Elizabeth McGeorge

Last updated: April 2024

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Seattle, WA

Education

PhD (Mathematics) *University of Canterbury*
2019 – 2023 | Conferred October 2023

- Thesis: "Beyond Observations: Recovery of unknown parameters in ice flows using optimisation techniques and other tools."

BSc (Hons. First Class) *University of Canterbury*
2015 – 2018 | Conferred April 2019 | Grade: 8.75/9.00

Major: Mathematics.

- With semester abroad to University of British Columbia

NCEA Levels 1,2,3 (High School) *Villa Maria College, Christchurch, New Zealand*
2012 – 2014 | University Entrance: 2013

NCEA Levels 1, 2 & 3 with excellence endorsement. NZQA Scholarship in Calculus, Physics, & Statistics. Level 3 subjects: Biology, Calculus, Chemistry, Classics, English, Physics, Religious Studies, Statistics.

Professional Experience

Postdoctoral Scholar *University of Washington*
Jan 2024 – Current | Seattle, WA

- Collaboration with Dr. Yolande Serra (UW CICOES), Dr. Dongxiao Zhang (UW CICOES/NOAA PMEL) and Dr. Meghan Cronin (NOAA PMEL).
- Investigating the usefulness of acoustic doppler current profilers (ADCPs) on Saildrones for calculating vertical velocity. This work aims to assist in reducing model biases in the eastern tropical Pacific and improving skill in El Niño Southern Oscillation (ENSO) predictions.

Teaching Lecturer *University of Canterbury*
Feb 2022 – Nov 2022 | Christchurch, New Zealand

- Experience lecturing in two courses: ENCH298 and EMTH119.
- EMTH119, a course of approximately 1000 students, is designed for first year engineering students. The course has four 1-hour teaching lectures a week, delivered in two separate streams morning and afternoon. For this course, I delivered all lectures for a 3 week section on probability theory. Topics covered include set theory, discrete and random variables, expectation, mean, and variance. In addition to the lecturing responsibilities, I had two hours a week of office hours for students to come ask questions one-on-one.
- ENCH298 is a course for second year chemical and process engineering students. It is designed to amalgamate the mathematics they need along with the applications they will experience in their field. Topic lectured include Laplace and Fourier transforms as well as some simple multivariate calculus. The course had a single stream of three one-hour lectures. I delivered all the lectures for 7 weeks of this course and as before. For this course I had freedom to revise lecture content. This was done with the aim of revitalizing the course and I handed over a new set of notes for the course at the end of my position.
- For both, in addition to teaching, I wrote and marked both assignments and examination questions. I also providing regular office hours for one-on-one student help.

Mathematics Tutor *University of Canterbury*
Feb 2022 – Nov 2022 | Christchurch, New Zealand

- Ran help sessions in applied mathematics, mainly in linear algebra and differential equations. Topics covered in linear algebra include vector spaces, linear transformations, eigenvalues, and orthogonality with applications to Markov chains, population and economic models, least squares approximation, cryptography, coding theory, data compression. Topic in differential systems include systems of linear and non-linear first order differential equations, phase plane techniques, numerical methods, stiff systems, Laplace transforms (including initial value problems, shift theorems, step functions and impulses, convolution, resonance), Fourier series and elementary Fourier transforms.

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Publications

*2024 E. K. McGeorge, M. Moyers-Gonzalez, M. Sellier, and P. L. Wilson (Apr. 2024). "Recovery of basal slip and ice thickness for ice flwo describe by the Shallow Ice Approximation using an adjoint based optimisation method in two-dimensions." *In preparation.*

2022 E. K. McGeorge, M. Moyers-Gonzalez, M. Sellier, and P. L. Wilson (Dec. 2022). "Exact recovery of kiwi-shaped bed topography in a no-slip ice sheet using only surface data." In: *23rd Australasian Fluid Mechanics Conference Proceedings.*

2022 E. K. McGeorge, M. Moyers-Gonzalez, M. Sellier, and P. L. Wilson (Mar. 2022). "An augmented Lagrangian algorithm for recovery of ice thickness in unidirectional flow using the Shallow Ice Approximation". In: *Applied Mathematical Modelling 107, pp. 650–669.*

2021 E. K. McGeorge, M. Sellier, M. Moyers-Gonzalez, and P. L. Wilson (Jan. 2021). "Bedrock reconstruction from free surface data for unidirectional glacier flow with basal slip". In: *Acta Mechanica 232.1, pp. 305–322*

Professional Service

2021, 2022 **New Zealand Mathematical Society Colloquium**, New Zealand Mathematical Society
Early career committee member for two years. Update the conference website, organised student accommodation.

2022 **FiNZ Organising Committee**, Fluids in New Zealand
Early career committee member for organising this annual conference. Planned catering, name badges, conference dinner, student accommodation.

2018, 2021 **Maths Craft New Zealand**
Maths Craft uses the medium of craft to introduce adults and children alike to a new and exciting way of engaging with mathematics. As a volunteer, I guided attendees through the activities. When there was interest, further insight into the mathematical nature of the craft was provided.

