FRASER WILLIAM GOLDSWORTH

frasergocean@gmail.com

Dr. Fraser W. Goldsworth
Max Planck Institut für Meteorologie,
Bundesstraße 53,
20146,
Hamburg,
Deutschland

https://fraserwg.github.io

RESEARCH EXPERIENCE

Post-doctoral research scientist, Climate Energetics group; Max Planck Institute for Meteorology, Hamburg (2023 — 2026)
Work on the EU funded EERIE project, analysing high-resolution (5 km) coupled ocean-atmosphere climate (multi-decadal to centennial timescales) simulations. Focussing on the impact of mesoscale ocean eddies and their impact on AMOC stability, and their effect on anthropogenic carbon and ocean heat content. *(Supervisor: Jin-Song Von Storch.)*

DPhil Student, Ocean Physics group; University of Oxford (2018 — 2022)
Symmetric instability in the Atlantic Meridional Overturning Circulation: Investigating symmetric instability in the the cross-equatorial North Brazil Current and Deep Western Boundary Current, and the high latitude Irminger Current. Using high resolution models to explore the interactions between the instability and mixing processes. *(Supervisors: Professor David Marshall, Professor Helen Johnson.)*

Junior scientist, RAPID AMOC expedition; National Oceanography Centre, Southampton (2020)
Took part in a research cruise to service and deploy moorings which form part of the RAPID array. Was responsible for monitoring the quality of meteorological observations taken by on board instruments, as well as assisting in mooring operations. Produced a three dimensional map of the ship for use in outreach and training settings. *(Supervisor: Dr Ben Moat.)*

MSci research project, SPAT group; Imperial College London (2017 — 2018)
Understanding ocean carbon-cycle model sensitivities to prescribed forcings: Investigated sensitivity of Ocean CO_2 uptake to atmospheric CO_2 concentrations and wind speeds used to force carbon cycle models. Used the Transport Matrix Method of modelling tracer transport. *(Supervisor: Dr Heather Graven.)*

Summer research project, SPAT group; Imperial College London (2017)
Investigated correlations between ship derived aerosol concentrations and aerosol concentrations in the clouds above them. Created a piece of semiautomated software that identifies ship-tracks in satellite imagery. *(Supervisor: Dr Edward Gryspeerdt.)*

Summer research project, Centre for Environmental Policy; Imperial College London (2016)
Aided in literature search and review, extracting and summarising data on air pollution exposures of commuters from various studies. Summary tables produced subsequently included in paper published in Environment International. *(Supervisor: Dr Audrey de Nazelle.)*

EDUCATION

University of Oxford, *Oxford, UK* (2018 — 2022)
DPhil physics (physical oceanography)

Imperial College London, *London, UK* (2014 — 2018)
MSci Physics (1st class honours)

RELEVANT RESEARCH SKILLS

- Strong background in theoretical physical oceanography & AMOC science.
- Data analysis and visualisation in python, including pangeo libraries and the use of *Dask* when handling extremely large datasets.
- Effective use of tier 1 HPC systems. Helped to test the UK's ARCHER2 super computing system before it came online.
- Writing documentation for software & HPC systems.
- Open source software development, including use of git and automated testing.
- Numerical modelling of geophysical flows using MITgcm & ICON.
- Experience of sea-going oceanography.

AWARDS

ARCHER2 image competition (2020)
Winner of the best video category in scientific image competition run by UK's national supercomputer provider (£150.)

St Anne's College graduate travel grant (2022)
Awarded funding to attend Ocean Mixing GRC in Massachusetts, USA (£500.)

NERC studentship (2018 — 2022)
Awarded fully funded place on NERC environmental research DTP at the University of Oxford, covering tuition, stipend and research support grant (Approx. £100,000.)

Ogden Trust summer internship (2016 & 2017)
Received funding to carry out summer research projects at Imperial College London (Approx. £5,000.)

TEACHING & OUTREACH

Tutor, University of Oxford (2021 — 2022)

Run tutorials and problems classes for several small groups of students, for a third year undergraduate fluids course. Responsible for the setting and marking of mock exams.

Demonstrator, University of Oxford (2019 — 2022)

Demonstrated for three years on the advanced quantitative methods course for first year PhD students. Course covers numerical methods and scientific computing. Also demonstrated for undergraduate laboratory experiments.

Summer school coordinator, University of Oxford (2019)

Planned and ran sessions at a two day summer school on "environmental research", aimed at penultimate year undergraduate students. Role involved administrative tasks such as managing registration and arranging accommodation, as well as organising science sessions.

Lead instructor, Oxford University Yacht Club (2022)

Designed and taught the introduction to navigational theory course run by Oxford University Yacht Club. Topics covered include tidal calculations and theory, meteorology, and mathematics for navigation.

Outreach Talk, Trent Valley Sailing Club (2022)

Gave an after dinner talk focussing on the drivers of the Atlantic Meridional Overturning Circulation, it's impact on weather & climate, and the importance of net-zero.

