Institute for Geophysical Research

Annual Report 2017

The Institute for Geophysical Research

Overview

The Institute for Geophysical Research fosters interactions and collaborations between geophysical researchers. The Institute defines geophysical research quite broadly to include study of the Earth's core, mantle and lithosphere, its oceans, atmosphere and cryosphere and its near-space environment. It also includes study of the sun, the other planets, the solar wind and its interactions with planetary magnetic fields.

The Institute is composed primarily of Faculty members and their students in three Departments of the University of Alberta: the Department of Earth & Atmospheric Sciences, the Department of Mathematical and Statistical Sciences and the Department of Physics.

The Institute aims to advance geophysical studies within the University, to assist in the dissemination of knowledge, to help train leaders in areas of importance for the future well-being of our environment, and to promote interaction between the University and the broader community in academia, government and industry.

The focus of these goals is upon graduate students involved in geophysical research at the University of Alberta. The students get experience in giving oral presentations through the Annual Symposium, which gives students exposure to presenting conference-style talks. The students are exposed to research in the broader international community both through talks given by invited speakers and through attending conferences, the funds for which are partially provided by the Institute through the Dr. Roy Dean Hibbs endowment and through external agencies. Through the Institute, funding and support from professional organizations outside the University of Alberta have served to expose students to career opportunities in geophysics.

The Faculty Members of the Institute maintain active research programs. The recent accomplishments of each Faculty Member and research-active Emeritus Members are highlighted in this report. The Institute facilitates collaborations among geophysical researchers within the University of Alberta in part through seminars, an annual symposium and other meetings. International collaborations are facilitated by providing some financial support for invited speakers to travel to the University to work with their host and interact with the broader membership through talks and individual meetings.

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Associate Directors

Claire Currie

Vakhtang Putkaradze

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Claire Currie

Rick Sydora

John Wilson

Ex Officio Council Members

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Mauricio Sacchi, Chair, Department of Physics

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Heather Zwicker, Dean, Graduate Studies and Research

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Xiewei Chen, Geophysics
Miroslaw Ciurzynski, Space Physics
Thomas Eyre, Geophysics
Charlene Feucher, Atmos-Ocean-Ice
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Frank Calixto Mory, Geophysics
Louis Ozeke, Space Physics
Jean-Baptiste Tary, Geophysics
Lei Wu, Geophysics
Jiyang Ye, Geophysics

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Ibinabo Bestmann, Geophysics
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Sohel Bhulyan, Geophysics
Colin Brisco, Geophysics
Daniel Brown, Atmos-Ocean-Ice
Ryan Borowiecki, Geophysics
Sam Bowman, Geochemistry
Mauricio Reyes Canales, Geophysics
Mitchell Canham, Fluid Dynamics
Fernanda Carozzi, Geophysics
Laura Castro de la Guardia, A-O-I
Ke Chen, Geophysics
Yunfeng Chen, Geophysics
Darcy Cordell, Geophysics
Keith Cuff, Geophysics
Judit Deri-Takacs, Hydrogeology
Nho Hung Dinh, Geophysics
Ramin Dokht, Geophysics
Ashley Dubnick, Atmos-Ocean-Ice
Vivian Ebufegha, Geophysics
Tyson Epp, Geophysics
Quinton Farr, Fluid Dynamics
Ryan Ferguson, Geophysics
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Amna Feroz, Geophysics
Kyle Foster, Space Physics
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Wenlei Gao, Geophysics
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Hossna Gharaee, Space Physics
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Manir Hossain, Space Physics
Nan (Jack) Hu, Atmos-Ocean-Ice
Tianqi Hu, Geophysics
Scott Karbashewski, Space Physics
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Benjamin Lee, Geophysics
Shuo Li, Mech Eng
Zhenhua Li, Geophysics
Pedro Resendiz Lira, Space Physics
Xiaowen Liu, Geophysics
Hang Lu, Geophysics
Benjamin Lysak, Geophysics
Yongxing Ma, Atmos-Ocean-Ice
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Gian Matharu, Geophysics
Tariq Mohammed, Geophysics
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Oliver Nam Ong, Geophysics
Oliver Organowski, Geophysics
Iliana Papathanasaki, Geophysics
Min Jun Park, Geophysics
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Arif Rabbani, Geophysics
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Stuart Rogers, Fluid Dynamics
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Craig Thompson, Hydrogeology
Ujjwal Tiwari, Atmos-Ocean-Ice
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Jon Toma, Geochemistry
Hava Turkakin, Space Physics
Pamela Twerdy, hydrogeology
Yoones Vaezi, Geophysics
Enci Wang, Geophysics
Ruijia Wang, Geophysics
Tai-Chieh Yu, Geophysics
Shuyu Zhang, Atmos-Ocean-Ice

Seminars

Aibing Li, University of Houston

Jan 10, 2017: Fate of continental cratons

W. Richard Peltier, University of Toronto

Mar 14, 2017: The physics of the Dansgaard-Oeschger Oscillation

Irina Rypina, Woods Hole Oceanographic Institution

Nov 22, 2017: Trajectory encounter volume as a diagnostic of mixing potential in fluid flows

Doug Schmitt, University of Alberta (CSEG Distinguished Lecturer)

Nov 29, 2017: Finding the State of Stress in the Crust in Deep Boreholes: Examples from the Antarctic, Alberta, and the Alpine Fault

Annual Graduate Symposia

The Annual Spring IGR Graduate Symposium took place on the afternoon of Wednesday, April 12, 2017. The Annual Fall IGR Graduate Symposium took place on the afternoon of Wednesday, October 30, 2017.

As in previous years, graduate students gave short, conference-style 12 minute talks including 2 minutes for questions.

During the presentations, three judges evaluated the quality of the slides, oral presentation and question answering. Based on these criteria, an award was given for the best presentation. This Best Presenter Awards were given to Anja Rutishauser and Colin More for the Fall and Spring Symposia, respectively. The evaluations were also used as a criteria for students applying for the IGR Hlbbs Travel Awards.

Fall 2017 Best Presentation Award winner, Yarisbel Garcia Quintana (left), with supervisor, Paul Myers (right)

Spring 2017 Best Presentation Award winner, Colin More (right), with supervisor, Mathieu Dumberry (left)

Schedule of talks for the IGR Symposium, April 12, 2017

IGR Graduate Symposium Oct 26 in L1-047: Chair - Bruce Sutherland		
2:00	*Speakers in Session A upload their talks to computer or otherwise test the laptop connection*	
2:10	Nathan Grivault	Volume and freshwater exchange inside and outside of the Canadian Arctic Archipelago
2:23	Reza Malehmir	Ultrasonic Reflectivity Measurements and Modelings from an Orthotropic media: a Physical Modelings case study
2:36	Anja Rutishauser	Characterizing near-surface firn from airborne radio-echo sounding measurements
2:49	Ali Moradi	Emptying filling boxes - free turbulent vs. laminar porous media plumes
3:02	Clark Pennelly	Freshwater transport into the interior of the Labrador Sea: A modelling study
3:15	Lei Wu	Paleomagnetic-based rotation fields disclose the kinematics of the deformation of the Tianshan Mountains for the last 45 Myr
3:28	Natasha Ridenour	Modelling freshwater dynamics in the Hudson Bay Complex using the ANHA4 configuration
3:41	Tyson Epp	Geomechanical Measurements of an Analogue to the Grosmont Fm.
3:54	*Session Ends. Pizza followed by Best Presentation Award*	

Schedule of talks for the IGR Symposium, October 30, 2017

IGR Graduate Symposium Oct 30 in L1-047		
2:00	*Speakers in Session A upload their talks to computer or otherwise test the laptop connection*	
2:10	Laura Castro de la Guardia	Arctic Rivers: important food source for algae?
2:23	Shuo Li	Coaxial Plume Dynamics with Applications to Visible Plume Abatement
2:36	Luyi Shen	Constraining In-situ stress near Fox Creek, Alberta and its implication on fault stability
2:49	Yongxing Ma	Plume Splitting in a Two-layer Stratified Ambient Fluid
3:02	Yarisbel Garcia Quintana	Atlantic Water transformation in the Nordic Seas
3:15	Xiaowen Liu	Numerical modeling of Farallon Plate flat-slab subduction: Influence of lithosphere structure and rheology on slab dynamics
3:28	Natasha Ridenour	Modelling High Frequency Variability in Hudson Strait Outflow Using the ANHA Configuration
3:41	Arif Rabbani	Physical properties of bitumen - and saturated carbonates
3:54	*Pizza break until Session B begins at 4:10. Speakers in Session B upload their talks to computer or test laptop connection*	
4:10	Anja Rutishauser	Discovery of a hypersaline subglacial lake complex beneath Devon Ice Cap, Canadian Arctic
4:23	Charlene Feucher	Labrador Sea Water formation rate and its impact on the Meridional Overturning Circulation
4:36	Tai-Chieh Yu	Geophysical constraints on the mantle structure of the Canadian Cordillera and North America Craton
4:49	Nathan Grivault	Transport out of the Arctic: frequency of events
5:02	Clark Pennelly	Variability of cross-isobath exchange within the Labrador Sea for select water masses
5:15	Tayyaba Firdous	Nanomechanical Torque Magnetometry of Magnetic Nanoparticles
5:28	Amanda Kahn	Model estimates of the carbon budget of the Labrador Sea
5:41	Andrew Hamilton	Ocean forcing of marine-terminating glaciers in the Canadian High Arctic
5:54	*Session ends with closing refreshments before Best Presentation Award given in L1-047 shortly after 6pm*	

Awards and Scholarships

Dr. Roy Hibbs was a geophysics graduate student in the Department of Physics from 1970 – 1977. He received an MSc in 1972 and a PhD. in 1977. His research was in electromagnetic induction in the Earth, and his numerical studies of source effects in two-and three-dimensional problems provided an important early contribution in that field. After graduating from the University of Alberta, Dr. Hibbs held postdoctoral fellowships at the University of Alberta and the University of Victoria and subsequently worked in the petroleum industry on projects in Canada, United States and Libya. Dr. Hibbs died in a tragic plan crash in Libya in January 2000.

Thanks to a generous endowment provided by the family of Dr. Hibbs, travel awards and scholarships are given each year to gradate students of Faculty Members of the IGR.

