

**MEMBER COUNTRY:**  
**National Report to SCAR for**  
**year:**

**CANADA**

2010–2011

Activity	Contact Name	Address	Telephone	Fax	Email	web site
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	Prof. Marianne S.V. Douglas	Director, Canadian Circumpolar Institute, University of Alberta, 1-37 Pembina Hall, Edmonton, Alberta T6G 2E1, Canada	[1](780)492-0055	[1](780)492-1153	<a href="mailto:marianne.douglas@ualberta.ca">marianne.douglas@ualberta.ca</a>	<a href="http://www.uofaweb.ualberta.ca/polar">www.uofaweb.ualberta.ca/polar</a>

<p style="text-align: center;"><b>Geosciences</b></p> <p><b>1) Member</b></p> <p><b>2) Member</b></p> <p><b>3)</b></p> <p><b>4)</b></p>	<p>Prof. Wayne H. Pollard</p> <p>Dr Peter L. Pulsifer</p>	<p>Department of Geography, McGill University, Burnside Hall, 805 Sherbrooke Street W., Montréal, Quebec, H3A 2K6, Canada</p> <p>Geomatics and Cartographic Research Centre, Carleton University and National Snow and Ice Data Center, 449 UCB, University of Colorado, Boulder, CO 80309, USA</p>	<p>[1](514)398-4454</p> <p>[1](613)620-7195</p>	<p>[1](514)398-7437</p> <p>[1](613)249-7067</p>	<p><a href="mailto:wayne.pollard@mcgill.ca">wayne.pollard@mcgill.ca</a></p> <p><a href="mailto:pulsifer@nsidc.org">pulsifer@nsidc.org</a></p>	<p><a href="http://www.geog.mcgill.ca/mag2/pollard.htm">www.geog.mcgill.ca/mag2/pollard.htm</a></p>
<p style="text-align: center;"><b>Physical Sciences</b></p> <p><b>1) Member</b></p> <p><b>2)</b></p> <p><b>3)</b></p> <p><b>4)</b></p>	<p>Dr Thomas S. James</p>	<p>Geological Survey of Canada, Natural Resources Canada, 9860 West Saanich Road, P.O. Box 6000, Sidney, British Columbia, V8L 4B2, Canada</p>	<p>[1](250)363-6403</p>	<p>[1](250)363-6565</p>	<p><a href="mailto:tjames@nrcan.gc.ca">tjames@nrcan.gc.ca</a></p>	<p><a href="http://www.pgc.nrcan.gc.ca/geodyn/people/tj_home.htm">www.pgc.nrcan.gc.ca/geodyn/people/tj_home.htm</a></p>

Activity	Contact Name	Address	Telephone	Fax	Email	web site
<b>Scientific Research Program</b>						
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<b>AGCS</b> 1) 2) 3) 4)						
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<b>ICESTAR</b> 1) TAG D 2) 3) 4)	Prof. Eric Donovan	Department of Physics and Astronomy, University of Calgary, Calgary, Alberta T2N 1N4, Canada	[1](403)220-5385	[1](403)282-5016	<a href="mailto:edonovan@ucalgary.ca">edonovan@ucalgary.ca</a>	<a href="http://phas.ucalgary.ca/profiles/eric-donovan">http://phas.ucalgary.ca/profiles/eric-donovan</a>
<b>SALE</b> 1) 2) 3) 4)						
<b>AAA (2010-)</b> 1) Working Group B, Vice-chair 2) 3) 4)	Dr Eric Steinbring	Canadian Gemini Office, Dominion Astrophysical Observatory, National Research Council Canada, 5071 West Saanich Road, Victoria, British Columbia V9E 2E7, Canada	[1](250)363-3452	[1](250)363-0045	<a href="mailto:eric.steinbring@nrc-cnrc.gc.ca">eric.steinbring@nrc-cnrc.gc.ca</a>	

