

Future Changes in Arctic River Runoff and its Impact on the Ocean



Digital Research Alliance of Canada

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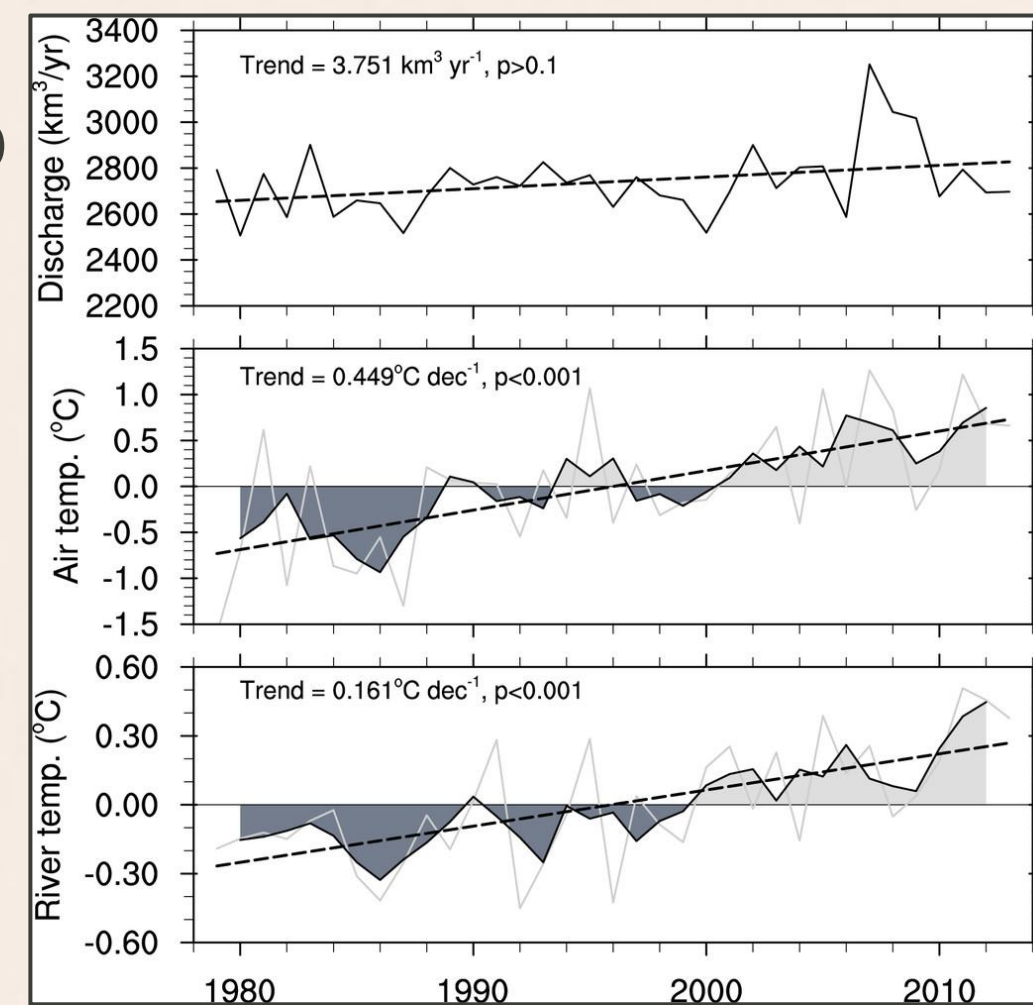
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Introduction

