

# John R. Taylor

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Reader in Oceanography  
Department of Applied Mathematics and Theoretical Physics  
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## EDUCATION

- Ph.D. Mechanical and Aerospace Engineering, University of California, San Diego, 2008
- M.S. Mechanical and Aerospace Engineering, University of California, San Diego, 2004
- B.S. Engineering Physics, Santa Clara University, 2001  
Computational Physics Emphasis, University Honors Program

## PROFESSIONAL EXPERIENCE

Reader in Oceanography, 2017 -  
Department of Applied Mathematics and Theoretical Physics, University of Cambridge  
Teaching (Title B) Fellow, 2013-  
College of St. John the Evangelist, University of Cambridge  
Director of Studies in Mathematics, 2017-2019  
College of St. John the Evangelist, University of Cambridge  
University Lecturer in Oceanography, 2011-2017  
Department of Applied Mathematics and Theoretical Physics, University of Cambridge  
Postdoctoral Research Associate, 2010-2011  
Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of  
Technology  
NSF Mathematical Sciences Postdoctoral Research Fellow, 2008-2010  
Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of  
Technology  
National Defense Science and Engineering Graduate Fellow, 2003-2007  
Department of Mechanical and Aerospace Engineering, University of California, San  
Diego  
Visiting Scientist, 2000-2002  
University Corporation for Atmospheric Research, Fleet Numerical Meteorology and  
Oceanography Center, U.S. Navy, Monterey, CA  
Research Assistant, 1998-2000  
Chemical Oceanography, Oregon State University  
Research Assistant, 1995-1997  
Atmospheric Science, Oregon State University

## PEER-REVIEWED JOURNAL ARTICLES & BOOK CHAPTERS

1. Gula, J., J.R. Taylor, A. Shcherbina, and A. Mahadevan, 2021, Submesoscale processes and mixing: in: *Ocean Mixing; Drivers, Mechanisms and Impacts*, eds. M. Meredith and A. Naviera Garabato, *Elsevier*.
2. Wienkers, A.F., L.N. Thomas, and J.R. Taylor, 2021, The influence of front strength on the development and equilibration of symmetric instability. Part 2. Nonlinear evolution. *J*

- Fluid Mech. accepted.*
3. Wienkers, A.F., L.N. Thomas, and J.R. Taylor, 2021, The influence of front strength on the development and equilibration of symmetric instability. Part 1. Growth & saturation. *J. Fluid Mech. accepted.*
  4. Middleton, L., E. Fine, J. Mackinnon, M. Alford, and J.R. Taylor, 2021, Estimating dissipation rates associated with double diffusion. *Geophys. Res. Lett. accepted.*
  5. Howland, C.J., J.R. Taylor and C.P. Caulfield, 2021, Shear-induced breaking of internal gravity waves. *J. Fluid Mech.*, 921.
  6. Howland, C.J., J.R. Taylor, and C.P. Caulfield, 2021, Quantifying mixing and available potential energy in vertically periodic simulations of stratified flows. *J. Fluid Mech.*, 914.
  7. Ruan, X., A.F. Thompson, and J.R. Taylor, 2021, The evolution and arrest of a turbulent stratified oceanic bottom boundary layer over a slope: Upslope regime and PV dynamics, *J. Phys. Ocean.*, 51(4), 1077-1089.
  8. Couston, L.-A., E. Hester, B. Favier, J.R. Taylor, P.R. Holland, and A. Jenkins, 2020, Topography generation by melting and freezing in a turbulent shear flow, *J. Fluid Mech.*, 911.
  9. Middleton, L., C.A. Vreugdenhil, P. Holland, and J.R. Taylor, 2020, Numerical Simulations of Melt-Driven Double-Diffusive Fluxes in a Turbulent Boundary Layer beneath an Ice Shelf, *J. Phys. Ocean.*, 51(2), 403-418.
  10. Smith, K.M., C.P. Caulfield, and J.R. Taylor, 2020, Turbulence in forced stratified shear flows, *J. Fluid Mech.*, 910.
  11. Wenegrat, J.O., L.N. Thomas, M.A. Sundermeyer, J.R. Taylor, E.A D'Asaro, J.M. Klymak, R.K. Shearman, C.M. Lee, 2020, Enhanced mixing across the gyre boundary at the Gulf Stream front, *Proc. Nat. Acad. Sci.*, 117(30) 17607-17614.
  12. Crowe, M., and J.R. Taylor, 2020, The effects of surface wind stress and buoyancy flux on the evolution of a front in turbulent thermal wind balance. *Fluids*, 5(2), 87.
  13. Howland, C., C.P. Caulfield, and J.R. Taylor, 2020, Mixing in forced stratified turbulence and its dependence on large-scale forcing. *J. Fluid Mech.*, 898.
  14. Middleton, L. and J.R. Taylor, 2020, A general criterion for the release of background potential energy through double diffusion, *J. Fluid Mech.*, 893.
  15. Taylor, J.R., K.M. Smith, and C.A. Vreugdenhil, 2020, The influence of submesoscales and vertical mixing on the export of sinking tracers in large-eddy simulations, *J. Phys. Ocean.*, 50(5), 1319-1339.
  16. Whitt, D.B., M. Lévy, and J.R. Taylor, 2019, Submesoscales Enhance Storm-Driven Vertical Mixing of Nutrients: Insights From a Biogeochemical Large Eddy Simulation. *J. Geophys. Res.*, 124, <https://doi.org/10.1029/2019JC015370>.
  17. Crowe, M., and J.R. Taylor, 2019, Baroclinic instability with a simple model for vertical mixing. *J. Phys. Ocean.*, in press.
  18. Taylor, J.R., S.M. de Bruyn Kops, C.P. Caulfield, and P.F. Linden, 2019, Testing the assumptions underlying ocean mixing methodologies using direct numerical simulations, *J. Phys. Ocean.*, 49, 2761-2779.
  19. Crowe, M., and J.R. Taylor, 2019, The evolution of a front in turbulent thermal wind balance. Part 2. Numerical Simulations, *J. Fluid Mech.*, 850, 179-211.
  20. Ruan, X., A.F. Thompson, and J.R. Taylor, 2019, The evolution and arrest of a turbulent stratified oceanic bottom boundary layer over a slope, *J. Phys. Ocean.*, 49, 469–487.
  21. Vreugdenhil, C., and J.R. Taylor, 2019, Stratification effects in the turbulent boundary layer beneath a melting ice shelf: insights from resolved large-eddy simulations, *J. Phys. Ocean.*, 49, 1905–1925.
  22. Stamper, M., J.R. Taylor, and B. Fox-Kemper, 2018, The growth and saturation of submesoscale instabilities in the presence of a barotropic jet, *J. Phys. Ocean.*, 48,