Activity	Contact Name	Address	Telephone	Fax	Email	web site
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<b>2) WCRP/SCAR IPAB Co-ordinator</b>	Dr Christian Haas	Department Earth and Atmospheric Sciences, University of Alberta, Edmonton, Alberta, T6G 2E3, Canada	[1](780)492-8171	[1](780)492-2030	<a href="mailto:chaas@ualberta.ca">chaas@ualberta.ca</a>	<a href="http://easweb.eas.ualberta.ca/index.php?page=14&amp;person=haasc">http://easweb.eas.ualberta.ca/index.php?page=14&amp;person=haasc</a>
<b>3) SERCE PPG</b>	Dr Thomas S. James	Geological Survey of Canada, Natural Resources Canada, 9860 West Saanich Road, P.O. Box 6000, Sidney, British Columbia, V8L 4B2, Canada	[1](250)363-6403	[1](250)363-6565	<a href="mailto:tjames@nrcan.gc.ca">tjames@nrcan.gc.ca</a>	<a href="http://www.pgc.nrcan.gc.ca/geodyn/people/tj_home.htm">www.pgc.nrcan.gc.ca/geodyn/people/tj_home.htm</a>
<b>4) SALE Code of Conduct, Chair</b>	Prof. Warwick F. Vincent	Département de biologie, Université Laval, 1045 avenue de la Médecine, Québec G1V 0A6, Canada	[1](418)656-2131x5739	[1](418)656-2043	<a href="mailto:warwick.vincent@bio.ulaval.ca">warwick.vincent@bio.ulaval.ca</a>	<a href="http://www.cen.ulaval.ca/wvvincent.html">www.cen.ulaval.ca/wvvincent.html</a>
<b>5) IPICS Steering Committee</b>	Dr David A. Fisher	National Glaciology Program, Geological Survey of Canada, Booth Street, Ottawa, Ontario K1A 0E4, Canada	[1](613)996-7623	[1](613)996-5448	<a href="mailto:david.fisher@nrcan-nrcan.gc.ca">david.fisher@nrcan-nrcan.gc.ca</a>	<a href="http://gsc.nrcan.gc.ca/glaciology/national/contact_e.php">http://gsc.nrcan.gc.ca/glaciology/national/contact_e.php</a>
<b>6) AntETR</b>	Dr Irene R. Schloss	Institut des sciences de la mer de Rimouski, Université du Québec à Rimouski, C.P. 3300, 310, allée des Ursulines, Rimouski, Québec G5L 3A1, Canada	[1](418)723-1986x1391	[1](418)724-1842	<a href="mailto:irene_schloss@uqar.qc.ca">irene_schloss@uqar.qc.ca</a>	<a href="http://ismer.uqar.ca/cvismer/?153/Schloss-Irene-R">http://ismer.uqar.ca/cvismer/?153/Schloss-Irene-R</a>
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<b>8) AntEco</b>	Dr Kathleen Conlan	Canadian Museum of Nature, Life Sciences, P.O. Box 3443, Station D, Ottawa, Ontario, K1P 6P4, Canada	[1](613)364-4063	[1](613)364-4027	<a href="mailto:kconlan@mus-nature.ca">kconlan@mus-nature.ca</a>	
<b>9) GWSWF</b>	Dr Paul Prikryl	Earth-Space Propagation, Communications Research Centre Canada, 3701 Carling Avenue, P.O. Box 11490, Station H, Ottawa Ontario K2H 8S2, Canada	[1](613)998-2068	[1](613)998-4077	<a href="mailto:paul.prikryl@crc.gc.ca">paul.prikryl@crc.gc.ca</a>	

