

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

Associate 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.)

- [28] Henry, M. and T. M. Merlis (2018): The role of the nonlinearity of the Stefan-Boltzmann law on the structure of radiatively forced temperature change. *Journal of Climate*, submitted.
- [27] Merlis, T. M. and M. Henry (2018): Simple estimates of polar amplification in moist diffusive energy balance models. *Journal of Climate*, **31**, 5811–5824.

- [26] Jansen, M., L.-P. Nadeau, and T. M. Merlis (2018): Transient vs Equilibrium Response of the Ocean's Overturning Circulation to Warming. *Journal of Climate*, **31**, 5147–5163.
- [25] Kirshbaum, D. J., T. M. Merlis, J. R. Gyakum, R. McTaggart-Cowan (2018): Sensitivity of idealized moist baroclinic waves to environmental temperature. *Journal of the Atmospheric Sciences*, **75**, 337–360.
- [24] O’Gorman, P. A., T. M. Merlis, and M. S. Singh (2018): 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*, **144**, 208–217.
- [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

- 2018– **McGill University Department of Atmospheric and Oceanic Sciences**
Associate Professor
Canada Research Chair (Tier II) in Atmospheric and Climate Dynamics
Member of McGill Space Institute
- 2013–2018 **McGill University Department of Atmospheric and Oceanic Sciences**
Assistant Professor
- 2011–2013 **Princeton University and Geophysical Fluid Dynamics Laboratory**
Princeton Center for Theoretical Science Postdoctoral Fellow, Hosted by Isaac Held

Teaching

- 2018 Instructor of McGill’s ATOC/PHYS 404: Climate Physics, Fall 2018
- 2018 Instructor of McGill’s ATOC 531: Dynamics of Current Climates, Fall 2018

- 2018 Instructor of McGill's ATOC 215: Oceans, Weather and Climate, Winter 2018
- 2018 Instructor of McGill's ATOC 215: Oceans, Weather and Climate, Winter 2018
- 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), Marie-Pier Labonté (2018–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 (2016–2017), 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), Anne-Sophie Fortin (2018)

Advisee Awards and Fellowships

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| 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

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| 2018 | Stony Brook University |
| 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

- 2018 CMOS Congress (invited plenary), MIT Lorenz Center Water and Climate Change (invited)
- 2017 CMOS Congress, AMS Conference on Atmospheric and Oceanic Fluid Dynamics, Northeast Tropical Workshop, AGU Fall Meeting (invited)
- 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