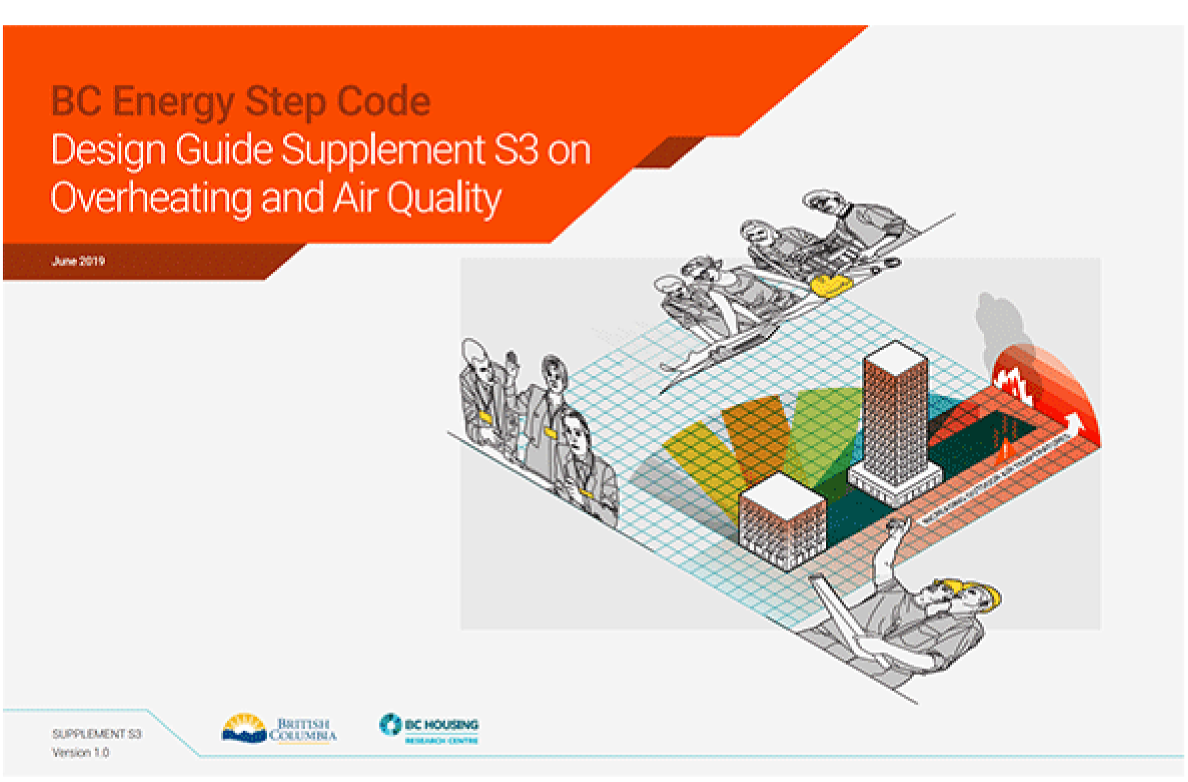
PACIFIC CLIMATE IMPACTS CONSORTIUM

PCIC UPDATE February 2020

PROJECT AND RESEARCH UPDATES

PCIC Data Used in Overheating and Air Quality Guide



This figure shows the cover of the *BC Energy Step Code Design Guide Supplement* for which PCIC's data was used.

British Columbia's changing climate brings with it impacts that can affect buildings and their inhabitants. These include changes to the type, timing and amount of precipitation that falls, changes to seasonal heating and cooling demands, and fire-related air pollution, as well as flooding, fire risk and windstorms. PCIC's RCI Theme has been contributing to a BC Ministry of Housing project, entitled, *Mobilizing Climate Adaptation and Resilience in Building Design and Renovations in BC*, which aims to increase the resilience of BC's communities in the face of the impacts of climate change. PCIC has provided data and guidance to assist with the analysis of the impacts of future climate on buildings, information that will be used to inform decision making by design teams. This has included presenting at a workshop at the 2019 Ecocity Conference in Vancouver in October. Data that PCIC provided has been used in the BC Energy Step Code Design Guide Supplement on Overheating and Air Quality.

