



On the Formation Mechanisms of Nares Strait Ice Arches

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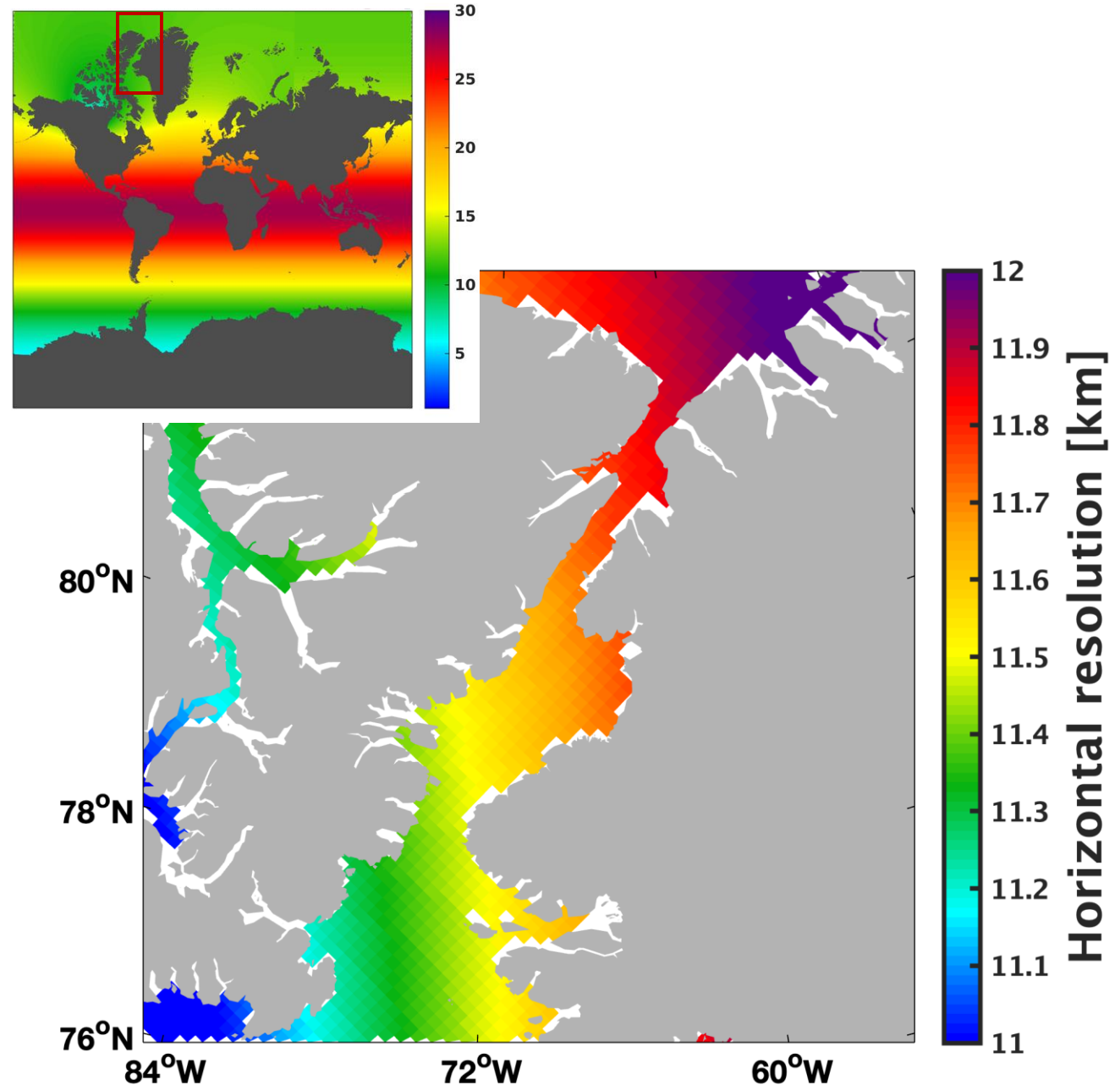
Nares Strait is one of the main pathways connecting the Arctic Ocean to the North Atlantic.



