

Siwei He, Ph.D.

Assistant Professor

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Affiliations: Civil Engineering Department, Montana State University

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Education

- 09/2014 - 05/2018 Ph.D., *Hydrologic Science*, Department of Civil and Environmental Engineering, University of Wyoming, Laramie, USA
◊ *Dissertation: Toward Physically-Based Modeling of Snow Sub-grid Variability*
- 09/2010 - 06/2013 M.E., *Hydrology and Water Resources Engineering*, Department of Civil and Environmental Engineering, Sichuan University, Chengdu, China
◊ *Thesis: Meteorological Forcing Data Evaluation and Water Heat Processes Simulation over the Upstream Area of the Heihe River Basin*
- 09/2006 - 06/2010 B.E., *Hydraulic and Hydro-power Engineering*, Department of Civil and Environmental Engineering, Xi'an University of Technology, Xi'an, China
- 09/2011 - 03/2013 Visiting student, Northwest Institute of Eco-environment and Resources, Chinese Academy of Sciences, Lanzhou, China

Research Interests

Hydrological/land-surface modeling, land-atmosphere interactions, spatio-temporal high-resolution observations, snow hydrology, wildfire impacts

Research Experience

- 08/2023 - present **Assistant Professor** at Montana State University, Bozeman, USA
◊ *Teaching graduate and undergraduate level courses on water resources and hydrology.*
◊ *Conducting research on mountain hydrology, land-atmosphere interactions, sustainability and resilience,*
- 03/2020 - 08/2023 **Research Scientist (I, then II)** at the University of Colorado Boulder and the National Oceanic and Atmospheric Administration (NOAA) Global System Laboratory, Boulder, USA
◊ *Studied wildfire impacts on hydrological processes and numerical weather prediction.*
◊ *Evaluated performance of the weather prediction models in simulated near-surface meteorologic variables*
◊ *Investigated land-atmosphere interactions during the afternoon to evening transition period.*
- 10/2020 - 07/2022 **Visiting Scientist** at National Center for Atmospheric Research (NCAR), Boulder, USA
◊ *Tested NOAA next-generation weather forecast system, Unified Forecast System (UFS).*
- 08/2018 - 02/2020 **National Research Council (NRC) Research Associate** with Dr. Stanley Benjamin and Dr. Tatiana Smirnova at the NOAA Global System Laboratory, Boulder, USA
◊ *Coupled spatial heterogeneity snow model with the weather systems Rapid Refresh (RAP) and High-Resolution Rapid Refresh (HRRR).*
- 09/2014 - 05/2018 **Research Assistant** with Dr. Noriaki Ohara at the University of Wyoming, Laramie, USA
◊ *Developed a stochastic model to represent spatial heterogeneity of snow.*
◊ *Conducted field work to collect data and install in-situ equipments and sensors.*
◊ *Applied a coupled groundwater and surface-water flow model in a watershed.*
◊ **Fieldwork** of regular snow survey and installing In-Site sensors for monitoring groundwater and surface water.
- 06/2017 - 07/2017 **Summer Institute Student Research Fellow** with Dr. Fred Ogden at the NOAA National Water Center, Tuscaloosa, USA
◊ *Compared the coarse and high-resolution hydrological modeling over a mountainous area.*
- 07/2011 - 07/2014 **Research Assistant** with Dr. Zhuotong Nan at the Northwest Institute of Eco-environment and Resources, Chinese Academy of Sciences, Lanzhou, China
◊ *Applied hydrological models over a cold and arid mountainous area.*

- ◇ *Participated field campaign at the Qinghai-Tibet plateau to measure permafrost distribution using geophysics techniques.*
- ◇ ***Fieldwork** of measuring permafrost using geophysical methods on the Qinghai-Tibet Plateau.*

