City of Timmins

Location Summary

For the City of Timmins, located at 48.47°N, 81.33°W on the Mattagami River west of Night Hawk Lake in northeastern Ontario, the following summary changes in temperature and precipitation are projected with respect to the 1981-2010 baseline under RCP8.5 ensemble (current Greenhouse Gas pathway) results:

For the 2050s:

- Annual mean temperature is projected to increase by 3.5 °C.
- Annual mean total precipitation is projected to increase by 67.6 mm (+8%).

For the 2080s:

- Annual mean temperature is projected to increase by 5.8 °C.
- Annual mean total precipitation is projected to increase by 95.6 mm (+12%).

Further details on these and more complex variables are provided in the subsequent sections.

1. Temperature

Variable	1981 – 2010	2020s	2050s	2080s
Annual Maximum Temperature (°C)	7.7	9.1	11.0	13.2
Annual Minimum Temperature (°C)	-4.1	-2.6	-0.4	2.1
Annual Mean Temperature (°C)	1.8	3.2	5.3	7.6

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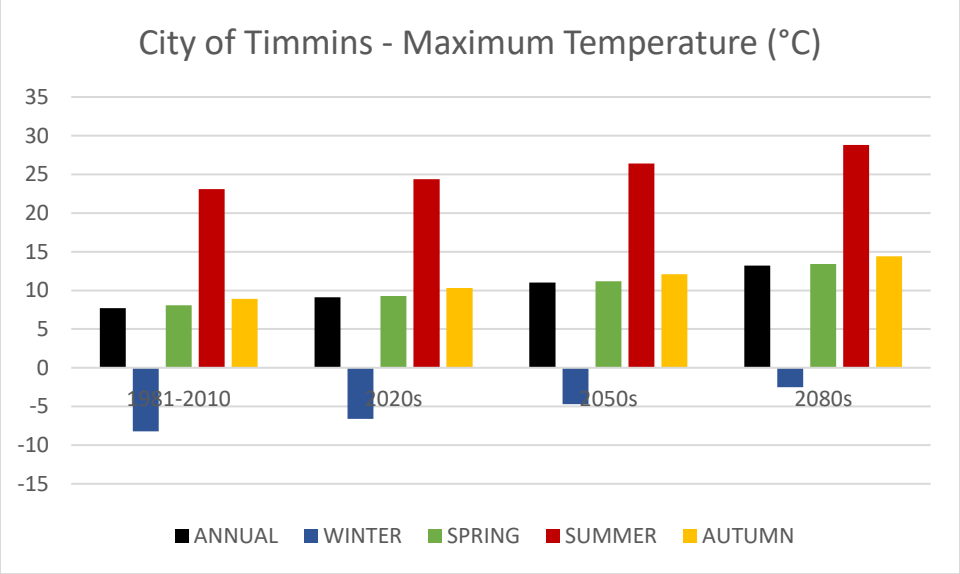

