Mitch Bushuk

Research Oceanographer
NOAA Geophysical Fluid Dynamics Laboratory
201 Forrestal Road, Princeton, NJ 08540
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RESEARCH INTERESTS

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

EDUCATION

Ph.D. Mathematics and Atmosphere-Ocean Science 2010–2015
Center for Atmosphere Ocean Science, Courant Institute of Mathematical Sciences, New York University
"A Statistical and Dynamical Study of Arctic Sea-Ice Variability"
Ph.D. advisor: Dimitris Giannakis

Honours BSc Mathematics and Physics joint specialist 2005–2009
University of Toronto
Graduated with high distinction

APPOINTMENTS

Research Oceanographer 2022–present
Geophysical Fluid Dynamics Laboratory, National Oceanic and Atmospheric Administration
ZP-4 band

Research Scientist 2017–2022
Geophysical Fluid Dynamics Laboratory, University Corporation for Atmospheric Research
Permanent position

Visiting Research Collaborator 2017–present
Princeton University

Postdoctoral Research Associate 2015–2017
Princeton University, Geophysical Fluid Dynamics Laboratory

Graduate Research Assistant 2010–2015
Courant Institute of Mathematical Sciences, New York University

PUBLICATIONS

† indicates supervised student or postdoc

36. **Bushuk, M.**, Y. Zhang†, M. Winton, B. Hurlin, T. Delworth, F. Lu, L. Jia, L. Zhang, W. Cooke, M. Harrison, N. C. Johnson, S. Kapnick, C. McHugh, H. Murakami, A. Rosati, K.-C. Tseng, A. T. Wittenberg, X. Yang, F. Zeng, 2022. "Mechanisms of Regional Arctic Sea Ice Predictability in Two Dynamical Seasonal Forecast Systems", *J. Climate*, 35, 13, 4207–4231, doi: 10.1175/JCLI-D-21-0544.1.

35. Zhang, Y.†, **M. Bushuk**, M. Winton, B. Hurlin, T. Delworth, M. Harrison, L. Jia, F. Lu, A. Rosati, X. Yang, 2022. "Subseasonal-to-Seasonal Sea Ice Forecast Skill Improvement from Sea Ice Concentration Assimilation", *J. Climate*, 35, 13, 4233–4252, doi: 10.1175/JCLI-D-21-0548.1.

34. Winton, M, **M. Bushuk**, Y. Zhang†, B. Hurlin, L. Jia, N.C. Johnson, F. Lu, 2022. "Prospects for Seasonal Prediction of Summertime Trans-Arctic Sea Ice Path", *J. Climate*, 35, 13, 4253–4263, doi: 10.1175/JCLI-D-21-0634.1.

33. Landy, J.C., G. J. Dawson, M. Tsamados, **M. Bushuk**, J. C. Stroeve, S. E. L. Howell, T. Krumpen, D. G. Babb, A. S. Komarov, H. D. B. S. Heorton, Y. Aksenov, 2022. "A year-round satellite sea-ice thickness record from CryoSat-2", *Nature*, 609(7927), 517–522, doi: 10.1038/s41586-022-05058-5.

32. Zhang, L., T. Delworth, S. Kapnick, J. He, W. Cooke, A. T. Wittenberg, N. C. Johnson, A. Rosati, X. Yang, F. Lu, **M. Bushuk**, C. McHugh, H. Murakami, F. Zeng, L. Jia, K.-C. Tseng, Y. Morioka, 2022. "Roles of meridional overturning in subpolar Southern Ocean SST trends: Insights from ensemble simulations", *J. Climate*, 35, 5, 1577–1596, doi: 10.1175/JCLI-D-21-0466.1.

31. Wang, Y., X. Yuan, H. Bi, **M. Bushuk**, Y. Liang, C. Li, and H. Huang, 2022. "Reassessing seasonal sea ice predictability of the Pacific-Arctic sector using a Markov model", *The Cryosphere*, 16(3), 1141–1156, DOI: 10.5194/tc-16-1141-2022.

30. Zhang, L., T. L. Delworth, X. Yang, F. Zeng, F. Lu, Y. Morioka and **M. Bushuk**, 2022. "The relative role of the subsurface Southern Ocean in driving negative Antarctic Sea ice extent anomalies in 2016-2021", *Communications earth & environment*, in press.

