Nechako IRC NEWSLETTER

June 2024 | Volume 6 Issue 2

NSERC/Rio Tinto Industrial Research Chair

"To better understand and quantify the roles of climate variability, climate change, and water management on the long-term water security of the Nechako Watershed."

Territorial Acknowledgement

Working on traditional First Nations territories in a scientific context is a humbling and deeply appreciated privilege. The opportunity to work hand-in-hand with Indigenous communities is a gift for which we are sincerely grateful. This collaboration not only enriches scientific understanding but also fosters mutual respect and cultural exchange. We are grateful for the trust and partnership extended to us, and we strive to approach this work with the utmost gratitude and responsibility. We acknowledge that our work takes place within the unceded traditional lands of 15 First Nations:

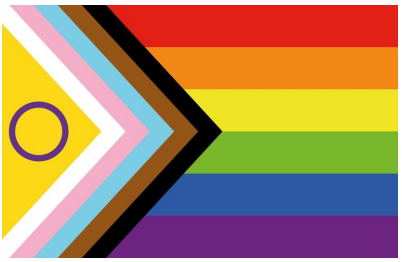
- Binche Whut'en
- Cheslatta Carrier Nation
- Lake Babine Nation
- Lheildli T'enneh
- Nadleh-Whut'en
- Nak'azdli Whut'en
- Nee-Tahi-Buhn Indian Band
- Saik'uz
- Skin Tyee Band
- Stellat'en
- Takla Lake
- Tl'azt'en
- Ts'il Kaz Koh (Burns Lake) Band
- Wet'suwet'en First Nation
- Yekooche First Nation

Netʃa koh (Nechako River) at Cottonwood Island Nature Park in Prince George

The Nechako River is referred to as Netʃa koh, meaning **'Big River'** in the traditional language of the Dakelh Nations

CONTENT

In this issue of the Nechako IRC newsletter you will find updates from the current team of researchers, including updates on another busy summer season!



Happy Pride Month!

Happy Summer Solstice!

An introduction from the project leader

Francois Lake, 22 May 2024

We welcome yet another summer across the Nechako Watershed with high hopes wildfire activity will not be anywhere near the intensity experienced during summer 2023. The ongoing drought, however, persists across the area despite some recent rains. More rainfall is desperately needed as near-record low snowpacks are likely insufficient to replenish our low water levels across the region. An encouraging sign is the ongoing dissipation of the warm pool in the tropical Pacific Ocean associated with El Niño and the possible emergence of its cool phase, La Niña, by this summer or fall. La Niña is typically associated with cooler than average air temperatures and more abundant precipitation (both rain and snow) across British Columbia. This would likely diminish the potential for increased wildfire activity during summer 2024.

This issue of the Nechako IRC Newsletter covers yet again a broad spectrum of topics that the IRC team is investigating. Included in this issue are research updates by PhD candidate Bruno Sobral and Research Skills Trainee Tamar Richards-Thomas who are both exploring aspects of atmospheric rivers that have affected the Nechako Watershed. As well, Lisa Rickard provides an introduction of her research focused on wildfires in the Nechako Watershed and their potential impacts on hydrology. Meanwhile, post-doctoral fellow Mostafa Khorsandi summarizes recent achievements in the application of computer modeling in reconstructing past and projecting future water temperatures for the Nechako River at Vanderhoof.

We welcomed this spring three new field technicians to the IRC team: Lynn Poeppelmann, Kainen Parmar, and Maria Tavares. All three are current undergraduate students at UNBC who undertook their positions as undergraduate research assistants on April 29th. You will find in this newsletter short biographies for all three new team members along with some information on the training they are experiencing as part of their positions. Aside from these introductions, you will find short biographies for two NSERC Alliance project team members, namely Habiba Ferchichi and Milad Fakhari. Both are based at the Institut National de Recherche Scientifique (INRS) in Quebec City with their projects focused on thermal refugia in the Nechako River.

My research update in this issue highlights a recent paper that was published in a journal called Communications Earth & Environment. As you will see, this study explored the impacts of four extreme hydrometeorological events on water temperatures across the Pacific Northwest of North America including the Nechako Watershed during 2021.

We thank the many individuals and organizations that supported our deployment of water temperature loggers in the Nechako Watershed since 2019 as these provided primary data and motivation for this study. The outreach section of this newsletter summarizes some of the attention this study attracted by the media, as well as details on a press release issued by UNBC. I recently also participated in meetings of the Water Engagement Initiative on May 2nd, the Nechako Valley Working Group on May 6th and the Core Committee of the Nechako Watershed Roundtable on May 21st.

Our team had the distinct pleasure of travelling to Cheslatta Territory on May 22nd to meet with representatives of the Cheslatta Carrier Nation. This was an incredibly informative and enriching experience for all of us, particularly those new to the IRC team. We sincerely thank our hosts at the Nation for taking the time to provide us with an introduction to the history of the Cheslatta Carrier Nation and for providing a description of the geography that their traditional territory covers. Dylan Broeke and I also had the opportunity to visit local residents at Nulki Lake in late April where we have now installed a new weather station (see further details later in this newsletter). No doubt we will continue to meet many more residents of the Nechako Watershed as our field work ramps up this summer.

I am pleased to announce that the Natural Sciences and Engineering Research Council of Canada (NSERC) has now granted us a one-year, no-cost extension to the NSERC / Rio Tinto Industrial Research Chair in climate change and water security. As such, the program of research has been extended by one year and will end on June 30th, 2025. I take this opportunity to sincerely thank UNBC, NSERC and Rio Tinto in facilitating this extension to the IRC position so that we can complete several projects that were delayed due to the COVID-19 pandemic. While this extension comes with no additional funding, our field activities and research are well supported through other efforts including the NSERC Alliance project led by Dr. André St-Hilaire and by the Nechako Environmental Enhancement Fund (NEEF). As such, our team is now preparing for another exceptionally busy summer visiting our many field sites across the Nechako Watershed.