Fellowships and Grants

1. PI, \$293,492. **National Science Foundation (NSF)** EPSCoR Research Fellows: Enhancing Rain-on-Snow Flood Forecasting through Advancing Hydrologic Modeling. Jan 2025 - Dec 2026.
2. PI, ≈\$25,000. **Developmental Testbed Center** Visitor Program: Evaluating snow and soil simulations in the unified forecast system (UFS) short-range weather system. Jun 2024 - May 2025.
3. PI, \$4,137. **Montana State University** Center for Faculty Excellence: Traveling to Michigan State University to Collaborate on Building Resilient and Sustainable Communities from a Water Resources Perspective.
4. PI, \$10,000. **Montana State University Norm Asbjornson College of Engineering (NACOE)** Thorson Excellence in Engineering Research (TEER): Exploring the spatial and temporal connections of snowpack, soil moisture, and runoff across the plains of Montana. Jun 2024 - Oct 2024.
5. Co-I, \$270,000. **Department of Energy (DOE)** Atmospheric Systems Research Program: Characterizing Boundary Layer Processes During Transition Periods With Observations and Modeling.
6. PI, \$75,000. **NOAA Global Systems Laboratory** Director's Directed Research Funds: Quantify the impact of wildfire on the land-surface biogeophysical properties and weather prediction. May 2022 - April 2023.
7. **National Research Council Research Fellowship**: Improving the Rapid Update Cycle Land Surface Model (RUC LSM) Performance through Considering the Sub-grid Variability of Snow. August 2018 - February 2020.

Mentoring Experience

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| 01/2024 - present | Advisor of two graduate and one undergraduate students at Montana State University. |
| 05/2022 - 12/2022 | Mentor of a post-doc in the Postdoc Peer Mentoring Program at the University of Colorado Boulder. |
| 05/2022 - 08/2022 | Mentor of a graduate student in the CIRES/GSL NOAA Summer Research Program at NOAA GSL. |

Teaching Experience

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| 01/2024 - present | Instructor at Montana State University, Bozeman, USA.
<i>ECIV231: Introduction to Engineering Hydrology.</i> |
| 01/2018 - 05/2018 | Teaching Assistant at the University of Wyoming, Laramie, USA.
<i>A junior level course in civil engineering: host office hours, lab instructor, and grade assignments.</i> |

Publications

1. Corrie, Timothy D, Bart Geerts, Tatiana G Smirnova, Stanley G Benjamin, Michael Charnick, Matthew Brothers, Siwei He, Zachary J Lebo, and Eric P James, (2024). Representation of Blowing Snow and Associated Visibility Reduction in an Operational High-Resolution Weather Model. Weather and Forecasting. DOI: 10.1175/WAF-D-23-0195.1.
2. He, Siwei, David D. Turner, Stanley G. Benjamin, Joseph B. Olson, Tatiana G. Smirnova, and Tilden Meyers, (2023). Evaluation of the near-surface variables in the HRRR using observations from the ARM SGP site. Journal of Applied Meteorology and Climatology. DOI: 10.1175/JAMC-D-23-0003.1.
3. Benjamin, Stanley G, Tatiana G Smirnova, Eric P James, Liao-Fan Lin, Ming Hu, David D Turner, and Siwei He, (2022). Land-Snow Data Assimilation Including a Moderately Coupled Initialization Method Applied to NWP. Journal of Hydrometeorology 23(6), 825–845. DOI: 10.1175/JHM-D-21-0198.1.

