

TIMOTHY M. MERLIS

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Research Interests

Climate dynamics of Earth and exoplanets, tropical meteorology, ocean-atmosphere general circulation, hurricanes, atmospheric hydrological cycle, and baroclinic instability

Current Position

Assistant Professor in Atmospheric and Oceanic Sciences, McGill University

Education

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| 2006–2011 | California Institute of Technology
Ph.D. Environmental Science and Engineering | Pasadena, CA |
| 2002–2006 | Columbia University
B.S. Cum Laude in Applied Mathematics | New York, NY |

Awards and Fellowships

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| 2015–2020 | Canada Research Chair (Tier II) |
| 2014 | James R. Holton Early Career Scientist Award, Atmospheric Sciences Section of the American Geophysical Union |
| 2011–2013 | Princeton Center for Theoretical Science Postdoctoral Fellow |
| 2009 | Best Student Poster, 17th Atmospheric and Oceanic Fluid Dynamics Conference |
| 2007–2011 | National Science Foundation Graduate Research Fellowship |
| 2006–2009 | National Defense Science and Engineering Graduate Fellowship |
| 2006 | Outstanding Student Paper, AGU Joint Assembly |

Refereed Journal Publications (See <http://www.meteo.mcgill.ca/~tmerlis/publications.html> for up-to-date list.)

- [27] Merlis, T. M. and M. Henry (2017): Simple estimates of polar amplification in moist diffusive energy balance models. *Journal of Climate*, submitted.
- [26] Kirshbaum, D. J., T. M. Merlis, J. R. Gyakum, R. McTaggart-Cowan (2017): Sensitivity of idealized moist baroclinic waves to environmental temperature. *Journal of the Atmospheric Sciences*, submitted.

- [25] Henry, M. and T. M. Merlis (2017): The role of the nonlinearity of the Stefan-Boltzmann law on the structure of radiatively forced temperature change. *Journal of Climate*, submitted.
- [24] O’Gorman, P. A., T. M. Merlis, and M. S. Singh (2017): Increase in the skewness of extratropical vertical velocities with climate warming: fully nonlinear simulations versus moist baroclinic instability. *Quarterly Journal of the Royal Meteorological Society*, in press.
- [23] Defforge, C. L. and T. M. Merlis (2017): Evaluating the evidence of a global sea surface temperature threshold for tropical cyclone genesis, *Journal of Climate*, **30**, 9133–9145.
- [22] Viale, F. and T. M. Merlis (2017): Variations in tropical cyclone frequency response to solar and CO₂ forcing in aquaplanet simulations. *Journal of Advances in Modeling Earth Systems*, **9**, 4–18, doi:10.1002/2016MS000785.
- [21] Defforge, C. L. and T. M. Merlis (2017): Observed warming trend in sea surface temperature at tropical cyclone genesis. *Geophysical Research Letters*, **44**, 1034–1040, doi:10.1002/2016GL071045.
- [20] Seo, J., S. Kang, and T. M. Merlis (2017): A model intercomparison of the tropical precipitation response to a CO₂ doubling in aquaplanet simulations. *Geophysical Research Letters*, **44**, 993–1000, doi:10.1002/2016GL072347.
- [19] Feldl, N., S. Bordoni, and T. M. Merlis (2017): Coupled high-latitude climate feedbacks and their impact on atmospheric heat transport. *Journal of Climate*, **30**, 189–201.
- [18] Galbraith, E. D., T. M. Merlis, and J. B. Palter (2016): Destabilization of glacial climate by the radiative impact of Atlantic Meridional Overturning Circulation disruptions. *Geophysical Research Letters*, **43**, 8214–8221, doi:10.1002/2016GL069846.
- [17] Yang, J., J. Leconte, E. T. Wolf, C. Goldblatt, N. Feldl, T. M. Merlis, Y. Wang, D. D. B. Koll, F. Ding, F. Forget, and D. S. Abbot (2016): Differences in water vapor radiative transfer among 1D models can significantly affect the inner edge of the habitable zone. *The Astrophysical Journal*, **826**, doi:10.3847/0004-637X/826/2/222.
- [16] Trossman, D., J. Palter, T. M. Merlis, Y. Huang, and Y. Xia (2016): Large-scale ocean circulation-cloud interactions reduce the pace of transient climate change. *Geophysical Research Letters*, **43**, 3935–3943.
- [15] Merlis, T. M. W. Zhou, I. M. Held, and M. Zhao (2016): Surface temperature dependence of tropical cyclone-permitting simulations in a spherical model with uniform thermal forcing. *Geophysical Research Letters*, **43**, 2859–2865.
- [14] Merlis, T. M. (2016): Does humidity’s seasonal cycle affect the annual-mean tropical precipitation response to extratropical forcing? *Journal of Climate*, **29**, 1451–1460.
- [13] Merlis, T. M. (2015): Direct weakening of tropical circulations from masked CO₂ radiative forcing. *Proceedings of the National Academy of Science*, **112**, 13167–13171.
- [12] Ballinger, A. P., T. M. Merlis, I. M. Held, and M. Zhao (2015): The sensitivity of tropical cyclone activity to off-equatorial thermal forcing. *Journal of the Atmospheric Sciences*, **72**, 2286–2302.
- [11] Merlis, T. M. (2014): Interacting components of the top-of-atmosphere energy balance affect changes in regional surface temperature. *Geophysical Research Letters*, **41**, 7291–7297, doi:10.1002/2014GL061700.
- [10] Merlis, T. M., I. M. Held, G. L. Stenchikov, F. Zeng, and L. Horowitz (2014): Constraining transient climate sensitivity using coupled climate model simulations of volcanic eruptions. *Journal of Climate*, **27**, 7781–7795.