29. **Bushuk, M.**, M. Winton, F. A. Haumann, T. Delworth, F. Lu, Y. Zhang†, L. Jia, L. Zhang, W. Cooke, M. Harrison, B. Hurlin, N. C. Johnson, S. Kapnick, C. McHugh, H. Murakami, A. Rosati, K.-C. Tseng, A. T. Wittenberg, X. Yang, F. Zeng, 2021. "Seasonal prediction and predictability of regional Antarctic sea ice", *J. Climate*, 34, 6207-6233, doi: 10.1175/JCLI-D-20-0965.1.

28. Pauling, A., **M. Bushuk**, C. Bitz, 2021. "Robust inter-hemispheric asymmetry in the response to symmetric volcanic forcing in model large ensembles", *Geophys. Res. Lett.*, 48, 1-10, doi: 10.1029/2021GL092558.

27. Keen, A., E. Blockley, D. Bailey, J. Boldingh Debernard, **M. Bushuk**, S. Delhaye, D. Docquier, D. Feltham, F. Massonnet, S. O'Farrell, L. Ponsoni, J. Rodriguez, D. Schroeder, N. Swart, T. Toyoda, H. Tsujino, M. Vancoppenolle, and K. Wyser, 2021. "An inter-comparison of the mass budget of the Arctic sea ice in CMIP6 models", *The Cryosphere*, 15, 951–982, doi: 10.5194/tc-15-951-2021.

26. Zhang, Y.†, **M. Bushuk**, M. Winton, B. Hurlin, X. Yang, T. Delworth, and L. Jia, 2021. "Assimilation of satellite-retrieved sea ice concentration and new prospects for September predictions of Arctic sea ice", *J. Climate*, 34, 2107–2126, doi: 10.1175/JCLI-D-20-0469.1.

25. Zhang, L., T. Delworth, W. Cooke, H. Goosse, **M. Bushuk**, Y. Morioka, X. Yang, 2021. "The dependence of internal multidecadal variability in the Southern Ocean on the ocean background mean state", *J. Climate*, 34, 1061–1080, doi: 10.1175/JCLI-D-20-0049.1.

24. Luo, R., Q. Ding, Z. Wu, I. Baxter, **M. Bushuk**, Y. Huang, X. Dong, 2021. "Summertime atmosphere-sea ice coupling in the Arctic simulated by CMIP5/6 models: Importance of large scale circulation", *Clim. Dyn.*, 56(5), 1467–1485, doi: 10.1007/s00382-020-05543-5.

23. Zhang, G., H. Murakami, W. F. Cooke, Z. Wang, L. Jia, F. Lu, X. Yang, T. L. Delworth, A. T. Wittenberg, M. J. Harrison, **M. Bushuk**, C. McHugh, N. C. Johnson, S. B. Kapnick, K.-C. Tseng, and L. Zhang, 2021. "Seasonal predictability of baroclinic wave activity", *npj Climate and Atmospheric Science*, 4(50), 1–11, doi: 10.1038/s41612-021-00209-3.

22. Tseng, K.-C., N. C. Johnson, S. B. Kapnick, T. L. Delworth, F. Lu, W. F. Cooke, A. T. Wittenberg, A. Rosati, L. Zhang, C. McHugh, X. Yang, M. Harrison, F. Zeng, G. Zhang, H. Murakami, **M. Bushuk**, L. Jia, 2021. "Skillful Seasonal to Multiseasonal Prediction of Atmospheric Rivers over Western North America", *Geophys. Res. Lett.*, 48, 1-12, DOI: 10.1029/2021GL094000.

21. **Bushuk, M.**, M. Winton, D. B. Bonan†, E. Blanchard-Wrigglesworth, T. Delworth, 2020. "A mechanism for the Arctic sea ice spring predictability barrier", *Geophys. Res. Lett.*, 47, 1–13, doi: 10.1029/2020GL088335.

20. Lu, F., M. J. Harrison, A. Rosati, T. Delworth, X. Yang, W. F. Cooke, C. McHugh, N. C. Johnson, L. Jia, **M. Bushuk**, Y. Zhang†, A. Adcroft, 2020. "GFDL's SPEAR seasonal prediction system: ocean data assimilation (ODA), ocean tendency adjustment (OTA) and coupled initialization", *J. Adv. Model. Earth Syst.*, 12, 1–36, doi: 10.1029/2019MS001895.

19. Sea-Ice Model Intercomparison Project Community (incl. **M. Bushuk**), 2020. "Arctic Sea Ice in CMIP6", *Geophys. Res. Lett.*, 47, 1–11, doi: 10.1029/2019GL086749.

