J. MICHAEL JOHNSON

Curriculum Vitae · January 02, 2021

University of California, Santa Barbara, California · Department of Geography

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Keywords:

Geoinformatics (GIS); Hydroinformatics; Big Data Hydrology; Large Scale Modeling

EDUCATION

March 2021 (Expected) — **University of California, Santa Barbara, California (UCSB)**

- **Degree:** PhD Candidate in Geography (ABD)
- **Advisor:** Dr. Keith C. Clarke
- **Committee:** Dr. Hugo Loaiciga, Dr. Kelly Caylor, David Blodgett
- **Emphasis:** Modeling, Measurement, and Computation
- **Title:** Spatial Challenges of 21st Century Water Resource Research

2015 — **California Polytechnic State University, San Luis Obispo, CA**

- **Degree:** B.S. Anthropology & Geography
- **Honors:** Cum Laude
- **Minors:** Geographic Information Systems (GIS) for Agriculture
  Water Science (Watershed Management Emphasis)
  Statistics
  Economics
  Environmental Studies

RESEARCH EXPERIENCE

Post-Doctoral Researcher — **Center for Spatial Studies, UCSB**

- April 2021 (Offered Start)

Graduate Student — **University of California, Santa Barbara, California (UCSB)**

- I seek to bridge data-intensive computational geography with water resources research
- Work with international and domestic collaborators across academia, the USGS, NCAR, and NOAA
- Develop open source software to ease community access to big data
- Served as research coordinator for the NOAA National Water Center Summer Institute
- Helped author and am a primary data scientist on a multi-million dollar NSF-funded project
- 10 peer-review articles; 2 in revision; 1 in review (8 first author)
- 47 citations; h-index 4; i-index 1

PUBLICATIONS

Peer-Reviewed Journal Articles

[10] **J.M. Johnson**, Keith C. Clarke. (2020). "An Area Preserving Method for Improved Categorical Raster Resampling". *Cartography and Geographic Information Science (In Press).*

[9] David Blodgett, **J.M. Johnson**, Mark Sondheim, Michael Wieczorek, Nels Frazier. (2020). "Mainstems: A logical data model implementing mainstem and drainage basin feature types based on WaterML2 Part 3: HY-Features concepts.". *Environmental Software & Modelling.* Available here.

[8] Wens, M., Veldkamp, T., Mwangi,M., **J.M. Johnson**, Lasage, R., de Moel, H., Haer, T, and Aerts, J.C.J.H.. (2020). "Simulating small-scale agricultural adaptation decisions in response to drought risk: an empirical agent-based socio-hydrologic drought risk model for semi-arid Kenya". *Frontiers in Water.* Available here.

[7] Keith C. Clarke, **J.M. Johnson**. (2020). "Calibrating SLEUTH with Big Data: Projecting California's Land Use to 2100". *Computers, Environment and Urban Systems.* Available here.

[6] Keith C. Clarke, **J.M. Johnson**, Tim Trainor. (2019). "Contemporary American Cartographic Research: A Review and Prospective". *Cartography and Geographic Information Science.* Available here.

[5] **J.M. Johnson***, Marthe Wens*, Cecilia Zagaria, T.I.E Veldkamp. (2019). "Integrating human behavior dynamics into drought risk assessment - A socio-hydrologic, agent-based approach". *WIRES Water (*co-first author).* Available here.

[4] **J.M. Johnson**, Dinuke Munasinghe, Damilola Eyelade, Sagy Cohen. (2019). "An Integrated Evaluation of the National Water Model (NWM) Height Above Nearest Drainage (HAND) Flood Mapping Methodology". *Natural Hazards and Earth System Sciences.* Available here.

[3] H.A. Loaiciga, **J.M. Johnson**. (2018). "Infiltration on sloping terrain and its role on runoff generation and slope stability". *Journal of Hydrology.* Available here.

[2] **J.M. Johnson**, Jim M. Coll, Paul J. Ruess, and Jordan T. Hastings. (2018). "Challenges and Opportunities for Creating Intelligent Hazard Alerts: The 'FloodHippo' Prototype". *Journal of the American Water Resources Association (JAWRA).* Available here.

[1] **J.M. Johnson**, H.A. Loaiciga. (2017). "Coupled Infiltration and Kinematic-Wave Runoff Simulation in Slopes: Implications for Slope Stability". *Water.* Available here.

