
Robert Rice Jr., Ph.D.

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RESEARCH INTERESTS

Snow science, mountain hydrology, water resources, sensor networks, remote sensing, data assimilation, climate change.

EDUCATION

University of Utah Doctor of Philosophy Department of Civil and Environmental Engineering	Salt Lake City, UT June 2004
Master of Science Department of Civil and Environmental Engineering	June 1998
Hobart College Bachelor of Arts in History and Economics	Geneva, NY June, 1986

WORK EXPERIENCE

University of California, Merced School of Engineering, LPSOE SNRI, Research Scientist/Project Scientist SNRI, Postdoctoral Scholar	Merced, CA July 2012-Present June 2006-Present September 2003-June 2006
Winter Alpine Engineering Corporation President and CEO	Salt Lake City, UT June 1998-September 2003
University of Utah Graduate Research Assistant	Salt Lake City, UT September 1995-December 2002
Utah Department of Transportation Avalanche Forecast Technician	Salt Lake City, UT October 1995-May 1998
Chase/JPMorgan Credit Analyst	New York, NY July 1986-September 1988

TEACHING EXPERIENCE

University of California, Merced
Courses Developed and Taught

- Climate and Hydrology (ENVE/ESS 110)
- Field Methods in Snow Hydrology (ENVE/ESS181)

- Mountain Hydrology (ENVE 114)

University of Utah

Teaching Assistant and Guest Lecturer

- Hydrology (CVEEN 3420)
- Fluid Mechanics (CVEEN 3410)
- Snow and Avalanche Dynamics (GEOG 5260)

AWARDS AND HONORS

- University of Utah, Department of Civil Engineering Departmental Scholarship, (September 1995-June 1996).
- NASA/Langley Research Center. Graduate Research Assistant Low Speed Aerodynamics Computational Fluid Dynamics Lab. (June-September 1994).

REFEREED JOURNAL PUBLICATIONS

1. Decker, R., N. Jensen, **R. Rice**, 1997. Automated snow avalanche hazard reduction. International Conference on Debris - Flow Hazard Mitigation: Mechanics, Prediction and Assessment, 1997, published by ASCE, 530-539.
2. **Rice, R.**, R. Decker, N. Jensen, R. Patterson, S. Singer, 2000. Rural intelligent transportation system for snow avalanche detection and warning. *Transportation Research Record*, 1700:17-23.
3. **Rice, R.**, R. Decker, N. Jensen, R. Patterson, S. Singer, S. Sullivan, L. Wells, 2002. Avalanche hazard reduction for transportation corridors using real-time detection and alarms, *Cold Regions Science and Technology*, 34:31-42.
4. Decker, R., **R. Rice**, S. Putnam, S. Singer, 2003. Rural ITS natural hazard management on low volume roads, *Transportation Research Record*, 1(1819):255-259.
5. **Rice, R.**, R. Decker, 2004. Modeling waves, and short lived peak velocities and impact loads associated with snow avalanches, *Cold Regions Science and Technology*, 41: 221-233.
6. Bales, R.C., N. Molotch, T.H. Painter., **R. Rice**, J. Dozier, M. Dettinger, 2006. Mountain Hydrology of the semi-arid western United States, *Water Resources Research*, 42, W08432, doi:10.1029/2005WR004387.
7. **Rice, R.** and Roger C. Bales, Embedded sensor network design for snow cover measurements around snow pillow and snow course sites in the Sierra Nevada of California, *Water Resources Research*, VOL. 46, W03537, doi:10.1029/2008WR007318, 2010.
8. **Rice, R.**, Bales, R.C., Painter, T.H., J. Dozier, Snow cover along elevation gradients in the upper Merced and Tuolumne river basins of the Sierra Nevada. *Wat. Resour. Res.*, 47, W08515, doi:10.1029/2010WR009278, 2011.
9. Meromy, L., N.P. Molotch, T.E. Link, S.R. Fassnacht, **R. Rice**, 2012, Subgrid variability of snow water equivalent at operational snow stations in the western United States, *Hydrol. Processes*, doi: 10.1002/hyp.

IN REVIEW

1. Welch, S.C., B. Kerkez, R.C. Bales, S.D. Glaser, K. Rittger, R. Rice, 2012, Sensor placement strategies for SWE estimation in the American River basin, *in review*.

