

Review of Lake Diefenbaker Operations, 2010-2011

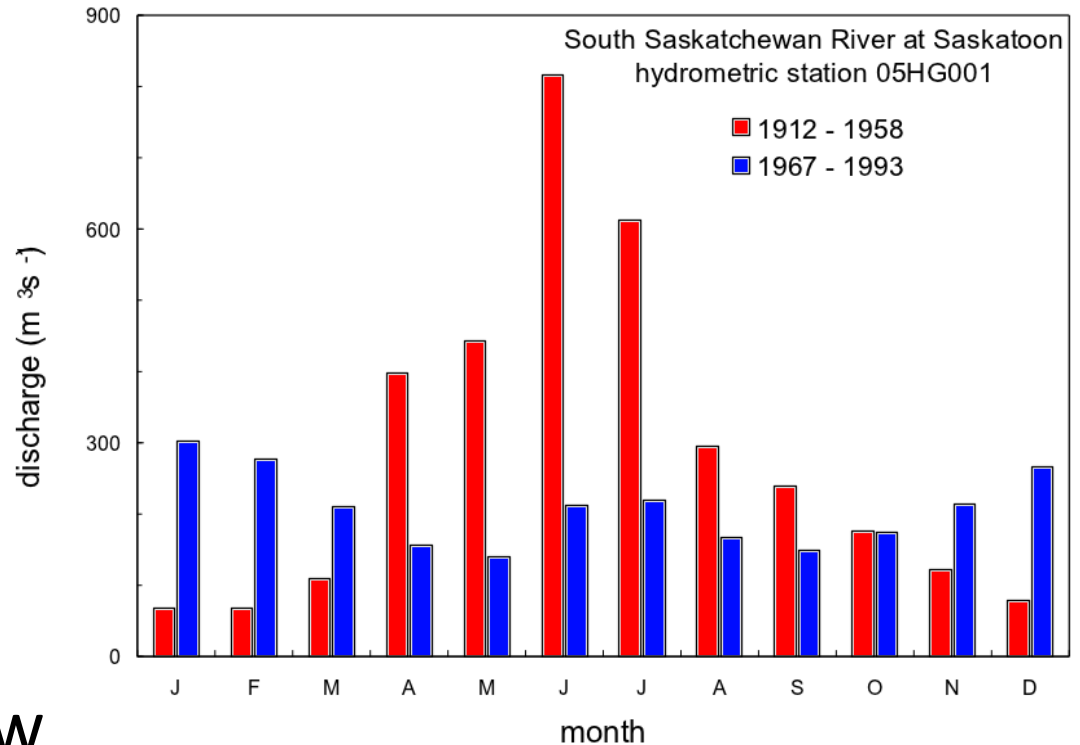
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Purpose

- Post-event evaluation of operation of Lake Diefenbaker 2010-2011
 - Evaluate decisions made in light of multi-use objectives
 - Assess policy needs or gaps

