale spatial variability of snow density and depth over complex alpine terrain: Implications for estimating snow water equivalent, *Advances in Water Res.*, 55, 40-52.

[4] **Musselman, K.N.**, N.P. Molotch, S.A. Margulis, M. Lehning, and D. Gustafsson (2012), Improved snowmelt simulations with a canopy model forced with photo-derived direct beam canopy transmissivity, *Water Resources Research*, 48(10).

[3] **Musselman, K.N.**, N.P. Molotch, S.A. Margulis, P.B. Kirchner, and R.C. Bales (2012), Influence of canopy structure and direct beam solar irradiance on snowmelt rates in a mixed conifer forest. *Agricultural and Forest Meteorology*, 161, 46 – 56.

[2] Molotch, N.P., P.D. Brooks, S.P. Burns, M. Litvak, R.K. Monson, J.R. McConnell, and **K.N. Musselman** (2009), Ecohydrological controls on snowmelt partitioning in mixed-conifer sub-alpine forests, *Ecohydrology*, 2, 129–142.

[1] **Musselman, K.N.**, N.P. Molotch, and P.D. Brooks, (2008), Effects of vegetation on snow accumulation and ablation in a mid-latitude sub-alpine forest, *Hydrological Processes*, Vol 22 (15), 2767-2776.

CONFERENCE PROCEEDINGS

Musselman, K.N., F. Lehner, T. Eidhammer, A. Pendergrass, and E. Gutmann (2021), Assessing the predictability and probability of 21st century rain-on-snow flood risk for the conterminous U.S., *AGU Fall Meeting*.

Newman, A., Cheng, Y., **Musselman, K.N.**, Craig, A., Swenson, S., Hamman, J., & Lawrence, D. (2021). High-Resolution Regional Climate Simulations of Arctic Hydroclimatic Change. *American Geophysical Union Fall Meeting*.

Livneh, B., N.R. Bjarke, K. Marvel, A. Pendergrass, J.J. Barsugli, E.D. Gutmann, P. Williams, K.N. Musselman, F. Lehner, K.M. Grise, D. Schmidt, and M.P. Hoerling (2021), The primary drivers of climate change impacts on the terrestrial water cycle, *AGU Fall Meeting*.

Cheng, Y., A.J. Newman, S.C. Swenson, D.M. Lawrence, K.N. Musselman, and J. Hamman (2021), A novel application and multi-objective optimization of CTSM: Arctic hydrology in Alaska and Yukon River Basin, *AGU Fall Meeting*.

Rittger, K., M.C. Serreze, M.J. Brodzik, **K.N. Musselman**, T. Stilling, N. Bair, M. Skiles (2021), Snow Today at the National Snow and Ice Data Center, *AGU Fall Meeting*.

Hale, K., **K.N. Musselman**, K.S. Jennings, and N.P. Molotch (2021), Changes in snow water storage and hydrologic partitioning across the Western United States, *AGU Fall Meeting*.

Yang, K., **K.N. Musselman**, K Rittger, SA Margulis, TH Painter, and NP Molotch (2021) Improving the estimation of snow water equivalent in a Linear Regression Model using remotely sensed snow cover data, *AGU Fall Meeting*.

Herman-Mercer, N., Cozzetto, K., & **Musselman, K.N.** (2021). *Working with an Indigenous Advisory Council to facilitate effective communication and collaboration between researchers and Arctic communities* (No. EGU21-16368). *European Geophysical Union Annual Meeting*.

Newman, A., Cheng, Y., **Musselman, K.N.**, Craig, A., Swenson, S., Hamman, J., & Lawrence, D. (2021). *High-Resolution Regional Climate Simulations of Arctic Hydroclimatic Change* (No. EGU21-6085). *European Geophysical Union Annual Meeting*.

Musselman, K.N. (2021) The Arctic Rivers Project: A Co-produced Assessment of the Climate Sensitivity of Rivers, Fish and Communities, 50th Arctic Workshop. Virtual.

Musselman, K.N., N. Addor, J.A. Vano, and N.P. Molotch, (2020), Melting winter snowpack signals a growing threat to water security not captured by operational metrics. *AGU Fall Meeting 2020*.

