

Kelly E. McCusker

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Research Interests

Sea ice-atmosphere-ocean interaction. Climate and sea ice variability and change. Climate dynamics. Climate modeling. General circulation of the atmosphere and ocean. Climate engineering.

Education

Ph.D. Atmospheric Sciences, University of Washington, *August, 2013*

- *Dissertation*: Investigations of the Climate System Response to Climate Engineering in a Hierarchy of Models
- *Advisors*: Dr. David S. Battisti, Dr. Cecilia M. Bitz

B.A. Mathematics, Computer Science minor, *Magna Cum Laude*, Providence College, 1999

Research Experience

University of Washington, Department of Atmospheric Sciences

Research Associate, Canadian Sea Ice and Snow Evolution Network, Sep 2016 - present
Research supervisors: Prof Cecilia Bitz, Dr John Fyfe (CCCma), Prof Paul Kushner (University of Toronto)

Examine the partitioning of the influences of CO₂ forcing and Arctic sea ice loss on the local and remote atmosphere. Evaluate the role of sea surface temperature in sea ice and land temperature variability and change. Design and perform simulations in the Canadian Earth System climate model and Community Earth System climate model using relaxation to specified conditions. Organize network meetings.

University of Victoria, School of Earth and Ocean Sciences / Canadian Centre for Climate Modelling and Analysis (CCCma)

Research Associate, Canadian Sea Ice and Snow Evolution Network, Nov 2015 - Aug 2016
Postdoctoral Fellow, Canadian Sea Ice and Snow Evolution Network, Nov 2013 - Oct 2015
Research supervisors: Dr. John Fyfe, Dr. Paul Kushner (University of Toronto)

Examined the influence of Arctic sea ice trends on the local and remote atmosphere. Evaluated variability versus forced signal using statistical techniques. Designed and performed simulations in the Canadian atmospheric general circulation model with prescribed boundary conditions, and in the Canadian Earth System climate model utilizing relaxation to specified conditions.

University of Washington, Department of Atmospheric Sciences
Research Assistant, Sep 2007 - Aug 2013

Research advisors: Dr. David Battisti and Dr. Cecilia Bitz

Investigated the climate response to climate engineering with solar radiation management (SRM). Designed and conducted climate change and SRM simulations in a global climate model and upwelling-diffusion energy balance model. Diagnosed mechanisms for residual climate changes. Determined how resulting climate compared with historical climate variability using statistical techniques.

Professional Experience

Harvard-Smithsonian Center for Astrophysics, Cambridge, MA

Software Developer, Virtual Observatory, 2004-2007

Developed software package for analysis of spectral energy distributions as part of a team. Helped to design software library for storing spectra for later analysis. Performed all coding, testing, documenting, and distributing of software library. Presented to the International Virtual Observatory Alliance, 2006.

Software Developer, Chandra X-ray Telescope, 2002-2004

Created and enhanced software applications that access archive databases storing Chandra data. Developed Java web service to retrieve astronomical data and image files. Enhanced sky region search algorithms for typical Chandra observation queries. Wrote C++ client program that archives spacecraft measurements and observational data for later analysis. Enhanced monitoring and trends analysis programs to handle new x-ray data.

Thomson Financial, Boston, MA

Software Engineer, 2000-2002

Worked on team projects to develop new financial reporting software and enhance existing portfolio management software. Wrote code to obtain financial data and expose to third party applications. Created graphical user interface to test database access over Java to C++ bridge. Worked with XML data to transfer data across language boundaries. Solved a software deadlocking issue as a team member through detailed debugging and multi-user testing.

Logicon Northrop Grumman, Naval Underwater Warfare Center, Newport, RI

Systems Analyst, 1999-2000

Participated on project developing software to image sonar from hydrophones as well as submarine trainer software. Added data processing capabilities and enhanced software's graphical user interface.