IN PREPARATION

1. **R. Rice**, R.C. Bales, P. Kirchner, T.H. Painter, K. Rittger, J. Dozier, 2012. Canopy-adjustment of the MODIS fractional snow covered area in forest catchments in the Sierra Nevada, *Remote Sensing of the Environment*.
2. Mizukami, N, **R. Rice**, R. Decker, 2012. Modeling of snow water equivalent distribution in meso-scale mountainous environments, *Journal of Hydrology*.
3. R. Decker, **R. Rice**, 2012. Unsteady hydraulic analogs to model waves, and short lived peak velocities and peak impact loads associated with snow avalanches, *Journal of Multi-phase Flows*.

CONFERENCE PRESENTATIONS AND INVITED TALKS

1. **Rice, R.**, R. Decker, R.W. Shorthill, 1994. Modal analysis: a dynamic ski test. *In Proceedings of International Snow Science Workshop*, Snowbird, Utah, 606-616.
2. Shorthill, R.W., R. Decker, **R. Rice**, 1995. Modal analysis of segmented, laminated, anisotropic, inhomogeneous, beams. *Proceedings of IEEE Conference on Aerospace Structures*, Snowmass, CO.
3. **Rice, R.**, D. Howlett, R. Decker, 1996. Preliminary investigations of a glide/creep motion sensor in Alta, Utah. *Proceedings of International Snow Science Workshop*, Banff, Alberta Canada, 189-194.
4. Decker, R., N. Jensen, R. Patterson, **R. Rice**. A rural ITS system for knowledge based avalanche hazard management. *International Rural ITS Conference*. University Park, PA, 1998.
5. **Rice, R.**, R. Decker, 2000. A rural ITS snow avalanche detection and alarm system. *Transportation Research Board Annual Meeting*, Washington, D.C., January, 2000.
6. Decker, R., R. Patterson, G. Merrill, **R. Rice**, L. Wells, 2000. Adapting KIolkalfen for avalanche hazard reduction at the Milepost 151 avalanche, Jackson, Wyoming, USA. *International Glaciological Society, International Symposium on Snow, Avalanches and Impact of the Forest Cover*, Innsbruck, Austria, May, 2000.
7. **Rice, R.**, R. Decker, N. Jensen, R. Patterson, S. Singer, C. Sullivan, L. Wells, 2000. Avalanche hazard reduction for transportation corridors using real-time detection and alarms, *International Glaciological Society International Symposium on Snow, Avalanches and Impact of the Forest Cover*, Innsbruck, Austria, May, 2000.
8. **Rice, R.**, R. Decker, 2004. Using unsteady hydraulic analogs to model waves, and short lived peak velocities and peak impact loads associated with snow avalanches. *International Symposium on Snow and Avalanches*, Davos, Switzerland, 2-6 June 2003.
9. Decker, R., **R. Rice**, L. Wells, J. Yount, 2004. Avalanche Hazard Reduction on USR 89/191 (Jackson, Wyoming) using Snow Sails. *5th International conference on Snow Engineering*, Davos, Switzerland, July, 2004.
10. Yount, J., R. Decker., **R. Rice**, L. Wells, 2004. Reducing avalanche hazard to US route 89/91 in Jackson Wyoming using snow sails, *Proceedings of the International Snow Science Workshop*, Jackson Hole, WY, 705-710.
11. **Rice, R.**, R. Patterson, S. Putnam, R. Decker., T. Wells, J. Yount, G. Richards, O. Garber, O. D. Sly, M. Bee, 2004. Avalanche Hazard Reduction using the Avalanche Guard, a Cache and Mortar Technology. *Proceedings of the International Snow Science Workshop*, Jackson Hole, WY, 688-695.
12. Bales, R. C., J. Dozier, J. Famiglietti, G. Fogg, J. Hopmans, J. Kirchner, T. Meixner, N. P. Molotch, K. Redmond, **R. Rice**, J. Sickman, and J. Warwick, 2004. Plan for a Sierra Nevada hydrologic observatory: science aims, measurement priorities, research

