

# The Nechako IRC Newsletter

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## An update from Dr. Stephen Déry, Project Leader

Yet another academic year came to a close in late April at UNBC in what remained a challenging session for many students with the relentless effects of the COVID-19 pandemic. Despite these challenges, many students participated in their convocation on Friday May 27<sup>th</sup> to celebrate the completion of their academic degrees. Congratulations to all our recent graduates including former NHG member Jeremy Morris who officially received his Master's degree at the event! We now look forward to the warm season with research and field work on the agenda for many at UNBC including the Northern Hydrometeorology Group (NHG).

With the cool spring and delayed snowmelt, water levels are still on the rise for many streams and lakes across the Nechako Watershed. As such, site visits to local waterways to collect water temperature data may be delayed until later in the summer. Nevertheless, the team is preparing in anticipation of an exceptionally busy summer with over 40 field sites to visit in the next three months in the Nechako Watershed alone. Data have already been collected from sites in the vicinity of Prince George while our new recruits undertake some safety and field work training.

We are delighted to welcome four new members under the umbrella of the Industrial Research Chair (IRC) program of research at UNBC. Leading our field work this summer are two undergraduate students, Jade Reynolds and Meghan Hunter-Gauthier, who are developing expertise in environmental monitoring and remote field skills. Both will be occasionally supported by Gracie Wilson who has been recruited as a Research Skills Trainee to assist with water temperature data quality control and analysis. With 25 sites where water temperature is being monitored across the Nechako Watershed since the summer of 2020, we have already accumulated a rich database that now requires close examination and interpretation. Assisting with data management efforts is another UNBC undergraduate student Abhishek Arora who has been hired on a part-time basis as Data Administrator. He will ensure our data are properly archived and accessible for others including stakeholders across the Nechako Watershed as a legacy of the IRC for many years to come. All four new members of the IRC team provide introductory pieces in this edition of the Nechako IRC Newsletter.

While we already have many field sites scattered across the Nechako Watershed, we are seeking other opportunities to expand monitoring of atmospheric and hydrologic conditions. To that end, an application was submitted to UNBC's call for funding to the Real Estate Foundation of BC's Partnering Fund in partnership with Cheslatta Carrier Nation. If successful, this would allow the purchase of a new meteorological station that would be deployed at Cheslatta Lake. This would not only provide critical information on meteorological conditions in this remote area of the Nechako Watershed but also provide useful data for modeling and analyzing water temperatures along the Murray-Cheslatta system. As well, we anticipate expanding our monitoring of water temperatures to a few other sites including on the Cheslatta River and Sather Creek.

We continue our outreach efforts through public presentations, media interviews and videography – see details on the last page of the newsletter. The annual report for Year 3 of the IRC program of research is now [available on our website](#). Finally, we sincerely thank the members of the Science Advisory Board (SAB) for their participation in our progress meeting on June 14<sup>th</sup>. The SAB continues to provide critical feedback and guidance on our research and activities, ensuring the continued success of the team!

The members of the IRC team at UNBC wish everyone a very pleasant summer.

Stephen

Northern Hydrometeorology Group (NHG), UNBC

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## Special points of interest

- Photos from the Field
- Four New NHG Team Members
- Looking into the Future Snowpack of the Nechako



Fig 1. A view of the Pacific Ocean from a field trip to Kitimat, BC. Traditional Territory of the xà'ísla wáwís (Haisla) Nation



Fig 2. Angel, the NHG's unofficial mascot, supervising fieldwork at the Ness Lake Weather Station, 2 June 2022

# Research Manager Update

Kelly Hurley



**Above:** Taiga, the dog, looking over Jade and I at her first ST site visit. 11 May 2022

**Below:** Jade visiting her first weather station. Ness Lake, 12 May 2022



Since our last newsletter update in March, the NHG has been very busy with the preparation and start of a new summer field season! In May, Jade Reynolds and Meghan Hunter-Gauthier joined the team as our summer field technicians, and I feel very lucky to have such intelligent, capable, and strong field technicians visiting our 37+ hydrometeorological stations this summer. In the following pages, you will learn about some of the training they underwent and the fieldwork they have completed thus far.