Read the Design Guide Supplement, here.

Northeast Region Assessment Report Released

Climate Projections for the BC Northeast Region, a report that makes use of both hydrological analysis and regional climate impacts in order to assess how the Northeast's climate is changing and is projected to change in the future, has just been released and is now available online. As mentioned in our June 2019 PCIC Update, the co-produced report is the product of a partnership between the Northeast Climate Risk Network and PCIC, and was funded by the Fraser Basin Council. The report provides an overview of the climate projections for the region, detailed chapters on temperature and precipitation indicators, tables of data and maps, hydrological analysis including projected changes in streamflow for several sites selected by communities, a discussion of potential regional impacts and some preliminary observations. Some of the key findings include increased precipitation and warming across all seasons. Changes in temperature and precipitation will drive summer streamflow to decrease by roughly a quarter compared to the past, on average, and to increase in the rest of the year.

Read the report, here.

The Impact of Dynamical Changes on Atmospheric Rivers Over Western North America

Atmospheric river events are streams of warm, moist, tropical air that are drawn poleward by midlatitude cyclones. When they pass over British Columbia, they meet the mountains of the Coast Range, are forced upward, cool and release large amounts of moisture over the province. Reanalysis results suggest that the extreme precipitation that results from these events—roughly twenty each year—is responsible for somewhere between a fifth and a quarter of the province's annual precipitation. Atmospheric rivers help to fill reservoirs and build snowpack, but they can also cause flooding and so understanding how they may change in the future due to anthropogenic climate change would be useful for planning.

To explore this, PCIC researchers evaluated a group of climate models and selected one of the models that best represented atmospheric rivers over western North America. They then used a machine learning approach to classify the atmospheric rivers into three types: southern, northern and middle, depending on the latitude at which they make landfall. The researchers then examined the physical processes responsible for each. Armed with their understanding and a method of identifying these events, they examined the future projections from this model, assuming a business-as-usual emissions scenario. They found that the frequency of atmospheric rivers along the coastline increases by the end of the 21st Century, especially for the area that includes California and Vancouver Island.

Tan, Y., **F.W. Zwiers**, S. Yang, **C. Li** and K. Deng, 2020: The role of circulation and its changes in present and future atmospheric rivers over western North America. *Journal of Climate*, **33**, 4 1261-1281, doi:10.1175/JCLI-D-19-0134.1.

Climate Science Course for Working Professionals in BC

The first course offered by the Inspiring Climate Action project, for which PCIC has been collaborating with the Resilience By Design Lab at Royal Roads University, will be offered online through Royal Roads. The course is entitled, *Climate Change Adaptation Fundamentals* and is an introduction to climate science for working professionals in BC. The Inspiring Climate Action project has been funded by the BC Ministry of Environment and Climate Change Strategy and Natural Resources Canada as part of their Building Regional Adaptation Capacity and Expertise program. The course begins on Feb 3, 2020

More information about registration can be found, here.

Climate Information for Decision Making Webinar

PCIC and CCCS recently held a joint webinar titled, *An Introduction to Climate Information for Decision Making: Pilot Presentation*. This webinar provided an overview of climate change for decision-makers, covering the baseline information that decision-makers should know and discussed the role of climate change in decision-making.

The webinar can be viewed, here.

A PCIC Researcher's Experience at the Northwest Climate Science Conference

Recently, PCIC Regional Climate Impacts Analyst Stephen Sobie attended the Northwest Climate Conference in Portland, Oregon. While there, he shared information about research undertaken at PCIC that uses high-resolution downscaling and process-based snow modelling to simulate past and future daily snowpack levels at the resolution of a kilometre. Being able to model snowpack and cover is important for correctly simulating the hydrology of many regions in BC. PCIC researchers found that simulated snowpack variation matched observed inter-annual variability, but underestimated peaks in some areas. The future projections show substantial declines in snow cover and snow pack at low-to-mid elevation areas, with accelerating decreases in the latter half of this century. Stephen also discussed some potential impacts of reduced snowpack for Metro Vancouver in the context of the *Climate Projections for Metro Vancouver* report

He shares his experience at the conference, below.

