Shelby Ahrendt, Ph.D.

CONTACT INFORMATION	U.S. Geological Survey Landslide Hazards Program 1711 Illinois St Golden, CO 80401	sahrendt@usgs.gov +1 (218) 370-9628 ORCID: 0000-0002-3678-5087 Google Scholar

EDUCATION

University of Washington, Seattle, WA

> *June 2023:* Ph.D., Civil and Environmental Engineering
> Thesis Title: *Feedbacks between river morphodynamics and overbank flooding.*

St. Olaf College, Northfield, MN

> *May 2017:* B.A., Physics & Studio Art

RESEARCH EXPERIENCE

Mendenhall Research Civil Engineer, *Golden, CO*   Aug. 2023 - Present
U.S. Geological Survey, Landslide Hazards Program

- Independently design, conduct, present, and write-up research for publication on landslide-river coupling in high-risk river corridors. Lead field instrumentation of a river-adjacent landslide to investigate triggering conditions and understand connectivity between river stage and hillslope groundwater. Design a network-scale landslide susceptibility and hazard map due to fluvial erosion. Develop methods for rapidly evaluating stability of landslide dams in response capacity.

Graduate Research Assistant, *Seattle, WA*   June 2022 – June 2023
University of Washington   Sept 2018 – Sept 2021
Department of Civil & Environmental Engineering

- Conducted regional data analyses using field measurement and continuous streamflow records from 50 USGS river gages to investigate for temporal shifts in in Western Washington State flood hazard due to changes in river geomorphology and hydrology (Ahrendt, et al., 2022). Concieved of and tested hypothesis that explained sediment-driven flood hazards at an historic avulsion node using Delft3D-Flexible mesh hydro-morphodynamic model simulations (Ahrendt, 2024: Ch 4). Attended and presented at five major academic conferences, communicated relevant results to stakeholders in meetings on local flood hazard management strategies.

Fulbright Research Fellow, *Delft, The Netherlands*   Sept. 2021 – June 2022
Technical University of Delft, Dept. of Civil & Environmental Engineering

- Investigated morphodynamic response and recovery to floods using bi-weekly bathymetry measurements and hydrodynamic model output to explain spatial variability in river bed response (Ahrendt et al., 2024). Participated in three field campaigns involving suspended and bedload sediment sampling on the Rhine River, manual, offshore GPS measurements to monitor bluff erosion in the Ijsselmeer, and human haards due to levee flood over-topping in Prosper Polder. Attended and presented research at two conferences.

Groundwater Modeler, *Urabana, IL*   Dec 2017 – Aug 2018
Illinois State Water Survey, Univ. of Illinois at Urbana-Champaign

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- Used the Python package 'FloPy' to initialize, run, and calibrate groundwater MODFLOW models; translated the operational Mahomet Aquifer MODFLOW groundwater model into Python-based framework. Developed novel, 'head-specified' model frameworks to accommodate real-time well data and predict regional groundwater levels in Mason County, IL. Created IPython notebook teaching materials for FloPy including modeling exercises and conceptual graphics. Lead and co-led bi-weekly, two-hour workshops on using Python and FloPy for groundwater

Undergraduate Research Assistant, *Northfield, MN*   June 2016 – Aug 2016
St. Olaf College, Physics Department

- Wrote MATLAB scripts to extract ice sheet elevation information from CryoSat-2 radar altimetry data. Processed and interpolated elevation data points to create digital elevation model of Hercules Dome, Antarctica. Calibrated map accuracy with ground-based radar measurements. Presented research at one conference and one symposium.

HONORS &
AWARDS

- ***Mendenhall Postdoctoral Fellowship*** *(2023)*
  U.S. Geological Survey, Landslide Hazards Program
- ***Ronald & Mary Nece Endowed Fellowship in Water Engineering*** *(2023)*
  Civil & Environmental Engineering Dept., University of Washington, Seattle
- ***Open Earthscape Summer Fellowship*** ($10,750) *(2022)*
  Community Surface Dynamics Modeling System, Univ. of Colorado, Boulder
- ***Fulbright Research Fellowship*** ($18,000) *(2021)*
  The Netherlands Fulbright Commission
- ***Ann Bostrom Research Award*** ($2,500) *(2021)*
  University of Washington
- ***NSF Graduate Research Fellowship***, Honorable Mention *(2019)*
- ***Valle Scholarship*** *(2018)*
  Civil & Environmental Engineering Dept, University of Washington, Seattle
- ***Presidential Scholarship*** *(2013-2017)*
  St. Olaf College
- ***Sigma Pi Sigma Physics Honor Society*** *(2016)*
  Induction: St. Olaf College Physics Dept.
- ***Academic All-American*** *(2014 & 2015)*
  US Collegiate Ski Nationals