18. Holland, M. M., **M. Bushuk**, A. Jahn, A. Roberts, 2020. "Integrating Models and Observations to Better Predict a Changing Arctic Sea Ice Cover", *Arctic Report Card 2020*, 123–129, 10.25923/bx13-ja71.

17. 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, 2020. "SPEAR–the next generation GFDL modeling system for seasonal to multidecadal prediction and projection", *J. Adv. Model. Earth Syst.*, 12, 1–36, doi: 10.1029/2019MS001895.

16. **Bushuk, M.**, X. Yang, M. Winton, R. Msadek, M. Harrison, A. Rosati, and R. Gudgel, 2019. "The value of sustained ocean observations for sea-ice predictions in the Barents Sea", *J. Climate*, 32, 7017–7035, doi: 10.1175/JCLI-D-19-0179.1.

15. **Bushuk, M.**, D. M. Holland, T. P. Stanton, A. A. Stern and C. Gray, 2019. "Ice Scallops: A laboratory investigation of the ice-water interface", *J. Fluid Mech.*, 873, 942–976, doi: 10.1017/jfm.2019.398.

14. Adcroft, A., W. Anderson, C. Blanton, **M. Bushuk**, C. O. Dufour, J. P. Dunne, S. M. Griffies, R. W. Hallberg, M. J. Harrison, I. Held, M. F. Jansen, J. John, J. P. Krasting, A. Langenhorst, S. Legg, Z. Liang, C. McHugh, A. Radhakrishnan, B. G. Reichl, T. Rosati, B. L. Samuels, A. Shao, R. Stouffer, M. Winton, A. T. Wittenberg, B. Xiang, N. Zadeh, R. Zhang, 2019. "The GFDL Global Ocean and Sea Ice Model OM4.0: Model Description and Simulation Features", *J. Adv. Model. Earth Syst.*, 11, 1–45, doi: 10.1029/2019MS001726.

13. Bonan, D.†, **M. Bushuk**, and M. Winton, 2019. "A spring barrier for regional predictions of Arctic sea ice", *Geophys. Res. Lett.*, 46, 1–11, doi: 10.1029/2019GL082947.

12. Held, I. M. Held, H. Guo, A. Adcroft, J. P. Dunne, L. W. Horowitz, J. Krasting, E. Shevliakova, M. Winton, M. Zhao, **M. Bushuk**, A. T. Wittenberg, B. Wyman, B. Xiang, R. Zhang, W. Anderson, V. Balaji, L. Donner, K. Dunne, J. Durachta, P. Gauthier, P. Ginoux, J.-C. Golaz, S.M. Griffies, R. Hallberg, L. Harris, M. Harrison, W. Hurlin, J. John, P. Lin, S. J. Lin, S. Malyshev, R. Menzel, P.C.D. Milly, Y. Ming, V. Naik, D. Paynter, F. Paulot, V. Ramaswamy, B. Reichl, T. Robinson, A. Rosati, C. Seman, L. Silvers, S. Underwood, N. Zadeh, 2019. "Structure and Performance of GFDL's CM4.0 Climate Model", *J. Adv. Model. Earth Syst.*, 11, 1–37, doi: 10.1029/2019MS001829.

11. 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, 2019. "Fingerprints of internal drivers of Arctic sea ice loss in observations and model simulations", *Nature Geoscience*, 12(1), 28, doi: 10.1038/s41561-018-0256-8.

10. **Bushuk, M.**, R. Msadek, M. Winton, G. Vecchi, X. Yang, A. Rosati, R. Gudgel, 2018. "Regional Arctic sea-ice prediction: Potential versus operational seasonal forecast skill", *Clim. Dyn.*, 52(5), 2721–2743, doi: 10.1007/s00382-018-4288-y.

9. Blanchard-Wrigglesworth, E. and **M. Bushuk**, 2018. "Robustness of Arctic sea-ice predictability in GCMs", *Clim. Dyn.*, 52(9), 5555–5566, doi: 10.1007/s00382-018-4461-3.

8. **Bushuk, M.**, R. Msadek, M. Winton, G. Vecchi, R. Gudgel, A. Rosati, X. Yang, 2017. "Skillful regional prediction of Arctic sea ice on seasonal timescales", *Geophys. Res. Lett.*, 44, 4953–4964, doi: 10.1002/2017GL073155.

7. **Bushuk, M.** and D. Giannakis, 2017. "The seasonality and interannual variability of Arctic sea-ice reemergence", *J. Climate*, 30, 4657–4676, doi: 10.1175/JCLI-D-16-0549.1.

