

Gong Cheng

Academic Position

- since 2023 **Research Scientist, Lecture**, *Department of Earth Sciences, Dartmouth College, Hanover, NH, USA.*
- 2021–2023 **Postdoctoral Researcher**, *Department of Earth Sciences, Dartmouth College, Hanover, NH, USA.*
- 2020–2021 **Postdoctoral Researcher**, *Department of Earth System Science, University of California, Irvine, CA, USA.*

Education

- 2014–2019 **Ph.D in Computational Science**, *Uppsala University, Sweden.*
Thesis: Numerical ice sheet modeling-Forward and inverse problems. Dissertation on 18 October 2019.
Thesis available at: <http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-392268>
- 2012–2014 **Master of Computational Science**, *Uppsala University, Sweden.*
- 2009–2012 **Master of Biomedical Engineering**, *Zhejiang University, Hangzhou, China.*
- 2005–2009 **Bachelor of Biomedical Engineering**, *Zhejiang University, Hangzhou, China.*
- 2005–2007 **Mixed Honors Class**, *Zhejiang University, Hangzhou, China.*
Mixed Honors Class is an honors program for the top 5% students of Zhejiang University. 139 students are selected out of approximately 3500 freshmen majoring in science and engineering at the whole university, based on their high school GPA, performance in screening tests and personal interviews.

Research Interests

- Numerical methods for ice sheet modeling
- Machine learning in glaciology
- Data assimilation and inverse modeling
- Ice-ocean and ice-bed interaction
- Scientific computing and numerical analysis for linear and nonlinear PDEs.
- Finite element method, Radial Basis Function method

Grants

- 2024-2027 **NASA Research Opportunities in Space and Earth Sciences (ROSES) - Cryospheric Science**, *Reconstructing the evolution of Helheim Glacier between 1981 and 2023 by combining numerical modeling and remote sensing data, (PI, \$354,812).*

Publications

- 17* **A Python library for solving ice sheet modeling problems using Physics Informed Neural Networks, PINNICLE v1.0**, G. Cheng, M. Krishna and M. Morlighem, Geoscientific Model Development, under review, 2025.
- 16* **Ice front and Mélange Dynamics at Kangerlussuaq Glacier, eastern Greenland, since 1981, and future stability**, E. Lippert, M. Morlighem, G. Cheng, D. Berg, J. Hassan and S. Khan, under review, 2024.
- 15* **Calving Parameterization of Helheim Glacier, East Greenland, using Graph Neural Network Emulators for Numerical Ice Sheet Models**, Y. Koo, G. Cheng, M. Morlighem and M. Rahnemoonfar, The Cryosphere, under review, 2024.
- 14* **Monthly Greenland ice sheet elevation changes during 2003-2023 reveal complex evolving mass change pattern**, S. Khan, G. Cheng ,..., Earth System Science Data, under review, 2024.
- 13 **Ice thickness-induced variations in effective pressure and basal conditions influence seasonal and multi-annual ice velocity at Sermeq Kujalleq (Jakobshavn Isbræ)**, X. Lu, A. Sole, S. Livingstone, G. Cheng, L. Jiang, T. Chudley, B. Noël and D. Li, Geophysical Research Letters, <https://doi.org/10.1029/2024GL111092> 52 (2025): e2024GL111092.
- 12 **Forward and Inverse Modeling of Ice Sheet Flow Using Physics-Informed Neural Networks: Application to Helheim Glacier, Greenland**, G. Cheng, M. Morlighem, and S. Francis , JGR: Machine Learning and Computation, <https://doi.org/10.1029/2024JH000169> 1.3 (2024), e2024JH000169.
- 11 **Numerical stabilization methods for level-set-based ice front migration**, G. Cheng, M. Morlighem and H. Gudmundsson, Geoscientific Model Development, (2024) <https://doi.org/10.5194/gmd-17-6227-2024> .
- 10 **Modeling a century of change: Kangerlussuaq Glacier's mass loss from 1933 to 2021**, E. Lippert, M. Morlighem, G. Cheng and S. Khan, Geophysical Research Letters, <https://doi.org/10.1029/2023GL106286> 51.4 (2024): e2023GL106286.
- 9 **Evaluation of four calving laws for Antarctic ice shelves**, J. Wilner, M. Morlighem and G. Cheng, The Cryosphere, <https://doi.org/10.5194/tc-17-4889-2023> 17 (2023): 4889–4901.
- 8 **Helheim Glacier's Terminus Position Controls Its Seasonal and Inter-Annual Ice Flow Variability**, G. Cheng, M. Morlighem, J. Mouginot, and D. Cheng, Geophysical Research Letters, <https://doi.org/10.1029/2021GL097085> 49.5 (2022): e2021GL097085.
- 7 **Sensitivity of ice sheet surface velocity and elevation to variations in basal friction and topography in the Full Stokes and Shallow Shelf Approximation frameworks**, G. Cheng, N. Kirchner and P. Lötstedt, The Cryosphere, <https://doi.org/10.5194/tc-15-715-2021> 15.2 (2021): 715-742.
- 6 **Parameter sensitivity analysis of dynamic ice sheet models-Numerical computations**, G. Cheng and P. Lötstedt, The Cryosphere, <https://doi.org/10.5194/tc-14-673-2020> 14.2 (2020): 673-691.