Stephen Déry

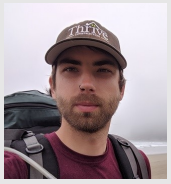
"Thanks again for your continued support of the IRC program of research! Given all of the extreme weather and climate events the Nechako Watershed has experienced in recent years, it is absolutely imperative we continue our efforts in better understanding how climate change impacts its water resources and security. We are most appreciative to everyone who supports our research one way or another, whether by guiding us on potential new field sites, allowing the installation of equipment on their properties, or even sharing local knowledge of ongoing issues or events we often times are not aware of. Your support motivates us to work that much harder in addressing the urgent environmental issues afflicting the Nechako Watershed."

The Team

Industrial Research Chair members from the NHG

Stephen Déry

Project Leader



Justin Kokoszka

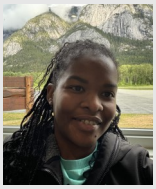
Research Manager
M.Sc. Candidate

Bruno Sobral

Ph.D. Candidate

Lisa Rickard

Research Manager
Research Associate



Tamar Richards-Thomas

Research Skills Trainee

Kirsten Calder-Sutt

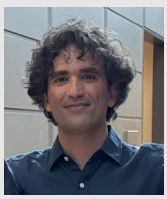
Database Administrator

Dylan Broeke

Field Crew Team Leader

Meng Wang

M.Sc. Candidate



Mostafa Khorsandi

Post-Doctoral Fellow

Field Crew in front of the WX build during training

New Team Members

We welcome three new Field Technicians to the IRC team

Kainen Parmar

Hi everyone, I'm Kainen and I'm a UNBC undergraduate geography student. I'm excited to participate with a wonderful team and I am thankful for the opportunity to contribute to meaningful research! I grew up in Prince George and I am excited to learn more about the hydrometeorology of the Nechako Watershed. I'm looking forward to meeting members of the community and enjoying the wonderful scenery the Nechako Watershed has to offer!

I grew up in the bustling streets of downtown Toronto, surrounded by skyscrapers and concrete, but I've always longed for greener vistas. In 2021, I made the leap and moved to Prince George, seeking the tranquility of nature after a lengthy career in healthcare. My journey began as a paramedic, serving on the front lines of emergency response, before advancing to a supervisory role with Toronto Paramedic Services.

Now, I find myself embarking on a new chapter as an environmental science student at UNBC. This summer, I'm excited to join UNBC's Northern Hydrometeorology Group as a field technician, where I'll have the opportunity to apply my love for environmental science in a hands-on setting.

Outside of academics, I cherish spending quality time with my 15-year-old son. When he's not around, you'll often find me immersed in home renovations, finding joy in transforming spaces and making them my own. On quieter days, you'll find me engrossed in a book, practicing yoga for inner peace, or lost in the creative flow of painting canvases.

As I continue to settle into life in Prince George, I am eager to embrace all that this community has to offer and participate in critical research aimed at promoting responsible stewardship of this beautiful region!

Maria Tavares

Lynn Poeppelmann

Hi everyone, my name is Lynn and I'm a third-year student at UNBC in the conservation science program. I'm originally from Germany and have been living in Canada for seven years. Before I was granted Permanent Resident status in 2021 and moved to Prince George I was working in the tourism industry in Vancouver. Last summer I worked with the Avian Ecology Lab at UNBC as an undergraduate research assistant and collected data on tree swallows; during the season I discovered my passion for outdoor-based field work and ecosystem science. I'm so excited to be joining the NHG as a field technician this year and expand my knowledge on weather and climate. In my spare time I enjoy going camping, hiking, birdwatching, and spending time with my two cats, Cleo and Wily.

Research Chair Update

Impacts of extreme hydrometeorological events on freshwater temperatures in the Pacific Northwest of North America

Over the past two years, I have worked closely with UNBC colleagues Drs. Eduardo Martins, Philip Owens and Ellen Petticrew on a study that explores the impacts of extreme hydrometeorological events on freshwater temperatures in the Pacific Northwest of North America. The study was motivated by four extreme weather events that afflicted our region in 2021: deep cold snaps in mid-February and late December, the early summer heat dome that brought record-breaking torrid air temperatures, and the pair of mid-November atmospheric rivers that caused catastrophic flooding in BC's Lower Mainland. The team of researchers was, quite fortunately, monitoring freshwater temperatures across the Nechako, Parsnip and Quesnel watersheds during that year thereby providing primary data to undertake this study.

Our study was published on 1 May 2024 in the open-access journal "Communications Earth & Environment" and is titled: "Extreme hydrometeorological events induce abrupt and widespread freshwater temperature changes across the Pacific Northwest of North America". We applied not only the water temperature data we collected in northern BC but also assembled data from other sources including the Water Survey of Canada, Fisheries and Oceans Canada, the province of BC and Rio Tinto. In all, we acquired hourly water temperature data for 554 sites spanning northern BC to southern Oregon from 1 January to 31 December 2021. Our analyses then focused on how water temperatures changed over the duration of those four extreme events.

The two cold waves saw water temperatures cool on average by 1 to 1.2°C while for the heat dome they warmed on average by 2.7° C. Figure 1 illustrates the weekly change in water temperature at each site (colored dots) across the Pacific Northwest during the heat dome with the red dots showing sites with the largest rises in water temperatures. The top right inset map (red box) focuses on the Nechako Watershed for which the water temperature increase averaged 4.1°C during the last week of June. Some low-land waterways were particularly affected with the Necoslie River (near Fort St. James) and Otter Creek (near Tatuk Lake in the upper Chilako Watershed) warming by over 6°C in one week alone. Both saw hourly water temperatures exceed 30°C at one point during the heat wave. Conversely, headwater creeks draining the Coast Mountains were much more resilient to the heat dome as pulses of alpine

snow and glacier melt led to minimal warming of water temperatures.