6. Shean, D., K. Christianson, K. Larson, S. Ligtenberg, I. Joughin, B. Smith, C. Stevens, D. Holland, **M. Bushuk**, 2017. "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.

5. **Bushuk, M.**, R. Msadek, M. Winton, G. Vecchi, R. Gudgel, A. Rosati, X. Yang, 2017. "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.

4. 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. Bindschadler, D. Holland, 2016. "Sensitivity of Pine Island Glacier to observed ocean forcing", *Geophys. Res. Lett.*, 43, 10817–10825, doi: 10.1002/2016GL070500.

3. **Bushuk, M.** and D. Giannakis, 2015. "Sea-ice reemergence in a model hierarchy", *Geophys. Res. Lett.*, 42, 5337–5345, doi: 10.1002/2015GL063972.

2. **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.

1. **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 PUBLICATIONS

- **Bushuk, M.**, L. Polvani, M. England, "Comparing the impacts of Ozone Depleting Substances and Carbon Dioxide on Arctic Sea Ice loss", *Submitted to GRL.*
- Feng, X., Q. Ding, L. Wu, C. Jones, H. Wang, **M. Bushuk**, and D. Topal, "Comprehensive representation of tropical-extratropical teleconnections obstructed by tropical Pacific convection biases in CMIP6", *Submitted to JGR: Atmospheres.*
- Tseng, K.-C., N. C. Johnson, A. T. Wittenberg, T. L. Delworth, S.-K. Lee, H. Lopez, D. Kim, A. Kumar, H. Wang, F. Lu, W. Cooke, A. Rosati, L. Zhang, C. McHugh, X. Yang, M. Harrison, F. Zeng, H. Murakami, **M. Bushuk** and L. Jia, "Skillful forecasts of springtime CONUS tornado activity up to a year in advance", *Submitted to Science Advances.*
- Luo, R., Q. Ding, X. Chen, Z. Wu, **M. Bushuk**, H. Wang, and I. Baxter, "Uncertain role of clouds in shaping summertime atmosphere-sea ice connections in reanalyses and CMIP6 models", *Submitted to JGR: Atmospheres.*
- Zeng, J., X. Li, Q. Yang, X. Yuan, **M. Bushuk**, D. Chen, "Reducing the spring barrier in predicting summer Arctic sea ice", *Submitted to GRL.*
- Blanchard-Wrigglesworth, E., **M. Bushuk**, F. Massonnet, L. Hamilton, C. M. Bitz, U. Bhatt, "Forecast skill of the Sea Ice Outlook 2008–2022", *Submitted to GRL.*

RESEARCH GRANTS

2021–2026: Schmidt Futures, "M^{2}LInES - Multiscale Machine Learning In Coupled Earth System Modeling", \$10M total budget, \$2M Princeton University budget, Research Scientist role (lead PI: Laure Zanna, New York University).

2021–2023: Weather Program Office, "Sea Ice Data Assimilation for Skill Improvement", \$348,673, Co-PI role.

2019–2021: NOAA Climate Program Office's Modeling, Analysis, Prediction, and Projection (MAPP), "Sea ice variability over the Pacific sector of the Arctic Ocean driven by atmospheric circulation

changes: Developing a process-based understanding of biases in CMIP6 models", $199,193, Co-PI role (lead PI: Qinghua Ding, University of California, Santa Barbara).

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

Princeton AOS Postdoctoral Fellowship	2015–2017
Moses A. Greenfield Research Prize for outstanding interdisciplinary studies by a current student, New York University	2014
NSERC Postgraduate Scholarship, Doctoral level	2011–2014
NSERC Postgraduate Scholarship, Master's Level	2010–2011
New York University MacCracken Graduate Scholarship	2010–2015
University of Toronto National Scholarship	2005–2009
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	2008–2009
NSERC Undergraduate Student Research Award	2007–2008
William R. Hossack 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	2007–2008
NSERC Undergraduate Student Research Award	2006–2007
C.L. Burton Scholarship in Mathematics and Physics, University of Toronto	2006–2007
Governor General's Medal, Glenlawn Collegiate Institute	2005
Whitey Howard Memorial Scholarship	2005

TEACHING EXPERIENCE

Guest Lecturer, Introduction to Physical Oceanography, Princeton University	2016–2022
Guest Lecturer, Introduction to Climate, Colorado State University	Spring 2022
Guest Lecturer, Oceans, Atmosphere, and Climate	Spring 2021
Teaching Assistant, Math for Economics III, New York University	Spring 2014
Teaching Assistant, Math for Economics II, New York University	Fall 2013
Teaching Assistant, Math for Economics I, New York University	Spring 2013
Teaching Assistant, Calculus I, New York University	Fall 2012

