Predicting the Future(s) of Renewable Energy in Canada's Arctic

MEOPAR Year of Polar Prediction Proposal

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Plain-Language Summary

Reliance of communities in Canada's Arctic on fossil-fuel based power generation exposes them to high costs and vulnerabilities. Furthermore, such power generation results in strong point sources of greenhouse gases and other airborne pollutants. A pair of feasibility studies commissioned by the World Wildlife Fund and the Government of Nunavut found that integration of renewable energy generation (both wind and solar power) is cost-effective for communities in Canada's North. The proposed research is a collaboration of atmospheric scientists and engineers from the University of Victoria, the Université de Québec à Montréal, and the University of Alaska, in partnership with the World Wildlife Fund, the Government of the NWT (GNWT), the community of Sachs Harbour, Hydro-Québec, Manitoba Hydro, and the Ouranos Consortium to produce and study predictions of future wind and solar power resources in Northern Canada, with a particular focus on coastal communities. The four specific research problems to be addressed are:

1. A study of how wind power and solar irradiance in Canada's Arctic will change in the future (due to anthropogenic- human caused - change and natural variability), and to what degree future variations in these two resources might complement each other.

2. Detailed observations of near-surface atmospheric variability using an instrumented tower in Sachs Harbour. These observations will allow us to understand the relationship of wind and solar power in this coastal community with larger-scale weather variations; to ground-truth our prediction models; and to provide essential information regarding the physical operation of wind turbines in this climate (e.g. mechanical stresses and ice loading).

3. Further developing the Canadian Regional Climate Model (CRCM) for high-latitude applications. While the CRCM provides the best tool we have for predictions of future climates in Canada's North, relatively little work has been done so far in determining how well it simulates near-surface processes in this environment. We propose carrying out detailed sensitivity studies using the model, the results of which will be used to guide model development. This work will result in a substantial increase in predictive capacity for environmental variability (and in particular wind and solar power) in Canada's Arctic.

4. An extension of the engineering/economic analysis previously undertaken by the World Wildlife Fund for the present climate at a subset of community sites, considering different energy system model formulations and different renewable energy systems (e.g. airborne wind energy), and extending the analysis into the mid-21st Century to assess possible risks associated with climate change.

All predictions of future climates (and associated renewable energy resources) are uncertain. Some uncertainties, associated with observational gaps and model biases, can be reduced with continued research. Others, such as those associated with natural internal variability of the climate system, cannot be reduced and therefore must be quantified. The proposed research will improve modelling capacity (both environmental and energy systems) in Canada's North through systematic analysis of the models and collection of new and valuable data. Through analysis of natural variability of wind and solar power resources, it will also quantify the range of possible renewable energy futures in this region. Particular attention will be paid to coastal regions, as it is expected that changes in summertime sea ice extent will result in changes of the wind and irradiance regimes.

Alignment with MEOPAR Strategic Objectives

The proposed research has three key objectives: (1) assessment and development of regional climate modelling capacity for the Canadian Arctic, with an emphasis on improving boundary layer process representation in numerical models; (2) assessment of wind and solar energy resources in the Canadian Arctic over the next 20-50 years, with a focus on natural variability and anthropogenically forced change; (3) an engineering/economic assessment of the integration of renewables into electricity generation in communities in the Canadian Arctic, taking into account projected climactic changes and technology evolution. Particular emphasis will be paid to these issues in coastal areas. This research program involves partnerships and multidisciplinary interactions bringing university-based scientists and engineers together with the community of Sachs Harbour, the Government of the NWT (GNWT), the World Wildlife Fund, Hydro-Québec, and Manitoba Hydro. The proposed research directly addresses two of the four central socio-economic challenges of primary concern to MEOPAR: "2. Our ability to **predict change of** ocean and **atmospheric conditions**, especially **in Canada's North**", and "3. Our understanding of the **vulnerability of Canada's coastal communities** and industries." Furthermore, the proposed research is directly aligned with the first priority of the POLAR Science and Technology Program relevant to this call: "Baseline information to prepare for **northern sustainability**". Through the inclusion of both observational and modelling work, this research will address the YOPP objectives to: "**gather additional observations through field programmes** aimed at **improving understanding of polar key processes**", "develop **improved representation of polar key processes** in uncoupled and coupled models used for prediction ... **such as stable boundary layer representation**, surface exchange, and steep orography", "improve understanding of the **benefits of using existing prediction information and services in the polar regions**", and "provide **training opportunities** to generate a **sound knowledge base** on polar prediction related issues". Finally, regarding the specific project areas in this call for proposals, the proposed research relates to "3. Cost effective ways of **enhancing observation capacities in support of modelling** and forecasting", "4. **Innovative methods** for verification and **new parameterizations**", "5. Development … of **coupled climate models to predict future weather** ...of the Arctic on the scales of seasons to **decades**, and "6. **Interdisciplinary projects** that bridge **observations and/or predictions** with the MEOPAR concept of 'response' (i.e. **decision-making, solutions, and impact**)".

Research Plan, Approach, and Deliverables

The recent World Wildlife Fund report "Renewable Energy Deployment in Canadian Arctic" (Das and Cañizares, 2016) found extensive opportunities for the integration of renewables into electricity generation in Canada's North. The present reliance on diesel-powered generators results in a large expense (and vulnerability) for Northern communities as well strong point sources of pollution. Using a 25-year planning horizon, Das and Cañizares (2016) found that both cost savings and pollution reductions (including greenhouse gases) could be realized through the generation of electricity by wind and solar energy. Another study commissioned by Qulliq Energy Corporation (QEC) in Nunavut (Pinard, 2016) identified similar results, with both studies indicating the need for detailed study of additional community sites. Both of these analyses were based on past climate data and assumed a stationary climate into the future. Polar amplification of climate change and the related reductions of Arctic summertime sea ice extent are resulting in changes of Arctic climate that are larger and faster than those elsewhere in the world (e.g. Kirtman et al., 2013). Furthermore, even in the absence of anthropogenic change, atmospheric quantities (and associated renewable energy resources) display substantial variability from decade to decade (Deser et al., 2014).

We propose a modelling approach to predict opportunities and vulnerabilities of renewable energy generation over the next several decades, using a work plan split into four cross-linked sub-projects. The climate modeling will be based on the Canadian Regional Climate Model (CRCM5). As the availability of the wind energy resources is strongly affected by atmospheric boundary layer processes, a major focus of the proposed work is to assess the skill of CRCM5 in their representation – and to improve this where necessary. Next we propose collecting tower observations in the coastal community of Sachs Harbour, NWT, to provide the ground-truthing constraints for model simulations. Observations of this type are very rare in the North, and they will be able to inform boundary process parameterization for predictive models beyond CRCM5, including weather forecast models. Finally, an energy systems analysis will be used to refine and expand project feasibility of renewable energy generation by communities in the Canadian Arctic, with a particular focus on coastal communities, in light of projected variability and change of the resources. Northern communities and territorial governments are keen to see these sorts of initiatives, and in fact are moving ahead on their own with incremental adoption of renewable solutions where funding allows. This research project will further develop predictive modelling capacity – both HQP and the models themselves – for continuing investigation of variability and change in Canada's Arctic together with renewable generation options for those communities.

1. Future predictions of wind power and irradiance, and their potential complementarity
   (MSc, UVic; Monahan and Curry, co-supervisors)

Future changes in wind and irradiance climate in Canada's Arctic result from two sources: forced change (FC) resulting from anthropogenic changes to atmospheric composition, and natural decadal internal variability (IV) of the climate system. Recent years have seen increased appreciation that IV can be as large as or larger than FC, particularly for variables other than temperature and on sub-hemispheric spatial scales (e.g. Deser et al., 2014). The relative sizes of FC and IV for wind speed and power in British Columbia and Alberta were recently considered in Daines et al. (2016), driving the CRCM with an ensemble of global climate model realizations . That study showed that while there were robust increases and decreases of near-surface speed and power density across the model domain, these changes were small relative to the magnitude of internal variability. Daines et al. also showed that the ensemble spread differed between the two driving models. We propose to carry out a similar

analysis for Canada's Arctic, to assess the baseline potential for renewable energy generation (wind and solar), its reliability (in terms of natural interdecadal variability), and its potential for change in a warming climate. This analysis will be carried out using an ensemble of RCM simulations driven by members of the CanESM and CESM large ensembles (Kay et al., 2015; Sigmond and Fyfe, 2016). In these dedicated simulations, daily-mean fields of wind power density at altitudes from 10 m to 150 m, along with estimates of surface horizontal irradiance, will be produced for historical (1971-2000) and future (2040-2070, based on RCP 8.5) periods. Because in situ observations of wind, and particularly irradiance, are sparse in the Arctic, we will also focus on relative change in wind and solar power, which substantially reduces the need for observations to calibrate model projections (Daines et al., 2016). Calibrated absolute projections of FC and IV-related spread of 10 m wind speed and irradiance will be produced at locations where sufficiently long time series of reliable observations are available.

While the intermittency of wind power and solar irradiance presents a challenge to energy system design, an understanding of covariability between these resources provides the opportunity to further reduce reliance on fossil fuels. For example, differences in the seasonality of wind and solar energy (respectively largest in winter and summer; Wan et al. 2010) allows for balancing of generation from these two sources. Recent studies have assessed this covariability in Southern Canada and abroad (e.g. Hoicka and Rowlands, 2011; Miglietta et al. 2017). We propose to use the CRCM ensemble to assess the complementarity of wind and solar energy on monthly, daily, and sub-daily time scales. Relative to previous studies, the proposed work has the advantages that both fields come from the same model, that multi-decadal simulations can be used, and that we can assess IV-related spread in wind-solar complementarity (which to our knowledge has never been studied).

In all of these analyses, particular attention will be paid to coastal areas. These analyses of future change and its uncertainty will provide the long-term prediction baseline information necessary for energy producers, governments, and local communities to proceed with informed decision making regarding renewable energy.

2. Linking synoptic variability to observed near-surface winds and turbulence
(MSc, UVic; Atkinson supervisor)

There are indications that the changing climate is inducing changes to atmospheric pressure patterns and areas of storm activity in the North that are likely to continue into the future (Nishii et al. 2015). A direct association between large-scale (synoptic) weather patterns and expression at the local-scale is typically lacking, a disconnect noted by northern residents on weather forecasts they are receiving (Atkinson community visits). As well, it is often the case in the winter that a surface-based radiative thermal inversion is strong enough to effectively “decouple” the very lowest layer of the atmosphere from higher levels (Malingowski et al. 2014); the vertical scale of this is typically on the order of tens of meters and, within the lowest layer, wind speeds are often very low (as discussed in Project 3).

To examine the near-surface layer of the atmosphere it is proposed to install an instrumented tower in the coastal community of Sachs Harbour, on the southwest corner of Banks Island, NWT (Fig 1). There are four activities for the data that will be provided by this installation: 1) link the local situation to the prevailing synoptic state; 2) analyze turbulence, radiation budget, and other elements of near-surface meteorological controls; 3) verify operation of CRCM; and 4) provide data back to ECCC to aid forecast model initialization. The tower and its instruments will be designed to operate year round. In addition to this, there will be a focused campaign consisting of boundary layer instruments designed to better link the point-source tower measurements into the slightly larger vertical and horizontal context. The instrumental suite is listed in Table 1 (Budget section).

Engineering applications (Project 4) for this instrumental array include determination of wind forces for power assessment, turbulent loading potential of the turbine structures, and assessment of the potential ice loading regime. This array will allow the determination of wind forces at typical wind turbine heights of ~ 18 m for purposes of wind energy harvesting. Operation of the sonic and cup anemometers, combined with Doppler sodar, will allow determination of seasonal variations of wind force in the ABL. The determination of the turbulence spectrum of land-surface atmosphere heat and momentum transfer as function of changes in the land-cover (i.e., uncovered summer and snow and ice covered during winter), will be important to verify ultimate and fatigue loading on wind energy systems. As well, we use wind and hygro-thermal observations to determine potential blade ice loading.

We have budgeted procurement a 20 m tower to do this work. Atkinson has established links with the Arctic Forecast Office of Environment and Climate Change Canada, with whom results would be shared in an ongoing basis. It is the intent of the project to provide data from the in-situ observations to ECCC to aid with forecast model initialization. This research will be carried out in collaboration with Dr. Javier Fochesatto from the University of Alaska, Fairbanks.

3. RCM simulation of boundary-layer structure: Resolution and improved parameterizations (PhD, UQAM; Sushama and Monahan, co-supervisors)

The availability of renewable energy is strongly influenced by processes within the planetary boundary layer. Surface friction results in strong wind shears in the bottom several tens of meters of the atmosphere; accordingly, the turbulence and wind power density also strongly vary with altitude (e.g. He et al. 2013; Mayfield and Fochesatto, 2013; Optis et al., 2015; Monahan et al., 2016). The character of this shear is determined by boundary-layer stability. Under conditions of unstable or weakly stable stratification, the shears are relatively weak and the turbulence strong. In contrast, when the near-surface air is strongly stably stratified, shears are strong and turbulence is weak (e.g. Monahan et al. 2016). The character of stratification is determined by both large-scale and local processes, and can change rapidly. Successful model simulations of the vertical distribution of near-surface wind power and its variability require accurate representations of turbulent momentum and heat transport within the boundary layer. This problem is especially challenging in the stably stratified boundary layer common in high latitudes, particularly in the wintertime (Mahrt, 2014). Recent studies have emphasized the fact that the wind profile and stratification under stable stratification show two distinct states, or regimes, transitions between which remain poorly understood (Monahan et al. 2016, van de Wiel et al. 2017). Near surface-stratification also influences, and is influenced by, low clouds and fog (He et al. 2013; Holtslag et al. 2013). Thus, the problems of modelling near-surface winds and irradiance are coupled.

Particularly under conditions of stable stratification, the vertical scales of boundary layer processes are small and not well represented by the standard vertical discretization of global or regional models. Observations and idealized modelling indicate that the SBL regime structure is strongly sensitive to the surface scheme. Furthermore, key physical processes associated with episodic turbulence in stable stratification are likely absent in model parameterizations (e.g. Mahrt, 2014). When the stratification is unstable, transport of heat and other tracers in the boundary layer is often nonlocal and requires special treatment (e.g. Bretherton and Park, 2009). As part of the CCAR-supported CRCMD network, a new prognostic TKE scheme including an explicitly stochastic representation of intermittent mixing (He et al. 2012) will soon be implemented in the CRCM. In combination with the observational constraints obtained in Project 2, we propose to investigate the representation of the Arctic atmospheric boundary layer in CRCM. This investigation will first use existing simulations to assess the representation of boundary layer wind, temperature, moisture, and

turbulence profiles in the standard model configuration, and how sensitive these results are to the details of the surface scheme.

These simulations will be performed over a pan-Arctic domain (Fig.2) and will provide the opportunity to extend the analysis over Eurasia. In particular, we will be focusing on the simulations that will be performed with and without dynamic vegetation. While current climate simulations will be used for validation, future simulations corresponding to various RCP scenarios will be used to study boundary layer characteristics in a future climate. These simulations will soon be completed and available for analysis. Second, a series of targeted simulations using different vertical and horizontal resolutions, with and without the new prognostic TKE scheme, will assess the sensitivity of model representations of the boundary layer to resolution and the representation of physical processes. The third subproject will investigate the relationship between the simulation of boundary layer processes and low clouds, fog, and surface irradiance in CRCM. The result of these projects will be a substantially improved capacity for prediction of near-surface processes in the Canadian Arctic, underpinned by improved understanding of the key physical processes.

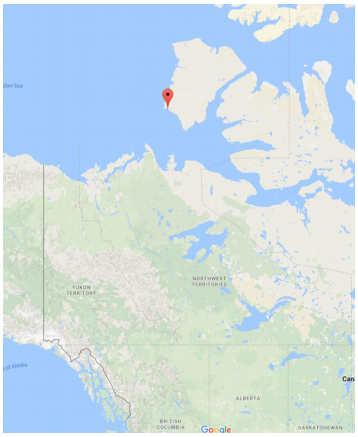

Fig. 1: Location of Sachs Harbour

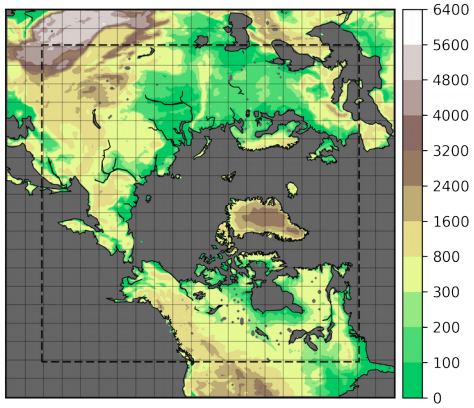

Fig. 2: CRCM5 experimental domain at 0.5° resolution, with topography (in m) in colour. The region enclosed by the dashed rectangle is the free domain.

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4. Integration of renewables into the energy systems of Northern communities (PhD, UVic; Crawford supervisor)

Das and Cañizares (2016) and Pinard et al. (2016) have performed feasibility studies for a number of communities in the Arctic using HOMER, examining a range of performance indicators and a variable mix of diesel/solar/wind generation with battery backup. Previous work on remote energy systems by Crawford's group (Hoevenaars, 2012) found that the optimal generation mix could be quite sensitive to the simulation time-step used; Das et al. used 1 hr, but depending on the load characteristic this can mask challenges (costs and emissions) associated with diesel genset operation. Das et al. also used only one turbine design (100 kW on 30 m tower) for all but one larger community, and do not make mention of icing events curtailing operations. Pinard et al. Only studied a few sites in detail, leaving others for future work. The proposed work will extend these earlier studies, using a mixed time-stepping/probabilistic algorithm to simulate the interplay between generation and loads, and thereby examine intra-hourly variability and its impact on diesel genset operation. The short term, turbulent variability in the wind resource, together with decadal variability due to natural variation superimposed on climate change, will be used to seed the requisite wind inputs to the energy system

simulation. The meteorology-focused aspects of the proposed project, in particular examination of near-surface winds and turbulence, will be very important to ascertain wind generator performance and lifetime as both power fluctuation and fatigue loads are driven by the wind spectral characteristics.

Given the protracted periods of reduced insolation in the North during the winter, additional wind generation options bear examination. A range of different machines will be considered, in terms of conventional machine size, rotor loading and tower construction techniques, all of which have implications for the balance of delivered energy costs. Moreover, options for deploying airborne wind energy will be considered; these systems are emergent and rely on kites or gliders flying autonomously aloft to generation electricity either through tractive force on a ground-based winch or via turbines on the glider with power transmitted to the ground. They have tremendous potential for deployment in the North, given the greatly reduced transportation and installation requirements and lowered costs. Twingtec, an airborne wind technology developer targeting the North, has been collaborating with Crawford and inform this aspect of the project. They can also fly much higher than the tower heights feasible for erection in the North, accessing an improved wind resource (of particular importance in periods of very stable stratification). Crawford is also developing a cloud-passing solar energy generation model to account for transients in that resource. Ultimately, the work is directed toward affecting actual project initiations in Northern communities by helping to de-risk and optimize renewable system options, an objective strengthened by the expert involvement of Mr. Banjac who has active links and projects in the North to ensure that research results lead to action on the ground.

As a united whole, these four projects address key issues and uncertainties in the prediction of the renewable energy resources and options for their integration into Northern Canadian energy systems, with particular attention on coastal areas. The proposed projects are linked: Projects 1 and 4 are naturally connected through the focus on future predictions (of the resources themselves and electricity generation, respectively) and will both make use of the ensemble of RCM simulations. Projects 2 and 3 are connected through the focus on the physics of atmospheric boundary layer processes. The tower data will provide essential guidance for the assessment of boundary layer processes in the RCM, and their future development. Projects 2 and 4 connect through the use of observational constraints to assess the mechanical performance of wind turbines in the present environment, and connect to Project 1 through the prediction of potential future changes in the associated environmental conditions. A Gantt chart listing deliverables and timelines is presented in the Budget section.

Deliverables of this research will be:

1. Predictions of future renewable energy resources (wind and solar), including their forced change, natural internal variability, and potential complementarity.

2. An instrumented tower in Sachs Harbour providing information about near-surface wind and irradiance conditions, and linking these to boundary layer turbulent processes and synoptic conditions. These data will also be used for addressing engineering issues such as mechanical load on wind turbines; ground-truthing long-term predictive models like CRCM5; and providing data for initializing short-term weather forecast models.

3. Improved prediction capacity by CRCM5 in the Arctic domain, based on new observational constraints; carefully constructed sensitivity analyses targeting the simulation of near-surface wind and solar irradiance; and continued development of fundamental physical understanding.

4. A refinement of existing feasibility studies of integration of renewables into the electricity supply of Northern communities, extending the analysis from the recent past into the middle of the 21st century; investigation of the performance of generation systems in Arctic conditions; and investigation of novel wind power systems.

Linkages and Support

The proposed research involves linkages with the community of Sachs Harbour; the Government of the Northwest Territories (GNWT); Hydro-Québec; Manitoba Hydro; TwingTec inc; and the non-governmental organizations Ouranos and the World Wildlife Fund (WWF). As well, we have engaged Sonny Banjac (an energy systems engineer specializing in wind and solar projects in high latitudes and remote communities) as a consultant. The proposed research has been endorsed by the YOPP secretariat. Atkinson's MEOPAR project, which will aid this proposed effort with in-kind field support, has also received YOPP endorsement.

Sachs Harbour and GNWT are working together to assess the potential for wind power generation at Sachs Harbour. The proposed instrumentation will provide a much more comprehensive dataset than is usually collected in wind assessments, allowing a detailed analysis of both the meteorological and engineering aspects of renewable energy production in this region . This information, along with future projections of renewable resources, will be shared with these two levels of government as the research progresses for use in their intermediate- to long-term planning. Co-PI Atkinson has an ongoing relationship with the community of Sachs Harbour; information sharing between the research team and community members will occur during his visits there with his MSc student and his collaborator Fochesatto.

The analysis of predictions of future renewable energy resources and production feasibility will be developed in consultation with Hydro-Québec and Manitoba Hydro through a series of annual meetings involving the co-PIs, the HQP, and representatives from these two companies.

Ouranos interacts regularly with the Regional Climate Modelling group at UQAM, and uses CRCM5 as their main simulation tool for climate projections. The process of assessing and further developing the boundary layer representation for the simulation of Arctic conditions will involve regular collaborations between Ouranos scientists and the team of Sushama, Monahan, and the HQP working on the project (who will receive office space at Ouranos).

The World Wildlife Fund is working toward to goals regarding renewable energy in Canada's Arctic: to “Work with governments, experts, and community leaders to create a replicable, scalable, and self-sustaining deployment model for renewable energy investments to reduce dependence on diesel in Arctic communities”, and to “Deploy low-impact, community-wide, habitat-friendly renewable energy technologies in three candidate communities by 2020”. The WWF has enthusiastically supported the proposed research, which will provide important information about both present and future conditions that is needed to meet these goals. We will regularly report research results to WWF as the research progresses, and at the end of the research project we will present them with a summary report describing the key findings.

Sonny Banjac has worked on many projects related to wind and solar energy in Canada's Northern communities. The proposed engineering analysis will benefit substantially from his expert guidance (which he is providing without charge). We will work with Banjac to extend the results obtained in the detailed study of Sachs Harbour to the other communities in Canada's Arctic he works with.

Twingtec is a developer of airborne wind systems, and are exploring remote Canadian communties for deploying their system. They will provide input on the airborne wind system performance modeling through meetings with the team members. TwingTec will be consulted on a monthly basis during definition of the airborne wind modelling, and kept up to date on a quarterly basis as that generation option is embedded in the work.

HQP Focus

The research project will train four graduate students in atmospheric observations and data analysis; climate modelling; and engineering/economic analysis of energy systems. Two MSc students will be based at the University of Victoria, one in the Department of Geography (Project 2; to be supervised by David Atkinson) and the other in the School of Earth and Ocean Sciences (Project 1; to be co-supervised by Adam Monahan and Charles Curry). One PhD student will be in the Department of Mechanical Engineering at University of Victoria (Project 4; supervised by Curran Crawford), while the second PhD student will be in the Département des Sciences de la Terre et de l'Atmosphère at the Université de Québec à Montréal (Project 3; co-supervised by Laxmi Sushama and Adam Monahan). The supervisory committee of each HQP will include other Co-PIs on the project. All PIs, Co-PIs, and HQP will meet virtually at least monthly and in person annually (at the MEOPAR Annual Scientific Meeting/Training Event). Through these regular interactions, the students will be exposed to research problems and methods in both climate science and engineering, from observationally-based and modelling perspectives. As well, all HQP will participate in the annual meetings with Hydro-Québec and Manitoba Hydro. All HQP will be members of the Institute for Integrated Energy Systems at the University of Victoria (IESVic), a research centre at the leading edge of fostering collaborations between engineers, economists, and environmental scientists. The MSc student working with Atkinson will accompany him to Sachs Harbour to instrument the tower and work with the local community; getting HQP into the field and into communities is an important aspect of HQP training. The PhD student working with Sushama and Monahan will be provided with office space at Ouranos, exposing them to a multidisciplinary community of scientists working on climate change impacts and adaptation.

Excellence of the Researchers

Adam Monahan is Professor of atmospheric sciences in the School of Earth and Ocean Sciences at the University of Victoria. His research areas include the meteorology of renewables; developing novel statistical and probabilistic approaches to the analysis and modelling of climate processes; and biogeochemical dynamics. He has extensive experience in the dynamics of the stably-stratified atmospheric boundary layer (ABL), and is presently collaborating on studies of ABL wind and turbulence regimes with colleagues at TU Delft and solar irradiance variability with researchers in the Energy Meteorology Unit of the University of Oldenburg. Dr. Monahan is a member of the Institute for Integrated Energy Systems at the University of Victoria (IESVic) and Chair of the Scientific Committee of the Canadian Meteorological and Oceanographic Society (CMOS). In 2009 he was awarded the President's Prize of CMOS for his work on the variability of sea-surface wind speed. Relevant publications include Daines et al. 2016, Lohmann et al. 2016, Monahan et al. 2015, and Optis et al. 2015.

Laxmi Sushama is Associate Professor and Canada Research Chair in Regional Climate Modelling at Centre ESCER and the Department of Earth and Atmospheric Sciences at the Université de Québec à Montréal. Prior to becoming a faculty member at UQAM, she completed postdocs at UCLA and UQAM, and also worked as a climate specialist at Ouranos Consortium. She is currently leading the Canadian Network for Regional Climate and Weather Processes (cnrcwp.uqam.ca), and has also led other large networks in the past. Her expertise is in regional climate modelling, with an emphasis on improving the representation of land surface processes and types in climate models. Her research has laid important steps towards improved understanding of land-climate interactions and feedbacks in the Canadian high latitudes. She has also made significant contributions to the assessment of climate-change impacts on Canadian water resources and hydrometeorologic extremes. Relevant publications include Paquin and Sushama 2015, Jeong et al. 2016, and Gangi et al. 2017.

David Atkinson is Associate Professor at in the Dept. of Geography, University of Victoria an Associate Editor for Journal of Geophysical Research-Atmospheres, and Affiliate at University of Alaska Fairbanks (UAF)/Dept. of Atmospheric Sciences. His research has been Arctic focussed since his Master's in 1990. In 2010 he came from UAF to University of Victoria in 2010 where he has established successful field-based research efforts in the western Canadian Arctic. His primary interests centre around the wind/wave forcing of coastal zones and the analysis of weather data for extreme events, specifically storms, with the particular angle of guiding the research process using end-user input. His work also covers synoptic analyses of weather occurrences that present particular problems for northerners, such as fog. Atkinson and his HQP will analyze the synoptic setting of events of interest recorded by the instruments and engage the community with research results and applications of recorded data for classroom use. Atkinson is PI on projects from various funding sources – relevant ones include: Phase II MEOPAR, ArcticNet, Transport Canada, and NSERC-Belmont. He currently supervises 7 graduate students and co-supervises 3 more.

Curran Crawford is an Associate Professor at UVic in the Mechanical Engineering department and a member of IESVic, with a background in multidisciplinary design optimization (MDO) applied to a range of sustainable energy and aerospace systems. He worked on MDO of wind turbines during his SM at MIT, and advanced rotor concepts during his PhD at Cambridge University. He has worked in wind energy for 15 years, including floating offshore and airborne wind energy, and operates a trailer-based wind turbine test rig at UVic alongside water tunnel rotor testing equipment. His research

also includes tidal and wave energy devices, from hydrodynamic, structural, resource and integration perspectives. He also works in the area of grid integration of renewable energy and plug-in electrified vehicles with national grids as well as remote communities through various centrally controlled and distributed market-based techniques. Throughout his work, he applies probabilistic analysis techniques to improve the robustness of these systems. He has received grant and contract funding of over $4M since starting at UVic to support these various research activities. He is also member of the Institute for Integrated Energy Systems at UVic, sits on various non-profit boards, technical standards committees in wind and tidal energy and international project groups in renewable energy. He was a part of the NSERC Canadian Wind Energy Network and IEA Task 29 Mexico Rotor Project, is on the scientific board of the WindEEE dome wind facility at Western University, and participates in the EU Airborne Wind Energy Systems Modelling, Control and Optimization (AWESCO) project, the EU Wind Energy Masters program and the IEA Task 37 Wind Energy Systems activity.