While there are concerns about the potential for the recurrence of extreme weather events such as the heat dome in the context of climate change, there are various ways to mitigate their impacts on freshwater temperatures. This could include restoring or enhancing riparian vegetation to provide more shade to waterways, preserving or creating wetlands by building beaver dam analogues, and by constructing thermal refugia. For the Cheslatta and Nechako rivers, releasing additional water from the Nechako Reservoir could also alleviate the warm water spells.

We continue monitoring water temperatures at over 30 sites in the Nechako Watershed to better understand how climate variability including extreme hydrometeorological events influence water quality. During the 2024 summer field season, we will revisit all of our field sites to collect these valuable data and to ensure our sensors remain fully operational to capture yet another year's of freshwater temperature data across the Nechako Watershed. Once data have been quality controlled, we will deposit the time series of water temperature in a publicly accessible, online data archive. This will allow various end users, stakeholders and researchers the option to download our data and perform their own assessment of water temperature variability in the Nechako Watershed. Next, our team will be extending the results of our recent publication by perhaps exploring the impact of the 2022-2023 drought and wildfires on water temperatures across northern BC.

For more general information on our study, please consult the UNBC media release and a blog entry posted to Springer Nature's Research Communities. Sincere thanks to everyone across the Nechako Watershed that assisted with our field work and in developing our water temperature monitoring network. We are also most grateful the primary funders of this work, namely the Natural Sciences and Engineering Research Council of Canada (NSERC), Rio Tinto, the Nechako Environmental Enhancement Fund, Eco Canada, Project Learning Tree Canada and UNBC. Without all of this support, our study simply could not have been accomplished!

Stephen Déry

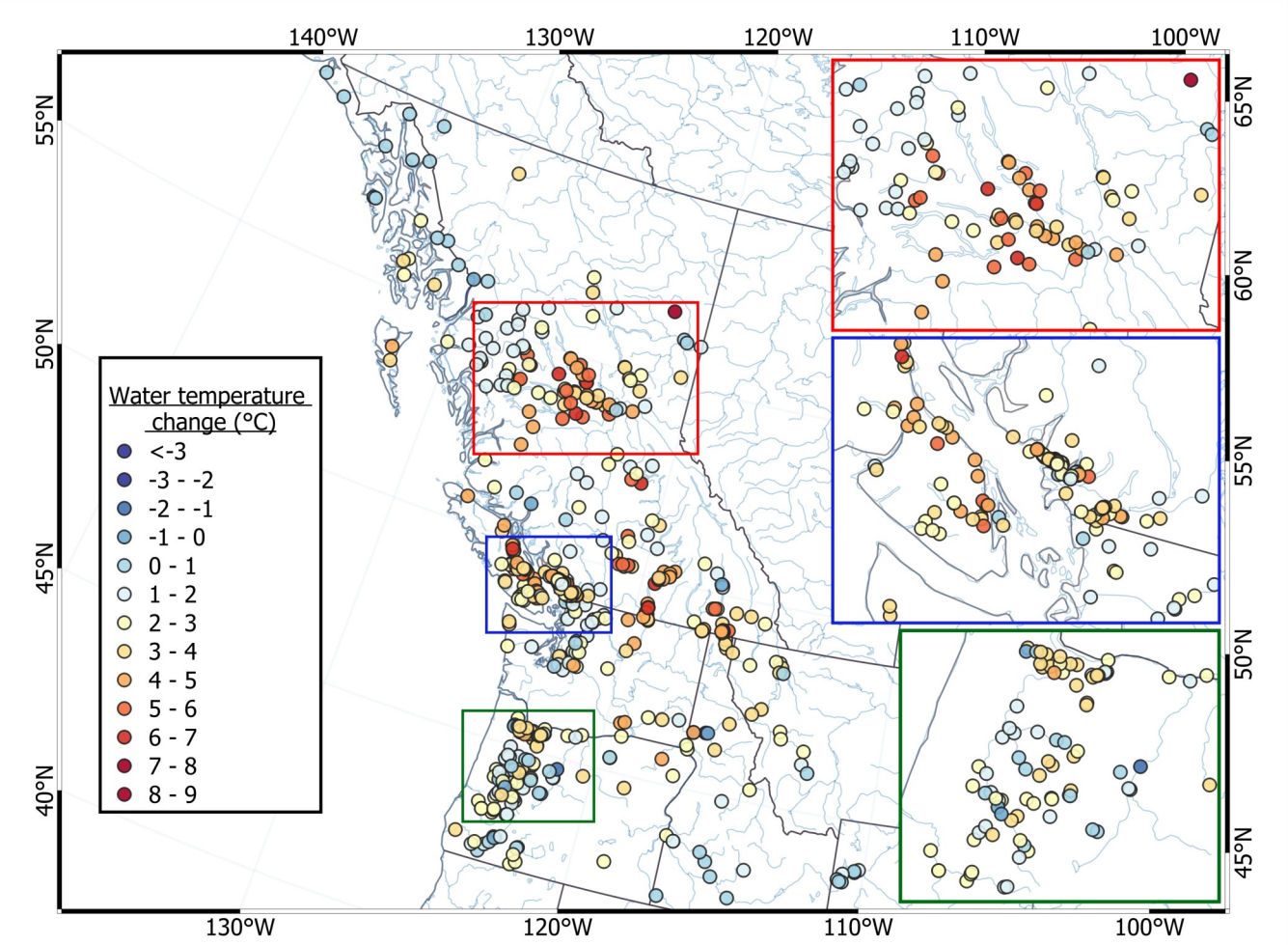


Figure 1: Weekly change in water temperature (°C) for 492 sites across the Pacific Northwest of North America during the late June 2021 heat dome. Blue dots indicate cooling of water temperatures while white, light yellow, orange and red dots mark increasing rates of warming of weekly water temperatures. Hotspots of enhanced warming include the lower Nechako Watershed, the Kootenay, Nicola, and Okanagan river valleys as well as eastern Vancouver Island.

