

The Nechako IRC Newsletter

September 16, 2022
Volume 4, Issue 3

An update from Dr. Stephen Déry, Project Leader

It is difficult to fathom that yet another summer season is coming to an end! We hope your summer has been most pleasant and that you were able to enjoy the lovely weather northern BC experienced this summer. While the summer season got off to a somewhat slow start with relatively cool, wet weather, it blossomed into a magnificent July and August that encouraged outdoor activities and recreation. It also facilitated some of our field work as there were some challenges accessing stream temperature sites in May and June due to the high water levels many waterways experienced this spring.

In this newsletter, post-doctoral fellow Jingwen Wu assesses the cool, wet start to the 2022 warm season in a historical context that led to the above average Nechako Reservoir inflows and downstream flooding in the Cheslatta system. With summer soon coming to an end, atmospheric river activity will ramp up along the northeastern Pacific Ocean and BC’s Coast Mountains including the headwaters of the Nechako Watershed. As part of his doctoral research at UNBC, Bruno Sobral explores in this issue the number of days the Nechako Watershed experiences the influence of atmospheric rivers. Meghan Hunter-Gauthier and Jade Reynolds reflect on a very busy summer field season traveling across vast stretches of the Nechako and Stuart river basins collecting critical field data. Gracie Wilson also summarizes her busy summer season that involved long field days working on weather stations and setting water temperature loggers but also analyzing and performing quality control on our stream temperature data. MSc student Justin Kokoszka reports on our data management efforts and long term archiving, an effort assisted over the summer by Abhishek Arora. Finally, Kelly Hurley reports on the managerial aspects of all IRC-related activities and her involvement on field and outreach activities through the summer.

As the summer field season comes to an end, several of our research team members are completing their positions at UNBC. As such, we sincerely thank Abhishek Arora, Meghan Hunter-Gauthier, Jade Reynolds, and Gracie Wilson for their exceptional work and dedication this past summer to ensure our data collection, quality control, and management efforts proceeded smoothly and successfully. Although Jade’s full-time position has ended, we are pleased to retain her services for the fall 2022 semester as a part-time field technician. She will join former undergraduate research assistant Spencer Woyke who returns to the NSERC/Rio Tinto IRC team on a part-time basis this autumn as well. We are saddened to hear that Kelly Hurley will be leaving her position as Research Manager on September 16th to join the BC Government Snow Monitoring Program in Prince George. We sincerely thank Kelly for her incredible leadership and hard work since joining the team in the fall of 2020, and wish her all the best in future endeavors. We have therefore initiated a search to recruit a new Research Manager who will join the group later this fall.

Our communication efforts progressed well over the summer with the release of several short videos on the TRARE field campaign created by the UNBC Communications Office – consult the Outreach section of the newsletter for details and links to the Youtube videos. Furthermore, I had the opportunity to interact with regional media on recent weather conditions and climate change in the Nechako Watershed. I also continue participating in meetings of the Main Table and the Technical Working Group of the Water Engagement Initiative. Finally, we invite all members of the community to attend an outreach event planned for this fall at UNBC to be hosted by members of the Integrated Watershed Research Group.

The IRC team takes this opportunity to thank many members of the communities across the Nechako Watershed that provided generous support and guidance during our summer field activities. Of note, we are especially grateful to Cheslatta Carrier Nation and the Tl’azt’én First Nation for providing boat support to reach remote field sites across the upper Nechako and Stuart river basins, respectively. The NSERC/Rio Tinto IRC team wishes everyone a most pleasant fall season!

Stephen

Northern Hydrometeorology Group (NHG), UNBC

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Special points of interest

- Looking ahead to Atmospheric River Storms this Fall
- Looking back on this year’s cool, damp spring
- A Farewell from Summer Research Staff



Fig 1: A view of the Cariboo Mountains from our helicopter, 17 August



Fig 2: Members of the NHG team during a Friday meeting, held outdoors during sunny weather, 24 June

Research Manager Update

Kelly Hurley

Summer 2022 has certainly been a busy one! I am very grateful for our two summer field technicians, Jade and Meghan who made this summer a successful (and fun) one! We also could not have done it without the help of other colleagues who jumped in to lend an extra set of hands in the field—Justin, Stephen, and especially Gracie.