- 2779-2797.
23. Vreugdenhil, C., and J.R. Taylor, 2018, Large-eddy simulations of stratified plane Couette flow using the anisotropic minimum-dissipation model, *Phys. Fluids*, in press.
  24. Crowe, M., and J.R. Taylor, 2018, The evolution of a front in turbulent thermal wind balance. Part 1. Theory, *J. Fluid Mech.*, 850, 179-211.
  25. Taylor, J.R., 2018, Accumulation and subduction of buoyant tracers at submesoscale fronts, *J. Phys. Ocean.*, 48, 1233-1241.
  26. Taylor, J.R., S. Bachman, S., M. Stamper, K. Adams, P. Hosegood, J.-B. Sallee, R. Torres, 2018, Submesoscale Rossby waves on the Antarctic Circumpolar Current, *Science Advances*, 4(3), DOI: 10.1126/sciadv.aao2824.
  27. Howland, C., J.R. Taylor, C.P. Caulfield, 2018, Testing marginal stability in stratified shear layers. *J. Fluid Mech.* 839, 2018.
  28. Whitt, D.B., and J.R. Taylor, 2017, Energetic submesoscales maintain strong mixed layer stratification during an autumn storm, *J. Phys. Ocean.*, 47(10) 2419-2427.
  29. Bachman, S.D., J.R. Taylor, K.A. Adams, and P. Hosegood, 2017, Mesoscale and submesoscale effects on mixed layer depth in the Southern Ocean, *J. Phys. Ocean.*, 47, 2173-2188.
  30. Kaminski, A.K., C.P. Caulfield, and J.R. Taylor, 2017, Nonlinear evolution of linear optimal perturbations of strongly stratified shear layers, *J. Fluid Mech.*, 825, 213-244
  31. Taylor, J.R., and Q. Zhou, 2017, A multi-parameter criterion for layer formation in a stratified shear flow using sorted buoyancy coordinates, *J. Fluid Mech.*, 823, R5
  32. Whitt, D.B, J.R. Taylor, and M. Levy, M, 2017, Synoptic-to-planetary scale wind variability enhances phytoplankton biomass at ocean fronts, *J. Geophys. Res.*, 122, 4602-4633
  33. Adams, K.A., P. Hosegood, J.R. Taylor, J.-B. Sallee, S.D. Bachman, R. Torres, M. Stamper, 2017, Frontal circulation and submesoscale variability during the formation of a Southern Ocean mesoscale eddy, *J. Phys. Ocean.*, 47, 1737-1753.
  34. Zhou, Q., J.R. Taylor., and C.P. Caulfield, 2017, Self-similar mixing in stratified plane Couette flow for varying Prandtl number, *J. Fluid Mech.* 820, 86-120.
  35. Zhou, Q., J.R. Taylor., C.P. Caulfield, and P.F. Linden, 2017, Diapycnal mixing in layered stratified plane Couette flow quantified in a tracer-based coordinate, *J. Fluid Mech.* 823, 198-229.
  36. Bachman, S.D., B. Fox-Kemper, J.R. Taylor, and L.N. Thomas, 2017, Parameterization of Frontal Symmetric Instabilities. I: Theory for Resolved Fronts, *Ocean Modelling*, 109, 72-95.
  37. Whitt, D.B, M. Levy, and J.R. Taylor, 2017, Low and high frequency oscillatory winds synergistically enhance nutrient entrainment and phytoplankton at fronts, *J. Geophys. Res.*, 122, 2, 1016-1041.
  38. Stamper, M., and J.R. Taylor, 2016, The transition from symmetric to baroclinic instability in the Eady model. *Ocean Dyn.*, 67(1), 65-80
  39. Portwood, G., S.M. de Bruyn Kops, J.R. Taylor, H. Salehipour, and C.P. Caulfield, 2016, Robust identification of dynamically distinct regions in stratified turbulence. *J. Fluid Mech. Rapids*, 807, R2
  40. Taylor, J.R., E. Deusebio., C.P. Caulfield, and R. Kerswell, 2016, A new method for isolating turbulent states in transitional stratified plane Couette flow. *J. Fluid Mech. Rapids*, 808, R1
  41. Shakespeare, C.J., and J.R. Taylor, 2016, Spontaneous wave generation at strongly strained density fronts, *J. Phys. Ocean.* 46 (7), 2063-2081.
  42. Taylor, J.R., 2016, The influence of submesoscale restratification and convection on light-limited phytoplankton growth. *Geophys. Res. Lett.* 2016GL069106.
  43. Thomas, L.N., J.R. Taylor, E. D'Asaro, C. Lee, and J. Klymak, 2016, Symmetric