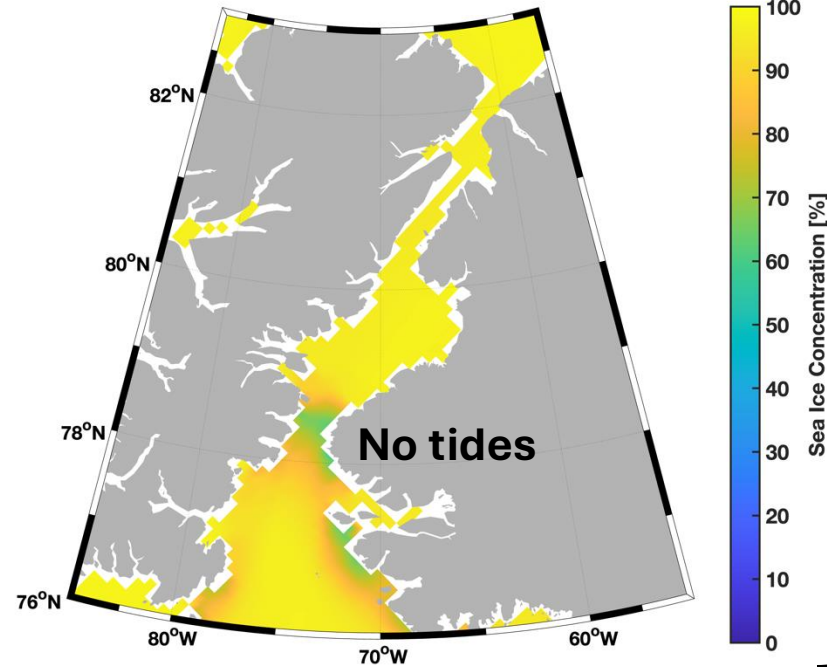
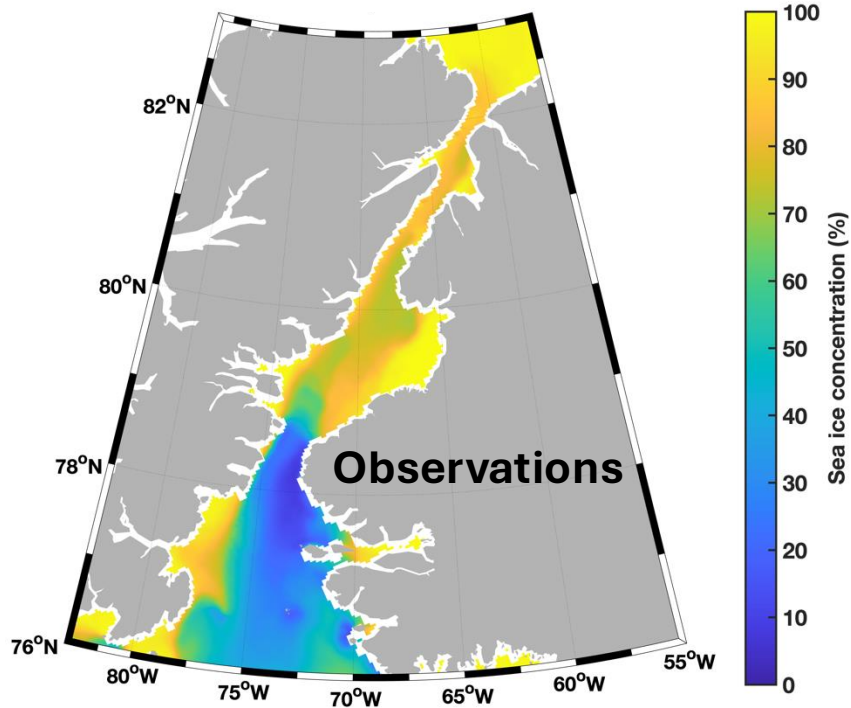
Model and Experiments

