



RioTinto

Nechako Reservoir

Reservoir Management Workshop

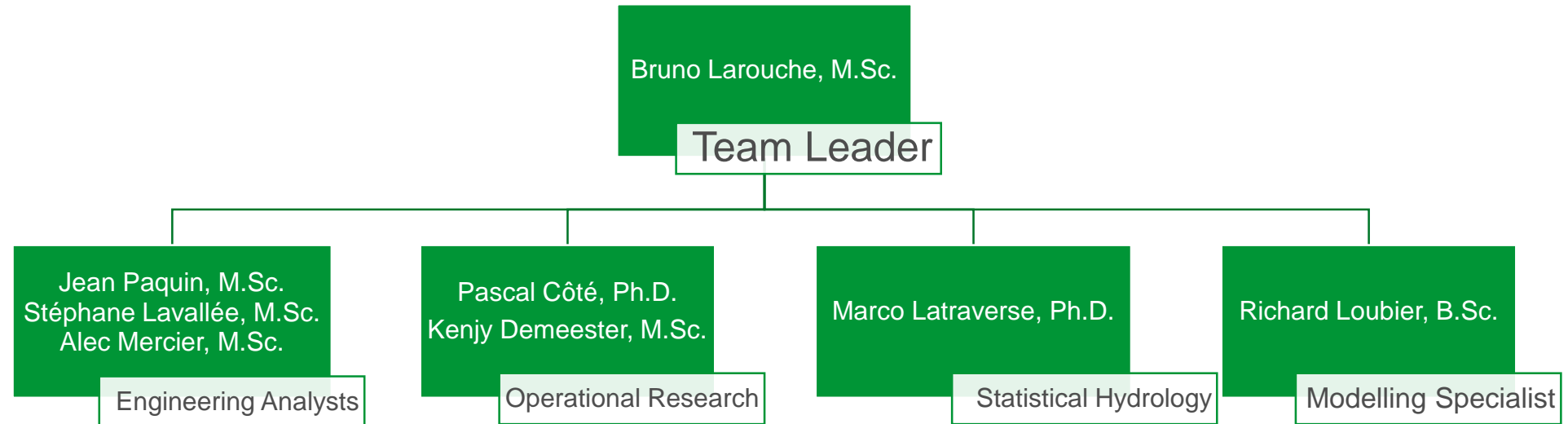
Alec Mercier and Andrew Czornohalan

25 September 2020

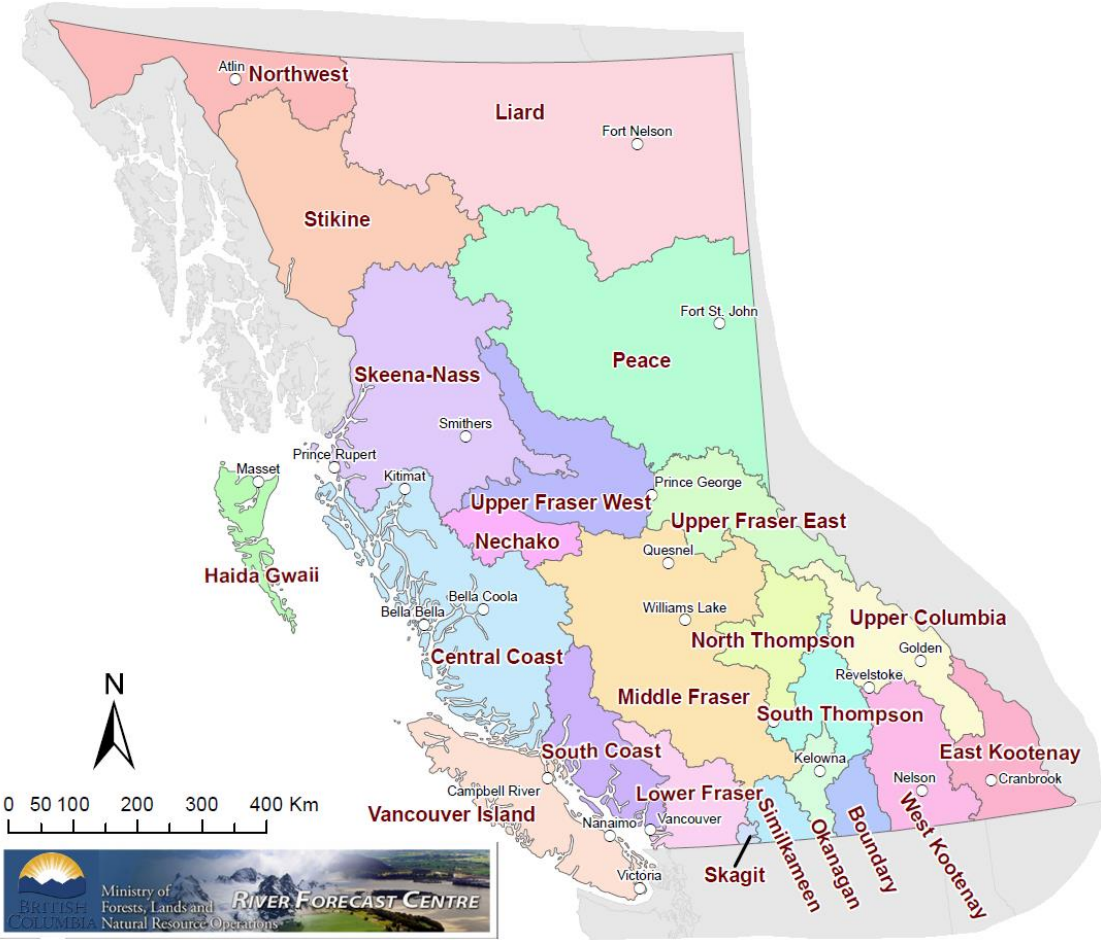
Reservoir management workshop

- Hydrological forecasting and management
 - Review Rio Tinto reservoir management tools and approach