- instability, inertial oscillations, and turbulence at the Gulf Stream front. *J. Phys. Ocean.* 46, 197-217.
44. Bachman, S.D., and J.R. Taylor, 2015, Numerical simulations of the equilibration between eddy-induced restratification and vertical mixing. *J. Phys. Ocean.* 46, 919-935.
  45. Watteaux, R., R. Stocker, and J.R. Taylor, 2015, Sensitivity of the nutrient uptake rate by chemotactic bacteria to physical and biological parameters in a turbulent environment. *J. Theor. Biol.* 387, 120-135.
  46. Deusebio, E., C.P. Caulfield, and J.R. Taylor, 2015. The intermittency boundary in stratified plane Couette flow. *J. Fluid Mech.*, 781, 298-329.
  47. Shakespeare, C.J., and J.R. Taylor, 2015, The spontaneous generation of inertia-gravity waves during frontogenesis forced by large strain: numerical simulations. *J. Fluid Mech.*, 772, 508-534.
  48. Enriquez, R.M., and J.R. Taylor, 2015, The competition between wind-driven mixing and surface heating in triggering spring phytoplankton blooms. *J. Mar. Sci.*, doi:10.1093/icesjms/fsv071
  49. Shakespeare, C.J., and J.R. Taylor, 2014, The spontaneous generation of inertia-gravity waves generated during frontogenesis forced by large strain: theory. *J. Fluid Mech.*, 757, 817-853.
  50. Kaminski, A.K., C.P. Caulfield, and J.R. Taylor, 2014. Transient growth in strongly stratified shear layers. *J. Fluid. Mech.*, 758, R4.
  51. Shcherbina, A. et al, 2014. The LatMix summer campaign: Submesoscale stirring in the upper ocean. *Bulletin of the American Meteorological Society.*
  52. Bachman, S.D., and J.R. Taylor, 2014. Modelling of partially resolved oceanic symmetric instability. *Ocean Modelling.* 82, 15-27.
  53. Thomas, L.N., and J.R. Taylor, 2014. Damping of inertial motions by parametric subharmonic instability. *J. Fluid Mech.* 743, 280-294.
  54. Ferrari R., S.T. Merrifield and J.R. Taylor, 2014. Shutdown of convection triggers increase of surface chlorophyll. *J. Mar. Sys.*, <http://dx.doi.org/10.1016/j.jmarsys.2014.02.009>
  55. Shakespeare C.J. and J.R. Taylor, 2013, Geostrophic adjustment and frontogenesis in zero and uniform PV flows: a generalised mathematical model. *J. Fluid Mech.*, 736, 366-413.
  56. Thomas L.N., J.R. Taylor, R. Ferrari, and T.M. Joyce, 2013, Symmetric instability in the Gulf Stream. *Deep Sea Res. II*, 91, 96-110.
  57. Taylor J. R., and R. Stocker, 2012, Trade-offs of chemotactic foraging in turbulent water, *Science*, 338, (6107), 675-679.
  58. Taylor J.R., and R. Ferrari, 2011, Ocean fronts trigger high latitude phytoplankton blooms, *Geophys. Res. Lett.* doi:10.1029/2011GL049312.
  59. Taylor J.R., and R. Ferrari, 2011, Turbulent convection and the onset of the spring phytoplankton bloom. *Limnology and Oceanography.* 56, 6, 2293–2307.
  60. Thomas L.N., and J.R. Taylor, 2010, Reduction of the usable wind-work on the general circulation by forced symmetric instability. *Geophys. Res. Lett.*, 37, L18606, doi:10.1029/2010GL044680.
  61. Taylor J.R., and R. Ferrari, 2010, Buoyancy and wind-driven convection at mixed layer density fronts. *J. Phys. Ocean.*, 40, 1222-1242.
  62. Gayen B., J.R. Taylor, and S. Sarkar, 2010, Large eddy simulation of a stratified boundary layer under an oscillatory current. *J. Fluid Mech.*, 643, 233-266.
  63. Taylor J.R., and R. Ferrari, 2009, On the equilibration of a symmetrically unstable front via a secondary shear instability. *J. Fluid. Mech.*, 622, 103-113.
  64. Taylor J.R., and S. Sarkar, 2008, Stratification effects in a bottom Ekman layer *J. Phys. Ocean.*, 38, 2535-2555.

