

Work Address:

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Research webpage: <https://tomshudson.github.io/>

Code Repository: <https://github.com/TomSHudson/>

Personal Profile:

I am a seismologist, using geophysical observations, novel data processing methods and models to improve our understanding of fundamental earth system processes. My current research focus is primarily in elucidating geophysical processes at glaciers and volcanoes.

Key Research Topics:

Passive seismology, glaciology, time-series/signal processing, inversion methods, numerical modelling, volcanology, high performance computing

Education:

2015 - 2019 – PhD, Earth Sciences, University of Cambridge. Title: Investigating Volcanic and Glacial Processes Using Microseismicity.

2012 – 2015 – Master of Physics (MPhys), University of Durham, First Class (Honours).

2010 – 2012 – Mechanical Engineering (Meng), University of Bath, First Class with commendation upon completion of year two, before transferring directly into second year of physics degree at University of Durham)

2005 – 2010 – Secondary Education, Clayesmore Senior School. A-Levels: Maths (A*) Physics (A*) Further Maths (A*) Chemistry (A); GCSE's: 6A*s, 2As, B, C

Employment:

2022 to present – Leverhulme Early Career Research Fellow, Dept. Earth Sciences, University of Oxford

Independent Research Fellow, funded to research hydrofracture crevassing at ice sheets and ice shelves.

Also co-supervising 3 PhD students working on earthquake tomography, anisotropy and ambient noise tomography at volcanoes and for mineral exploration.

2022 to present – Stipendiary Lecturer (tutor), Exeter College, University of Oxford

Responsible for small group teaching of earth sciences to undergraduate students at the college.

2020 to 2022 – Post-Doctoral Research Associate, Dept. Earth Sciences, University of Oxford

Responsible for undertaking the following projects:

1. Using microseismicity to investigate fluid migration at Uturuncu volcano, Bolivia (NSF-NERC funded project)
2. Development of Distributed Acoustic Sensing methodologies for microseismic studies (part of the DigiMon BEIS UK government funded project)
3. Investigating glacier sliding using icequakes (as part of the NERC-funded BEAMISH project)

2019 - 2020 – Research Scientist, Metrol Technology Ltd

Responsible for leading a project to increase understanding the physical behaviour of an acoustic downhole communications system. Included data analysis of considerable downhole datasets, as well as numerical modelling.

Note: Could not publish during this period due to commercial sensitivities.

2015 - 2019 – NERC Doctorial Research Fellow (PhD student), British Antarctic Survey and University of Cambridge

Undertook a PhD using microseismicity to investigate fundamental physical processes at glaciers and volcanoes. Project involved seismic data analysis, developing new seismological data processing methodologies, creating numerical and analytical models, and fieldwork in various environments.

2016 - Field scientist (seismology), British Antarctic Survey

Responsible for on-the-ground acquisition of an active seismic survey of the Larsen C Ice Shelf, Antarctica. Project involved data collection, processing and managing a small field team in a remote part of the world.

2014 - Observations R&D Internship, UK Met Office

Undertook research as part of a Software R&D team to research and develop methods of improving the UK Met Office's lightning detection system, ATDNet.

2013 – Summer Placement, European Fusion Reference Laboratory, Durham

Developed a high current (8000 A) power supply for testing superconductors.

Peer Reviewed Publications:**Published:**

Hudson, T.S., Kufner, SK., Brisbourne, A.M., Kendall, JM., Smith, A.M., Arthern, R., Alley, R., Murray, T.. (2023) Friction and slip measured at the bed of an Antarctic ice stream. *Nature Geoscience*. <https://doi.org/10.1038/s41561-023-01204-4>

Hudson, T.S., Kendall, J.-M., Blundy, J.D., Pritchard, M.E., MacQueen, P., Wei, S.S., Gottsmann, J., Lapins, S.. (2023). Hydrothermal fluids and where to find them: Using seismic attenuation and anisotropy to map fluids beneath Uturuncu volcano, Bolivia. *Geophysical Research Letters*. <http://dx.doi.org/10.1029/2022GL100974>

Kufner, SK., Wookey, J., Brisbourne, A.M., Garcia, C.M., **Hudson, T.S.**, Kendall, JM., Smith, A.M.. (2023). Constraining ice fabric in a fast-flowing Antarctic ice stream using icequakes. *Journal of Geophysical Research: Earth Surface*. <https://doi.org/10.1029/2022JF006853>