eORCA025: a global configuration

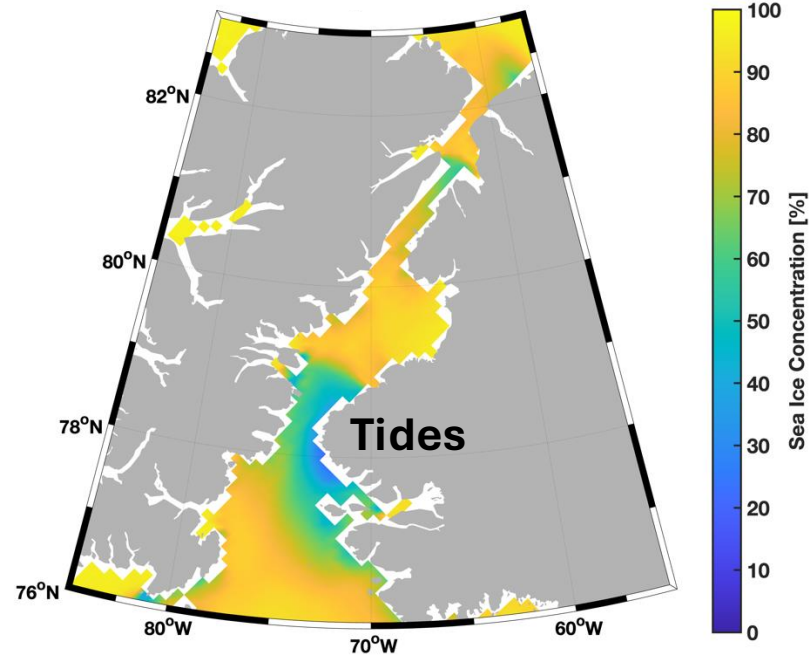
- * NEMO v3.6
- * LIM3 [sea ice]
- * 50 vertical levels
- * Horizontal resolution: $1/4^\circ$
- * 5-day average output (2002-2019) * River runoff: Dai et al. (2009)
