Integrated Watershed Research Group

# Climate change and water security in the Nechako River Basin

Photo: Tatuk Lake


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# Nechako River Basin

**Hydrometric Gauges**
*(Water Survey of Canada)*

**Regulated sub-basin**

1 François Lake
2 Fraser Lake
3 Nechako Reservoir
4 Stuart Lake
5 Takla Lake
6 Trembleur Lake

**Elevation**
*(WWF / USGS HydroSheds Dataset)*

Max: 2569 m a.s.l.

Min: 550 m a.s.l.

*Additional spatial data supplied by DataBC*

Map by Michael Allchin

# Water security and climate change

Stephen Déry and students

## Areas of inquiry:

1) Is a warming climate leading to more or less surface availability in the Nechako River Basin?

2) What is the impact of human-induced versus natural influences on the basin's water resources, including streamflow amounts and their timing?

# Data Analysis

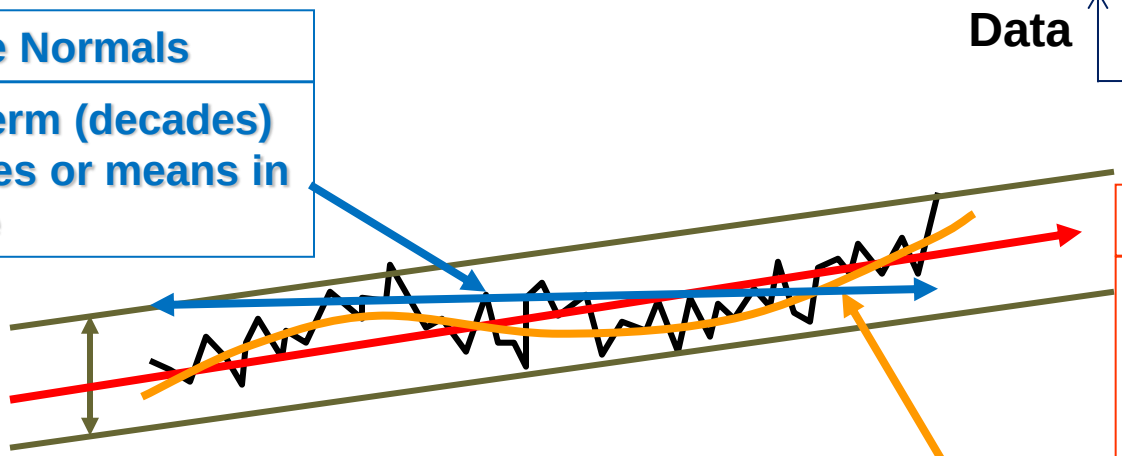
- Air temperature
- Precipitation
- River runoff

Tatuk Lake weather station

# Climate Normals, Variability & Change

**Climate Normals**

Long term (decades) averages or means in climate




**Climate Change**

Long term (decades to centuries) trends or major shifts in climate

**Climate Variability**

Short term (years to decades) rises and falls about the trend line (El Niño)