65. Taylor J.R., and S. Sarkar, 2007, Direct and large eddy simulations of a bottom Ekman layer under and external stratification *Int. J. Heat and Fluid Flow*, 29, 3, 721-732.
66. Taylor J.R., and S. Sarkar, 2007, Internal gravity waves generated by a turbulent bottom Ekman layer. *J. Fluid Mech.*, 590, 1, 331-354.
67. Taylor J.R., S. Sarkar, and V. Armenio, 2005, Large eddy simulation of stably stratified open channel flow. *Phys. Fluids* 17, 116602
68. Bennett A.F., J.R. Taylor, and B.S. Chua, 2005, Lattice Boltzmann open boundaries for hydrodynamic models. *J. Comp. Phys.*, 203, 89-111.
69. Taylor J.R., K.K. Falkner, U. Schauer, and M. Meredith, 2003, Quantitative considerations of dissolved Barium as a tracer in the Arctic Ocean. *J. Geophys. Res.*, 108 (C12), 3374.

#### PROFESSIONAL ACTIVITIES

- Ocean Visions Expert Working Group, 2021
- Peer Review College, Natural Environment Research Council, 2012 – 2015.
- Member of organizing committee and head of computational projects, Fluid Dynamics of Sustainability and the Environment Summer School, DAMTP, University of Cambridge, 2012 – 2018.

#### RESEARCH GRANTS

- 2019 – present Co-Investigator, *NSFGEO-NERC*: Collaborative Research: Energy transfer between submesoscale vortices and resonantly-forced inertial motions in the northern Gulf of Mexico, Natural Environment Research Council (£294,281)
- 2016 – 2019 Principal Investigator, Understanding the Ice-shelf Ocean Boundary Layer, Natural Environment Research Council (£371,126)
- 2015 – 2018 Co-Investigator, Gulf of Mexico Research Initiative, CARTHE consortium (£366,636)
- 2013 – 2018 Co-Investigator, Mathematical Underpinnings of Stratified Turbulence (MUST), Engineering and Physical Sciences Research Council (£2,324,418)
- 2013 – 2016 Co-Investigator, Surface Mixed Layer Interactions at Submesoscales (SMILES), Natural Environment Research Council, (£316,215)
- 2013 – 2015 Royal Society, Newton International Fellowship for Rica Mae Enriquez (£99,000)
- 2013 Research Grant, Isaac Newton Trust, (£20,773)
- 2011 – 2012 Starting grant, Engineering and Physical Sciences Research Council Fund, University of Cambridge, (£50,000)

