CARLY HYATT HANSEN, PhD

WATER RESOURCES ENGINEER

CONTACT

Email

carlyahansen@gmail.com

EDUCATION

2014-2018

PhD, Civil and Environmental Engineering: University of Utah

Dissertation: Using Remote Sensing to Evaluate Historical Trends and Contributing Factors to Algal Bloom Dynamics and Forecasting Future Conditions in the Great Salt Lake System

2013-2014

MS, Civil and Environmental Engineering: Water Resources: Brigham Young University

Thesis: Development and Regional Application of Sub-Seasonal Remote-Sensing Chlorophyll Detection Models

2008-2013

BS, Civil and Environmental Engineering: Brigham Young University

SOCIAL

linkedin.com/in/carlyhyatthansen

github.com/cahhansen

Portfolio: www.cahhansen.com

PROFILE

I am a water resources engineer who is interested in improving water quality and quantity by leveraging fundamental data science strategies: fusing different types of data to explore relationships between natural and built systems, classifying features to identify patterns, and using data-driven models to support monitoring and management decisions. I want to connect infrastructure + water + community information in creative ways so we can explore complexities of multi-use water systems.

RESEARCH AND TEACHING EXPERIENCE

SEPT 2019—PRESENT: **Research staff/Water Resources Engineer, Oak Ridge National Laboratory**

- Hydrologic modeling/analysis in the Water Resources Science & Engineering Group
- Greenhouse gas emissions and water quality modeling using GIS and remote sensing
- Dataset and interactive tool development to support understanding of design, operations, environmental, and socioeconomic aspects of dams/reservoir infrastructure
- External engagement to develop a roadmap and system of metrics for intelligent watersheds

SEPT 2018—JULY 2019: **Postdoctoral Instructor & Research Assistant, University of Utah**

- Led modeling efforts for major EPA-funded integrated water resource/water quality modeling study exploring effects of climate & development changes in the Jordan River Watershed
- Prepared curriculum and deliver several courses in the Civil and Environmental Engineering Department (Engineering Probability and Statistics, Engineering Economic Analysis, and Engineering Informatics/Computer Tools)

AUG 2014—AUG 2018: **Research Assistant/Hydroinformatics Co-Instructor, University of Utah**

- Created climate data processing, downscaling, & analysis programs for Python and R
- Prepared manual for data and modeling needs for hydrologic/water quality for Los Alamos National Lab
- Developed learning modules (including exercises, resources, and in-class assignments) for Hydroinformatics course (programming and data analysis in R and Python)

DEC 2011—JUNE 2014: **Research/Teaching Assistant, Brigham Young University (Part-time)**

- Managed five other research assistants, field sampling, and lab work
- Provided individual assistance and regular topical reviews for Introduction to Environmental Engineering Course

PROFESSIONAL EXPERIENCE

JULY 2016—JULY 2018: **WaDE Program Intern, Western States Water Council (Part-time)**

- Built data portals & web applications for accessing/visualizing water data using R & ArcGIS
- Prepared reports and conference materials for inter-agency scientific workshops
- Managed components of Water Data Exchange (WaDE) program using GitHub
- Assisted in drafting grant applications

JAN—NOV 2014: **GIS Analyst/Hydrologic Modeling Intern, Stanley Consultants (Part-time)**

- Modeled management practices for soil salinity remediation for agriculture
- Created complex 1D/2D Hydrologic models using GSSHA, HEC-1 , HEC-HMS
- Prepared internal and client-facing modeling documentation, training material, map products and reports
- Managed geodatabases for various projects

TECHNICAL SKILLS

GIS and Remote Sensing: ArcGIS, QGIS, Google Earth Engine

Modeling: Goldsim, EPA-SWMM, HEC-HMS, HEC-RAS

Programming Languages: R, Python, SQL

Microsoft Office Suite

ADDITIONAL RESEARCH EXPERIENCE

JUNE—JULY 2017: **CUAHSI Summer Institute, National Water Center, Tuscaloosa, AL**

- Evaluated retrospective streamflow models during low-flow conditions
- Created an interactive web-based application using Geoserver and Python and documentation using ESRI Story Maps

MAY—AUG 2013: **RISE Professional Scholar, Forschungszentrum-Jülich, Germany**

- Performed field measurements with ground penetrating radar for mapping of subsurface hydro-geological structures
- Improved efficiency in data processing programs

PUBLICATIONS

- Shifts in carbon emissions versus sequestration from hydropower reservoirs in the southeastern United States, *Journal of Geophysical Research: Biogeosciences,* 2024 (Co-author)
- Hydropower Capacity Factor Trends & Analytics for the United States, *Nature Communications*, 2024 (Co-author)
- Data Driven modeling of municipal water system responses to hydroclimate extremes, *Journal of Hydroinformatics,* 2023 (Co-author)
- Diversity in reservoir surface morphology and climate limits ability to compare and upscale estimates of greenhouse gas emissions, *Science of the Total Environment,* 2023
- Insights from Dayflow: A Historical Streamflow Reanalysis Dataset for the Conterminous United States, *Water Resources* Research, 2023 (Co-author)
- Variability in modelled reservoir greenhouse gas emissions: comparison of select US hydropower reservoirs against global estimates, *Environmental Research Communications,* 2023
- Evaluation of Nominal Energy Storage at Existing Hydropower Reservoirs in the US, *Water Resources Research,* November 2022
- Getting lost tracking the carbon footprint of hydropower, *Renewable and Sustainable Energy Reviews,* July 2022 (Co-author)
- Hydropower development potential at non-powered dams: Data needs and research gaps, *Renewable and Sustainable Energy Reviews*, July 2021
- Assessing Retrospective National Water Model Streamflow with Respect to Droughts and Low Flows in the Colorado River Basin, *Journal of American Water Resources Association*, August 2019
- Evaluating historical trends and influences of meteorological and seasonal climate conditions on lake chlorophyll a using remote sensing, *Lake and Reservoir Management,* July 2019
- Evaluating Remote Sensing Model Specification Methods for Estimating Water Quality in Optically Diverse Lakes throughout the Growing Season, *Hydrology*, November 2018
- Downscaling Precipitation for Local-Scale Hydrologic Modeling Applications: Comparison of Traditional and Combined Change Factor Methodologies, *Journal of Hydrologic Engineering,* June 2017
- Spatiotemporal Variability of Lake Water Quality in the Context of Remote Sensing Models, *Remote Sensing,* April 2017
- How does climate change affect combined sewer overflow in a system benefiting from rainwater harvesting systems?, *Sustainable Cities and Society,* July 2016 (Co-author)
- Reservoir Water Quality Monitoring using Remote Sensing with Seasonal Models: Case Study of Five Central-Utah Reservoirs, *Lake and Reservoir Management,* September 2015