- * Greenland (melt - Bamber et al., 2012) and Antarctic icebergs
- * ERA5 [atmospheric forcing]
- * GLORYS 2v4 [initial conditions]



Climatological mean for the month of May (2003-2019)

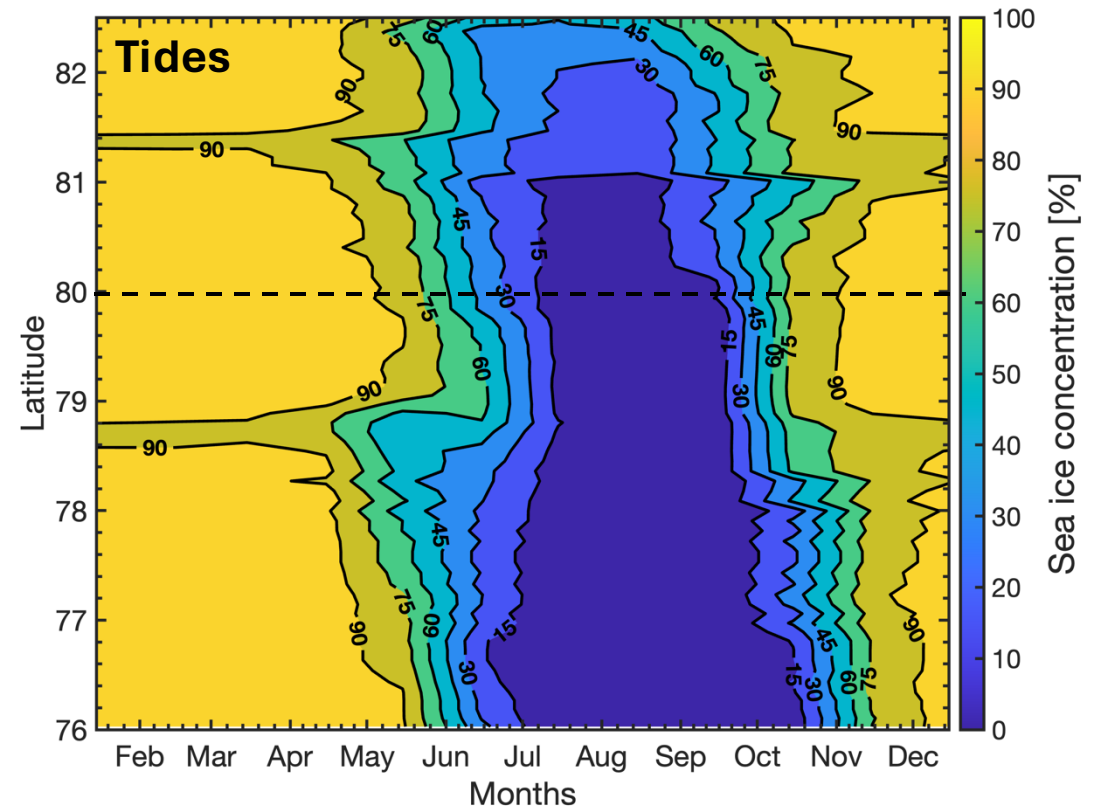
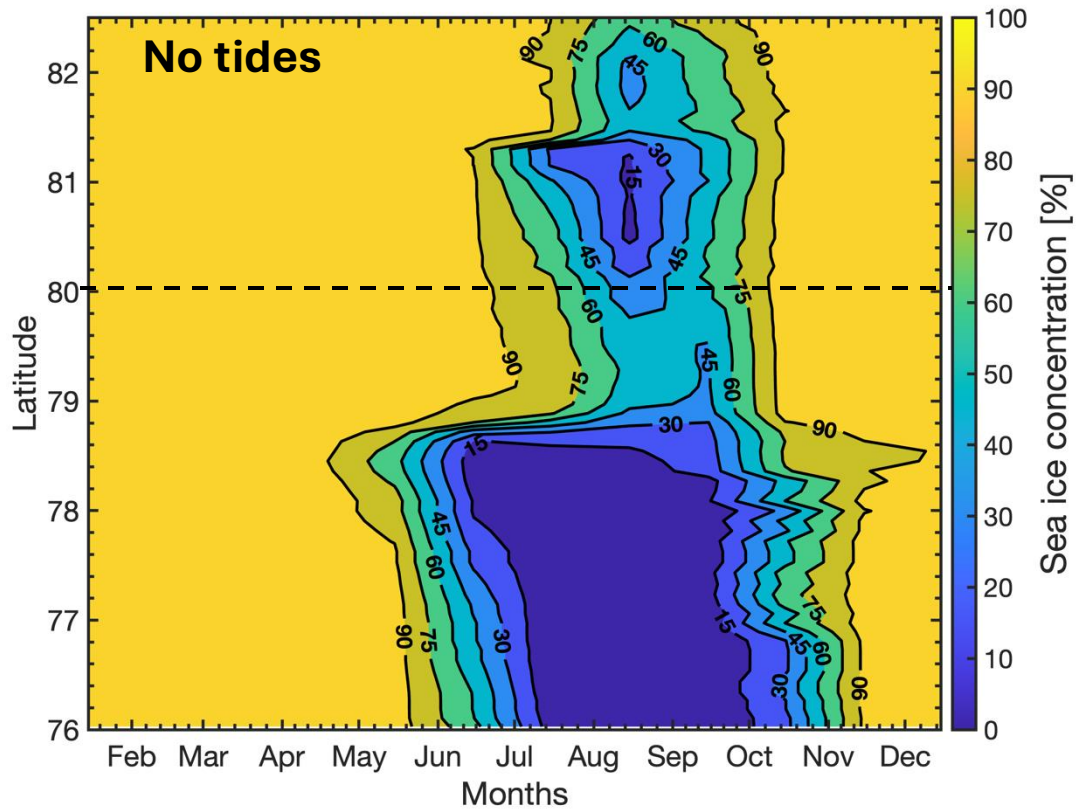