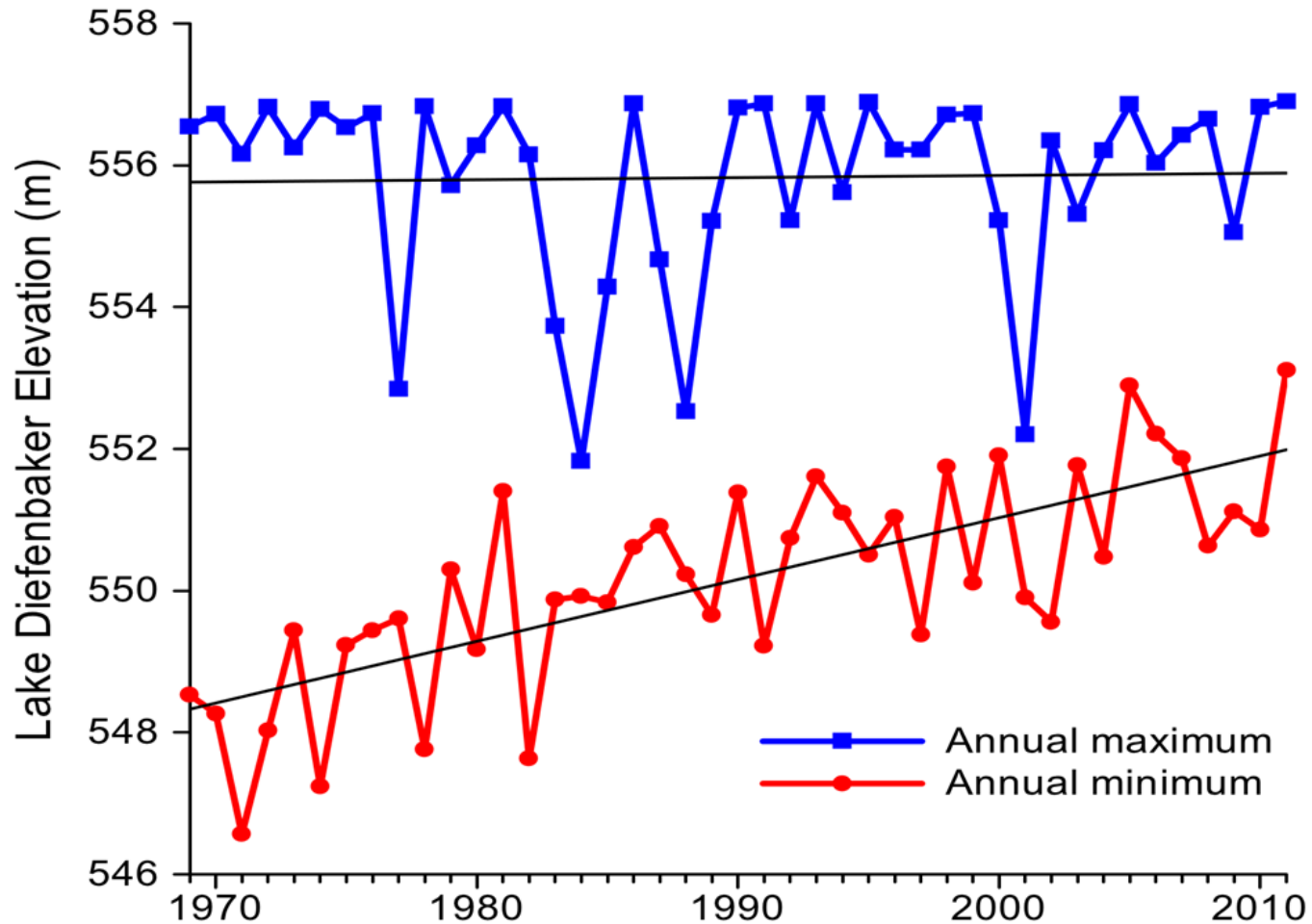
Gardiner Dam

- Operated for:
 - **Water supply**
 - **Hydroelectricity**
 - Flood protection
 - Shoreline habitat
 - Recreation
- Summer inflow peaks translated into winter outflow peaks