1. Background

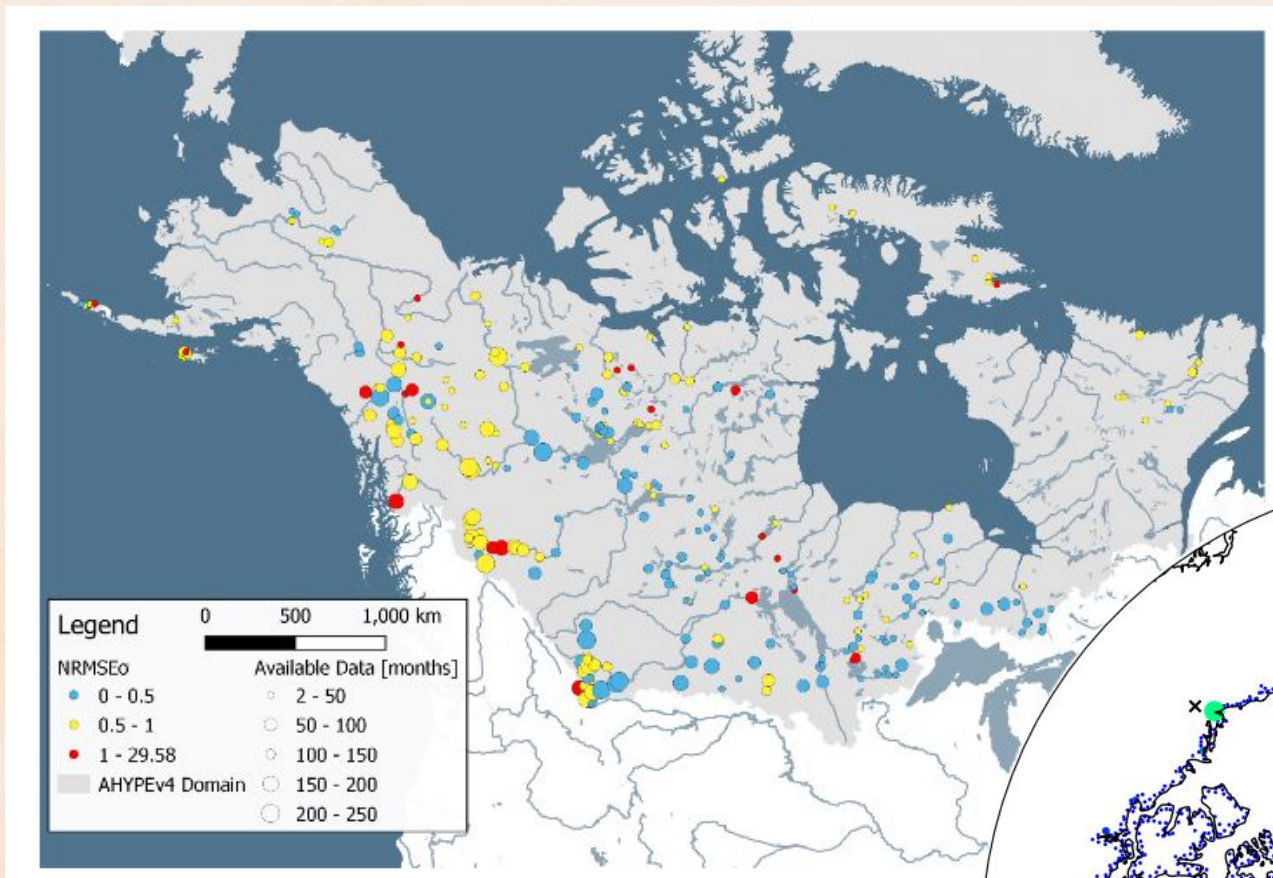
River runoff into the Arctic Ocean, has been increasing in both discharge amount and temperature with climate change.



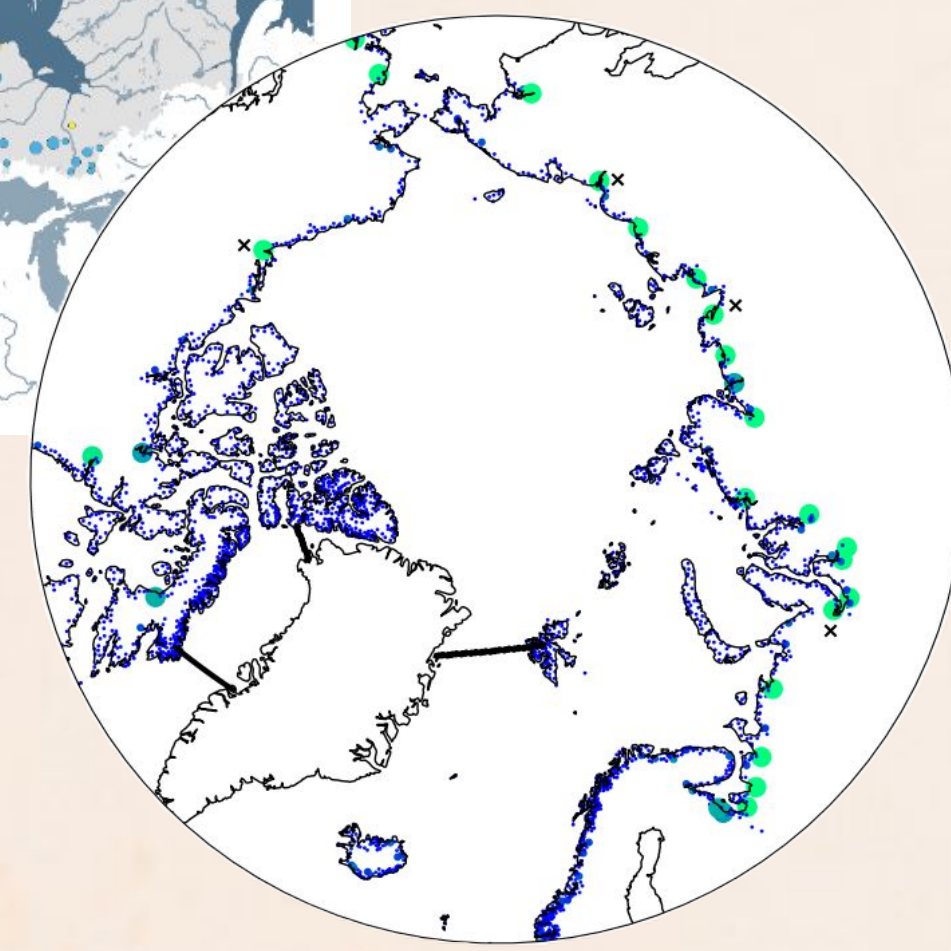
Observed trends in Arctic runoff. From Park, Hotaek, et al. (2017)