Publications

In Prep / Under Review

McCusker, K. E. *et al.* Remarkable separability of the circulation response to sea ice loss and greenhouse gas forcing, *Geophys. Res. Lett.*, in review

Published

- 2017 Melton, J. R., Sospedra-Alfonso, R., **McCusker K. E.** Tiling soil textures for terrestrial ecosystem modelling via clustering analysis: a case study with CLASS-CTEM (version 2.1), *Geosci. Model Dev.*, doi:10.5194/gmd-2017-3, *accepted*
- 2016 **McCusker, K. E.**, Fyfe, J. C. & Sigmond, M. Twenty-five winters of unexpected Eurasian cooling unlikely due to Arctic sea-ice loss. *Nat. Geosci.* 9, 838–842 (2016). doi:10.1038/ngeo2820
- 2016 Spengler, T., I. Renfrew, A. Terpstra, M. Tjernström, J. Screen, I. Brooks, A. Carleton, D. Chechin, L. Chen, J. Doyle, I. Esau, P. Hezel, T. Jung, T. Kohyama, C. Lüpkes, **K. E. McCusker**, T. Nygård, D. Sergeev, M. Shupe, H. Sodemann, and T. Vihma, 2016: High Latitude Dynamics of Atmosphere-Ice-Ocean Interactions. *Bull. Amer. Meteor. Soc.* (2016), 97 (9), ES179-ES182 doi:10.1175/BAMS-D-15-00302.1
- 2015 **McCusker, K.E.**, D.S. Battisti, C.M. Bitz (2015): Inability of stratospheric sulfate aerosol injections to preserve the West Antarctic Ice Sheet. *Geophysical Research Letters* 42 (2015), doi:10.1002/2015GL064314.
- 2014 **McCusker, K. E.**, K.C. Armour, C.M. Bitz, and D.S. Battisti: Rapid and extensive warming following cessation of solar radiation management. *Environmental Research Letters* 9 024005 doi:10.1088/1748-9326/9/2/024005. (**Monthly Highlight, Feb. 2014**)
- 2012 **McCusker, K. E.**, D.S. Battisti, and C.M. Bitz: The climate response to stratospheric sulfate injections and implications for addressing climate emergencies. *J. Clim.* 25, 3096–3116 (2012). (**BAMS Paper of Note**)
- 2011 K.C. Armour, I. Eisenman, E. Blanchard-Wrigglesworth, **K.E. McCusker**, and C.M. Bitz: The reversibility of sea ice loss in a state-of-the-art climate model. *Geophysical Research Letters*. (**GRL Editors' Highlight**)
- 2003 Zografou, P., P. Harbo, **K. McCusker**, J. Moran, A. Patz, P. Ramadurai, and D. van Stone: High Availability Architecture for the Chandra Data Archive. *Astronomical Data Analysis Software and Systems (ADASS) XIII*, Strasbourg, France, Astronomical Society of the Pacific, 145.

Non-Peer Reviewed

- 2016 P. J. Kushner, J.T. Ambadan, C.C. Bajish, A. Berg, A. Bichet, C.P. Dersken, S.J. Déry, A. Dirkson, G. Flato, C. Fletcher, J. Fyfe, N. Gillett, C. Haas, S. Howell, F. Laliberté, **K.E. McCusker**, W. Merryfield, L. Mudryk, M. Sigmond, R. Sospedra, C. Thackeray, B. Tremblay, F. Zwiers: Assessment of Snow, Sea Ice, and Related Climate Processes in Canada's Earth System Models and Climate Prediction Systems. *Deliverable 1 Report of the Canadian Sea Ice and Snow Evolution (CanSISE) Network*

Teaching Experience

Courses at the University of Victoria

Guest Lecturer, Climate and Society (EOS/ES 365), Jan. 14 & Mar. 10, 2016

Instructor and Coordinator, Climate and Society (EOS/ES 365, 3 hours), Spring 2015.
Course description: <http://web.uvic.ca/calendar2015-01/CDs/EOS/365.html>

Courses at the University of Washington

Guest Lecturer, Climate Modeling (ATMS 559), Cecilia Bitz, Spring 2017

Instructor, Introduction to Global Warming: Understanding the Issues (ATMS 111, 5 credits), Summer 2012. Course website: <http://www.atmos.washington.edu/~kelly/courses/atms111/>

Guest Lecturer, Climate and Climate Change (ATMS 211), Joel Thornton, Autumn 2011

Guest Lecturer, Introduction to Atmospheric Physics and Chemistry (ATMS 501), Cecilia Bitz, Autumn 2011