Before the arrival of our summer field technicians, Stephen, myself, as well as former field assistants, Derek Gilbert and Spencer Woyke, spent four days in the Terrace area. We deployed a brand new weather station on the UNBC Northwest Campus in Terrace. This replaced older instruments that were deployed originally at the campus in March 2020. In addition to replacing the existing sensors, we raised the station to six meters and added a second wind sensor. We will be adding a second air temperature and relative humidity sensor in the fall. This new weather station was graciously funded by the BC Real Estate Foundation (BC REF), and we kindly thank them for their support. On our last full day, after completing all work, we saw the exterior of the Rio Tinto aluminum smelter in Kitimat, BC. It was the first time seeing it for Derek, Spencer and I, and it offered important context for our work with the IRC.

This year, we reapplied for BC REF funding to help support a new weather station at Cheslatta Lake. The Cheslatta Carrier Nation (CCN) has voiced their interest in having a weather station to help them monitor climate change on their homelands. As a collaborative project between the CCN and the NHG, we hope to deploy a Campbell Scientific ClimaVUE weather station, and start collecting data this summer.

I have also been working closely with Justin Kokoszka and Abhishek Arora to give my input into the development of our new operational database. It has been a wonderful collaborative effort between the data team and the field team. On June 2nd, the field team and data team convened at the Ness Lake Weather Station to teach each other about our respective “worlds”, and facilitate an understanding of each others’ needs with respect to data collection, management and storage.

Looking forward to the rest of the summer, we still have 23 stream temperature, seven weather station, and seven tipping bucket sites to visit. Some of this work has been delayed due to a cold, wet spring that has deferred spring freshet in many of the rivers we work in. Although this is a lot of sites to visit in the remaining summer months, luckily, a majority of these sites are located in close proximity, and will be tackled on multi-day trips. For example, over two days in the Stuart Basin, we will visit seven stream temperature sites. On a five-day trip to the Mount Sweeney area in July, we will visit six stream temperature sites, five tipping buckets, and one weather station. Although these will make for long field days, I have no doubt that we have a strong team who can make it happen!

As the NHG team makes their way throughout the Nechako this summer, visiting all of our field sites, we hope to come across some of you in person. After a long two (plus) years of a pandemic, we are eager to see smiles off-screen!



**Left:** The Data and Field Teams working collaboratively at the Ness Lake Weather Station, 2 June 2022

**Right:** Meghan visiting her first ST site. Chilako River, 20 May 2022

**Farthest Right:** Kelly avoiding the bugs by wearing a reusable produce bag on her head when she forgot her bug net. Aleza Lake Weather Station, 3 June 2022.





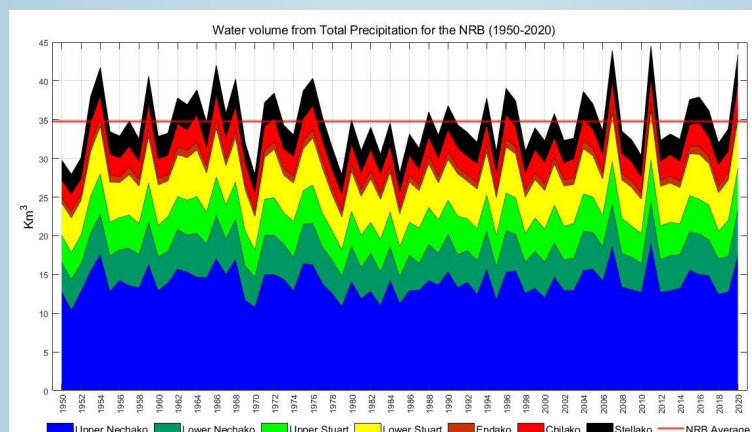
# Water from Precipitation and Atmospheric Rivers in the Nechako River Basin

Bruno Sobral

A recent analysis of water-related variables (ERA5-Land) over the Nechako River Basin (NRB) revealed that the average water volume precipitating yearly in the watershed is approximately 35 km<sup>3</sup>. Although the water volume is impressive and sufficient to fill nearly 14 million Olympic swimming pools, numerous activities within the NRB demand a lot of water. Fulfilling everyone's needs within the watershed is becoming more challenging as the region develops. Also, the water volume that precipitates yearly is not evenly distributed over the watershed nor during the months of the year, posing additional challenges to sustainable water management in the Nechako.

Amid the sub-basins of the Nechako, the Upper Nechako stands out with 14.0 km<sup>3</sup> (trillions of litres), greatly influenced by its southwestern position and mountain ranges. It can be considered the water tower of the Nechako system receiving 40% of all the water. The Lower Stuart, with 5.2 km<sup>3</sup>, follows as the second (15%) most significant water contributor to the NRB. The other sub-basins receive an average precipitation volume of 4.6 (Lower Nechako), 4.4 (Upper Stuart), 3.0 (Stellako), 2.6 (Chilako) and 0.9 (Endako) km<sup>3</sup>.

