Michael Dunphy

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Current Position

2016–present Post-doctoral Research Associate
Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, Vancouver, Canada

Research Interests

I am interested in understanding the life cycle of the internal tide, beginning with its production via topographic generation, interaction with mesoscale features such as mesoscale eddies and jets, and eventual dissipation at small scales.

Education

2010–2014 *Ph.D.* in Applied Mathematics, University of Waterloo, Waterloo, ON, Canada
Supervised by Dr. Kevin Lamb
Thesis "Focusing and vertical mode scattering of the first mode internal tide by mesoscale eddy interaction" defended September 2014

2007–2009 *M.Math* in Applied Mathematics, University of Waterloo, Waterloo, ON, Canada
Supervised by Dr. Kevin Lamb
Thesis "The Influence of Mesoscale Eddies on the Internal Tide" defended August 2009

2002–2006 *B.Eng.* in Electrical Engineering at Dalhousie University, Halifax, NS, Canada

Employment History

2015–2016 (18 months) *Post-doctoral Research Associate*, Laboratoire d'Océanographie Physique et Spatiale, IFREMER Centre de Brest, Plouzané, France. Supervised by Dr. Patrice Klein and Dr. Aurélien Ponte.
Investigating internal tide interactions with quasi-geostrophic turbulence.

2014 (3 months) *Post-doctoral Research Associate*, Department of Applied Mathematics, University of Waterloo, Waterloo, Canada. Supervised by Dr. Kevin Lamb.
Investigating the internal wave generation process in the presence of a vertically sheared background current.

2009 (3 months) *Ocean Modelling and Programming Assistant*, Bedford Institute of Oceanography (BIO), Dartmouth, NS, Canada. Supervised by Dr. Youyu Lu.
Work involved the design and testing of an Arctic Ocean model based on NEMO, including an embedded high-resolution region over the Canadian Arctic Archipelago using AGRIF.

2007 (8 months) *Ocean Modelling and Programming Assistant*, BIO, Dartmouth, NS, Canada. Supervised by Dr. Dan Wright.
Work involved R&D on a parameterisation for 2D flow in a Global Ocean Circulation Model based on NEMO.

2006 (4 months) *Co-op student*, BIO, Dartmouth, NS, Canada. Supervised by Dr. Dan Wright.
Work involved the tuning of mixing parameters for a NEMO based numerical model of the North Atlantic ocean.

2005 (4 months) *Co-op student*, BIO, Dartmouth, NS, Canada. Supervised by Dr. Dan Wright.
Work involved evaluating a new nesting technology called AGRIF to embed fine grids in a coarse

grid numerical model based on NEMO.

2005 (4 months) *Co-op student*, BIO, Dartmouth, NS, Canada. Supervised by Dr. Charles Hannah. Work involved evaluating tidal solutions from a 2D barotropic FEM model of the Canadian Arctic Archipelago.

Peer Reviewed Publications

2017 **Dunphy, M.**, Ponte, A., Klein, P. and Le Gentil, S. "Low-mode internal tide propagation in a turbulent eddy field". *J. Phys. Oceanogr.*, 47(3) 649–665, 2017.

2017 Ponte, A., Klein, P., **Dunphy, M.** and Le Gentil, S., "Low-mode internal tides and balanced dynamics disentanglement in altimetric observations: Synergy with surface density observations". *J. Geophys. Res. Oceans*, 122(3), 2143–2155, 2017.

2014 **Dunphy, M.**, and K. G. Lamb (2014), "Focusing and vertical mode scattering of the first mode internal tide by mesoscale eddy interaction", *J. Geophys. Res. Oceans*, 119, doi:10.1002/2013JC009293.

2011 **Dunphy, M.**, Subich, C., and Stastna, M. "Spectral methods for internal waves: indistinguishable density profiles and double-humped solitary waves". *Nonlinear Processes in Geophysics*, 18, 351–358, 2011.

2009 Hannah, G. C., Dupont, F., and **Dunphy, M.** "Polynyas and Tidal Currents in the Canadian Arctic Archipelago". *Arctic*, 62(1): 83–95, 2009.