Data Management

Data compilation and quality control

This spring, I have continued to work on NHG data administration. The most pressing and onerous tasks on my plate have included compiling a great number of historical field notes, field photos, and data from our water temperature sites as well as populating site and equipment info in a temporary online database. Our ultimate goal with NHG data management activities is straightforward: to achieve the highest quality, best-organized data possible. These aforementioned tasks, while being surprisingly time-consuming, will contribute significantly to our data management goals.

Moving forward, I will continue to populate our online database and will likely begin to enter 2024 site visit data and documentation as the team's field work commences. With our first year enjoying a new equipment inventory and field documentation system behind us, I look forward to assisting with fine tuning this new system in the coming months and seeing this year's data begin to roll in. This is always an exciting time of year for the NHG, and I am pleased to be a part of it all a second time!

Kirsten Calder-Sutt

Nechako River at Vanderhoof, 23 April 2024

Field Work

Preparing for a busy field season

The last few weeks have been very full of our newly developed field work training program that Justin Kokoszka and I built and designed for a smooth introduction and training for our new field crew members. The training program covered everything from logistics and safety to hands-on practice and system deployment. Now that the training has finished, we are now all able to fully build, wire, and code full weather stations (Figure 2A), tipping bucket rain gauges (Figure 2B), and stream temperature loggers (Figure 2C). This was the first season of this training program and I want to say a big thanks to the field crew for their understanding and ability to work with Justin and I as we worked through different hiccups along the way.

I am looking forward to the last few weeks of May where we are headed out for our first few field work trips where we will be visiting multiple stations including water temperature loggers, tipping bucket rain gauges and a weather station (WX) for data downloads. In the last week of May, we will be building a brand new WX which will be the same WX that was built during the training weeks for practice (Figure 2A). From the practice during the training program, the new WX should be able to be built quickly and efficiently with all the newly acquired skills.

Dylan Broeke

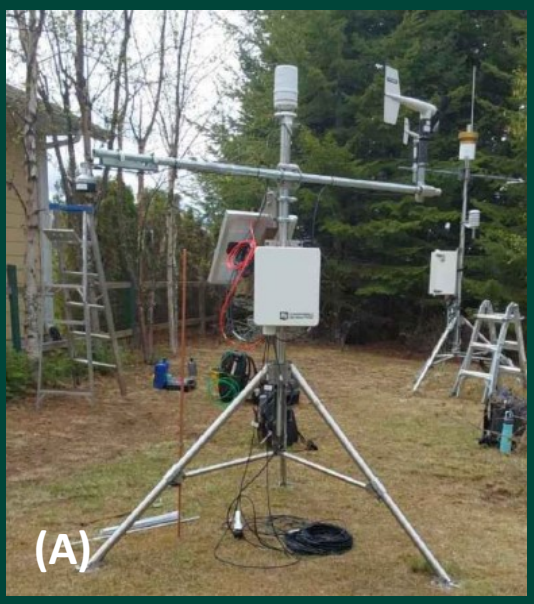


Figure 2: (A) Weather station build during training session, (B) tipping bucket rain gauge, and (C) water temperature logger system.

Big congratulations to our field crew on successfully deploying the Nulki Lake weather station on May 29! Very efficient day in the field that yielded the newest site in our ever-expanding hydrometeorological network. Well done crew, and now on to the next one!

Nulki Lake weather station, 29 May 2024 (Photo courtesy of Kainen Parmar)

Nechako Research

Explore some of our research!

The Hydrological Response of the Nechako River Basin (NRB) to Exceptional Atmospheric Rivers (ARs)

In this IRC Newsletter update, I'll briefly present my progress on chapter 4 of my PhD dissertation. With less than six months until my PhD dissertation defence at UNBC, my current research focuses on the hydrological response of the Nechako River Basin (NRB) to exceptional Atmospheric Rivers (ARs) in December 1952, October 1978, and October 2009. More precisely, the exceptional AR events occurred on 12-14 December 1952, 28 October – 1 November 1978, and 27-31 October 2009.

AR activity peaks in the fall, but winter ARs also significantly affect snowpack accumulation in the elevated portions of the NRB. The western NRB shows consistent patterns over time, with significant impacts from ARs on water levels and discharge, especially during fall events. No discharge data are available west of the NRB for 1952, nor was the Nechako Reservoir operational to provide water level data then. The contribution of the 1952 AR event in the west of the watershed was mainly precipitated as snow. Even so, in the eastern portion, the Nautley River near Fort Fraser (08JB003 – Figure 3 - station 5) saw a 17% discharge increase during 14-16 December, while the Stuart River near Fort St. James (08JE001 – Figure 3 - station 6) had a 12% rise in the same period.

During the 1978 fall AR event, stations within the NRB experienced significant discharge increases. Laventie Creek (08JA015 – Figure 3 - station 1) within the Nechako Reservoir saw a 56-fold increase. These results emphasize the potential for ARs to cause flash floods. In addition, Nadina Lake's water level rose by 1 meter, sustaining higher levels until mid-December. The Stellako River's flow at Glenannan (08JB002 – Figure 3 - station 4) rose by ~42%, and the Nautley River near Fort Fraser (08JB003 – Figure 3 - station 5) gradually increased by 33%. The Upper Nechako sub-basin consistently experiences the most pronounced effects in discharge, with major water level increases post-AR events.

