

# Christian Sutherland Sampson

## Curriculum Vitae

Joint Center for Satellite Data Assimilation, UCAR/NCAR ,  
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## Education

- B.S. Mathematics with a minor in Earth Science, University of Utah, 2010
- B.S. Physics, University of Utah, 2010
- Ph.D. Mathematics, University of Utah 2017

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## Research Interests

I am interested in finding novel ways to apply advanced mathematics to problems in climate science, geophysics, Earth science, human health and equity. I am interested in developing new data assimilation methods, earth-system modelling (both reduced order and large scale), physical process models, sea ice and climate, and the effects climate change may have on vulnerable groups and ecosystems. I am also interested in experimental work, especially in the field. Currently I am developing new data assimilation methods in the Joint Effort for Data assimilation Integration (JEDI) system aimed to be the operational assimilation system for NOAA, NASA, The Navy, USAF, and UK Met-Office.

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## Research Experience

- (2022-pres.) Project Scientist: JEDI Development Core Team, Algorithms  
Joint Center For Satellite Data Assimilation, UCAR/NCAR
- (2018-2022) Post-Doctoral Fellow: Data Assimilation and Sea Ice Modeling  
University of North Carolina at Chapel Hill, Department of Mathematics  
Mentor: Distinguished Professor Chris Jones
- (2019) Field Work: expedition member of the Breaking Bubbles cruise aboard the *RV Sikuliaq* (December), in the Gulf of Alaska
- (2017-2018) Post-Doctoral Fellow: Program on Mathematical and Statistical Methods for Climate and the Earth System (CLIM)  
Statistical and Applied Mathematical Sciences Institute (SAMSI)  
Mentors: Professors Richard Smith and Chris Jones
- (2013) Field Work: participant in University of Alaska Fairbanks course on field techniques in sea ice research, Barrow, AK
- (2012) Field work: expedition member of the Sea Ice Physics and Ecosystem Experiment II aboard the *Aurora Australis* (Sept. - Nov.), off the coast of East Antarctica
- (2012) Field work: *in situ* measurements of the fluid permeability and electrical conductivity of Arctic sea ice, Barrow, AK
- (2011) Field work: *in situ* measurements of the fluid permeability and electrical conductivity of Arctic sea ice, Barrow, AK
- (2010-2017) Doctoral Dissertation Research: modeling wave dynamics in the marginal ice zone  
University of Utah, Department of Mathematics  
Mentor: Distinguished Professor Kenneth M. Golden

- (2008-2010) Undergraduate Research: modeling and analyzing the electrical properties of sea ice  
University of Utah, Department of Mathematics  
Mentor: Distinguished Professor Kenneth M. Golden

