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The Nechako IRC Newsletter

Nine Mile Creek, near Fort Fraser, near peak flow in April 2019. We're anticipating high water this spring due to the high snow pack—see Update from Dr. Stephen Déry for details about spring 2020.

An update from Dr. Stephen Déry, Project Leader

Greetings!

Spring is upon us and as we enter the snowmelt season, all eyes will be on the creeks, streams and rivers draining into the Nechako Watershed. In early February, the BC River Forecast Centre reported snowpack accumulations of 100% and 121% of normal in the Upper Nechako and Upper Fraser West watersheds, respectively, elevating concerns about the potential for spring flooding in parts of the Nechako Watershed. Indeed, I had the opportunity to discuss the particularly abundant January snowfall in parts of the Nechako Watershed on CBC Daybreak on February 13th and the potential implications to the spring freshet in northern BC.

As of early March 2020, the BC River Forecast Centre reports that snowpack levels are now at 104% in the upper Nechako and 135% in the upper Fraser West (Stuart and Nautley River Basins) Watersheds. While not at near record levels, the above normal snowpacks could lead to some flooding in the region, particularly the Stuart River, depending on how quickly the snow melts. Thus we will continue closely monitoring current snowpack levels and weather conditions for any flood potential.

In this edition of the Nechako IRC Newsletter, you will find an article by Ivy Strother describing a new array of rainfall gauges that we will deploy in the Upper Nechako Watershed during this summer field season. These gauges will improve monitoring of heavy rainfall including during Pineapple Express storms that can also lead to flooding. The newsletter also includes a piece by Rajtantra Lilhare describing an ongoing effort at UNBC to use a computer model to reproduce historical flows for the main waterways in the Nechako Watershed including during some of the recent floods (e.g. in 2007/2008) that have plagued the area. The newsletter also introduces three new members of the Northern Hydrometeorology Group (NHG) that are contributing to the Industrial Research Chair's program of climate change and water security research, field monitoring and data analysis. Finally, an update on other recent activities and news items are provided throughout the newsletter.

Depending on the COVID-19 outbreak, in the coming weeks and months we will make a concerted efforts to visit some of the communities and First Nations in the Nechako Watershed and so we look forward to meeting some of you in the near future. A final reminder that we welcome any feedback you may have on this newsletter and our research, and encourage to keep track of our activities on our website.
All the best,
Stephen

Inside this issue

Special points of interest

- Stephen delivered a presentation providing a progress update on the IRC program of research at the True North Business Development Forum in Prince George on January 28th, 2020.
- The science advisory board (SAB) for the IRC program of research (Dr. Ellen Petticrew, Dr. Francis Zwiers, Mr. James Rakochy, Mr. Chelton van Geloven, and Justus Benckhuysen will be meeting with the Chairholder and IRC team members for an annual progress meeting at UNBC on June 2nd, 2020.
- Depending on the COVID-19 outbreak, we intend to conduct several outreach events in the coming weeks and months to initiate discussions about our research plan with stakeholders across the Nechako Watershed. For instance, Stephen will present to the Kitimat Public Advisory Committee on May 26th, 2020.

The development of a precipitation gauge transect to monitor atmospheric rivers and precipitation gradients in BC's upper Nechako Watershed

Ivy Strother, Research Skills Trainee

There is a distinct precipitation gradient in the upper Nechako Watershed from the Tahtsa Ranges in the Coast Mountains to the vast Interior Plateau. Weather systems originating in the Pacific Ocean travel eastward and release large amounts of precipitation when they hit the mountainous terrain of the Coast Mountains. As the systems continue eastward onto the Interior Plateau, descending motion in the atmosphere leads to a prominent rain shadow such that mean annual precipitation ranges from ~2500 mm in the Tahtsa Ranges to ~500 mm in the Interior Plateau. Additionally, extreme weather events such as atmospheric rivers, or Pineapple Express storms, release copious amounts of precipitation in the region. For these reasons, along with a paucity of existing monitoring stations, we will be implementing a new precipitation gauge array in the upper Nechako Watershed.

