

Mitch Bushuk

Geophysical Fluid Dynamics Laboratory
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Citizenship: Canadian

Research Interests

Sea ice variability and predictability, polar oceanography, sea ice and coupled climate modeling, data assimilation, geophysical fluid dynamics, data analysis methods

Education

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| 2010–2015 | PhD, Mathematics and Atmosphere-Ocean Science
Center for Atmosphere Ocean Science, Courant Institute of Mathematical Sciences,
New York University
PhD advisor: Dimitris Giannakis
Thesis: A Statistical and Dynamical Study of Arctic Sea-Ice Variability |
| 2005–2009 | Honours BSc, Mathematics and Physics joint specialist, University of Toronto |

Research Experience

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| 2017-present | Research Scientist (permanent), Geophysical Fluid Dynamics Laboratory, University Corporation for Atmospheric Research |
| 2017-present | Visiting Research Collaborator, Princeton University |
| 2015-2017 | Postdoctoral Research Associate, Princeton University, Geophysical Fluid Dynamics Laboratory |
| 2010-2015 | Graduate Research Assistant, Courant Institute of Mathematical Sciences, New York University |
| 2007-2008 | Undergraduate Research Assistant, Department of Physics, University of Manitoba |
| 2006 | Undergraduate Research Assistant, Department of Chemistry, University of Manitoba |

Publications

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| 2019 | Ding, Q., A. Schweiger, M. L'Heureux, E. J. Steig, D. S. Battisti, N. C. Johnson, E. Blanchard Wrigglesworth, S. Po-Chedley, Q. Zhang, K. Harnos, M. Bushuk, B. Markle, I. Baxter: Fingerprints of internal drivers of Arctic sea ice loss in observations and model simulations. <i>Nature Geoscience</i> , 12(1), 28, doi: 10.1038/s41561-018-0256-8. |
| 2018 | Bushuk, M., R. Msadek, M. Winton, G. Vecchi, X. Yang, A. Rosati, R. Gudgel: Regional Arctic sea-ice prediction: Potential versus operational seasonal forecast skill. <i>Clim. Dyn.</i> , 1–23, doi: 10.1007/s00382-018-4288-y |
| 2018 | Blanchard-Wrigglesworth, E. and M. Bushuk: Robustness of Arctic sea-ice predictability in GCMs. <i>Clim. Dyn.</i> , 1–12, doi: 10.1007/s00382-018-4461-3 |

- 2017 Bushuk, M., R. Msadek, M. Winton, G. Vecchi, R. Gudgel, A. Rosati, X. Yang: Skillful regional prediction of Arctic sea ice on seasonal timescales. *Geophys. Res. Lett.*, 44, 4953–4964, doi: 10.1002/2017GL073155.
- 2017 Bushuk, M. and D. Giannakis: The Seasonality and Interannual Variability of Arctic Sea-Ice Reemergence. *J. Climate*, 30, 4657–4676, doi: 10.1175/JCLI-D-16-0549.1.
- 2017 Shean, D., K. Christianson, K. Larson, S. Ligtenberg, I. Joughin, B. Smith, C. Stevens, D. Holland, M. Bushuk: GPS-derived estimates of surface mass balance and ocean-induced basal melt for Pine Island Glacier ice shelf, Antarctica. *The Cryosphere*, 11, 2655–2674, doi: 10.5194/tc-2016-288.
- 2017 Bushuk, M., R. Msadek, M. Winton, G. Vecchi, R. Gudgel, A. Rosati, X. Yang: Summer enhancement of Arctic sea-ice volume anomalies in the September-ice zone. *J. Climate*, 30, 2341–2362, doi: 10.1175/JCLI-D-16-0470.1.
- 2016 Christianson, K., M. Bushuk, P. Dutrieux, B. Parizek, I. Joughin, R. Alley, D. Shean, P. Abrahamsen, S. Anandakrishnan, K. Heywood, T. Kim, S. Lee, K. Nicholls, T. Stanton, M. Truffer, B. Webber, A. Jenkins, S. Jacobs, R. Bindshadler, D. Holland: Sensitivity of Pine Island Glacier to observed ocean forcing. *Geophys. Res. Lett.*, 43, 10817–10825, doi: 10.1002/2016GL070500.
- 2015 Bushuk, M. and D. Giannakis, 2015: Sea-ice reemergence in a model hierarchy. *Geophys. Res. Lett.*, 42, 5337–5345, doi: 10.1002/2015GL063972.
- 2015 Bushuk, M., D. Giannakis, and A. J. Majda, 2015: Arctic sea-ice reemergence: The role of large-scale oceanic and atmospheric variability. *J. Climate*, 28, 5477–5509, doi: 10.1175/JCLI-D-14-00354.1.
- 2014 Bushuk, M., D. Giannakis, and A. J. Majda, 2014: Reemergence mechanisms for North Pacific sea ice revealed through nonlinear Laplacian spectral analysis. *J. Climate*, 27, 6265–6287, doi: 10.1175/JCLI-D-13-00256.1.