4. Ohara, Noriaki, Siwei He, Andrew D Parsekian, Benjamin M Jones, Rodrigo C Rangel, Ian O Nichols, and Kenneth M Hinkel, (2022). Spatial Snowdrift Modeling for an Open Natural Terrain using a Physically-based Linear Particle Distribution Equation. *Hydrological Processes* 36(1), e14468. DOI: 10.1002/hyp.14468.
5. He, Siwei, Tatiana G Smirnova, and Stanley G Benjamin, (2021). Single-Column Validation of a Snow Subgrid Parameterization in the Rapid Update Cycle Land-Surface Model (RUC LSM). *Water Resources Research* 57(8), e2021WR029955. DOI: 10.1029/2021WR029955.
6. He, Siwei and Noriaki Ohara, (2019). Modeling Subgrid Variability of Snow Depth Using the Fokker-Planck Equation Approach. *Water Resources Research* 55(4), 3137–3155. DOI: 10.1029/2017WR022017.
7. He, Siwei, Noriaki Ohara, and Scott N Miller, (2019). Understanding subgrid variability of snow depth at 1-km scale using Lidar measurements. *Hydrological Processes* 33(11), 1525–1537. DOI: 10.1002/hyp.13415.
8. He, Siwei, Tatiana G Smirnova, and Stanley G Benjamin, (2019). A scale-aware parameterization for estimating subgrid variability of downward solar radiation using high-resolution digital elevation model data. *Journal of Geophysical Research: Atmospheres* 124, 13680–13692. DOI: 10.1029/2019JD031563.
9. He, Siwei and Noriaki Ohara, (2017). A New Formula for Estimating the Threshold Wind Speed for Snow Movement. *Journal of Advances in Modeling Earth Systems* 9(7), 2514–2525. DOI: 10.1002/2017MS000982.
10. He, Siwei, Zhuotong Nan, and Yuting Hou, (2015). Accuracy evaluation of two precipitation datasets over upper reach of Heihe River Basin, north-western China. *Sciences in Cold and Arid Regions* 7(2), 157–169.
11. He, Siwei, Zhuotong Nan, Ling Zhang, and Wenjun Yu, (2015). Modeling spatial-temporal distribution of water and energy fluxes in the upper reaches of the Heihe River simulated with VIC model. *Journal of Glaciology and Geocryology* 37(1). (in Chinese), 211–225.
12. He, Siwei and Zhuotong Nan, (2013). Application of rank set pair method to predict groundwater dynamics. *Journal of Sichuan University: Engineering Science Edition* 45(S2). (in Chinese), 211–225.
13. He, Siwei, Zhuotong Nan, Shugong Wang, and Yongjian Ding, (2012). Application and comparative analysis of four conceptual hydrological models over the upper reach of Heihe River Basin. *Journal of China Hydrology* 32(3). (in Chinese), 13–19.

Presentations

1. He, Siwei, (2023). Modeling subgrid variability of the land-surface properties: potential solutions to snow distribution and downward shortwave radiation. Invited. Canmore, Canada: University of Saskatchewan.
2. He, Siwei, Tatiana G. Smirnova, Stanley G Benjamin, Joseph B. Olson, and Dave D. Turner, (2022). Quantify the impact of wildfire on the land-surface biogeophysical properties and numerical weather prediction. In: AGU Fall Meeting. Chicago, IL.
3. He, Siwei, Dave D. Turner, Tatiana G. Smirnova, Stanley G Benjamin, and Joseph B. Olson, (2022). Quantifying the contributions from the surface, advection, and entrainment on the evening transition at SGP. In: ARM/ASR Joint Meeting. Rockville, MD.
4. He, Siwei, Dave D. Turner, Tatiana G. Smirnova, Stanley G Benjamin, and Joseph B. Olson, (2021). Evaluation of the near-surface variables in the HRRR forecast model using observations from the ARM SGP sites. In: AGU Fall Meeting. New Orleans, LA.
5. He, Siwei, (2020). A physically-based subgrid snow model and its effects on the performances of land surface models. Invited. Boulder, CO: National Center for Atmospheric Research (NCAR).
6. He, Siwei, (2020). Subgrid variability of snow and its simulation in hydrologic models. Invited. Wuhan, China: Hubei University of Technology.
7. He, Siwei, Tatiana G. Smirnova, and Stanley G Benjamin, (2019). A scale-aware parameterization for estimating subgrid variability of downward solar radiation using high-resolution Digital Elevation Model data. In: AGU Fall Meeting. San Francisco, CA.
8. He, Siwei, Tatiana G. Smirnova, and Stanley G Benjamin, (2019). Integrating the Fokker-Planck approach for sub-grid variability of snow depth into the RUC land-surface model: Preliminary results from off-line ESM-SnowMIP site simulations. In: AMS Annual Meeting. Phoenix, AZ.

9. He, Siwei, Tatiana G. Smirnova, and Stanley G Benjamin, (2019). Integrating the Fokker-Planck Equation (FPE) subgrid snow model into the Rapid Refresh (RAP) weather prediction system to address snow heterogeneity in surface-atmosphere interactions. In: AGU Fall Meeting. San Francisco, CA.
10. He, Siwei, Tatiana G. Smirnova, Stanley G Benjamin, and Georg Grell, (2018). Integrating the Fokker-Planck approach for sub-grid variability of snow depth into the RUC land-surface model: Preliminary results from off-line ESM-SnowMIP site simulations. In: AGU Fall Meeting. Washington, DC.
11. Garousi-Nejad, Irene, Siwei He, Qicheng Tang, Fred Ogden, and ..., (2017). A Study on the Effects of Spatial Scale on Snow Process in Hyper-Resolution Hydrological Modelling over Mountainous Areas. In: AGU Fall Meeting. New Orleans, LA.
12. He, Siwei and Noriaki Ohara, (2016). A physical based formula for calculating the critical stress of snow movement. In: AGU Fall Meeting. San Francisco, CA.
13. He, Siwei and Noriaki Ohara, (2015). Modeling of sub-grid variability for snow redistribution and ablation processes using Fokker-Planck Equation. In: AGU Fall Meeting. San Francisco, CA.