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## Publications

1. J. Zhu, K.M. Golden, A. Gully, and C. Sampson. A network model for electrical transport in sea ice. *Physica B: Condensed Matter*, 405(14):3033 – 3036, 2010
2. C. Sampson, K.M. Golden, A. Gully, and A.P. Worby. Surface impedance tomography for Antarctic sea ice. *Deep Sea Research II*, 58(9-10):1149 – 1157, 2011
3. M. Barjatia, T. Tasdizen, B. Song, C. Sampson, and K.M. Golden. Network modeling of Arctic melt ponds. *Cold Regions Science and Technology*, 124:40 – 53, 2016
4. Yawen Guan, Christian Sampson, J. Derek Tucker, Won Chang, Anirban Mondal, Murali Haran, and Deborah Sulsky. Computer model calibration based on image warping metrics: An application for sea ice deformation. *Journal of Agricultural, Biological and Environmental Statistics*, 24(3):444–463, Sep 2019
5. Geir Evensen, Javier Amezcua, Marc Bocquet, Alberto Carrassi, Alban Farchi, Alison Fowler, Pieter L. Houtekamer, Christopher K. Jones, Rafael J. de Moraes, Manuel Pulido, Christian Sampson, and Femke C. Vossepoel. An international initiative of predicting the SARS-CoV-2 pandemic using ensemble data assimilation. *Foundations of Data Science*, 0(2639-8001\_2019\_0\_28):65, 2020
6. Christian Sampson, Alberto Carrassi, Ali Aydoğdu, and Chris K. R. T Jones. Ensemble Kalman Filter for non-conservative moving mesh solvers with a joint physics and mesh location update. *Quarterly Journal of the Royal Meteorological Society (in press text available on arXiv)*, 2021
7. Emmanuel Fleurantin, Christian Sampson, Daniel Paul Maes, Justin Bennett, Tayler Fernandes-Nunez, Sophia Marx, and Geir Evensen. A study of disproportionately affected populations by race/ethnicity during the sars-cov-2 pandemic using multi-population seir modeling and ensemble data assimilation. *Foundations of Data Science*, 3(3):479–541, 2021
8. Julie Sherman, Christian Sampson, Emmanuel Fleurantin, Zhimin Wu, and Christopher K. R. T. Jones. A data-driven study of the drivers of stratospheric circulation via reduced order modeling and data assimilation. *Meteorology*, 3(1):1–35, 2024
9. Eric J. Lingerfelt, Tariq J. Hamzey, Maryam Abdi-Oskoue, Jérôme Barré, Fábio Diniz, Clémentine Gas, Ashley Griffin, Dominikus Heinzeller, Stephen Herbener, Evan Parker, Benjamin Ruston, Christian Sampson, Travis Sluka, Kristin Smith, and Yannick Trémolet. The research repository for data and diagnostics (r2d2): An online database software system for high performance computing and cloud-based satellite data assimilation workflows. In *International Conference on Conceptual Structures*, 2024
10. C. S. Sampson, N.B. Murphy, E. Cherkaev, and K.M. Golden. Effective rheology and wave propagation in the marginal ice zone. *Submitted*, 2024
11. K.M. Golden, H. Eicken, A. Gully, M. Ingham, K.A. Jones, J. Lin, J. Reid, C. Sampson, and A.P. Worby. Electrical signature of the percolation threshold in sea ice. *Submitted*, 2024
12. K.M. Golden, A. Gully, C. Sampson, D.J. Lubbers, and J.-L. Tison. Percolation threshold for fluid permeability in Antarctic granular sea ice. *Submitted*, 2024
13. C. S. Sampson, Y-M Chung, D.J. Lubbers, and K.M. Golden. Crystallographic control of fluid and electrical transport in sea ice. *In Preperation*, 2024

14. Christian Sampson, Tom Hill, Maryam Abdi-Oskouei, Jérôme Barré, Yannick Tremolet, and Anna Shlyueva. A hybrid tangent linear model in the jedi data assimilation system. *In Preperation*, 2024