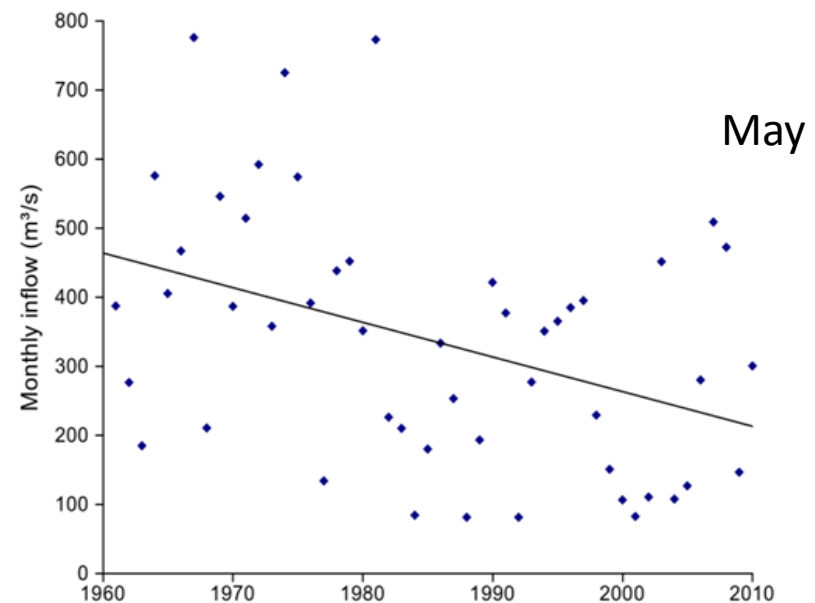
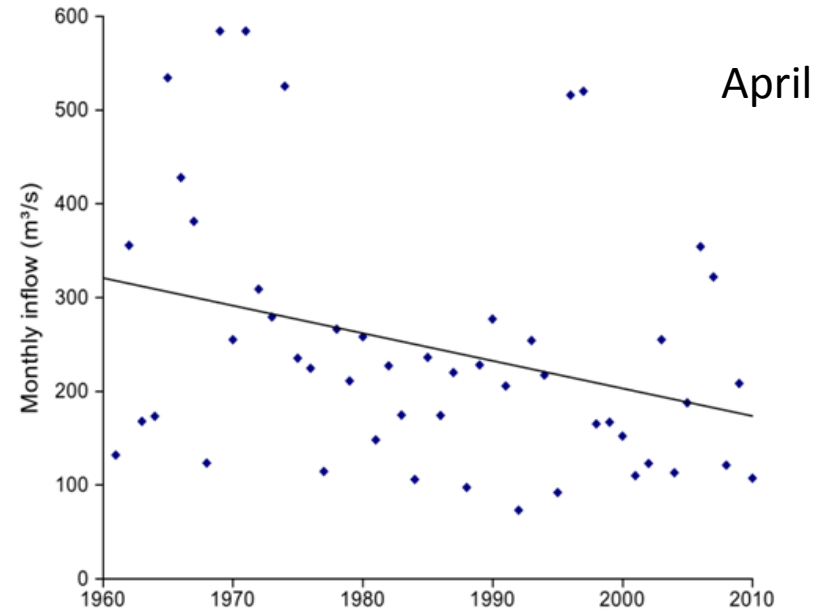
Operational Objectives and Trends in Elevations

- 3 m increase in minimum lake level from 1969
- Peak elevations show no trend
- No official change in objectives



Why the Trend in Minimum Elevations?

- Increased confidence in high flow predictions
- Dropping spring inflows (40%-50%)
 - Oldman Dam
 - Consumption
 - Climate change