Charles Curry is a Research Associate at the Pacific Climate Impacts Consortium and Adjunct Professor at UVic. He has conducted research in the area of wind climatology, variability, predictability and extremes (Curry, van der Kamp and Monahan, 2011a; Daines, Monahan & Curry, 2016). He has also investigated the complementarity of wind and hydroelectric energy in BC and the U.S. Pacific Northwest (Curry, Bailey & Kohfeld, in preparation). From 2011-2016, Dr. Curry helped manage a NSERC-funded Collaborative Research and Development (CRD) project in partnership with Ouranos Consortium and with RioTinto Alcan, BC Hydro and Hydro-Québec as industrial partners, keeping partners apprised on research progress on a regular basis. He has also consulted on future projected changes in winds with the Electric Power Research Institute in the U.S. and BC Transmission Corp., collaborated with forestry experts on climate change impacts in BC (Haughian et al. 2012), and constructed a versatile climate extremes index for use by actuarial societies in Canada and the U.S., their member communities and the public (the *Actuaries Climate Index*™). Through this work, he developed effective strategies for the exchange of science-based advice to stakeholders with a vested interest in gaining an understanding of climate variability and change. Relevant references include Curry et al. 2011, Daines et al. 2016, Haughian et al. 2012.

Gilberto J. Fochesatto is an Associate Professor in the Department of Atmospheric Sciences at University of Alaska Fairbanks and leads the Atmospheric Boundary Layer & Micrometoerology Research Group. He holds a B.Eng in Electrical Engineering and a PhD in Physics from CNRS Ecole Polytechnique in Paris. His interest focusses on surface-atmosphere interactions in complex heterogeneous surfaces and canopies characterizing high latitude environments. The work of his team improves understanding of land-atmosphere coupling processes from micro-meteorological to atmospheric boundary layer scales via direct field measurements of surface fluxes of heat, moisture and carbon as tracers of surface-atmosphere interaction in Arctic Tundra, Alaskan Boreal Forest and high latitude agro-ecosystems. They also use land-surface and atmospheric models as well as remote sensing platforms to improve understanding of surface fluxes aggregation to the mesoscale flow as function of the atmospheric boundary layer turbulence and dynamic, surface characteristics, vegetation complexities, etc. This research has intersections with Climate Change, Hydrometeorology, Eco-Hydrology, Ecosystems dynamics, Natural Resources and Agriculture.

Budget (Appendices C&D)

The proposed funding will support two MSc students and two PhD students, at $20K/yr per student. As the recruitment of good graduate students in climate science and engineering is a competitive process, it is necessary that graduate students be provided with competitive stipends. Furthermore, Victoria is an expensive rental market. We also request $21K ($1K per PI/Co-PI and HQP) to support travel to the MEOPAR Annual Scientific Meetings: $7K in Year 1 (5 PI/Co-PI + 4 HQP, of which only 7 need to travel to Montreal); $9K in Year 2 (5 PI/Co-PI+4 HQP); and $7K in Year 3 (5 PI/Co-PI+2 HQP).

Funds are requested for two trips from Victoria to Sachs Harbour (Atkinson and HQP), at a cost of $8K each. In-kind support is provided as Atkinson will make a second visit to the tower as part of another project.

Funds are requested to provide support for collaborator Dr. Javier Fochesatto to travel to Sachs Harbour to collaborate with Atkinson and HQP ($10K), and to travel to Victoria for further collaboration ($3K).

Instrumentation costs are $42K for the tower, as well as $4K for the shipment of the tower to Sachs Harbour. $4K are also requested to cover the costs of Fochasetto shipping gear to Sachs Harbour.

A detailed description of the requested equipment and breakdown of costs follows.

Table 1. Instrumentation for the tower and for the focussed surface campaign.

Instrument	**Type**	**Variable**	**Ranges**
Tri-Axial Sonic Anemometer (x4) (tower)	RMYoung	u,v,,w,q_e	10-20 Hz, 0.01 m/s, 0.01 K, 0-30 m/s, -40C min.
Doppler Acoustic Sounder	Remtech PA-0	ws, wd, C_T^2, w	20-750 m, 10 m vertical, 15 min time resolution
Optical Scintillometer	Scintec BLS-900	C_N^2, H	500m-5 km suggested 1 km matching MODIS
Humicap sensor T, RH (x4) (tower)	Vaisala HTM333	T, RH	1 min resolution
Ambient Pressure sensor (tower)	CS100	P	1 min resolution
Cup Anemometer (x4) (tower)	Propeller	ws, wd	1 min resolution
4-component radiation	CS CNR4	Kup,dn Lup,dn	1 min resolution
Surface radiant temperature	SI-111	“skin” temperature	1 min resolution
Snow depth (x2)	SR-50	Snow depth	15 min resolution
Cameras (tower)	Campbell Scientific Canada		

Instruments description and setup

The tower will be equipped with four crossarms mounting anemometers (sonic and cup) and temperature/humidity (humicap) instruments would be established in a logarithmic profile vertically up from the ground. Humicap sensor allow determination of temp and relative humidity to correct sonic anemometer measurements and as well determine Bowen ratio. The pressure sensor and cup anemometers will be used in flux retrievals and multilevel wind observations. The snow depth sensors measure snow depth; two are used for signal redundancy and to account for micro-scale variations in snow depth. The radiation instruments allow a full accounting of the radiative aspects of the energy budget.

The sonic anemometer will measure three dimensional components of the wind flow (u,v,w) and sonic temperature (similar to equivalent temperature q_e) at a high sampling rate (10-20Hz) with accuracies of 0.01 m/s and 0.01C. Methodologies to process turbulent data include despiking algorithms and QA/QC algorithms adopted as international standards (Starkenburg et al, 2016). The instrument allows calculation of wind speed, wind direction and temperature evolution at time resolution of 1 sec. or finer. Turbulent components will be deduced from sonic measurements to calculate second order covariance and determine tri-dimensional momentum fluxes, shear stress, friction velocity, heat fluxes, turbulent kinetic energy, mean kinetic energy, turbulent intensities and spectral covariance.

The Doppler Acoustic Sounder is a remote sensing profiler which measures wind speed and direction in the atmospheric boundary layer by acoustic sounding. A multi-frequency 3.5 KHz acoustic beam is emitted vertically and on tilted directions to deduce by Doppler effect the vertically resolved wind speed and wind direction as well as vertical velocity and atmospheric surface layer thermal turbulent structure (C_T^2). The instrument vertical range is 20 to 750 m with 10 m vertical resolution and 15 min time resolution per profile. Acoustic backscatter allows the identification of turbulent structure in the atmospheric boundary layer and shear-driven thermal turbulence (Fochesatto et al 2013). Near the shore line in particular, the instrument is able to determine the presence of organized large eddies as secondary circulation structures in the atmospheric boundary layer (ABL), that can exist near coastlines (Drobinski et al 2008).

The Large Aperture Scintillometer is a laser based instrument that uses a laser emitter set on a tripod that is aimed at an optical receiver anywhere from 500 to 5000 m away. The laser is eye-safe (880 nm). This instrument allows determination of line integrated and spatially distributed C_N^2 coefficient of refractive index of turbulence. The large scale area-average C_N^2 is then combined with sonic anemometer or meteorological data to determine C_T^2. This quantity can then be integrated together with the set of non-linear equations corresponding to the Monin-Obukhov similarity hypothesis to calculate the large-scale area-average sensible heat flux (Gruber and Fochesatto, 2013; Gruber et al, 2014)

item	unit	qty	total
CR1000 logger/microcontroller	$2,500	2	$5,000
RM Young Alpine wind	$2,300	4	$9,200
HC-S3 T/RH	$1,000	4	$4,000
CNR4 four component radiation	$9,000	1	$9,000
Surface irradiance	$1,500	1	$1,500
SR50 snow depth	$900	2	$1,800
Camera	$2,500	2	$5,000
Enclosure	$700	1	$700
20m tower	$2,000	1	$2,000
guys & hardware	$1,000	1	$1,000
base/anchor	$2,000	1	$2,000
Cross arms	$200	4	$800
total			**$42,000**

In-kind support will be provided from the following sources:

1. RCM simulations will be carried out using computational resources from Compute Canada. Sushama and Monahan will both submit proposals for dedicated computer time to augment their default allocations.

2. Publication page charges and local computing resources for HQP will be provided by the Co-PIs from other research support.

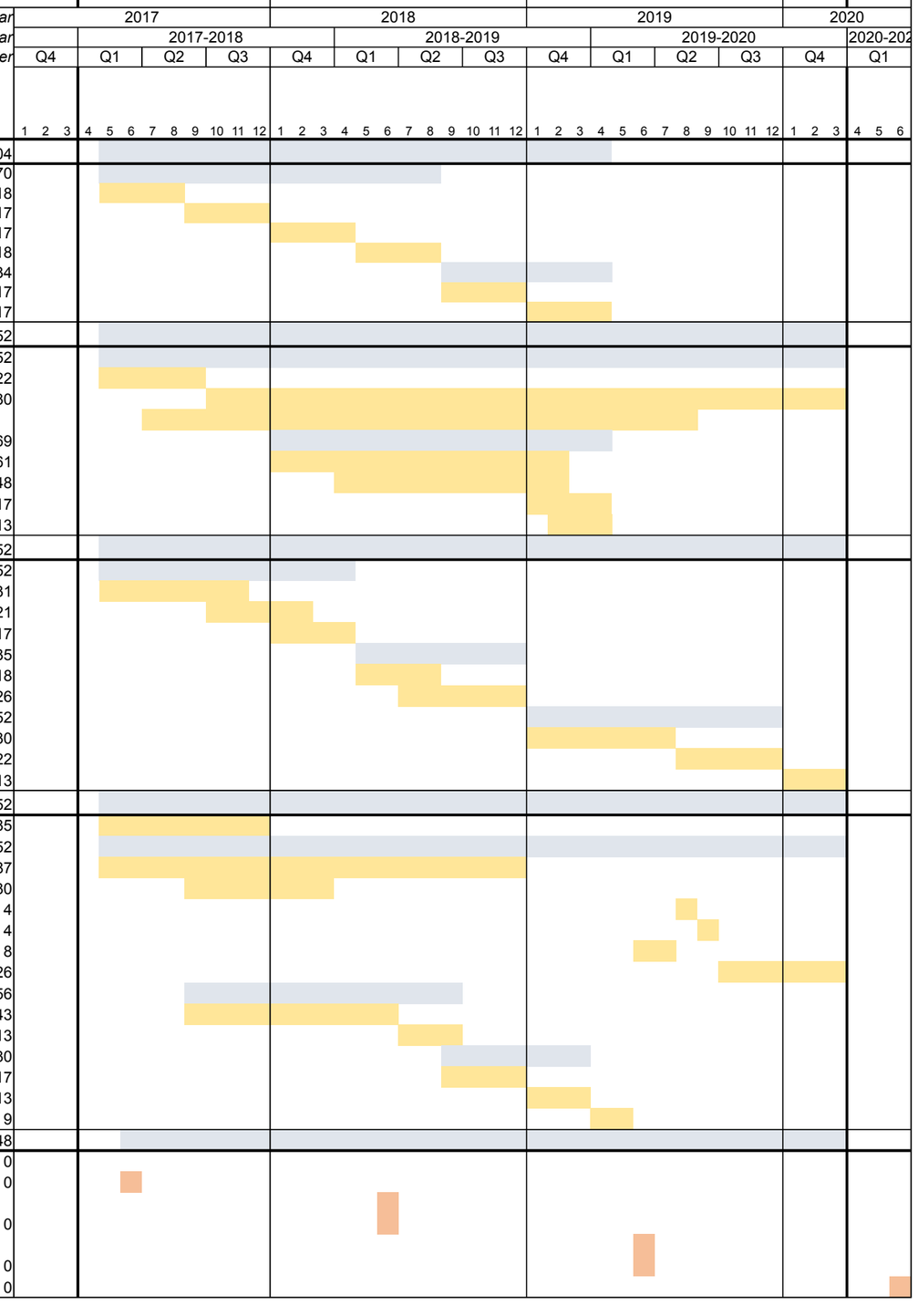
3. Atkinson will make two trips to Sachs Harbour for tower installation and maintenance. The second of these two trips will be paid from other research funds available to Atkinson. ($6000 contribution)

4. Javier Fochesatto's collaboration represents an in-kind contribution of time and equipment (respectively $20000 and $250000; to be confirmed).

5. Sonny Banjac's extensive expertise regarding renewable energy projects in remote Northern communities is being provided without charge (2 hours per month, at $90/hour for the first year; continuing subject to his availability).

6. The PhD student working on Project 3 will be provided with an office at Ouranos.

WBS	Task	Start	End	% Complete	Wrapper	Wks	Wk wks
	Project start date	**01/05/2017**					
1	**Future projections of wind power and irradiance**	01/05/2017	30/04/2019		Y	104	104
1.1	Ensemble CRCM simulations	01/05/2017	31/08/2018		Y	70	70
1.1.1	Selection of CanESM & CESM driving ensemble members	01/05/2017	31/08/2017			17	18
1.1.2	CRCM sims: historial (1971-2000) wind & irradiance	01/09/2017	31/12/2017			17	17
1.1.3	Calibration of abs projects to long series observations	01/01/2018	30/04/2018			17	17
1.1.4	CRCM sims: future (2040-2070) wind & irradiance	01/05/2018	31/08/2018			17	18
1.2	Assess wind-solar complimentarity	01/09/2018	30/04/2019		Y	34	34
1.2.1	Monthly, daily, sub-daily CRCM ensemble post-processing	01/09/2018	31/12/2018			17	17
1.2.2	Assess IV-related wind-solar complimentarity	01/01/2019	30/04/2019			17	17
2	**Linking synoptic variability to observations**	01/05/2017	31/03/2020		Y	152	152
2.1	Instrument tower	01/05/2017	31/03/2020		Y	152	152
2.1.1	Installation at Sachs Harbour	01/05/2017	30/09/2017			22	22
2.1.2	Data campaign & ECCC data sharing	01/10/2017	31/03/2020			130	130
2.1.3	Work with Northern partners for data from other met masts	01/07/2017	30/08/2019				
2.2	Data analysis	01/01/2018	30/04/2019		Y	69	69
2.2.1	Idenfity synoptic state	01/01/2018	27/02/2019			60	61
2.2.2	Analyze near-surface metrology (turbulence, radiation, etc.)	01/04/2018	27/02/2019			47	48
2.2.3	Quantify icing conditions	01/01/2019	30/04/2019			17	17
2.2.4	Provide CRCM validation data	01/02/2019	30/04/2019			13	13
3	**RCM simulation of boundary-layer structure**	01/05/2017	31/03/2020		Y	152	152
3.1	Analysis of existing CRCM simulations of pan-Arctic domain	01/05/2017	30/04/2018		Y	52	52
3.1.1	Assess performance of standard ABL model	01/05/2017	30/11/2017			30	31
3.1.2	Assess sensitivity of result to surface scheme	01/10/2017	27/02/2018			21	21
3.1.3	Extend model to Eurasia domain	01/01/2018	30/04/2018			17	17
3.2	Targetted CRCM simulations	01/05/2018	31/12/2018		Y	35	35
3.2.1	Vertical & horizontal resultion study	01/05/2018	30/08/2018			17	18
3.2.2	With & without new prognostic TKE scheme	01/07/2018	31/12/2018			26	26
3.3	Boundary layer process investigation with CRCM	01/01/2019	31/12/2019		Y	52	52
3.3.1	Low clouds/fog influence	01/01/2019	30/07/2019			30	30
3.3.2	Surface irradiance influence	01/08/2019	31/12/2019			22	22
3.4	Colate near-surface Arctic process simulation best practices	01/01/2020	31/03/2020			13	13
4	**Integration of renewables into Northern communities**	01/05/2017	31/03/2020		Y	152	152
4.1	Community consultations & energy system data gathering	01/05/2017	31/12/2017			35	35
4.2	Stochastic energy system optimization framework	01/05/2017	31/03/2020		Y	152	152
4.2.1	Refine time-steppping/probablistic optimization tool	01/05/2017	30/12/2018			87	87
4.2.2	System data input for existing systems	01/09/2017	30/03/2018			30	30
4.2.3	Synthesize inputs from CRCM & observational data	01/08/2019	30/08/2019			4	4
4.2.4	Synthesize correlated solar-wind inputs	01/09/2019	30/09/2019			4	4
4.2.5	Input refined technology models	01/06/2019	30/07/2019			8	8
4.2.6	Community energy system optimization studies	01/10/2019	31/03/2020			26	26
4.3	Airborne wind power study	01/09/2017	30/09/2018		Y	56	56
4.3.1	Performance prediction model (including ABL effects)	01/09/2017	30/06/2018			43	43
4.3.2	Transportation/operational cost model	01/07/2018	30/09/2018			13	13
4.4	Conventional wind turbine study	01/09/2018	30/03/2019		Y	30	30
4.4.1	Cost modeling including on-site installation	01/09/2018	31/12/2018			17	17
4.4.2	Turbine design study	01/01/2019	30/03/2019			13	13
4.5	Battery technology cost-benefits study	01/04/2019	30/05/2019			8	9
5	**Administration**	01/06/2017	30/03/2020		Y	148	148
5.1	MEOPAR Cycle II Annual Scientic Meeting Presentations					0	0
5.1.1	Kick-off presentation detailing workplan for feedback	01/06/2017				0	0
5.1.2	Prelim CRCM results & met data analysis, energy system & airborne wind models	01/06/2018				0	0
5.1.3	CRCM sensitivities & wind variability predictions, met data detailed analysis, energy system component studies	01/06/2019				0	0
5.1.4	Present final results of overall integrated project	01/06/2020				0	0



Data Management Plan

Observational data gathered by the project will be used to address the science questions proposed by the project. These data will be deposited with MEOPAR administration, with the Government of the Northwest Territories, with the Northwest Territories Power Corporation [if they partner onto the project], and with the community of Sachs Harbour. All of these groups will be free to use the observational data for future projects as they see fit.

A number of simulations will be performed within the project using the fifth generation Canadian Regional Climate Model over a pan-Arctic domain (Fig. 2). While a number of these are related to sensitivity studies, several others are transient climate change simulations, for different RCP scenarios, driving GCMs and resolution. These simulations will be performed on Compute Canada cluster Guillimin. The computing support group at UQAM will be responsible for data management. Long term archiving involves a transfer from the high performance computing platform to the small tape archiving system at UQAM or on servers at UQAM, which have large volumes of disk space, for later analyses of the data. The commonly used variables are generally stored on discs, while other variables are stored on tapes and will be available beyond the lifetime of the project.
The data will be made available upon request to the larger scientific community to fully analyse the data and to promote scientific collaboration. It must be noted though that since the data is generated as part of PhD and MSc projects, it will generally become available to the scientific community after the students defend their PhD and publish results from the simulations. Though the model outputs are generally in RPN standard format, they can be made available in NetCDF format.

Research results will also be published in open-access journals, with versions deposited in the University open-access repositories according to specific copyright restrictions. Likewise, student theses will be available in open-access University repositories.

Knowledge Mobilization Plan (Appendix B)

The Knowledge Mobilization Plan is detailed in Appendix B.

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Official Languages

As all researchers, collaborators, and members of participating organizations in the proposed research are either native English speakers or bilingual, the Official Languages Act has not been taken into account in developing the project.

Gender-Based Analysis

The proposed research involves 4 HQP. The PIs recognize the challenges associated with women entering STEM fields. We commit to making an effort to recruit women into these research positions. Monahan has already identified a Brazilian student, Renata Grassi, as a recruit for the MSc position in Project 1 if the proposal is successful.

Total Government Funding and Stacking Limits

No other governmental funding is sought for the proposed research.

Letters of Support

Letters of support have been received from

YOPP Secretariat
The Government of the Northwest Territories
Hydro-Québec
Manitoba Hydro
World Wildlife Fund
Ouranos
Sonny Banjac
Twingtec Inc

and we expect but have not yet received letters from

The Community of Sachs Harbour

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Dr. Adam Monahan

Correspondence language: English
Sex: Male

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The primary information is denoted by (*)

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NSERC CRSNG

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Dr. Adam Monahan

Language Skills

Language	Read	Write	Speak	Understand	Peer Review
English	Yes	Yes	Yes	Yes	Yes
French	Yes	No	No	No	Yes

Degrees

- 2001/7	Post-doctorate, Stochastic dynamics, Humboldt Universitat
- 2000/5	Post-doctorate, Climate Diagnostics, University of British Columbia
- 2000/2	Doctorate, Physical Oceanography, University of British Columbia
- 1995/11	Master's Thesis, Physics, University of British Columbia
- 1993/6	Bachelor's, Physics, The University of Calgary

Recognitions

2010/1

Faculty of Science Award for Research Excellence
University of Victoria
Prize / Award
Research achievement award.

User Profile

Research Specialization Keywords: Atmospheric variability, Climate dynamics, Multiscale dynamics, Multivariate statistics, Near-surface winds, Predictability, Statistics/probability in atmosphere/ocean science, Stochastic processes in atmosphere/ocean science, Wind power meteorology

Employment

2013/7

Professor
School of Earth and Ocean Sciences, University of Victoria
Full-time, Professor
Tenure Status: Tenure

2007/7 - 2013/6

Associate Professor
School of Earth and Ocean Sciences, University of Victoria
Full-time, Associate Professor
Tenure Status: Tenure

2001/7 - 2007/6
Assistant Professor
School of Earth and Ocean Sciences, University of Victoria
Full-time, Assistant Professor
Tenure Status: Tenure Track

1993/9 - 1999/12
Teaching Assistant
Physics and Astronomy, University of British Columbia
Part-time
Tenure Status: Non Tenure Track

1999/5 - 1999/6
Sessional Lecturer
Earth and Ocean Sciences, University of British Columbia
Part-time, Sessional
Tenure Status: Non Tenure Track

Research Funding History

Awarded [n=4]

2014/4 - 2019/3
Principal Investigator
Variability and Predictability of Near-Surface Winds, Grant

Funding Sources:

2014/4 - 2019/4 Natural Sciences and Engineering Research Council of Canada (NSERC)
Discovery Grant
Total Funding - 260,000
Portion of Funding Received - 156,000
Funding Competitive?: Yes

2013/4 - 2018/4
Co-investigator
Canadian Network for Regional Climate and Weather Processes, Grant

Funding Sources:

2013/4 - 2018/4 Natural Sciences and Engineering Research Council of Canada (NSERC)
Climate Change and Atmospheric Research
Total Funding - 4,078,255
Portion of Funding Received - 325,000
Funding Competitive?: Yes

Principal Investigator : Laxmi Sushama

2014/4 - 2017/3
Principal Investigator
Variability and Predictability of Near-Surface Winds, Grant

Funding Sources:

2014/4 - 2017/4 Natural Sciences and Engineering Research Council of Canada (NSERC)
Discovery Accelerator Grant
Total Funding - 120,000
Portion of Funding Received - 120,000
Funding Competitive?: Yes

2013/9 - 2016/4
Principal Applicant
Sea surface wind extremes: downscaling and modelling, Grant

Funding Sources:

2013/9 - 2015/8	Networks of Centres of Excellence (NCE) MEOPAR Total Funding - 24,997,535 Portion of Funding Received - 108,000 Funding Competitive?: Yes

Completed [n=7]

2009/4 - 2014/3
Co-investigator

NSERC Program in Interdisciplinary Climate Science, Grant

Funding Sources:

2009/4 - 2014/3	Natural Sciences and Engineering Research Council of Canada (NSERC) Collaborative Research and Training Experience Total Funding - 1,341,400 Portion of Funding Received - 427,000 Funding Competitive?: Yes

Principal Investigator : Weaver, A.

2009/4 - 2014/3
Principal Investigator

Probabilistic Climate Dynamics: Exploring the Weather-Climate Connection, Grant

Funding Sources:

2009/4 - 2014/3	Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery Total Funding - 200,000 Portion of Funding Received - 200,000 Funding Competitive?: Yes

Principal Investigator :

2010/4 - 2011/3
Co-investigator

Impact of Projected Climate Change on Surface Winds Over British Columbia, Grant

Funding Sources:

2010/4 - 2011/3	Canadian Foundation for Climate and Atmospheric Sciences (CFCAS) Outreach grant Total Funding - 40,000 Portion of Funding Received - 40,000 Funding Competitive?: Yes

Co-investigator : Charles Curry; David Rodenhuis

2007/4 - 2011/3
Co-investigator

The Canadian Regional Climate Modelling and Diagnostics (CRCMD) Network, Grant

Funding Sources:

2006/7 - 2011/3	Canadian Foundation for Climate and Atmospheric Sciences (CFCAS) CFCAS Network Total Funding - 3,095,753 Portion of Funding Received - 62,000 Funding Competitive?: Yes

Principal Applicant : Jones, C.; Laxmi Sushama

2006/4 - 2010/3
Co-investigator

Simulating Climate Processes with a High-Resolution Regional Climate Model, Grant

Funding Sources:

2006/4 - 2010/3 Mathematics of Information Technology and Complex Systems (MITACS)
Scientific Program
Total Funding - 495,752
Portion of Funding Received - 80,000
Funding Competitive?: Yes

Principal Investigator : Jones, C.