Travel Awards

The travel awards provide financial assistance to graduate students giving talks or presenting posters at conferences outside of Edmonton. Travel Awards Competitions are held in the Spring and Fall Terms.

Spring 2017 award winners were Laura Castro de la Guardia, Tariq Mohammed (with distinction) and Arif Rabbani.

Fall 2017 award winners were Xiaowen Liu, Yongxing Ma, Yarisbel Garcia Quintana (with distinction) and Anja Rutishauser (with distinction)

Scholarships

The Roy Dean Hibbs Scholarships are given once a year to graduate students with demonstrated academic and research excellence. The winners of the 2017 competition were Laura Castro de la Guardia, Reza Malehmir, Tariq Mohammed and Arif Rabbani.

Our Members and their Research

The Faculty Members of the Institute for Geophysical Research are actively engaged in research into processes deep in the Earth, in its atmosphere, oceans and glaciers, and in its near space environment. The profiles that follow describe their research interests with citations given to selected recent publications.

Andrew Bush: climate modelling

Dr. Bush is a Professor in the Department of Earth and Atmospheric Sciences and is an Adjunct Professor at Texas A&M University. His research focuses on atmosphere-ocean-cryosphere dynamics and how they apply to our understanding of paleoclimates and future climates. Dr. Bush's research group uses global coupled atmosphere-ocean general circulation models as well as higher resolution regional atmospheric models to perform simulations of past and future climates. Recent interests include the potential fate of high altitude alpine glaciers, particularly those in the Rockies and the Himalaya, and of the future freshwater resources that they may be able to provide.

Recent Publications

Bush, A.B.G. and M.P. Bishop, 2017: Glaciers in the Anthropocene: Fighting an uphill battle. In: Sean Simms (editor-in-chief). Encyclopedia of the Anthropocene. In press, Elsevier.

Dobreva, I., M.P. Bishop, and A.B.G. Bush, 2017. Climate--Glacier Dynamics and Topographic Forcing in the Karakoram Himalaya: Concepts, Issues and Research Directions. Water, 9, 1-28.

Collier, E., F. Maussion, L.I. Nicholson, T. Molg, W.W. Immerzeel, and A.B.G. Bush, 2015: Impact of debris cover on glacier ablation and atmosphere-climate feedbacks in the Karakoram. The Cryosphere, 9, 1617-1632.

Collier, E., L. I. Nicholson, B.W. Brock, F. Maussion, R. Essery, and A.B.G. Bush, 2014: Representing moisture fluxes and phase changes in glacier debris cover using a reservoir approach. The Cryosphere, 8, 1429-1444.

Stumpf, A.J., T. Ferbey, A. Plouffe, J.J. Clague, B.C. Ward, R. C. Paulen and A.B.G. Bush, 2014: Discussion: ``Streamlined erosional residuals and drumlins in central British Columbia, Canada'' by J. Donald McClenagan. Geomorphology, 189, 41-54.

Bush, A.B.G. and M.P. Bishop, 2014: Glaciers, Topography, and Climate, in "Encyclopedia of Atmospheric Sciences (2nd Edition)", editor Gerald North. Elsevier, Oxford, UK. in press.

Pollock, E.W. and A.B.G. Bush, 2013: Changes in Snow Mass balance in the Canadian Rockies caused by CO2 Rise: a Regional Atmosphere Model Simulation. Atmosphere-Ocean, in press.

Gascon, G., M. Sharp, P. Bezeau, A.B.G. Bush, and D. Burgess, 2013: Three-dimensional changes of the stratigraphy of the accumulation area of the Devon Ice Cap, Nunavut, Canada, during a period of climate warming. Journal of Geophysical Research (Earth Surface), in press.

Gascon, G., M. Sharp, and A. Bush, 2013: Changes in melt season characteristics on Devon Ice Cap, Canada, and their association with the Arctic atmospheric circulation. Annals of Glaciology, 54, 101-110.

Collier, E., T. Molg, F. Maussion, D. Scherer, C. Mayer, and A.B.G. Bush, 2013: High- resolution interactive modelling of the mountain glacier-atmosphere interface: An appli- cation over the Karakoram, The Cryosphere, 7, 779-795, doi: 10.5194/tc-7-779-2013.

Robert Creaser: geochemistry

Professor Creaser was educated in Australia, obtaining B.Sc. (Honours) and Ph.D. degrees in Geology and Geochemistry, respectively, in 1984 and 1990, from the Australian National University and La Trobe University. He held the position of Research Fellow in Geochemistry at the California Institute of Technology from 1990 to 1992 working with Prof. G.J. Wasserburg to develop efficient mass spectrometry methods for isotopic analysis of Os, Re and other platinum group elements. He was appointed at the University of Alberta in 1992 and is currently a Professor, and Canada Research Chair in Isotope Geochemistry, in the Department of Earth and Atmospheric Sciences. His primary research interest lies in the application of geochemical and isotope techniques to further the understanding of fundamental processes which control the origin and evolution of Earth's crustal rocks. In particular, his current research focus involves continued development and application of the rhenium-osmium (Re-Os) radioactive isotope system, which can be used to provide absolute age determinations on geologic materials difficult to date by other methods, such as sedimentary rocks and sulfide minerals. He is a Fellow of the Royal Society of Canada, a Distinguished Fellow of the Geological Association of Canada, and a Fellow of the Society of Economic Geologists.

Recent Publications

T Baker D Bickford, S Juras, P Lewis, Y Oztas, K Ross, A Tukac, F Rabayrol, A Miskovic, R Friedman, RA Creaser and R Spikings. "The Geology of the Kisladag Porphyry Gold Deposit, Turkey". Society of Economic Geologists Special Publication, 19, 57-83.

NH Jansen, JB Gemmell, Z Chang, DR Cooke, F Jourdan, RA Creaser and P Hollings. "Geology and Genesis of the Cerro la Mina Porphyry-High Sulfidation Au (Cu-Mo) Prospect, Mexico". Economic Geology (2017), 112, 799-827.

RH Sillitoe, J Perelló, RA Creaser, J Wilton, AJ Wilson and T Dawborn. "Age of the Zambian Copperbelt". Mineralium Deposita (2017), 52, 1245-1268.

NJ Saintilan, RA Creaser and AA Bookstrom. "Re-Os systematics and geochemistry of cobaltite (CoAsS) in the Idaho cobalt belt, Belt-Purcell Basin, USA: Evidence for middle Mesoproterozoic sediment hosted Co-Cu sulfide mineralization with Grenvillian and Cretaceous remobilization". Ore Geology Reviews (2017), 86, 509-525.

NJ Saintilan, RA Creaser, PG Spry and D Hnatyshin. "Re-Os systematics of löllingite and arsenopyrite in granulite facies garnet rocks: Insights into the origin of the Broken Hill deposit and the thermal evolution of the Broken Hill block during the Early Mesoproterozoic (New South Wales, Australia)". Canadian Mineralogist (2017), 55, 29-44.

JP Richards, GP Lopez, JJ Zhu, RA Creaser, AJ Locock and AH Mumin. "Contrasting Tectonic Settings and Sulfur Contents of Magmas Associated with Cretaceous Porphyry Cu ± Mo ± Au and Intrusion-Related Iron Oxide Cu-Au Deposits in Northern Chile". Economic Geology (2017), 112, 295-318.

L Ackerman L, Haluzová E, RA Creaser etc "Temporal evolution of mineralization events in the Bohemian Massif inferred from Re-Os geochronology of molybdenites". Mineralium Deposita (2017), 52, 651-662.

J Babo, N Oliver, C Spandler, M Brown, M Rubenach and RA Creaser. "The high grade Mo-Re Merlin deposit, Cloncurry District, Australia: Deposit description, geochronology and ore genesis". Economic Geology, (2017), 112, 397-422.

Claire Currie: mantle-plate dynamics

Dr. Currie's research examines the structure and dynamics of the upper ~600 km of the Earth. She is particularly interested in the lithosphere dynamics and convergent plate margins. Current work focuses on subduction and mountain-building in western North and South America. Most research is carried out using physically-based numerical models. These are combined with geophysical observations (e.g., seismic tomography and surface heat flow) in order to constrain the processes that control the evolution of the Earth's lithosphere and upper mantle.

Recent Publications

Wang, H. and C.A. Currie (2017), Crustal deformation induced by mantle dynamics: Insights from models of gravitational lithosphere removal, Geophysical Journal International, v. 210, p. 1070-1091.

Copeland, P., C.A. Currie, T.F. Lawton and M.A. Murphy (2017), Location, location, location: The variable lifespan of the Laramide orogeny, Geology, v. 45. p. 223-226.

Currie, C.A. and J. van Wijk (2016), How craton margins are preserved: Insights from geodynamic models, Journal of Geodynamics, v. 100, p. 144-158.

Rosas, J.C., C.A. Currie and J. He (2016), Three-dimensional thermal model of the Costa Rica-Nicaragua subduction zone, Pure and Applied Geophysics, v. 173, p. 3317-3339.

Liu, S. and C.A. Currie (2016), Farallon plate dynamics prior to the Laramide orogeny: Numerical models of flat subduction, Tectonophysics, v. 666, p. 33-47.

Wang, H. and C.A. Currie (2015), Magmatic expressions of continental lithosphere removal, Journal of Geophysical Research, v. 120, p. 7239-7260.

Krystopowicz, N.J. and C.A. Currie (2013), Crustal eclogitization and lithosphere delamination in orogens, Earth and Planetary Science Letters, v. 361, p. 195-207.

Mathieu Dumberry: dynamics of planetary cores

Dr. Dumberry's primary research interest is focused on the dynamics taking place in Earth's deep interior. More specifically, my research focuses on how dynamics directly or indirectly related to fluid motion in the core cause changes in the geomagnetic and gravitational fields observed at the surface, as well as changes in the Earth's rotation, both in amplitude and direction. Many of these ideas can also be applied to other planets to learn about their interior.

Recent Publications

More, C. and Dumberry, M., 2018, Convectively driven decadal zonal accelerations in Earth's fluid core, Geophysical Journal International, in press.

Dumberry, M and Wieczorek, M. A., 2016, The forced precession of the Moon's inner core. Journal of Geophysical Research Planets, 121, 1-29.

