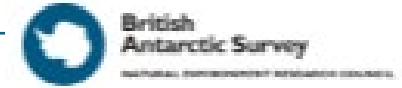




# OCEAN:ICE



Ocean-Cryosphere Exchange in Antarctica: Impacts on Climate and the Earth System

# Geometric feedback of ice shelf basal melt in the UKESM runs

Speaker: Jing Jin.

Contributions from: Tony Payne, Robin Smith, Paul Holland

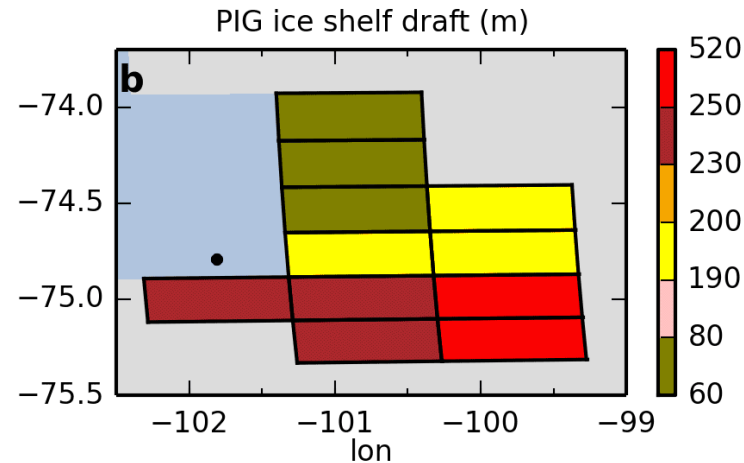
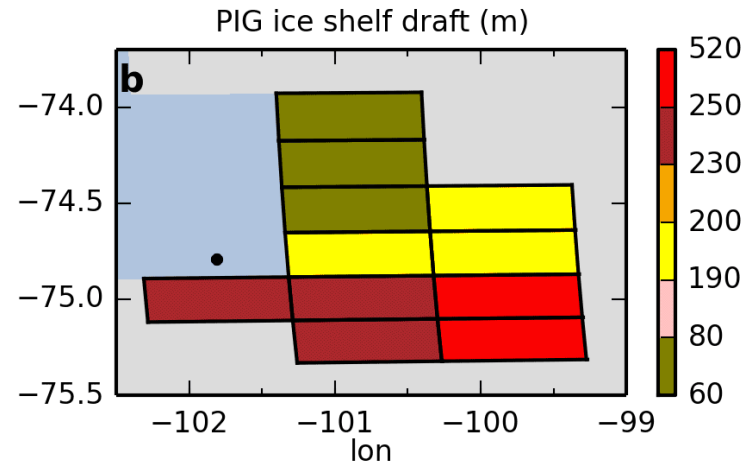
Event: OCEAN:ICE Annual Meeting

Date: 24/09/2024



OCEAN:ICE is co-funded by the European Union, Horizon Europe Funding Programme for research and innovation under grant agreement Nr. 101060452 and by UK Research and Innovation

## Smith et al. (2021)



## De Rydt and Naughten (2024)

## To assess the impact of Antarctic ice loss on the global climate

- **A run with an interactive icesheet model**
- **A run without an interactive icesheet model**
- **A run with fixed freshwater fluxes** (open ice shelf cavities but with prescribed ice shelf basal melt rate)