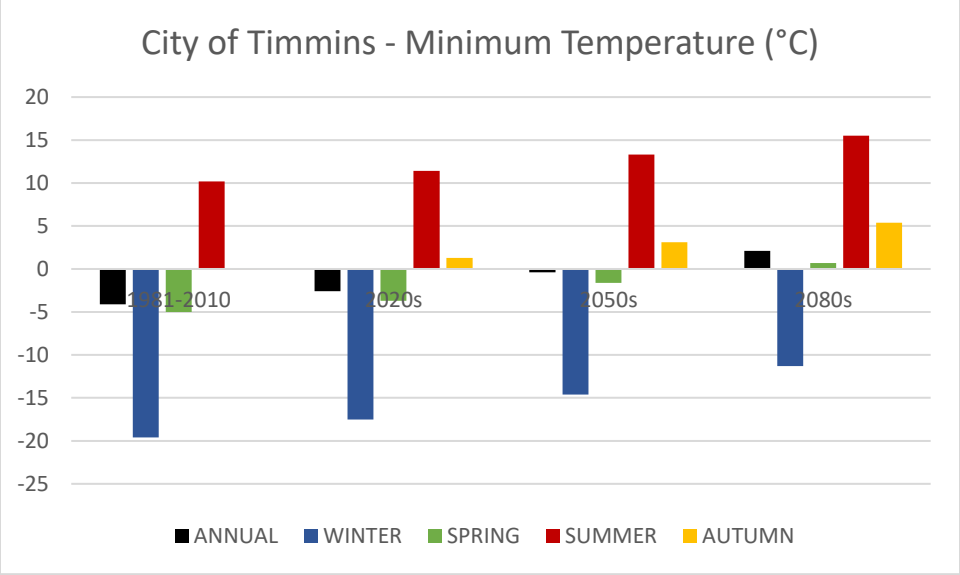

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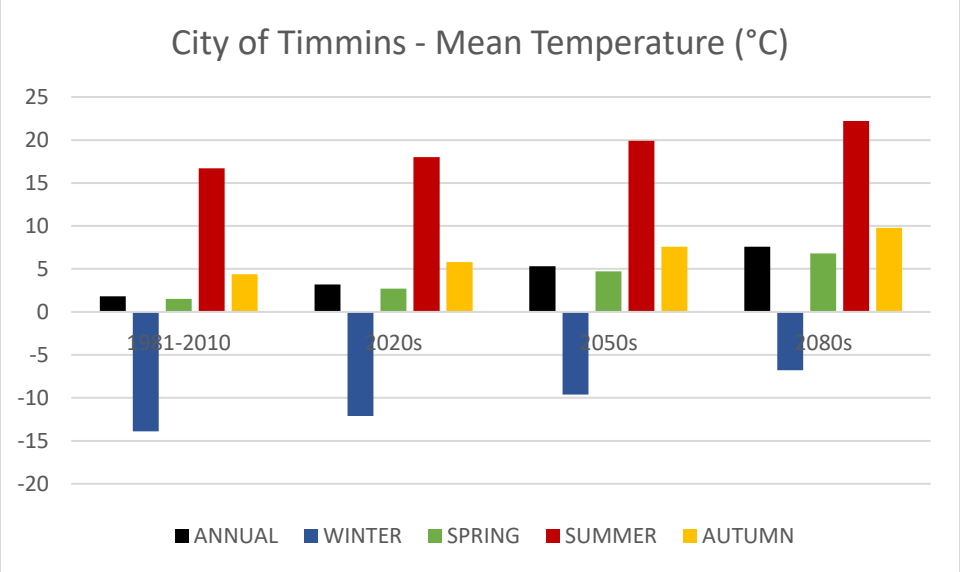
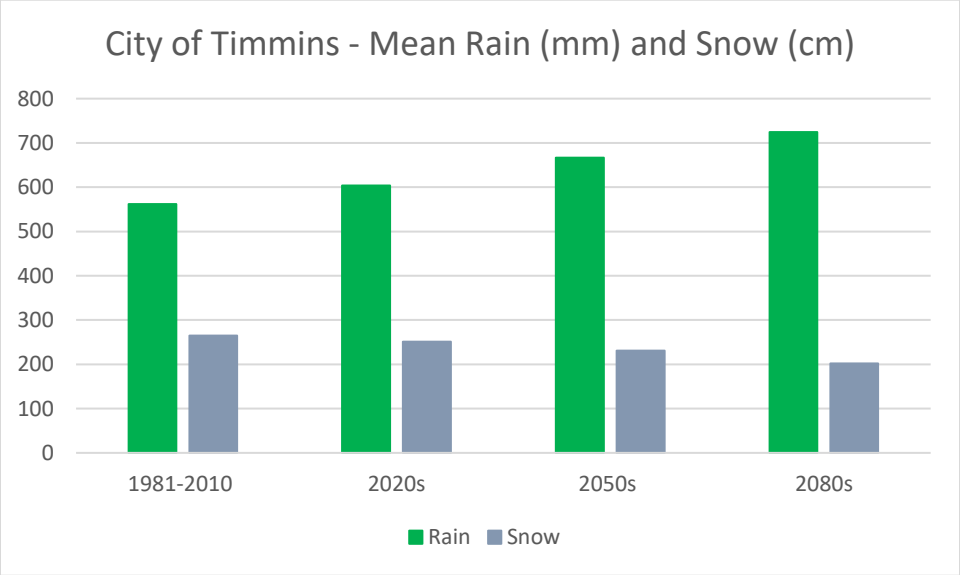


Summary

- Annual mean maximum temperature in the projection period will increase from a 1981-2010 baseline of 7.7 °C to 9.1 °C, 11.0 °C, and 13.2 °C for the 2020s, 2050s, and 2080s respectively under RCP8.5 ensemble results.
- Annual mean minimum temperature in the projection period will increase from a 1981-2010 baseline of -4.1 °C to -2.6 °C, -0.4 °C, and 2.1 °C for the 2020s, 2050s, and 2080s respectively under RCP8.5 ensemble results.
- Annual mean temperature in the projection period will see an increase from a 1981-2010 baseline of 1.8 °C to 3.2 °C, 5.3 °C, and 7.6 °C for the 2020s, 2050s, and 2080s respectively under RCP8.5 ensemble results.

