Sensitivity of Arctic Ocean Model Simulations to River Runoff and Temperature Forcing From Hydrological Models

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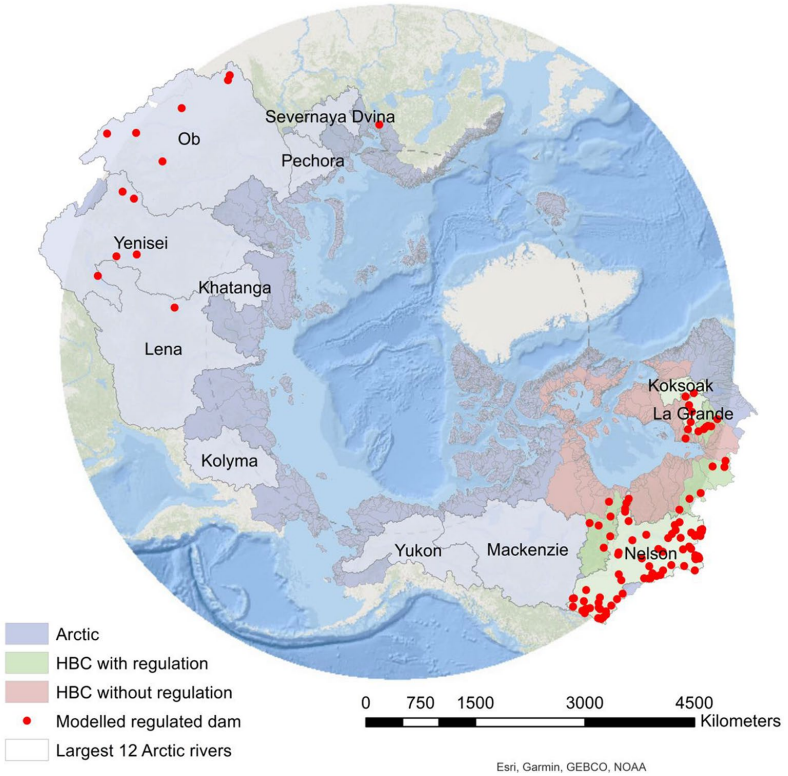