Project Objective: To understand the impact of increasing river water temperatures on the Arctic Ocean

2. Hydrological Model



A-HYPE performance across North America, compared with available gauge and station data. From Broesky, 2024



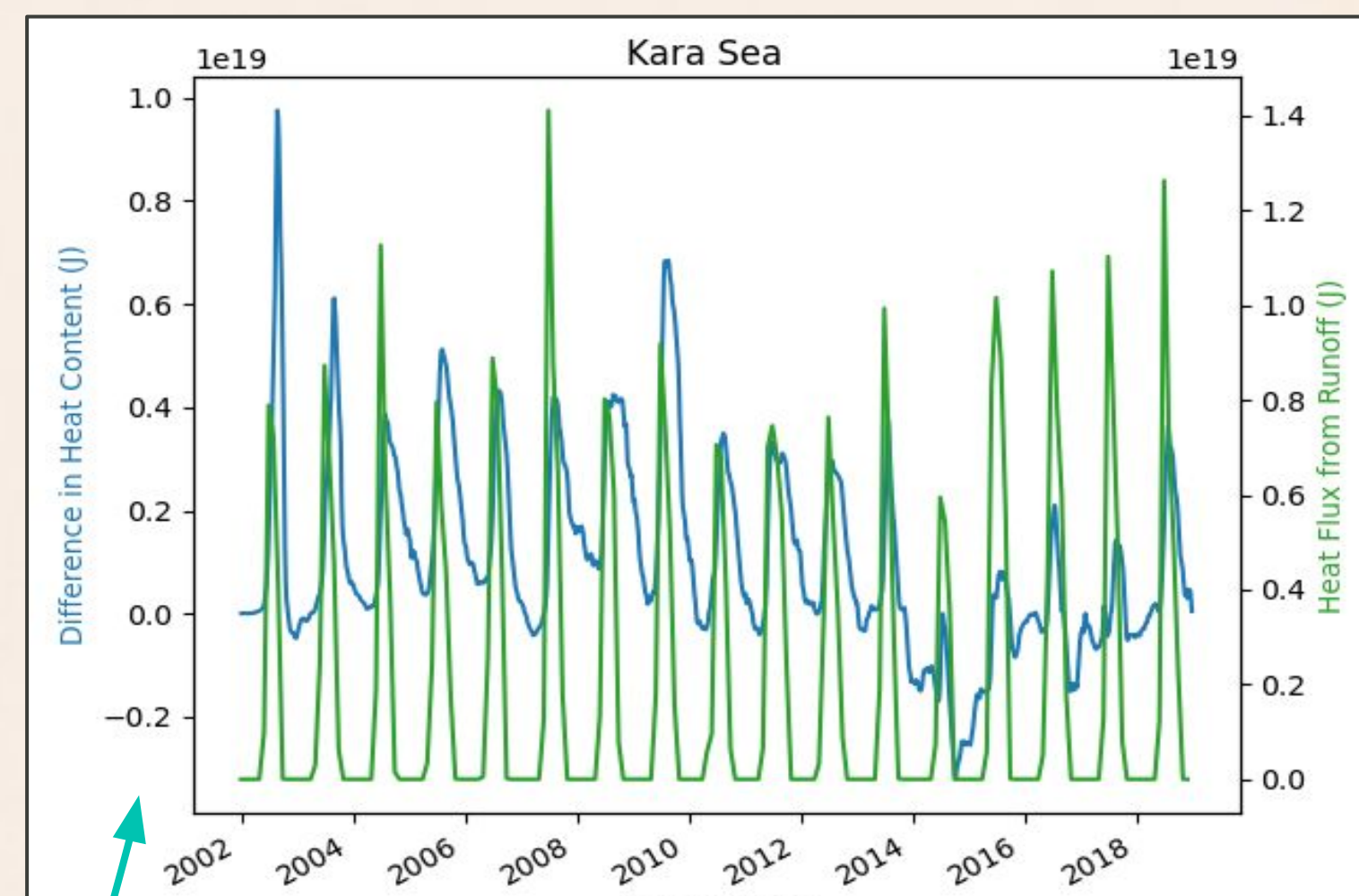
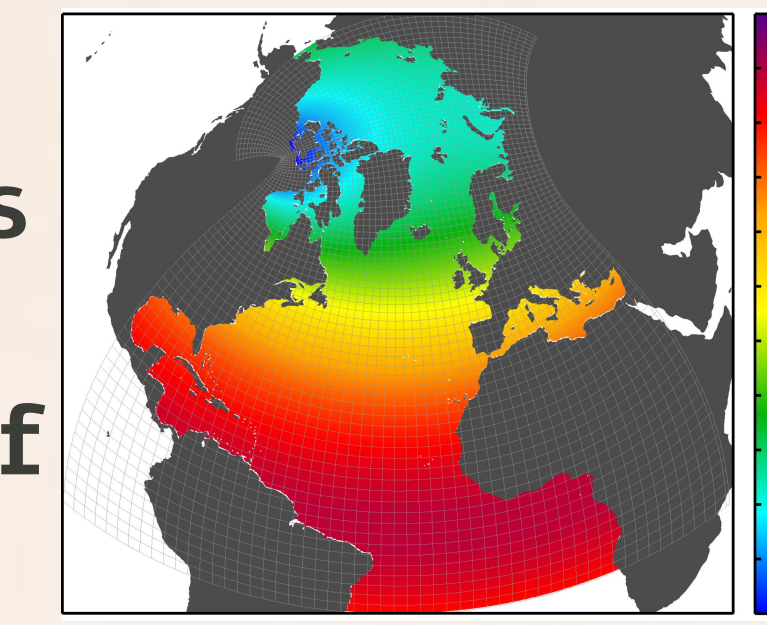
Runoff locations from A-HYPE