AWARDS

- Member of Chi Epsilon, Civil Engineering Honor Society; 2016
- First place, American Water Resources Association, Utah Chapter Paper Competition; 2012 & 2013
- American Water Works Association Scholarship Recipient; 2012

OUTREACH AND SERVICE

- Mentor for US DOE GEM Fellowship program; Summer 2023
- Mentor for US DOE Science Undergraduate Laboratory Internships (SULI) Program; Summer 2021, 2024
- Contributor to DOE-funded "DEI in STEM" project, leading task on collaborative planning with STEM educational professionals
- Community outreach through Oak Ridge National Laboratory ("Stump a Scientist", classroom presentations, etc.)
  - https://www.ornl.gov/news/ornl-scientists-share-excitement-engineering-students-statewide
- Reviewer for *Remote Sensing, Climatic Change, Nature: Scientific Data, J. of Hydrologic Eng., Lake & Reservoir Management*
- NASA ROSES reviewer; 2019
- STEM Ambassador for the University of Utah – participated in a number of community educational outreach events to engage different audiences in University-level science activities; 2016

OUTREACH AND SERVICE (CONTINUED)

- Director of Online Communications and Outreach for Utah Women of Water; 2015-2018
  - Manage social media accounts and website, produce original content
  - Facilitate networking events for members
- BYU Global Engineering Outreach – Peru, a humanitarian engineering club – designed & implemented clean burning stoves; 2011-2012

RECENT CONFERENCE AND PROFESSIONAL MEETING PRESENTATIONS

- Declining reservoir storage capacity in the US—what can existing data tell us?, *EWRI World Water Congress*, Milwaukee, WI, May 2024
- Progress and Priorities for Developing Intelligent Watersheds, *AGU Fall Meeting,* San Francisco, CA, December 2023
- Data and informatics innovations to support dam retrofit and development decisions, *AGU Fall Meeting,* San Francisco, CA, December 2023

ADDITIONAL PRESENTATIONS

- Reservoir management strategies to reduce GHG emissions at hydropower facilities, *EWRI World Water Congress,* Atlanta, GA, June 2022
- Building bridges between big datasets to better describe US hydropower reservoirs, *Joint Aquatic Sciences Meeting,* Grand Rapids, MI, May 2022
- Tools to facilitate large-scale analysis of non-powered dam opportunities for hydropower development, HYDRO2022, Strausburg, France, April 2022 (Virtual)
- Approaches to Quantify Energy Storage at National Hydropower Reservoirs, *EWRI World Water Congress*, Virtual, June 2021
- Historical Streamflow Reanalysis at the National Scale using Hierarchical Routing and Data Assimilation, *AGU Fall Meeting,* Virtual, December 2020
- Assessment of remote sensing for hydropower projects in the US, *North American Lake Management Symposium,* Virtual, November 2020
- Implications and Context for Effects of Climate Change on Urban Water Demands in the Mountain-West, *American Water Resources Association Annual Meeting,* Salt Lake City, UT, November 2019
- Developing and Implementing and Early Warning System for HABs in Utah Lake, *ASLO Annual Meeting: Planet Water*, San Juan, PR, February 2019
- Short-term Forecasting and Decision Support Tool for Algal Blooms in a Multi-Lake System, *EWRI World Water Congress,* Minneapolis, MN, June 2018
- Integrated Modeling Framework for Improved Future Management of the Utah Lake-Jordan River Watershed, *Salt Lake County Watershed Symposium,* November 2017
- Sensitivity of Water System Vulnerability to Changing Snowpack from Dust Deposition and Climate Change, *EWRI World Water Congress,* Sacramento, CA, May 2017
- Identifying Contributing Factors to Utah Lake Algal Blooms, *Salt Lake County Watershed Symposium,* November 2016
- A Tale of Two Bays: Enhancing understanding of historical conditions and Evaluating Patterns of Water Quality In the Great Salt Lake*, EWRI World Water Congress,* West Palm Beach, FL, May 2016
- Google Earth Engine as a Platform for Making Remote Sensing of Water Resources a Reality for Monitoring Inland Waters, *EWRI World Water Congress,* Austin, Texas, May 2015
- Watershed GIS and Remote Sensing to Assess Regional Water Quality, *AWRA GIS Conference*, Snowbird, Utah, May 2014
- Regional Application of Sub-Seasonal Remote Sensing Chlorophyll Detection Models*, North American Lake Management Symposium*, San Diego, October 2013
- Developing Seasonal Models to Accurately Assess Algal Succession and Water Quality Using Remotely Sensed Data*, North American Lake Management Symposium*, Madison, Wisconsin, October 2012