LEO MIDDLETON

85 Bromfield Road, Somerville, MA, USA, 02144
(+1)7743614084 ⋄ leo.middleton@whoi.com

SUMMARY

Physical Oceanographer interested in ocean mixing, stirring and transport in the polar oceans. Process-based research using observations, theory, and simulations. Looking for a collaborative work environment that encourages me to develop new skills and tackle new challenges.

SKILL SET

- Ocean observation processing and analysis
- Ocean data collection
- Geophysical fluid dynamics
- Large-Eddy-Simulations
- Scientific computing (MATLAB, Python, Julia, Fortran)

EDUCATION

Ph.D, Physical Oceanography and Fluid Dynamics *October 2017 - September 2021*
DAMTP, University of Cambridge and *British Antarctic Survey (BAS)*

- **Thesis:** Unmixing the Ocean: Double Diffusion and Turbulence in Polar Oceans
- **Supervisors:** Dr. John Taylor (primary), Dr. Paul Holland and Dr. Keith Nicholls (co-supervisors)

M.Sci, Mathematics, First Class with Honours *October 2013 - June 2017*
University College London (with 1 year at *University of British Columbia*)

- **Thesis:** Perturbation Dynamics of a Thermally Forced Vortex in a Deep Rapidly-Rotating Fluid
- **Supervisor:** Prof. Ted Johnson

Undergraduate Research Project, London Mathematical Society
University College London *July 2015- August 2015*

- **Thesis:** Point vortex equilibria: Solutions of the Sinh-Poisson Equation - from low to high energy
- **Supervisor:** Dr. Gavin Esler

EMPLOYMENT

Postdoctoral Investigator *November 2021 - Current*
Woods Hole Oceanographic Institute

- **Supervisors:** Amala Mahadevan, Tom Farrar, Isabela Le Bras
- **Topic:** Submesoscale Dynamics
- **Responsibilities:** Data collection, data calibration and analysis, cruise planning, preparing manuscripts, CALYPSO, S-MODE and NORSE Projects

FIELDWORK

Northern Ocean Rapid Surface Evolution (NORSE) IOP2 (https://www.mod.ucsd.edu/norse)
Jan Mayen, Norwegian Sea : *R/V Kronprins Haakon, NPI* *November 2023*

- **Principal Scientific Officer:** Prof. Jennifer Mackinnon
- **Responsibilities:** Towed-chain profiling lead; air-sea flux buoy preparation; data processing.

Sub-Mesoscale Ocean Dynamics Experiment (S-MODE) IOP2 (https://smode.whoi.edu/)
California Current, USA : *R/V Sally Ride, Scripps* *April 2023 - May 2023*

- **Principal Scientific Officer:** Dr. Andrey Scherbina
- **Responsibilities:** Night watch lead; EcoCTD profiling; data processing; data management.

Sub-Mesoscale Ocean Dynamics Experiment (S-MODE) IOP1 (https://smode.whoi.edu/)
California Current, USA : *M/V Bold Horizon, Eclipse Group* *October 2022 - November 2022*

- **Principal Scientific Officer:** Dr. Andrey Scherbina
- **Responsibilities:** EcoCTD profiling; data processing; data management; Nitrate sampling.

Coherent Lagrangian Pathways from Surface Ocean to Interior (CALYPSO) IOP2
Balearic Sea, Mediterranean : *R/V Pourquoi Pas? IFREMER* *February 2022 - March 2022*

- **Principal Scientific Officers:** Dr. Amala Mahadevan, Dr. Eric D'Asaro
- **Responsibilities:** Cruise organisation; drifter & float deployment; underway profiling; data processing; data management.

Ocean Regulation of Climate by Heat and Carbon Sequestration and Transports (ORCHESTRA)
January 2019 - February 2019
Orkney Passage, Southern Ocean : *RSS James Clark Ross, British Antarctic Survey*

- **Principal Scientific Officer:** Dr. Alexander Brearley,
- **Responsibilities:** Mooring recovery; CTD casts; glider & float deployment; salinometry.

Left-Right Asymmetry in Flowers
Cederberg, South Africa *August 2022*
Missouri, USA *August 2023*

- **Principal Scientific Officer:** Dr. Alice Fairnie,
- **Responsibilities:** Flower population counts; pollinator observations; data processing.