In Review Articles

[3] **J.M. Johnson**, David L. Blodgett, Keith C. Clarke, Jon Pollack. (NA). "Optimized time series retrieval from the hourly 1993-2018 NOAA National Water Model Reanalysis Products". *Nature Scientific Data (In Revision).*

[2] **J.M. Johnson**, Damilola Eyelade, Keith C. Clarke, Justin Singh*. (NA). "Characterizing Roughness in Terrain Based Synthetic Rating Curves". *Water Resources Research (In Revision).*

[1] **J.M. Johnson**, Amir Mazrooei, A.Sankarasubramanian, Keith C. Clarke, Lilit Yeghiazarian. (NA). "Diagnosing performance in continental-scale, high-resolution, processed-based hydrologic models: The National Water Model". *JGR: Atmospheres (submitted for review: 2020-11-27).*

Technical Reports

[4] **J.M. Johnson**, [+22 others]. (2020). "Moving from Information to Insight by Linking Urban and Hydrologic Systems through the Urban Flooding Open Knowledge Network". *American Water Resources Association IMPACT Magizene: Geospatial Water Technology.*

[3] **J.M. Johnson**, Coll J.M, et al. (2017). "National Water Centers Innovators Program Summer Institute Report". *Consortium of Universities for the Advancement of Hydrologic Science, Inc. Technical Report 14.* Available here.

[2] Coll J.M, **J.M. Johnson**, Ruess P.J.. (2016). "Radar Measurement and Flow Modeling: Methods". *National Water Center Innovators Program Summer Institute Report. Consortium of Universities for the Advancement of Hydrologic Science, Inc. Technical Report 13, Ch 1.* Available here.

[1] **J.M. Johnson**, Coll J.M, Ruess P.J.. (2016). "OPERA-Operational Platform for Emergency Response and Awareness: Reimagining Disaster Alerts". *National Water Center Innovators Program Summer Institute Report. Consortium of Universities for the Advancement of Hydrologic Science, Inc. Technical Report 13, Ch 11.* Available here.

Cartography

[3] **J.M. Johnson**. (2017). "Map of Staats-Brabant indicating territories and boundaries c. 1648 [map]. Scale not given". *van de Meerendonk et al. Striving for Unity: The Significance and Original Context of Political Allegories by Theodoor van Thulden for 's-Hertogenbosch Town Hall. Early Modern Low Countries. Figure 6.* Available here.

[2] **J.M. Johnson**. (2017). "Rising Sea Levels: Hawaii [map]. Scale not given". *Water: An Atlas. Oakland, CA: Guerrilla Cartography.*

[1] **J.M. Johnson**. (2017). "Peoples and Regions of Africa [map]. Scale not given". *Cole, Herbert M. Maternity: Mothers and Children in the Arts of Africa, CT: Yale University Press.*

RESEARCH GRANTS

[6]	2021-2022 (Approved start in Feb.)	**Hydrologic Addressing Through a Spatial Data Lens** Role: Researcher, authored proposal USGS Pathways Program $30,000
[5]	2020-2022	**The UFOKN: Delivering Flood Information to AnyOne, AnyTime, AnyWhere** Role: Lead Data Scientist, helped author proposal National Science Foundation $2,853,561
[4]	2019-2020	**Convergence Accelerator Phase I (RAISE): The Urban Flooding Open Knowledge Network (UFOKN)** Role: Data Scientist National Science Foundation $1,027,958

[3] 2018-2019 **A National Water Model R Package: Improving access and application of model output**
Role: Co-Principal Investigator, authored proposal
UCAR COMET
$15,000

[2] 2017-2018 **FOSSFlood: The LivingFlood Application Built on Free Open Source Software**
Role: Contributor
UCAR COMET
$5,000

[1] 2017-2018 **Integrating farmers' adaptive behaviors in California's Central Valley to assess water and food security risks under climate change**
Role: Co-Principal Investigator, authored proposal
UCGHI Planetary Health Seed Grant
$10,000

FELLOWSHIPS

[3] 2020-2021 **HydroInformatics Fellowship**
Consortium of Universities for the Advancement of Hydrologic Science
$5,000

[2] 2019-2020 **Jack and Laura Dangermond GIS Fellow in Residence**
Jack and Laura Dangermond
$5,000

[1] 2015-2016 **Disciplines Fellowship**
University of California Regents
$30,000

SCIENTIFIC SOFTWARE

Author, Creator

[7] **AOI** Fast & flexible geocoding and AOI creation

[6] **climateR** Compiling gridded and observation climate data

[5] **FloodMapping** Flood mapping using CFIM and the National Water Model

[4] **nwmHistoric** Accessing the National Water Model reanalysis streamflow

[3] **NFHL** Interface to the FEMA National Flood Hazards Layer

[2] **NWM** An R client for the operational National Water Model

[1] **nomadsNC** Time Series Optimiezed National Water Model Forecasts

Author On

[1] **USGS-R dataRetrieval** R Interface to the USGS data holdings

Contributor To

[2] **USGS-R nhdplusTools** — Manipulating hydrographic data with the NHDPlus data model

[1] **elevatr** — Accessing elevation data from various sources

Roles as assigned in package description and defined here

INSTRUCTOR, DEPARTMENT OF GEOGRAPHY, UCSB:

Summer 2020 **Introduction to Geoinformatics**

- Independently developed and taught to address the growing need for data science in the GIS profession.
- Will become new prerequisite course for the UCSB Geography Department and new Masters in GIS Curriculum starting in 2021
- Content Available here: https://mikejohnson51.github.io/spds/

TEACHING ASSISTANT, DEPARTMENT OF GEOGRAPHY, UCSB:

[9] **2021, 2020** — **Remote Sensing of the Environment 2**
- Dr. Vena Chu, Alana Ayasse

[8] **2020, 2019, 2018, 2016** — **Living with Global Warming**
- Dr. Catherine Gautier

[7] **2020, 2019, 2017** — **Conceptual Modeling and Programming for the Geo-Sciences**
- Dr. Krzysztof Janowicz

[6] **2020** — **Remote Sensing of the Environment 1**
- Dr. Joe McFadden

[5] **2019** — **Remote Sensing of the Environment 3**
- Dr. Vena Chu

[4] **2019, 2018, 2017** — **Maps and Spatial Reasoning**
- Dr. Werner Kuhn, Dr. Keith Clarke

[3] **2018** — **Cartographic Design and Geovisualization**
- Dr. Keith Clarke

[2] **2017** — **Environmental Water Quality**
- Dr. Hugo Loaiciga

[1] **2016** — **Oceans and Atmosphere**
- Dr. Tim DeVeries

TEACHING AWARD NOMINATIONS, UCSB

[1] **2020, 2019** — Nominated for UCSB Geography Excellence in Teaching by faculty member

[2] **2020, 2019** — Nominated for UCSB GSA Excellence in Teaching by students

MENTORSHIP EXPERIENCE, UCSB

- Have mentored 11 undergraduates in formal capacities including independent research projects, inclusion in research efforts, and instructional independent study.
- Served as a sponsor for the Ronald E. McNair Postbaccalaureate Achievement Program
- Serving as a faculty mentor for the Gene and Susan Lucas Undergraduate Research Fund created to help first-generation undergraduate students experience research

PROFESSIONAL EXPERIENCE

Lecturer — **Department of Geography, UCSB**
- Summer 2021 (Offered Position)

Sep 2019 - Present — **Data Scientist**: Urban Flooding Open Knowledge Network

Sep 2020 - Present — **Water Resourcees Engineer II***: Lynker Technologies/ NOAA-Affiliate
- Assigned to the NOAA Next Generation Water Modeling Engine and Framework Prototype development group

Visiting Researcher — **Institute for Environmental Studies. Vrije Universiteit, Amsterdam**
- June - July 2019
- January - March 2018

Research Applications Laboratory. NCAR, Boulder, Colorado
- August - September 2018

NOAA National Water Center. Tuscaloosa, Alabama
- June - August 2017
- June - August 2016

*security clearance (secret)

PROSFESSIONAL SERVICE

[9] **2019-2021** — UCSB Geography Chair's Graduate Advisory Committee

[8] **2020** — Advisory Board: Azavea NOAA SBIR Phase I

[7] **2018-Present** — Reviewer for: European Journal of Environmental and Civil Engineering, Transactions in GIS, rOpenSci

[6] **2014 - 2019** — Irrigation Association: Certified Agricultural Irrigation Specialist

[5] **2019** — Spatial Discovery Experts Meeting

[4] **2018** — UCSB Geography Spatial Data Science Faculty Search Committee

[3] **2017** — NOAA National Water Center Summer Institute Research Coordinator

[2] **2015-2017** — UCSB Geography Department Outreach Committee

[1] **2016** — NOAA National Water Center Summer Institute Research Fellow

PRESENTATIONS

[25]	**Nov 2020**	**University of Kansas GIS day** *Climate Analysis with R*	presentation
[24]	**Nov 2020**	**Unidata Users Committee** *Fall 2020 Student Panel*	panel
[23]	**Oct 2020**	**Eco Data Science** *Working with Gridded Climate Data in R*	presentation
[22]	**July 2020**	**ESIP Summer Meeting** *Does slightly better data equal much better information?*	presentation
[21]	**Feb 2020**	**USGS Water Mission Area** *Urban Flooding Open Knowledge Network*	presentation
[20]	**Feb 2020**	**Microsoft Research and Development Team** *Urban Flooding Open Knowledge Network*	presentation
[19]	**Feb 2020**	**ESIP: Interoperability and Technology/Tech Dive Webinar Series** *Urban Flooding Open Knowledge Network*	presentation
[18]	**Dec 2019**	**American Geophysical Union Fall Meeting** *Representing Landcover in the National Water Model*	poster
[17]	**Dec 2019**	**American Geophysical Union Fall Meeting** *Identifying distrubed watersheds using 20 years of MODIS and Google Earth Engine*	poster
[16]	**Dec 2019**	**American Geophysical Union Fall Meeting** *Using Google Earth Engine and MODIS to detect watershed disturbance*	presentation (Google Booth)
[15]	**Dec 2018**	**American Geophysical Union Fall Meeting** *The National Water Model and R: Providing fast discovery, access, and usability of NWM output and earth systems data*	presentation
[14]	**Dec 2018**	**American Geophysical Union Fall Meeting** *Drought adaptation behavior of agricultural stakeholders: An Agent Based Model for Kenya*	presentation
[13]	**June 2018**	**International Congress on Environmental Modelling and Software** *An agent-based approach to evaluating sustainable drought adaptation policy*	presentation
[12]	**June 2018**	**International Congress on Environmental Modelling and Software** *Simulating dynamic drought adaptation behavior of agricultural stakeholders using Agent-Based Models*	presentation
[11]	**April 2018**	**European Geophysical Union** *Integrating Adaption behavior in drought risk analysis*	poster
[10]	**Dec 2017**	**American Geophysical Union Fall Meeting** *HydroData: Discover Earth Systems Data with R*	eLightning talk