Jade and Meghan’s newsletter entries will showcase the fieldwork they accomplished this summer, but I would also like to highlight a few key accomplishments.

Our weather station at the Ancient Forest/Chun T'oh Whudujut Provincial Park finally has working remote telemetry, which allows us to download its data once daily without having to visit the station (a 90-minute drive away). Late this summer, we re-visited and downloaded data from some of the stream temperature (ST) sites that were deployed earlier this summer in Nadina River, Nadina Lake, Whiting Creek, Endako River, and Stellako River. We also visited our weather station on the slopes of Mount Sweeney and completed some much-needed maintenance; the deep snow and fierce winds are particularly hard on our weather station at this site (see before and after photos). Huckleberry Mine was scouted to find a suitable location for a new, permanent weather station. In mid-August, we visited our aging weather stations at the Castle Glacier and decommissioned them—leaving no trace of human activity in the sensitive alpine environment. And finally, we visited the Southside and the Cheslatta Carrier Nation Band Office to scope out a site for a new weather station we will be deploying soon.

In addition to fieldwork, I have been collaborating with our Data Manager, Justin, as he and Abhi (Database Administrator) create a new database for the NHG and improve our data management practices.

As I am writing this, we are officially one year since the kickoff of the Tahtsa Ranges Atmospheric River Experiment (TRARE). The resulting data paper is nearing completion and we will be depositing the data in a publically-available repository in the coming weeks. If you are interested in accessing the TRARE dataset, please reach out to Stephen—we would be happy to share it!

As Stephen mentioned in his Project Leader update, my time with the NHG will soon come to an end. I am incredibly grateful for the two years I have spent working with such a lovely and talented group of people. When I reflect upon my time here, I am in awe of how much I have learned since my start with the NHG in October 2020. The skills I have obtained as a Research Skills Trainee, TRARE Program Manager, and finally, Research Manager have prepared me well for my career in climate science and hydrology. The mentorship and support I have had from Stephen and my other colleagues has taught me many “soft skills” as well. I am also grateful for the relationships I have built with you, our partners across the Nechako and beyond!

I am pleased to continue fortifying my skills and professional relationships as a Snow & Climate Technician with the BC Government. This new position will allow me to stay in Prince George, so I hope to stay in touch with the NHG and the happenings of the Nechako.

Thank you for a wonderful two years with the NHG!



Above: Stephen, Gracie, and Angel the dog, on the way to our new ST site above Nadina Lake, 14 July

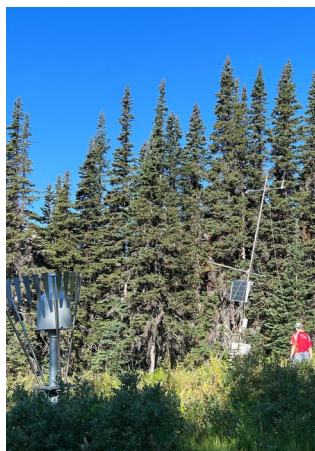
Below: Gracie and Justin visiting our Nadina River ST site, 23 August



Left: The field team after dismantling the old radio repeater on the ridge above Castle Glacier

Right: The Mount Sweeney weather station leaning after a long, intense winter

Far Right: The repaired Mt Sweeney station after a full day of repairs from the field team



Atmospheric River (AR) Frequency this Autumn near the Nechako River Basin

Bruno Sobral

With Fall being the region's most prominent season for ARs, Western Canada should see increased atmospheric river (AR) activity in the following months. For the Nechako River basin (NRB), the season promotes the intensification of a wetter period that starts in late Summer with occasional rainfall. The current year is the third consecutive with La Nina conditions in the tropical Pacific Ocean, often associated with higher precipitation for the Western Canada region^{1,2,3}. Although last year a sequence of landfalling ARs in mid-November caused flooding and landslides in southern BC, in what has been classified "as the most costly weather extreme in the province's history"⁴, it is essential to note the predominantly beneficial impacts of ARs in replenishing water resources throughout the province. ARs are responsible for about 20% of the annual total precipitation in the NRB and are a crucial atmospheric system for the hydrological cycle of the watershed.