Conferences

Feb 19–23 2024 **Ocean Sciences Meeting**, New Orleans, LA
AFMC was a meeting of 100s of researchers across the South Pacific held in Sydney. For this conference, I published a paper in the conference proceedings, which was peer reviewed, as well as giving a 20 minute talk on the research.

Dec 5–8 2022 **Australasian Fluid Mechanics Conference**, Sydney, Australia
AFMC was a meeting of 100s of researchers across the South Pacific held in Sydney. For this conference, I published a paper in the conference proceedings, which was peer reviewed, as well as giving a 20 minute talk on the research.

Jan 26–28 2022 **Fluids in New Zealand**, Auckland, New Zealand
FiNZ provides a forum to facilitate the dissemination of ideas across the different branches of fluid mechanics, and to promote interdisciplinary collaborations between New Zealand scientists. This is the third year I have participated in the conference. This year I gave a talk about my paper "An augmented Lagrangian algorithm for recovery of ice thickness in unidirectional flow using the Shallow Ice Approximation".

Nov 14–16 2022 **Inverse Problems and Uncertainty Workshop,** Auckland, New Zealand (online)
This workshop brings together experts from the fields of uncertainty quantification, inverse problems, and model calibration to network and exchange ideas. I gave a 30 minute presentation on optimisation methods I have employed in my PhD candidature and their outputs.

Aug 22–27 2021 **ICTAM 2020+1**, Milan, Italy The ICTAM congresses was a unique occasion to gain a direct experience of the new progresses in mechanics and of the continuously growing field of applications of this ever-green discipline. I presented a poster on my paper "Bedrock reconstruction from free surface data for unidirectional glacier flow with basal slip."

Jan 27–29 2021 **Fluids in New Zealand**, Christchurch, New Zealand
This presentation was not on any particular research results but was rather a expose on the uses of two open-source Python libraries I was using at the time; FEniCS and dolfin-adjoint.

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Conferences cont'd

Jan 30–31 2020 **Southern Exposure: Antarctic Research**, University of Canterbury, Christchurch, New Zealand
This conference aimed to enhance and promote Antarctic research within the University of Canterbury, to create greater transparency around ongoing Antarctic research projects and encourage inter-departmental and intercollegiate coordination and collaboration on Antarctic research and inspire researchers interested in working on Antarctic issues. I gave a 15 minute presentation covering the governing models for ice sheet flow as well as some key results from my research. This talk was targeted to an audience with little mathematical background.

Jan 30–31 2020 **Fluids in New Zealand**, Auckland, New Zealand This was a presentation on the results of the paper "Bedrock reconstruction from free surface data for unidirectional glacier flow with basal slip".

Nov 25–26 2019 **Materials @ UC: The Story Behind the Research**, Christchurch, New Zealand
The story behind the research theme explores and shares the human element behind research. The conference placed emphasis on participants research stories, professional, and personal development as the hidden engine driving scientific and technical innovations. I gave a poster presentation on my paper "Bedrock reconstruction from free surface data for unidirectional glacier flow with basal slip."

Nov 22–25 2019 **New Zealand Mathematics and Statistics Postgraduate Conference**, Wainui, New Zealand The New Zealand Mathematics and Statistics Postgraduate conference is an annual event for postgraduates in New Zealand. It provides a platform for students to gain experience in presenting our work to an audience. I gave a 15 minute presentation covering the basic mathematics of the inverse problem in ice flows, targeted towards an audience of mainly statisticians, as well as some key results.

Numerical Skills

Methods

finite elements • CFD • optimal control • sensitivity analysis • analytical solutions

Libraries/Frameworks

pandas • matplotlib • xarray • netcdf4 • scipy • statsmodels • FEniCS • dolfin-adjoint

Programming

Proficient:

Python • MATLAB • LATEX

Familiar:

Sage Math • R • markdown

Tools/Platforms

Git • conda • linux

Interests

In 2023, I sailed 7,000 nm across the Pacific from New Zealand to Japan in a 37 ft sailing yacht. While crossing the Pacific, as one half of a double-handed crew, I was in command of the vessel for a total of 12 hours a day, split into four 3-hour shifts. To date, I have spent 66 days offshore, including one non-stop passage lasting 32 days. I contributed to all decision making while onboard and was solely in charge of provisioning. After arriving to Japan, I remained onboard for 5 months while cruising the Seto Inland Sea. This experience has given me competence in a broad range of areas related to vessel command, weather routing, logistics planning, and vessel clearance procedures.

References

Postdoctoral PIs:

Yolande Serra
Senior Research Scientist
Cooperative Institute for Climate, Ocean, and Ecosystems Studies
University of Washington

Meghan Cronin
Research Oceanographer
Lead Ocean Climate Stations
Pacific Marine Environment Laboratory
National Oceanographic and Atmospheric Administration

Doctoral Advisors:

Miguel Moyers-Gonzalez
Associate Professor
School of Mathematics and Statistics
University of Canterbury

Mathieu Sellier
Head of Department
Mechanical Engineering
University of Canterbury