

Andrew H. MacDougall
Curriculum Vitae

Department of Earth Sciences
St. Francis Xavier University
Antigonish, Nova Scotia, Canada B2G 2W5
amacdoug@stfx.ca
Citizenship: Canadian

University Education

- 2011 – 2014 PhD, School of Earth and Ocean Sciences, University of Victoria, Canada
Simulating the permafrost carbon feedback to climate change: feedback strength and carbon cycle consequences.
Supervisor: Dr. Andrew Weaver.
- 2008 – 2010 MSc, Earth Sciences, Simon Fraser University, Canada
Distributed energy-balance glacier melt-modelling in the Donjek Range of the St. Elias Mountains, Yukon Territory, Canada: model transferability in space and time.
Supervisor: Dr. Gwenn Flowers.
- 2004 – 2008 BSc (1st Class Hon.), Earth Sciences, St. Francis Xavier University, Canada
Senior Advisor: Dr. Hugo Beltrami.

Academic Positions

- 2016 – present Assistant Professor, Department of Earth Sciences, St. Francis Xavier University, Canada

Postdoctoral Experience

- 2014 – 2016 Postdoc, Institute for Atmospheric and Climate Science, ETH Zürich, Switzerland
Advisor: Prof. Reto Knutti

Teaching Experience

- 2016 – present Assistant Professor, Department of Earth Sciences, St. Francis Xavier University
ESCI 246: Quantitative Methods in Earth & Environmental Sciences
ESCI 305: Geochemistry of Natural Waters
ESCI 366: Hydrology
ESCI 386: Oceanography
- 2014 Sessional Instructor, School of Earth & Ocean Sciences, University of Victoria
EOS 365: Climate and Society
- 2011 Teaching Assistant, School of Earth & Ocean Sciences, University of Victoria
EOS 110: Oceans and Atmosphere
- 2009 Teaching Assistant, Geography, Simon Fraser University,
GEOG 314: The Climate System

Grants

Awarded:

- 2016-2021 NSERC Discovery Grant, PI (\$170 000)
2016 NSERC Research Tools and Instruments, Co-PI (\$43170)

Journal Articles

Submitted or under Review:

MacDougall, A.H.: The oceanic origin of path-independent carbon budgets, *Scientific Reports*, (In review, May 2017).

Accepted or Published:

- MacDougall, A.H.,** H. Beltrami: Impact of deforestation on subsurface temperature profiles: implications for the borehole paleoclimate record. *Environmental Research Letters*, (In press, May 2017).
- MacDougall, A.H.,** N.C. Swart, R. Knutti, 2017: The uncertainty in the transient climate response to cumulative CO₂ emissions arising from the uncertainty in physical climate parameters. *Journal of Climate*, 30, 813–827, doi: 10.1175/JCLI-D-16-0205.1.
- MacDougall, A.H.,** 2016: Permafrost Carbon: Catalyst for deglaciation. *Nature Geoscience (New & Views)*, 9, 648–649, doi:10.1038/ngeo2802
- MacDougall, A.H.,** R. Knutti, 2016: Enhancement of non-CO₂ radiative forcing via intensified carbon cycle feedbacks. *Geophysical Res. Lett.*, 43, doi:10.1002/2016GL068964.
- Zickfeld, K., **A.H. MacDougall**, H.D. Matthews, 2016: Is there a proportional relationship between global cooling and cumulative negative CO₂ emissions? *Environ. Res. Lett.* 11 055006
- MacDougall, A.H.,** R. Knutti, 2016: Projecting the release of carbon from permafrost soils using a perturbed physics ensemble. *Biogeosciences*, 13, 2123–2136.
- MacDougall, A.H.,** 2016: The Transient Response to Cumulative CO₂ emissions: A Review. *Current Climate Change Reports*, 2, 39–47, DOI:10.1007/s40641-015-0030-6
- MacDougall, A.H.,** K. Zickfeld, R. Knutti, H.D. Matthews, 2015: Sensitivity of carbon budgets to permafrost carbon feedbacks, non-CO₂ forcings, and negative emissions. *Environ. Res. Lett.* 10 125003
- MacDougall, A. H.,** and P. Friedlingstein, 2015: The origin and limits of the near proportionality between climate warming and cumulative CO₂ emissions. *J. Climate*, 28, 4217–4230.
- Wheler, B.A., **A. H. MacDougall**, G.E. Flowers, E.I. Petersen, P.H. Whitfield , and K.E. Kohfeld, 2014: Effects of temperature forcing provenance and extrapolation on the performance of an empirical glacier-melt model. *Arct. Alp. Res.*, 46 (2), 379-393.
- MacDougall, A. H.,** 2013: Reversing climate warming by artificial atmospheric carbon-dioxide removal: can a Holocene-like climate be restored? *Geophys. Res. Lett.* 40, 5480-5485.
- MacDougall, A. H.,** M. Eby, and A. J. Weaver, 2013: If anthropogenic CO₂ emissions cease, will atmospheric CO₂ concentration continue to increase? *J. Climate*, 26, 9563-9576.
- MacDougall, A. H.,** C. A. Avis, and A. J. Weaver, 2012: Significant contribution to climate warming from the permafrost carbon feedback. *Nature Geoscience*, 5, 719-721.
- MacDougall, A. H.,** B. A. Wheler, and G. E. Flowers, 2011: A preliminary assessment of glacier melt model parameter sensitivity and transferability in a dry subarctic environment. *The Cryosphere*, 5, 1011-1028.
- MacDougall, A. H.** and G. E. Flowers, 2010: Spatial and temporal transferability of a distributed energy-balance glacier melt model. *J. Climate*, 24, 1480-1498.