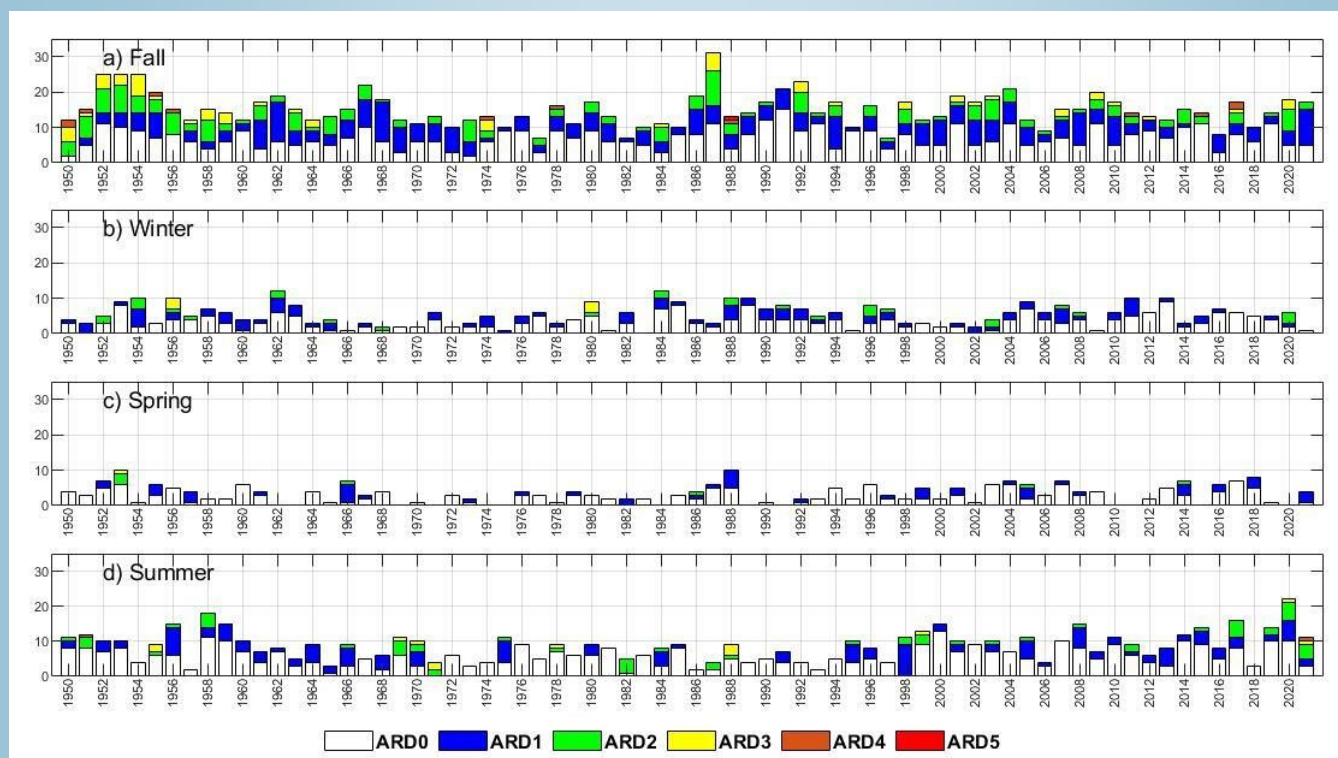


Figure 3: Seasonal frequency of AR-days near the Nechako River Basin according to the adapted scale of Ralph et al. (2019)