Submitted/In Preparation

- In Revision Bushuk, M., D. M. Holland, T. P. Stanton, A. A. Stern and C. Gray: Ice Scallops: A laboratory investigation of the ice-water interface. Revised for *J. Fluid Mech.*
- In Revision Bushuk, M., X. Yang, M. Winton, R. Msadek, M. Harrison, A. Rosati, and R. Gudgel: The value of sustained ocean observations for sea-ice predictions in the Barents Sea. Revised for *Geophys. Res. Lett.*.
- In Prep Bonan, D., M. Bushuk, and M. Winton: A spring barrier for regional predictions of Arctic sea ice. To be submitted to *Geophys. Res. Lett.*
- In Prep Adcroft, A., R. Hallberg, S. Griffies, M. Winton, M. Bushuk, M. Harrison, B. Reichl, J. Dunne, J. Krasting, J. John, R. Zhang, A. Wittenberg, A. Rosati, C. Dufour, I. Held, and S. Legg: The ocean component of the NOAA-GFDL’s coupled model for CMIP6. To be submitted to *J. Adv. Model. Earth Syst.*
- In Prep Held, I. M., H. Guo, A. Adcroft, J. P. Dunne, L. W. Horowitz, J. Krasting, E. Shevliakova, M. Winton, M. Zhao, M. Bushuk, A. T. Wittenberg, R. Zhang: Structure and Performance of GFDL’s CM4.0 Climate Model. To be submitted to *J. Adv. Model. Earth Syst.*

In Prep	Delworth, T., W. Cooke, A. Adcroft, M. Bushuk, J-H Chen, P. Ginoux, R. Gudgel, R. Hallberg, L. Harris, M. Harrison, N. Johnson, S. Kapnick, S-J Lin, F. Lu, S. Malyshev, P. C. Milly, H. Murakami, V. Naik, S. Pascale, D. Paynter, A. Rosati, M. D. Schwarzkopf, E. Shevliakova, S. Underwood, A. Wittenberg, B. Xiang, X. Yang, F. Zeng, H. Zhang, L. Zhang, M. Zhao: The influence of the Antarctic surface energy balance on Southern Ocean deepwater formation and deep ocean circulation. To be submitted to <i>J. Climate</i> .
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Teaching Experience

Fall 2018	Guest Lecturer, Introduction to Physical Oceanography, Princeton University
Fall 2017	Guest Lecturer, Introduction to Physical Oceanography, Princeton University
Fall 2016	Guest Lecturer, Introduction to Physical Oceanography, Princeton University
Spring 2014	Teaching Assistant, Math for Economics III, New York University
Fall 2013	Teaching Assistant, Math for Economics II, New York University
Spring 2013	Teaching Assistant, Math for Economics I, New York University
Fall 2012	Teaching Assistant, Calculus I, New York University

Student/Postdoc Mentoring

2018-present	Yongfei Zhang, Postdoctoral Research Fellow, Princeton University and GFDL
Summer 2018	David Bonan, Hollings Internship Program, GFDL
2018-2019	Rees Hughes, University of Toronto Physics Mentorship Program
2017-2018	Yanzheng Shen, University of Toronto Physics Mentorship Program
2016-2017	Bryce Wu, University of Toronto Physics Mentorship Program
2015-2016	Subin Kim, University of Toronto Physics Mentorship Program
Summer 2013	Brandon Wabah, New York University Abu Dhabi undergraduate summer research program, NYU

Field Experience

2013	Pine Island Glacier, Antarctica: GPS and seismic data collection, maintenance of automatic weather station
2011 & 2012	Jakobshavn and Sermilik fjords, Greenland: conductivity-temperature-depth (CTD) ocean data, deployment and retrieval of ocean moorings, xCTD probes, and GPS devices.

Laboratory Experience

2012 & 2013 | Cold Regions Research and Engineering Laboratory, New Hampshire: Designed and performed experiments to study ice scallops. Measured flow, ice geometry and heat fluxes using PIV, LIDAR, and fast thermistors.

Professional Service

- Member of AMS Polar Meteorology and Oceanography Committee (01/2016–present)
- Reviewer for *Climate Dynamics*, *The Cryosphere*, *Eos*, *Geophysical Research Letters*, *Journal of Geophysical Research - Atmospheres*, *Journal of Geophysical Research - Oceans*, *Journal of Climate*, *Nature Scientific Reports*, *Quarterly Journal of the Royal Meteorological Society*, *Swiss Data Science Center*, *Weather and Forecasting*
- Member of AGU
- GFDL Impacts Working Group Committee Member (05/2018–present)
- GFDL Formal seminar co-ordinator (2018–2019)
- GFDL Employee Association Vice President (02/2018–present)

Research Grants

- 2018–2020: ExxonMobil Research and Engineering, EM09125.A1.TO12. “Novel data assimilation techniques for seasonal Arctic sea-ice prediction”, \$208,444, Co-PI role.
- 2018–2021: NOAA Climate Program Office’s Modeling, Analysis, Prediction, and Projection (MAPP). “Advancing understanding of Arctic sea ice variability and diagnostic predictability in ESMs with regional-to-global-scale process- oriented evaluation”, \$508,420, Unfunded collaborator role (lead PI: Cecilia Bitz, University of Washington).