Work in Review

2017 Lamb, K. G. and **Dunphy, M.**, "Internal Wave Generation by Tide-Topography Interactions in the Presence of a Vertically Sheared Background Current". *Under review at J. Fluid Mech.*

Technical Reports

2008 Hannah, C. G., F. Dupont, Collins, K., **Dunphy, M.**, D. Greenberg. 2008. "Revisions to a Modelling System for Tides in the Canadian Arctic Archipelago". *Can. Tech. Rep. Hydrogr. Ocean Sci.* 259: vi + 62 pp. Available online at http://www.dfo-mpo.gc.ca/Library/332543.pdf.

2005 **Dunphy, M.**, F. Dupont, C. G. Hannah, D. Greenberg. 2005. "Validation of Modeling System for Tides in the Canadian Arctic Archipelago". *Can. Tech. Rep. Hydrogr. Ocean Sci.* 243: vi + 70 pp. Available online at http://www.dfo-mpo.gc.ca/Library/316074.pdf.

Published Software

2015–2017 **DJLES** – A software package that calculates a mode-one internal solitary wave solution to the Dubreil-Jacotin-Long equation. MATLAB code and a user guide are freely available at my website and maintained on GitHub at https://github.com/mdunphy/DJLES.

Conference Proceedings

2010 Lu, Y., S. Nudds, F. Dupont, **M. Dunphy**, C. Hannah, and S. Prinsenberg. "High-resolution Modelling of Ocean and Sea-ice Conditions in the Canadian Arctic Coastal Waters". *Proceedings of the Twentieth (2010) International Offshore and Polar Engineering Conference.* Beijing, China, June 20–25, 2010, (1):1280–1284.

Conference Talks

2014 **M. Dunphy** and K. Lamb. "Focussing and vertical mode scattering of the first mode internal tide by mesoscale eddy interaction". *6th International Workshop on Modeling the Ocean.* Halifax, NS, Canada, June 2014.

2014 **M. Dunphy** and K. Lamb. "Focussing and normal mode scattering of the first mode internal tide by mesoscale eddy interaction". *2014 Ocean Sciences Meeting.* Honolulu, HI, USA, February 2014.

2013 **M. Dunphy** and K. Lamb. "Focussing and normal mode scattering of the first mode internal tide by mesoscale eddy interaction". *4th New York Conference on Applied Mathematics*. Cornell University, Ithaca, NY, USA, November 2013.

2013 **M. Dunphy** and K. Lamb. "Focussing and normal mode scattering of the first mode internal tide by mesoscale eddy interaction". *Thematic Program on the Mathematics of Oceans, Workshop on Sub-mesoscale Ocean Processes*. Fields Institute, Toronto, ON, Canada, June 2013.

2009 **M. Dunphy** and K. Lamb. "Influence of Mesoscale Eddies on Internal Waves of Tidal Frequency". *MOCA–09, the IAMAS/IAPSO/IACS 2009 Joint Assembly*. Montreal, QC, Canada, July 2009.

2009 **M. Dunphy** and K. Lamb. "Influence of Mesoscale Eddies on Internal Waves of Tidal Frequency". *Dynamics in Environmental and Geophysical Flows Work-shop*. University of Waterloo, Waterloo, ON, Canada, July 2009.

Co-authored Conference Talks

2009 I. Yashayaev and **M. Dunphy**, 2009. "Seasonal Cycle, Interannual Variability and Associated Heat and Freshwater Content Changes in the Subpolar North Atlantic Inferred from Argo, Hydrographic and Moored Measurements". *The Third Argo Science Workshop*, Hangzhou, China, 2009.

2008 Yashayaev, I., R. R. Dickson, **M. Dunphy**, D. Kieke, J. W. Loder, H. van Aken, and D. G. Wright "Recent thermohaline changes in the northern North Atlantic". *2008 Ocean Sciences Meeting*, Orlando, Florida.

Conference Posters

2015 **M. Dunphy**, A. Ponte and P. Klein. "Investigating Internal Tides in a Quasi-geostrophic Background". *NewWave: New challenges in internal wave dynamics*. Lyon, France, Oct 2015.

2012 **M. Dunphy** and K. Lamb. "Normal mode scattering of the first mode internal tide by mesoscale eddy interaction". *The 46th CMOS Congress*. Montreal, QC, Canada, May 2012.

2012 **M. Dunphy** and K. Lamb. "Excitation of MODE-TWO internal waves by a MODE-ONE internal wave and a MODE-ONE eddy". *2012 Ocean Sciences Meeting*. Salt Lake City, UT, USA, February 2012.

