Update on climate change research for the Nechako Watershed Rajtantra Lilhare, Jingwen Wu & Stephen Déry

Confluence of the Nechako River and Stony Creek, Vanderhoof, BC Traditional & Unceded Saik'uz First Nation territory



RioTinto UNBC UNIVERSITY OF NORTHERN BRITISH COLUMBIA



Ongoing Climate Change Research

- As part of the Industrial Research Chair, we have several projects focused on climate change and water security in the Nechako Basin.
- Two of these involve using the fifth generation of the Variable Infiltration Capacity (VIC) hydrological model to simulate the naturalized hydrology of the Nechako and its tributaries for:
 - 1) historical (1950-2019) conditions (led by Dr. Rajtantra Lilhare); and
 - 2) the potential future (up to 2100) conditions (led by Dr. Jingwen Wu).
- Another project focuses on water temperatures across the Nechako.

Observed (Regulated) and Simulated (Naturalized) Total Annual Discharge, Upper Nechako River, 1955-2019



Observed and Simulated Hydrographs for the Upper Nechako River, 1990-2019



Ongoing and future tasks:

Landcover sensitivity (disturbances) runs:

Substitution of all forested areas with grasslands in VIC simulations.

Analyses and results (baseline and sensitivity):

- Analyses: Quantification of flow regulation versus climate change impacts on the overall hydrology of the Nechako Watershed.
- Results: Reconstruction of daily flows and hydrographs for the Nechako River (main stem at Big Bend Creek, Vanderhoof, Prince George) and major tributaries/systems (Chilako, Eutsuk, Nadina-Stellako-Nautley, Stuart).

Annual extreme precipitation events across Nechako Reservoir

□ Seasonality patterns of maximum 2-day precipitation across the Upper Nechako Watershed



•	Rainfall (2030-2099)
•	Snowfall (2030-2099)
0	Rainfall (1950-2019)
0	Snowfall (1950-2019)

Top 10 events from future climate projections from 18 climate model simulations up to 2100, and top 10 events in historical data are from a reanalysis climate dataset

Relative to historical (1950-2019) conditions, the upper Nechako Watershed may experience heavy precipitation events over a longer period of the year (mostly from September through to February) with rain in autumn and rain/snow in winter.

Preliminary Results – 2021 early summer heat dome

 Used hourly water temperature data for 35 sites across the Nechako Watershed: 25 UNBC, 3 Rio Tinto and 7 from Water Survey of Canada

- Computed average water temperature for one week (week 1: 18-24 June 2021) prior to heat dome and for one week during heat dome (week 2: 25 June – 1 July 2021).
- Calculated difference in water temperature for week 2 – week 1.
- Tracked overall maximum water temperature during week 2. Cheslatta Lake





3.1 - 4.0 -0.3 - 0.0 4.1 - 5.0 0.1 - 1.0 5.1 - 6.0 1.1 - 2.0 2.1 - 3.0 6.1 - 7.0 Temperature Difference (°C) – 10 Week 2 – Week 1

Maximum Temperature (°C) – Week 2 (25 June – 1 July 2021) 3.5 - 5.0

5.1 - 7.5

7.6 - 10.0

10.1 - 12.5

12.6 - 15.0

15.1 - 17.5

17.6 - 20.0

20.1 - 22.5

22.6 - 25.0

25.1 - 27.5

27.6 - 30.0

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April 8, 2022

Zendo

Sub-hourly water temperature data collected by UNBC's northern hydrometeorology group (NHG) across the Nechako Watershed, 2019-2021

Q

Upload

Communities

Open Access

Dataset

Jeremy Morris; Derek Gilbert; Anna Kaveney; 🝺 Stephen Déry

This is a dataset of water temperature time series collected at 15 minute intervals at 24 sites across the Nechako Watershed. Data are provided in comma-delimited format with one file for each site. Each file name identifies the site location. The first column contains the date/time (UTC) in the format MM/DD/YEAR HH:MM. The second column contains the corresponding water temperature in degrees Celsius to two decimals. The third column contains a recommended flag for data quality, with "P" representing a "pass", "F" denoting a "fail", and "B" denoting "backwater conditions" with the likely presence of ice and below freezing temperatures. Additional issues encountered at specific sites are identified in the attached "read me" file along with basic metadata (site coordinates, elevation and period of record). A map of the sites is also attached to depict their locations across the Nechako Watershed.

Data collection at most sites is ongoing and time series will be periodically updated as more recent data become available.



Log in





Plans for 2022 summer field season

- Two undergraduate students (Jade Reynolds and Meghan Hunter-Gauthier) have been hired as field technicians to lead our data collection efforts across the Nechako Watershed.
- In addition, Gracie Wilson will be joining the IRC team next week to undertake some water temperature data analyses and quality control.
- Plans are to visit all 25 currently active NHG sites for data downloads.
- Possible addition of other water temperature loggers (e.g. Cheslatta River, Sather Creek) and a weather station at Cheslatta Lake.