<b>EXPERT GROUPS</b>						
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<b>2) ANTPAS Steering Committee</b>	Dr Charles T. Tarnocai	Research Branch (ECORC), Agriculture and Agri-Food Canada, 960 Carling Avenue, Ottawa, Ontario K1A 0C6, Canada	[1](613)759-1857	[1](613)759-1926	<a href="mailto:tarnocai@agr.gc.ca">tarnocai@agr.gc.ca</a>	<a href="http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1181923002120&amp;lang=eng">http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1181923002120&amp;lang=eng</a>
<b>3) PPE</b>	Prof. Wayne H. Pollard	Department of Geography, McGill University, Burnside Hall, 805 Sherbrooke Street W., Montréal, Quebec, H3A 2K6, Canada	[1](514)398-4454	[1](514)398-7437	<a href="mailto:wayne.pollard@mcgill.ca">wayne.pollard@mcgill.ca</a>	<a href="http://www.geog.mcgill.ca/mag2/pollard.htm">www.geog.mcgill.ca/mag2/pollard.htm</a>
<b>4) PPE</b>	Prof. Kevin J. Hall	Geography Program, University of Northern British Columbia, 3333 University Way, Prince George, British Columbia, V2N 4Z9, Canada	[1](250)960-5864	[1](250)960-6533	<a href="mailto:hall@unbc.ca">hall@unbc.ca</a>	<a href="http://www.unbc.ca/geography/faculty/hall/">http://www.unbc.ca/geography/faculty/hall/</a>
<b>5) ADMAP</b>	Dr Jacob Verhoef	Director, UNCLOS Program, Geological Survey of Canada, Natural Resources Canada, 1 Challenger Drive, P.O. Box 1006, Dartmouth, Nova Scotia B2Y 4A2, Canada	[1](902)426-3448	[1](902)426-1466	<a href="mailto:jacob.verhoef@nrca-nrcan.gc.ca">jacob.verhoef@nrca-nrcan.gc.ca</a>	
<b>6) Human Biology and Medicine</b>	Dr Dave R. Williams	McMaster Centre for Medical Robotics, St. Joseph's Healthcare, 50 Charlton Avenue East, Hamilton, Ontario L8N 4A6, Canada	[1](905)522-1155x 33901	[1](905)521-6197	<a href="mailto:willd@mcmaster.ca">willd@mcmaster.ca</a>	
<b>7) Human Biology and Medicine</b>	Prof. Peter Suedfeld	Department of Psychology, University of British Columbia, 3533 - 2136 West Mall, Vancouver, British Columbia V6T 1Z4, Canada	[1](604)822-5713	[1](604)822-6923	<a href="mailto:psuedfeld@psych.ubc.ca">psuedfeld@psych.ubc.ca</a>	

<b>SCADM</b>						
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<b>ATCM, CEP &amp; permitting</b>	Paul Mudroch	Marine Pollution Prevention Section, Environmental Stewardship Branch, Environment Canada, 16th Floor, 351 St. Joseph Blvd., Gatineau, Quebec K1A 0H3, Canada	[1](819)953-0663	[1](819)953-0913	antarctique-antarctic@ec.gc.ca	<a href="http://www.ec.gc.ca/gdd-mw/default.asp?lang=En&amp;n=AEB7D114-1">www.ec.gc.ca/gdd-mw/default.asp?lang=En&amp;n=AEB7D114-1</a>
<b>Antarctic Names</b>	Heather Ross	Antarctic Working Group, Geographical Names Board of Canada, 634 – 615 Booth Street, Ottawa, Ontario K1A 0E9, Canada	[1](613)992-4136	[1](613)943-8282	heross@nrcan.gc.ca	<a href="http://geonames.nrcan.gc.ca/pdf/antarctic_guidelines_e.pdf">http://geonames.nrcan.gc.ca/pdf/antarctic_guidelines_e.pdf</a>
<b>Antarctic Map Depository</b>	David L. Jones	William C. Wonders Map Collection, 1-55 Cameron Library, University of Alberta, Edmonton, Alberta T6G 2J8, Canada	[1](780)492-3433	[1](780)492-2721	david.jones@ualberta.ca	<a href="http://guides.library.ualberta.ca/content.php?pid=45635&amp;sid=817949">http://guides.library.ualberta.ca/content.php?pid=45635&amp;sid=817949</a>
<b>NATIONAL ANTARCTIC DATA CENTRE</b>						
No centre yet established						
<b>SCAR DATABASE</b>						
Canada not responsible for an Antarctic database						