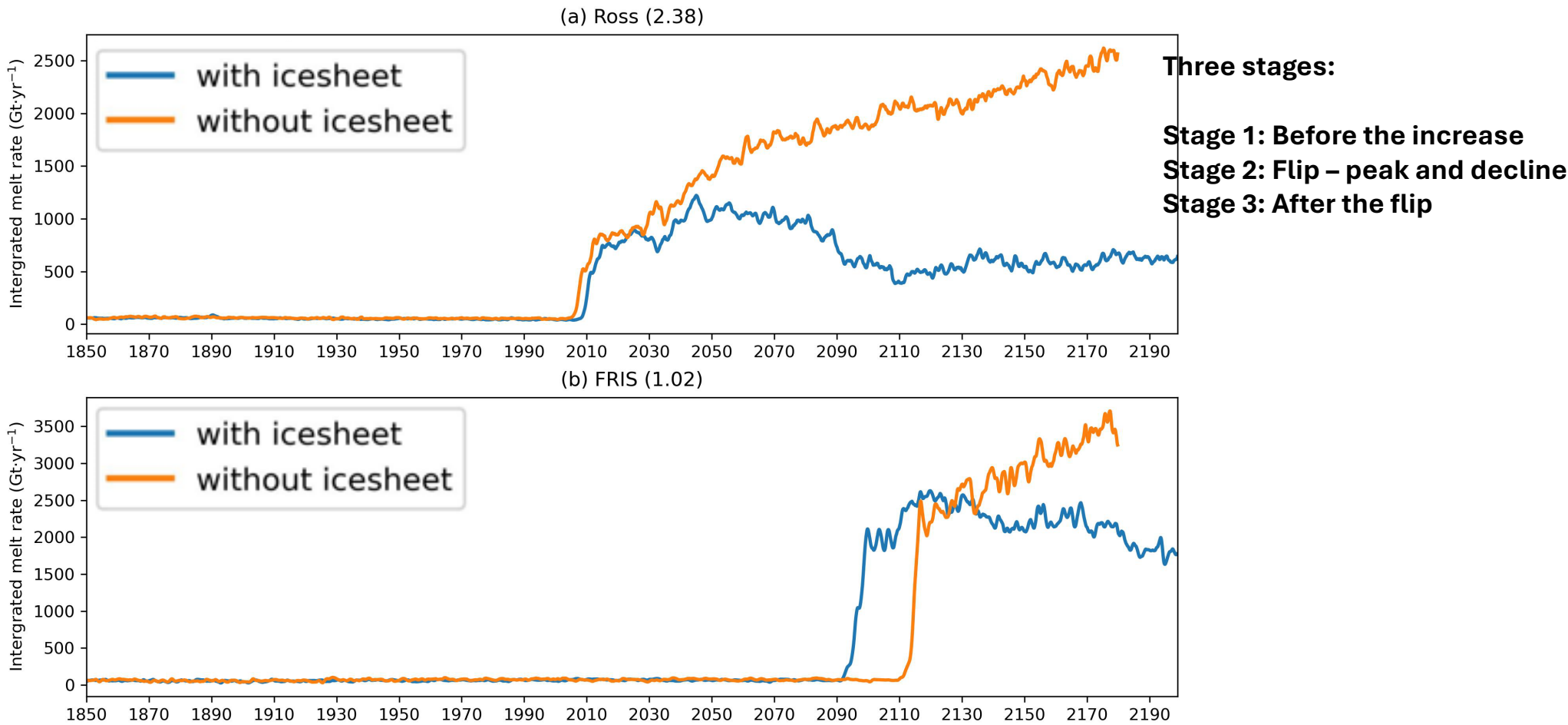
+8 Gt/yr ramp-up run

with icesheet: 1850-2200

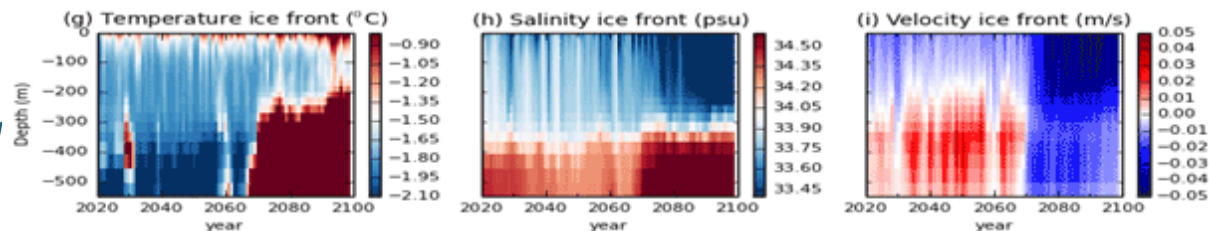
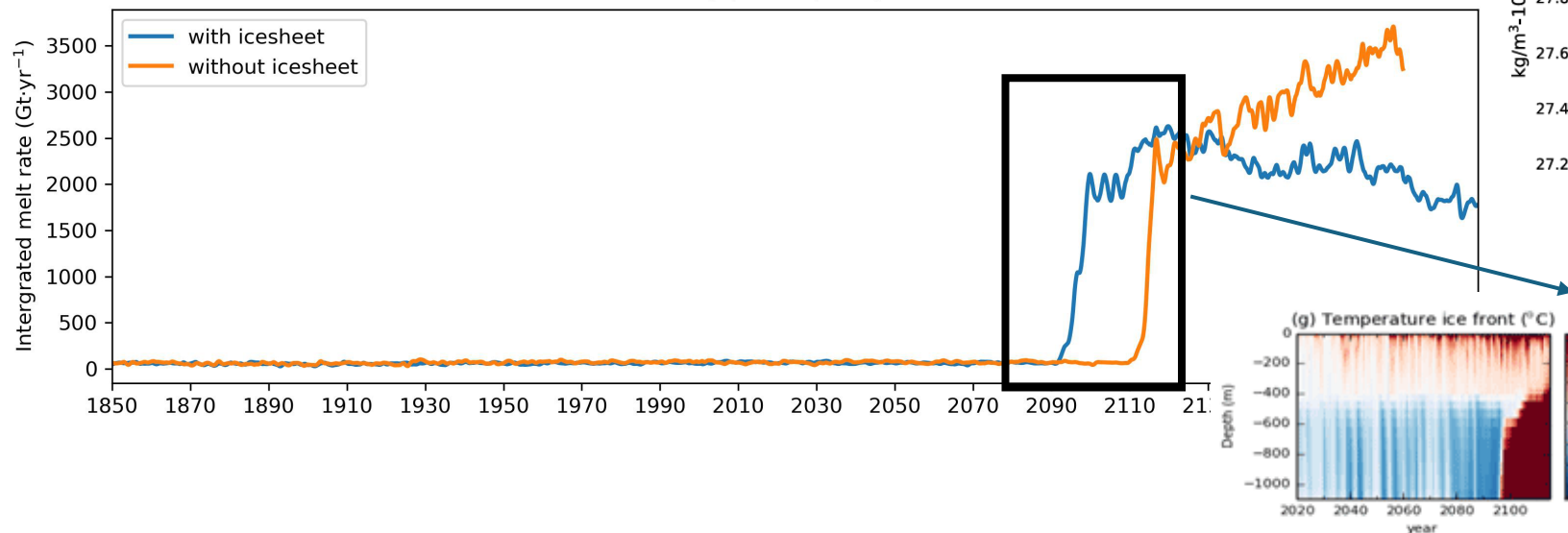
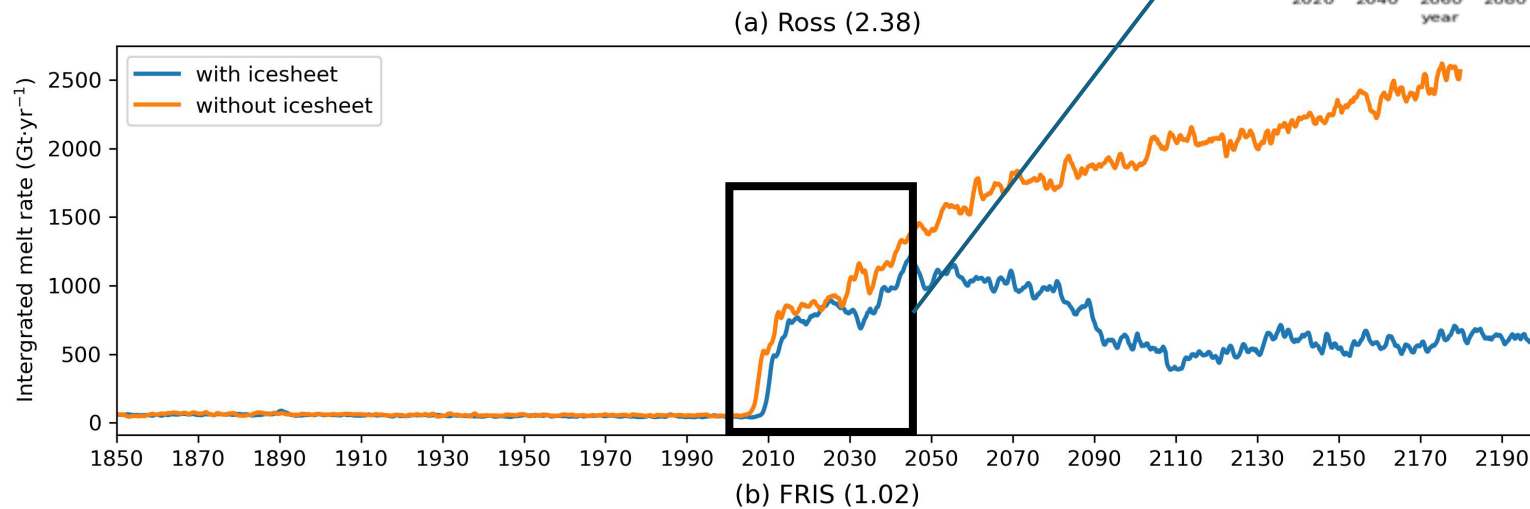
without icesheet: 1850-2180

