Effect of Lake Water Storage Change in Canada on GRACE/GRACE-FO and GNSS Station Displacements: Implications for Subsurface Water

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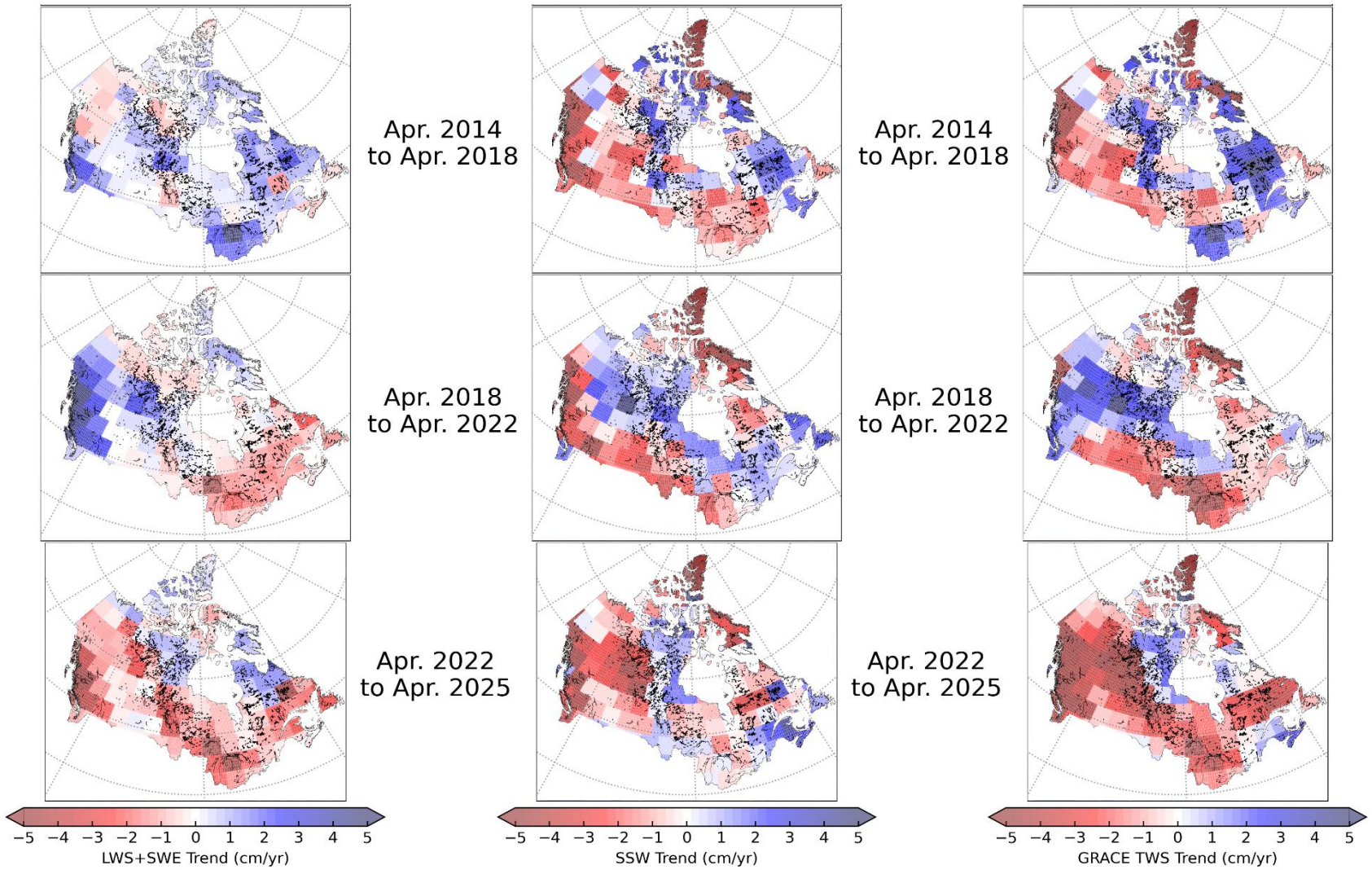
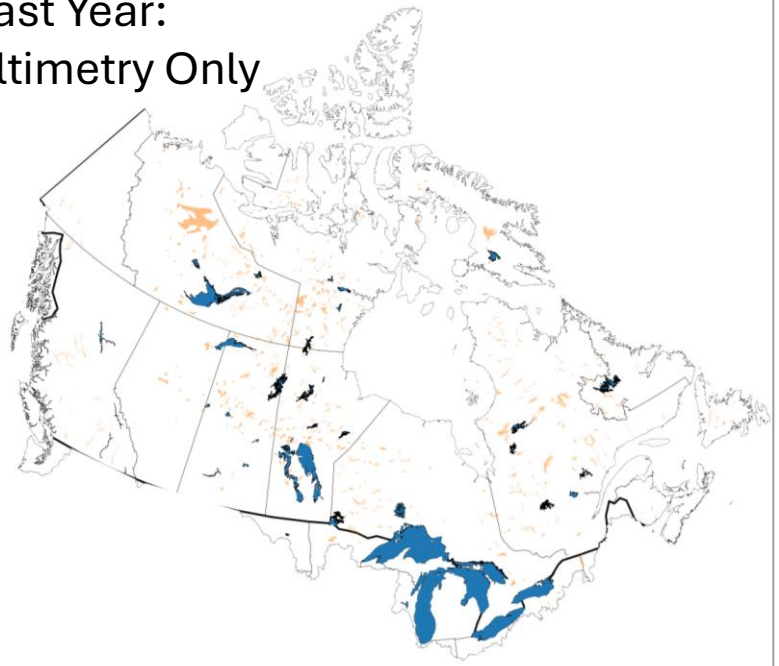
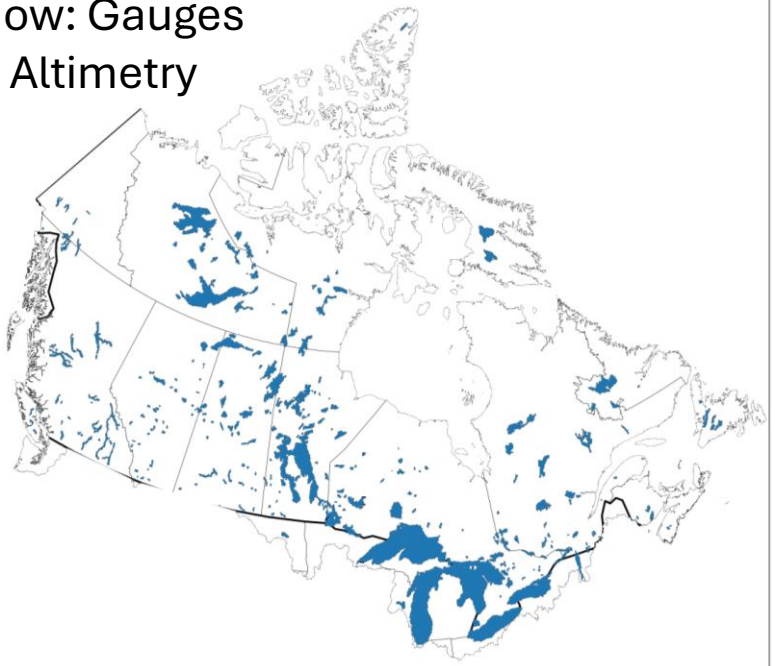