- [9] Merlis, T. M., M. Zhao, and I. M. Held (2013): The sensitivity of hurricane frequency to ITCZ changes and radiatively forced warming in aquaplanet simulations. *Geophysical Research Letters*, **40**, 4109-4114, doi:10.1002/grl.50680.
- [8] Merlis, T. M., T. Schneider, S. Bordoni, and I. Eisenman (2013): The tropical precipitation response to orbital precession. *Journal of Climate*, **26**, 2010–2021.
- [7] Merlis, T. M., T. Schneider, S. Bordoni, and I. Eisenman (2013): Hadley circulation response to orbital precession. Part II: Subtropical continent. *Journal of Climate*, **26**, 754–771.
- [6] Merlis, T. M., T. Schneider, S. Bordoni, and I. Eisenman (2013): Hadley circulation response to orbital precession. Part I: Aquaplanets. *Journal of Climate*, **26**, 740–753.
- [5] Merlis, T. M. and T. Schneider (2011): Changes in zonal surface temperature gradients and Walker circulations in a wide range of climates. *Journal of Climate*, **24**, 4757–4768.
- [4] Merlis, T. M. and T. Schneider (2010): Atmospheric dynamics of Earth-like tidally locked aquaplanets. *Journal of Advances in Modeling Earth Systems*, **2**, Art. #13, doi:10.3894/JAMES.2010.2.13
- [3] Merlis, T. M. and T. Schneider (2009): Scales of linear baroclinic instability and macroturbulence in dry atmospheres. *Journal of the Atmospheric Sciences*, **66**, 1821–1833.
- [2] Merlis, T. M. and S. Khatiwala (2008): Fast dynamical spin-up of ocean general circulation models using Newton-Krylov methods. *Ocean Modelling*, **21**, 97–105.

Book Chapters

- [1] Showman, A. P., R. D. Wordsworth, T. M. Merlis, and Y. Kaspi (2013): Atmospheric Circulation of Terrestrial Exoplanets. *Comparative Climatology of the Terrestrial Planets*, S. J. Mackwell, A. A. Simon-Miller, J. W. Harder, and M. A. Bullock, Eds., University of Arizona Press, pp. 277–326.