In the 1978 AR event, the Nechako Reservoir rose ~32 cm, while the 2009 AR event caused a ~22 cm increase (Figure 4). These fall AR events added 0.35 km³ and 0.21 km³ to the Nechako Reservoir, respectively, not considering the accumulated snowpack that only reaches the reservoir in the following freshet. In 2009, the Eutsuk River at Eutsuk Lake outlet (08JA028) surged by ~160%, maintaining high levels until year-end. Nadina Lake doubled its level from 0.48 to 0.95 m, and Nadina River's discharge at the Nadina Lake outlet (08JB008) increased ninefold. These findings underscore the influence of exceptional ARs on the NRB's hydrology, highlighting the need for ongoing and future research on the impacts of ARs on the NRB.

Bruno Sobral

These findings underscore the influence of exceptional ARs on the NRB's hydrology, highlighting the need for ongoing and future research on the impacts of ARs on the NRB.

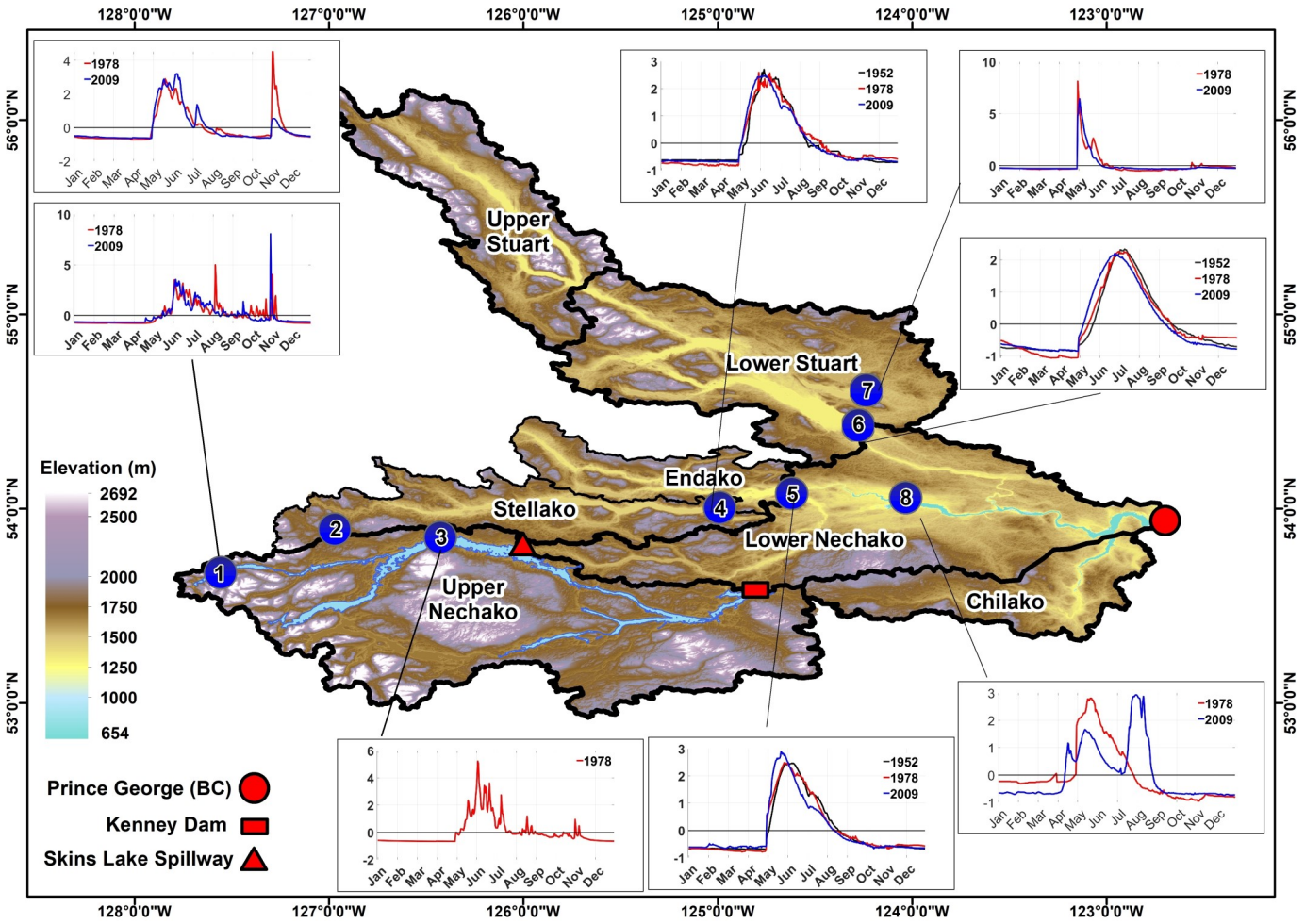


Figure 3: Standardized daily discharge at a few stations inside the NRB in 1952, 1978 and 2009.

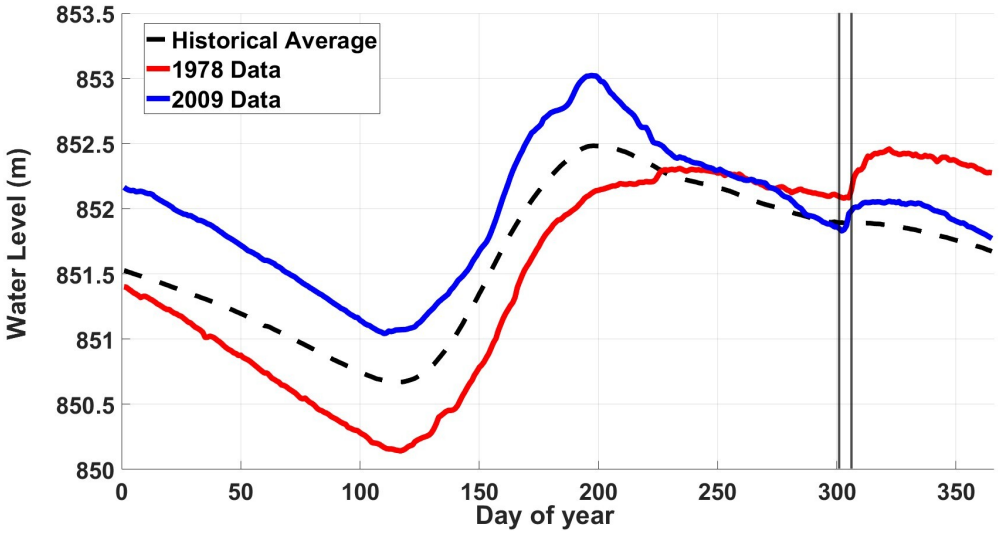


Figure 4: Historical daily average of the Nechako Reservoir water level based on data from 1955-2021 compared to 1978 and 2009.

