Christine Marie Downs

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Education

Ph.D. Geology, Near-Surface Geophysics | University of South Florida, Florida, 2012–2017
Dissertation: *Imaging Wetland Hydrogeophysics: Applications of Critical Zone Hydrogeophysics to Better Understand Hydrogeologic Conditions in Coastal and Inland Wetlands and Waters*

M.Sc. Geology | University of Vermont, Vermont, 2010–2012
Thesis: *The Characterization of Ductile Deformation in the Upper and Lower Plates of the Hinesburg Thrust Fault Through Detailed Geometric Analysis of Selected Outcrops*

B.Sc. Geology | Salem State University, Massachusetts, 2006–2010
Honors Thesis: *Applications of Electromagnetic Induction in Archaeology*

Work Experience

AUG 2021 – PRESENT R&D Geoscientist | Sandia National Laboratories

2020 – 2021 Radar Systems Specialist | Technology Service Corporation
- Refined the evaluation scheme that measures non-coherent change detection (NCD) performance.
- Supporting the developing of improved algorithms for NCD from synthetic aperture radar (SAR) imagery.
- Experimenting with various image processing techniques to increase SAR signal to noise and prioritize feature preservation.

2010 – 2020 Instructor
University of South Florida (2012–2017, 2020); University of Indianapolis (2018–2020); Hillsborough Community College (2015–2018); University of Vermont (2010–2012)
- Instructed undergraduate Geoscience courses. Full list below.

Undergraduate Curriculum & Educational Software Development | University of South Florida
- Developing a teaching module for introductory geophysics course.
- Creating robust visualizations that describe geophysical phenomena: 3D renderings, animations, interactive graphics.
- Customizing open source software for instructional purposes.

2019–2020 Postdoctoral Scholar | University of South Florida Libraries
- Designed and executed a series of ground-penetrating radar (GPR) surveys at small cemeteries.
- Produced a collection of confirmed marked burials and potential unmarked burials at historical cemeteries within Cape Canaveral Air Force Station.
- Managed GIS information in a geodatabase containing geophysical and remote sensing data, and maintained metadata.

- Had success using singular value decomposition (a subspace projection method) to improve GPR data resolution.
- Quantified ground surface deformation using Multiscale Model to Model Cloud Comparison (M3C2) of terrestrial LiDAR data.
- Integrated M3C2 results with geophysical data in 3D visualizations and further interpretation.

2016–2018 Graduate Student Intern | Sandia National Laboratories
- Summer 2016; Summer to Year-round 2017-2018
- Developed a Python wrapper that parametrically loops over various input model parameters and executes FORTRAN software, which calculates the electromagnetic (EM) induction response from a fully 3D, heterogeneous whole-space for a defined EM source.
- Designed and executed batch model runs in parallel on a high-performance cluster.
- Codified model results and archived into a searchable library for ease-of-access.
- Compared inversion schemes (non-negative least squares and damped least squares) to assess model parameter sensitivity of the inversion algorithm. Regularly produced descriptive 3D renderings of model results.

Grants & Recognition (totaling $91,000)

2022	Laboratory Direct Research & Development ($75,000)
2020	University of South Florida (USF) Postdoctoral Affairs Professional Development Award ($500)
2019	USF Libraries Travel Award ($2700)
2019	USF Postdoctoral Research Symposium Outstanding Lightning Talk ($500)
2017	Sandia National Laboratories Special Recognition Award ($500)
2012-2017	USF Conference Travel Awards ($7500 in total)
2015	USF College of Arts & Sciences Outstanding Research Presentation
2014	Sigma Xi Grants-In-Aid Recipient ($1500)
2014	Geological Society of America Southeastern Section Graduate Research Grant ($1000)
2012	University of Vermont Graduate School Outstanding Graduate Teaching Assistant
2011	University of Vermont Graduate Senate Travel Award ($800)
2009	National Park Service STAR (Special Thanks for Achievement) Award ($1000)

