

# Lucas Howard, MS

772 30th Street, Boulder CO 80303 | 347-217-4331 | lucas.howard@colorado.edu

## Education

**Ph.D., Atmospheric and Oceanic Science | University of Colorado, Boulder CO | Expected 2026**

Advisor: Professor Aneesh Subramanian

Research focus: data assimilation and machine learning

**M.S., CIVIL AND ENVIRONMENTAL ENGINEERING | UNIVERSITY OF VERMONT, BURLINGTON VT | 2016**

Thesis: *Leveraging the Information Content of Process-Based Models Using Differential Evolution and the Extended Kalman Filter*

Advisor: Professor Donna M. Rizzo

Selected Courses: Hydrology, Advanced Hydrology, Numerical Methods for Engineers, Applied Artificial Neural Networks, Evolutionary Computation

**B.A., PHYSICS | REED COLLEGE, PORTLAND OR | 2013**

Senior Thesis: *A Numerical Investigation of Water Waves*

Advisor: Professor Joel Franklin

Selected Courses: Scientific Computation, Multivariable Calculus I and II, Linear Algebra, Introduction to General Relativity, Elementary Particle Physics

Extracurricular: Senior Reactor Operator at the on-campus nuclear research reactor

## Professional Experience

**University of Colorado | Graduate Research Assistant | August 2021-Present**

- Perform research into methods of improving west coast precipitation forecasts using data assimilation.

**Hydrogeologic, Inc. | Staff Engineer/Leader | June 2020 – Present**

**Hydrogeologic, Inc. | Staff Engineer | June 2018 – June 2020**

**Hydrogeologic, Inc. | Associate Engineer | June 2016 – June 2018**

- Constructed groundwater and surface water models to inform environmental remediation activities and planning at federal facilities, including both CERCLA and RCRA sites.
- Technical lead and lead author for a task order using the ensemble Kalman filter to analyze the results of an existing 1-D 2,000 realization set of flow and transport simulations. Client found the work valuable and is planning on presenting the analysis in an annual meeting with the state regulator.
- Co-lead an effort to implement an Ensemble Kalman Filter calibration of a groundwater model. Calibration performance was comparable to industry-standard parameter estimation methods (PEST) and provided additional probabilistic insights to the client to inform future cleanup activities and modeling. Results presented at the 2020 Waste Management Symposium.
- Served as technical lead and lead author for a surface water modeling project and report submitted to U.S. Army Corps of Engineers. Maintained consistent communication with the client and stakeholders resulting in minimal reviewer comments on the final work product. Profit on the fixed-price contract exceeded 10%.
- Performed MODFLOW 6 and MODPATH 7 groundwater modeling and particle tracking using python. The use of automated scripts allowed many versions of the model to be run quickly giving the client valuable information about the impact of different conceptualizations on contaminant transport results. These results were key to planning the next phase of modeling at

the site and resulted in an approach that was both more cost effective and accurate than previous efforts.

### **University of Vermont | Graduate Research Assistant | January 2015 – May 2016**

- Assisted with experimental design and executed x-ray tomography analysis of porous media and other geologic samples in coordination with internal and external research groups.
- Independently pursued research towards MS thesis.

### **Hydrogeologic, Inc. | Intern | December 2014 – January 2015**

- Coupled a suite of optimization algorithms with the hydraulic modeling software HEC-RAS using Visual Basic to facilitate automated design involving the sizing of flood control storage areas. The automated design outperformed an expert design by approximately 8%.

### **Refereed Publications and Proceedings**

- **Howard, L.** Lie, Z., and Rizzo, D.M. (2020), "Leveraging the information content of biased model predictions using the extended Kalman filter." *Journal of Environmental Engineering* (in revision).
- **Howard, L.** and Ross, J. (2020). "Uncertainty quantification and calibration of a large subsurface flow and transport model using the ensemble Kalman filter." *Waste Management Symposium*, Phoenix, AZ. March 10-14.
- **Howard, L. J.**, Anderson, I. A., Underwood, K., Dewoolkar, M. M., Deschaine, L. M., and Rizzo, D. M. (2016), "Heuristic assessment of bridge scour sensitivity using differential evolution: case study for linking floodplain encroachment and bridge scour," *Environmental Systems Research*, 5:20. doi: 10.1186/s40068-016-0071-4.
- Akimana, R. M., Bista, H., Seo, Y., Li, L., **Howard, L. J.**, Dewoolkar, M. M., and Hu, L.-B. (2016). "Multi-scale experimental and numerical study of microbially induced calcite precipitation in sandy soils: preliminary evidences and observations" *Geo-China 2016*: pp. 77–84. doi: 10.1061/9780784480069.010.
- Akimana, R. M., Bista, H., Seo, Y., Li, L., **Howard, L. J.**, Dewoolkar, M. M., and Hu, L.-B. (2016). "Exploring x-ray computed tomography characterization and reactive transport modelling of microbially induced calcite precipitation in sandy soils." *Geo-Chicago 2016*, pp. 62–71. doi:10.1061/9780784480120.008.

### **Presentations**

- "Uncertainty Quantification and Calibration of a Large Subsurface Flow and Transport model using the Ensemble Kalman Filter." *Waste Management Symposium*, Phoenix, AZ. Presented March 13, 2020.
- "Uncertainty Quantification and Calibration of a Large Subsurface Flow and Transport model using the Ensemble Kalman Filter." Internal Company Presentation, presented February 28, 2020.
- "Introduction to QGIS"; Internal Company Presentation, presented May 16, 2018.
- "A Finite Difference Method for Modeling Water Waves." Internal Company Presentation, presented June 19, 2014.

### **Teaching**

- University of Vermont, Co-instructor with Professor Donna Rizzo: *Applied Statistics for Surface*

*Water Hydrology (Summer, 2015)*

- Mentored multiple undergraduates in their summer research, assisting them with sediment transport model design and analysis as well as computational experimental design. (*Summer 2015*)

## **Funding**

- Graduate Research Assistant: National Science Foundation (NSF) Major Research Instrumentation (MRI) award (ID 1429252) for the acquisition of an X-Ray Micro-CT Scanner.
- Hydrogeologic, Inc. Research and Development Gift, 2015/2016.

## **Service**

- Curriculum committee member, 2021/2022
- Student complaints committee member, 2021/2022

## **Skills and Training**

**Languages:** Python (including NumPy/SciPy, pandas, PyMC, FLOPY), MATLAB, Octave, Mathematica, Visual Basic

**Software:** MODFLOW, HEC-RAS, Groundwater Vistas, ArcGIS, QGIS, TecPlot, Visual Studio, Git

**Training:** 20-hour project management, 3-day HEC-RAS, 3-day X-ray tomography scanner operations and analysis