MacDougall, A. H., H. Beltrami, J. F. Gonzalez Rouco, M. B. Stevens, and E. Bourlon, 2010: Comparison of observed and general circulation model derived continental subsurface heat flux in the northern hemisphere. *J. Geophys. Res.*, 115, D12 109.

MacDougall, A. H., J. F. Gonzalez Rouco, M. B. Stevens, and H. Beltrami, 2008: Quantification of subsurface heat storage in a GCM simulation. *Geophys. Res. Lett.*, 35, L13 702.

Other Peer Reviewed Publications:

Xia, J., A. D. McGuire, D. Lawrence, E. Burke, G. Chen, X. Chen, C. DeLire, C. Koven, **A. MacDougall**, S. Peng, A. Rinke, K. Saito, W. Zhang, R. Alkama, P. Ciais, B. Decharme, T. Bohn, I. Gouttevin, T. Hajima, D. Hayes, D. Ji, G. Krinner, D. Lettenmaier, P. Miller, J. Moore, B. Smith, T. Sueyoshi, Z. Shi, L. Yan, J. Liang, L. Jiang, Y. Luo, K. Huang, Q. Zhang, 2017: Terrestrial ecosystem model performance in simulating productivity and its vulnerability to climate change in the northern permafrost region, *Journal of Geophysical Research: Biogeosciences*, 122(2), 430–446.

McGuire, A.D., C. Koven, D. M. Lawrence, J. S. Clein, J. Xia, C. Beer, E. Burke, G. Chen, X. Chen, C. Delire, E. Jafarov, **A. H. MacDougall**, S. Marchenko, D. Nicolsky, S. Peng, A. Rinke, K. Saito, W. Zhang, R. Alkama, T. J. Bohn, P. Ciais, B. Decharme, A. Ekici, I. Gouttevin, T. Hajima, D. J. Hayes, D. Ji, G. Krinner, D. P. Lettenmaier, Y. Luo, P. A. Miller, J. C. Moore, V. Romanovsky, C. Schädel, K. Schaefer, E.A.G. Schuur, B. Smith, T. Sueyoshi, Q. Zhuang, 2016: Variability in the sensitivity among model simulations of permafrost and carbon dynamics in the permafrost region between 1960 and 2009, *Global Biogeochemical Cycles*, 30(7), 1015-1037

Wang, W, A Rinke, JC Moore, X Cui, D Ji, Q Li, N Zhang, C Wang, S Zhang, DM Lawrence, AD McGuire, W Zhang, C Delire, C Koven, K Saito, **A MacDougall**, E Burke, B Decharme, 2016: Diagnostic and model dependent uncertainty of simulated Tibetan permafrost area, *The Cryosphere* 10 (1), 287-306.

Peng, S, P Ciais, G Krinner, T Wang, I Gouttevin, AD McGuire, D Lawrence, E Burke, X Chen, B Decharme, C Koven, **A MacDougall**, A Rinke, K Saito, Wenxin Zhang, R Alkama, TJ Bohn, C Delire, T Hajima, D Ji, DP Lettenmaier, PA Miller, JC Moore, Benjamin Smith, T Sueyoshi, 2016: Simulated high-latitude soil thermal dynamics during the past four decades, *The Cryosphere*, 10 (1), 179–192.