To further investigate AR behaviour near the NRB, we adapted the AR scale proposed by Ralph et al. (2019) to quantify the frequency of AR-Days (ARDs) and their respective classifications (AR0-AR5) (Fig.1). The AR0 classification was added to the original AR scale of Ralph et al. (2019) to enable the analysis of short-duration (<24 hours) and low-intensity ($250-500 \text{ kg.m}^{-1}.\text{s}^{-1}$) AR events, which make the bulk (57%) of the ARDs and reinforces the importance of studying these "Pineapple Expresses" (AR0s) for the region. The results show that the average frequency of ARDs in the Fall is 15, with 7 AR0s, 4 AR1s, 3 AR2s and 1 AR3. AR-Days with moisture transport above the 90% percentile, or Extreme AR-Days (EARDs), usually occur for 2 days in the Fall. The past couple of years has registered above the average number of ARDs and EARDs for the NRB region during the Fall, possibly linked to the ongoing La Nina conditions. Therefore, based on previous findings and recent (2020-2021) AR data analysis, the NRB region might see above-average AR activity in the 2022 Fall again.

1 - Sharma, A. R., & Déry, S. J. (2020). Variability and trends of landfalling atmospheric rivers along the Pacific Coast of northwestern North America. *International Journal of Climatology*, 40(1), 544–558. <https://doi.org/10.1002/joc.6227>

2 - Fleming, S., & Whitfield, P. (2010). Spatiotemporal mapping of ENSO and PDO surface meteorological signals in British Columbia, Yukon, and southeast Alaska. *Atmosphere-Ocean*, 48(2), 122–131. <https://doi.org/10.3137/AO1107.2010>

3 - Shabbar, A., Bonsal, B., & Khandekar, M. (1997). Canadian precipitation patterns associated with the Southern Oscillation. *Journal of Climate*, 10 (12), 3016–3027. [https://doi.org/10.1175/1520-0442\(1997\)010<3016:CPPAWT>2.0.CO;2](https://doi.org/10.1175/1520-0442(1997)010<3016:CPPAWT>2.0.CO;2)

4 - Gillett, N., Cannon, A., Malinina, E., Schnorbus, M., Anslow, F., Sun, Q., et al. (2022). Human Influence on the 2021 British Columbia Floods. *SSRN Electronic Journal*, 1–48. <https://doi.org/10.1016/j.wace.2022.100441>

Reflections on Summer Fieldwork

Meghan Hunter-Gauthier

In total, twelve weather stations, thirty stream temperature sites, and four tipping bucket rain gauges (TBRG) have been visited this summer! Indeed, it was a busy time; new data loggers were deployed, weather stations decommissioned, and sites scouted for new deployments. Overall, operations went well with many successes.

A weather station at Lunate Creek was decommissioned by the field team over the course of two visits in order to hike-out equipment safely. This was one of the more physically demanding tasks of the summer, as the team had to carry large amounts of instruments and metal tripod components on foot.

Four new stream temperature data loggers were deployed in the Nechako drainage basin: Cheslatta River, Glacier Creek, Nadina Lake, and Nadina River. The logger in the Cheslatta River will help monitor the impact of Rio Tinto's Stream Temperature Management Program (STMP). The other three loggers are outside of the regulated portion of the Nechako – allowing for us to compare river temperatures against non-regulated portions of the Nechako. Additionally, a new weather station site at Huckleberry Mine was determined and will be deployed next summer.

Field work at Quesnel River Research Centre resulted in a spectacular boat visit to three weather stations, as well as a hike to the Browntop Mountain station. All but one weather station was faring well. Unfortunately, the high water-levels at Quesnel Lake earlier in the summer resulted in damage to the station at Goose Point. The data logger has since been removed and will be replaced during a fall visit. Amazingly, Browntop station is doing great, even after contending with the above-average winter snowfall.

In September I will return to Okanagan College to continue my studies in Water Engineering Technology. I will bring with me an understanding of different data loggers and how they operate, along with skills in wiring, and instrumentation. Collecting data for the NHG has been one of the more meaningful responsibilities I have had in my life, and one I will not soon forget. In closing, I would like to thank each and every member of the NHG; you have all helped to make this summer job amazing!