- 5 **A full Stokes subgrid scheme in two dimensions for simulation of grounding line migration in ice sheets using Elmer/ICE (v8.3)**, *G. Cheng, P. Lötstedt and L. von Sydow*, Geoscientific Model Development, <https://doi.org/10.5194/gmd-13-2245-2020> 13 (2020): 2245–2258.
- 4 **Thermal conductivity of firn at Lomonosovfonna, Svalbard, derived from subsurface temperature measurements**, *S. Marchenko, G. Cheng, P. Lötstedt, V. Pohjola, R. Pettersson, W. van Pelt, and C. Reijmer*, The Cryosphere, <https://doi.org/10.5194/tc-13-1843-2019> 13.7 (2019): 1843-1859.
- 3 **Dynamically coupling Full Stokes and Shallow Shelf Approximation for marine ice sheet flow using Elmer/Ice (v8. 3)**, *E. CH van Dongen, N. Kirchner, M. B. van Gijzen, R. SW van de Wal, T. Zwinger, G. Cheng, P. Lötstedt, and L. von Sydow*, Geoscientific Model Development, <https://doi.org/10.5194/gmd-11-4563-2018> 11 (2018): 4563-4576.
- 2 **Anisotropic Radial Basis Function Methods for Continental Size Ice Sheet Simulations**, *G. Cheng and V. Shcherbakov*, Journal of Computational Physics, <https://doi.org/10.1016/j.jcp.2018.06.020> 372 (2018): 161-177.
- 1 **Accurate and stable time stepping in ice sheet modeling**, *G. Cheng, P. Lötstedt, and L. von Sydow*, Journal of Computational Physics, <https://doi.org/10.1016/j.jcp.2016.10.060> 329 (2017): 29-47.

Supervising Experiences

- since 2023 Co-supervise Ph.D. student, Mansa Krishna, Inferring sub-glacial bed topography with physics-informed machine learning, Dartmouth College, USA
- 2023-2024 Supervise Bachelor research project, Artificial Intelligence Ice Flow Models for Sea Level Rise Projections: leveraging Physics-Informed Neural Networks (PINNs) to predict ice sheet behavior in a changing climate, Sade Francis, Dartmouth College, USA
- 2022-2024 Co-supervise Ph.D. student, Eigil Lippert, Numerical glacier flow modelling in Greenland, DTU, Denmark
- 2022-2023 Co-supervise Ph.D. student, Joel Wilner, Evaluating and Comparing Calving Laws in Antarctica, Dartmouth College, USA
- 2019 Supervise Master thesis: Numerical ice sheet modeling using FEniCS, André Löfgren, Uppsala University, Sweden
- 2018 Supervise student project: Ice Sheet Modeling: Accuracy of First-Order Stokes Model with Basal Sliding, Eskil Jonsson, Uppsala University, Sweden
- 2017 Supervise Master thesis: Coupling approximation levels for modeling ice flow on paleo time scales, Eef van Dongen, Uppsala University
- 2016 Supervise Bachelor student project: Observational Sensitivity to Sliding Coefficient in Shallow Ice Approximation, Anton Sundin, Uppsala University
- 2016 Supervise Bachelor student project: Quantification of the effects of perturbed bedrock data on the surface of moving ice sheets, Fredrik Lauren, Joakim Johansson, Uppsala University

Teaching Experiences

- 2025 EARS 70/170: Glaciology, main teacher, Dartmouth College, USA
- 2022 GEOG 15.01: Climate Change, main teacher, Dartmouth College, USA
- 2021 ESS 17: Catastrophes, main teacher, UC Irvine, USA
- 2019 Programming in Python(Master level, 5 ECTS), main teacher, Uppsala University, Sweden
- 2019 Scientific Computing, Bridging Course(Master level, 5 ECTS), main teacher, Uppsala University, Sweden
- 2018 Applied Finite Element Methods(Master level, 5 ECTS), main teacher, Uppsala University, Sweden
- 2014-2017 Optimization(Master level, 5 ECTS), teaching assistant, Uppsala University, Sweden