River runoff scenarios were produced using the A-HYPE hydrological model, for both present day and future scenarios.

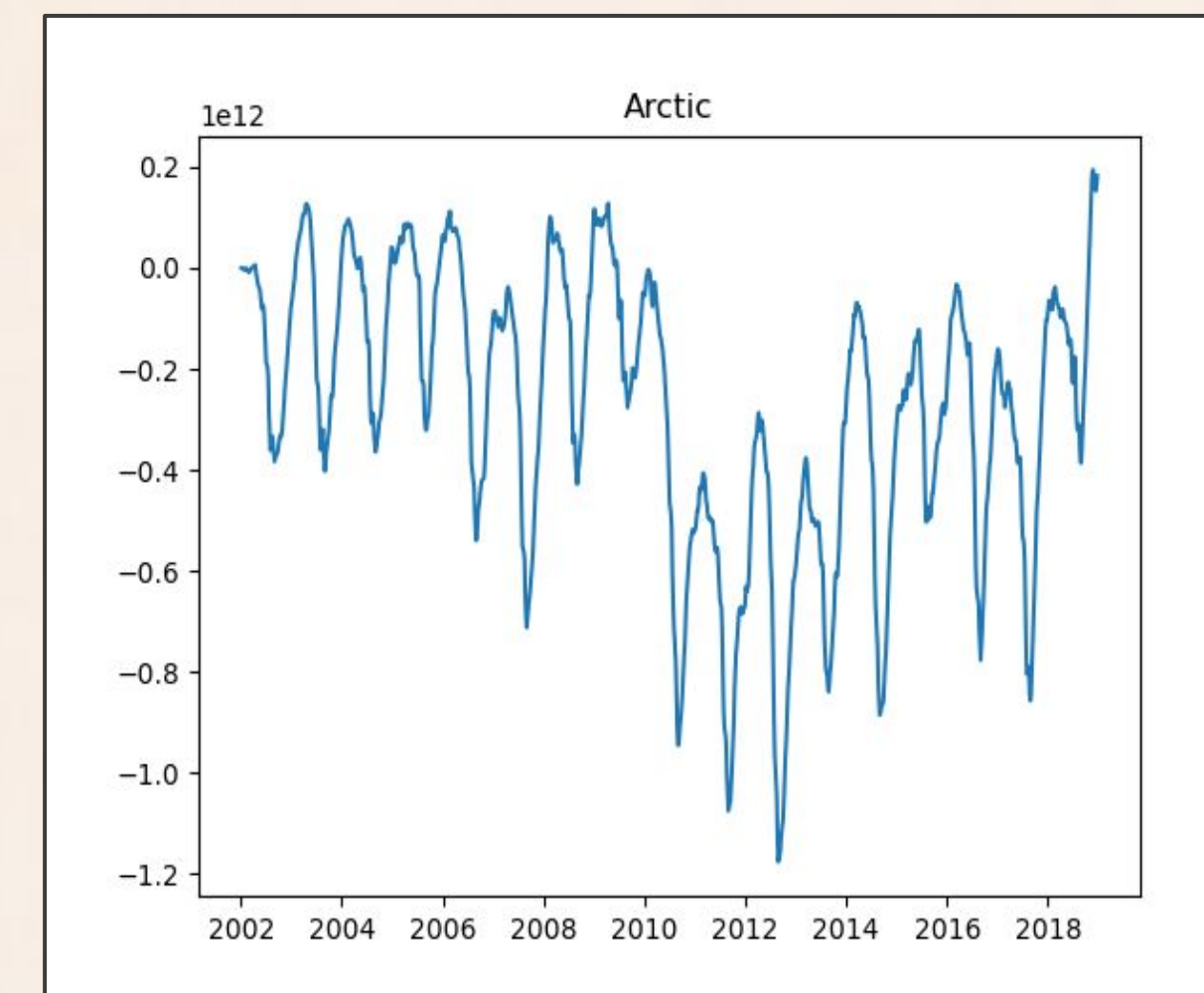
Research

3. Impacts of River Water Temperature in Current Day Simulations

Ocean model simulations were completed with a regional configuration of NEMO v3.6