By associating daily precipitation totals with atmospheric river (AR) events that affected the region from 1950 to 2020 (see fig. 3), the average yearly contribution of ARs to precipitation was estimated at 21% for the entire NRB, with the Upper Nechako receiving a higher (24%) contribution. When estimates reveal that ARs originating in the Tropical Pacific Ocean bring one in every five drops of water to the Nechako Watershed, studying the potential impacts and trends of pineapple expresses becomes even more evident. Future analysis in the NHG will focus on quantifying the water volume associated with other water-related variables such as rain, snow, runoff, snow depth and evaporation, which will allow the calculation of the water budget for each sub-basin of the Nechako River Basin.



**Figure 3:** Estimates of yearly water volume from total precipitation for the sub-basins of the Nechako Watershed, based on ERA-5 Land data.

## An Update from the Field

Jade Reynolds & Meghan Hunter-Gauthier

Jade Reynolds joined the NHG in early May with Meghan Hunter-Gauthier joining two weeks later. Jade worked with Kelly Hurley during her first two weeks, training on weather stations (WX), stream temperature loggers (ST), tipping bucket rain gauges (TBRG), and undertaking safety training. Jade visited Nechako at Miworth (ST), and Ness Lake (WX) during her first two weeks. At the Nechako site, Jade recovered a ST logger and performed a data download with guidance from Kelly. This visit provided an opportunity to practise using the InReach, including tracking and inputting waypoints, and provided an introduction to downloading data in the field.

When Meghan joined the group in mid May, Jade was able to help in the training process. Meghan worked with both Jade and Kelly as she learned how to conduct data downloads on WX, ST loggers, and TBRG both in the lab and the field. The in-field site visits included Chilako River (above Nechako River), and Chun T'oh Whudujut / Ancient Forest. (Continued on next page...)



**Figure 4:** Meghan and Jade working on the Ancient Forest Weather Station, 19 May 2022



**Figure 5:** Jade and Meghan locating the ST logger at the Chilako Site. 20 May 2022

At Chilako River, the late freshet resulted in high flows and muddy water, which prevented retrieval of the ST logger. Kelly put together an example ST assembly for future deployment, providing Meghan with in-field experience obtaining data. This site visit also provided an opportunity for Meghan and Jade to practise safely entering swift water using appropriate PPE.

A return trip to the Chilako site, with NHG team member Gracie Wilson, proved successful! The water level dropped to a point where the ST anchor could be located along the river bank (thanks Gracie)! The logger was retrieved, data downloaded, and updates to the assembly implemented. This included a new PVC enclosure for the data logger, and a new concrete anchor.

At Chun T'oh Whudujut / Ancient Forest, Meghan and Jade experienced a failed data download due to insufficient power to the station. Under Kelly's guidance, troubleshooting took place. After determining there was no damage to instruments, wiring, or the battery, it was decided to adjust the solar panel in an attempt to acquire a better charge. After a few days of monitoring the WX remotely, telemetry issues became apparent. The site was revisited on June 3rd, with no improvement to telemetry or power issues. The troubleshooting continues!

Meghan and Jade also visited Aleza Lake Research Forest WX on their own to perform a data download and replace a temperature probe that was malfunctioning. Being their first solo field-visit, it provided a great opportunity to test their skills and knowledge. Upon arrival at the WX, an assessment of the site was undertaken, followed by a successful data download. The cause of the malfunctioning temperature probe was determined to be a broken wire. The damaged instrument was removed and the cable extracted from the ground; both were replaced and re-wired. This site was also revisited on June 3rd due to telemetry issues. Ultimately it was discovered the cell modem stopped functioning. The modem was removed and returned to the lab where a more in depth inspection can take place.

Having undergone excellent training and numerous field visits, Jade and Meghan are feeling excited for what the summer has in store. They are looking forward to building on their skills and the adventure that comes with field work.



**Figure 6:** Meghan and Gracie smiling through the bugs while decommissioning the Lunate Creek Weather Station. 10 June 2022

## New Team Members

### Abhishek Arora



Abhishek Arora is an undergrad UNBC student pursuing Bachelor of Science in Computer Science, Graduating in 2023. He has recently joined the NHG team as a Database Administrator Skills Trainee to assist our data manager (Justin Koszka). Abhishek is interested in becoming a Data Scientist in future and will be employing his skills to help create a procedural database for the NGH Research team.