"I recently attended the Northwest Climate Conference, which brings together scientists, managers, policy-makers, users, and communicators to discuss climate research from a wide variety of perspectives. The conference is in its 10th year and continues to grow, with an expanding range of topics. There were sessions on communication and health impacts, and new this year were discussions on risk and liability from legal and insurance industry representatives.

"My focus was attending the climate science and climate impacts sessions and to present some of our research on modelling snow pack. I attended a number of interesting oral and poster presentations covering new research on atmospheric rivers, applications of self-organizing maps, and how climate change may affect Portland's public infrastructure. There was also an interesting discussion on cross-border cooperation regarding forestry issues between BC, Washington, and California.

"I presented in the Snow and Ice session on recent work modelling snow pack in British Columbia using the high-resolution downscaled climate simulations. Other topics in this session included forest fire impacts on snow accumulation, a tool to enable citizen snow pack observations, and glacier changes in the Olympics. During the conference I met with a variety of researchers working in different fields and had a number of interesting discussions on new tools and methods that I hope to make use of in my research."

BC Hydro Agreement Renewal

Long-time partner BC Hydro has reaffirmed its commitment to working with PCIC with a four-year agreement that will extend to March 2023. The relationship between PCIC and BC Hydro extends back to the 2005 meeting at which PCIC was organized. It has resulted in climate projections across BC and the US Columbia River basin, improved hydrologic models for the region, and hydrologic projections for most of the watersheds that BC Hydro manages. The current agreement will include support for BC Hydro's use of climate science in its planning. It also includes work by PCIC to push at the boundaries of knowledge within climate science and hydrology, and to develop and adopt ever more capable, cutting-edge models to meet BC Hydro's needs.

Future Weather Files

PCIC has recently signed an agreement with the Ministry of Environment and Climate Change Strategy to prepare a large collection of "future weather files." Weather files are used to represent meteorological conditions for the energy modelling of buildings. The files prepared under this project will be used by public sector organizations and buildings professionals in BC. PCIC will be engaging with users in these sectors to inform the development of an online interface to make the files publicly available.

Other New Agreements

PCIC has also recently signed an agreement with the Ministry of Transportation and Infrastructure (MoTI) for a project entitled, *Climate Information, Projections and Process for use in the Ministry Highway Maintenance Renewal Data Mapping Tool.* MoTI awards multi-year, high-value highway maintenance contracts over large regions. Climate information, particularly for the future, is imperative for effective bidding on these contracts. PCIC is partnering with MoTI to deliver the PCIC Climate Explorer's future climate scenarios via a software interface that will allow the best and most up-to-date climate information to be incorporated into MoTI's full knowledge base and used for decision making.

STAFF PROFILE: ROD GLOVER

Rod Glover joined PCIC as a software developer in PCIC's Computational Support Group in the fall of 2017. He holds an M.Sc. in Computer Science from the University of Toronto, a degree in Mathematics and Computer Science from UVic and an M.A. in Counselling Psychology, which he describes as, "another story entirely," alluding to his decade of experience as a psychotherapist and counsellor. Rod's career in software engineering has been focused on scientific research and applications. Describing these Rod says, "I've worked on ocean modelling, medical devices, civil engineering infrastructure, environmental monitoring, and now climate research," he continues, "I also worked for a couple of years at a Silicon Valley start-up, which was exciting, stressful, and ultimately unstable."

Explaining why he got into the field of software engineering, Rod explains it's his interest in the intersection of mathematics, physics, and computer science, "[i]n part, it's pure intellectual excitement." He explains that it is also where he can serve one of his most important personal goals, which is to help make the world a better place. "Working at PCIC fits extremely well with that goal," he adds.

As the Web Front-End Developer Rod helps to maintain and develop the public-facing web applications that allow people to locate, visualize, interpret, and download climate data produced and managed by PCIC. "But more than that, I get to participate in the chain of intellectual effort that makes such tools possible," Rod says, continuing, "all the way from working with the scientists whose research is the foundation of what PCIC offers, through researching and adopting efficient and effective software engineering practices, and into the nitty-gritty backend web services that deliver data to the applications you see in your browser."