Proposals

2020	Jill Hruby Fellowship "Modeling the Geophysical Response of Subsurface Structures to the Excitation of Existing Infrastructure in the Built Environment"
2020	L'Oreal Women in STEM Postdoctoral Fellowship "Multiscale Hydrogeophysical Investigation of Methane Ebullition in a Coastal Wetland"
2019	National Science Foundation Division of Earth Science Postdoctoral Fellowship "Multiscale Hydrogeophysical Investigation of Methane Ebullition in a Coastal Wetland"
2019	National Institute of Justice R&D in Forensic Science for Criminal Justice Purposes "Beyond the Chalk Outline: Physicochemical Footprints of Cadavers in the Environment"

GIS Work

- Suitability model for the purpose of locating undocumneted orphan wells. (DOE Undocumented Orphan Wells Program).
- Integrated geophysical data from multiple geoarchaeological surveys into GIS (i.e., to compare buried structures identified from geophysical data to known structures or historical maps).
- Digitized geologic mapping data.
- Georeferenced historical aerial photographs to track changes in (wetland) land cover.

- GIS data management for a Southwest Water Management District funded project.
- LiDAR and geospatial data integration.
- Created a ArcMap-Python workflow to extracted 2D profile from raster and integration with geophysical data processing.

Skills

Communication & Organization

Comfortable addressing a group • Technical writer and reviewer • Enjoys collaborating with others within and outside my discipline • Experienced teacher • Can create high-quality educational/outreach material including descriptive visualizations of complex data
Ability to design & execute field work • Critical thinker • Enjoys problem solving • Capable of designing effective workflows

Languages & Operating Systems

MATLAB • Python • shell scripting in Linux and Windows • familiarity with JavaScript (via P5), C++, and FORTRAN

Proprietary and Open Source Software

APhiD (EM induction simulator) • ArcGIS Pro • Bentley Pointools (point cloud processing software) • CloudCompare (point cloud and mesh proces sing software) • Geotomo RES2DINV (electric restistivity simulator & inversion code) • Golden Surfer (mapping, modeling, and analysis software) • gprMax (EM wave simulator) • GPR-SLICE (ground penetrating radar data processor and visualization) • GSSI RADAN (EM wave data processor) • Interprex IX1D (electric conductivity simulator & inversion code) • MODFLOW (groundwater flow simulator) • ReflexWin (seismic & electromagnetic (EM) wave data processor) • SUTRA (groundwater flow simulator)

Presentation tools

VisIt/Paraview • Adobe Illustrator & Premiere • GMT • gnuplot • LaTeX • Plotxy

Courses Taught

Instructor of Record			
	Earth Science	Hillsborough Community College	Sp 2015–2018, Fa 2019
online	Elements of Earth-Space Science	University of Indianapolis	Su 2017-2019
online	Introduction to Earth Science	University of South Florida	Fa 2020
Labs Taught			
	Essential of Geology	University of South Florida	Fa 2012–Sp 2016
	Structural Geology & Tectonic	University of South Florida	Sp 2014, Sp 2015
	Earth System Science	University of Vermont	Fa 2010–Sp 2012
Field Teaching			
	Structural Geology & Tectonic	Snake River Plain, Idaho, US	Sp 2014, Sp 2015
	Field Mapping	Snake River Plain, Idaho, US	Su 2015
	Field Geophysics	Snake River Plain, Idaho, US	Su 2015
	Applied Geophysics	west-central Florida, US	Fa 2013
	Earth System Science	Champlain Lowlands, Vermont, US	Fa 2010–Sp 2012
Teaching Assisted			
	History of Life		Fa 2016
	Applied Geophysics	University of South Florida	Fa 2013

Geology of National Parks	Fa 2013
Scientific Writing	Sp 2013

Additional Training

Feb 2019 Seismic Surface Wave Short Course, ParkSeis LLC
Fundamentals and applications of the multichannel analysis of surface waves (MASW) method.

May 2018 Applying the Quality Matters Rubric, Hillsborough Community College, Tampa, FL
Day Course provided insight and resources for developing quality online and hybrid courses that meet national standards of best practices.

Nov 2016 PaSSAGE to Student Success in Florida 2YCs, Daytona State College, Daytona, FL
NSF funded, multi-year collaboration between faculty within community college institutions who share a vision to effect change and improvement within 2YC geoscience courses, programs, and departments using evidence-based practices.

Mar 2016 Seismic Surface Wave Short Course, University of Kansas, Lawrence, KS
Fundamentals and applications of the multichannel analysis of surface waves (MASW) method.