Mitrovica, J. X., Hay, C.C., Morrow, E. Kopp, R. E, Dumberry, M. and Stanley, S., 2015, Reconciling past changes in Earth's rotation with 20th century global sea-level rise: resolving Munk's enigma, Sci. Adv., 1, e1500679.

Dumberry, M. and Rivoldini, A., 2015, Mercury's inner core size and core-crystallization regime, Icarus, 248, 254–268.

Davies, C. J., Stegman, D. R. and Dumberry, M., 2014, The strength of gravitational core-mantle coupling, Geophys. Res. Lett., 41, 3786–3792, doi:10.1002/2014GL059836.

Koot, L. and Dumberry, M. 2013, The role of the magnetic field morphology on the electromagnetic coupling for nutations, Geophys. J. Int.,195, 200-210.

Yseboodt, M., Rivoldini, A., Van Hoolst, T. and Dumberry, M. 2013, Influence of an inner core on the long period forced librations of Mercury, Icarus, 226, 41-51.

Dumberry, M., Rivoldini, A., Van Hoolst, T. and Yseboodt, M. 2013, The role of Mercury's core density structure on its longitudinal librations, Icarus, 225, 62-74.

Koning, A. H., and Dumberry, M. 2013, Internal forcing of Mercury's long period free librations, Icarus, 223, 40-47.

Ted Evans: geomagnetism and paleomagnetism

Dr. Evans is Professor Emeritus in the Department of Physics. His research has two main themes: the evolution of the geomagnetic field (paleogeomagnetism), and the unravelling of past climatic changes (magnetoclimatolgy). One project (with Vadim Kravchinsky, and Duane Froese and Britta Jensen, Earth and Atmospheric Sciences) involves both of these themes as revealed by wind-blown sediments in Alaska. Investigations with Moritz Heimpel and Finnish co-workers concerning the long-term stability of the geocentric axial dipole are focussed on the statistical characteristics of geomagnetic field strength. Collaboration with Adrian Muxworthy (Imperial College London) continues with a new project to enquire into the shortest time required for the geomagnetic field to reverse its polarity.

Recent Publications

Jensen, B.J.L., Evans, M.E., Froese, D.G., Kravchinsky, V.A., 150,000 years of loess accumulation in central Alaska, Quaternary Science Reviews, 135, 1-23, 2016. http://dx.doi.org/10.1016/j.quascirev.2016.01.001. Invited Review.

Veikkolainen,T., Heimpel, M., Evans, M.E., Pesonen, L.J., Korhonen, K., A paleointensity test of the geocentric axial dipole (GAD) hypothesis, Physics of the Earth and Planetary Interiors, 265, 54-61, 2017. http://dx.doi.org/10.1016/j.pepi.2017.02.008

Evans, M.E., V. Pavlov, R. Veselovsky and A, Fetisova, Late Permian paleomagnetic results from the Lodeve, Le Luc, and Bas-Argens Basins (southern France): Magnetostratigraphy and geomagnetic field morphology, Physics of the Earth and Planetary Interiors, 237, 18-24, 2014.

Heimpel, M. and M. E. Evans, Testing the geomagnetic dipole and reversing dynamo models over Earth's cooling history, Physics of the Earth and Planetary Interiors, 224, 124-131, 2013.

Muxworthy, A., M. E. Evans, S.J. Scourfield and J.G. King, Paleointensity results from the late-Archaean Modipe Gabbro of Botswana, Geochemisry, Geophysics, Geosystems, 14, 2198-2205, 2013. LERBEKMO, J.F. and M.E. EVANS, Cryptochrons and tiny wiggles: New magnetostratigraphic evidence from chrons 32 and 33 in western Canada, Physics of the Earth and Planetary Interiors, 202-203, 8-13, 2012.

Muxworthy A. and M. E. Evans, Micromagnetics and magnetomineralogy of ultrafine magnetite inclusions in the Modipe Gabbro, Geochemisry, Geophysics, Geosystems, 14, 921-928, 2012.

Morris Flynn: environmental and geophysical fluid dynamics

Morris Flynn is an Associate Professor of mechanical engineering with interests in environmental fluid mechanics. He completed a Ph.D. in engineering science at the Univ. of California, San Diego in 2006 and subsequently worked as a postdoctoral fellow at MIT in 2007 and 2008. Morris is especially interested in problems of buoyancy-driven flow, for example, the propagation of rectilinear and axisymmetric gravity currents through density-stratified media. Other research pursuits include tidal conversion (i.e. the conversion of the barotropic to the baroclinic tide by time-periodic sloshing over marine bathymetry), buoyant convection in porous media and the buckling of thin, viscous films.

Recent Publications

Sahu, C. and M.R. Flynn, 2015: Filling box flows in porous media. J. Fluid Mech., 782, 455--478.

Nicholson, M. and M.R. Flynn, 2015: Gravity current flow over sinusoidal topography in a two-layer ambient. Phys. Fluids, 27, 096603.

Roes, M. A., Bolster, D. and M. R. Flynn, 2014: Buoyant convection from a discrete source in a leaky porous medium. J. Fluid Mech., 755, 204–229.

Marleau, L. J., M. R. Flynn and B. R. Sutherland, 2014: Gravity currents propagating up a slope. Phys. Fluids, 26, 046605.

Bhattacharya, S., Craster, R.V. and M. R. Flynn, 2013: Buckling of a thin, viscous film in an axisymmetric geometry. Phys. Fluids, 25, 043102.

Bellino, P. W., Flynn, M. R. and A. S. Rangwalla, 2012: A study of in-situ burning of oil in an ice channel. Proceedings of the Combustion Institute, 17 pages, in-press.

Flynn, M. R., Ungarish, M. and A. W. Tan, 2012: Gravity currents in a two-layer stratified ambient: the theory for the steady-state (front condition) and lock-released flows, and experimental confirmations. Phys. Fluids, 24, 026601.

Echeverri, P., Flynn, M. R., Peacock, T. and K. B. Winters, 2009: Low-mode internal tide generation by topography: an experimental and numerical investigation. J. Fluid Mech., 636, 91–108.

Jeff Gu: seismology

Dr. Gu's is a professor of Geophysics in the Physics department. His work focuses on seismic sources and the elastic properties of the Earth's crust and mantle. His recent studies on seismic sources include 'conventional' earthquakes, which occur in episodically, and more enigmatic micro-tremors (e.g.,'induced earthquakes) that are triggered by industrial activities. The same types of seismic data are also used to probe the interior of the Earth. The propagation of these ground motions enables the determination of seismic velocity, major interfaces and the anisotropic (direction-dependent) properties of rocks. Dr. Gu also has long-standing interests in array methods and numerical analysis of ultrasound signals. The same techniques and principles have also been applied successfully to the imaging of bone structures based on ultrasounds. Lastly, Dr. Gu's group is mainly responsible for the Canadian Rockies and Alberta Network (CRANE), the first broadband seismic array in Alberta.

Recent Publications

R Schultz, D Eaton, G Atkinson, YJ Gu and H Kao, 2017: Hydraulic fracturing completion volume is associated with induced earthquake productivity in the Duvernay play. Science, Accepted.

S Sneider, C Thomas, R Dokht, YJ Gu and Y Chen, 2017: Resolution improvement and reconstruction of global seismic data using fk-methods. Geophys. J. Int, 212, 1288-1301.

L Wu, V Kravchinsky, YJ Gu and D Potter, 2017: Absolute reconstruction of the closing of the Mongol-Okhotsk Ocean in the Mesozoic elucidates the genesis of the slab geometry underneath Eurasia. J. Geophys. Res., 122, doi: 10.1002/2017JB014261.

R Wang, YJ Gu, R Schultz, M Zhang and A Kim, 2017: Source characteristics and geological implications of the January 2016 induced earthquake swarm near Crooked Lake, Alberta. Geophys. J. Int., 210, doi:10.1093/gji/ggx204.

Q Liu, YJ Gu and H Yao, 2017: Understanding Earth's internal structures and earthquake source mechanisms – the seminal contributions of Adam Dziewonski. Scientia Sinica Terrae, 47, 509-517.

R Dokht, YJ Gu and M Sacchi, 2017: Singular spectrum analysis and its applications in mapping mantle seismic structure. Geophys. J. Int., 208, 1430-1442.

Y Chen, YJ Gu and S Hung, 2017: Finite-frequency P-wave tomography of the Western Canada Sedimentary Basin: Implication for the Lithosphere Evolution in Western Laurentia. Tectonophys., 698, 79-90.

GM Atkinson, DW Eaton, H Ghofrani, D Walker, B Cheadle, R Schultz, R Shcerhbokov, K Tiampo, YJ Gu, RM Harrington, Y Liu, M van der Baan and H Kao, 2916: Hydraulic fracturing and seismicity in the western Canada Sedimentary Basin. Seismo. Res. Lett., 87, 631-647.

Moritz Heimpel: dynamics of planetary interiors

Dr Heimpel's main research interest is the dynamics of planetary interiors, which involves theoretical and numerical modelling of deep flow and convection, and generation of global magnetic fields. The ongoing goal of this research is to advance understanding and solve current scientific problems in Earth and planetary dynamics. A primary collaboration is with Jonathan Aurnou, (UCLA, USA), Johannes Wicht (MPI for Solar System Research, Germany), and my former student, Natalia Gomez Perez, now a professor at Universidad de los Andes, Colombia. Studies of deep convection, turbulence and zonal flows in deep atmospheres, and dynamo action in planetary cores have implications for the dynamical evolution the Earth, terrestrial, and giant solar system planets, as well as exoplanets.

Recent Publications

M. Heimpel, T. Gastine, and J. Wicht, Simulation of deep-seated zonal jets and shallow vortices in gas giant atmospheres, Nature Geoscience 9, 19–23, 2015.

T. Gastine, J. Wicht, L. Duarte, M. Heimpel, and A. Becker. Explaining jupiter's magnetic field and equatorial jet dynamics. Geophys. Res. Lett., 41, 5410–5419, 2014.

T. Gastine, M. Heimpel, and J. Wicht. Zonal flow scaling in rapidly-rotating compressible convection. Phys. Earth Planet. Int., 232, 36–50, 2014.