2006/4 - 2010/3
Co-applicant

Research Support, Grant

Funding Sources:

2006/4 - 2010/3 Canadian Institute for Advanced Research (CIAR)
Earth System Evolution Program
Total Funding - 120,000
Portion of Funding Received - 120,000
Funding Competitive?: No

Principal Investigator : Jerry Mitrovica

2007/4 - 2010/3
Co-investigator

Mathematical Problems in Climate Modelling: Multiscale Processes in the Tropics, Grant

Funding Sources:

2007/4 - 2010/3 Pacific Institute for the Mathematical Sciences
Period of Concentration
Total Funding - 194,000
Portion of Funding Received - 40,000
Funding Competitive?: Yes

Co-investigator : Boualem Khouider

Under Review [n=1]

2017/4 - 2022/3
Co-applicant

MEOPAR Prediction Core, Grant

Funding Sources:

2017/4 - 2022/4 MEOPAR
Total Funding - 190,000
Portion of Funding Received - 0
Funding Competitive?: Yes

Student/Postdoctoral Supervision

Bachelor's [n=2]

2012/5 - 2012/8
Principal Supervisor

Marlene Machemy (Completed) , University of Victoria
Thesis/Project Title: Land/sea breeze variability in the Captial Regional District

2012/5 - 2012/8
Principal Supervisor

Robert Fajber (Completed) , University of Victoria
Thesis/Project Title: Timing of daily extreme winds in the lower atmosphere

Bachelor's Honours [n=5]

2016/9 - 2017/4 Academic Advisor	Sarah Bozoian (In Progress) , University of Victoria Student Degree Expected Date: 2017/6 Thesis/Project Title: Atmospheric Tides on Vancouver Island
2015/9 - 2016/4 Principal Supervisor	Sarah Maleska (Completed) , University of Victoria Thesis/Project Title: Urban heat island effects in the Capital Regional District
2013/9 - 2014/4 Principal Supervisor	Robert Fajber (Completed) , University of Victoria Thesis/Project Title: Modelling Sea Surface Wind Variability Present Position: PhD Student, University of Toronto
2013/9 - 2014/4 Co-Supervisor	Fei Luo (Completed) , University of Victoria Thesis/Project Title: Diagnosis of Aerosol Direct Effects in the Canadian AGCM Present Position: MSc student, Universitaet Hamburg
2010/5 - 2010/12 Principal Supervisor	Kyla Bishop (Completed) , University of Victoria Thesis/Project Title: Empirical statistical downscaling of surface winds in BC Present Position: Consulting geologist at Kyla Bishop Consulting, Calgary

Master's Thesis [n=6]

2014/3 - 2017/11 Co-Supervisor	Bennit Mueller (Completed) , University of Victoria Thesis/Project Title: Detection and attribution of anthropogenic and natural influences on Arctic sea ice
2012/9 - 2015/8 Co-Supervisor	Jeff Daines (Completed) , University of Victoria Thesis/Project Title: Present and future wind energy resources in Western Canada
2011/9 - 2014/8 Co-Supervisor	Jan-Erik Tesdal (Completed) , University of Victoria Thesis/Project Title: The spatial and temporal distribution of oceanic dimethylsulfide and its effects on atmospheric composition and radiative forcing Present Position: PhD Student, Columbia University
2010/9 - 2012/8 Principal Supervisor	Cangjie (Ross) Sun (Completed) , University of Victoria Thesis/Project Title: Statistical downscaling of sea surface winds over the global oceans Present Position: Secondary school teacher
2009/9 - 2012/4 Principal Supervisor	Aaron Culver (Completed) , University of Victoria Thesis/Project Title: Not all speeds are created equal. Investigating the predictability of statistically downscaled historical land surface winds over central Canada. Present Position: Renewable Energy Consultant, SgurrEnergy
2008/9 - 2011/7 Principal Supervisor	Mitch Bruce (Completed) , University of Victoria Thesis/Project Title: An examination of zonal-mean geopotential variability Present Position: High school teacher; Yukon

Doctorate [n=11]

2015/5 - 2019/4 Principal Supervisor	Carsten Abraham (In Progress) , University of Victoria Student Degree Expected Date: 2019/4 Thesis/Project Title: Regimes of wind speed and stratification in the stable boundary layer
2014/1 - 2017/12 Co-Supervisor	Arlan Dirkson (In Progress) , University of Victoria Student Degree Expected Date: 2018/4 Thesis/Project Title: The influence of sea ice thickness initialization on high-latitude seasonal prediction
2013/9 - 2017/8 Co-Supervisor	Eric Mortenson (In Progress) , University of Victoria Student Degree Expected Date: 2017/8 Thesis/Project Title: Air-sea-ice CO2 fluxes in the Arctic Ocean

2013/9 - 2017/8 Co-Supervisor	Zelalem Engida (In Progress) , University of Victoria Student Degree Expected Date: 2017/8 Thesis/Project Title: Physical Drivers of Upwelling Variability along the West Coast of North America
2013/9 - 2017/8 Co-Supervisor	Hakase Hayashida (In Progress) , University of Victoria Student Degree Expected Date: 2013/9 Thesis/Project Title: Modelling Air-Sea DMS Fluxes in the Arctic Ocean
2013/1 - 2016/12 Principal Supervisor	Yiwen Mao (In Progress) , University of Victoria Student Degree Expected Date: 2016/12 Thesis/Project Title: Anisotopy in Surface Wind Predictability
2011/9 - 2015/7 Co-Supervisor	William Thompson (Completed) , University of British Columbia Thesis/Project Title: Parameterization and multiple time scale problems with non-Gaussian statistics related to climate dynamics Present Position: Researcher, NMi
2010/9 - 2015/8 Principal Supervisor	Michael Optis (Completed) , University of Victoria Thesis/Project Title: The modelling of the wind profile under stable stratification at heights relevant to wind power: A comparison of models of varying complexity Present Position: Research Scientist AWS Truepower
2010/3 - 2010/10 Co-Supervisor	Consent not obtained (Withdrawn) , University of Victoria Thesis/Project Title: Modelling Arctic Biogeochemical Fluxes Present Position: Unknown
2009/9 - 2010/8 Co-Supervisor	Laura Bianucci (Completed) , University of Victoria Thesis/Project Title: Carbon, Oxygen, and Nitrogen Cycles on the Vancouver Island Shelf Present Position: Research Associate, Oceanography, Dalhousie
2006/9 - 2011/5 Co-Supervisor	Daniel Godlovitch (Completed) , University of Victoria Thesis/Project Title: Idealised models of sea ice thickness dynamics Present Position: Researcher, Harman Canada

Doctorate Equivalent [n=3]

2014/7 - 2015/12 Co-Supervisor	Gerald Lohmann (In Progress) , Universitaet Oldenburg Thesis/Project Title: Spatial and temporal variability of surface irradiance
2013/10 - 2013/12 Co-Supervisor	Martin Doerenkaemper (Completed) , Universitaet Oldenburg Thesis/Project Title: On the offshore advection of boundary-layer structures and the influence on offshore wind conditions
2013/1 - 2013/4 Co-Supervisor	Carsten Abraham (Completed) , Universitaet Hamburg Thesis/Project Title: Modelling light penetration in sea ice Present Position: PhD student, University of Victoria

Post-doctorate [n=5]

2015/1 - 2016/12 Principal Supervisor	Amber Holdsworth (Completed) , University of Victoria Thesis/Project Title: Modelling transitions between regimes of stably stratified flow Present Position: Research scientist, DFO
2011/9 - 2014/12 Principal Supervisor	Timothy Rees (Completed) , University of Victoria Thesis/Project Title: Stability of stably stratified near-surface flows Present Position: Researcher, Coast Dynamics Group
2009/8 - 2011/5 Principal Supervisor	Philip Poon (Completed) , University of Victoria Thesis/Project Title: Reduction of multiscale models of air-sea interaction Present Position: Postdoctoral fellow at University of Wisconsin-Madison

2009/1 - 2010/12 Co-Supervisor	Ian Ross, University of Victoria Thesis/Project Title: Modelling Subgrid-scale Convection Present Position: Independent software contractor, Austria
2007/9 - 2013/4 Co-Supervisor	Yanping He (Completed) , University of Victoria Thesis/Project Title: Probability distribution of land-surface wind speeds

Research Associate [n=6]

2013/9 - 2016/8 Principal Supervisor	Johannes Gemmrich, University of Victoria Thesis/Project Title: Modelling SST Influences on the Distribution of Sea Surface Winds
2013/6 - 2013/8 Co-Supervisor	Zelalem Engida (Completed) , University of Victoria Thesis/Project Title: Physical Drivers of Upwelling Variability along the West Coast of North America
2013/4 - 2018/4 Co-Supervisor	Yanping He (In Progress) , University of Victoria Thesis/Project Title: A new coupled cloud/boundary layer scheme for the Canadian GCM and RCM
2012/4 - 2012/12 Principal Supervisor	Aaron Culver (Completed) , University of Victoria Thesis/Project Title: Best practices in the statistical prediction of surface winds. Present Position: Renewable Energy Consultant, SgurrEnergy, Vancouver
2011/1 - 2011/8 Principal Supervisor	William Thompson (Completed) , University of Victoria Thesis/Project Title: Spectral estimation of stochastic wind model parameters Present Position: Researcher, NMi
2009/9 - 2010/8 Co-Supervisor	Derek van der Kamp (Completed) , University of Victoria Thesis/Project Title: Prediction of surface winds over British Columbia Present Position: PhD student, UBC

Event Administration

2017/1 - 2017/1	Co-organizer, Transport in Unsteady Flows: From Deterministic Structures to Stochastic Models and Back Again. Banff International Research Station., Workshop, 2017/1 - 2017/1
2016/5 - 2016/6	Co-organizer, Atmosphere, Ocean, and Climate Dynamics. Special Session, 2016 CMOS Congress., Conference, 2016/5 - 2016/6
2015/12 - 2015/12	Co-organizer, Stochastic Modeling in Atmosphere, Ocean, and Climate Dynamics: Pattern Organization in Earth Systems. Special Session, 2015 AGU Fall Meeting., Conference, 2015/12 - 2015/12
2015/5 - 2015/6	Co-organizer, Atmosphere, Ocean, and Climate Dynamics. Special Session, 2015 CMOS Congress., Conference, 2015/5 - 2015/6
2014/12 - 2014/12	Co-organizer, Stochastic Modeling and Complex System Approaches to Nonlinear Geophysical Systems. Special Session, 2014 AGU Fall Meeting, Conference, 2014/12 - 2014/12
2014/5 - 2014/6	Co-Organizer, Atmosphere, Ocean, and Climate Dynamics. Special Session, 2014 CMOS Congress., Conference, 2014/5 - 2014/6
2013/5 - 2013/5	Co-organizer, Atmosphere, Ocean, and Climate Dynamics. Special Session, 2013 CMOS Congress., Conference, 2013/5 - 2013/5
2013/5 - 2013/5	Co-organizer, Mathematics of Planet Earth, Special Symposium, 2013 CMOS Congress, Conference, 2013/5 - 2013/5

2012/12 - 2012/12	Co-organizer, Stochastic Parameterizations in Numerical Weather and Climate Models. 2012 AGU Fall Meeting., Conference, 2012/12 - 2012/12
2012/5 - 2012/5	Co-organizer, Atmosphere, Ocean, and Climate Dynamics. Special Session, CMOS Congress, Conference, 2012/5 - 2012/6
2012/1 - 2012/1	Co-organizer, 21st Conference on Probability and Statistics, American Meteorological Society, Conference, 2012/1 - 2012/1
2011/12 - 2011/12	Co-organizer, Current Issues in Stochastic Weather and Climate Modeling. 2011 AGU Fall Meeting., Conference, 2011/12 - 2011/12
2011/6 - 2011/6	Member, Scientific Committee, 2011 CMOS Congress, Conference, 2011/6 - 2011/6
2011/6 - 2011/6	Co-organizer, Atmosphere, Ocean, and Climate Dynamics. 2011 CMOS Congress., Conference, 2011/6 - 2011/6
2010/6 - 2010/6	Co-organizer, Atmosphere, Ocean, and Climate Dynamics. Special Session, 2010 CMOS Congress., Conference, 2010/5 - 2010/6

International Collaboration Activities

2017/1	ResearcherUnited States Collaboration with Judith Berner (NCAR) and Nikki Vercauteren (FU Berlin) on modelling of regime transitions in stably stratified boundary layer
2016/10	Researcher, Netherlands Collaboration with group of Bas van de Wiel of TU Delft on dynamics of stably stratified atmospheric boundary layer.
2016/8	Researcher, Colombia Collaboration with Michael Hoegele (Universidad de los Andes), Tetiana Kosenkova (Universitaet Potsdam), and Jan Gairing (Humboldt Universitatet zu Berlin) on Levy process parameter estimator to environmental data.
2014/5	Researcher,Supervisor, Germany Co-supervision of Gerald Lohmann, and collaboration with group of Detlev Heinemann, at Universitaet Oldenburg.
2008/8 - 2013/5	Researcher, Netherlands Spectral estimation of parameters of stochastic wind model from data. Work with Daan Crommelin.
2008/1 - 2011/8	Researcher, United States Analysis of large dataset of land surface winds. Work with Aiguo Dai.
2009/4 - 2011/1	Researcher, United States Application of stochastic reduction methodology to two-layer quasigeostrophic model. Work with Sergey Kravtsov.
2009/7 - 2010/11	Research, Australia Application of newly-developed characterisation of finite-time coherent sets to stratospheric transport. Work with Gary Froyland.

Committee Memberships

2013/2 - 2016/2	Chair, Scientific Committee, Canadian Meteorological and Oceanographic Society
2010/1 - 2016/1	Committee Member, Probability and Statistics Committee, American Meteorological Society

2010/4 - 2013/2	Committee Member, Scientific Committee, Canadian Meteorological and Oceanographic Society

Other Memberships

2013/6 - 2015/6	Member, Board of Directors, Pacific Climate Impacts Consortium

Publications

Journal Articles

1. M. Optis* and A. Monahan. (2017). A comparison of equilibrium and time-evolving approaches to modelling the wind profile under stable stratification.J. App. Meteo. Clim.
   In Press
   Refereed?: Yes
2. G. Lohmann*, A. Hammer, A.H. Monahan, T. Schmidt, and D. Heinemann. (2017). Simulating clear-sky index increment correlations under mixed sky conditions using a fractal cloud model.Solar Energy.
   Submitted
   Refereed?: Yes
3. A. H. Monahan.(2016). Idealized models of the joint probability distribution of wind speeds.J. Climate.
   Submitted
   Refereed?: Yes
4. E. Mortenson*, H. Hayashida*, N. Steiner, A. Monahan, M. Blais, M.A. Gale, V. Galindo, M. Gosselin, X., Hu, D. Lavoie, and C.J. Mundy.(2016). A model-based analysis of physical and biological controls on ice algae and pelagic primary production in Resolute Passage.Elementa.
   Revision Requested
   Refereed?: Yes
5. A. Dirkson*, W.J. Merry field, and A. Monahan. (2016). Impacts of sea ice thickness initialization on seasonal Arctic sea ice predictions.J. Clim.30: 1001-1017.
   Published
   Refereed?: Yes
6. A.M. Holdsworth*, T. Rees*, and A. H. Monahan. (2016). Parameterization sensitivity and instability characteristics of the maximum sustainable heat flux framework for predicting turbulent collapse. J. Atmos. Sci.73: 3527-3540.
   Published
   Refereed?: Yes
7. Michael Optis* and Adam Monahan. (2016). The extrapolation of near-surface wind speeds under stable stratification using an equilibrium-based single-column model approach.Journal of Applied Meteorology and Climatology. 55: 923-943.
   Published
   Refereed?: Yes, Open Access?: No
8. Z. Engida *, D. Ianson, A.Monahan, and R. Thomson. (2016). Remote forcing of subsurface currents and temperatures in the Northern California Current System. J. Geophys. Res.121: 7244-7262.
   Published
   Refereed?: Yes

9. Jan-Erik Tesdal*, James R. Christian, Adam H Monahan, and Knut von Salzen. (2016). Sensitivity of modelled sulphate aerosol and its radiative effect on climate to DMS concentration and air-sea flux formulation. Atmospheric Chemistry and Physics. 16: 10847-10864.
   Published
   Refereed?: Yes, Open Access?: Yes

10. Y. Mao* and A. Monahan. (2016). Predictive anisotropy of surface winds by linear statistical prediction.J. Clim.
   Submitted
   Refereed?: Yes

11. H. Hayashida*, N. Steiner, A. Monahan, V. Galindo, M. Lizotte, and M. Levasseur. (2016). Implications of sea-ice biogeochemistry for oceanic production and emissions of dimethylsulfide in the Arctic.Biogeosciences.
   Revision Requested
   Refereed?: Yes

12. G.M. Lohmann*, A.H. Monahan, and D. Heinemann. (2016). Local short-term variability in solar irradiance. Atmos. Chem. Phys.16: 6365-6379.
   Published
   Refereed?: Yes

13. J. T. Daines*, A. H. Monahan, and C. Curry. (2016). Model-based projections and uncertainties of near-surface wind climate in Western Canada. J. Appl. Metor. Clim.55: 2229-2245.
   Published
   Refereed?: Yes

14. Carsten Abraham*, Nadja Steiner, Adam Monahan, and Christine Michel. (2015). Effects of subgrid-scale snow thickness variability on radiative transfer in sea ice.Journal of Geophysical Research Oceans. 120: 5597-5614.
   Published
   Refereed?: Yes, Open Access?: No

15. Adam H Monahan, Tim Rees*, Yanping He*, and Norman McFarlane. (2015). Multiple regimes of wind, stratification, and turbulence in the stable boundary layer. Journal of Atmospheric Sciences. 72: 3178-3198.
   Published
   Refereed?: Yes, Open Access?: No

16. Arlan Dirkson* , William J. Merryfield, and Adam H. Monahan. (2015). Real time estimation of Arctic sea ice thickness through maximum covariance analysis. Geophysical Research Letters. 42: 4869-4877.
   Published
   Refereed?: Yes, Open Access?: No

17. Martin Doerenkaemper*, Michael Optis*, Adam Monahan, Gerald Steinfeld. (2015). On the offshore advection of boundary-layer structures and its influence on offshore wind conditions.Boundary Layer Meteorology. 155: 459-482.
   Published
   Refereed?: Yes

18. Jan-Erik Tesdal* and James Christian and Adam Monahan and Knut von Salzen. (2015). Evaluation of diverse approaches for estimating DMS concentration and flux at global scale.Environmental Chemistry. : doi:10.1071/EN14255.
   Published
   Refereed?: Yes, Open Access?: No

19. Michael Optis* and Adam Monahan and Fred C. Bosveld. (2015). Limitations and breakdown of Monin-Obukhov similarity theory for wind profile extrapolation under stable stratification.Wind Energy. : doi:10.1002/we.1883.
Published
Refereed?: Yes, Open Access?: Yes

20. W.F. Thompson* and R.A. Kuske and A.H. Monahan. (2015). Stochastic averaging of dynamical systems with multiple time scales forced with alpha-stable noise.Multiscale Modelling and Simulation. 13: 1194-1223.
Published
Refereed?: Yes, Open Access?: No

21. Timothy Rees* and Adam Monahan. (2014). A general numerical method for analyzing the linear stability of stratified parallel shear flows.J. Atmos. Ocean. Tech.31: 2795-2808.
Published
Refereed?: Yes, Open Access?: No

22. Michael Optis* and A.H. Monahan and F.C. Bosveld. (2014). Moving beyond Monin-Obukhov similarity theory in modelling wind-speed profiles in the lower atmospheric boundary layer under stable stratification.Boundary Layer Meteorology. 153: 497-514.
Published
Refereed?: Yes, Open Access?: No

23. William Thompson*, Adam Monahan, and Daan Crommelin. (2014). Parametric estimation of the stochastic dynamics of sea surface winds. Journal of the Atmospheric Sciences. 71: 3465-3483.
Published
Refereed?: Yes, Open Access?: No

24. Robert Fajber*, Adam Monahan, and Bill Merryfield. (2014). At what time of day do daily extreme near surface wind speeds occur?. Journal of Climate. 27: 4226-4244.
Published
Refereed?: Yes, Open Access?: No

25. Cangjie Sun* and Adam Monahan. (2013). Statistical downscaling prediction of sea surface winds over the global ocean.Journal of Climate.26: 7938-7956.
Published
Refereed?: Yes, Open Access?: No

26. Adam Monahan. (2013). The gaussian predictability of wind speeds.Journal of Climate. 26: 5563-5577.
Published
Refereed?: Yes, Open Access?: No

27. Yanping He*, Adam Monahan, and Norm McFarlane. (2013). Diurnal variations of land surface wind speed probability distributions under clear sky and low cloud conditions. Geophysical Research Letters. 40: 10.1002/grl.5057.
Published
Refereed?: Yes, Open Access?: No

28. Aaron M.R. Culver* and Adam Monahan. (2013). The statistical predictability of surface winds over Western and Central Canada.Journal of Climate. 26: 8305-8322.
Published
Refereed?: Yes, Open Access?: No

29. Adam Monahan. (2012). Temporal autocorrelation structure of sea surface winds.Journal of Climate. 25: 6684-6700.
Published
Refereed?: Yes, Open Access?: No

30. Derek van der Kamp*, Charles Curry and Adam Monahan. (2012). Statistical downscaling of historical monthly mean winds over a coastal region of complex terrain. II: Predicting wind components.Climate Dynamics. 38: 1301-1311.
    Published
    Refereed?: Yes, Open Access?: No
31. Daniel Godlovitch*, Adam Monahan and Greg Flato. (2012). An idealised stochastic model of sea ice thickness dynamics.Cold Regions Science and Technology.78: 14-30.
    Published
    Refereed?: Yes, Open Access?: No
32. Adam Monahan. (2012). Can we see the wind? Statistical downscaling of historical sea surface winds in the Subarctic Northeast Pacific.Journal of Climate. 25: 1511-1528.
    Published
    Refereed?: Yes, Open Access?: No
33. Yanping He*, Norman McFarlane and Adam Monahan. (2012). The influence of boundary layer processes on the diurnal variation of the land surface wind speed probability distribution.Journal of Climate.25: 6441-6458.
    Published
    Refereed?: Yes, Open Access?: No
34. Charles Curry, Derek van der Kamp* and Adam Monahan. (2012). Statistical downscaling of historical monthly mean winds over a coastal region of complex terrain. I: Predicting wind speed.Climate Dynamics. 38: 1281-1299.
    Published
    Refereed?: Yes, Open Access?: No
35. Joel Culina*, Sergey Kravtsov and Adam Monahan. (2011). Stochastic parameterisation schemes for use in realistic climate models.Journal of the Atmospheric Sciences.68: 284-299.
    Published
    Refereed?: Yes, Open Access?: No
36. Adam Monahan and Joel Culina*. (2011). Stochastic averaging of idealised climate models.Journal of Climate.24: 3068-3088.
    Published
    Refereed?: Yes, Open Access?: No
37. Daniel Godlovitch*, Reinhard Illner and Adam Monahan. (2011). Smoluchowski coagulation models of sea ice thickness distribution dynamics.Journal of Geophysical Research. 116: C12006.
    Published
    Refereed?: Yes, Open Access?: No
38. Adam Monahan, Yanping He*, Norman McFarlane and Aiguo Dai. (2011). The probability distribution of land surface wind speeds.Journal of Climate. 24: 3892-3909.
    Published
    Refereed?: Yes, Open Access?: No

Book Chapters

1. Adam Monahan. (2012). Probability distribution of surface winds. Y. Wang. Encyclopedia of Natural Resources. : 1084-1088.
    Published, Taylor and Francis
    Refereed?: Yes

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Protected when completed

Dr. Laxmi Sushama

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Sex: Female

Contact Information

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Dr. Laxmi Sushama

Language Skills

Language	Read	Write	Speak	Understand	Peer Review
English	Yes	Yes	Yes	Yes	Yes
French	Yes	Yes	Yes	Yes	Yes

Degrees

- 2006/12	Post-doctorate, Land surface processes, Université du Québec à Montréal Supervisors: René Laprise, 2002/4 - 2006/12
- 2000/8	Post-doctorate, low frequency variability in the mid-latitude oceans using dynamical systems theory, University of California, Los Angeles Supervisors: Michael Ghil, 1999/1 - 2000/7
- 1999/1	Doctorate, Civil and Environmental Engineering, University of Melbourne Supervisors: Roger Hughes, 1995/6 - 1998/8
- 1994/12	Master's Thesis, Engineering Hydrology, National University of Ireland, Galway Supervisors: F. Dolezal, 2003/9 - 2004/12
- 1992/12	Master's Thesis, Hydromechanics and Water Resources Engineering, Indian Institute of Science
- 1990/1	Bachelor's, Civil Engineering, University of Kerala

User Profile

Research Specialization Keywords: climate change, Hydrology, land-atmosphere interactions, land surface processes, regional climate

Employment

2008/12	Associate Professor, Canada Research Chair in Regional Climate Modelling Earth and Atmospheric Sciences, Université du Québec à Montréal Full-time Tenure Status: Tenure
2007/1 - 2008/12	Specialist in Climate Modelling Ouranos consortium

2006/1 - 2008/11
Adjunct Professor
Centre ESCER, Université du Québec à Montréal
Part-time
Tenure Status: Non Tenure Track

2004/1 - 2005/12
Research Associate
Earth and Atmospheric Sciences, Université du Québec à Montréal
Full-time
Tenure Status: Non Tenure Track

2002/4 - 2004/12
Post-doctoral fellow
Earth and Atmospheric Sciences, Université du Québec à Montréal
Full-time
Tenure Status: Non Tenure Track

2001/10 - 2002/1
Programmer Analyst
Transalta

2001/1 - 2001/4
Sessional Instructor
Mechanical Engineering, The University of Calgary
Part-time
Tenure Status: Non Tenure Track

1999/1 - 2000/8
Post-doctoral fellow
Atmospheric and Ocean sciences, University of California, Los Angeles
Full-time
Tenure Status: Non Tenure Track

1998/10 - 1998/11
Research Assistant
Earth and Atmospheric Sciences, University of Melbourne
Part-time, Term
Tenure Status: Non Tenure Track

Research Funding History

Awarded [n=6]

2016/8 - 2021/7
Co-investigator

Mercury: Solving emerging environmental challenges of the hydroelectric sector, Grant

Funding Sources:

2016/8 - 2021/7 Natural Sciences and Engineering Research Council of Canada (NSERC)
Collaborative Research and Development
Total Funding - 1,060,501
Portion of Funding Received - 10,605
Funding Competitive?: Yes

2013/3 - 2019/3
Principal Applicant

Land surface processes and their climate interactions in high-latitude regions, Grant

Funding Sources:

2013/3 - 2019/2 Natural Sciences and Engineering Research Council of Canada (NSERC)
Discovery Grant
Total Funding - 198,000
Portion of Funding Received - 198,000
Funding Competitive?: Yes

2008/12 - 2018/12
Principal Applicant

Regional Climate Modelling, Research Chair

Funding Sources:

2008/12 - 2018/12 Government of Canada
Canada Research Chairs (CRC)
Total Funding - 1,000,000
Portion of Funding Received - 1,000,000
Funding Competitive?: Yes

2013/2 - 2018/1
Principal Investigator

Canadian Network for Regional Climate and Weather Processes, Grant

Funding Sources:

2013/2 - 2018/1 Natural Sciences and Engineering Research Council of Canada (NSERC)
CCAR
Total Funding - 4,078,255
Portion of Funding Received - 2,446,953
Funding Competitive?: Yes

Co-investigator : Adam Monahan; Claude Duguay; Diana Verseghy; Francis Zwiers; John Gyakum; John Scinocca; Julie Thériault; Philippe Gachon; Ramon de Elia; René Laprise; Shawn Marshall; Stephen Déry; Vivek Arora

2016/1 - 2016/12
Principal Applicant

Study of land surface processes and land-atmosphere interactions in the high-latitude and Arctic regions using the Canadian Regional Climate Model, Grant

Funding Sources:

2016/1 - 2016/12 Compute Canada
Total Funding - 108,554
Portion of Funding Received - 108,554
Funding Competitive?: Yes

2014/12 - 2014/12
Co-investigator

Modélisation et observation de l'atmosphère, Grant

Funding Sources:

2014/12 - 2014/12 Government of Canada
Canadian Foundation for Innovation
Total Funding - 160,000
Portion of Funding Received - 128,000
Funding Competitive?: Yes

Completed [n=15]

2016/2 - 2016/7
Principal Applicant

Multi-resolution lake-river system for the Nelson-Churchill watershed, Grant

Funding Sources:

2016/2 - 2016/7 Natural Sciences and Engineering Research Council of Canada (NSERC)
Engage
Total Funding - 25,000
Portion of Funding Received - 25,000
Funding Competitive?: Yes

2015/1 - 2015/12
Principal Investigator

Regional climate modelling and process studies, Grant

Funding Sources:

2015/1 - 2015/12 Compute Canada
Total Funding - 500,000
Portion of Funding Received - 250,000
Funding Competitive?: Yes

2010/6 - 2015/6
Co-investigator

Training strategies to meet the challenges imposed by a changing climate: preparing for societal impacts and adaptation, Grant

Funding Sources:

2010/6 - 2015/6 Natural Sciences and Engineering Research Council of Canada (NSERC)
CREATE
Total Funding - 1,349,500
Portion of Funding Received - 36,000
Funding Competitive?: Yes

Co-investigator : Ferguson, Grant; Kellman, Lisa; O'Driscoll, Nelson; Risk, David; Tarasov, Lev; Ziegler, Susan;

Principal Investigator : Beltrami, Hugo

2010/9 - 2013/8
Co-investigator

Recherche et formation en sciences de l'atmosphere et physique du climat regional au centre ESCER, Grant

Funding Sources:

2010/9 - 2013/8 Ministère du développement économique, de l'innovation et de l'exportation (MDEIE)
Special
Total Funding - 1,500,000
Portion of Funding Received - 300,000
Funding Competitive?: No

Co-investigator : Blanchet, Jean Pierre; Gauthier, Pierre; Girard, Eric; Torlaschi, Enrico;

Principal Investigator : Laprise, René

2010/9 - 2013/8
Principal Investigator

A Regional Climate Modelling system for climate/hydrology process and feedback studies, Grant

Funding Sources:

2010/9 - 2013/8 Natural Sciences and Engineering Research Council of Canada (NSERC)
CRD
Total Funding - 1,373,550
Portion of Funding Received - 1,098,840
Funding Competitive?: Yes

Co-investigator : De Elia, Ramon; Dugas, Bernard; Laprise, René

2012/4 - 2013/3
Principal Investigator

Validation and analysis of CRCM5 simulations over North America, Grant

Funding Sources:

2012/4 - 2013/3 Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)
Project grant
Total Funding - 100,000
Portion of Funding Received - 100,000
Funding Competitive?: Yes

Co-investigator : De Elia, Ramon; Dugas, Bernard; Laprise, René

2008/8 - 2012/7
Co-investigator

Permafrost and climate change in Northern Coastal Canada, Grant

Funding Sources:

2008/8 - 2010/7 National Centers of Excellence (The) (NCOE)
ArcticNet
Total Funding - 480,000
Portion of Funding Received - 19,200
Funding Competitive?: Yes

Co-investigator : Bernier, M; Laprise, René; Lévesque, E;

Principal Investigator : Allard, Michel; Pollard, Wayne

2011/4 - 2012/3
Principal Investigator

Technical assistance for CRCMD Network, Grant

Funding Sources:

2011/4 - 2012/3 Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)
Project grant
Total Funding - 96,000
Portion of Funding Received - 96,000
Funding Competitive?: Yes

Principal Investigator : Laxmi Sushama

2010/10 - 2011/12
Principal Investigator

High resolution modelling over India using the Canadian Regional Climate Model, Grant

Funding Sources:

2010/10 - 2011/12 Ministère du développement économique, de l'innovation et de l'exportation (MDEIE)
PSR-SIIRI
Total Funding - 12,500
Portion of Funding Received - 12,500
Funding Competitive?: Yes

Co-investigator : Laprise, René; Naghesh, Kumar

2008/6 - 2011/3
Principal Investigator

Canadian Regional Climate Modelling and Diagnostics Network, Grant

Funding Sources:

2008/6 - 2011/3 Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)
Network grant
Total Funding - 2,100,000
Portion of Funding Received - 420,000
Funding Competitive?: Yes

Co-investigator : Arora, Vivek; Blanchet, Jean-Pierre; Brunet, Gilbert; Caya, Daniel; Coté, John; De Elia, Ramon; Dugas, Bernard; Flato, Greg; Girard, Eric; Laprise, René; Monaha, Adam; Peng, Changhui; Scinocca, John; Vaillancourt, Paul; Zadra, Ayrton

2008/10 - 2011/3
Principal Investigator

Assessment of climate-change impacts on Canadian water resources using Regional Climate Model projections, Grant

Funding Sources:

2008/10 - 2011/3 Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)
Project grant
Total Funding - 186,000
Portion of Funding Received - 148,800
Funding Competitive?: Yes

Co-investigator : Caya, Daniel; Khaliq, Naveed; Laprise, René; Roy, René; Soulis, Rick

