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What is the purpose of this report?

This report is designed to help local governments and communities in your region prepare for climate change. The Pacific Climate Impacts Consortium (PCIC) developed high resolution (~800m) regional climate projections, providing information on a range of temperature and precipitation-related variables up to the end of this century. The report highlights projections for mid-century under a high greenhouse gas emissions scenario (SSP5-8.5). Other future outcomes for low (SSP1-2.6) and moderate (SSP2-4.5) emissions scenarios are also available as Excel files in the complete data package. For access to the complete dataset, please contact sustainability@rdn.bc.ca.

What is the Pacific Climate Impacts Consortium (PCIC)?

The Pacific Climate Impacts Consortium (PCIC) is a regional climate service provider at the University of Victoria that provides practical information on both historical climate and future climate projections in support of long-term planning. PCIC operates in collaboration with climate researchers and regional stakeholders on projects driven by user needs. Downscaling climate projections to the regional scale is one of the main project areas at PCIC.

What can climate projections data be used for?

Broadly speaking, climate projections data allow end-users to plan for and manage future climate risk. This can range from broader considerations (e.g., to inform strategic planning) to more detailed analyses (e.g., to inform a sensitivity analysis). Certain climate variables (e.g., “Cooling Degree Days”, “Heating Degree Days”, “1-in-20-year Wettest Day”, etc.) can be helpful for designing climate resilient buildings or other infrastructure. To incorporate future climate projections into design processes, users must understand the risk tolerance associated with a given project.

What are Shared Socioeconomic Pathways (SSPs)?

Shared Socioeconomic Pathways, or SSPs, are an updated set of global emissions scenarios for the latest phase of the Coupled Model Intercomparison Project, CMIP6. These scenarios make assumptions about how various socio-economic conditions (i.e., land-use changes, population, education, energy use, technology, etc.) may change over the next century in combination with global ambition to reduce greenhouse gas emissions. They are used for climate projections to allow climate modelers and end-users to explore climate change under a range of possible future conditions.

What emissions scenario(s) should I use?

This report presents projections to the 2030s, 2050s and 2080s under a high emissions scenario (SSP5-8.5). We chose to highlight this scenario because it is most consistent with the current progress on emissions reductions reflected by policies worldwide. For communications, strategic planning, and most high-level analyses, we recommend using what has been presented in the report. Planning based on climate projections under SSP5-8.5 could be considered a “no regrets” strategy for adaptation. For detailed analyses and/or design work, however, it is best practice to look at more than one emissions scenario to understand the range of possibilities. For more information about understanding which emissions scenario(s) to use, see the report *Appendix C: Guidance for Using Climate Projections*.

Which indices should I focus on for my work?

We have created the *Hazard Reference Tables* (see report *Appendix E*) to help users identify which climate indices included in the data package might be best suited to a particular context or application.

How does this report compare with other climate projections resources?

Compared to generally available climate data resources, this report offers the most localized information for understanding climate change in the Regional District of Nanaimo. The associated data package should be well-suited to further work requiring authoritative, quantitative results for many climatic quantities of interest.

Users may decide to access other existing climate projections resources for applications that require different variables, higher spatiotemporal resolution (e.g., time series for follow-on model simulations), or for sector-specific information. Data sources that may be helpful to review in conjunction with the current assessment are listed in *Appendix D* of the report.

Where can I find information for the near future (2030s)?

Projections for the "2030s" period for low, moderate, and high emissions scenarios are available as part of the complete data package. However, because the "2030s" is a 30-year average from 2021 to 2050, the three emissions scenarios (SSPs) driving the climate models will not be very different from the historical (1981-2010) period, nor will they be distinguishable from each other. For certain variables, changes may not be very noticeable by the 2030s period. In addition, climate variable responses under the three emissions scenarios (low, or SSP1-2.6; moderate, or SSP2-4.5; and high, or SSP5-8.5) do not begin to diverge noticeably until roughly 2050.

What is the difference between climate and weather?

Weather refers to the short-term conditions of the atmosphere at a specific location. Weather is highly variable, and can change from minute-to-minute, hour-to-hour, and day-to-day. *Climate*, on the other hand, is the average weather in a specific location or region over a longer period of time – usually 30 years or more. Climate varies on time scales from months to decades and longer. To cite an old but accurate adage: "Climate is what you expect; weather is what you get."

What is the difference between a weather forecast and a climate projection?

The aim of a weather forecast is to describe the *near-term* behaviour of the atmosphere, in a local area and on an hourly basis, up to 1 to 2 weeks into the future. In contrast, the aim of a climate projection is to describe the statistics of weather *in the distant future*. This includes the mean values of weather variables and their variability, the frequency and magnitude of extremes, and other features specific to certain variables (e.g., the percent coverage of sea ice over the Arctic Ocean). Because the distant future is much less certain than the near-term, a weather forecast comes with greater precision and accuracy than a climate model projection. Climate projections cannot tell us what the exact weather will be on June 18, 2054, but they *can* give us a good idea of what the climate of a typical season or year might be like in the 2050s.

This report is about climate change. Why is there no information about sea level rise or windstorms?

The report is based on statistically downscaled regional projections for **temperature and precipitation-based variables only**. PCIC has assembled Canada-wide, gridded, observational datasets for these two variables (called "target data") that are necessary for producing the downscaling results. At this time, target data of adequate quality and geographical extent are not available for other climate variables, such as wind, specific humidity, etc. Hence, this prohibits the production of downscaled data for these additional variables.

Why are there no hydrological projections provided with this report?

Hydrological modelling (which is also conducted at PCIC but is outside the scope of this work) employs a separate modelling framework and different input variables to produce future projections.

Why are recent extreme events not explicitly addressed in this report?

Climate models require different information than weather models to simulate the future (*see above: 'What's the difference between a weather forecast and a climate projection?'*). Specifically, scientists train climate models using available observations from the recent past, along with changing global concentrations of greenhouse gases and aerosols from the preindustrial period to the present, to produce a historical simulation of the Earth's climate. For CMIP6, all modelling groups used the same convention for the "past" (ending at 2014) and "future" (starting at 2015). After 2015, the climate models evolve freely, constrained only by the emissions scenarios (SSPs) as boundary conditions. This is one reason why weather events from very recent years are not reflected in the CMIP6 simulations. Another reason is that the Past period chosen for this report spans 1981-2010, one of the standard climatological periods used by the World Meteorological Organization.

To help contextualize recent extreme events that have occurred in your region, it may be best to view them as part of the "future" rather than the "past," given the simulation methodology just described. While the magnitude and especially the timing of future extreme events in the simulations are not directly comparable to actual events, projected changes in their frequency and magnitude should be useful for planning purposes.

How do "tipping points" factor into climate projections?

The global climate models used for the assessment are able to simulate certain "tipping points"—broadly understood as a situation in which at least part of the climate system undergoes "irreversible" change as a result of a particular global temperature being exceeded—but not others. For example, by later in this century, some of the models lose most or all their Arctic Sea ice (these models are often described as having "high climate sensitivity"). This accelerates warming in high-latitude land areas, melting their snow cover, and leading to further warming. On the other hand, the CMIP6 models do not dynamically simulate the Greenland and Antarctic ice sheets, whose degradation is another tipping point of concern, mainly for sea level rise. The models with high climate sensitivity are often those corresponding to the 90th percentile of the projections for temperature-related indices.