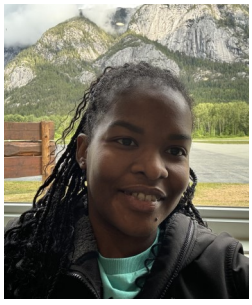
Big congratulations to Bruno, who was recently awarded the 2024 CMOS Congress Student Poster Award prize!

A Brief Update on my AR-Related Research Projects

Dr. Julie Thériault, Dr. Ronald Stewart, Dr. Stephen Déry and I are currently working to prepare a resubmission of our revised paper titled 'Climatological Context of the Mid-November 2021 Floods in the Province of British Columbia, Canada' to Weather and Climate Extreme Journal by the deadline on Monday, June 3, 2024. Dr. Julie Thériault is from the Université du Québec à Montréal (UQAM), and Dr. Ronald Stewart is from the University of Manitoba. This paper aims to i) assess a range of climatological factors that affected the severity of the mid-November 2021 floods in Lower Mainland, British Columbia (BC) and ii) identify the principal mechanisms and climatological variables that characterise BC's floods occurring from 2000 to 2021. These revisions will help to improve the manuscript and position our study for a wider audience.

After completing the revised paper, Dr. Stephen Déry, Spencer Woyke, and I will work on submitting a second manuscript, titled 'Moisture Transport to the Upper Nechako Watershed During Three Atmospheric Rivers in September and October 2021' to the Journal of Geophysical Research: Atmospheres. This manuscript aims to quantify moisture fluxes and analyze the impact of three ARs (named Events 3, 5, and 10) recorded during Tahtsa Ranges Atmospheric River Experiment (TRARE) on the upper Nechako Watershed over the duration of three atmospheric rivers (ARs). TRARE gathered detailed hydrometeorological data in the upper Nechako Watershed from September to October 2021. This manuscript offers valuable insights into the magnitude of the moisture fluxes and their transport across the upper Nechako Watershed. We recently submitted an abstract titled 'Moisture Fluxes during Three Atmospheric Rivers in September and October 2021 in British Columbia's Upper Nechako Watershed' for an oral presentation at the Canadian Meteorological and Oceanographic Society (CMOS) 58th Congress from 3 June to 6 June 2024 in a virtual/online format. This abstract was also accepted, and Stephen will be presenting our study.

Dr. Stephen Déry and I recently submitted an application for the British Columbia Real Estate Foundation Grant, in support of a proposed research project titled 'When atmospheric rivers interact with the Coast Mountains of British Columbia: Unraveling the impact of flooding in sub-watersheds of the Fraser River Basin'. This application was awarded a funding valued at nearly $17,000 to begin this research project on July 1, 2024. We want to thank the British Columbia Real Estate Foundation Grant for supporting our upcoming research project, which will offer new insights into the complex dynamics of atmospheric rivers across sub-watersheds of the Fraser River Basin. I am excited to continue working and collaborating with the Rio Tinto Industrial Research Chair (IRC) and Northern Hydrometeorology Group (NHG).



Tamar Richards-Thomas

Exploring the Impacts of Land Cover Changes on the Hydrology of the Nechako Watershed

Funded by the Nechako Environmental Enhancement Fund (NEEF), the objective of this project is to gauge the hydrological response to the cumulative impacts of land cover disturbances and land use changes in the Nechako Watershed. As part of this larger project, my research focuses specifically on wildfires, a major driver of land cover disturbance, and their potential impact on hydrology.

Initial research questions include:

1. Where and when have wildfires occurred across the Nechako Watershed,
2. What are the geophysical characteristics of the burned areas (area, distribution of elevations, slope and aspect characteristics, etc.), and
3. Are these characteristics changing over time (are we seeing higher elevations, western parts of the watershed, etc. being more affected over time)?

Preliminary results reveal that, although the number of wildfires in the Nechako Watershed have decreased over time, the mean fire size and total area burned have increased (Figure 5). While the mean slope on which wildfires have occurred has remained fairly consistent, the wildfires appear to be shifting to higher elevations, as the mean fire elevation has slightly increased over time. Increases are also observed in the proportion of wildfires ignited by lightning.

Upcoming tasks include taking a closer look at the sub-watersheds of the Nechako (e.g., calculating the burned area per year upstream of hydrometric gauges) and quantifying the change in freshet between large wildfire and non-wildfire years.