2. Precipitation

Variable	1981 – 2010	2020s	2050s	2080s
Annual Rainfall (mm)	561.9	603.7	666.5	724.3
Annual Snowfall (cm)	264.8	251.2	230.7	201.9
Annual Precipitation (mm)	824.5	852.5	892.1	920.1



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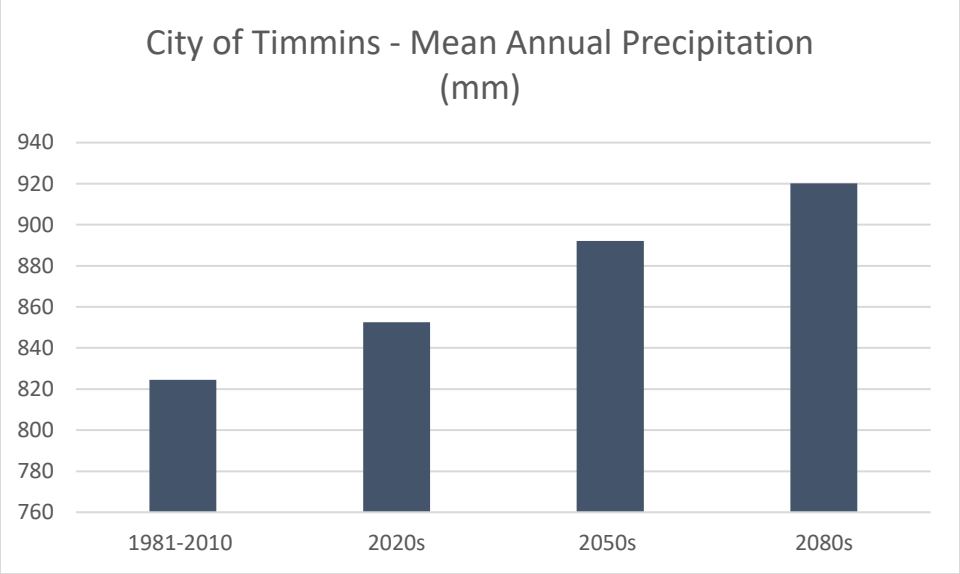


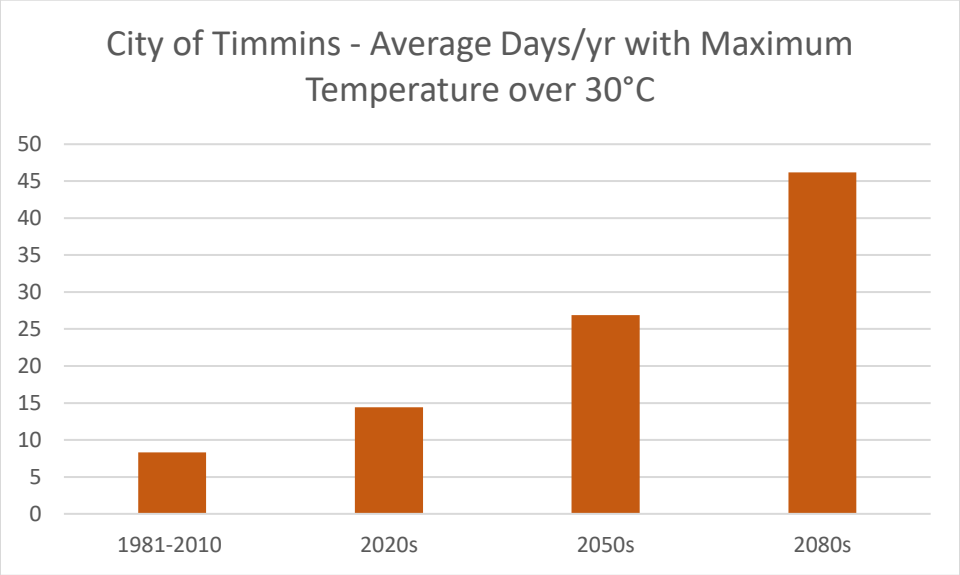
Summary

- Annual mean rainfall[1] in the projection period will increase from a 1981-2010 baseline of 561.9 mm to 603.7 mm, 666.5 mm, and 724.3 mm for the 2020s, 2050s, and 2080s respectively under RCP8.5 ensemble results.
- Annual mean snowfall[1] in the projection period will decrease from a 1981-2010 baseline of 264.8 cm to 251.2 cm, 230.7 cm, and 201.9 cm for the 2020s, 2050s, and 2080s respectively under RCP8.5 ensemble results.
- Annual mean total precipitation in the projection period will increase from a 1981-2010 baseline of 824.5 mm to 852.5 mm, 892.1 mm, and 920.1 mm for the 2020s, 2050s, and 2080s respectively under RCP8.5 ensemble results.

[1] Mean rainfall and snowfall are calculated using an empirically-derived optimal temperature for splitting precipitation based on daily maximum and minimum temperature thresholds. Total sum of rain and snow resulting from this procedure may be different than the total precipitation values presented in the chart, though fall within the acceptable range of uncertainty in future climate projections.

