PCIC Update

February 2026

PACIFIC CLIMATE IMPACTS CONSORTIUM

Improved Modelling of BC's Salmon Habitats

Understanding how climate change will affect rivers, streams, and lakes is critical for protecting and preserving healthy fish populations. Many species will be affected by changes in streamflow and water quality. To address this need, PCIC has developed new high-resolution modelling for streamflow, water temperature, and saturated dissolved oxygen, and is working to make these results available through a new data portal, complementing the existing Salmon Climate Impacts Portal. These data will provide essential information to support ecosystem management in British Columbia's watersheds, which are home to a large and diverse number of species, including five species of Pacific salmon.

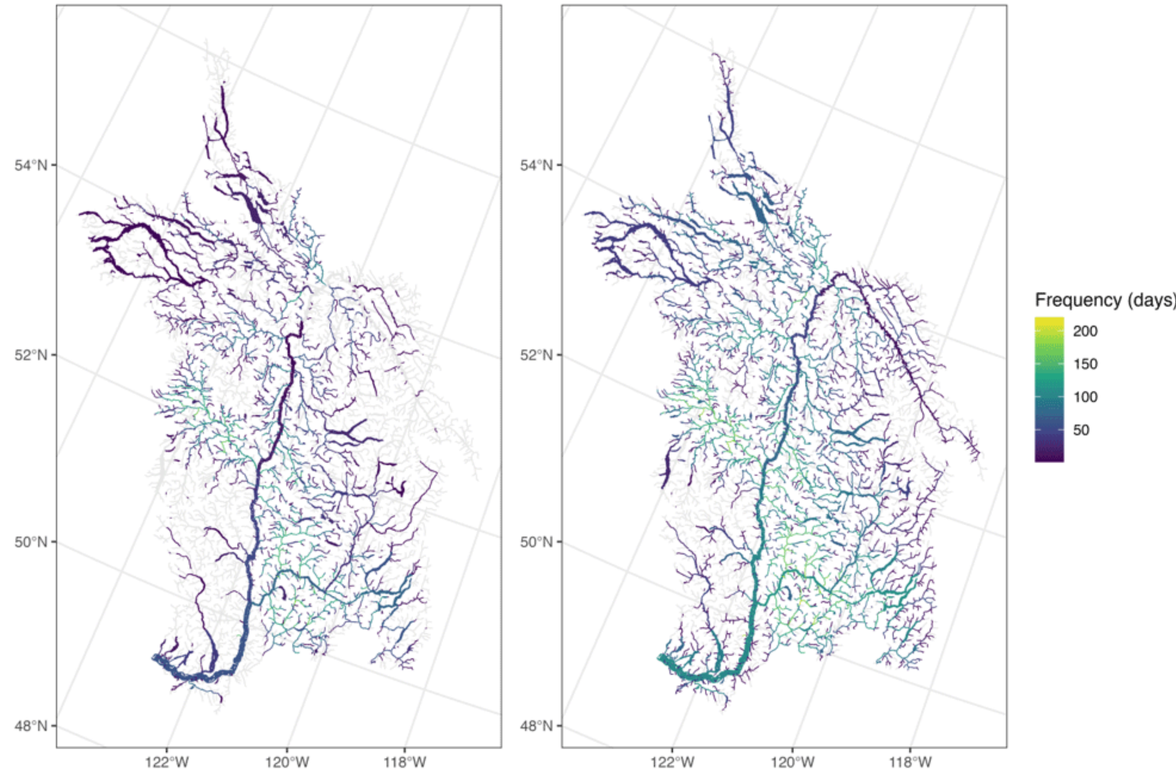


Figure 1: This figure shows how the frequency of warm-water days is projected to change across individual river reaches and lakes in the Fraser River basin. The colours represent the annual average number of warm-water days—defined as days with a daily average water temperature above 19°C in a year—for the historical period (1971-2000, left panel) and the future period (2071-2100, right panel). Greyed-out areas are not projected to experience any warm-water days. These results are based on a single CMIP6 climate projection using the CNRM-ESM2-1 model under a high-emission (SSP5-8.5) scenario. This projection was used to drive the VIC-GL model, and the resulting outputs were then downscaled and routed through the Raven model.

To develop these high-resolution projections, PCIC hydrologists created and refined a multi-step modelling workflow. This workflow uses existing runoff output from the Variable Infiltration Capacity Model with Glaciers (VIC-GL), which is then fed to the routing component of the Raven model. The Raven model provides a wide variety of modelling options, including spatial discretization (how the model divides space), temporal resolution, and representation of physical processes and important elements such as lakes. Raven was deployed using a catchment discretization where the river network is represented as individual sub-basins with discrete stream channels. This 'vector-based' approach to routing provides a much more accurate representation of the river network, leading to a more faithful representation of streamflow and water quality at the scale of individual channel reaches and lakes. Using VIC-GL alone, streamflow can only be derived for areas larger than a single grid cell in the hydrologic model, about 25 km^2. However, by using VIC-GL to drive the Raven model, the spatial resolution can be improved by about a factor of five.