In the summer of 2020 we are planning to deploy a transect of precipitation gauges in the Nechako Reservoir area. To help select the location of these new gauges we have mapped out the location of existing weather stations managed by agencies such as Environment and Climate Change Canada (ECCC), BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), and Rio Tinto (Figure 1). The location of existing weather stations together with the observed pattern of precipitation within the Reservoir area, will help us decide where we should locate our new gauges. We will be using Onset tipping bucket precipitation gauges (Figure 2) to measure rainfall in our study area. The tipping buckets function by collecting rainwater through the black funnel at the top. The water drips inside onto a tipping mechanism (Figure 3) that tips when it is filled with a precise amount of water. The built in logger counts the number of tips and then based on the diameter of the funnel the amount of rainfall (mm) can be calculated. Each tipping bucket also includes an air temperature monitor which will be deployed under a radiation shield. The addition of ten precipitation gauges as well as two full weather stations (measuring barometric pressure, precipitation, air temperature, humidity, snow depth and wind speed and direction) will complement existing stations and allow NHG to enhance climate modelling and the research of atmospheric rivers in the region.

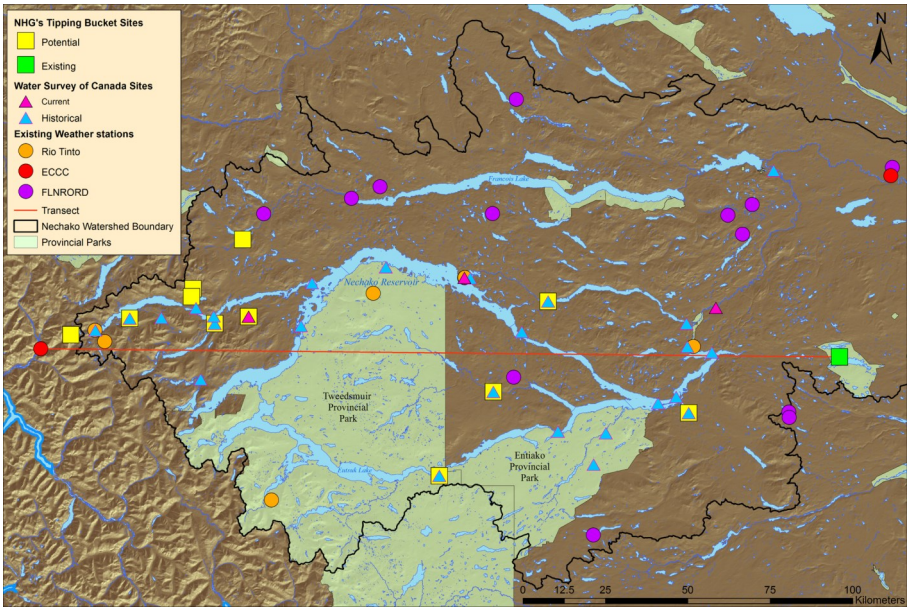

Figure 1. Map of existing and potential weather monitoring sites in the upper Nechako Watershed

Summary of work on this project:

So far we have completed a number of tasks including:

- Determined eleven potential sites for tipping buckets
- Tested the calibration of the tipping buckets
- Designed and built a tripod prototype for deployment
- Applied for a Parks Use Permit as one of the sites is within Tweedsmuir Provincial Park

Development of a precipitation gauge transect continued…..

Next steps will include:

- Building the remainder of the tripods for field deployment;
- Preparing a research poster on the development of the precipitation gauge array that we will bring to future outreach activities.

Figure 2. Onset tipping bucket precipitation gauge

Figure 3. Tipping mechanism within the tipping bucket

Proposed hydrologic modelling in the Nechako

Rajtantra Lilhare, PhD candidate

Cold regions and snow-dominated river basins are particularly sensitive to changing climate. As a result it is essential to analyze drivers of historical trends in water resources of these basins to understand how these resources may change in the future. Hydrological models are widely used tools to quantify such trends by simulating the hydrology of the basin using historical climate datasets. With the advance in computational resources and improvements in hydrological modelling, new hydrological models allow for simulations at higher spatial and temporal resolutions with proper depictions of glaciers, lakes, reservoirs, and land cover types.