## SCIENTIFIC HIGHLIGHTS:

Canadian research in the Antarctic is strongly influenced by the ability of individual scientists to develop partnerships within the scientific programs of other Antarctic nations. The assistance of these national programs is greatly appreciated. Canadian work fits within the broad categories of the three Standing Scientific Committees, but is not necessarily specific to any group or project. As reflected in the attached bibliography, many Canada-based scientists have been active in the collection and analysis of Antarctic data, and publication of results, but have not necessarily reported on their current work in this annual report.

One highlight of the past year was the second Canadian University Antarctic Expedition run in partnership with the Students on Ice organization from 14–27 February 2011. A total of 60 individuals from 23 universities, mentored and taught by some 30 scientists, historians, artists, explorers, educators, innovators and polar experts, were able to obtain credit for courses offered on board the *M/V Ushuaia*.

The Canadian RADARSAT-2 satellite acquired high-resolution, multi-polarization C-band SAR data of Antarctica between October 14 and December 3, 2008. 1788 individual scenes were processed into a cohesive, 25-m resolution mosaic that matches the RADARSAT-1 SAR mosaic acquired in 1997. The dual-polarization capability of RADARSAT-2 SAR will likely improve detailed detection and differentiation of snow- and ice-related features vis-à-vis subglacial morphology over very large areas.

Using RADARSAT-2 data, from the Canadian Space Agency (Yves Crevier: yves.crevier@asc-csa.gc.ca), it was possible to complete an Antarctic velocity map and grounding-line map (south of 78°S) with 3-pass interferometric SAR data. The Earth Science Data Records (ESDR) will be distributed through the National Snow and Ice Data Center (NSIDC). This effort establishes a long-term legacy for quantitative measurements of the dynamics of polar ice sheets.

## LIFE SCIENCES

Émilien Pelletier (emilien\_pelletier@uqar.qc.ca), in partnership with the Instituto Antártico Argentino, continues his work on anthropogenic contamination of soils, sediments and organisms in the vicinity of sub-Antarctic and Antarctic scientific stations. He is characterizing hydrocarbons, trace metals and chlorinated pesticides in various environmental compartments and developing bioremediation techniques to eliminate them.

Brian Lanoil (brian.lanoil@ualberta.ca) has re-assessed how microbes impact weathering processes and geochemical transformations beneath Kamb Ice Stream and whether they may be a major unrecognized reservoir of microorganisms and biological carbon.

Piotr Angiel (pangiel@uwo.ca) is working up results of earlier research from King George Island (2005–07 & 2008–09) on fluctuations of penguins and other seabird colonies, sea mammal populations, glaciers, and plant community colonization in response to climate change.

Hayley Hung (hayley.hung@ec.gc.ca) is collaborating with Susan Bengtson Nash (Griffith University, Australia) on the atmospheric measurement of persistent organic pollutants (POPs) at Casey, in a study of atmospheric transport and air–soil exchange of these chemicals. A Canadian-designed flowthrough sampler, which can operate under extreme cold conditions, captured air samples from November 2009 to November 2010.

Philippe Tortell (ptortell@eos.ubc.ca) and his group have measured photosynthetic activity and inorganic C utilization by *in situ* algal assemblages in the Bellingshausen, Amundsen and Ross Seas, from the *RV/IB Oden*. They also measured the concentrations and turnover rates of methylated sulfur compounds (DMS, DMSP and DMSO). On a second cruise, to the Weddell Sea, Antarctic Peninsula region, and the Atlantic sector of the Southern Ocean, aboard the *RV Polarstern*, the fine-scale distribution of surface water gases (DMS,  $p\text{CO}_2$  and  $\text{O}_2/\text{Ar}$  ratios) was mapped across hydrographic frontal regions.