Technical Reports

1. Chang, Jason, Irene Garousi-Nejad, Lauren Grimley, Siwei He, Mariam Khanam, Tyler Madsen, and ..., (2017). ADHydro Introduction and Workflow. Tech. rep. Tuscaloosa: National Water Center, NOAA, pp. 6–13. DOI: 10.4211/technical.20171009.
2. Garousi-Nejad, Irene, Siwei He, and Qicheng Tang, (2017). Comparison of coarse and high-resolution hydrologic modeling in mountainous area. Tech. rep. Tuscaloosa: National Water Center, NOAA, pp. 14–22. DOI: 10.4211/technical.20171009.

Training and Workshops

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| Sep 6 - 9, 2022 | 4th NOAA Workshop on Leveraging AI in Environmental Sciences. NOAA Center for Artificial Intelligence (NCAI), Virtual. |
| Nov 4 - 9, 2020 | Unified Forecast System (UFS) Medium-Range Weather (MRW) Application users training. Developmental Testbed Center (DTC), Boulder, CO. |
| Jun 22 - 26, 2020 | Artificial Intelligence for Earth System Science Summer School. National Center for Atmospheric Research (NCAR), Boulder, CO. |
| Jun 20 - 22, 2017 | Watershed modeling with Gridded Surface Subsurface Hydrologic Analysis (GSSHA). US Army Watershed Modeling Support Center, Tuscaloosa, AL. |
| May 2 - 4, 2017 | The Weather Research and Forecasting Model Hydrological (WRF-Hydro) modeling system. NCAR, Boulder, CO. |

Services

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| 2024 | Reviewer of the Belmont Forum proposal on behalf of National Science Foundation (NSF). |
| 2023 | Reviewer of the NOAA Small Business Innovation Research (SBIR) proposals. |
| 2021 - 2022 | Primary convener of the AGU Falling Meeting session "Subgrid parameterization of physical processes in Earth System Models". |
| 2019 - 2023 | Board member of the Chinese-American Oceanic and Atmospheric Association(COAA) Colorado Chapter. |
| 2019 - present | Reviewer of the professional journals (<i>Water Resource Research</i> , <i>Journal of Geophysical Research</i> , <i>Geophysical Research Letters</i> , <i>Journal of Hydrology</i> , <i>Advances in Water Resources</i> , <i>Journal of Hydrologic Engineering</i> , <i>Natural Hazards</i> , <i>Agricultural and Forest Meteorology</i>). |
| 2021 | Board member of the Young Hydrologic Society (YHS). |
| 2019, 2020 | Ad hoc reviewer of the Hydrologic Sciences Program at National Science Foundation (NSF). |
| 2019 | Judge member of the 2019 Colorado Science and Engineering Fair (SCEF). |

Awards and Honors

- 2021 National Oceanic and Atmospheric Administration (NOAA) Administrator's Award, NOAA.
The NOAA Administrator's Award recognizes employees who have demonstrated exceptional leadership, skill, and ingenuity in their significant and innovative contributions that bring unusual credit to NOAA, the Department of Commerce, and the Federal Government as a whole.
- 2018 Paul A Recharad Fellowship, University of Wyoming, US.
For outstanding graduate student in civil engineering for water resources.
- 2009 Excellent Student Scholarship of Hydro-power, Shaanxi Society for Hydro-power Engineering, China.
For senior outstanding undergraduate student in hydro-power engineering.
- 2009 First Prize for Innovation, Xi'an University of Technology (XAUT), China.
For outstanding undergraduate student attending Undergraduate Innovative Research Program.
- 2008 Second Prize of China Undergraduate Mathematical Contest in Modeling (CUMCM), China.
- 2007 Third Prize in Physics Experimental Contest, XAUT, China.

Professional Memberships

- American Geophysical Union
- American Meteorological Society