PAPERS

1. **Middleton, L.**, Wu, Weiguang., D'Asaro E. A., Johnston, S., Rudnick, D., Tarry, D., Poulain, P. M., Farrar, J. T., Berta, M., Shcheribina, A., Mahadevan, A., Ocean cyclone splitting ventilates the upper ocean, *in review*, Nature Communications
2. **Middleton, L.**, Brown, J., and Taylor, J.R., Reconciling layering mechanisms in double-diffusive and single-diffusive fluids *in revision*, Physical Review Letters
3. Gentil, M., Pallàs-Sanz, E., **Middleton, L.**, Ruiz-Angulo, A., Meunier, T., Durante, G., Tenreiro, M., Estrada-Allis, S.N. and Sheinbaum Pardo, J., 2024. Distribution, Mixing, and Transformation of a Loop Current Ring Waters: The Case of Gulf of Mexico.
4. Farrar, J.T., D'Asaro, E., Rodriguez, E., Shcherbina, A., Lenain, L., Omand, M., Wineteer, A., Bhuyan, P., Bingham, F., Villas Boas, A. B., Czech, E., D'Addezio, J., Freilich, M., Grare, L., Hypolite, D., Jacobs, G., Klein, P., Lang, S., Leyba, I., Mahadevan, A., McWilliams, J., Menemenlis, D, **Middleton, L.**, Molemaker, J., O'Neill, L., Perkovic-Martin, D., Pizzo, N., Rainville, L., Rocha, C., Samelson, R. M., Simoes-Sousa, I., Statom, N., Thompson, A., Thompson, D., Torres, H., Uchoa, I., Wenegrat, J., Westbrook, E., S-MODE: the Sub-Mesoscale Ocean Dynamics Experiment, 2024. *Bulletin of the American Meteorological Society (BAMS)*
5. **Middleton, L.**, Davis, P.E., Nicholls, K.W., and Taylor, J.R. 2022, Double-Diffusion as a Driver of Turbulence in the Stratified Boundary Layer under George VI Ice Shelf, *Geophysical Research Letters*
6. Fine, E. C., MacKinnon, J. A., Alford, M. H., **Middleton, L.**, Taylor, J., Mickett, J. B., and Peacock, T. 2021, Double diffusion, shear instabilities, and heat impacts of a Pacific Summer Water intrusion in the Beaufort Sea, *Journal of Physical Oceanography (JPO)*
7. **Middleton, L.**, Fine, E., Alford, M., Mackinnon, J. and Taylor, J.R. 2021, Estimating Dissipation Rates Associated with Double-Diffusion, *Geophysical Research Letters*
8. **Middleton, L.**, Vreugdenhil, C.E., Holland, P.R. and Taylor, J.R. 2021, Numerical Simulations of Melt-Driven Double-Diffusive Fluxes in a Turbulent Boundary Layer beneath an Ice Shelf, *JPO*
9. **Middleton, L.** and Taylor J.R. 2020, A general criterion for the release of background potential energy through double diffusion, *Journal of Fluid Mechanics: Rapids*

PAPERS : IN-PREP

1. **Middleton, L.**, and Farrar, J. T., Statistics of curvature-modified frontogenesis in submesoscale flows
2. **Middleton, L.**, Mackinnon, J., Sanchez-Rios, A. and Farrar, J. T., Resolving vertical transport via finescale plume-like features in the Arctic Ocean

DATASETS

1. **Middleton, L.**, Thunherr (2024). Lowered acoustic Doppler current profiler (LADCP) data from cruise JR18004. NERC EDS UK Polar Data Centre. https://doi.org/10. 5285/1fbb7874-5433-3b07-e063-7086abcobee9,
2. **Middleton, L.**, and S-MODE Team, S-MODE IOP1 Shipboard uCTD and EcoCTD Measurements Version 1. Ver. 1. PO.DAAC, CA, USA.https://doi.org/10.5067/SMODE-RVECT
3. **Middleton, L.**, and S-MODE Team, S-MODE IOP2 Shipboard uCTD and EcoCTD Measurements Version 1. Ver. 1. PO.DAAC, CA, USA.https://doi.org/10.5067/SMODE-RVECT
4. **Middleton, L.**, Johnston, S., Rudnick, D., Tarry, D., Poulain, P. M., Farrar, J. T., Berta, M., Shcheribina, D'Asaro E. A., A., Mahadevan, A., CALYPSO 2022 Cruise Data, *in prep*
5. **Middleton, L.**, Davis, P., and Nicholls, K. (2021). Borehole data from George VI Ice Shelf (Version 1.0). NERC EDS UK Polar Data Centre. https://doi.org/10.5285/c4a8ad33-2c09-44e9-b4ea-2923bb4b85f1,

