

# Long-term stream thermal regime of Granger Creek, Yukon Territory

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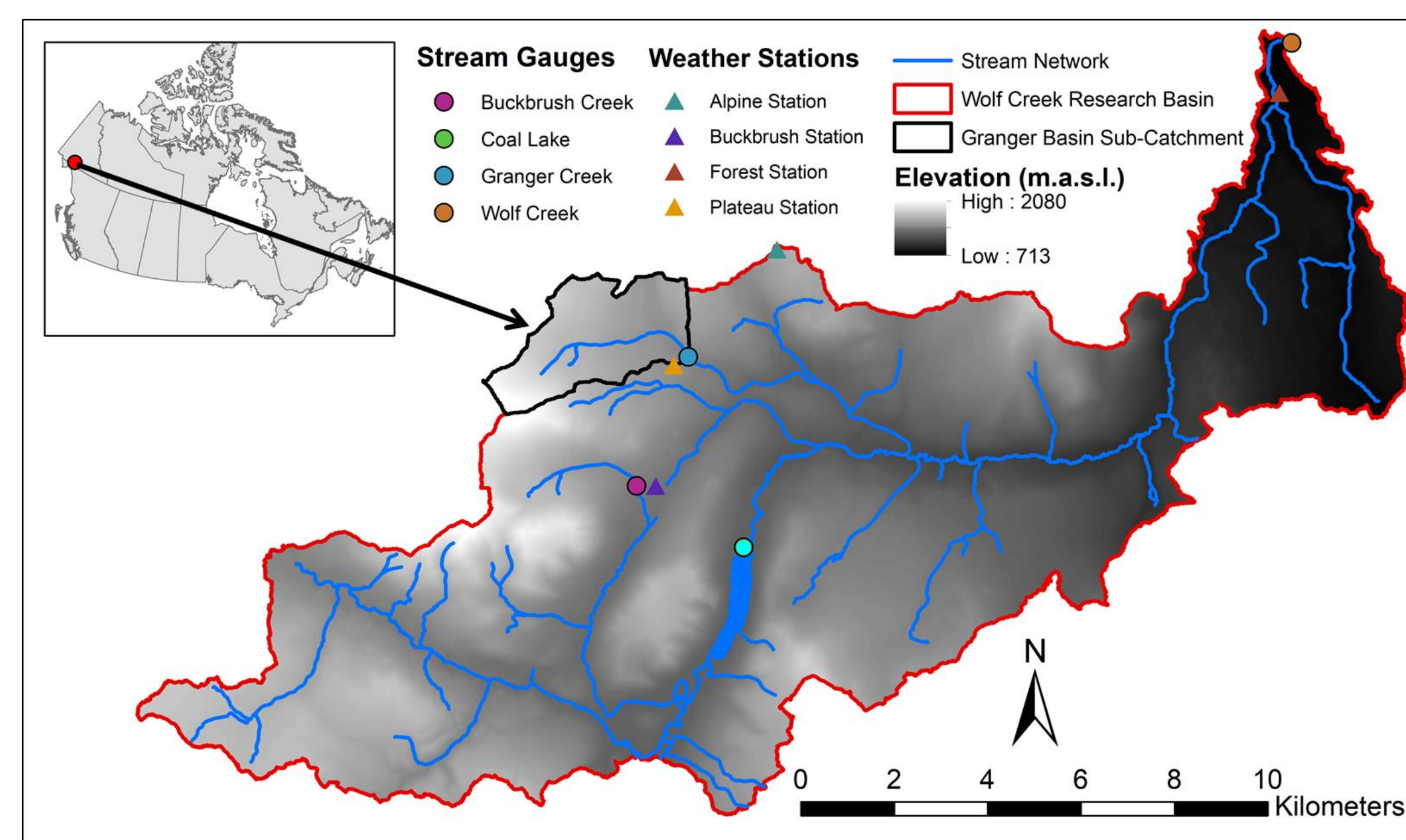
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## INTRODUCTION

- Water temperature is an important stream characteristic that influences biological and chemical processes within an ecosystem.
- Stream temperature dynamics are driven by heat exchange processes with the atmosphere and the interaction between surface water and groundwater.
- The objective of this study is to explore the interannual stream temperature variability in the Wolf Creek Research Basin, Yukon Territory.
- The correlation between stream temperature and snowmelt timing, stream thermal memory, and summer weather conditions are evaluated
- Multiple hypotheses are tested:
  - 1) There is a positive relationship between air and stream temperature.
  - 2) Later snowmelt will result in cooler summer water temperatures.
  - 3) Precipitation has a cooling effect on water temperature.
  - 4) Thermal memory can explain stream temperature dynamics.

