AGU FALL MEETING

San Francisco | 12–16 December 2016

Linkages between atmospheric blocking, sea ice export through Fram Strait and the Atlantic Meridional Overturning Circulation

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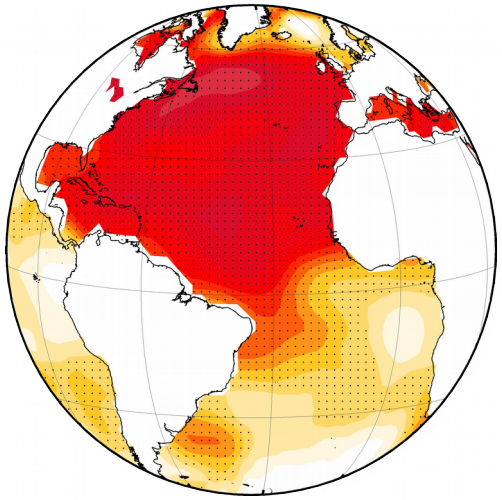
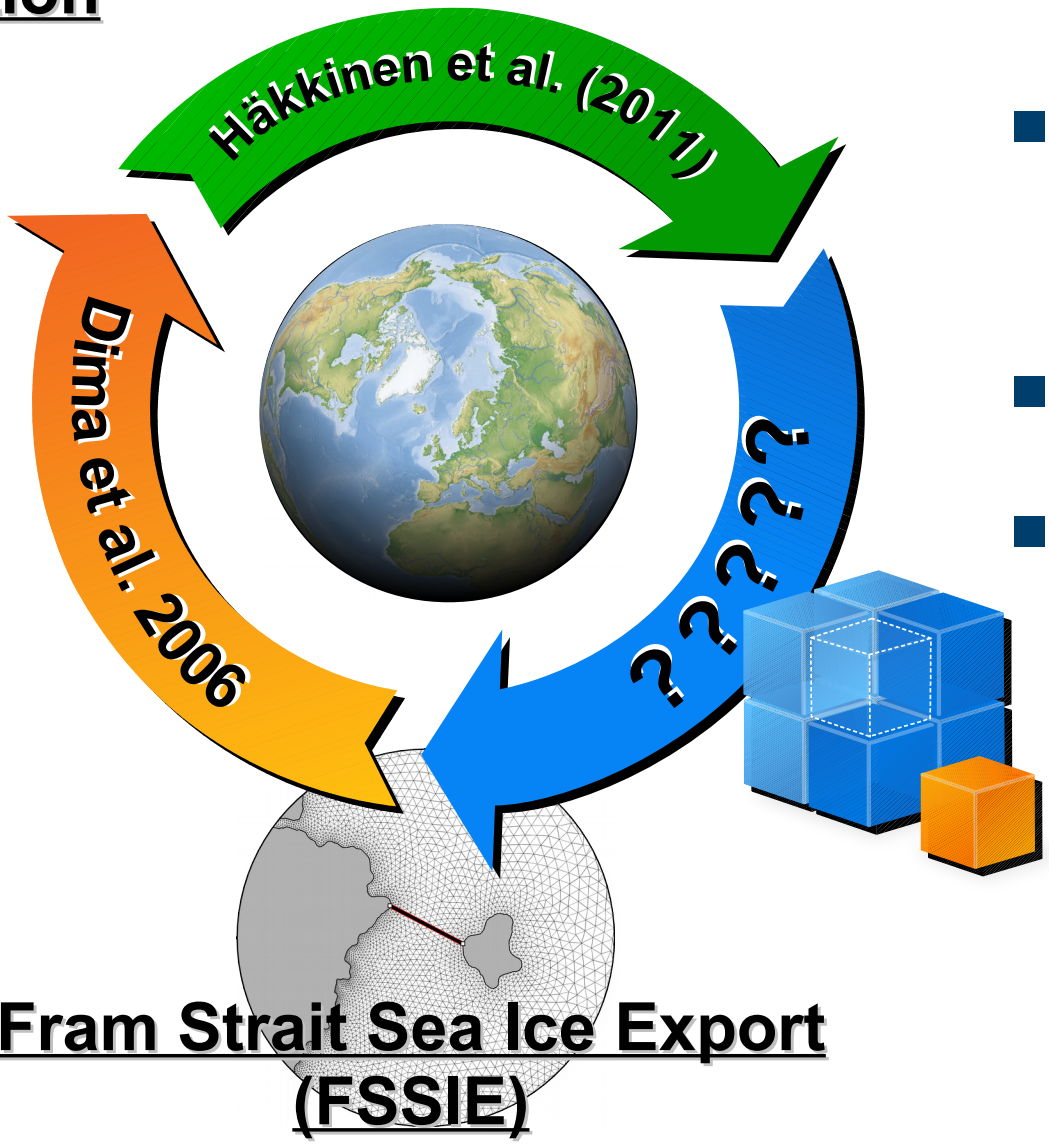
Introduction