[9]	**July 2017**	**CUAHSI Hydroinformatics Conference** *Real-time Discharge-to-Damage Flood Mapping 'Anywhere, USA'*	presentation
[8]	**May 2017**	**@Spatial Tech Talk UCSB Spatial Center** *Accessing National Water Model Output*	presentation
[7]	**Nov 2016**	**UCGIS Webinar** *2017 CUAHSI SI: Collaborative Problem Solving at the National Water Center*	presentation
[6]	**Nov 2016**	**HAZUS Users Conference** *Reimagining Disaster Alert Systems: OPERA*	presentation
[5]	**Oct 2016**	**UCSB-SDSU Retreat** *The Five Meanings of Water Security*	presentation
[4]	**July 2016**	**CUAHSI Biennial Conference** *Densified Radar Measurement and Flow Modeling*	poster
[3]	**May 2016**	**California Geography Society 2016 Annual Conference** *Rising Temperatures and Water Supply: Tools for Water Security*	presentation
[2]	**April 2016**	**UC Student Lobby Conference** *Water Research: Problems with Scale*	presentation
[1]	**May 2015**	**California Geography Society 2015 Annual Conference** *Developing a Decision Support System for California Surface Water*	presentation

REFERENCES

Keith Clarke, PhD
Professor
Department of Geography, University of California, Santa Barbara
kcclarke@ucsb.edu

Sankar Arumugam, PhD
Professor and University Faculty Scholar
Department of Civil, Construction, and Environmental Engineering, North Carolina State University
sankar_arumugam@ncsu.edu

Krzysztof Janowicz, PhD
Professor
Department of Geography, University of California, Santa Barbara
janowicz@ucsb.edu

Lilit Yeghiazarian, PhD
Associate Professor
Environmental Engineering and Science, University of Cincinnati
yeghialt@ucmail.uc.edu

Trey Flowers, PhD
Director of the Analysis and Prediction Division
NOAA National Water Center
trey.flowers@noaa.gov

David Blodgett
Civil Engineer
USGS Office of Water Information Center for Integrated Data Analytics
dblodgett@usgs.gov

J. Michael Johnson · Research Statement
University of California, Santa Barbara, California · Department of Geography

As a spatial data scientist I work with a range of engineers, geographers, computer scientists, hydrologists, and social scientists. I am interested in the data architecture supporting continental hydrologic modeling, and the development of methods to learn from, improve, and apply model output to research and application pursuits. When approaching the challenge of large-scale hydrologic modeling, there is an increasing need for a spatial perspective to inform process representation, analysis, and how output can be made accessible. Within these interests there are clear synergies with the faculty at Mines aligned with the *Hydrologic Science & Engineering* and *GIS & Geoinformatics* interdisciplinary programs related to hydrologic prediction, land cover disturbance and its impacts of hydrologic process and representation, building geospatial techniques for natural resource management, and leveraging data science techniques to answer novel questions related to the earth and environment.

Broadly, my work contributes to the United Nations Sustainable Development Goal of *Water and Sanitation*, the Open-Source Geospatial Foundation's mission to "promote collaborative development of open geospatial technologies and data," and the Semantic Web's mission to "allow everyone to find, share, and combine information more easily." In application, it contributes to the grand challenge of high-resolution continental scale hydrology; the US mission of becoming a more weather ready nation, and NOAA's aim of strengthening national water forecasting through the National Water Center. In the context of these societal goals, my research focuses are summarized below:

1) Supporting the Use of Big Earth Systems Data
(Data Science)

Large scale models provide a wealth of data that can transform research possibilities. However, the volume and structure of data outputs often limit usability. Therefore, I develop tools and software to facilitate flexible and programmatic ways to query remote geospatial data products for use in local computing environments. As a Consortium of Universities for Hydrologic Science (CUAHSI) HydroInformatics Fellow, I have been tackling the challenge of optimizing continental streamflow forecasts for time series extraction (paper in revision with *Nature Data Science*). Other data efforts have included: (1) improving the accessibility of the NHDPlus attribute and geometry data to support machine learning, statistical, and mapping applications (2) streamlining the data workflows and core data products for national flood forecasting using the Continental Flood Mapping Framework (CFIM), and (3) building tools for subseting the National Water Model (NWM) to support local model development, testing, and application.

