

# GRAEME MACGILCHRIST

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Atmospheric and Oceanic Science,  
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## Current employment

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**Postdoctoral Research Scholar** SOCCOM research project 2018 – present  
Research focus: Dynamics of the Southern Ocean and its impact on tracer transport.

## Education

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**DPhil Physical Oceanography** University of Oxford, U.K. 2013 – 2017

Thesis: Lagrangian perspectives on ocean ventilation

Supervisors: Prof. David Marshall and Dr. Helen Johnson

**MSc Oceanography** (with Distinction) University of Southampton, U.K. 2011 – 2012

Dissertation: Quantifying carbon sequestration in the Arctic Ocean (84%)

Supervisor: Prof. Alberto Naveira Garabato

**MMath Mathematics** (Hons, 1<sup>st</sup> Class) Newcastle University, U.K. 2006 – 2010

Broad degree incorporating applied maths, pure maths and statistics

Dissertation: Magnetic fields in accretion discs (78%)

## Publications [Google Scholar] and manuscripts

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### In preparation

Yan et al., (in prep) Rapid onset of labour productivity reduction due to heat stress in the 21<sup>st</sup> century, intended submission to *Nature Communications*.

MacGilchrist et al., (in prep) Evaluating the biological carbon pump in a watermass transformation framework, intended submission to *Global Biogeochemical Cycles*.

MacGilchrist et al., (in prep) Decadal variability of the Southern Ocean overturning circulation, intended submission to *AGU Advances*.

### Published

MacGilchrist, G.A. et al. (2020) Locations and mechanisms of ocean ventilation in the high-latitude North Atlantic in an eddy-permitting ocean model, in press at *Journal of Climate*.

MacGilchrist, G.A. et al. (2019) Reframing the carbon cycle of the subpolar Southern Ocean, *Science Advances*, 5(8): eeav6410.

van Sebille, E. et al. (2018) Lagrangian ocean analysis: Fundamentals and practices, *Ocean Modelling*, 121: 49-75.

Naveira Garabato, A.C., MacGilchrist, G.A et al. (2017) High latitude ocean ventilation and its role in Earth's climate transitions, *Philosophical Transactions of the Royal Society A*, 375: 20160324.

MacGilchrist, G.A. et al. (2017) Characterizing the chaotic nature of ocean ventilation. *Journal of Geophysical Research: Oceans*, 122: 7577-7594.

MacGilchrist, G.A. et al. (2014) Effect of enhanced pCO<sub>2</sub> levels on the production of DOC and TEP in short term bioassay experiments. *Biogeosciences*, 11: 3695-3706.

MacGilchrist, G.A. et al. (2014) The Arctic Ocean carbon sink. *Deep Sea Research I*, 86: 39-55.

## Awards and Scholarships

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<b>Postdoctoral</b>	DoE/LLNL Subcontract No. 640108 (Prime Contract No. DE-AC52-07NA27344) “Diagnostics and Performance Metrics for Evaluating Ventilation Pathways and Interior Water Mass Properties in Ocean Models” Cooperative Institute for Modelling the Earth System, Princeton/NOAA-GFDL project award, “Evaluating the biological carbon pump in a watermass transformation framework”
<b>Doctoral studies</b>	Natural Environment Research Council PhD studentship CASE studentship, NERC (linked to U.K. Met Office) Oxford-Radcliffe-Graduate Scholar, University College Sykes scholarship for travel in mainland China
<b>Masters studies</b>	School fees bursary, University of Southampton Educational Support Fund, Society for Underwater Technology John Raymont Fund for highest aggregate mark in MSc Oceanography
<b>Undergraduate studies</b>	Excellence in 1 <sup>st</sup> three years, Newcastle University Individual awards for merit in 1 <sup>st</sup> and 2 <sup>nd</sup> years, Newcastle University

## Presentations

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<i>Evaluating the biological carbon pump in a WMT framework</i>	Ocean Sciences Meeting (San Diego, 2020, <i>poster</i> )
<i>Reframing the carbon cycle of the subpolar Southern Ocean</i>	ORCHESTRA-RoSES UK Annual Meeting (Cambridge, 2020) Institute for Marine and Antarctic Science, UTas (Hobart, 2019) Australian National University (Canberra, 2019) Geology and Geoscience Seminar, Yale University (Newhaven, 2018) AGU Fall Meeting (Washington, D.C., 2018)
<i>Ocean ventilation in the high-latitude North Atlantic</i>	CASPO Seminar, Scripps Institution of Oceanography (San Diego, 2018) Physical Oceanography seminar, Ifremer (Brest, 2017) Ocean Modelling Group, Challenger Society (Newcastle, 2018; Exeter, 2017; Liverpool, 2016)
<i>Characterising the chaotic nature of ocean ventilation</i>	Sources and Sinks of Mesoscale Eddy Energy workshop (Tallahassee, 2019) Ocean Sciences Meeting (Portland, 2018; New Orleans, 2016, <i>poster</i> ) Ocean ventilation and deoxygenation, Royal Society (London, 2017, <i>poster</i> ) MEOM Research Group seminar (Grenoble, 2017) Drakkar project meeting (Grenoble, 2017) Nanjing University Institute of Science and Technology (Nanjing, 2016) Ocean University of China (Qingdao, 2016) Peking University (Beijing, 2016) Physical Oceanography and Climate seminar, NOC (Southampton, 2016) Ocean Modelling Group, Challenger Society (Cambridge, 2015) Rapid-USAMOC International Science Meeting (Bristol, 2015) IUGG General Assembly (Prague, 2015) ResClim All-staff meeting (Norway, 2015)
<i>The Arctic Ocean carbon sink</i>	Advances in Marine Biogeochemistry, Challenger Society (Oxford, 2016) Ocean Sciences Meeting (Hawaii, 2014) GEOMAR (Kiel, 2012) Physical Oceanography and Climate seminar, NOC (Southampton, 2012) UK Polar Network Symposium (Bangor, 2012)