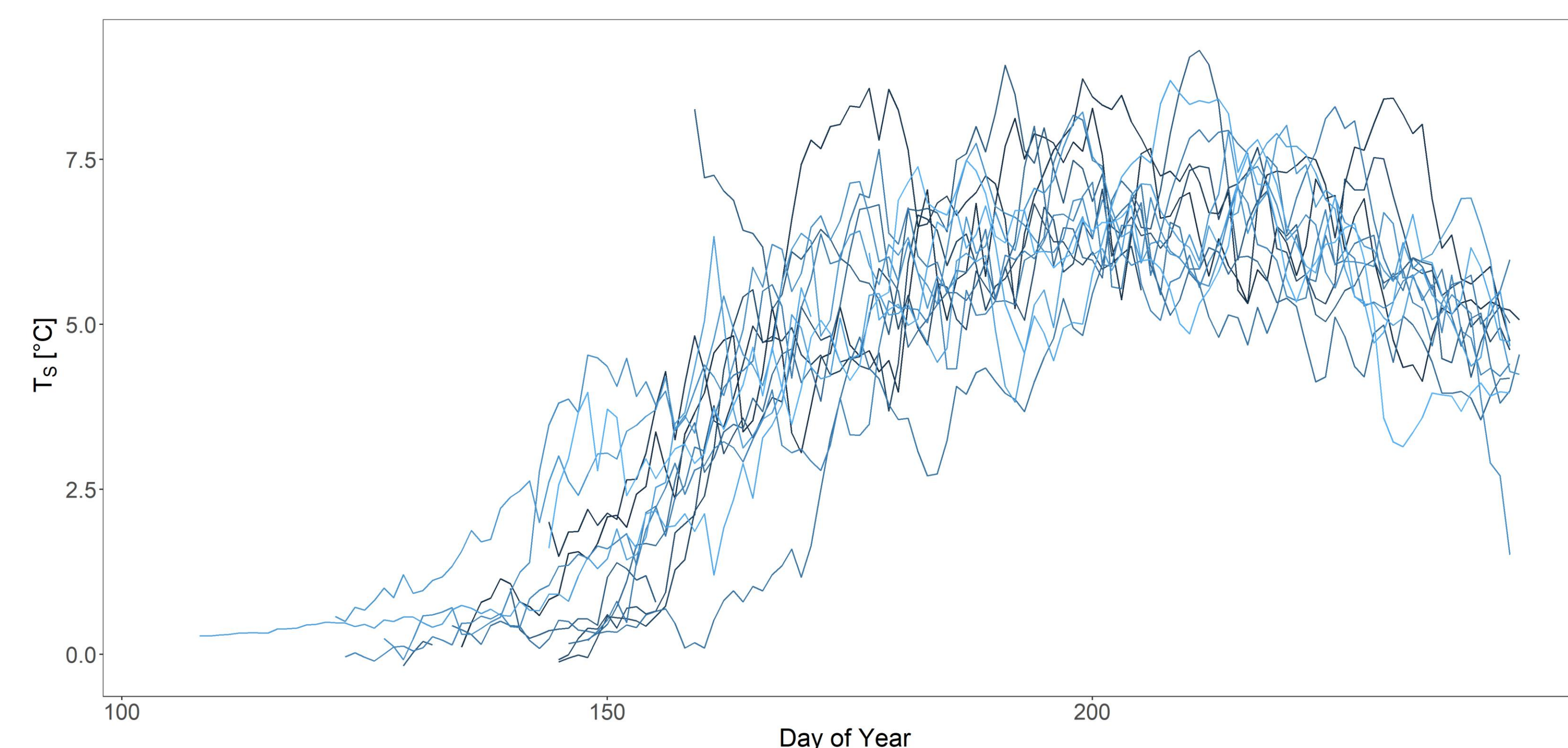
## STUDY SITE



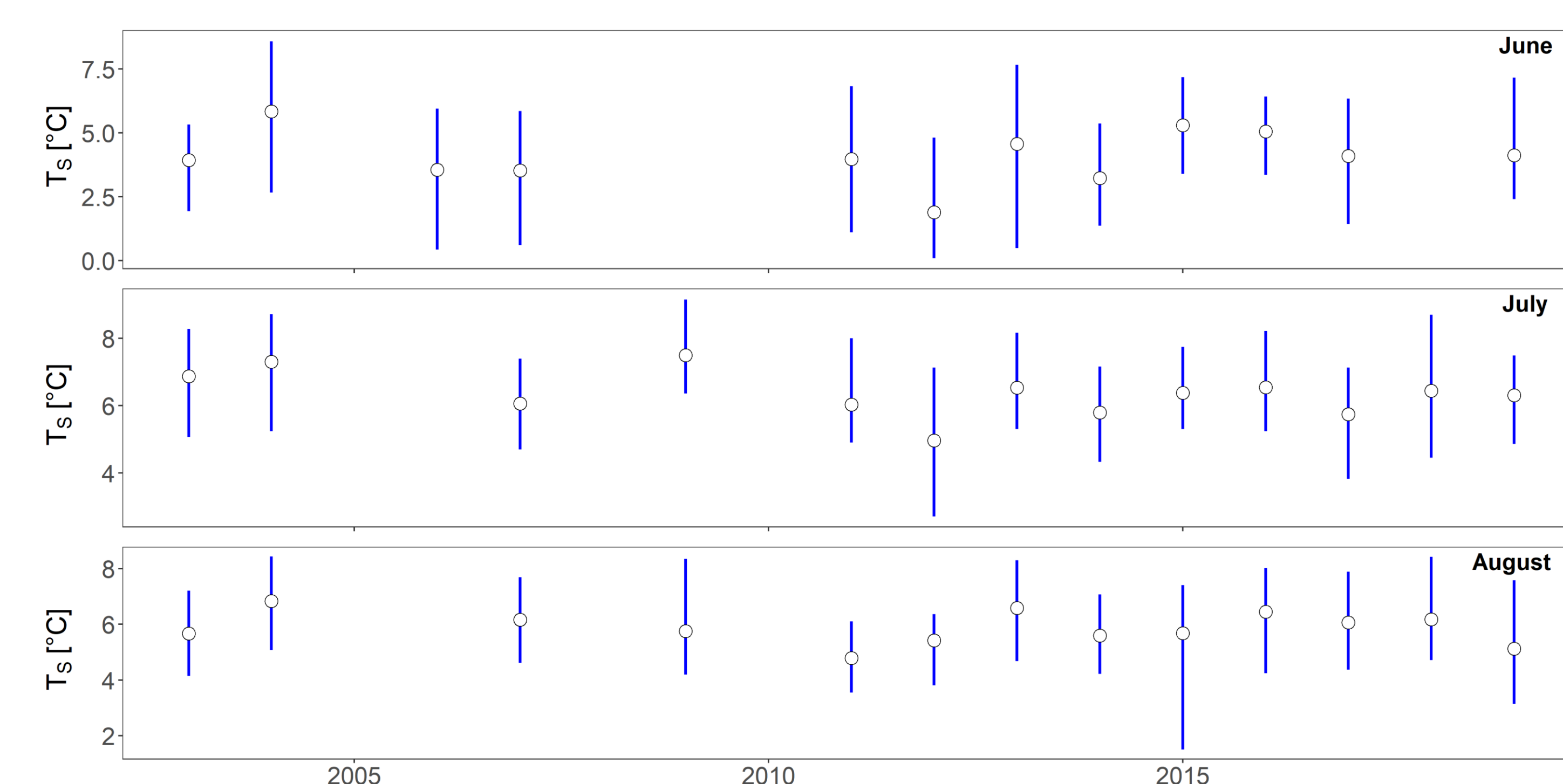
- The Wolf Creek Research Basin (WCRB) is located at 60° 32' N, 135° 07' W, and drains an area of approximately 179 km<sup>2</sup>. Granger Creek is a headwater catchment located within the WCRB, with a catchment area of 7.6 km<sup>2</sup>.
- Multiple sites within WCRB are instrumented with stream gauges and weather stations. The Buckbrush and Forest weather stations, and Granger Creek (GC) and Wolf Creek (WC) stream gauges are used for this research project.
- WCRB is located on the traditional territory of the Kwanlin Dün First Nation, Ta'an Kwach'an Council, and Carcross-Tagish First Nation.