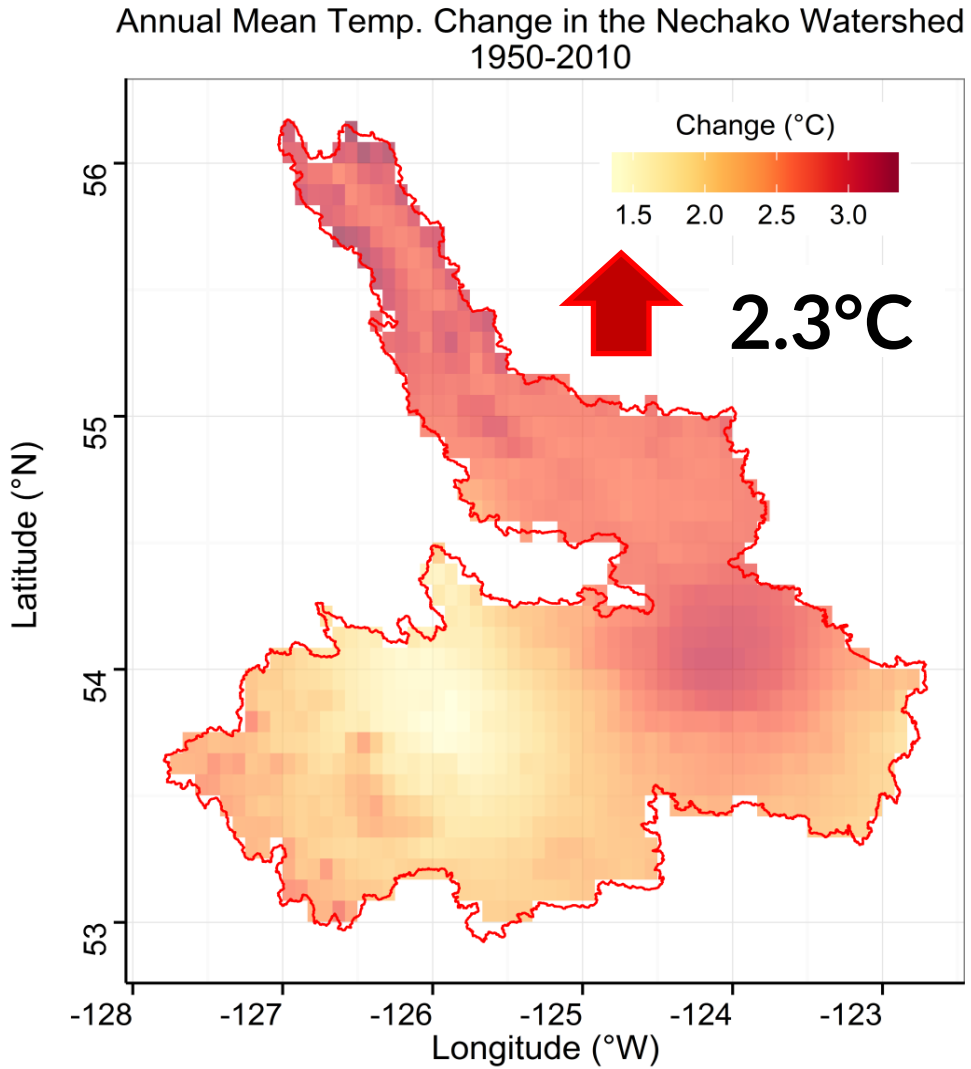
**Climate Oscillations**

Long term (decades to centuries) oscillations in climate

# Air Temperature

## Mean and Change in Annual and Seasonal Air Temperature across the Nechako, 1950-2010

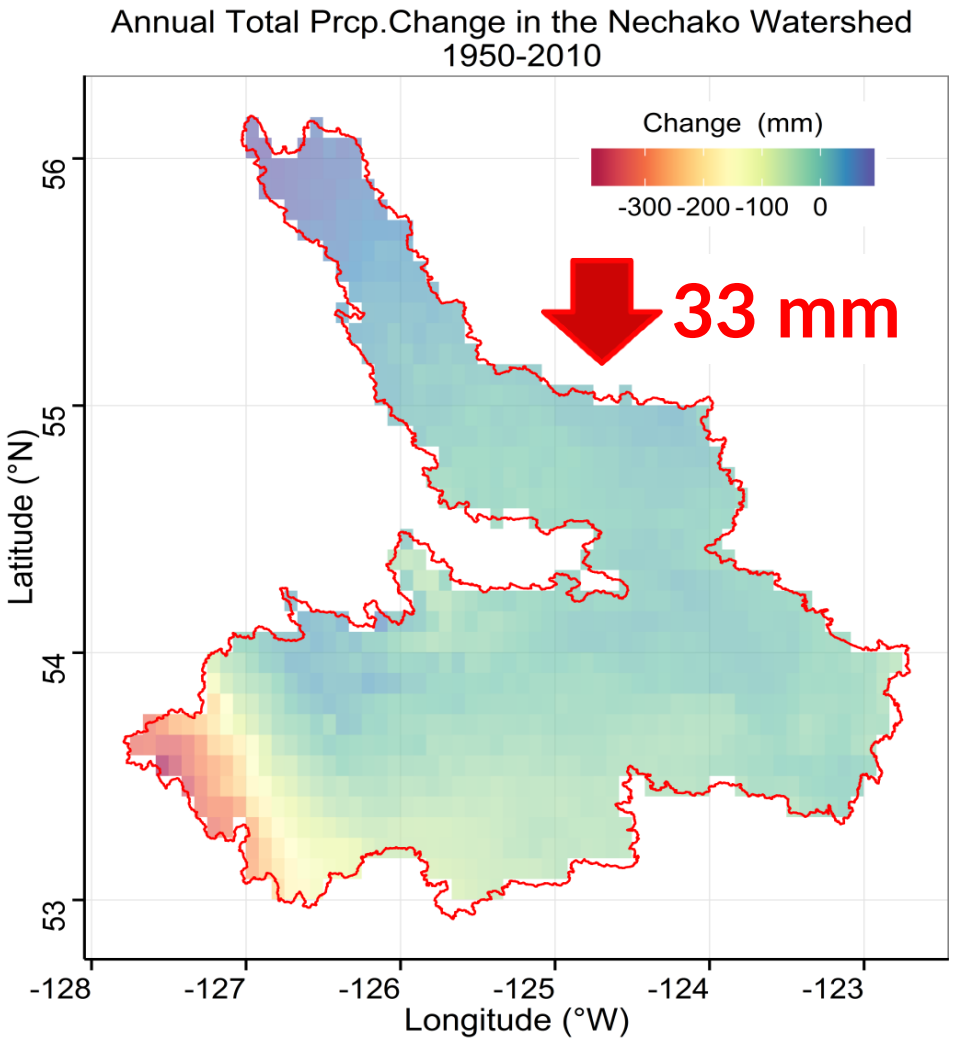
| Period | Mean | Change |
|---|---|---|
| Annual | 1.8°C | 2.3°C ⬆ |
| Winter | -9.2°C | 4.3°C ⬆ |
| Spring | 1.7°C | 2.0°C ⬆ |
| Summer | 12.0°C | 0.0°C ⬍ |
| Fall | 2.4°C | 1.1°C ⬆ |



# Precipitation

## Mean and Change in Annual and Seasonal Precipitation across the Nechako, 1950-2010

| Period | Mean | Change |
|---|---|---|
| Annual | 597 mm | -33 mm (-5%) ⬇ |
| Winter | 167 mm | -55 mm (-33%) ⬇ |
| Spring | 99 mm | 5 mm (5%) ⬆ |
| Summer | 154 mm | 14 mm (9%) ⬆ |
| Fall | 177 mm | 13 mm (7%) ⬆ |



