PACIFIC CLIMATE IMPACTS CONSORTIUM

2013-2014 | CORPORATE REPORT

LOOKING BACK: 5 YEARS OF REGIONAL CLIMATE SERVICES

LOOKING BACK

FIVE YEARS OF REGIONAL CLIMATE SERVICES

A RETROSPECTIVE

PCIC received a renewed mandate effective 1 April 2014 based on a highly successful comprehensive 5-year review that was completed during fiscal year 2013-2014. This extended corporate report for 2013-2014 is based on the self-evaluation report that PCIC produced for the review. It therefore reports not only on PCIC's activities and the products and services that PCIC has delivered during the past year, but also takes the opportunity to provide a longer term retrospective view of how our capabilities have developed.

TODAY

PCIC STAFF, MARCH, 2014

Front row, left to right: James Hiebert, Arelia Werner, Trevor Murdock, Shelley Ma, Christian Seiler, Stephanie Saal, Francis Zwiers, Mohammad Reza Najafi.

Back row, left to right: Shaham Sharifian, Basil Veerman, Sanjiv Kumar, Faron Anslow, Stephen Sobie, Alex Cannon, Rajesh Shrestha, Michael Shumlich, Kirien Whan, David Bronaugh, Markus Schnorbus, Cassbreea Dewis.

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TIMELINE

SOME HIGHLIGHTS FROM PCIC'S HISTORY,1994-2014

2013-2014

Launched plain language PCIC Science Briefs

Launched Seasonal Climate Maps

Regional workshop on Atmospheric Rivers

New PRISM-based 800 m resolution climate normals for BC

Downscaled large ensemble of new CMIP5 climate projections to 10-km resolution with national coverage.

Significantly expanded data portal to deliver climate normals and downscaled scenarios

Glacier mass balance now operational within VIC Hydrologic Model

New regional climate summaries developed for BC's resource regions

Launched the PCIC Data Portal Page for Statistically Downscaled Climate Scenarios

Launched the PCIC Data Portal Page for Gridded Hydrologic Model Output

2012-2013

Launched the PCIC Data Portal Page for station data

Opened an open source software library

Downscaled climate data to examine streamflow extremes for four major BC basins

2011-2012

Hosted an international workshop on Regional Climate Services at UVic

Completed a 3-year evaluation of downscaling methods.

Completed a regional analysis for the Georgia Basin

Updated Plan2Adapt based on user feedback to include new base maps and an 'impacts' section.

2010-2011

Francis Zwiers began his term as PCIC Director

Partnered with the Columbia Basin Trust to analyze the impacts of extreme climate events on the region

Completed 4 year study in collaboration with BC Hydro assessing the impacts of temperature and precipitation changes on stream flow for three BC watersheds

Signed a three year agreement with the PRISM Climate Group at OSU to transfer high resolution climatological mapping technology to PCIC

2009-2010

Completed 3-year project studying the impacts of climate change on spruce and Douglas Fir forests in BC

Completed regional climate summary for City of Prince George

Signed the CRMP agreement with MoTI, MoFR, MoA, BCH & Rio Tinto and initiated the CAM theme;

PRE-2009

1994: CICS incorporated with a federal mandate to further the understanding of climate change and variability

2005: PCIC emerges as a project within CICS and the BC Ministry of Environment partnered first in a series of initial projects

2008: The BC Government grants a $90 million endowment to Uvic in support of PCIC and PICS.

2008: CICS becomes PCIC, an incorporated NPO, governed by UVic

2008: VIC hydrologic model brought to PCIC

2008: Hydroloclimate projections project initiated with BCH

MANDATE & STRATEGY

MANDATE

PCIC's mandate is to provide high-quality regional climate services to stakeholders in the Pacific and Yukon region of Canada. We are dedicated to ensuring the provision of high-quality quantitative, climate information. Motivated by our stakeholders' needs, PCIC both distils relevant findings from the global climate research community and performs applied, regional climate research.

STRATEGY

Because planning for the effects of climate change and variability involves a broad spectrum of users of climate-information with various needs and goals, PCIC offers an array of quantitative climate information, ranging from high-level regional overviews to raw observational data and climate model output.

PCIC aims to provide high quality climate services and information that are increasingly comprehensive, and to continually strengthen the underlying scientific basis for these products. We have carefully defined the strategic scope of the organization to help guide it towards these objectives. To this end, PCIC is organized around three scientific themes:

- Regional Climate Impacts
- Hydrologic Impacts
- Climate Analysis and Monitoring

In support of these themes, we have a computational support group and a communications and operations team.

This Corporate Report examines PCIC's progress and successes over the past five years.

GOVERNANCE

As a not-for-profit corporation, PCIC is committed to public and accountable access to climate information. A key component of PCIC's accountability rests in its governance structure, which includes its Board of Directors and its subcommittees.

The PCIC Board of Directors includes representatives from a wide range of disciplines, resulting in a balanced and rational strategic vision. The Board is responsible for the strategic review and oversight of the PCIC program and is chaired by the Vice-President Research of University of Victoria. Board membership includes representatives from the University of Victoria, the Provincial Government, the Federal Government, BC Hydro and Ouranos.

The Program Advisory Committee (PAC) consists of PCIC stakeholders and climate researchers. Members provide advice on the PCIC scientific program and priorities, stakeholder needs and participation in projects. PAC membership, which is determined on the basis of programmatic needs, currently includes representation from PICS, several BC government ministries, BC Hydro and Environment Canada. PAC membership is being expanded in 2014-15 and will include a broader range of stakeholders, including representatives from municipal and regional governments as well as the private sector.

Direction and the operation of the consortium is the responsibility of the President and CEO of the Corporation who is also the Director of PCIC. The Director reports to the Board of Directors and is advised by regular meetings of a Program Advisory Committee (PAC).

BOARD OF DIRECTORS, MARCH 2014

Howard Brunt (Chair), University of Victoria

Renata Kurschner (Vice Chair), BC Hydro

Alain Bourque, Ouranos

Don Barnhardt, University of Victoria

Carol Pendray, University of Victoria

James Mack, BC Ministry of Environment

Asit Mazumder, University of Victoria

Tom Pedersen, Pacific Institute for Climate Solutions

Terry Prowse, University of Victoria

Adam H. Monahan, University of Victoria

Paul Knowles, BC Ministry of Forests, Lands and Natural Resource Operations

Francis Zwiers (Director, President and CEO), PCIC

Cassbreea Dewis (Treasurer), PCIC

Jamie Millin (Secretary), University of Victoria

PROGRAMME ADVISORY COMMITTEE, MARCH 2014

Thomas White (Chair), BC Ministry of Environment

Greg Flato, Environment Canada

Brenda Goehring, BC Hydro

Dirk Nyland, BC Ministry of Transportation and Infrastructure

Stephanie Smith, BC Hydro

Dave Spittlehouse, BC Ministry of Forests, Lands and Natural Resource Operations

Lawrence Pitt, Pacific Institute of Climate Solutions

MESSAGE FROM THE CHAIR OF THE PCIC BOARD OF DIRECTORS

DR. DAVID CASTLE, VICE PRESIDENT RESEARCH, UVIC

The PCIC Corporate Report, a retrospective look at 2008-2014, provides an opportunity to introduce myself as the new Vice President Research at UVic and Chair of the PCIC Board to PCIC's stakeholders. I come to UVic and PCIC from the University of Edinburgh where I was a professor and Chair of Innovation in the Life Sciences, in the College of Humanities and Social Science and the College of Science, and Engineering Director of the Innogen Institute for Innovation Generation in the Life Sciences. There, my focus was on the exploration of the social and economic impact of life science innovation, including regulation, governance, intellectual property and knowledge management. Among my objectives for the coming year will be learning all I can about research organizations I will be leading at UVic and how I can harness my past experiences to add value and strength to them. To this end, I look forward to working with PCIC Director Francis Zwiers and his team.

PCIC is a distinctive and specialized organization that combines two of UVic's strengths: pursuing excellence in research and ensuring that research has social impact. Future climate variability, climate change, and adaptation to that change are among the greatest scientific and social challenges we face. As you read through this report I encourage you to reflect on the tremendous scientific and technical skill and dedication that has been required for PCIC to generate insights into these challenges in the 2008 – 2014 period covered by the report. The leadership and support of outgoing Board Chair, Dr. Howard Brunt, has certainly been a key factor in PCIC's success, and I am grateful for his stewardship as I take over as Board Chair. While I am new to UVic and PCIC, I recognize that the robust relationship between PCIC Management and the PCIC Board has been critical in developing PCIC into the thriving organization it is today.

MESSAGE FROM THE CHAIR OF THE PCIC ADVISORY COMMITTEE

THOMAS WHITE, MANAGER, SCIENCE AND ADAPTATION, CLIMATE ACTION SECRETARIAT, BC MINISTRY OF ENVIRONMENT

PCIC has enjoyed another successful year in 2013-2014. An important focus this year was answering the question "How can PCIC best meet users' needs for climate information?" by organizing a series of workshops engaging the PCIC user community to obtain feedback on PCIC's products and identify future needs. The outcome of this process will ensure PCIC continues to provide the excellent products and services its growing user base has come to expect.

This report reflects on PCIC's evolution as a regional climate service provider from 2008 to 2014, developing innovative products that meet the needs of users in British Columbia. Highlights from this period include:

- PCIC's in-house expertise has matured to include climatology, the development of climate change scenarios, hydrology, scientific computing, geographic information systems and communications.
- The first PCIC products were innovative answers to specialized users' needs for downscaled regional climate analyses and hydro-climatic modelling for major river basins in British Columbia. Over the years, PCIC's user base has grown steadily to include stakeholders at all levels of government, publicly- and privately-owned industries and the general public.
- PCIC has fostered enduring relationships with key stakeholders and partners such as BC Hydro, BC Government (Ministries of Environment; Agriculture; Transportation and Infrastructure; and Forests Land and Natural Resource Operations), the Ouranos Consortium and the Pacific Institute for Climate Solutions (PICS).

Most recently, PCIC has

- Released new datasets and maps, accessible through the online data portal, such as gridded climate data (PRISM) and statistically downscaled climate projections, to accompany station data released in 2012.
- Developed a monthly map product that displays differences (anomalies) between average weather conditions in different regions of BC and what was actually experienced.
- Organized, with PICS, a public briefing on the IPCC 5th Assessment Report, the physical science basis. The briefing reached an audience over 500 members of the media and public.
- Released summaries of the effects of climate on eight resource regions in BC.

I would like to thank all of the staff at PCIC for their efforts and commitment this past year, and recognize in particular their efforts to engage and collaborate with the user community to assess needs and priorities over the near term. I would also like to thank current and past members of PCIC's Program Advisory Committee, who have provided invaluable scientific and strategic advice concerning the PCIC program since 2008.

Happy reading!