AWARDS AND PRIZES

Consiglio Nazionale della Richerche Visitors Funding: Two-week visit to CNR, Vencie *2024*
International Meteorological Institute Visitors Funding: Two-week visit to Gothenberg *2024*
GRC Funding: Funding for invited speakers to attend the Gordon Research Conference *2024*
International Meteorological Institute Visitors Funding: Month visit to Gothenberg *2023*
NASA Group Achievement Award: for S-MODE Field Campaign *2023*
NERC Ph.D Studentship: Full fee and maintenance award *2017-2021*
Smith-Rayleigh and Knight-Rayleigh Prize: First year Ph.D essay award *2019*
Susan N. Brown Prize: Best fourth-year undergraduate in Applied Mathematics *2016*
Dean's List: A commendation for undergraduates excelling in their chosen field *2016*
LMS Undergraduate Research Bursary Award: Funding for summer research project *2015*
Andrew Rosen Prize: Awarded for excellence in second year Applied Mathematics *2014*
Jefferey Sessional Prize: Best results in first year B.Sc/M.Sci *2013*

SELECTED PRESENTATIONS

1. **Double Diffusion in the Global Oceans**
   Gordon Research Conference, 2024
2. **Ocean Cyclone Splitting Ventilates the Upper Ocean**
   Ocean Sciences Meeting, 2024; WHOI Seminar, 2023; VEPOSSSS Conference, 2023
3. **Un-mixing the Ocean: Double-Diffusion and Turbulence in Polar Oceans**
   Gordon Research Conference, 2024; VEPOSSSS Seminar,2022; MIT PAOC Seminar, 2022; OSU Seminar, 2022; Leeds Seminar, 2022; Cambridge GEP Seminar, 2021
4. **Melt-driven convection as a driver of under-ice turbulence**
   Maths on Ice Seminar, 2021; Forum for Research into Ice Shelf Processes, 2019; Atmospheric and Oceanic Fluid Dynamics Meeting, 2019; EGU General Assembly, 2020
5. **An introduction to layering beneath ice**
   KITP Layering Conference, 2021
6. **A general criterion for the release of background potential energy by double diffusion**
   UCL Seminar Series, 2019; Cambridge Seminar Series, 2019

TEACHING AND PUBLIC SCIENCE OUTREACH

Guest lecturer:
- Waves and Instabilities course for WHOI graduate students *2022, 2023*

Supervision:
- Geophysical Fluid Dynamics Summer School project supervision on simulations of doubly diffusive Kolmogorov flow *2024*
- Summer student on ADCP data taken during CALYPSO *2022*
- Summer student on mooring data beneath Filchner-Ronne Ice Shelf *2021*

Teaching assistant:
- Fluid Dynamics, final year undergraduate course *2020*
- FDSE summer school on numerical simulation *2019*
- Mathematics for Natural Sciences, first year undergraduate course *2019*

Outreach presentations:
- COP26 London Exhibition on behalf of BAS *2019*
- Bluedot festival on behalf of BAS *2021*
- Fluid dynamics lab experiments open day *2019*

ADDITIONAL ROLES

Reviewer: GRL (2), JFM (5), JAMES (1), JPO (4), PRFluids (1), Cryosphere (1), JGR (1) *2021-2023*

Convener:
- WHOI DEI working group on post-cruise surveys *2022-2024*
- CALYPSO working group on submesoscale dynamics *2023*
- WHOI Physical Oceanography retreat for strategic planning *2023*
- KITP Layering Workshop session on Layering Beneath Ice *2021*
- EGU session on Ice-Ocean Boundary Layers *2020*

Organiser:
- WHOI Physical Oceanography seminar series *2023-2024*
- CALYPSO symposium *2022*
- Ice Shelf-Ocean Boundary Layers group meeting *2017-2020*
- G.K.Batchelor Laboratory seminar series *2018-2019*
- British Antarctic Survey student symposium *2018*

Member:
- WHOI Fieldwork Climate working group *2023-2024*
- WHOI Strategic Planning working group *2023*