3. Temperature and Precipitation Thresholds and Extremes

Variable	1981 – 2010	2020s	2050s	2080s
Days per year with T> 30°C	8.3	14.4	26.9	46.2
Days per year with T<-25°C	32.0	24.1	15.4	7.2
Days per year with P>40 mm	0.5	0.6	0.8	0.9



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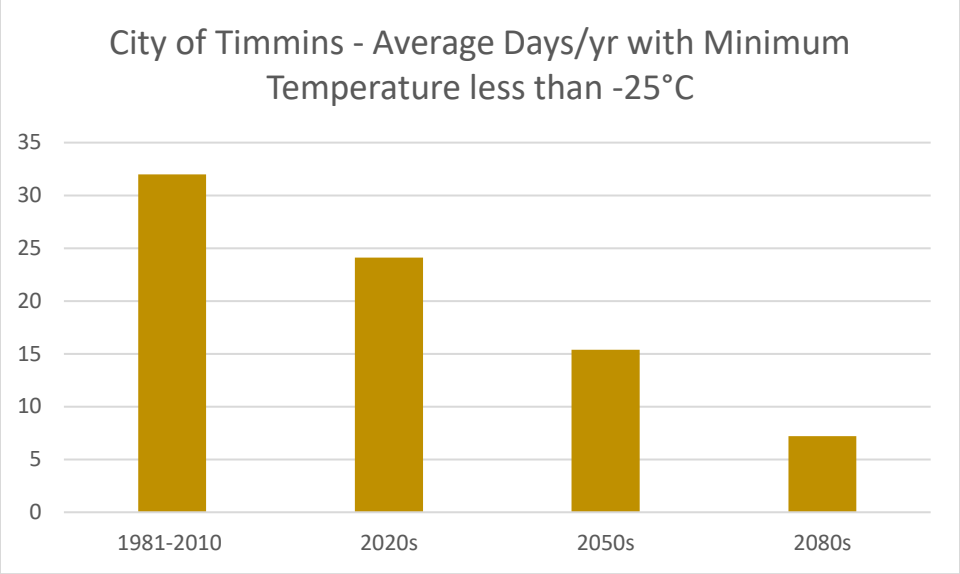