SIC remains over 60% the entire month.

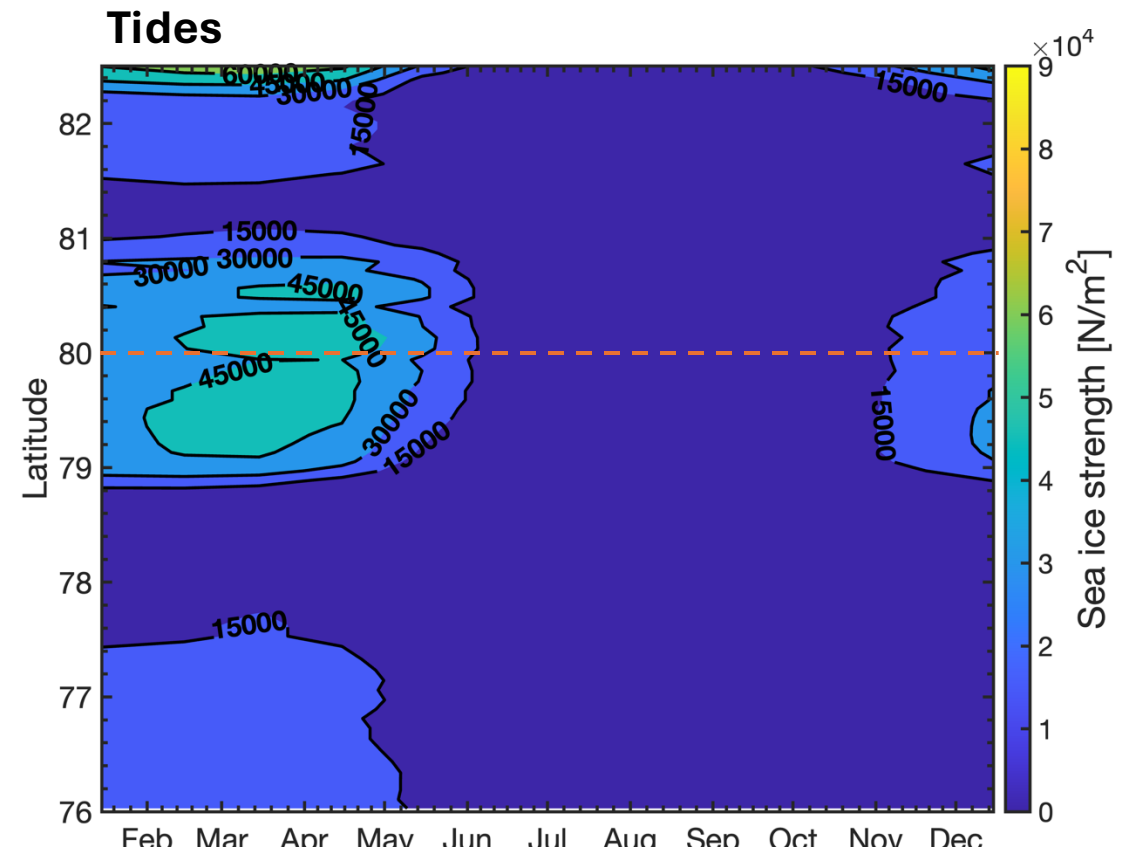
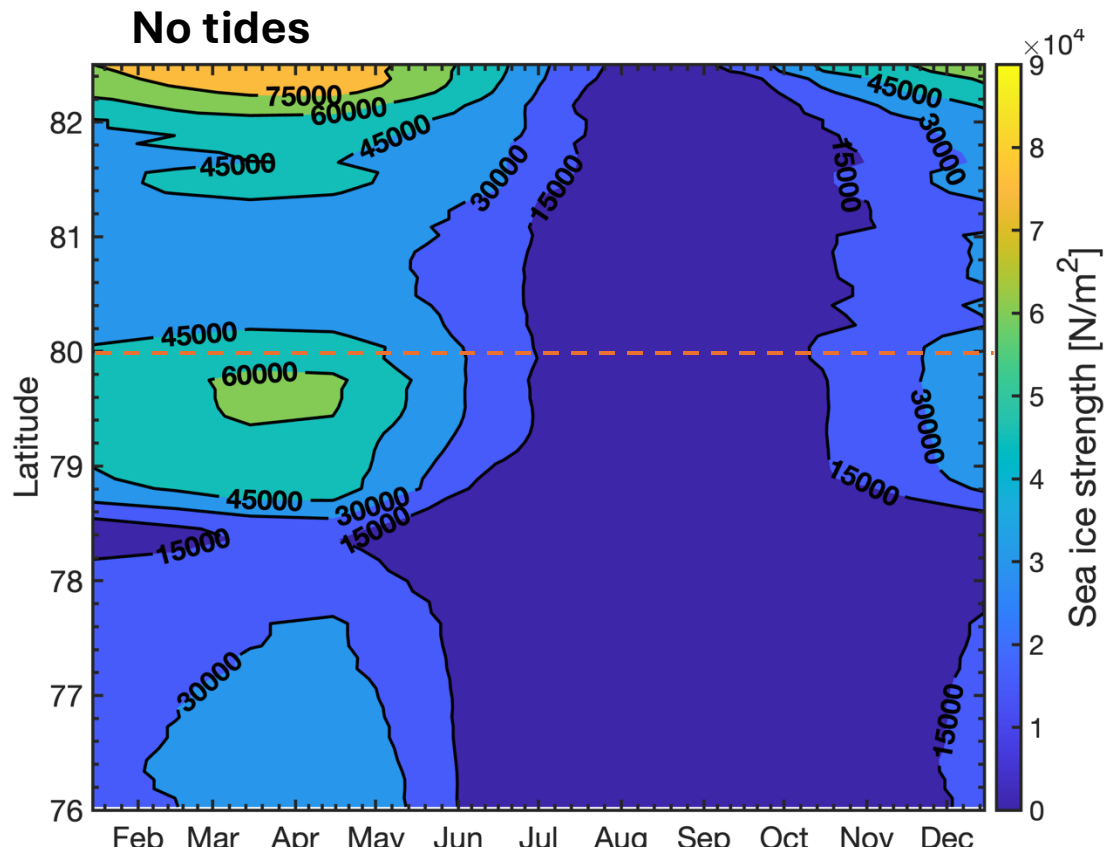


Southern arch appears to form. SIC in northern Baffin Bay larger compared to observations.

