

# ANDREW BENNETT

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## CONTACT

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## EDUCATION

**University of Washington** **Sept. 2016 - Mar. 2021**  
*Ph.D. - Department of Civil and Environmental Engineering*  
*Hydrology and hydrodynamics, Advisor: Bart Nijssen*

**University of Wisconsin, La Crosse** **Sept. 2008 - May 2013**  
*Bachelor of Science - Physics and Mathematics*

## PROFESSIONAL EXPERIENCE

**University of Arizona** **Sept. 2021 - Present**  
*Postdoctoral Research Associate - Department of Hydrology and Atmospheric Sciences*

**University of Washington** **Apr. 2021 - Sept. 2021**  
*Research Scientist - Department of Civil and Environmental Engineering*

**Oak Ridge National Laboratory** **Oct. 2013 to Aug. 2016**  
*Research Associate - Computer Science and Mathematics Division*

**University of Wisconsin, La Crosse** **Jan. 2012 to May 2013.**  
*Physics Tutor*

## STUDENT MENTORING

**Peter Sumner** JISAO Summer Intern **Summer 2017**  
Project: Google Earth Analysis of Soil Moisture  
and Landslide Risk in the Pacific Northwest

**Tushar Khurana** Undergraduate Research Assistant **Fall 2018**  
Project: Information Theoretic Analysis of Hydrological Land Surface Models

**Adi Stein** Undergraduate Research Assistant **Spring 2019- Summer 2021**  
Project: Developing spatially-consistent and process-aware  
bias-correction methods for streamflow simulations

## TEACHING EXPERIENCE & PUBLIC LECTURES

**Workshop speaker** Knowledge Guided Machine Learning Workshop **Summer 2021**  
Embedding neural networks to simulate turbulent heat  
fluxes in a process-based hydrologic modeling framework

**Seminar** University of Arizona TRIPODS Seminar **Spring 2021**  
Embedding neural networks into physics-based hydrologic models

**Seminar** University of Washington Data Science Seminar **Winter 2020**  
Embedding neural networks into large Earth systems models

**Guest lecturer** University of Saskatchewan GEOG 825 **Fall 2020**  
Meteorologic Forcing Data

**Public speaker** Puget Sound Programming Python Meetup  
Algorithms, information and the environment

**Winter 2019**

**Workshop instructor** WaterHackWeek  
MetSim: A python library for meteorological data simulation

**Spring 2019**

**Excercise development** CUAHSI Virtual Snow Modeling  
Snow modeling with SUMMA

**Fall 2019**

AWARDS &  
HONORS

<b>AGU Outstanding Student Presentation Award</b>	<b>2020</b>
<b>EGU Outstanding Student Poster and Pico Award</b>	<b>2019</b>
<b>COMAP Mathematical Contest in Modeling Honorable Mention</b>	<b>2013</b>

SERVICE

**Reviewer**

- Water Resources Resources
- Geophysical Research Letters
- Journal of Hydrology
- Journal of Advances in Modeling Earth Systems
- Journal of Open Source Software
- Stochastic Environmental Research and Risk Assessment

SOFTWARE &  
TECHNICAL  
SKILLS

**Programming Languages:**

Bash, Fortran, Python, Java, Javascript, Julia, R, LaTeX

**Technologies:**

git, NetCDF, HPC systems, Python packaging (pypi, conda), automake, pytorch, tensorflow

**Model Development Experience:**

- **SUMMA**: <https://github.com/NCAR/summa>
- **pysumma**: <https://github.com/UW-Hydro/pysumma>
- **bmorph**: <https://github.com/UW-Hydro/bmorph>
- **MetSim**: <https://github.com/UW-Hydro/MetSim>
- **LIVVkit**: <https://github.com/LIVVkit/LIVVkit>
- **Eclipse ICE**: <https://gitlab.eclipse.org/eclipse/ice/ice>

PUBLICATIONS

**Bennett, Andrew**, Adi Stein, Yifan Cheng, Bart Nijssen, and Marketa McGuire. “A process-conditioned and spatially consistent method for reducing systematic biases in modeled streamflow”. *Journal of Hydrometeorology* in review (2021).

Lumbrazo, Cassie, **Andrew Bennett**, William Currier, Bart Nijssen, and Jessica Lundquist. “Evaluating multiple canopy-snow unloading parameterizations in SUMMA with time-lapse photography characterized by citizen scientists”. *Water Resources Research* in review (2021).

Van Beusekom, Ashley, Lauren E. Hay, **Andrew R. Bennett**, Young-Don Choi, Martyn P. Clark, Jon L. Goodall, Zhiyu Li, Iman Maghami, Bart Nijssen, and Andrew W. Wood. “Hydrologic Model Sensitivity to Temporal Disaggregation of Meteorological Forcing Data: a Case Study for the Contiguous USA”. *Journal of Hydrometeorology* accepted (2021).

**Bennett, Andrew** and Bart Nijssen. “Explainable AI uncovers how neural networks learn to regionalize in simulations of turbulent heat fluxes at FluxNet sites”. *Water Resources Research* in revision (2021).

Cristea, Nicoleta, **Andrew Bennett**, Bart Nijssen, and Jessica Ludquist. “Models with multiple snow layers are essential to improve snow predictions in current and future climate”. *Water Resources Research* in revision (2021).