Gracie Wilson is a recent graduate from the University of Victoria with a Bachelor of Science in combined Physical Geography and Earth and Ocean Sciences. Her studies concentrated on earth systems, geomorphology, hydrology, and GIS. She joined the NHG at the start of June as a Research Skills Trainee and will be conducting analyses of water temperature data collected throughout the Nechako Watershed. Gracie grew up in Prince George and has spent the last 6 years working various forestry jobs throughout the province. She is excited to be joining the NHG and starting in a new direction, expanding her understanding of the hydrology and water temperature patterns of the Nechako watershed.

### Gracie Wilson



### Jade Reynolds



Jade Reynolds is set to graduate in December from the University of Northern British Columbia with her Bachelors of Science in Biology. As of May 2022, she has joined the NHG team for the summer, working as a field research assistant, and is incredibly excited for the opportunity to be working in her field of study. Her research interests include climate change impacts and ecology of aquatic environments. Jade is looking forward to working alongside a very supportive team and learning new skills both in the field and the office.

### Meghan Hunter-Gauthier

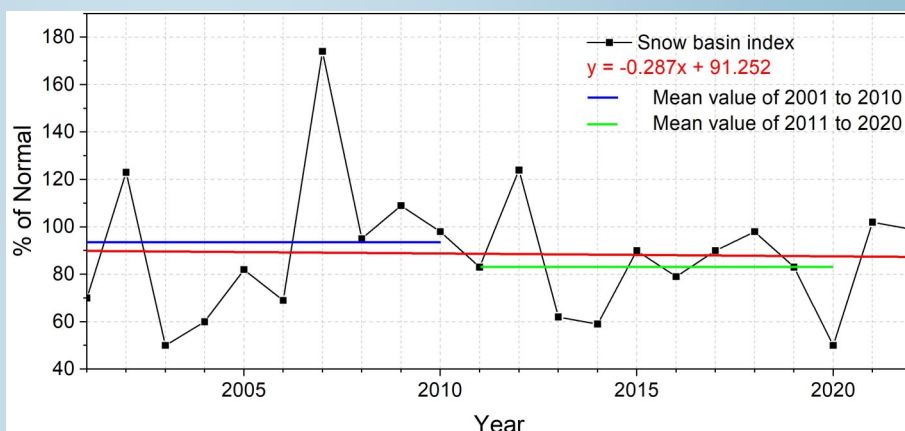
Meghan Hunter-Gauthier is a Research Skills Trainee with the NHG for the 2022 field season. She is a student enrolled in the Water Engineering Technology program at Okanagan College. Meghan has a background working in the visual arts as a Curator with a focus on environmental issues. Her goal upon graduation is to become a Level 1 Operator, and work in the domain of water treatment, or environmental monitoring. Meghan is looking forward to experiencing her first field season and learning about the Nechako Watershed through stream temperature data. She also looks forward to developing her instrumentation skillset in relation to weather stations and climate monitoring.



# Assessment of January 1st snow conditions in the Nechako River Basin, 2001 to 2022

Jingwen Wu

Seasonal snow is an important part of Earth's climate system. Snow cover not only helps regulate the exchange of heat between Earth's surface and the atmosphere, and even the Earth's energy balance on a global scale, variations in snow cover also affect regional weather patterns at smaller scales. In addition, it is also an important freshwater resource, once that snow melts, the water replenishes rivers and reservoirs in many regions of the world. However, extreme snowfall sometimes can cause natural disasters like avalanches, snowstorms, blizzards and ice storms, etc., which could severely affect agriculture, also making transportation very hazardous. Therefore, it is important to know regional snow conditions, especially in the snowy Nechako River Basin.



**Figure 7:** The January 1<sup>st</sup> snow basin index in Nechako river basin during 2001 to 2022. The normal condition means average annual Snow Water Equivalent for 1981-2010.