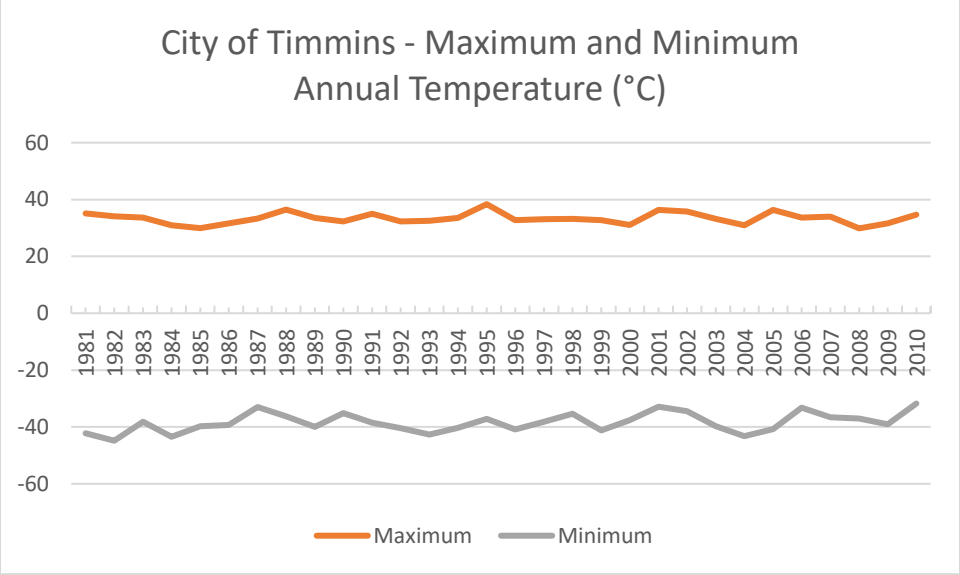

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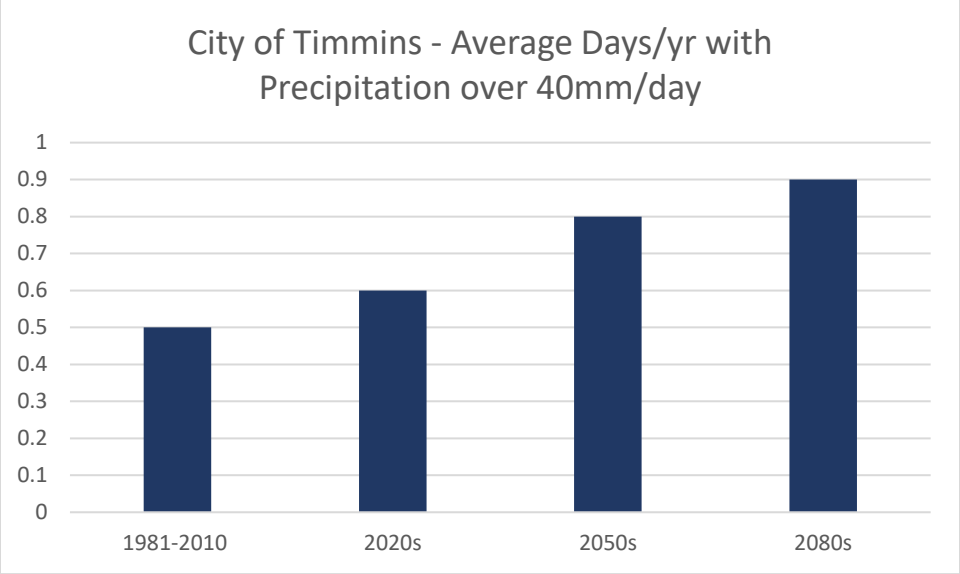

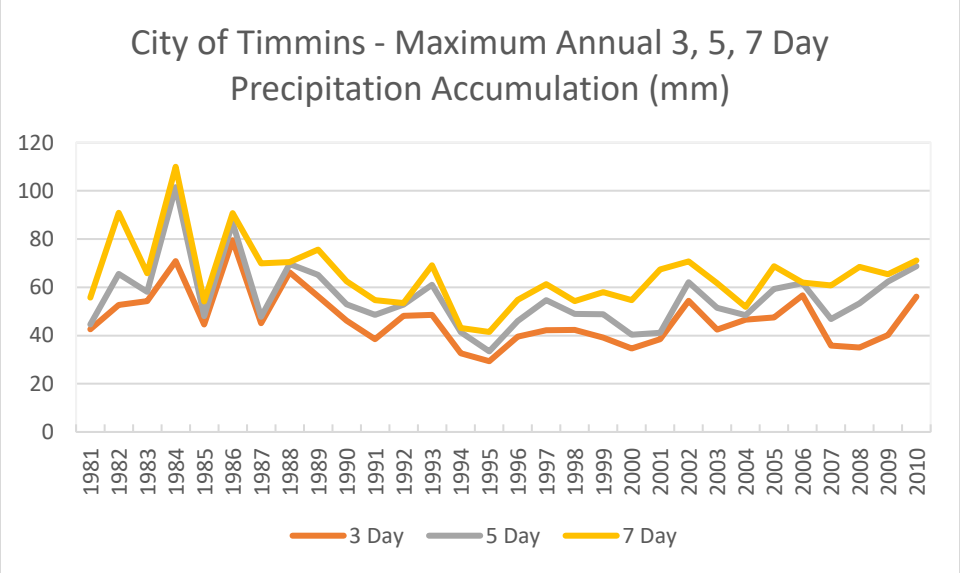

Summary

- An increase in the number of days with maximum temperature exceeding 30 °C from 8.3 days in the 1981-2010 baseline period to 14.4, 26.9, and 46.2 days is expected in the 2020s, 2050s, and 2080s respectively under the RCP8.5 ensemble results.
    - This could have increased impacts on cooling demands, populations sensitive to heat, and coldwater fisheries, for example.
- A decrease in the number of days with minimum temperature below -25 °C from 32.0 days in the 1981 – 2010 baseline period to 24.1, 15.4, and 7.2 days is expected in the 2020s, 2050s, and 2080s respectively under the RCP8.5 ensemble results.

- This could have decreased impacts on heating demands in the winter and lead to safer overall conditions in winter from extreme cold. It is still expected that polar vortex winters will continue to occur into the future, even under a warming climate, so there will continue to be periods of extreme cold even under average warming conditions.

4. Complex Variables

Variable	1981 – 2010	2020s	2050s	2080s
Frost-free Days Per Year	166	185	211	234
Freeze-thaw Cycles per Year	87.1	80.2	70.4	63.8
Annual Water Budget (mm)	318.9	326.4	317.9	274.7
Annual Accumulated GDD	1540.9	1772.3	2124.5	2600.4

- Frost-free days represent the number of days where the minimum temperature does not go below 0 °C. These days are associated with growing season lengths.
- Freeze-thaw cycles represent the number of days where the maximum daily temperature is greater than 0 °C and the minimum daily temperature is less than 0 °C. Freeze thaw cycles are indicators of infrastructure stress on such items as paved surfaces, bridges, and buildings.
- Annual water budget refers to the annual difference between incoming annual precipitation and outgoing potential evaporation. A higher positive value indicates more precipitation is available for agriculture and consumption. Lower values (or even negative values) would indicate the potential for great moisture stress and drought conditions.
- Annual Accumulated GDD (Growing Degree Days) are the total of degree days over 5 °C suitable for agriculture. A higher number is preferable for crop growth but does not consider moisture limitations. It represents heat available for crop growth.