2008/4 - 2011/3
Principal Investigator

Simulating climate processes with a high-resolution regional climate model, Grant

Funding Sources:

2008/4 - 2012/3 Mathematics of Information Technology and Complex Systems (MITACS)
Research project - Environment and natural resources
Total Funding - 340,000
Portion of Funding Received - 85,000
Funding Competitive?: Yes

Co-investigator : Arora, Vivek; de Elia, Ramon; Laprise, René; Lin, Hai; Marshall, Shawn; Monahan, Adam; Vaillancourt, Paul

2008/12 - 2010/12
Principal Applicant

Start-up funds, Grant

Funding Sources:

2008/12 - 2010/12 Université du Québec à Montréal (UQAM)
Start-up funds
Total Funding - 30,000
Portion of Funding Received - 30,000
Funding Competitive?: No

2008/9 - 2010/8
Principal Investigator

Assessment of climate-change impacts on Canadian water resources, Grant

Funding Sources:

2008/9 - 2010/8 Consortium on Regional Climatology and Adaptation to Climate Change : Ouranos
Ouranos and PCIC
Total Funding - 160,000
Portion of Funding Received - 160,000
Funding Competitive?: No

Co-investigator : Caya, Daniel; Khaliq, Naveed; Laprise, René; Roy, René; Soulis, Rick

2009/4 - 2010/4
Principal Applicant

Infrastructure for advanced land surface modelling, Grant

Funding Sources:

2009/4 - 2009/4 Canada Foundation for Innovation (CFI)
Leaders opportunity fund
Total Funding - 690,000
Portion of Funding Received - 690,000
Funding Competitive?: Yes

Principal Investigator : Laxmi Sushama

Student/Postdoctoral Supervision

Master's Thesis [n=13]

2016/5 - 2018/4 Principal Supervisor	Francois Roberge (In Progress) , UQAM Thesis/Project Title: Simulations of the Montreal urban heat island
2014/5 - 2016/4 Principal Supervisor	Bruno Fang (Completed) , UQAM Thesis/Project Title: Ice-albedo feedback in current and future climates over North America as simulated by CRCM5 (snow-albedo feedback in CRCM) Present Position: RA at Ouranos
2014/5 - 2016/4 Principal Supervisor	Gregory Yang (Completed) , UQAM Thesis/Project Title: Role of land-atmosphere interactions in modulating heat and precipitation extremes over North America Present Position: Meteorologist at Environment Canada
2014/5 - 2015/8 Principal Supervisor	Bernardo Teufel (Completed) , UQAM Thesis/Project Title: Impact of vegetation competition on regional climate (impact of interactive phenology on the pan-Arctic land surface state) Present Position: PhD student
2013/5 - 2015/12 Principal Supervisor	Maher Ben Mansour (Completed) , UQAM Thesis/Project Title: Climate change impacts on spring floods in Quebec using multi-model and multi-variate approach
2013/5 - 2015/12 Principal Supervisor	Arlette Chacon (Completed) , UQAM Thesis/Project Title: Impact of land use change on North American regional climate (Biophysicalimpacts of land use change on North American climate) Present Position: RA at St. Francis Xavier University
2012/5 - 2015/5 Principal Supervisor	Boujanna Abdellah (Completed) , UQÀM Thesis/Project Title: Energy and water budgets over Africa (Hydrological cycle in current and future climates over Africa)
2011/1 - 2013/12 Principal Supervisor	Bouagila Bessam (Completed) , UQÀM Thesis/Project Title: CRCM5 simulated precipitation characteristics over Africa Present Position: Meteorologist at Météo-Média/Environment Canada
2010/9 - 2012/6 Principal Supervisor	Monette André (Completed) , UQÀM Thesis/Project Title: Regional frequency analysis of precipitation extremes over Québec Present Position: Meteorologist at Météo-média
2010/9 - 2012/4 Principal Supervisor	Clavet-Gaumont Jacinthe (Completed) , UQÀM Thesis/Project Title: Regional frequency analysis of Quebec streamflows Present Position: Climate specialist at Ouranos/researcher at Hydro-Quebec
2009/9 - 2011/3 Principal Supervisor	Morin Jean-Philippe (Completed) , UQÀM Thesis/Project Title: Projected changes to soil moisture over North America Present Position: Meteorologist at Environment Canada/Météomedia
2008/9 - 2010/9 Principal Supervisor	Poitras Vincent (Completed) , UQÀM Thesis/Project Title: Impact of climate change on Canadian stream flows Present Position: PhD student at McGill University
2008/9 - 2010/9 Principal Supervisor	Mladjic Bratislav (Completed) , UQÀM Thesis/Project Title: Projected changes to precipitation characteristics over Canada Present Position: Environment Canada; System administrator (Santropol Roulant)

Doctorate [n=9]

2016/9 - 2019/8 Principal Supervisor	Gaurav Madan (In Progress) , UQAM Thesis/Project Title: Downscaling of subseasonal to seasonal forecast using CRCM5
2016/9 - 2019/8 Principal Supervisor	Sareh Hesaraki (In Progress) , UQAM Thesis/Project Title: Improved representation of snow in CRCM5
2016/5 - 2019/4 Principal Supervisor	Caio Ruman (In Progress) , UQAM Thesis/Project Title: State of canadian Arctic glaciers in future climate
2015/9 - 2018/8 Principal Supervisor	Bernardo Teufel (In Progress) , UQAM Thesis/Project Title: Vegetation-climate feedbacks in the pan-Arctic region
2015/5 - 2018/4 Principal Supervisor	Gemechu Fanta (In Progress) , UQAM Thesis/Project Title: Assesment of the impact of cuban region on climate
2010/9 - 2014/5 Principal Supervisor	Camille Garnaud (Completed) , UQÀM Thesis/Project Title: Study of vegetation-climate interactions over North America using CRCM5/CLASS/CTEM framework Present Position: Research scientist at RPN, Environment Canada
2010/5 - 2014/11 Principal Supervisor	Oleksandr Huziy (Completed) , UQÀM Thesis/Project Title: Study of lake-river-atmosphere interactions for northeast Canada in current and future climates Present Position: PDF at Centre ESCER
2008/9 - 2013/5 Principal Supervisor	Paquin Jean-Philippe (Completed) , UQÀM Thesis/Project Title: On the large scale control mechanisms of Arctic sea ice and permafrost using regional climate models Present Position: PDF at Dalhousie University/Bedford Institute of oceanography
2007/9 - 2010/12 Co-Supervisor	Blanchette Jean-Philippe (Withdrawn) , UQÀM Thesis/Project Title: Interactive permafrost in the Canadian RCM Present Position: Teacher in secondary school

Post-doctorate [n=10]

2016/9 - 2017/1 Principal Supervisor	Behnam Golzan (Completed) , UQAM Thesis/Project Title: Assessing the impact of climate change on infrastructure
2016/3 - 2016/6 Principal Supervisor	Deepthi Joshi (Completed) , UQAM Thesis/Project Title: Soil moisture-precipitation coupling over the Canadian Prairies
2016/2 - 2018/1 Principal Supervisor	Oleksandr Huziy (In Progress) , UQAM Thesis/Project Title: Implementation of a 3D ocean model NEMO for the Great Lakes in CRCM5
2013/5 - 2016/7 Principal Supervisor	Gulilat Tefero Diro (Completed) , UQAM Thesis/Project Title: Land/snow-atmosphere intercations Present Position: Research Associate at UQAM
2013/2 - 2014/12 Principal Supervisor	Arman Ganji (Completed) , UQAM Thesis/Project Title: Improved representation of hydrology in land surface models Present Position: Research Associate at UQAM
2012/4 - 2014/9 Principal Supervisor	Dae Il Jeong (Completed) , UQÀM Thesis/Project Title: Multivariate analysis of hydrometeorological extremes Present Position: Research Associate at UQAM
2012/2 - 2013/3 Principal Supervisor	Sheena Solomon (Completed) , UQAM Thesis/Project Title: Snow-albedo feedback in CRCM5

2009/5 - 2011/12 Principal Supervisor	PaiMazumder Debasish (Completed) , UQÀM Thesis/Project Title: Droughts in a changing climate Present Position: Research Scientist at NCAR
2008/12 - 2010/9 Co-Supervisor	Braun Marco (Completed) , UQAM Thesis/Project Title: Projected changes to Major Canadian water sheds Present Position: Climate specialist at Ouranos Consortium
2007/6 - 2012/12 Principal Supervisor	Martynov Andrey (Completed) , UQAM Thesis/Project Title: Implementation of lakes in Canadian RCM Present Position: PDF at University of Bern

Research Associate [n=9]

2016/9 - 2018/1 Principal Supervisor	Gulilat Tefero Diro (In Progress) , UQAM Thesis/Project Title: Snow-atmosphere interaction over North America
2014/12 - 2017/7 Principal Supervisor	Arman Ganji (In Progress) , UQAM Thesis/Project Title: Onimproving cold region hydrological processes in the Canadian Land SurfaceScheme
2014/9 - 2017/7 Principal Supervisor	Dae Il Jeong (In Progress) , UQAM Thesis/Project Title: Projected changes to climate extreme events over Canada based on an RCM ensemble
2012/11 - 2013/5 Principal Supervisor	Bensaid Samira (Completed) , UQAM Thesis/Project Title: Streamflows over Africa in current and future climates Present Position: Statistics Canada (term position)
2011/1 - 2011/12 Principal Supervisor	Muncaster Ryan (Completed) , UQAM Thesis/Project Title: Land surface heterogeneity using mosaic approach Present Position: Physical Scientist at RPN, Environment Canada
2010/1 - 2012/1 Co-Supervisor	Hernandez-Diaz Leticia (Completed) , UQAM Thesis/Project Title: CRCM5 validation over Africa Present Position: Research Associate at UQAM
2008/6 - 2016/9 Principal Supervisor	Alexandru Adelina (Completed) , UQAM Thesis/Project Title: Co-ordination of Canadian Regional Climate Modelling Network and validation of CRCM5 over west Asia domain Present Position: ESCER co-ordinator at UQAM
2008/6 - 2018/1 Principal Supervisor	Duarte Luis (In Progress) , UQAM Thesis/Project Title: Implementation of advanced land modules in CRCM5
2008/3 - 2011/4 Co-Supervisor	Winger Katja (Completed) , UQAM Thesis/Project Title: CRCM5 maintenance and development Present Position: Research Associate at UQAM

Presentations

1. Garuma, G. F., L. Sushama. (2016). Preliminary results with CLASS and urban model TEB over eastern North America. CNRCWP Annual Science meeting, Montreal, Canada
   Main Audience: Researcher
   Invited?: No, Keynote?: No

2. Sushama, L.(2016). Selected CRCM5 developments and applications. Canadian sea ice and snow evolution workshop, Victoria, Canada
   Main Audience: Researcher
   Invited?: Yes, Keynote?: No

3. Golzan, B., B. Teufel, A. Ganji, D. Jeong, M. Vieira, K. Koenig , L. Sushama. (2016). Potential climate change impacts on Arctic infrastructure from permafrost degradation related land subsidence. Annual science meeting of CNRCWP, Montreal, Canada
   Main Audience: Researcher
   Invited?: No, Keynote?: No

4. Teufel, B., G.T. Diro, K. Whan, S. Milrad, D.I. Jeong, A. Ganji, O. Huziy, K. Winger, J. Gyakum, R. de Elia, F. Zwiers, L. Sushama. (2016). Investigation of the 2013 Alberta flood from weather and climate perspectives.International Meeting on Statistical Climatology, Canmore, Canada
   Main Audience: Researcher
   Invited?: No, Keynote?: No

5. Jeong, D.I., L. Sushama. (2016). Projected Changes to rain-on-snow events over North America.European Geosciences Union (EGU) General Assembly, Vienna, Austria
   Main Audience: Researcher
   Invited?: No, Keynote?: No

6. Huziy, O., L. Sushama. (2016). Lake-river and lake-atmosphere interactions in a changing climate over Northeast Canada. EGU, Vienna, Austria
   Main Audience: Researcher
   Invited?: No, Keynote?: No

7. Ganji, A., L. Sushama. (2016). On the Frozen Soil Scheme for High Latitude Regions. CMOS, Fredericton, Canada
   Main Audience: Researcher
   Invited?: No, Keynote?: No

8. Diro, G.T., L. Sushama, H. Lin. (2016). Dynamical downscaling of seasonal forecasts with CRCM5.CNRCWP Science meeting, Montreal, Canada
   Main Audience: Researcher
   Invited?: No, Keynote?: No

9. Diro, G.T., L. Sushama. (2016). Snow-atmosphere coupling in current and future climates over North America in CRCM5.CNRCWP Science meeting, Montreal, Canada
   Main Audience: Researcher
   Invited?: No, Keynote?: No

10. Teufel, B., L. Sushama. (2016). The impact of dynamic vegetation on land-atmosphere interactions over a pan-Arctic domain.AGU Fall Meeting, San Francisco, United States
    Main Audience: Researcher
    Invited?: No, Keynote?: No

11. Ganji, A., L. Sushama. (2016). Improved representation of surface-groundwater interactions in Canadian Land Surface Scheme (CLASS). CMOS, Fredericton, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

12. Diro, G.T., L. Sushama. (2016). Snow-atmosphere coupling in current and future climates over North America in the Canadian Regional Climate Model (CRCM5).CMOS, Fredericton, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

13. Teufel, B., L. Sushama. (2016). Impact of dynamic vegetation on the simulated pan-Arctic land surface state.CMOS, Fredericton, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

14. Teufel, B., L. Sushama. (2016). Impact of dynamic vegetation on the simulated pan-Arctic land surface state.EGU General Assembly, Vienna, Austria
    Main Audience: Researcher
    Invited?: No, Keynote?: No

15. Diro, G.T., L. Sushama. (2016). Snow-atmosphere coupling in current and future climates over North America in the Canadian Regional Climate Model (CRCM5).EGU, Vienna, Austria
    Main Audience: Researcher
    Invited?: No, Keynote?: No

16. Ganji, A., L. Sushama, S. Deri. (2016). Subgrid snow parameterization in Canadian Land Surface model. CNRCWP annual science meeting, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

17. B. Fang, G. Diro, P. Samuelsson, D. Verseghy, S. Dery. (2016). Snow and snow-albedo feedback in CRCM5 simulations over north America. CMOS, Fredericton, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

18. Jeong, D.I., L. Sushama. (2016). Projected Changes to rain-on-snow events over North America based on two Canadian Regional Climate Models.International Meeting on Statistical Climatology, Canmore, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

19. Teufel B., G.T. Diro, K. Whan, S. Milrad, D.I. Jeong, A. Ganji, O. Huziy, K. Winger, J. Gyakum, R. de Elia, F. Zwiers, L. Sushama. (2016). Investigation of the 2013 Alberta flood from weather and climate perspectives.CMOS, Fredericton, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

20. Jeong, D.I., L. Sushama. (2016). Projected Changes to rain-on-snow events over North America based on two Canadian Regional Climate Models.CMOS, Fredericton, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

21. Huziy, O., L. Sushama. (2016). Lake-river and lake-atmosphere interactions in a changing climate.CMOS, Fredericton, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

22. Diro, G.T., L. Sushama. (2016). The role of land-atmosphere interaction on future hot-spells over North America as simulated by the Canadian Regional Climate Model (CRCM5). CMOS, Fredericton, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

23. (2016). Targeted developments in the fifth generation Canadian Regional Climate Model. Adaptation Canada, Ottawa, Canada
    Main Audience: Knowledge User
    Invited?: No, Keynote?: No

24. K. Winger. (2016). Dynamic glaciers in CRCM5. CMOS, Fredericton, Canada
    Invited?: No, Keynote?: No

25. Huziy, O., L. Sushama. (2016). Representation of the Great Lakes in CRCM5 using 3D ocean model NEMO: impacts on simulated climate.CNRCWP annual science meeting, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

26. Yang Kam Wing, G., G.T. Diro, D. Joshi, L. Sushama, J. Scinocca, J. Yanjun. (2016). Intra-annual variability of land-atmosphere coupling over North America in CRCM5 and CanRCM4.CNRCWP annual science meeting, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

27. Jong, D.I., L. Sushama, G.T. Diro, M.N. Khaliq, H. Beltrami, D. Caya. (2015). Projected changes to high temperature events for Canada based on a Regional Climate Model ensemble.Ouranos, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

28. Fang, B., l. Sushama, G.T. Diro. (2015). Snow and snow-albedo feedback in the Canadian Regional Climate Model simulations over North America. AGU-CGU Joint Assembly, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

29. Sushama, L.(2015). Research within the Canadian Network for regional climate and weather processes. Canadian cold regions workshop, Saskatoon, Canada
    Main Audience: Researcher
    Invited?: Yes, Keynote?: No

30. Sushama, L.(2015). Representation of high-latitude hydrology in climate models. Joint AGU/CGU meeting, Montreal, Canada
    Main Audience: Researcher
    Invited?: Yes, Keynote?: No

31. Teufel, B.S., L. Sushama. (2015). Impact of interactive vegetation phenology on the simulated pan-arctic land surface state and climate for the historical period. Joint AGU-CGU Assembly, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

32. Chacon, A., L. Sushama, H.Beltrami. (2015). Biogeophysical impacts of land use change over North America as simulated by the Canadian regional climate model. Joint AGU-CGU Assembly, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

33. Diro, G.T., L. Sushama, O. Huziy, P. Samuelsson. (2015). Snow-atmosphere coupling over North America in the fifth generation of the Canadian Regional Climate Model (CRCM). Joint AGU-CGU Assembly, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

34. Jeong, D.I., L. Sushama, G.T. Diro, M.N. Khaliq. (2015). Projected changes to hot/cold spell characteristics over Canada based on a Regional Climate Model ensemble. Workshop on Extreme Climate Events, Riederalp, Switzerland
    Main Audience: Researcher
    Invited?: No, Keynote?: No

35. Jeong, D.I., L. Sushama, M.N. Khaliq. (2015). The role of temperature in drought projections over North America based on a Regional Climate Model ensemble. AOGS, Singapore, Singapore
    Main Audience: Researcher
    Invited?: No, Keynote?: No

36. Ganji, A., L. Sushama. (2015). Climate/hydrology sensitivity to frozen soil parameterization. Joint AGU-CGU Assembly, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

37. Jeong, D.I., L. Sushama, G.T. Diro, M.N. Khaliq. (2015). Projected changes to hot temperature spells for Canada based on NARCCAP simulations. AOGS, Singapore, Singapore
Invited?: No, Keynote?: No

38. Yang Kam Wing, G., L. Sushama, G.T. Diro. (2015). Intra and inter seasonal variability of land-atmosphere coupling over North America. Joint AGU-CGU Assembly, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

39. Ganji, A., L. Sushama. (2015). Improved representation of surface-groundwater interactions in land surface models. AOGS, Singapore, Singapore
Invited?: No, Keynote?: No

40. Jeong, D.I., L. Sushama, G.T. Diro, M.N. Khaliq, H. Beltrami, D. Caya. (2015). Projected changes to hot air-temperature spells for Canada based on a Regional Climate Model ensemble. Joint AGU-CGU Assembly, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

41. Diro, G.T., L. Sushama. (2015). The impact of land-atmosphere interactions on North American temperature extremes as simulated by the Canadian RCM (CRCM5). Extreme Climate Events, Riederalp, Switzerland
Invited?: No, Keynote?: No

42. Ganji, A., L. Sushama. (2014). Frozen soil scheme for high latitude regions in land surface models. CMOS, Rimouski, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

43. Diro G.T., L. Sushama. (2014). Land-atmosphere coupling in the present and future climates from multi-GCM, multi-RCP driven CRCM5. CNRCWP annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

44. Jeong, D.I., L. Sushama, M.N. Khaliq. (2014). The role of temperature in drought projections over North America based on NARCCAP simulations. CMOS, Rimouski, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

45. Jeong, D.I., L. Sushama, M.N. Khaliq. (2014). Future temperature increases and associated drought risks over North America based on NARCCAP simulations. EGU, Vienna, Austria
Main Audience: Researcher
Invited?: No, Keynote?: No

46. Diro, G.T., L. Sushama, A. Martynov, D.I. Jeong. (2014). Land-atmosphere coupling in CRCM5.Centre ESCER, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

47. Diro, G.T., L. Sushama. (2014). Land-atmosphere coupling over North America in the CRCM5 simulations for current and future climates. CMOS, Rimouski, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

48. Sushama, L.(2014). Land surface processes and land climate interactions in climate models. CMOS, Rimouski, Canada
Invited?: Yes, Keynote?: Yes

49. Diro, G.T., L. Sushama, A. Martynov, D.I. Jeong, D. Verseghy, K. Winger. (2014). Land-Atmosphere coupling in CRCM5 and its impact on selected extremes.Ouranos, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

50. Diro, G.T., L. Sushama, A. Martynov, D.I. Jeong, D. Verseghy, K. Winger. (2014). Land-Atmosphere coupling in CRCM5 and its impact on selected extremes.CNRCWP annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

51. Garnaud, C., L. Sushama. (2014). Biosphere-atmosphere interactions over North America in current and future climates. EGU, Vienna, Austria
Main Audience: Researcher
Invited?: No, Keynote?: No

52. Huziy, O., L. Sushama, R. Laprise. (2014). Lake-river-atmosphere Interactions as Simulated by the Canadian Regional Climate Model (CRCM5) over North-east Canada. AGU, San Francisco, United States
Main Audience: Researcher
Invited?: No, Keynote?: No

53. Diro, G.T., L. Sushama. (2014). Land-atmosphere coupling over North America in the Canadian Regional Climate Model (CRCM5) simulations for current and future climates. EGU, Vienna, Austria
Main Audience: Researcher
Invited?: No, Keynote?: No

54. Ganji, A., L. Sushama. (2014). On the soil frozen scheme for high-latitudes in land surface schemes. EGU, Vienna, Austria
Main Audience: Researcher
Invited?: No, Keynote?: No

55. Alexandru, A., L. Sushama. (2014). CRCM5- performance errors, boundary forcing error and climate projections for the Indian domain. CMOS, Rimouski, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

56. Chacon, A., L. Sushama, H. Beltrami. (2014). Impact of land use change over North America as simulated by the Canadian Regional Climate Model. AGU, San Francisco, United States
Main Audience: Researcher
Invited?: No, Keynote?: No

57. Alexandru, A., L. Sushama. (2014). CRCM5- performance errors, boundary forcing error and climate projections for the Indian domain. Regional-scale Climate Modelling Workshop, Lund, Sweden
Main Audience: Researcher
Invited?: No, Keynote?: No

58. Huziy, O., L. Sushama, R. Laprise. (2014). Lake-river-atmosphere interactions as simulated by the Canadian Regional Climate Model (CRCM5) over north-east. CMOS, Rimouski, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

59. Jeong, D.I., L. Sushama, M.N. Khaliq. (2014). Future temperature increases and associated drought risks over North America.Ouranos, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

60. Huziy, O., L. Sushama, R. Laprise. (2014). Lakes and rivers in CRCM5 and 3D simulations of The Great Lakes. CNRCWP annual meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

61. Diro, G.T., L. Sushama. (2014). Land-atmosphere coupling over North America in current and future climates as simulated by the Canadian RCM. AGU, San Francisco, United States
Main Audience: Researcher
Invited?: No, Keynote?: No

62. Alexandru, A., L. Sushama. (2013). Current climate and climate change over CORDEX West-Asian domain as simulated by CRCM5. EGU, Vienna, Austria
Main Audience: Researcher
Invited?: No, Keynote?: No

63. Hernández-Díaz, L., R. Laprise, K. Tete, L. Sushama, L.Šeparović, A. Martynov, K. Winger, M. Valin. (2013). Simulating current and future climate over CORDEX Africa domain using the fifth-generation Canadian Regional Climate Model (CRCM5). EGU, Vienna, Austria
Main Audience: Researcher
Invited?: No, Keynote?: No

64. Khaliq, M.N., L. Sushama, A. Monette, H. Wheater. (2013). Evaluation of NARCCAP multi-RCM simulations over the Canadian Prairies. CMOS, Saskatoon, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

65. Huziy, O., L. Sushama, M.N. Khaliq, R. Laprise, B. Lehner, R. Roy. (2013). Analysis of streamflow characteristics over northeastern Canada in a changing climate. CMOS, Saskatoon, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

66. Huziy, O., L. Sushama, R. Laprise. (2013). Impact of lakes and rivers on the regional climate and hydrology of northeast Canada. Workshop on Regional Climate modelling and Diagnostics, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

67. Jeong, D.I., L. Sushama, M.N. Khaliq, R. Roy. (2013). Multivariate analysis of Canadian RCM projected changes to flood characteristics for northeastern Canada. CMOS, Saskatoon, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

68. Alexandru, A., L. Sushama. (2013). Current climate and climate change over CORDEX West-Asian domain as simulated by CRCM5. Workshop on Regional Climate modelling and Diagnostics, montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

69. Jeong, D.I., L. Sushama, M.N. Khaliq, R. Roy. (2013). Multivariate analysis of Canadian RCM projected changes to flood characteristics for northeastern Canada. Workshop on Regional Climate modelling and Diagnostics, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

70. Sushama, L., J.P. Paquin, A. Martynov, K. Winger, O. Huziy. (2013). Near-surface permafrost in current and future climates. Workshop on Regional Climate modelling and Diagnostics, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

71. Sushama, L.(2013). Land-atmosphere interactions. Association canadienne des ressources hydriques, Quebec city, Canada
Invited?: Yes, Keynote?: No

72. Hernández-Díaz, L., R. Laprise, L. Sushama, A. Martynov, L.˘Separović, K. Tete, K. Winger, B. Dugas, M. Valin. (2013). Simulation of current and future climate over Africa using the fifth-generation Canadian Regional Climate Model (CRCM5): A contribution to the CORDEX project. Workshop on Regional Climate modelling and Diagnostics, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

73. Garnaud, .C, L. Sushama. (2013). Impact of dynamic vegetation on CRCM5 simulated climate over North America. Workshop on Regional Climate modelling and Diagnostics, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

74. Sushama, L., B. Bouagila, S. Bensaid, K. Winger. (2013). Selected diagnostics of CRCM5 simulations over Africa. Workshop on Regional Climate modelling and Diagnostics, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

75. Paquin, J-P., L. Sushama. (2012). Sensitivity of Canadian RCM simulated surface/sub-surface climate for the pan- Arctic region to soil model configuration and organic matter.CMOS, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

76. Muncaster, R., L. Sushama. (2012). Comparison of composite and mosaic approaches of land-surface heterogeneity representation in CRCM5. CMOS, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

77. Martynov, A., L. Sushama, R. Laprise, K. Winger, B. Dugas. (2012). Performance of the lake model FLake in the Canadian Regional Climate Model, version 5 simulations over two CORDEX domains – North America and Africa. CMOS, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

78. Huziy, O., L. Sushama, M.N. Khaliq, R. Laprise, B. Lehner, R. Roy. (2012). Analysis of streamflow characteristics over northeastern Canada in a changing climate. CMOS, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

79. Jeong, D.I., L. Sushama, N. Khaliq, D. Paimazumder. (2012). A Copula-based Multivariate Analysis of Canadian RCM Projected Changes to Flood Characteristics for Québec. 46th CMOS Congress, Montreal.CMOS, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

80. Monette, A., L. Sushama, M.N. Khaliq, R. Laprise, R. Roy. (2012). Projected changes to precipitation extremes for Northeast Canadian watersheds using a multi-RCM ensemble. CMOS, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

81. Tete, K., L. Hernandez-Diaz, R. Laprise, L. Sushama, A. Martynov, K. Winger, M. Valin. (2012). Climate-change projections made with the fifth-generation Canadian Regional Climate Model (CRCM5) over the African CORDEX domain. CMOS, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

82. Lapse, R., L. Hernandez-Diaz, A. Martynov, L. Sushama, K. Tete, K. Winger, M. Valin. (2012). CORDEX-Africa climate change projection using the fifth-generation Canadian Regional Climate Model (CRCM5). CMOS, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

83. Martynov, A., R. Laprise, L. Sushama, K. Winger, B. Dugas. (2012). Reanalysis-driven climate simulation over CORDEX North America domain using the Canadian Regional Climate Model, version 5: model performance evaluation. CMOS, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

84. Winger, K., R. Laprise, A. Martynov, L. Separovic, A. Alexandru, B. Dugas, M. Valin, L. Sushama. (2012). A high-resolution CRCM5 climate simulation over the North America CORDEX domain. CMOS, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

85. Alexandru, A., L. Separovic, R. Laprise, A. Martynov, L. Sushama, K. Winger, M. Valin. (2012). Climate-change projections with the fifth-generation Canadian Regional Climate Model (CRCM5) over the North American CORDEX domain. CMOS, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

86. Hernandez-Diaz, L., R. Laprise, L. Sushama, A. Martynov, K. Winger, B. Dugas. (2012). CORDEX-Africa climate simulation using the fifth-generation Canadian Regional Climate Model (CRCM5). CMOS, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

87. Separovic, L., A. Alexandru, R. Laprise, A. Martynov, L. Sushama, K. Winger,M. Valin. (2012). Climate and climate change over North America CORDEX domain as simulated by the fifth-generation Canadian Regional Climate Model. CMOS, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