T. Gastine, J. Wicht, L. Duarte, M. Heimpel, and A. Becker. Explaining jupiter's magnetic field and equatorial jet dynamics. Geophys. Res. Lett., 41, 5410–5419, 2014.

Heimpel, M.H. and Evans, M.E., Testing the geomagnetic dipole and reversing dynamo models over Earth's cooling history, Phys. Earth Planet. Int., 224, 124-131, 2013.

Soderlund, K.M., M.H. Heimpel, E.M. King, and J.M. Aurnou, Turbulent models of ice giant internal dynamics: Dynamos, heat transfer, and zonal flows, Icarus, 224, 97-113, 2013.

Heimpel, M. and Aurnou, J., Convective bursts and the coupling of Saturn's equatorial storms and interior rotation, Astrophys. J., 746, 51-64, 2012.

Heimpel, M. and Gomez-Perez, N., On the relationship between zonal jets and dynamo action in giant planets, Geophys. Res. Lett., 38, L14201, 6 pp., doi:10.1029/2011GL047562, 2011.

Jeff Kavanaugh: glaciology and climate

Dr. Jeffrey Kavanaugh is an Associate Professor in the Department of Earth and Atmospheric Sciences, where he investigates the dynamics of glaciers and ice sheets, their impact on the landscape, and their response to changing climate. His recent research focus has been on examining how changing glacier volumes and snowpack conditions impacts river discharge in glacierized basins. Dr. Kavanaugh received a B.Sc. in Physics from Sonoma State University and a Ph.D. in Geophysics from the University of British Columbia. His research has taken him to glaciers in Yukon, British Columbia, Alaska, the Canadian High Arctic, and Antarctica.

Recent Publications

Dow, C.F., J.L. Kavanaugh, J.W. Sanders, and K.M. Cuffey. 2014. A test of common assumptions used to infer subglacial water flow through overdeepenings. Journal of Glaciology, 60(222), 725–734, doi:10.3189/2014JoG14J027.

DeBeer, C.M., J.L. Kavanaugh, and S. Laxton. 2014. Projected future changes in glaciers and their contribution to discharge of the Yukon River at Whitehorse. Technical report, Northern Climate ExChange, Yukon Research Centre, Yukon College, Whitehorse, YT.

Pelto, M., J. Kavanaugh, and C. McNeil. 2013. Juneau Icefield mass balance program 1946–2011. Earth System Science Data, 5, 319–330, doi:10.5194/essd-5-319-2013.

Buizert, C., V.V. Petrenko, J.L. Kavanaugh, K.M. Cuffey, N.A. Lifton, E.J. Brook, and J.P. Severinghaus. 2012. In situ cosmogenic radiocarbon production and 2-D ice flow line modeling for an Antarctic blue ice area. Journal of Geophysics – Earth Surface, 117, F02029, doi:10.1029/2011JF002086.

Dow, C.F., J.L. Kavanaugh, J.W. Sanders, K.M. Cuffey, and K.R. MacGregor. 2011. Subsurface hydrology of an overdeepened cirque glacier, Journal of Glaciology, 57(206), 1067–1078.

Cuffey, K.M. and J.L. Kavanaugh. 2011. How non-linear is creep deformation of polar ice? A new field assessment, Geology, 39(11), 1027–1030, doi:10.1130/G32259.1.

Vadim Kravchinsky: paleomagnetism and petromagnetism

Dr. Kravchinsky works in a broad area of paleo and petro-magnetism and their applications to solid earth, stratigraphic, tectonic and environmental studies. His current research encloses three main themes: (1) plate tectonic reconstructions, (2) paleoclimatic and paleoenvironmental study; (3) fine structure of geomagnetic polarity chrons. During last year my students and I have been primarily working on plate tectonic reconstructions of Asia, global paleoclimate reconstruction in Cenozoic and Holocene, intensification of winter monsoon and aridification in Asia, developing techniques for absolute plate tectonic reconstructions and calculating ancient longitudes for continents.

Recent Publications

Anwar, T., Mumpy, A.J., Blanco, D., Kravchinsky, V.A., Catuneanu, O. Core Magnetostratigraphy: Chron 33r in the Southern Alberta Plains. Bulletin of Canadian Petroleum Geology, 2017.

Wu, L., Kravchinsky, V.A., Gu, Y.J., Potter, D.K. Absolute reconstruction of the closing of the Mongol-Okhotsk Ocean in the Mesozoic elucidates the genesis of the slab geometry underneath Eurasia. Journal of Geophysical Research, 2017.

Kravchinsky, V.A. Magnetostratigraphy of the Lake Baikal sediments: A unique record of 8.4 Ma of continuous sedimentation in the continental environment. Global and Planetary Change 152, 209–226, 2017.

Wu, L., Kravchinsky, V.A., Potter, D.K. Apparent polar wander paths of the major Chinese blocks since the Late Paleozoic: Toward restoring the amalgamation history of east Eurasia. Earth-Science Reviews 171, 492–519, 2017.

Anwar, T., Hawkins, L., Kravchinsky, V.A., Biggin, A.J., Pavlov, V.E. Microwave paleointensities indicate a low paleomagnetic dipole moment at the Permo-Triassic boundary. Physics of the Earth and Planetary Interiors 260, 62–73, 2016.

Jensen, B.J.L., Evans, M.E., Froese, D.G., Kravchinsky, V.A. 150,000 years of loess accumulation in central Alaska. Quaternary Science Reviews 135, 1–23, 2016.

Kravchinsky, V.A. Geomagnetism. Encyclopedia of Scientific Dating Methods, 298-301, 2015. Springer.

Wu, L., Kravchinsky, V.A., Potter, D.K. A new MATLAB toolbox for absolute plate motion reconstructions from paleomagnetism. Computers & Geosciences 82, 139–151, 2015.

Chen, J., Liu, X., Kravchinsky, V.A., Lv, B.; Chen, Q. Post-depositional forcing of magnetic susceptibility variations at Kurtak section, Siberia. Quaternary International, 2015.

Rouslan Krechetnikov: experimental and theoretical fluid mechanics

Dr. Krechetnikov's research interests include experimental and theoretical fluid mechanics at all scales (aerodynamics, geophysics, micro-hydrodynamics, and physics of complex interfaces), as well as analytical mechanics. In direct relevance to geophysics, he studied effects of dissipation on baroclinic instability, phenomena and mathematical foundations of thin layer approximations (boundary layers, lubrication and quasi-geostrophic equations) as well as various hydrodynamic instabilities encountered in geophysical contexts. His work was recognized by a number of honors and awards – among most recent ones are NSF CAREER (2011), DARPA Young Faculty Award (2011), Ig Nobel (2012), and Presidential Early Career Award for Scientists and Engineers (2014).

Recent publications

Krechetnikov R. "Cusps and cuspidal edges at fluid interfaces: existence and application," Phys. Rev. E 91, 043019 (2015).

Knobloch E., Krechetnikov R. "Problems on time-varying domains: formulation, dynamics, and challenges," Acta Appl. Math. 137, 123-157 (2015).

Krechetnikov R. "Flow around a corner in the water impact problem," Phys. Fluids 26, 072107 (2014).

Krechetnikov R. "Origin of ejecta in the water impact problem," Phys. Fluids 26, 052105 (2014).

Knobloch E., Krechetnikov R. "Stability on time-dependent domains," J. Nonlinear Sci. 24, 493-523 (2014).

Mayer H. C., Krechetnikov R. "Singular structures on liquid rims," Phys. Fluids 26, 032109 (2014).

Mayer H. C., Krechetnikov R. "The nature of chemical reaction-driven tip-streaming," J. Appl. Phys. 113, 174907 (2013).

Mayer H. C., Krechetnikov R. "Landau-Levich flow visualization: revealing the flow topology responsible for the film thickening phenomena," Phys. Fluids 24, 052103 (2012).

Mayer H. C., Krechetnikov R. "Walking with coffee: why does it spill?," Phys. Rev. E 85, 046117 (2012).

Krechetnikov R. "Structure of Marangoni-driven singularities," Phys. Fluids 24, 022111 (2012).

Edward Lozowski: ice accretion

Dr Lozowski is Professor Emeritus in Earth and Atmospheric Sciences. His research program has two components: 1. Ice Friction and Winter Sports (IFAWS), 2. Ice Accretion Research and Forecasting (IARF). The respective objectives are 1. To investigate ice friction in winter sports through numerical modeling and on-ice experiments, 2. To improve ice accretion mitigation strategies, using a numerical modelling system that combines an innovative ice accretion model and a state-of-the-art numerical weather prediction model, interfaced with intelligent algorithms. Together with national and international colleagues and with current and former students, I am conducting numerical and physical experiments designed to elucidate and exploit the physics of ice friction and to mitigate the problems of ice accretion.

Recent Publications

Lozowski, E.P., 2016: Sea spray icing of ships and offshore structures. Chapter in Encyclopedia of Life Support Systems, (in press).

Lozowski, E.P., Szilder, K., Maw, S., Morris, A., Poirier, L. and B. Kleiner, 2015: Towards a first principles model of curling ice friction and curling stone dynamics.

Lozowski, E.P., 2014: Sea spray icing of ships and offshore structures. Chapter in Encyclopedia of Life Support Systems, (in press).

Lozowski, E.P., Szilder, K., Maw, S. and A. Morris, 2014: A model of ice friction for a skeleton sled runner. Proceedings 24th International Ocean and Polar Engineering Conference, Busan, Korea, June 15-20, 1102-1110.

Lozowski, E.P., Szilder, K., and Poirier, L., 2014: A bobsleigh ice friction model. International Journal of Offshore and Polar Engineering, Vol. 24, No. 1, 52-60.

Lozowski, E.P. and K. Szilder, 2013: Derivation and new analysis of a hydrodynamic model of speed skate ice friction. International Journal of Offshore and Polar Engineering, Vol. 23, No. 1, 1-8.

Lozowski, E., Szilder, K., and S. Maw, 2013: A model of ice friction for a speed skate blade. Sports Engineering, 16 (4), 239-253, doi: 10.1007/s12283-013-0141-z.

Li, Y., Musilek, P., and E. Lozowski, 2013: Identification of atmospheric pressure troughs using image processing techniques. IFSA World Congress and NAFIPS Annual Meeting, 2013 Joint, 661-666.

