PACIFIC CLIMATE IMPACTS CONSORTIUM

PCIC UPDATE June 2022

PROJECT AND RESEARCH UPDATES

Providing Extreme Streamflow Values for the Fraser River

As the disastrous events of November 2021 made clear, the impacts of flooding on highway infrastructure can be catastrophic. The frequency and magnitude of future flooding events is likely to be altered as the climate continues to change. Understanding changes in peak streamflow events is thus important for designing climate-resilient transportation infrastructure and, in particular, culverts and bridges that must cross or convey water.

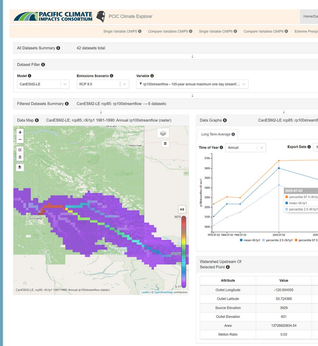

Figure 1: This figure shows the user interface for the PCIC Climate Explorer with extreme streamflow selected. In this instance, the user has selected a point, for which streamflow and other information is being provided.

To better understand these changes, PCIC has partnered with the BC Ministry of Transportation and Infrastructure (MoTI) to study peak streamflow across the entire Fraser River. This work began last year, with a pilot project that focused on the Upper Fraser. It continued this year, with PCIC researchers using a hydrologic model to provide estimates of projected future design flow values for streamflow events with return periods from two to 200 years. Design flow values describe the volume of water passing through a location in a given period of time and are used in the design and evaluation of infrastructure. Values for various return periods will be available on a gridded domain, with a grid resolution of 1/16th of a degree latitude by longitude, or about 25-30 square kilometres, depending on the latitude. The projections were made with PCIC's Variable Infiltration Capacity hydrologic model with glaciers (VIC-GL), using downscaled output from a large ensemble of climate simulations from the Canadian Earth System Model (CanESM2) that were driven using a high greenhouse-gas emissions scenario.

Currently, results for the Upper Fraser River are available through the Extreme Streamflow tab on PCIC's Climate Explorer. The output is spatially continuous, allowing users to pick a point that is directly available for their project and receive the streamflow information for that area. In addition, when users pick a point, the tool indicates the upstream drainage area, so that users can see the basin they are getting runoff from. This data will also be made available through an application programming interface, so that MoTI will be able to use it in their internal tools. We look forward to continued collaboration with MoTI to further expand the available coverage of design flow values in British Columbia.

Joint CMOS/ESC/CGU Conference

The start of June saw 830 Earth scientists gather virtually for the largest Earth science conference in Canada. June 1st marked the opening day of the Canadian Meteorological and Oceanographic Society's (CMOS) 56th Congress, which was held jointly with the Canadian Geophysical Union's (CGU) Annual Meeting, and the 78th Eastern Snow Conference (ESC). The joint conference was held virtually and closed on June 8th. The theme of the conference was "Science Serving Society" and session topics were broad, ranging from the Arctic atmosphere to plate tectonics, remote sensing to coastal oceanography and engineering solutions for adaptation. As might be expected given the theme of the conference, the wide and varied program included a substantial focus on climate and other kinds of services.

The conference offered a selection of excellent plenary talks from some of the top experts in their fields, including Professors Amanda Lynch, Michelle Walvoord, Debra Wunch, Karen Kohfeld and Sonia Seneviratne. Holding the conference virtually allowed for it to have a very low carbon impact compared to a traditional in-person scientific conference, due to the reduced emissions from travel.

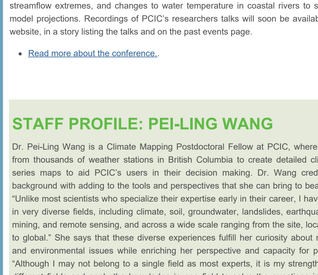

Figure 2: Markus Schnorbus (Lead, Hydrologic Impacts theme) and Dr. Charles Curry (Acting Lead, Regional Climate Impacts theme) co-convene one of the sessions to which PCIC researchers contributed, over the Zoom Meetings platform.