2) Data Interoperability & Integration
(Computational Hydrology/Data Science)

To improve large scale modeling efforts, there is a need to integrate local and national data using a consistent data model to support dataset integration, feature addressing, and data assimilation. Much like we are able to provide a postal address for every home in the world, there is a need to assign hydrologic addresses that persist across scales. A recent collaboration with the USGS, NOAA, and Natural Resources Canada focused on the development of a logical model, called *Mainstems*, for multi-scale data integration. Building on this, I was selected as a USGS Pathways participant to help develop a continental dataset of mainstem identifiers, an initial set of community reference features (streamgages, dams, water quality sites), and methods for other agencies to annotate their data with mainstem identifiers. In conjunction, I was hired as a NOAA-Affiliate to contribute to the data model development for the next generation hydrologic modeling efforts. Collectively these efforts will make it easier to index disparate datasets and observation networks to a common addressing scheme, and the inclusion of mainstem identifiers in the next generation hydrologic modeling efforts will support model improvement, evaluation, intercomparison, and application.

3) Large-scale Modeling
(Computational Hydrology/Geoinformatics/Applied Machine Learning)

Water and energy simulations are often computed across grids representing the land surface that are analogous to the raster data model. The way grid cell properties are assigned can have cascading impacts on the accuracy of model results and are particularly difficult to get right in continental domains. While most high-resolution continental models operate on a ~1 km^2 grid, there are many modern resources that describe the variability of the land surface at finer scales. I am interested in how spatial properties can be characterized across scales to better inform model inputs and processes using novel applications of the raster data model. My initial work in the area focused on refining landcover maps and has sparked collaborations with members at San Diego State University focusing on advancing model base layers, and also at NCAR to explore how infiltration is represented in the NWM (WRF-Hydro). Equally, I am interested in quantifying the impacts of land cover change, both persistent and sudden, on water/energy simulations and the timescales at which change should be included in land surface models. This work relies heavily on integrating multiple-scale datasets and methods, including observation data from MODIS, historic simulations from NLDAS, feature datasets like fire burn perimeters and urban planning zones, and numerical models like NOAH-MP and urban growth models. Collectively these tools can help quantify what has happened in the past, evaluate how those processes were captured in historic simulations, highlight the capacity for new methods to capture these changes, and context for what we can expect in the future.

Aside from gridded model layers, many model elements are expressed in terms of parameters, including river channel geometry and reservoir operations. I am interested how hydrologic, hydraulic, and anthropogenic behavior can be learned from observation networks, and generalized using combinations of spatial data, network topologies, and machine learning. With early success in predicting rating curve relationships across the United States (in revisions at *Water Resources Research*), I am evaluating other hydraulic relations with the goal of providing a national dataset of idealized channel geometries that are necessary for hydrologic routing as well as many finer scale issues including sediment transport, species modeling, and flood forecasting.

4) Earth & Environment Information Infrastructures
(Data & Computer Science/Large-scale Modeling)

The last decade has seen unprecedented events including fires, floods, and a pandemic that have stressed aging infrastructure, revealed weaknesses in regional policies, and exposed the interconnected nature of social, ecological and technological systems. Within the NSFs focus on *"accelerating research to impact society at scale"* under the *"harnessing the big data revolution"* initiative, I have been part of the multi-phase, multi-university Urban Flooding Open Knowledge Network (UFOKN) project performing as a lead data scientist to formalize the connections between geodata (like roads and homes) and hydrologic models. These connections are expressed as linked data resources that rapidly relate forecasts to impacts in a knowledge graph infrastructure. Forecasting impacts in graph space is not only more efficient than traditional GIS approaches, but allows for integrative questions such as *"will there be flooding near me,"* *"what substations will flood,"* or *"what communities rely on this road,"* that can be queried using search engines and semantic technologies.

As part of the project, we are required to develop a self-sustaining product through active industry partnerships with Google, Microsoft, Streamline Technologies, StormGeo, element84 and LeapAnalysis; academic partnerships with CUAHSI, Woods Hole Oceanographic Institution, Consortium for Ocean Leadership, the Internet of Water; and with federal partners like the EPA, USGS, and NOAA, and a number of local and county municipalities. Concurrently I am on also on the advisory board for a NOAA small business grant with Azavea Geographic Solutions which has provided more insights into how academia can support business. In all cases, these experiences have exposed ways for academic research to contribute to industry and entrepreneurial endeavors and cemented a number of partnerships that will help accelerate the impact and goals of my future research.