Service to the Profession

Reviewer for *Groundwater*, *Near-Surface Geophysics*, *Water Resources Research Institute*, *IEEE Geoscience and Remote Sensing Letters*, *Acta Geophisica*, *The Sinkhole Conference Proceedings*

Judge for *Sigma Xi Student Research Virtual Meeting* (2013), *American Geophysical Union Virtual Poster Showcase* (2019), and *American Geophysical Union Fall Meeting Outstanding Student Presentation Award* (2019, 2020).

Oct 2023	Geological Society of America, Annual Meeting Session Co-chair
Oct 2021	Society of Exploration Geophysicists, Annual Meeting Session Co-chair
Oct 2020–	Society of Exploration Geophysicists, Near Surface Technical Section, Secretary
2017–2020	Association for Women Geoscientists Florida Chapter, Chapter President
2019	IRIS Urban and Environmental Geophysics Course Planning Workshop, contributing attendee
2017	American Geophysical Union Congressional Visit Day, Selected Representative
2013–2017	Geoscience Graduate Student Organization (USF), Secretary (2016-2017); Treasurer (2013-2014)
2010–2012	Graduate Student Senate (UVM), Senator

Publications & Reports

Peer-reviewed Articles

2022 Nowicki, ReNae, Rains, Mark, LaRoche, Jason, **Downs, Christine**, Kruse, Sarah. The peculiar hydrology of west-central Florida's sandhill wetlands, ponds, and lakes – Part 2: hydrologeologic controls. *Wetlands*, https://doi.org/10.21203/rs.3.rs-489214/v1.

2021 Robinson, Tonian, Rodgers, Bruce, Oliver-Cabrera, Talib, **Downs, Christine**, Kruse, Sarah, Wdowinski, Shimon, Zhang, Boya, Jazayeri, Sajad, Esmaeili, Sanaz, Kiflu, Henok. Complex relationships between surface topography, ground motion, and cover sediments in covered karst, west-central Florida, USA. *Geomorphology*, 392(1), https://doi.org/10.1016/j.geomorph.2021.107927.

2021 **Downs, Christine**, Jazayeri, Sajad, 2020, Resolution Enhancement of Deconvolved Ground Penetrating Radar Images Using Singular Value Decomposition. *Journal of Applied Geophysics* https://doi.org/10.1016/j.jappgeo.2021.104401.

2020 **Downs, Christine**, Rogers, Jaime, Collins, Lori, Doering, Travis, 2020, Integrated Approach to Investigating Historic Cemeteries. *Remote Sensing*, 12(17): 2690 https://doi.org/10.3390/rs12172690.

2015 George, Ophelia A., McIlrath, Judy, Farrell, Alexandra, Gallant, Elisabeth, Tavarez, Samantha, Marshall, Anita, **McNiff (Downs), Christine**, Njoroge, Mary, Wilson, James, Connor, Charles, Connor, Laura, and Kruse, Sarah, 2015, High-Resolution Ground-Based Magnetic Survey of a Buried Volcano: Anomaly B, Amargosa Desert, NV. *Statistics in Volcanology*: Vol. 1: 1-23 http://dx.doi.org/10.5038/2163-338X.1.3

Conference Papers

2022 Uhlemann, Sebastian, **Downs, Christine**, Wang, Jiannan, Otto, Shawn, Kuhlmann, Kristopher, and Wu, Yuxin. Investigating the coupled thermal-hydrological-mechanical behavior of salt for nuclear waste disposal through resistivity monitoring and laboratory experiments, *International High-Level Radioactive Waste Management Conference Proceedings*. p. 451-455. https://www.ans.org/pubs/proceedings/article-52714/

2020 **Downs, Christine**, Weiss, Chester. Frequency-domain EM Response of Complicated, Highly Conductive Structures Simulated with a 3D Electromagnetic Solver, *SEG Technical Program Expanded Abstracts*. p. 3546-3551. https://doi.org/10.1190/segam2020-3426481.1