# Vanderhoof Climate

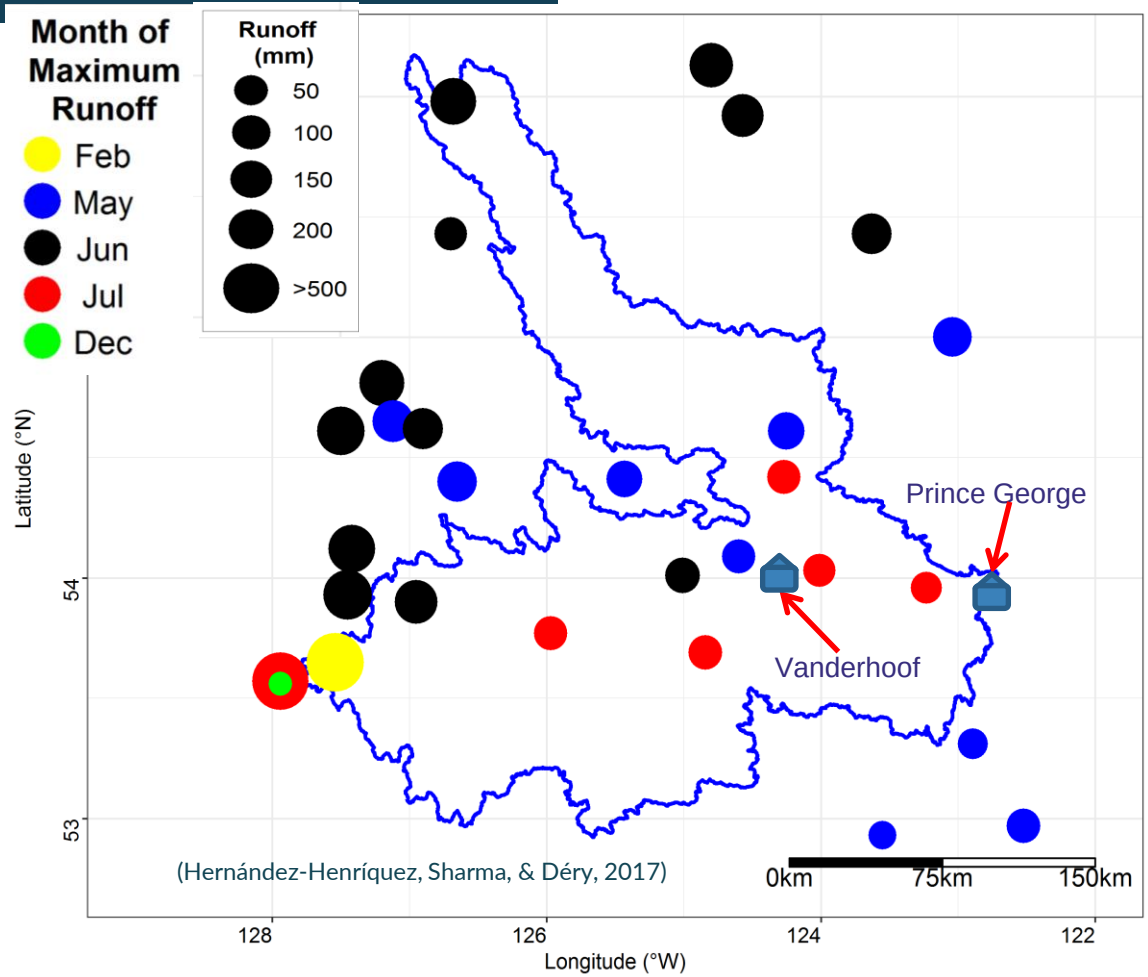
## Mean and Change in Annual and Seasonal Temperature (Temp.) and Precipitation (Prcp.) at the Vanderhoof climate station, 1980-2015

| Period | Mean Temp. | Temp. Change | Mean Prcp. | Prcp. Change |
|---|---|---|---|---|
| **Annual** | **4.4 °C** | **1.4 °C ⬆** | **470 mm** | **-10 mm (-2%) ⬇** |
| Winter | **-7.5 °C** | **1.7 °C ⬆** | 110 mm | -13 mm (-11%) ⬇ |
| Spring | **5.3 °C** | **-0.2 °C ⬇** | 87 mm | 14 mm (16%) ⬆ |
| Summer | **15.6 °C** | **1.5 °C ⬆** | 143 mm | -19 mm (-13%) ⬇ |
| Fall | **4.5°C** | **0.3 °C ⬆** | 135 mm | 14 mm (10%) ⬆ |