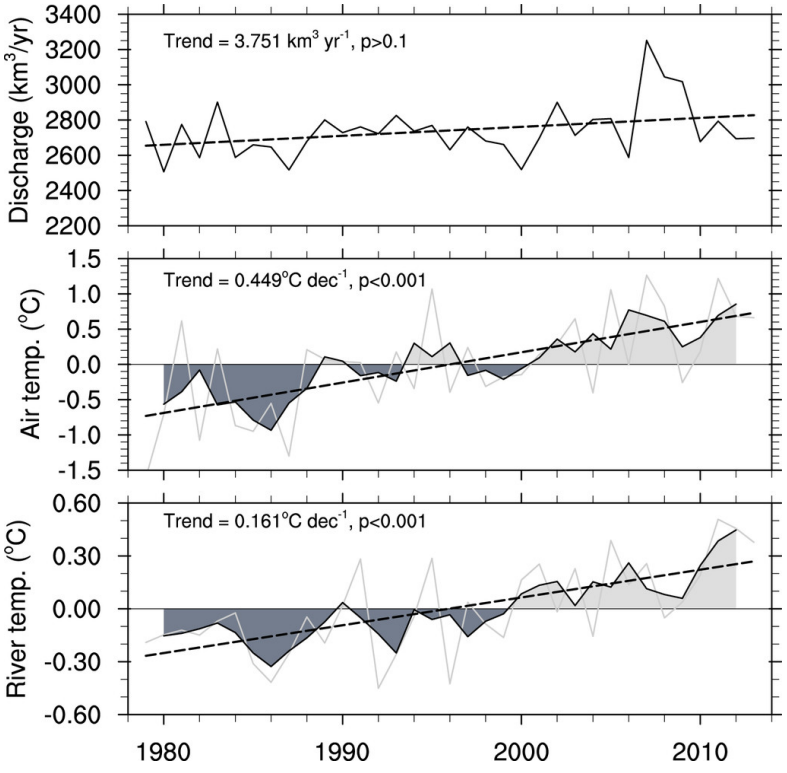
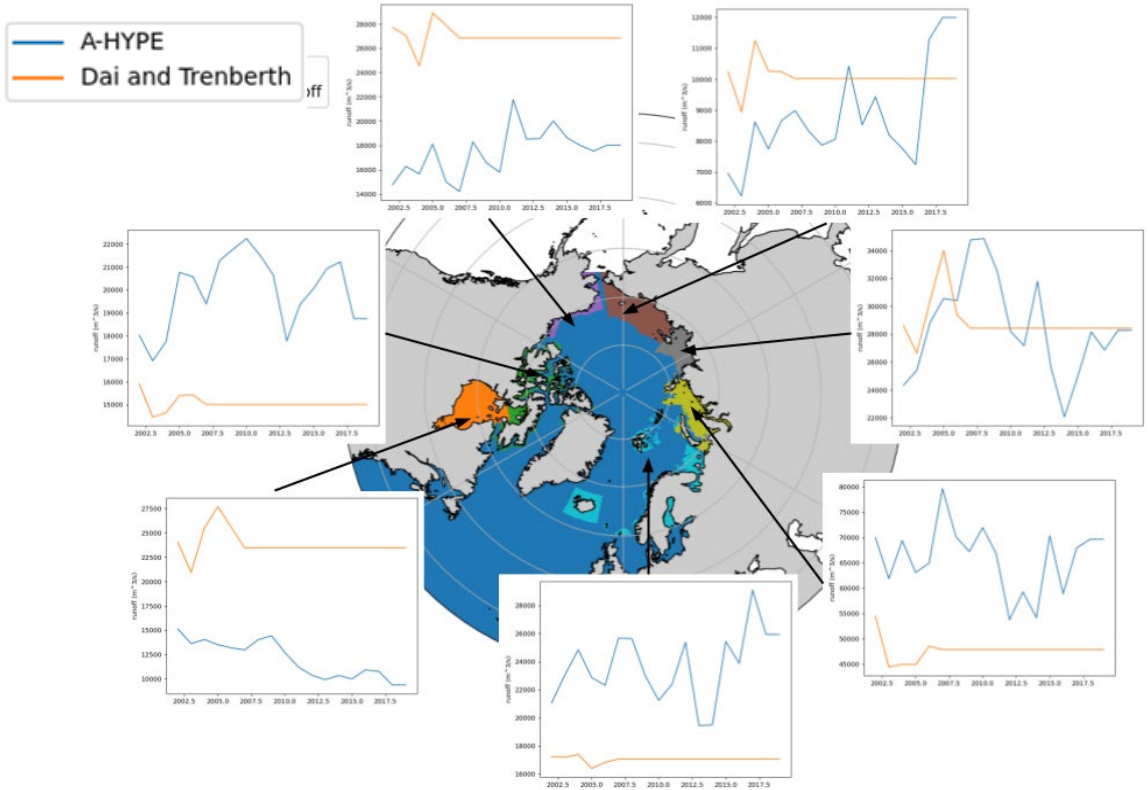
River runoff is an important source of freshwater in the Arctic Ocean