Roberta Hamme (rhamme@uvic.ca) has been estimating net community production in the Southern Ocean from measurements of  $\text{O}_2/\text{Ar}$  and other dissolved gases from the *R/V Ronald H. Brown* as part of SO GasEx.

Jared Towers (mersociety@gmail.com) made observations on, and collected photographs of, cetaceans in the Southern Ocean between January and March 2010 while working as the marine mammal expert aboard a tour vessel.

Stephanie King and Jim Gower (gowerj@pac.dfo-mpo.gc.ca), using the MERIS satellite imager, have observed a continuing increase in Antarctic “superblooms” in ice since they first reported on them in 2007. A major bloom event, observed over 6 days in March 2011 in the Bellingshausen Sea (71.7°S, 89°W), covered an area of 12,800 km<sup>2</sup> and contributed 30% of the total count for the year. Blooms have increased by a factor of 3 to 5 over the period 2003–11, occurring at different longitudes in different years.

## PHYSICAL SCIENCES

Studies by Michael Sigmond (sigmond@atmosph.physics.utoronto.ca), John Fyfe (john.fyfe@ec.gc.ca) and others indicate the hole in the Earth's ozone layer over the South Pole has affected atmospheric circulation in the Southern Hemisphere all the way to the Equator, and increased rainfall in the subtropics; the first time ozone depletion has been linked to climate change over such a wide area. The depletion of the ozone layer, from 8–25 miles up, causes severe cooling in the lower stratosphere, expanding the troposphere, altering patterns of air circulation, and leading to a poleward shift of mid-latitude westerly winds. They have run carefully constructed climate model experiments to determine the impact of the ocean on the atmospheric response to ozone depletion. They simulated the effects on Antarctic sea ice extent and found that ozone depletion would lead to a year-round *decrease* in Antarctic sea ice extent. Thus processes other than ozone depletion must be causing the observed *increase* in Antarctic sea ice extent. Coupling an atmosphere–ocean model with interactive stratospheric chemistry showed that the impact of ozone depleting substances on Antarctic Circumpolar Current transport exceeds the corresponding greenhouse gas impact up to the second quarter of the 21st century, highlighting the importance of stratospheric ozone trends for simulating ocean circulation, an element currently missing from most climate models. Theodore Shepherd (tgs@atmosph.physics.utoronto.ca) was Principal Investigator for the Canadian SPARC Network (Stratospheric Processes And their Role in Climate), which ran from 2006 to 2011 and was the prime mover behind many of these studies.

Nathan Gillett (nathan.gillett@ec.gc.ca) and colleagues have investigated the long-term effects of a simulation of complete cessation of carbon dioxide emissions in the Canadian Earth System Model. A pronounced delayed mid-depth warming in the Southern Ocean, adjacent to the ice shelves, could have implications for the long-term stability of the West Antarctic ice sheet.

Ali Mashayek (amashaye@atmosph.physics.utoronto.ca) and colleagues have been investigating the effective eddy diffusivity in ocean general circulation models. They found it to be more strongly enhanced on the flanks of the Antarctic Circumpolar Current (ACC) and demonstrated that the influence of critical layers is profound. Eddy diffusivity can be predicted on the basis of minimal information from the observations, such as latitudinal variation of the zonal current velocity alone.

Over the last 2 years Dr Wayne Hocking (whocking@uwo.ca) has been involved in building a meteor radar, designed for meteor astronomy and upper atmospheric physics, at the Brazilian Comandante Ferraz Base on King George Island. He also helped install a simpler SKIYMET radar at Rothera, which was a joint development between Mardoc Inc., of London, Ontario, and Genesis Software Pty Ltd, of North Adelaide, Australia.