# Month of Maximum Runoff

**Months with no maximum runoff in the region:**

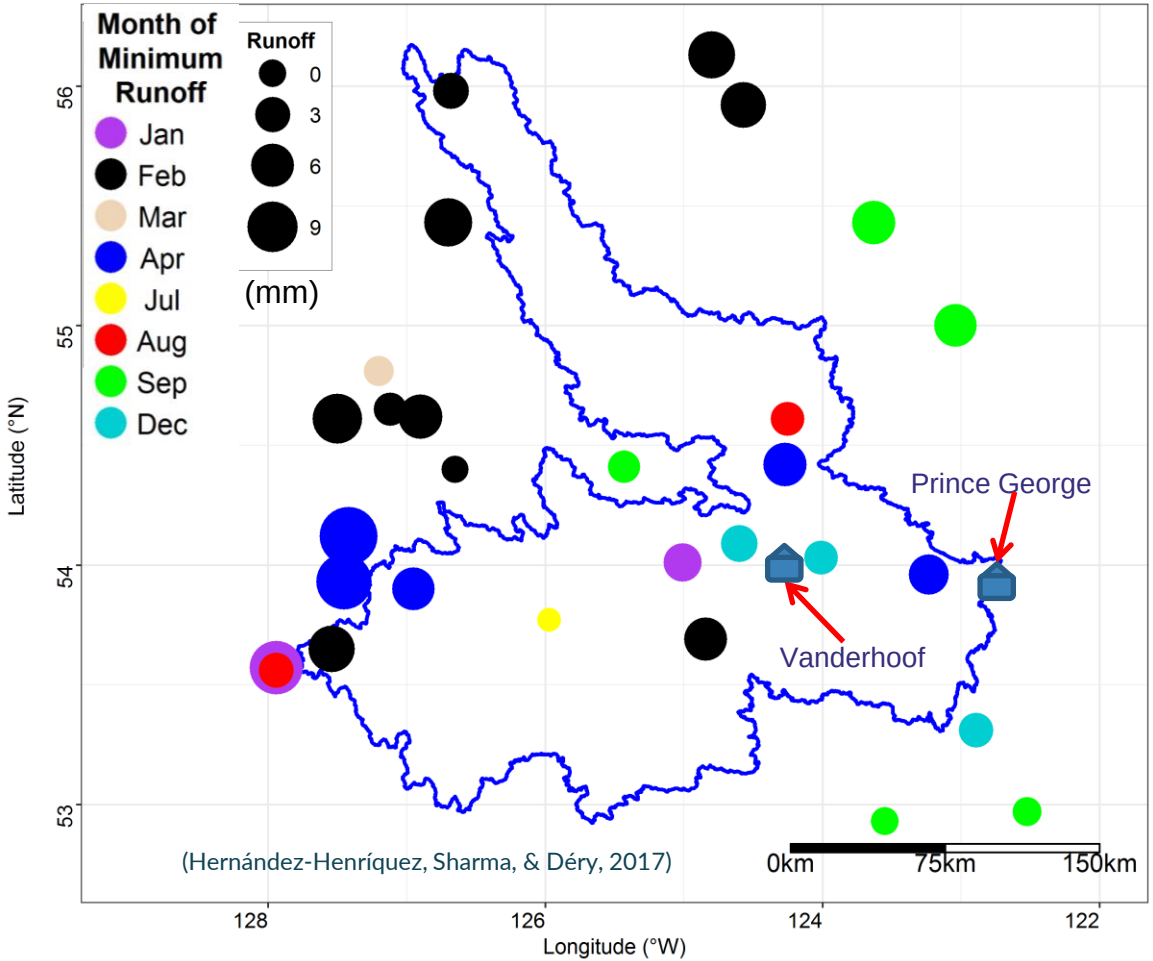
**Jan., Mar., Apr., Aug., Sep., Oct., and Nov.**



