Christine Marie Downs

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Education

Ph.D.	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

2020 – present	Radar Systems Engineer | Technology Service Corporation • Evaluating noncoherent change detection (CD) from synthetic aperature radar imagery. • Experimenting with image processing techniques to improve CD performance.
2010 – 2020	Instructor University of South Florida (2020–present); University of Indianapolis (2018–2020); Hillsborough Community College (2015–2018); University of South Florida (2012–2017); University of Vermont (2010–2012) • Instruct undergraduate Earth Science courses (in-person, online, and hybrid).
May– Aug 2020	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. (Python, MATLAB, JavaScript). • Customizing open source (Python) software for instructional purposes.
Jan 2019– May 2020	Postdoctoral Scholar | University of South Florida Libraries • Designed and executed a series of ground-penetrating radar (GPR) surveys for the Digital Heritage & Humanities Collections. • 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 (MATLAB). • 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.

Jun 2016–
Mar 2018

Graduate Student Intern | Sandia National Laboratories

- Developed a Python wrapper to parametrically loop over various design parameters of a FORTRAN model that 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 (Linux).
- Developed Python code to codify 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 with Python and VisIt.

Publications & Reports

Peer-reviewed Articles

2021 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: hydrogeologic controls. *Wetland. In review.*

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. In review.*

2021 **Downs, Christine**, Jazayeri, Sajad, 2020, Resolution Enhancement of Deconvolved Ground Penetrating Radar Images Using Singular Value Decomposition. *Journal of Applied Geophysics. Accepted.*

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

Manuscripts In Preparation

2021 **Downs, Christine**, Krauss, Ken, and Kruse, Sarah. The Utility of Time-lapse Electric Resistivity Imaging of Subsurface Salt Mobilization in an Impounded Mangrove Forest.

2021 **Downs, Christine**, Kruse, Sarah, Robinson, Tonian. Characterizing Regional Patterns in Complex Mantled Karst System.

Peer-reviewed Conference Papers

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

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.

Grants & Awards (totaling $16,000)

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"

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)

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.

GIS Work

- 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).
- Produced a geodatabase of my own geologic mapping data and combined it with existing geologic maps.
- Georeferenced historical aerial photographs of a wetland to track changes in its size and shape.
- Organized and archive pre-existing GIS data for the Southwest Water Management District.
- Integrated LiDAR datasets into GIS.
- Created a workflow into ArcGIS and Python that extracted 2D profile information from LiDAR datasets for 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 • Can design effective workflows • Highly organized

Languages & Operating Systems

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

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

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

Oct 2020–	Society of Exploration Geophysicists, Near Surface Technical Section, Secretary
2017–2020	Association for Women Geoscientists Florida Chapter, Current President
2019	IRIS Urban and Environmental Geophysics Course Planning Workshop, attendee
2019	American Geophysical Union Virtual Poster Showcase, Student Presentation Judge
2017	American Geophysical Union Congressional Visit Day, Selected Representative
2013–2017	Geoscience Graduate Student Organization (USF), Secretary (2016-2017); Treasurer (2013-2014)
2013	Sigma Xi Student Research Virtual Meeting, Student Presentation Judge
2010–2012	Graduate Student Senate (UVM), Senator