

January 2017

**CURRICULUM VITAE
(Full Version)**

Lawrence A. MYSAK

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1. **BIOGRAPHICAL DATA**

Born: January 1940 in Saskatoon, SK (Canadian citizen)
Marital Status: Married to D. Mary Eeles, BA (hons.), in August 1974
(Canadian Citizen); deceased on Dec. 8, 2011
Married to Janet Scott Boeckh, BA, MEd, in Sept. 2015
Children: Paul Alexander Mysak, BCom (MIS), BSc (Forestry Eng),
born June 1975;
Claire Anastasia Mysak, BA (hons.), born February 1978

2. **EDUCATION**

1957-61: University of Alberta, Edmonton
BSc (hons.) in Applied Mathematics 1961, Certificate in Arts
1960 (performance in flute), both with first class honours
1962-63: University of Adelaide, Adelaide, S. Australia
MSc in Mathematics; Thesis (supervised by G. Szekeres,
FAA): "The Schwarzschild singularity"
1963-66: Harvard University, Cambridge, MA
AM and PhD in Applied Mathematics; PhD thesis
(supervised by A.R. Robinson, FAGU): "Continental shelf
waves" (Note: Degree awarded in March 1967)

3. **PROFESSIONAL POSITIONS**

1966-67: Harvard University
Research Fellow in Geophysical Fluid Dynamics
Under the supervision of A.R. Robinson and G.F. Carrier, Mem.NAS
1967-86: University of British Columbia
1967-70: Assistant Professor, Mathematics
1970-76: Associate Professor, Mathematics and Oceanography
Founding Member, Institute of Appl. Math. &
Statistics

1976-86: Professor, Mathematics and Oceanography

- 1971-72: Sabbatic leave (Univ. of Cambridge, UK)
- 1976-77: Sabbatic leave (Inst. of Ocean Sciences, Sidney, BC and National Center for Atmospheric Research, Boulder, CO)
- 1982-83: Sabbatic leave (ETH Zurich, Switzerland)

1986-present: McGill University

- 1986-96: AES/NSERC Industrial Chair Professor of Climate Research
- 1986-90: Director of Climate Research Group, Department of Meteorology (now Atmospheric and Oceanic Sciences)
- 1986-2010: Assoc. Member, Dept. of Mathematics and Statistics
- 1989-2010: Canada Steamship Lines Professor of Meteorology, Dept. of Atmos. & Oceanic Sciences
- 1990-96: Founding Director of Centre for Climate and Global Change Research (C²GCR)
- 1997-2014: Member, Global Environmental and Climate Change Centre (GEC3)
- 2010- : Canada Steamship Lines Emeritus Professor of Meteorology, Dept. of Atmospheric and Oceanic Sciences

- 1993-94: Sabbatic Leave (McGill Univ., Montreal)
- 2000-01: Sabbatic Leave (ETH Zurich; Inst. of Geophysics and Volcanology, Bologna, Italy)
- 2007-08: Sabbatic Leave (ETH Zurich; Univ. of Stockholm, Sweden)

3A. **Concurrent Visiting and Distinguished Lectureship Positions**

1. 1968 (Summer): Visiting Research Associate with M.S. Longuet-Higgins, FRS, School of Oceanography, Oregon State University, Corvallis.
2. 1971-72: Senior Visitor, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, England.
3. 1976 (Fall): Visiting Scientist and Guest Lecturer, Institute of Ocean Sciences, Sidney, British Columbia.
4. 1977 (January-August): Visiting Scientist, National Center for Atmospheric Research, Oceanography Project, Boulder, Colorado.
5. 1981 (Summer): Visiting Professor, Naval Postgraduate School, Monterey, California.
6. 1982-83: Visiting Professor, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland.
7. 1984 (April): Distinguished Visiting Scholar, State University of New York,

Stony Brook, New York.

8. 1987-88: Tour Speaker for the Canadian Meteorological and Oceanographic Society.
9. 1993 (July): S. Burr Steinbach Visiting Scholar, Woods Hole Oceanographic Institute, Woods Hole, MA.
10. 1995 (April/May): "George Lemaitre" Visiting Professor of Climate Dynamics, Catholic University of Louvain, Belgium.
11. 1997 (May/June): Invited Lecturer in Japan under the support of an "Invitation Fellowship for Research in Japan" from the Japan Society for the Promotion of Science.
12. 1998 (Feb.): "Distinguished Lecturer in Fluid Mechanics", Univ. of Manitoba, Winnipeg.
13. 2000 (July): Atmosphere-Ocean Environment Invited Lecturer, Peter Wall Institute for Advanced Studies, UBC, Vancouver.
14. 2000 (Sept.)-2001 (Feb.): Visiting Professor, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland.
15. 2001 (Mar. to Aug.): Visiting Scientist, National Institute of Geophysics and Volcanology, Bologna, Italy.
16. 2002 (June): Invited RSC-National Academy of Sciences of Ukraine (NASU) Exchange Lecturer. Gave a series of lectures on "Climate modelling" at NASU institutes in Kyiv, Sevastopol and Lviv.
17. 2004 (Jan.): Sverdrup Lecturer, AGU Ocean Sciences Meeting, Portland, OR.
18. 2006 (April): Alfred Wegener Medal Lecturer, EGU, Vienna.
19. 2007 (Oct.): Visiting Professor, ETH, Zurich, Switzerland.
20. 2008 (May): Visiting Professor, Stockholm University, Stockholm, Sweden.
21. 2009 (Oct.): Priestly Lecturer, CSIRO Aspendale (Melbourne), Australia
22. 2009 (Oct.): Distinguished Speaker, Institute of Advanced Study, Hong Kong
University of Science and Technology, Hong Kong.

3B. **Editorships**

1. 1977-1992: Associate Editor, Journal of Physical Oceanography.
2. 1983-1995: Editorial Board, Geophys. and Astrophys. Fluid Dynamics.
3. 1983-1986: Editor, UBC Institute of Applied Mathematics Newsletter.
4. 1986-1987: Founding Editor, McGill Climate Research Group Newsletter.
5. 1987-2000: Contributing Editor, Springer-Verlag (now Amer. Geophys. Union) books on Coastal and Estuarine Studies.
6. 1988-1991: Associate Editor, Atmosphere-Ocean.
7. 1992-1993: Associate Editor, Climatological Bulletin
8. 2001-2003: Editor, CCGCR Newsletter

9. 2001-2016: Editor-in-Chief, Atmospheric and Oceanographic Library Series, Springer, Dordrecht, The Netherlands
10. 2015-present: Inaugural Subject Editor (Atmospheric and Climate Sciences) for FACETS, a multidisciplinary journal of Canadian Science Publishing, Ottawa (www.facetsjournal.com)

3C. **Consulting and Appraisal Work; NSERC Committees**

1. 1978 (September-December): Consultant on ocean waves to Evans-Hamilton, Inc, Applied Oceanography, Seattle.
2. 1978-1980: Consultant for Coastal Ocean Dynamics Experiment, carried out by Institute of Ocean Sciences, Sidney, British Columbia.
3. 1981 (Spring): Consultant on nonlinear internal waves to Seaconsult Marine Research Ltd., Vancouver, British Columbia.
4. 1981-84: Member, NSERC Strategic Grants Oceans Panel
5. 1986-87: Member, NSERC Task Force on Supercomputing
6. 1987-89: Member, NSERC Earth Sciences Grant Selection Committee.
7. 1992-93: Consultant for Great Whale Public Review Support Office on 'Climate and hydroelectric development in northern Quebec'
8. 1993 (February): Chair of Science Quality Review Team for Physical Oceanography and Ocean Climate Chemistry, Institute of Ocean Sciences, Sidney, BC
9. 1995 (summer): Reviewer for Climate Change Chapter in 1996 edition of 'State of the Environment Report', Environment Canada
10. 1996 (June): Participant in TV documentary on the 'Restless Planet', for The Discovery Channel
11. 1996 (Sept.): Interviewed by CBC radio producer R. Vigod for inclusion in "The World this Weekend, Nov. 23, 1996 'World Scientists' Warning to Humanity'"
12. 1997 (Nov.): Chair of Site Visit Team to review the proposed NSERC Industrial Research Chair in "Regional ocean modelling and prediction" at Dalhousie Univ., Halifax
13. 1998-present: Consultant for appointments to the Order of Canada
14. 1999 (Feb.): Consultant to Ontario Council on Graduate Studies, for the appraisal of the MSc program in Physics at Royal Military College, Kingston
15. 1999 (Nov.): Invited participant and moderator for National Planning Workshop of the DFO Ocean Climate Program
16. 2001 (Nov.): Provided assessment of 40-month progress report of NSERC Industrial Research Chair at Dalhousie (see 12. above)
17. 2002-05: Member, Grant Review Committee for Can. Foundation for Climate and Atmos. Sciences (CFCAS); Chair, 2004-05.

3D. **Royal Society of Canada (RSC) Positions**

1. 1987-90: Deputy Leader of RSC Working Group on Marine and Atmospheric Interactions of the Canadian Global Change Program (CGCP).
2. 1987-88: Rapporteur of Interdisciplinary Section of Academy of Science.
3. 1988-90: Member of Natural Sciences Research Committee of the Canadian Global Change Program (CGCP).
4. 1988-90: Convener of Interdisciplinary Section of Academy of Science.
5. 1988-90: Academy of Science representative on Council of the RSC.
6. 1988-89: Member of RSC Committee on the Reorganization of the Academy of Science (CORAS).
7. 1989-96: Member of CGCP Board.
8. 1990-91: Member of Division Fellowship Review Committee for Space and Earth Sciences, Academy of Science.
9. 1991-93: Vice-President of the Academy of Science (elected in a contested ballot).
10. 1992-93: Chairman, Program Committee for Annual Meeting of RSC, Montreal, May 1993.
11. 1992-2002: Co-Chair, Fundraising Committee for RSC-Ukrainian Academy of Sciences Exchange Lecture Program.
12. 1993-96: President of 900-member Academy of Science (the largest of the three RSC academies). First President to be elected in a contested ballot.
13. 1993-96: Chair, Advisory Committee for the Evaluation of Research.
14. 1995-96: Founding Chair, Partnership Group for Science and Engineering (PAGSE), a new (1995) initiative of the Academy of Science to unite Canadian science and engineering societies in order to speak with a common voice for science and technology on important issues of the day.
15. 1996-99: Past President, Academy of Science.
16. 1996-99: Member, Awards and Medals Committee.
17. 1996-99: Chair, Academy of Science Nominations Committee for Academy Executive positions.
18. 1997-2000: Chair, Academy of Science Distinctions Committee.
19. 1998-2000: Member, Adjudication Procedures Committee for the proposed international Canada Prize for "Earth and Environmental Science", to be first awarded in 2003.
20. 1997-2000: Chair, Academy of Science Council Fellowship Selection Committee.
21. 2002-2006: Member, Selection Committee for Bancroft Award in Earth Sciences.
22. 2014-2017: Chair, Nominations Committee for Academy of Science

Division of Earth, Ocean and Atmospheric Sciences, and Member,
Academy of Science Council.

23. 2016-2019: Chair, Past Presidents' Council, Academy of Science

3E. **Other Canadian Professional Positions**

1. 1985-88: Member of Canadian Climate Program (CCP) Research Committee.
2. 1985-91: Member of CCP/CGCP Working Group on large-scale atmosphere/ocean models.
3. 1987-93: Member of CNC/SCOR Committee on WOCE (World Ocean Circulation Experiment).
4. 1988-97: Member of Canadian Climate Program Board.
5. 1994-95: Member of CNC for ACSYS: Arctic Climate SYstem Study (new program of WCRP).
6. 1994: Invited Delegate to Montreal Regional Meeting (Sept. 22, 23) of Federal Science and Technology Review.
7. 1998-2000: Member and Chair (1999), Scientific Advisory Panel for the Canadian Climate Research Network, Environment Canada.
8. 1999-2004: Member, Can. Meteorological and Oceanographic Society (CMOS) Prizes and Awards Committee.
9. 2000-03: Member, Science and Technology Advisory Board, Environment Canada.
10. 2005-07: Member, Selection Committee for Fellows of CMOS.
11. 2005-09: Member, National Organizing Committee for Joint Assembly of IAMAS, IAPSO, and IACS, Montreal, July 2009.
12. 2008-14: Board of Trustees, Canadian Foundation for Climate and Atmospheric Sciences (CFCAS); since 2012: renamed The Canadian Climate Forum.
13. 2010-present: Member, Steacie Prize Selection Panel; Chair, 2013-.
14. 2016-present: Member, Steering Committee for IUGG General Assembly, Montreal, 2019.

3F. **International Professional Appointments and Workshops**

1. 1983-86: Member of Amer. Meteorol. Soc. Committee, "Atmospheric and Oceanic Waves and Stability."
2. 1985-87: Convenor of IAPSO Symposium on "Pacific Ocean Studies" at 19th General Assembly of IUGG, Vancouver, Aug. 1987.
3. 1988-89: Program Convener of 16th Stanstead Seminar, Bishop's University, Lennoxville, QC, July 1989.
4. 1989-92: Member of American Meteorological Society Committee, "Polar Meteorology and Oceanography".
5. 1990-93: McGill University Member of University Corporation for

- Atmospheric Research, Boulder, Colorado.
6. 1990-92: Member of IOC/SCOR Committee on Climatic Changes and the Ocean (CCCO).
 7. 1991 (June): Invited participant at WCRP workshop in Bremerhaven to help plan new international research program: Arctic Climate SYstem Study (ACSYS).
 8. 1991-92: Program Convener of special session on "Arctic Oceanography" at joint AGU-CGU Spring Meeting, Montreal, May 1992.
 9. 1992-93: Member of CCCO Ad Hoc Study Group on Interdecadal Climate Variability.
 10. 1992 (Sept.): Invited speaker and discussion leader at US National Academy of Sciences Workshop on "Decade to Century Time Scales of Natural Climate Variability", Irvine, California.
 11. 1992-present: Member, International Advisory Board of the University of "Kiev-Mohyla Academy", Kiev, Ukraine.
 12. 1993-95: Co-Convener of IAPSO Symposium on 'Interdecadal ocean climate variability', at 21st General Assembly of IUGG, Honolulu, HI, Aug. 1995.
 13. 1996 (Oct.): Invited participant at CLIVAR (Climate Variability and Predictability) Program workshop, Villefranche, France.
 14. 1997-2001: Member, Science Advisory Committee for the International Arctic Research Center, University of Alaska Fairbanks, a cooperative Japan-US centre initiated by the Japan Frontier Research Program for Global Change.
 15. 1998 (June): Invited speaker and participant at the AGU Chapman Conference on "Millennial-scale Global Climate Change", Snowbird, Utah.
 16. 1999 (May): Invited speaker and participant at 'Arctic Climate Workshop' sponsored by the International Arctic Research Center, Univ. of Alaska, Fairbanks.
 17. 1999 (Aug.): Invited speaker and participant at SCAR/SCOR/IOC/WCRP Workshop on 'Large scale variability in the Southern Ocean region', Cambridge, UK.
 18. 2000-01: Convener of IAPSO session on "The Arctic and subpolar seas and their links to the thermohaline circulation: Past, present and future", at the joint IAPSO-IABO conference in Mar-del-Plata, Argentina, Oct. 2001.
 19. 2001-05: Advisory Panel of NATO Environmental and Earth Science & Technology Sub-Program, Brussels.
 20. 2001 (Nov.): Keynote speaker at SEARCH (Study of Environmental Arctic Change) workshop, Seattle, WA.
 21. 2002-03: Invited Co-convener for IAPSO-IAMAS-IAHS Symposium on

- "Environmental Change in the Arctic", IUGG Assembly, Sapporo, Japan, July 2003.
22. 2003-04: Scientific Committee for Bjerknes Centennial Conf., Bergen, NO, Sept. 2004.
 23. 2003: Convener for AO/NAO session for Fall AGU meeting, San Francisco, Dec. 2003.
 24. 2003-07: Vice-President, International Association for the Physical Sciences of the Oceans (IAPSO), one of 8 associations of IUGG.
 25. 2004-08: Selection Committee for Fellows of AGU.
 26. 2006-12: Selection Committee for Alfred Wegener Medal and Hon. Membership EGU; Chair, 2011 & 2012.
 27. 2006 (Aug.): Invited Plenary Speaker and participant at the Hokkaido University International Symposium on Sustainable Development, Sapporo, Japan.
 28. 2007 (May): Invited Speaker, Climate and EMIC Symposium at Collège de France, Paris.
 29. 2007-11: President, IAPSO.
 30. 2007-11: Executive Committee member, Scientific Committee on Oceanic Research (SCOR).
 31. 2010-present: Reviewer for AXA Research Fund (France).
 32. 2011-15: Immediate Past President, IAPSO.
 33. 2011-2015: IUGG Union Commission on Climatic and Environmental Change.
 34. 2014-15: Selection Committee for the Inaugural IUGG Gold Medal, to be awarded in Prague in 2015, at the 26th General Assembly of IUGG.

4. **AWARDS AND HONOURS**

4A. **Awards**

1. 1962-63: Rotary Foundation Fellowship for International Understanding. Used for MSc studies at University of Adelaide, South Australia.
2. 1963-66: Canadian NRC and Harvard Scholarships for PhD studies.
3. 1981: Canadian Meteorological and Oceanographic Society's (CMOS) President's Prize for 1980 (co-recipient, with Paul LeBlond), for "outstanding ocean research and the book, 'Waves in the Ocean'".
4. 1982-83: UBC Killam Memorial Senior Fellowship for sabbatical in Zurich.
5. 1991: CMOS Citation for "Reviewer of the Year in Meteorology".
6. 1997: Japan Society for the Promotion of Science (JSPS) "Invitation Fellowship for Research in Japan" (May and June).
7. 1998: Patterson Distinguished Service Medal from Environment Canada's Atmospheric Environment Service for 1997, for "outstanding service to meteorology in Canada".
8. 1998: CMOS J.P. Tully Medal in Oceanography for 1997, "in recognition

- of his impact on, and leadership in, oceanographic research and education in Canada".
9. 2000: McGill University David Thomson Award for Excellence in Graduate Supervision and Teaching.
 10. 2002: Golden Jubilee Medal for contributions to science, Canadian Governors General.
 11. 2005: Prix Michel-Jurdant (environmental sciences), Acfas, QC
 12. 2006: Alfred Wegener Medal and Honorary Membership, European Geosciences Union, "in recognition of his leadership in oceanography and fundamental contributions in ocean dynamics, sea ice and climate".
 13. 2006: Prix Marie-Victorin (natural sciences), Government of Quebec. This is one of the 11 "Prix du Quebec" awarded annually in all areas of culture and the sciences.
 14. 2009: Distinguished Alumni Award, University of Alberta, Edmonton.
 15. 2010: Inaugural recipient of the McGill University Medal for "Exceptional Academic Achievement".
 16. 2013: Queen Elizabeth II Diamond Jubilee Medal.

4B. **Honours**

1. 1986: Elected, by the Academy of Science, a Fellow of the Royal Society of Canada (FRSC), for "notable applications of mathematics to oceanography and ocean climate-fisheries interactions".
2. 1989: Elected a Member of Rotary Club of Westmount (of Rotary International) for "leadership and service in climate research".
3. 1989 (June): Appointed to the endowed Canada Steamship Lines Chair of Meteorology, in Dept. of Meteorology (now Atmospheric and Oceanic Sciences), McGill University.
4. 1991 (May): Elected a Vice-President of the Academy of Science of the RSC.
5. 1993 (April): Elected to a three-year term as President of the 900-member Academy of Science, RSC.
6. 1995 (June): Conferred the title of Honorary Professor of the University of "Kiev-Mohyla Academy", Kiev, Ukraine.
7. 1996 (Nov. 14): Appointed a Member of the Order of Canada (CM) for "pioneering work in climatology, mathematics and oceanography, and accomplishments as a gifted team builder in founding the McGill Centre for Climate and Global Change Research and serving as President of the Academy of Science".
8. 1999: Named an inaugural Fellow of CMOS (FCMOS), for "contributions to our knowledge of the oceans, sea ice and climate as researcher, teacher and supervisor, and for leadership in the Canadian science community".

9. 1999: Elected a Fellow of the American Meteorological Society (FAMS), for "outstanding contributions to the atmospheric, oceanic and hydrologic sciences during a substantial period of years" (certificate received Jan. 2000).
10. 2000: Elected a Fellow of the American Geophysical Union (FAGU), for "novel contributions to research in climate dynamics, especially of the Arctic regions, and for outstanding service and mentorship in linking international scientific communities".
11. 2000: Elected a Foreign Member of Academia Europaea (For.Mem.AE), the science and humanities academy of the European Union, founded in 1988.
12. 2001: Invited to have biography included in "Who's Who in the 21st Century", International Biographical Centre, Cambridge, UK.
13. 2005 (May): Invited to serve as "Opponent" for PhD defense at the University of Stockholm.
14. 2005 (June 1-2): The Lawrence A. Mysak Symposium, a special session on Oceans and Climate at 39th CMOS Congress, Vancouver, BC, in honour of Mysak's 65th birthday. Organizer: Prof. William Hsieh.
15. 2007: Elected President of the International Association for the Physical Sciences of the Oceans (IAPSO), one of eight associations of IUGG.
16. 2010 (June 1-2): The Lawrence Mysak Session on "Ocean and Climate Dynamics", held at the 44th Annual CMOS Congress, Ottawa, in honour of Mysak's retirement on May 31, 2010. Organizers: Professors William Hsieh and Bruno Tremblay.
17. 2011: Biographical profile in Who's Who in the World (28th Edition)
18. 2012: Publication of Atmosphere-Ocean 50-2 Special Issue, "Ocean and Climate Dynamics", a Tribute to Professor Lawrence A. Mysak, in honour of his retirement from McGill University on May 31, 2010. This issue was edited by former PhD student Prof. William Hsieh and contains eight research papers written by former students and colleagues of Lawrence Mysak.
19. 2015: Named an inaugural Fellow of IUGG (FIUGG), for "exceptional contributions to international cooperation in geosciences and eminence in Earth and space sciences".