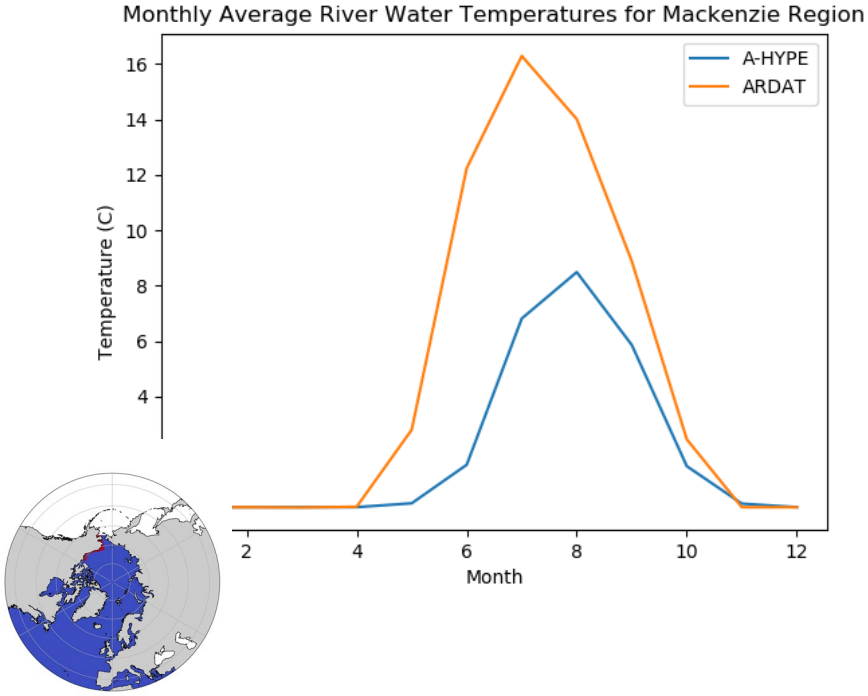


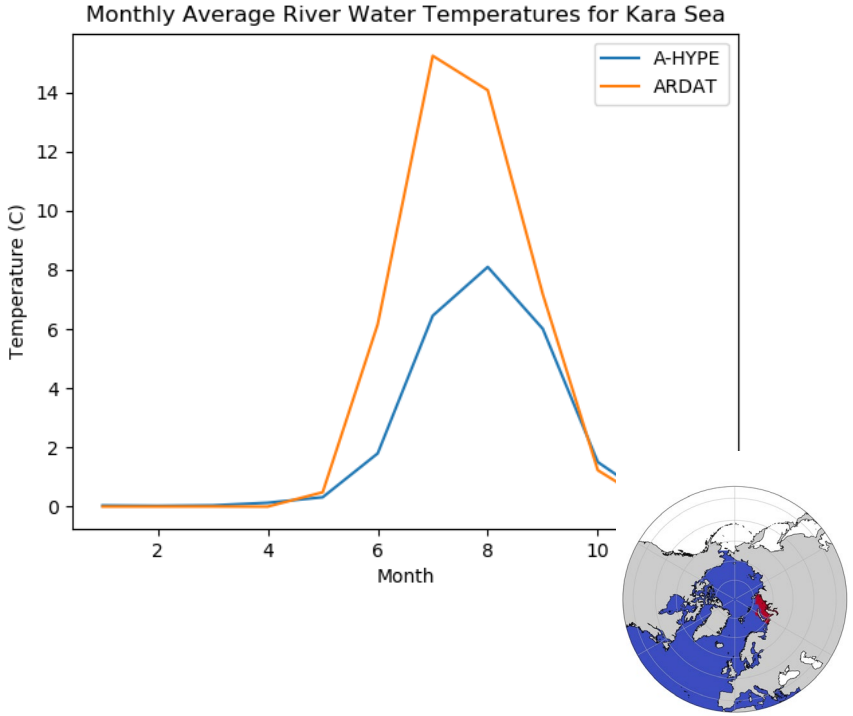
How are we able to represent the effects of rising river water temperatures in ocean model simulations?

Using Hydrological Models!