Last Year:
Altimetry Only

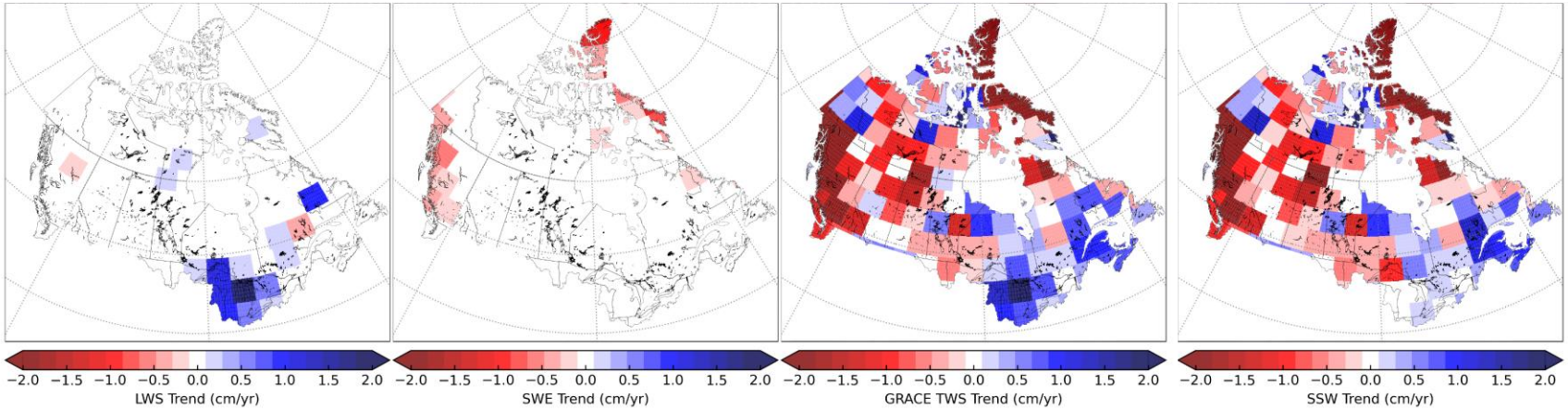


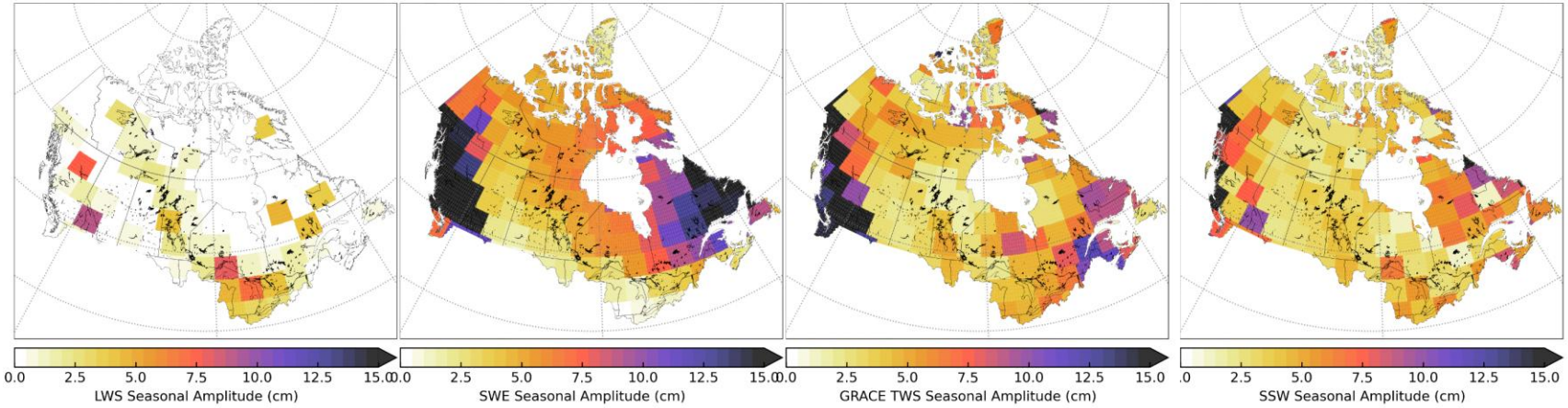
Now: Gauges
& Altimetry

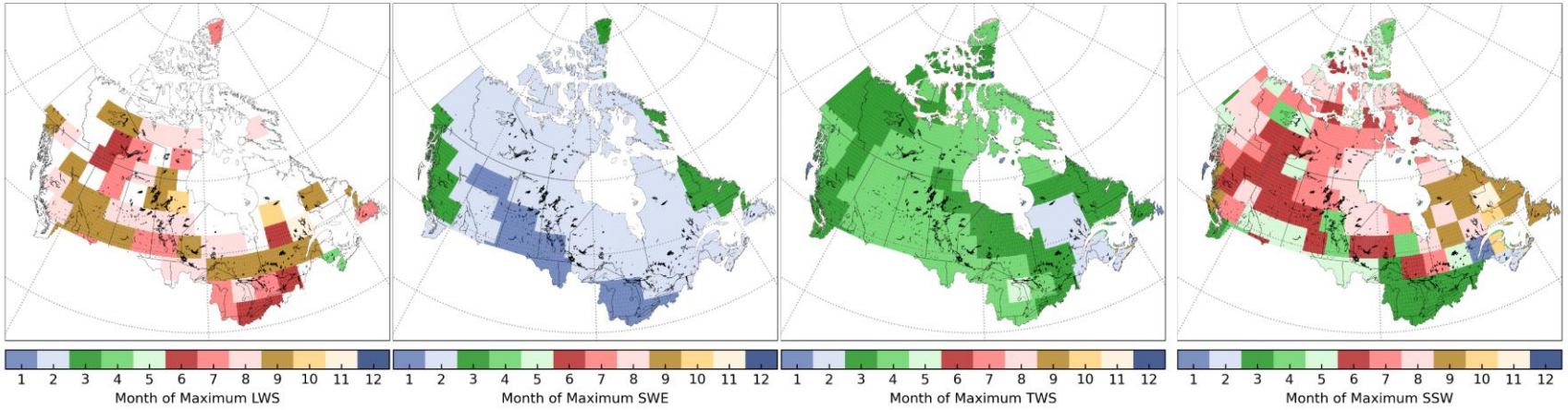


Adding Gauges to High Latitude Lake Level Estimation

- 40 altimetrically derived lakes storage timeseries in Canada passed our criteria last year:
  - More than 6 different months of data in at least one year
  - More than 50% of months have data
- 3066 gauges from the Water Survey of Canada were added and altimetric timeseries of lakes were updated to May 2025
- Gauge and altimetry timeseries are combined with gauge data favored in winter to avoid ice cover issues
- 405 lakes in Canada now pass the same criteria