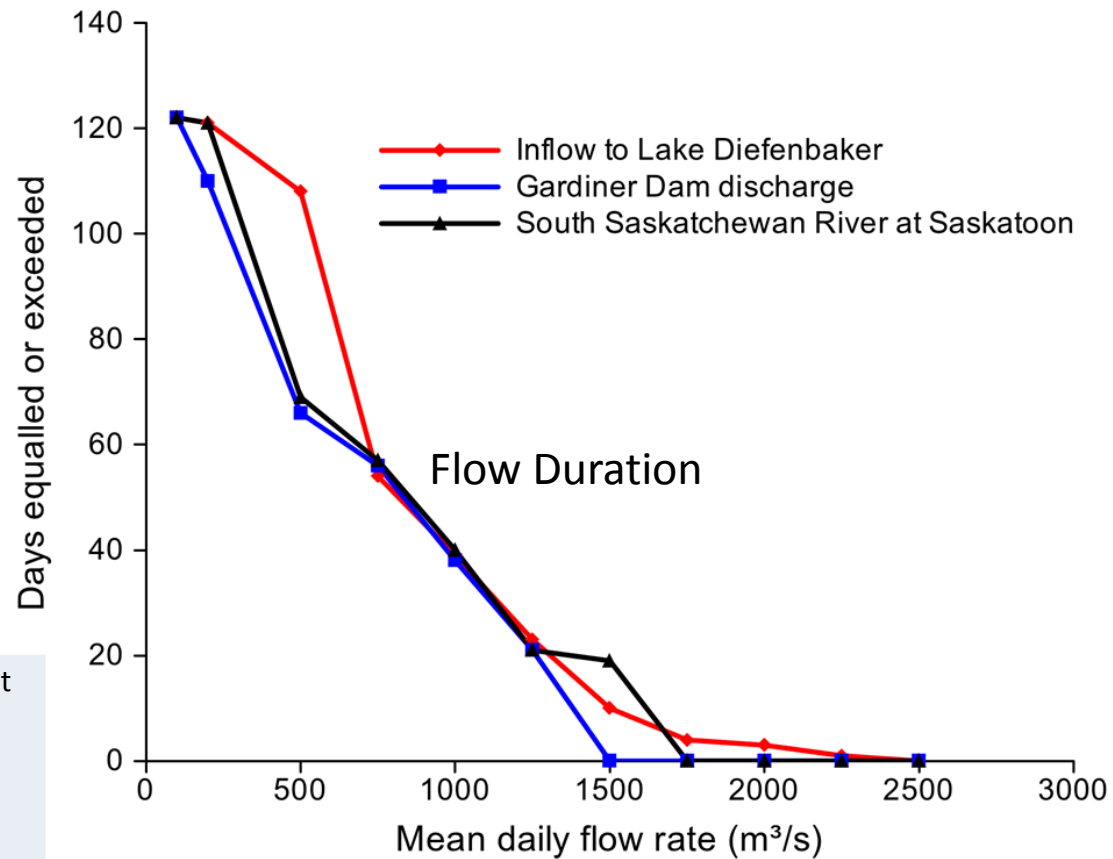


Downstream Effects – 2011 Streamflows

SSR streamflows over 1750 m³/s entirely prevented

SSR streamflow duration near 1500 m³/s were increased by operations

Sask River June peak flow not reduced, possibly increased by operations

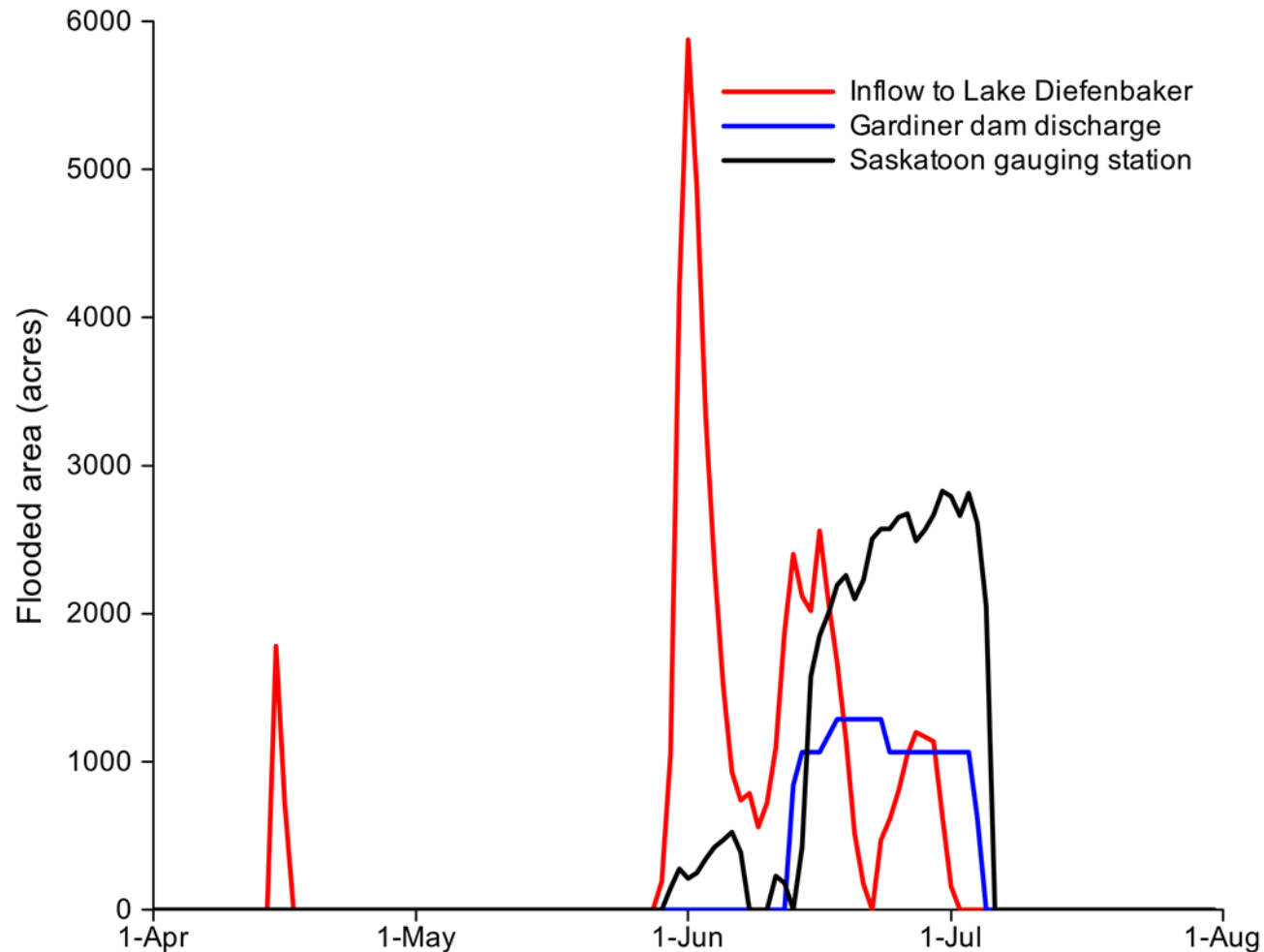


Understood discharge ≤ gauged streamflow

Date	Inflow to Lake Diefenbaker (m ³ /s)	Same day discharge (m ³ /s)	Next day SSR at Saskatoon (m ³ /s)
15 April	1471	160	211
2 May	869	337	402
1 June	2391/2594	1060	1118
14 June	1606	1310	1425

Downstream Flooding (Moon Lake – Saskatoon)