## Workshops and Summer Schools

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<b>ECCO Summer School</b> Friday Harbor Laboratories (UW), Friday Harbor, U.S.A. NASA-sponsored summer school on state estimation	2019
<b>Water Mass Transformation Workshop</b> University of New South Wales, Sydney, Australia Invitational international workshop, organised by Sjoerd Groeskamp	2019
<b>Advanced Climate Dynamics Course</b> Newfoundland, Canada Topic: Role of high latitudes in centennial to millennial scale climate variability.	2016
<b>Future of Lagrangian Ocean Modelling Workshop</b> Imperial College, London, U.K. Invitational international workshop, organised by Erik van Sebille.	2015
<b>Alpine Summer School</b> Val d'Aosta, Italy Topic: Dynamics, stochastics and predictability of the climate system.	2014
<b>Fluid Dynamics and Sustainability of the Environment</b> Cambridge, U.K. Broad topics in fluid dynamics, with focus on GFD. Computational and laboratory-based practical components.	2014

## Previous employment

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<b>Research assistant</b> OSMOSIS project cruise JR090, RRS James Cook Responsibilities: Operation of tethered microstructure profiler. CTD sample collection and salinometer measurements.	2013
<b>Researcher</b> University of Southampton, U.K. Responsibilities: Publication of MSc research, further work on ocean acidification.	2012 – 2013
<b>Field Research Coordinator</b> Madagascar Cultures and Nature, Ifotaka, Madagascar Responsibilities: Lead researcher in survey of invasive plant species near Ifotaka. Coordination of U.K. students, as part of Operation Wallacea.	2011

## Teaching experience

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<b>Research mentor</b> Princeton University, U.S.A. Project design and supervision of five undergraduate interns over two summers	2019, 2020
<b>Lecturer</b> Prison Teaching Initiative, NJ, U.S.A. Undergrad-level lecturing and tutoring at the Federal Correctional Institute, Fort Dix Subject: MAT125 Elementary Statistics	2019
<b>Demonstrator</b> Princeton University, U.S.A. Subjects: AOS578 Chemical Oceanography GEO521 Southern Ocean seminars AOS571 Introduction to Geophysical Fluid Dynamics	2018 - present
<b>Tutor and demonstrator</b> University of Oxford, U.K. Subjects: Vector Calculus, 3 <sup>rd</sup> year undergraduate Mathematics for Materials and Earth Science, 1 <sup>st</sup> year undergraduate Planet Earth, 1 <sup>st</sup> year undergraduate Physical Oceanography, 3 <sup>rd</sup> year undergraduate Responsibilities: Combination of small-group (2-5 students) tutorials and large-group (20+ students) problem classes and demonstrations. Design and planning of weekly, hour-long tutorials.	2013 – 2017

## Science outreach

2011-present

Lecturing and outreach events at Bronx Community College, NYC.  
 Fluid dynamics demonstrations to students and general public, University of Oxford.  
 Outreach talks on fluid dynamics and oceanography at Cheney School, Oxford, and  
 King's College School, London.  
 Society for Underwater Technology Christmas Lecture at the National Maritime  
 Museum, Greenwich, 2013.  
 Tutoring with 'Science Plus Oxford', an initiative to introduce high school children to  
 science and scientists.

**Academic tutor and sports coach** Future Hope, Kolkata, India 2006 & 2008

Voluntary work with disadvantaged children and young adults.

Responsibilities: Daily tutoring and sports coaching with groups of between 10 and  
 30 children, aged between 4 and 20.

### Extra-curricular and skills

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<i>Rugby</i>	International honours Scotland Under 18, 19 and 20, 2005-2007 Under 19 World Cup in Dubai, 2006 Tynedale R.F.C. Promotion to English National League 1, 2008 Northumberland County Cup Winner, 2008 – 2010 Oxford University R.F.C. Player in Varsity Match versus Cambridge, 2013-2016 Two full Blues.
<i>I.T. Literacy</i>	Proficient in Python, MATLAB, Linux, Fortran, and R. Comfortable with version control and committed to open source software development.
<i>Research tools</i>	Coding and analysing numerical simulations of a range of complexities. Experience working with NEMO, MITgcm (including adjoint and data assimilation), and MOM6 ocean models. Applying dynamical systems theory to oceanographic problems. Lagrangian analysis of numerical simulations and observations. Budget calculations from box inversions.
<i>Languages</i>	Native English speaker. Good spoken French, basic Gaelic.
<i>Music</i>	Guitar, trumpet, piano, mandolin, ukulele.

### References

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Prof. Jorge Sarmiento, Postdoc mentor, Princeton University (jls@princeton.edu)  
 Dr. Stephen Griffies, Postdoc mentor, Princeton University (stephen.griffies@noaa.gov)  
 Prof. David Marshall, PhD supervisor, University of Oxford (david.marshall@physics.ox.ac.uk)  
 Dr. Helen Johnson, PhD supervisor, University of Oxford (helen.johnson@earth.ox.ac.uk)  
 Prof. Alberto Naveira Garabato, MSc supervisor, University of Southampton (acng@noc.soton.ac.uk)