Podolskiy, E.A., Nygaard, B.E.K., Nishimura, K., Makkonen, L., and Lozowski, E.P., 2012: Study of unusual atmospheric icing at Mount Zao, Japan, using the Weather Research and Forecasting model. Journal of Geophysical Research, Vol. 117, D12106, 24 pp., 2012, doi:10.1029/2011JD017042.

Lozowski, E.P., K. Szilder and S. Maw, 2012: A model of ice friction for an inclined incising slider. Paper 2012-TPC-1018. Proceedings ISOPE 2012, International Society of Offshore and Polar Engineers.

Ian Mann: space physics

Dr. Mann is a Professor in the Department of Physics and was a Canada Research Chair in Space Physics from 2003-13. He does research in partnership with the Canadian Space Agency, including being the PI of the CARISMA magnetometer network and is a Co-Investigator on the NASA THEMIS and NASA Van Allen Probes missions. He is active in space outreach, including the www.aurorawatch.ca program, and was named as one of Canada's Top-40-under-40 in 2009. He is also a PI and was the founding Principal Co-Director of the the University of Alberta Institute for Space Science, Exploration and Technology (ISSET; www.isset.ualberta.ca). He was recently elected by the United Nations to serve as the Chairman of an international Expert Group on Space Weather which reports to the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS).

Recent Publications

Dimitrakoudis, S., Mann, I. R., Balasis, G., Papadimitriou, C., Anastasiadis, A., & Daglis, I. A. (2015). Accurately specifying storm-time ULF wave radial diffusion in the radiation belts. Geophysical Research Letters, 42(14), 5711-5718.

Schrijver, Carolus J.,…. I. R. Mann et al. "Understanding space weather to shield society: A global road map for 2015–2025 commissioned by COSPAR and ILWS." Advances in Space Research 55, no. 12 (2015): 2745-2807.

Mann, I. R., et al. (2014), Spatial localization and ducting of EMIC waves: Van Allen Probes and ground-based observations, Geophys. Res. Lett., 41, 785–792, doi:10.1002/2013GL058581.

Murphy, Kyle R., Ian R. Mann, and Louis G. Ozeke. "A ULF wave driver of ring current energization." Geophysical Research Letters 41.19 (2014): 6595-6602.

Wallis, D. D., D. M. Miles, B. B. Narod, J. R. Bennest, K. R. Murphy, I. R. Mann, and A. W. Yau. "The CASSIOPE/e-POP Magnetic Field Instrument (MGF)." Space Science Reviews (2014): 1-13.

Murphy, K. R., Mann, I. R., Rae, I. J., Walsh, A. P., & Frey, H. U. (2014). Inner magnetospheric onset preceding reconnection and tail dynamics during substorms: Can substorms initiate in two different regions?. Journal of Geophysical Research: Space Physics, 119(12), 9684-9701.

Ozeke, L. G., Mann, I. R., Turner, D. L., Murphy, K. R., Degeling, A. W., Rae, I. J., & Milling, D. K. (2014). Modeling cross L shell impacts of magnetopause shadowing and ULF wave radial diffusion in the Van Allen belts. Geophysical Research Letters, 41(19), 6556-6562.

Mann, I. R., et al. (2014), Spatial localization and ducting of EMIC waves: Van Allen Probes and ground-based observations, Geophys. Res. Lett., 41, 785–792, doi:10.1002/2013GL058581.

Richard Marchand: space physics

Professor Marchand's research interests are in the area of computational and theoretical plasma physics. This includes modelling plasma dynamics in the near Earth space, and on the interaction between satellites and space environment. I developed 2D structured and unstructured mesh generators, and a finite element code that solves a general set of partial differential transport equations. The use of unstructured meshes and finite elements was then extended to 3D and applied to space plasma dynamics in the ionosphere, plasmasphere and magnetosphere. I also develop and use kinetic models based on the Particle In Cell (PIC) and Test-Particle approaches to simulate space plasma. These models are based on three dimensional structured and unstructured meshes. They are used to study the interaction of spacecraft and space borne instruments with space environment. In this topic, I am particularly interested in quantifying plasma sheath perturbation effects on sensitive in situ measurements as obtained, for example, with thermal particle sensors or flow meters. Looking to the future, my goal is to continue to develop and optimize my simulation tools in order to apply them to increasingly more realistic conditions and thus, provide much needed computational support to space missions. I am a member of the European Space Agency's Swarm validation and calibration team, in which I will apply my models to help calibrate and make optimal use of Electric Field Instrument (EFI) measurements.

Recent Publications

Sunlight Illumination Models for Spacecraft Surface Charging, S. Grey, R. Marchand, M. Ziebart, and R. Omar, IEEE Trans. Plasma Sci., 45/8, pp. 1898-1905 (2017).

Kinetic Simulation of Spacecraft-Environment Inteaction, R. Marchand and P.A. Resendiz Lira, IEEE Trans. Plasma Sci., 45/4, pp 535-554, DOI: 10.1109/TPS.2017.2682229 (2017).

Kinetic modeling of Langmuir probe characteristics in a laboratory plasma near a conducting body, S. ur Rehman, L. E. Fisher, K. A. Lynch, and R. Marchand, Phys. Plasmas, 44 DOI: 10.1063/1.4972879 (2017).

Ionospheric Langmuir Probe Electron Temperature Asymmetry and Magnetic Field Connectivity, R. Marchand, IEEE Trans. Plasma Sci., 2016.

Carl Mendoza: hydrogeology

Carl Mendoza is a hydrogeologist/hydrologist who specializes in studying the movement of water within hydrologic systems at a variety of temporal and spatial scales, with particular emphasis on interactions between the near-surface (geologic) and surface (wetland and forestland) environments. On the natural Boreal Plain landscape his research programs focus on characterizing and understanding interactions between groundwater, surface water, vegetation and the atmosphere on the range of possible unconsolidated geologic deposits and geomorphic expressions. The outcomes of these studies provide conceptual models and quantitative evaluations of the dominant hydrologic processes under different climatic, geologic, geomorphic and topographic configurations. These systems also serve as natural analogues for designing, and benchmarks for evaluating, reclamation strategies on oil-sands mining leases. On oil-sands leases Dr. Mendoza has research sites that are used to evaluate the fate of water and salt, and the subsequent rate of salt flushing, in tailings dams, the formation and evolution of ponds and wetlands, and their interaction with adjacent hillslopes, on coarse-grained tailings structures and fine-grained waste-rock piles, and the overall hydrologic behaviour of these interconnected systems. Knowledge gained from these studies and the natural analogue sites has led to modifications of reclamation strategies and has been used to design future landscapes.

Recent Publications

Kettridge, N., M.C. Lukenbach, K.J. Hokanson, C. Hopkinson, K.J. Devito, R.M. Petrone, C.A. Mendoza, J.M. Waddington, 2017. Low evapotranspiration enhances the resilience of peatland carbon stocks to fire. Geophysical Research Letters. doi: 10.1002/2017GL074186

Dixon, S.J., N. Kettridge, P.A. Moore, K.J. Devito, A.S. Tilak, R.M. Petrone, C.A. Mendoza, and J.M. Waddington, 2017. Peat depth as a control on moss water availability under evaporative stress. Hydrological Processes. doi: 10.1002/hyp.11307

Devito, K.J., K.J. Hokanson, P.A. Moore, N. Kettridge, A.E. Anderson, L. Chasmer, C. Hopkinson, M.C. Lukenbach, C.A. Mendoza, J. Morissette, D.L. Peters, R.M. Petrone, U. Silins, B. Smerdon and J.M. Waddington, 2017. Landscape controls on long-term runoff in sub-humid heterogeneous Boreal Plains catchments. Hydrological Processes. doi: 10.1002/hyp.11213

Thompson, C., C.A. Mendoza and K.J. Devito, 2017. Potential influence of climate change on ecosystems within the Boreal Plains of Alberta. Hydrological Processes. doi: 10.1002/hyp.11183

Lukenbach, M.C., K.J. Hokanson, K.J. Devito, N. Kettridge, R.M. Petrone, C.A. Mendoza, G. Granath and J.M. Waddington, 2017. Post-fire ecohydrological conditions at peatland margins in different hydrogeological settings of the Boreal Plain. Journal of Hydrology, 548, 741-753. doi: 10.1016/j.jhydrol.2017.03.034

Leonard, R., N. Kettridge, S. Krause, K.J. Devito, G. Granath, R. Petrone, C. Mendoza and J.M. Waddington, 2016. Peatland bryophyte responses to increased light from black spruce removal. Ecohydrology. doi: 10.1002/eco.1804

Ketcheson, S.J., J.S. Price, S.K. Carey, R.M. Petrone, C.A. Mendoza and K.J. Devito, 2016. Constructing fen peatlands in post-mining oil sands landscapes: Challenges and opportunities from a hydrological perspective. Earth-Science Reviews, 161, 130-139. doi: 10.1016/j.earscirev.2016.08.007

Paul Myers: physical oceanography

Professor Myers' current research focuses on the role of freshwater in the oceans, as well as links between the Arctic and North Atlantic Oceans. This research involves a combination of the analysis of oceanographic data with numerical modeling as well as more theoretical ocean model development. Specific scientific questions are related to the impact of freshwater in these basins, explanations for observed variability at inter-annual and inter-decadal time scales as well as the linkages between these basins. My main geographical areas of research are the Canadian Arctic Archipelago, Baffin Bay, the sub-polar North Atlantic and the Labrador Sea. In terms of data studies, this work is focused on examining the historical database to answer questions on changes in salinity, freshwater, atmospheric precipitation as well as water formation and exchanges between the boundary currents and the interior of this basin. For the Labrador Sea, I am the lead PI on a new NSERC CCAR Network, VITALS (Ventilation, Interactions and Transports Across the Labrador Sea - http://knossos.eas.ualberta.ca/vitals/), which will answer fundamental questions about how the deep ocean exchanges carbon dioxide, oxygen, and heat with the atmosphere through the Labrador Sea. I'm also a member of the Canadian Arctic Geotraces Network, involved in building coupled ocean/sea-ice/biogeochemistry models of the Canadian Arctic, including the Northwest Passage.