- opportunities and expected impacts, *Eos, Transactions American Geophysical Union*, 85(47), Fall Meeting Supplement, Abstract H31C-0399.
13. Bales, R. C., J. Dozier, N. P. Molotch, T. H. Painter, and **R. Rice**, 2004. Mountain hydrology of the semi-arid western U.S.: research needs, opportunities and challenges, *Eos, Transactions American Geophysical Union*, 85(47), Fall Meeting Supplement, Abstract U51A-04.
 14. **Rice, R.**, and R. C. Bales, 2004. Catchment scale study of the spatial variability of snow depths: implications for broader long-term snow monitoring and measurement designs, *Eos, Transactions American Geophysical Union*, 85(47), Fall Meeting Supplement, Abstract C31A-0289.
 15. **Rice, R.**, R.C. Bales, K. Delin, S. Jackson, 2005. Sensor Web technology: implications for a network design in an alpine environment of the Sierra Nevada Mountains of California, *Eos, Transactions American Geophysical Union*, 86(52): Fall Supplement, Abstract IN21B-1180.
 16. **Rice, R.**, T.H. Painter, R.C. Bales, 2006. Integration of the MODIS snow cover products into snowmelt runoff modeling. *Proceedings of the Western Snow Conference*, Las Cruces, New Mexico, 55-56.
 17. **Rice, R.**, 2006. Snow measurement and distribution research, California Cooperative Surveys 52nd Annual Meeting of Cooperators, Monterrey, CA.
 18. Bouffon, T., **R. Rice**, R.C. Bales, 2006. Spatial properties of snowcover in the Upper Merced River Basin: implications for a distributed snow measurement network, *Eos, Transactions American Geophysical Union*, 87(52): Fall Supplement, Abstract C21C-1172.
 19. **Rice, R.**, R.C. Bales, T.H. Painter, 2006. Estimating the spatial distribution of snow properties in the Sierra Nevada, California basins using MODIS fractional snowcover products, *Eos, Transactions American Geophysical Union*, 87(52): Fall Supplement, Abstract C21A-1134.
 20. Liu, F., M.H. Conklin, G. Shaw, R.C. Bales, M.E. Conrad, **R. Rice**, 2006. Processes Controlling Baseflow and Climatic Warming Effects in Merced River, Sierra Nevada, California, *Eos, Transactions American Geophysical Union*, 87(52): Fall Supplement, Abstract H43E-0547.
 21. **Rice, R.**, R.C. Bales., T.H. Painter, J. Dozier, 2007. Snowcover along elevation gradients in the Upper Merced and Tuolumne river basins of the Sierra Nevada of California from MODIS and blended ground data, *Proceedings of the Western Snow Conference*, Kailua-Kona, Hawaii, 3-14. [Best paper award]
 22. **R. Rice**, R.C. Bales, T.H. Painter, J. Dozier, M.L. Anderson, 2007. Snowcover along elevation gradients in the Sierra Nevada of California from MODIS and blended ground data, California Energy Commission 4th Annual Climate Change Conference, Sacramento California, September.
 23. **Rice, R.**, 2007. California water, mountain hydrology, and UC Merced, California Air Resource Board Annual Meeting, Merced, CA.
 24. **R. Rice**, N.P. Molotch, R.C. Bales, 2007. Embedded sensor network design for spatial snowcover, *Eos, Transactions American Geophysical Union*, 88(52): Fall Supplement, Abstract C21B-0460.
 25. Dozier, J., J.S. Famiglietti, **R. Rice**, N.P. Molotch, K. Ritterger, T.H. Painter, R.C. Bales, 2007. Analysis of the Sierra Nevada Snowpack in the 21st Century, *Eos, Transactions American Geophysical Union*, 88(52): Fall Supplement, Abstract C33A-01.
 26. Kirchner, P., **R. Rice**, F. Liu, 2007. Stream Flow Contributions of Rock Glaciers in the Southern Sierra Nevada Mountains of California, *Eos, Transactions American Geophysical Union*, 88(52): Fall Supplement, Abstract C41A-0048.

