How Climate Change Could Affect Water Supply of Potash Solution Mining in Southern Saskatchewan

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Introduction

- Canada is the primary potash producer and exporter.
- 96% of Canadian potash is produced in Saskatchewan by 11 mines.
- 9 developments:
  - All, but one, solution method;
  - 6 approved.
- 7 expansion projects.
- Water use:
  - 2010: 22M m³
  - 2060: 127M m³
Stable water supply in the QRB depends on water diversion from the SSR.

Paleohydrology reveals possible prolonged droughts in the region.

Design life of solution mine is up to 100 years.

Possible effects of climate change on water supply need to be studied.
Research objectives

- Projecting the SSRB runoff for 2041-2070 using NARCCAP and CORDEX data.
- Projecting the QRB runoff for 2041-2070 using NARCCAP and CORDEX data.
Streamflow projection methodology

- Simulating SSRB and QRB runoff
  - Runoff estimators
  - Statistical downscaling
    - Performance evaluation
    - Projecting SSRB and QRB runoff
      - Bias correction
Research findings

- The South Saskatchewan River Basin (mrro):
  - Increase in mean of annual runoff by 24% (3 RCMs);
  - Increase in variance of annual runoff by 177% (4 RCMs);
  - Wetter spring and winter, drier summer.
Research findings

- The South Saskatchewan River Basin (SPEI):
  - Hargreave’s PET: decrease in mean of annual runoff by 20% (5 RCMs) and increase in variance of annual runoff by 160% (2 RCMs);
  - Thornthwaite’s PET: decrease in mean of annual runoff by 23% (5 RCMs) and increase in variance of annual runoff by 161% (3 RCMs).
Research findings

- The Qu’Appelle River Basin:
  - Potential increase in mean annual runoff by 29%;
  - Wetter summer and winter, drier spring;
  - Potential changes in seasonal distribution of the runoff.
Conclusions

- Water supply would remain relatively constant (mrro ↑, SPEI ↓);
- Possible change in seasonal distribution;
- Potential declines of runoff (SPEI).