Recent Publications

Mueller V*, Kieke D, Myers P, Penelly C*, Mertens C. (2017). Temperature flux carried by individual eddies across 47N in the Atlantic Ocean. Journal of Geophysical Research. 122: 2441-2464.

Saenko O, Yang D, Myers P. (2017). Response of the North Atlantic dynamic sea level and circulation to Greenland melt-water and climate change in an eddy-permitting ocean model. Climate Dynamics, in press

Marson JM*, Myers PG, Hu X*,Petrie B, Azetsu-Scott K, Lee CM. (2017). Cascading off the West Greenland Shelf: A numerical perspective. Journal of Geophysical Research. 122

Grivault N*, Hu X*, Myers P. (2017). Evolution of Baffin Bay water masses and transports in a climate change experiment including Greenland runoff. Atmosphere-Ocean. 55(3): 169-194.

Castro de la Guardia L*, Myers P, Derocher A, Lunn N, Terwisscha van Scheltinga A. (2017). Sea ice cycle in western Hudson Bay from a polar bear perspective. Marine Ecology Progress Series. 564: 225-233.

Hughes K*, Klymak J, Hu X*, Myers P. (2017). Water Mass Modification and Mixing Rates in a 1/12 degree Simulation of the Canadian Arctic Archipelago. Journal of Geophysical Research. 122: 803-820.

Dukhovskoy D, Myers P, Platov G, Timmermans, M-L, Curry B, Proshutinsky A, Bamber J, Chasisgnet E, Hu X*, Lee C, Somavilla R. (2016). Greenland freshwater pathways in the sub-Arctic Seas from model experiments with passive tracers. Journal of Geophysical Research. 121: 1-31.

Gillard L*, Hu X*, Myers P, Bamber J. (2016). Meltwater pathways from marine terminating glaciers of the Greenland ice sheet. Geophysical Research Letters. 43: 10873-10882.

Yang Q*, Dixon T, Myers P, Bonin J, Chambers, D, van den Broeke M, Ribergaard MH, Mortensen J. (2016). Recent increases in Arctic freshwater flux affects Labrador Sea convection and Atlantic overturning circulation. Nature Communications. 7

David Potter: rock magnetism, nanomagnetism and petrophysics

Professor Potter has research interests in several broad areas of geophysics and petrophysics. These include fundamental rock magnetism, palaeomagnetism, nanomagnetism, petrophysical parameter prediction, anisotropic properties, borehole logging, core analysis, shock impact processes, and geophysical fluid dynamics. Most of my research is experimental and laboratory based, but some involves theoretical modeling.

Recent Publications

Firdous, T., Vick, D., Belov, M., Sani, F. F., McDermott, A., Losby, J. E., Bazylinski, D. A., Prozorov, T., Potter, D. K. and Freeman, M. R., 2015. Nanomechanical torque magnetometry of an individual aggregate of ~ 350 nanoparticles. Canadian Journal of Physics, 93, Issue 11, 1252-1256. DOI: 10.1139/cjp-2014-0722.

Morrow, L., Potter, D. K. and Barron, A. R., 2015. Detection of magnetic nanoparticles against proppant and shale reservoir rocks. Journal of Experimental Nanoscience, 10, Issue 13, 1028-1041. DOI: 10.1080/17458080.2014.951412.

Wu, L., Kravchinsky, V. A. and Potter, D. K., 2015. PMTec: A new MATLAB toolbox for absolute plate motion reconstructions from paleomagnetism. Computers and Geosciences, 82, 139-151. DOI: 10.1016/j.cageo.2015.06.009.

Khan, S., Potter, D. K. and Kuru, E., 2015. Quantifying the transport of superparamagnetic nanoparticles in porous media using an acrylic flow cell and integrated magnetic susceptibility sensor technique. Transport in Porous Media, 106, Issue 3, 691-705. DOI: 10.1007/s11242-014-0420-6.

Miah, K. H. and Potter, D. K., 2014. Geophysical signal parameterization and filtering using the fractional Fourier transform. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 7, issue 3, 845-852. DOI: 10.1109/JSTARS.2013.2285383.

Potter, D. K. and Ahrens, T. J., 2013. Moderate velocity oblique impact sliding: production of shocked meteorite textures and palaeomagnetically important metallic spherules in planetary regoliths. Meteoritics and Planetary Science, 48, Issue 4, 656-664. DOI: 10.1111/maps.12081.

Potter, D. K. and Ahrens, T. J., 2013. Moderate velocity oblique impact sliding: production of shocked meteorite textures and palaeomagnetically important metallic spherules in planetary regoliths. Meteoritics and Planetary Science, 48, Issue 4, 656-664. DOI: 10.1111/maps.12081.

Vakhtang Putkaradze: nonlinear models of physical systems

Dr. Putkaradze's research focuses on the application of mathematical, and in particular geometrical methods to problems in mechanics. Of particular interest are the problems arising in fluid mechanics, kinetic theory and fluid-structure interactions. Variational geometric methods developed in our group are capable of giving exact, quantitative predictions even when the application of standard methods of mechanics is difficult. We have applied the new methods to a wide range of engineering problems, including resonator sensor development, energy harvesting, renewable (solar) energy production and others.

Recent Publications

D. Bates, D. Brake, A. Maciejewski, V. Putkaradze, Workspace Multiplicity and Fault Tolerance of Cooperating Robots, Lecture Notes in Computer Science, in press (2015).

P. Kevrikidis, V. Putkaradze and Z. Rapti, Non-holonomic constraints and their impact on discretizations of Klein-Gordon lattice dynamical models, Dynamical Systems, Differential Equations and Applications, pp. 696-704, Proceedings of AIMS (2015),

F. Gay-Balmaz, V. Putkaradze, Dynamics of elastic strands with rolling contact, Physica D, 294, 6-23 (2015).

M. Chi, F. Gay-Balmaz, V. Putkaradze and P. Vorobieff, Dynamics and control of flexible solar updraft towers, Proc. Roy. Soc A, 471, 20140539 (2014).

M. Kubota, V. Putkaradze and T. Hikihara, Energy absorption at synchronization in phase between coupled Duffing systems, Intl. J. Dynamics and Control, 2195-268X (2014).

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Gerhard Reuter: cloud physics and radar meteorology

Professor Reuter's interests and expertise span cloud physics, radar meteorology, cloud modelling and severe storms. The aim of his research is to improve understanding and prediction of cumulus convection, severe convective storms, hail, tornadoes, and flooding, The emphasis is on clarifying interactions between dynamic, thermodynamic and microphysical processes in clouds and storms. His research group combines observations from radar and soundings with cloud-scale models. Recent research focused on predicting hail size, tornado intensity, and flash flooding,

Recent Publications

C. Pennelly, G.W. Reuter, and T. Flesch, 2013: Verification of the WRF model for heavy precipitation over Alberta. Atmospheric-Research, in press.

Flesch, T.K., and G.W. Reuter, 2012: WRF model simulation of two Alberta flooding events and the impact of topography. Journal of Hydrometeorology, 13, 695-708.

Brown, D.M, G.W. Reuter and T.K. Flesch, 2011: Temperature, precipitation, and lightning modification in the vicinity of the Athabasca Oil Sands, Earth Interactions,15, 1-14.

Dupilka, M.L., and G.W. Reuter, 2011: Composite soundings associated with severe and tornado thunderstorms in central Alberta, Atmosphere-Ocean, 49, 269-278.

Brimelow, J.C. and G.W. Reuter, 2009: Explicit forecasts of hail occurrence and expected hail size using the HAILCAST/GEM system with a rainfall filter. Weather and Forecasting, 24, 206-219.

Anderson, K., P. Englefield, J. Little, and G.W. Reuter, 2009: An approach to operational forest fire growth predictions for Canada. International Journal of Wildland Fire, 18, 893-905.

Mauricio Sacchi: geophysics

Professor Sacchi's research focuses in the area of seismic imaging, seismic inversion and statistical and transform methods for seismic signal enhancement. In recent years, in collaboration with students, he has made advancements on problems pertaining seismic data representation via sparsity promoting methods and multilinear algebra. Students in his lab have also developed full-waveform inversion algorithms, new systems for fast and accurate earthquake detection using modern tools from the field of compressive sensing and multi-dimensional seismic reconstruction algorithms. Fourteen companies currently support his lab with funding primarily used to support graduate student in applied seismology. In addition to his teaching duties at the University of Alberta, he regularly teaches short courses for industry on topics in the area seismic inversion, imaging, signal processing and multi-dimensional seismic signal reconstruction. He was the recipient of the 2012 Medal of the Canadian Society of Exploration Geophysicists (CSEG). The CSEG Medal is the highest award that the Society bestows. The CSEG Medal is given in recognition of the contribution to Exploration Geophysics by a member of the profession in Canada. Mauricio was the 2014 SEG Honorary Lecturer for Latin America. He is currently the 2015-2016 CSEG Distinguished Lecturer. Mauricio is also the editor-in-chief of the journal Geophysics for 2015-2017.

Recent Publications

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G Li, M D Sacchi, Y Wang, and H Zheng (2015). "Characterization of interbedded thin beds using zero-crossing-time amplitude stratal slices." GEOPHYSICS, 80(5), N23-N35.

A Ibrahim and MD Sacchi, 2014, Simultaneous source separation using a robust Radon transform, GEOPHYSICS, 79(1), V1–V11.

N Kreimer, A.Stanton and MD Sacchi, 2013, Tensor completion based on nuclear norm minimization for 5D seismic data reconstruction, GEOPHYSICS, 78(6), V273–V284.

A Gholami and MD Sacchi, 2013, Fast 3D Blind Seismic Deconvolution via Constrained Total Variation and GCV, SIAM Journal on Imaging Sciences 6 (4), 2350-2369

D Pérez, D Velis and MD Sacchi, 2013, High-resolution prestack seismic inversion using a hybrid FISTA least-squares strategy, GEOPHYSICS, 78(5), R185–R195.