Vano, J.A., J.R. Arnold, M.P. Clark, B. Nijssen, E.D. Gutmann, A.W. Wood, F. Lehner, **K.N. Musselman**, J. Hamman, N. Addor & A.J. Newman (2020, December), Dos and Don'ts for navigating

model selection in climate change work for water planning and management, In *AGU Fall Meeting 2020*.

Safa, H., **Musselman, K. N.**, Krogh, S.A., & Harpold, A.A. (2020, December). How well do we melt snow? A multi-model intercomparison project (MuMIP) illustrates the challenges of hydrological prediction. In *AGU Fall Meeting 2020*.

Yang, K., **Musselman, K. N.**, Jennings, K. S., & Molotch, N. P. (2020, December). Climate and topographic controls on the variability of snow water equivalent and snowmelt in a continental alpine watershed. In *AGU Fall Meeting 2020*.

Hale, K., Molotch, N.P., & **Musselman, K.N.** (2020, December). Water Towers of the West: Where are they and how have they changed? *AGU Fall Meeting 2020*.

Kaspari, S., Uecker, T.M., **Musselman, K.N.**, & Skiles, M. (2020, December). The Post-Wildfire Impact of Burn Severity and Age on Black Carbon Snow Deposition and Implications for Snow Water Resources, Cascade Range, Washington, USA. In *AGU Fall Meeting 2020*.

Webb, R., **Musselman, K.N.**, Hale, K., Ciafone, S., & Molotch, N.P. (2020, December). Characterizing a Snowpack's Ability to Store Liquid Water at the Small Catchment Scale—A Comparison of Ground-Based Remote Sensing Observations and Hydrologic Modeling. In *AGU Fall Meeting*.

Webb, R., **Musselman, K.N.**, Hale, K., & Molotch, N. (2020, November). Monitoring a snowpack's ability to store liquid water at the small catchment scale. In *18th Int'l Conference on Ground Penetrating Radar* (pp. 101-104). Society of Exploration Geophysicists.

Pinto Escobar, F., Mendoza, P. A., Shaw, T. E., Revuelto, J., **Musselman, K.N.**, & McPhee, J. (2020, May). Wind effects on the spatial distribution of snow and seasonal water balance in two Mediterranean basins. In *EGU General Assembly Conference Abstracts* (p. 10994).

Mendoza, P., Shaw, T., Pinto, F., Lagos, M., Revuelto, J., **Musselman, K.N.**, MacDonell, S. & McPhee, J., (2020, May). Scaling behavior of lidar-derived snow depth across the semi-arid Chilean Andes. In *EGU General Assembly Conference Abstracts* (p. 11313).

Yang, K., **Musselman, K. N.** & Molotch, N. P. (2019, December). Bias Correction of Snow Water Equivalent Estimates in near real-time over the California Sierra Nevada. *AGU Fall Meeting 2019*.

Ackroyd, C., M. Skiles, K. Rittger, S. Supper, **K.N. Musselman** (2019, December). A Comparison of WorldView and MODIS in Detecting Fractional Snow Cover over High Mountain Asia. *AGU Fall Meeting 2019*.

K. Rittger, **K.N. Musselman**, A.L. Dugger, M.J. Brodzik, B. Rajagopalan, W. Kleiber, K.J. Bormann, H.G.V. Chan, W.P. Doan, & T.H. Painter (2019, December). Multi-platform, multi-sensor snow surface properties for energy balance and model validation. *AGU Fall Meeting 2019*.

Musselman, K.N., H.T. Berglund, K. Yang, & N.P. Molotch (2019, December). Monitoring the Sierra Nevada's water balance and deficits using GPS-derived vertical displacement time series data. *AGU Fall Meeting 2019*.

Musselman, K.N., A.J. Newman, & F. Lehner (2019, December). Projected end-of-century changes in water available for runoff across mountain basins of western North America. *AGU Fall Meeting 2019*. Invited.

Vano, J.A., J.R. Arnold, M.P. Clark, B. Nijssen, E.D. Gutmann, A.W. Wood, F. Lehner, J. Hamman, N. Addor, A.J. Newman & **K.N. Musselman** (2019, December). Dos and Don'ts for Supporting Better Water Management in a Changing Climate, In *AGU Fall Meeting 2019*. Invited.

