

The Nechako IRC Newsletter

An update from Dr. Stephen Déry, Project Leader

June 17, 2021
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The summer solstice is nearly upon us, an indication the warm season is (finally!) arriving. As the high mountain snowpack continues to melt, hydrologists continue to monitor rising water levels in rivers, lakes and reservoirs to assess potential risk for flooding. The NSERC / Rio Tinto IRC team continues to monitor atmospheric and hydrological conditions in the Nechako Watershed to see how the 2020/2021 water year compares to historical records and future projections of the hydroclimate in the basin.

The IRC team is preparing for another busy summer field season with site visits across the Nechako Watershed to check on the status of monitoring equipment deployed mainly last year. This includes an array of 9 tipping bucket rain gauges, 28 water temperature loggers, and 3 weather stations (one in conjunction with Rio Tinto at Eutsuk Narrows). In support of this, two field technicians were hired for the summer who will lead the field efforts across the Nechako Watershed. In this issue of the Nechako IRC Newsletter, you will therefore find short biographies on Derek Gilbert and Spencer Woyke, who joined the IRC team in early May. As well, we are pleased to introduce Dr. Jingwen Wu to the IRC team as he embarks on a post-doctoral fellowship with the goal of generating future projections of the Nechako Watershed’s hydrology. Alas, we are saddened to see of another IRC team’s member early departure from UNBC as Adam MacDonald seeks other opportunities instead of graduate school.

We continue to connect with various stakeholders across the Nechako Watershed either virtually or in person when circumstances allow this. Over the past couple of months, I had the opportunity to present on the IRC program of research to the Water Engagement Initiative and to the Nechako Watershed Roundtable to provide greater visibility on the research focused on climate change and water security being done at UNBC. As well, I had the opportunity to do a brief presentation to the Mayor and Council of the City of Terrace in April to discuss the important role of Pineapple Express storms in the Terrace-Kitimat Valley. Kelly Hurley, Derek Gilbert, Spencer Woyke and I also had the opportunity to meet members of the Cheslatta Carrier Nation to discuss ongoing collaborative efforts and interests on climate change and water security. I also had the opportunity to meet with local champion Wayne Salewski in Vanderhoof recently for his insights on the changing land and waterscapes in the agricultural belt. Finally, there is an open line of communication between the IRC team and Rio Tinto staff who continue to support our research efforts. Special thanks here to Andy Lecuyer, the newest member of the Science Advisory Board (SAB) of the NSERC / Rio Tinto IRC, for bringing new energy to the team.

This June marks the completion of the second full year of the IRC program of research. The SAB met with the IRC team in late May for a progress update and for introductions to the new team members. As well, the annual report for Year 2 of the IRC program of research is [now available on the IRC website](#). We welcome any feedback you may have on our progress over the past year and the path we are on for our third year of activity. With the upcoming TRARE field campaign this autumn, it will no doubt be an exceptionally busy, but productive year!

The IRC team wishes you a very pleasant and safe summer season! We hope to see you during our trips across the Nechako Watershed!

Stephen

Northern Hydrometeorology Group (NHG)

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Special points of interest

- Updates from the Field
- A Report on the May 31 Atmospheric River Storm
- Exploring the Relationship Between Water Discharge and Stream Temperature
- New Team Members



The NHG mascot, Angel, overseeing our two new research assistants, Derek & Spencer, on their first station visit. Ness Lake Weather Station, May 7 2021

Research Manager Update

Jeremy Morris

I am happy to say that we are now deep into summer field work. Data collection from our climate stations is progressing well and our IRC dataset is growing. Kudos to our skillful field techs Spencer and Derek for already developing a variety of complex skills in their short time with the NHG. High water levels have prevented visits to a handful of our river temperature monitoring sites, but we have many trips planned for July and August as more sites become accessible. I am personally looking forward to getting out to the upper Stuart watershed with the help of our colleagues of the Tl'azt'en Nation and Nak'azdli Whut'en, and to the Tahtsa Reach area where we will be spending much of the fall doing field work with support from the Cheslatta Carrier Nation.