5. **GENERAL RESEARCH INTERESTS AND SUPPORT**

Ocean and Climate dynamics (1986-): Modelling and analysis of large and intermediate scale atmosphere-ice-ocean circulation and climate variability in the Arctic, analysis and modelling of interannual, decade-to-century and millennial scale variability of the ocean-ice-atmosphere-land climate system; paleoclimate modelling (the mid-Cretaceous, the PETM, the Ice Ages and glacial inceptions, the mid to late Holocene, the late Pleistocene); modelling of long-term

geosphere-biosphere interactions and feedbacks; influence of climate variability on fisheries; recent Holocene climate-architecture interactions.

Leader of Project MOIST (1984-87): Meteorological and Oceanographic Influences on Sockeye Tracks (MOIST), an interdisciplinary study funded by an NSERC Strategic Grant.

Geophysical fluid dynamics and applied mathematics (1966-85): Ocean and atmospheric waves, stability of geophysical flows, coastal oceanography, remote sensing of the oceans, lake dynamics, oceanic eddy and frontal dynamics, stochastic differential equations, wave propagation in random media, nonlinear wave motions, and wave-wave interactions.

5A. Current and Recent Research Interests

1. Modelling the effects of chemical weathering in regulating atmospheric CO₂ concentrations during glacial-interglacial cycles
2. Model study of the global carbon cycle during the Holocene and late Pleistocene with an intermediate complexity climate model
3. The evolution of Antarctic Bottom Water since the Last Glacial Maximum
4. Model study of late Pleistocene megafauna-forest vegetation interactions in an Earth system climate model
5. Impact of climate change and variability on outdoor skating rinks in Canada, 1951-2005
6. A carbon cycle box model study of the Paleocene-Eocene Thermal Maximum (PETM) around 55 Myr ago
7. The response of a low-order atmosphere-ocean-sea ice climate model to Milankovitch forcing
8. Modelling the freshwater budget of the Arctic Ocean and exchanges with the North Atlantic: Present, past, and future

5B. Research Support (since 1985)

Note: Total career research funding (1968-present): over \$ 7 million

1. NSERC Discovery Grant

"Dynamical oceanography and limnology," 1985-88	\$43,000/yr
"Ocean and climate dynamics", 1988-89;	\$73,000/yr
1989-91: see 2. below	
1991-94 (to follow NSERC Chair grant-see 2. below)	\$86,000/yr
1994-98	\$83,000/yr
1998-99	\$91,000/yr
"Ocean, climate and paleoclimate dynamics"	
1999-03	\$89,460/yr
2003-08	\$83,200/yr
2008-13	\$74,000/yr

2. AES/NSERC Industrial Res. Chair in 'Climate Research',
1989-91 \$100,000/yr
3. U.S. Office of Naval Research, contract
"Long-period waves and currents," 1980-87 (aver.) \$45,000/yr
"Mesoscale and large-scale dynamics at middle
and high latitudes", 1988-1992 U.S. \$39,000/yr
4. AES, science subvention (1990-96, joint with NSERC)
"Numerical model of wind-generated baroclinic Rossby
waves in the North Atlantic Ocean," 1987-88 \$22,000/yr
"Development of coupled ice-ocean circulation models,
with application to the Arctic Ocean," 1988-89 \$20,000/yr
1989-91 \$25,000/yr
1991-92 \$22,000/yr
1992-95 \$29,000/yr
"Development of coupled ice-ocean circulation models,
with application to the Arctic climate"
1995-96 \$25,000/yr
1996-97 \$20,000/yr
1997-98 \$13,000/yr
5. AES CRYSYS Collaborative Research Grant
1997-98 \$15,000/yr
6. AES/NSERC
"Research funds from Industrial Research Chair in
Climate Research," 1988-1989 \$27,000/yr
(This was combined with my NSERC oper. grant in 1989 to give 2. above)
7. NSERC, strategic (group) awards
"Interannual variability in the northeast Pacific Ocean
and its influence on sockeye salmon migration routes"
1984-87 (Mysak (P.I.), Hamilton and Groot) \$120,000/yr
(This was the main support for Project MOIST - Meteorological and
Oceanographic Influences on Sockeye Tracks)
"The development of an ocean circulation model for
coupling to the Canadian atmospheric general
circulation model for climate studies,"
1986-89 [Lin (P.I.), Mysak and Boer] \$100,000/yr
"Numerical modelling of the interannual variability
in the northeast Pacific Ocean," 1987-88
[Hsieh (P.I.) and Mysak] \$48,000/yr
"Impact of freshwater discharge on the recruitment of
anadromous fish in ice covered Arctic waters,"
1988-1991 [Ingram (P.I.), Fortier, Legendre, Mysak...] \$149,000/yr
8. NSERC, major equipment award "Computer network and workstations,"
1987-88 [Mysak (P.I.), Derome, Hamilton, Leighton, Lin and Yao].

- | | | |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| | | \$198,000/yr |
| 9. | FCAR, équipe, "Analyse et simulation des fluctuations climatiques,"
1987-90 [Mysak (P.I.), Derome, Hamilton, Lewis and Lin] \$29,000/yr
1990-93 [Mysak (P.I.), Derome, Lewis, Lin and Weaver] \$71,000/yr
1993-96 [Lin (PI), Derome, Lewis and Mysak] \$80,000/yr
1996-99 [Lin (PI), Derome and Mysak] \$34,000/yr
1999-2002 [Derome (PI), Brunet, Lin, Mysak and Straub] \$57,000/yr | |
| 10. | NATO Collaborative Research Grant
"Modelling the coupling between the ice edge and
climate variability," 1987, 1988 (with A.J. Willmott) | \$5,000/yr |
| 11. | McGill Faculty of Graduate Studies & Research
"Infrastructure and publications grant for the
Centre for Climate and Global Change Research",
1991-92 \$23,000/yr
1992-93 \$21,000/yr
1993-94 \$17,000/yr
1994-95 \$18,000/yr
1995-96 \$17,500/yr
1996-97 \$20,000/yr | |
| 12. | Infrastructure grants for the Centre for Climate and Global Change
Research from the Faculties of Arts, Agricultural and Environmental
Sciences and UQAM, (\$2,000 each), 1992-94 | \$6,000 |
| 13. | Equipment grants for C ² GCR from the Faculty of Science, 1992-93 | \$31,000 |
| 14. | FCAR Centre Grant for C ² GCR, 1994-97 \$110,000/yr
Equipment component for 1994-95 \$48,000/yr | |
| 15. | NSERC NOW polynya Collaborative Grant, 1997-2000 - LAM share | \$25,000/yr |
| 16. | Canadian Institute for Climate Studies - Collaborative Res. Agreement 1999
- 2002
"The Arctic Ocean and its Role in Climate
Change/Climate Variability" (Carmack, Flato, Mysak
and Weaver (PI)) | \$200,000/yr |
| 17. | NSERC/Canadian Foundation for Climate and Atmospheric Sciences
(CFCAS), 2001-2006 CLIVAR Network Grant (Derome (PI), Mysak
and 15 others) - LAM share | \$60,000/yr |
| 18. | CFCAS, 2002-05 ("Glacial and Interglacial Geosphere-Biosphere
Interactions in the McGill Paleoclimate Model") | \$96,000/yr |

6. **PUBLICATIONS (see also attached list, p. 23, and Achievements in Research, p. 74)**

1. Circa **25** refereed book chapters and conference proceedings, and **ca. 175** refereed papers in over **45** journals: Ann. Rev. Fluid Mech.; Annals of Glaciology; Appl. Math. Notes; Arch. Sci. Rev.; Atmosphere; Atmosphere-Ocean; Biological Oceanogr.; Can. Geographer; Can. J. Fish.

Aquat. Sci.; Can. J. Phys.; Climate Dynamics; Climatic Change; Climate of the Past; Climatological Bulletin; CMOS Bulletin SCMO; Discovery; Dyn. Atmos. & Oceans; Earth System Dyn.; Environ. Res. Letters; FACETS; Geophys. & Astrophys. Fluid Dyn.; Geophys. Fluid Dyn.; Geophys. Res. Lett.; Global Biochemical Cycles; J. Climate; J. Eng. Math.; J. Fish. Res. Bd. Can.; J. Fluid Mech.; J. Geophys. Res.; J. Marine Res.; J. Math. Anal. Applic.; J. Meteorol. Soc. Japan; J. Oceanogr.; J. Phys. Oceanogr.; Mar. Geodesy; Mon. Weather Rev.; Nature; Paleoceanography; Phil. Trans. R. Soc. Lond.; Progr. Oceanogr.; Rev. Geophys. & Space Phys.; Science; Scientia Meteor. Sinica; SIAM Rev.; Tellus; and The Global Atmosphere and Ocean System.

2. Co-author (with Paul H. LeBlond, FRSC) of the widely cited treatise "Waves in the Ocean," Elsevier, 1978; paperback edition, 1980; translated into Russian and Chinese (early 1980s) and into Spanish (1990s); reprinted, 1989.
 3. Over sixty technical reports and atlases.
7. **LECTURES (see also attached list, p. 45)**
1. Over **600** seminars and conference papers (over **380** of these invited) given in Argentina, Austria, Australia, Belgium, Bulgaria, Canada, China, Czech Republic, Denmark, France, Germany, Hong Kong, Hungary, Israel, Italy, Japan, New Zealand, Norway, Portugal, Russia, Slovakia, South Africa, Spain, Sweden, Switzerland, The Netherlands, Ukraine, UK, and USA (29 countries).
 2. In July 1983, I was an invited lecturer on the topics of nonlinear internal waves and lake topographic waves at the summer school "Lake Hydrodynamics," Udine, Italy.
 3. For a list of named distinguished lectureships, see section 3A above.
8. **GRADUATE STUDENTS, PDFs, RESEARCH ASSOCIATES, and SABBATICAL VISITORS (see also attached list of 100 names, p. 68)**
- Note:** My graduate students have won 24 major awards and prizes (exclusive of scholarships), and many of them and my PDFs have become leaders in their field, and now hold leading positions (e.g., directorships, professorships) around the world: PhD students include M.J. Manton (Director emeritus of Bureau of Meteorology Research Centre, Melbourne), D.G. Wright (Senior Scientist at Bedford Institute of Oceanogr., Dartmouth, NS; deceased July 2010), W.W. Hsieh (Professor Emeritus at UBC), G.E. Swaters (Professor at Univ. of Alberta), A.J. Weaver, FRSC (CRC Professor and past Steacie Fellow at Univ. of Victoria); PDFs include E.R. Johnson (Professor at Univ. College London), A.J. Willmott (Head, Dept. of Ocean Science and Technology, Newcastle Univ., UK), M. Ikeda (Professor and Dean Emeritus at Hokkaido Univ., Sapporo, Japan), T. Stocker (Professor and Institute Director, Univ. of Bern, Switzerland), G. Schmidt

(Director of NASA Goddard Inst. for Space Studies, New York).

UBC (1967-86)

1. Supervised the theses of 7 M.Sc. students.
2. Supervised the theses of 9 Ph.D. students.
3. Supported 12 postdoctoral students and research associates.
4. Served as host to 13 sabbatical visitors.

McGill (1986-present)

1. Supervised the theses of 16 M.Sc. students.
2. Supervised the theses of 15 Ph.D. students.
3. Supported 21 postdoctoral students and research associates.
4. Served as host to 5 sabbatical visitors.

9. **TEACHING ACTIVITIES**

Note: In student teaching evaluations, I have consistently received top scores for "enthusiasm for teaching, knowledge of the subject, and openness to questions".

UBC

1. Mathematics: linear algebra, vector and advanced calculus, differential equations, complex variables, applied analysis (methods for partial differential equations), advanced methods (asymptotics, perturbation methods, Wiener-Hopf method, stochastic equations) and applied mathematical modelling.
2. Oceanography: waves, tides, hydrodynamic stability, dynamic oceanography, advanced seminar on physical oceanography.

McGill

1. Meteorology and climatology: dynamic meteorology, climate dynamics and paleoclimate.
2. Oceanography: ocean circulation, ocean physics, Arctic oceanography and climate, introduction to ocean sciences.
3. Earth system science: Introduction.

10. **DEPARTMENTAL AND UNIVERSITY SERVICE AT UBC**

Mathematics Department:

Graduate Affairs Committee (1970-71, 1973-75)

Tenure and Promotion Committee (1974-75)

Instructor-in-charge, Math 255, 256, 300, 165, 400

Chairman of Review Committee (for promotions and tenure, 1979-80, 1980-81)

Appeals Committee (1981)

Undergraduate advisor (1984-85)

Institute of Applied Mathematics and Statistics:

Secretary (1970-71)

Seminar Chairman (1972-73)

Graduate Student Registrar (1973-74)

Search Committee for Director (1973-74)

Acting Director, May, July 1975, Sept. 1978, Dec. 1978

Institute of Applied Mathematics

Newsletter Editor, Oct. 1983 - June 1986

Department of Oceanography:

Member, search committee for Director of Institute of Oceanography, 1977-78

Library Committee (1981-82); Scholarship and Awards Committee (1981-1982)

Building Committee (1984-86) and Graduate Admissions (1984-86)

UBC:

Member of committee which recommended the formation of the Institute of Applied Mathematics and Statistics, 1968-70

Science representative to Faculty of Applied Science (1972-76).

UBC NSERC Postgraduate Fellowship Committee (1981-82).

Committee member for many Ph.D. students in Mathematics, Oceanography, Engineering, Physics, Geophysics and Astronomy.

Have given 20 seminars at the regular colloquia of Oceanography, Mathematics, Applied Mathematics, Mechanical Engineering, Animal Resource Ecology, and Physics.

Have served as chairman for several final Ph.D. orals in Faculty of Graduate Studies.

11. **DEPARTMENTAL AND UNIVERSITY SERVICE AT MCGILL**

Department of Atmospheric and Oceanic Sciences (formerly

Meteorology)

Member, search committee for two new faculty positions, 1986-87.

Departmental representative to Graduate Faculty Council, 1986-1988 and 1995-98.

Member, search committee for new faculty position in climate research, 1987, 1988, 1989.

Member, curriculum committee for graduate program, 1987.

Served as host to 18 invited speakers in the Department during 1986-87.

Served as host to 10 invited speakers in the Department during 1987-88.

Editor of departmental Graduate Studies brochure, 1988.

Served as host to 10 invited speakers in the Department during 1988-89.
Member of Chairman's Advisory Committee, 1988-99.
Served as host to 10 invited speakers in the Department during 1989-90.
Served as host to an average of 12 invited speakers in the Department during 1990-00.
Chairman, Recruitment Committee, 1991-1992, and 1994-98.
Curriculum and Recruitment Committees, 1992-93.
Chair, Curriculum Committee, 1994-95.
Seminar Coordinator, 1995-98.
Chair, Departmental 175th McGill Anniversary Committee, 1995-96.
Admissions Committee, 1996-00, 2001-04; Chair, 2004-05.
Member, Search Committee for new faculty member in environmental chemistry, 1998 and 2001-02.
Chair, Full Professor Promotion Committee, 2000-02.
Graduate Program Director, 2004-07.
Member, Search Committee for new faculty members for ESS position, winter 2005.

McGill, outside of Department

Internal examiner for several Ph.D. theses in Oceanography, Biology, Economics and Meteorology, 1987-present.
Faculty of Science elected representative on Senate, 1987-1990.
Member, Physical Sciences & Engineering Area Library Advisory Committee, 1987-88.
Member, Burnside Hall Ad-Hoc Project Group, 1987-88.
Founding member, Ad-Hoc Committee of Concerned Scholars, 1987.
Member, Statutory Selection Committee, for two Chairs in Earth Sciences, 1988.
Member, Burnside Hall "Geosciences Library" Working Committee, 1988-89.
Member, Faculty of Science Tenure Committee, 1989-90.
Member, Beatty Subcommittee for lecture series "The Listening Earth" (featuring N. Myers, F. Bretherton and D. Boorstin), 1989-90.
Member, Cyclic Review Committee for Dept. of Physics, 1990.
Member, Statutory Selection Committee for two Chairs in Renewable Resources, 1990.
Member, Cyclic Review Committee for Dept. of Renewable Resources, 1991.
Pro-Dean, for PhD final oral in School of Computer Science, June 1995.
Co-Chair, Organizing Committee for the CCGCR Public Conference (Feb. 23, 1996, Montreal) "Should we (still) be concerned about Greenhouse Warming?"
Member, Statutory Selection Committee for Chair in Engineering, 1996.
Member, Selection Committee for Staff Service Awards in Faculty of Science, 1997.
Member, Beatty Memorial Lectures Committee, 1997-2000.

Member, Search Committee for Director, School of the Environment, 1998.
 Pro-Dean, for PhD final oral in Chemistry, July 1998.
 Chair, Selection Committee for "The Faculty of Science Excellence Award", 1999.
 Member, Statutory Selection Committee for Chair in Mathematics and Physics, 1999.
 Member, CCGCR Executive (in charge of Centre Colloquia), 1999-2000.
 Coordinator, Memorial Symposium (Nov. 23, 1999) in honour of former McGill MSc and PhD student Tertia Hughes, who died tragically Nov. 23, 1998.
 Member, Search Committee for joint position in the McGill School of Environment and the Faculty of Law.
 Executive Member of CCGCR, 1999-2000 (Colloquium Chair), 2001-02 (Newsletter Editor).
 Member, Scholarly Awards Committee, 1999-2000.
 Pro-Dean, for PhD final oral in Geography, Feb. 2000.
 Member, Statutory Selection Committee for Chair in Mathematics, 2000.
 Member, Statutory Selection Committee for Chair in Atmos. & Oceanic Sciences, 2001.
 Chair, Search Committee for Director of CCGCR, 2002.
 Member, Selection Committee for David Thomson Award for Excellence in Graduate Student Supervision and Teaching, 2002-04.
 Pro-Dean, for PhD final oral in Anthropology, 2002.
 Member, Statutory Selection Committee for Chair in Music, 2002.
 Pro-Dean, for PhD final oral in Civil Engineering, 2003.
 Member, Honorary Degrees and Convocations Committee, 2002-05.
 Chair, Ad-hoc Nominations Committee for Academy of Science, RSC, 2001-present.
 Pro-Dean, for PhD final oral in Bio-medical Engineering, 2004.
 Council member, MAUT, 2004-06.
 Pro-Dean for PhD final oral in Chemical Engineering, 2005.
 Senate Representative on Tenure Committee in Faculty of Music, 2006-08.
 Committee on Student Standing, 2008-2010
 Co-organizer, Cutting Edge Lectures in Science, Redpath Museum, 2008-present.
 Pro-Dean for many PhD final orals in engineering, medicine and science, 2006-present.
 Member of selection committee for Principal's Prize for "outstanding emerging researchers", 2014, 2015, 2016 and 2017.

12. **REFEREEING AND RELATED ACTIVITIES**

1. Referee for most of the journals listed in Sec. 6 (PUBLICATIONS) as well as for about 15 other journals (e.g., Deep-Sea Res., Oceanolog. Acta, Phys. Fluids, J. Appl. Math. and Phys., Pure and Applied Geophys., J. Atmos. Sci., J. Austral. Math. Soc., SIAM J. Appl. Math., Applied Math. Modelling, Continental Shelf Res., Biol. Oceanogr., J. Oceanogr. Soc.

- Japan, Polar Res....).
2. Referee for NATO, NSERC, NSF, ONR, NOAA, U.K., Norwegian, Swedish, Swiss, Belgian, Cyprus and Australian research grant applications.
 3. Provided letters of reference for over 500 applicants seeking promotion or senior academic or research positions in Australia, Canada, England, Germany, Japan, New Zealand, South Africa, Switzerland and USA.
13. **MEMBERSHIPS IN PROFESSIONAL SOCIETIES**
1. The Royal Society of Canada (elected a Fellow in 1986) - the national academy of the sciences and humanities. Life Member.
 2. Canadian Applied and Industrial Mathematics Society.
 3. Canadian Meteorological and Oceanographic Society; named an inaugural Fellow in 1999.
 4. Academia Europaea, elected a Foreign Member in 2000.
 5. American Meteorological Society; elected a Fellow in 1999.
 6. American Geophysical Union; elected a Fellow in 2000.
 7. European Geosciences Union; appointed Honorary Member in 2006.
14. **PERSONAL INTERESTS AND ACTIVITIES**
1. **Interests:**
Music, theatre, bridge, travel, golf, hiking, cross-country skiing, canoeing, tennis, reading (especially biography), and world affairs.
 2. **Languages:**
Some speaking and reading facility in French, German and Ukrainian.
 3. **Public Service (past and present):**
Interviewer (1974-76) of applicants from UBC for positions with Can. University Service Overseas.
Performer on flute (1980-present) at schools, hospitals and senior citizens homes. Ten performances given in Montreal and Westmount, 2011-2014.
Assistant Cub Master (1984-86) in the Boy Scouts organization.
Member (1989-90) of Westmount Rotary Club of Rotary International.
Lecturer for schools, community organizations and service clubs on "Climate and global change".
Radio, Newspaper and Television Consultant on environmental, climate and global change issues, and other science and scholarly issues.
Member (1994-present) of flute section of "I Medici di McGill", a Student and Faculty Symphony Orchestra based in the McGill Faculty of Medicine. Member of the Orchestra Executive since 2002. In May and Sept. 1996, appeared as Soloist in Vivaldi Concerto for two flutes in C Major. Soloist in Heineke Concerto for two flutes and two horns, April 2010. Soloist in Gluck's Dance of the Blessed Spirits, April 2013.
Order of Canada mentor, 2009-2010

15. **SUMMARY OF INNOVATIVE CONTRIBUTIONS**

In addition to my various research achievements, my career has been marked by a series of initiatives, many of which continue on to this day. These include:

1. Founding member of the Institute of Applied Math. and Statistics, UBC (1970).
2. Co-author of the first comprehensive (600 pp.) treatise on Ocean Waves (1978).
3. Principal Investigator of first sockeye salmon-climate interaction study, Project MOIST: Meteorological and Oceanographic Influences on Sockeye Tracks (1984-1987).
4. Initiated the oceans and climate research and graduate program at McGill (1986), and the name change of the McGill Dept. of Meteorology to the Dept. of Atmospheric and Oceanic Sciences (1992).
5. Founding Director of McGill's Centre for Climate and Global Change Research (1990-1996).
6. First President of the Canadian Academy of Science of the RSC elected to this position in a contested ballot (served for the period 1993-1996).
7. Organized the first regional meetings of the Canadian Academy of Science (1993-1996).
8. Instituted the program of "Inaugural Lectures" by newly elected Canadian Academy of Science Fellows (1995).
9. Founding Chair of PAGSE: Partnership Group for Science and Engineering, an umbrella organization under the aegis of the Canadian Academy of Science (1995).
10. Initiated (with Jurij Darewych, York Univ.) the Exchange Lecture Series between the Royal Society of Canada and the Ukrainian Academy of Sciences (1995).
11. Established and endowed the "Stephen and Anastasia Mysak Graduate Fellowship" in the McGill Department of Atmospheric and Oceanic Sciences (2006). This is the first endowed McGill Major Graduate Fellowship in the department, and it is given annually to a meritorious MSc or PhD graduate student in air-sea interaction, oceanography, or climate.
12. Established and endowed, together with 75 donors, the "Mary Mysak Prize" in the McGill Faculty of Religious Studies, for highest standing obtained by a graduating student in Asian Religions (2012).
13. Established and endowed the "Lawrence A. Mysak Prize for Woodwinds" in the Schulich School of Music at McGill, for an undergraduate student studying any woodwind instrument (2015). This is the first endowed prize for woodwinds in the School of Music.
14. Established and endowed the "Lawrence A. Mysak Award in Science" in the

Faculty of Science, Univ. of Alberta. The award is for an undergraduate student studying ocean, atmospheric or climate (including paleoclimate) sciences (2016).