J. Michael Johnson · Teaching Statement
University of California, Santa Barbara, California · Department of Geography

The University of California, Santa Barbara offers one of the top geography departments in the world, and I have been fortunate to learn from a number of motivating instructors as a teaching assistant (TA) for lower division, upper division, and graduate level courses on topics including water quality, software engineering, cartography and data visualization, remote sensing, and physical geography. In both 2019 and 2020 I was nominated for the department *Excellence in Teaching* award by our faculty, and for the University *Teaching Assistant* award by my students. One of my proudest accomplishments was being allowed to independently design and teach our department's Introduction to GIS course (available here). I redesigned this course as an Introduction to Geoinformatics to fill a departmental gap in data science and geospatial programming. In summer of 2020, due to the COVID-19 campus closure, I taught this class remotely to 48 students from around the world, most of whom had never programed. In response to student demand, and a recognition that programming skills are now required of Geoscience professionals, I was offered the opportunity to refine this class as a permanent department offering and a pre-requisite for undergraduates and the newly established Masters in GIS. I will be hired as a lecturer at UCSB to teach this again in the 2021 summer session.

At UCSB, I have had a range of experience teaching in traditional, hybrid, remote and online classrooms. In addition to my summer course, I have been a remote TA for three classes: Modeling and Programming for the Geo-Sciences, Introduction to Remote Sensing, and Advanced Remote Sensing. Each summer, I have TA'd and administered a synchronous online, writing-based course on climate change for non-majors. Further, my advisor created a hybrid course in which labs are given in person, but lectures are activity based and asynchronous. I have both TA'd and helped develop labs for this course which is now offered across the University of California system. Each of these experiences have helped me better understand the complexity of teaching through different platforms and has prepared me to teach in an increasingly remote and/or hybrid world.

With respect to teaching interests at Mines, I enjoy helping students use programming and computational methods to solve problems, document and share their work, and guide the way they think, research and advance their learning. I would be interested in providing data science, data management, and data visualization courses that could serve as a common beginning for students across the Computational Science and Data Analytics allied departments. In line with the GIS and Geoinformatics Interdisciplinary group and the Geology and Geological Engineering Department, I would enjoy teaching a range of geospatial data science and geostatistics courses including GIS Applications, spatial modeling and data models, remote sensing and analysis, and applied machine learning for environmental research. In the Hydrologic Science and Engineering program

and aligned with the department of Civil & Environmental Engineering, I would be prepared to teach a range of courses covering topics such as hydrologic analysis and design, surface water hydrology, rainfall-runoff modeling, and watershed modeling. Equally, I would be eager to organize graduate seminars that take a deep dive into methods and technologies including data science, geospatial analysis, linked data and semantic technologies, or hydrologic and land surface modeling (e.g., NOAH-MP, WRF-Hydro).

From my experiences as a student, a TA, and an instructor, a few aspects guide how I prefer to structure a class regardless of platform. My teaching philosophy is certainly a product of my undergraduate university's philosophy of "Learn by Doing," and I am a strong believer that classes should: (1) be challenge based and flexible, (2) teach a practical skill alongside a strong theoretical foundation, and (3) require students to integrate the skill and theory to produce something meaningful.

I use programming as a way to teach and reinforce concepts. While it's rare to spend time "learning to program," code is used throughout lectures and is required to solve daily exercises and labs. One of the biggest stressors and areas of inequity in the classroom expressed by past students are timed, memorization heavy tests that favor populations who have been trained to perform under those circumstances. Instead, my courses evaluate students with low stress, but high expectation, projects that push their ability to find and synthesize information, clean and work with real-world data, and actively problem solve and communicate results.

Core learning objectives are clearly established at the beginning of the course; however, the timeline and the way material is presented remains flexible to meet student needs. Equally, students are encouraged to see the classroom as a collaborative rather than competitive environment in which the instructor is an active participant. All courses start with a steep learning curve that motivates students to collaborate, overcome their initial fears of coding, and open channels of communication with me about what is and is not working.

Lecture material aims to be deep and comprehensive, so students are exposed to the central concepts, theories, and organizations in a field, while building the foundations to independently find material. They are not expected to retain every detail from lecture, but rather how to recall, reference, and find material as they need it. To support this process, every lecture is followed by a completion-based assignment that requires the lecture concepts to be translated to code in a way that represents a process or idea. The labs each week challenge students to mix and extend these daily exercises and apply them to a real-world topical problems that they document and share using reproducible version-controlled technology. These assignments help students work at their own pace, grapple with the material, seek help, and better relate concepts to real-world applications.