# Month of Minimum Runoff

**Months with no minimum runoff in the region**

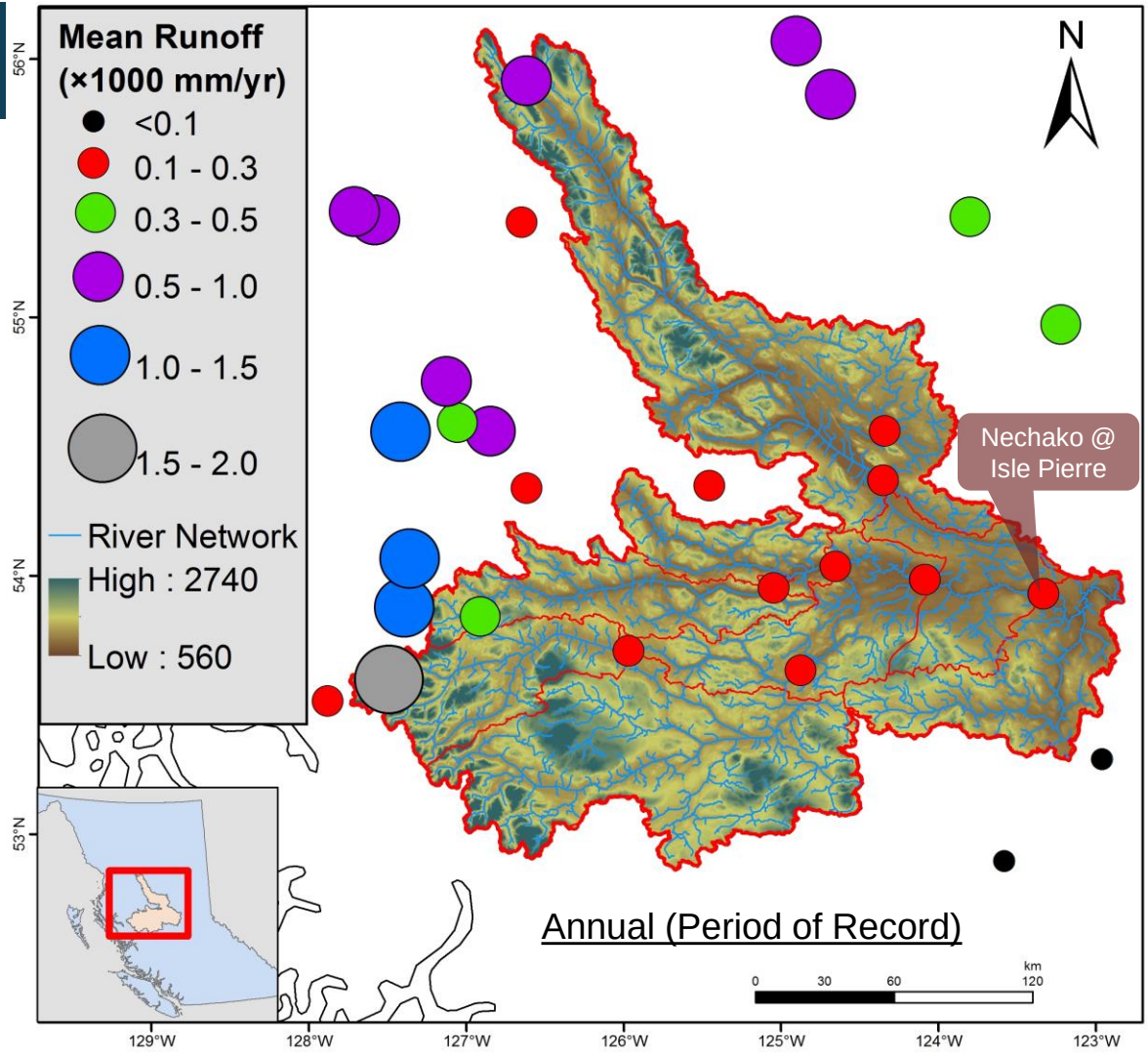
May, Jun., Oct., and Nov.



# River Runoff

## Mean and Change in Annual and Seasonal Runoff for the Nechako River (at Isle Pierre), 1950-2010

| Period | Mean | Change |
|---|---|---|
| Annual | 205 mm | -82 mm (-40%) ⬇ |
| Winter | 25 mm | -7 mm (-28%) ⬇ |
| Spring | 44 mm | -8 mm (-18%) ⬇ |
| Summer | 93 mm | -24 mm (-25%) ⬇ |
| Fall | 41 mm | -27 mm (-65%) ⬇ |