Gauntlett, M., **Hudson, T.S.**, Kendall, J. M., Rawlinson, N., Blundy, J., Lapins, S., et al. (2023). Seismic Tomography of Nabro Caldera, Eritrea: Insights Into the Magmatic and Hydrothermal Systems of a Recently Erupted Volcano. *Journal of Geophysical Research: Solid Earth*. <https://doi.org/10.1029/2022JB025742>

Hudson, T.S., Kendall, J.-M., Pritchard, M.E., Blundy, JD, & Gottsmann, J. (2022). From slab to surface: Earthquake evidence for fluid migration at Uturuncu volcano, Bolivia. *Earth and Planetary Science Letters*. <https://doi.org/10.1016/j.epsl.2021.117268>

Lanza, F., Roman, D.C., Power, J.A., Thurber, C.H., **Hudson, T.S.** (2022) Complex magmatic-tectonic interactions during the 2020 Makushin Volcano, Alaska, earthquake swarm. *Earth and Planetary Science Letters*. <https://doi.org/10.1002/essoar.10506629.1>

Hudson, T.S., Kendall, JM., Kufner, SK., Brisbourne, A.M., Smith, AM, Chalari A. & Clarke A. (2021). Distributed acoustic sensing (DAS) for microseismicity studies: A case study from Antarctica. *Journal of Geophysical Research: Solid Earth*. <https://doi.org/10.1029/2020jb021493>

Brisbourne, A.M., Kendall, J.-M., Kufner, S.-K., **Hudson, T.S.**, Smith, A.M., Chalari, A., Clarke, A. (2021). Downhole distributed acoustic seismic profiling at Skytrain Ice Rise, West Antarctica. *Cryosphere*. <https://doi.org/10.5194/tc-2021-1>

Kufner, S.-K., Brisbourne, A. M., Smith, A. M., **Hudson, T.S.**, Murray, T., Schlegel, R., Kendall, JM (2021). Not all icequakes are created equal: Diverse bed deformation mechanisms at Rutford Ice Stream, West Antarctica, inferred from basal seismicity. *Journal of Geophysical Research: Earth Surface*. <https://doi.org/10.1029/2020JF006001>

Hudson, T.S., Brisbourne, A.M., White, R.S., Kendall, JM., Arthern, R., & Smith, A.M. (2020). Breaking the ice: How to identify hydraulically-forced crevassing. *Geophysical Research Letters*. <https://doi.org/10.1029/2020GL090597>

Hudson, T.S., Brisbourne, A.M., Walter, F., Graff, D., & White, R. S. (2020). Icequake source mechanisms for studying glacial sliding. *Journal of Geophysical Research: Earth Surface*. <https://doi.org/10.1029/2020JF005627>

Brisbourne, A., Kulesa, B., **Hudson, T.S.**, Harrison, L., Holland, P., Luckman, A., Bevan, S., Ashmore, D., Hubbard, B., Pearce, E., White, J., Booth, A., Nichols, K., & Smith, A. (2020). An updated seabed bathymetry beneath Larsen C Ice Shelf, west Antarctic. *Earth System Science Data*, 12, 887–896. <https://doi.org/10.5194/essd-12-887-2020>

Hudson, T.S., Smith, J., Brisbourne, A., & White, R. (2019). Automated detection of basal icequakes and discrimination from surface crevassing. *Annals of Glaciology*, 60(79), 1–11. <https://doi.org/10.1017/aog.2019.18>

Woods, J., Donaldson, C., White, R. S., Caudron, C., Brandsdóttir, B., **Hudson, T.S.**, & Ágústsdóttir, T. (2018). Long-period seismicity reveals magma pathways above a laterally propagating dyke during the 2014–15 Bárðarbunga rifting event, Iceland. *Earth and Planetary Science Letters*, 490, 216–229. <https://doi.org/10.1016/j.epsl.2018.03.020>

Hudson, T. S., White, R. S., Greenfield, T., Ágústsdóttir, T., Brisbourne, A., & Green, R. G. (2017). Deep crustal melt plumbing of Bárðarbunga volcano, Iceland. *Geophysical Research Letters*, 44(17), 8785–8794. <https://doi.org/10.1002/2017GL074749>

Hudson, T. S., Horseman, A., & Sugier, J. (2016). Diurnal, seasonal, and 11-yr solar cycle variation effects on the virtual ionosphere reflection height and implications for the Met Office's lightning detection system, ATDnet. *Journal of Atmospheric and Oceanic Technology*, 33(7), 1429–1441. <https://doi.org/10.1175/JTECH-D-15-0133.1>

In review:

Hudson, T.S., Brisbourne, A.M., Kufner, S., Kendall, J., & Smith, A. (*in review*). Array processing in cryoseismology. *The Cryosphere*.