To produce future water temperature projections in these watersheds, PCIC hydrologists also employed Raven's thermal wrapper and introduced an improved lake temperature model. This modelling chain has been used to downscale global climate model projections from CMIP6 to create high-resolution streamflow projections, an example of which is shown in Figure 1. The thermal wrapper represents heat transfer processes and accounts for incoming and outgoing radiation, evaporation, and heat exchange with the ground and air. The model uses two layers to represent heat in waterbodies: the top layer exchanges heat with the atmosphere, while heat transfer between the top and bottom layers occurs via conduction and convection. PCIC researchers have also implemented a model to estimate the maximum amount of dissolved oxygen in the water (termed oxygen saturation), which depends on temperature and atmospheric pressure. Dissolved oxygen is a critical water quality parameter that indicates the amount of oxygen available to aquatic organisms and is vital for sustaining aquatic ecosystems.

With the modelling workflow established, PCIC's hydrologists have now deployed it across BC's entire coastal domain, including the Fraser Basin, covering a combined area of about 405,000 km^2. This model will be used to downscale VIC-GL projections based on climate model output from CMIP6. This work is near completion, and the resulting high-resolution vector-based output will be available from a new data portal. This effort demonstrates how PCIC can pool resources from its collaborators to develop a wide range of tools and applications, enabling much larger return on investment for individual partners. The foundation of this work relies on core hydrologic modelling capabilities funded by BC Hydro, which in turn enables research on an expanded set of variables. This specific research is supported by funding from the BC Salmon Restoration and Innovation Fund.

Reassessing past and projected future warming in Canada

PCIC scientists recently led a project that attributed the causes of warming in Canada's climate since pre-industrial times and substantially reduced the uncertainty in raw climate projections by using historical observations. Reducing the uncertainty in future projections improves the quality and cost-effectiveness of adaptation planning that depends on these projections. By combining information from climate models and observations, the researchers were also able to overcome limitations in historical observations, which are sparse in northern Canada.

The researchers used a consistent framework to examine both the past and projected future climate. Looking backward in time, they found that Canada did not warm during the pre-industrial period (1850-1900), warmed gradually through the early to mid-20th century, and warmed most rapidly since the 1970s, particularly in northern Canada. By the 2015-2024 period, Canada had warmed by about 2.2°C relative to the preindustrial era, a change that the researchers found was driven primarily by anthropogenic greenhouse gas emissions.

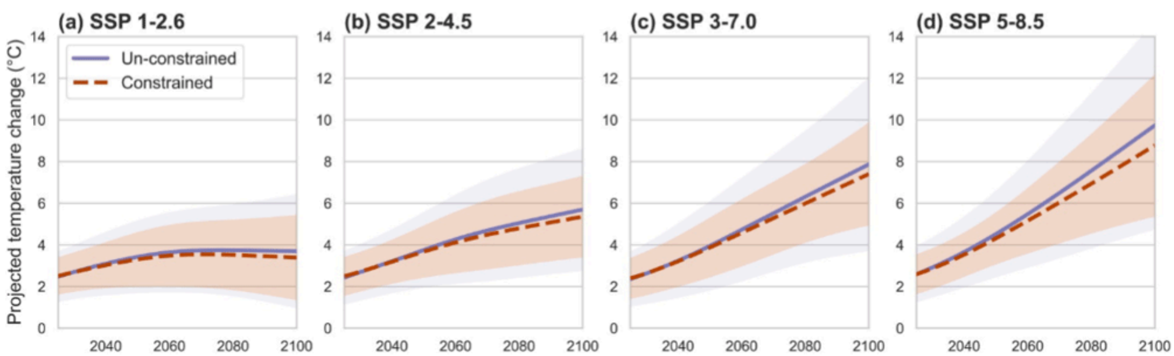


Figure 2: This figure shows the projected warming from 2026-2100 relative to the preindustrial period (1850-1900) over Canada under four future emissions scenarios (here SSP stands for Shared Socioeconomic Pathways). The solid lines show the best estimates of projected future warming from climate models, while the dashed lines show the corresponding projections after applying the observational constraints. The grey shading indicates the range of uncertainty (5% - 95%) in raw model projections, while the orange shading shows the corresponding range for the constrained results. Figure adapted from Li et al., 2025.