Musselman, K.N., N. Addor, J. Vano, & N.P. Molotch, (2019, April) Reconsidering the utility of the April 1st snow water equivalent metric for water resource applications. Oral presentation at the Western Snow Conference, Reno, NV.

Yang, K., **K.N. Musselman**, K. Rittger, & N.P. Molotch (2019 April), Bias correction of SWE estimates with the NASA Airborne Snow Observatory SWE data. Oral presentation at the Western Snow Conference, Reno, NV.

K.N. Musselman, B. Henn, F.M. Ralph, L. Lestak, and N.P. Molotch (2018), The role of atmospheric river rain-snow levels and antecedent snowpack in the 2017 Oroville Dam crisis. Oral presentation at the American Meteorological Society Mountain Meteorology Conference, Santa Fe, NM.

Musselman, K.N., N. Addor, J. Vano, J. Berggren, and N. Molotch, (2018) Reconsidering the utility of the April 1st snow water equivalent metric. Oral presentation at the Eastern Snow Conference, College Park, MD.

Mendoza, P.A., **K.N. Musselman**, I. López-Moreno, R. Essery, N.P. Molotch, and J. McPhee, (2018), The effects of geospatial decisions on the accuracy of a distributed blowing snow model, Oral presentation at the European Geophysical Union General Assembly, Vienna, Austria.

Musselman, K.N., F. Lehner, K. Ikeda, M.P. Clark, A. Prein, C. Liu, M. Barlage and R. Rasmussen (2018), Projected increases and shifts in rain-on-snow flood risk over western North America. Oral presentation at the Western Snow Conference, Albuquerque, NM.

Henn, B., **K.N. Musselman**, F.M. Ralph, L. Lestak, and N.P. Molotch (2018), The role of atmospheric river rain-snow levels and antecedent snowpack in the 2017 Oroville Dam crisis. Oral presentation at the Western Snow Conference, Albuquerque, NM.

Musselman, K.N., M.P. Clark, B. Nijssen and J. Arnold (2017), Challenges in land model representation of heat transfer in snow and frozen soils. Oral presentation at the American Geophysical Union Fall Meeting, New Orleans, LA.

Musselman, K.N., F. Lehner, K. Ikeda, M.P. Clark, A. Prein, C. Liu, M. Barlage and R. Rasmussen (2018), Large projected increases in rain-on-snow flood potential over western North America. Oral presentation at the American Geophysical Union Fall Meeting, New Orleans, LA. Invited.

Musselman, K.N., F. Lehner, K. Ikeda, M.P. Clark, A. Prein, C. Liu, M. Barlage and R. Rasmussen (2017), Projected increases in rain-on-snow flood potential over western North America. Annual Meeting of the Rocky Mountain Hydrologic Research Center, Boulder, Colorado.

Musselman, K.N., M.P. Clark, Changhai Liu, Kyoko Ikeda, and R. Rasmussen (2017), Slower snowmelt in a warmer world. Oral presentation at the European Geophysical Union General Assembly, Vienna, Austria.

Musselman, K.N., M.P. Clark, A. Endalamaw, W.R. Bolton, B. Nijssen and J. Arnold (2017), Assessing the effects of modeling decisions on cold region hydrologic model performance. Interactive Poster presentation at the European Geophysical Union General Assembly, Vienna, Austria.

Musselman, K.N., M.P. Clark, Changhai Liu, Kyoko Ikeda and R. Rasmussen (2016), Slower snowmelt in a warmer world. Oral presentation at the American Geophysical Union Fall Meeting, San Francisco, CA. Invited.

Musselman, K.N., M.P. Clark, A. Endalamaw, W.R. Bolton, B. Nijssen and J. Arnold (2016), Effects of model decisions on cold region hydrologic model performance: snow, soil and streamflow. Poster presentation at the American Geophysical Union Fall Meeting, San Francisco, CA.