In this aspect of our research program, we will utilize the Variable Infiltration Capacity (VIC) hydrologic model to simulate the historical and future climate change impacts on the hydrology of the Nechako River Basin (NRB). We will implement VIC version 5 at 1/16 degree horizontal resolution using a daily time scale and a reservoir module. The goal is to simulate natural and regulated flows within the NRB to estimate the impact of regulation and climate change. Figure 4 shows simulated (red) and observed (black) daily flows (1979-1990) as an example of our initial efforts for VIC model implementation across the Stuart River Basin within the NRB. The close correspondence of observed vs simulated values indicates high reliability of model simulations.

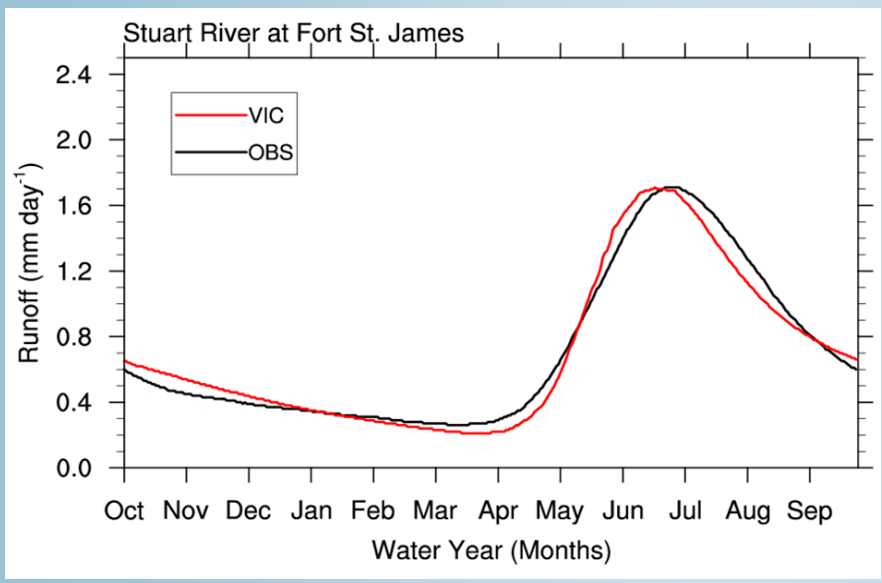

Figure 4. Simulated (red) and observed (black) daily runoff in the Stuart River Basin from 1979-1990

New equipment installed at Terrace campus of UNBC

In early March NHG members Jeremy Morris and Ivy Strother deployed a new monitoring station on the roof of the UNBC campus in Terrace. The station includes a Micro Rain Radar (MRR) dish which detects precipitation and clouds high into the atmosphere from a single beam. Additionally, a weather station was set up with sensors to detect temperature, humidity, precipitation, barometric pressure, and wind speed and direction. Currently the data are being stored locally, but we will soon have remote access to real time data. This is part of a pilot project to employ the MRR on loan from Université du Québec à Montréal.

Scenes from the Nechako: Mouse Mountain on a foggy morning, Fraser Lake. Fall of 2019.

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New Team Members

We are pleased to add three new members to the IRC team.

Justin Kokoszka will be joining the NHG as the part-time Data Manager for the IRC program and a Masters of Science student in the Natural Resources and Environmental Studies program at UNBC. Justin received his bachelor's degree in Physical Geography with a Certificate in Earth Science (2015-2019) from Simon Fraser University. Since 2015, Justin has worked with the Northwest Territories Geological Survey, as a Research Assistant, where his research focused on the effects of permafrost thaw on hydrological networks in Northwestern Canada. In the IRC program, Justin's research will focus on quantifying the individual roles of flow regulation, climate variability, and climate change on the observed trends in discharge for the Nechako and Fraser Rivers over the past six decades.

Dan Scurfield is an undergrad UNBC student pursuing a Bachelors of Science in Wildlife and Fisheries, Graduating 2021. He has recently become a member of the NHG team as a field and lab research assistant. He is involved in instrument deployment, data collection, maintenance and data analysis. Dan's study interests are stream physiography, hydrology and its application in the realm of fisheries.

Natalya Klutz is a third year Environmental Science student at the University of Northern British Columbia. She is pursing a Bachelor of Science with a minor in Aquatic Sciences. She will be working as a field and lab assistant in the IRC program for the winter semester and the summer. She is excited to obtain more hands-on experience regarding stream temperature analysis and data collection, while learning valuable lab skills.