PEER-REVIEWED
PUBLICATIONS

4. **Ahrendt, S. M.,** Blom, A., Van Denderen, R. P., Schielen, R. M. J., Horner-Devine, A. R., (2024) Geometric floodplain controls on riverbed elevation change within and between flood events , *River Flow 2022 (1st ed.)* CRC Press. https://doi.org/10.1201/9781003323037-43

3. Wuming, N., Morgan, J., Horner-Devine, A. R., Kumar, N., **Ahrendt, S.** (2022) Impacts of Sea-Level Rise on Morphodynamics and Riverine Flooding in an Idealized Estuary. *Water Resources Research*, https://doi.org/10.1029/2022WR032544

2. **Ahrendt, S.**, Horner-Devine, A. R., Collins, B., Morgan, J., Istanbulluoglu, E., (2022) Channel Conveyance variability can influence flood risk as much as streamflow variaibility in western Washington State, *Water Resources Research.* https://doi.org/10.1029/2021WR031890

1. Morgan, J. A., Kumar, N., Horner-Devine, A. R., **Ahrendt, S.**, Istanbullouglu, E., Bandargoda, C., (2020), Simulating large-scale and long-term fluvial morphodynamics: The efficacy of using a morphological acceleration factor. *Geomorphology, 356,* p. 107088 https://doi.org/10.1016/j.geomorph.2020.107088

THESES
Ahrendt, S. (2024) "Feedbacks between river morphodynamics and overbank flooding". PhD Thesis. Seattle, WA, USA: University of Washington, Seattle

CONFERENCE PRESENTATIONS

20. **Ahrendt, S.** (Invited Presenter), Blom, A., Van Denderen, P., Schielen, R., Horner-Devine, A.R., Tucker, G., Hutton, E., Campforts, B. "Channel-floodplain flow echange explains main-channel bed elevation change within and between flood events" Oral presentation at the Community Surface Dynamics Spring Conference; May 2024: Montclair, NJ

19. **Ahrendt, S.** (Presenter), Horner-Devine, A., Morgan, J., Ni, W., Istanbulluoglu, E., "Feedbacks between river morphodynamics and overbank flooding during an atmospheric river event in the Nooksack River, Washington State, US" Oral presentation at the American Geophysical Union Fall Conference; Dec 2023: San Francisco, CA

18. **Ahrendt, S.** (Presenter), Horner-Devine, A., Morgan, J., Ni, W., Istanbulluoglu, E., "River morphodynamics and flooding on the Nooksack River, Washington State: an investigation of drivers and feedbacks" Poster presentation at the Community Surface Dynamics Modeling System Annual Meeting; May 2023: Boulder, CO

17. **Ahrendt, S.** (Presenter), Blom, A., VanDenderen, R. P., Schielen, R. M. J., Horner-Devine, A. R., "Can streamwise variation in floodplain geometry and peak flow rate explain river bed elevation change during and between peak flows?" Poster presentation at the American Geophysical Union Fall Meeting; Dec 2022: Chicago, IL

16. **Ahrendt, S.** (Presenter), Blom, A., VanDenderen, R. P., Schielen, R. M. J., Horner-Devine, A. R., "Geometric floodplain controls on river bed elevation change within and between flood events" Oral Presentation at RiverFlow 2022; Nov 2022: Online

15. **Ahrendt, S.** (Presenter), Blom, A., VanDenderen, R. P., Schielen, R. M. J., Horner-Devine, A. R., The influence of floodplain geometry on riverbed elevation change within and between floods Poster Presentation at the Netherlands Centre for River Studies, NCR-Days Conference; April 2022: Delft, The Netherlands

14. Schwat, E. (Presenter), Knuth, F., Istanbulluoglu, E., Horner-Devine, A., Shean, D., Keck, J., **Ahrendt, S.**, & Morgan, J. (2021, December). Historical Aerial Images and Structure from Motion Software Allow Repeat Measurement of Sediment Yields in Proglacial Environments, Poster presentation at the American Geophysical Union Fall Meeting: Dec 2021

13. **Ahrendt, S.** (Presenter), Horner-Devine, A., Collins, B., Morgan, J. A., Istanbulluoglu, E., Kumar, N., River morphodynamics and flood risk in Western Washington State, US Poster presented at the River, Coastal, Estuarine Morphodynamics Conference; Nov 2021: Online

12. **Ahrendt, S.** (Presenter), Horner-Devine, A., Kumar, N., Morgan, J. A., Collins, B., Istanbulluoglu, E. "Understanding Morphologic Flood Risk Relevant to River Management in Western Washington State" Oral Presentation at the American Geophysical Union Fall Meeting; Dec 2020: Online

11. Morgan, J. A. (Presenter), Kumar, N., Horner-Devine, A., **Ahrendt, S.**, Ni, W., Istanbulluoglu, E., The effect of upstream sediment supply on flood risk, Poster presentation at the American Geophysical Union Fall Meeting; Dec 2020: Online