# Comparison with and without interactive icesheet

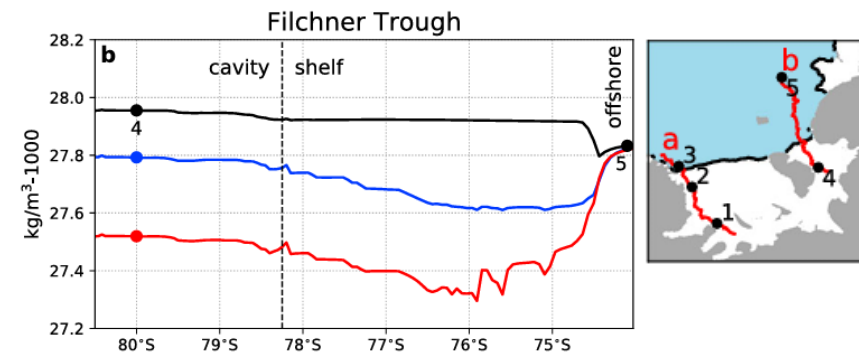
- Abrupt increase
- Different trajectories



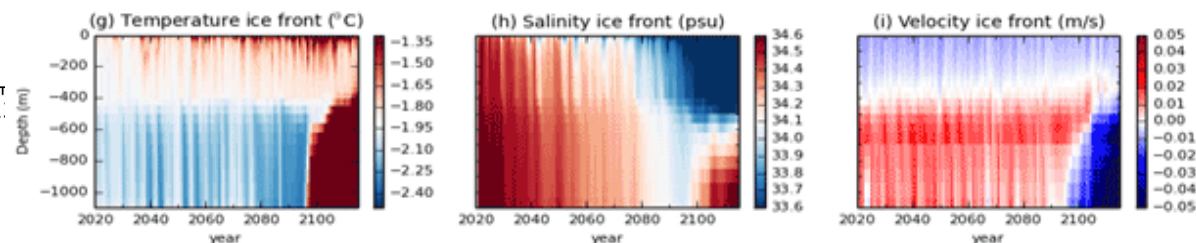
# What causes the abrupt increase in melt rate?



Siahaan et al. (2022)  
SSP5-8.5 run

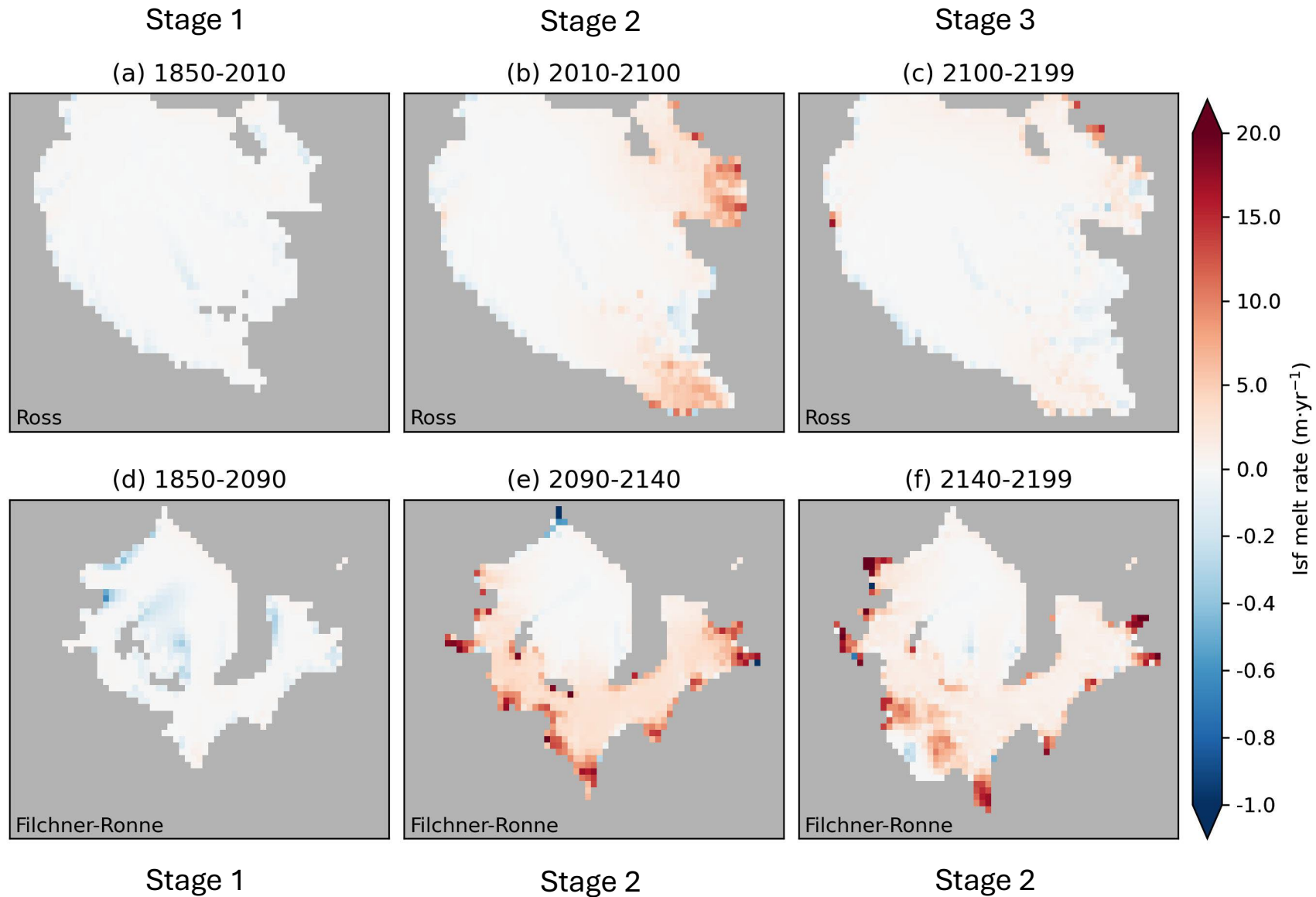


Naughten et al. (2021)



Siahaan et al. (2022)  
SSP5-8.5 run

## Melt rate – with interactive icesheet





# Barotropic stream function (BSF) – with interactive icesheet

→ inflow  
→ outflow

Stage 1

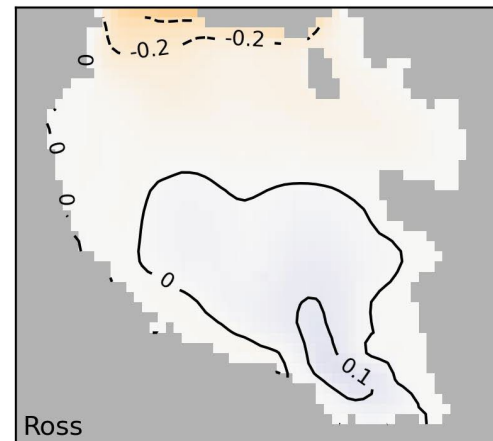
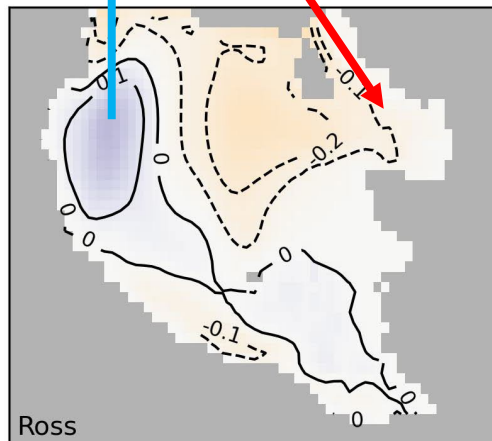
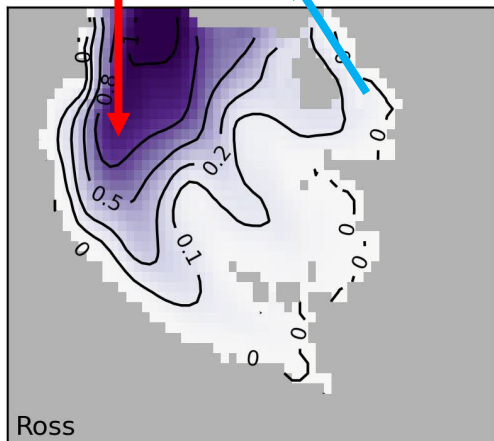
Stage 2