88. Paimazumder, D., L. Sushama, R. Laprise. (2012). CRCM5 simulations over CORDEX-West Asia domain: Evaluation of Indian Summer Monsoon. CMOS, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

89. Bouagila, B., L. Sushama. (2012). Precipitation characteristics over Africa as simulated by the Canadian RCM. CMOS, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

90. Clavet-Gaumont, J., L. Sushama, M.N. Khaliq, R. Roy. (2012). Canadian RCM projected changes to high flows for Québec watersheds using regional frequency analysis. CMOS, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

91. Tete, K., L. Hernandez-Diaz, R. Laprise, L. Sushama, A. Martynov, K. Winger, B. Dugas, M. Valin. (2012). Validation of the fifth-generation Canadian Regional Climate Model (CRCM5) over the African CORDEX domain. CMOS, Montreal, Canada
    Main Audience: Researcher
    Invited?: No, Keynote?: No

92. Martynov, A., R. Laprise, L. Sushama, K. Winger, B. Dugas. (2012). Canadian Regional Climate Model, version 5: performance in simulating the current climate over North America. CMOS, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

93. Garnaud, C., L. Sushama, V. Arora. (2012). The effect of driving climate data on the simulated terrestrial carbon pools and fluxes. CMOS, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

94. Martynov, A., L. Sushama, R. Laprise, K. Winger, B.Dugas. (2011). Interactive Lakes in the Canadian Regional Climate Model, version 5: The Role of Lakes in the Regional Climate of North America, oral presentation. ESCER annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

95. Bouagila, B., L. Sushama, R. Laprise, K. Winger, B. Dugas. (2011). Precipitation characteristics over Africa as simulated by CRCM5. International Conference on the Coordinated Regional Climate Downscaling Experiment (CORDEX). CORDEX meeting, Trieste, Italy
Main Audience: Researcher
Invited?: No, Keynote?: No

96. Huziy, O., J. Clavet-Gaumont, L. Sushama, N. Khaliq, B. Lehner, R. Laprise, R. Roy. (2011). Projected changes to streamflow extremes in Quebec basins as simulated by the Canadian Regional Climate Model (CRCM4). Annual ESCER science meeting, UQAM. ESCER annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

97. PaiMazumder, D., L. Sushama. (2011). Validation of CRCM5 simulations over the West-Asian CORDEX domain. ESCER annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

98. Sushama, L.(2011). Climate change impacts on Canadian water resources.ESCER annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

99. Bouagila, B., L. Sushama, R. Laprise, K. Winger, B. Dugas. (2011). Precipitation characteristics over Africa as simulated by CRCM5.ESCER annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

100. Morin, J.P., L. Sushama. (2011). Canadian RCM Projected Changes to Soil Moisture Characteristics. ESCER annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

101. PaiMazumder, D., L. Sushama, N. Khaliq, R. Laprise, S. Karmakar. (2011). Canadian RCM projected changes to flood events for the Ottawa River basin using copula approach. ESCER annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

102. Winger, K., R. Laprise, B. Dugas, L. Sushama, L. Hernández-Díaz. (2011). Validation of CRCM5 simulations over Africa.CORDEX meeting, Trieste, Italy
Main Audience: Researcher
Invited?: No, Keynote?: No

103. Monette, A., L. Sushama, M.N. Khaliq, R. Roy. (2011). Projected changes to multi-day precipitation extremes over Quebec watersheds using a multi-RCM ensemble. CMOS, Victoria, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

104. Garnaud, C., L. Sushama, V. Arora, K. Winger, L. Duarte. (2011). Implementation of dynamic vegetation in CRCM5.ESCER annual science meeting, UQAM, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

105. Monette, A., L. Sushama, N. Khaliq, R. Roy. (2011). Projected changes to multi-day precipitation extremes over Quebec watersheds using a multi-RCM ensemble. ESCER Annual Science meeting, UQAM.ESCER annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

106. Paquin, J.-P., L. Sushama, R. Döscher, T. Königk. (2011). Effects of Arctic Rapid Ice Loss Events in RCAO future climate projections.ESCER annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

107. Martynov, A., L. Sushama, R. Laprise, K. Winger, B. Dugas. (2011). Interactive Lakes in the Canadian Regional Climate Model, version 5: The Role of Lakes in the Regional Climate of North America. CMOS, Victoria, Canada
Invited?: No, Keynote?: No

108. Clavet-Gaumont, J., L. Sushama, M.N. Khaliq, R. Roy. (2011). Canadian RCM projected changes to extreme flows in Quebec watersheds. CMOS, Victoria, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

109. Clavet-Gaumont, J., L. Sushama, N. Khaliq, R. Roy. (2011). Canadian RCM projected changes to extreme flows in Quebec watersheds.ESCER annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

110. Martynov, A., D. Beletsky, L. Sushama, R. Laprise. (2011). Empirically-based parametrization of water mixing in 1D lake models, applied to the Great Lakes. International Workshop on Physical Processes in Natural Waters, Burlington, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

111. Garnaud, C., L. Sushama, V. Arora, K. Winger, L. Duarte. (2011). Implementation of dynamic vegetation in CRCM5. CMOS, Victoria, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

112. Winger, K., R. Laprise, B. Dugas, L. Sushama, L. Hernández-Díaz. (2011). Validation of CRCM5 simulations over Africa. ESCER Annual science meeting, UQAM, Montréal.ESCER annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

113. Winger, K., R. Laprise, B. Dugas, L. Sushama, L. Hernández-Díaz. (2011). Validation of CRCM5 simulations over Africa. CMOS, Victoria, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

114. PaiMazumder, D., L. Sushama, M.N. Khaliq, R. Laprise, S. Karmakar. (2011). Canadian RCM projected changes to flood events: A bivariate frequency analysis using the copula approach for the Ottawa River basin. EGU, Vienna, Austria
Main Audience: Researcher
Invited?: No, Keynote?: No

115. Hernández-Díaz, L., R. Laprise, L. Sushama. (2011). West African Monsoon: An Overview.ESCER annual science meeting, Montreal, Canada
Main Audience: Researcher
Invited?: No, Keynote?: No

Publications

Journal Articles

1. Diro, G.T.*, L. Sushama. (2016). The role of soil moisture-atmosphere interaction on future hot-spells over North America as simulated by the Canadian Regional ClimateModel (CRCM5). Journal of Climate.
Revision Requested
Refereed?: Yes

2. Huziy, O.*, L. Sushama. (2016). Lake–river and lake–atmosphere interactions in a changing climate over Northeast Canada.Journal of Climate Dynamics.
Published
Refereed?: Yes, Open Access?: Yes

3. Jeong, D.I.*, L. Sushama. (2016). Rain-on-snow events over North America based on two Canadian regional climate models. Climate Dynamics.
Submitted
Refereed?: Yes

4. Huziy, O.*, L. Sushama. (2016). Impact of lake–river connectivity and interflow on the Canadian RCM simulated regional climate and hydrology for Northeast Canada.Journal of Climate Dynamics.
Published
Refereed?: Yes

5. Yang, G.*, L. Sushama, G.T. Diro*. (2016). The intra-seasonal variability of land-atmosphere coupling over North America in CRCM5. Journal of Geophysical Research.
Accepted
Refereed?: Yes

6. Teufel, B*., G.T. Diro*., K. Whan, S. Milrad., D.I.Jeong*., A. Ganji*., O. Huziy*., K. Winger, J. Gyakum, R. de Elia, F. Zwiers, L. Sushama. (2016). Investigation of the 2013 Alberta flood from weather and climate perspectives. Journal of Climate Dynamics.
Published
Refereed?: Yes, Open Access?: Yes

7. Fang, B.*, L. Sushama, G.T. Diro, P. Samuelsson, D. Verseghy, S. Dery. (2016). Snow characteristics and snow albedo feedback over North America in the fifth generation Canadian Regional Climate Model. Climate Dynamics.
Revision Requested
Refereed?: Yes

8. Alexandru, A.*, L. Sushama. (2015). Current climate and climate change over India as simulated by the Canadian Regional Climate Model. Climate Dynamics.
Published
Refereed?: Yes

9. Ganji, A.*, L. Sushama, D. Verseghy, R. Harvey. (2015). On improving cold region hydrological processes in the Canadian Land Surface Scheme. Theoretical and Applied Climatology.
Published
Refereed?: Yes, Open Access?: Yes

10. Chacon, A.*, L. Sushama, H. Beltrami. (2015). Biophysical impacts of land-use change over North America as simulated by the Canadian Regional climate model.Atmosphere.
Published
Refereed?: Yes, Open Access?: Yes

11. Garnaud, C.*, L. Sushama, D. Verseghy. (2015). Impact of interactive vegetation phenology on the Canadian RCM simulated climate over North America. Climate Dynamics.
Published
Refereed?: Yes, Open Access?: Yes

12. Garnaud, C.*, L. Sushama. (2015). Biosphere-climate interactions in a changing climate over North America. Journal of Geophysical Research.
Published
Refereed?: Yes, Open Access?: Yes

13. Jeong, D.I.*, L. Sushama, M.N. Khaliq. (2015). Attribution of anthropogenic effects to spring snow water equivalent changes over the Northern hemisphere. Climate Dynamics.
Published
Refereed?: Yes, Open Access?: Yes

14. Jeong, D.I.*, L. Sushama, G.T. Diro*, M.N. Khaliq. (2015). Projected changes to winter temperature characteristics over Canada based on an RCM ensemble. Climate Dynamics.
Published
Refereed?: Yes

15. Alexandru, A.*, L. Sushama. (2015). Impact of **land-use** and land-cover changes on CRCM5 climate projections over North America for the twenty-first century. Climate Dynamics.
Published
Refereed?: Yes

16. Jeong, D.I.*, L. Sushama, G.T. Diro*, M.N. Khaliq, H. Beltrami, D. Caya. (2015). Projected changes to high temperature events for Canada based on a Regional Climate Model ensemble. Climate Dynamics.
Published
Refereed?: Yes

17. Sushama, L., S. Bensaid*, M.N. Khaliq, D. NageshKumar, R. Laprise. (2014). Dry spell characteristics over India based on IMD and APHRODITE datasets.Climate dynamics.
Published
Refereed?: Yes

18. Khaliq, M.N., L. Sushama, A. Monette*, H. Wheater. (2014). Seasonal and extreme precipitation characteristics for the watersheds of the Canadian Prairie Provinces as simulated by the NARCCAP multi-RCM ensemble. Climate Dynamics.
Published
Refereed?: Yes

19. Jeong, D.I.*, L. Sushama, M.N. Khaliq, R. Roy. (2014). A copula-based multivariate analysis of Canadian RCM projected changes to flood characteristics for northeastern Canada. Climate Dynamics.
Published
Refereed?: Yes, Open Access?: Yes

20. Paquin, J.P.*, L. Sushama. (2014). On the simulated Arctic near-surface permafrost and climate sensitivities to soil and snow formulations. Climate Dynamics.
Published
Refereed?: Yes, Open Access?: Yes

21. Jeong, D.I.*, L. Sushama, M.N. Khaliq. (2014). The role of temperature in drought projections over North America. Climatic Change.
Published
Refereed?: Yes

22. Diro, G.T.*, L. Sushama, A. Martynov*, D.I. Jeong*, D. Verseghy, K. Winger. (2014). Land-atmosphere coupling over North America in CRCM5. Journal of Geophysical Research – Atmospheres.
Published
Refereed?: Yes, Open Access?: Yes

23. Thiery, W., A. Martynov*, F. Darchambeau, J.P. Descy, P.D. Plisnier, L. Sushama, N.V. Lipzig. (2014). Understanding the performance of the FLake model over the African Great Lakes. Geoscientific model development. 7: 317-337.
Published
Refereed?: Yes, Open Access?: Yes

24. Laprise, R., L. Hernández-Díaz, K. Tété, L. Sushama, L.ˇSeparovíc, A. Martynov*, K. Winger, M. Valin. (2013). Climate change projections over CORDEX Africa domain using the fifth-generation Canadian Regional Climate Model (CRCM5). Climate Dynamics.
Published
Refereed?: Yes, Open Access?: Yes

25. Martynov, A.*, R. Laprise, L. Sushama, K. Winger, L.ˇSeparovíc, B. Dugas. (2013). Reanalysis-driven climate simulation over CORDEX North America domain using the Canadian Regional Climate Model, version 5: Model performance evaluation. Climate Dynamics.
Published
Refereed?: Yes, Open Access?: Yes

26. Paquin, J.P.*, R. Doescher, L. Sushama, T. Konigk. (2013). Causes and consequences of mid-21st century rapid ice loss events simulated by the Rossby Centre Regional Atmosphere-Ocean model. Tellus.
Published
Refereed?: Yes, Open Access?: Yes

27. Separovíc, L., A. Alexandru*, R. Laprise, A. Martynov, L. Sushama, K. Winger, K. Tété, M. Valin. (2013). Present climate and climate change over North America as simulated by the fifth-generation Canadian Regional Climate Model (CRCM5). Climate Dynamics.
Published
Refereed?: Yes, Open Access?: Yes

28. Bouagila, B.*, L. Sushama. (2013). On the current and future dry spell characteristics over Africa. Atmosphere.
Published
Refereed?: Yes, Open Access?: Yes

29. Garnaud, C.*, L. Sushama, V. Arora. (2013). The effect of driving climate data on the simulated terrestrial carbon pools and fluxes over North America. International Journal of Climatology.
Published
Refereed?: Yes, Open Access?: Yes

30. Martynov, A.*, L. Sushama, R. Laprise, K. Winger*, B. Dugas. (2012). Interactive Lakes in the Canadian Regional Climate Model, version 5: The Role of Lakes in the Regional Climate of North America. Tellus A.
Published
Refereed?: Yes, Open Access?: Yes

31. Clavet-Gaumont, J.*, L. Sushama, M.N. Khaliq, O. Huziy*, R. Roy. (2012). Canadian RCM projected changes to high flows for Québec watersheds using regional frequency analysis. International Journal of Climatology.
Published
Refereed?: Yes, Open Access?: Yes

32. Huziy, O.*, L. Sushama, M.N. Khaliq, R. Laprise, B. Lehner, R. Roy. (2012). Analysis of streamflow characteristics for northeastern Canada in a changing climate. Climate Dynamics.
Published
Refereed?: Yes, Open Access?: Yes

33. Hernandez-Diaz, L., R. Laprise, L. Sushama, A. Martynov, K. Winger, B. Dugas. (2012). Validation of CRCM5 simulations over CORDEX-Africa domain.Journal of climate dynamics.
Published
Refereed?: Yes

34. Nikulin, G., C. Jones, P. Samuelsson, F. Giorgi, M. Sylla, G. Asrar, M. Büchner, R. Cerezo-Mota, O. Christensen, M. Déqué, J. Fernandez, A. Hanzler, E. Meijgaard, L. Sushama. (2012). Precipitation climatology in an ensemble of CORDEX-Africa regional climate simulations. Journal of Climate.
Published
Refereed?: Yes, Open Access?: Yes

35. Monette, A.*, L. Sushama, M.N. Khaliq, R. Laprise, R. Roy. (2012). Projected changes to precipitation extremes for Northeast Canadian watersheds using a multi-RCM ensemble. Journal of Geophysical Research.
Published
Refereed?: Yes, Open Access?: Yes

36. Mladjic, B.*, L. Sushama, M.N. Khaliq, R. Laprise, D. Caya, R. Roy. (2011). Canadian RCM projected changes to the characteristics of precipitation extremes over Canada. Journal of Climate.
Published
Refereed?: Yes, Open Access?: Yes

37. Poitras, V.*, L. Sushama, F. Segleniks, M.N. Khaliq, E. Soulis. (2011). Projected Changes to Streamflow Characteristics over Western Canada as Simulated by the Canadian RCM. Journal of Hydrometeorology.
Published
Refereed?: Yes, Open Access?: Yes

38. Roberts, A., J. Cherry, R. Doscher, R. Elliott, L. Sushama. (2011). Exploring the potential for Arctic System Modelling. Bulletin of American Meteorological Society.
Published
Refereed?: Yes, Open Access?: Yes

39. Khaliq, M.N., T.B.M.J. Ouarda, P. Gachon, L. Sushama. (2011). Stochastic modeling of hot weather spells and their characteristics. Climate Research.
Published
Refereed?: Yes, Open Access?: No

40. PaiMazumder, D*., L. Sushama, R. Laprise, M.N. Khaliq, D. Sauchyn. (2011). Canadian RCM projected changes to short- and long-term drought characteristics over the Canadian Prairies. International Journal of Climatology.
Published
Refereed?: Yes

Book Chapters

1. Khaliq, M.N., L. Sushama. (2011). Analysis of trends in low flow time series of Canadian rivers. Machiwal, D., M. Jha. Hydrologic time series analysis. : 201-217.
Published, Springer Germany and Capital publishing company
Refereed?: Yes

Professor David Atkinson

Correspondence language: English
Sex: Male
Date of Birth: 8/23
Canadian Residency Status: Canadian Citizen

Contact Information

The primary information is denoted by (*)

Address

Courier	Mailing	Primary Affiliation
University of Victoria Dept. of Geography Social Science and Mathematics Building 3800 Finnerty Road Victoria British Columbia V8P 5C2 Canada	Department of Geography University of Victoria PO Box 3060 STN CSC Victoria British Columbia V8W 3R4 Canada	University of Victoria Dept. of Geography Social Science and Mathematics Building 3800 Finnerty Road Victoria British Columbia V8P 5C2 Canada

Telephone

(*)	250-7217332 250-7217332

Email

(*)	datkinso@uvic.ca

Protected when completed

Professor David Atkinson

Language Skills

Language	Read	Write	Speak	Understand	Peer Review
English	Yes	Yes	Yes	Yes	
French	Yes	No	No	No	
Russian	Yes	No	No	No	

Degrees

2002/8 - 2004/7

Post-doctorate, Postdoctorate, Arctic coastal storm and wave dynamics, Atlantic Geoscience Center, Bedford Institute of Oceanography
Degree Status: Completed

Areas of Research: Coastal Sedimentation

Research Disciplines: Climatology and Meteorology

Supervisors: Steven Solomon

2001/7 - 2002/7

Post-doctorate, Postdoctorate, Paleoclimatolgy computational methods, University of Ottawa
Degree Status: Completed

Supervisors: Konrad Gajewski

2000/7 - 2001/7

Post-doctorate, Postdoctorate, High latitude weather data, University of Ottawa
Degree Status: Completed

Supervisors: Konrad Gajewski

1993/9 - 2000/6

Doctorate, Doctor of Philosophy in Geography, High latitude climatology, University of Ottawa
Degree Status: Completed

Supervisors: Konrad Gajewski

1989/9 - 1992/6

Master's Thesis, Master's in Arts in Physical Geography, Satellite Remote Sensing, Carleton University
Degree Status: Completed
Thesis Title: Spectral Reflectance Survey on Fosheim Peninsula, NWT, Canada.

Supervisors: Michael Smith

1985/9 - 1989/6

Bachelor's, Bachelor of Science, Honours, Physical Geography, Carleton University
Degree Status: Completed

Supervisors: Peter Williams

Credentials

	Science Steering Committee, International Study of Arctic Change Sit on Science Steering Committee; organization works to coordinates Arctic Research activities where possible
2009/6	Associate Editor, J. Geophysical Res. Atmospheres, American Geophysical Union

User Profile

Researcher Status: Researcher
Engaged in Clinical Research?: No

Research Specialization Keywords: Arctic, climate, coastal impacts, glacier weather, paleoclimate, storm dynamics, synoptic meteorology

Employment

2010/8	Professor Geography, University of Victoria
2004/7 - 2010/7	Professor, Researcher Department of Atmospheric Sciences, International Arctic Research Center and University of Alaska Fairbanks

Affiliations

The primary affiliation is denoted by (*)

(*) 2010/8	Professor, Geography, University of Victoria

Research Funding History

Awarded [n=12]

2012/6 Principal Applicant	Natural Resources Canada/Geological Survey of Canada – Ice-modified coastal wave energy calculation algorithm (PI - $5000), Contract Clinical Research Project?: No
2013/9 Principal Investigator	Marine Environmental Observation, Prediction, and Response (MEOPAR), User-driven monitoring of adverse marine and weather states, Eastern Beaufort Sea ($257,000), Grant, Operating Clinical Research Project?: No
2015/9 Principal Investigator	ArcticNet Phase II. Weather impacts on Northern Coastal Canada (PI - $50,000), Grant, Operating Clinical Research Project?: No Project Description: Devleop climatology of fog and low-visibility events for the Canadian North. Link their occurrence to synoptic weather patterns.
2013/6 Principal Investigator	Canada Foundation for Innovation (Leadership Opportunities Fund) University of Victoria High Country and Northern Weather Impacts Laboratory (PI – $120,000), Grant, Equipment Clinical Research Project?: No
2015/9 Co-investigator	NOAA Climate Program Office. Climate and Societal Interactions: Supporting Resilient Coastal Communities and Ecosystems in a Changing Climate: Understanding climate-related human health risks within the coastal environment., Grant, Operating Clinical Research Project?: No

2012/9 Principal Investigator	ArcticNet Canada – Weather impacts on Northern Coastal Canada (PI - $60,000), Grant, Operating Clinical Research Project?: No
2015/9 Co-investigator	NSF/NSERC Belmont Forum Grant. Arctic Fog Variability in a Warming Arctic and Its Impact on Maritime Human Activities (Co PI, Canadian Lead $50,000) with Will Perrie, DFO, Grant, Operating Clinical Research Project?: No
2014/9 Principal Investigator	Transport Canada. Northern Transportation Adaptation Initiative. Expanding user-driven monitoring of adverse marine and weather states in the Western Canadian Arctic (PI - $50,000), Grant, Operating Clinical Research Project?: No
2013/7 - 2018/6 Principal Investigator	Natural Sciences and Engineering Research Council of Canada (Discovery Grant), Synoptic Drivers of Canadian Cordilleran Icefield Snowpack Response: Columbia Icefield and Brintnell Glacier ($135,000), Grant, Operating Clinical Research Project?: No
2012/5 - 2014/4 Principal Investigator	Western Alaska Landscape Conservation Cooperative, The role of sea ice berm formation to alter environmental marine forcing in West Alaska coastal communities (PI - $59,000), Grant, Operating Clinical Research Project?: No
2012/6 - 2014/4 Co-investigator	Western Alaska Landscape Conservation Cooperative, Western Alaska Buoy Deployment and Data Streaming (project partner, $32,000), Grant, Operating Clinical Research Project?: No
2006/6 - 2013/9 Principal Investigator	Social Vulnerability to Climate Change in Alaskan Coastal Communities, Grant, Operating **Funding Sources:** 2006/6 - 2013/9 National Oceanic and Atmospheric Administration (NOAA) Total Funding - 2,200,000 (Canadian dollar) Principal Investigator :

Courses Taught

Professor, University of Victoria
Course Title: Applied Climatology
Course Code: GEOG373

Professor, Geography, University of Victoria
Course Title: Advanced Quantitative Methods
Course Code: GEOG 524
Course Topic: Advanced analytical programming, advanced statistical and analytical methods, focus on large data se
Course Level: Graduate

Professor, University of Victoria
Course Title: Synoptic Meteorology
Course Code: GEOG484

Professor, University of Victoria
Course Title: Introduction to Climatology and Hydrology
Course Code: GEOG272

Professor, University of Victoria
Course Title: Introduction to Physical Geography
Course Code: GEOG103
Course Level: Undergraduate

Student/Postdoctoral Supervision

Master's Thesis [n=8]

2015/9
Principal Supervisor

Yaqiong Wang (In Progress) , University of Victoria
Student Degree Start Date: 2015/9
Student Canadian Residency Status: Study Permit
Thesis/Project Title: Homogenization of non-federal temperature networks in British Columbia
Student Country of Citizenship: China

Other Supervisors: Co-Supervisor - Zwiers, Francis

2014/9
Principal Supervisor

Chris Krasowski (In Progress) , University of Victoria
Student Canadian Residency Status: Canadian Citizen
Thesis/Project Title: Synotpic influences on atmospheric transmissivity in Victoria, BC.

Project Funding Sources:
Amount - 30,000 (Canadian dollar)

2013/9
Co-Supervisor

Eric Courtin (In Progress) , University of Victoria
Student Canadian Residency Status: Canadian Citizen
Thesis/Project Title: Synoptic Drivers of Snow Events, Nahanni Icefield, NWT.

Other Supervisors: Co-Supervisor - Demuth, Michael

Project Funding Sources: Natural Sciences and Engineering Research Council of Canada (NSERC)
Amount - 50,000 (Canadian dollar)

2013/9 - 2015/4
Principal Supervisor

Adam Wicks (Completed) , University of Victoria
Student Canadian Residency Status: Canadian Citizen
Thesis/Project Title: Coastal Storm Surge Identification, Classification, and Evaluation at Red Dog Dock, Alaska, 2004-2014
Project Description: Storms over southern the Chukchi and Bering Seas drive positive and negative water level set-up (storm surges) events. Positive set-up events can cause coastal inundation and negative set-up events can be problematic for shallow-draft marine equipment. A ten year record of water level data from Red Dog port were used to develop a database of surge events. The database was analyzed to identify type and timing of events, seasonal patterns and frequencies of occurrence, and to determine likely atmospheric driving mechanisms. 44 events were identified – 21 positive, 23 negative – that occured during the months of November, December, and January. The event typing work suggested four distinct surge patterns. Analysis of weather drivers, performed via use of an Empirical Orthogonal Function (EOF) analysis, suggested favoured locations for storm systems. The sea level pressure weather patterns for positive set-up surge events are much stronger and shorter lived than for negative set-up events
Student Country of Citizenship: Canada

Project Funding Sources: National Oceanic and Atmospheric Administration (NOAA)
Amount - 50,000 (Canadian dollar)

Research Disciplines: Climatology and Meteorology

2012/9 - 2016/12
Principal Supervisor

Vida Khalilian (Completed) , University of Victoria
Student Degree Start Date: 2012/9
Student Degree Received Date: 2016/12
Student Canadian Residency Status: Study Permit
Thesis/Project Title: Climatological patterns of fog in the Canadian Arctic and their synoptic drivers.
Present Position: Research assistant, University of Victoria
Student Country of Citizenship: Iran, Islamic Republic of

Project Funding Sources:
Amount - 75,000 (Canadian dollar)

2006/9 - 2010/4
Principal Supervisor

Austin Cross (Completed) , University of Alaska Fairbanks
Student Degree Start Date: 2006/9
Student Degree Received Date: 2010/4
Student Canadian Residency Status: Not Applicable
Thesis/Project Title: Synoptic drivers of storm surge In Kotzebue Sound
Present Position: Forecaster, US National Weather Service, Monterey Bay
Student Country of Citizenship: United States

Research Disciplines: Climatology and Meteorology

2006/9 - 2010/4
Principal Supervisor

Julie Malingowski (Completed) , University of Alaska Fairbanks
Student Degree Start Date: 2006/9
Student Degree Received Date: 2010/4
Student Canadian Residency Status: Not Applicable
Thesis/Project Title: An Observational study of the surfaced---based radiation temperature inversion in Fairbanks, Alaska
Present Position: Forecaster, US National Weather Service, Fort Collins

Research Disciplines: Climatology and Meteorology

2005/9 - 2009/4
Principal Supervisor

Jennifer March (Completed) , University of Alaska Fairbanks
Student Degree Start Date: 2005/9
Student Degree Received Date: 2009/4
Student Canadian Residency Status: Not Applicable
Thesis/Project Title: Synoptic Climatology of the Eastern Brooks Range, Alaska: A Data Legacy of the International Geophysical Year
Present Position: Data rescue speciallist, University of Alaska Fairbanks
Student Country of Citizenship: United States

Research Disciplines: Climatology and Meteorology

Doctorate [n=8]

2016/1
Principal Supervisor

Benjamin Paquette-Struger (In Progress) , University of Victoria
Student Canadian Residency Status: Canadian Citizen
Thesis/Project Title: Synoptic drivers of thermal and moisture transfer in icefield snowpacks, Columbia Icefield and Nahanni National Park Reserve.