PCIC's team worked behind the scenes to lead the development of the scientific program, which included over 550 presentations, and also assisted in facilitation and convening sessions. PCIC researchers delivered nine talks on topics ranging from downscaling, precipitation and streamflow extremes, and changes to water temperature in coastal rivers to selecting climate model projections. Recordings of PCIC's researchers talks will soon be available on the PCIC website, in a story listing the talks and on the past events page.

- Read more about the conference.

STAFF PROFILE: PEI-LING WANG

Dr. Pei-Ling Wang is a Climate Mapping Postdoctoral Fellow at PCIC, where she uses data from thousands of weather stations in British Columbia to create detailed climate and time series maps to aid PCIC's users in their decision making. Dr. Wang credits her diverse background with adding to the tools and perspectives that she can bring to bear on questions: "Unlike most scientists who specialize their expertise early in their career, I have been working in very diverse fields, including climate, soil, groundwater, landslides, earthquakes, oil & gas, mining, and remote sensing, and across a wide scale ranging from the site, local and regional, to global." She says that these diverse experiences fulfill her curiosity about natural hazards and environmental issues while enriching her perspective and capacity for problem-solving. "Although I may not belong to a single field as most experts, it is my strength to understand different fields and apply the knowledge in one field to solve the questions in another." She sees an urgent need to bridge gaps between various fields because many of the environmental problems we are facing today are interconnected. For instance, extreme weather events due to climate change may lead to more frequent landslides and greater soil erosion.

"My current work at PCIC will help characterize climates in BC with high-resolution maps and statistics," she explains. These maps will include estimates of climate variables in areas that lack weather station coverage, making them especially useful for those areas. These high-resolution maps of temperature and precipitation can also support studies in climate, water and land-use planning, and agricultural activities. In addition to these, when an extreme event occurs, such as heavy rainfall or extreme temperature, past experiences can be used to estimate the impacts on the community. Dr. Wang has another project that continues the studies of her late advisor Dr. Johannes Feddema on human-induced soil degradation. "This work indicates different human land uses have varying impacts on soils and that can affect temperature and water resources," she explains. "For example, different agricultural practices affect how much water the soil can store and water infiltration, which could help farmers find nature-based approaches to mitigate flood or drought events."

Beyond research, Dr. Wang believes that community engagement is the key to getting people onboard in making positive changes for our environment. Highlighting some of her work in this area, she says, "I created an animation for a general public to illustrate human impacts on soil and the resulting consequences for water and climate, and I love to work with communities to build a better future together."

PCIC STAFF NEWS

The late spring saw two staff changes at PCIC. First, PCIC extends a fond farewell to Post-Doctoral Research Scientist Dr. Qiaohong Sun as she returns to China to take on her new position as a professor at the Nanjing University of Information Science and Technology. While at PCIC, Dr. Sun amassed a truly impressive body of research focused on precipitation and other climate extremes. We wish Dr. Sun all the best as she moves into her new role as a professor and we look forward to seeing the future contributions she makes to the field. Second, PCIC is happy to welcome Isabelle Lao to our Climate Analysis and Monitoring theme, as our new Climate Data Analyst. Her work at PCIC will be focused on applying her skills in data science to developing and analyzing data from observational networks across the province.

PUBLICATIONS

Li, M., **Q. Sun**, M. A. Lovino, S. A, M. Islam, T. Li, C. Li and Z. Jiang, 2022: Non-uniform changes in different daily precipitation events in the contiguous United States. *Weather and Climate Extremes*, **35**, 100417, doi:10.1016/j.wace.2022.100417.

Tai T.C., Calosi P., Gurney-Smith H.J., Cheung W.W.L., 2021: Modelling ocean acidification effects with life stage-specific responses alters spatiotemporal patterns of catch and revenues of American lobster, Homarus americanus. *Scientific Reports*, 11, 23330, doi:10.1038/s41598-021-02253-8.

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