Stage 3

(a) 1850-2010

(b) 2010-2100

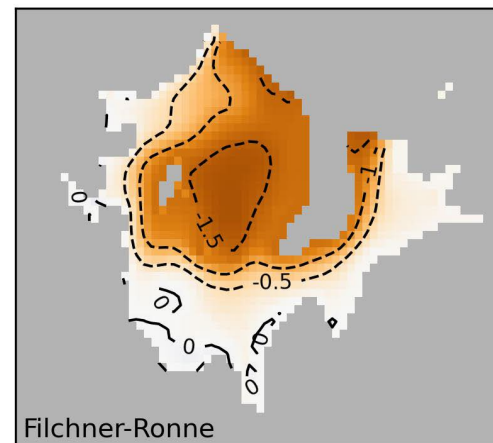
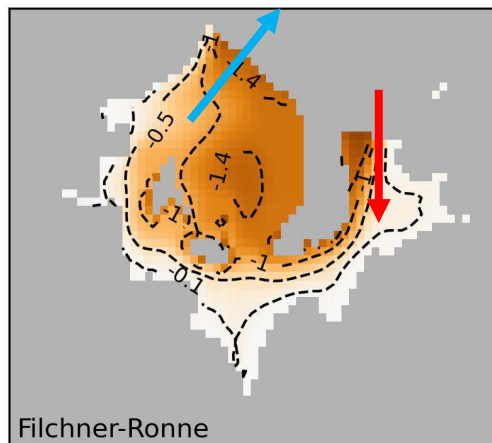
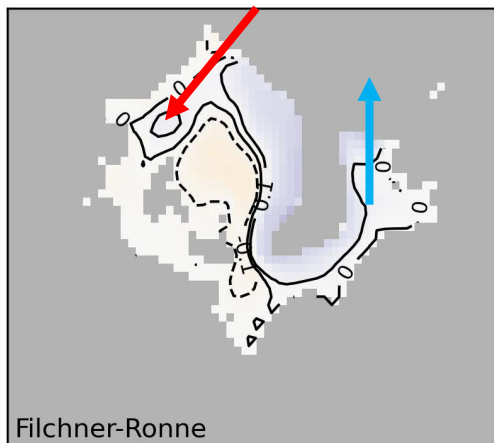
(c) 2100-2199



(d) 1850-2090

(e) 2090-2140

(f) 2140-2199

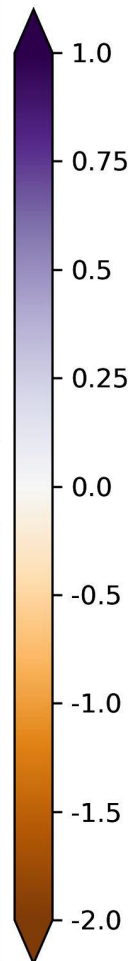


Stage 1

Stage 2

Stage 2

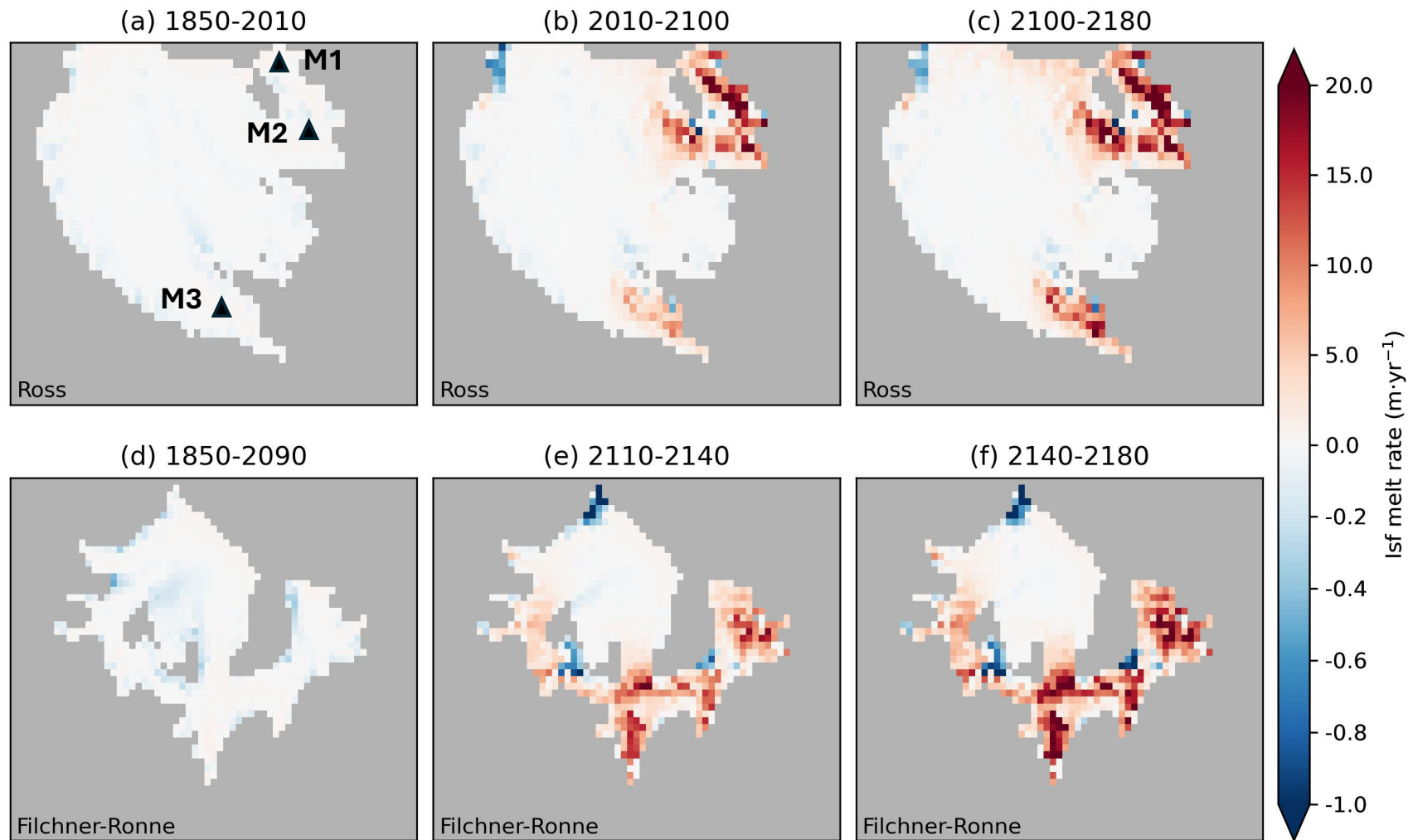
Barotropic stream function (Sv)



