

PROJECT AND RESEARCH UPDATES

Downscaled CMIP6 Data Now Available

PCIC is in the process of incorporating the latest climate projections produced by the Earth system models used in the sixth phase of the Coupled Model Intercomparison Project (CMIP6) into its online tools. These models feature improved representations of the Earth system and will complement the downscaled CMIP5 projections currently available via PCIC's Data Portal and Analysis Tools. PCIC researchers statistically downscaled the CMIP6 climate model output to create high-resolution climate information that can be used in further research and to examine projected impacts at the regional scale. PCIC has added the CMIP6 results to its "Statistically Downscaled Climate Scenarios" page, where they can be downloaded, and has also incorporated those results into the PCIC Climate Explorer tool so that users can explore the scenarios without downloading them to their own computers.

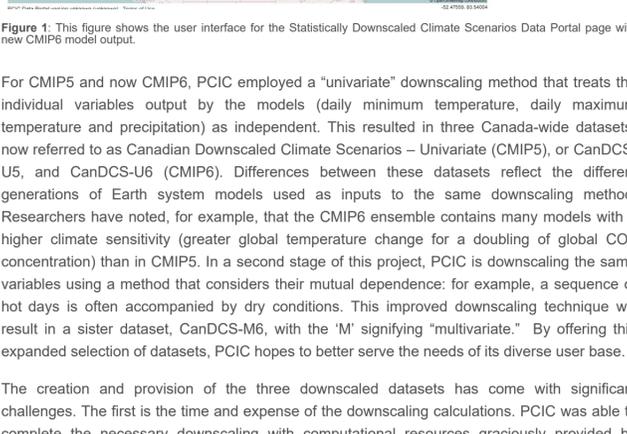


Figure 1: This figure shows the user interface for the Statistically Downscaled Climate Scenarios Data Portal page with new CMIP6 model output.

For CMIP5 and now CMIP6, PCIC employed a "univariate" downscaling method that treats the individual variables output by the models (daily minimum temperature, daily maximum temperature and precipitation) as independent. This resulted in three Canada-wide datasets, now referred to as Canadian Downscaled Climate Scenarios – Univariate (CMIP5), or CanDCS-U5, and CanDCS-U6 (CMIP6). Differences between these datasets reflect the different generations of Earth system models used as inputs to the same downscaling method. Researchers have noted, for example, that the CMIP6 ensemble contains many models with a higher climate sensitivity (greater global temperature change for a doubling of global CO2 concentration) than in CMIP5. In a second stage of this project, PCIC is downscaling the same variables using a method that considers their mutual dependence: for example, a sequence of hot days is often accompanied by dry conditions. This improved downscaling technique will result in a sister dataset, CanDCS-M6, with the 'M' signifying "multivariate." By offering this expanded selection of datasets, PCIC hopes to better serve the needs of its diverse user base.

The creation and provision of the three downscaled datasets has come with significant challenges. The first is the time and expense of the downscaling calculations. PCIC was able to complete the necessary downscaling with computational resources graciously provided by Compute Canada—now named the Digital Research Alliance of Canada (the Alliance)—and support from Environment and Climate Change Canada (ECCC). The second challenge involves storage of the resulting data products. Thanks again to cloud storage resources provided by the Alliance and PCIC's local storage cluster, PCIC's platforms serve terabytes of data to its thousands of users each month, across its three Analysis Tools and seven Data Portal pages. A final challenge arose from PCIC's need to share these data with its main partners on the project, namely ECCC and the Computer Research Institute of Montréal (who together host a version of the data on the national ClimateData.ca website). Moving such a large amount of data across the country via standard networks is a non-trivial undertaking, but we were able to do so quickly by using CANARIE's National Research and Education Network, with which we were able to complete the transfer in around 12 hours. Moving forward, PCIC will offer these datasets in a self-serve manner via the PCIC Data Portal and in their entirety via BitTorrent. PCIC continues to provide its users with data and tools based on projections from the most recent climate models on the cutting edge of Earth system science, but focused on the regions that PCIC serves.

- Explore [PCIC's Analysis Tools](#).