Monaghan, A.J., M.P. Clark, J.R. Arnold, A.J. Newman, **K.N. Musselman**, M.J. Barlage, L. Xue, C. Liu, E.D. Gutmann and R. Rasmussen (2016), High resolution regional climate change simulations over Alaska. Poster presentation at the American Geophysical Union Fall Meeting, San Francisco, CA.

Musselman, K.N., M.P. Clark, Changhai Liu, Kyoko Ikeda and R. Rasmussen (2016). Evidence for slower snowmelt in a warmer world. Oral presentation at the Mountain Climate Conference, Leavenworth, Washington.

Musselman, K.N., M.P. Clark, A. Endalamaw, W.R. Bolton, B. Nijssen (2016), A Multi-Decadal Analysis of Cold Region Hydrological Model Performance and Challenges at the Caribou – Poker Creeks Research Watershed. Oral presentation at the American Water Resources Association Spring Specialty Conference ‘Water – Energy – Environment’, Anchorage, Alaska

S. Gascoin, J.I. López-Moreno, J. Herrero, E. Sproles, L. Hanich, A. Boudhar, M. Pons, E. Alonso-González, and **K.N. Musselman** (2016), Spatio-temporal variability of the snow cover in different Mediterranean mountain regions from in situ and remote sensing data, oral presentation at the European Geosciences Union General Assembly, Vienna, Austria.

Musselman, K.N., N.P. Molotch, and S.A. Margulis (2015), Snowpack response to warmer temperatures: a southern Sierra Nevada case study, invited oral presentation at the American Geophysical Union Fall Meeting, San Francisco, CA.

Musselman, K.N. and J.W. Pomeroy (2015), The influence of tree temperatures on potential snowmelt energy in a discontinuous coniferous forest, poster presentation at the American Geophysical Union Fall Meeting, San Francisco, CA.

Arnold, J., M. Clark, J. Cherry, T. Giambelluca, E. Gutmann, G. Liston, M. Sturm, A. Monaghan, **K.N. Musselman**, A. Newman, R. Rasmussen, and A. Wood (2015), New tools and data to understand and adapt to hydroclimatic variability and change in Alaska and Hawaii, poster presentation at the American Geophysical Union Fall Meeting, San Francisco, CA.

Musselman, K.N. and J.W. Pomeroy (2015), A snow – canopy energy balance model for disturbed forested environments, oral presentation at the Joint Canadian Geophysical Union and American Geophysical Union Spring Meeting, Montreal.

Musselman, K.N., N.P. Molotch, and S.A. Margulis (2014), Snowmelt sensitivity to warmer temperatures: a field-validated model analysis, southern Sierra Nevada, California, California, poster presentation at the American Geophysical Union Fall Meeting, San Francisco, CA.

Musselman, K.N. and J.W. Pomeroy (2014), Ray trace modeling to determine optimal forest canopy gap size for reduced solar irradiance during snowmelt: field verification and

continental scale application, invited oral presentation at the American Geophysical Union Fall Meeting, San Francisco, CA.

Leroux, N., J.W. Pomeroy, and **K.N. Musselman** (2014), Modelling windflow over the Canadian Rockies, poster presentation at the Canadian Geophysical Union Annual Meeting, Banff, Alberta.

Musselman, K.N. and J.W. Pomeroy (2014), Complexities in seasonal snowpack development, melt rates, and hydrological partitioning across a forest-gap continuum, oral presentation at the Canadian Geophysical Union Annual Meeting, Banff, Alberta.

Musselman, K.N., J.P. Pomeroy, N. Leroux, R. Essery (2013), Uncertainty in alpine snow mass balance simulations due to snow model parameterization and windflow representation, poster presentation at American Geophysical Union Annual Fall Meeting, San Francisco, California.

Musselman, K.N., J.P. Pomeroy, N. Leroux, R. Essery (2013), Simulating snow distribution and melt in alpine and forested terrain, oral presentation at the Davos Atmosphere and Cryosphere Assembly, Davos, Switzerland.

Musselman, K.N., J.P. Pomeroy, N. Leroux, R. Essery (2013), Evaluation of alpine snow processes simulated by snow and windflow models, oral presentation at the Canadian Geophysical Union, Saskatoon, Saskatchewan.