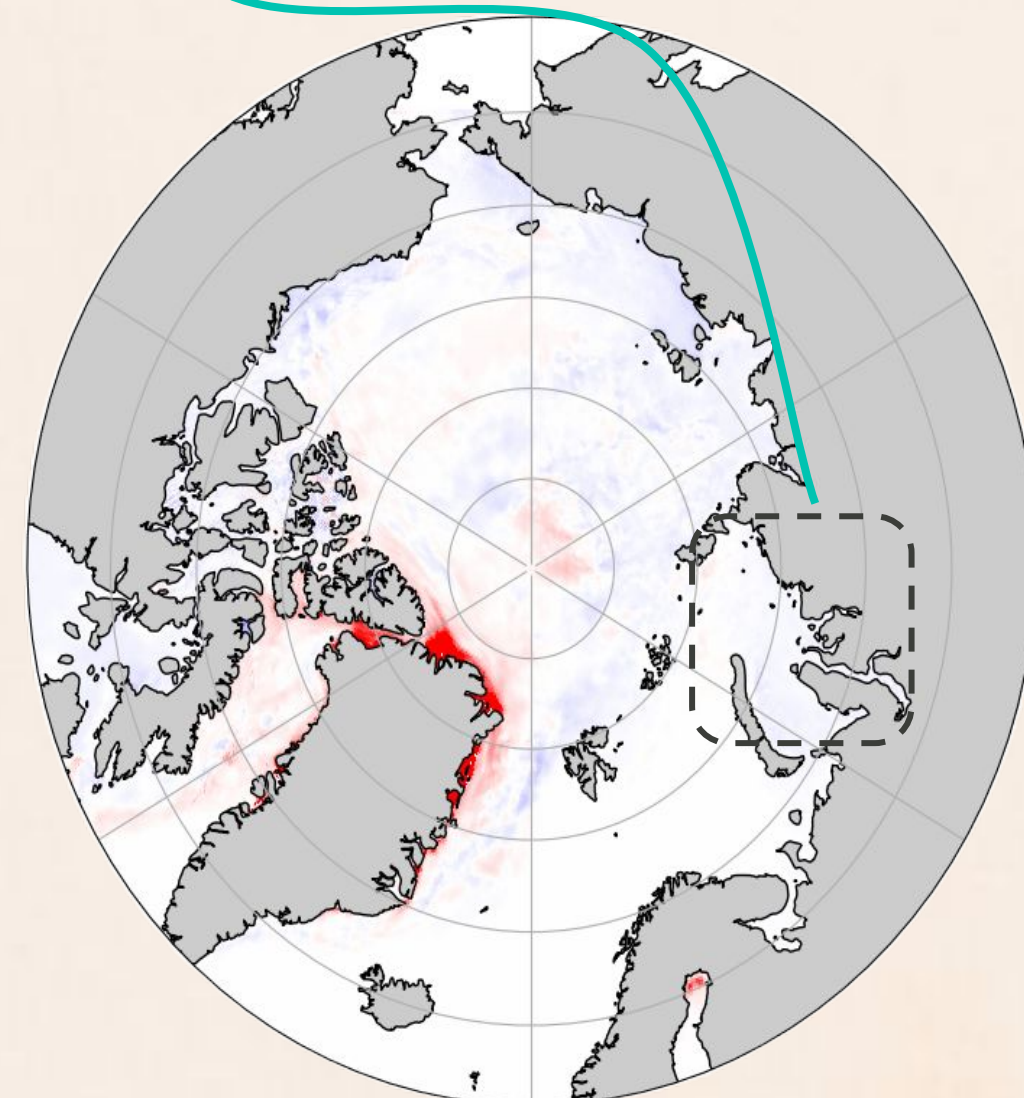


Change in the heat content in the Kara Sea, compared with riverine heat flux

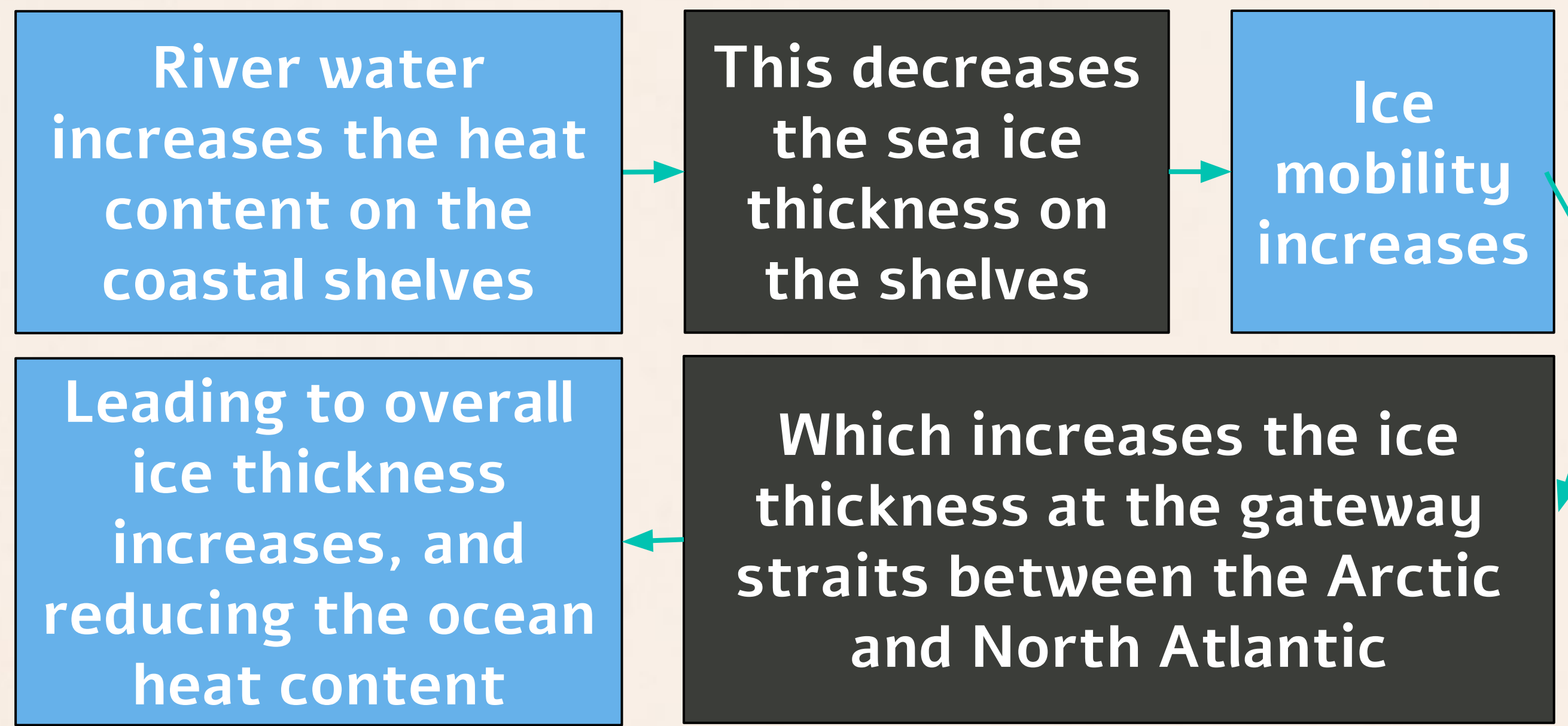


Arctic wide heat content change

While the heat content increases along the coastal regions, it decreases when averaged across the whole Arctic domain.