Guest Lecturer, Introduction to Weather (ATMS 101), Nicole Feldl, Summer 2011

Teaching Assistant, Introduction to Weather (ATMS 101), Jérôme Patoux, Winter 2009

Other selected teaching experience

Mathematics Tutor, Providence College Tutorial Center, Sr. Carolyn A. Sullivan, O.P., 1996-1999

Selected Presentations

CanSISE West Regional meeting, "Isolating the influence of sea ice loss versus enhanced CO₂ in a coupled environment", University of Victoria, Victoria, BC, May 2016 (oral)

2015 Canadian Meteorological and Oceanic Society Congress joint with AMS Conference on Polar Meteorology and Oceanography "Exploring the link between human-induced Arctic sea ice loss and cold Eurasian winters", Whistler, BC, Canada, June 2015 (oral)

Invited Speaker: Atmospheric and Climate Dynamics Seminar "Impact of human-induced Arctic sea ice loss on the atmosphere in the face of internal variability", University of Washington, Seattle, WA, April 2015

Dynamics of Atmosphere-Ice-Ocean Interactions in the High-Latitudes Workshop "The linkage between human-induced Arctic sea ice loss and cold Eurasian winters", Rosendal, Norway, March 2015 (oral)

CanSISE workshop "Is there a link between human-induced Arctic sea ice loss and cold Eurasian winters?", University of Toronto, Toronto, ON, Canada, March 2015 (oral)

2014 American Geophysical Union Fall Meeting “Isolating the impact of human-induced Arctic sea ice loss on the atmosphere”, December, 2014 (oral)

CanSISE workshop, University of Victoria, Victoria, BC, Canada “Influence of simulated Arctic sea ice loss on the atmosphere”, May 2014 (oral)

Invited Speaker: Topics in Atmospheres and Oceans, University of Victoria, Victoria, BC, Canada “Climate response to stratospheric solar radiation management”, June 2013

Invited Speaker: Desert Research Institute, Reno, NV, June 2013

Invited Speaker: University of Washington, ATMS 220 Exploring Atmospheric Sciences (February, 2013)

2012 American Geophysical Union Fall Meeting “Climate response to abrupt cessation of solar radiation management”, December, 2012 (oral)

5th Graduate Climate Conference, MIT/Woods Hole Oceanographic Institute, Woods Hole, MA “Climate engineering and Earth system timescales”, October 28-30, 2011 (poster)

91st American Meteorological Society Annual Meeting, Seattle, WA “Geoengineering with stratospheric aerosols to avoid climate emergencies”, January 25, 2011 (oral)

2010 American Geophysical Union Fall Meeting, San Francisco, CA “Arctic climate response to geoengineering with sulfate aerosols”, December 2010 (poster)

4th Graduate Climate Conference, University of Washington “Regional implications of geoengineering with stratospheric sulfate injections”, October 15-17 2010 (oral)

University of Washington Atmospheric Physics & Chemistry Seminar “Regional implications of geoengineering with stratospheric sulfate injections”, October 4 2010 (oral)

University of Washington Atmospheric Dynamics Seminar “Geoengineering with sulfate aerosols: Global climatic response”, June 3, 2010 (oral)

Gordon Conference on Radiation and Climate “Tropical precipitation response to stratospheric sulfur injections”, July 2009 (poster)

3rd Graduate Climate Conference, University of Washington “Geoengineering: a review with focus on stratospheric sulfur injections”, April 16-18 2009 (oral)

American Astronomical Society (AAS) / American Association of Physics Teachers (AAPT) Joint Meeting, Computation, Data Handling, and Image Analysis Session “An Implementation of the VO Spectrum Model”, January 2007 (poster)

International Virtual Observatory Alliance Interoperability Meeting, Victoria, BC “Spectrum data model Java implementation”, May 2006 (oral)