Musselman, K.N., S.A. Margulis, and N.P. Molotch (2012), Seasonal and inter-annual snowmelt patterns in the southern Sierra Nevada, California, invited oral presentation at American Geophysical Union Fall Meeting, San Francisco, CA.

Musselman, K.N., S.A. Margulis, and N.P. Molotch (2012), Integration of airborne LiDAR data and voxel-based ray tracing to determine high-resolution solar radiation dynamics at the forest floor: implications for improving stand-scale distributed snowmelt models, oral presentation at American Geophysical Union Fall Meeting, San Francisco, CA.

Molotch, N.P., **Musselman, K.N.**, P.B. Kirchner, R.C. Bales, and P.D. Brooks (2012), Effects of forest structure on snow accumulation and melt derived from ecohydrological instrument clusters across the Western US, invited poster presented at American Geophysical Union Fall Meeting, San Francisco, CA.

Kirchner, P.B., R.C. Bales, **Musselman, K.N.**, and N.P. Molotch (2012), Under-canopy snow accumulation and ablation measured with airborne scanning LiDAR altimetry and in-situ instrumental measurements, southern Sierra Nevada, California, oral presentation at American Geophysical Union Fall Meeting, San Francisco, CA.

Musselman, K.N., N.P. Molotch, S.A. Margulis, P.B. Kirchner, and R.C. Bales (2011), Inter-annual snow accumulation and melt patterns in a sub-alpine mixed conifer forest: results from a distributed physically based snow model, poster presented at American Geophysical Union Fall Meeting, San Francisco, CA.

Kirchner, P.B.; R.C. Bales, J. Flanagan, **K.N. Musselman**, and N.P. Molotch (2011), Mountain front precipitation accumulation over a 3300 m elevation gradient from scanning LiDAR snow depth and in-situ instrumental measurements, southern Sierra Nevada, California, poster presented at American Geophysical Union Fall Meeting, San Francisco, CA.

Molotch, N.P., E. Trujillo, and **K.N. Musselman** (2011), Vegetation-snowpack feedbacks from plot to regional scales, oral presentation at Western Snow Conference Annual Meeting, Stateline, NV.

Kirchner, P.B., R.C. Bales, R.R. Rice, **K.N. Musselman**, and N.P. Molotch (2011), Measuring and modeling under-canopy snow ablation in southern Sierra Nevada subalpine red-fir forest, oral presentation at Western Snow Conference Annual Meeting, Stateline, NV.

Molotch, N.P., **K.N. Musselman**, E. Trujillo, P.D. Brooks, J.R. McConnell, and M.W. Williams (2010), Ecohydrological response to snowmelt dynamics from plot to regional scales, invited oral presentation at American Geophysical Union Fall Meeting, San Francisco, CA.

Musselman, K.N., N.P. Molotch, S.A. Margulis, M. Lehning, P.B. Kirchner, and R.C. Bales (2010), Simulating plot-scale variability of snowpack states in conifer forests using hemispherical photography and a process based one-dimensional snow model, poster presented at American Geophysical Union Fall Meeting, San Francisco, CA.

Perrot, D.O., N.P. Molotch, **K.N. Musselman**, and E.T. Pugh (2010), Modeling the effects of the mountain pine beetle on snowmelt rates in a subalpine forest, poster presented at American Geophysical Union Fall Meeting, San Francisco, CA.

Kahl, A., A. Winstral, D. Marks, J. Dozier, and **K.N. Musselman** (2010), Heterogeneity of Snow Water Equivalent Derived from MODIS Imagery and the ISNOBAL Snowmelt Model, poster presented at American Geophysical Union Fall Meeting, San Francisco, CA.

Kirchner, P.B., R.C. Bales, R. Rice, **K.N. Musselman**, and N.P. Molotch (2010), Estimating under-canopy ablation in a subalpine red-fir forest, southern Sierra Nevada, California, poster presented at American Geophysical Union Fall Meeting, San Francisco, CA.

Musselman, K.N., N.P. Molotch, and S.A. Margulis (2010) A physically-based approach to improving estimates of snow states and fluxes in a conifer forest of Sequoia National Park, poster presented at Eastern Snow Conference, Hancock, MA.