Academic Awards

2015-2017	Princeton AOS Postdoctoral Fellowship
2014	Moses A. Greenfield Research Prize for outstanding interdisciplinary studies by a current student, New York University
2011-2014	NSERC Postgraduate Scholarship, Doctoral level
2010-2011	NSERC Canadian Graduate Scholarship, Master’s Level (Declined and accepted Postgraduate Scholarship, Master’s level, for study abroad)
2010-2015	New York University MacCracken Graduate Scholarship
2005-2009	University of Toronto National Scholarship
2008-2009	3T0 M&P and Associates Scholarship, University of Toronto
2008-2009	Coxeter Scholarship in Mathematics, University of Toronto
2008-2009	Dickson JA and CP Scholarship, University of Toronto

2008-2009	Reuben Wells Leonard Scholarship in the Physical Sciences, University of Toronto
2007-2008	NSERC Undergraduate Student Research Award
2007-2008	William R. Hossack Memorial Scholarship in Mathematics and Physics, University of Toronto
2007-2008	3T0 M&P and Associates Scholarship, University of Toronto
2007-2008	Reuben Wells Leonard Scholarship in the Physical Sciences, University of Toronto
2007-2008	William Mulock Prize in Mathematics and Physics, University of Toronto
2006-2007	NSERC Undergraduate Student Research Award
2006-2007	C.L. Burton Scholarship in Mathematics and Physics, University of Toronto
2005	Governor General's Medal, Glenlawn Collegiate Institute
2005	Whitey Howard Memorial Scholarship

Invited Seminar Talks

Apr 8, 2019	AOS/PEI/GEO climate seminar series, Princeton University
Apr 4, 2017	Research Seminar, Météo France and CNRM
Nov 16, 2016	Research Seminar, University of Manitoba
Nov 9, 2016	Research Seminar, GFDL
Oct 12, 2016	CAOS Colloquium, Courant Institute, NYU
Feb 5, 2015	Atmosphere Ocean Climate Dynamics Seminar, Yale
Jan 7, 2015	Sack Lunch Seminar, MIT
Dec 9, 2014	Research Seminar, GFDL
Oct 8, 2014	Topics in Atmospheric and Oceanic Sciences Seminar, Stony Brook University

Conference Presentations*

*These presentations are talks, unless specified as poster

Dec 12, 2018	AGU Fall Meeting, Washington, D.C.
Sept 20, 2018	International Conference on Seasonal to Decadal Prediction, Boulder
Sept 14, 2018	SIAM Conference on Mathematics of Planet Earth, Philadelphia
Jun 22, 2018	Polar2018 Meeting, Davos, Switzerland
May 7, 2018	Polar Prediction Workshop, McGill University
Dec 11, 2017	AGU Fall Meeting, New Orleans
Nov 2, 2017	GFDL Science Symposium, Princeton
July 13, 2017	Sea Ice Workshop, University of Washington, Seattle
June 26, 2017	Arctic Modeling Workshop, NASA, Washington, D.C.

June 6, 2017	Canadian Meteorological and Oceanographic Society Congress, Toronto
June 4, 2017	Canadian Snow and Sea Ice Evolution Network (CanSISE) Workshop, Toronto
Mar 27, 2017	Polar Predictability Workshop, Alfred Wegener Institute
Feb 1, 2017	GFDL Poster Expo, Princeton (poster)
Jan 26, 2017	AMS Annual Meeting, Seattle
Nov 2, 2016	FAMOS Meeting, Woods Hole Oceanographic Institution (poster)
May 5, 2016	Polar Prediction Workshop, Lamont Doherty Earth Observatory
Feb 3, 2016	Sea Ice Forecasting Workshop, NCAR
Jan 28, 2016	MURI Workshop, NYU
Dec 18, 2015	AGU Fall Meeting, San Francisco (poster)
Nov 20, 2015	Regional Climate Symposium, Rutgers University (poster)
Apr 9, 2015	Polar Predictability Workshop, University of Reading
Dec 18, 2014	AGU Fall Meeting, San Francisco
Jan 20, 2014	MURI Workshop, NYU
July 12, 2013	SIAM Annual Meeting, San Diego.
June 6, 2013	AOS Days, Johns Hopkins University
May 26, 2013	Sea Level Rise Meeting, NYU Abu Dhabi
Aug 16, 2012	Greenland Summer School, Tasiilaq, Greenland
Mar 14, 2012	Sea Level Rise Meeting, NYU Abu Dhabi
Nov 11, 2011	Graduate Student Symposium, Princeton (poster)
July 26, 2011	Greenland Summer School, Illulisat, Greenland.
June 21, 2011	AOS Days, MIT