Looking forward in time, the researchers found that Canada is projected to warm by 5.1°C by the end of the century under an intermediate emissions scenario, and by 6.7°C under a higher emissions scenario. They were able to narrow the uncertainty range of the projections by 17%-42% by the end of the century, compared to raw climate model results, as shown in Figure 2. The authors also noted that both the magnitude of the projected warming and the reductions in uncertainty vary by region (Figure 3), with northern and eastern Canada expected to experience the greatest increases in temperature. The substantially larger projected warming under the higher emissions scenario underscores the critical need for climate mitigation.

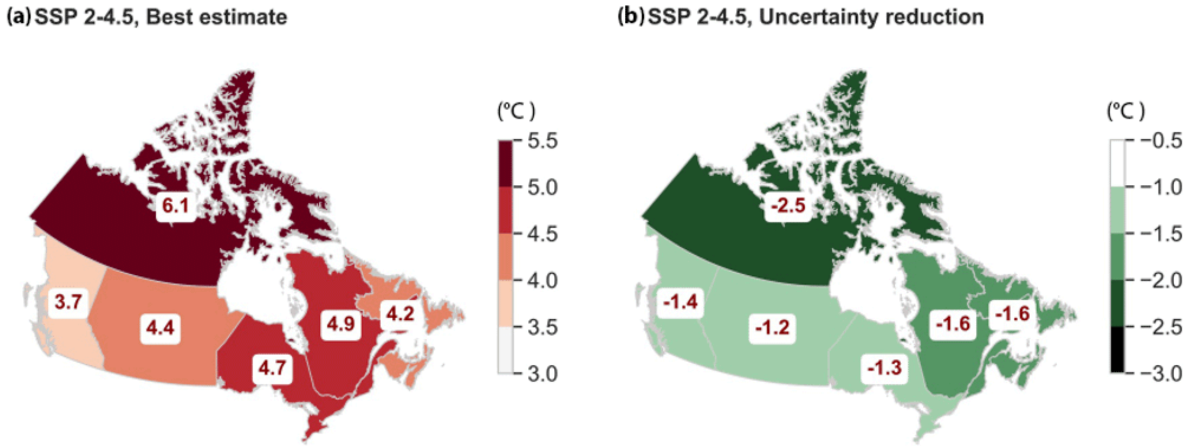
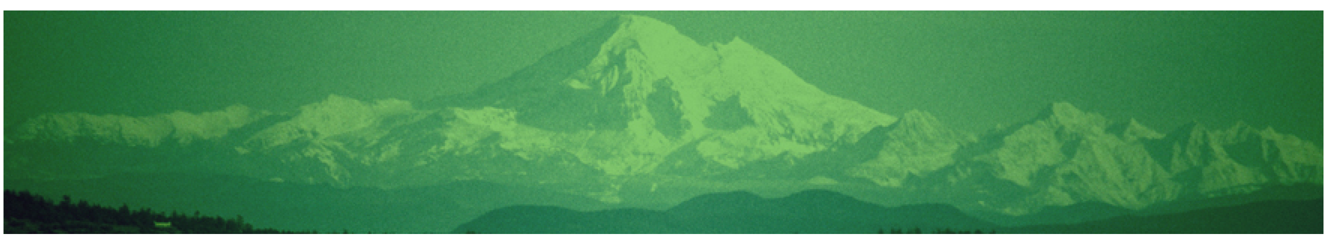


Figure 3: This figure shows results for subregions under a moderate emissions scenario: (a) the best estimates of the constrained projection at the end of the 21st century (2081–2100) and (b) the reduction in the width of the uncertainty range between the constrained and unconstrained projections. All temperatures are in degrees Celsius. (Figure and caption adapted from Li et al., 2025.)

Results from this work are already being used in an upcoming national assessment titled, *Canada's Changing Climate Report 2026*. This report will thoroughly assess both how and why Canada's climate has changed in the past, and also the range of projected future climates.
Read the paper.



Canada's New Building Code Reflects a Changing Climate

Last December, the Canadian Board for Harmonized Construction Codes released an update to the National Model Codes, including the National Building Code of Canada 2025 (NBCC2025). The latter draws in part on work conducted at PCIC several years ago in partnership with Environment and Climate Change Canada (ECCC) and supported by the National Research Council of Canada. The NBCC sets out technical requirements for the design and construction of new buildings, as well as for alterations to existing ones. For this update, PCIC's team extended and improved the analysis of historical data underlying the design values that building professionals and infrastructure engineers use to account for environmental influences on the built environment. PCIC and ECCC combined their expertise in future climate projections to estimate how each of the NBCC design values may change from now until the end of the century.

Many of these future-projected values are included in the NBCC2025, making it the first version of the national building code to include future climate change. These updates reflect the reality that buildings and infrastructure constructed today will be exposed to a future climate that differs substantially from that of the past.