The positive  
- anti-clockwise

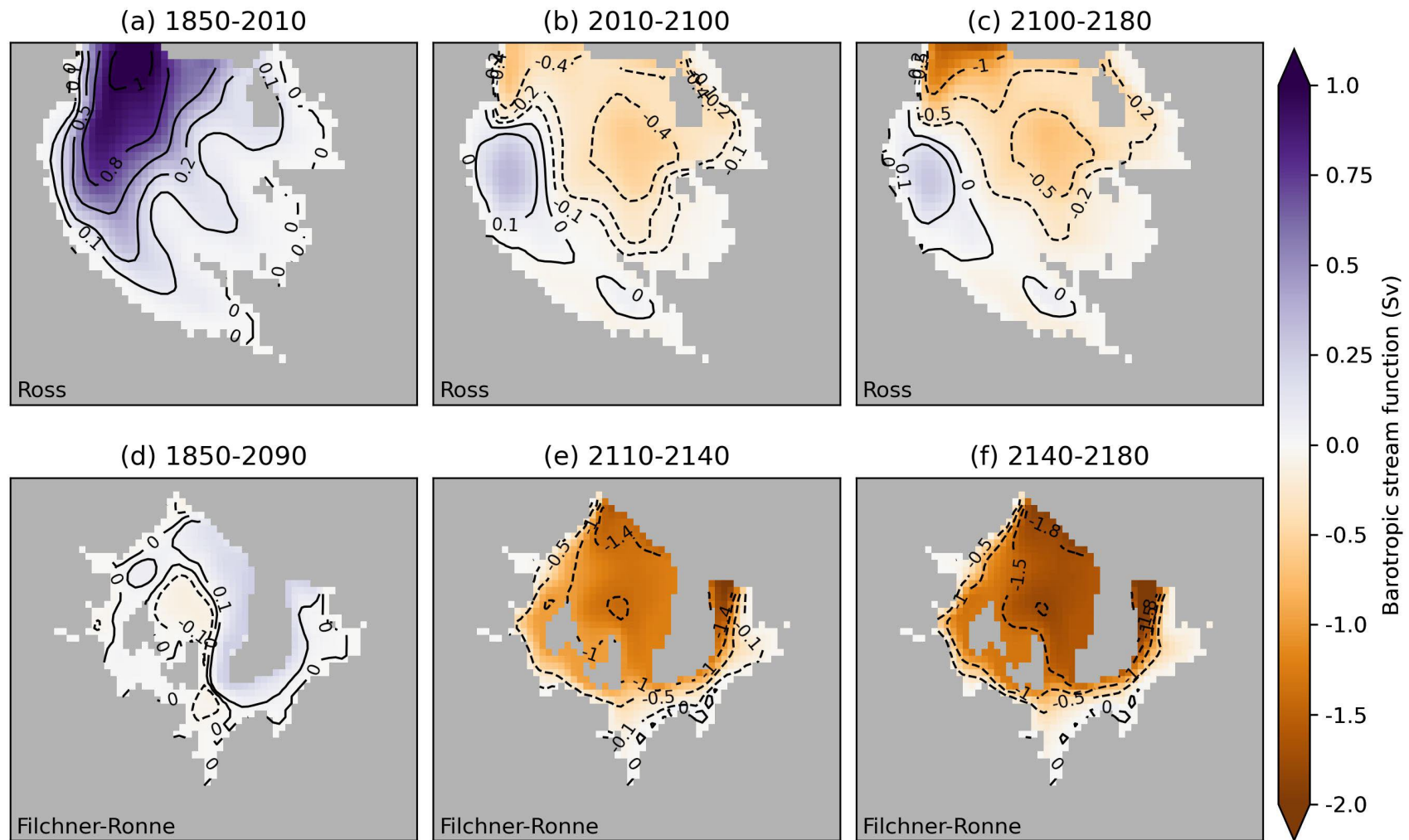
The negative  
- clockwise

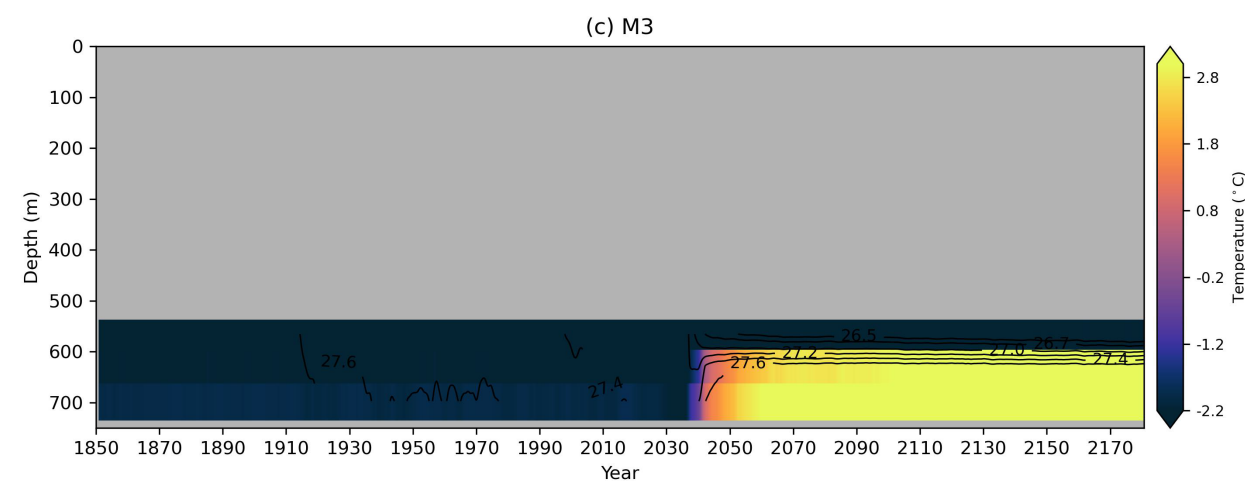
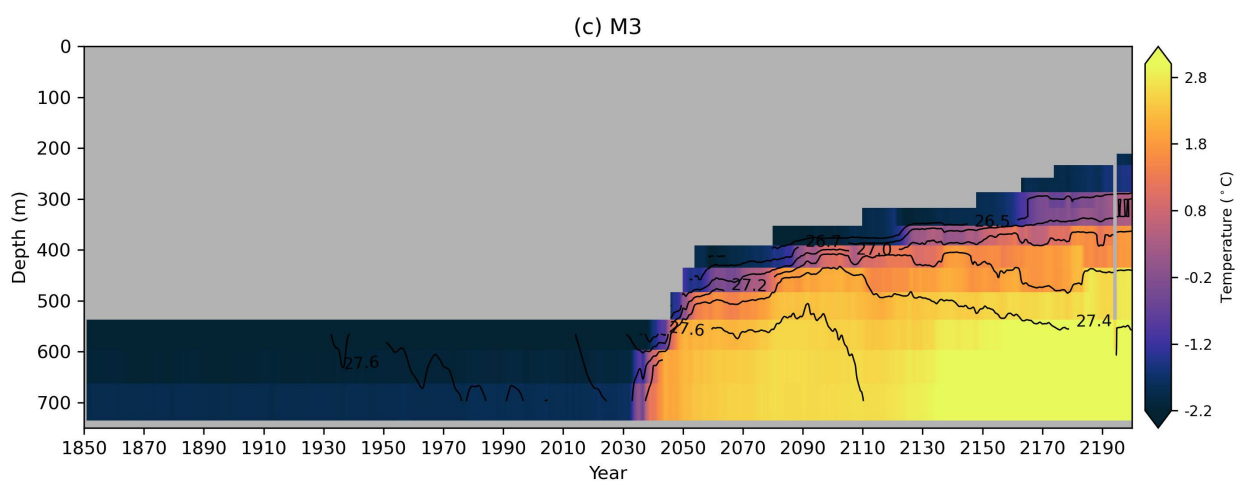