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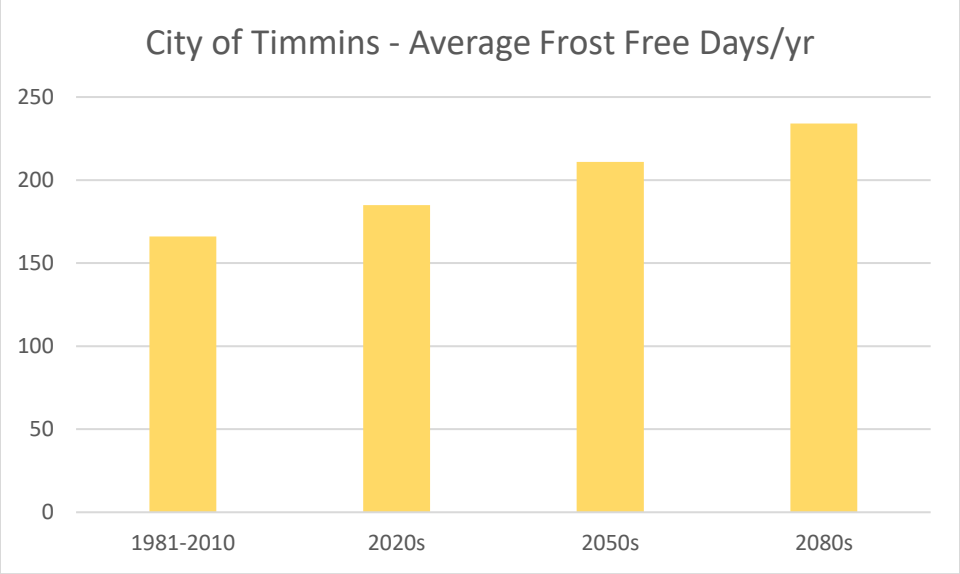