Amplification of CV, Section 6: Publications of LAWRENCE A. MYSAK

NOTE: The * denotes significant publications that are described in the document "Achievements in Research", which is located at the end of the CV (p. 74).

Refereed Journal Publications

2017

174. Brault, M-O., L.A. Mysak and H.D. Matthews, Carbon-cycle implications of terrestrial weathering changes since the last glacial maximum. FACETS, doi: 10.1139/facets-2016-0040.

2016

173. Marson, J.M., L.A. Mysak, M.M. Mata and I. Wainer, Evolution of the deep Atlantic water masses since the last glacial maximum based on a transient run of NCAR-CCSM3. Climate Dynamics, Published online 28 Oct. 2015, doi: 10.1007/s00382—015-2876-7
172. Simmons, C.T., H.D. Matthews and L.A. Mysak, Deglacial climate, carbon cycle and ocean chemistry changes in response to a terrestrial carbon release. Climate Dynamics, 46, 1287-1299, doi: 10.1007/s00382-015-2646-6.

2013

171. Brault, M.-O., L.A. Mysak, H.D. Matthews and C.T. Simmons. Assessing the impact of late Pleistocene megafaunal extinctions on global vegetation and climate. Climate of the Past, 9, 1761-1771, doi:10.5194/cp-9-1761-2013.
170. Simmons, C.T., L.A. Mysak and H.D. Matthews. Investigation of the natural carbon cycle since 6000 B.C. using an intermediate complexity model: The role of Southern Ocean ventilation and marine ice shelves. Atmosphere-Ocean, 51:2, 187-212, doi:10.1080/07055900.2013.773880.

2012

- *169. *Damyanov, N.N., H.D. Matthews and L.A. Mysak. Observed decreases in the Canadian outdoor skating season due to recent winter warming. Environmental Research Letters, 7 (8pp), doi:10.1088/1748-9326/7/1/014028.
- *168. Simmons, C.T. and L.A. Mysak. Stained glass and climate change: How are they connected? Atmosphere-Ocean, 50:2, 219-240.

2011

- *167. Carozza, D.A., L.A. Mysak and G.A. Schmidt. Methane and environmental change during the Paleocene-Eocene thermal maximum (PETM): Modeling the PETM onset as a two-stage event. Geophysical Research Letters, 38, L05702, doi: 10.1029/2010GL046038.

2010

166. Antico, A., O. Marchal, L.A. Mysak and F. Vimeux. Meridional moisture flux in the atmosphere and deuterium excess in polar ice: insight from a zonally-averaged ocean-atmosphere model. *Journal of Climate*, 23: 4841-4855.
165. Antico, A., O. Marchal and L.A. Mysak. Time-dependent response of a zonally-averaged ocean-atmosphere-sea ice model to Milankovitch forcing. *Climate Dynamics*, 34: 763-779, DOI: 10.1007/s00382-010-0790-6.
164. Jahn, A., B. Tremblay, R. Newton, M.M. Holland, L.A. Mysak and I.A. Dmitrenko. A tracer study of the Arctic Ocean's liquid freshwater export variability. *Journal of Geophysical Research*, 115, C07015, DOI:10.1029/2009JC005873.
163. Yang, S., D.A. Carozza and L.A. Mysak. Re-tuning the Walker-Kasting global carbon cycle box model using a parameter sensitivity analysis. *McGill Science Undergraduate Research Journal*, 5: 67-72.
- *162. Simmons, C.T. and L.A. Mysak. The transmissive properties of medieval and renaissance stained Glass in European churches, *Architectural Science Review*, 53: 251-274, DOI: 10.3763/asre.2009.0073
161. Jahn, A., B. Tremblay, L.A. Mysak and R. Newton. Effect of the large-scale atmospheric circulation on the variability of the Arctic Ocean freshwater export. *Climate Dynamics*, 34: 201-222. DOI: 10.1007/s00382-009-0558-z.
- 2009
160. Wang, Y., N.T. Roulet, S. Frohling and L.A. Mysak. The importance of Northern Peatlands in global carbon systems during the Holocene, *Climate of the Past*, 5: 683-693. Corrigendum, 5: 721-722.
- *159. Sedlacek, J. and L. A. Mysak. A model study of the Little Ice Age and beyond: changes in ocean heat content, hydrography, and circulation since 1500. *Climate Dynamics*, 33: 361-475, DOI: 10.1007/s00382-008-0503-6.
- *158. Sedlacek, J. and L.A. Mysak. Sensitivity of sea ice to wind stress and radiative forcing since 1500: A model study of the Little Ice Age and beyond. *Climate Dynamics*, 32: 817-831. DOI: 10.1007/s00382-008-0406-6.
- 2008
157. Lemieux, J.F., L.B. Tremblay, S. Thomas, J. Sedlacek and L.A. Mysak. Using the Generalized Minimum RESidual (GMRES) method to solve the sea-ice momentum equation. *Journal of Geophysical Research*, 113, C10004, DOI: 10.1029/2007JC004680.
156. Mysak, L.A., Glacial inceptions: Past and future. *Atmosphere-Ocean*, 46: 317-341, DOI: 10.3137/ao.460303.
- 2007

- *155. Sedlacek, J., J.-F. Lemieux, L.A. Mysak, L.B. Tremblay and D.M. Holland. The granular sea ice model in spherical coordinates and its application to a global climate model. *Journal of Climate*, 20: 5946-5961, DOI: 10.1175/2007JCLI1664.1

2006

- *154. Wang, Z. and L.A. Mysak. Glacial abrupt climate changes and Dansgaard-Oeschger Oscillations in a coupled climate model. *Paleoceanography*, 21: PA2001, DOI 10.1029/2005PA001238.
- *153. Cochelin, A.-S.B., L.A. Mysak and Z. Wang. Simulation of long-term future climate changes with the Green McGill Paleoclimate Model: The next glacial inception. *Climatic Change*, 79: 381-410, DOI 10.1007/s10584-006-9099-1.
- *152. Papa, B.D., L.A. Mysak and Z. Wang. Intermittent ice sheet discharge events in northeastern North America during the last glacial period. *Climate Dynamics*, 26: 201-216, DOI 10.1007/s00382-005-0078-4.

2005

151. Rahmstorf, S., M. Crucifix, A. Ganopolski, H. Goosse, I. Kamenkovich, R. Knutti, G. Lohmann, R. Marsh, L.A. Mysak, Z. Wang and A. Weaver. Thermohaline circulation hysteresis: a model intercomparison. *Geophysical Research Letters*, 32, L23605, DOI 10.1029/2005GL023655.
- *150. Wang, Y., L.A. Mysak and N.T. Roulet. Holocene climate and carbon cycle dynamics: Experiments with the "green" McGill Paleoclimate Model. *Global Biogeochemical Cycles*, 19: GB3022. DOI 10.1029/2005GB002484.
- *149. Wang, Y. and L.A. Mysak. Response of the ocean, climate and terrestrial carbon cycle to Holocene freshwater discharge. *Geophysical Research Letters*, 32: L15705, DOI 10.1029/2005GL023344.
- *148. Wang, Z., A.-S. Cochelin, L.A. Mysak and Y. Wang. Simulation of the last glacial inception with the green McGill Paleoclimate Model. *Geophysical Research Letters*, 32: L12705. DOI 10.1029/2005GL023047.
147. Petoukhov, V., M. Claussen, A. Berger, M. Crucifix, M. Eby, A.V. Eliseev, T. Fichefet, A. Ganopolski, H. Goosse, I. Kamenkovich, I. Mokhov, M. Montoya, L.A. Mysak, A. Sokolov, P. Stone, Z. Wang and A.J. Weaver. EMIC intercomparison project (EMIP - CO₂): Comparative analysis of EMIC simulations of current climate and equilibrium and transient responses to atmospheric CO₂ doubling. *Climate Dynamics*, 25: 363-385, DOI 10.1007/s00382-005-0042-3.
- *146. Wang, Y., L.A. Mysak, Z. Wang and V. Brovkin. The greening of the McGill Paleoclimate Model. Part II: Simulation of natural millennial-scale variability during the Holocene. *Climate Dynamics*, 24: 481-496. DOI 10.1007/s00382-004-0516-8.
- *145. Wang, Y., L.A. Mysak, Z. Wang and V. Brovkin. The greening of the McGill Paleoclimate Model. Part I: Improved land surface scheme with vegetation dynamics. *Climate Dynamics*, 24: 469-480. DOI 10.1007/s00382-004-0515-9
- *144. Mysak, L. A., K.M. Wright, J. Sedlacek and M. Eby. Simulation of sea ice and ocean variability in the Arctic during 1955-2002 with an intermediate

complexity model. *Atmosphere-Ocean*, 43: 101-118.

2004

143. Wang, Z., R.-M. Hu and L.A. Mysak. Reply to the comment on the Paper "A Parameterization of Solar Energy Disposition in the Climate System" (Wang et al. 2004). *Atmosphere-Ocean*, 42(4): 295-296.
142. Wang, Z., R.-M. Hu, L.A. Mysak, J.-P. Blanchet and J. Feng. A parameterization of solar energy disposition in the climate system. *Atmosphere-Ocean*, 42: 113-125.

2003

141. Newbigging, S.C., L.A. Mysak and W.W. Hsieh. Improvements to the Nonlinear Principal Component Analysis method, with applications to ENSO and the QBO. *Atmosphere-Ocean*, 41: 291-299.
140. Armstrong, A.E., L.-B. Tremblay and L.A. Mysak. A data-model intercomparison study of Arctic sea-ice variability. *Climate Dynamics*, 20: 465-476.
139. Smith, G.C., L.A. Mysak, Z. Wang and H. Blatter, McGill paleoclimate model ice sheet sensitivity to ice flow rate and discharge parameters. *Climate Dynamics*, 20: 315-323.

2002

- *138. Wang, Z., and L.A. Mysak. Simulation of the last glacial inception and rapid ice sheet growth in the McGill Paleoclimate Model. *Geophysical Research Letters*, 29(23): 2102, DOI 10.1029/2002GL015120.
- *137. Claussen, M., L.A. Mysak, A.J. Weaver, M. Crucifix, T. Fichefet, M.-F. Loutre, S.L. Weber, J. Alcamo, V.A. Alexeev, A. Berger, R. Calov, A. Ganopolski, H. Goosse, G. Lohmann, F. Lunkeit, I.I. Mokhov, V. Petoukhov, P. Stone and Z. Wang. Earth system models of intermediate complexity: closing the gap in the spectrum of climate system models. *Climate Dynamics*, 18: 579-586.
136. Wang, Z., L.A. Mysak and J.F. McManus. Response of the thermohaline circulation to cold climates. *Paleoceanography*, 17(1), DOI 10.1029/2000PA000587, 2002.

2001

135. Newbigging, S.C, L.A. Mysak and Z. Wang. A stabilizing atmospheric feedback to the thermohaline circulation. *The Global Atmosphere and Ocean System*, 7: 347-364.
134. Mysak, L.A., Patterns of Arctic Circulation. *Science*, 293: 1269-1270.
133. Royer, T.C., C.E. Grosch and L.A. Mysak, Interdecadal variability of Northeast Pacific coastal freshwater and its implications on biological productivity. *Progress in Oceanography*, 49: 95-111.
- *132. Wang, Z., and L.A. Mysak. Ice sheet-thermohaline circulation interactions in a climate model of intermediate complexity. *Journal of Oceanography (JO)*, 57: 481-494. Received the 'Hidaka Scientific Paper Award' for publications in JO, 2001.
- *131. Bjornsson, H., A.J. Willmott, L.A. Mysak and M.A. Morales Maqueda. Polynyas in a high resolution dynamic-thermodynamic sea ice model and their parameterization using flux models. *Tellus*, 53A: 245-265.

- *130. Bjornsson, H., and L.A. Mysak. Present-day and last-glacial-maximum ocean thermohaline circulation in a zonally averaged coupled ocean-sea ice-atmosphere model. *Journal of Climate*, 14: 1422-1439.

2000

129. Mysak, L.A., and Z. Wang. The McGill Paleoclimate Model (MPM): A new Earth system model of intermediate complexity. *CMOS Bulletin SCMO*, 28: 104-109.
128. Wang, Z., and L.A. Mysak. Are there interannual-to-decadal scale oscillations associated with sea ice-thermohaline circulation interactions in a simple coupled atmosphere-ocean-sea ice model? *Scientia Meteorologica Sinica*, 20: 413-425.
- *127. Venegas, S.A., and L.A. Mysak. Is there a dominant timescale of natural climate variability in the Arctic? *Journal of Climate*, 13: 3412-3434.
- *126. Wang, Z., and L.A. Mysak. A simple coupled atmosphere-ocean-sea ice-land surface model for climate and paleoclimate studies. *Journal of Climate*, 13: 1150-1172.
- *125. Arfeuille, G., L.A. Mysak and L.- B. Tremblay. Simulation of the interannual variability of the wind driven Arctic sea ice cover during 1958-1998. *Climate Dynamics*, 16: 107-121. **Note:** This paper was awarded the Third Annual ARCUS Award for Arctic Research Excellence.

1999

124. Yi, D., L.A. Mysak and S.A. Venegas. Decadal-to-interdecadal fluctuations of Arctic sea-ice cover and the atmospheric circulation during 1954-1994. *Atmosphere-Ocean*, 37: 389-415.

1998

- *123. Mysak, L.A., and S.A. Venegas. Decadal climate oscillations in the Arctic: A new feedback loop for atmosphere-ice-ocean interactions. *Geophysical Research Letters*, 25: 3607-3610.
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10. Mysak, L.A., Decadal-scale variability of ice cover and climate in the Arctic Ocean and Greenland and Iceland seas. In "Natural Climate Variability on Decade-to-Century Time Scales", edited by D.G. Martinson, K. Bryan, M. Ghil, M.M. Hall, T.R. Karl, E.S. Sarachik, S. Sorooshian and L.D. Talley. U.S. National Academy Press, Washington, DC, pp. 253-261.
11. Mysak, L.A., Interdecadal climate variability at northern high latitudes: observations and models. Contribution No. 78, Institute of Astronomy and Geophysics G. Lemaître, Catholic Univ. of Louvain, Louvain-la-Neuve, Belgium, 24pp. + 12 figs.

1999

12. Mysak, L.A., Interdecadal variability at northern high latitudes. In "Beyond El Niño: Decadal and Interdecadal Climate Variability", edited by A. Navarra, Springer-Verlag, pp. 1-24.

2001

13. Mysak, L.A., Arctic sea ice and its role in climate variability and change. In "Continuum Mechanics and Applications in Geophysics and the Environment" (Dedicated to Prof. Kolumban Hutter on the occasion of his 60th birthday - Jan. 22, 2001), edited by B. Straughan, R. Greve, H. Ehrentraut and Y. Wang, pp. 326-336, Springer-Verlag, Berlin.

2016

14. Bryden, H.L., and L.A. Mysak, Ocean Circulation: Knowns and Unknowns. In "Global Change and Future Earth: The Geodetic and Geophysical Perspective", edited by T. Beer et al., pp. ddd-yyy, Cambridge Univ. Press, to appear in 2017.

Non-refereed Publications

1985

1. Mysak, L.A., K. Hamilton, and C. Groot, Year-to-year changes in the migration routes of the Fraser River sockeye salmon. *Discovery*, 14: 40-43.

1986

2. Mysak, L.A., Book review of "Predictability of Fluid Motions (La Jolla Institute--1983)," edited by Greg Holloway and Bruce J. West. *Marine Geodesy*, 10: 85-87.

1987

3. Mysak, L.A., McGill's Climate Research Group. *Can. Appl. Math. Soc. Newsletter*, No. 23, pp. 1-2; *Climatol. Bull.*, 21(2): 26-27; *EOS*, 68(22), p. 554.

1988

4. Mysak, L.A., McGill University Climate Research Group. *Ice Community Newsletter*, Canada Centre for Remote Sensing, 7, p. 14; *CO₂/Climate Report*, Environment Canada, 88-2.

1990

5. Mysak, L.A., Centre for Climate and Global Change Research. *Climatol. Bull.*, 24(3): 180-181; *Delta*, vol. 1, No. 2, p. 4.

2000

6. Mysak, L.A., and A. Mansi, The Hughes Memorial Symposium: A tribute to the legacy of Dr. Tertia M.C. Hughes, 1967-1988. *CMOS Bulletin*, 28, No.1: 18-20

2002

7. Wang, Z., and L.A. Mysak, The McGill Paleoclimate Model (MPM): History, development and its recent applications. *C²GCR Quarterly*, No. 2002-2: 6-14, McGill Univ.

2015

8. Dence, M.R., and L.A. Mysak, The Willet G. Miller Medal of the Royal Society of Canada. *Bulletin of the Academy of Science, RSC*, Aug., 2 pp.

2016

8. Mysak, L.A., The Canada-Ukraine Exchange: A Brief History and Current Status. *Bulletin of the Academy of Science, RSC*, Dec., 3 pp.

Technical Reports and Atlases (unrefereed)

1960

1. Mysak, L.A., and T.V. Jacobson, A survey of geomagnetic impulses observed

during solar cycle 1949-59. Memorandum, Defence Research Telecommunications Establishment, Defence Research Board (DRB), Ottawa, Ont., 49 pp.

1961

2. Mysak, L.A., On the velocity profile for flow past a hemispherically-tipped cone. Pacific Naval Laboratory (PNL) Note 61-15 D.R.B., Esquimalt, B.C., 34 pp.
3. Mysak, L.A., Determination of the boundary layer velocity profile for flow past a hemispherically-tipped cone using an approximate method. PNL Note 61-16, D.R.B., Esquimalt, B.C., 9 pp.

1976

4. Mysak, L.A., Shelf and planetary wave propagation along the British Columbia Coast. Institute of Ocean Sciences Internal Report, Patricia Bay, B.C., 10 pp.

1979

5. Helseth, J.M., L.A. Mysak, and C.C. Ebbesmeyer, A study of internal waves and their effect on offshore oil operations. A special report prepared for Mobile Research and Development Corp., 102 pp.

1981

6. Mysak, L.A., and D.O. Hodgins, Preliminary study of internal solitary waves in Davis Strait. A special report prepared for Aquitane Co. of Canada Ltd., 21 pp.
7. Mysak, L.A., Satellite images and their use in modelling ocean circulation. In "Modern Developments in the Uses of Mathematics," G. Bluman (ed.). Technical Rept. No. 15, Inst. Appl. Math. Stat., UBC, 14 pp.

1984

8. Mysak, L.A., El Nino, interannual variability and fisheries in the Northeast Pacific Ocean. Technical Report No. 84-17, Institute of Applied Mathematics, UBC, 137pp.

1985

9. Hamilton, K., and L.A. Mysak, The possible effects of the Sitka Eddy on sockeye and pink salmon migration off southeast Alaska. Technical Report No. 85-1, Institute of Applied Mathematics, UBC, 26 pp.

1986

10. Mysak, L.A., A note on "El Nino, interannual variability and fisheries in the northeast Pacific Ocean" (Addendum to Rept. No. 84-17). Technical Report No. 86-1, Institute of Applied Mathematics, UBC, 7 pp.
11. Weaver, A.J., and L.A. Mysak, Seasonal oceanic heat flux anomaly charts for the North Pacific 1950-1979. Manuscript Report No. 46, Dept. of Oceanography, UBC, 133 pp.
12. Weaver, A.J., and L.A. Mysak, Statistical relationships between atmospheric surface pressure, 500 & 700 mb geopotential heights and oceanic heat flux anomalies over the Kuroshio Region. Manuscript Report No. 47, Dept. of Oceanography, UBC, 116 pp.

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13. Weaver, A.J., L.A. Mysak and A.F. Bennett, The steady state response of the atmosphere to midlatitude heating with various zonal structures. Climate Research Group Report No. 87-1, Dept. of Meteorology, McGill Univ., 58 pp.
14. Allingham, A.M., K. Hamilton and L.A. Mysak, Climatic Atlas Of The North Atlantic - Seasonal sea level pressures and sea surface temperature anomalies, 1919-1979. Climate Research Group Report No. 87-4, Dept. of Meteorology, McGill Univ., 248 pp.
15. Weaver, A.J., and L.A. Mysak, A time dependent model of the atmospheric response to midlatitude heating with various zonal structures. Climate Research Group Report No. 87-7, Dept. of Meteorology, McGill Univ., 41 pp.
16. Manak, D.K., and L.A. Mysak, Climatic Atlas of Arctic Sea Ice Extent and Anomalies, 1953-1984. Climate Research Group Report No. 87-8, Dept. of Meteorology, McGill Univ.
17. Cherniawsky, J.Y., L.A. Mysak, C.A. Lin and C.W. Yuen, Numerical Experiments with a Two-Layer Upper-Ocean Box Model: I. Initialization and Wind-Driven Deepening of the Mixed Layer. Climate Research Group Report No. 87-9, Dept. of Meteorology, McGill Univ.
18. Yuen, C.W., C.A. Lin, L.A. Mysak and J.Y. Cherniawsky, Preliminary Results of a Two-Layer Upper-Ocean General Circulation Model Forced at the Surface. Climate Research Group Report No. 87-10, Dept. of Meteorology, McGill Univ.