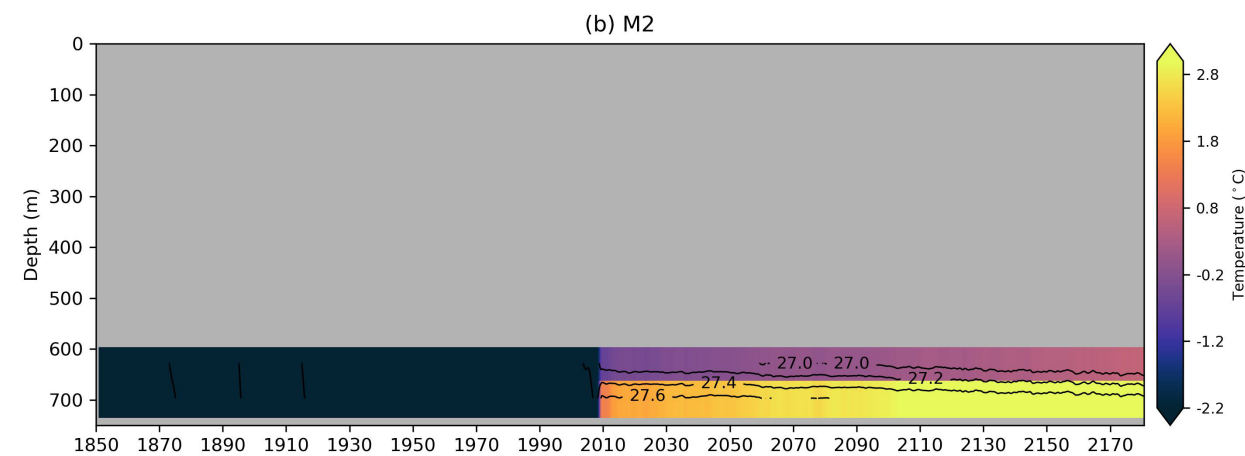
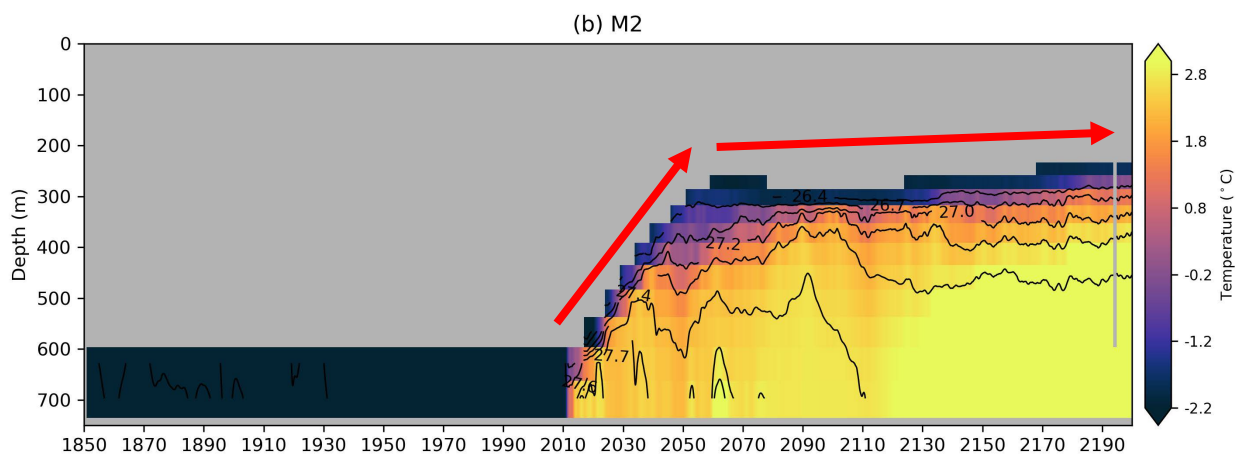
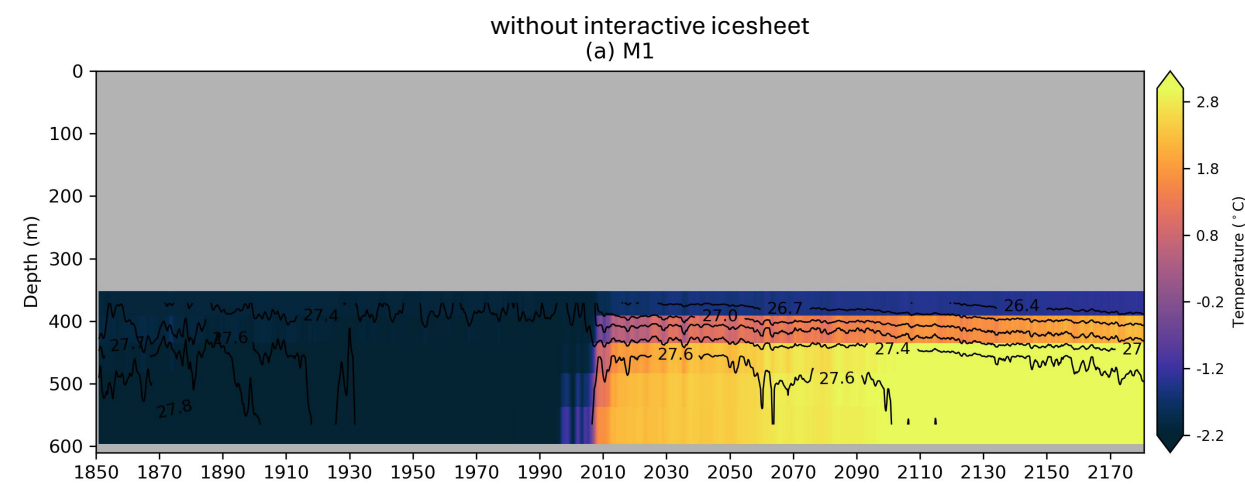
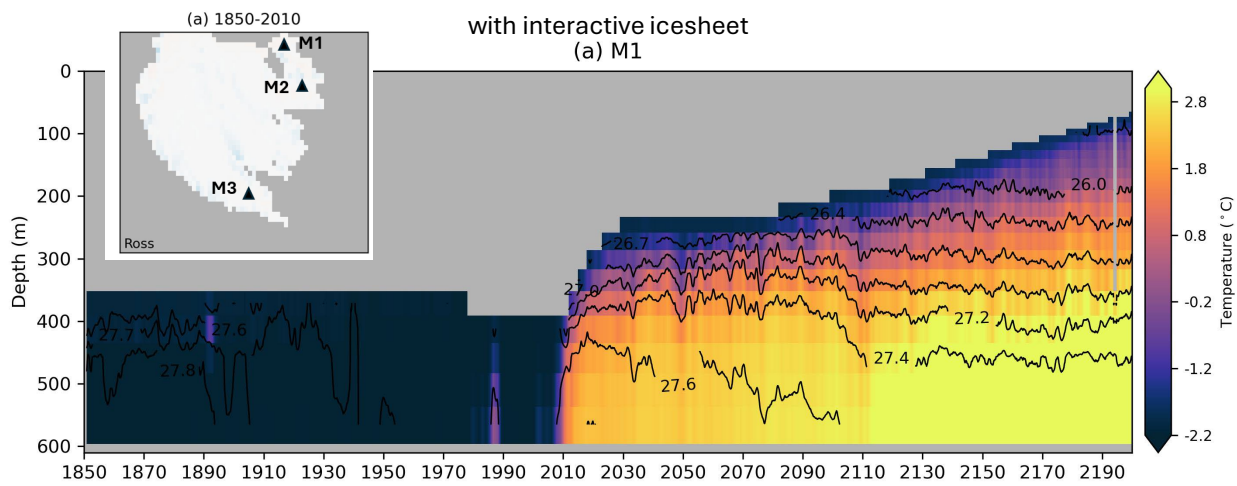
## Melt rate – without interactive icesheet