Freshet and Firsts: My Summer with the NHG

Gracie Wilson

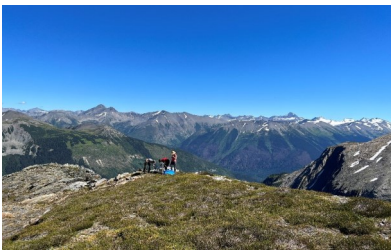


Figure 4: Working on our radio repeater near the Castle Creek Glacier, 17 August

The time I spent working with the NHG this summer has been an invaluable learning experience, both in terms of the skills I was able to develop, as well as the relationships formed with both colleagues and partners of the IRC. Before joining the group as a research skills trainee, I had never worked with weather stations or stream temperature monitoring equipment and had limited experience working with large datasets in R. Now, at the end of my tenure, I am able to deploy and download data from temperature monitoring stations, and I am familiar with the equipment used in weather stations. This summer proved to have challenging field conditions, with a delayed freshet and high water levels throughout the season. This required ingenuity and improvisation when things didn't go to plan during our field visits. That kind of troubleshooting is one of the most valuable skills I will take with me!

When not in the field, I was able to expand my knowledge of data quality assurance and quality control (QA/QC) under guidance from Dr. Stephen Déry and former NHG member Derek Gilbert. This involved the flagging of any erroneous data from the stream temperature monitoring program to ensure greater accuracy of the dataset. With support from data manager Justin Kokoszka, I undertook a GIS analysis of the Nechako watershed to determine the contributing drainage area to each of our 29 stream temperature sites. This will be used in future analysis to explore relationships between basin area and temperature, in order to better understand the patterns of warming in the Nechako watershed!

In addition to the technical skills I have acquired, I feel very lucky to have worked with such an outstanding group of individuals. I thank you all for your mentorship and the many laughs we shared over the summer. I hope to stay in touch as I continue on to the east coast of Canada!



Figure 5: Visiting the tipping bucket rain gauge at the base of Mount Sweeney with stunning views of Rhine Crag in the background, 12 July

The Nechako's Coolest Spring in Two Decades

Jingwen Wu

Climate change continues to be a hot topic in climate science research. The earth's atmosphere has warmed by about 1°C globally since 1900 according to multiple sources like the Intergovernmental Panel on Climate Change. Furthermore, results from a wide range of climate model simulations suggest that our planet's average temperature will likely continue to rise in the 21st century by between 1.1°C to 5.4°C relative to present conditions. Moreover, according to a new government report, Canada is warming faster than the world average — at more than twice the global rate. Despite the context of climate warming, we experienced a relatively cool, wet spring in 2022 across Nechako River Basin. In this section, we employ a gridded climate product of near-surface air temperature and total precipitation to investigate springtime meteorological conditions across the Nechako River Basin during the last two decades (Fig. 1).

We clearly see that spring temperature has an upward trend over Nechako River Basin during 2000 to 2022, rising by 1.02°C over this period. Although an increasing trend in spring temperature is observed, the past three years have been cooler than average over 2000 to 2022 (Fig. 1(a)), with the coolest spring in 2022 (0.76°C). This is 1.64°C lower than the average spring temperature over those 23 years (i.e., 2.40°C). Spring precipitation was 13% above average in 2022 across the Nechako River Basin while showing only a slight downward trend over 2000 to 2022 (Fig. 1(b)). The combination of the cool, wet weather this spring led to the delayed onset of spring melt and high water levels across many waterways, lakes and the Nechako Reservoir at the onset of the warm season.