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19. Mysak, L.A., and C.A. Lin, NSERC/AES Industrial Research Chairs in Climatology, McGill University. Annual Progress Report. Climate Research Group Report No. 88-1, Dept. of Meteorology, McGill Univ., 15pp.
20. Willmott, A.J., and L.A. Mysak, A simple steady-state coupled ice-ocean model, with application to the Greenland-Norwegian Sea. Climate Research Group Report No. 88-4, Dept. of Meteorology, McGill Univ., 44 pp+ 16 figures.
21. Mysak, L.A., and D.K. Manak, Arctic sea ice extent and anomalies, 1953-1984. Climate Research Group Report No. 88-8, Dept. of Meteorology, McGill Univ., 39 pp + 25 figures.
22. Wood, R.G., and L.A. Mysak, A simple ice-ocean model for the Greenland Sea. Climate Research Group Report No. 88-11, Dept. of Meteorology, McGill Univ., 32 pp + 8 figures.
23. Manak, D.K., and L.A. Mysak, Atlas of April and July Arctic ice edge limits, 1901-1956. Climate Research Group Report No. 88-12, Dept. of Meteorology, McGill Univ., 106 pp.

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24. Mysak, L.A., and C.A. Lin, NSERC/AES Industrial Research Chairs in Climate

- Research, McGill Univ. Annual Progress Report. Climate Research Group Report No. 89-4, Dept. of Meteorology, McGill Univ., 14 pp.
25. Mysak, L.A., and C.A. Lin, The oceans' role in climate variability and climate change. Climate Research Group Report No. 89-9, Dept. of Meteorology, McGill Univ., 29 pp. + 12 figures.
 26. Mysak, L.A. (Editor), Proceedings of the sixteenth Stanstead Seminar "High-latitude climate processes, with special emphasis on large scale air-ice-sea interactions". Climate Research Group Report No. 89-12, Dept. of Meteorology, McGill Univ., 142 pp.
 27. Stocker, T.F., and L.A. Mysak, Climatic fluctuations on the century timescale; A review of high-resolution proxy-data. Climate Research Group Report No. 89-13, Dept. of Meteorology, McGill Univ., 27 pp. + 17 figures.
 28. Mysak, L.A., D.K. Manak and R.F. Marsden, Sea-ice anomalies observed in the Greenland and Labrador Seas during 1901-1984 and their relation to an interdecadal Arctic climate cycle. Climate Research Group Report No. 89-14, Dept. of Meteorology, McGill Univ., 52 pp + 24 figures.

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29. Stocker, T.F., D.G. Wright and L.A. Mysak, Experiments with a coupled, zonally averaged atmosphere-ocean model: variability of the thermohaline circulation. Centre for Climate and Global Change Research Report No. 90-4, McGill Univ., 17 pp + 5 figures.
30. Manak, D.K., and L.A. Mysak, Simulation of the seasonal Arctic sea-ice cover with a dynamic thermodynamic sea-ice model. Centre for Climate and Global Change Research Report No. 90-10, McGill Univ., 72pp.
31. Mysak, L.A., and S.B. Power, Greenland Sea ice and salinity anomalies and interdecadal climate variability. Centre for Climate and Global Change Research Report No. 90-16, McGill Univ., 18 pp + 9 figures.
32. Power, S.B., L.A. Mysak, W.L. Chapman, and J.E. Walsh, Climatic Atlas of the Northern Hemisphere Seasonal and Annual Mean Sea-level Pressures, 1952-1987. Centre for Climate and Global Change Research Report No. 90-17, McGill Univ., 192 pp.

1991

33. Mysak, L.A., Current and future trends in Arctic climate research: Can changes of the Arctic sea ice be used as an early indicator of global warming? Centre for Climate and Global Change Research Report No. 91-1, McGill Univ., 27 pp + 6 figures.
34. Wang, J., and L.A. Mysak, Climatic atlas of seasonal sea-level pressure and sea-ice concentration in the Hudson Bay-Baffin Bay-Labrador Sea region: 1953-1988. Centre for Climate and Global Change Research Report No.91-5, McGill Univ., 103 pp.
35. Power, S.B., and L.A. Mysak, Interannual variability of sea-level pressure, sea-ice and runoff over the Arctic. Centre for Climate and Global Change Research Report No. 91-6, McGill Univ., 41 pp + 26 figures.

36. Mysak, L.A., and C.A. Lin, AES/NSERC Industrial Research Chairs (IRC) in Climate Research McGill University. Second Term Renewal (57 months) Progress Report. Centre for Climate and Global Change Research Report No. 91-9, McGill Univ., 25pp.
37. Mysak, L.A., Report to the Principal for 1990-91. Centre for Climate and Global Change Research Report No. 91-10, McGill Univ., 22pp.
38. Peng, S., and L.A. Mysak, A teleconnection study of interannual sea surface temperature fluctuations in the northern North Atlantic and precipitation and runoff over western USSR. Centre for Climate and Global Change Research Report No. 91-13, McGill Univ., 35pp + 16 figures.
39. Mysak, L.A., and J. Wang, Climatic atlas of seasonal and annual Arctic sea-level pressures, SLP anomalies and sea-ice concentrations, 1953-88. Centre for Climate and Global Change Research Report No. 91-14, McGill Univ., 194pp.
40. Holland, D.M., L.A. Mysak and J. M. Oberhuber, Simulation of the seasonal Arctic sea-ice cover with a dynamic thermodynamic sea-ice model. C²GCR Rept. 91-17, McGill Univ., 68pp.
41. Mysak, L.A., T.F. Stocker and F. Huang, Century-scale variability in a randomly forced, two-dimensional thermohaline ocean circulation model. C²GCR Rept. 91-21, McGill Univ., 29pp + 15 figures.
42. Holland, D.M., L.A. Mysak and J.M. Oberhuber, Sensitivity study of a dynamic thermodynamic sea-ice model. C²GCR Rep. 91-22, McGill Univ., 68pp + figures.

1992

43. Mysak, L.A., A. Cossette and I. McKendry (Editors), Proceedings of the Second Annual C²GCR Student Day. C²GCR Rep. 92-7, McGill Univ., 18pp.
44. Mysak, L.A., Report to the Principal for 1991-92. C²GCR Rep. No. 92-10, McGill Univ., 24pp.
45. Mysak, L.A., and S.B. Power, Sea-ice anomalies in the western Arctic and Greenland-Iceland Sea and their relation to an interdecadal climate cycle. C²GCR Rep. No. 92-17, McGill Univ., 39pp + figures.

1993

46. Mysak, L.A., M. Bess, J. Bubier and M. Klasa (Editors), Proceedings of the Third Annual C²GCR Student Day. C²GCR Rep. No. 93-6, McGill Univ.
47. Mysak, L.A., Report to the Principal for 1992-93. C²GCR Rep. No. 93-9, McGill Univ., 23 pp.
48. Darby, M.S., A.J. Willmott and L.A. Mysak, A nonlinear steady-state model of the north water polynya, Baffin Bay. C²GCR Rep. No. 93-16, McGill Univ.
49. Peng, S., L.A. Mysak, H. Ritchie, J. Derome and B. Dugas, On the differences between early and middle winter atmospheric responses to sea surface temperature anomalies in the northwest Atlantic. C²GCR Rep. No. 93-18, McGill Univ.
550. Tyler, R.H., and L.A. Mysak, The potential for using geomagnetic data in ocean

and climate studies. I: Theory of electromagnetic fields induced by ocean currents. C²GCR Rep. No. 93-20, McGill Univ., 46 pp. + 14 figures.

1994

51. Tyler, R.H., and L.A. Mysak, The potential for using geomagnetic data in ocean and climate studies. II: Electrodynamics in a rotating frame of reference. C²GCR Rep. No. 94-2, McGill Univ.
52. Mysak, L.A., R.G. Ingram and J. Wang, The anomalous sea-ice extent in Hudson Bay,, Baffin Bay and the Labrador Sea during the simultaneous ENSO and NAO episodes of 1972/73 and 1982/83. C²GCR Rep. No. 94-8, McGill Univ.
53. Tyler, R.H., and L.A. Mysak, The potential for using geomagnetic data in ocean and climate studies. III: Electromagnetic fields induced by idealized ocean currents. C²GCR Rep. No. 94-9, McGill Univ.

1995

54. Schmidt, G.A., and L.A. Mysak, The stability of a zonally averaged thermohaline circulation model. C²GCR Rep. No. 95-1, McGill Univ., 31 pp.
55. Wang, J., A. Van der Baaren and L.A. Mysak, A principal component analysis of gridded sea-level pressure, surface air temperature, and sea-ice concentration of the Arctic region, 1953-93. C²GCR Rep. No. 95-4, McGill Univ., 18pp + figs.
56. Tyler, R.H., and L.A. Mysak, On the numerical calculation of electromagnetic fields generated by ocean currents. C²GCR Rep. No. 95-5, McGill Univ., 13pp + figs.
57. Tyler, R.H., and L.A. Mysak, The potential for using geomagnetic data in ocean and climate studies. C²GCR Rep. No. 95-6, McGill Univ., 42pp + figs.
58. Bjorsson, H., L.A. Mysak and R.D. Brown, On the interannual variability of precipitation and runoff in the Mackenzie drainage basin. C²GCR Rep. No. 95-9, McGill Univ., 25pp + figs.
59. Mysak, L.A., Report to the Principal for 1994-95. C²GCR Rep. No. 95-10, McGill Univ., 23pp.

1996

60. Mysak, L.A., and C. Green (Editors), Proceedings of the Conference "SHOULD WE (STILL) BE CONCERNED ABOUT GREENHOUSE WARMING?". C²GCR Rep. No. 96-5, McGill Univ., 77pp.
61. Cossette, A., and L.A. Mysak (Editors), Proceedings of the Sixth Annual C²GCR Student Day. C²GCR Rep. No. 96-8, McGill Univ.
62. Slonosky, V.C., and L.A. Mysak, Salinity and temperature anomalies in the northern North Atlantic: Can the Great Salinity Anomaly be traced in coastal tree-ring chronologies? C²GCR Quarterly, No. 96-1, 5-12.
63. Mysak, L.A., Report to the Vice-Principal (Planning and Resources) for 1995-96. C²GCR Rep. No. 96-9, McGill Univ., 23pp.
64. Tremblay, L.-B., and L.A. Mysak, Modelling sea ice as a granular material, including the dilatancy effect. C²GCR Rep. No. 96-11, McGill Univ., 36pp + figs.

65. Mysak, L.A., and C.A. Lin, AES/NSERC Industrial Research Chair in "Climate Research", 1986-96, McGill Univ., FINAL PROGRESS REPORT. C²GCR Rep. No. 96-12, McGill Univ., 13pp.
66. Venegas, S.A., L.A. Mysak and D.N. Straub, Atmosphere-ocean coupled variability in the South Atlantic. C²GCR Rep. No. 96-13, McGill Univ., 24pp + figs.

Amplification of CV, Section 7

Papers and seminars given at conferences, workshops, universities, etc. by

LAWRENCE A. MYSAK

7A. Invited Presentations

7B. Contributed Presentations

(**Note:** The two lists below do not include over 200 joint papers presented by my graduate students and PDFs.)

7A. Invited Presentations

"Continental Shelf Waves"

1. Sixth Symposium on Naval Hydrodynamics, Washington, D.C. Sept., 1966.

"On the theory of continental shelf waves"

2. Massachusetts Inst. of Technology, Cambridge, Mass., Jan., 1967.

"The low frequency spectrum of sea level and continental shelf waves"

3. The Johns Hopkins University, Baltimore, MD., Mar., 1967.

"Low frequency waves in a rotating channel"

4. Oregon State University, Corvallis, Ore., Nov., 1967.

"Ocean waves"

5. Berg Science Seminar, Vancouver School Board, Jan., 1968.

"Low frequency sea level behaviour off North Carolina"

6. Oregon State University, Corvallis, July, 1968.

"Progressive internal waves in water of variable depth"

7. Cambridge Univ., Sept., 1970.

"Wave diffraction in rotating fluids"

8. Univ. of Toronto, Aug., 1971.

"Internal waves in a randomly stratified fluid"

9. 4th Colloquium in Ocean Hydrodynamics, Liege Univ., Mar., 1972.

10. Oregon State Univ., Corvallis, Feb., 1973.

"Time Series and Oceanography"

11. Imperial College, London, June, 1972.

"Waves in a rotating stratified fluid with laterally varying random inhomogeneities"

12. IUTAM Symposium on Stability of Stochastic Dynamical Systems, Univ. of Warwick, Coventry, July 1972.

"Kelvin wave propagation along an irregular coastline"

13. Symposium on Stochastic Problems in Mechanics, Univ. of Waterloo Sept., 1973.

14. Assembly of International Assoc. of the Physical Sciences of the Ocean (IAPSO), Melbourne, Australia, Jan., 1974.

"Kinetic theory, internal waves and oceanic fine-structure"

15. Oregon State Univ., Corvallis, July, 1973.
16. Assembly of IAPSO, Melbourne, Australia, Jan., 1974.

17. First Canadian Symposium on Theoretical Fluid Dynamics, Univ. of Western Ontario, London, June, 1974.
- "Low-frequency oscillations in the Strait of Georgia, B.C."
18. IUTAM Symposium on Waves on Water of Variable Depth, Canberra, July, 1976.
19. University of Western Australia, Perth, August, 1976.
- "Trapped Coastal Waves"
20. Symposium on Wave Propagation in Honour of Prof. Fritz Oberhettinger, Oregon State University, Corvallis, May, 1976.
21. Australian Math. Society Conference on Applied Mathematics in Fluid Mechanics, Univ. of New South Wales, Sydney, July, 1976.
22. Univ. of Western Australia, Perth, Aug., 1976.
- "Internal waves and oceanic fine-structure"
23. Univ. of Western Australia, Perth, August, 1976.
24. Defence Research Establishment Pacific, Esquimalt, B.C., November, 1976.
- "Coastally trapped waves: A review of results old and new"
25. Rutgers State Univ. of New Jersey, May, 1977.
- "Resonant interactions between topographic planetary waves in a continuously stratified fluid"
26. CBMS/NSF Conference "Geofluidynamical Wave Mathematics," Seattle, Wash., August, 1977.
- "Wave propagation in random media"
27. Conference "Geofluidynamical Wave Mathematics," Seattle, Wash., Aug., 1977.
- "Nonlinear resonant interactions between ocean waves"
28. Simon Fraser Univ., February, 1978.
- "Continental shelf waves"
29. International Symposium on Long Waves in the Ocean, Ottawa, June, 1978 (Keynote Address).
- "Trench waves"
30. PNW SIAM meeting, Vancouver, June, 1979.
- "Recent advances in shelf wave dynamics"
31. Univ. of Miami, Jan., 1979.
- "The Sitka eddy"
32. Univ. of Hawaii, Honolulu, Nov., 1979.
33. Univ. of New South Wales, Sydney, Nov., 1979.
- "Topics on circulation in the Northeast Pacific"
34. Institute of Ocean Sciences, Patricia Bay, B.C., April, 1980.
- "Wave propagation in random media, and oceanographic applications"
35. Landis and Gyr Corporation, Zug, Switzerland, May, 1980.
- "On the structure of low-frequency currents in the Strait of Georgia"
36. Swiss Federal Institute of Technology, June, 1980.

- "Baroclinic and barotropic instabilities of coastal currents"
 37. Swiss Federal Institute of Technology, June, 1980.
- "Barotropic instability of flow along a trench"
 38. Univ. of Hawaii, Honolulu, Jan., 1981.
 39. Theoretical Phys. Group, UBC, Nov., 1981.
 40. Univ. Erlangen, W. Germany, Nov., 1982.
- "Baroclinic instability in a downstream varying channel: Shelikof Strait, Alaska"
 41. Univ. of Hawaii, Honolulu, Jan., 1981.
 42. Univ. Stuttgart, W. Germany, Nov., 1982.
- "Satellite images and their use in modelling ocean circulation"
 43. Canadian Math. Society winter meeting, Vancouver, Dec., 1980.
- "Baroclinic waves and fish?"
 44. Research Station, Lethbridge, Aug., 1982.
 45. Inst. for Meereskunde, Kiel, May, 1983.
 46. Lowestoft Fisheries Lab., U.K., May, 1983.
 47. Inst. of Ocean Sciences, Sidney, B.C., Nov., 1983.
- "Observation and modelling of meanders and eddies off Vancouver Island"
 48. Univ. Wurzburg, W. Germany, Nov., 1982.
 49. Federal Institute of Technology, Zurich, March, 1983.
 50. Technion, Haifa, Israel, April, 1983.
 51. Meteorol. Institute, Hamburg, May, 1983.
 52. SUNY, Long Island, N.Y., April, 1984.
- "Rossby waves in the North Pacific: observation, theory and conjecture"
 53. Federal Institute of Technology, Zurich, Dec., 1982.
 54. Institute for Meereskunde, Kiel, May, 1983.
 55. Univ. of East Anglia, May, 1983.
 56. Institute of Ocean Sciences, Sidney, B.C., Nov., 1983.
 57. SUNY, Long Island, N.Y., April, 1984.
 58. ONR, Wash., D.C., April, 1984.
- "Second Class oscillations in lakes"
 59. Ecole Polytechnique Federale, Laussane, March, 1983.
 60. Univ. of Hawaii, Feb., 1984.
- "The elliptical topographic wave: a newly found oscillation in the lakes of Switzerland"
 61. Federal Institute of Technology, Zurich, May, 1983.
- "Nonlinear internal waves"
 62. Two invited lectures at summer school, "Hydrodynamics of Lakes," Udine, Italy, July, 1983.
- "Topographic waves in lakes"
 63. Four invited lectures at summer school, "Hydrodynamics of Lakes," Udine, Italy, July, 1983.
- "The southern oscillation, wave signals and fish populations in the Northeast Pacific"
 64. AGU Fall Meeting, San Francisco, Dec., 1983.
 65. Univ. of Hawaii, February, 1984.

- "The influence of large-scale environmental fluctuations on fish populations in the Northeast Pacific"
66. Pacific Biological Station, Nanaimo, Nov., 1983.
- "El Nino - southern oscillation episodes and fish populations in the Northeast Pacific"
67. SUNY, Long Island, N.Y., April, 1984.
68. UBC Connect Program, June 1984.
- "On the interannual variability of eddies in the northeast Pacific Ocean"
69. PMEL/NOAA, Seattle, Sept., 1984.
- "El Nino, interannual variability and fisheries in the northeast Pacific"
70. UBC Physics Dept., Sept., 1984.
71. SFU, Oct., 1984.
72. Univ. Victoria, Nov., 1984.
73. McGill Univ., March, 1985.
74. CSIRO Marine Lab., Hobart, Tasmania, May, 1985.
- "ET waves: theory and observation"
75. Institute of Ocean Sciences, Sidney, B.C., Jan., 1985.
- "Recent results on annual Rossby waves in the North Pacific"
76. Univ. of Hawaii, May, 1985.
77. CSIRO Marine Lab., Hobart, Tasmania, May, 1985.
78. Univ. of Melbourne, May, 1985.
79. Univ. of New South Wales, May, 1985.
80. Atmos. Environment Service, Downsview, Ont., June, 1985.
- "Effect of increased CO2 on ocean circulation"
81. Ocean Sciences Council of UBC, March, 1985.
- "Periodic events with global significance"
82. Pacific Northwest Oceanographers Meeting, Victoria, May, 1985.
- "Atmosphere-ocean interactions in the Pacific Ocean and their effect on salmon"
83. Sockeye migration seminar, Courtenay, B.C., November, 1985.
- "Overview of project MOIST: Meteorological and Oceanographic Influences on Sockeye Tracks"
84. Climate Workshop, McGill Univ., December, 1985.
85. Institute of Ocean Sciences, Sidney, January, 1986.
86. Simon Fraser University, February, 1986.
87. University of Toronto, March, 1986.
88. Swiss Federal Institute of Technology, Zurich, May, 1986.
89. Fisheries Res. Lab., DFO, Halifax, Feb., 1987.
90. Annual CMOS Congress, St. Johns, June 1987.
91. SUNY at Stony Brook, N.Y., June 1987.
92. Univ. Que. at Rimouski, Oct. 1987.
93. Univ. of Maine, Oct. 1987.
- "Climate change and sockeye salmon migration routes"
94. Quebec Bursary students, UBC, June, 1986.
- "Recent results on annual Rossby waves in the Ocean"

95. Division de Rech. En Prevision Num., Dorval, Que., Oct. 1986.
96. York Univ., Jan., 1987.
97. Bedford Institute of Oceanography, Dartmouth, N.S., Feb., 1987.
- "Generation of annual Rossby waves by the wind stress curl in the South Atlantic"
98. 19th General Assembly of IUGG, Vancouver, Aug. 1987.
- "Recent activities of the McGill Climate Research Group"
99. CCP Research Committee meeting, McGill Univ., Oct. 1987.
100. Can. Climate Planning Bd. and AES Directors, Downsview, July 1988.
- "Large scale atmosphere-ice-ocean interactions in the Arctic: observations and models"
101. Physical Society, McGill Univ., Nov. 1987.
102. Ottawa Chapter of CMOS, Feb., 1988.
103. Toronto CMOS Chapter, April 1988.
104. Montreal CMOS Chapter, April, 1988.
105. CMOS Rimouski Chapter, April, 1988.
106. Quebec CMOS Chapter, April, 1988.
107. St. John's CMOS Chapter, April, 1988.
108. Halifax CMOS Chapter, April, 1988.
109. Fredericton Chapter of CMOS, Apr. 1988.
110. Southwest Chapter of Royal Meteorol. Soc., Exeter, Oct. 1988.
- "Quasi-geostrophic circulation model of the northeast Pacific"
111. INO Symposium on Global Ocean Prediction Systems, GFDL/NOAA, Princeton, N.J., May 1988.
- "Air/sea/ice interactions in the Arctic"
112. National Hydrology Research Centre, Saskatoon, June 1988.
- "Interactions of climate change and salmon migration"
113. McGill Chapter of Sigma Xi, Sept. 1988.
- "Overview of climate and global change research activities in Canada"
114. Arctic Policy Conference, McGill Univ., Dec. 1988.
- "Climate - salmon migration interaction"
115. Women Associates of McGill, Feb. 1989.
- "The greenhouse effect - a hot time ahead?"
116. Guest Speaker at Symposium sponsored by the Montreal Chapter of the Canadian Society for The Weizmann Institute of Science, McGill Univ., March 1989.
- "Climate and global change"
117. Westmount Rotary Club, Apr. 1989.
118. Montreal Westward Rotary Club, May 1989.
- "Impacts of global change on the Arctic marine environment"
119. Climate Institute Symposium on the Arctic and Global Change, Ottawa, Oct. 1989.
- "Global change and the oceans"
120. York University Global Change Symposium on Science and Society: Prospects for the Future. North York, Ont., Nov. 1989.