10. Ni, W. (Presenter), Horner-Devine, A., Kumar, N., Morgan, J. A., **Ahrendt, S.**, Sun, Z. Impacts of Sea-Level Rise on Morphodynamics and Flooding in an Idealized Estuary, Poster presentation at the American Geophysical Union Fall Meeting; Dec 2020; Online

9. **Ahrendt, S.** (Presenter), Horner-Devine, Kumar, N., A., Morgan, J. A., Collins, B., Istanbulluoglu, E. River Morphology and Flood Risk in the Pacific Northwest Oral Presentation at the Community Surface Dynamics Modeling System: Summer Science Series; July 2020: Online

8. **Ahrendt, S.**, (Presenter) A. Horner-Devine, N. Kumar, J. Morgan, B. Collins, E. Istanbulluoglu, C. Bandargoda, A. Pfeiffer, How is channel capacity connected to flood risk in high sediment supply mountain basins? Oral presentation at the American Geophysical Union Fall Conference: Dec 2019; San Francisco, CA

7. Morgan, J. A. (Presenter), Kumar, N., Horner-Devine, A., Ni, W., **Ahrendt, S.,** Istanbulluoglu, E. Simulating flood risk in a lowland river with high sediment supply. Poster presentation at the American Geophysical Union Fall Conference; Dec 2019: San Francisco, CA

6. **Ahrendt, S.** (Presenter), Morgan, J. A., Horner-Devine, A., Kumar, N., Keck, J., Duan, Z., Istanbulluoglu, E., Bandaragoda, C., Collins, B., Pfeiffer, A. A mountain-to-coast hydrogeomorphic modeling framework for flood risk prediction Poster Presentation at the Comminty Surface Dynamics Modeling System Meeting; May 2019: Boulder, CO

5. **Ahrendt, S.** (Presenter), Istanbulluoglu, E., Horner-Devine, A., Mauger, G., Bandaragoda, C., Collins, B., Lundquist, J., Montgomery, D., Kumar, N., Shean, D., Pfeiffer, A., Morgan, J. A., Duan Z., Riedel, J., Kennard P., Anderson, S., Jaeger, K., Whorton E. Integrated Modeling of HydroGeomorphic Hazards (MoHGeoH): Floods, landslides and sediment Poster Presentation at the National Science Foundation PREEVENTS PI Meeting; Sept 2018: Washington D.C.

4. **Ahrendt, S.** (Presenter), Abrams, D. A Head-Specified Model; Concept Proof and Application in the Mahomet Aquifer, Presentation at the Mahomet Aquifer Consortium Meeting; July, 2018; Urbana, IL

3. Abrams, D. (Presenter), **Ahrendt, S.**, Hadley, D. Moving toward a real-time model of groundwater/surface water interactions in two heavily irrigated systems Presentation at the International Congress on Environmental Modelling and Software; June 2018: Ft. Collins, CO

2. Abrams, D. (Presenter), **Ahrendt, S.** ANIMATING THE POTENTIOMETRIC SURFACE OF A HEAVILY IRRIGATED AQUIFER, Presentation at the GSA Annual Meeting; Jan 2018: Indianapolis, IN

1. **Ahrendt, S**. (Presenter), Jacobel, Christianson, Steig, Porter (2016). A New Digital Elevation Model for Hercules Dome, Antarctica from CryoSat-2 Altimetry – Toward Site Selection for the Next Antarctic Deep Ice Core Poster presentation

at the American Geophysical Union Fall Conference; Dec 2016: San Francisco, CA

INVITED
LECTURES

- University of British Columbia, Oct 2022
  "River morphodynamics and flood risk in western Washington State, US"
  Western Coastal Collaboratorium (WCC) Seminar Series

- University of Washington, Field Measurements Course April 2022
  "Stream gaging and flooding in Washington State and beyond" April 2024

- St. Olaf College, Physics Dept. Colloquium June 2022
  Landscape Evolution Modeling: Growing and Eroding Mountains using Physics & Python

- Risk and Resilience DAT\Arathon June 2022
  Techniques for communicating code using graphics

- CSDMS Summer Science Series III (virtual): July 2020
  River morphology and flood risk in the Pacific Northwest, US

TEACHING &
MENTORING

Research Advisor for Two Undergraduate Students June 2021 - Sept. 2021
University of Washington, Seattle, WA

- Co-wrote NSF application for REU funding for undergraduate students to work on river & landslide modeling; advised two students on research involving weekly check-ins & project development, created educational materials for learning Python coding and modeling

Earth Surface Processes Institute (ESPIn) Program Mentor June 2021
Community Surface Dynamics Modeling Systems Lab, Boulder, CO