We at the NHG are all very grateful that many COVID-19 vaccinations have been successfully administered in Prince George and the communities of the Nechako Watershed. This will enable eventual outreach opportunities and collaborations again. Lastly, I am excited to start sharing the data collected over the last year, so stay tuned for lots of temperature and precipitation graphs from the Nechako in the next newsletters!

One Month in: What we Have Learned About Weather Stations and Fieldwork

Spencer Woyke



During our first month of work as research technicians for the NHG, Derek Gilbert and I have undertaken routine weather station maintenance at a number of sites in the Nechako River Basin and Prince George area. Our first two expeditions were both to Ness Lake to visit our weather station there. These visits provided Derek and I with sufficient knowledge on the maintenance and troubleshooting of weather stations with the help of other NHG members: Stephen Déry, Jeremy Morris, and Kelly Hurley. What also helped streamline the site visit process was the template of a fieldwork sheet created by Justin Kokoszka. This document – created for future application in the NHG database – clearly outlined the series of steps to follow at a typical weather station visit. Derek and I are thankful for the work other NHG members have done to optimize the fieldwork process!

After our hands-on training, Derek and I went to weather stations in the Prince George area: Ancient Forest, Aleza Lake, Lunate Creek, and Tatuk Lake. During these visits, we encountered some novel challenges that can occur when out in the field. For instance, we were required to visit the Ancient Forest site twice given the urgency of the power issues that we encountered at the station during the first visit. As another example, when visiting Aleza Lake, Derek and I were to replace a 12-volt battery at the station, but the new battery was much larger in dimension than the old battery and required different cables to connect to the battery terminals.

Neither issue was expected, so Derek and I had to think on our feet with the tools at our disposal in the field. Fortunately, with patience, communication, and problem-solving, both issues were resolved: the battery was replaced and the station was running!

In all, these two examples illustrate the tricky situations that can occur in the field. In both of these scenarios and others like them, Derek and I felt like we had sufficient training, tools, and knowledge to tackle whatever problem came our way in the field. If we were ever unsure what to do in a situation, communication with other NHG members was possible with the use of an InReach – a satellite communication device. We also felt safe in the field due to training on wilderness safety and use of the InReach for regular check-ins with external contact points. Ultimately, Derek and I have felt like the weather station visits have provided a comfortable environment to develop our fieldwork skills, serve other NHG members, and help maintain the NHG data network. We are looking to continuing to refine our skills with future field visits!



Figures 1 & 2: Weather station wiring at the Aleza Lake site. The upper left picture contains the old battery, whereas the lower right picture contains the new battery. Note the shifting of components and electrical tape on the battery terminals in the latter picture.

Pineapple Express Storm of May 31st, 2021

Bruno Sobral

While the Province of British Columbia (BC) has already enjoyed milder weather and some sunshine in the final days of Spring 2021, a long “Pineapple Express” storm struck the coast of BC as May drew to a close. Starting on the 31st of May and lasting for over 48 hours, an Atmospheric River (AR) fed the region with moisture from the Pacific Ocean, causing cloudy and rainy weather over BC. Near the Nechako Watershed, the characteristic rain shadow effect over BC’s terrain was observed as coastal areas registered AR3 (Strong¹), the foothills registered AR2 (Moderate¹) and inland areas registered AR2/AR1 (Weak¹) activity during what we may call British Columbia’s “AR-off-season”. The “AR-off-season” occurs in BC during Spring and Summer when meteorological conditions discourage the approach of new ARs towards the continent and water vapour transport from the Pacific Ocean is reduced. This is partially explained by the increasing temperatures that gradually build up a high-pressure zone over the province and repel new incoming atmospheric flows. This makes ARs much more frequent in the Fall-Winter period, when low-pressure levels associated with lower temperatures create better conditions for storms to approach BC and make landfall.