"Global warming and the Arctic"

121. Centre for Northern Studies and Research, McGill Univ., Jan. 1990.
122. Institute Maurice Lamontagne, Mont Joli, Que., Nov. 1990.
123. Dept. of Civil Engineering, McGill Univ., March 1991.
124. Dept. of Geography, McGill Univ., April 1991.
125. MIT, Cambridge, MA, April 1991.
126. Lamont-Doherty Geological Observatory, N.Y., April 1991.
127. Dept. of Physics, McGill Univ., Oct. 1991.

"Greenhouse warming and climate variability"

128. Lower Canada College, Mar. 1990.
129. Ontario Ministry of Energy, Toronto, Mar. 1990.
130. Ecocare Meeting, Montreal West, Mar. 1990.
131. Chomedey Seniors Club, April 1990.
132. McGill Education Summer School for gifted children, July 1990.

"Activities of Marine-Atmosphere Interaction Working Group of CGCP"

133. 1st Annual Assembly of Canadian Global Change Program (CGCP), Toronto, April 1990.

"Greenland Sea ice anomalies and their relation to an interdecadal Arctic climate cycle"

134. Atmospheric Environment Service, Downsview, April 1990.

"Recent developments in the Canadian Global Change Program"

134. Annual Meeting of the Academy of Science Council, Royal Society of Canada, Victoria, June 1990.

"Climate change on decadal to century time scales"

136. La quinzaine des sciences, McGill Univ., Oct. 1990.

"Current and future trends in Arctic climate research: Can changes of the Arctic sea ice be used as an early indicator of global warming?"

137. Workshop of the Canadian Ice Working Group on "The role of sea ice in climate change studies", Montreal, November 1990.

"C2GCR: What is it? What are its activities?"

138. Macdonald campus, McGill Univ., April 1991.

"Interdecadal variations in climate and ice cover of the Arctic Ocean and Greenland Sea"

139. Annual CMOS Congress, Winnipeg, June 1991.
140. CCCO Workshop on Interdecadal climate variability, Honolulu, Feb. 1992.

"Evidence for an interdecadal Arctic climate cycle"

141. IUGG General Assembly, Vienna, August 1991.

"Century-scale variability in a randomly forced, two-dimensional thermohaline ocean circulation model"

142. IUGG General Assembly, Vienna, August 1991.
143. AES Workshop on Ocean Circulation Modelling, IOS, Sidney, B.C., Oct. 1991.

"Climate variability on the century time scale: observations and models"

144. Univ. of Hawaii, Feb. 1992.
145. Seminars in Mechanics series, McGill Univ., Mar. 1992.

146. SUNY, Stony Brook, NY, April 1992.
 147. Tenth Canadian Symposium on Fluid Dynamics, St. John, NB, June 1992.
 148. Exeter Univ., June 1993.
 149. Woods Hole Oceanographic Inst., Woods Hole, MA, July 1993.
 150. Univ. of B.C., Oct. 1993.
 151. Univ. of Manitoba, Oct. 1993.
 152. Univ. of Alberta, Nov. 1993.
 153. Queen's Univ., Kingston, ON, Jan. 1994.
 154. Univ. of Western Ont., London, ON, Oct. 1994.
 155. Carleton Univ., Ottawa, Mar. 1995.
 156. Catholic Univ. of Louvain, Belgium, May 1995.
 157. Univ. of Montreal, Oct. 1995.
 158. Centre for Nonlinear Dynamics in Physiology and Medicine, McGill, Mar. 1996.
 159. Univ. of Calgary, Distinguished Faculty of Science Lecturer, Mar. 1996.
- "Careers in atmospheric, oceanic and climate sciences"
160. LaSalle High School, Montreal, Jan. 1992.
 161. Trafalgar School for Girls, March 1992.
 162. Lower Canada College/Trafalgar School Career Day, Nov. 1992.
- "Interdecadal climate variability in the northern North Atlantic and possible implications for fisheries"
163. St. Andrews Biological Station, N.B., June 1992.
- "Decadal-scale variability of ice cover and climate in the Arctic Ocean and Greenland Sea"
164. US National Academy of Sciences Workshop on Decade-to-Century Time Scales of Climate Variability, Irvine, CA, Sept. 1992.
 165. ACSYS Workshop, Ottawa, Dec. 1992.
- "Global warming versus natural climate variability"
166. Marianopolis College, Montreal, Oct. 1992.
- "Decadal-scale climate variability in the Arctic and Greenland Sea: observations and models"
167. Can. Applied Math. Soc. Annual Meeting, York Univ., June 1993.
 168. Nansen Symposium, Bergen, Norway, June 1993.
 169. Hadley Centre, Bracknell, England, June 1993.
 170. Woods Hole Oceanographic Inst., Woods Hole, MA, July 1993.
 171. Inst. of Atmos. Physics, Prague, August 1993.
 172. Ukrainian Academy of Sciences, Kiev, Aug. 1993.
 173. UCAR Climate System Modelling Workshop on the thermohaline circulation, UCLA, Los Angeles, Oct. 1993.
 174. National Hydrological Research Inst., Saskatoon, Oct. 1993.
 175. Univ. of Alberta, Nov. 1993.
 176. Univ. of Alabama, Feb. 1994.
 177. Univ. of B.C., Feb. 1994.

- 178. Univ. of Waterloo, Mar. 1994.
 - 179. Univ. of Toronto, Apr. 1994.
 - 180. GFDL/NOAA, Princeton Univ., Apr. 1994.
 - 181. Dalhousie Univ., Halifax, May 1994.
 - 182. Fourth Amer. Meteorol. Soc. Meeting on Polar Meteorology and Oceanography, Dallas, Jan. 1995.
 - 183. Catholic Univ. of Louvain, Belgium, May 1995.
 - 184. Univ. of New Hampshire, Feb. 1996.
 - 185. MIT, Cambridge, MA, Feb. 1996.
 - 186. Queen's Univ., Kingston, ON, April 1997.
 - 187. Univ. of Tokyo, Japan, May 1997.
 - 188. Meteorological Res. Institute, Tsukuba, Japan, May 1997.
 - 189. Tohoku Univ., Sendai, Japan, May 1997.
 - 190. Hokkaido Univ., Sapporo, Japan, May 1997.
 - 191. Atmos. Environment Service Ice Branch, Ottawa, Nov. 1997.
- "The Royal Society of Canada and the proposed lecture exchange with the Ukrainian Academy of Sciences"
- 200. Victoria Branch of the Ukrainian Canadian Congress, Feb. 1993.
 - 201. Ukrainian Professional and Business Club, Winnipeg, Oct. 1993.
 - 202. Ukrainian Professional and Business Club, Saskatoon, Oct. 1993.
 - 203. Canadian Institute for Ukrainian Studies, Edmonton, Nov. 1993.
 - 204. Ukrainian-Canadian Professional and Business Club, Ottawa, Feb. 1994.
 - 205. Ukrainian-Canadian Professional and Business Club, Calgary, Mar. 1996.
 - 206. Ukrainian-Canadian Professional and Business Association, Montreal, Mar. 1997.
- "Global Change and Society"
- 207. University of 'Kiev-Mohyla Academy', Ukraine, Sept. 1993
(Keynote address).
- "Oceans, climate change and greenhouse gases"
- 208. Federal Government Panel on Energy, Research and Development (of Nat. Res. CANADA) Workshop, Ottawa, August 1994.
 - 209. Royal Meteorological Inst., Brussels, May 1995.
 - 210. Annual Meeting of the Statistical Society of Canada, Montreal, July 1995.
 - 211. McGill Education Summer School for gifted children, July 1995.
 - 212. McGill Postgraduate Student Society, Feb. 1996.
- "Current issues on climate change and climate variability"
- 213. Club 55, St. Bruno, QC, March 1995.
- "Interannual and decadal scale climate variability of the South Atlantic"
- 214. Catholic Univ. of Louvain, Belgium, May 1995.
 - 215. Univ. of Tokyo, Japan, May 1997.
 - 216. Kyushu Univ., Fukuoka, Japan, May 1997.
 - 217. Kyoto Univ., Japan, May 1997.
 - 218. Workshop on Large-Scale Variability in the Southern Ocean, British Antarctic

- Survey, Cambridge, UK, Aug. 1999.
- "The stability and variability of a zonally averaged thermohaline circulation model"
219. UBC, Vancouver, Dec. 1995.
220. NCAR, Boulder, CO, Mar. 1996.
- "Can increased poleward oceanic heat flux explain the warm Cretaceous climate?"
221. Univ. of Alberta, Edmonton, Mar. 1996.
222. Univ. of Toronto, April 1996.
223. Univ. of Saskatchewan, Saskatoon, May 1996.
224. GFDL, Princeton Univ., July 1996.
225. ETH, Zurich, Nov. 1996.
226. UBC, Vancouver, Dec. 1996.
227. Univ. of Tokyo, Japan, May 1997.
228. Hokkaido Univ., Sapporo, Japan, May 1997.
- "A simple coupled ocean-atmosphere model for paleoclimate studies"
229. Twelfth Can. Symp. of Fluid Dyn., Winnipeg, May 1996.
- "Should we (still) be concerned about Greenhouse Warming?"
230. Westmount (QC) Rotary Club, Oct. 1996.
231. Oxford-Cambridge Society of Montreal, March 1997.
232. Ecole Polytechnique, Montreal, March 1997.
233. Association for Canadian General Counsel, St. John's, Nfld., Sept. 1997.
234. York Univ., North York, ON, Oct. 1997.
235. Royal Military College, Kingston, ON Oct. 1997.
236. Univ. of Manitoba, Winnipeg, Feb. 1998 (Distinguished Invited Lecture).
237. Univ. College London, UK, May 1998.
238. Faculty of Medicine, McGill, May 1998.
- "The dinosaurs' climate: a scenario for the future?"
239. Montessori School, Saskatoon, May 1996.
- "Global change and natural climate variability"
240. CIAR Earth System Symposium, Toronto, Dec. 1996.
- "Modelling of the ocean circulation and millennial scale climate variability during the last ice age"
241. Univ. of Alberta, Edmonton, Dec. 1997.
242. Univ. of Keele, UK, April 1998.
243. Univ. of Reading, UK, May 1998.
244. Univ. College London, UK, May 1998.
- "A decadal climate cycle in the Arctic and its links with lower latitudes"
245. AGU Chapman Conference on Millennial-Scale Global Climate Change, Snowbird, Utah, June 1998.
246. Univ. of Alberta, Edmonton, Aug. 1998.
247. AAAS 49th Arctic Science Conference, Univ. of Alaska, Fairbanks, Oct. 1998 (Invited Plenary Speaker).
248. UBC, Vancouver, Dec. 1998.
249. York Univ., Toronto, Jan. 1999.

250. 22nd General Assembly of IUGG, Birmingham, UK, July 1999.
 "Decadal and longer-scale variability of the Arctic sea ice cover and overlying atmospheric circulation"
251. 22nd General Assembly of IUGG, Birmingham, UK, July 1999.
 "What can we learn from paleoclimates?"
252. UQAM-McGill Meteorology-Oceanography Student Day, McGill Univ., May 1999.
- "Is there a dominant timescale of natural climate variability in the Arctic?"
253. Arctic Climate Workshop, Inter. Arctic Research Center, Univ. of Alaska, Fairbanks, May 1999.
254. Univ. of East Anglia, Norwich, UK, Aug. 1999.
255. Can. Centre for Climate Modelling and Analysis, Victoria, BC, Oct. 1999.
256. Old Dominion Univ., Norfolk, VA, Feb. 2000.
257. Meteorological Service of Can., Downsview, ON, Mar. 2000.
258. Italian National Research Council, Bologna, May 2000.
259. Potsdam Inst. for Climate Research, Potsdam, Germany, Sept. 2000.
260. Inst. fur Meereskunde, Kiel, Germany, Nov. 2000.
261. Alfred Wagener Inst. for Polar and Marine Res., Bremerhaven, Nov. 2000.
262. Univ. of Bern, Switzerland, Jan. 2001.
263. Ecole Poly. Fed. Lausanne, Switzerland, Jan. 2001.
264. Univ. of Goteborg, Sweden, Aug. 2001.
265. Stockholm Univ., Sweden, Aug. 2001.
- "Climate change and the atmosphere and oceans"
266. Public Symposium, Climate Change - Impacts and Adaptations, Macdonald Campus, McGill Univ., Sept. 1999.
- "Role of the thermohaline circulation in the initiation of a glaciation"
267. Ocean Sciences Meeting, San Antonio, TX, Jan. 2000.
- "History of the Academy and its contribution to Canadian Science"
268. RSC Academy of Science Public Lectures - 25th Anniversary, Redpath Museum, McGill Univ., Oct. 1999.
- "The McGill Centre for Climate and Global Change Research: 1990 and ten years later"
269. 10th Anniversary Faculty Symposium of C2GCR, McGill Univ., March 2000.
270. Italian National Research Council, Bologna, May 2000.
- "The McGill Paleoclimate Model (MPM), with applications to warm and cold climates"
271. EMIC workshop, Nice, France, April 2000.
272. Conference in honour of Prof. K. Hutter's 60th birthday, Seeheim, Germany, March 2001.
273. LSCE, Gif-sur-Yvettes, France, May 2001.
274. Univ. Cath. Louvain, Louvain-la-Neuve, Belgium, June 2001.
- "What can we learn from paleoclimate modelling?"
275. Peter Wall Inst. for Advanced Studies, UBC, Vancouver, July 2000.
276. Univ. of Copenhagen, Denmark, Sept. 2000.
277. Univ. of Kiel, Germany, Nov. 2000.

278. Dalhousie Univ., Halifax, Dec. 2000.
279. ETH, Zurich, Jan. 2001.
280. EAWAG (Federal Water Res. Inst.), Dübendorf, Switzerland, Feb. 2001.
281. Southampton Oceanography Centre, UK, Feb. 2001.
282. Univ. of Bologna at Ravenna, Italy, May 2001.
283. ENEA, Rome, May 2001.
284. Technical Univ., Darmstadt, Germany, June 2001.
285. National Research Council, Bologna, June 2001.
- "The response of the MPM to 2XCO₂ atmospheric concentration"
286. EMIC workshop, Nice, France, March 2001.
- "Influence of freshwater input on the thermohaline circulation in the MPM"
287. EMIC workshop, Nice, France, March 2001.
- "The Arctic Ocean, sea ice, ice sheets and climate"
288. A series of 8 lectures given at the Inst. of Geophysics and Volcanology, Bologna, Italy, May-June 2001.
- "Ice sheets and the thermohaline circulation during glacial climates"
289. Workshop on "Paleoperspective on Sustainability", Potsdam, Germany, Oct. 2001.
290. IAPSO Symposium, Mar del Plata, Argentina, Oct. 2001.
291. UBC, Vancouver, Nov. 2001.
292. Bogolyubov Institute of Theoretical Physics, National Academy of Sciences of Ukraine (NASU), Kyiv, June 2002.
293. Marine Hydrophysical Inst., NASU, Sevastopol, June 2002.
294. Inst. of Geology and Geochemistry, NASU, Lviv, June 2002.
295. Inst. of Condensed Matter Physics, NASU, Lviv, June 2002.
- "The North Atlantic Oscillation: past, present and future"
296. Joint McGill-Laval-UQAR PhD program in oceanography, Montreal, Nov. 2001.
- "The changing Arctic"
297. SEARCH workshop, Seattle, WA, Nov. 2001 ([Keynote address](#)).
298. Royal Military College, Kingston, ON, March 2002.
- "Is the climate changing?"
299. Montreal Westward Rotary Club, Jan. 2002.
300. Quebec Association of Alumni and Friends of Croatian Universities, Montreal, Feb. 2002.
301. Aveiro Univ., Portugal, Oct. 2002.
- "Glacier fluctuations"
302. McGill University, Montreal, March 2002.
- "Climate Change: Where on Earth are we going?"
303. Royal Can. Institute, Toronto, Nov. 2002.
304. McGill Univ., Montreal, March 2003.
305. Univ. of Saskatchewan, Saskatoon, May 2003.
306. UBC, Vancouver, May 2003.

307. National Wildlife Research Centre, Env. Can., Ottawa, May 2003.
308. Univ. of Manitoba, Winnipeg, Feb. 2004 (Distinguished invited lecturer).
309. Annual Meeting, Statistical Society of Canada, June 2004.
310. Univ. of Auckland Leigh Marine Lab., Leigh, NZ, Aug. 2005
- "Reflections on RSC-NASU exchange lectures and travels in Ukraine, June 2002"
311. Ukrainian Professional and Business Club, Saskatoon, May 2003.
312. Ukrainian Professional and Business Club, Calgary, May 2003.
- "Oceans and Climate"
313. John Abbott CEGEP students, McGill Univ., Montreal, April 2003.
- "The greening of the McGill Paleoclimate Model"
314. ETH Zurich, Switzerland, Sept.2003.
315. Free University, Amsterdam, Oct. 2003.
316. UBC, Vancouver, Dec. 2003.
- "The oceans and climate: Earth system models and their application to abrupt and not-so-abrupt changes"
317. AGU 2004 Ocean Sciences meeting, Portland, OR, Jan.2004. (The Sverdrup Lecture, AGU).
318. Bulgarian Academy of Sciences, Sofia, May 2004.
319. Prof. John Johnson retirement symposium, Norwich, UK, June 2004.
320. Oxford University, UK, June 2004.
321. CRREL, U.S. Army, Hanover, HN, July 2004.
322. SLOAN Climate Change Workshop, Montreal, Sept. 2004.
323. SUNY, Stony Brook, NY, Oct. 2004.
324. Stockholm University, Sweden, May 2005.
325. University of Auckland, New Zealand, Aug. 2005.
326. MIT, Cambridge, MA, Dec. 2005.
327. Bureau of Meteorology Research Centre, Melbourne, Australia, Feb. 2006.
- "Simulation of sea ice and ocean variability in the Arctic during 1955-2002 with an intermediate complexity model"
328. Bjerknes Centenary 2004 Conference, Bergen, Norway, Sept. 2004.
- "Large-scale ice discharge events in a pure ice sheet model"
329. UBC, Vancouver, Jan. 2005.
330. Hokkaido University, Sapporo, Japan, August 2006.
- "Simulation of Long-Term Future Climate Changes with the Green McGill Paleoclimate Model: The next glacial inception"
331. IAG, IAPSO and IABO General Assembly, Cairns, Australia, August 2005
- "Glacial inceptions: Past and future"
332. EMIC Workshop, Melbourne, Australia, Feb. 2006.
333. Alfred Wegener Medal Lecture, EGU, Vienna, April 2006.
334. International Symposium on Sustainable Development, Hokkaido University, Sapporo, Japan, August 2006.
335. Eotvos-Lorand University, Budapest, Hungary, Sept. 2006.
336. Comenius University, Bratislava, Slovakia, Sept. 2006.

337. Faculty of Science STARS (Science Talks About Research for Staff) lecture, McGill University, Montreal, Jan. 2007.
338. Collège de France Conference on EMICs, Paris, May 2007.
339. ETH, Zurich, Switzerland, Oct. 2007.
340. World Meteorological Organization, Geneva, Switzerland, Oct. 2007
341. UBC, Vancouver, Dec. 2007.
342. Imperial College London, England, March 2008.
343. Univ. of East Anglia, Norwich, England, April 2008.
344. Stockholm University, Sweden, May 2008.
345. Memorial University of Newfoundland, St. John's, NL, Oct. 2008
346. Hong Kong University of Science and Technology, Hong Kong, Oct. 2009.
347. Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China, Oct. 2009.
- “Sea level rise associated with climate change”
348. Media event at CMOS Annual Congress, Toronto, May 2006.
- “Climate Change: From Here to Eternity”
349. Professional Development School on Mineral Processing, McGill Univ., Montreal, May 2007.
350. Pearson Adult and Career Centre, LaSalle, QC, Jan. 2008.
351. Canadian Inst. Of Mining, Montreal, Nov. 2009.
352. Montreal Field Naturalist's Club, Montreal, Oct. 2010.
353. McGill Science Outreach Day, Oct. 2011.
354. Concordia Univ., Dec. 2011.
355. Lunch and Learn Lectures, McGill Univ., Feb. 2012
356. Cote St. Luc Library, Montreal, April 2012
357. MAUT Retired Group, McGill Univ. May 2012
358. Cummings Senior Residence, Montreal, July 2012
359. First Choice Science Program, Dawson College, Montreal, Sept. 2012
- “Transient simulations of the Little Ice Age and beyond with a global reduced complexity climate model”
360. British Antarctic Survey, Cambridge, England, April 2008.
361. Gothenburg University, Sweden, May 2008.
362. Stockholm University, Sweden, May 2008.
363. UBC, Vancouver, Feb. 2009.
364. Inst. of Ocean Sciences, Sidney, BC, Feb. 2009.
365. Seventeenth International Northern Research Basins Symposium and Workshop, Baffin Bay, August 2009.
366. CSIRO Aspendale Laboratories (The 2009 Priestly Lecture), Melbourne, Australia, Oct. 2009.
367. University of Calgary, AB, June 2011
368. Geological Assoc. of Canada Annual Meeting (Keynote address), Ottawa,

May 2011

- 369. Royal Military College, Kingston, ON, Oct. 2011.
 - 370. Simon Fraser Univ., Burnaby, BC, Jan. 2012.
 - 371. McGill Univ., GEC3, Montreal, March 2012.
 - 372. Univ. of Cape Town, South Africa, Oct. 2012.
 - 373. Univ. of Alberta, Edmonton, March 2013.
 - 374. Univ. of Copenhagen, Denmark, July 2013.
- "Methane and environmental change during the Paleocene-Eocene thermal maximum (PETM): Overview and box model studies of the PETM "
- 375. Univ. of Alberta, Edmonton, Oct. 2009.
 - 376. UBC, Vancouver, Dec. 2009.
 - 377. Univ. Autonoma de Barcelona, Spain, Sept. 2010.
- "Recent past EMIC modelling work at McGill"
- 378. International EMIC workshop, Potsdam, Germany, Jan. 2011.
- "Box model studies of the Paleocene-Eocene thermal maximum"
- 379. Conference in honour of K. Hutter's 70th birthday, Zurich, Feb. 2011.
 - 380. Institute of Ocean Sciences, Sidney, BC, June 2011.
- "IAPSO: Objectives and Activities"
- 381. Chapman Conference on the Agulhas System, Stellenbosch, South Africa, Oct. 2012.
- "Hockey sticks, outdoor rinks and climate change"
- 382. Westmount Library, QC, Jan. 2013
 - 383. Shevchenko Scientific Society of Canada, Montreal, Feb. 2013.
 - 384. McGill Post Graduate Student Society, Montreal, Sept. 2013.
 - 385. Place Kensington Residence, Westmount, QC, Oct. 2013.
 - 386. COSMOS (Mining Engineers) Annual Meeting, Montreal, June 2014.
 - 387. Dawson College Environmental Science Series, Montreal, March 2015.
 - 388. Unitarian Church, North Hatley, QC, June 2015.
 - 389. James McGill Society, McGill Univ., Nov. 2015.
 - 390. Earth Hour evening, Westmount, QC, Mar. 2016.
 - 391. Cutting Edge Lectures in Science, Redpath Museum, McGill Univ., April 2016
- "The Little Ice Age and beyond: Societal impacts and modelling the long-term changes"
- 392. State Univ. of New York, Stony Brook, NY, May 2016.