Lisa Rickard

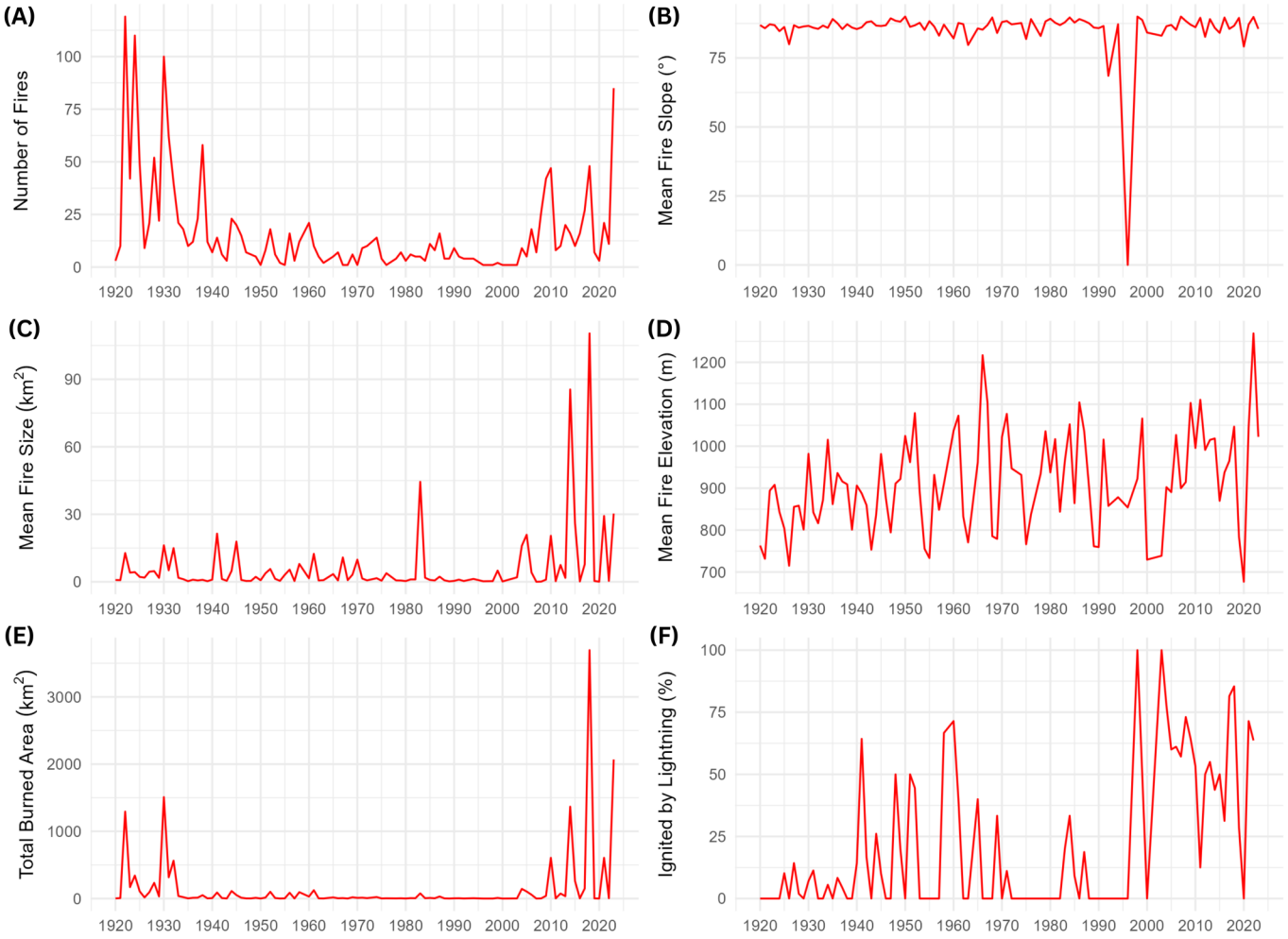


Figure 5: Characteristics of wildfires that occurred in the Nechako Watershed from 1920 to 2023, including (A) number of fires, (B) mean fire slope, (C) mean fire size, (D) mean fire elevation, (E) total burned area, and (F) proportion ignited by lightning (Data sources: BC Wildfire Fire Perimeters - Historical and Canadian Digital Elevation Data).

Station-Based Modeling of Water Temperature in Nechako Using a Combined Modeling Approach

On 16 April 2024, I successfully defended my Ph.D. dissertation, “Adaptation of modeling tools for impact analysis on the thermal regime of rivers in the context of dam management and climate change,” at the Institut national de la recherche scientifique (INRS) in Quebec City, Canada.

Also, I presented the results from chapter 4 of my Ph.D. dissertation at the ISE-FP 2024 conference in Quebec City, titled “Assessing the surface downward longwave irradiance models using ERA5 input data for station and watershed scales in Canada.”

In my Ph.D. research on the Nechako thermal regime, my colleagues and I used a chain of models to simulate water flow and temperature in the Nechako watershed. The modeling effort consists of VIC, RBM, and CE-QUAL-W2 models for the upstream of Skins Lake Spillway (SLS). The outputs of this process were forced to the CEQUEAU model as the upstream boundary conditions.

By calibrating the CEQUEAU model, we were able to simulate water flow and temperature from SLS to Finmoore for the summer season. This modeling was the foundation for multiple studies on the climate change impact assessment on water flow and temperature in the Nechako. Moreover, it was the basis for watershed-scale habitat analysis of Sockey, Chinook, and white sturgeon in the Nechako.

Currently, I am focused on improving my water temperature simulation skills by focusing on single hydrometry stations. Therefore, I’m using the outputs of the CEQUEAU model for discharge, combined with the Air2Stream model for water temperature. With Root Mean Square Error (RMSE) ≈ 1°C, the preliminary results are promising. Better water temperature simulations will help us decrease uncertainty in water temperature modeling, which is essential while studying the possible impacts of climate change on water temperature. With higher accuracy, this modeling effort provides the advantage of seeing the effects of flow management and climate change for the whole year (both summer and winter seasons). Moreover, we could soon compare the impacts of damming the Nechako River on its water temperature for the first time by having the naturalized water modeling results (water discharge if the Kenney Dam and SLS did not exist).

The results of this research will be submitted to scientific journals relevant to water temperature modeling.

Mostafa Khorsandi

“Currently, I’m working on the station-based water temperature simulation using CEQUEAU and Air2Stream models.”