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## Conferences and Talks

- (2024) **Speaker**, Mathematics and Climate Research Network Colloquium (Virtual)  
**Talk title:** “Numerical Weather Prediction, JEDI , and a Hybrid Tangent Linear Model.”
- (2024) **Speaker**, SIAM Central States Mini-symposium on Data Assimilation,  
**Talk title:** “A Hybrid Tangent Linear Model in The Joint Effort for Data Integration (JEDI) system.”
- (2024) **Speaker**, Adjoint Workshop, Lake George NY,  
**Talk title:** “A Hybrid Tangent Linear Model in The Joint Effort for Data Integration (JEDI) system.”
- (2024) **Speaker**, American Metrological Society Annual Meeting, Baltimore MD,  
**Talk title:** “A Hybrid Tangent Linear Model in The Joint Effort for Data Integration (JEDI) system.”
- (2023) **Speaker**, Math Hub Workshop Georgia Tech, (Virtual)  
**Talk title:** “Predicting The Weather, 4d-Var, Hybrid Tangent Linear Models, A.I. and JEDI”
- (2022) **Speaker**, Math Hub Workshop Georgia Tech, (Virtual)  
**Talk title:** “Predicting The Weather, 4d-Var, Hybrid Tangent Linear Models, and JEDI”
- (2021) **Speaker**, Math Biology Seminar University of Colorado Boulder, (Virtual)  
**Talk title:** “A Study of Disproportionately Affected Populations by Race-Ethnicity During the SARS-CoV-2 Pandemic Using Multi-Population SEIR Modeling and Ensemble Data Assimilation”
- (2020) **Speaker** Applied Mathematics Seminar University of North Carolina at Greensboro, (Virtual)  
**Talk title:** “Ensemble Kalman Filter for non-conservative moving mesh solvers with a joint physics and mesh location update”
- (2020) **Speaker Applied Mathematics Seminar (SIAM student chapter), Florida Atlantic University** , (Virtual)  
**Talk title:** “Ensemble Kalman Filter for non-conservative moving mesh solvers with a joint physics and mesh location update”
- (2020) **Speaker** SIAM Conference on Mathematics of Data Science, (Virtual)  
**Talk title:** “Model Calibration Using Warping Metrics: With Application to Sea Ice Deformation in MPM-ice”
- (2019) **Speaker**, Big Data, Data Assimilation, and Ucertanty Quantification, Poincare institute, Paris, Fr.  
**Talk title:** “Data Assimilation for Adaptive Mesh Models”
- (2019) **Poster**, SIAM Conference on Dynamical Systems, Snowbird, UT  
**Poster title:** “Machine Learning to Improve Data Assimilation For Arctic Sea Ice”
- (2019) **Speaker**, Nansen Environmental and Remote Sensing Center, Bergen, Norway  
**Talk title:** “Model Calibration Using Warping Metrics: With Application to Sea Ice Deformation in MPM-ice”
- (2019) **Speaker**, SAMSI Post-Doc Seminar, Statistical and Applied Mathematical Sciences Institute  
**Talk title:** “Sea Ice and Data Assimilation: Challenges and Proposed Approaches”

- (2018) **Poster** American Geophysical Union Fall Meeting, Washington DC  
**Poster title:** “Effective Rheology and Wave Propagation in The Marginal Ice Zone”
- (2018) **Speaker**, SAMSI Post-Doc Seminar, Statistical and Applied Mathematical Sciences Institute  
**Talk title:** “New Approaches in Sea Ice Modeling”
- (2018) **Speaker**, International Conference on Advances in Interdisciplinary Statistics and Combinatorics, University of North Carolina at Greensboro  
**Talk Title:** “Stochastic Surfaces for Sea Ice Modeling
- (2018) **Speaker**, AMS Sectional Meeting AMS Special Session on Nonlinear Water Waves and Related Problems, University of Delaware  
**Talk Title:** “Bounds on The Effective Viscoelasticity of an Ice Covered Ocean”
- (2018) **Speaker**, SIAM Conference on Mathematics of Planet Earth (MPE18), Philadelphia, PA  
**Talk Title:** “Bounds on The Effective Viscoelasticity of an Ice Covered Ocean”
- (2018) **Organizer**, SIAM Conference on Nonlinear Waves and Coherent Structures, Special Session: Wave-ice Interactions: Nonlinearity, Paradigms, and Modelling Approaches
- (2018) **Speaker**, SIAM Conference on Nonlinear Waves and Coherent Structures, Special Session: Wave-ice Interactions: Nonlinearity, Paradigms, and Modelling Approaches  
**Talk Title:** “Bounds on The Effective Viscoelasticity of an Ice Covered Ocean”
- (2018) **Speaker**, Prediction and Data Assimilation for Nonlocal Diffusions, University of Edinburgh  
**Talk Title:** “Toward a Metric for Large Scale Sea Ice Model Fracture Forecast Skill”
- (2018) **Speaker**, CLIM Transition Workshop, Statistical and Applied Mathematical Sciences Institute (SAMSI)  
**Talk Title:** ”Understanding Sea Ice Data for Data Assimilation”
- (2018) **Speaker**, 42nd SIAM Southeastern Atlantic Sectional Conference, University of North Carolina at Chapel Hill  
**Talk Title:** ”Mathematics for Sea Ice and Climate”
- (2018) **Speaker**, SAMSI Post-Doc Seminar, Statistical and Applied Mathematical Sciences Institute  
**Talk title:** “Data driven explorations aimed at the improvement of sea ice modeling”
- (2017) **Speaker**, SAMSI Post-Doc Seminar, Statistical and Applied Mathematical Sciences Institute  
**Talk title:** “Open Questions and Proposed Approaches in Sea Ice Modeling.”
- (2017) **Speaker**, Mathematics of sea ice phenomena: Multi-scale modelling of ice characteristics and behaviour, Isaac Newton Institute for Mathematical Sciences  
**Talk title:** “Effective Rheology and Wave Propagation in the Marginal Ice Zone”
- (2017) **Poster**, SAMSI Program on Mathematical and Statistical Methods for Climate and the Earth System (CLIM) Opening Workshop, Statistical and Applied Mathematical Sciences Institute  
**Poster title:** “Effective Rheology and Wave Propagation in the Marginal Ice Zone”
- (2016) **Organizer**, AMS Special Session on Differential Equations, Probability and Sea Ice, Joint Mathematics Meetings, Seattle, Washington
- (2015) **Poster**, Pacific Institute for the Mathematical Sciences (PIMS) Conference on the Mathematics of Sea Ice, Vancouver, Canada  
**Poster Title:** “The Percolation Threshold for Fluid Flow in Antarctic Granular Sea Ice”
- (2015) **Assistant Organizer**, American Mathematical Society (AMS) Mathematics Research Community: Differential Equations, Probability and Sea Ice, Snowbird, Utah