In a world that is increasingly competitive, visual, and online, students need ways to showcase their skills to employers and graduate admission committees. Thus, each class

aims to develop something tangible that students can take with them. These projects are introduced at the beginning of the course and mature through the quarter by scaling lab and lecture assignments. In my Geoinformatics course this was a personal website that highlighted their labs, resume, and an 'About Me' page. In the first week's lab students built this website to reinforce reproducible data science practices and each week they added to it linking their labs and material from previous classes. The course final was to fine tune this website, while adjusting the About Me page to verbalize what they had learned, and document their abilities as a spatial data scientist. Already, four students have commented on these webpages being key to securing post graduate jobs or internships.

In the end, I truly enjoy teaching. One of the most appealing features of a career in academics is the ability to do both cutting edge research and teach students material I am enthusiastic about. I am particularly excited about the opportunity to teach as a university like Mines that embraces a learn by doing philosophy, devotes significant time and resources to educating students, has an established tradition of faculty and students working together, and strong interdisciplinary programs focused on Geoinformatics and water resources research.

J. Michael Johnson · Diversity Statement
University of California, Santa Barbara, California · Department of Geography

Despite having significant Hispanic ancestry, I have always identified as white in large part because of my suburban geography. Opportunities were never closed to me or made more difficult because of who I was or economic limitations, and I benefited from a family that supported me and emphasized educational pursuits. I never feared asking for help, always considered looking for opportunities, and felt that I had a fair shot in everything I did. Resulting, I entered college with the educational preparation and social perspective needed to succeed in an American university.

My early attraction to geography was the field's embrace of, if not dependency on, an interdisciplinary perspective. As an undergraduate, I was a registered student (major or minor) in all six colleges at California State Polytechnic University San Luis Obispo and since coming to UCSB, I have been fortunate to collaborate with people who represent a diversity in ethnicity, culture, gender, and specialty of study. My education and life experiences have been reflective of the global scientific community, enriched by opportunities they have offered, humbled by the challenge's others persevered through, and because of these, I am a far better scientist and person. While striving for more equal representation in the college setting is certainty a matter of fairness, a diverse and inclusive campus environment also inspires creativity and innovation as well as compassion and empathy. Thus, a university's commitment to diversity is also a commitment to preparing the next generation of engaged global citizens.

While diversity can be embodied in many ways there are concrete aspects of modern society that have made opportunity less available to certain groups. It is also clear in our country that opportunity begets opportunity and work ethic alone is often not enough to overcome structural imbalances. While universities have a duty to recruit student populations that represent American society, professors must recognize the current system is meant to engage students with a certain academic and social preparation. It is unfair to bring someone who, through no fault of their own, hasn't been prepared to succeed in a university classroom and expect them to thrive with no guidance.

As a Hispanic Serving Institution with almost 15% international enrollment, UCSB provides many resources for students. Mines too has a well-articulated mission to provide support services and resources through their Diversity, Inclusion and Access initiative. What has been notable in my experience, however, is that traditionally underrepresented students are not accustomed to seeking out opportunities tailored to help them succeed simply because it is antithetical to their life experience. Due to their day-to-day role with students, faculty have the ability to identify areas where students are struggling and provide a bridge between the university as an institution and the students as individuals.

As a teaching assistant and instructor, I have taken this role seriously, and each quarter

solicit feedback from students on a regular basis to adjust the way content is shared. These efforts have directly impacted the way I frame classes as a group of people working towards a common goal, the way I design evaluations, and the choices I make to use open-source textbooks and software everyone can afford. The group driven nature of classes indirectly exposes students to the ways others seek help and navigate a university system, and challenges students to bring their strengths to the forefront. Not only have these efforts made the classes more welcoming and interactive to all, but they have also improved the experience of everyone as the exposure to diverse backgrounds enriches the educational and social experience.

Outside of the structured classroom, faculty have a unique ability to help develop young researchers. In my time as a graduate student, I have mentored eleven students representing a range of gender, nationality and study. In some cases, students asked for these opportunities, but in most it required an invitation or a passing comment that the opportunity was available. Of these mentees, two have been non-traditional students who came back to school. For one of them, I served as sponsor for the federally funded, Ronald E. McNair Scholars Program which aims to prepare underrepresented students for success in PhD programs with the long-term goal of diversifying the faculty in colleges across the country. My participation in this program gave me a lot of insight into the institutional efforts aiming to address disparities, but also the desperate need these programs have for faculty involvement and buy in. Other mentees have been a first-generation student for whom I am serving as the faculty sponsor for the Gene and Susan Lucas Undergraduate Research Fund (created to help first-generation undergraduate students experience STEM research), a military professional who is attending school on his GI bill and is a co-author on a set of research articles, and students from other departments who have found GIS and geography useful for their interests.

