Elizabeth K. McGeorge

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Current Position

2024 – **Postdoctoral Scholar**, *CICOES University of Washington / NOAA PMEL*

Education

2019 – 2023 **Doctor of Philosophy (Mathematics)**, *University of Canterbury.*
Thesis title: Beyond Observations: Recovery of unknown parameters in ice flows using optimisation techniques and other tools. Conferred October 11, 2023.

2015 – 2018 **Bachelor of Science (Honours, 1st Class)**, *University of Canterbury.*
Major: Mathematics, GPA: 8.75/9.00. With semester abroad at the *University of British Columbia*.

2012 – 2014 **NCEA Levels 1,2,3 (High School)**, *Villa Maria College*, Christchurch.
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.

Publications and Conference Proceedings

Items marked with a "*" are in progress. Unless otherwise stated, I am the lead author.

*2023 E. K. McGeorge, M. Moyers-Gonzalez, M. Sellier, and P. L. Wilson (2022b). "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: *TBC*

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

2022 E. K. McGeorge, M. Moyers-Gonzalez, M. Sellier, and P. L. Wilson (Mar. 2022c). "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

Conference Presentations

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 27 – 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, 2021 **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.

Jan 30 – 31, 2020 **Southern Exposure: Antarctic Research at the 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.

Teaching Experience

2022, S2 **Teaching Lecturer, EMTH119 - Engineering Mathematics 1B**, *University of Canterbury*

This course mathematics course for first year engineering students. It has approximately 1000 students and 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. Finally, I was also in charge of writing exam questions for their final exam on the probability topic, around 25% of the exam content.

2022, S1 **Teaching Lecturer, ENCH298 - Chemical Engineering Mathematics**, *University of Canterbury*

This 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. Other duties, in addition to teaching, will include writing and marking both assignments and examination questions, and providing regular office hours for one-on-one student help. 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.

2020 **Guest speaker, EMTH171 - Mathematical Modelling and Computation**, *University of Canterbury*

EMTH171 is a course for first year engineers witch covers the mathematics and implementation of some basic numerical methods. I gave a talk to the students outlining the background of my research and how I used some of the methods they learned different stages.

2020 – 2021 **Mathematics Tutor, 200 Level**, *University of Canterbury*

Tutoring 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.

2018 – 2021 **Mathematics Tutor, 100 Level**, *University of Canterbury*

Tutoring in a variety of first year mathematics papers. This involves both explanations to small groups as well as one-on-one work with the students. One of the courses tutored on has a large distance cohort of high-school students which often reuired a more hands-on approach with regards to content explanation.

2018 – 2022 **Examination Marker/Supervisor**, *University of Canterbury*

Assisting in marking of test and exam papers for a number of both first and second year courses. This task requires consistency across up to 800 exam scripts while working to a tight deadline.

2016 **Teaching Assistant, CHCH101 - Strengthening Communities through Social Innovation**, *University of Canterbury*

CHCH 101 is a course designed around the community response to the Christchurch earthquakes in 2010 and 2011. The course covered a variety of topics including hazard mitigation and post disaster response with a focus on volunteerism. As a teaching assistant, I was in charge of students health and safety on off-campus trips. Additionally, I lead group discussions regarding learning objectives, assessment requirements and projects. Administration duties included marking written essays fairly and efficiently to the set guidelines.

Other employment history

2016 – 2017 **Store Supervisor**, *Vail Resorts Retail*, Keystone, CO
General management duties including shipping/receiving, mentoring, timetabling, inventory monitoring, ensuring company policy compliance, day-to-day floor management as well as store cash handling.

2015 – 2016 **UC Events Host**, *University of Canterbury*, Christchurch, New Zealand
Provided support for a number of different events throughout the year which specialised in community and corporate engagement as well as recruitment. At each event, duties involved setting up venues, greeting and assisting guests, giving tours and food services.

2014 **Casual Labourer**, *Canterbury PVC Windows*, Christchurch, New Zealand
Assisted in the design and construction of a retaining wall and deck. This required attention to detail, precision and extensive planning.

2012 – 2014 **Cashier and Kitchen Hand**, *Burger Wisconsin*, Christchurch, New Zealand
Worked in a variety of roles; on the till, answering the phone, food preparation, fryer, grill and dishes. Often had to deal with customer enquiries and complaints while working under high stress. Food preparation required strict adherence to set procedures.

Volunteer work

2021, 22 **NZMS Colloquium Organising Committee**, *New Zealand Mathematical Society*
In charge of updating the website with new information in a timely manner.

2021 **FiNZ Organising Committee**, *Fluids in New Zealand*
Organised accommodation and catering as well as being in charge of daily space set-up/pack-down during the conference.