2011 **M. Dunphy** and K. Lamb. "Internal Tide Generation with a Background Shear Current". *The 45th CMOS Congress*. Victoria, BC, Canada, June 2011.

2009 Lu, Y., **M. Dunphy**, F. Dupont, P. Myers, G. Holloway, C. Hannah, and S. Prinsenberg. "A High-resolution Ice-ocean Model of the Arctic Ocean Based on NEMO". *ArcticNet's 6th Annual Scientific Meeting*. Victoria, BC, Canada, December 2009.

2009 **M. Dunphy** and K. Lamb. "Influence of Mesoscale Eddies on Internal Waves of Tidal Frequency". *The 43rd CMOS Congress*. Halifax, NS, Canada, June 2009.

2009 I. Yashayaev, **M. Dunphy**. "An Interactive Tool for Real-Time Monitoring and Exploration of Ocean Basins (ArgoBrowser)". *The 43rd CMOS Congress*. Halifax, NS, Canada, June 2009.

Computing Expertise

Proficient in C, C++, FORTRAN 77/90/95, Python, MATLAB, MPI/OpenMP, LaTeX, Numerical models (MITgcm, NEMO, ROMS), Linux enviroments (scripting, compiling, PBS, etc.).

Seagoing Experience

2006 CCGS Hudson, Labrador Sea HUD2006019, May 24 to June 8, 2006.
Duties: Winch room, CTD rosette preparation, water sample collection.

2007 CCGS Hudson, Labrador Sea HUD2007011, May 10 to May 27, 2007.
Duties: Winch room, CTD rosette preparation, water sample collection.

2008 CCGS Hudson, Orphan Basin HUD2008006, May 8 to May 19, 2008.
Duties: Computer room, operation of the CTD data logging computer.

Scholarships

2012–2014 NSERC PGS D2
2012 University of Waterloo President's Graduate Scholarship
2012 Queen Elizabeth II Graduate Scholarship
2007–2009 University of Waterloo President's Graduate Scholarship
2007–2009 NSERC CGS M
2007 John J Jodrey Scholarship
2002–2006 Dalhousie University Renewable Entrance Scholarship

Honors / Awards

2014 Outstanding Young Scientist Award, 2nd place (*6th International Workshop on Modeling the Ocean.* Halifax, NS, Canada, June 2014).
2007 University Medal (Dalhousie University)
2007 IEEE Medal (Dalhousie University)
2003–2007 Sexton Scholar Distinction (GPA $\geq$ 3.85, Dalhousie University)

Training

2016 Ocean Remote Sensing Synergy summer school #3, Logonna Daoulas, France, June 20–24, 2016.
2013 Fundamentals of University Teaching Program offered by CTE at the University of Waterloo.
2010 International School on Topographic Internal Waves in the Atmosphere and the Ocean, Cargèse (Corsica), France, November 2–11, 2010.

Lecturing

Winter 2013 MATH119 – Calculus II for Software Engineering students

Teaching Assistantships

Fall 2012 MATH137 – Calculus I for Honours Mathematics
Winter 2012 AMATH 741 – Numerical Methods for Partial Differential Equations
Fall 2011 AMATH 250 – Introduction to Differential Equations
Fall 2011 MATH 227 – Calculus III for Honours Physics
Winter 2011 MATH 109 – Mathematics for Accounting
Fall 2010 AMATH 250 – Introduction to Differential Equations
Winter 2010 AMATH 361 – Continuum Mechanics
Winter 2010 MATH 119 – Calculus II for Software Engineering
Fall 2008 MATH 137 – Calculus I for Honours Mathematics
Fall 2007 MATH 117 – Calculus I for Software Engineering

Committee Participation

2010–2014 Applied Math Representative of the Graduate Student Computing Advisory Committee. My role was to liaison between the graduate students and the computing group in order to improve the computing facilities available to the graduate students in a continual improvement process.

2011–2014 Member of SWIGS Academic (Students of the Water Institute, Graduate Section), we organised a monthly seminar series as well as a variety of other academic and social events for graduate students interested in water research.

2010–2011 Member of the Graduate Student Seminar Series committee, responsible for organising weekly talks by graduate students for graduate students within the Applied Math department.