Rawlins, M.A., A. D. McGuire, J. S. Kimball, P. Dass, D. Lawrence, E. Burke, X. Chen, C. Delire, C. Koven, **A. MacDougall**, S. Peng, A. Rinke, K. Saito, W. Zhang, R. Alkama, T. J. Bohn, P. Ciais, B. Decharme, I. Gouttevin, T. Hajima, D. Ji, G. Krinner, D. P. Lettenmaier, P. Miller, J. C. Moore, B. Smith, and T. Sueyoshi, 2015: Assessment of model estimates of land-atmosphere CO₂ exchange across Northern Eurasia, *Biogeosciences*, 12, 4385–4405.

Koven, C.D., E. A. G. Schuur, C. Schädel, T. J. Bohn, E. J. Burke, G. Chen, X. Chen, P. Ciais, G. Grosse, J. W. Harden, D. Hayes, G. Hugelius, E. E. Jafarov, G. Krinner, P. Kuhry, D. M. Lawrence, **A. H. MacDougall**, S. S. Marchenko, A. D. McGuire, S. M. Natali, D. J. Nicolsky, D. Olefeldt, S. Peng, V. E. Romanovsky, K. M. Schaefer, J. Strauss, C. C. Treat, M. Turetsky, 2015: A simplified, data-constrained approach to estimate the permafrost carbon-climate feedback, *Phil. Trans. R. Soc.*, A 373.

Awards & Scholarships

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| 2015 | Canadian Meteorological and Oceanographic Society Tertia MC Hughes Memorial Graduate Student Prize (\$500) |
| 2014 | Royal Society Newton International Fellowship (£48000) (Declined) |
| 2013 | UVic President's Scholarship (\$4000) |
| 2013 | Michael Smith Foreign Study Supplement (Supported a four month visit to the University of Exeter, UK, \$5140) |
| 2011 –2013 | NSERC Canadian Graduate Scholarship, Doctoral-2 (\$70000) |
| 2010 | Graduate Fellowship, Masters (\$6250) |

- 2008 – 2010 NSERC Post Graduate Scholarship, Masters (\$34600)
 2008 Professor D.J. MacNeil Memorial Award (Top student Earth Sciences BSc)
 2007 Barrik Gold Scholarship (\$4000)
 2007 Keating Memorial Award (\$1000)
 2007 NSERC Undergraduate Research Award (\$4500)
 2004 – 2008 Canadian Scholarship (\$24000)
 2004 Canadian Cadet Scholarship (\$1000)
 2004 – 2008 Nova Scotia Power Scholarship (\$6000)

Professional Service

Reviewer for: *Nature Climate Change*
Geophysical Research Letters
Climatic Change
Climate Dynamics
Biogeosciences
Nature Climate Change
Journal of Climate
Environmental Research Letters
The Cryosphere
Arctic, Antarctic, and Alpine Research.
United States National Science Foundation, Arctic Science Division

Conference Organizer:

Annual meeting of Northwest glaciologists, Vancouver BC, Oct. 2009

Conference Presentations

Invited Oral Presentations:

A.H. MacDougall, “If anthropogenic CO₂ emissions cease, will atmospheric CO₂ concentration continue to increase?”, Third international symposium on energy challenges, University of Aberdeen, Scotland (2015).

A.H. MacDougall, “The permafrost carbon feedback to climate change as simulated by the UVic Earth system climate model”, Canadian Meteorological and Oceanographic Society Congress (2013).

Oral Presentations:

A.H. MacDougall, K. Zickfeld, R. Knutti, and H.D. Matthews, “Sensitivity of carbon budgets to permafrost carbon feedbacks and non-CO₂ forcings”, EGU General Assembly (2016)

A.H. MacDougall and R. Knutti, “Projecting the release of carbon from permafrost soils using a perturbed physics ensemble modelling approach”, EGU General Assembly (2016)

A.H. MacDougall, P. Friedlingstein, and R. Knutti, “The origin and limits of the near proportionality between transient climate warming and cumulative CO₂ emissions”, EGU General Assembly (2015).