The January 1<sup>st</sup> snow conditions (i.e. Snow basin index which is annual Snow Water Equivalent, i.e. a measurement used to gage the amount of liquid water contained within the snowpack, divided by the average condition for 1981-2010) in the Nechako River Basin during 2001 to 2022 were analyzed in this section (Fig. 7). For this analysis, annual snow basin index data spanning 2001 to 2022 were sourced from the BC River Forecast Centre's Snow Survey and Water Supply Bulletin. We observe that the January 1<sup>st</sup> snow basin index shows a slight downward trend over Nechako River Basin during 2001 to 2021, with a decreasing value of 0.287% per year. In addition, it approaches 82% of the normal in the second decade, compared to 93% of normal in the first decade, the 11% decreasing amplitude of snowpack in response to a warming climate in this area. Although snowpacks in 2020 (102%) and 2021 (99%) are higher than the past several years, the long-term trend of snowpack is likely to continue decreasing with global warming unceasingly as projected by the Intergovernmental Panel on Climate Change (IPCC).

## Data Management Update

Justin Kokoszka & Abhishek Arora

In May of 2022, the NHG has reignited its data management initiative. Over the course of the summer our data management team will develop a procedural database to store observational records and associated metadata for the CAMnet and IRC research initiatives. The team will also develop a protocol for managing data within the NHG. We hope this will increase our ability to share high quality data with both the public and IRC stakeholders.

### Welcome Abhishek Arora!

Abhishek recently joined the NHG as a Data Administrator. Read his bio on page 4 of the newsletter.

### Data Management Planning

Over the past three weeks, the data management team has been busy conducting a feasibility study for the NHG database. The purpose of this study is to determine our group's data needs and to highlight any technical requirements such as hardware and software requirements. The feasibility study involved meetings with NHG group members as well as a comprehensive review of database options. Throughout this process we aimed to answer some basic questions regarding database implementation including where our database will be hosted, how our data will be recovered and backed-up, what privileges users may have, and much more. This study is ongoing and will provide a framework for choosing the best data management approach for the NHG. The data management team has also begun the process of planning the structure of the database given the group's data needs which includes the development of a field database! (Continued on next page...)



## The Field Database

Will the database integrate data collected over the summer of 2022? Yes!

The procedural database is expected to launch after the summer of 2022. In the meantime, our data management crew has collaborated with the field crew to plan, develop, and test a field specific database. The field database aims to keep track of our equipment, field reports, and metadata associated with observations made over the summer of this year. The database has been structured to allow easy integration of field data to the final NHG database upon its release.

## Data Warehousing

Making data accessible is a part of our data management strategy. Our data management team has considered several data platforms to store our final data outputs including Zenodo, an open repository for research data. This makes our data accessible to both the public and IRC stakeholders. As an example, we have deposited data for both [water temperature](#) (2019-2021) and [meteorological observations](#) (2017-2021), which are both currently available through the Zenodo website.



**Figure 8:** The Data Management and Fieldwork Teams visiting the Ness Lake Weather Station to better understand each group's database needs, 2 June 2022.

## Outreach Update

Kelly Hurley

Our IRC program has a website! Follow our work at anytime [here](#)

The Annual IRC report is now published. [View it here](#)

### Peer-Reviewed Publications:

- 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.
- Gilbert, D. E., Morris, J. E., Kaveney, A. R., and Déry, S. J. (2022). Sub-hourly water temperature data collected across the Nechako Watershed, 2019-2021. In revision for submission to Data in Brief.

### Public Presentations:

- On April 25th, Stephen delivered a presentation entitled "Rivers in the sky: Unraveling the atmospheric river phenomenon" at the Exploration Place's Virtual Adult Speaker Series, Prince George, Canada. [Watch it here](#)
- On May 25th, Stephen, Raj, and Jingwen presented an update on climate change research in the Nechako Watershed to the Main Table of the Water Engagement Initiative
- On June 1st, Stephen presented at the Joint CMOS/CGU/ESC congress. His presentation was entitled: "The Tahtsa Ranges Atmospheric River Experiment (TRARE)"
- On June 8th, Stephen presented a talk entitled "Atmospheric Rivers and their role on floods in BC" to the Real Estate Foundation of BC and the Northern BC Real Estate Board

### Participation in Stakeholder Groups:

- Stephen participated in the May meeting of the Main Table of the Water Engagement Initiative
- Stephen continues to participate in the bi-weekly meetings of the Technical Working Group of the Water Engagement Initiative

### Interactions with Media:

- 2022/05/30 - Recent warming trend, heavy rainfall and potential for floods in northern BC including Peace Country, CKPG News, CKPG (Prince George, BC)
- 2022/05/11 - Current cool, wet weather, above average snowpacks and potential for floods in the upper Fraser River Basin, CKPG News, CKPG (Prince George, BC) [Watch it here](#)
- The UNBC Media Team has published five videos on YouTube showcasing our IRC work. [View them here](#)