## TEMPERATURE VARIABILITY

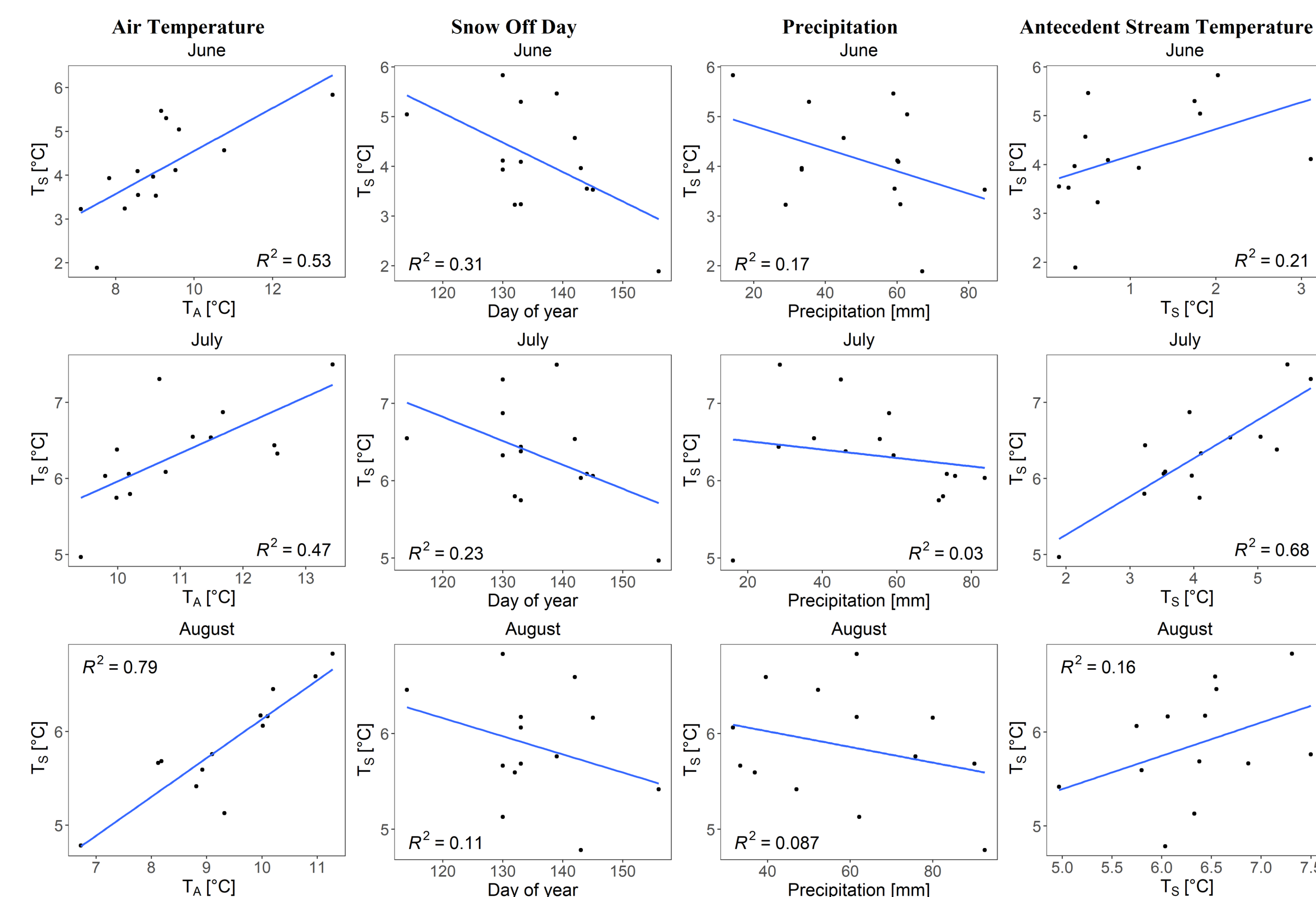


- Granger Creek water temperatures maintained a seasonal trend, reaching a peak in July before declining.
- Summer (June 15 – August 31) stream temperatures from 2003 to 2019 ranged between 1.2°C and 9.1°C, with a mean of 6.1°C.