A Stanton and M D Sacchi, 2013, Vector Reconstruction of Multicomponent Seismic Data, GEOPHYSICS, 78(4), V131-V145

H Li, LH Le, MD Sacchi, EHM Lou, 2013, Ultrasound Imaging of Long Bone Fractures and Healing with the Split-Step Fourier Imaging Method, Ultrasound in medicine & biology 39 (8), 1482-1490

J Gao, MD Sacchi and X Chen, 2013, A fast reduced-rank interpolation method for prestack seismic volumes that depend on four spatial dimensions, GEOPHYSICS, 78(1), V21–V30.

Doug Schmitt: geophysics

Professor. Schmitt is a Tier 1 Canada Research Chair in Rock Physics(since 2002) and a Professor of Geophysics and Physics at the Universityof Alberta. His research group carries out a unique blend of field and laboratory experiments that focus primarily on understanding of rock

physics and mechanics and how they influence geophysical observations. He has and is playing active roles in international scientific drilling projects on 5 continents. This last year was exceptionally busy with in-field projects at the International Continental Drilling Program Alpine Fault (Oct-Dec 2014), seismic acquisition on Baffin Island (June, 2015), repeat geophysical logging at nearly 2 km in Sudbury for deep stress monitoring (July, 2015), seismic monitoring at nearly 3 km and 115°C in the SaskPower CO2 sequestration project (May-Dec, 2015), and vertical seismic profiling on the Alpine Fault (Jan-2016) and with the Chicxulub impact crater drilling project (Apr-May, 2016). Detailed studies of crustal stress states are nearing completion in three sites in Alberta. Studies of the elastic anisotropy of shales and schists to high pressures, of rock strength in carbonates, of the reflectivity of anisotropic media, and on the physical properties of bitumen and CO2- saturated brines are underway in the laboratory. The group may also have discovered that the wetting capacity of fluids may influence seismic wave propagation.

Recent Publications

Malehmir, R., and D.R. Schmitt, Acoustic Reflectivity from Variously Oriented Orthorhombic Media: Analogies to Seismic Responses from a Fractured Anisotropic Crust, doi: 10.1002/2017JB014160, submitted, J. Geophys. Res., Accepted October 6, 2017.

Wang, Z., D.R. Schmitt, and R. Wang, Modelling of viscoelastic properties of nonpermeable porous rocks saturated with viscous fluid at seismic frequencies at the core scale, J. Geophys. Res. Solid Earth, 122, doi:10.1002/2017JB013979, 20 pp., 2017.

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Sutherland, R., J. Townend, V.G. Toy, P. Upton, and the DFDP-2B Science Team, Extreme hydrothermal conditions at an active plate-boundary fault, Nature, doi:10.1038/nature22355, published online May 17, 2017.

Kessler, J.A., K.K. Bradbury, J.P. Evans, M.A. Pulshiper, D.R. Schmitt, J.W. Shervais, F.E. Rowe, and J. Varriale, Geology and in situ stress of the MH-2 borehole, Idaho, U.S.A.: Insights into Western Snake River Plain structure from geothermal exploration drilling, Lithosphere, doi: 10.1130/L609.1, published online April, 2017.

Perozzi, L., B. Giroux, D.R. Schmitt, and R.S. Kofman, Sensitivity of seismic response for monitoring CO2 storage in a low porosity reservoir of the St. Lawrence Lowlands, Quebec, Canada: Part 1 - Laboratory measurements, Greenhouse Gases: Science and Technology, 11 pp., doi: 10.1002/ghg.167, 2017.

Schmitt, D.R. and B. C. Haimson, Hydraulic Fracturing Stress Measurements in Deep Holes, Chapter 6, in Rock Mechanics and Engineering, Vol. 1, ed., X-T. Feng, CRC Press, 183-225, 2016.

Morgan, J.V., S.P. Gulick, and the IODP/ICDP Expedition 364 Science Team, The formation of peak rings in large impact craters, Science, 354, 878-882, 10.1126/science.aah6561, 2016.

Martin Sharp: glaciology and climate

Professor Sharp works on glacier-climate interactions, how Arctic glaciers contribute to global sea level change, glacier dynamics and glacier hydrology, glacier biogeochemistry, and microbial life in glacial environments. He has done fieldwork in Iceland, Alaska, Norway, the Swiss Alps, Arctic Canada, the Canadian Rockies and Antarctica. Current field programs focus on the Devon Ice Cap (Nunavut), and the Ecology Glacier in the South Shetland Islands. His work uses a combination of fieldwork, satellite and airborne remote sensing (including work with UAVs), numerical modelling, and analytical geochemistry. He is leading the initiative to bring the Canadian National Ice Core Archive to the University of Alberta, to develop a mutidisciplinary ice core research program that specializes in the study of climate change, atmospheric contaminant deposition to glaciers and ice caps, and the genomics and biogeochemistry of glacier ice. An immediate goal is to fund a new ice coring program on the Rocky Mountain Icefields to evaluate their contaminant inventory and model the time trajectory of contaminant release into the headwaters of the Athabasca, North Saskatchewan, Bow, Fraser and Columbia Rivers. Professor Sharp is Co-Chair of the International Arctic Science Committee's Network on Arctic Glaciology and a Fellow of the Royal Society of Canada.

Recent Publications

Pfeffer, W.T., Arendt, A.A., Bliss, A., Bolch, T., Cogley, J.G., Gardner, A.S., Hagen, J-O., Hock, R., Kaser, G., Kienholz, C., Miles, E.S., Moholdt, G., Mölg, N., Paul, F., Radić, V., Rastner, P., Raup, B., Rich, J., Sharp, M.J. and the Randolph Consortium. 2014. The Randolph Glacier Inventory: a globally complete inventory of glaciers. Journal of Glaciology 60, 537-552.

Gascon, G.*, Sharp, M., Burgess, D., Bezeau, P.*, Bush, A.B.G., Morin, S., and Lafaysse, M. 2014. How well is firn densification represented by a physically-based multi-layer model? Model evaluation for the Devon Ice Cap, Nunavut, Canada. Journal of Glaciology 60, 694-704.

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Wyatt, F. and Sharp, M. 2015. Linking surface hydrology to flow regimes and patterns of velocity variability of the Devon Ice Cap, Nunavut. Journal of Glaciology 61, 387-399.

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Gascon, G., Sharp, M., Burgess, D., Bezeau, P., Bush, A.B.G., Morin, S., and Lafaysse, M. 2014. How well is firn densification represented by a physically-based multi-layer model? Model evaluation for the Devon Ice Cap, Nunavut, Canada. Journal of Glaciology 60, 694-704.

Bruce Sutherland: geophysical and environmental fluid dynamics

Through a combination of laboratory experiments, numerical simulations and theoretical modelling, Professor Sutherland examines the fluid dynamics of oceanic and atmospheric flows. His research focuses upon processes in stratified fluids, for which the effective density decreases with height. Such fluids support internal waves that propagate vertically through the atmosphere and ocean. Laboratory experiments have examined their generation from topography, storm-tops, turbulence and intrusions of fluid such as sea-breezes or estuary outflows. Simulations and theory have explored internal wave dynamics as the grow to large amplitude. Other lines of research include experimental and numerical studies of intrusions, plumes and fountains in stratified ambient. More recently he has begun exploring problems involving sediment resuspension, bed load transport and particle settling.

Recent Publications

B.R. Sutherland, “Excitation of Superharmonics by Internal Modes in Non-uniformly Stratified Fluid", J. Fluid Mech., doi: 10.1017/jfm.2016.108, 793, 335-352 (2016)

B.R. Sutherland, “Internal Wave Transmission through a Thermohaline Staircase", Phys. Rev. Fluids, doi:10.1103/PhysRevFluids.1.013701, 1, 013701:1-13 (2016)

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B.R. Sutherland and C.P. Caulfield, “Optimal Perturbation Growth in Axisymmetric Intrusions”, J. Fluid Mech., doi: 10.1017/jfm.2015.798, 811, R4:1-13 (2017)

Y. Ma, M.R. Flynn and B.R. Sutherland, “Convection from a line-source into a two-layer stratified ambient fluid", J. Fluid Mech, doi:10.1017/jfm.2017.143, 818, 46-67 (2017)

T. Playter, K. Konhauser, G. Owttrim, C. Hodgson, T. Warchola, A. M. Mloszewska, B.R. Sutherland, A. Bekker, J.-P. Zonneveld, S. G. Pemberton, M. Gingras, “Microbe-clay interactions as a mechanism for the preservation of organic matter and trace metal biosignatures in black shales”, Chem. Geol., doi:10.1016/j.chemgeo.2017.04.007, 459 , 75-90 (2017).

M. Reichert, B. Blunt, T. Gabruch, T. Zerulla, A. Ralph, M. Gamal El-Din, B.R. Sutherland, K. Tierney, “Sensory and behavioral responses of a model fish to oil sands process-affected water with and without treatment", Environ. Sci. Technol., doi:10.1021/acs.est.7b01650, 51, 7128-7137 (2017).

T. S. van den Bremer and B. R. Sutherland, “The wave-induced flow of internal gravity wavepackets with arbitrary aspect ratio", J. Fluid Mech., doi:10.1017/jfm.2017.745, 834, 385-408 (2018).

Gordon Swaters: theoretical and computational physical oceanography

Professor. Swaters's research, which is an interdisciplinary blend of applied mathematics, physical oceanography and computational science, is focused on understanding the planetary-scale dynamics of ocean currents.

Recent Publications

Swaters, G. E., H. V. Dosser & B. R. Sutherland, Conservation laws, Hamiltonian structure, modulational instability properties and solitary wave solutions for a higher-order model describing nonlinear internal waves. Stud. Appl. Math. 128, 159-182, 2011.

Swaters, G. E., Perturbation theory for the solitary wave solutions to a Sasa-Satsuma model describing nonlinear internal waves in a continuously stratified fluid. Stud. Appl. Math. 128, 420-432, 2012.

Swaters, G. E., Flow of grounded abyssal ocean currents along zonally-varying topography on a rotating sphere. Geophys. Astrophys. Fluid Dynamics 107, 564-586, 2013.

Somayaji, C. R., & G. E Swaters, Kelvin-Helmholtz instability of a bottom-intensified jet in a stratified fluid. Can. Appl. Math. Quart. 21, 355-377, 2013.

Kim, A., G. E Swaters & B. R. Sutherland, Cross-equatorial flow of grounded abyssal ocean currents. Geophys. Astrophys. Fluid Dynamics 108, 363-386, 2014.