Academic Employment

- 2013– **McGill University Department of Atmospheric and Oceanic Sciences**
Assistant Professor
Canada Research Chair (Tier II) in Atmospheric and Climate Dynamics
Member of McGill Space Institute
- 2011–2013 **Princeton University and Geophysical Fluid Dynamics Laboratory**
Princeton Center for Theoretical Science Postdoctoral Fellow, Hosted by Isaac Held

Teaching

- 2017 Instructor of McGill’s ATOC 531: Dynamics of Current Climates, Fall 2017
- 2017 Instructor of McGill’s ATOC 215: Oceans, Weather and Climate, Winter 2017
- 2016 Instructor of McGill’s ATOC 531: Dynamics of Current Climates, Fall 2016
- 2016 Instructor of McGill’s ATOC 513: Waves and Stability, Winter 2016
- 2016 Instructor of McGill’s ATOC 531: Dynamics of Current Climates, Winter 2016
- 2015 Instructor of McGill’s ATOC 513: Waves and Stability, Winter 2015
- 2015 Instructor of McGill’s ATOC 183: Climate and Climate Change, Winter 2015

- 2014 Organizer of McGill's ATOC 550: Special Topics in Meteorology and Oceanography, Fall 2014
- 2014 Instructor of McGill's ATOC 513: Waves and Stability, Winter 2014
- 2012 Guest lecturer for AOS 523: Water in the Atmosphere, Princeton University
- 2012 Guest lecturer for AOS 576: The General Circulation of the Atmosphere, Princeton University
- 2010 Teaching Assistant and guest lecturer for ESE 148a: Climate Change, California Institute of Technology
- 2009, 2010 Teaching Assistant for ESE 148b: Atmosphere-Ocean Circulations, California Institute of Technology

Outreach

- 2016 Lecturer at McGill University high school outreach event *Snappy Science*
- 2016 McGill University Atmospheric and Oceanic Science department high school outreach *Canada Wide Science Fair*
- 2016 Lecturer at McGill University undergraduate outreach event *Soup & Science*
- 2014 Lecture on physical climate science for McGill University *Under the Weather: Climate Change Research and Justice* series
- 2014 Lecture on climate change for Science Undergraduate Society of McGill University
- 2013 Interviews with *Le Devoir* newspaper and radio station CJAD 800 about Typhoon Haiyan and climate change
- 2013 Lecturer at McGill University undergraduate outreach event *Soup & Science*
- 2013 Panelist at AGU Chapman Conference "Crossing the Boundaries in Planetary Atmospheres: From Earth to Exoplanets"
- 2012 Panelist for "Five Controversies in Climate Science Symposium" in honor of George Philander

Advising

Ph.D. Advisees: Arkadiusz Bembenek (2014–present, co-advisor with Prof. David Straub), Pei-Ning Feng (2014–present, co-advisor with Dr. Hai Lin, ECCC), Matthew Henry (2016–present), Nicholas Soulard (2015–present, co-advisor with Dr. Hai Lin, ECCC)

M.Sc. Advisees: Flora Viale (2014–2016), Cécile Defforge (2015–2016), Molly Syme (2015–present), Marie-Pier Labonté (2016–present), Zhong Yi Chia (2016–present, co-advisor with Prof. Daniel Kirshbaum), Michael Rollings (2017–present)

Undergraduate Research Assistants: Bryn Ronalds (2013–2014), Valérie Losier (2013–2014, co-advisor with Prof. Daniel Kirshbaum), Luke Davis (2014–2016), Kaiti Jiang (2015), Michael Rollings (2017)

Advisee Awards and Fellowships

- 2015 Arkadiusz Bembenek, NSERC Ph.D. Fellowship

- 2015 Cécile Defforge, Mysak Fellowship (McGill AOS Department Award)
- 2016 Cécile Defforge, Best Student Poster Award AMS Hurricanes and Tropical Meteorology Meeting
- 2016 Marie-Pier Labonté, McGill Space Institute M.Sc. Fellowship

Professional Activities and Memberships

Member of AMS Atmospheric and Oceanic Fluid Dynamics Committee, 2017–2019

Member of US CLIVAR Working Group: Changing Width of the Tropical Belt, 2016–2018

Co-organizer of California Institute of Technology workshop “Monsoons: Past, Present and Future” in May, 2015.

