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# Jack B. Muir

## Computational Geophysicist

jbmuir.github.io  
github.com/jbmuir  
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I'm a computationally focused geophysicist who seeks to make the world a better place by combining deep expertise in Earth science with a wide ranging technical ability in the latest developments in applied mathematics and computer science. My work will save lives and improve the prosperity of everyone on Earth (and one day beyond).

### EDUCATION

<b>Doctor of Philosophy in Geophysics</b> , <i>California Institute of Technology</i>	Oct 2021
<b>Master of Science in Geophysics</b> , <i>California Institute of Technology</i>	Jun 2019
<b>Bachelor of Philosophy in Physics</b> , <i>Australian National University</i>	Dec 2014

### SELECT EXPERIENCE

<b>Marie Skłodowska-Curie Fellow / TerraPINN</b> <i>Department of Earth Sciences, University of Oxford</i>	<b>Mar 2022–Present</b> Oxford, UK
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- Developed a hybrid physics-informed neural network (PINN) framework for full seismic wave propagation in JAX, Google's scientific machine learning platform.
- Identified key tactical priority of exploiting wavefield axisymmetry to accelerate computation, laying the groundwork for our strategic vision of highly efficient PINNs for full physics seismic hazard calculations.
- Constructed reference seismic simulations using the computational geophysics code AxiSEM3D on the UK Archer2 high-performance computing cluster.
- Secured over €225,000 in independent research funding through competitive European and UK based grant processes.
- Fostered collaborative research between Oxford and other bodies. This required communication with both academic (Harper Adams University, soil seismology) and industry (Alan Turing Institute, natural language processing for macroseismic observables) organizations.
- Developed independent research projects, including deep-Gaussian-process models for seismicity and closed-form Bayesian solutions for surface wave tomography.

<b>Graduate Researcher / Seismic Data Fusion with Compressive Sensing</b> <i>California Institute of Technology</i>	<b>Dec 2016–Oct 2021</b> Pasadena, CA, USA
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- Used classical machine learning and signal processing techniques in Python to optimally interpolate seismic data recorded on irregular, sparse arrays.
- Synthesized distributed-acoustic-sensing (DAS) strain rate data with nodal velocity sensors to create a unified data product which allowed for calibration of the DAS array to near-surface site effect.
- Delivered two invited talks communicating research results at the American Geophysical Union annual meeting.

<b>Graduate Researcher / Geological Parameterizations for Tomography</b> <i>California Institute of Technology</i>	<b>Jun 2017–Oct 2021</b> Pasadena, CA, USA
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- Constructed a new model of the Northeastern Los Angeles basin using Love-wave data and a geologically motivated level-set parameterization of the basin edge.
- Created a new algorithm for derivative-free quasi-Bayesian inversion — hierarchically regularized Tikhonov Ensemble Kalman Sampling. This algorithm allows for efficient usage of black-box or legacy forward modelling code within a probabilistic inversion framework.
- Curated a refraction-seismic dataset from field collection to publication as an algorithm test case.

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### Teaching Assistant

California Institute of Technology

Jan 2017–Jun 2020

Pasadena, CA, USA

- Developed students' skills in machine learning during Caltech's first ever ML in geophysics course; advised course instructor on how to successfully match content to student interest and ability.
- Co-ran two field geophysics campaigns, with techniques including refraction seismics, resistivity tomography, magnetometry, gravity, drone digital elevation modelling and real-time kinematic GNSS.
- Mentored students in practical near-surface geophysics data analysis.
- Communicated challenging concepts in theoretical seismology.

### FELLOWSHIPS & AWARDS

Marie Skłodowska-Curie Actions Individual Fellowship, <i>University of Oxford</i>	2022–2024
General Sir John Monash Scholarship, <i>California Institute of Technology</i>	2015–2018
University Medal in Physics, <i>Australian National University</i>	2014
Dunbar Scholarship in Physics, <i>Australian National University</i>	2014
Australian Society for Exploration Geophysics ACT Branch Student Award	2014
Australian Meteorological and Oceanographic Society ACT Branch Student Award	2014
National Merit Scholarship, <i>Australian National University</i>	2010–2013

### TECHNICAL SKILLS

<b>Quantitative Research</b>	Seismology, Field Geophysics, Inverse Problems, Optimization, Deep Learning, Signal Processing
<b>Technical Tools</b>	Python, Julia, STAN, Git, AxiSEM3D
<b>Communication Tools</b>	MS Office Suite, G-Suite, Affinity Designer / Publisher, $\LaTeX$

### SELECTED SERVICE ACTIVITIES

Journal Reviewing (GRL, GJI, JGR, BSSA, P&AG, Phys. Rev. Res., Seismica)	2016–Present
Standards and Copy Editor, <i>ad hoc</i> Handling Editor (Seismica)	2023–Present
Oxford Research and Innovation Committee	2022–Present
Oxford Mathematical, Physical and Life Sciences Research Staff Forum Co-Chair	2022–Present
American Geophysical Union Seismology Session Convener	2020
Caltech Graduate Student Council Representative (Steering, Academics Chair, Treasurer)	2016–2019
Australian Council for Undergraduate Research Conference Co-Organizer	2014

### CONFERENCE AND WORKSHOP PARTICIPATION

Southern California Earthquake Center Annual Meeting	2018–2022
StatSei12 conference on Statistical Seismology	2022
SPIN-ITN Workshop and Conference on Wavefield Gradients	2022
American Geophysical Union Fall Meeting (invited 2x 2021)	2014–2021
Seismological Society of America Virtual Tomography Meeting (invited)	2021
Dr. Lucy Jones Center for Science and Society Science Activation Workshop	2019
Gene Golub SIAM Summer School: Inverse Problems	2018

### REFERENCES

Prof. Tarje Nissen-Meyer, *University of Oxford*  
Prof. Victor Tsai, *Brown University*

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