STUDENT/POSTDOCTORAL RESEARCH MENTORING

Xia Li, Postdoctoral Research Fellow, Princeton University and GFDL	2022–present
William Gregory, Postdoctoral Research Fellow, Princeton University and GFDL	2022–present
Yongfei Zhang, Postdoctoral Research Fellow, Princeton University and GFDL	2018–present
Saumya Malik, HMEI Summer Internship Program, Princeton University	Summer 2022
Ben Buchovecky, HMEI Summer Internship Program, Princeton University	Summer 2021
Alex DiNovi, High School Research Internship Program, GFDL	Summer 2019
David Bonan, Hollings Undergraduate Internship Program, GFDL	Summer 2018
Brandon Wabah, NYU Abu Dhabi undergraduate summer research program, NYU	Summer 2013

PH.D. THESIS COMMITTEE MEMBER

Joseph Fogarty, Princeton University, PhD Committee Member	2021–present
Charles Brunette, McGill University, External PhD Committee Member	2022
Xinyang Yang, New York University, External PhD Committee Member	2019

STUDENT CAREER MENTORING

Ishaan Chandok, University of Toronto Physics Mentorship Program	2021–2022
Rosalie Cormier, University of Toronto Physics Mentorship Program	2020–2021
Kathleen Zhao, University of Toronto Physics Mentorship Program	2019–2020
Rees Hughes, University of Toronto Physics Mentorship Program	2018–2019
Yanzheng Shen, University of Toronto Physics Mentorship Program	2017–2018
Bryce Wu, University of Toronto Physics Mentorship Program	2016–2017
Subin Kim, University of Toronto Physics Mentorship Program	2015–2016

PROFESSIONAL SERVICE

- Associate Editor of *Journal of Advances in Modeling Earth Systems* (2022–present)

- Member of American Meteorological Society Polar Meteorology and Oceanography Committee (01/2016–present)
- Member of Modeling, Observing, Monitoring, and Prediction (MOMP) Foundational Activity Team for IARPC (Interagency Arctic Research Policy Committee) (01/2022–present)
- Reviewer for Annals of Glaciology, Climate Dynamics, The Cryosphere, Eos, Environmental Research Letters, Geophysical Research Letters, IPCC Sixth Assessment Report, Journal of Advances in Modeling Earth Systems, Journal of Geophysical Research - Atmospheres, Journal of Geophysical Research - Oceans, Journal of Climate, Journal of Glaciology, Journal of Fluid Mechanics, Nature Climate Change, Nature Scientific Reports, Polar Geography, Proceedings of the National Academy of Sciences, Quarterly Journal of the Royal Meteorological Society, Swiss Data Science Center, Weather and Forecasting
- Proposal Reviewer for National Science Foundation
- Member of American Geophysical Union, American Meteorological Society
- GFDL Diversity, Equity, and Inclusion Committee Member (01/2021–present)
- Organizer of Princeton/GFDL Polar Climate Interest Group (09/2022–present)
- Organizer of GFDL Climate Sensitivity Journal Club (03/2020–present)
- GFDL Impacts Working Group Committee Member (05/2018–present)
- GFDL Formal seminar co-ordinator (2018–19, 2019–20)
- GFDL Employee Association President (2019)
- GFDL Employee Association Vice President (2018)

INVITED SEMINAR TALKS

Glaciological Seminar, ETH Zurich (virtual seminar)	Nov 3, 2022
Climate and Global Dynamics Seminar, NCAR (virtual seminar)	April 5, 2022
AOS Department Seminar, McGill University (virtual seminar)	Nov 30, 2021
Euro-Mediterranean Center on Climate Change (CMCC) Seminar Series (virtual)	Sept 20, 2021
ARCUS Sea Ice Prediction Network Webinar Series (virtual seminar)	July 13, 2021
US CLIVAR PPAI Webinar Series (virtual seminar)	Feb 10, 2021
Polar Oceans Seminar Series, British Antarctic Survey (virtual seminar)	Oct 21, 2020
SEAS Colloquium in Climate Science, Columbia University	Oct 3, 2019
Applied and Computational Math Seminar, University of Wisconsin-Madison	Sep 20, 2019
AOS/PEI/GEO Climate Seminar Series, Princeton University	Apr 15, 2019
Research Seminar, Météo France and CNRM	Apr 4, 2017
Research Seminar, University of Manitoba	Nov 16, 2016
Research Seminar, GFDL	Nov 9, 2016
CAOS Colloquium, Courant Institute, NYU	Oct 12, 2016