2015/9
Principal Supervisor

Mohamed Elgundi (In Progress) , University of Victoria
Student Degree Start Date: 2015/9
Student Canadian Residency Status: Study Permit
Thesis/Project Title: Cause and occurrence of atmospheric river events along the Canadian Western seaboard.
Student Country of Citizenship: Libyan Arab Jamahiriya

2014/9 Co-Supervisor	Katherine Pingree-Shippee (All But Degree) , Pacific Climate Impacts Consortium Student Canadian Residency Status: Study Permit Thesis/Project Title: Seasonal prediction of North Pacific wave states Student Country of Citizenship: United States Other Supervisors: Co-Supervisor - Zwiers, Francis Project Funding Sources: Amount - 80,000 (Canadian dollar)
2014/9 Co-Supervisor	Weixun Lu (In Progress) , University of Victoria Student Degree Start Date: 2014/9 Student Canadian Residency Status: Permanent Resident Thesis/Project Title: Weather impacts on pathogen initiation and spread in cereal crops of the Canadian Prairies. Student Country of Citizenship: China Other Supervisors: Co-Supervisor - Newlands, Nathaniel Project Funding Sources: Agriculture Canada
2013/9 - 2017/1 Principal Supervisor	Laura Eerkes-Medrano (Completed) , University of Victoria Student Degree Start Date: 2013/9 Student Degree Received Date: 2017/1 Student Canadian Residency Status: Canadian Citizen Thesis/Project Title: Slush-ice berms on the west coast of Alaska: development of a conceptual model of formation based on input from and work with local observers in Shaktoolik, Gambell and Shishmaref, Alaska Project Description: Slush-ice berms are accumulations of slush ice that develop frequently along the west coast of Alaska under the right wind, water level, water and air temperature, and snow conditions. Strong winds can push slush onto the shore, where it can accumulate, solidify and protect communities from flooding and erosion. These berms can also be problematic, restricting access to the coast and presenting other hazards. Little research has been conducted on this phenomenon, with the result that a physical conceptual model describing the formation of slush-ice berms does not exist. This work identifies and documents the environmental and synoptic weather conditions that lead to surges, and to develop a descriptive physical conceptual model of slush-ice berm formation. A key to this work was the engagement of traditional knowledge holders and local observers to gather data and information about slush ice and slush-ice berm formation, along with the specific dates when these events took place. Project Funding Sources: Western Alaska Landscape Conservation Consortium Amount - 100,000 (Canadian dollar)
2011/9 - 2016/9 Principal Supervisor	Norman Shippee (All But Degree) , University of Victoria Student Canadian Residency Status: Student Work Permit Thesis/Project Title: Storminess metrics, mechanics and seasonal prediction in the Arctic. Student Country of Citizenship: United States Project Funding Sources: National Oceanic and Atmospheric Administration (NOAA) Amount - 180,000 (Canadian dollar)

2007/9 - 2012/4
Principal Supervisor

Oceana Francis (Completed) , University of Alaska Fairbanks
Student Degree Start Date: 2007/9
Student Degree Received Date: 2012/4
Student Canadian Residency Status: Not Applicable
Thesis/Project Title: Atmospheric Forcing of Wave States in the Southeast Chukchi Sea
Present Position: Assistant Professor, University of Hawaii, Dept. of Engineering
Student Country of Citizenship: United States

Project Funding Sources: National Oceanic and Atmospheric Administration (NOAA)
Amount - 100,000 (United States dollar)

Research Disciplines: Climatology and Meteorology

2006/9 - 2009/4
Principal Supervisor

Michel dos Santos Mesquita (Completed) , University of Alaska Fairbanks
Student Degree Start Date: 2006/9
Student Degree Received Date: 2009/4
Student Canadian Residency Status: Not Applicable
Thesis/Project Title: Characteristics and variability of storm tracks in the North Pacific', Bering Sea and Alaska
Present Position: Research Scientist, Bjerknes Climate Research Center, Norway
Student Country of Citizenship: Brazil

Project Funding Sources: National Oceanic and Atmospheric Administration (NOAA)
Amount - 75,000 (United States dollar)

Post-doctorate [n=1]

2016/9
Principal Supervisor

Matthew Asplin, University of Victoria
Student Canadian Residency Status: Canadian Citizen
Thesis/Project Title: Storm surge mechanics and forcing, Western Canadadian Arctic

Project Funding Sources: W. Garfield Weston Foundation
Amount - 111,000 (Canadian dollar)

Editorial Activities

2009/6

Associate Editor, Journal of Geophysical Research - Atmospheres, Journal
Solicit reviewers for manuscripts. Provide decision recommendation and summary to senior editor.

Expert Witness Activities

Expert Witness, Bonanza Fuels of Nome, Alaska vs. Delta Western Shipping Company.,
Provided expert deposition regarding weather conditions during the time of the case.

Journal Review Activities

Reviewer,Arctic
Number of Works Reviewed / Refereed: 3

Graduate Examination Activities

PhD External Examiner, Samaneh Ebrahimi, The University of Calgary

Text Interviews

2016/04/20	Assessing weather impacts on Arctic stakeholders, Patricia Pitts, Victoria Times-Colonist newspaper
2015/09/10	Work on weather impacts on icefields in the Rockies, Gregor Cragie, CBC radio "On the Island"

Publications

Journal Articles

1. Wicks, A and DE Atkinson. (2016). Synoptic drivers of anomalous water level occurrences at Red Dog Port, Alaska.Natural Hazards.
   Co-Author
   Revision Requested,
   Refereed?: Yes
   Number of Contributors: 2
   Contribution Percentage: 21-30
2. Katherine Pingree-Shippee, Norman J Shippee, David Atkinson. (2016). Overview of Bering/Chukchi Sea Wave States for Four Severe Storms Following Common Synoptic Tracks. Journal of Oceanic and Atmospheric Technology. 33(2): 283-302.
   Last Author
   Published, Blackwell Press,
   Refereed?: Yes
   Number of Contributors: 3
   Contribution Percentage: 11-20
3. Shippee, NJ, DE Atkinson and KI Hodges. (2016). Integrating Eulerian and Lagrangian Storm Identification and Tracking Methods for Extratropical Cyclones in the North Pacific. Geophysical Research Letters.
   Co-Author
   Submitted,
   Refereed?: Yes
   Number of Contributors: 3
   Contribution Percentage: 11-20
4. Laura Eerkes-Medrano, David E. Atkinson, Hajo Eicken, Bill Nayokpuk, Harvey Sookiayak, Eddie Ungott, Winton Weyapuk, Jr. (2016). Slush-ice Berm Formation on the West Coast of Alaska. Arctic.
   Co-Author
   Published,
   Refereed?: Yes
   Number of Contributors: 7
   Contribution Percentage: 11-20
5. Malingowski, J, D. Atkinson, J. Cherry, J Fochesatto, E Stevens. (2015). AnObservational Study of Radiation Temperature Inversions in Fairbanks, Alaska. Polar Science. 8(1): 24-39.
   Co-Author
   Published,
   Refereed?: Yes
   Number of Contributors: 5
   Contribution Percentage: 21-30

6. Atkinson, D. E., Sassen, K., Hayashi, M., Cahill, C. F., Shaw, G., Harrigan, D., and Fuelberg, H. (2013). Aerosol properties over InteriorAlaska from lidar, DRUM Impactor sampler, and OPC-sonde measurements and their meteorologicalcontext during ARCTAS-A, April 2008. Atmospheric Chemistry and Physics. 13: 1293-1310.
http://dx.doi.org/10.5194/acp-13-1293-2013
First Listed Author
Published, Copernicus,
Refereed?: Yes, Open Access?: Yes
Number of Contributors: 7
Contribution Percentage: 71-80

7. Kruk, M.C., J.J. Marra, P. Ruggiero, D. Atkinson, M. Merrifield, D. Levinson, and M. Lander.(2013). Pacific Storms Climatology Products (PSCP): Understanding Extreme Events. Bulletin of the American Meteorological Society (BAMS). 94: 13-18.
Co-Author
Published, Blackwell Press,
Refereed?: Yes
Number of Contributors: 7
Contribution Percentage: 11-20

8. Heathfield, D., I Walker, and D.E. Atkinson. (2013). Erosive water level regime and climate variability forcing of beach-dune systems on south-western Vancouver Island. Earth Surface Processes and Landforms. 38: 751-762.
Last Author
Published,
Refereed?: Yes
Number of Contributors: 3
Contribution Percentage: 11-20

9. Peters, D.L, D.E. Atkinson, W.A. Monk, D.E. Tenenbaum and D.J. Baird. (2013). A multi-scale hydroclimatic analysis of runoff generation in the Athabasca River, western Canada. Hydrological Processes. 7: 1915-1934.
Co-Author
Published,
Refereed?: Yes
Number of Contributors: 5
Contribution Percentage: 21-30

10. Lantuit, H, PP Overduin, N Couture, F Are, DE Atkinson, et al.(2012). The ACD Coastal Database: A new classification scheme and statistics on Arctic permafrost coasts. Estuaries and Coasts. 35: 383-400.
Co-Author
Published,
Refereed?: Yes
Number of Contributors: 10
Contribution Percentage: 0-10

11. Francis, O.P., D.E. Atkinson.(2012). Synoptic forcing of wave states in the southeast Chukchi Sea, Alaska, at nearshore locations. Natural Hazards. 62: 1273-1300.
Co-Author
Published,
Refereed?: Yes
Contribution Percentage: 21-30

12. Humphries, GRW, F Huettmann, GA Nevitt, C Deal, D Atkinson.(2012). Species distribution modeling of storm-petrels (Oceanodroma furcata and O. leucorhoa) in the North Pacific and the role of dimethyl sulphide.Polar Biology. 35(11): 1669-1680.
http://dx.doi.org/10.1007/s00300-012-1207-2
Last Author
Published,
Refereed?: Yes
Number of Contributors: 5
Contribution Percentage: 11-20

13. Jobard, F. and D.E. Atkinson.(2012). Aspects synoptiques des visibilités réduites dans l'Ouest alaska.La Météorologie. 78
http://dx.doi.org/doi: 10.4267/2042/47515
Co-Author
Published,
Refereed?: Yes
Number of Contributors: 2
Contribution Percentage: 11-20

14. Francis, O.P., D.E. Atkinson.(2012). Synoptic forcing of wave states in the southeast Chukchi Sea, Alaska, at an offshore location.Natural Hazards. 62: 1169-1189.
Co-Author
Published,
Refereed?: Yes
Number of Contributors: 2
Contribution Percentage: 21-30

15. Loring, PA, SC Gerlach, DE Atkinson, MS Murray.(2011). Ways to help and ways to hinder: governance for successful and sustainable livelihoods in an uncertain climate. Arctic. 64(1): 73-88.
Co-Author
Published,
Refereed?: Yes
Number of Contributors: 4
Contribution Percentage: 11-20

16. Wheeler, D, VL Harvey, DE Atkinson, RL Collins, MJ Mills. (2011). A climatology of cold air outbreaks over North America: WACCM and ERA-40 comparison and analysis.Journal of Geophysical Research Atmospheres. 116: D12.
Co-Author
Published,
Refereed?: Yes
Number of Contributors: 5
Contribution Percentage: 21-30

17. Francis, O.P., G.G. Panteleev, and D.E. Atkinson.(2011). Ocean wave conditions in the Chukchi Sea from satellite and observations.Geophysical Research Letters. 38(24)
http://dx.doi.org/10.1029/2011GL049839, 2011
Last Author
Published,
Refereed?: Yes
Number of Contributors: 3
Contribution Percentage: 0-10

18. Lantuit, H., D.E. Atkinson, M. Grigoriev, V. Rachold, G. Grosse, H.-W. Hubberten.(2011). Coastal erosion dynamics on the permafrost–dominated Bykovsky Peninsula, North Siberia,1951-2006. Polar Research. 30 http://dx.doi.org/10.3402/polar.v30i0.7341
Co-Author
Published,
Refereed?: Yes
Number of Contributors: 6
Contribution Percentage: 11-20

19. Mesquita, M, Hodges, K, Atkinson, DE, and Bader, J.(2011). Sea-ice Anomalies in the Sea of Okhotsk and the Relationship with Storm Tracks in the Northern Hemisphere. Tellus A. 63: 312-323.
Co-Author
Published,
Refereed?: Yes
Number of Contributors: 4
Contribution Percentage: 11-20

20. Mesquita, M., Atkinson, D.E., and Hodges, K.(2010). Characteristics and Variability of Storm Tracks in the North Pacific, Bering Sea, and Alaska. Journal of Climate. 23: 294-311.
http://dx.doi.org/10.1175/2009JCLI3019.1
Co-Author
Published,
Refereed?: Yes
Number of Contributors: 3
Contribution Percentage: 11-20

21. Atkinson, D.E., Brown, R., Alt, B., Agnew, T., Bourgeois, J., Burgess, M., Duguay, C., Henry, G., Jeffers, S., Koerner, R., Lewkowicz, A.G., McCourt, S., Melling, H., Sharp, M., Smith, S., Walker, A., Wilson, K., Wolfe, S., Woo, M-k., and Young, K.L.(2006). Canadian Cryospheric Response to an Anomalous Warm Summer: A Synthesis of the Climate Change Action Fund Project “The State of the Arctic Cryosphere during the Extreme Warm Summer of 1998”. Atmosphere-Ocean. 44: 347-375.
First Listed Author
Published,
Refereed?: Yes
Number of Contributors: 20
Contribution Percentage: 21-30

22. David Atkinson. (2005). Observed storminess patterns and trends in the circum-Arctic coastal regime. GeoMarine Letters. 25: 98-109.
First Listed Author
Published,
Refereed?: Yes
Number of Contributors: 1
Contribution Percentage: 91-100

Book Chapters

1. David E. Atkinson, Donald L. Forbes,Thomas S. James. (2016). CHAPTER 2: DYNAMIC COASTS IN A CHANGING CLIMATE. Lemmen, D.S., Warren, F.J., James, T.S. and Mercer Clarke, C.S.L. Canada's Marine Coasts in a Changing Climate.
First Listed Author
Published,
Refereed?: Yes
Contribution Percentage: 31-40

2. James Ford, Trevor Bell (Atkinson was contributing author). (2016). CHAPTER 5: PERSPECTIVES ON CANADA'S NORTH COAST REGION. Canada's Marine Coasts in a Changing Climate.
   Co-Author
   Published,
   Refereed?: Yes
   Contribution Percentage: 0-10

Conference Publications

1. Francis, Oceana, D.E. Atkinson, R.E. Jensen, U Bhatt. (2015). One-Dimensional Wave Spectra in the Chukchi Sea. Proceedings. ISOPE-2015 # The Twenty-fifth (2015) International Offshore and Polar Engineering Conference, Kona, United States,
   Conference Date: 2015/6
   Paper
   Co-Author
   Published
   Number of Contributors: 4
   Contribution Percentage: 11-20

NSERC CRSNG

Canadian Common CV commun canadien

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Dr. Curran Alexander Crawford

Correspondence language: English
Sex: Male

Contact Information

The primary information is denoted by (*)

Address

Primary Affiliation (*)

University of Victoria
Department of Mechanical Engineering
PO Box 1700 Stn CSC
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NSERC CRSNG

Canadian Common CV commun canadien

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This is a draft version only. Do not submit to any funding organization. Only the final version from the History page can be submitted.

Dr. Curran Crawford

Language Skills

Language	Read	Write	Speak	Understand	Peer Review
English	Yes	Yes	Yes	Yes	Yes

Degrees

- 2007/3	Doctorate, Mechanical Engineering, University of Cambridge
- 2003/6	Master's Thesis, Aeronautics and Astonautics, Massachusetts Institute of Technology
- 2001/6	Bachelor's, Mechanical Engineering, University of Victoria

Recognitions

2010/5 - 2010/5

NSF EcoCAR Outstanding Incoming Faculty Advisor Award - 10,000
US National Science Foundation
Prize / Award
Co-Awarded to Professor Zuomin Dong and Professor Curran Crawford

User Profile

Research Specialization Keywords: Demand response, Energy system modeling, Multidisciplinary optimization, Plug-in electric vehicles, Probabilistic modeling, Renewable energy, Tidal energy, Wave energy, Wind energy

Employment

2013/7

Associate Professor
Mechanical Engineering, University of Victoria
Full-time, Associate Professor
Tenure Status: Tenure

2007/1 - 2013/6

Assistant Professor
Mechanical Engineering, University of Victoria
Full-time, Assistant Professor
Tenure Status: Tenure Track

Research Funding History

Awarded [n=8]

2016/1 - 2021/12

Transportation Futures for BC, Grant
Co-applicant

Funding Sources:

2016/1 - 2021/12 Pacific Institute for Climate Solutions (PICS)
Total Funding - 1,500,000
Portion of Funding Received - 250,000
Funding Competitive?: Yes

2015/9 - 2018/12
Principal Applicant

Airborne Wind Energy Systems, Fellowship

Funding Sources:

2015/9 - 2018/12 Pacific Institute for Climate Solutions (PICS)
Graduate Fellowships
Total Funding - 63,000
Portion of Funding Received - 63,000
Funding Competitive?: Yes

2013/4 - 2018/4
Principal Applicant

Optimizing Stochastic Renewable Energy Systems, Grant

Funding Sources:

2013/4 - 2018/4 Natural Sciences and Engineering Research Council of Canada (NSERC)
Discovery
Total Funding - 160,000
Portion of Funding Received - 160,000
Funding Competitive?: Yes

2009/1 - 2016/12
Co-applicant

The Canadian Integrated Multi-Trophic Aquaculture Network (CIMTAN)for the development of responsible aquaculture, Grant

Funding Sources:

2009/1 - 2013/12 Natural Sciences and Engineering Research Council of Canada (NSERC)
NSERC Strategic Networks
Total Funding - 5,000,000
Portion of Funding Received - 62,500
Funding Competitive?: Yes

Principal Applicant : Chopin, T

2012/1 - 2016/12
Co-applicant

Canadian Hydrokinetic Turbine Test Centre (CHTTC), Contract

Funding Sources:

2012/1 - 2016/12 Natural Resources Canada
ecoEII R&D
Total Funding - 4,063,000
Portion of Funding Received - 45,000
Funding Competitive?: Yes

: Bibeau, E

2012/1 - 2016/3
Principal Applicant

Powering Plug-in Electric Vehicles with Renewable Energy Supply in BC, Contract

Funding Sources:

2012/1 - 2016/3 Natural Resources Canada
ecoEII R&D
Total Funding - 1,480,525
Portion of Funding Received - 254,962
Funding Competitive?: Yes

2011/1 - 2013/12

Wind Turbine Design and Siting for Turbulent Conditions, Grant

Principal Applicant

Funding Sources:

2011/1 - 2015/12 Pacific Institute for Climate Solutions (PICS)
The Low Carbon Emissions Economy
Total Funding - 81,000
Portion of Funding Received - 81,000
Funding Competitive?: Yes

2012/1 - 2012/12
Co-applicant

Development of Floating Offshore Wind Turbine Platforms for BC, Fellowship

Funding Sources:

2014/1 - 2016/12 Pacific Institute for Climate Solutions (PICS)
Graduate Fellowship
Total Funding - 60,000
Portion of Funding Received - 30,000
Funding Competitive?: Yes

Co-applicant : Buckham, Brad

Completed [n=20]

2016/1 - 2016/6
Principal Applicant

Improving Electrical Demand Baseline Forecasting Techniques, Grant

Funding Sources:

2016/1 - 2016/6 Mathematics of Information Technology and Complex Systems (MITACS)
Accelerate
Total Funding - 15,000
Portion of Funding Received - 15,000
Funding Competitive?: Yes

2015/9 - 2016/2
Principal Applicant

Development of Kite Driven Emergency Propulsion Device, Grant

Funding Sources:

2015/9 - 2016/2 Natural Sciences and Engineering Research Council of Canada (NSERC)
Engage
Total Funding - 25,000
Portion of Funding Received - 25,000
Funding Competitive?: Yes

2008/1 - 2013/12
Co-applicant

Canadian Wind Energy Strategic Network (WESNet), Grant

Funding Sources:

2008/1 - 2012/12 Natural Sciences and Engineering Research Council of Canada (NSERC)
NSERC Strategic Networks
Total Funding - 4,999,893
Portion of Funding Received - 102,000
Funding Competitive?: Yes

Principal Applicant : Chang, Liuchen

2011/1 - 2013/12
Co-investigator

Wave Energy Generation and Integration -the West Coast Wave Initiative, Grant

Funding Sources:

2011/1 - 2013/12 Natural Sciences and Engineering Research Council of Canada (NSERC)
Strategic
Total Funding - 406,500
Portion of Funding Received - 60,000
Funding Competitive?: Yes

: Buckham, Bradley; Oshkai, Peter; Rowe, Andrew; Wild, Peter

2010/1 - 2012/12
Co-applicant

Development of Design Tools and Key Technology for Next Generation Commercial Hybrid Vehicles, Grant

Funding Sources:

2010/1 - 2012/12 British Columbia Innovation Council (BCIC)
Natural Resources and Applied Sciences (NRAS) BCFRST Endowment Fund
Total Funding - 295,800
Portion of Funding Received - 10,000
Funding Competitive?: Yes

: Dong, Zuomin; Wang,

2011/1 - 2012/12
Co-applicant

Linking Oceanographic and CFD Tidal Turbine Models, Contract

Funding Sources:

2011/1 - 2012/12 Offshore Energy Research Association (OERA)
Total Funding - 139,360
Portion of Funding Received - 57,100
Funding Competitive?: Yes

Co-applicant : Hiles, Clayton; Klaptocz, Voytek

2012/1 - 2012/12
Principal Applicant

PC Funding, Grant

Funding Sources:

2012/1 - 2012/12 University of Victoria
PC Fund
Total Funding - 1,053
Portion of Funding Received - 1,053
Funding Competitive?: Yes

2008/1 - 2012/12
Principal Applicant

Wind Turbine Design and Optimization, Grant

Funding Sources:

2008/1 - 2012/12 University of Victoria
Top-up Grant
Total Funding - 5,000
Portion of Funding Received - 5,000
Funding Competitive?: Yes

2008/1 - 2012/12 Natural Sciences and Engineering Research Council of Canada (NSERC)
Discovery Grant
Total Funding - 92,500
Portion of Funding Received - 92,500
Funding Competitive?: Yes

2008/1 - 2012/12 Travel Grant, Grant

Principal Applicant

Funding Sources:

2008/1 - 2012/12 University of Victoria
Travel Grant
Total Funding - 5,750
Portion of Funding Received - 5,750
Funding Competitive?: Yes

2008/1 - 2011/12
Principal Applicant

Top-up Grant, Grant

Funding Sources:

2008/1 - 2011/12 University of Victoria
Top-up Grant
Total Funding - 3,000
Portion of Funding Received - 3,000
Funding Competitive?: Yes

2011/1 - 2011/12
Co-applicant

PIV Endoscope, Grant

Funding Sources:

2011/1 - 2011/12 Natural Sciences and Engineering Research Council of Canada (NSERC)
RTI
Total Funding - 12,500
Portion of Funding Received - 5,000
Funding Competitive?: Yes

Co-applicant : Oshkai, Peter

2009/1 - 2011/12
Co-applicant

Multidisciplinary Optimization Framework for the Design of the Next-Generation Quiet Wind Turbine Rotors, Grant

Funding Sources:

2009/1 - 2011/12 Natural Sciences and Engineering Research Council of Canada (NSERC)
Strategic Project Grants
Total Funding - 401,000
Portion of Funding Received - 132,000
Funding Competitive?: Yes

: Martins, J; Nadarajah, S

2011/1 - 2011/12
Co-applicant

Canada-China Smart Distribution System With Communication Constraints, Grant

Funding Sources:

2011/1 - 2011/12 University of Victoria
UVic VPR Canada-China Research Project Seed Funds
Total Funding - 10,000
Portion of Funding Received - 5,000
Funding Competitive?: Yes

Co-investigator : Yan, Hong-Chuan

2011/1 - 2011/12
Co-applicant

Design and Development of Unmanned Air Systems, Grant

Funding Sources:

2011/1 - 2011/12 Mathematics of Information Technology and Complex Systems (MITACS)
Accelerate
Total Funding - 26,666
Portion of Funding Received - 13,333
Funding Competitive?: Yes

: Shi, Yang; Suleman, Afzal

2010/1 - 2010/12
Principal Applicant

Special Project Fund, Grant

Funding Sources:

2010/1 - 2010/12 Natural Sciences and Engineering Research Council of Canada (NSERC)
Wind Energy Strategic Network
Total Funding - 5,000
Portion of Funding Received - 5,000
Funding Competitive?: Yes

2010/1 - 2010/12
Co-investigator

Green Vehicle Research and Testing Centre, Grant

Funding Sources:

2010/1 - 2010/12 Western Economic Diversification Canada
Capital Assistance
Total Funding - 550,000
Portion of Funding Received - 275,000
Funding Competitive?: Yes

Co-investigator : Wise, Jeremy;

Principal Investigator : Dong, Zuomin

2010/1 - 2010/12
Principal Investigator

Water Tunnel Propeller Dynomometer, Grant

Funding Sources:

2010/1 - 2010/12 University of Victoria
IESVic Artindale Fund
Total Funding - 4,286
Portion of Funding Received - 4,286
Funding Competitive?: Yes

2010/1 - 2010/12
Principal Investigator

IEC Tidal Turbine Standards Blockage Study, Contract

Funding Sources:

2010/1 - 2010/12 Mavi Innovatons
Total Funding - 2,500
Portion of Funding Received - 2,500
Funding Competitive?: No

2010/1 - 2010/12
Principal Applicant

Bicycle Power Measurement Device, Grant

Funding Sources:

2010/1 - 2010/12 University of Victoria
Wighton Product Development Fund
Total Funding - 4,500
Portion of Funding Received - 4,500
Funding Competitive?: Yes

Co-investigator : Gray,

2008/1 - 2010/4
Principal Applicant

Sustainable Systems Design Laboratory, Grant

Funding Sources:

2009/1 - 2009/12 B.C. Ministry of Advanced Education
BC Knowledge Development Fund, New Initiatives Fund
Total Funding - 105,000
Portion of Funding Received - 105,000
Funding Competitive?: Yes

2008/1 - 2008/12 Canada Foundation for Innovation (CFI)
Leaders Opportunity Fund
Total Funding - 105,000
Portion of Funding Received - 105,000
Funding Competitive?: Yes

Student/Postdoctoral Supervision

Bachelor's [n=2]

2011/9 - 2012/8
Principal Supervisor
Magni, Alan (Completed) , University of Victoria
Thesis/Project Title: Small Wind Turbine Testing Rig Design
Present Position: Engineer at Endurance Windpower

2008/9 - 2010/8
Principal Supervisor
Stack, Luke (Completed) , University of Victoria
Thesis/Project Title: Small Wind Turbine Design
Present Position: Engineer at Viking Air

Master's non-Thesis [n=4]

2012/9 - 2016/4
Principal Supervisor
Yin, Zhijie (In Progress) , University of Victoria
Thesis/Project Title: Energy Efficient Buildings
Present Position: Graduate Student

2012/9 - 2015/12
Principal Supervisor
Jancowski-Walsh, John (In Progress) , University of Victoria
Thesis/Project Title: Hybrid Vehicle Drivetrain Component Integration
Present Position: Graduate Student

2012/1 - 2013/12
Principal Supervisor
Ladia, Kaustubh (Completed) , University of Victoria
Thesis/Project Title: All Wheel Drive Hybrid Drivetrain Control Limits
Present Position: Graduate Student

2010/9 - 2012/12
Principal Supervisor
Rodriguez, Alejandro (Completed) , University of Victoria
Thesis/Project Title: Waste to Energy Anaerobic System for Residential Apartment
Present Position: Industry

Master's Thesis [n=20]

2012/9 - 2015/12
Principal Supervisor
Franchini, Italo (In Progress) , University of Victoria
Thesis/Project Title: Tidal Turbine Water Tunnel Rotor Testing
Present Position: Graduate Student

2012/9 - 2015/8
Principal Supervisor
Asgari, Iman (Completed) , University of Victoria
Thesis/Project Title: Small Wind Turbine Aerodynamic Testing and Validation
Present Position: Industry

2012/9 - 2015/12 Co-Supervisor	Kamiya, George (In Progress) , University of Victoria Thesis/Project Title: Plug-In Vehicle Consumer Preferences Present Position: Graduate Student
2012/9 - 2015/9 Principal Supervisor	Al Hanif, Ehtesham (Completed) , University of Victoria Thesis/Project Title: Hybrid Vehicle Powertrain Optimization
2012/9 - 2015/9 Co-Supervisor	Pirquet, Oliver (Completed) , University of Victoria Thesis/Project Title: Energy Extraction from Oscillating Flows Present Position: Graduate Student
2012/1 - 2012/12 Principal Supervisor	Marcangeli, Naic (Completed) , University of Victoria Thesis/Project Title: Hydrofoil Lift and Drag Measurement Using PIV Present Position: Graduate Student
2011/9 - 2015/4 Principal Supervisor	Gray, Adam (Completed) , University of Victoria Thesis/Project Title: User-Constrained Algorithms for Aggregate Residential Demand Response Programs with Limited Feedback Present Position: Industry
2011/9 - 2015/8 Co-Supervisor	Kaban, Stephan (Completed) , University of Victoria Thesis/Project Title: Hybrid Vehicle Drivetrain Control Present Position: Industry
2010/9 - 2011/8 Co-Supervisor	Parkinson, Simon (Completed) , University of Victoria Thesis/Project Title: Dispatchable Load Control for Community Energy Systems Present Position: Engineer at Ecofys
2010/9 - 2012/12 Co-Supervisor	Ross, Dian (Completed) , University of Victoria Thesis/Project Title: On Designing Coarse Grain Reconfigurable Arrays to Operate in Weak Inversion Present Position: Industry
2010/9 - 2011/8 Co-Supervisor	Bussiers, Frederic (Completed) , University of Victoria Thesis/Project Title: Multivariate Parametric Analysis of Wind Turbine Blade Roots Present Position: Edison Engineer at GE Energy
2010/9 - 2013/5 Co-Supervisor	Hall, Matthew (Completed) , University of Victoria Thesis/Project Title: Floating Offshore Wind Turbine Modelling and Optimization Present Position: Graduate student
2010/9 - 2010/12 Principal Supervisor	Suarez, Milenko (Completed) , University of Victoria Thesis/Project Title: Dispatchable thermal loads Present Position: Energy Analyst at IAEA
2009/9 - 2011/8 Co-Supervisor	Wise, Jeremy (Completed) , University of Victoria Thesis/Project Title: Hybrid Vehicle Drivetrain Design Present Position: Test Engineer at GM
2009/9 - 2011/8 Principal Supervisor	Shives, Michael (Completed) , University of Victoria Thesis/Project Title: Analysis of Ducted and Unducted Tidal Turbine Rotors Present Position: Graduate Student
2009/9 - 2012/8 Principal Supervisor	Hoevenaars, Eric (Completed) , University of Victoria Thesis/Project Title: Renewable Energy for Integrated Aquaculture Systems Present Position: Engineer at Enbala
2009/9 - 2011/8 Co-Supervisor	Wild, Kristin (Completed) , University of Victoria Thesis/Project Title: Pumped Hydro Storage Present Position: Engineer at KWL