Kirchner, P.B., R.C. Bales, **K.N. Musselman**, and N.P. Molotch (2009), Multi-scale observations and modeling of the snowpack in a forested Sierra Nevada catchment, oral presentation at American Geophysical Union Fall Meeting, San Francisco, CA.

Musselman, K.N., N.P. Molotch, S.A. Margulis, P.B. Kirchner, and R.C. Bales (2009), A mechanistic approach for estimating snowpack dynamics in a conifer forest, oral presentation at American Geophysical Union Fall Meeting, San Francisco, CA.

Margulis, S.A., C. Huang, **K.N. Musselman**, and M.T. Durand (2009), Examination of the implications of snow model complexity, stratigraphy, and grain-size representation on SWE estimation via passive microwave radiance data assimilation, invited oral presentation at American Geophysical Union Fall Meeting, San Francisco, CA.

Musselman, K.N., N.P. Molotch, and S.A. Margulis (2008), Spatial, Seasonal, and Interannual Variability of Snow Accumulation Control Mechanisms in two Neighboring Alpine and Sub-alpine Catchments in California's Seasonally Snow-covered Southern Sierra Nevada; poster presentation at American Geophysical Union Fall Meeting, San Francisco, CA.

Brooks, P.D., N.P. Molotch, **K.N. Musselman**, E. Small, J. McConnell, R. Bales, and A. Rinehart (2006), The effects of forest vegetation on snow accumulation, ablation, and meltwater routing, Valles Caldera National Preserve, NM, oral Presentation at American Geophysical Union Fall Meeting, San Francisco, CA.

Musselman, K.N., B. Wemple, P. Bierman, and J. Shanley (2003), Analysis of Spatial Variability of Precipitation and Snow Accumulation on Mount Mansfield, Stowe, Vermont, poster presentation at the American Geological Society Annual Meeting, Seattle, WA.

PROFESSIONAL AFFILIATIONS &
SERVICE ACTIVITIES

Peer Reviewer

- . NASA Terrestrial Hydrology
- . NASA Applied Sciences Program
- . NSF Office of Polar Programs
- . NSF Hydrologic Sciences

Primary Session Convener, American Geophysical Union Fall Meeting (2019)

- . Blue and Green Water in the Mountains: Water Supply, Extreme Events, and Ecological Responses in Snow- and Glacier-Fed Catchments

Journal Peer Review

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| . Advances in Water Resources | . J. of Applied Met. and Climatology |
| . Agricultural and Forest Meteorology | . J. Advances Modeling Earth Systems |
| . Arctic, Antarctic, and Alpine Research | . JGR – Atmospheres |
| . Bulletin of the American Meteol. Society | . Journal of Hydrology |
| . Earth System Science Data | . Journal of Hydrometeorology |
| . Ecohydrology | . Nature Climate Change |
| . Frontiers of Earth Science | . Nature Communications |
| . Geophysical Research Letters | . Remote Sensing of Environment |
| . Hydrological Processes | . Science Advances |
| . Hydrology Research | . The Cryosphere |
| . iScience | . Water Resources Research |

Society Member:

- . American Geophysical Union (2006-present)
- . Canadian Geophysical Union (2013-2015)
- . European Geophysical Union (2017)
- . American Meteorological Society (2017)
- . USGS Rocky Mountain Hydrologic Research Center
- . Sigma Gamma Epsilon Earth Sciences Honor Society
- . Changing Cold Regions Network

Committee Member:

- . Directorate Member & Fellow, INSTAAR, CU Boulder
- . Executive Board Member, Western Snow Conference
- . NOAA CMIP6 Climate Change Task Force
- . Data Acquisition Round Table (DART) committee for the California
- . Cooperative Snow Survey (CA DWR)