- Mentored project teams in week long program on earth surface processes modeling; helped with Python coding bugs, provided programming advice and project guidance

Teaching Assistant: Hydraulics of Sediment Transport April 2021 - June 2021
University of Washington, Seattle, WA

- Primary lab instructor for weekly, hour-long labs on sediment-transport modeling in HEC-RAS; developed HEC-RAS project guidelins and augmented lab material; graded course homework and exams

Teaching Assistant: Hydrology & Environmental Fluid Mechanics April - June 2021
University of Washington, Seattle, WA

- Developed and taught weekly, hour-long workshops; attended synchronous virtual class sessions and facilitated in-class group work

Teaching Assistant: Intro to Fluid Mechanics Jan - March 2020
University of Washington, Seattle, WA

- Taught biweekly, hour-long workshops; ran lab sessions and office hours; proctored & graded tests; delivered class lecture on dimensional analysis

Python Workshop Instructor: ENIGMMA Program Jan 2020 - April 2020
Illinois State Water Survey, Urbana, IL

- Lead and co-led bi-weekly, two-hour workshops on using Python and FloPy for groundwater modeling; developed Jupyter Notebook Tutorials

Teaching Assistant: Introductory Astronomy　　　　　Feb 2014 - May 2014
St. Olaf College Physics Dept., Northfield, MN

- Attended class lectures and facilitated in-class discussions; graded student work; set up and configured Celestron telescope equipment and instructed biweekly star-watching sessions

PROFESSIONAL
ACTIVITIES &
OUTREACH

Reviewer
Water Resources Research
Earth Surface Processes & Landforms
Landslides
Frontiers in Freshwater Science: Rivers & Floodplains

Conference Organization

- AGU Fall Meeting Session Co-Chair　　　　　　　　　　　　　　　　2024
  "Geomorphic Response to Extreme Events"
  San Francisco, CA

- CSDMS 2023 Annual Meeting Scientific Program Committee Member:　　2022
  "Patterns and Processes Across Scales"
  Boulder, CO

- AGU Fall Meeting Session Co-Chair & OSPA Liaison:　　　　　　　　2022
  "Modeling Earth Surface Processes Using Community Surface-Dynamics Software"
  Chicago, IL

- NCR Days 2022: "Anthropogenic Rivers" LOC Member　　　　　　　　2022
  Technical University of Delft, The Netherlands

- River, Coastal, and Estuarine Morphodynamics (RCEM) 2021　　　　　2021
  System Response to Anthropogenic Influence and Climate Change
  Session Co-Chair (Online)

- Program On Climate Change Summer Institute　　　　　　　　　　　2020
  Climate Extremes and Climate and Environmental Equity
  Hydrology Session Co-Chair (Online)

Representative
Graduate Student Steering Committee: Program on Climate Change　　2020 – 2022

Volunteer
University of Washington Fulbright Program: application feedback volunteer　2022
University of Washington Engineering Discovery Days　　　　　　　　　2019

Member
American Geophysical Union　　　　　　　　　　　　　　　　2017 – Present
Geological Society of America　　　　　　　　　　　　　　　2017 – Present
Sigma Pi Sigma Physics Honor Society　　　　　　　　　　　2016 – Present
Rocky Mountain Conservancy　　　　　　　　　　　　　　　2015 – 2018

SKILLS &
CERTIFICATIONS

COMPUTER SKILLS

Operating Systems:
- Linux, Windows

Programming Languages:
- Python (primary), Mathematica/Wolfram, R, MATLAB, Shell scripting, Microsoft Visual Basic

Software Tools:
- Git, HTML, CSS, Read the Docs

GIS Software:
- QGIS, ArcGIS, GRASS GIS

Numerical Models:
- Landlab, HEC-RAS, MODFLOW, Delft3D-Flexible Mesh

Graphics Programs:
- Adobe Illustrator, InDesign & Photoshop, Blender 3D-Modeling, Final-Cut Pro, Adobe Premier Pro

Typesetting:
- LaTeX, BibTeX

FIELD SKILLS

- Total station topographic surveying
- Field mapping of kinematic landslide features
- Stream gaging including stage and discharge wading measurements
- Wolman pebble counts of river bed material and substrate
- Surf-zone bathymetric surveying with GPS (RTK)
- Meteorological site maintenance
- Backcountry navigation
- Canoe and kayak travel

CERTIFICATIONS

- Wilderness First Aid (**2024**: Bondi Outdoor Leadership)
- Glacial Travel & Crevasse Rescue (**2019**: University of Washington, UWild)
- Wilderness First Responder (**2014-2021**: Wilderness Medical Associates)
- Class-A Chainsaw Sawyer (**2015-2018**: United States Forest Service)
- Lead Belay Climbing (**2011-2017**: Vertical Endeavors)