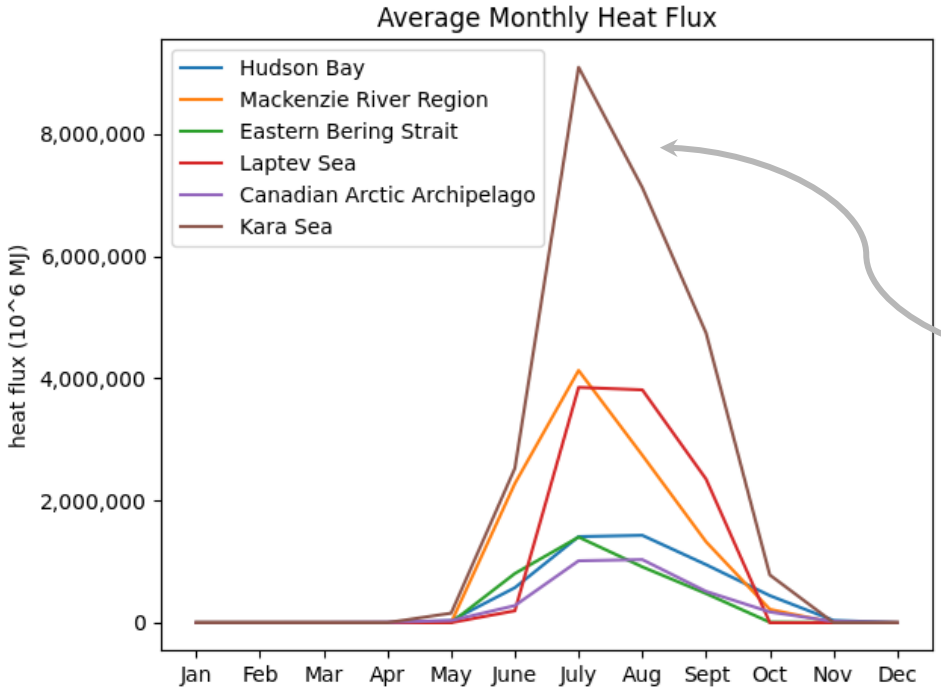


A-Hype Water Temperatures match observed seasonal cycle, though tend cooler





Large Heat Flux into the Arctic, Especially from the High Volume River Complexes



Largest heat flux from the Kara Sea region, as it has the highest volume of freshwater inflow