Lastly, one of the keys to success in an era of online applications, is "*who you know*". I make a concentrated effort to actively grow a research community that includes current and past students. By getting the opportunity to simply be recognized and showcase what they can do, students can begin to propel their futures on their skills, talent, and work ethic. I am in regular contact with a number of my past students and have written letters of recommendation and helped craft their graduate school applications. Last quarter, following the course I taught in the summer, I started a weekly research group with four motivated students and their efforts have led to one being recently hired at an environmental consulting firm, and another, who never felt graduate school was an option, to spark a number of conversations with potential advisors.

While issues of representation at the faculty level are huge, and commitment to institutional programs is critical, what is equally important is that students know they have professors who support them, and that this support is demonstrated in actions. If given the opportunity to join the Mines faculty, I am fully committed to learning about the programs in place to support students, to contribute to programs like the

Multi-Cultural Engineering Challenge Program, and the CASA faculty group, and to continue adapting my classroom and material to meet the needs of current students. As a Faculty member, I believe the ability to influence the trajectories of student's lives is equally important to our ability to shape a research agenda. In some cases, this will simply be helping them find a new passion, but in others it will be helping them work towards, and see, their full potential.

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Dr. Kamini Singha
Chair of the Search Committee
Colorado School of Mines, 1500 Illinois St, Golden, CO 80401

Dear Dr. Singha,

I am writing to apply for an Assistant Professor position in the Computational Science and Data Analytics cluster hire (Job no. 494587) at the Colorado School of Mines. I will earn my PhD in Geography in March 2021 from the University of California, Santa Barbara (UCSB).

For this call, my preferred home departments would be *Civil & Environmental Engineering* or *Geology & Geological Engineering*, and I would be eager to support both the Hydrologic Science and Engineering (HSE) and GIS and Geoinformatics Interdisciplinary Programs. I am most interested in the Computational Hydrology focus area but my research and teaching involves many aspects of spatial and statistical data science methods, applied machine learning, computer science technologies, hydrologic and land surface modeling, and software development.

Concurrent to my PhD studies, I am a NOAA Affiliate (Water Resource Engineer II through Lynker Technologies in Boulder, Colorado) assigned to support the National Water Center and their next generation water model efforts. Additionally, I am working as a primary data scientist for the Urban Flooding Open Knowledge Network which is a large-scale NSF-funded project building semantic technologies to integrate geodata with continental and local scale hydrologic models with principal investigators at University of Cincinnati, North Carolina State University, University of Illinois at Urban Champagne, Purdue University, Woods Hole Oceanographic Institution, and University of Maine. Additionally, I sit on an Advisory Board for Azevea which is supported by a NOAA small business grant to build systems for disseminating model output from continental land surface and hydrologic models.

As a graduate student, I have published ten papers with three currently in revisions/review (eight of the thirteen are first author) with UCSB undergraduates, domestic and international students and faculty, and researchers at the USGS, NOAA, and NCAR. I have written grants totaling $65,000, found external fellowships totaling $40,000, and helped author an NSF proposal worth $2,853,561. Through these experiences I have learned about the process of funding research through small and large solicitations and, if offered a position at Mines, will continue actively establishing a self-funded, diverse research group, that recruits and involves undergraduate and graduate students.

I am particularly excited about the opportunity to teach at a university like Mines that embraces a learn by doing philosophy, devotes significant time and resources to educating students, has an established tradition of faculty and students working together.

At UCSB, I designed a data science focused, *Introduction to Geoinformatics* course which is in process of being adopted as a new Geography prerequisite both for the undergraduates and the newly established Masters in GIS. I taught this course remotely in the summer of 2020 and am

scheduled to teach it as a lecturer this coming summer in person. Additionally, I have TA'd for 10 different classes (seventeen quarters) including remote sensing, GIS, software engineering, and data visualization.

Related to this call, I would be eager to develop and teach materials geared towards the study of earth, energy and engineering with a data-centric and data-science focus in traditional, hybrid, and online platforms. I would be able to support the modular MS in Data Science programs both by broadly integrating data science best practices and education into the core of STEM training and graduate certificates, and specifically in the domain of geospatial applications, including GIS, geoinformatics, geostatistics, and remote sensing. Equally I would bring my hydrologic and land surface modeling experience to support the HSE's research agenda and help grow graduate offerings related to local, regional, and continental scale water modeling, analysis, and evaluation.

On a more personal note, I grew up in Colorado and the combination of the aim of this call and Mines as a university, is a perfect opportunity for me to do what I love, surrounded by a community equally dedicated to research teaching, in the place I've always called home. Therefore, I could not be more excited to apply.

The enclosed material details specifically how I hope to contribute to your department(s) and the exciting interdisciplinary work being done at Mines.

Thank you for your consideration,

Mike Johnson

PhD Candidate

Department of Geography, University of California, Santa Barbara

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