Atmosphere Ocean Climate Dynamics Seminar, Yale	Feb 5, 2015
Sack Lunch Seminar, MIT	Jan 7, 2015
Research Seminar, GFDL	Dec 9, 2014
Topics in Atmospheric and Oceanic Sciences Seminar, Stony Brook University	Oct 8, 2014

CONFERENCE PRESENTATIONS*

*These presentations are talks, unless specified as poster

AGU Fall Meeting, Chicago	Dec 16, 2022
IARPC Modeling Sub-Team Meeting, Virtual Meeting	Oct 27, 2022
Polar AMS Conference, Madison	Aug 12, 2022
Michael Winton Retirement Symposium (invited), Virtual Meeting	Apr 13, 2022
Daily to Decadal Ecological Forecasting Workshop (invited), Woods Hole	Apr 12, 2022
AGU Ocean Sciences Meeting, Virtual Meeting	Mar 3, 2022
Polar AMS Conference, Virtual Meeting (poster)	June 1, 2021
IARPC Arctic Modeling Meeting, Virtual Meeting	May 27, 2021
Sea Ice Outlook Contributors Forum, Virtual Meeting	Jan 21, 2021
AGU Fall Meeting, Virtual Meeting	Dec 16, 2020
Sea Ice MURI Workshop, Virtual Meeting	Aug 27, 2020
OAR Senior Management Meeting, Webinar	July 27, 2020
IARPC Arctic Observing Systems and Modeling Sub-Team Meeting, Virtual Meeting	Jun 17, 2020
AGU Ocean Sciences Meeting, San Diego	Feb 19, 2020
AGU Fall Meeting, San Francisco	Dec 10, 2019
GFDL External Lab Review, Princeton	Oct 30, 2019
Sea Ice MURI Workshop, NYU	Oct 11, 2019
IGS Sea Ice Symposium, Winnipeg, Canada	Aug 20, 2019
Polar AMS Conference, Boulder	May 21, 2019
Polar Prediction Workshop, University of Oklahoma	Apr 25, 2019
AGU Fall Meeting, Washington, D.C.	Dec 12, 2018
International Conference on Seasonal to Decadal Prediction, Boulder	Sept 20, 2018
SIAM Conference on Mathematics of Planet Earth, Philadelphia	Sept 14, 2018
Polar2018 Meeting, Davos, Switzerland	Jun 22, 2018
Polar Prediction Workshop, McGill University	May 7, 2018
AGU Fall Meeting, New Orleans	Dec 11, 2017
GFDL Science Symposium, Princeton	Nov 2, 2017
Sea Ice Workshop, University of Washington, Seattle	July 13, 2017
Arctic Modeling Workshop, NASA, Washington, D.C.	June 26, 2017
Canadian Meteorological and Oceanographic Society Congress, Toronto	June 6, 2017
Canadian Snow and Sea Ice Evolution Network (CanSISE) Workshop, Toronto	June 4, 2017

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

FIELD EXPERIENCE

2013: Pine Island Glacier, Antarctica. GPS and seismic data collection, maintenance of automatic weather station. Lead Scientist: David Holland, NYU.

2012: Jakobshavn fjord and Jakobshavn glacier, Greenland. Conductivity-temperature-depth (CTD) ocean data, deployment and retrieval of ocean moorings, xCTD probes, and GPS devices. Lead Scientist: David Holland, NYU.

2012: Sermilik fjord, Greenland. Conductivity-temperature-depth (CTD) ocean data, deployment and retrieval of ocean moorings. Lead Scientist: David Holland, NYU.

2011: Jakobshavn fjord, Greenland. Conductivity-temperature-depth (CTD) ocean data, deployment and retrieval of ocean moorings. Lead Scientist: David Holland, NYU.

LABORATORY EXPERIENCE

2012 and 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.

OUTREACH ACTIVITIES

2022: Climate change presentation to Energy and Scholars program at Princeton Day School

2020: Webinar presentation on sea ice physics to Undergraduate Physical Oceanography class at Rider University, NJ

2019: Climate change presentation to retirement community at Greenbriar at Whittingham, Monroe Township, NJ

2019: Skype presentation on climate change to grade 5/6 students at Island Lakes school in Winnipeg, Manitoba

2019: Presentation on climate change to grade 7/8 students at French American School, Princeton, NJ