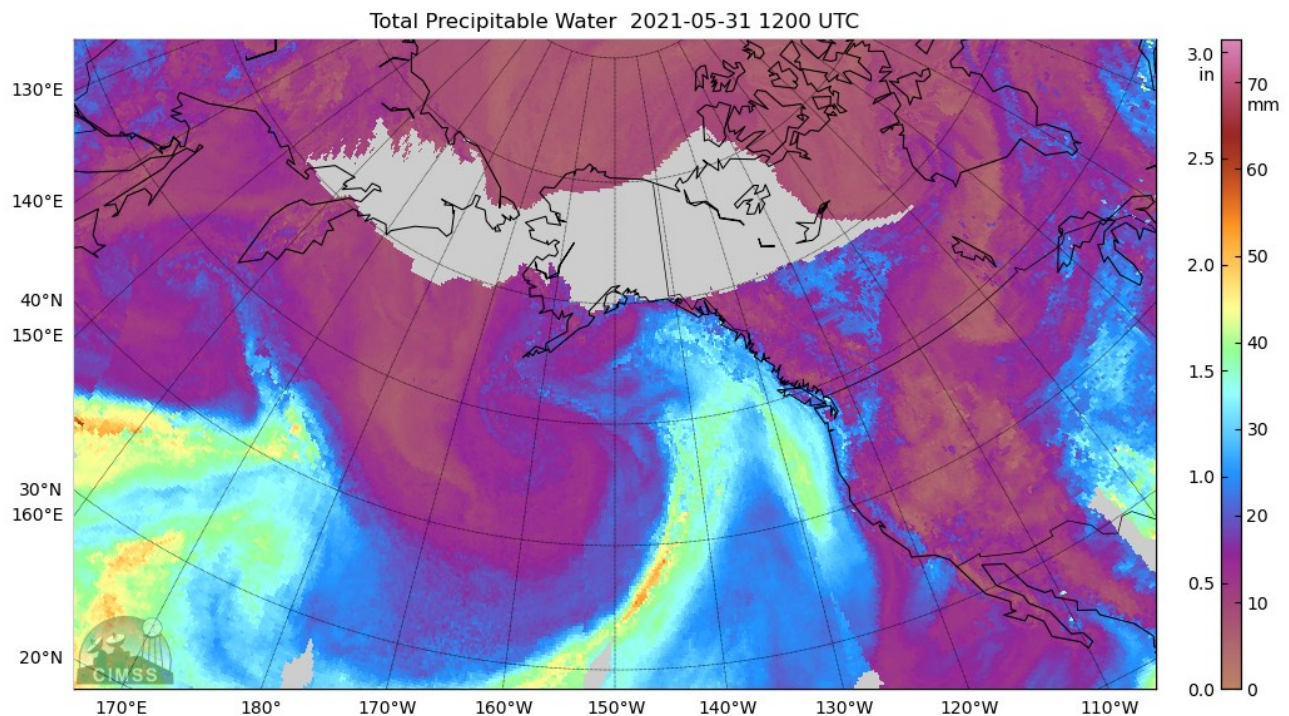


Figure 3: A satellite image of the Atmospheric River event that occurred on the 31st of May 2021 (MIMIC-TPW22).

Increases in streamflow linked to this AR event were registered in the Upper Nechako, Stellako and Upper Stuart sub-basins of the Nechako, and were sufficient to increase flows of creeks and rivers in the western and northern parts of the watershed. The Whitesail Middle Creek (08JA029*) and the Nadina River (08JB008*) are both located near the Tahtsa Mountain Ranges and experienced increased flows during the AR event, with the former more than doubling (from 0.40 to 0.96 m³/s) its flow and the latter rising from 18.4 to 25.0 m³/s. An even more significant increase in streamflow was registered near the headwaters of the Upper Stuart sub-basin, with river flow levels at Driftwood River (08JD006*) astonishingly rising from 32 to 120 m³/s in just two days. Although this “Pineapple Express” storm was of moderate to weak intensity when it reached regions of the Nechako, it still had a significant effect on the terrestrial hydrology of the watershed. This is a good example of how atmospheric rivers play a crucial role in the hydrological cycle of British Columbia, even in places located further east of the Coast Mountains where the orographic effect of ARs are shadowed by the mountain ranges.