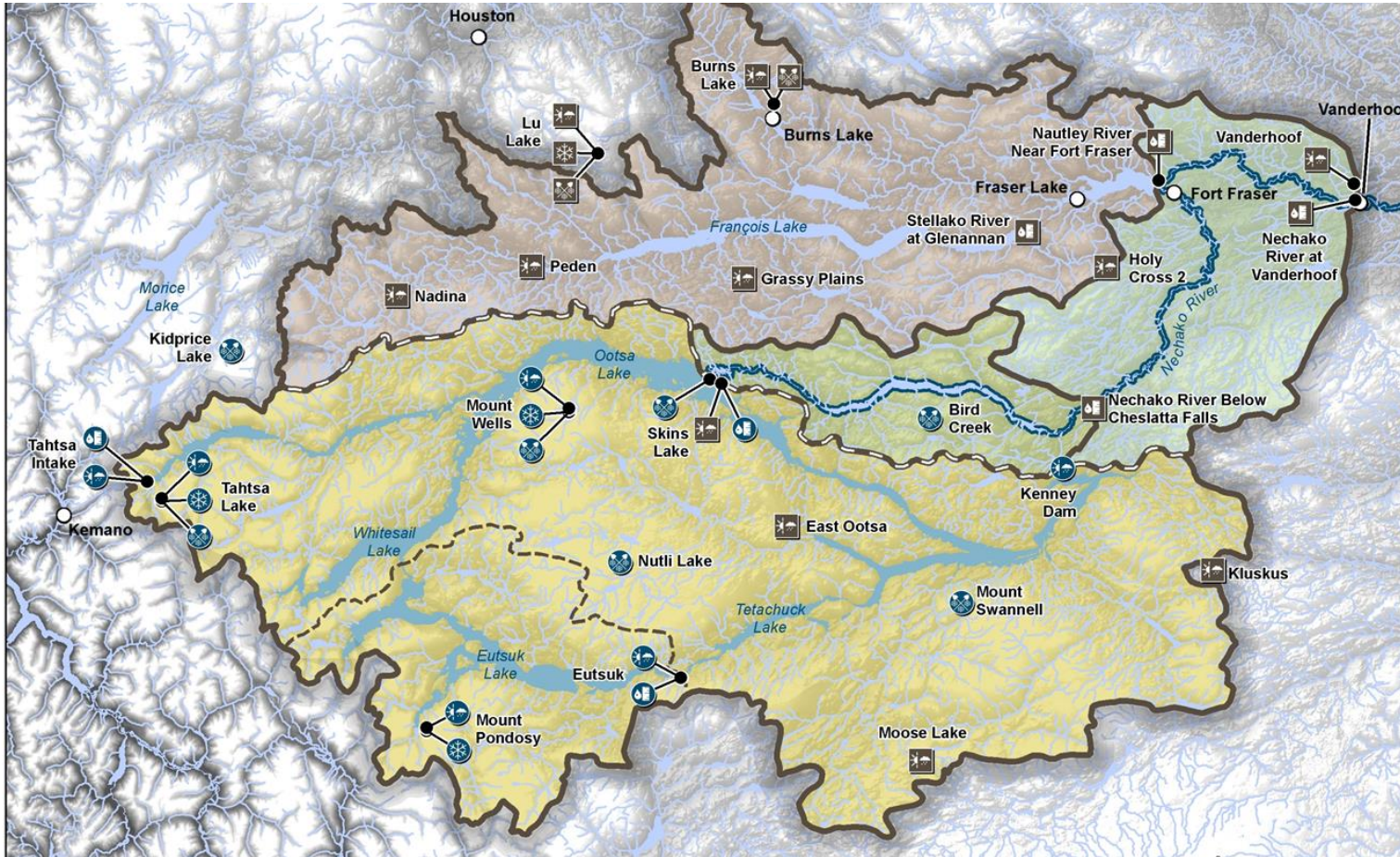
Rio Tinto Water Resources Team



Nechako Watershed



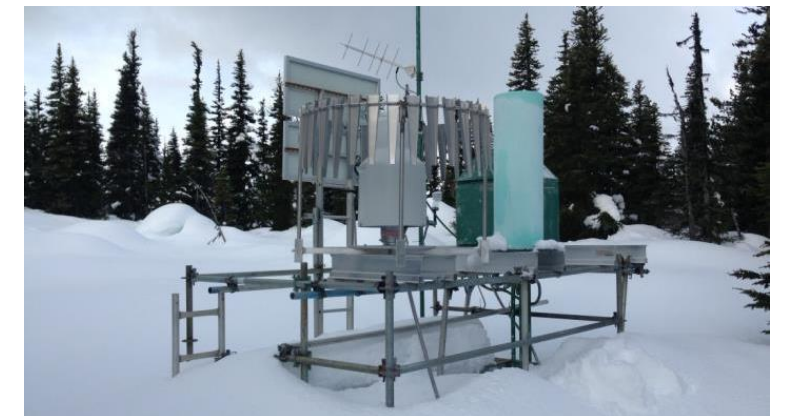
Hydrometeorological Network



Hydro-meteorological network

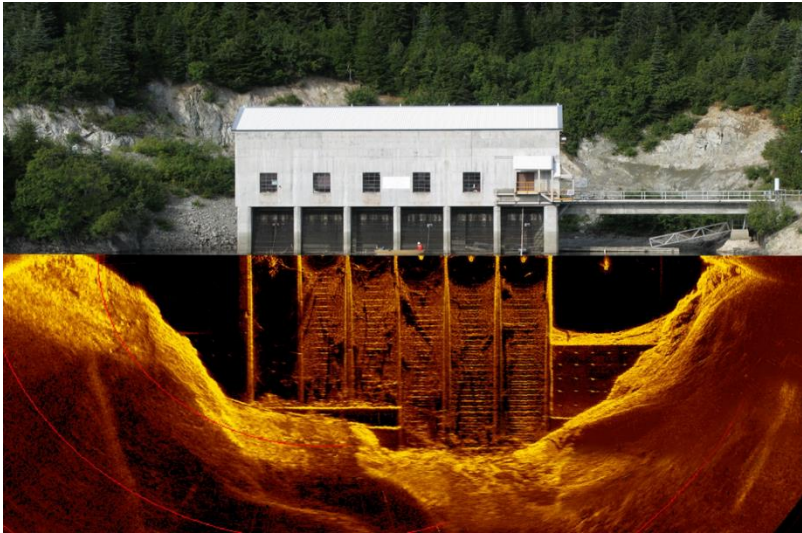


Snow pillow and meteorological station in October



Meteorological station in April

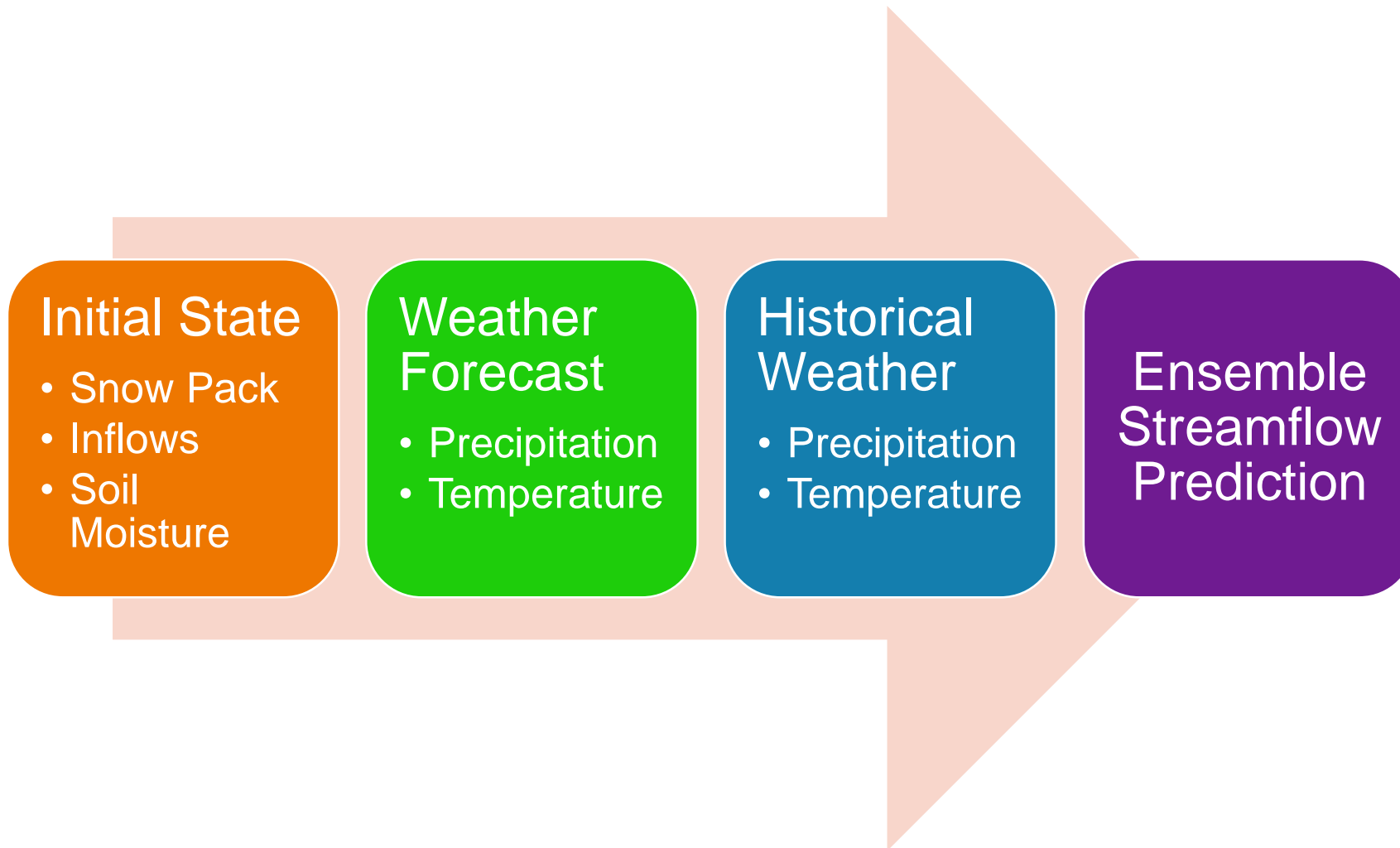
Operations Overview



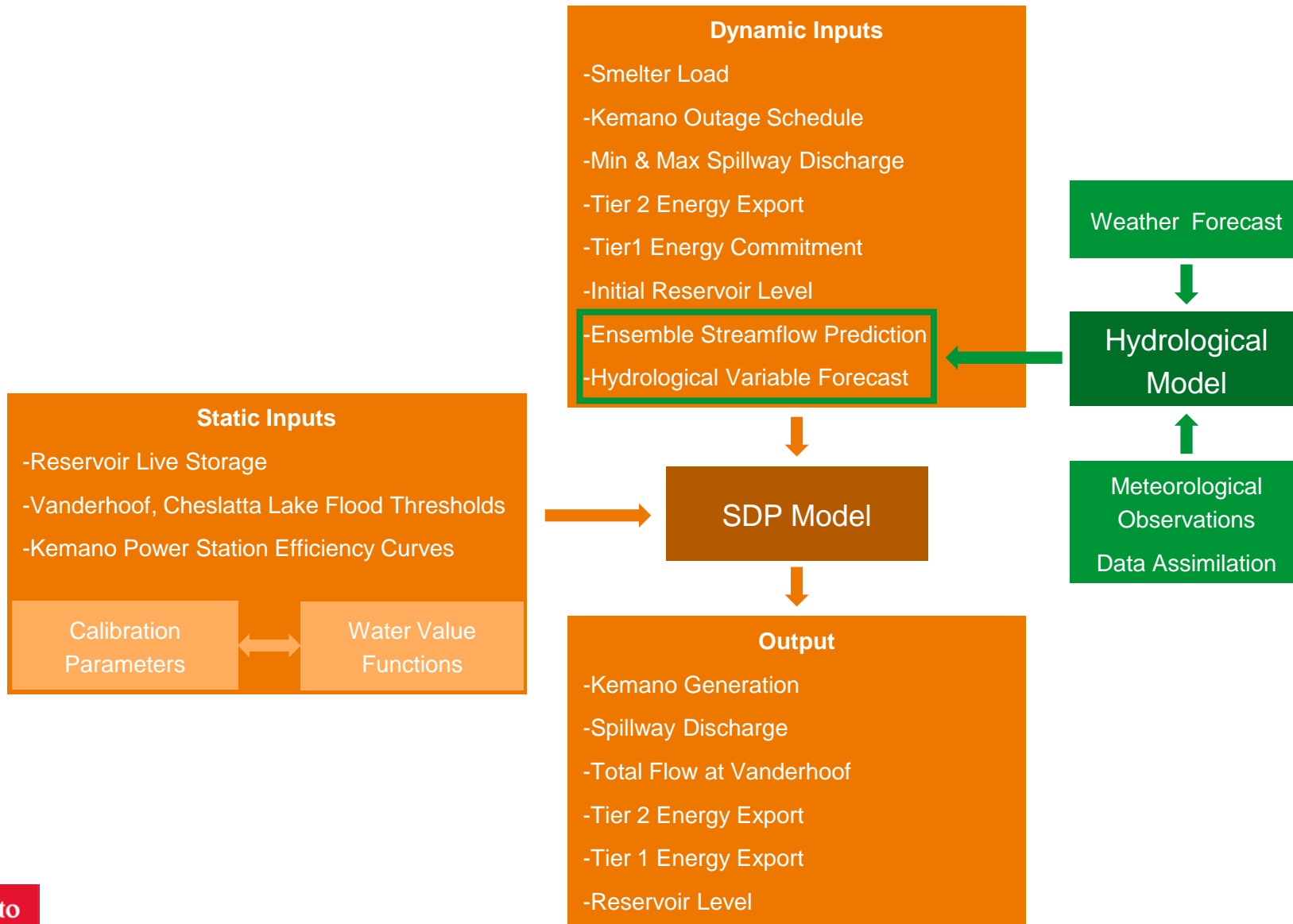
Tahtsa Intake

Feet	Reservoir elevation points of interest
2822	
2821	
2820	Top of Dams
2819	
2818	
2817	
2816	
2815	
2814	
2813	
2812	
2811	
2810	
2809	
2808	
2807	
2806	
2805	
2804	
2803	
2802	
2801	
2800	Maximum normal reservoir elevation
2799	
2798	
2797	
2796	
2795	
2794	
2793	
2792	
2791	
2790	
2789	
2788	
2787	
2786	Current minimum normal reservoir level
2785	
2784	
2783	
2782	Tahtsa narrows physical bottom
2781	
2780	
2779	Minimum reservoir elevation to achieve max STMP flows at SLS (453 m ³ /s)
2778	
2777	
2776	
2775	
2774	
2773	
2772	
2771	
2770	Minimum Licenced Reservoir elevation
2769	
2768	
2767	
2766	
2765	Skins Lake Spillway invert
2764	