MESSAGE FROM THE PCIC DIRECTOR

DR. FRANCIS ZWIERS

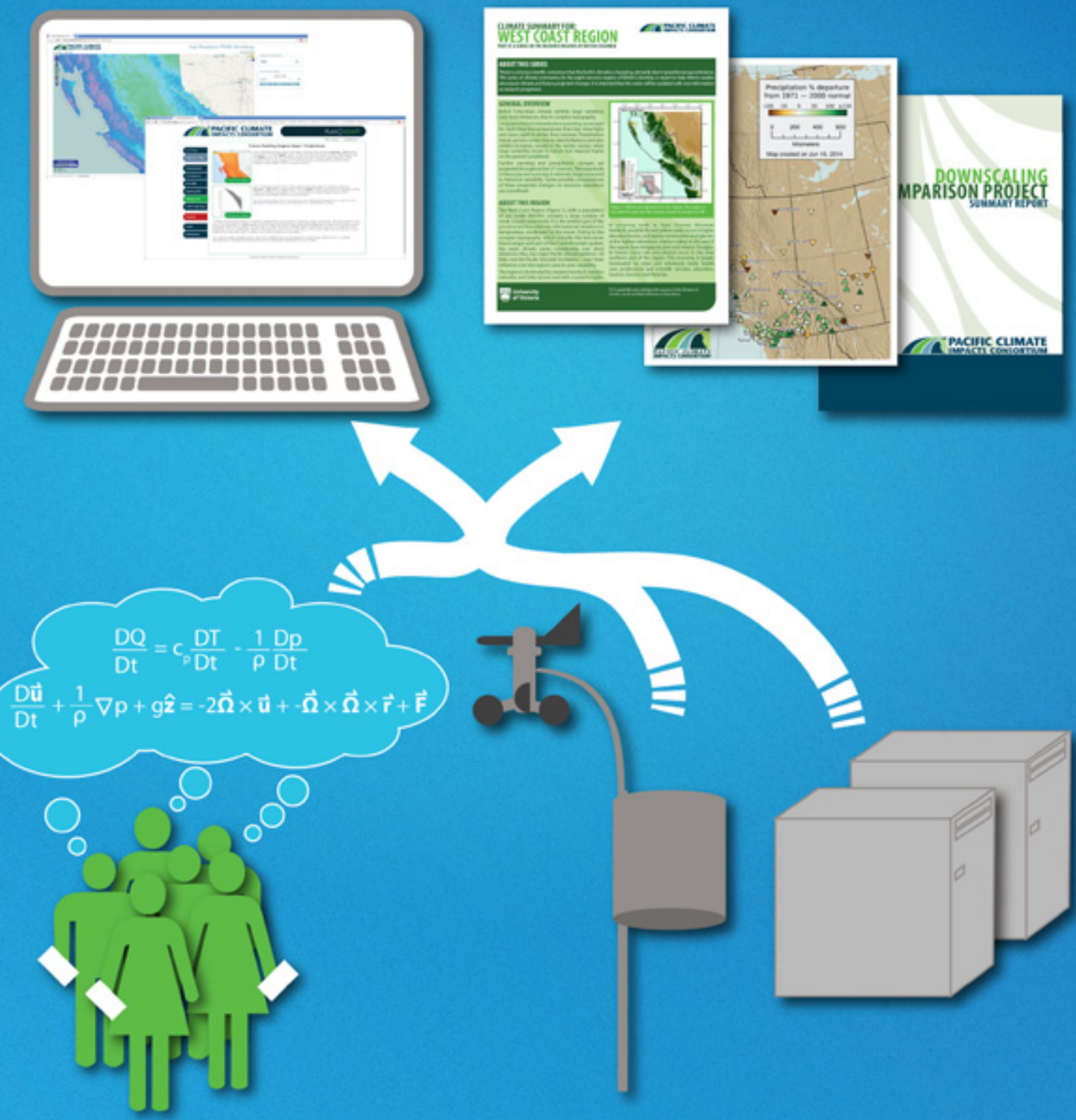
We are very appreciative of the continuing support for PCIC's mandate from the University and from all of our stakeholders and partners, both in terms of the renewed mandate that was obtained via the 5-year review process that we underwent in fiscal year 2013-1014 and the continuing and strong participation of our partners and stakeholders in PCIC's mission. During the past 5-years we have worked tirelessly to develop PCIC into a reliable and trusted climate service delivery organization, and this report demonstrates exactly how far we have come. With the help of our partners, we have developed an impressive capability to deliver climate services in multiple forms to broad audiences across the province and farther afield. This includes an increasing emphasis on high volume electronic information delivery via our data portals that are used by both the public and the expert community (including industry). In addition, we deliver service via interpretive tools such as Plan2Adapt, regular updates on the state of the evolving BC climate and the climate science literature, impacts assessments that are tailored to specific user needs, and our own solid contributions to climate science in the form of numerous peer reviewed publications.

None of this would be possible without the long-term stability that we have enjoyed as a consequence of the innovative way in which PCIC has been funded, as well as the continuing strong commitment of the University and our partners and stakeholders to PCIC, and an incredibly talented and dedicated team who collectively and consistently punch well above their weight. Their work responds to a need for comprehensive and authoritative climate information to support adaptation planning and decision making in BC that is becoming ever more apparent, as is made abundantly clear in the newly released reports of the Intergovernmental Panel on Climate Change.

It has been a humbling privilege to have had the opportunity to help guide PCIC's evolution over the past several years and to see its capabilities strengthen and mature in such a satisfying way. These are indispensible services that must be further developed and enhanced over time so that the Province will be able to successfully adapt to the inevitable climate changes that are in our future. I look forward to meeting that challenge with PCIC's dedicated staff and your continuing strong support as stakeholders, users and participants in the development of our services.

DELIVERING QUALITY CLIMATE SERVICES

CREDIBLE, HIGH-RESOLUTION AND USER-FRIENDLY



DATA DELIVERY

USER NEED: ENABLE THE OPEN EXCHANGE OF PAST AND FUTURE CLIMATE AND HYDROLOGIC DATA IN A VARIETY OF DATA FORMATS

Since 2008, PCIC has worked to establish data provision as a core service. At one time available only as an on request service, we have begun to fully automate complex data delivery on the PCIC website. This allows users to access both point and gridded data on demand for any purpose.

PAST OBSERVATIONS

PCIC STATION DATA PORTAL

370 million weather observations collected at more than 6700 BC locations available on a web portal and updated in "near real time."

HISTORICAL BASELINE CLIMATE AVERAGES

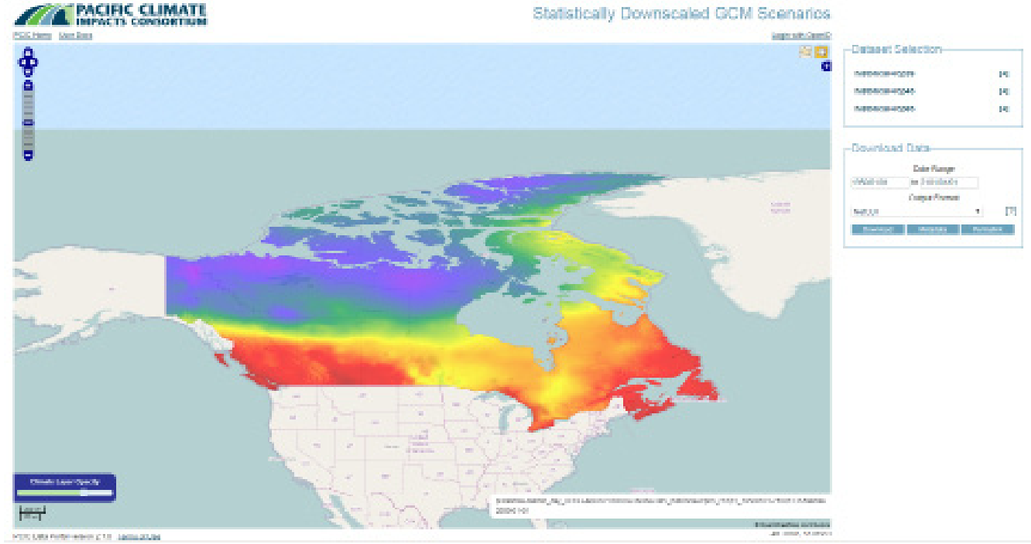
HIGH RESOLUTION PRISM CLIMATOLOGY

Expertly produced very high (800m) resolution 30-year averages of temperature and precipitation representing our best estimates of normal climate conditions in BC in visual representations of climate variables as well as numerically in the form of quantitative climatological data

FUTURE PROJECTIONS

STATISTICALLY-DOWNSCALED SCENARIOS OF FUTURE CLIMATE CHANGES

Statistical Downscaling is a core PCIC service; now users can access numerous downscaled scenarios online to conduct their own analyses of the impacts of future change. Global and regional climate change simulations from the international climate modelling community are downscaled to a 10-km resolution for all of Canada using a variety of well tested methods.



USER INTERFACE OF THE STATISTICALLY DOWNSCALED CLIMATE SCENARIOS PAGE
This image shows one of the pages that make up our Data Portal. With an easy to use, point-and-click interface, users can quickly access data for their region(s) of interest.

HYDROLOGIC PROJECTIONS

HYDROLOGIC MODEL OUTPUT

Scenarios of future surface water resources for the Fraser, Peace, upper Columbia and Campbell River basins can be accessed. This data is available in both gridded format (e.g. snow water equivalent) at 1/16-degree resolution and point format (e.g. streamflow) for select locations.

PROJECTIONS OF EXTREMES

STATISTICALLY DOWNSCALED EXTREMES

A further addition to the Data Portal that we will be able to offer to users in the coming year is a service to provide scenarios of future changes in extremes using the so-called ETCCDI extremes indices. PCIC provides scenarios of future changes in a wide range of indices of temperature and precipitation at high spatial resolution.

INFORMATION DELIVERY

USER NEED: DEVELOP INTERACTIVE TOOLS THAT ALLOW USERS TO SEE FOR THEMSELVES WHAT VARIOUS CLIMATE PROJECTIONS ARE SAYING ABOUT THEIR REGION'S FUTURE

Output files of spatial climate data are complex and can be difficult to work with. PCIC has invested significant effort over the past 5 years into providing visual representations of otherwise abstract climate data. These tools allow PCIC to communicate the complex information effectively to our users. The visual representations are delivered via online graphical interfaces that produce maps or graphs and plots. Two of our products help users imagine the many possible regional futures based on a number of climate models and scenarios; another provides up to date information about the present climate's departure from the past 30 year average.

PLAN2ADAPT

DOWNSCALED REGIONAL CLIMATE PROJECTIONS PROVIDED WITH A SIMPLE INTERFACE

Developed jointly with the urban and regional planning community, Plan2Adapt was born out of a need for a simple online interface to explore regional climate projections. After two major updates, users can now access a variety of variables as maps or time series plots:

The variables that can be displayed include: temperature, precipitation, snowfall, growing-degree days (which indicates the amount of heat energy available for plant growth), heating degree-days (useful for indicating energy demand for heating in winter) and frost-free days (the number of days per year when the night time low temperature stays above freezing).

The updates also improved the underlying map software, meaning users can choose from a number of overlays. Information about the implications of the projections is available interactively to help users understand the potential impacts of the future climate changes on various sectors.