* Real-time hydrometric data provided by The Water Office of Canada (https://wateroffice.ec.gc.ca/mainmenu/real_time_data_index_e.html)

1 – Ralph, F.M. et al. (2019). A scale to characterize the strength and impacts of atmospheric rivers. *Bulletin of the American Meteorological Society*, 100(2), 269-289. doi:[10.1175/BAMS-D-18-0023.1](https://doi.org/10.1175/BAMS-D-18-0023.1)

2 – MIMIC-TPW2 - JPSS Risk Reduction Program and the Office of Naval Research - University of Wisconsin –Madison - USA (http://tropic.ssec.wisc.edu/real-time/mtpw2/product.php?color_type=tpw_nrl_colors&prod=alaska×pan=120hrs&anim=html5)

Summer Field Campaign: Stream Temperature Loggers and Tipping Bucket Rain Gauges

Derek Gilbert

Our field campaign has been busy since the beginning of May, and will continue to ramp up as the freshet period becomes less severe, allowing us to safely access stream temperature loggers located throughout the Nechako Watershed. We have been able to successfully collect data from 3 temperature loggers so far and they have provided very promising data. The NHG has a total of 28 stream temperature loggers deployed in the watershed, and each of these will be visited at least once during the summer field campaign for data collection and maintenance.

The 9 tipping buckets that were installed last summer will all be visited during the summer field campaign as well. One site has been visited so far in Chedakuz. These rain gauges allow the NHG to get a better understanding of precipitation throughout the watershed and to produce precipitation fields with greater accuracy and a higher level of confidence. This grants critical information on the duration and intensity of precipitation events and how these move throughout the watershed.

Figures 4 & 5: Left photo: Pulling out a stream temperature logger from the Chilako River. Right photo: Tipping bucket rain gauge in Chedakuz



Safety Planning & Training for TRARE

Kelly Hurley

As the Tahtsa Ranges Atmospheric Rivers Experiment (TRARE) field campaign draws closer, the planning process has been moving along smoothly. I have been busy putting together an official risk assessment form. This involves coming up with communication protocols, training resources, and mitigation strategies for risks such as wildlife encounters, working around swiftwater, and weather extremes, to name a few. Luckily, UNBC has a robust Field Procedures & Safety Manual that I have been using frequently as a resource. On top of this, I have been applying my Wilderness First Aid training and my previous experience conducting fieldwork in remote, mountainous environments.

The importance of a robust safety plan is obvious given the remoteness of the TRARE field campaign. Our sites are over 100 km from Houston, BC along resource roads, so there is a narrow margin for error. Some of the realities of remote fieldwork that can increase risk and make safety planning more complex are distance from medical care, lack of cellphone service, and living in proximity to wildlife.

We have been budgeting for and acquiring essential safety gear and training ahead of TRARE's commencement as well. Some items we have acquired so far are: new bear sprays, new personal flotation devices and throw bags for swiftwater rescue, new first aid kits, additional radios for resource road use, and an extra Garmin InReach Satellite Communication device. In addition to safety gear, NHG staff have been obtaining various safety training. TRARE participants without basic first aid (or that has expired) will take a basic first aid course. Two staff members will obtain swiftwater rescue training in July to increase our safety and decision making along the riverbanks we frequent in the field.



Figure 6: Some of our new safety gear for TRARE

During the first week of June, I attended a 40-hour intensive first aid course in Smithers, BC to recertify my Wilderness First Responder (WFR) certification. I was able to refresh some of my first aid skills such as CPR, use of automated external defibrillators (AEDs), building splints out of improvised materials, techniques for carrying patients on rough terrain, identifying the different stages of hypo and hyperthermia, and treating wounds. Additionally, I acquired many new skills such as administering epinephrine by syringe and vial, in-depth spine injury assessment, treating and differentiating between the three types of life-threatening shock, and reducing dislocated shoulders, fingers and knee caps. Most importantly, I was taught critical thinking for wilderness first aid. Given that every first aid situation is different, a great Wilderness First Responder does not blindly follow steps and textbook protocols. It is advantageous to think critically in each first aid scenario so that you can decipher what the best treatment is for a patient, given the unique nature of each first aid situation.