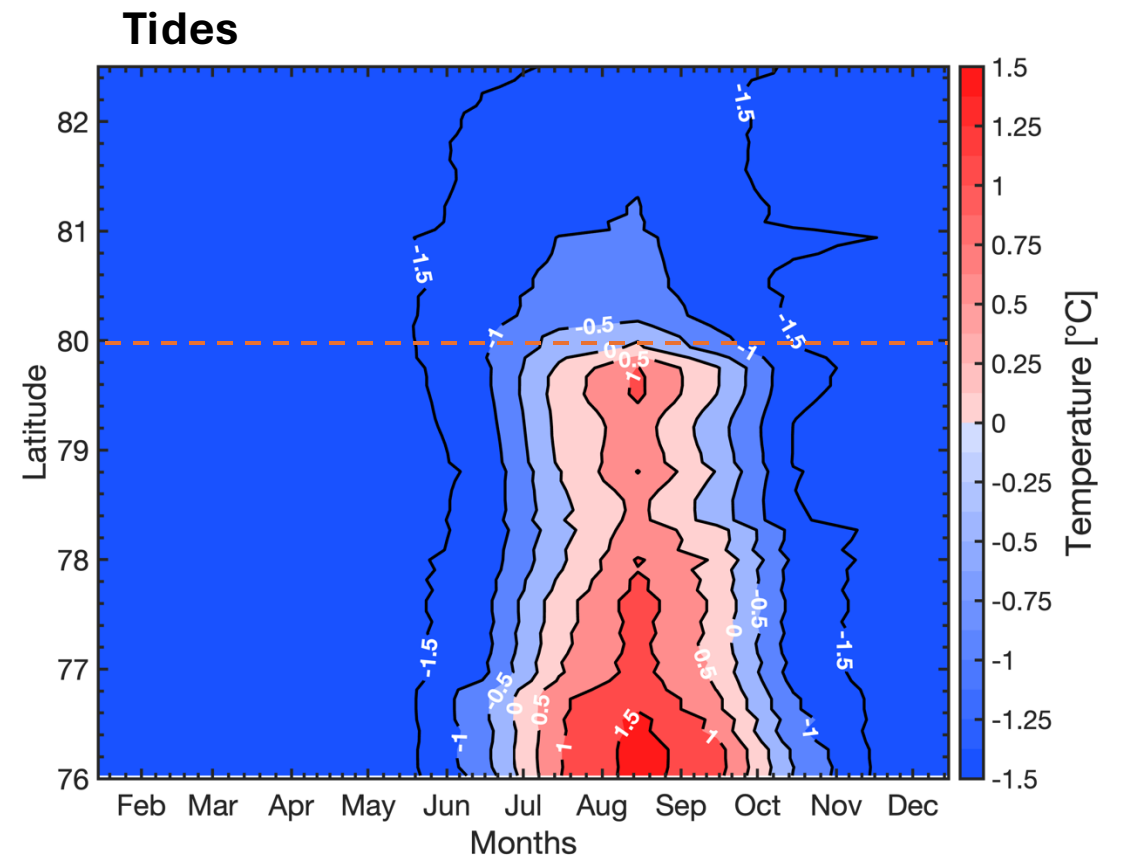
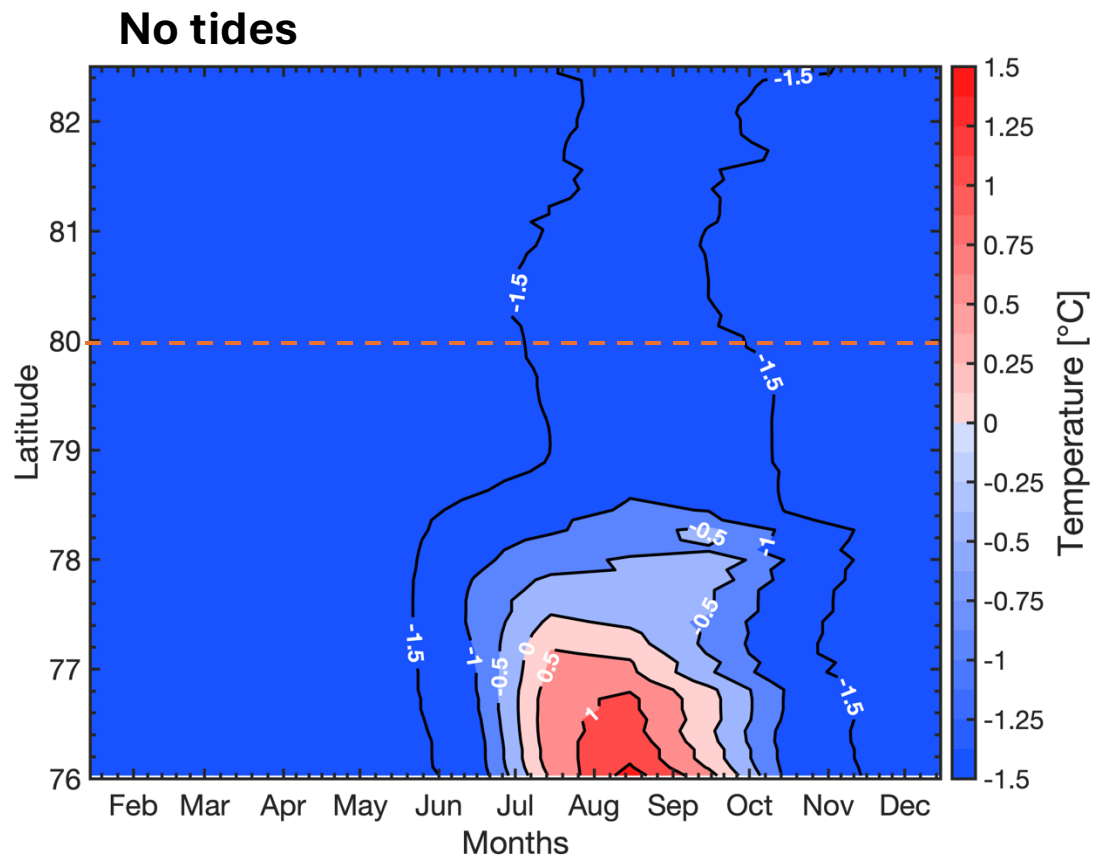
Tides appear to have a greater impact on the sea ice concentration north of Kennedy Channel