REGIONAL ANALYSIS TOOL

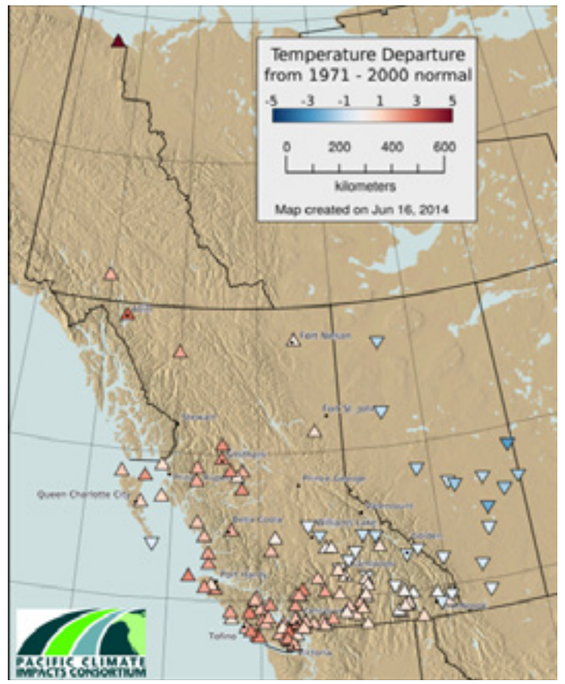
TECHNICAL FLEXIBILITY WITH A MORE COMPLEX INTERFACE

PCIC's original online tool provides an ensemble of more than 140 global climate model and emission scenario combinations along with associated metadata. The tool allows users to select data from various GCMs over custom areas and time periods and download the data, or compare variables and plot them. Although this tool uses the same data as the Plan2Adapt tool, it has a more complex user interface and greater number of configurable options corresponding to the needs of its target specialist audience.

SEASONAL CLIMATE MAPS

AT-A-GLANCE INFORMATION ABOUT HOW THE WEATHER OF THE PAST SEASON COMPARES TO BASELINE CLIMATE

We regularly produce monthly and seasonal maps that show temperature and total precipitation departures from the 30-year 1971-2000 climatology at observational weather stations throughout BC. The maps allow users to see the spatial patterns and extents of warm, wet and dry regions in a timely manner.



SEASONAL CLIMATE MAP OF MAY 2014 MAXIMUM TEMPERATURE
This figure shows the maximum temperature anomalies for May of 2014. The colour of the triangles indicates their value above or below the 1971-2000 average and the orientation of the triangles, tip up or tip down, indicates whether they are above or below the average, at a glance.

INFORMATION DELIVERY

USER NEED: ACCESS TO PCIC PROJECTION RESULTS VIA COMMUNICATION DOCUMENTS, SUMMARIES, SOFTWARE, AND RESEARCH PUBLICATIONS ON CLIMATE STUDIES RELEVANT TO PCIC'S WORK AND BC

Every PCIC applied research project results in a published document or piece of software. Our website, PacificClimate.org, is the hub for PCIC information delivery. Users can perform keyword searches through publications and find anything published by PCIC since 2008. The listing of software projects includes descriptions for users and links to the packages.

PUBLICATION LIBRARY

WRITTEN PUBLICATIONS ADDRESSING OUR USERS' NEEDS

Repository of all of PCIC publications from journal publications to newsletters. Research projects result in peer reviewed published articles or 'project reports'. These technical reports are often summarized by PCIC Communication experts into 'summary reports'. As well, the online repository holds the record of PCIC Science Briefs, PCIC Newsletters and Annual Reports.

SOFTWARE LIBRARY

DEVELOPING SOFTWARE TO HANDLE CLIMATE DATA

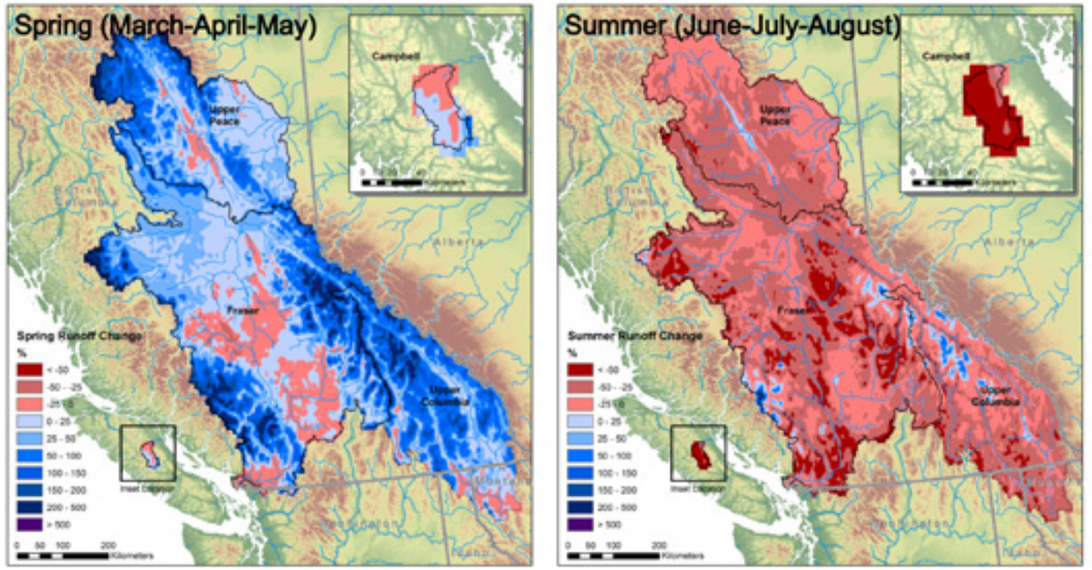
PCIC has developed and continues to develop software packages to aid in the handling of climate data, such as the calculation of climate trends and indices. The Software Library R packages for use with climate data are developed initially for use in PCIC projects, but are then provided publicly if they to solve problems that others have also encountered or improve upon existing software.

RECENT PUBLICATIONS FROM THE PCIC PUBLICATIONS LIBRARY
These are some examples of the publications that are available in PCIC's Publications Library, which contains materials aimed at users of various skillsets and needs.

MODELLING THE HYDROLOGIC IMPACTS OF CLIMATE CHANGE

USER NEED: UNDERSTANDING THE IMPACTS OF CLIMATE CHANGE ON BC'S WATER RESOURCES

Water is an essential element of the BC economy, supporting both citizen health and livelihoods. One of PCIC's three themes has been devoted to the ambitious objective of modelling the hydrologic impacts of climate change on every major river basin in the province. Starting with the major hydroelectric generating rivers, PCIC has made significant progress towards this goal using the Variable Infiltration Capacity (VIC) hydrology model to assess the hydrologic effects of climate change, including analyses for the upper Peace, upper Columbia, Fraser and Campbell River basins.



PROJECTED CHANGES TO SEASONAL RUNOFF FOR THREE BASINS IN BC
Projected mid-century (2041-2070) spring and summer runoff as the change (in percent) from the 1961-1990 baseline period for the A1B emissions scenario. Results shown are based on the median of eight different global climate models participating in the third phase of the Coupled Model Intercomparison Project.

CAMPBELL RIVER

Located on central Vancouver Island, the Campbell River is fed by a mix of snow melt and rain with peak flows in spring and fall. This is expected to change in the 2050s as warmer temperatures in the future result in a transition to a flow regime that is dominantly fed by rainfall. This will increase discharge in the winter and decrease volumes for the spring and summer.

UPPER COLUMBIA

The Upper Columbia River basin in south-western BC is bordered by the Rocky Mountains and the Shuswap-Okanagan Highlands. Rivers in the region exhibit a seasonal regime, where low flow occurs from late summer through early spring, and a large snowmelt freshet occurs during late spring and early summer. In some areas summer flows are augmented by glacier melt. Annual streamflow is expected to increase in the upper Columbia for the 2050s. However, on a seasonal basis it is expected that winter discharge will increase, the snowmelt freshet will occur earlier, and discharge will decrease throughout the late summer and early fall. Change in the glacier-fed component is uncertain, but its contribution is expected to diminish as glacier retreat in the regions continues. PCIC is developing a version of VIC with glacier mass balance and glacier dynamics components so that it will be able to better evaluate the future glacier-fed component of flow on the Columbia and other basins in which glaciers are prominent.

UPPER PEACE

In the north-eastern interior of BC, the Upper Peace Basin drains from the northern Rocky Mountains. Here, streamflow is fed predominantly by snow melt, peaking from May through July. The peak-flow season is expected to shift to earlier in the year, with fall and winter discharge increasing and late summer and early fall flows decreasing.

FRASER RIVER

The Fraser River system is the largest basin in British Columbia covering a drainage area of about 230,000 km^2. Given its physiographic and climatological variability, a spatially-varied hydrologic response to climate change can be expected. Additionally, since the basin is home to about 63% of BC's population, the changes to its hydrologic regime could have significant implications to water resource management in the province. Overall, for different sub-basins and regions, increased autumn, winter and spring precipitation, and decreased summer precipitation are projected for the 2050s. Increases in winter and spring flows and decreases in summer flow, and a smaller increase or decrease in autumn flow are projected.

SECTORAL ANALYSIS OF CLIMATE CHANGE IMPACTS

USER NEED: SPECIFIC CLIMATE INFORMATION FOR THE USERS' SECTORS OF INTEREST TO SUPPORT PLANNING AND DECISION MAKING

Many sectors of concern to users relate to changes in BC's ecology. Climate change and variability have the potential to impact plant and animal species, and as the climate changes, species may need to adapt or perish in new environmental conditions. Over the years, PCIC users have been concerned with potential changes to species throughout BC, particularly in sectors where the impacts will have an economic impact, such as forestry and agriculture.