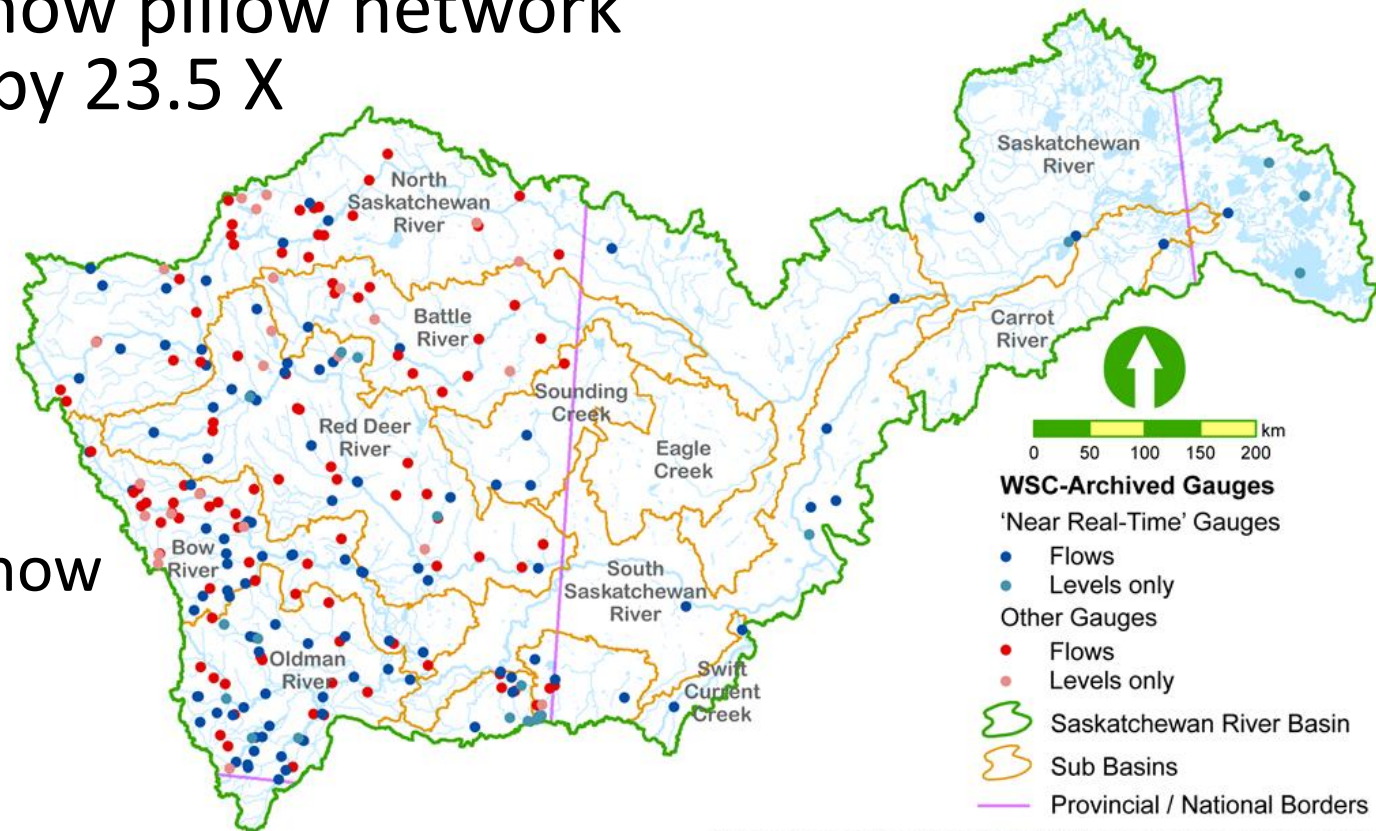
- Maximum flooded area cut in half
- Early flood eliminated or reduced
- Total flood area-duration was unaffected by operations