**Bennett, Andrew** and Bart Nijssen. “Deep Learned Process Parameterizations Provide Better Representations of Turbulent Heat Fluxes in Hydrologic Models”. *Water Resources Research* 57.5 (2021).

Clark, Martyn P., Reza Zolfaghari, Kevin R. Green, Sean Trim, Wouter J. M. Knoben, **Andrew Bennett**, Bart Nijssen, Andrew Ireson, and Raymond J. Spiteri. “The numerical implementation of land models: Problem formulation and laugh tests”. *Journal of Hydrometeorology* (2021).

Choi, Young-Don, Jonathan L. Goodall, Jeffrey M. Sadler, Anthony M. Castronova, **Andrew Bennett**, et al. “Toward Open and Reproducible Environmental Modeling by Integrating Online Data Repositories, Computational Environments, and Model Application Programming Interfaces”. *Environmental Modelling & Software* (2020).

Nearing, Grey S, Benjamin L Ruddell, **Andrew R Bennett**, Cristina Prieto, and Hoshin V Gupta. “Does Information Theory Provide a New Paradigm for Earth Science? Hypothesis Testing”. *Water Resources Research* 56.2 (2020).

**Bennett, Andrew R.**, Joseph J. Hamman, and Bart Nijssen. “MetSim: A Python package for estimation and disaggregation of meteorological data”. *Journal of Open Source Software* 5.47 (2020).

Lipscomb, William H, Stephen F Price, Matthew J Hoffman, Gunter R Leguy, **Andrew R Bennett**, Sarah L Bradley, Katherine J Evans, Jeremy G Fyke, Joseph H Kennedy, Mauro Perego, et al. “Description and evaluation of the Community Ice Sheet Model (CISM) v2. 1”. *Geoscientific Model Development* 12.1 (2019).

**Bennett, Andrew**, Bart Nijssen, Gengxin Ou, Martyn Clark, and Grey Nearing. “Quantifying Process Connectivity With Transfer Entropy in Hydrologic Models”. *Water Resources Research* 55.6 (2019).

Evans, Katherine J, Joseph H Kennedy, Dan Lu, Mary M Forrester, Stephen Price, Jeremy Fyke, **Andrew R Bennett**, Matthew J Hoffman, Irina Tezaur, Charles S Zender, et al. “LIVVkit 2.1: automated and extensible ice sheet model validation”. *Geoscientific Model Development* 12.3 (2019).

Billings, Jay Jay, **Andrew R Bennett**, Jordan Deyton, Kasper Gammeltoft, Jonah Graham, Dasha Gorin, Hari Krishnan, Menghan Li, Alexander J McCaskey, Taylor Patterson, et al. “The eclipse integrated computational environment”. *SoftwareX* 7 (2018).

Kennedy, Joseph H, **Andrew R Bennett**, Katherine J Evans, Stephen Price, Matthew Hoffman, William H Lipscomb, Jeremy Fyke, Lauren Vargo, Adrianna Boghozian, Matthew Norman, et al. “LIVVkit: An extensible, python-based, land ice verification and validation toolkit for ice sheet models”. *Journal of Advances in Modeling Earth Systems* 9.2 (2017).

SELECTED  
CONFERENCE  
PRESENTATIONS

**Bennett, A.** and B. Nijssen. “Searching for new physics: Using explainable AI to understand deep learned parameterizations of turbulent heat fluxes”. *EGU General Assembly*. 2021.

**Bennett, A.** and B. Nijssen. “A coupled approach to incorporating deep learning into process-based hydrologic modeling”. *AGU Fall Meeting 2020*. 2020.

**Bennett, A.** and B. Nijssen. “Hard to measure, hard to model: Using information theory to understand turbulent heat fluxes (invited)”. *EGU General Assembly 2020*. 2020.

**Bennett, A.**, B. Nijssen, Y. Cheng, A. Stein, and M. McGuire. “Post-processing Hydrologic Model Output for Water Resources Studies: A Spatially-consistent, Process-based Correction Method”. *EGU General Assembly 2020*. 2020.

**Bennett, A.**, J. Lundquist, J. Hamman, and B. Nijssen. “Leveraging Open Source Platforms to Foster Computational Thinking”. *University of Washington Teaching and Learning Symposium*. 2020.

**Bennett, Andrew**, B. Nijssen, and G.S. Nearing. “Dynamic process connectivity for model diagnostics, evaluation, and intercomparison”. *AGU Fall Meeting*. 2019.

**Bennett, A.**, B. Nijssen, G.S. Nearing, and M.P. Clark. “A process network based approach to model intercomparison using SUMMA ensembles”. *EGU General Assembly*. 2019.

**Bennett, A.**, B. Nijssen, G.S. Nearing, and M.P. Clark. “Information theoretic fingerprinting of hydrologic Models”. *AGU Fall Meeting*. 2018.

**Bennett, A.**, B. Nijssen, and M.P. Clark. “Fingerprinting hydrologic models by identifying coupling structures”. *SIAM Mathematics of Planet Earth*. Invited talk. 2018.

**Bennett, A.**, B. Nijssen, O. Chegwidan, A. Wood, and M.P. Clark. “What Makes Hydrologic Models Differ? Using SUMMA to Systematically Explore Model Uncertainty and Error”. *AGU Fall Meeting*. 2017.