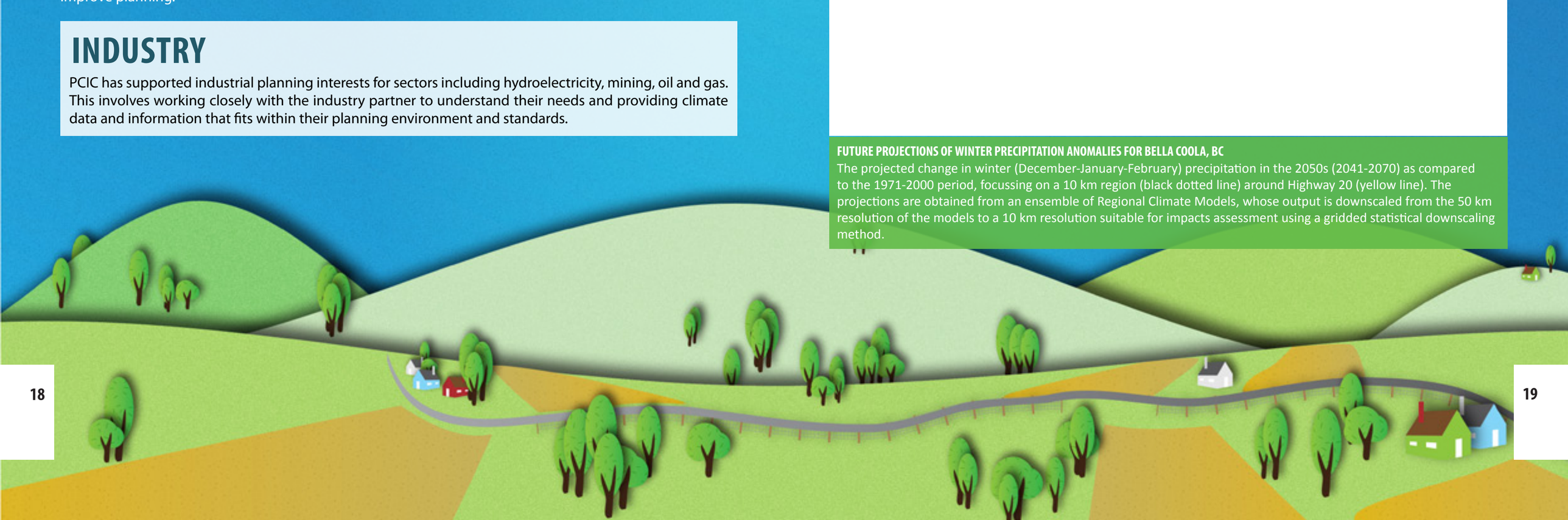
They have also been interested in understanding changes to the frequency of extreme events, in order to improve planning.

INDUSTRY

PCIC has supported industrial planning interests for sectors including hydroelectricity, mining, oil and gas. This involves working closely with the industry partner to understand their needs and providing climate data and information that fits within their planning environment and standards.

TRANSPORTATION

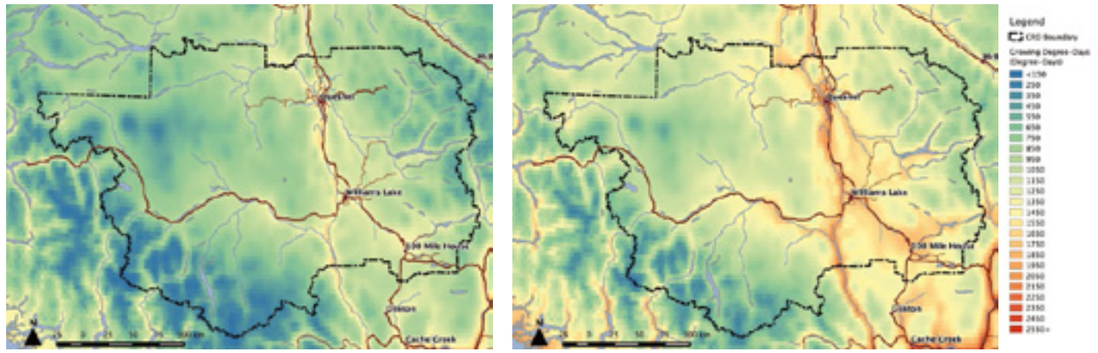
Projects for the transportation sector have focused on 'at risk' areas of BC's highway infrastructure, such as the Coquihalla (2010), Vanderhoof (2010), Bella Coola, Stewart and Pine Pass (2013). PCIC used statistical downscaling and regional climate models for this work, focussing on extreme precipitation. Extreme precipitation events have caused serious damage to BC's transportation infrastructure and fine-scale future projections show increases in both average and extreme precipitation for the 2050s—this information was incorporated into assessments for highway infrastructure and maintenance schedules.



FUTURE PROJECTIONS OF WINTER PRECIPITATION ANOMALIES FOR BELLA COOLA, BC

The projected change in winter (December-January-February) precipitation in the 2050s (2041-2070) as compared to the 1971-2000 period, focussing on a 10 km region (black dotted line) around Highway 20 (yellow line). The projections are obtained from an ensemble of Regional Climate Models, whose output is downscaled from the 50 km resolution of the models to a 10 km resolution suitable for impacts assessment using a gridded statistical downscaling method.

SECTORAL ANALYSIS OF CLIMATE CHANGE IMPACTS



GROWING DEGREE DAYS
Projected changes to Growing Degree-Days for the Cariboo. On the left is the baseline 1961-1990 period and on the right is the projection for the 2050s.

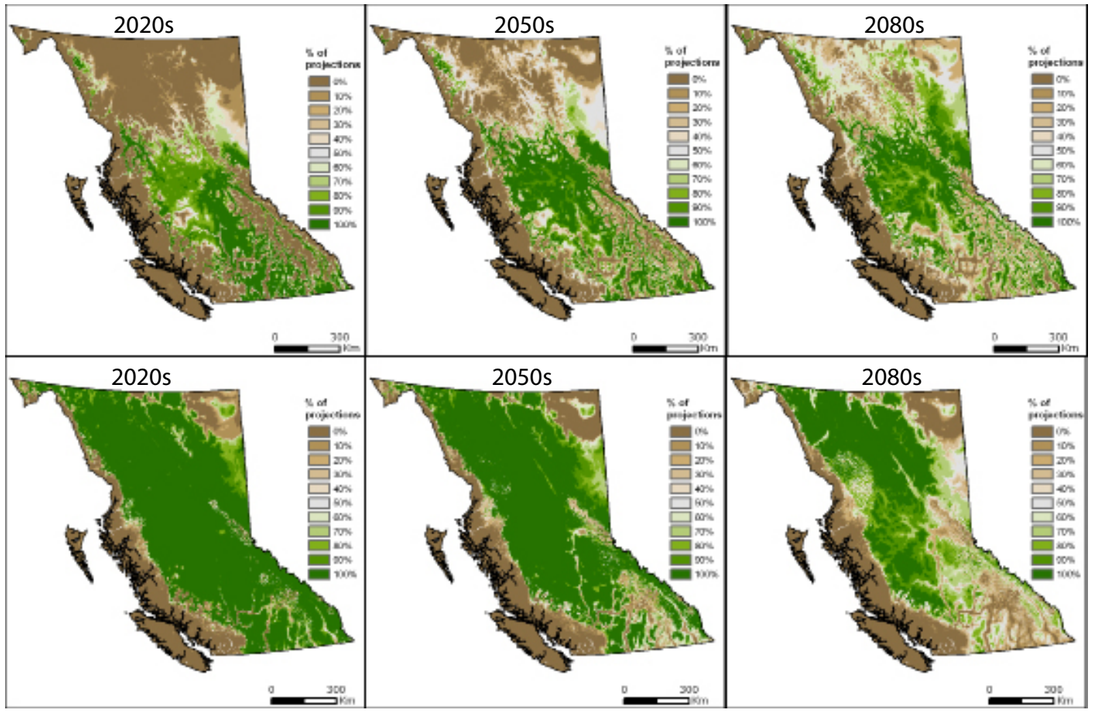
AGRICULTURE

The agriculture sector has diverse needs for climate information across the province. In the Okanagan, a joint project with the BC Ministry of Agriculture and Agriculture and Agri-Food Canada required very high resolution information to drive their models and planning scenarios. PCIC tailored downscaled daily minimum temperature, maximum temperature and precipitation scenarios to reach the high spatial resolution (500-m) required. In the Cariboo, PCIC advice, historical trends, and extreme event analysis was utilized in the development of a regional agriculture adaptation strategy for the region.

FORESTRY

Forestry is a major economic sector in BC and the BC Ministry of Forests, Lands and Natural Resource Operations and its predecessors has been a supporter of PCIC from the start. One of PCIC's first sectoral projects was to study the role of pest outbreak distribution and forest management impacts in a changing climate. PCIC researchers found that projections indicate a rapid shift in the locations where the climate will be suitable for spruce and Douglas-fir, with systemic shifts to higher elevations and latitudes.

In addition to many other projects, PCIC has produced a series of summary documents that distil climate information—historical trends and future projections—for the eight resource regions of BC.



PROJECTED DOUGLAS FIR AND SPRUCE SUITABILITY
The percentage of climate projections that indicate suitable climatic conditions for Douglas-fir (top row) and interior spruce species (Engelmann spruce, hybrid spruce and white spruce considered together, bottom row) for the 2020s, 2050s and 2080s.

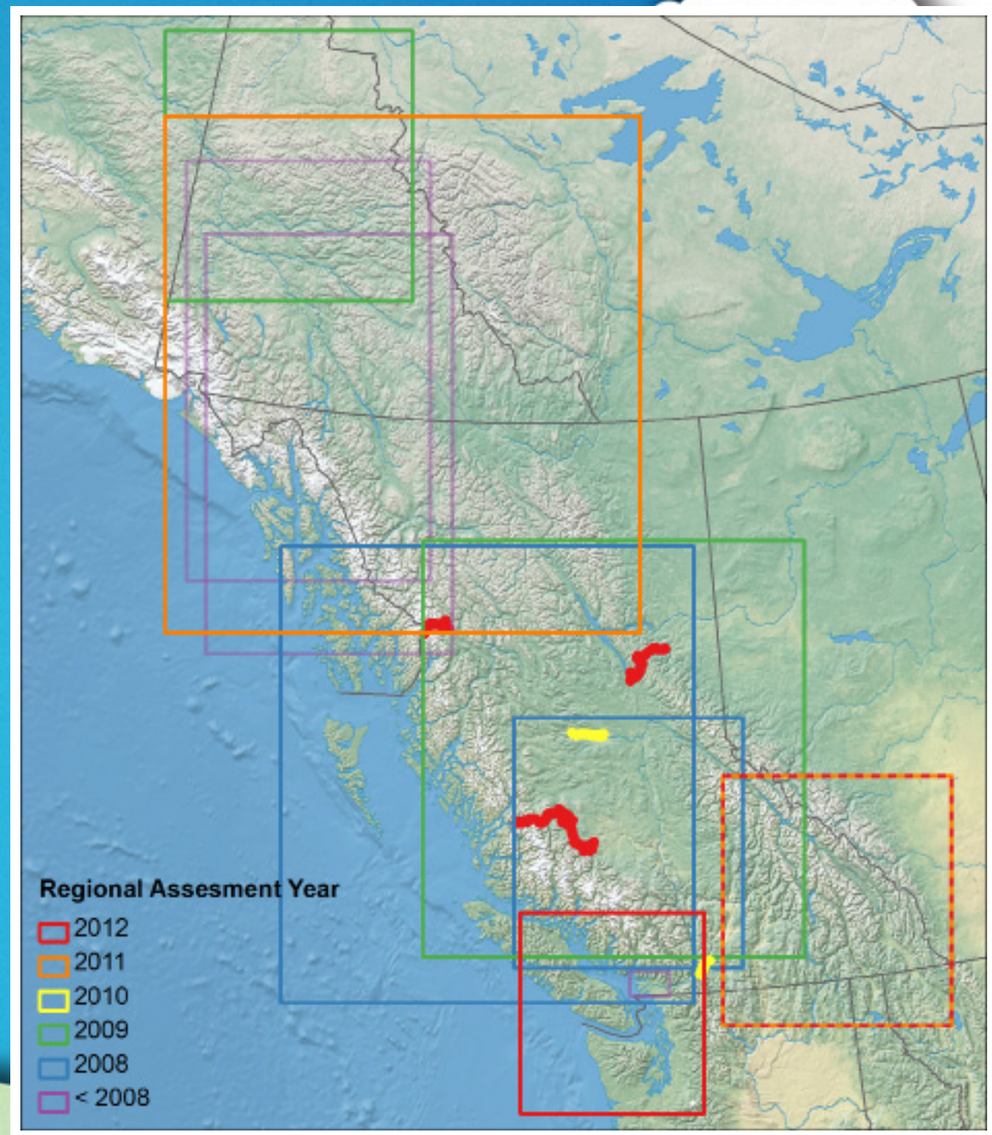
REGIONAL ANALYSIS OF CLIMATE CHANGE

USER NEED: LOCATION-SPECIFIC INFORMATION ON PAST AND FUTURE CLIMATE.