I am very excited to apply my new skills to the planning process and the creation of TRARE safety protocols; although, I hope I never have to use these skills in real-life scenarios! In August, I will be running a one-day field training workshop for all TRARE participants where I will go over the TRARE safety protocols and share some of the lessons from my WFR course.

Climate Change Impacts on the Flows and Water Temperature: Nechako Watershed

Jingwen Wu & Rajtantra Lihare

Climate change has affected the hydrology of the Nechako watershed, and water temperatures are no exception. Previous studies have shown that the mean air temperature has increased over the Nechako watershed more than 1°C during the last several decades, and subsequently, water temperatures have warmed across the Nechako. Our industrial partner, Rio Tinto, manages water releases and regulates flow from the Nechako Reservoir to the lower watershed. These regulations play an important role in maintaining water temperatures as high flows lower the river temperature and low flows lead to warmer river conditions. To ensure water temperatures do not exceed more than 20°C, as many fishes are sensitive to temperature and can survive only in specific temperature ranges (6°C to 20°C), we were interested in seeing how flow releases from the Skins Lake Spillway have managed to maintain water temperatures across the downstream segment of the Nechako watershed.

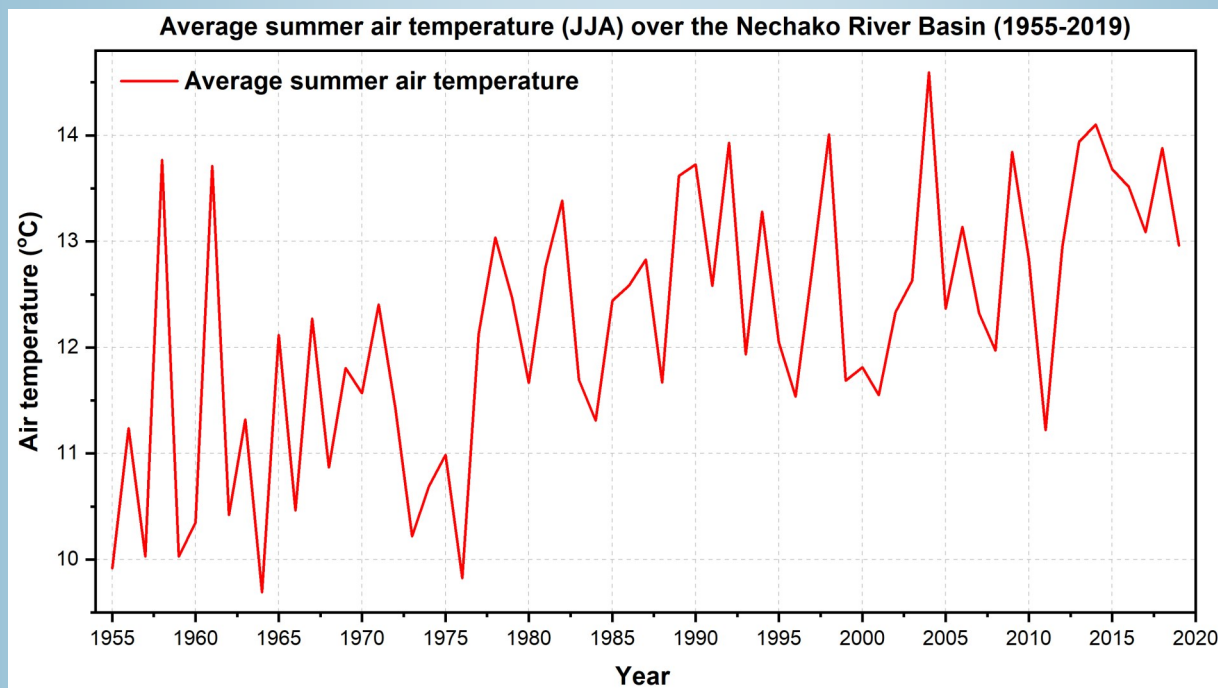


Figure 7: Average summer (June, July, and August) air temperature across the Nechako watershed from 1955-2019.