Sea ice strength decreases under the presence of tides, with the greater impact occurring north of Kennedy Channel.



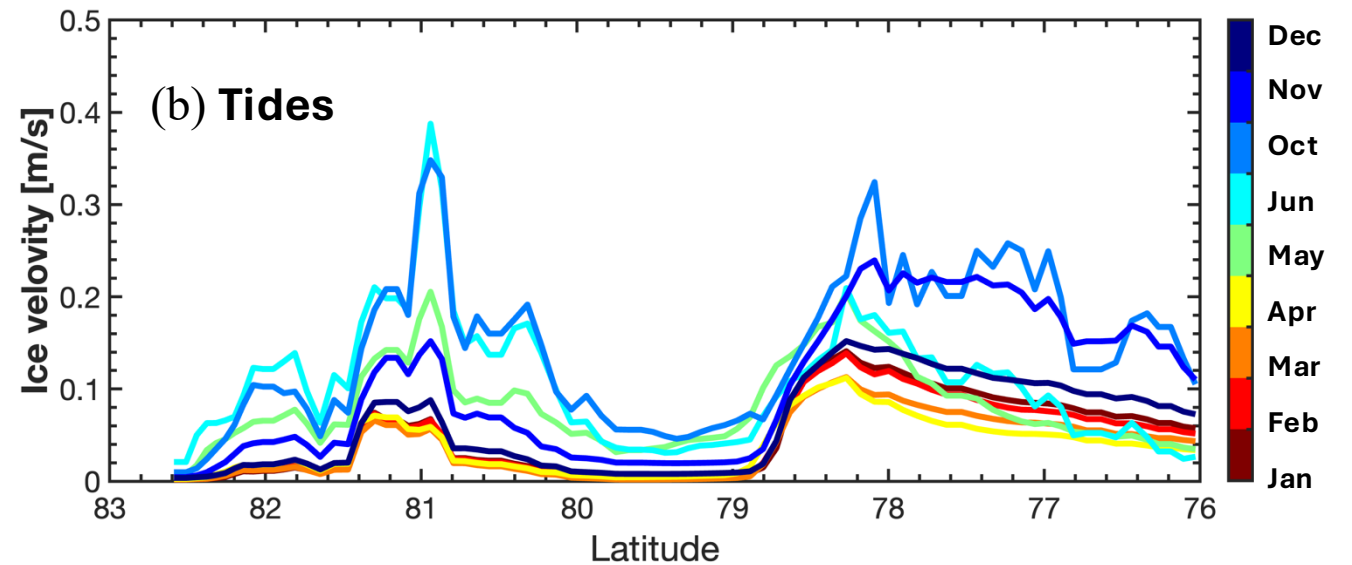
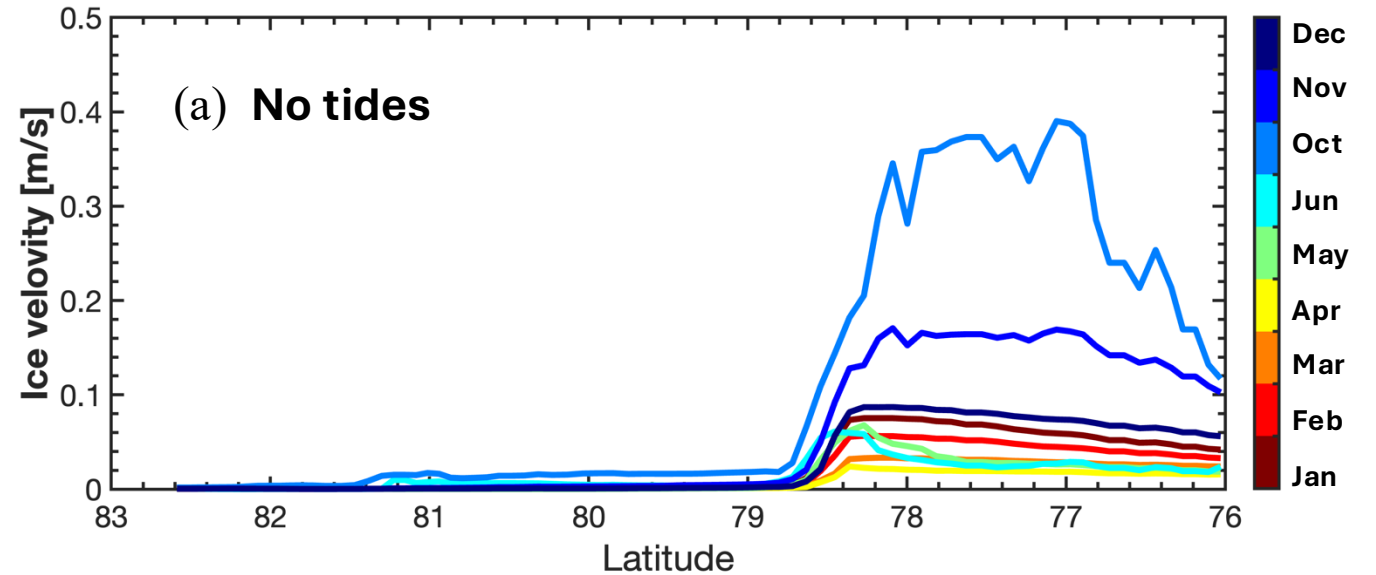
Upper 50 m ocean temperatures are larger in the "Tides" experiment mostly from June to October.



Tides play a crucial role in the timing of the arch formation

In the **absence of tides** (a) the southern arch **consolidates** as early as **November**.

When **tides are present** (b) the southern arch **consolidates** between **February and March**



Conclusions

1. The presence of tides has a greater negative impact on sea ice concentration, thickness and strength mostly north of Kennedy Channel.
2. Ocean surface temperatures in the presence of tides are larger south of Kennedy Channel, mostly from June to October.
3. Within Kane Basin, vertical tidal mixing is potentially playing a role in the upwelling of warm Atlantic origin water.
4. North of Kennedy Channel the mechanical effect of tides is potentially more relevant compared to tidal mixing.
5. The presence of tides delays the southern arch formation by up to five months.