PCIC has worked with local and regional governments almost since its inception, providing historical and future climate and hydrologic projections specific to their needs, to inform adaptation planning. Over this time, PCIC has covered nearly the entire province, producing projections and analysis reports for our stake-holders. PCIC has also worked with industry to provide interpretation and client-specific projections, and it has recently produced a comprehensive collection of climate summaries.

Local and regional organizations who have partnered with PCIC include:

- City of Whitehorse (2007).
- Raincoast Conservation Society, Great Bear Rainforest (2008)
- BC Ministry of Agriculture, Cariboo Chilcotin (2008)
- Yukon Government, Dawson City (2009)
- City of Prince George (2009)
- Columbia Basin Trust (2011)
- Community of Atlin (2011)
- Industry Partner, Columbia Basin (2012)
- Georgia Basin Municipalities (2012)
- BC Ministry of Forests, Lands, and Natural Resource Operations, Resource Regions Climate Summaries (2013).



GROWTH OF PCIC'S REGIONAL CLIMATE ANALYSES
The growth of PCIC"s regional climate analysis over time, from the pre-2008 period to 2012.

CLIMATE EXTREMES

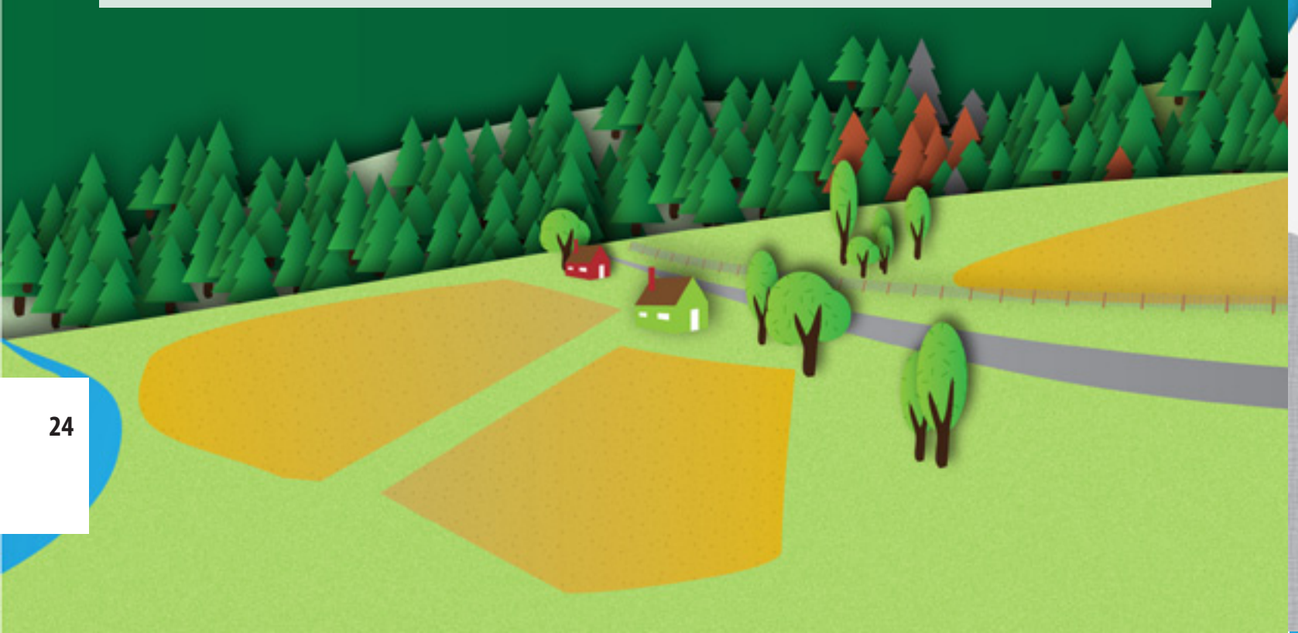
USER NEED: INFORMATION THAT CAN SUPPORT PLANNING FOR THE MOST EXTREME WEATHER EVENTS.

Extreme precipitation events that cause flooding impact communities across British Columbia. Extreme temperature and precipitation events can put populations and ecosystems at risk. As the climate changes, these rare or extreme events are projected to occur more frequently. PCIC has responded to concerns over this risk by working with stakeholders and studying observed and projected changes in extremes at a range of scales, from local to global.

CLIMATE EXTREMES IN BC

In the Columbia Basin, climate projections show considerable warming in the 2050s compared with the 1971-2000 baseline and an increase in the frequency of warm extremes. In addition, the projections show an increase in the frequency and intensity of extreme precipitation events and a decrease in the frequency of summer precipitation events. In the Georgia Basin precipitation events with a 3-hour duration that historically occur once every ten years are projected to occur three times as often in the 2050s. (Sectoral projects have also looked at Extreme Climate Events, see pp.18-21)

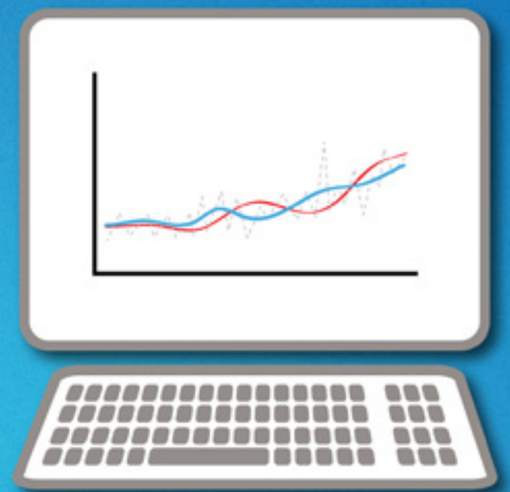
Some of the most extreme precipitation events along the Pacific Northwest coast result from so-called 'Atmospheric River' events. Atmospheric rivers are long, narrow (thousands of kilometres in length and hundreds of kilometres in width) bodies of tropical moisture which are transported in the atmosphere to the mid-latitudes. PCIC embarked on a project to summarize the state of the knowledge of Atmospheric Rivers and then explore the science of projecting the occurrence of atmospheric river events in BC. Early findings indicate that the average number of atmospheric river events is projected to approximately double along the BC coast with the timeframe depending on the particular location.

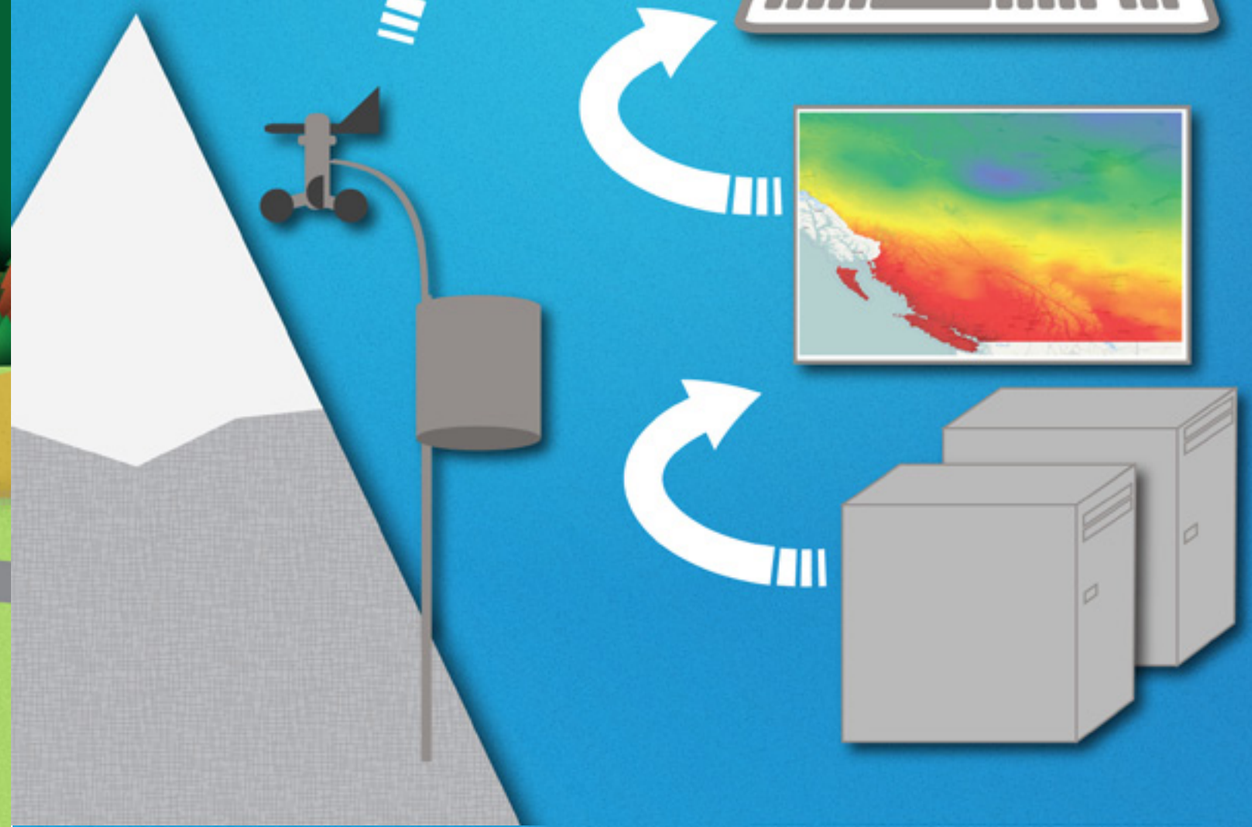


APPLIED RESEARCH

PUSHING THE BOUNDARIES OF APPLIED SCIENCE TOWARDS APPLICATIONS

PCIC has three clearly defined service objectives, which in turn are underpinned by a set of strategic objectives that are designed to ensure that PCIC has the information and capabilities needed to achieve the service objectives. While we rely on published research to the extent possible, meeting our objectives and the information requirements of our users does require us to engage in a certain amount of applied research in order to tailor and adapt methods and information to the requirements of PCIC's users.