2022 IRC Team



Working in partnership with industry, government, academic institutions, stakeholder groups, communities & funding agencies



Table 1. Currently active water temperature sites in the Nechako Watershed.

List of currently active NHG water temperature monitoring sites across the Nechako Watershed

Water Temperature Logger Site Name	Site Code	Latitude	Longitude	Elevation (m)	Data Period (dmy)
Chedakuz Creek above Nechako Reservoir	CNR	53° 19' 17.4" N	124° 44' 35.3" W	923	12/8/2020 - 30/7/2021
Cheslatta Lake above Sather Creek	CSC	53° 44' 52.8" N	125° 27' 16.7" W	786	30/7/2020 - 2/9/2021
Chilako River above Nechako River	CNE	53° 46' 54.2" N	122° 59' 20.8" W	618	8/7/2020 - 26/7/2021
Chilako River below Tatuk Lake	CTL	53° 30' 55.9" N	123° 59' 17.8" W	838	12/8/2020 - 19/8/2021
Endako River above Stellako River	ESR	54° 4' 52.0" N	125° 0' 13.7" W	672	12/11/2020 - 27/6/2021
Kasalka Creek above Tahtsa Lake	KTL	53° 38' 49.6" N	127° 08' 28.2" W	861	No data yet
Kazchek Creek above Middle River	KMR	54° 53' 20.6" N	125° 10' 01.4" W	722	17/7/2020 - 29/6/2021
Kuzkwa River below Tezzeron Lake	KTE	54° 47' 50.1" N	124° 41' 34.0" W	754	16/7/2020 - 29/6/2021
Laventie Creek above Tahtsa Lake	LTL	53° 39' 20.0"N	127° 32' 17.7"W	861	29/7/2020 - 12/8/2021
Middle River above Trembleur Lake	MTL	54° 52' 45.4" N	125° 8' 32.4" W	716	17/7/2020 - 29/6/2021
Nadina River above Francois Lake	NFL	53° 58' 1.0" N	126° 51' 50.7" W	844	29/7/2020 - 5/10/2021
Nechako above Cluculz Creek	NCC	53° 59' 03.1" N	123° 37' 54.1" W	632	13/7/2019 - 13/7/2021
Nechako River at Miworth	NMI	53° 57' 23.0" N	122° 55' 43.7" W	579	9/7/2020 - 30/9/2021
Nechako River off Dellwood Road	NDR	53° 59' 8.4" N	123° 49' 39.0" W	638	13/7/2019 - 13/7/2021
Necoslie River above Stuart Lake	NSL	54° 24' 35.0" N	124° 14' 07.2" W	586	17/7/2020 - 28/6/2021
Otter Creek below Finger Lake	OFL	53° 33' 10.1" N	124° 17' 20.2" W	927	3/6/2020 - 25/9/2021
Pinchi Creek above Stuart Lake	PSL	54° 34' 36.3" N	124° 29' 32.3" W	703	16/7/2020 - 28/6/2021
Rhine Creek above Sweeney Creek	RSC	53° 41' 56.8" N	127° 16' 24.2" W	902	24/8/2020 - 29/10/2021
Skins Lake Spillway	SLS	53° 46' 29.7" N	125° 59' 30.1" W	839	12/8/2019 - 4/9/2020
Stellako River above Fraser Lake	SFL	54° 4' 55.8" N	125° 0' 19.1" W	680	12/11/2020 - 23/8/2021
Stuart River above Nechako River	SNR	54° 09' 54.5" N	123° 37' 43.3" W	670	8/7/2020 - 8/6/2021
Tachie River above Stuart Lake	TSL	54° 42' 12.0" N	124° 47' 50.0" W	685	16/7/2020 - 28/6/2021
Tsilcoh River above Pinchi Lake	TPL	54° 36' 39.0" N	124° 14' 46.7" W	733	17/7/2020 - 28/6/2021
Whitesail Creek above Tahtsa Lake	WTL	53° 41' 43.7" N	126° 59' 07.4"W	866	29/7/2020 - 12/8/2021
Whiting Creek	WHC	53° 43' 7.3" N	127° 07' 43.0" W	988	17/9/2021 - 29/10/2021

25 currently active UNBC water temperature monitoring sites across the Nechako Watershed





Article information

Article title

Sub-Hourly Water Temperature Data Collected Across the Nechako Watershed, 2019-2021

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Abstract

Water temperature is actively being monitored along the regulated Nechako River and some of its unregulated tributaries in northern British Columbia (BC) to determine how climate variability, climate change and flow regulation influence water temperatures. The Nechako Watershed, located mainly in the sub-boreal spruce biogeoclimatic zone, spans 47,200 km² in area [1]. The regional climate experiences a prominent seasonal cycle in air temperature and precipitation, with subfreezing temperatures and snow accumulating during winter. Waterways therefore experience extended near 0°C water/ice temperatures during the winter season. The accumulation of snow yields snowmelt-generated hydrographic peaks in the spring freshet period in unregulated tributaries [2].