Honors, Awards, and Achievements

Peter B. Wagner Memorial Award for Women in Atmospheric Science, 2013
Outstanding Student Paper Award, AGU 2012
Bulletin of the American Meteorological Society, Paper of Note (May 2012): *The climate response to stratospheric sulfate injections and implications for addressing climate emergencies*, Journal of Climate
Second Trans-disciplinary Summer School on Climate Engineering, Banff, Canada, 2011
Advanced Climate Dynamics Course, Bjerknes Center for Climate Research, Norway, 2009
University of Washington Program on Climate Change First Year Fellowship, 2007
Private Pilot's License, 2005
NASA Public Service Group Achievement Award, 2005
Providence College Women's Soccer Captain, 1998 & 1999 seasons
Pi Mu Epsilon Mathematics Honor Society, Secretary, 1999
Dean's Scholarship for Academic Excellence, Providence College, 1995-1999
Liberal Arts Honors Program, Providence College, 1995-1999
NCAA Big East Conference Scholar Athlete, 1995-1999

Technical Skills

Proficient in: Python, MATLAB, Climate Data Operators (CDO), NetCDF operators (NCO), shell scripting
Extensive previous experience with: Java, C, C++, XML
Familiarity with: Fortran, Javascript, HTML, NCAR Command Language (NCL)
OS: Linux, Unix, Mac OSX
Climate models: CCSM3, CCSM4, CESM1, CAM3, CanAM4, CanESM2

Selected Service, Outreach, and Leadership Activities

Member, AMS Polar Meteorology and Oceanography Committee, Jan. 2016-

Reviewer for Peer-Reviewed Journals, 2011-

- Springer: Nature Climate Change
- Springer: Climate Dynamics
- American Geophysical Union: Geophysical Research Letters
- American Geophysical Union: Journal of Geophysical Research - Atmospheres
- Royal Meteorological Society: International Journal of Climatology

Reviewer, Medium article "Arctic Warming & the Quieting of Winds Bring Whispers of Environmental and Economic Change to Oregon" (<https://medium.com/our-arctic-nation/arctic-warming-the-quieting-of-winds-bring-whispers-of-environmental-and-economic-change-to-2acb891b5f19>), Sept. 2016: provide commentary and feedback

Organizer, Canadian Sea Ice and Snow Evolution Network regional meeting, Victoria, BC April 10, 2017: solicit abstracts and organize scientific content of agenda, help run meeting

Organizer, Canadian Sea Ice and Snow Evolution Network regional meeting, Victoria, BC May 9, 2016: solicit abstracts and organize scientific content of agenda

Organizer, *Community Climate Science Seminar* (<http://uvic.ca/climate>), University of Victoria, Sep 2015-April 2016: secure speakers for across-campus climate science seminar series, develop website and advertising posters.

Organizer, Canadian Sea Ice and Snow Evolution Network regional meeting, Victoria, BC Oct 30, 2015: solicit abstracts and organize scientific content of agenda

Participant, University of Victoria School Based Weather Network outreach, December 2014: present weather-related demos to elementary school students on a field trip

Presenter, *Expanding your Horizons (motivating young women in science + mathematics)*, March 2008-2013: design and present interactive demonstrations and activities for high school girls

Reviewer, *Facing the Future: Global Sustainability Curriculum and Teacher Professional Development*, April-May 2012: Reviewed draft Climate Change chapter for a new high school sustainability textbook (first of its kind)

Presenter, *NASA Climate Day at the Boeing Museum of Flight*, April 2012: develop and present climate-related demonstrations to the public

Presenter, *Paws on Science at Pacific Science Center*, April 2012: develop and present climate-related demonstrations to the public

Presenter, *American Meteorological Society WeatherFest science fair*, January 2011: present atmospheric science demonstrations to the general public including kids, families, and teachers

Organizer, *University of Washington 4th Graduate Climate Conference*, October 2009 - October 2010: help organize a climate conference for graduate students including design and oversee production of conference booklet and other visual materials, and manage advertising of the conference

Outreach Coordinator, *University of Washington Dept. of Atmospheric Sciences*, March 2009 - April 2011: coordinate outreach volunteers, manage outreach events, communicate with k-12 teachers, manage website, oversee and develop demo and presentation materials

Participant, *University of Washington Dept. of Atmospheric Sciences Outreach Video group*, 2009 - August 2013: help develop, script, and act in short videos on atmospheric science topics

Participant, *University of Washington Dept. of Atmospheric Sciences Outreach group*, September 2007 - August 2013: present talks and demos to k-12, university, and ESL classes