Change in sea ice thickness

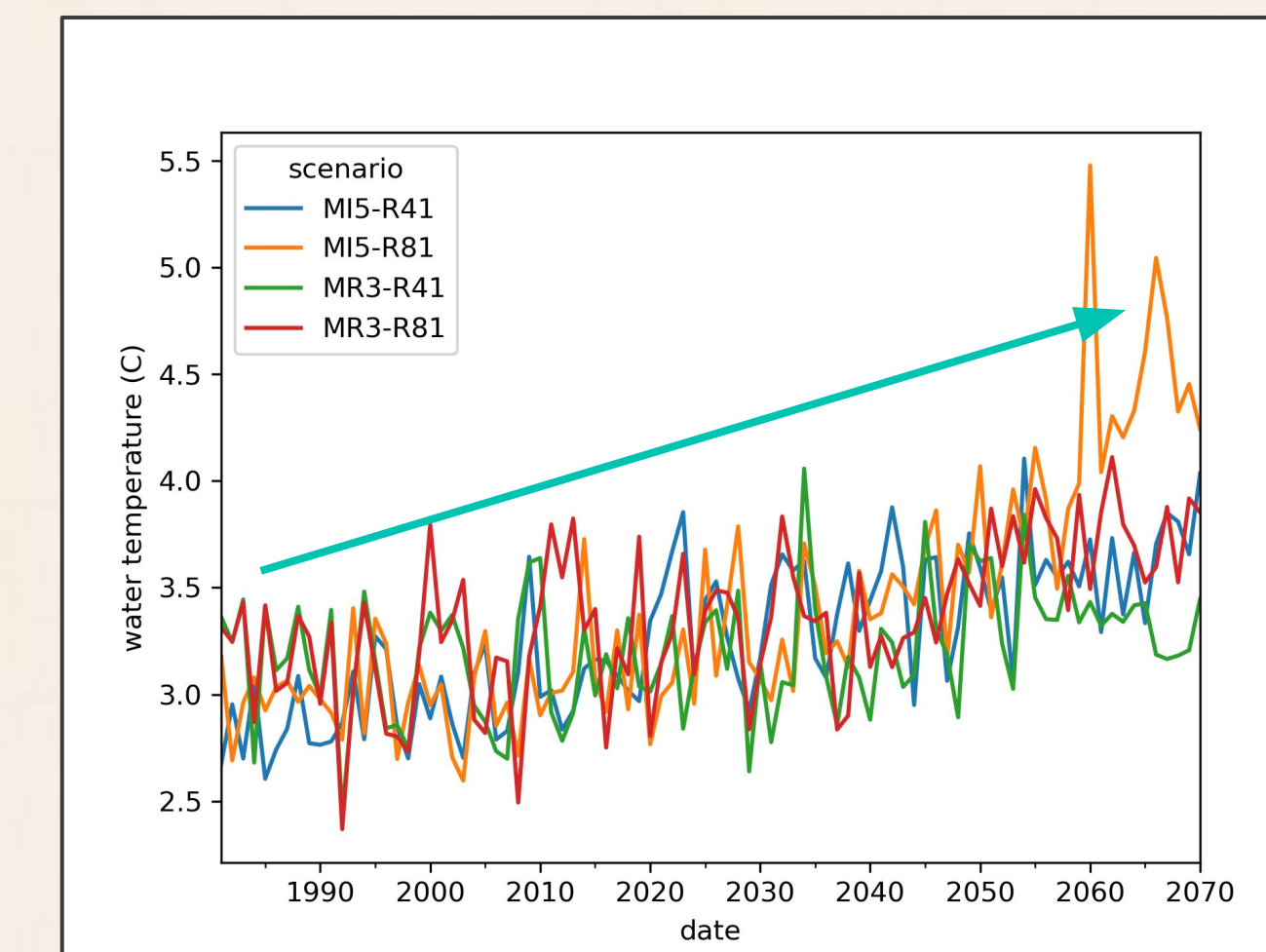


4. Future Projections

We see an Arctic wide warming trend in the river runoff from the A-HYPE model, across all scenarios.