Sander Geophysics Limited (SGL: Stefan Elieff, selieff@sgl.com) continued its participation in NASA's IceBridge campaign in Antarctica. An SGL AIRGrav airborne gravity meter, on the NASA DC-8, surveyed key areas of Antarctica in October and November 2010, building on data acquired in 2009. The mission is a multi-year campaign designed to monitor the health of sea ice and ice sheets in the polar regions.

Graham Cogley (gcogley@trentu.ca) is part of a team compiling an inventory of Subantarctic island glaciers, which have an estimated area of 7863 km<sup>2</sup>. Most of Heard Island's 29 glaciers have shrunk since first observed in 1947, several retreating from tidewater terminuses. Total glacier area there decreasing from 288 km<sup>2</sup> in 1947 to 231 km<sup>2</sup> in 2008. On Kerguelen, the 703 km<sup>2</sup> glacier extent in 1963–64 was reduced to 552 km<sup>2</sup> in 2001. Glacier shrinkage, thinning and negative mass balance is typical across the region. The first objective topographic map of Montagu Island, the largest of the South Sandwich Islands (glacierized area 94 km<sup>2</sup>), has been compiled using the ASTER Global Digital Elevation Model which is not only valuable for first-time mapping, but is also a useful aid for selecting scenes for estimating multi-decadal changes.

Raymond Turner (turnerr@ucalgary.ca) is analyzing ice and water samples from the McMurdo Dry Valleys, using fluorescence spectroscopy to characterize their organic material and correlate the DOC with microbial activity.

## **GEOSCIENCES**

Over the past 2–3 years Lev Tarasov and Rob Briggs (rdbiggs@mun.ca) have been working on a calibrated deglaciation history of Antarctica, applying methods from similar work on Eurasian and North American ice sheets. The Glacial Systems Model (GSM) for the Antarctic ice sheet has over 20 ensemble parameters that capture uncertainties in the glacial cycle climate, mass-balance processes, and dynamics. Observational data include: relative sea level and paleo ice surface indicators, borehole temperature profiles and the present-day ice-sheet configuration. The core of the model is a modified version of Dave Pollard's (Penn State, USA) Antarctica model.

Andrea Darlington (adarlin@uvic.ca) is examining geophysical (seismological) constraints and modelling glacial isostatic adjustment to better constrain mantle viscosity beneath Antarctica and explain GPS-observed crustal uplift for her M.Sc. studies at University of Victoria under the supervision of Thomas James.

Since 2009, the Communications Research Centre, in collaboration with the University of New Brunswick, has participated in the SCAR GWSWF Action Group, that is hoping to become a SCAR Expert Group. Paul Prikryl (paul.prikryl@crc.gc.ca) chairs the subgroup on "Solar-Terrestrial Interactions and Ionospheric Effects in the Current Solar-Cycle". Nine countries are developing ionospheric imaging capability and sharing Global Navigational Satellite System (GNSS) data for input to weather and space weather modeling and forecasting. The Antarctic array of GNSS ground receivers, that include GPS L-band scintillation monitors, is complemented in the Northern Hemisphere by the Canadian High Arctic Ionospheric Network (CHAIN), offering new opportunities for conjugate studies of scintillation and total electron content and space weather impacts on the polar and auroral ionosphere.

## **ASTRONOMY**

Tijmen de Haan (tijmen@physics.mcgill.ca), with Dr Matt Dobbs and his team from McGill University, is using the South Pole Telescope (SPT), to detect and study galaxy clusters, the most massive gravitationally collapsed structures, whose abundance can provide accurate constraints on the formation history of the universe. His observations in January 2011 helped confirm galaxy cluster candidates previously detected with the Planck satellite.

## **OTHER**

Ross A. Klein (rklein@mun.ca) is investigating issues related to the environment, and safety and security, in the polar cruise ship industry and tourism, based on documentary sources and key informants such as the shipboard naturalists and lecturers.