ADDITIONAL SKILLS AND COURSES

- Coding: Python, bash, Matlab, Fortran, C.
- Use of Microsoft office suite of applications.
- Use of LaTeX for typesetting reports and manuscripts.
- *Ocean circulation*, graduate level course, University of Oxford (2020.)
- *HPC: Introduction to advanced research computing & effective cluster use*, one day course, University of Oxford (2019.)
- *Scientific computing for DPhils*, graduate level course, University of Oxford (2019 — 2020.)
- *Advanced quantitative methods,* graduate level course, University of Oxford (2018.)
- *Scientific writing,* graduate level course, University of Oxford (2019.)
- *Effective oceanographic data analysis with Python*, Challenger Society for Marine Science (2022.)
- Sea survival — STCW95 personal survival skills (2019), RYA MCA sea survival & World sailing offshore personal survival (2021.)

PUBLICATIONS

Goldsworth, F. W., Johnson, H. L., Marshall, D. P. (2023). Density staircases generated by symmetric instability in a cross-equatorial deep western boundary current. Geophysical Research Letters, 49. https://doi.org/10.1029/2022GL100961

Goldsworth, F. W., Marshall, D. P., Johnson, H. L. (2021). Symmetric Instability in Cross-Equatorial Western Boundary Currents. Journal of Physical Oceanography, 51(6), 2049– 2067. https://doi.org/10.1175/JPO-D-20-0273.1.

Gryspeerdt, E., Smith, T. W. P., O'Keeffe, E., Christensen, M. W., & ***Goldsworth, F. W.*** (2019). The impact of ship emission controls recorded by cloud properties. Geophysical Research Letters, 46, 12547– 12555. https://doi.org/10.1029/2019GL084700.

Wilson, J.D., et al. (2022) Carbon Sequestration by the Biological Carbon Pump in CMIP6 models: 21st century trends and uncertainties. PNAS, 119(29). https://doi.org/10.1073/pnas.2204369119

Goldsworth, F. W., Johnson, H. L., Marshall, D. P., Le Bras, I. A. (2023). Saturation of restratifying and destratifying instabilities during down front wind events: a case study in the Irminger Sea . Submitted JGR:Oceans. https://doi.org/10.22541/essoar.169447421.13100701/v1.

Abernathey et al. (2021). *xmitgcm* v0.5.2 (software). https://doi.org/10.5281/zenodo.5139886.

Reviewer for the Journal of Physical Oceanography, JGR: Oceans.

INVITED TALKS

- National Oceanography Centre, Southampton, UK (November 2022.)
- Universität Hamburg, Center for Earth System Research and Sustainability, Germany (June 2022.)
- Met Office, Exeter, UK (May 2022.)
- University of Cambridge, Department of Applied Maths and Theoretical Physics, UK (June 2020.)

CONFERENCE PRESENTATIONS & POSTERS

EGU General Assembly 2023 (talk, Vienna)
Water mass transformation following instability in the mixed layer of the East Greenland Current.

TRR181 meeting 2023 (poster, Hamburg)
Water mass transformation by symmetric instability in the East Greenland Current.

Physical Oceanography dissertation symposium XII (talk, Hawaii)
Symmetric instability in the Atlantic Meridional Overturning Circulation.

Challenger Conference 2022 (talk, London)
Symmetric instability in components of the Atlantic Meridional Overturning Circulation.

Gordon Research conference 2022 (poster, Springfield, MA)
Density staircases and mixing barriers generated by symmetric instability in a deep western boundary current.

EGU General Assembly 2022 (talk, Vienna)
Symmetric instability in the surface and deep components of the Atlantic Meridional Overturning Circulation close to the equator.

US CLIVAR AMOC meeting 2022 (poster, Woods Hole, MA)
Symmetric Density staircases and mixing barriers generated by symmetric instability in a deep western boundary current.

Ocean Sciences Meeting 2022 (talk, virtual)
Symmetric instability in cross-equatorial western boundary currents.

Challenger ocean modelling meeting 2021 (talk, virtual)
Modelling symmetric instability in the Atlantic MOC.

Pirata 24-TAV workshop 2021 (talk, virtual)
Symmetric instability in cross-equatorial western boundary currents.

TRR181 meeting 2021 (talk, virtual)
Symmetric instability in cross equatorial western boundary currents.

EGU General Assembly 2021 (poster, virtual)
Symmetric (inertial) instability in cross-equatorial western boundary currents.

Challenger ocean modelling group 2020 (talk, virtual)
Symmetric instability in the cross-equatorial North Brazil Current.

MEMBERSHIP OF PROFESSIONAL SOCIETIES

- Challenger Society for Marine Science (2018 — present.)

LANGUAGES

- English — native speaker.
- French — CEFR B1.
- German — CEFR A2/B1.

REFEREES

Professor David P. Marshall, Atmospheric Oceanic and Planetary Physics, University of Oxford, UK.

Professor Helen L. Johnson, Department of Earth Sciences, University of Oxford, UK.

Professor Jin-Song von Storch, Max Planck Institut für Meteorologie, Hamburg, Germany.