Hudson, T. S., Asplet, J., & Walker, A. M. (*in review*). Automated shear-wave splitting analysis for single- and multi- layer anisotropic media. *Seismica*. <https://doi.org/10.31223/X5R67Z>

Funding and Awards:

Grants won:

John Fell Fund fieldwork grant (2023) (£8,000)

Leverhulme Early Career Research Fellowship (2022) (£195,000)

John Fell Fund grant (2021) (£50,000)

John Fell Fund grant (2020) (£50,000)

NERC Studentship (2015-2019)

AGU Cryosphere Innovation Award (2018) (\$1000)

EU COST Short Term Scientific Mission with ETH Zurich University, Switzerland (2018) (€1500)

EU COST grant to attend seismology workshop (2018) (€200)

NSF grant to attend cryoseismology workshop (\$500)

Icelandic Glaciological Society grant (~£2000)

Jesus College, Cambridge Post-Graduate Research Grants (2016, 2017, 2018, 2019) (Total: £2000)

Durham University Physics Masters Project Award (£4000)

Awards:

AGU Cryosphere Innovation Award (2018)

Best oral presentation, British Geophysics Association PGRiP Meeting, Cardiff (2018)

Runner up, best oral presentation, Joint VSMG-BGA-TSG Meeting, Liverpool (2017)

Selected Invited Seminars and Conference Proceedings:

Invited seminars and conference talks:

Bullard Seminar, University of Cambridge (2022)

Invited talk, IEEE SUM2022 Workshop on Distributed Acoustic Sensing (2022) Seismology and Wave Physics Seminar, ETH Zurich (2022)

IMS seminar, Institute of Mining Seismology (2022)

UTAS seismology seminar, University of Tasmania (2021)

Invited talk, SAGE/GAGE workshop on Frontiers in Distributed Acoustic Sensing (2021)

International Glaciological Society Seminar Series (2021)

Oxford Polar Forum (2021)

FOALAB group seminar, University of Oxford (2021)

IDP Seminar, British Antarctic Survey (2021)

GGM Seminar, Dept. Earth Sciences, University of Oxford (2020)

BiSEPPS Seminar, Dept. Earth and Planetary Sciences, Harvard University (2019)

Bullard Tea Time Talks Seminar Series, University of Cambridge (2018)

ETH Glaciology Seminar Series, ETH Zurich (2018)

Cambridge Volcanology Group Seminar Series, University of Cambridge (2017)

Selected conference proceedings:

T Hudson, SK Kufner, A Brisbourne, JM Kendall, A Smith, R Arthern, "Friction and slip measured at the bed of an Antarctic ice stream", American Geophysical Union Fall Meeting, 2021

T Hudson, SK Kufner, A Brisbourne, JM Kendall, A Smith, R Arthern, “Using icequakes to quantify basal slip and sliding behaviour at an Antarctic ice stream”, General Assembly of the European Seismological Commission, 2021

T Hudson, A Baird, J Kendall, S Kufner, A Brisbourne, A Smith, A Butcher, A Chalari, A Clarke “Distributed Acoustic Sensing in Antarctica: What we can learn for studying microseismicity elsewhere”, EAGE GeoTech 2021 Second EAGE Workshop on Distributed Fibre Optic Sensing (2021)

T Hudson, M Kendall, Y Liu, M Pritchard “From slab to surface: Earthquakes provide evidence for fluid migration at Uturuncu volcano, Bolivia”, VMSG virtual meeting, 2021

T Hudson, M Kendall, Y Liu, M Pritchard “Deciphering water from molten rock: Insights into Uturuncu volcano, Bolivia, using seismic velocity and attenuation tomography”, American Geophysical Union Fall Meeting, 2020

T Hudson, AM Brisbourne, F Walter, D Gräff, RS White “Basal icequake source mechanisms beyond the standard double-couple stick-slip model”, American Geophysical Union Fall Meeting, 2018

T Hudson, AM Brisbourne, RS White “Using microseismicity to study the role of subglacial fluids in basal slip”, POLAR2018, Davos, 2018

T Hudson, RS White, AM Brisbourne “Exploring Deep Melt Migration Before and After An Icelandic Eruption”, VMSG BGA TSG Joint Meeting, Liverpool, 2017

T Hudson, RS White, AM Brisbourne “Tracking deep magma movement preceding the 2014 Bardarbunga-Holuraun Eruption using microseismicity”, European Seismological Commission volcano seismology working group meeting (2016)

Teaching:

Postgraduate:

Currently co-supervising 2 PhD students

Supervised 1 Masters student

Lead, Research tools workshop, British Antarctic Survey (2018)

Undergraduate:

Tutor, Exeter College, University of Oxford (2022-present)

Delivered lectures for 2nd year maths course, Department of Earth Sciences, University of Oxford (2022)

Tutor, 3rd year seismology course, Department of Earth Sciences, University of Oxford (2020, 2021)

Tutor, 3rd year vector calculus course, Department of Earth Sciences, University of Oxford (2021)

Demonstrator, volcano seismology, Department of Geography, University of Cambridge (2019)

Demonstrator, Earth Sciences A, Department of Earth Sciences, University of Cambridge (2016-2018)

Service and Outreach:

Oxford Earth Sciences Postdoc Representative (2022-2023)

Reviewer for international journals (e.g. Geophysical Research Letters, Annals of Glaciology, JGR)

Reviewer for Intergovernmental Panel on Climate Change

Organiser, Oxford Earth Sciences Postdoc Fellowship Information Day (2020, 2021)

Organising committee and convener, BAS Student Symposium (2017, 2018)

Royal Society Summer Science Exhibition 2016 (science outreach event reaching approx. 15,000 people)

Cambridge Science Festival (2016)

Met Office Summer Camps (Met Office STEM Event) (2014)

Other Experience and Relevant Training:

Consultancy:

2021 to 2022 – Silixa Ltd: Developing novel data processing methods for Distributed Acoustic Sensing technology.

Academic and industrial courses participated in:

EU COST Short Term Scientific Mission with ETH Zurich University, Switzerland

Stanford Machine Learning Course

Science and Policy workshop, Cambridge Centre for Science and Policy

Satellites and Earth Observation Data 101 workshop, Satellite Applications Catapult, Harwell, Oxford

POLENET Glacial Seismology Summer School, Colorado State University

NERC advanced training course - ArcGIS

NNESMO NERC advanced training course - numerical modelling in the earth sciences

Glaciology Course, University of Svalbard

Royal Academy of Engineering WILD 1 and WILD 2 Teamwork and Leadership courses; Energy and Humanitarian Aid Workshops; and Negotiation Skills 1 and 2 Workshops

Fieldwork Experience:

Seismology deployment, Zambia (2022) – Deploying seismometers along a transect across Zambia

Cambridge Volcano Seismology Fieldwork, Iceland (2018) – Deploying, servicing and recovering seismometer network

Glaciology Fieldwork, Svalbard (2017) – GPR and glacier mass balance measurements

Larson C Ice Shelf Bathymetry Fieldwork, Antarctica (2016) – Bathymetry survey using active seismics

Cambridge Volcano Seismology Fieldwork, Iceland (2016) – Deploying, servicing and recovering seismometer network

Spring Expedition, Vatnajökull Ice Cap, Iceland (2016) – Deploying seismometers

Open source software packages developed:

SWSPy (shear-wave splitting software)

SeisSrcMoment (moment magnitude analysis)

SeisSrcInv (full-waveform earthquake source inversion)

QuakeMigrate (microseismic detection)

Programming Languages and Software Competence:

Python, Matlab, Bash, Linux, Git, ArcGIS, QGIS, Comsol, NI LabView, ANSYS Fluent

International Collaborations:

CuBES project (Uni. Leicester, First Quantum Minerals, Geological Survey of Zambia) (2021-present)

F. Lanza, ETH Zurich (2021)

M. Pritchard, Cornell (2020-present)

F. Walter and D. Graff, ETH Zurich (2018-2019)

F. Pálsson and the glaciology group, University of Iceland (2016-2017)

Industrial Partnership Experience:

Distributed Acoustic Sensing software development, Silixa Ltd (2021-present)

Commercial development of radar system for monitoring groundwater levels, Cambridge University Development iTeams Project (2017-2018)

Pipe integrity measurement system development on behalf of GE Oil and Gas (2014)

Teamwork and Leadership Experience:

Head Boy at Clayesmore Senior School

Captained various school and university sports teams

Royal Academy of Engineering WILD 1 and WILD 2 teamwork and leadership courses

Leading a three peaks challenge for Durham University Charity Committee (DUCK)

Other: Captain of various sports teams; Duke of Edinburgh Gold Award; Combined Cadet Force; World Challenge

Professional Affiliations:

Fellow of the Royal Astronomical Society

Member of the American Geophysical Union

Member of the Geological Society of London

Other Qualifications:

Full Clean UK Driving License

BORDA Standard 4x4 Driving Course

Fieldwork/Outdoor First Aid Qualifications