We analyzed the summer air temperature data and total annual flows released at the Skins Lake Spillway between 10th July to 20th August for 1955–2019. These data clearly show an increasing trend in the air temperature and flow releases, respectively (Figures 1 and 2). Moreover, the average air summer temperatures (June, July, and August) were between 10–12°C for most of the years between 1955 and 1980, while it increased to 12–14 °C after the 1980s. We also notice that average flow releases were between 100–250 m³/s for most of the years between 1955 and 2019; however, it increased to 250–400 m³/s after the late 1990s. The scatter plot shows the relationship between the average air summer temperature and water volume released at the Skins Lake Spillway (Figure 3). For most of the years, average flows were maintained between 150–250 m³/s when average summer air temperatures surpassed 11°C. Moreover, we did not find any clear correlation ($r < 0.20$) between the water released from the Skins Lake Spillway and summer air temperature.

Our analyses show that flow regulations to the lower Nechako play a vital part in maintaining water temperature and fish migration as fluctuations in river water temperatures can affect the growth and survival of fishes and other aquatic vertebrates within the watershed.

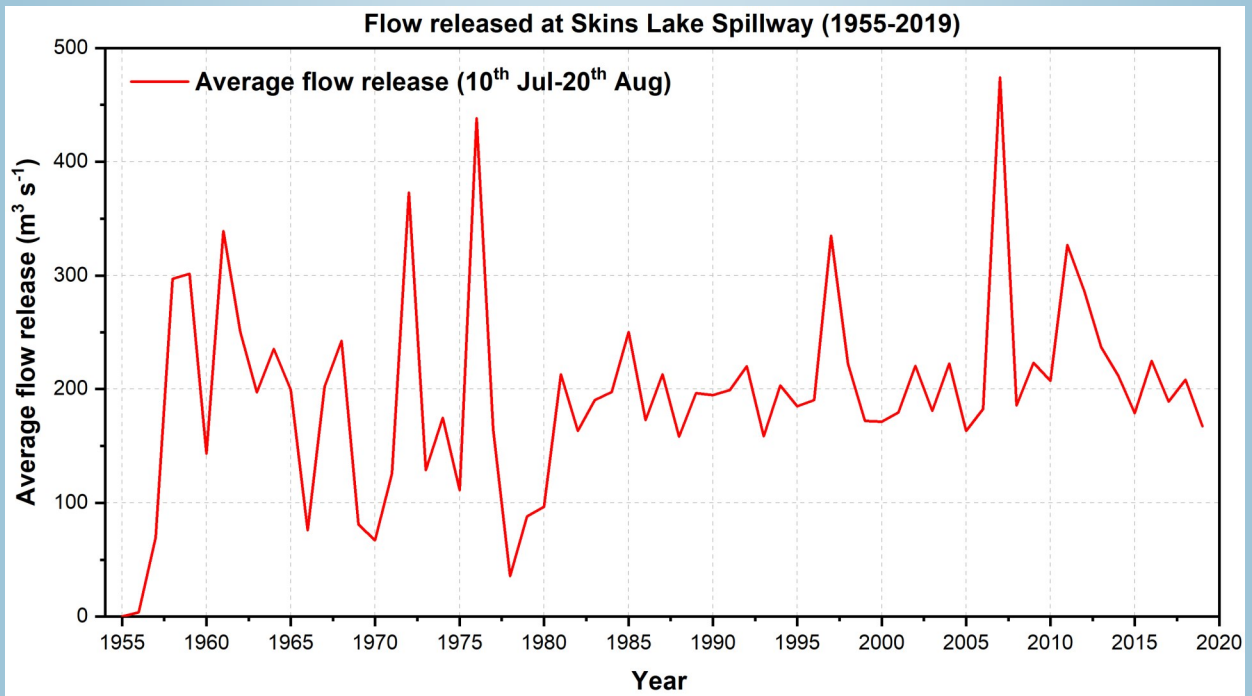


Figure 8: Average flows released from the Skins Lake Spillway between 10th July and 20th August from 1955—2019.