2008/9 - 2012/8 Principal Supervisor	Lartiga, Catalina (Completed) , University of Victoria Thesis/Project Title: Water Tunnel rotor Experiments with PIV Present Position: Energy Efficiency Lead at Sinclair Knight Merz
2008/9 - 2011/8 Principal Supervisor	Lillo, Patricio (Completed) , University of Victoria Thesis/Project Title: Wind Turbine Design for Cold Climates Present Position: Engineering Consultant in Renewable Energy
2008/9 - 2011/8 Principal Supervisor	Cline, Shane (Completed) , University of Victoria Thesis/Project Title: Wind Turbine Aerodynamics Present Position: Self-employed

Doctorate [n=14]

2017/1 - 2019/12 Principal Supervisor	Rad Haghi (In Progress) , University of Victoria Student Degree Expected Date: 2019/1 Thesis/Project Title: Stochastic wind energy systems optimization
2015/9 - 2018/12 Principal Supervisor	Markus Sommerfeld (In Progress) , University of Victoria Student Degree Expected Date: 2018/12 Thesis/Project Title: Airborne Wind Energy System Optimization
2012/9 - 2016/12 Co-Supervisor	Yeylaghi, Shahab (Completed) , University of Victoria Thesis/Project Title: SPH for Wave & Wind Energy Device Simulation Present Position: Graduate Student
2012/9 - 2016/12 Principal Supervisor	Shives, Michael (In Progress) , University of Victoria Thesis/Project Title: Tidal Turbines
2012/9 - 2016/12 Principal Supervisor	Fluck, Manuel (In Progress) , University of Victoria Thesis/Project Title: Small Wind Turbine Unsteady Aerodyanmics Present Position: Graduate Student
2012/9 - 2016/4 Principal Supervisor	Mustafa, Ghulam (Completed) , University of Victoria Thesis/Project Title: High Fidelity Micromechanics-Based Statistical Analysis of Composite Material Properties Present Position: Industry
2011/9 - 2016/4 Co-Supervisor	Kormos, Christine (Completed) , University of Victoria Thesis/Project Title: Personal, Interpersonal, and Contextual Influences on Consumer Preferences for Plug-in Electric Vehicles: A Mixed-methods and Interdisciplinary Approach Present Position: Postdoc
2011/9 - 2016/2 Co-Supervisor	Hammam, Mohamed (Completed) , University of Calgary Thesis/Project Title: Analytical Unsteady Aerodynamic Models for Horizontal Axis Wind Turbines Present Position: Professor
2010/9 - 2016/8 Principal Supervisor	Lawton, Stephan (In Progress) , University of Victoria Thesis/Project Title: Lagrangian Wind Turbine Aerdynamics Present Position: Graduate student
2010/9 - 2015/8 Principal Supervisor	McWilliam, Michael (Completed) , University of Victoria Thesis/Project Title: Towards Multidisciplinary Design Optimization Capability of Horizontal Axis Wind Turbines Present Position: Postdoc, Riso/DTU
2009/9 - 2016/12 Co-Supervisor	Dong, Jian (Completed) , University of Victoria Thesis/Project Title: Hybrid Vehicle Drivetrain Control Present Position: Industry

2009/9 - 2015/12 Co-Supervisor	Zhang, Xing (In Progress) , University of Victoria Thesis/Project Title: Hybrid Vehicle Drivetrain Control Present Position: Industry
2008/9 - 2010/8 Co-Supervisor	Paiva, Ricardo (Completed) , University of Victoria Thesis/Project Title: MDO Techniques for Aircraft Design Present Position: Engineer at Rolls-Royce
2008/9 - 2013/2 Principal Supervisor	Williams, Trevor (Completed) , University of Victoria Thesis/Project Title: Probabilistic Power Flow Modeling of Renewable Energy and PEV Grid Interactions Present Position: Deceased

Post-doctorate [n=1]

2010/9 - 2012/8 Co-Supervisor	Wang, Dan (Completed) , University of Victoria Thesis/Project Title: Demand Side Management in Power Systems Present Position: State Grid Corporation of China

Event Administration

2012/10 - 2013/4	Member of Organizing Committee, 4th Canada-China Clean Energy Conference: Sustainable Transportation, Workshop, 2013/4 - 2013/4
2011/10 - 2012/4	Member of Organizing Committee, 3rd Canada-China Clean Energy Research & Training Workshop, Workshop, 2012/4 - 2012/4
2010/10 - 2011/5	Member of Organizing Committee, 2011 Canada-China Clean Energy Research & Training Workshop, Workshop, 2011/5 - 2011/5
2010/1 - 2010/6	Organizing Committee Member, Advanced Energy Systems Symposium at 2010 CSME Forum, Conference, 2010/6 - 2010/6
2009/9 - 2010/1	Session Chair, 2010 AIAA/ASME Wind Conference, Conference, 2010/1 - 2010/1

Organizational Review Activities

2010/1 - 2012/6	Participant, International Energy Agency My research group is an active participant in the IEA Task 29 (MEXICO) wind turbine aerodynamics validation work package, which resulted in a number of conference publications and a funding application for a new round of testing and code validation
2011/1 - 2012/4	Reviewer, National Renewable Energy Laboratory Reviewed a white paper on system design/multidisciplinary optimization applied to wind turbines

International Collaboration Activities

2013/1	Organizing Committee MemberNetherlands Worked to include IESVic in the EU Wind Masters program which is starting this fall and is a collaboration between a number of EU Universities. This will see research students join my lab for thesis research, as well as opportunity for me to offer joint special courses in Europe

2012/1	Organizing Committee Member, Germany A PhD exchange program between IESViv/UVic and the University of Oldenburg, serving on the organizing committee. As part of this program two of my PhD students have visited Oldenburg to investigate potential collaboration
2012/4 - 2012/4	Organizing Committee Member, China Canada-China Workshop IESVic Organizing Committee
2011/5 - 2011/5	Organizing Committee Member, Canada Canada-China Workshop IESVic Organizing Committee

Committee Memberships

2008/1 - 2018/12	Committee Member, Mechanical Engineering Graduate Committee, University of Victoria
2009/1 - 2017/12	Committee Member, UVic Sustainability Advisory Committee, University of Victoria
2011/1 - 2013/12	Committee Member, UVic-Oldenburg Exchange Review Committee, University of Victoria
2008/1 - 2013/12	Committee Member, Engineering Faculty Website Committee, University of Victoria
2008/1 - 2013/12	Committee Member, Engineering Faculty Co-op Coordinator Hiring Committee, University of Victoria
2007/1 - 2013/12	Committee Member, Engineering Faculty Mentoring Committee, University of Victoria
2007/1 - 2013/12	Committee Member, Website Committee, University of Victoria
2007/1 - 2013/12	Committee Member, Engineering Faculty Co-op Committee, University of Victoria
2012/1 - 2012/12	Committee Member, Design Learning Outcomes Committee, University of Victoria
2010/1 - 2011/12	Committee Member, UVic Working Group on Research Internationalization, University of Victoria
2010/1 - 2011/12	Committee Member, Civil Engineering Hiring Committee, University of Victoria
2009/1 - 2011/12	Committee Member, UVic CRD Waste Treatment Liaison Committee, University of Victoria
2007/1 - 2011/12	Committee Member, UVic Bicycle Users Committee (BUC) Faculty Representative, University of Victoria
2009/1 - 2010/12	Committee Member, EcoCAR Faculty Advisor Board (FAB), University of Victoria

Other Memberships

2011/1 - 2020/1	Panel Member, Natural Sciences and Engineering Research Council of Canada (NSERC) Engineering NSERC Discovery Grant Review Panel
2009/2 - 2020/1	Member, The Association of Professional Engineers and Geoscientists of BC (APEGBC) PEng
2009/1 - 2016/12	Member, The Canadian Standards Association (CSA) CSA Technical Subcommittee (TSC)C2302.3 (Small wind Turbines), IEC-IEA 61400-2, IEC62600-200 TC 114 (tidal energy)
2010/1 - 2015/12	Panel Member, Engineering Committee on Oceanic Resources (ECOR) Member, ECOR Marine Renewable Energy Panel

2010/1 - 2015/12	Technical Committee Member, Marine Renewables Canada Canadian sub-committee TC 114 Marine Energy: Wave and Tidal Converters / a Technical Committee created by the International Electrotechnical Commission (IEC) to prepare international standard for marine energy conversion systems
2008/1 - 2015/12	Committee Member, Government of British Columbia Ministry of Energy, Mines, and Petroleum Resources (MEMPR) lead of the BC Committee on PHEVs
2010/1 - 2013/12	Member, Natural Sciences and Engineering Research Council of Canada (NSERC) WESNet Outreach Committee member
2008/1 - 2012/12	Member of the Board, City Green Solutions Board of Directors
2007/1 - 2012/12	Member, The American Institute of Aeronautics and Astronautics

Presentations

1. (2013). Wind Turbine Modeling for Multidisciplinary Optimization of Advanced Concepts. 2nd NREL Wind Energy Systems Engineering Workshop Agenda, Broomfield, United States
   Invited?: Yes, Keynote?: No
2. (2012). Exploring the challenges and opportunities of linking renewable generation with variable loads. UVic-TJU Smart Grid Workshop, Victoria, Canada
   Invited?: Yes, Keynote?: No
3. (2012). Building Virtual Power Plants to Enable Renewables Integration. Enbala Power Networks Techtalk, Vancouver, Canada
   Invited?: Yes, Keynote?: No
4. (2011). Grid Integration of Plug-in (Hybrid) Electrified Vehicles (PEVs). IESVic (Institute for Integrated Energy Systems at the University of Victoria) Smart Grid Workshop, Victoria, Canada
   Invited?: Yes, Keynote?: Yes
5. Klymak, J. (2011). Renewable Energy from the Ocean: is it Feasible?. UVic Faculty of Science Café Scientifique, Victoria, Canada
   Main Audience: General Public
   Invited?: Yes, Keynote?: No
6. (2011). Sustainable Energy Systems Design in the SSDL. 2nd Annual Canada-China Workshop, Victoria, Canada
   Invited?: Yes, Keynote?: No
7. (2011). An Overview of Energy System Research in the SSDL. UVIC-PNNL-TJU-BJTU Smart Grid & Energy System Workshop, Victoria, Canada
   Invited?: Yes, Keynote?: No

Publications

Journal Articles

1. Shives M, Crawford C. (2017). **Tuned actuator disk approach for predicting tidalturbine performance with wake interaction**. International Journal of Marine Energy. 17: 1-20.
   Published
   Refereed?: Yes

2. Hammam M, Wood D, Crawford C. (2016). Development Of An Analytical Unsteady Model For Wind Turbine Aerodynamic Response To Linear Pitch Changes. ASME Journal of Wind and Solar Engineering. 138(5)
   Published
   Refereed?: Yes

3. Manuel Fluck Curran Crawford. (2016). A stochastic aerodynamic model for stationaryblades in unsteady 3D wind fields. Journal of Physics: Conference Series, The Science of Making Torque from Wind.
   Published
   Refereed?: Yes

4. Shives M, Crawford C. (2016). Adapted two-equation turbulence closures foractuator disk RANS simulations of wind & tidal turbine wakes. Renewable Energy. 19: 273-292.
   Published
   Refereed?: Yes

5. Manuel Fluck Curran Crawford. (2016). Minimizing errors in interpolated discrete stochastic wind fields. Journal of Wind Engineering and Industrial Aerodynamics. 152: 15-22.
   Published
   Refereed?: Yes

6. Michael Shives Curran Crawford. (2016). Tuned Actuator Disk Approach for PredictingTidal Turbine Performance with Wake Interaction International Journal of MarineEnergy. Journal of Marine Energy.
   In Press
   Refereed?: Yes

7. Mustafa G, Crawford C, SulemanA. (2016). Fatigue Life Prediction of Laminated Composites Usinga Multi-Scale M-LaF and Bayesian Inference Model. Composite Structures. 151: 149-161.
   Published
   Refereed?: Yes

8. Shahab Yeylaghi Belaid Moa Peter Oshkai Bradley Buckham Curran Crawford. (2016). ISPH modelling for hydrodynamic applications using a new MPI-based parallel approach. Journal of Ocean Engineering and Marine Energy.
   Published
   Refereed?: Yes

9. Karimi M, Hall M, Buckham B, Crawford C. (2016). A multi-objective design optimization approachfor floating offshore wind turbine support structures. Journal of Ocean Engineering.
   Published
   Refereed?: Yes

10. Manuel Fluck Curran Crawford. (2016). Fast Analysis of Unsteady Wing Aerodynamics via Stochastic Models. AIAA Journal.
    Published
    Refereed?: Yes

11. Shahab Yeylaghi Belaid Moa Peter Oshkai Bradley Buckham Curran Crawford. (2016). ISPH Modelling of an Oscillating Wave Surge Converter Using an OpenMP-Based Parallel Approach. Journal of Ocean Engineering and Marine Energy. 2(301)
    Published
    Refereed?: Yes

12. Behboodi S, Chassin D, Crawford C, Djilali N. (2016). Interconnection-wide Hour-ahead Scheduling in the Presence of Intermittent Renewables and Demand Response: a SurplusMaximizing Approach. Applied Energy.
    Accepted
    Refereed?: Yes

13. Behboodi S, Chassin D, Crawford C, Djilali N. (2016). Renewable resources portfolio optimization inthe presence of demand response. Applied Energy. 162: 139-148.
Published
Refereed?: Yes

14. Khorsand I, Kormos C, MacDonald E, Crawford C. (2015). Social acceptance of wind energy projects: An international comparison. Energy Research & Social Science. 8: 66-77.
Published
Refereed?: Yes

15. Chassin D, Behboodi S, Crawford C, Djilali N. (2015). Agent-Based Simulation for Interconnection-ScaleRenewable Integration and Demand Response Studies. Engineering. 1(4): 422-435.
Published
Refereed?: Yes

16. Zhang X, Wu G, Dong Z, Crawford C. (2015). Embedded Feature-selection Support Vector Machine for Driving Condition Recognition of Hybrid Electric Vehicle. Journal of the Franklin Institute. 352(2): 669-685.
Published
Refereed?: Yes

17. Mustafa G, Suleman A, Crawford C. (2015). Probabilistic Micromechanical Analysis of Composite Material Stiffness Properties for a Wind Turbine Blade. Composite Structures. 131: 905-916.
Published
Refereed?: Yes

18. *Fluck M, Crawford C. (2014). A Lifting Line Model to Investigate the Influence of Tip Feathers on Wing Performance. Bioinspiration & Biomechanics. 9(4)
Published
Refereed?: Yes

19. *Hall M, Buckham B, Crawford C. (2014). Hydrodynamics-Based Floating Wind Turbine Support Platform Optimization: A Basis Function Approach. Renewable Energy. 66: 559-569.
Published
Refereed?: Yes, Open Access?: No

20. *Paiva R, Crawford C, Suleman A. (2014). Robust and reliability based optimization framework for wing design. AIAA Journal, Special Section on Multidisciplinary Design Optimization. 52(4): 711-724.
Published
Refereed?: Yes, Open Access?: No

21. Chopin T, MacDonald B, Cross S, Pearce C, Knowler D, Noce A, Reid G, Cooper A, Speare D, Burridge L, Crawford C, Sawhney M, Ang K P, Backman C et al. (2013). The Canadian integrated multi-trophic aquaculture network (CIMTAN) a network for a new era of ecosystem responsible aquaculture. Fisheries. 38(7): 297-308.
Published
Refereed?: Yes, Open Access?: Yes

22. *Williams T, Crawford C A et al. (2013). Probabilistic load flow modeling comparing maximum entropy and Gram-Charlier probability density function reconstructions. IEEE Transactions on Power Systems. 28(1): 272-280.
Published
Refereed?: Yes

23. *Williams T, *Wang D, Crawford C A, Djilali N et al. (2013). Integrating renewable energy using a smart distribution system: potential of self-regulating demand response. Renewable Energy. 52: 46-56.
Published
Refereed?: Yes

24. *Paiva R, Crawford C A, Suleman A et al. (2012). Robust and reliability based optimization framework for wing design. AIAA Journal.
Submitted
Refereed?: Yes

25. *Shives M, Crawford C A et al. (2012). Mesh and load distribution requirements for actuator line CFD simulations. Wind Energy.
Published
Refereed?: Yes

26. *Hoevenaars E, Crawford C et al. (2012). Examining temporal resolution in probabilistic models of renewable power systems using a cumulant-based approach. Energy.
Submitted
Refereed?: Yes

27. Hall M, Buckham B, Crawford C et al. (2012). Quantifying the importance of mooring line model fidelity in floating offshore wind turbine simulations. Wind Energy.
Submitted
Refereed?: Yes

28. *Wang D, *Parkinson S, Miao W, Jia H, Crawford C, Djilali N et al. (2012). Hierarchal electricity market-integration of disparate responsive load groups using comfort-constrained load aggregation as spinning reserve. Applied Energy.
Published
Refereed?: Yes

29. *Lawton S, Crawford C et al. (2012). A second order accurate lifting-line method for horizontal-axis wind turbines. Wind Energy.
Submitted
Refereed?: Yes

30. *Hoevenaars E, Crawford C A et al. (2012). Implications of temporal resolution for modeling renewables-based power systems. Renewable Energy. 41: 285-293.
Published
Refereed?: Yes

31. *McWilliam M K, Crawford C A et al. (2012). The behavior of fixed point iteration and newton-rapson methods in solving the blade element momentum equations. Wind Engineering. 35(1): 17-32.
Published
Refereed?: Yes

32. *Parkinson S, Wang D, Crawford C A, Djilali N et al. (2012). Wind integration in self-regulating electric load distributions. Journal of Energy Systems.
Published
Refereed?: Yes

33. Miao W, Jia H, *Wang D, *Parkinson S, Crawford C, Djilali N et al. (2012). Active power regulation of wind power system through a load-side solution: comfort-constrained heat pump management. Science China Technology Sciences. 55(1): 1-10.
Published
Refereed?: Yes

34. *McWilliam M K, vanKooten G C, Crawford C A et al. (2012). A method for optimizing the location of wind farms. Renewable energy.
Published
Refereed?: Yes

35. *Hoevenaars E, Crawford C et al. (2012). Renewables-based power system design for an integrated multi-trophic aquaculture site in British Columbia. Journal of Renewable and Sustainable Energy.
Submitted
Refereed?: Yes

36. *Wang D, *Parkinson S, Miao W, Jia H, Crawford C, Djilali N et al. (2012). Online voltage security assessment considering comfort-constrained demand response control of distributed heat pump systems. Journal of Applied Energy: Special issue on Smart Grids, Renewable Energy Integration, and Climate Change Mitigation Future Electric Energy Systems. 96: 104-114.
Published
Refereed?: Yes

37. *Shives M, Crawford C A et al. (2011). Developing an empirical model for ducted tidal turbine performance using numerical simulation results. Proceedings of the Institution of Mechanical Engineers Part A: Journal of Power and Energy. 226(1): 112-125.
Published
Refereed?: Yes

38. *Shives M, Crawford C A,. (2011). Merging blade element momentum (BEM) theory with an empirical ducted turbine model. Proceedings of the Institution of Mechanical Engineers, Part A, Journal of Power and Energy.
Submitted
Refereed?: Yes

Book Chapters

1. Younis A, Williams T, Wang D, Dong Z, Crawford C,Djilali N. (2017). Optimal Operation of Self-regulating Smart Distribution System with Wind Energy Integration and Demand Response. Energy Solutions to Combat Global Warming. : 707-734.
Published, Springer International
Refereed?: Yes

Reports

1. Klaptocz V, Crawford C, *Shives M, Karsten R, Hiles C et al. (2012). Cross-coupling Between Device-level CFD and Oceanographic Models Applied to Multiple TISECs in Minas Passage: 1st Interim Report. 35. Offshore Energy Research Association of Nova Scotia.

2. Klaptocz V, Crawford C, *Shives M, Karsten R, Hiles C et al. (2012). Cross-coupling Between Device-level CFD and Oceanographic Models Applied to Multiple TISECs in Minas Passage: 2nd Interim Report. 32. Offshore Energy Research Association of Nova Scotia.

3. Rawlings B, Klaptocz V, Crawford C, *Lartiga C, *Shives M, Sireli M, Alidadi M et al. (2011). Assessment of Blockage Effects on Tidal Energy Converter Performance. 49. Nova Scotia Power.

4. Fisher J, Pegg K, *Hoevenaars E, Crawford C et al. (2011). Renewable Power Generation Conceptual Plan for Ogden Point, Victoria. 29. Jordan Fisher & Associates.

Conference Publications

1. Fluck M, Crawford C. (2016). A stochastic aerodynamic model for stationary bladesin unsteady 3D wind fields. Journal of Phsyics: Conference Series. The Science of Making Torque from Wind, Munich, Germany
Conference Date: 2016/10
Paper
Published
Refereed?: Yes, Invited?: No

2. Amid P, Crawford C. (2016). Cumulant-based Probabilistic Load Flow Analysis ofWind Power and Electric Cars. 2016 International Conference on Probabilistic Methods Applied to Power Systems (PMAPS), Beijing, China
   Conference Date: 2016/10
   Paper
   Published
   Refereed?: Yes, Invited?: No

3. Mustafa G, Crawford C, Suleman A. (2016). Design of Composite Pressure Vessels Using the M-SaP and Bayesian Inference Approach. ICCS19, Porto, Portugal
   Conference Date: 2016/9
   Paper
   Published
   Refereed?: Yes, Invited?: No

4. Lajevardi M, Crawford C. (2016). Exploring the Transitional Role of B.C. NaturalGas Supply in Transportation and HVAC Systems. CSME International Congress, Symposium on Advanced Energy Systems, Kelowna, Canada
   Conference Date: 2016/6
   Paper
   Published
   Refereed?: Yes, Invited?: No

5. Tehrani N, Khan U, Crawford C. (2016). Baseline Load Forecasting Using a Bayesian Approach. 2016 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE), Vancouver, Canada
   Conference Date: 2016/5
   Paper
   Published
   Refereed?: Yes, Invited?: No

6. Mustafa G, Suleman A, Crawford C. (2016). Probabilistic First Ply Failure Analysis of WindTurbine Blade Laminates. AIAA SciTech, San Diego, United States
   Conference Date: 2016/1
   Paper
   Published
   Refereed?: Yes, Invited?: No

7. Fluck M, Crawford C. (2016). Exploring Stochastic Models for Fast Analysis ofUnsteady Wing Aerodynamics. AIAA SciTech, San Diego, United States
   Conference Date: 2016/1
   Paper
   Published
   Refereed?: Yes, Invited?: No

8. Behboodi S, Chassin D, Crawford C, Djilali N. (2016). Electric Vehicle Participation in TransactivePower Systems Using Real-time Retail Prices. 49th Hawaii International Conference on System Sciences, Hawaii, United States
   Conference Date: 2016/1
   Paper
   Published
   Refereed?: Yes, Invited?: No

9. Mishra V, Beatty S, Oshkai P, Buckham B, Crawford C. (2015). CFD Simulation of an Oscillating WEC using ArbitraryMesh Interface. 11th European Wave and Tidal Energy Conference, Nantes, France
Conference Date: 2015/9
Paper
Published
Refereed?: Yes, Invited?: No

10. Shives M, Crawford C. (2014). Turbulence Modelling for Accurate WakePrediction in Tidal Turbine Arrays. 5th International Conference on Ocean Energy, Halifax, Canada
Conference Date: 2014/11
Paper
Published
Refereed?: Yes, Invited?: No

11. *Mustafa G, Ha S K, Crawford C et al. (2013). Micromechanics investigation of wind turbine blade fatigue behavior considering multi-axial loading. the Proceedings. 54th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Boston, United States
Conference Date: 2013/4
Paper
Submitted
Refereed?: Yes, Invited?: No

12. *McWilliam M K, *Lawton S, Crawford C A. (2013). An implicit model for Lagrangian vortex dynamics for horizontal axis wind turbine design optimization. in the Proceedings. 54th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Boston, United States
Conference Date: 2013/4
Paper
Published
Refereed?: Yes, Invited?: No

13. *Lawton S, Crawford C A et al. (2013). An analysis of an implicit vortex method for wind turbine wake modeling. the Proceedings. 32nd ASME Wind Energy Symposium/51st AIAA Aerospace Sciences Meeting and Exhibit, Grapevine, United States
Conference Date: 2013/1
Paper
Accepted
Refereed?: Yes, Invited?: No

14. *McWilliam M K, Crawford C A et al. (2013). Composite lay-up optimization for horizontal axis wind turbine blades. the Proceedings. 32nd ASME Wind Energy Symposium/51st AIAA Aerospace Sciences Meeting and Exhibit, Grapevine, United States
Conference Date: 2013/1
Paper
Accepted
Refereed?: Yes, Invited?: No

15. Michael K. McWilliam and Stephen Lawton and Curran A. Crawford. (2013). Towards a framework for aeroelastic multidisciplinary design optimization of horizontal axis wind turbines. the Proceedings. 32nd ASME Wind Energy Symposium/51st AIAA Aerospace Sciences Meeting and Exhibit, Grapevine, United States
Conference Date: 2013/1
Paper
Accepted
Refereed?: Yes, Invited?: No

16. *Kaban S, *Killy D, *Prescott D, *Nelford J, Crawford C A, Dong Z. (2012). An Innovative 4WD PHEV Utilizing a Series-parallel Multiple-regime Architecture. the Proceedings of SAE Powertrains, Fuels and Lubricants Meeting. SAE 2012 Powertrains, Fuels and Lubricants Meeting, Malmo, Sweden
Conference Date: 2012/9
Paper
Published
Refereed?: Yes, Invited?: No

17. *Hall M, Buckham B, Crawford C A. (2012). Genetic Algorithm-based Platform Optimization for Floating Offshore Wind Turbines. the Proceedings of 11th International Conference on SET 2012. 11th International Conference on Sustainable Energy Technologies (SET 2012), Vancouver, Canada
Conference Date: 2012/9
Paper
Published
Refereed?: Yes, Invited?: No

18. *Younis A, *Williams T, Wang D, Dong Z, Crawford C, Djilali N. (2012). Optimization of a Self-regulating Smart Distribution Grid. the Proceedings of 11th International Conference on SET 2012. 11th International Conference on Sustainable Energy Technologies (SET 2012), Vancouver, Canada
Conference Date: 2012/9
Paper
Published
Refereed?: Yes, Invited?: No

19. *Ross D M, Crawford C A. (2012). PEV Charging in a Smart Grid Framework: Policy Drivers to Manage Load-Shaping and Environmental Impacts. International Battery, Hybrid and Fuel Cell Electric Vehicle Symposium (EVS26), Los Angeles, United States
Conference Date: 2012/5
Paper
Published
Refereed?: Yes, Invited?: No

20. *Paiva R M, Crawford C A, Suleman A. (2012). Robust and Reliability Based Design Optimization Framework for Wing Design. 53rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural dynamics, and Materials (SDM) Conference, 8th AIAA Multidisciplinary Design Optimization Specialist Conference, Honolulu, United States
Conference Date: 2012/4
Paper
Published
Refereed?: Yes, Invited?: No

21. *McWilliam M K, Crawford C. (2012). Adjoint Based Sensitivity Analysis for Geometrically Exact Beam Theory with Applications to Wind Turbine Design Optimization. 53rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials (SDM) Conference, 8th AIAA Multidisciplinary Design Optimization Specialist Conference, Honolulu, United States
Conference Date: 2012/4
Paper
Published
Refereed?: Yes, Invited?: No

22. *Lawton S, Crawford C. (2012). Development and Validation of Lib Aero, a Potential Flow Aerodynamics Library for Horizontal-Axis Wind Turbines. 31st ASME Wind Energy Symposium/50th AIAA Aerospace Sciences Meeting and Exhibit, Nashville, United States
Conference Date: 2012/1
Paper
Published
Refereed?: Yes, Invited?: No

23. *Hall M, Buckham B, Crawford C. (2012). Generalized Floating Wind Turbine Support Platform Optimization: A Basis Function Approach. 31st ASME Wind Energy Symposium/50th AIAA Aerospace Sciences Meeting and Exhibit, Nashville, United States
Conference Date: 2012/1
Paper
Published
Refereed?: Yes, Invited?: No