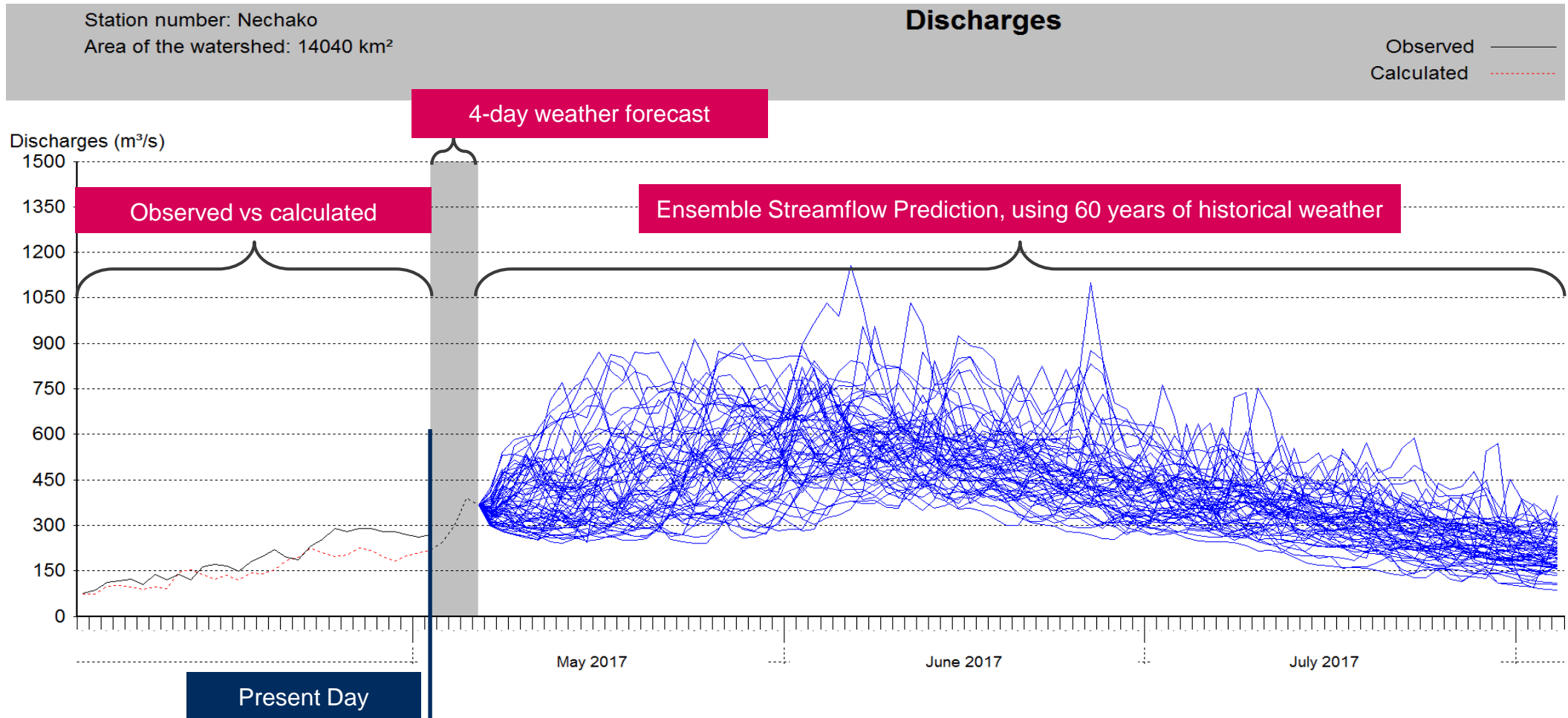
Hydrological Forecast System



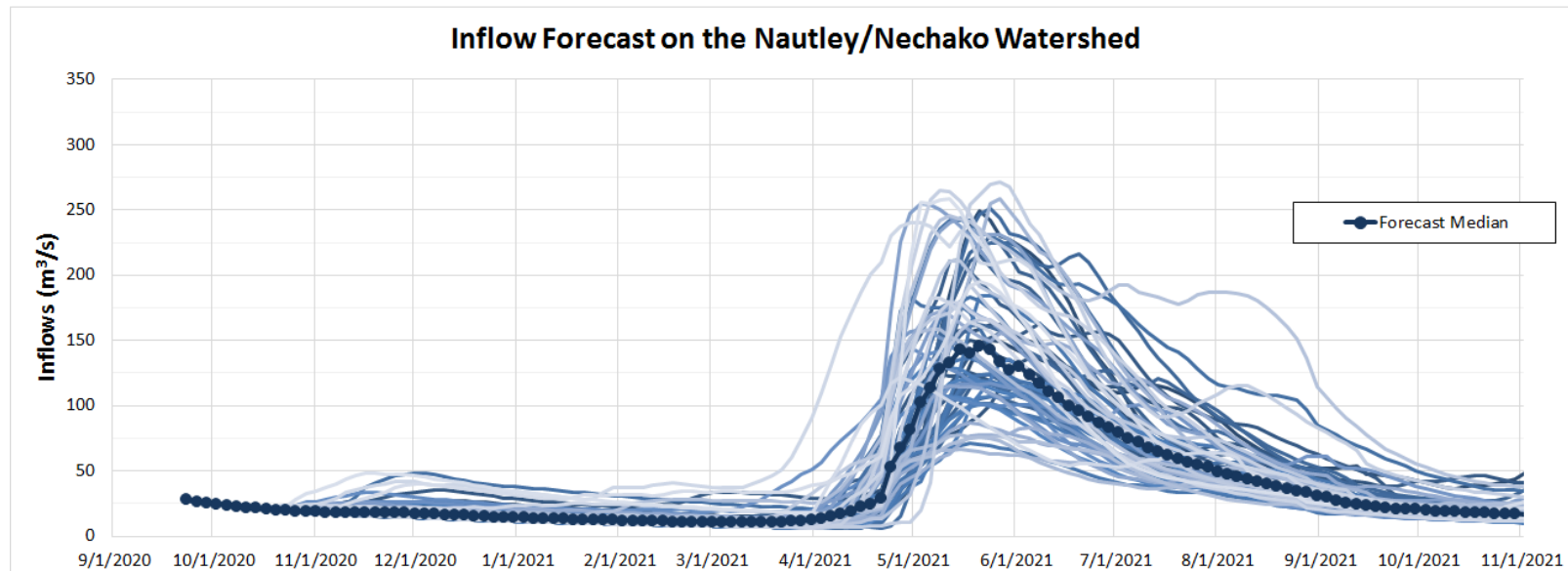
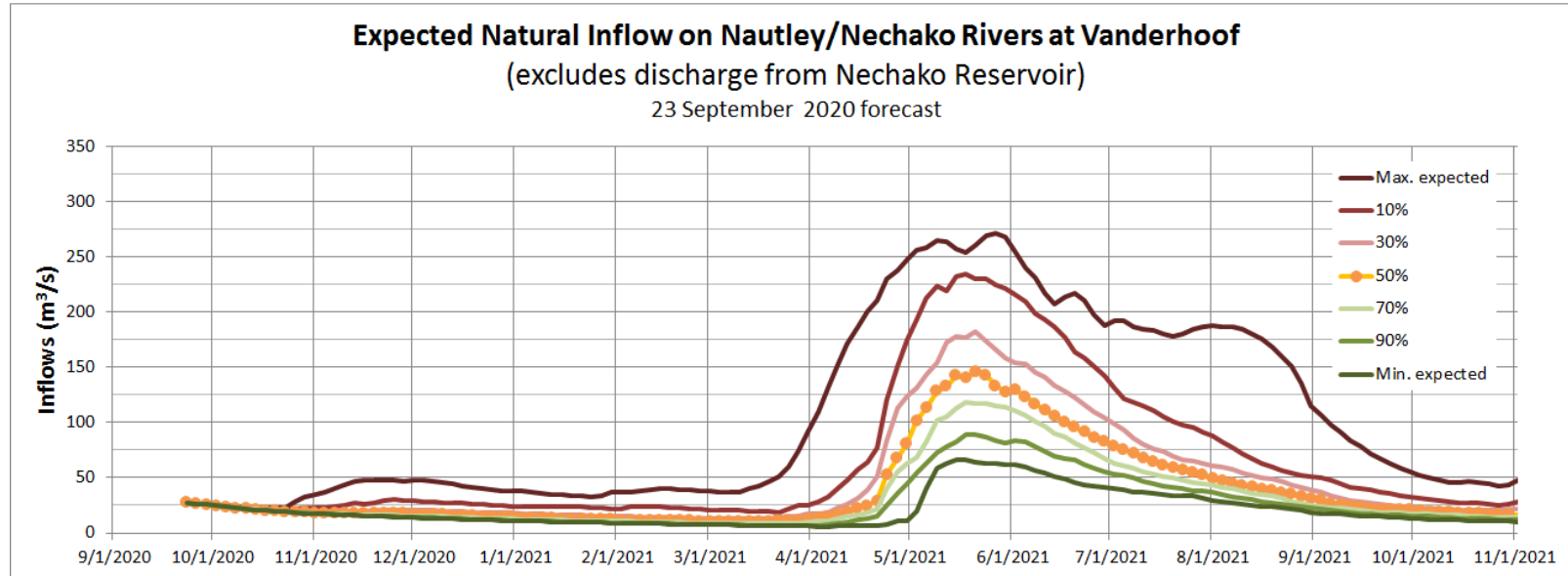
Reservoir Management