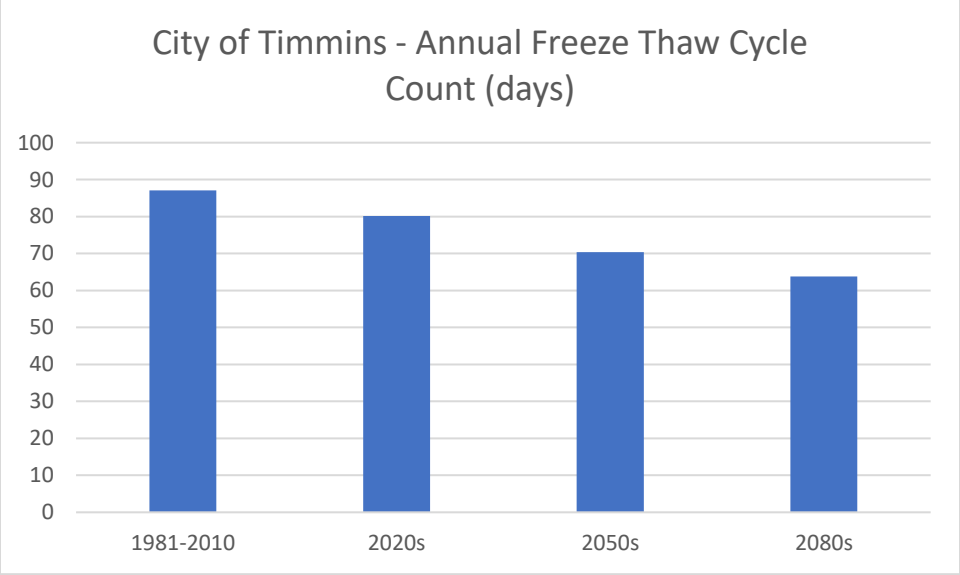

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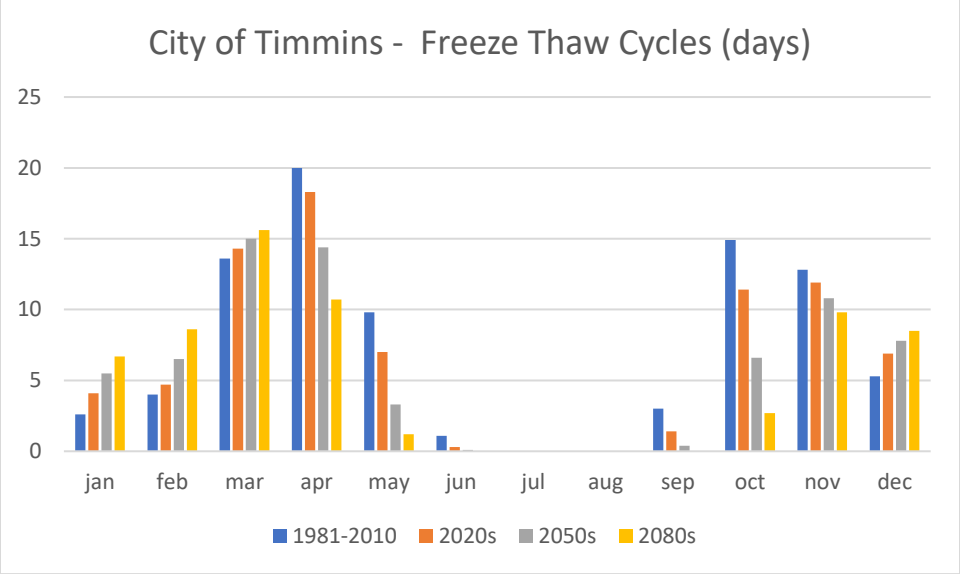

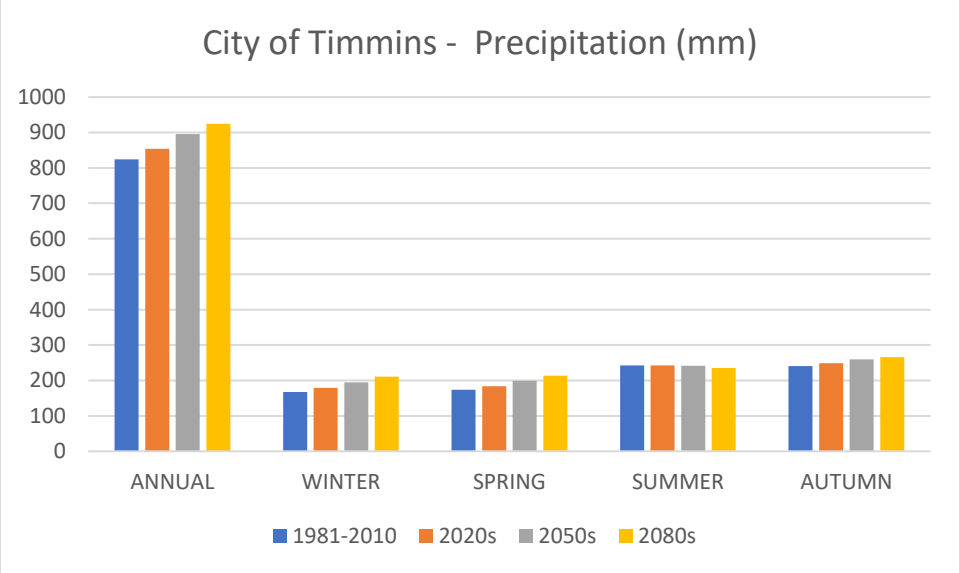

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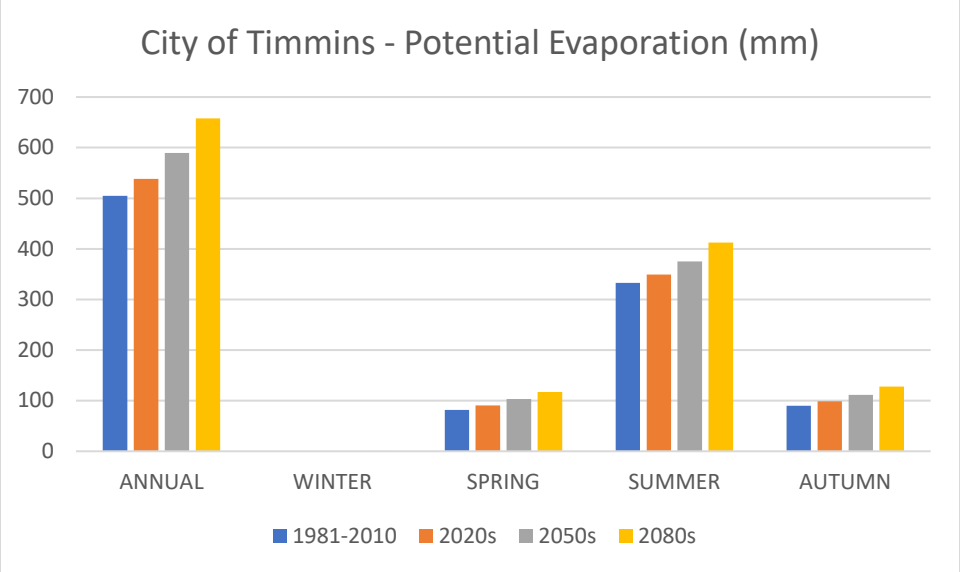