NSERC Alliance

New project on thermal refugia in the Nechako River

Project Scope. The study area for this project is the Nechako Watershed that is partially managed by Rio Tinto for hydropower generation in support of its BC Works operations in Kitimat, BC. This watershed is undergoing rapid climate change with impacts to its regional weather, hydrology, and temperature, all of which are variables that affect fish habitat. With the recent expansion of Rio Tinto's operations in Kitimat and the growing demands for renewable sources of energy such as hydropower, there is an urgent need to better understand the possible impacts of flow management and climate change on fish habitat. This project will focus on two fish species of importance in the Nechako system: Chinook salmon and white sturgeon.

Project Objectives. The long-term objective of the project is to increase our capacity to protect key fish habitat in the system. To achieve this, we need to: 1) improve our monitoring of the main spring flow generation mechanism in the Nechako, which is snowmelt; 2) Improve tools that allow managers to forecast flows and water temperature in the system; and 3) Investigate when and where sturgeon and Chinook salmon use different habitats in the river system to remain in habitats that are adequate, both from a physical and physiological perspective. This includes water temperature, which is changing in the Nechako because of climate warming.

Communication Plan. We are in the process of consulting key stakeholders to seek their inputs on potential sampling locations. We will be reporting the results and findings of our research back to the community on a quarterly basis through a special section of future issues of the Nechako IRC Newsletter. Communities and individuals wishing to receive this newsletter can simply send a confirmation email to Stephen Déry (sdery@unbc.ca or irc@unbc.ca). Fieldwork plans (i.e. timing and location) will be discussed with stakeholders regularly. Results will also be disseminated via an annual newsletter that will be sent to interested individuals. Finally all of the data acquired during this project will be made available upon request. Water temperature data will also be publicly available via the RivTemp database (www.rivtemp.ca).

Hi everyone, I'm Habiba Ferchichi, a PhD student at the Institut National de la Recherche Scientifique (INRS) in Quebec City, Quebec, Canada. I graduated with a MSc from INRS in 2020 and my thesis focused on modeling coastal water temperature using statistical methods (e.g., artificial neural networks, random forests, and multiple linear regression) in the context of climate change and its impact on the risk of potential growth of pathogenic Vibrio marine bacteria.

Following my MSc, I worked as a research professional, where I studied the importance of incorporating river temperature in evaluating environmental flow requirements in Eastern Canadian rivers. My interest in water temperature continued as I analyzed water temperature variation between hydrometric stations and other stations within the same drainage basin. This experience continued with computing thermal indices for Quebec rivers and developing thermal tolerance composite indices for specific fish species. My ongoing passion with river temperature research and environnemental modelling fueled my decision to pursue a PhD in modeling thermal refuges in the Nechako River using statistical models like generalized additive models and multivariate adaptive regression splines. Now as a PhD student, my project aims to develop statistically-based regional models for estimating thermal refuge areas using various physiographic and hydrometeorological variables as predictors. This summer, I'm thrilled to be participating in the field work of taking thermal images with drone for the first time in the Nechako River in order to identify thermal refuges areas and integrate this information, along with other variables, into the statistical models.

Habiba Ferchichi

My name is Milad Fakhari, I am a postdoc fellow at Institut National de la Recherche Scientifique (INRS) in Quebec City, Quebec, Canada. I have always been passionate about topics related to water resources, and I've dedicated my undergraduate and graduate studies to exploring this subject. I recently completed my PhD at INRS. The main objective of my PhD was studying how climate change impacts the way groundwater interacts with rivers and discover how and where the groundwater seepage to a river can create thermal refuges, which are zones with suitable temperature for fish to survive during extreme temperature events. Now as a postdoc fellow, my task is to investigate thermal refuges of Nechako River, by applying what I learned from my PhD and use similar techniques like thermal aerial imagery of rivers and computer modeling to simulate how groundwater and the river interact. The results of this project can be beneficial for better understanding of habitat selection and thermoregulation by Chinook salmon and white sturgeon. I look forward to visiting the Nechako River in the summer of 2024 to collect the required data for my project such as river and groundwater temperature, the river flow rate and taking thermal images of the river with a drone.

Milad Fakhari

Outreach

Communicating our findings through various means continues to be a top priority!

Meetings

- Stephen participated in a meeting of the Water Engagement Initiative on May 2
- Stephen participated in a meeting of the Nechako Valley Working Group on May 6
- Stephen participated in a meeting of the Core Committee of the Nechako Watershed Roundtable on May 21

Media Interviews and Articles

Mar 18	Low flows in the Nechako River, Daybreak North, CBC Radio (Prince George, BC)
Mar 28	Persistent drought conditions and low water levels in the Nechako River, The Tyee
Apr 4	The opening of golf courses with the early snowmelt and spring onset in Prince George, CKPG News, CKPG (Prince George, BC)
Apr 10	The BC River Forecast Centre's 1 April snow report and low snowpacks in northern BC, CKPG News, CKPG (Prince George, BC)
May 1	Extreme weather results in drastic changes to waterways, UNBC media release
May 1	Extreme hydrometeorological events induce abrupt and widespread freshwater temperature changes across the Pacific Northwest of North America, News, Fairchild TV; Daybreak North, CBC Radio; News, Vista Radio (Prince George, BC)
May 1	Extreme hydrometeorological events induce abrupt and widespread changes in Pacific Northwest freshwater temperatures, Blog entry at Springer Nature Research Communities
May 2	Extreme hydrometeorological events induce abrupt and widespread freshwater temperature changes across the Pacific Northwest of North America, CKPG News, CKPG; Rocky Mountain Goat (Prince George, BC)
May 5	UNBC Researcher's paper shows impacts of extreme weather on waterways, MyPGNow
May 29	The recent rains are alleviating the drought in northern BC, CKPG News, CKPG (Prince George, BC)

Contact Information

UNBC IRC Research Program, 3333 University Way, Prince George, BC V2N 4Z9
Phone: 250-960-5193
Email: irc@unbc.ca