2020 **Downs, Christine**, Jazayeri, Sajad, Collins, Lori, Doering, Travis. Joint Application of High-pass Eigenimages and Sparse Blind Deconvolution for Improved Reflectivity Models of Historic Graves. *SEG Global Meeting Abstracts*. p. 340-343. https://doi.org/10.1190/gpr2020-089.1

2019 **Downs, Christine**, Robinson, Tonian, Speed, Garrett, González García, Jorge, García Asenjo, Noelia, Collins, Lori, Doering, Travis, Landry, Shawn, Eilers, David, Jazayeri, Sajad, Esmaeili, Sanaz, Kruse, Sarah, Braunmiller, Jochen, Kiflu, Henok, 2020, Spatial and temporal imaging of a cover-collapse sinkhole in west-central Florida through high-resolution remote sensing and geophysical techniques. *16th Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst Proceedings*. https://doi.org/10.5038/9781733375313.1034

2019 Robinson, Tonian, **Downs, Christine**, Oliver-Cabrera, Talib, Zhang, Boya, Kruse, Sarah, Wdowinski, Simon, Relationships Between Sinkhole-Related Features and InSAR-Detected Subsidence Points in West Central Florida. *16th Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst Proceedings*. https://doi.org/10.5038/9781733375313.1005

Peer-reviewed Non-Technical Article

2018 Hills, D.J., Horton, D., Loureiro, R., Popendorf, K., **Downs, C**, Doel, R.E., Clement, T.P., and Kobelski, A., 2018, YOU should advocate for science, *Eos*, 99. https://doi.org/10.1029/2018EO097137

Technical Reports & Articles

2022 **Downs, Christine**, Kadeethum, Teeratorn, Heath, Jason. Persistent homology-based feature detection from remote-sensing data, United States: N. P.

2022 **Downs, Christine**, Ken Krauss, Sarah Kruse. "Hydraulic redistribution in mangroves: time-lapse electrical resistivity reveals diel patterns of subsurface salt mobilization consistent with exchange of water between trees and sediments." *Authorea Preprints*, https://doi.org/10.1002/essoar.10511305.2.

2017 **Downs, Christine**, Nowicki, ReNae, Jazayeri, Sajad, Assessment of Hydrogeological Controls on Sandhill Wetlands in Covered Karst Using Ground Penetrating Radar. FastTIMES, v. 22, n. 1, p. 43–51.

2016 **Downs, Christine**, Weiss, Chester, and Bach, Jeffrey A. Electromagnetic Prediction and Propagation. United States: N. P., https://doi.org/10.2172/1562621.

2016 Nowicki, ReNae, **Downs, Christine**, Rains, Mark, Kruse, Sarah, 2016, Assistance to Develop Methods for the Ecohydrologic Classification and Assessment of Northern Tampa Bay and Northern District Sandhill and Xeric Wetland and Lake Types. Southwest Florida Water Management District Technical Report.

2011 Kim, Jonathan, Klepeis, Keith, Ryan, Peter, Gale, Marjorie, **McNiff (Downs), Christine**, Ruksznis, Abigail, Webber, Jeffrey, 2011, A Bedrock Transect Across the Champlain and Hinesburg Thrusts in West-Central Vermont: Integration of Tectonics with Hydrogeology and Groundwater Chemistry. New England Intercollegiate Geological Conference, Guidebook for Fieldtrips in New York and Vermont, v. 102, p. B1-1– B1-35.

Invited Talks

2020 **Downs, Christine**, Weiss, Chester. Frequency-domain EM Response of Complicated, Highly Conductive Structures Simulated with a 3D Electromagnetic Solver, Hydrogeophysics Session, Society of Exploration Geophysics Annual Meeting, October 2020, Houston, TX

2020 **Downs, Christine**, Kruse, Sarah, Ormand, Carol, Parsekian, Andy, Slater, Lee, Sumy, Danielle, Taber, John. Teaching GPR in the context of Urban Geophysics: the IGUaNA project, Education Session, *18th International Conference on Ground Penetrating Radar*, June 2020, Boulder, CO. **Conference canceled due to COVID-19 pandemic.**

2017 Wetlands Behaving Badly, Taste of Science, April 26, 2017, Tampa, FL.

2016 Identifying the Geologic and Biologic Constraints on Local Flow Regimes of Florida Sandhill Wetlands Using Ground Penetrating Radar and Electric Resistivity, Rio Grande Valley Geophysical Society, August 24, 2016, Albuquerque, NM.