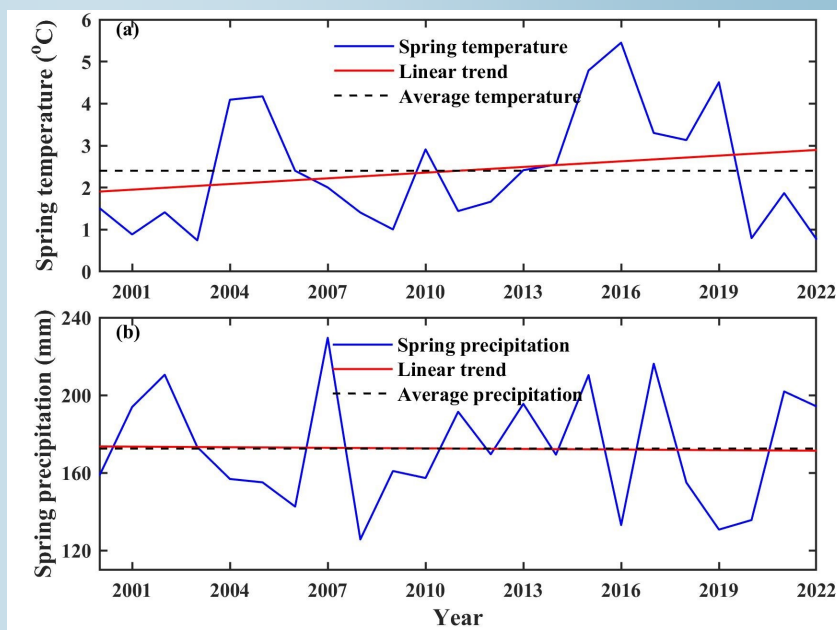


Figure 6: Spring air temperatures and precipitation across Nechako River Basin from 2000 to 2022. Spring denotes March, April and May.

This pattern is entirely consistent with climate projections showing significant inter-annual variable in both air temperature and precipitation despite longer term trends. Indeed, climate models indicate that the Nechako Watershed is quite likely to become warmer and wetter by the end of the 21st century. Ongoing research at UNBC is assessing the range of projections and their uncertainty to quantify potential impacts on freshwater resources and thus the long term water security in the Nechako.

Summer Fieldwork Recap

Jade Reynolds

This summer has come with many new adventures for me, from Tahtsa Lake to Castle Creek Glacier and Middle River to Quesnel Lake. Exploring northern BC with my field partner, Meghan, has been absolutely amazing and so much fun. I have learned more than I thought possible in four months, and not just about weather stations or stream sites, but about glaciology from Kelly and geology from Gracie. This has been one of the most fun summers, and it's because of these three ladies!



Figure 7: Flying up to our weather stations on the Castle Glacier, 17 August

Over the past four months, I have visited over 40 hydrological and meteorological sites. Most stream temperature sites have been accessible, and the data has been able to be downloaded, but there have been some tricky sites due to the high water levels this spring, such as the Endako and Stellako Rivers. In the cases of inaccessibility, new stream temperature logger assemblies have been deployed to ensure that data will still be collected in case last year's deployments are lost. The sites with double deployments will be revisited this fall once water levels drop to hopefully recover the data from last year, or at least from this summer with the new deployments.

(Continued on next page...)

I was part of a weeklong field trip to the Mount Sweeney and Nechako Reservoir area in early July where many sites were visited, including four on the reservoir's inflowing rivers where I was able to travel by boat and have a wonderful tour of the lakes. In early August, I also travelled to Quesnel Lake where I was able to visit five weather stations, with three being on the lake and one being up Browntop Mountain; again, I was taken around the lake by boat on a blue bird day where I was shown waterfalls and the surrounding mountains. Both were longer trips but worth it for the views and experiences I had. In mid-August, I had the pleasure of flying by helicopter up to Castle Creek Glacier to decommission the two weather stations and radio repeater we had up there. I had never flown in a helicopter prior to this trip, and it was breathtaking. It was definitely an unforgettable day! Overall, this summer has been filled with such fun adventures that have opened my eyes to a whole new side of academia and opportunities within environmental science.



Figure 8: A view of Quesnel Lake from our Dock Point Weather Station, 10 August



Figure 9: Meghan retrieving our ST logger at the Kuzkwa River, 3 August

I have extended my contract for the fall which I am very grateful for and excited to have the opportunity to continue working with the NHG. I'd like to thank everyone at the NHG for a great summer and especially my field partner, Meghan. She made this feel less like a job and more like a continuous adventure, getting through the tougher days and celebrating the better ones together.

Data Management Update

Justin Kokoszka

Starting in May of 2022, the NHG initiated a data management strategy for the collection and storage of observational records and metadata associated with CAMnet and IRC research. During the summer of 2022, our team developed a field database, began compiling historical data, and initiated organization of data within the NHG. A special thanks to Abhishek Arora (Database Administrator Skills Trainee) for his dedicated work during his summer contract. The NHG will continue to develop our data management initiative over the Fall of 2022.