#### TEACHING ACTIVITIES

- 2012 – 2021 Lecturer – Fluid Dynamics of Climate, University of Cambridge, UK
- 2017 – 2020 Lecturer – Differential Equations, University of Cambridge, UK
- 2012 – 2015 Lecturer – Mathematics for Natural Sciences, University of Cambridge, UK
- 2012 – 2021 Lecturer – Ocean Dynamics, Fluid Dynamics of Sustainability and the Environment Summer School, University of Cambridge, UK and École Polytechnique, France.
- 2018 Lecturer – CNRS Summer School on Active Transport in the Ocean, Wimmeraux, France.
- 2013 – 2014 Examiner, Senior Examiner, Part IB Mathematics for Natural Sciences Tripos, University of Cambridge, UK.
- 2013 – Supervisor – Differential Equations, Dynamics and Relativity, Fluid Dynamics, St. John's College, Cambridge, UK.

#### ADMINISTRATIVE ROLES

Co-Director, Fluid Dynamics of Sustainability and the Environment Summer School,

2021

Director for Computational Teaching for All Mathematics (CATAM), 2018 - present

Chair of Computational Projects Assessment Committee (CPAC), 2018 - present

Director of Studies in Mathematics, St. John's College, 2017 - 2019

Teaching Committee, Artificial Intelligence for Environmental Risk CDT, 2020 - present

Computing and Information Technology Committee, 2018 - present

Graduate Education Committee, 2014 - 2019

Applied mathematics coordinator for 3rd and 4th term reports and PhD registration,  
2014 - present

Part III committee, 2011 - 2014

Examiner, Part 1B Mathematics, Natural Science Tripos, 2013

Senior Examiner, Part 1B Mathematics, Natural Science Tripos, 2014

#### INVITED LECTURES

ORCHESTRA/RoSES Annual Meeting, 2-4 July, 2019, Plymouth, UK

CNRS Summer School on Active Transport in the Ocean, 2-6 July, 2018,

Wimmeraux, France

National Meeting of the Royal Meteorological Society, 16 April 2014, London

IUGG Conference on Mathematical Geophysics, 6-10 June, 2016, Paris, France

Turbulence and the Climate System, 24-26 August, 2016, NCAR, Boulder, CO, USA

OSMOSIS project science meeting, 22-23 May, 2014, Norwich, UK

Andreas Acrivos Dissertation Award Lecture, APS DFD meeting, 2008, San Antonio,  
TX, USA

#### AWARDS AND HONORS

- Pilkington Prize, University of Cambridge, 2020
- Faculty Lecturing Award, Faculty of Mathematics, University of Cambridge, 2019
- Andreas Acrivos Dissertation Award in Fluid Dynamics, American Physical Society, 2008
- Mathematical Sciences Postdoctoral Research Fellow, National Science Foundation, 2008-2011
- National Defense Science and Engineering Graduate Fellow
- Sigma Pi Sigma, National Physics Honor Society

#### ADVISORY ROLES

Co-supervisor: Charles Prior (PhD student, 2021 - )

Supervisor: Leyu Yao (Master's, PhD student, 2020 - )

Co-supervisor: Josephine Anselin (PhD student, 2021 - )

Supervisor: Amir Atoufi (PDRA, 2021 - )

Supervisor: Jenny Dingwall (PhD student, 2020 - )

Supervisor: Jinliang Liu (PDRA, 2020 - )

Supervisor: Aaron Wienkers (PhD student, 2018 - )

Supervisor: Leo Middleton (PhD student, 2017 - )

Supervisor: Cat Vreugdenhil (PDRA, 2017 - 2020)

Co-supervisor: Chris Howland (PhD student, 2016 - 2020)

Supervisor: Matthew Crowe (PhD student, 2015 - 2019)

Supervisor: Kat Smith (PDRA, 2017 - 2019)

Supervisor: Qi Zhou (PDRA, 2015 - 2017)

Supervisor: Megan Stamper (PhD student, 2013 - 2017)

Supervisor: Scott Bachmann (PDRA, 2013 - 2017)

Supervisor: Daniel Whitt (PDRA, 2015 - 2017)

Supervisor: Alexis Kaminski (PhD student, 2012 - 2016)

Supervisor: Callum Shakespeare (PhD student, 2012 - 2015)

Supervisor: Rica Enriquez (PDRA, 2013 – 2015)  
Supervisor: Enrico Deusebio (PDRA, 2014 – 2015)  
Supervisor: Romain Watteaux (PDRA, 2012 – 2013)