Rod's current projects include the PCIC Climate Explorer, released early this year, a Data Portal for the Northwest Territories Climate Data Set, PCIC's Data Portal and an upgraded version of Plan2Adapt driven by data used in the fifth phase of the Coupled Model Intercomparison Project (CMIP5). Rod closes by reflecting on the projects that he is working on, "it's very satisfying work, and we use some of the most modern tools available for it."

NEW PCIC SCIENCE BRIEF

PCIC recently released a new Science Brief that covers a paper in Geophysical Research Letters by Guo et al. (2019), in which the authors use a technique known as "dynamical adjustment," to estimate the atmospheric circulation and thermodynamic contributions to observed precipitation over Eastern North America and Northern Eurasia over the 1920-2015 period. They find that the thermodynamic component, due to anthropogenic emissions, contributes to increases in precipitation in both regions. They estimate that the dynamic component accounts for about 40% of the winter precipitation trend in Northern Europe and contributes a drying influence to Eastern North America. They then compare the spatial pattern and magnitude of these components to those obtained from global climate models driven with anthropogenic forcings. They find strong agreement between the thermodynamic components of precipitation obtained from the observational data and those obtained from climate model output.

Read the new Science Brief, here.

PACIFIC CLIMATE SEMINAR SERIES

The Pacific Climate Seminar Series continues through the winter semester with a talk by Dr. Robert Gifford on February 26th at 3.p.m. titled, *The Dragons of Inaction – and How to Slay Them*. Professor Gifford will be discussing the gap between good intentions and impactful behaviour as regards environmental issues. The talk will be held in Clearihue A127.

Read more on Dr. Gifford's upcoming talk.

PCIC also co-hosted two talks in the fall semester following the last newsletter. The first was by Dr. Hannah Teicher from the Pacific Institute for Climate Solutions whose presentation was titled, *Recognizing Interdependence: How Urban Collaborations Enhance Adaptation* on October 23rd. This was followed a talk delivered by Robert Lepage from RDH Building Science on November 20th, titled, *Climate Change and Building Science*.

Read more on the presentations by Robert Lepage and Dr. Hannah Teicher.

PCIC STAFF NEWS

PCIC is happy to welcome Md. Shahabul Alam to our Hydrologic Impacts Theme. Dr. Alam joins us from the University of Saskatchewan, from which he will soon be receiving his PhD in Civil, Geological and Environmental Engineering. At PCIC, his work will focus on modelling the impacts of climate change on the freshwater environment of coastal watersheds in British Columbia. His position is supported by the British Columbia Salmon Restoration and Innovation Fund.

PEER-REVIEWED PUBLICATIONS

Ben Alaya, M.A., **F.W. Zwiers** and X. Zhang, 2019: Probable maximum precipitation in a warming climate over North America in CanRCM4 and CRCM5. Early online view, *Climatic Change*, doi:10.1007/s10584-019-02591-7.

Chhetri, B.K, Galanis, E., **Sobie, S.**, Brubacher, J., Balshaw, R., Otterstatter, M., Mak, S., Lem, M., Lysyshyn, M., **Murdock, T.**, Fleury, M., Zickfeld, K., Zubel, M., Clarkson, L. and T.K. Takaro, 2019: Projected local rain events due to climate change and the impacts on waterborne diseases in Vancouver, British Columbia, Canada. *Environmental Health*, 18, 116, doi:10.1186/s12940-019-0550-y.

Sun, Q., C. Miao, A. Agha Kouchak, I. Mallakpour, D. Ji, and Q Duan, 2019: Possible Increased frequency of ENSO-related dry and wet conditions over some major watersheds in a warming climate. Early online release, *Bulletin of the American Meteorological Society*, doi:10.1175/BAMS-D-18-0258.1.

Sun, Q., C. Miao, M. Hanel, A.G.L. Borthwick, Q. Duan, D. Jid and H. Li, 2019: Global heat stress on health, wildfires, and agricultural crops under different levels of climate warming. *Environment International*, 128, 125-136, doi:10.1016/j.envint.2019.04.025.

Tan, Y., **F.W. Zwiers**, S. Yang, **C. Li** and K. Deng, 2020: The role of circulation and its changes in present and future atmospheric rivers over western North America. *Journal of Climate*, **33**, 4 1261-1281, doi:10.1175/JCLI-D-19-0134.1.

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