Release of the Design Value Explorer

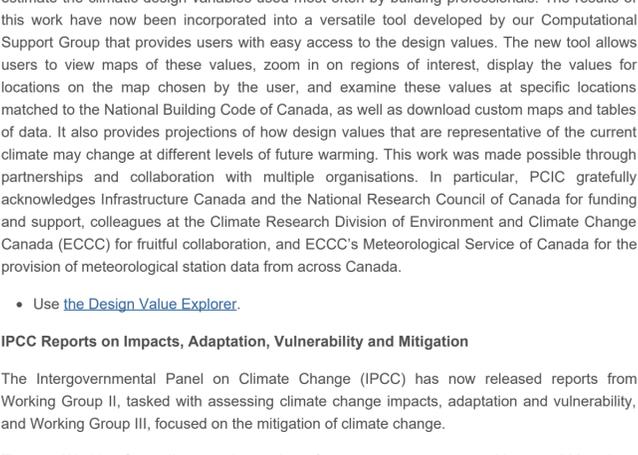


Figure 2: This figure shows the interface for the Design Value Explorer.

Canada's building professionals require information about the environmental conditions that buildings and infrastructure projects will be exposed to today and over the life of the structures. PCIC is pleased to announce the release of its newest analysis tool, the Design Value Explorer, which meets this need by supplying historical and projected future design values across Canada. PCIC's researchers worked from station observations and climate model output, to estimate the climatic design variables used most often by building professionals. The results of this work have now been incorporated into a versatile tool developed by our Computational Support Group that provides users with easy access to the design values. The new tool allows users to view maps of these values, zoom in on regions of interest, display the values for locations on the map chosen by the user, and examine these values at specific locations matched to the National Building Code of Canada, as well as download custom maps and tables of data. It also provides projections of how design values that are representative of the current climate may change at different levels of future warming. This work was made possible through partnerships and collaboration with multiple organisations. In particular, PCIC gratefully acknowledges Infrastructure Canada and the National Research Council of Canada for funding and support, colleagues at the Climate Research Division of Environment and Climate Change Canada (ECCC) for fruitful collaboration, and ECCC's Meteorological Service of Canada for the provision of meteorological station data from across Canada.

- Use [the Design Value Explorer](#).

IPCC Reports on Impacts, Adaptation, Vulnerability and Mitigation

The Intergovernmental Panel on Climate Change (IPCC) has now released reports from Working Group II, tasked with assessing climate change impacts, adaptation and vulnerability, and Working Group III, focused on the mitigation of climate change.

The new Working Group II report, the product of an assessment process with over 1000 authors in the physical and social sciences across the world, details the impacts that climate change is having on human societies and ecosystems. These impacts are wide-ranging and the report provides a global breakdown, by region, of the effects that climate change is having on water scarcity, food production, human health and wellbeing, cities, settlements and infrastructure, and ecosystem structure, range and timing. The report also provides a breakdown of projected impacts from a range of emissions scenarios and warming levels.

The report from Working Group III is the product of an assessment from over 230 authors from around the world. It discusses what can be done to mitigate the emission of anthropogenic greenhouse gases and otherwise reduce the impact of human activities on the climate system. The report discusses historical emissions thus far as well as the path of future emissions and what would be required to keep global warming under 2°C.

These reports underscore the need to rapidly reduce human greenhouse gas emissions and to adapt to the changes that are already occurring. The Working Group III report finds that unless significant action is taken beyond the policies agreed to as of 2020, the median warming by the end of the century is projected to be about 3.2°C, past the 2°C Paris guard rail meant to limit the destructive impacts of climate change. The Summary for Policy Makers for the Working Group II report ends with, "The cumulative scientific evidence is unequivocal: Climate change is a threat to human well-being and planetary health. Any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a liveable and sustainable future for all."

- Read [the Working Group II Report](#).
- Read [the Working Group III Report](#).

New Section and Sector Modules on ClimateData.ca

In order to incorporate the impacts of climate change into their planning processes, Canada's decision makers require high-resolution climate data, as well as context for, and guidance on, the use of this climate data. PCIC is part of a national collaboration that is working to make this available. This collaboration is supported by the Canadian Centre for Climate Services (CCCS) and involves the Computer Research Institute of Montréal (CRIM), Ouranos, PCIC, and a web applications development company called HabitatSeven. PCIC has recently contributed to the Analyze section and two sector modules, for buildings and transportation. ClimateData.ca also provides national access to PCIC's downscaled climate change scenarios.



Figure 3: This figure shows the user interface for the Analyze section of ClimateData.ca.