Hydrological Forecast System



Forecast with CEQUEAU Model - Nautley



Hydrological Forecast System

- Water management challenge: what is the best flow release/Kemano draft decision considering the uncertainties?
- Nature of uncertainties:
 - Snow Pack
 - Precipitation (spatial distribution, quantity between weather stations)
 - Inflows
 - Weather Forecasts

Competing Objectives

Four priorities for reservoir management

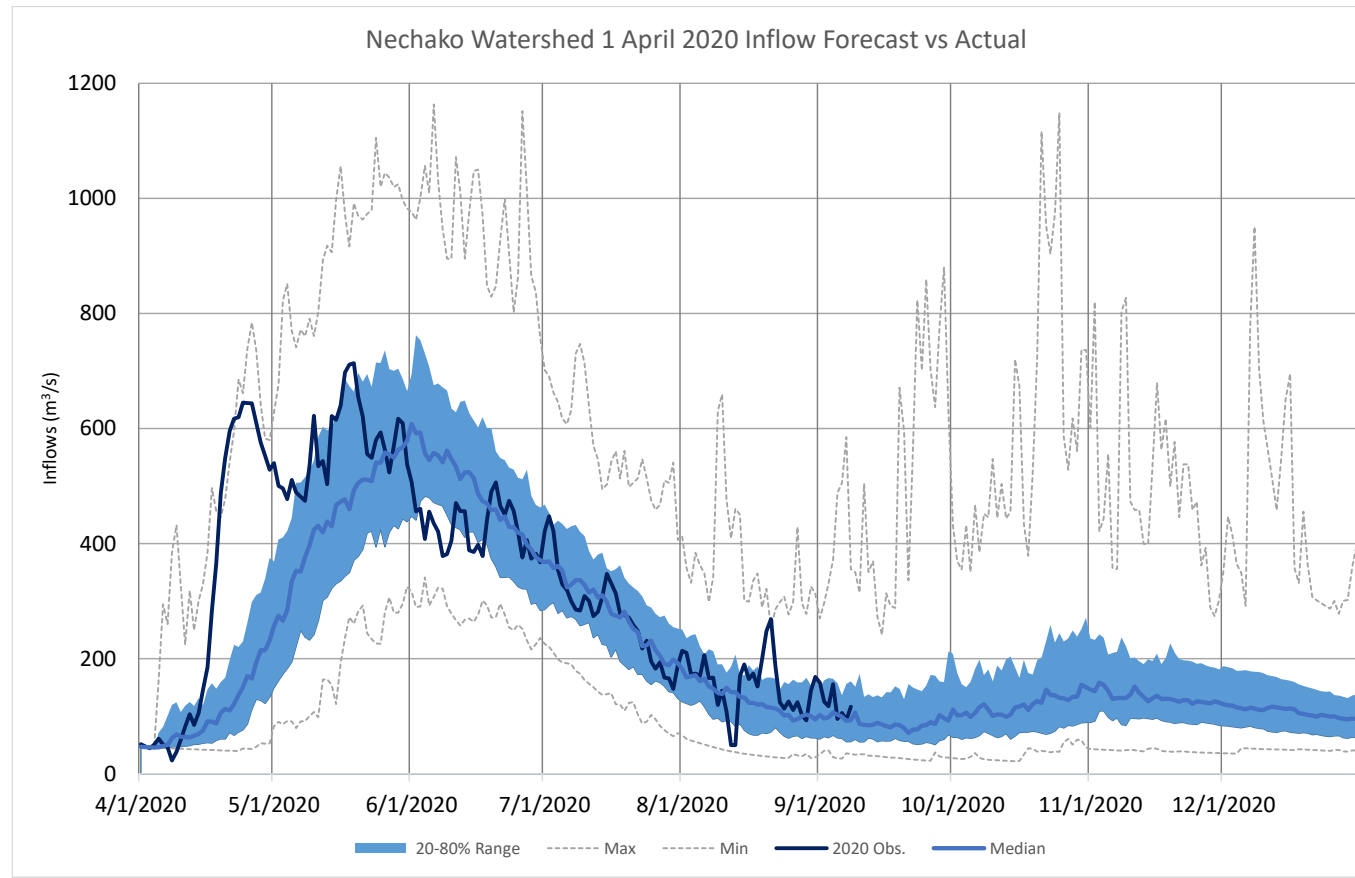
- Dam integrity and public safety
- Fisheries conservation (Nechako & Kemano)
- Flood control
- Kemano generation



Spring 2020 Inflow Forecast

How much snow-water equivalent was under-represented in the model forecast?