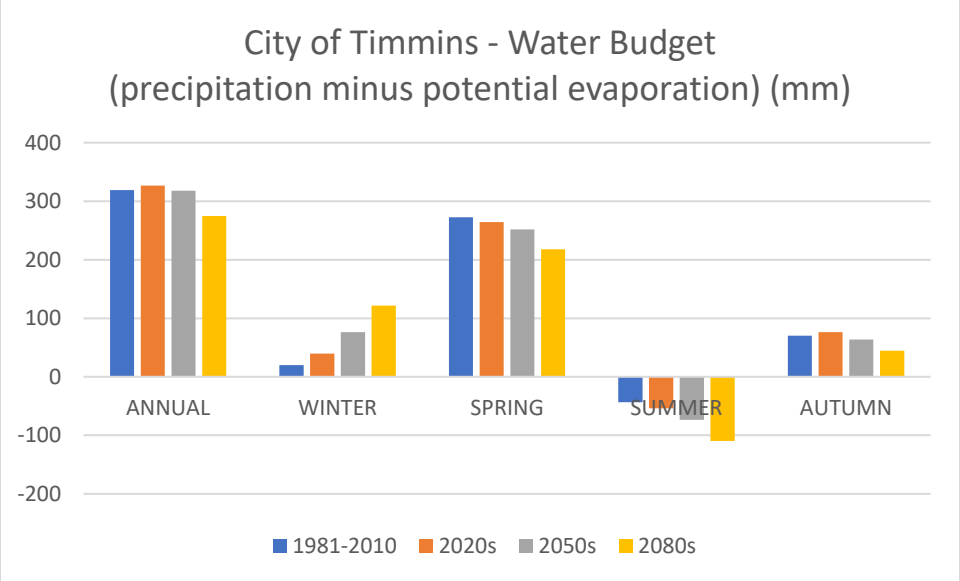

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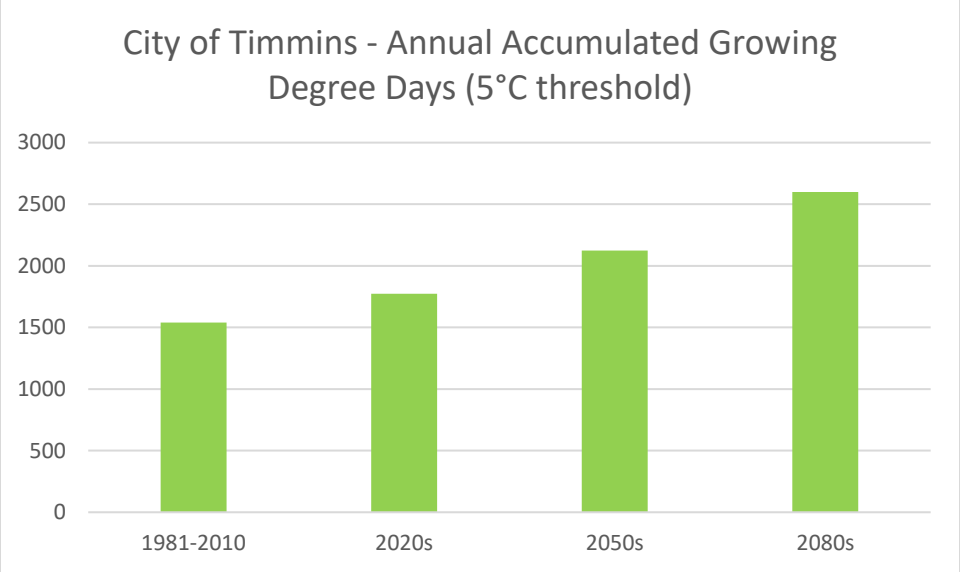

Summary

- The number of frost-free days in the projection period will increase from a 1981-2010 baseline of 166 days to 185, 211, and 234 days for the 2020s, 2050s, and 2080s respectively under RCP8.5 ensemble results.
- Decreases in the number of freeze-thaw cycles per year are expected from the 1981-2010 baseline of 87.1 cycles per year to 80.2, 70.4, and 63.8 cycles per year, for the 2020s, 2050s, and 2080s respectively under RCP8.5 ensemble results.
- Future water budget values show an overall decrease in the annual availability of water from a 1981-2010 baseline value of 318.9 mm to 326.4 mm, 317.9 mm, and 274.7 mm for the 2020s, 2050s, and 2080s, respectively under RCP8.5 ensemble results
    - Seasonal variation in the water budget shows that summer precipitation likely remains similar to current rates, but potential evaporation increases with increasing temperatures, leading to overall decreases in the total available water annually, especially in the spring, summer and autumn months.
- Increases in annual accumulated growing degree days reflect the overall warming of the climate, with increases from the 1981-2010 baseline of 1540.9 to 1772.3, 2124.5, and 2600.4 for the 2020s, 2050s, and 2080s, respectively.