Atlantic Multi-decadal Oscillation (AMO)

- Period of warm subpolar North Atlantic

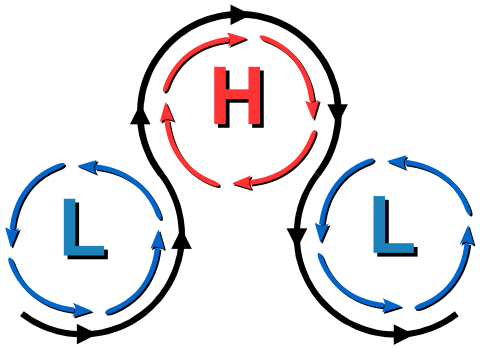




Fram Strait Sea Ice Export (FSSIE)

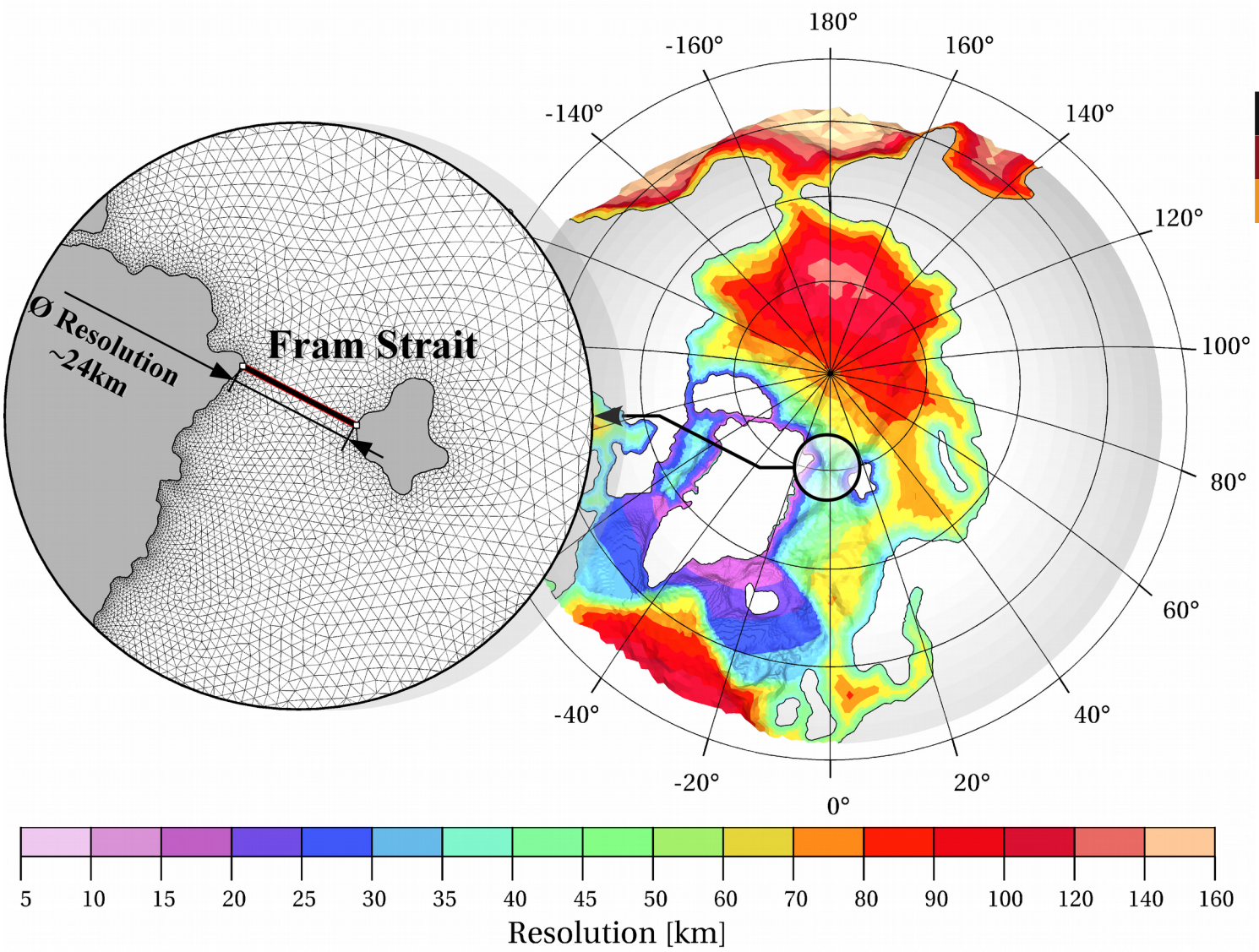
Atmospheric Blocking

- High latitude jet-stream develops nearly stationary meanders
- Trap air masses equatorward
- Persist for days up to weeks