- (2015) **Speaker**, Society for Industrial and Applied Mathematics (SIAM) Conference on Mathematical and Computational Issues in the Geosciences, Stanford University  
**Talk Title:** “Sea Ice, Climate, and Homogenization for Composite Materials”
- (2014) **Poster**, International Glacial Society (IGS) Symposium: Sea Ice in a Changing Environment, Hobart, Australia  
**Poster Title:** “The Percolation Threshold for Fluid Flow in Antarctic Granular Sea Ice”
- (2013) **Speaker**, University of Utah Applied Math Seminar, University of Utah  
**Talk Title:** “Waves in the Marginal Ice Zone”
- (2012) **Student Volunteer**, Ocean Sciences Meeting, Salk Lake City, Utah
- (2011) **Speaker**, University of Utah Applied Math Seminar, University of Utah  
**Talk Title:** “Tipping Points in the Arctic”
- (2011) **Speaker**, Gordon-Kenan Research Seminar on Polar and Marine Science, Ventura, CA  
**Talk Title:** “Electrical Measurements of Antarctic Sea Ice”
- (2011) **Poster**, Gordon Research Conference on Polar and Marine Science, Ventura, CA  
**Poster Title:** “Electrical Measurements of Antarctic Sea Ice”

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## Journals Refereed For

- (2023) AMS Monthly Weather Review
- (2018) Journal of Geophysical Research - Oceans
- (2018) Dynamics and Statistics of the Climate System: An Interdisciplinary Journal
- (2017) Cold Regions Science and Technology

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## Awards

- (2016) Nominated for The Thomas G. Stockham Medal For Conspicuously Effective Teaching, University of Utah.
- (2010) Nominated for Undergraduate Research Scholar Award, University of Utah, Department of Mathematics
- (2009) Exceptional Teaching Award for Supplemental Instruction, University of Utah

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## Grants

- (2024) American Institute of Mathematics (AIM) Research Community. Co-Organizer of an AIM research community on Mathematics and Climate built on the previous Mathematics and Climate Research Network. We support several active research groups, climate related curriculum development, mentoring groups, career development, and an ongoing colloquium series.
- (2018) Office of Naval Research (ONR) Support for a Minisymposium on Wave-Ice Interactions: Nonlinearity Paradigms, and Modelling Approaches as a part of the Society for Industrial and Applied Mathematics (SIAM) conference on Nonlinear Waves and Coherent Structures, June 2018. This grant provided funding for the travel of researchers studying waves in sea ice from around the world to Anaheim California to participate.