Member of AMS Atmospheric and Oceanic Fluid Dynamics Committee, 2011–2013

Co-convenor of session “Atmospheric Circulations and Climate Change” at AGU Fall Meeting, 2010

Reviewer for funding agencies: *NSERC, NASA, NSF*

Reviewer for journals: *Journal of the Atmospheric Sciences, Journal of Climate, Geophysical Research Letters, Nature Geoscience, Bulletin of the American Meteorological Society, Proceedings of the National Academy of Science, Nature Climate Change, Journal of Marine Research, Quarterly Journal of the Royal Meteorological Society, Journal of Geophysical Research, Environmental Research Letters, Climate Dynamics, and International Journal of High Performance Computing Applications*

Member of American Meteorological Society, American Geophysical Union, and Canadian Meteorological and Oceanographic Society

Department Seminars

- 2017 Scripps Institution of Oceanography, UCSD (Climate, Atmospheric Sciences, and Physical Oceanography Department), Seoul National University
- 2016 McGill University (Department of Physics), Columbia University, Lamont Doherty Earth Observatory
- 2015 University of Michigan
- 2014 MIT, Weizmann Institute of Science, Tel Aviv University
- 2013 University at Albany, University of Oxford, Caltech, Geophysical Fluid Dynamics Laboratory, McGill University, Harvard University, Stanford University, University of Toronto
- 2012 Cornell University, Yale University, Columbia University, Institute for Advanced Study, Harvard University
- 2011 MIT, Brown University, Caltech (thesis defense), University of New South Wales
- 2010 Geophysical Fluid Dynamics Laboratory

2009 MIT

Conference Presentations

- 2017 CMOS Congress, AMS Conference on Atmospheric and Oceanic Fluid Dynamics, Northeast Tropical Workshop, AGU Fall Meeting (invited, upcoming)
- 2016 AMS Conference on Hurricanes and Tropical Meteorology, CMOS Congress, AGU Fall Meeting (invited), WCRP Model Hierarchies Workshop, CLIVAR Width of the Tropical Belt Workshop
- 2015 Caltech Monsoon Workshop, Northeast Tropical Workshop, AMS Conference on Atmospheric and Oceanic Fluid Dynamics
- 2014 AMS Conference on Hurricanes and Tropical Meteorology, Latsis Symposium, World Weather Open Science Conference, AGU Fall Meeting (two invited presentations)
- 2013 AGU Fall Meeting (invited), Northeast Tropical Workshop, CLIVAR Hurricane Working Group Workshop, AMS Conference on Atmospheric and Oceanic Fluid Dynamics
- 2012 AGU Fall Meeting, Atmosphere-Ocean Science Days, AMS Conference on Hurricanes and Tropical Meteorology
- 2011 AGU Fall Meeting, AMS Conference on Atmospheric and Oceanic Fluid Dynamics
- 2010 AGU Fall Meeting, AMS Conference on Hurricanes and Tropical Meteorology
- 2009 AMS Conference on Atmospheric and Oceanic Fluid Dynamics*, Caltech Ocean-Atmosphere Energy Transport Conference
- 2008 AGU Fall Meeting, Kavli Institute Frontier of Climate Conference
- 2007 AGU Fall Meeting, AMS Conference on Atmospheric and Oceanic Fluid Dynamics, Southern California Symposium on Flow Physics
- 2006 SIAM Annual Meeting, AGU Joint Assembly[†]

*Best Student Poster Award

[†]Outstanding Student Paper