FIELDWORK EXPERIENCE

- 2021 - present EcoTram: Monitoring water, energy, and vegetation productivity, Como Creek, CO
- 2019 - 2020 NASA SnowEx field campaign, Niwot Ridge, Colorado
- 2019 Snow distribution in a forested South American Catchment, Valle Hermoso, Chile
- 2019 Snowmelt pathway study, Niwot Ridge Long Term Ecological Observatory, Colorado
- 2017 NASA SnowEx field campaign, Grand Mesa, Colorado
- 2016 Photogrammetric monitoring of SNOTEL sites snow depth dynamics, Colorado
- 2013 - 2015 Terrestrial laser survey of 4-D snowpack dynamics, Rocky Mountains, Canada
- 2012 - 2015 Hydrometeorological impacts of forest clearings, Kananaskis, Alberta, Canada
- 2011 NASA Goddard grain size measurement campaign, Steamboat Springs, Colorado
- 2010 NASA JPL vegetation biomass survey, Grand Mesa, Colorado
- 2010 Basin scale variability of snow properties, Pyrenees, Spain and France
- 2007 - 2009 Plot and basin scale snow surveys, Sequoia National Park, California
- 2005 - 2006 Snow-vegetation interactions, Valles Caldera, NM
- 2002 - 2003 Precipitation gauge deployment and maintenance, Stowe, VT

INVITED TALKS

Title: Co-defining climate change refugia to inform management of mountain headwater systems; Panelist, DOE Integrated Mountainous Hydroclimate Workshop, January 2022.

Title: Investigating impacts to ecosystem services tied to declining snow water resources; DOE Watershed Function Science Community Call, January 2022.

Title: Forest impacts on snow water resources: Management and climate adaptation possibilities; USGS North Central Climate Adaptation Science Center Seminar, October 2021

Title: Winter melt trends portend widespread declines in snow water resources
Pacific Northwest Drought Early Warning System Webinar, February 2021
NOAA National Integrated Drought Information System

Title: Mountains of change: Models, measurements, theory, and Indigenous perspectives of climate change impacts in headwater basins; Earth and Atmospheric Sciences Seminar, April 2021, Cornell University, Ithaca, NY

Title: Forest impacts on snow water resources: management and climate adaptation possibilities, Geography Colloquium, April 2021, University of Colorado Boulder

Title: Snow water resources in a warmer American West; Department of Civil Engineering, July 2019, Universidad de Chile, Santiago, Chile

Title: Snow water resources in a warmer American West; Rocky Mountain Association of Professional Geologists, Fall 2018, Denver, Colorado

Title: The Feb. 2017 Oroville Dam Atmospheric River Event: the role of rain-on-snow.
Earth System Research Laboratory, Spring 2018
NOAA, Physical Sciences Division, Boulder, Colorado

Title: *The science of snow and snow-cover persistence*
Cross Country Ski Area Association, Spring 2018

Snow Mountain Ranch, Granby, Colorado

Title: *Applications in mountain and forest hydrology: Observation, models, and advances*
Engineering Hydrology CVEN 4333, Fall 2017
Dept. of Civil, Environmental & Architectural Engineering
University of Colorado, Boulder

Title: *Slower snowmelt in a warmer world: Using observations and modeling to develop a new theory of hydrologic change*
Hydrology & Water Resources Seminar, Winter 2017
Dept. of Civil, Environmental & Architectural Engineering
University of Colorado, Boulder

Title: *Slower snowmelt in a warmer world*
Geology Visiting Lecture Series, Winter 2016
University of Vermont

Title: *LiDAR: a transformative tool for hydrological sciences*
Canadian Society for Hydrological Sciences, Short Course Principles of Hydrology, 2015
University of Saskatchewan
Held in the Canadian Rockies, Alberta

Title: *Snow Measurements*
Canadian Society for Hydrological Sciences, Short Course Principles of Hydrology, 2014
University of Saskatchewan, Canadian Rockies, Alberta

Title: *Hydrology and Landscape Processes in Kananaskis*
Ecology 413: Field Ecology. Summer 2013 University of Calgary, Alberta, Canada

Title: *Snow and Forest Hydrology*
4th-year Ecology course. Spring 2013
University of Calgary, Alberta, Canada

Title: Water and the Atmosphere
Geography 1001: Climate and Vegetation. Spring 2011
University of Colorado, Boulder

Title: Physically based snow modeling
Geography 5241: Advanced Field Methods in Snow Science. Spring 2011
University of Colorado, Boulder; course held in Steamboat Springs, CO

Title: Snow Hydrology
Civil Engineering 150: Introduction to Hydrology. Fall 2009
University of California Los Angeles