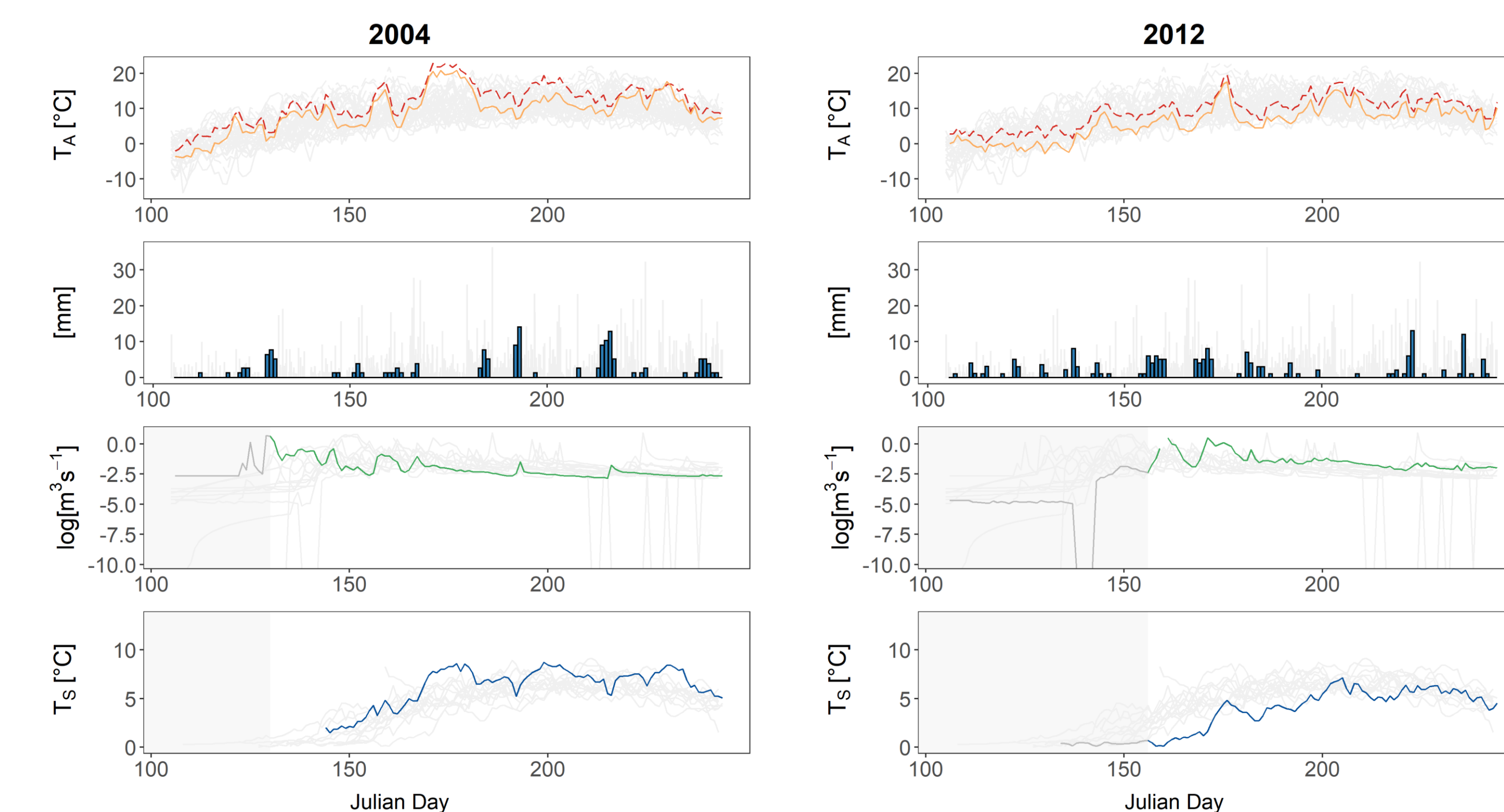


- Monthly mean temperatures were variable over time, with June ranging between 1.9°C and 5.8°C; July ranging between 5.0°C to 7.5°C; and August between 4.8°C to 6.8°C.

## STATISTICAL RELATIONSHIPS



- Air temperature, and precipitation represent weather conditions; snow off day and antecedent stream temperature (i.e. thermal memory) represent snowmelt influences.
- There were positive relationships between stream temperature and air temperature; and stream temperature and antecedent stream temperature.
- Negative relationships were found between snow off day (i.e. snowmelt timing) and stream temperature, and precipitation and stream temperature.



- The warmest and coldest Granger Creek water temperatures were in 2004 and 2012, respectively.
- Warm early summer water temperatures propagated throughout the 2004 summer; with the converse being true for 2012; indicative of the stream's thermal memory.
- Duration of snow cover and snowmelt timing could be responsible for early summer stream temperatures.

## CONCLUSION

- Monthly stream temperature at Granger Creek varied between 0.1°C and 8.6°C over 13 years of observations.
- Stream temperature variability was related to weather conditions, snowmelt influences, and thermal memory of the catchment.
- Further research considering hillslope thermal processes would develop a better understanding of stream thermal memory.