The Analyze section allows users to access indices for their region of interest that are generated from climate model output that has been downscaled by PCIC. Using this tool, users can specify thresholds for a set of climate indices at locations in Canada at the level of a health region, census division, watershed or a sub-watershed scale, for the past or in future projections. For instance, a user might be interested in projections of the number of days each year above a maximum temperature of, say, 12°C for the period of 2050-2070. The user can select the maximum temperature index, set the temperature threshold for days above 12°C and select the period of 2050-2070. ClimateData.ca will then handle the data processing and the user will receive an email with a link to the resulting files, in CSV and NetCDF formats. These files contain percentile values for the indices the user has selected from the ensemble of climate models. The exact output that the user would receive depends on the indices and thresholds that they select, but can include percentiles for such things as precipitation intensity, the number of heat waves, or the number of days per year that exceed a given threshold in temperature or precipitation parameters.

The buildings and transportation sector modules provide context for the use of climate data in planning for Canadian transportation systems and the built environment. The building sector module highlights PCIC's Design Value Explorer and links to the DVE and Weather Files Data Portal page, both of which PCIC has produced and made available nationally. In addition, these modules provide the user with in-depth case studies, sector resources that include education and engagement resources, and a discussion of the relevant variables for each sector.

- Explore [the Analyze section](#), and see [the Transportation](#) and [Buildings](#) modules.

New PCIC Science Brief

PCIC's most recent Science Brief is on research published in Remote Sensing of the Environment. This work, using satellite data, shows that western Canadian glaciers have been melting at an accelerating rate and examines how this is related to changes in seasonal temperature and precipitation. We place these into context and discuss what they tell us about changes to western Canada's.

- Read [the most recent Science Brief](#).

Past and Upcoming Talks at the Pacific Climate Seminar Series

The Pacific Climate Seminar series has continued through the winter and early spring. Professor Ted Shepherd delivered the last talk in 2021 on [Storylines as a way of bringing meaning to climate change at the local scale](#). PCIC's Dr. Mohamed Ali Ben Alaya started the series off for 2022 with his talk, [On updating climate extremes related engineering design values in a warming climate](#). This was followed by a talk on [the Human influence on the 2021 British Columbia floods](#), co-delivered by Dr. Nathan Gillett and PCIC's Markus Schnorbus, and a talk by Dr. John Fyfe on [The influence of short-term emission reductions on climate and air quality: lessons from COVID containment](#). Last month, Professor Paul Kushner spoke on [Engineering in a changing climate](#). The recordings for each of these talks is available from their individual pages on our website. The next talk in our series will be on Wednesday, May 18th, when Professor Hans von Storch will deliver his talk on [Intermittent divergence in phase space and regional modelling](#).

- For an abstract and attendance information for Professor von Storch's talk, see [the talk's page on our site](#).

STAFF PROFILE: STACEY O'SULLIVAN

Stacey O'Sullivan joined PCIC in spring of 2021 as a Content Development and User Engagement Assistant, starting as a co-op student and then becoming a staff member by the summer of that year. Stacey holds a Bachelors of Environmental Science and a Master of Climate Change from the University of Waterloo and has six years of experience in environmental monitoring and compliance work in the public and private sectors. Reflecting on her educational and work experience, Stacey says, "I knew from a young age that I wanted to study and work in the environmental field, but wasn't sure exactly what that would look like." Her choice to undertake her Master of Climate Change degree came after spending time in the field. "While I thoroughly enjoyed my time working in beautiful, northern settings, maintaining environmental compliance on remote industrial sites, I was deeply concerned with the urgent climate crisis, and wanted to transition my career to one with a direct climate change focus." In doing so, she found that working in the area confirmed that this was the career path for her.

Stacey's current work is focused on the ClimateData.ca website, a collaborative project between PCIC, Environment and Climate Change Canada, and other regional climate service providers across the Canada that provides climate information to help Canadian decision makers with their planning. ClimateData.ca is launching new sector-specific modules, and Stacey has been heavily involved in the development and launch of the Transportation and Buildings modules.

A major portion of these modules are the sector-specific case studies developed at PCIC. "Accessing climate data is not a silver bullet—it is only one piece of a larger puzzle," Stacey explains. While there is a need for high-quality climate data and projections, the case studies that PCIC is developing provide more puzzle pieces, helping decision makers to navigate uncertainty, as they place and use climate data within their specific context for adaptation decisions. "It has been an interesting challenge to think about how we can best offer this help and communicate these concepts to users of both PCIC tools and the ClimateData.ca website."

- Explore [the Transportation Module on ClimateData.ca](#).