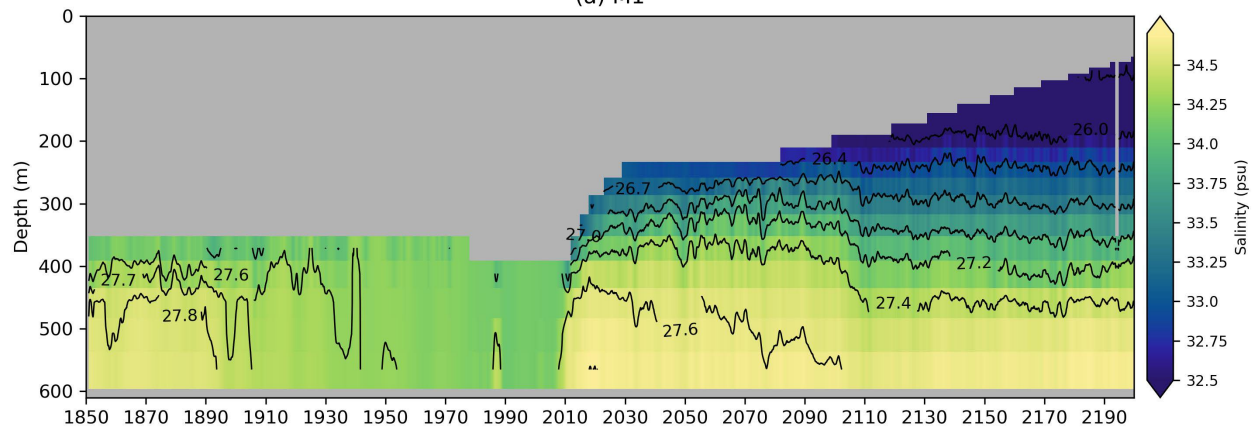
## Barotropic stream function (BSF) – without interactive icesheet