- (2014) National Science Foundation (NSF) Science Across Virtual Institutes (SAVI) Grant. This grant provided funding for a trip to Newcastle University, Newcastle, Australia, to collaborate with Dr. Michael Meylan on wave dynamics in the marginal ice zone.
- (2008-2010) National Science Foundation (NSF) Division of Mathematical Sciences (DMS) Vertical Integration of Research and Education in the Mathematical Sciences (VIGRE) Research Experiences for Undergraduates (REU) Grant, Department of Mathematics

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## Teaching

Examples of course materials and all teaching evaluations can be found at my website.

- (2021) **Instructor**, Math 383 Differential Equations, Fall, University of North Carolina at Chapel Hill
- (2019) **Instructor**, Math 547 Linear Algebra for Application, Fall, University of North Carolina at Chapel Hill
- (2020) **Assistant/Group Leader** American Institute of Mathematics Summer School on Dynamics and data in the COVID-19 pandemic, June-July, Held Online
- (2019) **Assistant/Group Leader** MCRN Summer School, Math Climate and Data, July, Durham, NC
- (2019) **Teaching Assistant** Lorentz Center Summer School: Data Science for Dynamical Systems, July, Lorentz Center, Leiden, NL
- (2019) **Instructor**, Math 547 Linear Algebra for Application, Fall, University of North Carolina at Chapel Hill
- (2018) **Mentor**, Carolina: Assisting in Development and Mentoring an Innovative Research Experience in Science (ADMIREs), Spring, UNC at Chapel Hill
- (2018) **Assistant/Group Leader** MCRN Summer School, Math Climate and Data, July, American Institute of Mathematics
- (2018) **Project Leader**, Statistical and Applied Mathematical Sciences Institute Undergraduate Modeling Workshop, May, North Carolina State University
- (2016) **Instructor**, Math 1220: Calculus II (online), Fall, University of Utah
- (2016) **Instructor**, Math 3160: Complex Variables, Summer, University of Utah
- (2016) **Instructor**, Math 3150: Partial Differential Equations, Summer, University of Utah
- (2016) **Instructor**, Math 1210: Calculus I (online), Spring, University of Utah
- (2015) **Instructor**, Math 1210: Calculus I (online), Fall, University of Utah
- (2015) **Instructor**, Math 3150: Partial Differential Equations, Summer, University of Utah
- (2014) **Teaching Assistant**, Math 2210: Calculus III, Fall, University of Utah
- (2014) **Instructor**, Math 1320: Engineering Calculus II, Summer, University of Utah
- (2014) **Guest Speaker**, Math 5750: Mathematics and Climate, Spring, University of Utah
- (2013) **Instructor**, Math 1050: College Algebra, Fall, University of Utah
- (2013) **Instructor**, Math 1050: College Algebra, Summer, University of Utah
- (2013) **Teaching Assistant**, Math 1220: Calculus II, Spring, University of Utah

- (2012) **Instructor**, Math 1210: Calculus I, Summer, University of Utah
- (2012) **Instructor**, Math 1010: Intermediate Algebra, Spring, University of Utah
- (2011) **Instructor**, Math 1010: Intermediate Algebra, Fall, University of Utah
- (2011) **Teaching Assistant**, Math 1220: Calculus II, Spring, University of Utah
- (2010) **Instructor**, Math 1060: Trigonometry, Fall, University of Utah
- (2010) **Supplemental Instructor**, Math 1050: College Algebra, Spring, University of Utah
- (2009) **Supplemental Instructor**, Math 1050: College Algebra, Fall, University of Utah
- (2009) **Supplemental Instructor**, Math 1010: Intermediate Algebra, Spring, University of Utah
- (2008) **Supplemental Instructor**, Physics 2220: Physics for Scientists and Engineers II, Fall, University of Utah
- (2008) **Supplemental Instructor**, Physics 2210: Physics for Scientists and Engineers I, Spring, University of Utah