Climate scenarios

MRI3	MIROC5
RCP4.5	RCP4.5
RCP8.5	RCP8.5



Annual average temperature of Arctic river runoff for the climate scenarios

Conclusion

5. Conclusions

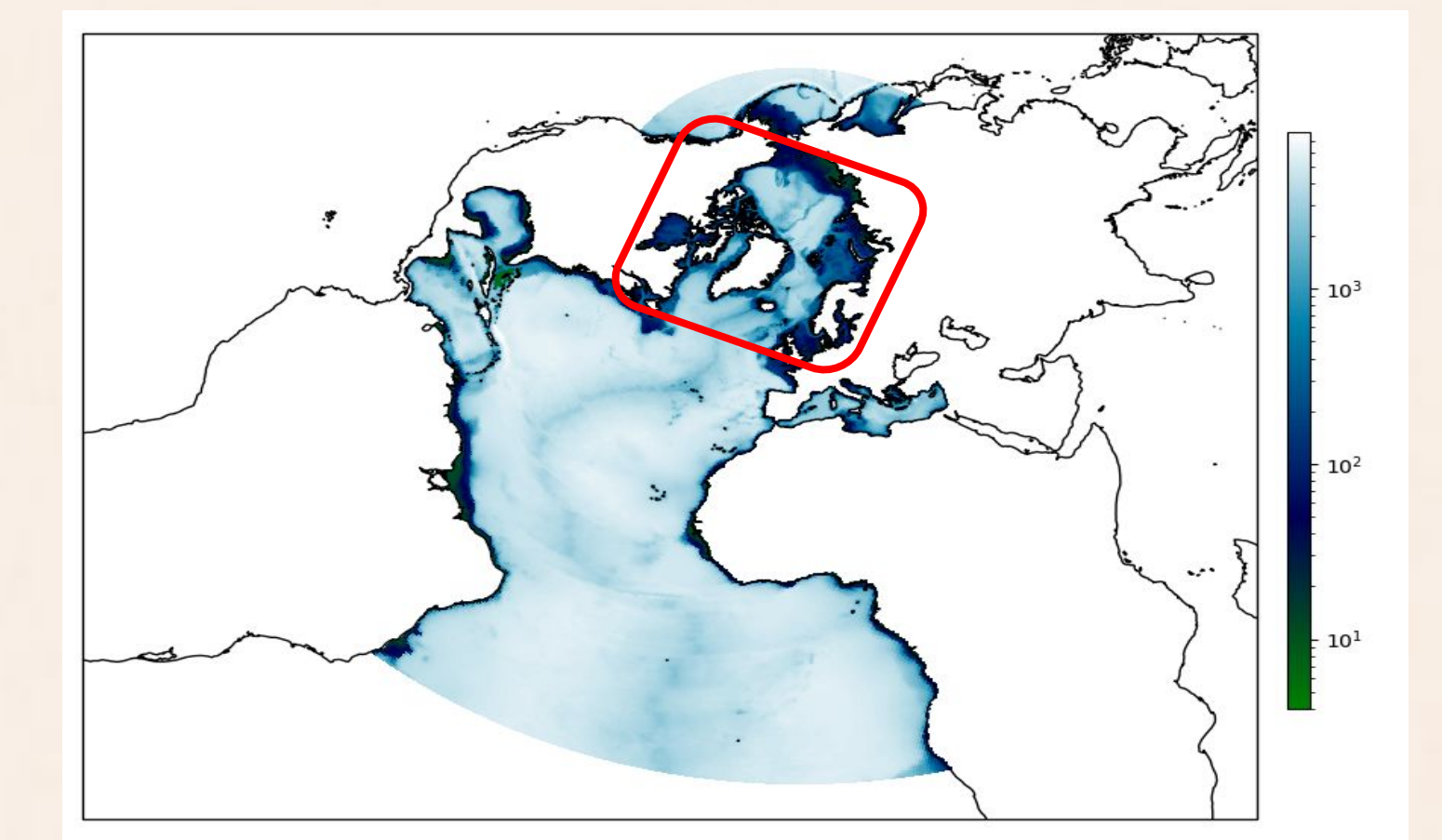
River runoff can be a significant source of heat to the Arctic Ocean, which is often neglected in ocean models.

This can have an affect on sea ice patterns and transport throughout the Arctic Ocean.

Runoff temperatures are expected to increase with future climate change, which is shown across multiple different climate scenarios.

6. Future Work

- Run a suite of ocean model simulations to understand future changes, using the runoff scenarios produced with A-HYPE
- Investigate runoff propagation in a higher resolution simulation



New regional configuration with extended boundary in the North Pacific, with planned high resolution nest highlighted