FORECASTING CLIMATE EXTREMES

EVALUATING THE POTENTIAL FOR USING CLIMATE MODELS TO MAKE SEASONAL PREDICTIONS IN BC

Forecasting climate and hydrological extremes over seasonal timescales involves accurately predicting land surface, ocean, and atmospheric conditions, such as seasonal snowpack and ENSO, that influence the evolution of the local hydroclimate system. With this challenge in mind, PCIC climatologists and hydrologists began an effort in 2011 to assess the extent to which it might be possible to make skilful seasonal predictions of hydroclimatic extremes in BC. This research cuts across all three of PCIC's themes, with contributions from Hydrologic Impacts, Regional Climate Impacts, and Climate Analysis and Monitoring groups.

Since its inception, these groups have developed expertise with modelling tools and datasets such as the VIC distributed hydrological model, gridded statistical downscaling algorithms, and the CRMP observational network. These efforts positioned PCIC to start the development of a state-of-the-art test-bed hydrologic forecasting system in 2011. Up until this time, the VIC model had only been applied at PCIC to the Peace, Campbell, and Upper Columbia watersheds. Although these watersheds are economically relevant as major sources of hydropower production, it was felt that the Fraser River basin with its larger catchment was a more suitable test case for a seasonal prediction system. From the perspective of streamflow extremes the Fraser River basin contains several of the province's largest population centers, including Greater Vancouver and the communities throughout the Fraser Valley, that are susceptible to flood hazards. A focus of work in 2011 therefore involved expanding the PCIC VIC domain to include the Fraser River basin (and assessing the VIC model with respect to reproducing streamflow metrics, including extreme low and high flows.

At the same time, PCIC began validating the performance of a variety of climate downscaling algorithms in the context of projections of climate extremes from global climate models (GCMs). This effort included the Bias Corrected Spatial Disaggregation (BCSD) algorithm used by PCIC to downscale GCM projections to the domain of the spatially interpolated CRMP dataset used to drive VIC. BCSD was shown to perform well in comparison to other downscaling methods. As a result, efforts in 2012 were devoted to modifying the BCSD algorithm and related methods at PCIC to allow their use in downscaling large ensembles of real-time GCM outputs from the Canadian Seasonal to Interannual Forecast System (CanSIPS) that are operated by Environment Canada. With these pieces in place, work in 2013 focused on implementing and testing the VIC hydrologic forecasting system using downscaled climate inputs from CanSIPS over a 1979-2006 hindcast period. For comparison, results were compared against a traditional ensemble streamflow prediction (ESP) setup based on historical traces of climate inputs. Results suggest that forecasts of mean April snow water equivalent are skillful for CanSIPS inputs initialized in December-April, with part of this skill arising from the hydrologic model initialization. Furthermore, the correlation skill of monthly streamflow forecasts from the system exhibited modest improvements relative to ESP, which shows the potential of using climate models for seasonal hydrologic prediction in BC.

DOWNSCALING METHOD INTERCOMPARISON

SELECTING THE BEST DOWNSCALING TECHNIQUE FOR USERS' NEEDS REQUIRES THAT PCIC EVALUATES MULTIPLE METHODS

Statistical downscaling is a method for producing high-resolution climate information by determining a statistical relationship between observations and climate model simulations during the past and then applying the same relationship to future climate model projections, in order to obtain future projections at high resolution. Knowing which downscaling technique to apply requires knowledge of the strengths and weaknesses of each method.

In order to compare and further the development of the statistical downscaling techniques that are often used for this purpose, PCIC has an ongoing research project to test the techniques for their ability to simulate climate extremes in BC, evaluating methods against past climate data and future climate projections. The innovative approach used for PCIC's Downscaling Intercomparison continues to be a critical aspect of the evaluation of the performance of downscaling schemes in current downscaling projects. This work furthers our ability to provide high-quality future climate projections and the resulting articles that have been published in peer reviewed journals help to further our overall understanding of climate downscaling.

VIC HYDROLOGIC MODEL

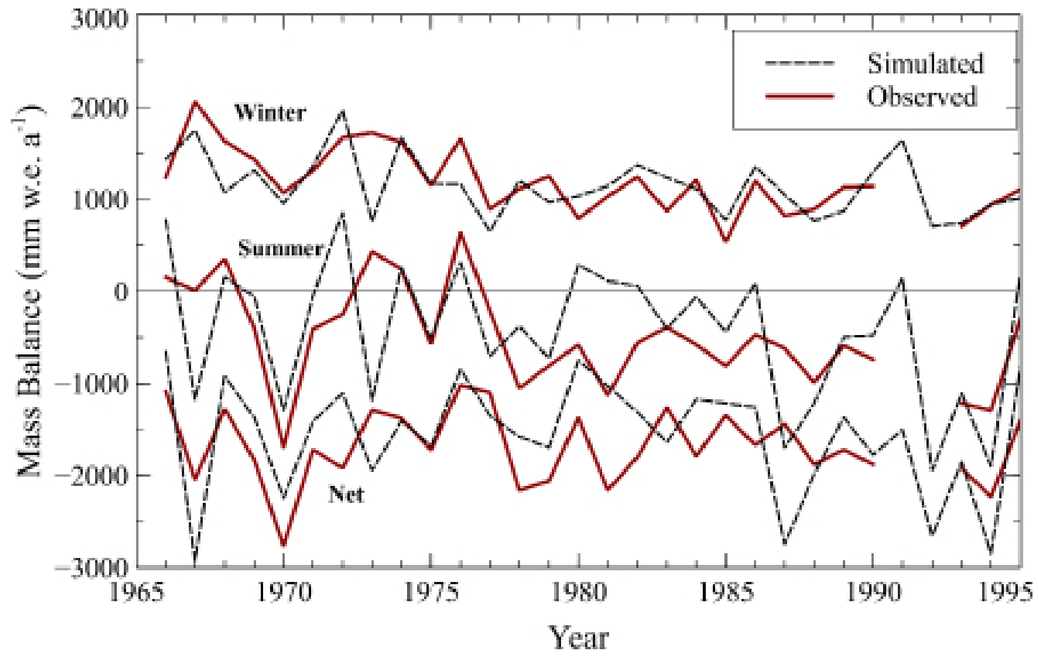
PROJECTING HYDROLOGIC CHANGES REQUIRES PCIC TO ADOPT HYDROLOGIC MODELLING METHODS THAT PERFORM WELL IN OUR COMPLEX TERRAIN

In 2007, PCIC selected the Variable Infiltration Capacity (VIC) model as PCIC's primary hydrologic model because its process-based, gridded structure makes it well suited for representing water balance components over large, topographically complex spatial domains.

A hydrological model was required to quantify the impacts of climate change's effect on streamflow, such as changes to monthly water availability and the frequency and magnitude of flood events, because climate models do not adequately resolve the elevation gradients that drive snow-melt and runoff processes at their coarse ~100 km scale. Furthermore, the land surface schemes in climate models are not locally calibrated to best represent regional hydrology, especially run-off timing, which can have consequences in quantifying changes.

Setting up and calibrating the VIC model was a substantial task, which included building inputs such as soil and vegetation characteristics and temperature and precipitation fields over the broad study area, and carefully selecting observed streamflow data to support the calibration and validation of more than 100 sub-basins.

PCIC hydrologists and computational staff have worked to improve the VIC hydrologic model, adding glacier mass balance and currently, glacier dynamics. They utilized VIC to complete assessments of streamflow forecasting, hydrologic projections from RCMs, uncertainty in projecting changes to extremes due to downscaling approach, evaluate the sensitivity of the model's output to various parameters and assess the ability of the model to replicate ecologically relevant streamflow indicators. The model results for four major BC river basins are complete (see Modelling Hydrologic Impacts of Climate Change, p.16) and have been made available via the data portal (http://www.pacificclimate.org/data). PCIC is well on its way to achieving its next major goal in understanding the future of the Province's water resources, which is to have VIC operational on every major river basin in the Province.



SIMULATED AND OBSERVED ANNUAL MASS BALANCE FOR THE PEYTO GLACIER
Comparison of observed and simulated glacier-average annual mass balance for the Peyto Glacier in Alberta, Canada, divided in to winter, summer and net (winter + summer) mass balance, for the period 1966 to 1995.

STREAMFLOW PROJECTION USING STATISTICAL EMULATION

To study the hydrologic impacts of climate change in BC, PCIC hydrologists drive the VIC hydrologic model that with downscaled climate change projections from global climate models (GCMs). As GCM uncertainty is a large part of streamflow projection uncertainty, PCIC hydrologists developed a methodology to update the projections using the most recent GCM projections (CMIP5) and compare them to previous CMIP3-driven projections. The new method uses a computationally-efficient statistical model to emulate VIC model projections, allowing for comparison.

The emulation model was used to obtain projections for the Peace River at Taylor and the Fraser River at Hope for three time periods and three emissions scenarios. The projections for CMIP5 and CMIP3 were found to be qualitatively similar.