27. **Rice, R.**, R.C.Bales, 2008. Embedded sensor network design for spatial snow cover, 2008 Western Snow Conference, Hood River, Oregon.
28. **Rice, R.**, 2008. Climate Change Impacts on Floodplain Management – Scientific Assessment, *Floodplain Management Association Annual Conference*, September 2-5, San Diego, CA.
29. **Rice, R.**, R.C. Bales, 2008. Ground-based measurements and the robust coupling of remotely sensed measurements and hydrologic models: California's Sierra Nevada, *International Workshop on Microwave Remote Sensing for Land Hydrology: Research and Applications*, Oxnard, CA., October 20-22.
30. Bales, R.C., **R. Rice**, 2008. Blended satellite and ground-based snow products for hydrologic predictions in mountain basins, American Geophysical Union Fall Meeting, *Abstract, H31J-04*
31. Molotch, N.P., T.Link, S.R. Fassnacht, E. Herchmer, L. Meromy, S. Roberts, **R. Rice**, 2008. Determining subgrid variability in snow water equivalent surrounding operational snow stations of the Western U.S., *American Geophysical Union*, Abstract C21A-0501.
32. **Rice, R.**, R.C. Bales, M.W. Meadows, B. Kerkez, S.D. Galser, M. Anderson, D.G. Marks, A. Mazurkiewicz, J. Dozier, B.J. McGurk, 2009, Design and implementation of a snow measurement network using ground-based wireless networks and space-bore measurements in the American River Basin of California, *American Geophysical Union*, Abstract C33A-0504.
33. Bales R.C., **R. Rice**, K. Rittger, T.H. Painter, 2009, Trends in Sierra Nevada snowmelt based on 10 years of MODIS fractional snow covered area data: the apparent and the missing, *American Geophysical Union*, Abstract C23D-02
34. **Rice, R.**, R.C. Bales, P. Kirchner, K., Rittger, T.H. Painter, 2010. Canopy-adjustment of the MODIS fractional snow covered area in forest catchments in the Sierra Nevada, *LAHS Remote Sensing and Hydrology*, Jackson Hole, WY, September 27-30.
35. Kerkez, B., **R. Rice**, S.D.Glaser; R.C. Bales; P.C. Saksa, 2010, Design and development of a wireless sensor network to monitor snow depth in multiple catchments in the American River basin, California: hardware selection and sensor placement techniques, American Geophysical Union, Abstract IN34A-07.
36. Welch, S.C., B. Kerkez, S.D. Glaser, R.C. Bales, **R. Rice**, 2011 Estimating Snow Water Equivalent over the American River in the Sierra Nevada Basin Using Wireless Sensor Networks, *American Geophysical Union*, Abstract IN32A-07.

SPONSORED RESEARCH PROJECTS

1. Idaho Transportation Department, Winter Access and Snowpack Stability Evaluations in the Avalanche Starting Zones of Canyon Creek (Idaho SH 21), (PI: Rice, 1 mo., \$1.2K, 1998). **COMPLETED.**
2. Colorado Department of Transportation, On-Site Investigation of Seven Sisters Avalanche Paths on Loveland Pass, (PI: Rice, 2 mos., \$2.5K, 1999). **COMPLETED.**
3. Wyoming Department of Transportation, Automation of the West Teton Pass Avalanche Closure Gate, (PI: Rice, \$50K, 1999-2001). **COMPLETED.**
4. Wyoming Department of Transportation, Avalanche Hazard Reduction using the Doppelmayer Avalanche Blaster, Cache and Mortar Technology (PI: Rice, \$140K, 2002-2004). **COMPLETED.**
5. Consortium of Universities for the Advancement of the Hydrologic Sciences (CUASHI) Travel Grant for Position Paper, *Mountain Hydrology of the Semi-Arid Mountain West*. Roger C. Bales (UC, Merced), Jeff Dozier (UCSB), Noah Molotch (CIRES-now at JPL), Thomas H.

Painter (NSIDC-now at U. Utah), and **Robert Rice** (UC, Merced). Amount: \$5,000. **COMPLETED.**

6. California Department of Water Resources, Remote sensing of snow using the MODIS snow products, (PI: Rice, \$45K). **COMPLETED.**
7. National Science Foundation, Hydrological Sciences, Quantifying Controls on Snow Distribution in the Sierra Nevada Using Ground-Based and Remotely Sensed Observations Within an Ensemble Kalman Smoother, (PI: Molotch, Co-PI: Rice, \$300K, 3-years). **COMPLETED.**
8. National Park Service, An Assessment of Snowcover in Major River Basins of Sierra Nevada Network Parks and Potential Approaches for Long-term Monitoring (PI: Bales, Co-PI: Rice, \$40K, 1-year). **COMPLETED.**
9. California Department of Water Resources, Improvement of Measurements of Seasonal Snowpack, (PI: Bales, Co-PI: Rice, \$200K, 2-years). **CURRENT.**
10. National Science Foundation: *Development of a Basin-scale Water-balance Instrument Cluster for Hydrology, Ecosystem Science and Water Resources* (PI: R.Bales, Co-PI's: M. Conklin, D. Marks, R. Rice, S. Glaser , \$1,995,156, 4-years). **CURRENT.**

PROFESSIONAL AFFILIATIONS AND SERVICE ACTIVITIES

- Society Member: American Geophysical Union (AGU), American Meteorological Society (AMS), American Avalanche Association (Professional Member).
- Manuscript Reviewer: Water Resource Research, Journal of Hydrometeorology, Journal of Hydrologic Engineering, Geophysical Research Letters, Climatic Change, Journal of Hydrology
- Proposal Reviewer: NSF, NASA, NOAA