Another key outcome of the project was PCIC's development of a dedicated web application, the Design Value Explorer (DVE), to display both historical and future design values in mapped and tabular formats. This has proved to be a popular resource for building and infrastructure engineers seeking to build additional resilience into their designs. The DVE is unique insofar as it provides information on specific variables, many of which describe climate extremes, that are not available through other climate services tools. These include, for example, snow loads, wind pressures, and moisture index. In addition to providing data for the NBCC, PCIC and ECCC contributed climate information for an updated version of the Canadian Highway Bridge Design Code, which is similarly the first of its kind to provide guidance for future climate change risks. This code was released by the Canadian Standards Association (CSA Group) in October of 2025.

PCIC's work on developing underlying data for infrastructure design is one example of how we provide climate services with tangible benefits, supporting climate adaptation to specific hazards and impacts. We are grateful to each of our partners who helped to make this important work possible.

Access the new Model Codes.

Access the Design Value Explorer.

New and Noteworthy

- In January, PCIC staff were invited to present at the Capital Regional District (CRD) Climate Adaptation Capacity Building Initiative, where they showcased climate projections data tools for the region, including a demonstration of PCIC's Climate Explorer.
- As part of an updated regional climate assessment for the Cowichan Valley Regional District (CVRD), PCIC recently co-organized a gathering of staff from local governments and community organizations in the region to discuss regional climate impacts. Insights garnered from this workshop will be used to inform an updated report for the CVRD, following on the previous assessment from 2017. We thank everyone who attended this event for sharing their knowledge and expertise.

- PCIC's national partner, ClimateData.ca, has released a new monthly and seasonal forecast data viewer, based on data provided by Environment and Climate Change Canada. These accessible maps show the probability of below-normal, above-normal or normal temperature and precipitation for a period of up to 12 months into the future. PCIC provided reviews of the viewer and accompanying materials on ClimateData's Learning Zone.
- According to organizations that maintain and analyse global climate records, including the National Aeronautics and Space Administration (NASA), Berkeley Earth, the National Oceanic and Atmospheric Administration (NOAA), and the Copernicus Climate Change Service at the European Centre for Medium-Range Weather Forecasts, 2025 was the third-hottest year on record, after 2024 and 2023.

PCIC Seminar Series

This semester of the Pacific Climate Seminar Series started on January 14th, with a presentation from the Lead of PCIC's Computational Support Group, James Hiebert. His talk, *Weather to Run: Building Climate Data Infrastructure for Science and Society,* discussed the Pacific Climate Data Set that PCIC maintains, a unique collaborative project between the all of the partners in the Climate-Related Monitoring Program that holds observations from over 7000 stations in BC, with some records going back to 1870. Hiebert highlighted the value of this extensive database through the intriguing lens of finding the number of days each year when the weather is suitable for outdoor running in a number of different locations in BC.

The second talk in the series was held on February 18th, and delivered by two co-presentors: Normand Gagnon, the acting director of the Meteorological Research Division, Environment and Climate Change Canada (ECCC), and Dr. Gilbert Brunet, a retired ECCC meteorologist whose career spans over three decades of leadership, research, and international collaboration. In their talk, *How are we doing weather forecasts? The Canadian recipe*, they discussed the history of weather forecasts and some of the current advances that are being made today. They also spoke on how weather forecasts are made, and the roles of observations, models and meteorologists. This talk will be made available in our Publications Library within the next two weeks.

Please stay tuned for information on upcoming talks.

Publications

Lavoie, J., L.P. Caron, T. Logan, **S.R. Sobie**, R. Turcotte, E. Mailhot and J. Pelletier-Dumont, 2025: On the importance of the reference data: Uncertainty partitioning of bias-adjusted climate simulations over eastern Canada. *Climate Services*, **40**, 100619, doi:10.1016/j.cliser.2025.100619.

Su, J., C. Miao, **F.W. Zwiers**, H. Beck, P.D. Jones, Q. Sun, L.J. Slater, W.R. Berghuijs, Y. Wada, D. Rosenfeld, J. Gou, Y. Wu, P. Taroli, P. Borrelli, P. Panagos, L.V. Alexander, Q. Zhang, J. Hu, S.-K. Min, L. Samaniego, Q. Duan, G. Destouni, J.A. Marengo, R. Modarres and S. Sorooshian, 2026: Precipitation Observing Network Gaps Limit Climate Change Impact Assessment. *Nature*, accepted.

Wang, X. L., Y. Feng, **F.W. Zwiers**, and V.Y.S. Cheng, 2026: Precipitation Trends in Version 2 of the Canadian Homogenized Monthly Precipitation Dataset. *Atmosphere-Ocean*, 1–16, doi:10.1080/07055900.2026.2617861.

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