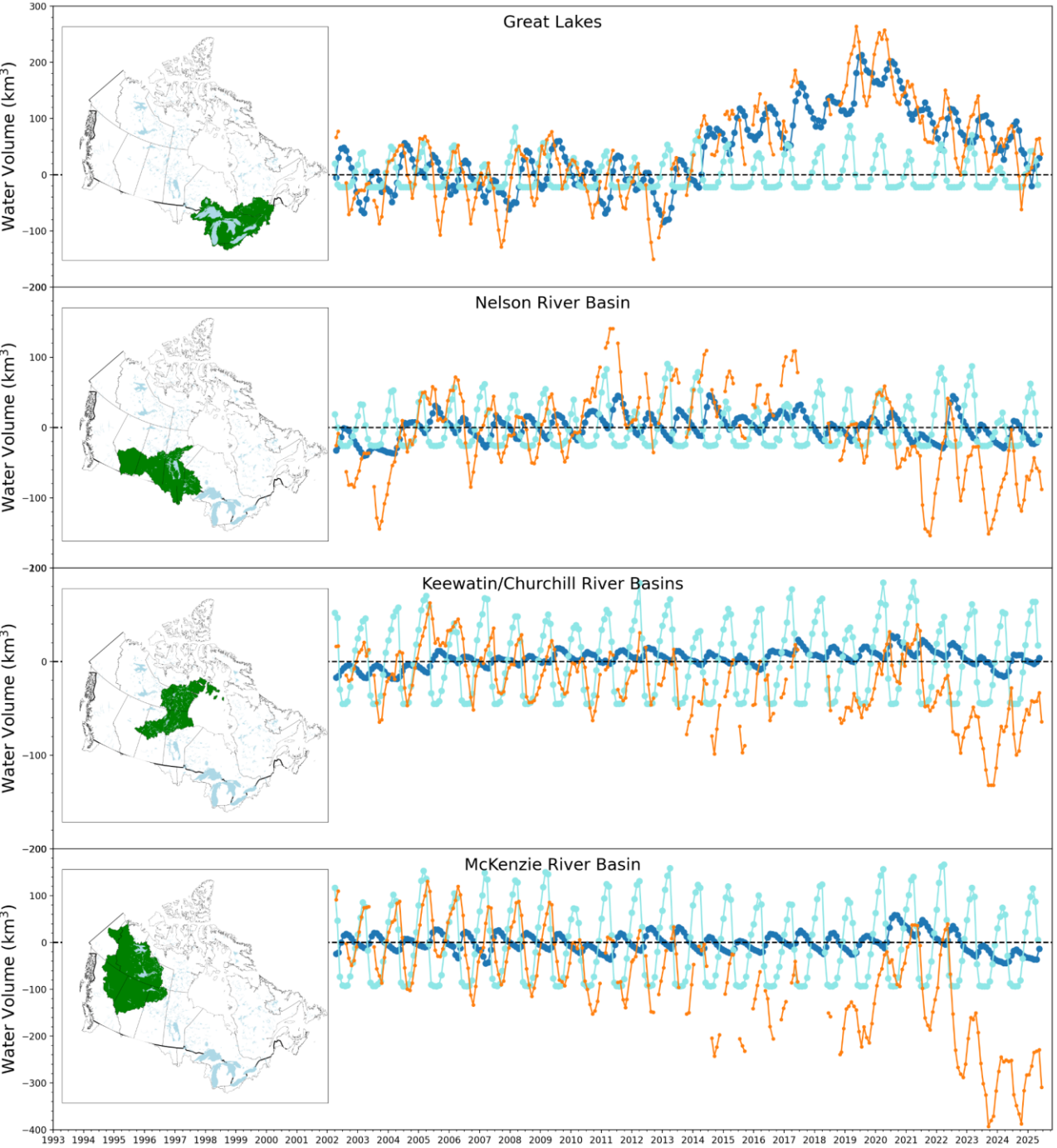






Long-term Trend and Seasonal Oscillation

- Lake water trend only significant over the Great Lakes
- No trend in snow water
- SSW has decreased in the west and remained constant in the east
- Maximum seasonal TWS from GRACE occurs between maximum snow and lake water



Basin Analysis

- Lake water explains nearly all of the water change observed by GRACE in the Great Lakes Basin
- Large drops of ~100 km^3 water occur in the Nelson, McKenzie, and Keewatin/Churchill River Basins over the last 3 years
- This water loss is not observed in lake water or snow models
- We interpret this as a mixture of permafrost loss, soil moisture loss, and groundwater change due to high temperature, low precipitation years