- Even after accounting for difference between manual and automated measurements, there was still a shortage of about 25% of snow-water equivalent.
- Note that the underestimate of snow-water equivalent may be due to a number of factors and not necessarily that there was more snow than measured (ie higher yield)



Spring 2020 Inflow Forecast

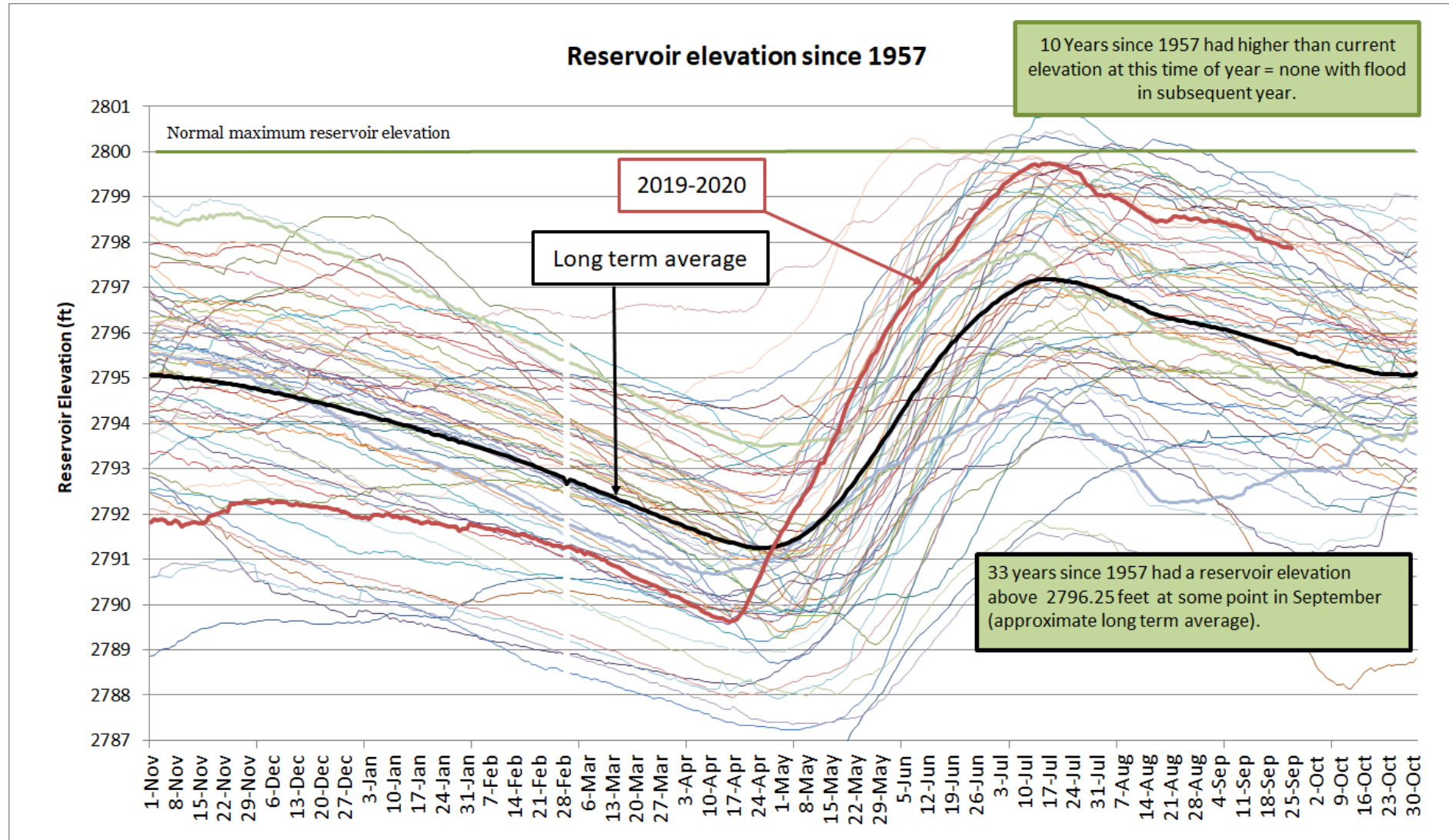
Potential causes of underestimation of inflows spring 2020:

- Potential underestimation of snowpack between stations
- Higher runoff coefficient due to areas affected by wildfire.
- Application of conservative snow data (automated vs manual measurements)
- Exceptionally early spring freshet, unusual temperature and snowmelt pattern.

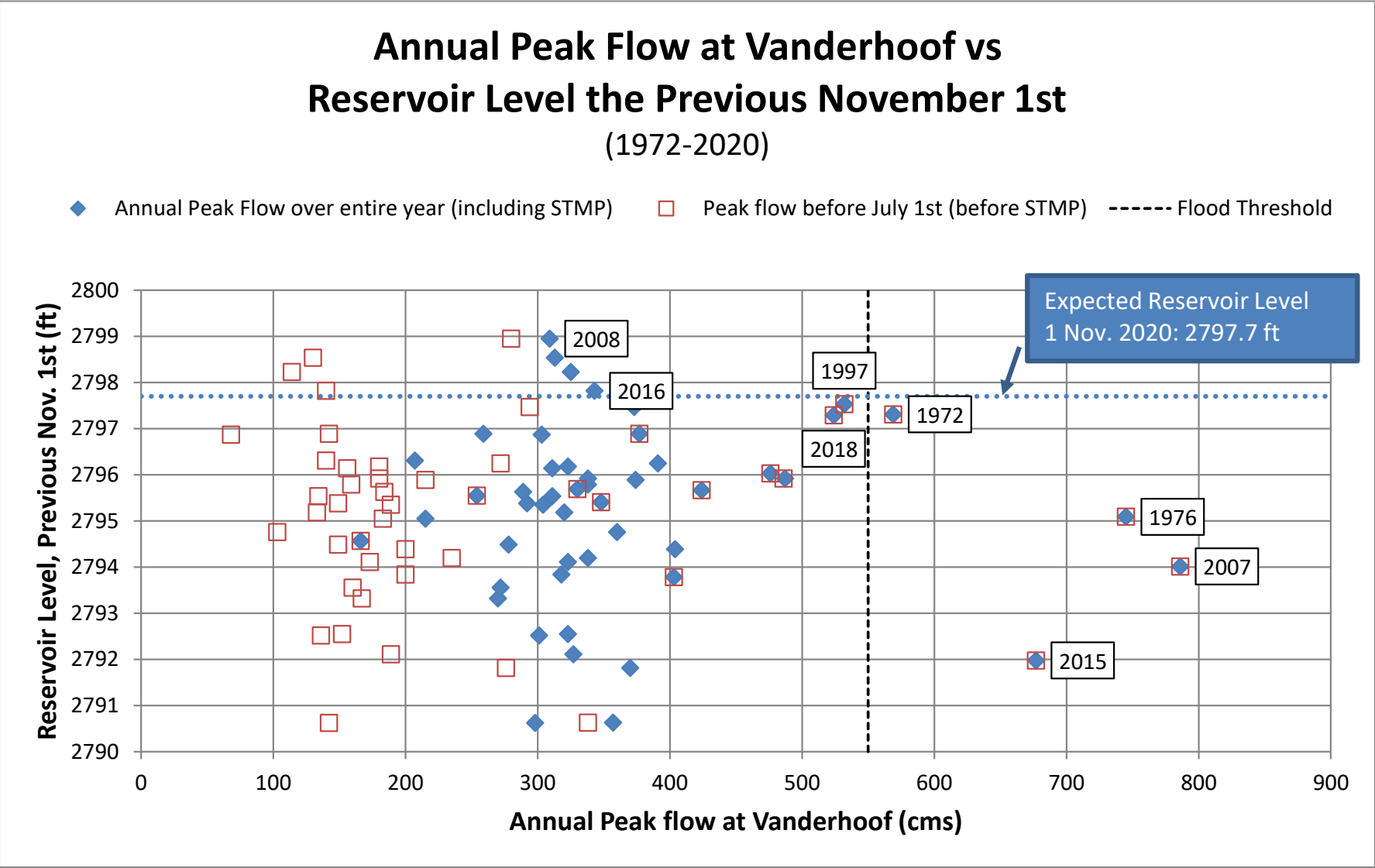
Ongoing investigations:

- Recalibrating the hydrological model
- Monitoring new snowpack monitoring techniques developed by others, including remote sensing between established monitoring stations
- Sensitivity analysis for range of snow data / adding variability to the initial state of snowpack in the model
- Adding monitoring stations
 - Added a hydrometric station at Kenney Dam (summer 2020)
 - Adding weather and hydrometric data collection at the Eutsuk station (Fall 2020)
 - Adding a hydrometric station at Chelaslie River (planned 2021)
 - Adding a permanent weather station and a snow pillow at Mt Sweeney (Temporary installation by UNBC Summer 2020)

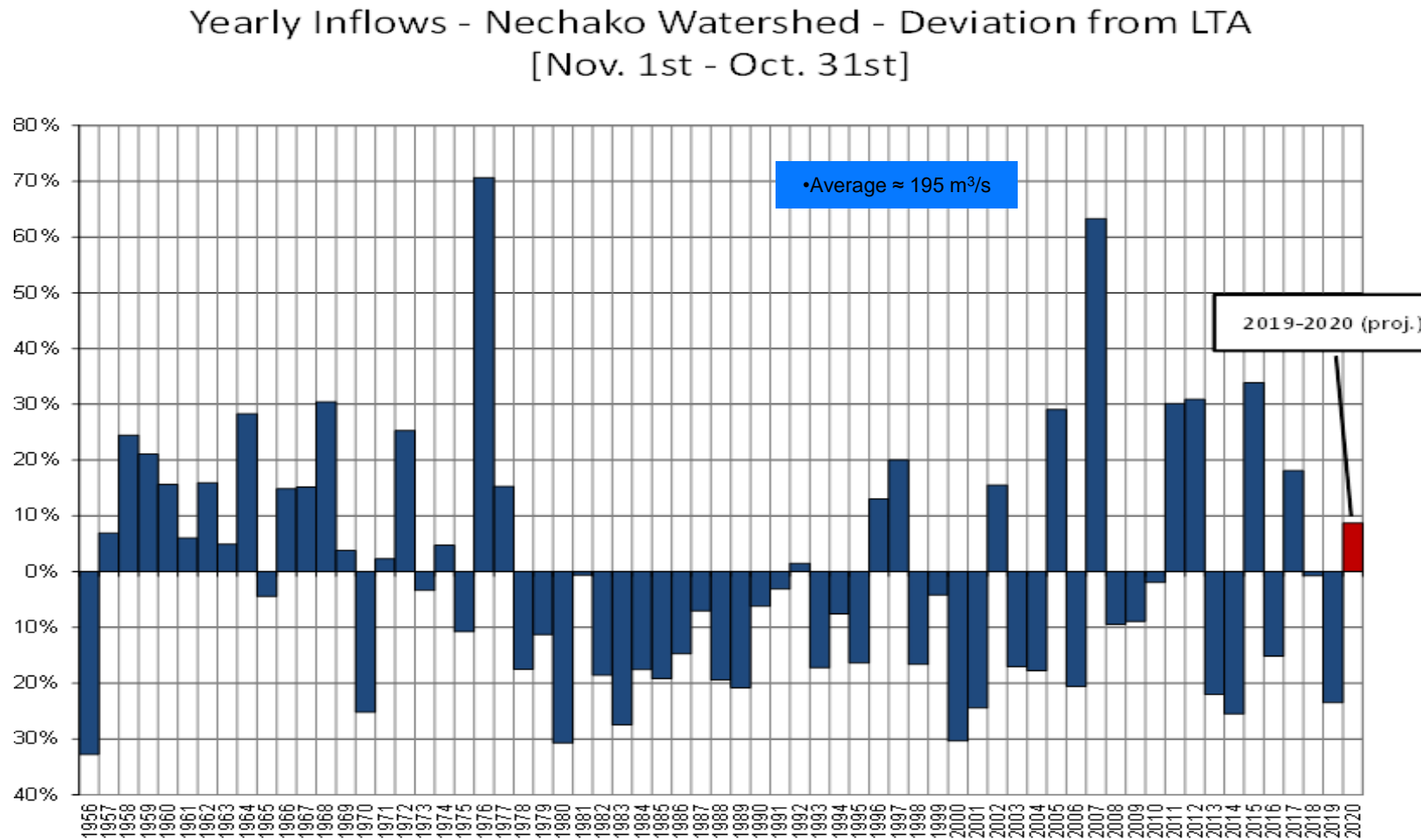
Historical reservoir level



Correlation between reservoir level and peak flow at Vanderhoof

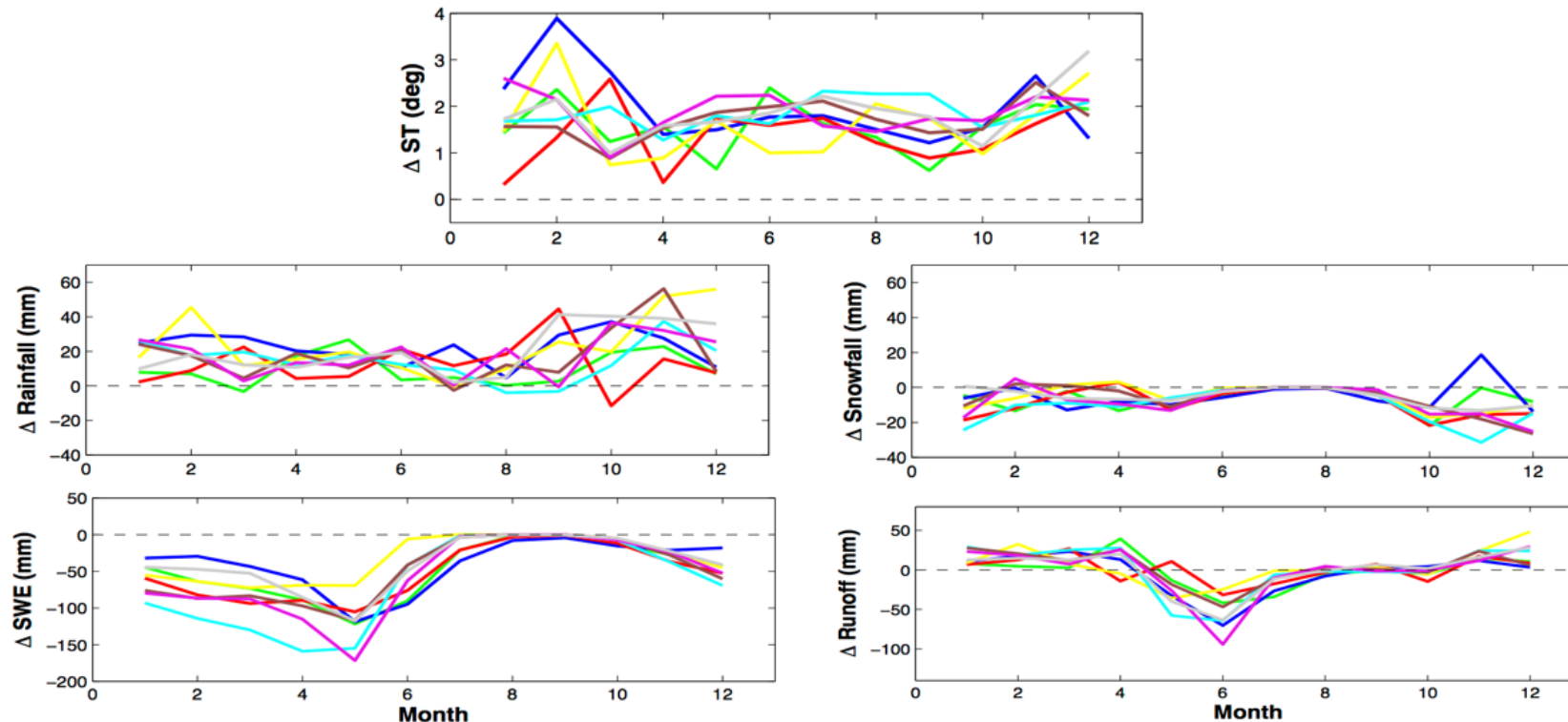


Nechako Hydrology – Deviation from Normal

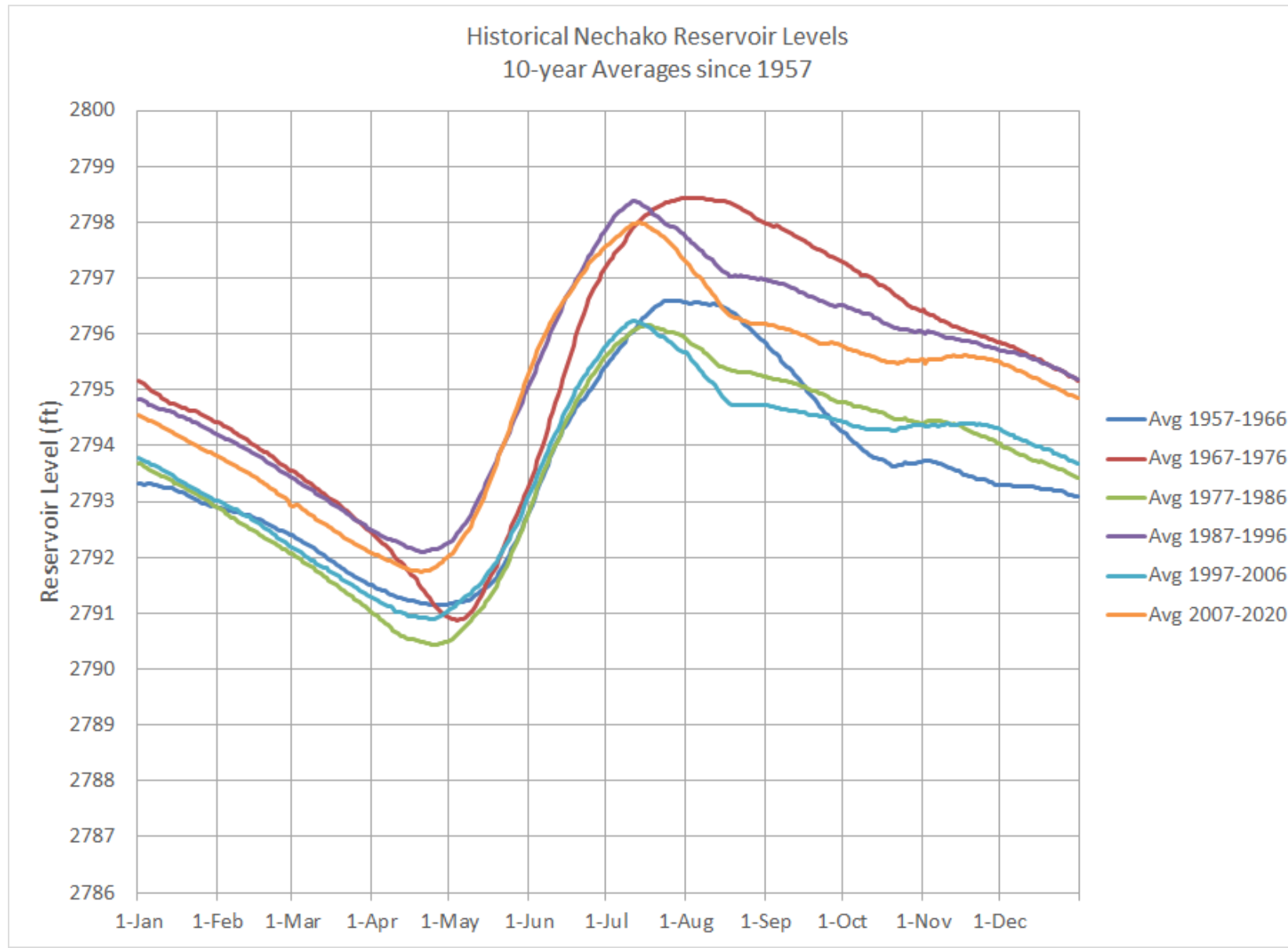


Climate Change

- What are the potential impacts of climate change?
- High uncertainty in long term climate change projections
 - Potential increase in temperature in all seasons, and change in precipitation patterns
 - By 2050: +100 mm/year rainfall, -40 mm/year snowfall, -16 mm/year runoff (-3.5%)



Historical Nechako Reservoir Levels



Constraints on Winter Spills

Ice jam formation is unpredictable

Ice jams can occur during freeze up in Fall or break-up in spring.

Ice jams can be caused by large changes in flow during winter.

Impact of ice jams worsens with increasing flow.



Ice jam Nechako River (Avison, 2018)



Ice Jam Prince George (McElhanney 2007)

An aerial photograph of a river meandering through a lush, green landscape. The river flows from the upper left towards the center, then curves to the right. A small, light-colored sandbar is visible in the middle of the river. The surrounding area is a mix of dense evergreen forests and open meadows with yellow-green vegetation. The sky is blue with scattered white clouds. In the bottom right corner, there is a small, faint number '21'.

RioTinto

Questions &
Comments?