2021, 2018 **Maths Craft Day Volunteer**, *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.

2018 – 2019 **Secretary**, *Canterbury University Snow Sports Club*
Organised and attended weekly meetings and provided detailed minutes within two days. Provided administration support for events throughout the year and kept track of club communications and finances.

2016 **Student Mentor**, *Emerging Leaders Development Programme, University of Canterbury*
Helped to organise retreats, leadership forums and social events, and create service projects as part of the Emerging Leaders Development Programme. Attended formal leadership training sessions and acted as a mentor to scholarship students.

2013 – 2014 **Band Manager**, *Villa Maria College Jazz Band*
Completed general administration for the band including organising rehearsals, selecting and providing music scores.

2010 – 2014 **Cantamath tutoring**, *Villa Maria College*
Cantamath, short for Canterbury Mathematics, is a yearly competition run in my region for ages 9 to 14. The competition has many aspects, with one of the most exciting being the team competition where teams of up to 4 students race in a relay type format to answer interesting mathematical questions and earn points. In the month leading up to this competition, I spent 5 hours a week tutoring the intermediate students at my school in preparation for the competition.

Computational Skills

Proficient
- Python (FEniCS, Dolfin-Adjoint, scipy, numpy, xarray, matplotlib, netcdf4)
- MATLAB
- GIT
- LaTeX
- conda

Scholarships & awards

2020 Best poster with a geological/natural material theme at the Materials @ UC Conference

2019 Edward and Isabel Kidson Memorial Scholarship

2019 University of Canterbury (UC) Doctoral Scholarship

2018 Graduate Women Canterbury Inc. Trust Board Scholarship

2017, 2018 Golden Key International Honours Society

2017 UC Senior Scholarship

2017 UC Outbound Exchange Scholarship

2016 Helen Wily Memorial Prize

2016 William Brent Wilson Memorial Prize in Applied Mathematics

2016, 2018 UC Mathematics and Statistics Scholarship

2015 Peter Bryant Memorial Prize

2015 UC Mathematics and Statistics STAR Scholarship

2015 UC Undergraduate Entrance Scholarship

2014 NZQA Scholarship in Calculus, Physics, and Statistics

2013 NZQA Scholarship in Calculus

Sailing Skills

In 2023, I sailed in a 37 ft yacht from Christchurch, New Zealand, to Kurashiki, Japan.

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 3-hour shifts. To date I have spent 66 days offshore, including one non-stop passage lasting 32 days. I contributed to decision making that saw us safely through two dangerous typhoons. This responsibility has given me competence in a broad range of areas.

Underway
- vessel command (sail and course change decisions, risk analysis for weather changes and ship-to-ship proximity)
- interpreting weather maps and GMDSS forecasts
- ship routing by considering weather, currents, and other hazards
- satellite communications (Iridium GO)
- Automatic Identification System (AIS) monitoring and target calling
- radio communications (calling high risk AIS and visual targets)
- radar operations (vessel identification and squall tracking)
- navigation (paper and electronic charts)
- supplies rationing at sea (regular tracking of remaining food, water, fuel, and gas)
- vessel systems (gas, electrical and plumbing)
- food preparation in rough weather
- managing medical conditions (Type II diabetic)

Administrative
- logistics planning (provisioning supplies including food, water, medicine, and fuel)
- daily ship logs and blog updates
- researching and understanding applicable regulations and requirements for each jurisdiction entered
- preparing clearance documents (customs, immigration, bio-security and health quarantine forms)
- contacting relevant port and government authorities in advance
- summarizing and translating all necessary requirements for entry to Japan for other yachts

Certificates
- Maritime Restricted Radio Operators Certificate (1 day, no expiry)
- Advanced Sea Survival (2 days, no expiry)
- PADI Dive License (up to 30m, no expiry)
- Comprehensive First Aid (2 days, expired 2022)
- Offshore Medical Course (1 day, expires 2023)
- Pre-Hospital Emergency Care (5 days, expired 2022)

Interests

Cycling — Keen commuter cyclist and mountain biker.

Rogaining — This is an orienteering-type sport which involves long distance cross-country navigation, including route planning and navigation between checkpoints using a variety of map types. Competing requires teamwork and endurance. This year I would like to compete in my first 24 hour rogaine.

Skiing — I enjoy back-country skiing for its diversity in skills. Particularly enjoy the route planning and risk assessment nature of the sport.

Sailing — I enjoyed sailing in numerous dinghy classes throughout high-school and university and have also sailed extensively off-shore in a keel yacht.

References

Academic

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Character

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