Our Field Database: Our data management team has designed, developed, and tested an operational database to keep track of field records and equipment using Microsoft Access. This initiative has helped increase the quality and accessibility of metadata associated with field work regarding meteorological and stream temperature observations. Additionally, the database has been useful in tracking equipment deployment, status, and location. We will continue to improve the features of this database as well as to include historical field records where possible.

Historical data: With over a decade of meteorological observations from multiple weather stations, the NHG has acquired a large amount of valuable data. However, the data needed to be compiled and organized before being put into a database. This task was overseen by Abhishek Arora. Abhishek developed a Python code to compile all meteorological observations from each weather station. This code enables a smooth transition of historical data records into a database for long-term storage. Over the fall of 2022 the data management team will begin processing historical data in preparation for the NHG database.

The NHG database: The NHG database has been designed with the purpose of storing all historical and current data related to meteorological and stream temperature observations. These data will also be linked to the meta records from the field database. Our data management team continues to explore options regarding the hosting environment for the database which include Amazon Web Service as well as the University of Northern British Columbia. Once a hosting environment has been initiated, our data management team will begin populating the NHG database with historical and current observational records and associated metadata.

Outreach Update

Kelly Hurley

Publications:

- Gilbert, D. E., Morris, J. E., Kaveney, A. R., Déry, S. J., 2022: Sub-hourly water temperature data collected across the Nechako Watershed, 2019-2021, *Data in Brief*, **43**, 108425. [Read the Article Here](#)
- Morris, J. E., Hernández-Henríquez, M. A., and Déry, S. J., 2022: Recent updates to the Cariboo Alpine Mesonet network and database, 2017-2021, submitted to *Earth System Science Data*.

Participation in Stakeholder Groups:

- Stephen continues to participate in the bi-weekly meetings of the Technical Working Group of the Water Engagement Initiative

Interactions with Media:

2022/08/17— Comments on MLA John Rustad's social media postings on the provincial carbon tax, CKPG News, CKPG (Prince George, BC) [View it Here](#)

2022/08/12 — Impact of the Nechako Reservoir on downstream river conditions, The Tye

2022/08/08 — Flood potential for the remainder of the summer in northern BC, CKPG News, CKPG (Prince George, BC)

2022/06/23 — Upcoming warm spell and potential for flooding in northern BC, CKPG News, CKPG (Prince George, BC)

Youtube Videos:



[Tahtsa Ranges Atmospheric River Experiment - What is it?](#)

12, July 2022



[Tahtsa Ranges Atmospheric River Experiment - Weather Stations](#)

20, July 2022



[Tahtsa Ranges Atmospheric River Experiment - The Fieldwork Experience](#)

10, Aug 2022

Publicly-Available Data:

- Sub-hourly water temperature data collected by UNBC's northern hydrometeorology group (NHG) across the Nechako Watershed, 2019-2021. [Click Here for Data](#)
- Cariboo Alpine Mesonet meteorological data, 2017-2021. [Click Here for Data](#)

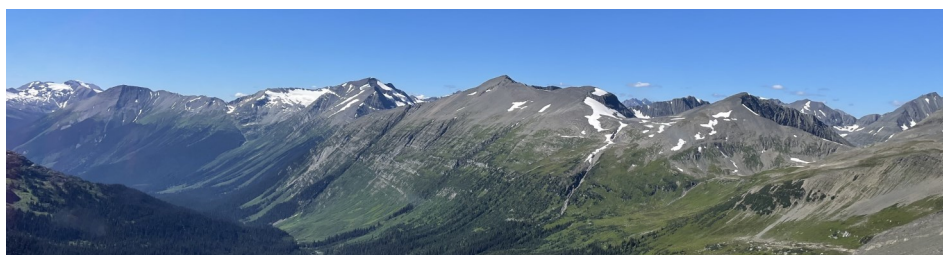


Figure 10: Views of the Cariboo Mountains from a helicopter, 17 August

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