7B. Contributed Presentations

"Edgewaves on a gently sloping continental shelf of finite width"

1. Spring American Geophysical Union Meeting, Washington, D.C., April, 1967.

"Low frequency sea level behaviour and continental shelf waves off North Carolina"

2. Spring American Geophysical Union Meeting, Washington, D.C., April, 1968.

- "On the generation of double Kelvin waves"
3. Fall American Geophysical Union meeting, San Francisco, Dec., 1968.
 4. Second Canadian Oceanographic Symposium, Victoria, Nov., 1969.
- "Progressive internal waves in water of variable depth"
5. Fall American Geophysical Union meeting, San Francisco, Dec., 1969.
 6. Sixth U.S. Congress of Applied Mechanics, Harvard University, June, 1970.
- "Diffraction of internal waves"
7. University of Washington, Seattle, February, 1970.
- "Barotropic waves along an eastern continental shelf"
8. Third Canadian Congress of Applied Mechanics, Calgary, Alberta, May, 1971.
 9. University of Cambridge, Oct., 1971.
 10. Univ. of Surrey, Nov., 1971.
- "Scattering of Rossby Waves"
11. SIAM National Meeting, Seattle, Wash., June, 1971.
 12. 14th British Theoretical Mechanics Colloquium, London, April, 1972.
- "Stochastic Differential Equations"
13. Univ. of Cambridge, Jan., 1972.
- "Internal waves in a randomly stratified fluid"
14. Univ. of Essex, Feb., 1972.
 15. Oxford Univ., April, 1972.
 16. Univ. of Reading, May, 1972.
 17. 13th IUTAM Congress, Moscow, Aug., 1972.
 18. Univ. of Wash., Seattle, Oct., 1972.
- "Propagation of internal and Kelvin waves in media with random properties"
19. National Institute of Oceanography, Wormley, Surrey, April, 1972;
 20. Institute of Coastal Oceanography and Tides, Liverpool, July, 1972.
- "Kelvin wave propagation along an irregular coastline"
21. Oregon State Univ., Corvallis, July, 1973.
 22. University of Toronto, Sept., 1973.
 23. Marine Sciences Data Service, Ottawa, June, 1974.
- "Kinetic theory, internal waves and oceanic fine-structure"
24. Univ. of Waterloo, Sept., 1973.
 25. Canada Center for Inland Waters, Burlington, Ont., Sept., 1973.
 26. Marine Sciences Directorate, Pacific Region, Victoria, Apr., 1974.
 27. National Center for Atmospheric Research, Boulder, Colo., June, 1974.
 28. Harvard Univ., June, 1974.
 29. Rutgers State Univ. of New Jersey, June, 1974.
 30. Woods Hole Oceanographic Institution, Mass., June, 1974.
 31. Bedford Institute of Oceanography, Dartmouth, Nova Scotia, June, 1974.
- "The stability of couette flow in the presence of random fluctuations"
31. Univ. of Washington, May, 1975.
- "Low-frequency oscillations in the Strait of Georgia, B.C."
32. Institute of Ocean Sciences, Patricia Bay, B.C., November, 1975;

33. Univ. of Washington, Seattle, January, 1976;
 34. Monash University, Melbourne, July, 1976;
 35. Flinders University, Adelaide, August, 1976;
 36. Second Canadian Symposium on Fluid Dynamics, UBC, Vancouver, May, 1976.
- "Coastal Trapped Waves"
37. U.B.C., Vancouver, October, 1975.
 38. Univ. of Melbourne, July, 1976.
 39. Univ. of Adelaide, August, 1976.
 40. Inst. of Ocean Sciences, Patricia Bay, B.C., October, 1976.
 41. NCAR, Boulder, Colo., April, 1977.
- "Internal waves and oceanic fine-structure"
42. Flinders Univ., Adelaide, August, 1976.
 43. U.B.C., September, 1976.
 44. Univ. of Washington, Seattle, October, 1976.
 45. University College, London, May, 1977.
- "A report on IUTAM Symposium on Waves of Variable Depth"
46. Institute of Ocean Sciences, Patricia Bay, B.C., September, 1976.
- "Ocean waves: periods of one second to one year"
47. Institute of Ocean Sciences, Patricia Bay, B.C., October, 1976.
- "Introduction to baroclinic instability"
48. Institute of Ocean Sciences, Patricia Bay, B.C., November, 1976.
- "Applications of baroclinic instability"
49. Institute of Ocean Sciences, Patricia Bay, B.C., November, 1976.
- "A review of stratified shear flow"
50. Institute of Ocean Sciences, Patricia Bay, B.C., December, 1976.
- "Dynamic oceanography: What are the equations and the scales?"
51. UBC, Vancouver, B.C., December, 1976.
- "The variability of the California Undercurrent off Vancouver Island"
52. Institute of Ocean Sciences, Patricia Bay, B.C., December, 1976.
- "Coastally trapped waves: A review of results old and new"
53. Geophysical Fluid Dynamics Laboratory, Princeton, May, 1977.
 54. Univ. of Cambridge, May, 1977.
- "Resonant interactions between topographic planetary waves in a continuously stratified fluid"
55. National Center for Atmospheric Research, Boulder, Colo., April, 1977.
 56. Canadian Meteorological and Oceanogr. Society Annual Meeting, London, Ont., June, 1978.
- "The stability of eastern boundary currents"
57. Institute of Oceanographic Sciences, Wormley, England, May, 1977.
 58. Canadian Meteorological Society Congress, Winnipeg, June, 1977.
 59. U.B.C., October, 1977.
- "Wave propagation in random media"

60. National Center for Atmospheric Research, Boulder, Col., August, 1977.
61. U.B.C., November, 1977.
- "Mr. Stokes visits the tropics"
62. U.B.C., November, 1977.
- "Equatorial topographic waves"
63. Canadian Meteorological and Oceanogr. Society Annual Meeting, London, Ont., June, 1978.
64. Third Canadian Symposium on Fluid Dynamics, Toronto, June, 1978.
65. Amer. Meteorolog. Society Waves and Stability Meeting, Boston, Oct., 1978
- "Trench waves"
66. U.B.C., Sept., 1978;
67. Canadian Meteorol. and Oceanogr. Society Annual Meeting, Victoria, May, 1979.
68. Naval Postgraduate School, Monterey, July, 1979.
69. I.U.G.G. meeting, Canberra, Dec., 1979.
70. Univ. of Melbourne, Nov., 1979.
- "Trapped coastal waves on an equatorial beta plane"
71. Amer. Meteorol. Society Waves and Stability Meeting, Boston, October, 1978.
- "Recent advances in shelf wave dynamics"
72. Canada Centre for Inland Waters, Burlington, Ont., Oct., 1978.
73. Harvard Univ., Oct., 1978.
- "Baroclinic and barotropic instabilities of coastal flows"
74. Canadian Meteorol. and Oceanogr. Society Annual Meeting, Victoria, May, 1979.
75. I.U.G.G. meeting, Canberra, Dec., 1979.
- "Images, eddies and instabilities"
76. UBC, Sept., 1979.
- "Atmospherically forced eddies in the Northeast Pacific"
77. I.U.G.G. meeting, Canberra, Dec., 1979.
78. CMOS Annual Meeting, Toronto, May, 1980.
- "Barotropic instability of flow along a trench"
79. UBC, Nov., 1980.
80. Naval Postgraduate School, Monterey, CA, July, 1981.
- "Baroclinic instability in a downstream varying channel: Shelikof Strait, Alaska"
81. UBC, Dec., 1980.
82. Amer. Meteorol. Society Waves and Stability meeting, San Diego, Jan., 1981.
83. Univ. of Arizona, Tuscon, Jan., 1981.
84. CMOS Annual Meeting, Saskatoon, May, 1981.
85. Naval Postgraduate School, Monterey, CA, July, 1981.
86. Dalhousie Univ., Halifax, June, 1982.
87. Federal Institute of Technology, Zurich, Sept., 1982.

- "Satellite images and their use in modelling ocean circulation"
88. UBC, Feb., 1981.
- "Baroclinic waves and fish?"
89. Naval Postgraduate School, Monterey, CA, August, 1981.
90. UBC, Oct., 1981.
91. CMOS Annual Meeting, Ottawa, May, 1982.
92. Bedford Inst. of Oceanogr., Dartmouth, N.S., May, 1982.
93. NATO symposium on fish migration, Italy, Dec., 1982.
94. Phys. Oceanogr. Lab., Paris, Feb., 1983.
95. IUGG Meeting, Hamburg, Aug., 1983.
- "Observation and modelling of meanders and eddies off Vancouver Island"
96. Cambridge Univ., May, 1983.
97. Phys. Oceanogr. Lab., Paris, Feb., 1983.
98. Weizmann Inst., Rehovot, Israel, April, 1983.
- "Rossby waves in the North Pacific: observation, theory and conjecture"
99. Phys. Oceanogr. Lab., Paris, Feb., 1983;
100. IUGG meeting, Hamburg, Aug., 1983;
101. UBC, Oct., 1983;
102. Univ. of Hawaii, Feb., 1984;
103. CAMS Meeting, Vancouver, July, 1984.
- "The elliptical topographic wave: a newly found oscillation in the lakes of Switzerland"
104. UBC, Oct., 1983.
- "Rossby wave driven mean flows along non-zonal barriers"
105. IUGG meeting, Hamburg, Aug., 1983.
- "El Nino - southern oscillation episodes and fish populations in the Northeast Pacific"
106. IARE, UBC, Jan., 1984.
- "Trench wave generation by incident baroclinic Rossby waves"
107. UBC, Nov., 1984;
108. CMOS annual meeting, Montreal, June, 1985.
- "Recent results on annual Rossby waves in the North Pacific"
109. Florida State Univ., Tallahassee, March, 1985.
- "Wind stress curl generation of annual Rossby waves in the North Pacific"
110. CMOS annual meeting, Montreal, June, 1985.
111. IAMAP/IAPSO Joint Assembly, Honolulu, August, 1985.
- "Overview of project MOIST: Meteorological and Oceanographic Influences on Sockeye Tracks"
112 UBC, November, 1985.
113. CMOS Annual Meeting, Regina, June, 1986.
114. Dept. of Biology, McGill Univ., Jan., 1987.
115. 19th General Assembly of IUGG, Vancouver, Aug. 1987.
- "El Nino and the Southern Oscillation phenomena"
116. NATO ASI on Climate Modelling and Simulation, Erice, Sicily, May, 1986.
- "Recent results on annual Rossby waves in the Ocean"

117. McGill Univ., Jan., 1987.
 "Generation of annual Rossby waves by the wind stress curl in the South Atlantic"
118. Annual CMOS Congress, St. John's, June 1987.
 "Recent activities of the McGill Climate Research Group"
119. AES/DFO Working Group on large scale ocean-atmosphere models, AES
 Downsview, March 1988.
 "Atmosphere-ice-ocean interactions in the Arctic"
120. Dept. of Meteorol., McGill Univ., Nov. 1987.
 "A simple coupled steady-state Arctic ice-ocean model"
121. AMS Conference on polar meteorology and oceanography, Madison, WI,
 March 1988.
 122. Annual CMOS Congress, Hamilton, June 1988.
 123. NATO Advanced Research Workshop on Climate-Ocean Interaction,
 Oxford, Sept. 1988.
- "Quasi-geostrophic circulation model of the northeast Pacific"
124. Annual CMOS Congress, Hamilton, June 1988.
 "Sea ice extent and anomalies in the Greenland and Labrador Seas"
125. Annual CMOS Congress, Hamilton, June 1988.
 "The cryosphere and its importance in climate"
126. McGill Univ., Oct. 1988.
 "A simple ice-ocean model for the Greenland Sea"
127. Annual CMOS Congress, Rimouski, Que., June 1989.
 "Simple ice-ocean climate models for the Greenland and Labrador Seas"
128. 16th Stanstead Seminar, Lennoxville, Que., July 1989.
 129. Inst. of Ocean Sciences, Sidney, B.C., Aug. 1989.
 "Impacts of global change on the Arctic marine environment"
130. McGill Univ., Oct. 1989.
 "Global warming and the Arctic"
131. UBC, May 1990.
 "Greenland Sea ice anomalies and their relation to an interdecadal Arctic climate cycle"
132. R.W. Stewart Symposium, Victoria, May 1990.
 133. International Conference on the Role of the Polar Regions in Global
 Change, Fairbanks, Alaska, June 1990.
 134. Annual CMOS Congress, Victoria, May 1990.
- "A latent- and sensible-heat model of the North Water, northern Baffin Bay"
135. IUGG General Assembly, Vienna, August 1991.
 "Climate variability on the century time scale: observations and models"
136. C²GCR, McGill, Jan. 1992.
 137. Institute of Ocean Sciences, Sidney, B.C., Sept. 1992.
 "On the relationship between sea-ice anomalies in the western Arctic and the Greenland
 Sea"
138. 1992 Spring Meeting of AGU, CGU and MSA, Montreal, May 1992.
 139. 1992 CMOS Congress, Quebec, June 1992.

- "Boolean Delay Equation Model of an Arctic interdecadal climate cycle"
140. 1993 CMOS Congress, Fredericton, NB, June 1993.
- "A coupled ice-ocean model of the Arctic Ocean"
141. 1993 CMOS Congress, Fredericton, NB, June 1993.
- "The Academy of Science of the Royal Society of Canada and its activities"
142. UBC, Vancouver, Oct. 1993.
143. Univ. of Manitoba, Winnipeg, Oct. 1993.
144. Univ. of Saskatchewan, Saskatoon, Oct. 1993.
145. Univ. of Alberta, Edmonton, Nov. 1993.
146. Deep River, ON, Nov. 1993.
147. Queen's Univ., Kingston, ON, Jan. 1994.
148. McGill Univ., Montreal, Mar. 1994.
149. Univ. of Waterloo, Mar. 1994.
150. Univ. of Toronto, Apr. 1994.
151. Dalhousie Univ., Halifax, NS, May 1994;
152. Univ. of Western Ont., London, ON, Oct. 1994.
153. Univ. of Victoria, BC, Nov. 1994.
154. Carleton Univ., Ottawa, Mar. 1995.
155. UBC, Vancouver, Dec. 1995.
156. Univ. of Victoria, BC, Dec. 1995.
157. Univ. of Calgary, AB, Mar. 1996.
158. Univ. of Alberta, Edmonton, Mar. 1996.
159. Univ. of Toronto, April 1996.
160. Univ. of Manitoba, Winnipeg, May 1996.
161. Univ. of Sask., Saskatoon, June 1996.
- "Interannual and decadal scale climate variability of the South Atlantic"
162. CLIVAR Ocean Workshop on Dec-Cen Climate Variability, Villefranche-sur-Mer, France, Oct. 1996.
163. Fall AGU Meeting, San Francisco, Dec. 1996.
164. ETH, Zurich, Nov. 2000.
- "The stability and variability of a zonally averaged thermohaline circulation model"
165. IAPSO General Assembly, Honolulu, Aug. 1995.
- "Can increased poleward oceanic heat flux explain the warm Cretaceous climate?"
166. McGill Univ., Oct. 1996.
- "The dinosaurs' climate: a scenario for the future?"
167. Outgoing Presidential Address to the Academy of Science, Ottawa, Nov. 1996.
- "Modelling millennial scale variability during the last ice age"
168. Fall AGU Meeting, San Francisco, Dec. 1997.
- "Sea-ice anomalies and atmospheric circulation in the Arctic Ocean"
169. 1998 CMOS Congress, Dartmouth, NS, June 1998.
- "A decadal climate cycle in the Arctic and its links with lower latitudes"
170. McGill Univ., Oct. 1998.

- "Arctic sea ice and atmospheric variations on the decadal timescale"
- 171. Fall AGU Meeting, San Francisco, Dec. 1998.
 - 172. McGill Univ., Oct. 1999.
- "Singular Value decomposition of Arctic sea ice cover and overlying atmospheric circulation fluctuations"
- 173. Fall AGU Meeting, San Francisco, Dec. 1998.
- "Polynyas in a dynamic-thermodynamic sea ice model"
- 174. Fall AGU Meeting, San Francisco, Dec. 1998.
- "Climate-ice sheet interactions in a simple climate model"
- 175. 33rd CMOS Congress, Montreal, May 1999;
 - 176. 22nd General Assembly of IUGG, Birmingham, UK, July 1999.
- "Is there a dominant timescale of natural climate variability in the Arctic?"
- 177. UBC, Vancouver, May 1999.
 - 178. Univ. of Manitoba, Winnipeg, Aug. 1999.
 - 179. 34th CMOS Congress, Victoria, BC, May 2000.
 - 180. Ocean Sciences Meeting, San Antonio, TX, Jan. 2000.
 - 181. European Geophysical Society (EGS) Annual Meeting, Nice, April 2000.
 - 182. ETH, Zurich, Oct. 2000.
 - 183. Fall AGU Meeting, San Francisco, Dec. 1999.
- "Intercomparison of Arctic and Antarctic sea ice and climate variability"
- 184. Workshop on Large-scale Variability in the Southern Ocean, British Antarctic Survey, Cambridge, UK, Aug. 1999.
- "The McGill Paleoclimate Model (MPM), with applications to warm and cold climates"
- 185. Italian National Research Council, Bologna, May 2000.
- "A coupled sea ice-ocean regional model of Baffin Bay to study the North Water polynya"
- 186. Fall AGU Meeting, San Francisco, Dec. 2000.
 - 187. IUGG Assembly, Sapporo, Japan, July 2003.
- "Nonlinear Principal Component Analysis (NLPCA) as a search algorithm for principal curves and surfaces"
- 188. EGS Annual Meeting, Nice, France, March 2001.
- "The changing Arctic"
- 189. CCGCR Colloquium, McGill Univ., Montreal, Jan. 2002.
 - 190. ETH, Zurich, April 2002.
- "McGill Paleoclimate Model ice sheet sensitivity to ice flow rate and discharge parameters"
- 191. Fall AGU meeting, San Francisco, Dec. 2001.
- "A data-model intercomparison study of Arctic sea-ice variability"
- 192. Fall AGU meeting, San Francisco, Dec. 2002
 - 193. 23rd General Assembly of IUGG, Sapporo, Japan, July 2003.
- "The McGill Paleoclimate Model: History, Development and Recent Applications"
- 194. McGill University, Nov. 2003.
 - 195. McGill University, Nov. 2004.

- "The greening of the McGill Paleoclimate Model. Part II: Simulation of the Holocene millennial-scale natural climate variability"
 196. Fall AGU meeting, San Francisco, Dec. 2003.
- "Simulation of the last glacial inception with the green McGill Paleoclimate Model"
 197. Fall AGU meeting, San Francisco, Dec. 2004.
- "Intermittent ice sheet discharge events in North-eastern North America during the last glacial period"
 198. EGU (European Geosciences Union) Annual Meeting, Vienna, April 2005.
 199. IAPSO meeting in Cairns, Australia, Aug. 2005
- "Simulation of long-term future climate changes with the green McGill Paleoclimate Model"
 200. EGU Annual Meeting, Vienna, April 2005.
- "Simulation of sea ice and ocean variability in the Arctic during 1955-2002 with an intermediate complexity model"
 201. IAPSO Assembly, Cairns, Australia, Aug. 2005.
 202. CLIVAR Workshop, Victoria, BC, March 2006.
- "The granular sea-ice model in spherical coordinates and its application to a global climate model"
 203. Fall AGU meeting, San Francisco, Dec. 2006.
 204. EGU Annual meeting, Vienna, April 2007.
 205. IUGG General Assembly, Perugia, Italy, July 2007.
- "Sensitivity of sea ice to wind stress and radiative forcing since 1500"
 206. IUGG General Assembly, Perugia, Italy, July 2007.
- "Effect of the large-scale atmospheric circulation on the Arctic Ocean freshwater and heat exchange"
 207. IUGG General Assembly, Perugia, Italy, July 2007.
- "Transient Simulations of the Little Ice Age and beyond with a global reduced complexity climate model"
 208. McGill Univ., Montreal, QC, Sept. 2008.
- "Meridional moisture flux in the atmosphere and deuterium excess in polar ice: insight from a zonally-averaged ocean-atmosphere model"
 209. IAMAS-IAPSO-IACS Joint Assembly, Montreal, July 2009.
 210. Fall AGU Meeting, San Francisco, Dec. 2010.
- "The role of methane during the Paleocene-Eocene Thermal Maximum"
 211. McGill Univ., Montreal, QC, Sept. 2009.
- "Methane and environmental change during the Paleocene-Eocene thermal maximum (PETM): Modelling the PETM as a two-stage event"
 212. 25th IUGG General Assembly, Melbourne, Australia, June 2011.
 213. EGU General Assembly, Vienna, April 2012.
- "Assessing the impact of late Pleistocene megafaunal extinctions on global vegetation and climate"
 214. IAHS-IAPSO-IASPEI Joint Assembly, Gothenburg, Sweden, July 2013.
- "Investigation of the Holocene carbon cycle with a model of intermediate complexity:"

The role of Southern Ocean Ventilation”

215. IAHS-IAPSO-IASPEI Joint Assembly, Gothenburg, Sweden, July 2013.

“Sensitivity simulations on the deglacial rise in CO₂: The Last Glacial Maximum to the Present according to the UVic Model”

216. CMOS Congress, Saskatoon, SK, May 2013.

“Current investigations on the natural carbon cycle since the Last Glacial Maximum using a model of intermediate complexity”

217. Ocean Sciences Meeting, Honolulu, HI, Feb. 2014.

“Evolution of the deep Atlantic water masses since the Last Glacial Maximum based on a transient run of NCAR-CCSM3”

218. 26th IUGG General Assembly, Prague, Czech Republic, June 2015.