Derived using SWA stage-inundation data

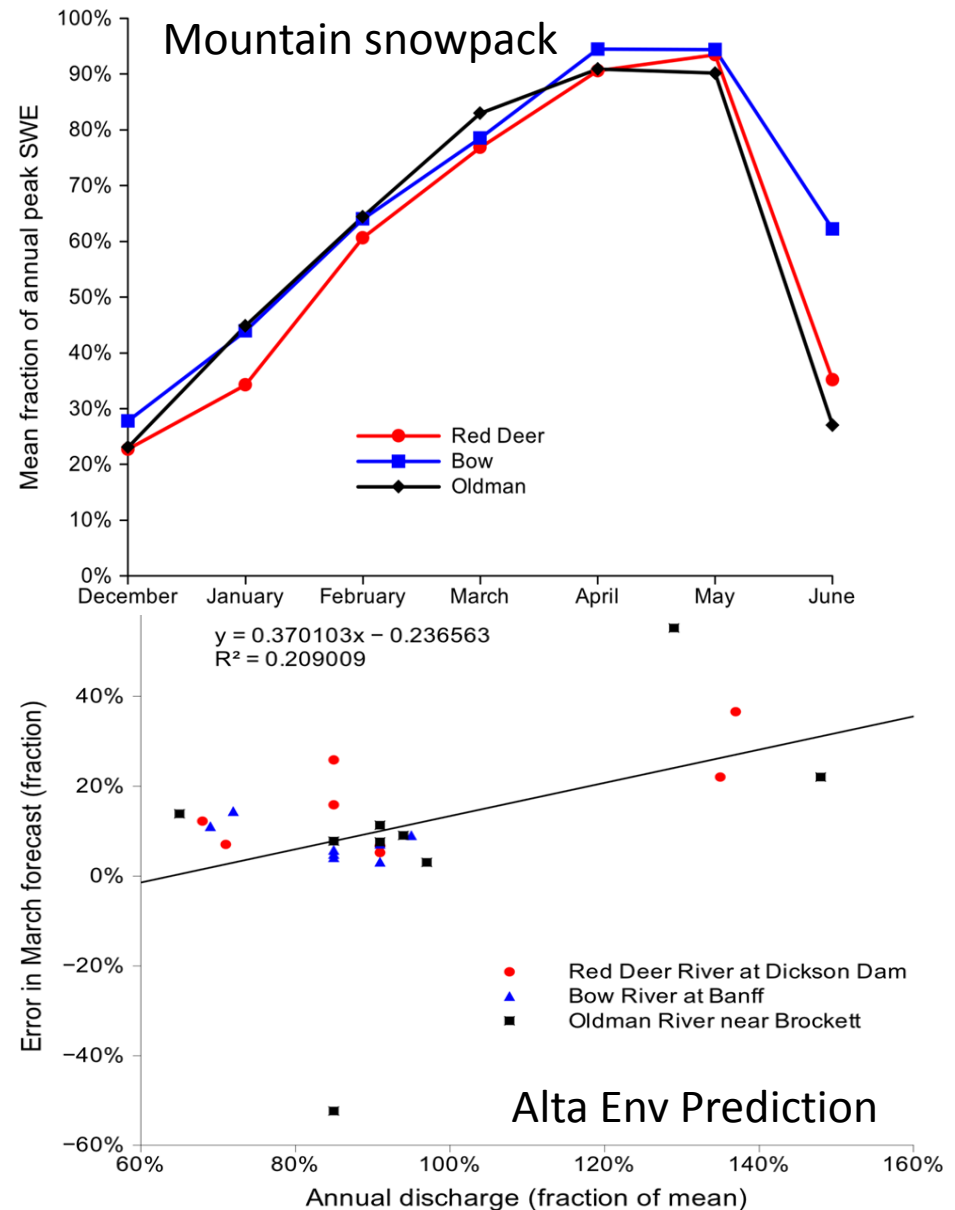
Resources for Operating

- Insufficient near-real time hydrometric or weather/snow stations for prairie inflow estimation
- Mountain snow pillow network insufficient by 23.5 X
- Need
 - Alta snow surveys
 - SNODAS
 - More Sask. Stations, snow surveys



Limits to Predictability?

- Most high mountain precipitation events in late winter
- Heavy late Spring precipitation in wet years reduces March predictability



Risk Assessment

- In attempts to avoid high summer outflows
 - Accumulation of individually acceptable risks led to higher than normal reservoir levels in spring 2011.
 - Ice jam risk, water supply risks possibly over estimated
 - Accumulation of moderately high inflow events led to high total inflows
- Unknowns -
 - discharge at Coteau Creek possibly underestimated
 - Mountain spring snowpacks
 - Mountain precipitation
 - Prairie contributing area and inflows
- Accumulation of risk and low probability inflow events inevitably led to high outflow events
- Rules and policies for risk management should be based on priority of operations

Answer (i)

- Dam objectives & rules are unclear
- As a result of dam operations in 2010-2011
 - Water supply goals were met
 - Flood protection capabilities were restricted
- Inflows were underpredicted and large
- So
 - Downstream flood extent cut in half
 - Area-duration of flooding not reduced
 - Annual peak of Saskatchewan River not reduced

Answer (ii)

- SWA forecasting staff did a superb job with the limited tools and resources, complex operating system and unspecified operating rules available to them

Recommendations – short term

1. Develop formal rules and priorities for Gardiner Dam operation- water supply or flood control?
2. If flood control remains a priority, reduce minimum reservoir levels until predictive capability is improved
3. Use all Alta Environment streamflow , meteorological and snow survey data to improve predictions
4. Establish reliable discharges from Coteau Creek and spillway that are consistent with downriver measured streamflows
5. Automate data management and forecast system to free up internal resources for forecasting

Recommendations – medium term

1. Establish a hydrological modelling capability for ungauged prairie streamflows
2. Enhance local hydrometric and meteorological observations upstream and downstream of Lake Diefenbaker
3. Better understand and monitor winter discharge - ice interactions on SSR and ice jam potential