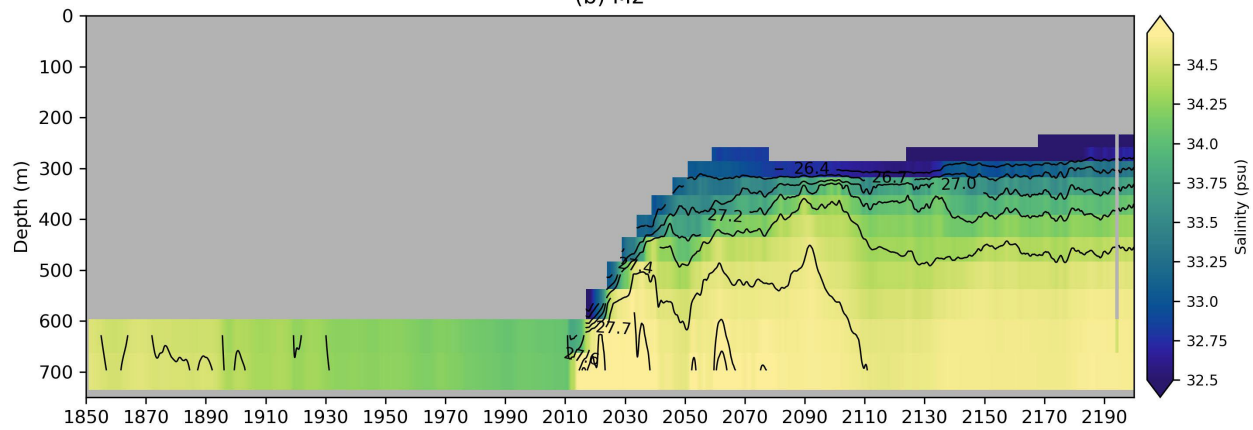


with interactive icesheet

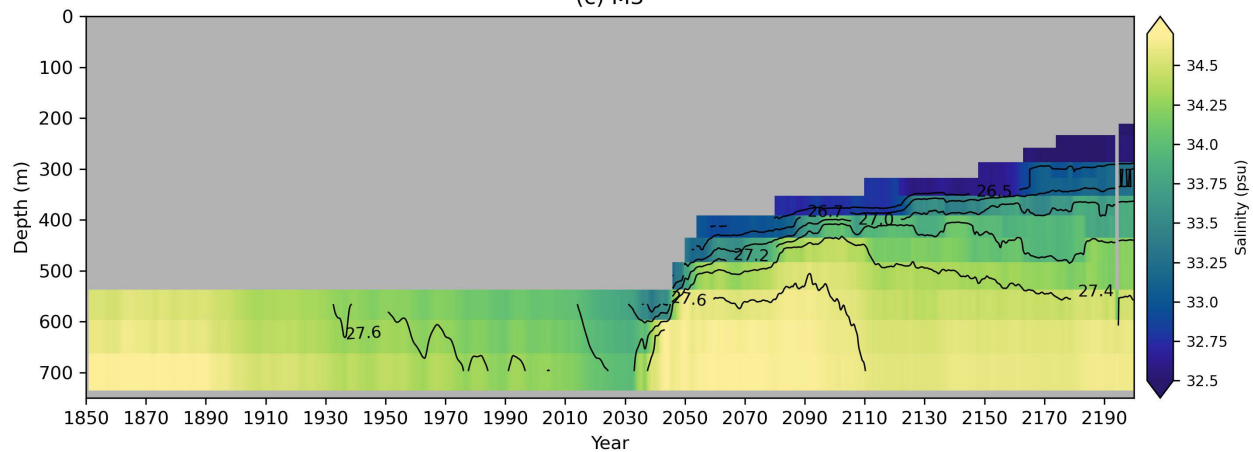
(a) M1



(b) M2

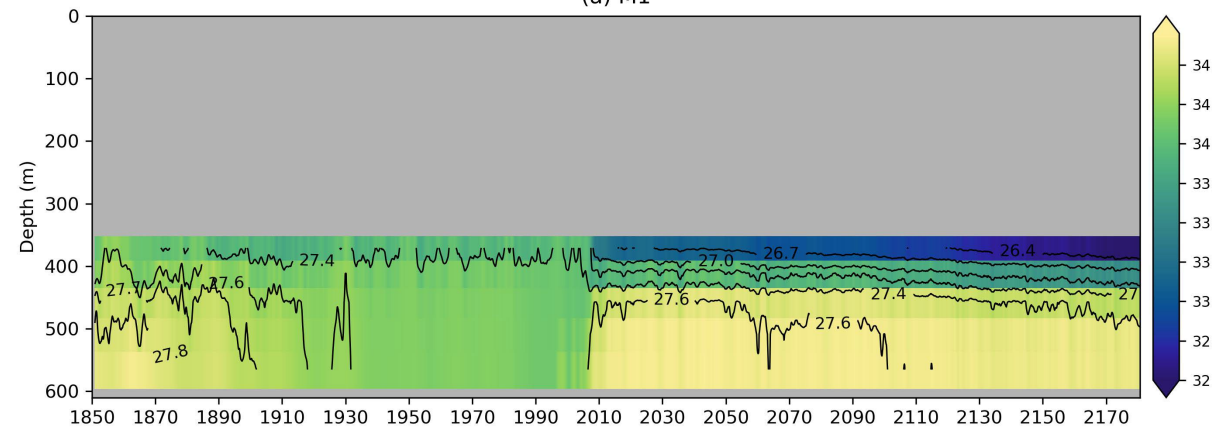


(c) M3

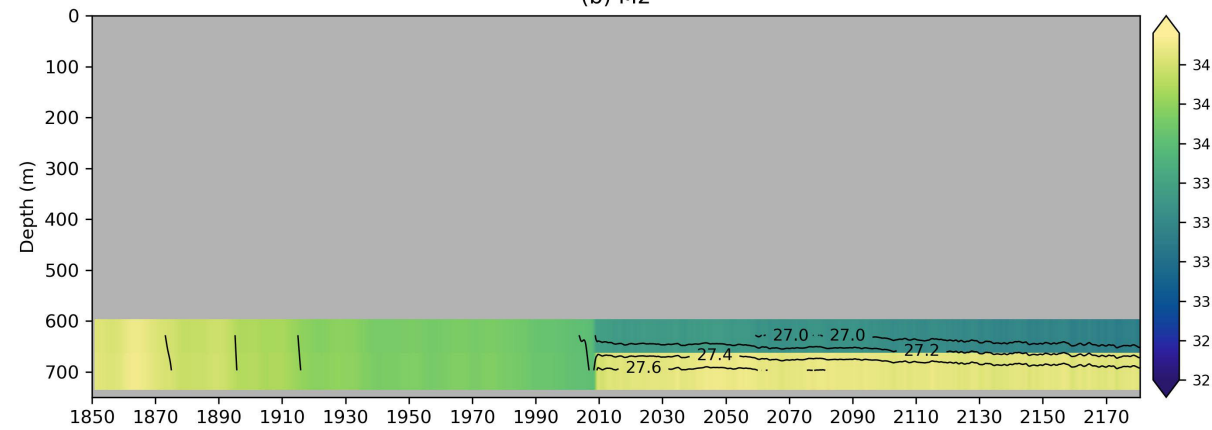


without interactive icesheet

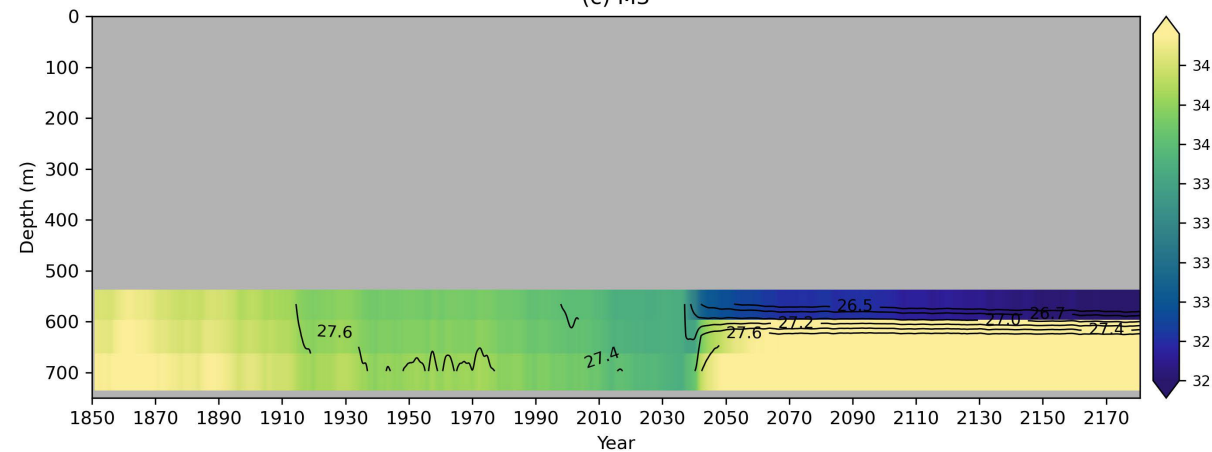
(a) M1



(b) M2



(c) M3



# Conclusion



- Peak-and-decline
- No interactive icesheet, no melt rate decrease
- Thermal driving is decreased

## Future work

- Geometric feedback of the cavity circulation
- Fixed FWF ramp-up run
- Reproducibility for the UKESM runs



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