219. EGU General Assembly, Vienna, April 2016.

“Terrestrial rock weathering and the carbon cycle in the UVic Earth System Climate Model (ESCM): Applications to past and future climates”

220. CMOS Congress, Toronto, ON, June 2017.

221. IAPSO-IAMAS-IAGA Joint Assembly, Cape Town, South Africa, Aug. 2017.

Amplification of CV, Section 8

Graduate Students, PDFs, Research Associates, and Sabbatical Visitors of LAWRENCE A. MYSAK

Note: My MSc and PhD graduate students have won a total of 24 major prizes and awards, in addition to various scholarships.

Twenty two of my graduate and postdoctoral students are now professors in thirteen countries: Australia, Belgium, Canada, China, Germany, Hong Kong, Japan, Mexico, South Africa, Spain, Switzerland, UK, and USA.

I. M.Sc. Students:

Current or Latest Known Position

- | | | |
|-----|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| 1. | R.E. McGorman (1969-72) | |
| 2. | J.D. Fuller (1973-75) | Management Sciences Professor at Waterloo Univ. |
| 3. | J.A. Helbig (1975-77) | Continued as my PhD student |
| 4. | G.E. Swaters (1981-83)
(Awarded CMOS 1984
Graduate Student Prize) | Continued as my PhD student |
| 5. | R. Bermejo-Bermejo
(1984-86) | Mathematics Professor in Madrid, Spain |
| 6. | C. Reason (1985-86) | Professor and Head of Oceanography,
Univ. of Cape Town, South Africa. |
| 7. | B.A. terHart (1985-90)

(Jointly supervised with W. Hsieh)
(Last of UBC MSc students) | President, Medical Software Co., Fraser
Valley, BC |
| 8. | D.K. Manak (1986-88)
(First McGill MSc student) | Administrative Officer, Federal Gov., Victoria |
| 9. | S. Peng (1987-89)
(Awarded 1989 Max Dunbar Prize) | Continued as my PhD student |
| 10. | F. Huang (1988-90) | Programmer at Can. Ice Service, Ottawa |
| 11. | D. Robitaille (1991-93) | Climate Scientist, CCCma, Victoria, BC |
| 12. | S.A. Venegas (1993-95)
(Jointly supervised with D.N. Straub) | PDF at Univ. of Copenhagen, DK |
| 13. | V.C. Slonosky (1994-96)
(Jointly supervised with J. Derome) | Res. Assoc. with Hydro-Quebec, Montreal |
| 14. | D. Yi (1996-98) | PDF in Biophysics, U. of Toronto |
| 15. | G. Arfeuille (1997-99)
(Awarded the Third Annual ARCUS
Award for Arctic Research Excellence) | Science Technical College teacher, Mexico |
| 16. | A. Armstrong (1998-00) | Science teacher, France |

- | | | |
|-----|----------------------------------------------------------------------|--------------------------------------------------------|
| 17. | G. Smith (1999- 01)
(Dean's Honour List) | Res. Scientist, DFO, Montreal |
| 18. | A.-S. Cochelin (2002-04) | Res. Scientist, French Electric Co., Paris |
| 19. | B. Papa (2002-04) | Data Systems Administrator, Lyndon State
College |
| 20. | C. Simmons (2006-08)

(Dean's Honour List) | PDF, Potsdam Inst. For Climate Impact
Res., Germany |
| 21. | D. Carozza (2007-09) | PDF, UQAM, Montreal |
| 22. | N. Damyanov (2009-11)
(D. Matthews, Co-supervisor) | Meteorologist with Engineering Co.,
St. John's, NL |
| 23. | M.O. Brault (2010-12)
(D. Matthews, J. Palter,
Co-supervisors) | PhD student, McGill University |
| 24. | E. Guerten (2016-17)
(Supervisory Committee member) | Student at Concordia Univ. |

II. **Ph.D. Students:**

Current or Latest Known Position

- | | | |
|----|---------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| 1. | M.J. Manton (1967-70) | Chief, Bureau of Meteorology
Research Centre, Melbourne (retired 2005)
Prof. Emeritus , Monash Univ., Australia |
| 2. | C.A. Lee (1970-75) | Head, Dept. of Mathematics
and Physics, Okanagan University College
Kelowna, B.C. |
| 3. | J.A. Helbig (1977-78) | Research Scientist,
DFO, St. John's, NL |
| 4. | D.G. Wright (1975-78)
(Awarded CMOS 1991
President's Prize) | Research Scientist, Bedford
Institute of Oceanography,
Dartmouth, NS (Deceased, July 2010) |
| 5. | W.W. Hsieh (1978-81)
(Awarded CMOS 1981
Graduate Student Prize;
Awarded CMOS 1999 President's Prize) | Professor and Director of Atmos. Sci.,
Dept. of Earth and Ocean Sciences, UBC
(Retired, July 2010) |
| 6. | G.E. Swaters (1983-85)
(Awarded CMOS 1993
President's Prize) | Professor, Dept. of Mathematical Sciences,
Univ. of Alberta |
| 7. | G.J. Mertz (1980-85) | Research Scientist, Northwest
Atlantic Fisheries Institute, DFO St. John's, Nfld.
(Deceased, Sept. 1997) |
| 8. | A.J. Weaver (1984-87)

(Awarded NSERC URF, 1989, | CRC Professor, School of Earth and Ocean
Sciences, Univ. of Victoria |

held at McGill Univ.;
 Awarded NSERC Steacie Fellowship, 1997;
 Awarded CRC Chair, 2000; elected FRSC 2001)

9. P.F. Cummins (1985-89) Research Scientist, Institute of
 (Last of UBC PhD students) Ocean Sciences, Sidney, B.C.

10. J. Wang (1989-93) Research Ice Climatologist/ Physical
 Oceanographer, GLERL, NOAA, Michigan

 (First McGill PhD student;
 Jointly supervised with R.G. Ingram)
11. D. Holland (1989-93) Prof., Courant Inst. For Math. Sciences, NYU
 (Dean's Honour List;
 Awarded CMOS 1993
 Graduate Student Prize)
12. S. Peng (1989-93) Res. Assoc. at CIRES, Boulder, CO
13. R. Tyler (1992-95) Research Scientist, GISS, NASA, Washington, DC
14. L.-B. Tremblay (1992-97) Assoc. Professor, Atmospheric & Oceanic Sci.,
 (Dean's Honour List; McGill University, Montreal
 Awarded CMOS 1997
 Graduate Student Prize;
 Awarded the 1997 Prix d'Excellence de l'Académie des
 Grand Montréalais, for top natural science PhD thesis from
 Montreal's four universities;
 Awarded 2000 Storke-Doherty
 Lectureship at Lamont)
15. H. Bjornsson (1992-97) Director of Research, Icelandic Met. Office
16. Z. Wang (1995-99) Full Professor, Nanjing University of Information
 (Dean's Honour List; and Technology, China
 Awarded 1999 Max Dunbar Prize;
 Awarded inaugural CMOS 1999
 Tertia M.C. Hughes Memorial Prize)
17. Y. Wang (2001-05) Lecturer, Sussex Univ., Brighton, England
 (awarded CMOS 2005 Graduate Student Prize)
18. J. Sedlacek (2003-08) Res. Assoc., ETH Zürich
19. J.-F. Lemieux (2003-09) Research Scientist at RPN, Montreal
 (B. Tremblay, Co-supervisor)
20. A. Antico (2003-09) Research Officer in Buenos Aires, Argentina
21. A. Jahn (2004-10) Assist. Prof., Univ. of Colorado, Boulder
 (B. Tremblay, Co-supervisor)
22. C. Simmons (2008-13) PDF, Potsdam Inst. For Climate Impact Res.

- (D. Matthews, Co-supervisor)
23. M.-O. Brault (2012-17) Current student
(D. Matthews and T. Moore, Co-supervisors)
24. J. Marson (2013-2014) PDF, Univ. of Alberta, Edmonton

III. PDFs and Research Associates:

Latest known position

- | | | |
|-------|----------------------------------------------------|----------------------------------------------------------------------------------------------------|
| 1. | C.L. Tang (1972-74) | Research Scientist, Bedford Institute of Oceanography, Dartmouth, N.S. |
| 2. | R. Kase (1973-74) | Professor, University of Hamburg, Germany |
| 3. | E.R. Johnson (1977-79) | Professor, Dept. of Mathematics, University College London, UK |
| 4. | A.J. Willmott (1979-81) | Head of School of Marine Science and Technology, Univ. of Newcastle, UK |
| 5. | W. Perrie (1980-81) | Research Scientist, Bedford Institute of Oceanography, Dartmouth, NS |
| 6. | H. Hukuda (1980-81) | Project Scientist, Sanyo Co., Tokyo, Japan |
| 7. | M. Ikeda (1981-83) | Professor of Oceanography, and Dean Emeritus Hokkaido Univ., Japan (Retired in 2015) |
| 8. | T. Yao (1981-83) | Consultant, Vancouver, BC |
| 9. | C. Frenzen (1982-84) | Associate Professor, Dept. of Mathematics, Naval Postgraduate School, Monterey, CA |
| 10. | T. Quinn (1984-87)
(Shared with C. Groot) | Associate Professor, School of Fisheries Univ. of Washington, Seattle |
| 11. | P. Cummins (1984-85) | Research Scientist, Institute of Ocean Sciences, Sidney, BC |
| 12. | W.W. Hsieh (1985-86)
(Last of UBC PDFs) | Professor and Director of Atmos. Sci., Dept. of Earth and Ocean Sciences, UBC (Retired, July 2010) |
| <hr/> | | |
| 13. | J.Y. Cherniawsky
(1987-1989) | Research Scientist, Inst. of Ocean Sciences Sidney, BC |
| 14. | C.W. Yuen (1987-89) | Research Scientist, Canadian Climate Centre, Downsview, ON |
| | (Above two McGill PDFs shared with Dr. C. Lin) | |
| 15. | R.G. Wood (1988-89) | Research Scientist, Plymouth Marine Laboratory, UK |
| 16. | D.K. Manak (1988-90) | Administrative Officer, Federal Gov., Victoria |
| 17. | T.F. Stocker (1989-91)
(Mem. Academia Europaea) | Professor and Director, Inst. of Physics, Univ. of Bern, Switzerland |

18. S.B. Power (1990-91) Research Scientist, BMRC, Melbourne, Australia
19. M.S. Darby (fall 1992) Senior NERC Res. Assoc., Exeter Univ., UK
20. G. Schmidt (1994-96) Director of GISS, NASA, New York
21. J. Gan (1995-96) Professor of Marine Science, Hong Kong University
(Shared with D. Straub) of Science and Technology
22. S.A. Venegas (1997-98) PDF at Copenhagen, Denmark
(Shared with D. Straub)
23. H. Bjornsson (1997-98) Director of Research, Iceland Met. Service
24. T. Arbetter (1999) Res. Scientist, CIRES/NSIDC, U. of Colorado,
Boulder, CO
25. Z. Wang (1999-2005) Full Prof., Nanjing Univ. of Science and Technology
26. B. L'Hévéder (2000) Res. Scientist, France
27. M. Crucifix (summer 2000) Assoc. Prof., Catholic Univ. Louvain, LLN, Belgium
28. K. Wright (2002-03) Maternity Leave, UK
29. A.-S. Cochelin (fall 2004) Res. Scientist, French Electric Co., Paris
30. Z. Kothavala (2004-05) Res. Assoc., Courant Institute, NYU, NY
31. Y. Wang (summer 2005) Lecturer, Sussex Univ., Brighton, UK
(shared with Dr. N. Roulet)
32. S. Yang (Summer 2009), PhD student, ETHZ, Zurich, Switzerland
(NSERC USRA)
33. D. Carozza (Spring 2010) PDF, UQAM, Montreal

IV. **SABBATICAL VISITORS HOSTED**

1. P.P. Niiler, FAGU (fall 1968) Professor, Scripps Inst. Oceanogr., LaJolla, CA
(Deceased, Oct. 2010)
2. V.T. Buchwald (1971) Dean Emeritus, Faculty of Science,
Univ. of New South Wales, Australia
(Deceased, April 1998)
3. W.D. Lakin (1974-75) Emeritus Professor, University of Vermont,
Burlington, VT
4. L. Todd (1975-76) Professor, Lakehead Univ., Sudbury, ON
5. M.J. Manton Chief, Bureau of Meteorol. Research
(spring 1975) Centre, Melbourne (Retired 2005)
6. M.S. Howe (spring 1976) Emeritus Professor, Boston Univ., Boston, MA
7. F. Schott, FAGU Professor, Univ. of Kiel, Germany
(summer 1976) (Deceased, April 2008)
8. A.M.J. Davis Professor, Univ. of Alabama
(summer 1978) (Retired 2010)
9. L. Magaard (1981-82) Chair, Department of Oceanography,
Univ. of Hawaii, Honolulu (Retired 2009)
10. J. Holyer (summer 1984) Lecturer, Bristol University, UK
11. H. Weinitschke (1985) Professor, University of Erlangen,
Germany (Deceased, Dec. 1991)

- | | | |
|-----|-----------------------------------------------|------------------------------------------------------------------------------------|
| 12. | J.A. Johnson
(summer 1985) | Professor, University of East Anglia, UK
(Retired 2005) |
| 13. | M. Bowman (1985-86)
(Last of UBC visitors) | Distinguished Service Professor, SUNY
Stony Brook, NY |
| 14. | A.J. Willmott
(summer 1987) | Head of School of Marine Science and Technology,
Univ. of Newcastle, UK |
| 15. | R.F. Marsden
(1988-89) | Emeritus Dean of Science, RMC, Kingston, ON |
| 16. | D.G. Wright
(1989-90) | Research Scientist, Bedford Inst. of Oceanog.,
Halifax, NS (Deceased July 2010) |
| 17. | D.M. Holland
(2004-05) | Professor, Courant Inst. of Math.
Sciences, NYU, New York, NY |
-
- | | | |
|-----|---------------------------|-------------------------------------------------------------------------------|
| 18. | H. Bjornsson
(2006-07) | Director of Research, Icelandic Meteorological
Service, Reykjavik, Iceland |
|-----|---------------------------|-------------------------------------------------------------------------------|

Lawrence A. MYSAK: ACHIEVEMENTS IN RESEARCH

Summary

Lawrence A. Mysak has earned international recognition for his early contributions (1966-1986) to our knowledge of the generation and propagation of ocean waves, the stability and meandering of ocean boundary currents, and the influence of interannual climate fluctuations on fisheries. During the past 30 years (1986-2016), he has focussed on the study of high-latitude and Arctic natural climate variability on interannual, decade-to-century and millennial timescales, the thermohaline circulation and its role in climate, vegetation-climate interactions, glacial inception, and paleoclimates. With his broad training in mathematics, physics, engineering sciences and geophysical fluid dynamics, he has been able to employ a wide range of mathematical techniques and scientific concepts in the study of the above topics in applied mathematics, oceanography and climate dynamics. Also, as an enthusiastic teacher and seminar speaker, he has attracted 100 graduate students, postdoctoral fellows and research associates to work in his laboratories, first at the University of British Columbia in Vancouver, and since 1986, at McGill University in Montreal. For his contributions and services to science, he has received over 30 national and international awards and honours.

RESEARCH WORK at the UNIVERSITY OF BRITISH COLUMBIA

Ocean waves and stability of geophysical flows

The first 15 years of Dr. Mysak's research career (1967-82) at UBC were devoted to the study of various classes of ocean waves and the stability of geophysical flows. In 1967 (see #3 in list of refereed journal publications), he was the first to show that deep-sea stratification significantly increases the phase speed of continental shelf waves. This result explained the discrepancy between the theoretical and observed propagation speeds of these low-frequency waves travelling along the east coast of Australia, where they were first discovered by Hamon. In #6, Mysak and Hamon provided the first observational evidence of shelf wave propagation along the east coast of the USA. Further, in #10 Niiler and Mysak showed that the Gulf Stream off Cape Hatteras was barotropically unstable with respect to shelf wave perturbations, and hence that the observed meanders in this western boundary current could be initiated by these coastally trapped waves. Dr. Mysak's many other contributions to shelf wave theory (e.g., effects of non-linearity, mean flows, offshore trenches and equatorial dynamics) are reviewed in #36, a paper which inspired, in the early 1980s, a major observational and theoretical study of shelf waves off the east coast of Australia known as ACE: Australian Coastal Experiment. Also, with his wide knowledge of shelf and other topographic wave theories, Mysak helped develop a new theory (#59) of 'oscillations of the second class' in a stratified, elliptical lake, which was subsequently used to explain several-day period fluctuations in the lakes of Switzerland and other European countries.

In 1977 (#22), Mysak used a simple two-layer channel model to show, for the first time, that Schott's observed current fluctuations in the Norwegian Current were due to

baroclinic instability of the mean flow. In subsequent papers it was established that many other eastern boundary currents and channel flows are also baroclinically unstable (e.g., the California Undercurrent off the west coast of the USA and Canada, the mean flows in Juan de Fuca Strait and Shelikof Strait). Based on these discoveries, he and his co-workers were able to provide simple dynamical interpretations of satellite-sensed meanders and eddies observed in several coastal regions.

During the 1970s, Dr. Mysak developed mathematical models to study the effects of random inhomogeneities on the propagation of various classes of ocean waves. In particular, an operator theory was constructed to describe the propagation of Kelvin and other trapped waves along a randomly varying boundary (#14), and a 'kinetic theory' was introduced in order to study the transport of internal wave energy in a randomly stratified ocean (#16). Other contributions of Mysak's work in this field are described in the comprehensive review #32.

In the early 1980s, Mysak made several notable contributions to our understanding of the generation and propagation of long-period baroclinic Rossby waves in the ocean. In #51 he was the first to propose that annual-period Rossby waves in the central Pacific may be remotely forced by seasonal oscillations in the eastern boundary current off Washington and BC, a result which he deduced from the subtle dispersion properties of Rossby waves. In #50 he and Maggaard showed that due to rectification, Rossby waves incident on the Hawaiian ridge can generate a mean flow along the northern side, which they named 'The North Hawaiian Ridge Current'. This theoretically predicted current was subsequently observed and has been the focus of a number of field studies involving not only biological and physical oceanographers, but also ocean engineers because of the implications of this current for the dispersion of pollutants in the Hawaiian waters.

Climate fluctuations and fisheries

During the 1980s, Dr. Mysak also turned his research interests to an entirely new field: climate fluctuations and fisheries. In #47, spectral analysis techniques were used to establish the existence of highly significant correlations between variations of northeast Pacific fish populations and interannual fluctuations in ocean parameters such as sea surface temperature, salinity and sea level. This inspired Mysak to delve further into the nature and causes of interannual climate variability in the North Pacific and its effect on fisheries in #63, a 1986 review which is still widely quoted today. This paper also set the stage for an interdisciplinary four-year study led by Mysak, meteorologist Hamilton and fisheries biologist Groot (from the Pacific Biological Station in Nanaimo, BC) entitled 'Project MOIST: Meteorological and Oceanographic Influences on Sockeye Tracks'. The goal of this study, which brought together 15 outstanding young scientists, was to determine to what extent the ocean conditions in the northeast Pacific determined the return migration paths of the Fraser River sockeye salmon (*Oncorhynchus nerka*). The answer to this question was partly provided in #83, which described the first attempt, albeit crude, to develop a 'numerical forecast model for fish migration', in analogy with early numerical models for weather prediction. It is now believed that upgraded fish migration forecast models could significantly improve fishery management. Meanwhile, project MOIST has served as a

model for many present day studies which focus on the influence of ocean climate on biological production and fisheries in the northeast Pacific (e.g., the 'La Perouse Bank Project' off Vancouver Island).

RESEARCH WORK at McGILL UNIVERSITY

Since moving to McGill in 1986 to take up an NSERC Chair, Dr. Mysak has devoted much of his attention to the study of air-sea and air-ice-sea interactions in the northern North Atlantic and the Arctic Ocean, and the role of such interactions in determining natural climate variability on interannual, decade-to-century and millennial timescales. In the 1990s, he began investigations of the stability and variability of the thermohaline circulation, and his group has developed coupled atmosphere-sea ice-ocean-land surface-ice sheet models of reduced complexity for paleoclimate studies. During the past few years (2000-present), his group has also investigated the roles of vegetation and the carbon cycle in these models.