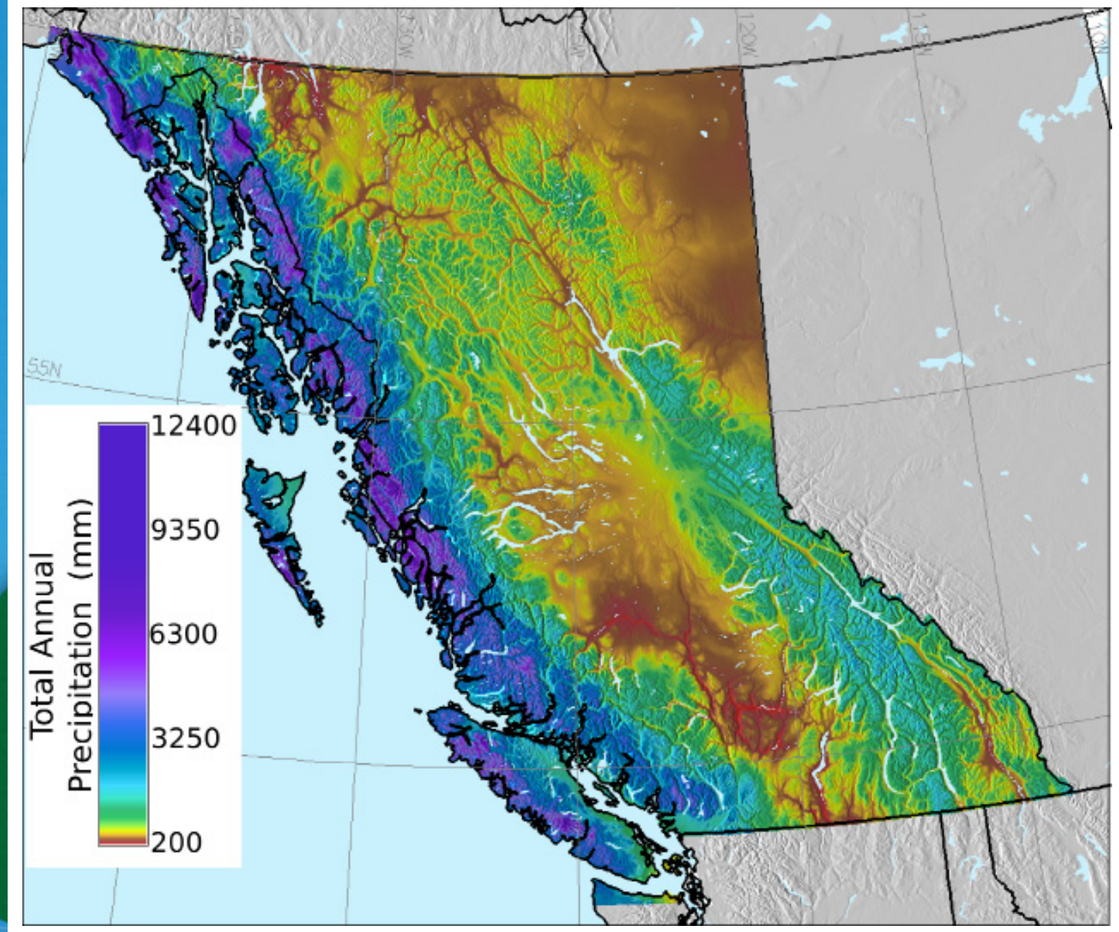
ADOPTING PRISM MAPPING TECHNOLOGY

A PROVINCE-WIDE VERY HIGH RESOLUTION CLIMATOLOGY THAT ACCOUNTS FOR COMPLEX TOPOGRAPHY

In the late 1990s, the BC government collaborated with the PRISM Climate Group at Oregon State University to develop digital precipitation and temperature maps for BC. The maps depicted mean monthly and annual climatological means of daily minimum temperature, daily maximum temperature and daily precipitation for the 1961-1990 climatological period. In 2008, PCIC saw an opportunity to update the maps to the 1971-2000 climatological period and improve accuracy and resolution. PRISM is an attractive methodology for BC because it can account for the complex topography by incorporating both expert judgement and alternative data sources where observing stations are sparse.

Applying and adopting the PRISM technology at PCIC to BC has been a three-year process involving significant investment of time and money together with support from the PCIC computational support group. Three years were needed due to data complexity, regional complexity, incorporation of non-station data, and the review and refinement process. The PRISM maps were generated using a recently compiled and comprehensive set of meteorological observations assembled under the BC MoE Climate Related Monitoring Program. British Columbia is complex in terms of topography, and has large variations in station density and quality. To provide information where traditional stations were not available, snow and glacier observations were used (primarily for precipitation). For temperature, upper atmosphere data from the North American Regional Reanalysis were used. A critical, final step in the PRISM process that helps to ensure a quality product is a formal review and refinement process that involves experts with detailed local knowledge of BC's complex climate.

PRISM climate maps are a primary source of climate information for use in various downscaling methods. These maps will be used to develop new, high resolution projections of BC climate in the future and for generating high resolution forcing data for both historical and future modelling studies. On a more distant timeline we intend to use PRISM mapping to develop monthly time series maps of weather conditions from the mid 1900s to the present and to map extremes in temperature and precipitation in the province.

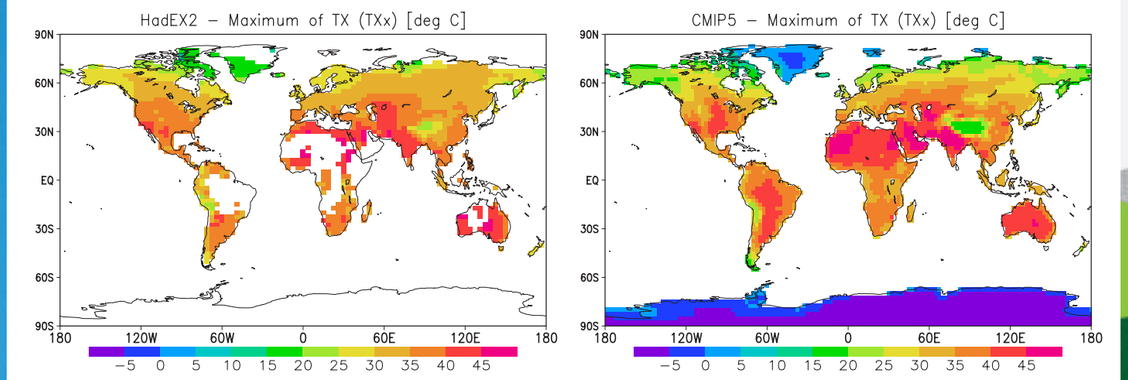


TOTAL ANNUAL PRECIPITATION FROM PRISM
The 1971-2000 annual climate normal of precipitation for British Columbia, developed at PCIC using PRISM.

EVALUATING AND PROJECTING CHANGES IN CLIMATE EXTREMES

DOWNSCALING CLIMATE MODEL OUTPUT TO CREATE PROJECTIONS OF CLIMATE EXTREMES

With investments made in statistical downscaling (see p. 29), we have been able to downscale the most recent set of Global Climate Model projections in a way that should help to address regional adaptation needs. In particular, for the first time an ensemble of spatially detailed downscaled GCM projections are available that also have high resolution in time. Daily time series at a 10 km spatial resolution allow for the computation of many standard indices of extremes and to estimate projected changes in return periods of extreme events. which are of critical importance for the impacts of future climate change. At PCIC, researchers have engaged deeply in this question, focussing on the BC region in particular.



THE 1981–2000 MEAN OF THE ANNUAL MAXIMUM OF THE TXX INDEX FOR HADEX2 AND THE CMIP5 MULTI-MODEL ENSEMBLE MEDIAN
The 1981–2000 mean of the annual maximum temperature for each month (also known as the CLIMDEX TXx index) for HadEX2 station data and the multi-model ensemble median of those global climate models participating in the fifth phase of the Coupled Model Intercomparison Project (CMIP5).

VALIDATING EXTREMES INDICES

The climate modelling community uses a standard set of 27 indices, the CLIMDEX indices, to evaluate climate extremes. PCIC validated and compared climate indices generated by an externally developed computer code and those generated by code developed at PCIC (climdex.pcic). Where differences were noted, we examined the output and the code for both programs to identify the source of the discrepancy. The code was improved to eliminate bugs and climdex.pcic is now adopted by the World Meteorological Organization Expert Team in Climate Change Detection and Indices as its standard.

Using our capability to calculate indices, PCIC compared the ability of several statistical downscaling methods (see Downscaling Intercomparison section) to simulate climate extremes in BC. This capacity was also leveraged to allow the evaluation of the ability of both global and regional climate models to simulate extremes.

MANAGING EXCELLENCE IN CLIMATE SERVICE DELIVERY

CONTRIBUTING TO THE CLIMATE SCIENCE COMMUNITY

SCIENTIFIC CREATIVITY AND INNOVATION INVOLVES THE CONSTANT EXCHANGE OF IDEAS AND RESULTS.

PCIC's team includes between 15-20 researchers and scientists at any given time, some of them visiting from other top climate research institutions and all of them working at the cutting edge of applied climate science.

PCIC's peer-reviewed publication track record is an indicator of the high calibre of the applied climate research that supports and validates the products and services that we deliver. Since 2008, PCIC staff have published many journal articles in scholarly journals, with considerable acceleration in the pace of publication in recent years. All of PCIC's articles and reports are available from our online Publications Library.

CONTRIBUTING TO THE PEER-REVIEW PROCESS

Also over the past five-plus years, PCIC scientists have attended about 20 conferences per year presenting scientific posters and making oral presentations. In addition, PCIC scientists are often asked to serve as peer reviewers of articles, research proposals and other documents, reviewing over 100 documents per year. Our work on the validation of climate extreme indices resulted in a computer code that has been adopted by the Expert Team on Climate Change Detection and Indices as its standard.

CONTRIBUTING TO CLMATE SERVICE DELIVERY IN CANADA

PCIC'S PLACE IN THE CLIMATE SERVICE DELIVERY COMMUNITY

PCIC is part of a larger, informal, tiered network of regional, national and international climate research and information-providing institutions. We rely on, and contribute to, the strengths of this community through collaborations and partnerships. The community includes national government institutions such as Environment Canada, other regional climate service organizations such as Ouranos in Montreal, Quebec, and climate researchers from Canada and around the world.

Our workshops over the years have contributed to an ongoing national discussion concerning the coordination of climate service delivery in Canada. PCIC contributes to the advancement of regional climate service delivery in Canada by developing our reputation and influence as a credible and reliable regional climate service provider. PCIC does this by contributing at professional meetings, coordinating actively with Ouranos at the Board of Director's level and by collaborating with Environment Canada and other Federal Government departments on projects that contribute to climate service delivery in Canada.

RESEARCH COLLABORATION

FACING BIG CHALLENGES, TOGETHER

PCIC's applied climate research requires both institutional and individual scientific collaborations. These research collaborations have served as a productive two-way exchange of information fostering many long term partnerships. PCIC is actively involved in collaborative projects with many partners, including BC Hydro, the BC Ministry of Transportation and Infrastructure, the BC Ministry of Environment, the BC Ministry of Agriculture, Environment Canada (Canadian Centre for Climate Modelling and Analysis; Climate Data Analysis Section; W-CIRC) and Agriculture and Agri-Food Canada.

In addition to our institutional collaborations, PCIC often participates in scientific collaborations with individual researchers or research groups from BC, Canada and around the world. Some of these groups include: BC Hydro, PICS, Oregon State University, the University of Alaska Fairbanks, the UK Met Office, the University of Adelaide, the University of New South Wales, the University of Oslo, Dalhousie University, UQAM, the University of British Columbia, the University of Victoria, the University of Northern British Columbia (UNBC) and Simon Fraser University.

PCIC has also completed several important research collaborations that have resulted in important deve lopments in our scientific capacity. Notably, the University of Washington was instrumental in helping PCIC implement the VIC hydrologic model and Oregon State University helped PCIC to establish our capacity to use PRISM.

EXTERNAL COLLABORATION

In 2013, PCIC's Director, Dr. Francis Zwiers initiated another method for leveraging research partnerships to help serve the needs of regional stakeholders. He successfully engaged three research networks with objectives that align with PCIC's.

The Network of Excellence, the Marine Environmental Observation, Prediction and Response Network (MEOPAR) is based at Dalhousie University with involvement from universities across Canada including a considerable focus of activity at the University of Victoria. PCIC's project involves study of historical and future variations in storminess on both Canada's west and east coasts.

The Canadian Sea Ice and Snow Evolution Network (CanSISE) is based at the University of Toronto with extensive participation at UVic involving both the Canadian Centre for Climate Modelling and Analysis (CCCma) and PCIC as well as collaboration with the University of Northern British Columbia. PCIC is collaborating with CCCma and others on understanding changes in snow cover, sea ice extent in the Arctic and water resources in BC.

The Canadian Network for Regional Climate and Weather Processes (CNRCWP) is based at L'Université du Québec à Montréal (UQAM) with involvement from the CCCma, Ouranos and seven universities across Canada, including UVic, UNBC, Waterloo and McGill. PCIC is working with researchers from these institutions to further our understanding of climate extremes with a particular focus on evaluating how well Canada's regional climate models simulate extreme events.