Attended Conferences & Talks

- 2025 **SIAM Conference on Computational Science and Engineering (CSE25)**, *Fort-Worth, TX, USA*, Mar 2025, Oral presentation, A Python Library for Solving Ice Sheet Modeling Problems Using a Unified Framework.
- 2024 **AGU Fall meeting 2024**, *Washington D.C., USA*, December 2024, Oral presentation, Physics-Informed Neural Networks for Ice and CLimatE (PINNICLE).
- 2024 **SIAM Conference on Mathematics of Planet Earth (MPE24)**, *Portland, OR, USA*, June 2024, Mini Tutorial, Differentiable Earth System Models in Julia.
- 2024 **EGU General Assembly 2024**, *Vienna, Austria*, April 2024, Poster, A Unified Framework for Forward and Inverse Modeling of Ice Sheet Flow using Physics Informed Neural Network.
- 2024 **Future of Greenland ice Sheet Science Workshop 2024**, *Moscow, ID, USA*, April 2024, Oral presentation, Neural networks for forward and inverse numerical modeling.
- 2023 **AGU Fall meeting 2023**, *San Francisco, CA, USA*, December 2023, Oral presentation, Using deep learning to constrain poorly represented basal processes in ice sheet models.
- 2023 **Mathematics on Ice Forum**, *online*, May 2023, Invited talk, Helheim Glacier's terminus position controls its seasonal and inter-annual ice flow variability.
- 2022 **AGU Fall meeting 2022**, *Chicago, IL, USA*, December 2022, Poster, Investigating the drivers of Helheim Glacier's variability from 2007 to 2020.
- 2022 **Seminar series in numerical analysis, KTH & Stockholm University**, *Stockholm, Sweden*, April 2022, Invited talk, Parameter sensitivity analysis of dynamic ice sheet models.
- 2021 **AGU Fall meeting 2021**, *New Orleans, LA, USA*, December 2021, Poster, Helheim Glacier's terminus position controls its seasonal and inter-annual ice flow variability.
- 2021 **TDB seminar at IT department, Uppsala University**, *Uppsala, Sweden*, October 2021, Invited talk, Investigating the drivers of Helheim Glacier's variability using numerical modeling.

- 2021 **SIAM Conference on Mathematical and Computational Issues in the Geosciences**, *online*, June 2021, Oral presentation, Sensitivity Study of Helheim Glacier using Automatic Differentiation.
- 2021 **EGU General Assembly 2021**, *online*, April 2021, Oral presentation, Investigating the drivers of Helheim Glacier's variability from 2007 to 2020.
- 2020 **AGU Fall meeting 2020**, *online*, December 2020, Oral presentation, Investigating the drivers of Helheim Glacier's variability from 2007 to 2020.
- 2019 **SIAM Conference on Mathematical and Computational Issues in the Geosciences**, *Houston, USA*, March 2019, Oral presentation, Efficient Numerical Ice-sheet Simulations over Long Time Spans.
- 2018 **International Glaciological Society - Nordic Branch Meeting**, *Rovaniemi, Finland*, October 2018, Oral presentation, Sub-grid modeling of grounding line migration problem.
- 2018 **13th World Congress in Computational Mechanics**, *New York City, USA*, July 2018, Oral presentation, Efficient Numerical Ice-Sheet Simulations over Long Time Spans.
- 2017 **International Glaciological Society - Nordic Branch Meeting**, *Uppsala, Sweden*, October 2017, Oral presentation, A meshfree approach to ice sheet simulations.
- 2017 **SIAM Conference on Mathematical and Computational Issues in the Geosciences**, *Erlangen, Germany*, September 2017, Oral presentation, Efficient Numerical Ice-Sheet Simulations over Long Time Spans.
- 2017 **SIAM Annual Meeting (AN17)**, *Pittsburgh, USA*, July 2017, Oral presentation, Efficient Numerical Ice-Sheet Simulations over Long Time Spans.
- 2017 **SIAM Conference on Computational Science and Engineering(CSE17)**, *Atlanta, USA*, February 2017, Oral presentation, Accurate and Stable Time Stepping in Ice Sheet Modeling.
- 2015 **International Glaciological Society - Nordic Branch Meeting**, *Copenhagen, Denmark*, October 2015, Poster, Accurate and Stable Time Stepping in Ice Sheet Modeling.

Professional Activities

- since 2024 Editor of EGU's journal: The Cryosphere
- since 2024 Founder and core developer of the Physics Informed Neural Networks for Ice and CLimatE ([PINNICLE](#))
- since 2022 Core developer of the differentiable JULia ICE model ([DJUICE.jl](#))
- since 2020 Core developer of the Ice-sheet and Sea-level model ([ISSM](#))
- since 2021 Member of the European Geosciences Union
- since 2020 Member of the American Geophysical Union
- 2017–2018 President of Uppsala University Student SIAM Chapter, Sweden
- since 2015 Member of the Society for Industrial and Applied Mathematics

Journal review Geophysical Research Letters, The Cryosphere, Geoscientific Model Development,
Journal of Geophysical Research: Earth Surface, Journal of Glaciology
Proposal review National Science Foundation, The Research Council of Norway