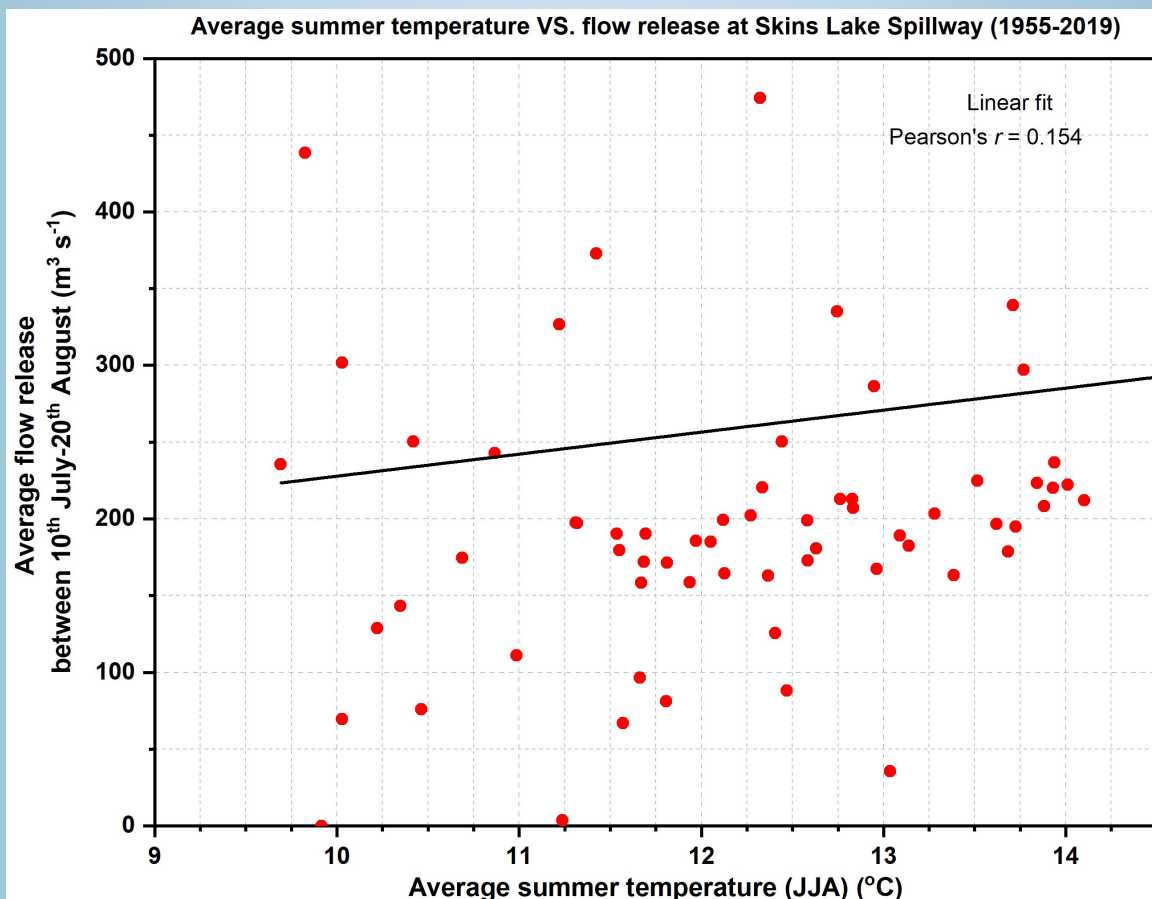


Figure 9: Scatter plot between average flows released from the Skins Lake Spillway (between 10th July to 20th August) and average summer air temperature across the Nechako watershed from 1955-2019.