Ocean Model Description

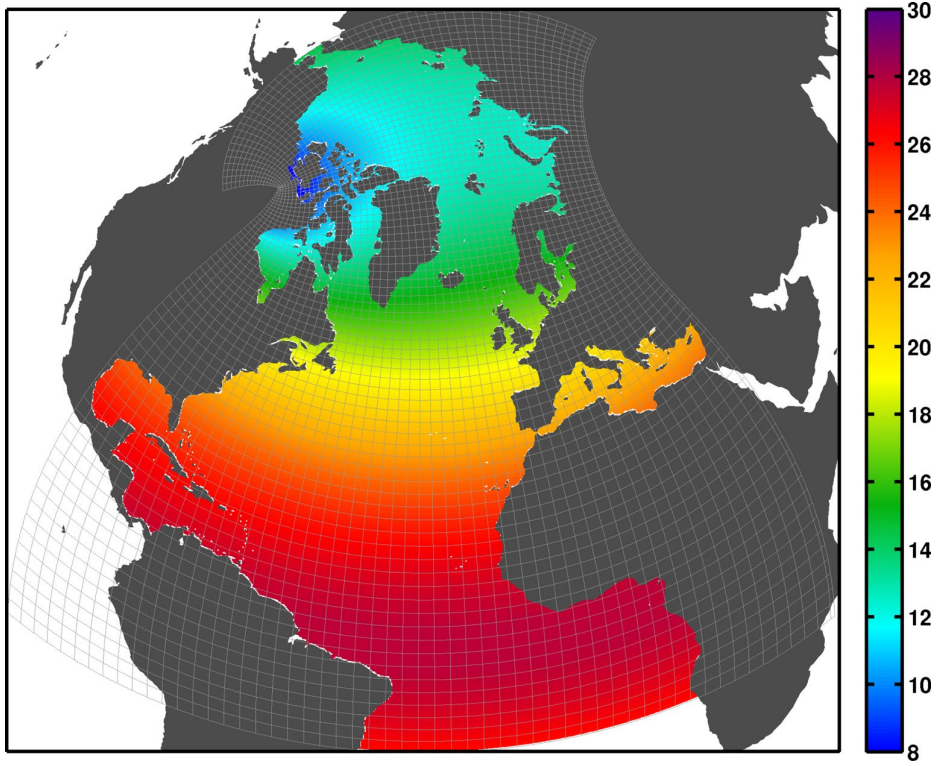
NEMO V3.6 at ¼ degree resolution

LIM2 and LIM3 Sea Ice Modules

CGRF atmospheric forcing

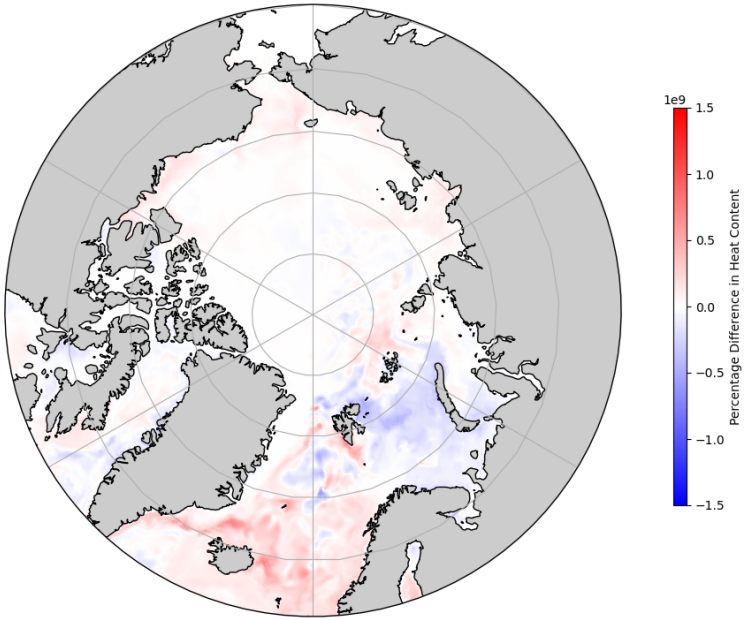
A-HYPE runoff product

Model run from 2002-2018



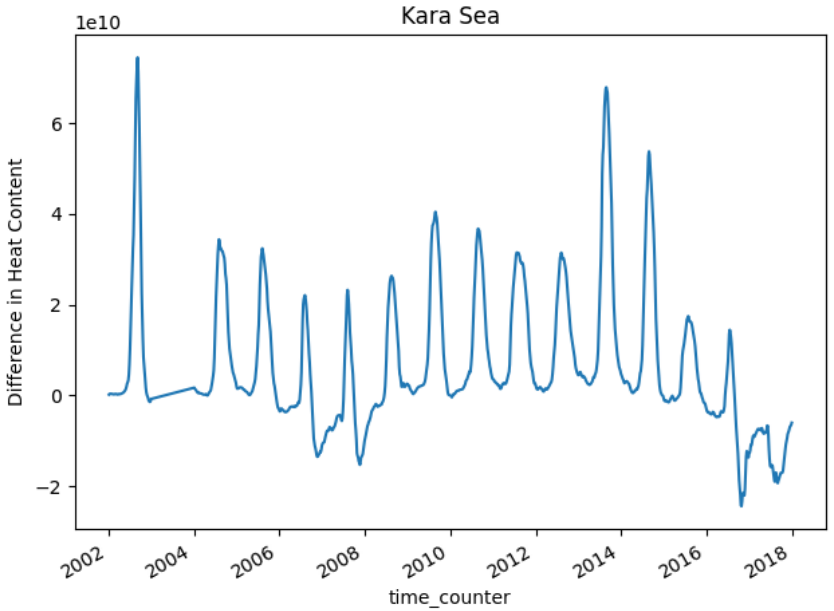
Let's look at the top surface temperature around these river mouths in our model output