24. *Wang D, deWit B, *Parkinson S, Fuller J, Chassin D, Crawford C, Djilali N. (2012). A Test Bed for Self-regulating Distribution Systems: Modeling Integrated Renewable Energy and Demand Response in the GridLAB-D/MATLAB Environment. 3rd Conference on Innovative Smart Grid Technologies (ISGT), Washington,
Conference Date: 2012/1
Paper
Published
Refereed?: Yes, Invited?: No

25. *Dong J, Dong Z, Crawford C A. (2011). A Review of Continuously Variable Transmission Powertrain Systems for Hybrid Electric Vehicles. ASME 2011 International Mechanical Engineering Congress and Exposition, Denver, United States
Conference Date: 2011/11
Paper
Published
Refereed?: Yes, Invited?: No

26. *Zhang X, Dong Z, Crawford C A. (2011). Hybrid Energy Storage System for Hybrid and Electric Vehicles: Review and a New Control Strategy. ASME 2011 International Mechanical Engineering Congress and Exposition, Denver, United States
Conference Date: 2011/11
Paper
Published
Refereed?: Yes, Invited?: No

27. *Lawton S, *McWilliam M, Crawford C. (2011). Optimal Aeroelastic Wind Turbine Design. CanWEA 2011 Conference and Exhibition, Vancouver, Canada
Conference Date: 2011/11
Paper
Published
Refereed?: No, Invited?: No

28. *McWilliam M, Crawford C, vanKooten G C,. (2011). Wind Farm Siting at the Provincial Level. CanWEA 2011 Conference and Exhibition, Vancouver, Canada
Conference Date: 2011/11
Paper
Published
Refereed?: No, Invited?: No

29. *Wild K, Crawford C. (2011). Coupled Operation of a Wind Farm Pumped Storage Facility: A Case Study in British Columbia. 6th International Renewable Energy Storage Conference and Exhibition, Berlin, Germany
Conference Date: 2011/11
Paper
Published
Refereed?: No, Invited?: No

30. *Zheng L, *Parkinson S, *Wang D, Cai L, Crawford C A. (2011). Energy Efficient Communication Networks Design for Demand Response in Smart Grid. International Conference on Wireless Communications and Signal Processing (WCSP), Nanjing, China
Conference Date: 2011/11
Paper
Published
Refereed?: Yes, Invited?: No

31. *Hall M, Buckham B, Crawford C A, Nicoll R. (2011). The Accuracy of Quasi-Static Mooring Line Models in Floating Wind Turbine Simulations. 3rd Annual New England Marine Renewable Energy Center (MREC) Technical Conference, Cambridge, United States
Conference Date: 2011/11
Paper
Published
Refereed?: No, Invited?: No

32. *Ross D M, Crawford C. (2011). Smart Grid Deployment in BC: A Case Study. EV2011 Conference and Trade Show, Montreal, Canada
Conference Date: 2011/9
Paper
Published
Refereed?: Yes, Invited?: No

33. *Hall M, Buckham B, Crawford C, Nicoll R S. (2011). The Importance of Mooring Line Model Fidelity in floating Wind Turbine Simulations. MTS/IEEE OCEANS, Kona, United States
Conference Date: 2011/9
Paper
Published
Refereed?: Yes, Invited?: No

34. *Parkinson S, *Wang D, Crawford C, Djilali N. (2011). Comfort-constrained Distributed Heat Pump Management. IEEE ICSGCE, Chendu, China
Conference Date: 2011/9
Paper
Published
Refereed?: Yes, Invited?: No

35. *Ross D M, Miller S, Sima M, Crawford C. (2011). Design Rules for Implementing CORDIC on FPGAS. 2011 IEEE Pacific Rim Conference on Communications, Computers and Signal Processing, Victoria, Canada
Conference Date: 2011/8
Paper
Published
Refereed?: Yes, Invited?: No

36. *Shives M, Crawford C. (2011). Ducted Turbine Blade Optimization Using Numerical Simulation. ISOPE-2011 International Offshore and Polar Engineering Conference, Maui, United States
Conference Date: 2011/6
Paper
Published
Refereed?: Yes, Invited?: No

37. *Kormos C, Gifford R, Crawford C. (2011). Psychological Influences on the Acceptance of New Energy Technologies: An Investigation of the Plug-in Hybrid Electric Vehicle. Canadian Psychology Annual Convention Issue. Canadian Psychology Annual Convention Issue, Toronto, Canada
Conference Date: 2011/6
Paper
Published
Refereed?: Yes, Invited?: No

38. *Waldner J, *Wise J, Crawford C, Dong Z. (2011). Development and Testing of the UVic EcoCAR Advanced Plug-In Hybrid Electric Vehicle. SAE 2011 World Congress & Exhibition, Detroit, United States
Conference Date: 2011/4
Paper
Published
Refereed?: Yes, Invited?: No

39. *Cline S, *McWilliam M K, *Lawton S, Crawford C. (2011). Validation of Potential Flow Aerodynamics for Horizontal-Axis Wind Turbines in Steady Conditions Using the MEXICO Project Experimental Data. 30th ASME Wind Energy Symposium/49th AIAA Aerospace Sciences Meeting and Exhibit, Orlando, United States
Conference Date: 2011/1
Paper
Published
Refereed?: Yes, Invited?: No

40. *Lillo P, Crawford C. (2011). Analysis of Fatigue Loads of Wind Turbine Blades Subject to Cold Weather Conditions Using a Finite Element Model. 30th ASME Wind Energy Symposium/49th AIAA Aerospace Sciences Meeting and Exhibit, Orlando, United States
Conference Date: 2011/1
Paper
Published
Refereed?: Yes, Invited?: No

41. *McWilliam M K, *Lawton S, *Cline S, Crawford C. (2011). A Corrected Blade Element Momentum Method for Simulating Wind Turbines in Yawed Flow. 30th ASME Wind Energy Symposium/49th AIAA Aerospace Sciences Meeting and Exhibit, Orlando, United States
Conference Date: 2011/1
Paper
Published
Refereed?: Yes, Invited?: No

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Date Submitted: 2017-03-01 15:09:19
Confirmation Number: 659982
Template: NSERC_Researcher

Dr. Charles Curry

Correspondence language: English

Contact Information

The primary information is denoted by (*)

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Primary Affiliation (*)

Pacific Climate Impacts Consortium
University House 1
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NSERC CRSNG

Canadian Common CV commun canadien

Protected when completed

Dr. Charles Curry

Language Skills

Language	Read	Write	Speak	Understand	Peer Review
English	Yes	Yes	Yes	Yes	Yes
French	Yes	No	No	Yes	No

Degrees

- 1995/9 Doctorate, Astrophysics, McMaster University
- 1990/6 Master's Thesis, Physics, Queen's University at Kingston
- 1988/6 Bachelor's Honours, Physics and Mathematics, Saint Mary's University

User Profile

Research Specialization Keywords: Climate science, hydrology, atmospheric physics

Employment

2016/4
Research Associate
Pacific Climate Impacts Consortium, University of Victoria
Full-time
Tenure Status: Non Tenure Track

2010/7
Adjunct Professor
School of Earth and Ocean Sciences, University of Victoria
Part-time, Adjunct
Tenure Status: Non Tenure Track

2011/7 - 2016/3
Research Associate
School of Earth and Ocean Sciences, University of Victoria
Full-time
Tenure Status: Non Tenure Track

2008/9 - 2011/6
Research Scientist (SE-RES-02)
Canadian Centre for Climate Modelling and Analysis, Environment Canada

2008/4 - 2008/7
Postdoctoral Intern
School of Earth and Ocean Sciences, University of Victoria
Full-time, Term
Tenure Status: Non Tenure Track

2003/1 - 2008/3
Research Associate
School of Earth and Ocean Sciences, University of Victoria
Full-time, Term
Tenure Status: Non Tenure Track

Research Funding History

Awarded [n=1]

2010/1 - 2010/8
Co-applicant

Impact of projected climate change on surface winds over British Columbia, Grant

Funding Sources:

2010/1 - 2010/8 Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)
Knowledge Synthesis Grant
Total Funding - 40,000
Portion of Funding Received - 0
Funding Competitive?: Yes

Principal Applicant : Adam H. Monahan

Student/Postdoctoral Supervision

Master's Thesis [n=1]

2012/9 - 2015/9
Co-Supervisor

Jeffrey Daines (Completed) , University of Victoria
Thesis/Project Title: Present and Future Wind Energy Resources in Western Canada

Presentations

1. (2015). Does increased resolution alone add value in RCM simulations of climate extremes? A multi-scale study over western Canada. CMOS Annual Congress, Whistler, Canada
   Main Audience: Researcher
   Invited?: No, Keynote?: No
2. (2014). Quantifying uncertainty in regional climate model projections over Western Canadian watersheds. 3rd International Lund Regional-Scale Climate Modelling Workshop, Lund, Sweden
   Main Audience: Researcher
   Invited?: No, Keynote?: No
3. (2014). A multimodel study of climate extremes in an idealized geoengineering experiment. Climate Engineering Conference 2014, Berlin, Germany
   Main Audience: Researcher
   Invited?: No, Keynote?: No

Publications

Journal Articles

1. A. Lew, P. von Aderkas, A. Berland, C.L. Curry, D. Kolotelo, T. Lacourse, B. Tencer and A.J. Weaver. (2017). An assessment of Pinus contorta seed production in British Columbia: Geographic variation and dynamically-downscaled climate correlates from the CanadianRegional Climate Model. Agricultural and Forest Meteorology.
   Published
   Refereed?: Yes

2. C.L. Curry, B. Tencer, K. Whan, A. J. Weaver, M. Giguère and E. Wiebe. (2016). Searching for added value in simulating climate extremes with a high-resolution regional climate model. II:Results at the basin scale. Atmosphere-Ocean.
Published
Refereed?: Yes

3. Saunois, M., Bousquet, P., Poulter, B., Peregon, A., Ciais, P., Canadell, J. G., ..., Curry, C.L., ... & Janssens-Maenhout, G.(2016). The Global Methane Budget, 2000-2012. Earth System Science Data. 8(2): 697-751.
Published
Refereed?: Yes

4. C.L. Curry, B. Tencer, K. Whan, A. J. Weaver, M. Giguère and E. Wiebe. (2016). Searching for added value insimulating climate extremes with a high-resolution regional climate model overWestern Canada: I. Large scale results. Atmosphere-Ocean.
Published
Refereed?: Yes

5. J. T. Daines, A.H. Monahan and C.L. Curry. (2016). Model-Based Projections and Uncertainties of Near-Surface Wind Climate in Western Canada. J. of Applied Meteorology and Climatology.
Published
Refereed?: Yes

6. C.L. Curry, J. Sillmann, D. Bronaugh, and 11 coauthors. (2014). A multi-model examination of climate extremes in an idealized geoengineering experiment. J. Geophys. Res.: Atmospheres.
Published
Refereed?: Yes

7. B. Kravitz, ... , C.L. Curry [9th of 24 authors], et al.(2014). Climate model response from the Geoengineering Model Intercomparison Project (GeoMIP). J. Geophys. Res.: Atmospheres.
Published
Refereed?: Yes

8. B. Kravitz, ... , C.L. Curry [7th of 18 coauthors], et al.(2014). A multi-model assessment of regional climate disparities caused by solar geoengineering. Environmental Research Letters. 9
Published
Refereed?: Yes

9. S.R. Haughian, P.J. Burton, S.W. Taylor, and C. Curry. (2012). Expected effects of climate change on forest disturbance regimes in British Columbia. Journal of Ecosystems and Management. 13: 16-38.
Published
Refereed?: Yes

10. D. van der Kamp, C.L. Curry, and A.H. Monahan. (2011). Statistical downscaling of historical monthly mean winds over a coastal region of complex terrain. II. Predicting wind components. Climate Dynamics.
Published
Refereed?: Yes

11. C.L. Curry, D. van der Kamp, and A.H. Monahan. (2011). Statistical downscaling of historical monthly mean winds over a coastal region of complex terrain. I. Predicting wind speed. Climate Dynamics.
Published
Refereed?: Yes

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School of Earth and Ocean Sciences
University of Victoria
PO Box 1700 STN CSC
Victoria BC V8W 2Y2
Canada

Via E-Mail: monahana@uvic.ca

World Meteorological Organization
Weather · Climate · Water

WWRP WORLD WEATHER RESEARCH PROGRAMME

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International Coordination Office for Polar Prediction
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(Direktorin)
Dr. Karsten Wurr
(Verwaltungsdirektor)
Dr. Uwe Nixdorf
(Stellvertretender Direktor)
Prof. Dr. Karen H. Wiltshire
(Stellvertretende Direktorin)

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HELMHOLTZ GEMEINSCHAFT

06.03.17

YOPP Endorsement for ***Predicting the Future(s) of Renewable Energy in Canada's North – PFRECaN***

Dear Dr Monahan,

Following your application for YOPP endorsement, the PPP steering group has reviewed your request taking into account the following criteria:

- The project addresses or contributes to the general YOPP objectives as outlined in the YOPP Implementation Plan.
- The project acknowledges the importance of close coordination of all planned YOPP activities.
- There is agreement that a summary of the planned activities of the endorsed projects/programmes/initiatives (including their logos, if applicable) will be made public through the website of the International Coordination Office (ICO) and other appropriate means.
- Open data sharing is an important element of the project and the project data relevant to YOPP will be made available in alignment with the YOPP data strategy as outlined in the YOPP Summit report (see http://www.polarprediction.net/yopp/yopp-summit/).
- The project researchers agree to support the work of the PPP Societal and Economic Research Applications (SERA) subcommittee, e.g., by interviews, discussions, surveys or other means of communication should they be contacted by PPP-SERA.
- There is agreement that points of contact have the obligation to inform the ICO about possible changes to the project.

It is my pleasure to let you know that the PPP steering group unanimously agreed to endorse *PFRECaN*. The activities make substantial contributions to YOPP.

Please note that the endorsement will be made public through the website of the International Coordination Office (http://www.polarpredicton.net).

Yours sincerely,

(Thomas Jung, Chair of the Polar Prediction Project)

David E. Atkinson
Associate Professor
Department of Geography
David Turpin Building
University of Victoria
Victoria, British Columbia, Canada

March 6, 2017

Dear David,

I am providing this letter in support of the project "Predicting the Future(s) of Renewable Energy in Canada's Arctic", proposed by University of Victoria in partnership with University of Québec at Montréal and University of Alaska Fairbanks.

The Government of the Northwest Territories is partnering with Northwest Territories Power Corporation to explore renewable energy options for Northern communities. We are exploring the option of establishing a wind-power monitoring station at Sachs Harbour. I see from your proposal that, at Sachs Harbour, you would be undertaking analyses of turbulence, icing potential, power and structural engineering issues, and now this local area is represented in numerical models of the atmosphere, which can lead to long-term forecasting potential. Your work is of great interest to us; it would be of benefit to us to have additional eyes on this effort. These things will strengthen the overall effort and will contribute to ensuring that renewable solutions are effective and robust. I also note the potential to improve predictive capacity by validating model operation with ground observations. We welcome any work that can improve weather prediction in the North.

GNWT would be happy to collaborate to share data, analyses and results from the project. GNWT would not be able to provide fiscal resources directly to your project.

We are excited about the potential to work together to improve Northerners' access to clean energy options and to improve the operation of atmospheric models for short- and long-term prediction.

All the best,

Geraldine Byrne
Manager, Energy Research and Development
Energy Division
Public Works and Services
Government of the Northwest Territories
Yellowknife, NT

Government of
Northwest Territories

Hydro-Québec
IREQ
1800 boulevard Lionel-Boulet
Varennes
Québec

Varennes, March 2nd 2017

Selection Committee
Year of Polar Prediction (YOPP)

Object : Hydro-Québec's support to Professor Monahan's proposal entitled : "The Future(s) of Renewable Energy in Canada's North"

To the Year of Polar Prediction selection committee,

Hydro-Québec is pleased to express its support for the project submitted by Pr. Monahan and colleagues to the Call for Research Proposals of the Year of Polar Prediction (YOPP) 2017-2020.

As you may be aware, Hydro-Québec is providing electricity to customers in Québec and neighboring Provinces and States in the Northeast of the continent. As per communities and industries in remote areas, such as the ones in Northern Québec, the Québec state owned utility is producing electricity from fossil fuel generating units. Given the drawbacks associated with such sources of energy, it is suitable and foreseen to investigate further how new renewable energies could contribute to bring a sound and sustainable energy source.

With respect to professor Monahan's proposal Hydro-Québec is mostly interested in two work packages, i) the "*future projections of wind power and irradiance, and their potential complementarity*", and 2) the "*integration of renewables into the energy systems of Northern communities*", since this information will be much valuable in planning the new generating installations that will eventually provide electricity to remote areas. Given the fact that this research project involves multidisciplinary interactions between climate modelers, field-based atmospheric observationalists, we expect to access to global, integrated and practical solutions to cope with energetic challenges in a changing climate.

We are looking forward to the opportunities provided by the Year of Polar Prediction call for proposals to continue and further develop collaboration with professor Monahan and collaborators towards addressing research gaps and issues affecting communities in Northern areas.

Sincerely,

René Roy
Program Manager, Climate Change
Institut de recherche
Hydro-Québec

Manitoba Hydro

360 Portage Ave (14) • Winnipeg Manitoba Canada • R3C 0G8
Telephone / *N° de téléphone :* 204-360-3221 • Fax / *N° de télécopieur :* 204-360-6146
rvorr@hydro.mb.ca

2017 03 03

Selection Committee
Year of Polar Prediction (YOPP)

RE: MANITOBA HYDRO'S SUPPORT TO PROFESSOR MONAHAN'S PROPOSAL TITLED: "THE FUTURE(S) OF RENEWABLE ENERGY IN CANADA'S NORTH"

This letter expresses Manitoba Hydro's support for Professor Adam Monahan's proposal titled: "The Future(s) of Renewable Energy in Canada's North". Manitoba Hydro is a provincial Crown Corporation that generates, transmits, and distributes over 5200 Megawatts (MW) of electricity from 15 hydroelectric generating stations. Electricity is also produced via diesel generators at four remote northern communities and purchased, under agreement, from two Manitoba wind farms.

Results from this project will provide an enhanced understanding of climate change impacts on wind and solar energy production which can then be considered in climate change adaptation studies. Manitoba Hydro is primarily interested in project deliverables related to (i) the projection of future renewable energy resources (wind and solar) including their forced change, natural internal variability, and potential compensation, and (ii) the integration of renewables into the electricity supply of northern communities and the investigation of the performance of generation systems in Arctic conditions. Manitoba Hydro also employs the Canadian Regional Climate Model (CRCM) in its climate change impacts studies and as such is interested in project deliverables related to improving CRCM prediction capacity.

For the above reasons, we support Professor Monahan's proposal and hope for a successful application.

Yours truly,

Rhonda Orr, P. Eng.
Research & Development Manager

R.V.O/mjfv

CC: Efrem Tekiemariam, M.Sc., P.Eng.
Kristina Koenig, M.Sc., P.Eng.
Michael J.F. Vieira, M.Sc., P.Eng.

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March 2, 2017

To: MEOPAR-YOPP Proposal Committee

Re: Proposal "Predicting the Future(s) of Renewable Energy in Canada's Arctic"

I am writing this letter on behalf of the World Wildlife Find (WWF), in support of the proposal "Predicting the Future(s) of Renewable Energy in Canada's Arctic" submitted in response to the MEOPAR-Year of Polar Prediction call for proposals.

As part of its commitment to work for Arctic conservation, WWF (in partnership with the Waterloo Institute for Sustainable Energy) has recently undertaken a feasibility analysis of the use of renewable energy sources (wind and solar) in a number of Northern communities. A detailed economic analysis has demonstrated the cost-effectiveness of adopting renewables in these communities, with the added benefit of also reducing emissions of greenhouse gases and other pollutants (such as black carbon).

The economic analysis carried out in our study used a 25-year planning horizon based on historical meteorological observations. It is well known that climate change is more rapid in the Arctic than elsewhere on Earth, and that environmental conditions in 2040 may differ considerably from those in 2015. The predictions of future Arctic wind and solar power conditions to be carried out in this proposed research are a valuable complement to the work that we have done. In particular, the extended feasibility assessment accounting for future environmental variability and novel renewable energy generation systems will provide useful guidance for WWF as we work to our goal to deploy low-impact, community-wide habitat-friendly renewable energy technologies in at least three northern communities by 2020. The investigators have committed to provide WWF with a summary document of the results obtained by this research to help us toward this end.

On behalf of WWF-Canada, I strongly support this proposed research.

Sincerely,

Farid Sharifi
Senior Specialist, Renewable Energy

Montreal, March 2, 2017

Object: Support for Professor Monahan's proposal: 'The Future of Renewable Energy in Canada's North'.

To the Year of Polar Prediction selection committee,

On behalf of Ouranos, I would like to express our support for the project proposed by Pr. Monahan and colleagues to the Call for Research Proposals of the Year of Polar Prediction (YOPP) 2017-2020.

Ouranos was created in 2001 as a joint initiative by the Quebec government and other institutional partners. The Consortium (http://www.ouranos.ca) exists thanks to fourteen members: eight Ministries from the Québec Government, four Quebec universities, Hydro-Québec and Environment and Climate Change Canada and six affiliated members -two Quebec universities, Manitoba Hydro, Ontario Power Generation (OPG), Rio Tinto and the Metropolitan Community of Quebec. Ouranos' mission is to acquire and develop knowledge on climate change, its impact and related socioeconomic and environmental vulnerabilities, in order to inform decision makers about probable climate trends and advise them on identifying, assessing, promoting and implementing local and regional adaptation strategies.

Ouranos is a boundary organisation between scientific research on climate change and the implementation of adaptation strategies. It works closely with research institutions and stakeholders to develop projects whose results will promote adaptation activities in Canada.

Ouranos is particularly interested in the evolution of climate over Northern Canada and Quebec. Wind power, wind turbulence and the consideration of renewable energies for the northern communities proposed in this project represent very relevant topics that should be addressed. Moreover, the planned work to improve the boundary layer physics in the Canadian Regional Climate Model (CRCM5) will be of great use to Ouranos since we have chosen to use this model to produce regional climate change projections for our impact projects. Such a development will help generate more realistic climate information for decision makers, as impacts of climate change are felt by humans who live near the surface (in the boundary layer). The fact that this research project involves multidisciplinary interactions between climate modellers, field-based atmospheric observationalists, and engineers will ensure that practical solutions are proposed to help us develop tools and strategies to adapt to climate change; this will be beneficial to society.

550 Sherbrooke West, 19th floor, Montreal, Quebec H3A 1B9
Telephone: 514 282-6464 | Fax: 514 282-7131

To support this project, Ouranos can provide office space for students attached to participating universities, an approach that has proven in the past to be beneficial to both parties, as it allows us to follow more closely the development of the work, to learn from it and to contribute with useful scientific input. Ouranos is interested in following the project so that we can learn from it and through knowledge transfer, such tools will help the organization better inform its members and decision makers to plan and to adapt to climate change.

I will reiterate our interest and would strongly recommend the selection committee to give positive consideration to the proposed project by Pr. Monahan and colleagues, which will prepare northern Canadian communities for climate change.

Sincerely,

Alain Bourque,

Executive Director

550 Sherbrooke West, 19th floor, Montreal, Quebec H3A 1B9
Telephone: 514 282-6464 | Fax: 514 282-7131

Sonny Banjac, Consultant, Renewable Energy
Specializing in wind and solar projects in high latitudes & remote communities
M: 604-803-0719 | **E:** sabanjac@gmail.com
https://www.linkedin.com/in/sonnybanjac

March 3, 2017

Curran Crawford PhD PEng
Associate Professor
Graduate Program Director | Department of Mechanical Engineering | University of Victoria
Sustainable Systems Design Lab | Institute for Integrated Energy Systems
Office: EOW Building Rm 537
Mail: Department of Mechanical Engineering | University of Victoria | PO Box 1700 STN CSC | Victoria, BC Canada V8W 2Y2
Courier: 3800 Finnerty Road (Ring Road)

RE: Letter of Support for University of Victoria's participation on Arctic community wind

Dear Dr. Crawford,

I am writing this letter to express support in your grant funding application intended to evaluate wind resource and wind energy potential in Northern/Arctic communities.

I am a renewable energy consultant with over six years of experience leading projects and initiatives in the North. I specialize in the facilitating and developing wind and solar energy projects in high latitudes, in off-grid communities often working directly for First Nations and Inuit groups. Over the years I have gained a unique understanding of the environmental, social and technical challenges that need to be overcome for renewable energy projects to be realized in remote locations in high latitudes. With that I am pleased and honored to assist you as an expert advisor on wind and solar energy evaluation on this project.

Presently, I am leading project development activates for a number of renewable-diesel-battery projects in off-grid communities in the Nunavut, Northwest Territories, and Yukon. Earlier last year, I assembled a team of senior Northern renewable energy consultants and wrote the bid that was awarded the contract by Qulliq Energy Corporation (QEC) to evaluate the wind energy potential in 25 communities in Nunavut. Since the completion of the study, working as an independent consultant for two Inuit business organizations, I have advanced two of the projects Sanikiluaq and Iqaluit secured $112,000 in grant funding in the process to aid the development work. Our study for QEC showed that there are over a dozen communities that have potential for wind energy in low penetration scenario (meaning instantaneous penetration of wind energy is below 20%). We did HOMER modeling for high-penetration of wind-diesel-battery projects for top 5 communities (Iqaluit and Sanikiluaq being most promising big and small projects, 12.7MW and 400kW of wind respectively). The reason that we did HOMER modeling

for only 5 was to reduce costs on our client. However, communities such as Resolute Bay and many others also hold a great deal of potential for wind energy and warrant high-penetration modelling to be carried out.

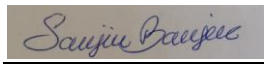
Previously, as a consultant for Sea Breeze Power Corp. and working closely with Government of Vuntut Gwitchin First Nation, I advanced a solar photovoltaic-diesel-storage project in the fly-in only community of Old Crow, Yukon. I started this project and managed it from the conceptualization phase all the way through the feasibility stage, securing over $150,000 from Indigenous and Northern Affairs Canada, Bullfrog Power and other sources to fund the work. Although where wind energy is economically feasible it will be preferred means of displacing diesel (due to parallels with the load which is winter peaking, versus solar which is summer peaking), looking at what is possible and will eventually be built in Old Crow, I can say that such system makes a lot of sense in many communities in Nunavut and Northwest Territories that suffer from high cost of electricity. In places where our QEC study showed non-economic wind opportunity solar should be pursued as it will still allow diesel displacement of 10-20% annually in economic manner, depending on latitude and other factors,.

In regards to the off-grid communities, according to NRCan's 2011 report on remote communities in Canada there are 292 remote communities with combined population of 194 thousand that are not connected to the North American grid and are largely dependent on diesel and other fossil fuels for electricity generation. Total installed fossil fuels generation capacity in these remote communities stands at 453 megawatts with 90 million litres of fossil fuel being purchased annually by the remote communities. Electricity rates depend on many factors including the size of the community, distance from major centres and the market cost of diesel, but the average cost of diesel generation is CAD $0.46/kWh and significantly higher in the more remote locations. All of this points to the need to find a more economic and more environmentally friendly means of generation.

Many of these communities are populated predominantly by First Nations peoples. There are many different First Nations in Canada, but all share the same respect for the environment and are committed to following in the sustainable path of their ancestors. The adoption of renewable technologies, such as wind energy, is aligned with these beliefs. Unfortunately, most of these communities do not have the capacity to undertake renewable energy projects on their own and are dependent on grant funding for economic support and on the knowledge of consultants such as myself.

As a developer of renewable energy projects in off-grid and remote communities, I am interested in supporting initiatives that will enable wide spread implementation of renewables in the remote communities in elsewhere with aim of transitioning from fossil fuel dependent generation. I therefore look forward to contributing to this project.

Kind Regards,



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Topic: Letter of Support for Application to MEOPAR Call for Research Proposals

Dear Dr. Crawford,

After reviewing your research plan, approach and deliverables for this proposal I would like to offer this letter of support on behalf of TwingTec. The research topics you plan to undertake during this work are highly important for the adoption of TwingTec's airborne wind energy technology to northern applications as well as to renewable energy adoption in the north in general. Potential variations in the available wind resources represent one of the largests risks to the economic evaluation of renewable energy projects and any efforts that can be made to better understand them are well worthwhile.

As you know, TwingTec is developing a mobile wind energy technology aimed at using tethered to harness the stronger and more consistent winds at higher altitudes. This technology is uniquely suited to Northern applications due to the low transportation and installation costs as well as the lower environmental impact compared to conventional wind turbines. We are current in touch with numerous stakeholders in both Northern Communities and Mines and aim to start pilot testing in 2018. The development of a full scale, 100kW product is planned for 2019 which we plan to integrate into a first commercial project in 2020.

In order to better understand the technical and economic potential of our technology in Northern power supply applications, TwingTec has prepared a number of case studies. One of which was for Cambridge Bay, Nunavut, where we were very pleased to receive your detailed feedback. Many of the topics of investigation of the proposed project would help to significantly reduce the uncertainties around various aspects of the Cambridge Bay study such as resource availability, year to year variations as well as the challenges and costs of integrating the power into the existing diesel grid.

Best regards.

Corey Houle