Altogether, six young researchers have arrived at UVic as part of these networks and are actively working in collaboration with PCIC.

VISITORS

PCIC also builds collaborations and contributes to the climate science and university community is by hosting short and longer-term visits to PCIC . On average, PCIC has benefited from about ten visitors per year, including shorter-term visitors as well as a number of longer-term stays by interns and others who have collaborated extensively in PCIC work. Visitors have come from all over the world, including America, Austria, Australia, France, Germany, Iran, Malaysia and South Korea.

LOCAL GOVERNMENT, PROVINCIAL MINISTRIES AND OTHER PARTNERS

BUILDING STRONG RELATIONSHIPS WITH RESEARCHERS AND OUR USERS

In order to provide climate services that are both robust and useful to our users, PCIC has built partnerships with a wide variety of organizations in the private and public sectors. PCIC approaches these partnerships as a two-way dialogue, exchanging knowledge, expertise, and data, and allowing PCIC to better understand our users' needs so that our climate services can be customized best meet them.

OUR CURRENT PARTNERS INCLUDE

Adaptive Resource Management, Ltd.
Agriculture and Agri-Food Canada
BC Hydro
BC Ministry of Agriculture
BC Ministry of Health
BC Ministry of Community Development
BC Agriculture & Food Climate Action Initiative
Capital Regional District
BC Ministry of Environment
BC Ministry of Forests Lands and Natural Resource Operation
BC Ministry of Transportation and Infrastructure
Bonneville Power Administration
Capital Regional District
Canadian Network for Regional Climate and Weather Processes (CNRCWP)
Canadian Sea Ice and Snow Evolution Network (CanSISE)
City of Prince George
City of Surrey
City of North Vancouver
City of Vancouver
City of Victoria
Columbia Basin Trust
Corporation of Delta
Dalhousie University
Environment Canada
Fraser Basin Council
Great Northern Landscape Conservation Council
Metro Vancouver
Marine Environmental Observation Prediction and Response Network (MEOPAR)
National Oceanic and Atmospheric Administration (NOAA)
Natural Resources Canada
North Pacific Landscape Conservation Council
Ouranos Inc.
Pacific Institute for Climate Solutions (PICS)
PRISM Climate Group, Oregon State University
Simon Fraser University
Université du Québec à Montréal
University of Northern British Columbia
University of Toronto
University of Washington
University of Victoria

EVENTS – CONNECTING WITH OUR COMMUNITY

USER NEED: A FORUM TO EXPLORE THE DISCIPLINE WITH CLIMATE SCIENTISTS, ASK QUESTIONS AND SHARE CONCERNS.

PCIC organizes and hosts a number of events each year to facilitate discussion between leading climate researchers, impacts specialists, planners and regional stakeholders. The events are an opportunity for specialists in different areas to share their knowledge, resources and needs with each other, and plan research projects with a diverse cross-section of domain experts in related fields.

IPCC BRIEFINGS

On September 30th, 2013, following the release of the Working Group I contribution to the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report, PCIC and the Pacific Institute for Climate Solutions held a briefing for the public and the media, to discuss the IPCC assessment process, the main findings of the report and what the IPCC's findings mean for British Columbia. The event featured PCIC's director, Dr. Francis Zwiers, who is a Vice Chair of Working Group I, and Dr. Greg Flato, from the Canadian Centre for Climate Modelling and Analysis. Held at the Wosk Centre for Dialogue in Vancouver, the event attracted 160 members of the media and general public, and a further 345 people who watched the live stream of the event, online. A further briefing was provided to a large audience of public servants at St. Anne's Academy in Victoria on October 2nd. Dr. Zwiers has subsequently spoken to a wide range of audiences on the IPCC report, including the Probus Club in Victoira, the Fort St. John Petroleum Association and very recently, an international petroleum industry association in Washington, DC.

USER MEETINGS

Over the last fiscal year, PCIC has engaged its users in a series of three meetings organized around PCIC's themes: Climate Analysis and Monitoring, Regional Climate Impacts and Hydrologic Impacts. These meetings brought together users of PCIC's data, analysis and interpretation products in a two-way exchange, to both inform users about PCIC services and to allow PCIC researchers to learn more about how our products are being used and how we can better serve our regional stakeholders. The meetings were organized into seminar presentations, followed by group discussions and the results of these meetings have been made into meeting reports that will be used in PCIC's strategic and research planning processes.

OPERATIONS & FINANCE

MAINTAINING A LONG-TERM BUDGETARY OUTLOOK WHILE PERSUING EXCELLENCE

For the past five years, I have had the pleasure to write a report reflecting on PCIC's success from a financial perspective. In 2013-2014, the refrain of our past years remained the same: PCIC continued to enjoy financial stability. In 2012-2013, PCIC increased its funding envelope, this past year we sustained that growth and continued to produce new products and services in response to user's needs. Evidence of these products fills the preceding pages.

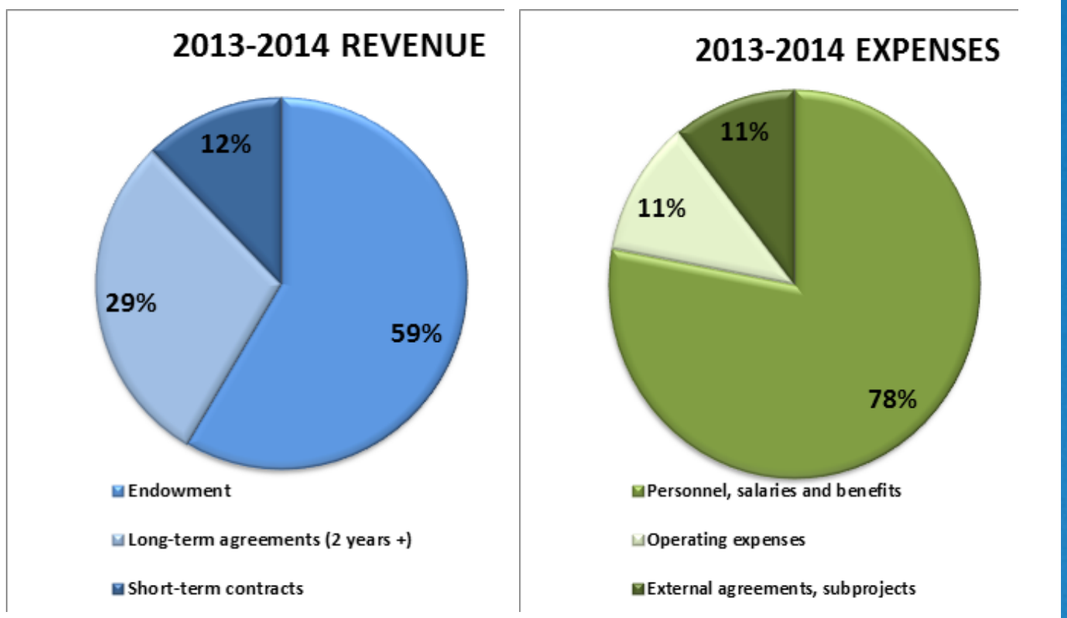
This Corporate Report takes a look back to 2008 and reflects on PCIC's development since the granting of the endowment to UVic to support PCIC and our sister organization, the Pacific Institute for Climate Solutions. It is an opportunity to summarize the cumulative impact of PCIC's service to BC and Canada. From a financial perspective, it is an opportunity to reflect on those early years, when PCIC transitioned from intermittent funding to sustained funding. The initial transition was not without challenges, building the right staff complement was the key and in 2008 recruitment efforts took precedent. With the right complement of staff in place, PCIC was able to secure matching funding. The expectation was that the endowment would not solely support PCIC but would encourage investment by other provincial strategic funding partners. Fast-forwarding to today, we can be proud of our success in this area. As 2013-2014 Revenue shows (see Figure), in 2013-2014 the endowment represented 52% of PCIC's financial resources.

Looking ahead five years, maintaining this ratio will be a significant challenge. As we work to deliver on our long term agreements, we also continue to look for new strategic opportunities that will support the financial strength of PCIC so that it can further improve access to past and future climate information.

We are extremely proud of the staff that make up our largest resource investment. They are PCIC's most important asset, as well as our largest expense and we foresee continuing to maintain the ratio of investment in personnel, salaries and benefits at around 75-80% as shown in 2013-2014 Expenses (see Figure).

Looking forward, at PCIC, we are cognizant of the difficult funding environment that the next years may bring. In response, we continue to work to maintain low operating costs while serving users high quality climate information. Strategic budgeting has ensured that we have the flexibility to withstand constrained funding while maintaining our status quo for a period of time. We will continue to leverage the endowment, and seek strong strategic partnerships and engage in new opportunities.

- Cassbreea Dewis (Treasurer), PCIC



REVENUE AND EXPENSES: APRIL 2013 - MARCH 2014
The left panel shows PCIC revenue for the 2013-2014 fiscal year and the right panel shows expenses over the same period.

PCIC PUBLICATIONS

SUMMARY REPORTS

Pacific Climate Impacts Consortium, 2014: *Testing the Monthly Drought Code as a Metric for Fire Weather in Southeast BC – Project Summary Report,* 8 pp.

Pacific Climate Impacts Consortium, 2014: *Climate Extremes in the Columbia Basin Summary Report*, 12 pp.

Pacific Climate Impacts Consortium, 2013: *Climate Analysis and Monitoring Meeting Report*, 8 pp.

Pacific Climate Impacts Consortium, 2013: *Climate Summary* series (8 reginal reports covering BC, 4pp each).

Pacific Climate Impacts Consortium, 2013: *Plan2Adapt Project Summary*, 2 pp.

Hamlet, A. F, **M. Schnorbus**, **A. Werner**, M. Stumbaugh and I. Tohver, 2013: *A Climate Change Scenario Intercomparison Study for the Canadian Columbia River Basin, Summary Overview*, 13 pp.

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Schnorbus, M. and **D. Rodenhuis**, 2010: *Assessing Hydrologic Impacts on Water Resources in BC – Summary Report Joint Workshop BC Hydro 20 April 2010*. Pacific Climate Impacts Consortium, 37 pp.

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Murdock, T.Q. and **A.T. Werner**, 2011: *Canadian Columbia Basin Climate Trends and Projections: 2007-2010 Update*. Pacific Climate Impacts Consortium, University of Victoria, Victoria, BC, 43 pp.

Lane, O., S. Cohen, **T.Q. Murdock**, 2011: *Climate Change Impacts and Adaptation in the Canadian Columbia River Basin: A Literature Review*. University of British Columbia/Environment Canada.

Rodenhuis, D., B. Music, M. Braun, and D. Caya, 2011: *Climate Diagnostics of Future Water Resources in BC Watersheds*. Pacific Climate Impacts Consortium, University of Victoria, 74 pp.

Schnorbus, M.A., K.E. Bennett, **A.T. Werner** and A.J. Berland, 2011: *Hydrologic Impacts of Climate Change in the Peace, Campbell and Columbia Watersheds, British Columbia, Canada*. Pacific Climate Impacts Consortium, University of Victoria, Victoria, BC, 157 pp.

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