impact then on the heat content for the whole ocean

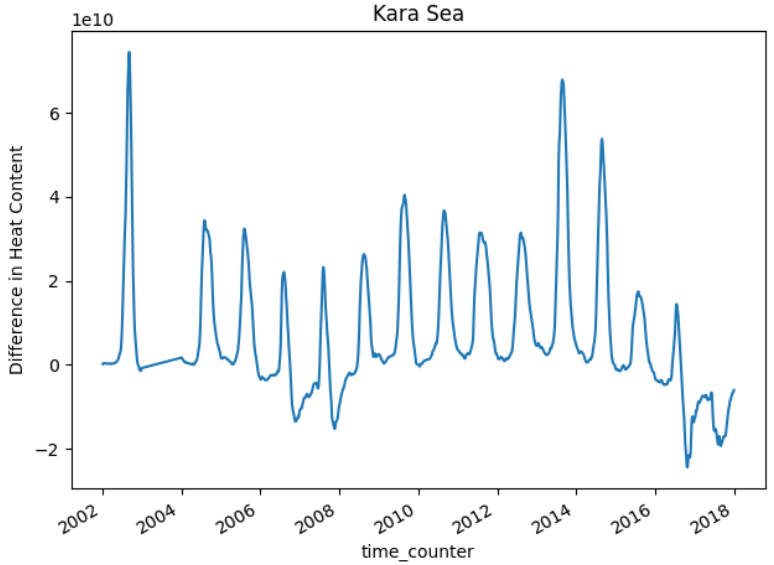


Difference in the annual average heat content over the top 100m for 2017

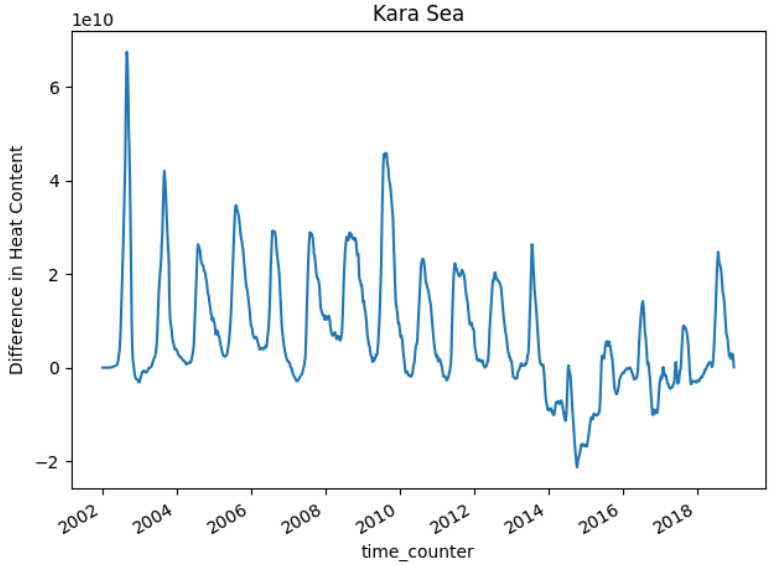
increase in the heat content in regions around the largest rivers



in these changes depending on how sea ice is represented



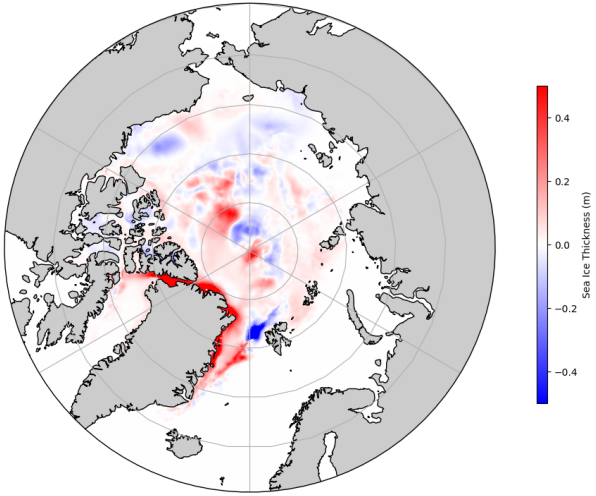
With the LIM2 sea ice module



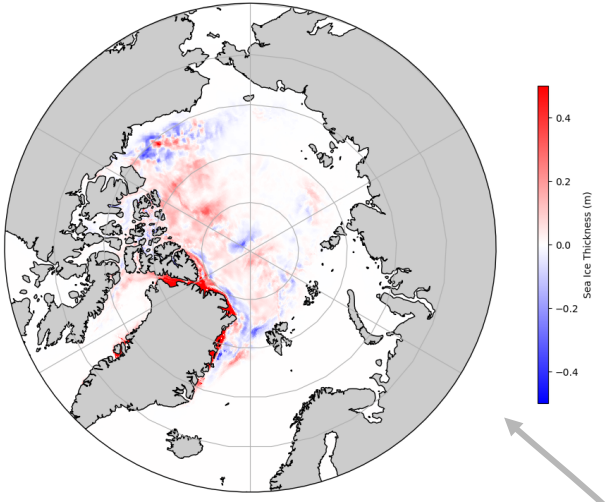
And similarly with LIM3

So what do these heat content changes mean for sea ice?

sea ice thickness between the pairs of model runs



Both for fall 2016, using the LIM2 sea ice module



And again with the LIM3 sea ice module

Conclusions

- River runoff can be a significant coastal heat source in the Arctic Ocean, but it is generally not represented in ocean models
- Using hydrological model output, we can include these water temperature affects
- It seems to consistently affect the heat content in coastal regions
- This likely has further affects on sea ice, especially when considering different sea ice representations