G. E. Flowers, B. Wheler, **A. H. MacDougall**, E. I. Petersen, P. H. Whitfield, K. E. Kohfeld “Combined influence of temperature forcing and lapse rate on empirical melt-model performance”, AGU Fall Meeting (2013).

A.H. MacDougall, C.A. Avis, A.J. Weaver “The strength and timing of the permafrost carbon feedback as simulated by the UVic Earth system climate model.”, AGU Fall Meeting (2012).

Press Conferences:

EGU 2013 “Press conference 5 – Can we undo climate warming?” Participants: **A. H. MacDougall**, J. Rogelj, and H. Böttcher, April 10th 2013.

Poster Presentations:

- A.H. MacDougall and R. Knutti, “Enhancement of non-CO₂ radiative forcing via intensified carbon cycle feedbacks”, EGU General Assembly (2016).
- A.H. MacDougall**, N.C. Swart, R. Knutti, “Atmospheric origin of simulated ocean heat uptake variability: partitioning the sources of uncertainty in the transient climate response”, EGU General Assembly (2015).
- A.H. MacDougall**, A.J. Weaver, M. Eby “Will atmospheric CO₂ concentration continue to increase if anthropogenic CO₂ emissions cease?”, AGU Fall Meeting (2013).
- A.H. MacDougall**, A.J. Wevaer, M. Eby “Would atmospheric CO₂ concentration continue to increase if anthropogenic CO₂ emissions were to suddenly cease?”, EGU General Assembly(2013).
- A.H. MacDougall**, “Undoing climate warming by atmospheric carbon-dioxide removal: can a Holocene-like climate be restored?”, EGU General Assembly(2013).
- A.H. MacDougall**, “The permafrost carbon-climate feedback simulated by a coupled global climate model: feedback strength and sensitivity.”, EGU General Assembly(2012).
- A.H. MacDougall**, “Incorporating the permafrost carbon feedback into a coupled Earth system climate model of intermediate complexity.”, AAAS Annual Meeting (2012).
- A.H. MacDougall**, G.E. Flowers, “Glacier melt-model parameter sensitivity and transferability in the dry subarctic environment of the southwest Yukon.”, AGU Fall Meeting (2011).
- A.H. MacDougall**, G.E. Flowers, “Glacier melt-model transferability within a small subarctic mountain range: successes and limitations”, AGU Fall Meeting (2010)
- A.H. MacDougall**, G.E. Flowers, “Transferability of distributed glacier-surface energy-balance models within a small subarctic mountain range”, AGU Fall Meeting (2009)
- H. Beltrami, **A.H. MacDougall**, J.F. Gonzalez-Rouco , M.B. Stevens and E. Bourlon, “Modelled and observed continental surface heat fluxes”, AGU Fall Meeting (2009)
- A. MacDougall**, J.F. González-Rouco, M.B. Stevens,H. Beltrami, “Quantification of subsurface heat storage in the GCM ECHO-g: Effects of shallow bottom boundary placement”, AGU Fall Meeting (2007).

Department Seminars

- Institute of Climate and Environmental Physics, University of Bern, Switzerland, *The transient climate response to cumulative CO₂ emissions: origin, uncertainty and limits* (March 2016).
- Exeter Climate Systems, University of Exeter, United Kingdom, *The Transient Climate Response to Cumulative CO₂ emissions: Physical origin, limits, and policy implications* (July 2015).
- Department of Earth Sciences, St. Francis Xavier University, Canada, *The strength, timing, and consequences of the permafrost carbon-cycle feedback to climate change* (September 2013).
- Hadley Centre, United Kingdom Met Office, *The Permafrost carbon feedback to climate change* (March 2013).
- Exeter Climate Systems, University of Exeter, United Kingdom *The Permafrost carbon feedback to climate change* (January 2013).

Fieldwork Experience

Summer 2008, 2009 Two six-week glaciological field campaigns in the St. Elias Mountains, Yukon Canada. Responsibilities included: logistics and operations of a remote helicopter-access field site, deploying and maintenance of weather stations and mass balance measurement network, and deploying and maintenance of automated GPS stations.

Community Outreach

2009-2014 Volunteer for Let's Talk Science, a Canadian organization that coordinates scientist school visits and laboratory tours for students in primary and secondary schools.

2006-2008 Chair of the Community Science Centre Association, a local charity that hosted afterschool science mentorship and activities for students in primary and secondary schools.