Decadal-scale fluctuations in sea-ice cover and climate in the Arctic

In #73, a significant decadal signal in ice cover variations in the Labrador, Greenland and Barents seas was observed for the first time and related to the 'Great Salinity Anomaly', a freshening of the upper waters of the northern North Atlantic during the 1960s and 1970s. In #78, it was first proposed that such ice and salinity anomalies may be remotely generated by prior large river runoffs into the western Arctic, and that together with various atmospheric circulation changes may be part of an interdecadal Arctic climate cycle that can be described in terms of a negative feedback loop. This loop was simplified in #92, where it was also shown that another Greenland Sea ice and salinity anomaly occurred in the late 1980s, in agreement with the prediction made in #78. Mysak's work on decadal and interdecadal climate variability has provided new insights into the nature of Arctic climate fluctuations (e.g., #110, 116) and has helped stimulate the development of a new World Climate Research Program: ACSYS: Arctic Climate SYstem Study.

With the availability of longer sea ice and atmospheric records, it has recently been shown (#123), using a combined complex empirical orthogonal function analysis, that the dominant signal in the Arctic has a decadal timescale (period range of 8-13 years) and is characterized by the clockwise propagation of a sea ice cover anomaly around the Arctic and marginal seas. The associated sea level pressure fluctuations represent a standing oscillation which in the Atlantic sector is intimately linked to the North Atlantic Oscillation (NAO). It is suggested via a new feedback loop that sea ice export from the Arctic may play a significant role in the switching of the NAO from one phase to the other. In #127, a frequency-domain singular value decomposition analysis was performed on century-long records of sea ice and sea level pressure to isolate both decadal and interdecadal signals in the Arctic and North Atlantic sector.

Polyntya modelling

In the 1990s, Mysak also became involved in the development of latent and sensible

heat models of a polynya (#89, 98) where large sea-to-air heat transfers occur in the Arctic. This work has provided a conceptual framework for the new NOW (North Water) project in Baffin Bay which has received four-year funding from NSERC @ \$4.8 M (1997-2001). The important roles of ice dynamics and wind direction in polynya formation are analyzed in #131.

Thermohaline circulation (THC) modelling and centennial climate variability

Dr. Mysak and his co-workers applied (#93) a simple two-dimensional thermohaline ocean circulation model developed at McGill by his associates Wright and Stocker to the study of century-scale climate oscillations in the North Atlantic. Such oscillations could explain alternating warm and cool periods every other century in northern Europe. The stability of such oscillations was investigated in #107, and the influences on the ocean circulation due to feedbacks from an interactive energy-moisture model of the atmosphere were elucidated in #117.

Atmospheric response to sea surface temperature anomalies in the North Atlantic

In #94, Peng and Mysak made the intriguing discovery that fluctuations in summer precipitation over Siberia and eastern Europe are strongly linked ('teleconnected') to the prior winter sea surface temperature (SST) anomalies in the northwest Atlantic Ocean. As a consequence, such temperature anomalies during winter could be used as a climate predictor for the amount of moisture and runoff over eastern Russia and Ukraine the following summer. The atmospheric response to such SST anomalies has been successfully modelled in #101.

Modelling of the Arctic sea-ice cover and ocean circulation

Beginning with sensitivity study #95, Mysak and his students initiated the development of coupled sea ice-ocean circulation models using the Hibler dynamic sea ice model and the Oberhuber isopycnal ocean model. In #108, it was shown that the mixed layer circulation in the Arctic was both wind and buoyancy driven. In #109, the cyclonic circulation of the subsurface Atlantic water was correctly simulated for the first time in an ice-ocean model. The Hibler model was also applied successfully to simulate the seasonal ice cover in Hudson Bay.

With PhD student Bruno Tremblay, a dynamic sea ice model based on granular material rheology was developed in #115 and successfully used to simulate the Arctic sea ice circulation and seasonal ice edge evolution. A novel feature of the model is that the sea ice model is coupled to both a dynamic upper ocean model and an energy balance model for the atmospheric temperature. In #119, the model was applied to the Holocene epoch in an attempt to explain the distribution of driftwood found in the Canadian Arctic Archipelago and northern Baffin Bay. It was shown that for periods of centuries to millennia, the Transpolar Driftstream was either strongly connected to the East Greenland Current, or shifted towards northern Greenland, in which case there was a very weak outflow through Fram Strait. In #125 (a paper which received a best paper award from

ARCUS), the Tremblay-Mysak sea ice model was used to investigate the interannual variability of the ice export through Fram Strait into the Greenland Sea.

In #144, version 2.6 of the UVic global ocean-atmosphere-sea ice model (with the EVP rheology of Hunke and Dukowicz (1997) used in the latter component), under high frequency wind and slowly changing atmospheric CO₂ forcing, has been successfully used to simulate a key set of Arctic Ocean changes observed over the past 50 years. These include: sea ice extent and thickness changes; Fram Strait ice export variability and its impact on the thermohaline circulation (THC); and the cyclonic and anticyclonic regimes of ice drift in the central Arctic basin. The significance of this paper is that it demonstrates that one can use a relatively coarse resolution Earth system Model of Intermediate Complexity (EMIC) to study large-scale interactions between the Arctic and lower latitudes on decadal and longer timescales.

Modelling of motionally-induced EM fields generated by ocean currents

In #106, a simple induction equation was derived and used to find the EM fields generated by prescribed ocean currents flowing through the earth's background magnetic field. From various examples of idealized ocean flow (plane-parallel shear flows, gyre circulations), it was shown that ocean-induced magnetic fields may be strong enough to be detected from magnetic field satellite surveys. In #113, the theory was extended to 3-D global ocean currents and applied to different types of ocean floor conductivity.

Paleoclimate modelling

The poleward transport of heat in the warm mid-Cretaceous (100 Myr BP) was investigated in #112 using an idealized coupled ocean-atmosphere model, which consists of two zonally averaged basins representing the large proto-Pacific and the smaller proto-Indian oceans that are linked to a simple energy-moisture balance model of the atmosphere. Different equilibria for the thermohaline circulation were found which are characterized by either polar sinking or low latitude sinking. In all cases, warm bottom water is formed in the model, with the deep ocean reaching up to 17°C. Significantly, the poleward transport of heat in the modelled Cretaceous oceans is larger than in some comparable models of the present-day THC. However, the largest increase over present-day model transports is in the atmospheric latent heat transport, where an increased hydrological cycle contributes up to an extra 1 PW of poleward heat transport.

In #130, a coupled ocean-atmosphere model, similar to that used in #112 but extended to include sea ice, was used to simulate the THC in a three-ocean basin model during the last glacial maximum (21 kyr BP). The model was also used to investigate the generation and evolution of millennial scale Dansgaard-Oeschger climate oscillations, as seen in the Greenland ice core records and in ocean sediment cores from the northern North Atlantic.

In #126, the model in #130 was extended to include a seasonal cycle and a land surface component and then used to simulate, for the first time in a coupled climate model, the initiation of glaciation after the end of the previous warm period (the Eemian). A more realistic glacial inception simulation was presented in #138. In #132, an ice sheet model

with an iceberg calving mechanism was added, and the resulting five-component model was used to simulate millennial-scale Dansgaard-Oeschger oscillations during the last glacial. These oscillations in the model are due to internal ice sheet-THC interactions. This five-component model has been termed "The McGill Paleoclimate Model (MPM)", and is an example of what is now called an EMIC: Earth system Model of Intermediate Complexity (see #137).

Interannual and interdecadal climate variability in the South Atlantic

For the first time, the singular value decomposition (SVD) analysis method was used in #111 to determine the coupled modes of variability of monthly sea surface temperature (SST) and sea level pressure (SLP) from the South Atlantic. Remarkably, the leading SVD mode has an interdecadal signal, which represents an approximately 15-to-20 year period oscillation in the strength of the subtropical anticyclone, accompanied by fluctuations of a north-south dipole structure in the SST. Further work in #122 showed that this mode is also linked to the global interdecadal joint mode in SST and SLP studied by Mann and Park and others.

Vegetation modelling with application to Holocene natural climate changes

Vegetation has great impacts on the energy cycle through land-surface processes. Vegetation is also an integral part of the water cycle and is linked to the global carbon cycle on seasonal and long-term time scales. In #145, the formulation of a new land surface scheme with vegetation dynamics for coupling to the MPM is presented. The vegetation-related parameters were simulated by coupling a vegetation model (the VECODE, Brovkin et al., 2002) to the fast components of the MPM. Significant improvements to the MPM include a parameterization of the seasonal cycle of tree leaf area index (LAI), and a calculation for the land surface albedo which uses the LAI, snow depth and the model's climatology. These improvements lead to an excellent simulation of the present-day surface climate.

In the companion paper #146, the green MPM is used to simulate millennial-scale natural climate changes during the Holocene epoch, from 8 kyr BP to the end of the pre-industrial period (1800 AD). Proxy data reveal that there was a pattern of warming and then cooling during this time period in the Northern Hemisphere (NH) that represents the response of the climate system to the changes in orbital forcing, vegetation cover, and the Laurentide Ice Sheet (LIS). By running a number of sensitivity experiments, the model investigates, for the first time, the effect of the retreating LIS and the role of ice-albedo and vegetation-albedo feedbacks on the evolution of the Holocene climate.

In #150, Y. Wang, Mysak, and Roulet take into consideration the vegetation-precipitation feedback in an improved version of the green MPM and evaluate the terrestrial carbon cycle for the pre-industrial Holocene epoch. From their coupled transient simulation under orbital forcing, reconstructed (Taylor Dome) atmospheric CO₂ forcing and a prescribed retreating LIS, the model simulates a loss of 70 PgC in total carbon storage in the Sahara desert, caused by desertification. The model results indicate that the retreating LIS, in association with the vegetation-albedo and vegetation-precipitation feedbacks,

causes the terrestrial carbon store to reach a maximum circa 6 kyr BP. Based on an inverse method, it is deduced that the first 10 ppmv atmospheric CO₂ increase from 8 to 6 kyr BP comes from the ocean carbon pool, which includes sedimentation processes.

In #149, the green MPM is used to investigate the impact of freshwater discharge due to the retreat of the LIS on the Holocene ocean, climate, and terrestrial carbon cycle from 8 to 0 kyr BP under Milankovitch forcing, Taylor Dome CO₂ (radiative forcing) and four prescribed meltwater scenarios. During each discharge scenario, the total volume of meltwater is constrained according to *Paterson* [1972] and the reconstructed sea level change between 8 to 6 kyr BP. The simulated maximum Atlantic MOC intensity is reduced during each discharge, and every time the MOC rebounds to a level higher than the original state, within 10 to 20 years after the termination of the freshwater input. Only a large freshwater perturbation (>0.1 Sv) has a significant impact on the Holocene climate and terrestrial carbon cycle; in this case there is an enhanced cooling of about 1°C in the NH and notable drops in the global net primary productivity and total land carbon storage.

Simulation of past and future glacial inceptions with the "green" MPM

In #148, the green MPM was run between 122 and 80 kyr BP under Milankovitch forcing and Vostok-derived atmospheric CO₂ concentration. The model simulates the last glacial inception (LGI) at around 119 kyr BP and the subsequent buildup of huge ice sheets over the high northern latitudes, especially over North America. Due to the improvements made to the MPM, the resulting ice sheet volume is relatively small over Eurasia but quite large over North America, which is in qualitative agreement with observations and represents a significant improvement over the LGI results from the previous MPM (see #138). The reduction of the forest area at high northern latitudes during the inception phase, which is induced by decreased warm season insolation, is necessary for the ice sheets to grow over Eurasia and to have large ice sheet growth over North America.

With the green MPM being able to successfully simulate the LGI, there was a strong motivation to run it for a long-term 100 kyr simulation into the future and determine when the next glacial inception might occur (#153). Thus, the model was used to study the response of the climate to various changes in the atmospheric CO₂ concentration. Since the MPM in these runs does not include a global carbon cycle model, different prescribed scenarios of atmospheric CO₂ were used as an external radiative forcing. When forced by a constant CO₂ level, the model predicts three possible evolutions for the ice volume over the next 100 kyr: an imminent glacial inception (for low CO₂ levels in the range of 240-270 ppm); a glacial inception in 50 kyr (for 280 or 290 ppm CO₂); or no glacial inception (for 300 ppm CO₂ or higher).

On the other hand, if a global warming episode is introduced in which the atmospheric CO₂ concentration first rises to 1200 ppm over the next 250 years and then decreases to a constant concentration after 1000 years, the model simulates no imminent glacial inception. However, a glacial inception could still occur in 50 kyr if the long-term CO₂ drops to 280 or 290 ppm. For long-term CO₂ levels of 300 ppm or higher, no glacial inception is simulated during the next 100 kyr.

Ice sheet modelling and Heinrich Events

In #152, the state-of-the-art 3-D ice sheet model of Marshall and Clarke (1997a,b) was used to show that ice sheets have natural millennial-scale oscillations due to the internal physics of the ice sheet itself. Ice sheet thickness and the surface slope affect the pressure melting point and strain heating, respectively. Both are critical for the formation and development of fast moving ice streams, which lead to large iceberg calving from the Laurentide Ice Sheet (LIS) every 5 to 10 kyr, known as a Heinrich Event. Modifications were made to the model to include an increased basal sliding velocity used in ice sheet reconstructions and a very high-level calving parameterization. Simulations were also performed to test extreme cases of deformable sediments. This had a significant impact on the location where ice streams developed. This modified the amplitude, period, and location of ice sheet oscillations; oscillations in the ice sheet were most successfully modelled in the narrow topographic channels along the northeastern side of the LIS, such as Lancaster Sound and Admiralty Inlet along Baffin Island.

Abrupt climate changes and Dansgaard-Oeschger oscillations

In #154, an attempt was made to explain three fundamental features of large glacial millennial (Dansgaard-Oeschger (D-O)) oscillations: 1) the climatic transitions were abrupt and large; 2) the lengths of both interstadials and stadials and the period of D-O oscillations were not uniform; 3) there were no large millennial oscillations during an early stage of a glacial period and a peak glacial period. By using the green MPM extended to a global domain (Wang, 2005, Climate Dynamics), it was demonstrated that a moderate global cooling forces the Atlantic Meridional Overturning Circulation (MOC) into an unstable state and hence causes the flip-flop of the Atlantic MOC between a strong mode and a weak mode. The durations of both interstadials and stadials associated with these millennial oscillations are modulated by the changing background climate, in qualitative agreement with the observations. In a warm or early glacial climate, the Atlantic MOC is strong and stable, with the deep water formed mainly by intense heat loss to the atmosphere. In a cold or peak glacial climate, the Atlantic MOC is weak and stable, and this mode is largely maintained by the process of sea-ice brine rejection. Since the simulated D-O oscillations consist of an alternation between these two MOC modes during an intermediate phase climate, we conclude that brine rejection plays a necessary role in the oscillations, confirming a hypothesis suggested in some proxy data studies.

Sensitivity of Arctic and Antarctic Sea-ice cover and global ocean properties to wind-stress and radiative forcings from 1500 to 2000

In #155, the granular sea-ice model (#115) in spherical coordinates is coupled to the atmosphere-ocean components of the UVic Earth System Climate Model (ESCM) and validated using present-day measurements of sea-ice thickness, drift and export through Fram Strait. Also, the thermodynamic fields of the sea-ice model are compared with the Surface Heat Budget of the Arctic Ocean (SHEBA) data sets which were collected between

autumn 1997 and autumn 1998.

This modified Uvic ESCM was then used in #158 to investigate which forcings had a dominant effect on the sea-ice cover in both polar regions during the Little Ice Age (LIA), defined as the period between 1500 and 1850, and the industrial period (1850-2000). Three different reconstructed wind-stress fields which take into account the North Atlantic Oscillation, one general circulation model wind-stress field, and three different radiative forcings are used (i.e., volcanic activity, insolation changes, greenhouse gas changes). The annual surface air temperature anomalies for the Northern Hemisphere, which are used as model validation, show good agreement with reconstructed temperature anomalies, i.e., cooling during the LIA and warming afterwards. The simulated sea-ice area and volume in the Northern Hemisphere were larger during the LIA as compared to the present. The comparison between wind-driven and radiatively-driven changes shows that both forcings result in equal magnitude changes in the case of ice volume; for ice area, the wind-driven part is twice as large as the radiatively-driven part. The simulations suggest that the main radiative forcing before 1850 was volcanic forcing, whereas after 1850 the greenhouse gas changes dominated the forcing field. In the Southern Hemisphere, no long-term trends are visible in the simulated sea-ice area and volume. The wind-driven changes are about four times larger than the radiatively-driven changes.

In #159 the long-term changes in several ocean properties were explored. The ocean heat content changes in the upper 300 m from the tropical to mid-latitudes are mainly driven by the changes in radiative forcing. In the high-latitudes the changes in heat content are wind-driven and represent poleward propagating warm anomalies which occur about every 50 yr. In the full ocean (0 – 3000 m), the wind-stress forcing reduces the radiatively-driven downward cooling trend prior to 1700. After 1700 no wind-driven effect is visible in the simulations. The ocean temperature changes from the LIA to the industrial era show a radiative cooling in the upper 600 m and a dynamical downward transport of cold water to lower depths during the LIA. Changes in salinity are mainly located in the northern high-latitudes. In the surface layers the water was saltier in the Arctic Ocean and fresher in the North Atlantic during the LIA due to increased sea-ice formation and subsequent transport to the south and melting during this period. In the subsurface layers of the Arctic Ocean there was a stronger inflow of saline water during the LIA. The simulated density changes are a composite picture of the temperature and salinity changes.

Finally, we found that the maximum strength of the meridional overturning circulation in the North Atlantic during the LIA was reduced as compared to the industrial era. In the Southern Hemisphere, on the other hand, the ventilation rate was increased during the LIA.

The Paleocene-Eocene thermal maximum (PETM): a box model study

Approximately 55 million years ago, an unprecedented amount of light carbon was abruptly released into the ocean and atmosphere. This event, known as the Paleocene-Eocene thermal maximum (PETM), is documented by large negative carbon isotope excursions in marine and soil carbonates and by global environmental changes, including regional warmings of 5 to 9 C. Various models have been applied to constrain the amount of carbon

released during the PETM; however, the models give a wide range in the amount of carbon released, from 840 to 6800 PgC.

In the MSc thesis of graduate student David Carozza, the Walker-Kasting (WK) carbon cycle box model is revisited. After correcting five of the model's carbon isotope equations, it is used to resolve a discrepancy in previously published emissions estimates for the PETM. In #167, the atmospheric methane box model of Schmidt and Shindell (2003) is coupled to the WK model tuned to pre-PETM conditions to explore the role of methane during the PETM, especially during its onset which is modelled as a two-stage event of lengths 3 and 1 kyr. The first 3 kyr of the onset, a pre-isotope excursion stage, is simulated by the atmospheric release of 900 to 1100 PgC CH₄ with a $\delta^{13}\text{C}$ of -22 to -30 ‰. For a global average warming of 3 °C, a release of CO₂ to the ocean and CH₄ to the atmosphere totalling 900 to 1400 PgC, with a $\delta^{13}\text{C}$ of -50 to -60 ‰, simulated the subsequent 1-kyr isotope excursion stage. To explain the observations, the carbon must have been released over at most 500 yr. While the first stage results cannot be associated with any known hypothesis for the PETM, the second stage results are consistent with a methane hydrate source.

Stained glass and climate change: How are they connected?

According to a number of proxy studies, northwestern continental Europe experienced a pronounced climatic transition toward cooler, wetter, and likely cloudier conditions during the Thirteenth and Fourteenth centuries (#168). At the same time, a significant change in stained glass aesthetics was observed over the same region (#168). It has been well-established by art historians that large windows and whitish-grey 'grisaille' glass, the clearest glass produced at the time, has always been preferred in the British Isles due to greater cloud cover. However, richly coloured glasses and/or smaller windows were preferred in the Mediterranean, ample for the sunnier climatology. Between the two stained glass/climate regimes lies France and western Germany, which switched permanently from a more 'Mediterranean' aesthetic of richly-coloured glasses in the twelfth and thirteenth centuries (corresponding to the Medieval Warm Period) to a more 'Northern' design with grisaille-dominated interiors at the end of the Thirteenth century and in the Fourteenth century (the transition to the Little Ice Age). A series of interior lighting field measurements (luminance and illuminance) were performed in Medieval churches and cathedrals to test whether this transition could have been related to the climatic shift seen in the proxies.

A new remote-sensing method for analyzing stained glass properties and transmissivity was presented in #162, which also quantitatively described the stained glass transition experienced in northern cathedrals. In general, it was found that white and yellow-dominated stained glass from after the fourteenth-century admits 5-10x more light into the church interior than the full-colour windows of the early and mid-Thirteenth century. However, an analysis of well-preserved full-colour interiors in #168 indicates that the difference in architectural lighting between sunny grisailed interiors and sunny full-colour

interiors is relatively small. However, the same comparison between the two types of interiors for cloudy conditions shows a broad 5 x increase in lighting for the grisailed aesthetic. The greater difference seen for the cloudy measurements (#168) suggests that cathedral/church planners had a cloudier aesthetic in mind if they switched to grisailles trying to increase interior lighting for architectural and theological reasons (as art historical theory has suggested). The field measurements also provide further distinctions between winter and summer lighting aesthetics, indicating that the greatest difference between cloudy and sunny interior lighting occurs in winter. Thus, the perceived need for more light may have been partially a consequence of greater winter cloudiness, which is supported by a number of proxy records that indicate markedly more negative NAO index values starting at the end of the Thirteenth century (#168).

Impact of recent winter warming on the Canadian outdoor skating season

Global warming has the potential to negatively affect two of Canada's leading winter sports: hockey and ice skating on outdoor rinks. In paper #169, we showed that the outdoor skating season (OSS) in Canada has significantly shortened in many regions of the country as a result of changing climate conditions. We first established a meteorological criterion for the beginning, and a proxy for the length of the OSS, based on the fact that outdoor rinks can only be formed after a minimum of three consecutive cold days when the temperature never rises above -5 C. We extracted this information from daily maximum temperature observations across Canada from 1951 to 2005, and tested it for significant changes over time due to global warming as well as due to changes in the patterns of large-scale natural climate variability (e.g., the PNA and the NAO). We found that many locations have seen a statistically significant decrease in the OSS length, particularly in Southwest and Central Canada. This suggests that future global warming has the potential to significantly compromise the viability of outdoor skating in Canada.

The ability to skate and play hockey outdoors is a critical component of Canadian identity and culture. Wayne Gretzky learned to skate on a backyard skating rink maintained by his father; our results imply that such opportunities may not be available to future generations of Canadian children.