Conference Presentations (boldface = presenter)

2022 oral Uhlemann, Sebastian, **Downs, Christine**, Wang, Jiannan, Otto, Shawn, Kuhlmann, Kristopher, and Wu, Yuxin. Investigating the coupled thermal-hydrological-mechanical behavior of salt for nuclear waste disposal through resistivity monitoring and laboratory experiments, International High-Level Radioactive Waste Management Conference, November 15, 2022, Phoenix, AZ.

2019 both **Downs, Christine**, Jazayeri, Sajad. Enhanced Ground Penetrating Imaging of Historic Graves Using Eigenimages and Reflectivity Models. American Geophysical Union Fall Meeting, December 12, 2019, San Fransisco, CA.

2019 oral **Downs, Christine.** Enhanced Ground Penetrating Imaging of Historic Graves Using Eigenimages and Reflectivity Models. Postdoctoral Research Symposium, September 20, 2019, University of South Florida, Tampa, FL.

2017 poster **Downs, Christine M.**, Krauss, Ken, Kruse, Sarah. Time-lapse Electric Resistivity In a Stressed Mangrove Forest to Image the Role of the Root Zone in Porewater Salt Distribution, American Geophysical Union Fall Meeting, December 11, 2017, San Francisco, CA.

2017 poster **Downs, Christine**, Kruse, Sarah. Time-lapse Electric Resistivity Imaging of Subsurface Salt Mobilization in an Impounded Mangrove Forest, AGU–SEG Hydrogeophysics Workshop, July 26, 2017, Stanford University, CA.

2016 poster **Downs, Christine M.**; Weiss, Chester J., Bach, Jeffrey, Williams, Jeffery T. Modeling Near-Surface Metallic Clutter Without the Excruciating Pain, American Geophysical Union Fall Meeting, December 16, 2016, San Francisco, CA.

2016 poster Rains, Mark C., **Downs, Christine M.**, Kruse, Sarah, Weiss, Chester J. Testing the Feasibility of Imaging a Complex, Highly Conductive Environment with Field Instruments via a Three-Dimensional Electromagnetic Induction Forward Solver, American Geophysical Union Fall Meeting, December 12, 2016, San Francisco, CA.

2016 oral **Downs, Christine M.** Testing the Feasibility of Imaging a Complex, Highly Conductive Environment with Field Instruments via a Three-Dimensional Electromagnetic Induction Forward Solver, Geographies In Space Research Symposium, November 9, 2016, Tampa, FL.

2015 poster **Downs, Christine M.**, Nowicki, ReNae S., Rains, Mark C., Kruse, Sarah. Investigating Hydrogeologic Controls on Sandhill Wetlands in Covered Karst with 2D Resistivity and Ground Penetrating Radar. American Geophysical Union Fall Meeting, December 15, 2015, San Francisco, CA.

2015 oral **Downs, Christine M.**, Kruse, Sarah E., Rains, Mark C. Interpreting EM Data In a Complex and Highly Conductive Environment Through Forward Modeling, NovCare: Novel Method in Subsurface Characterization, May 19, 2015, Lawrence, KS.

2013 poster **McNiff (Downs), Christine M.**, Kruse, Sarah E., Rains, Mark C., Stringer, Christina E. Relationships Between Vegetation and Ground Conductivity in a Mangrove Near Indian River Lagoon, Florida. Soil Science Society of America Joint Meeting, October 4, 2013, Tampa, FL.

2012 oral **McNiff (Downs), Christine**, Klepeis, Keith, Webb, Laura, Kim, Jonathan. Geometric Variability and Spatial Extent of an Acadian Dome and Basin Fold Interference Pattern in NW Vermont, Vermont Geological Society Spring Meeting, April 28, 2012, Middlebury, VT.

2012 poster **McNiff (Downs), Christine**, Klepeis, Keith, Webb, Laura, Kim, Jonathan. Geometric Variability and Spatial Extent of an Acadian Dome and Basin Fold Interference Pattern in NW Vermont. Geological Society of America Northeast Section 47th Annual Meeting, March 18, 2012, Hartford, CT.