New Team Members

We are pleased to introduce three new NHG members

Jingwen Wu

Dr. Jingwen Wu recently joined the NHG team as a Post-Doctoral Fellow. He is working on a project that will focus on projecting the future hydrology of the Nechako Watershed. He received his PhD degree (2020) and Masters degree (2017) in Global Environment Change at Beijing Normal University. His research interests included investigating the influence of climate change on streamflow, hydrologic modelling and evaluating future projections.



Derek Gilbert

Derek Gilbert is a recent 2021 graduate from the University of British Columbia Okanagan (UBCO) with a Bachelors of Science (Honours) in Earth and Environmental Science. He recently joined the NHG in May as a Research Skills Trainee/Field Technician and is responsible for instrument maintenance, data collection, and data analysis. His research interests include hydrology, geomorphology, GIS, and climate change.



Spencer Woyke

Spencer is a third-year Environmental Science student that is pursuing a minor in Atmospheric Science at the University of Northern British Columbia. His study interests include mesoscale meteorology and climate change impacts on the physical environment. Spencer started working with the NHG on October 2020 as a part-time Research/Lab Assistant. Since May 2021, he has worked as a Field Technician for NHG. As the fieldwork season is commencing, Spencer is looking forward to working with a team of highly-experienced professionals, enhancing his knowledge of the research process, and developing his fieldwork and office work skills.





A youth intern from the Lheidli T'enneh Nation, along with Spencer and Jeremy, setting up a weather station. April 7, 2021.



A beautiful view from our Lunate Creek weather station May 20, 2021



Wearing face nets to help deter the bugs at the Ancient Forest weather station on June 10, 2021

Outreach Coordinator Update

Kelly Hurley, Acting Outreach Coordinator

Public Presentations

- On June 9th, Stephen was co-covener for a session on atmospheric rivers and extratropical cyclones at the 55th annual Canadian Meteorological and Oceanographic Society (CMOS) Congress
- On May 26th, Stephen provided an update on IRC research at the Nechako Watershed Roundtable's Spring Technical Meeting

Outreach

- On June 10th, a youth intern from the Lheidli T'enneh Nation, along with Spencer & Derek, went to our Ancient Forest weather station to repair two sensors
- On May 26th, Stephen & Jeremy met with Rio Tinto's communication team to discuss social media plans
- On May 14th, Stephen, Kelly, Derek & Spencer met with James Rakochy & Mike Robertson from the Cheslatta Carrier Nation to discuss our ongoing relationship and upcoming fieldwork plans
- On April 7th, a youth intern from the Lheidli T'enneh Nation joined us to learn about weather stations, climate change, and our work in the Nechako. He helped us set up a complete weather station that was used to test our instruments
- On March 29th, we were featured on Rio Tinto's BC Works' Facebook page. [Click here to view](#)

Participation in Stakeholder Groups

- Stephen continues to participate in the monthly meetings on 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
- On May 26th, Stephen participated in the Nechako Watershed Roundtable meeting
- On April 12th, Stephen presented to the Terrace City Council about our research on Atmospheric Rivers (AR)

Annual IRC Report

- The first draft of the 2020/2021 Annual Report for the IRC is now available on the IRC website. [Click here to view](#)

Site Visits

- On May 14th, Stephen, and other IRC staff members went to visit the Skins Lake Spillway and met with Ken Hanson, the spillway attendant to scope out the area as a possible field site for the upcoming TRARE campaign
- On May 20th, Stephen met with local champion Wayne Salewski to chat watershed health & our research in the Nechako

Interactions with Media

- On May 3rd, Stephen's interview on the recent washouts in the Cariboo region aired on CBC's The National. [Click here to view](#)

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