Swaters, G. E., Midlatitude-equatorial dynamics of a grounded deep western boundary current. Part I. Midlatitude flow and the transition to the equatorial region. J. Phys. Oceanogr. 45, 2457-2469, 2015.

Swaters, G. E., Midlatitude-equatorial dynamics of a grounded deep western boundary current. Part II. Cross-equatorial dynamics. J. Phys. Oceanogr. 45, 2470-2483, 2015.

Swaters, G. E., Internal dissipative boundary layers in the cross-equatorial flow of a grounded deep western boundary current. Geophys. Astrophys. Fluid Dynamics 111, 91-114, 2017.

Rick Sydora: theoretical plasma physics

My research in theoretical plasma physics primarily concerns energy conversion and transport processes in plasmas (ionized gases) and the interrelationships between laboratory and space/astrophysical plasma environments. One of the main mechanisms of energy conversion in magnetized plasmas is through a process called magnetic reconnection where anti-parallel magnetic field components merge and cross-connect, leading to global magnetic topology changes, plasma energization and production of high energy charged particles. To study the complex dynamics converting magnetic energy into kinetic plasma energy, we use 3D kinetic particle simulations to investigate the detailed microphysical processes involved. This work also supports current and upcoming multi-satellite missions that locally probe regions of magnetic reconnection in the Earth's magnetosphere. I also do research on particle acceleration in space plasmas from nonlinear plasma waves such as solitons and collisionless shocks, as well as via high-powered lasers in the lab. Different mechanisms produce different limits to acceleration and energy spectra; nonlinear kinetic plasma simulations are employed to test various theoretical models. Lastly, in more recent research, together with plasma experimentalists, we have been investigating non-diffusive transport in magnetized plasma systems that are far from equilibrium. Non-diffusive in this context means that the fundamental macroscopic parameters of a system, such as temperature and density, does not follow the standard diffusive behaviour predicted by a classical Fokker-Planck equation. We have also been exploring transport “avalanches” in magnetized plasmas.

Recent Publications

RD Sydora, GJ Morales, JE Maggs, and B Van Compernolle, “3D gyrokinetic simulation of the relaxation of a magnetized temperature filament”, Phys. Plasmas, 22, 102303 (2015).

B Van Compernolle, GJ Morales, JE Maggs, and RD Sydora, “Laboratory study of avalanches in magnetized plasmas”, Phys. Rev. E, 91, 031102 (2015).

K Sauer and RD Sydora, “Current-driven Langmuir oscillations and amplitude modulations – Another view on electron beam-plasma interaction”, Jour. Geophys. Res., 120, 235 (2015).

DA St-Onge and RD Sydora, “The Kubo conductivity tensor for 2- and 3-dimensional magnetic nulls”, Phys. Rev. E, 90, 033103 (2014).

T Tacke, J Dreher, and RD Sydora, “Numerical magnetohydrodynamic simulations of expanding flux ropes: Influence of boundary driving”, Phys. Plasmas, 20, 072104 (2013).

K Fujimoto and RD Sydora, “Plasmoid-induced turbulence in collisionless magnetic reconnection”, Phys. Rev. Lett., 109, 265004 (2012).

Martyn Unsworth: plate tectonics, volcanology and magnetotellurics

My research is focused on the use of electromagnetic (EM) methods to study the structure of the Earth's interior. The electrical resistivity of the crust and mantle is sensitive to composition, temperature and fluid content, so these methods provide a complementary view to that obtained from seismic studies. Most of my research uses magnetotelluric (MT) exploration, which is an EM method that uses natural radio waves to image the electrical resistivity from the surface to depths greater than 1000 km.

Applied research areas include the development of improved methods for both mineral and geothermal exploration. I have also lead a number of projects that use MT to understand plate tectonic processes. Recent studies have investigated major mountain belts including the Canadian Cordillera, Tibetan Plateau and Andes. These methods are also being used in studies of magmatic processes associated with active volcanism in the Central and Southern Andes, and at Mount Erebus in Antarctica. Finally, I am using these methods are to study how past tectonic processes have formed the modern continents, with a focus on the evolution of Western Canada.

Recent Publications

Comeau MJ, MJ Unsworth, F Ticona, M Sunagua, Magnetotelluric images of magma distribution beneath Volcan Uturuncu, Bolivia : Implications for magma dynamics, Geology, 43(3), 243-246, 2015.

Comeau MJ, MJ Unsworth, D Cordell, New constraints on magma distribution beneath Volcan Uturuncu, Bolivia, from magnetotelluric data, Geosphere, 12(5), 1-22, 2016.

Hubert J, B Lee, L Liu, MJ Unsworth, JP Richards, B Abbassi, LZ Chen, DW Oldenburg, J Legault, M Rebagliati, Three-dimensional imaging of a Ag-Au-rich epithermal system in British Columbia, Canada using airborne ZTEM and ground-based magnetotelluric data, Geophysics, 81(1), B1-B12, 10.1190/GEO2015-0230.1, 2016.

Laumonier M, F Gaillard, D Muir, J Blundy and MJ Unsworth, Giant magmatic reservoirs at mid-crustal depth inferred from electrical conductivity and the growth of the continental crust, Earth and Planetary Science Letters, 457, 173-180, 2017

Liddell MV, MJ Unsworth, J Pek, Magnetotelluric imaging of anisotropic crust near Fort McMurray, Alberta: implications for engineered geothermal system development, Geophysical Journal International, 205, 1365-1381, 2016

Nieuwenhuis G, MJ Unsworth, D Pana and JA Craven, EA Bertrand, Three-dimensional resistivity structure of Southern Alberta : Implications for Pre-Cambrian tectonics, Geophysical Journal International, doi: 10.1093/gji/ggu068, 197, 838-859, 2014.

Turkoglu E, MJ Unsworth, F Bulut and I Caglar, Crustal structure of the North Anatolian and East Anatolian Fault Systems from magnetotelluric studies, Physics of the Earth and Planetary Interiors, 241, 1-14, 2015.

Mirko van der Baan: geophysics

Dr van der Baan joined the Department of Physics at the University of Alberta in 2008. Mirko graduated in 1996 from the University of Utrecht in the Netherlands, obtained a PhD with honours in 1999 from the Joseph Fourier University in Grenoble, France, and then joined the University of Leeds, UK, where he became the Reader of Exploration Seismology. He is the Principal Investigator of the joint-industry project on Blind Identification of Seismic Signals, focusing on advanced statistical signal processing and technology/knowledge transfer. Together with David Eaton (U of Calgary) he also leads the Microseismic Industry Consortium, currently funded by 28 companies. He is a co-founder of the Centre of Integrated Petroleum Engineering and Geosciences, a joint initiatve of several departments at the University of Leeds, to foster and promote multidisciplinary petroleum-related research and teaching.

Recent Publications

Dinh H., Van der Baan M. and Landro M. (2017) Processing and quality-control strategies for consistent time-lapse seismic attributes: A case history on an internal blowout using vintage data. Geophysics, 82(4), B135-B146.(link)

Eyre T. and Van der Baan M. (2017) The reliability of microseismic moment tensor solutions: Surface versus borehole monitoring. Geophysics, 82(6), KS113-K125.(link)

Li Z. and Van der Baan M. (2017a) Elastic passive source localization using rotational motion. Geophysical Journal International, 211(2), 1206-1222.(link)

Li Z. and Van der Baan M. (2017b) Tutorial on rotational seismology and its applications in exploration geophysics. Geophysics, 82(5), W17-W30.(link)

Roche V. and Van der Baan M. (2017) Modeling of the in situ state of stress in elastic layered rock subject to stress and strain-driven tectonic forces. Solid Earth, 8, 479-498.(link - open access)

Tary J-B., Van der Baan M. and Herrera R. H. (2017) Applications of high-resolution time-frequency transforms to attenuation estimation. Geophysics, 82(1), V7-V20.(link)

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Van der Baan M. and Calixto F. J. (2017) Human-induced seismicity and large-scale hydrocarbon production in the USA and Canada. Geochemistry, Geophysics, Geosystems, 18(7), 2467-2485.

John Wilson: micrometeorology of atmospheric surface layer

Professor, Department of Earth and Atmospheric Sciences, University of Alberta. Member of editorial boards of Boundary-Layer Meteorology (1986–2005) & Agricultural & Forest Meteorology (1995–). Micrometeorology. Recipient of 2012 Patterson Medal for distinguished service to Meteorology in Canada.

Micrometeorology & Agrometeorology. Turbulent fluid mechanics. Short range atmospheric dispersion. Theory of Lagrangian stochastic dispersion models, and application in the context of “inverse dispersion” to measure ground-air exchange fluxes (e.g. farm methane emissions). Numerical simulation of disturbed winds in the atmospheric surface layer.

Recent Publications

Wilson, JD, 2017 “Measured and modelled wind variation over irregularly undulating terrain.” In press, Agric. For. Meteorol. , accepted 21 Nov. 2017.

Flesch TK , Basarab JA, Baron VS, Wilson JD, Nan Hu, Tomkins NW, Ohama A, 2017. “Methane emissions from cattle grazing under diverse conditions: An examination of field configurations appropriate for line-averaging sensors.” In press, Agric. For. Meteorol. , accepted 9 October 2017.

Hu N, Flesch TK, Wilson JD, Baron V and Basarab JA. “Refining an inverse dispersion method to quantify gas sources on rolling terrain.” Agric. For. Meteorol. , 225, 1-7.

Flesch TK, Baron VS, Wilson JD, Griffith DWT, Basarab JA and Carlson PJ, 2016. “Agricultural Gas Emissions during the Spring Thaw: Applying a New Measurement Technique.” Agric. For. Meteorol. , 221, 111-121.

Wilson JD and TK Flesch, 2016. “Generalized flux-gradient technique pairing line-average concentrations on vertically separated paths.” Agric. For. Meteorol. , 220, 170-176.

J.D. Wilson, 2015. ``Dispersion from a surface source in the unstable surface layer: an approximate analytical solution." Q.J.R. Meteorol. Soc., 141, 3285-3296.

J.D. Wilson, 2015. ``Computing the flux footprint." Boundary-Layer Meteorol., 156, 1-14.

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