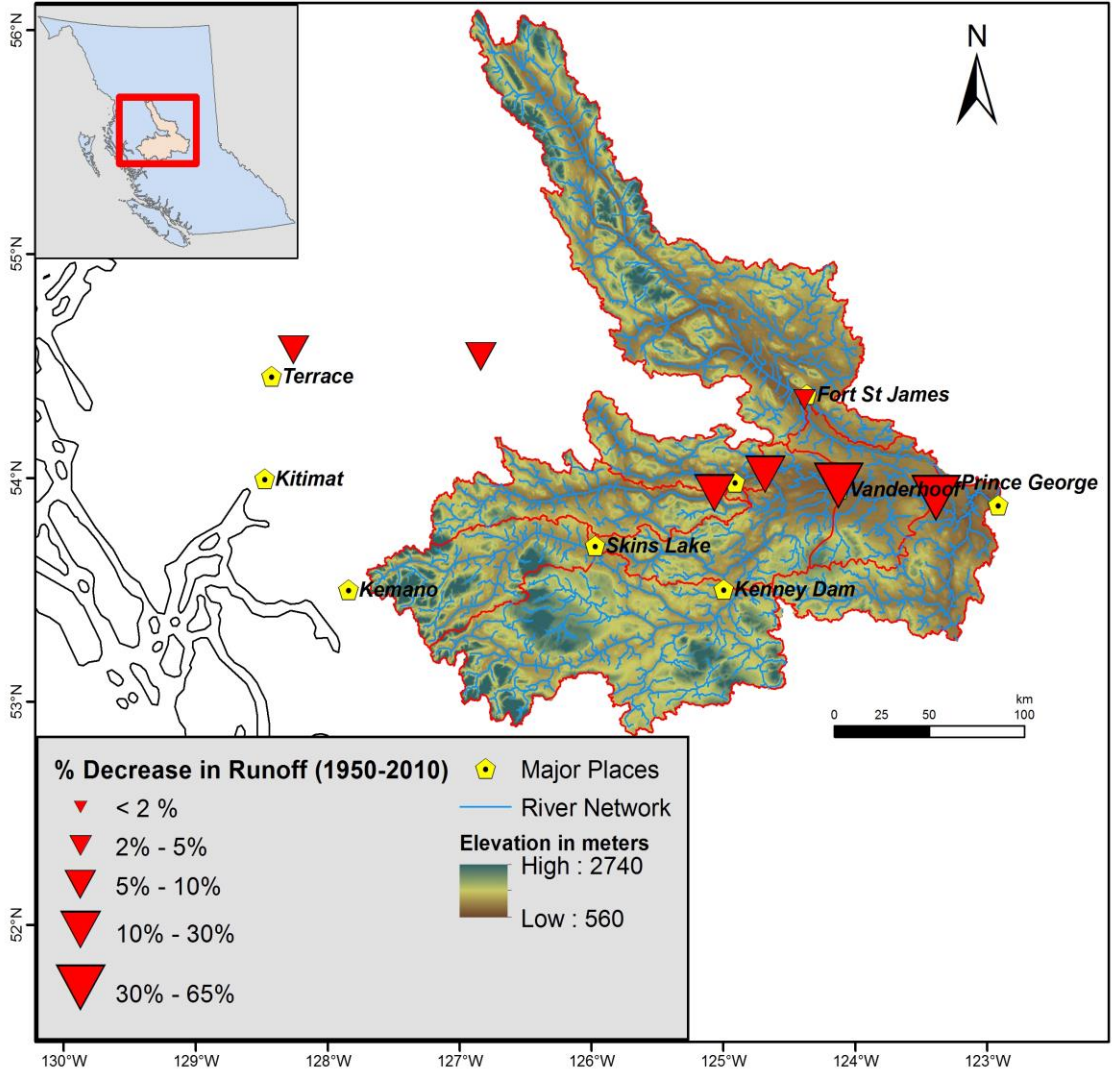


# Runoff Change

## Percentage change in mean annual runoff in the Nechako, 1950-2010

| | |
|---|---|
| Nechako (Isle Pierre) | -40% ⬇ |
| Nechako (Vanderhoof) | -61% ⬇ |
| Stuart | -2% ⬇ |
| Nautley | -27% ⬇ |
| Stellako | -29% ⬇ |

Blue: Regulated
Black: Unregulated



# Summary

- The Nechako River Basin has warmed by over **2°C** since 1950.
- Precipitation has decreased by about **5%** over the same period across the watershed.
- In response to these trends in air temperature and precipitation in addition to flow regulation, runoff for the Nechako River declined by **40%** since 1950.

# Ongoing research

- Hydrological modeling of past and potential future snow hydrology of the Nechako River Basin including its primary tributaries (Siraj ul Islam).
- Investigation of changes in extreme hydrological events such as heavy snowfall and rainfall that induce floods associated with **atmospheric rivers** (Aseem Sharma).
- Continued monitoring of weather conditions at Tatuk Lake.

# Acknowledgements

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