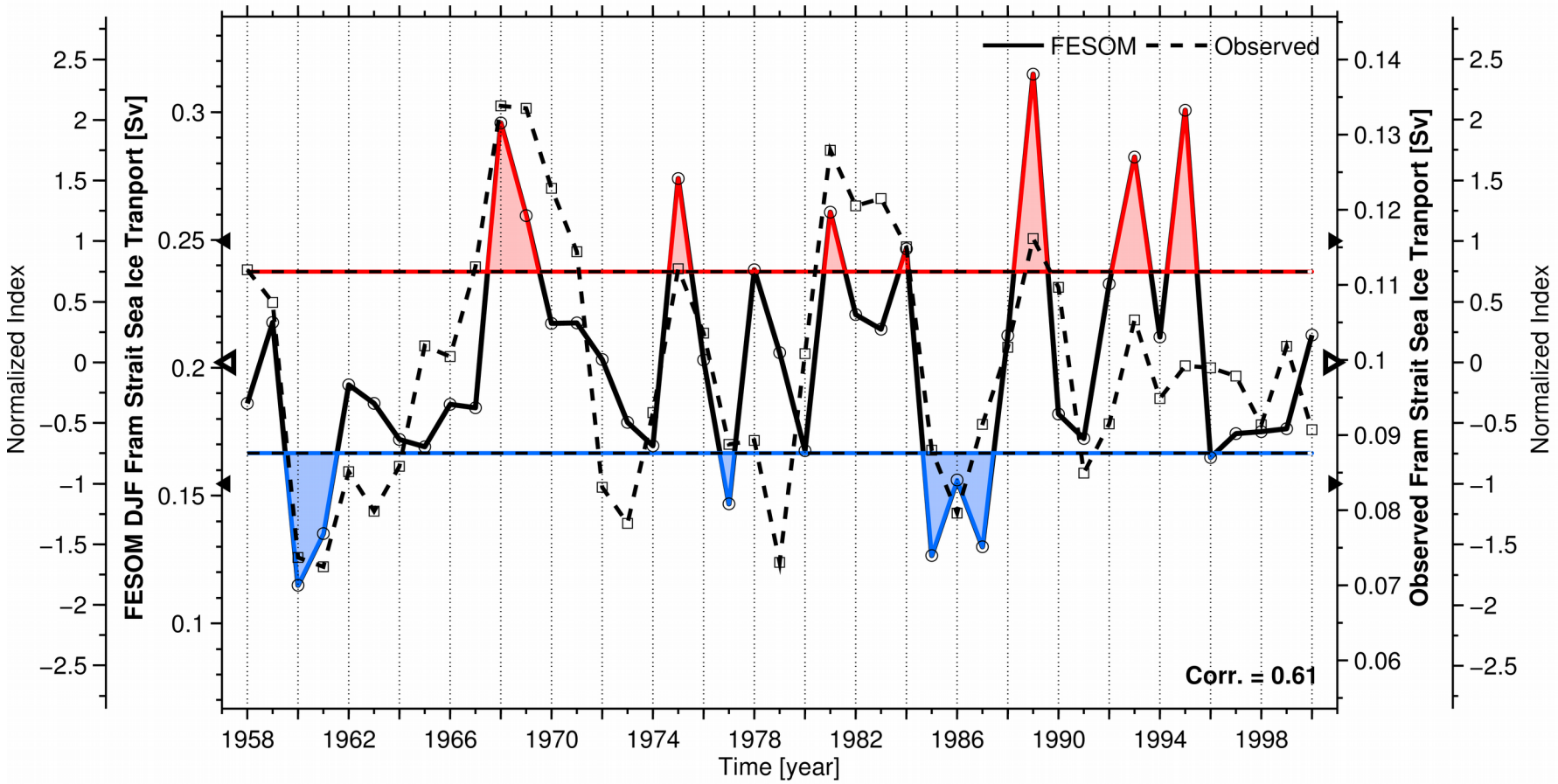


Model Setup

- Global Finite-Element Sea-Ice Ocean Model **(FESOM)** setup with regional focus in northern hemispheric deep water formation area
- Forced with **COREv2** data over the period 1958-2009

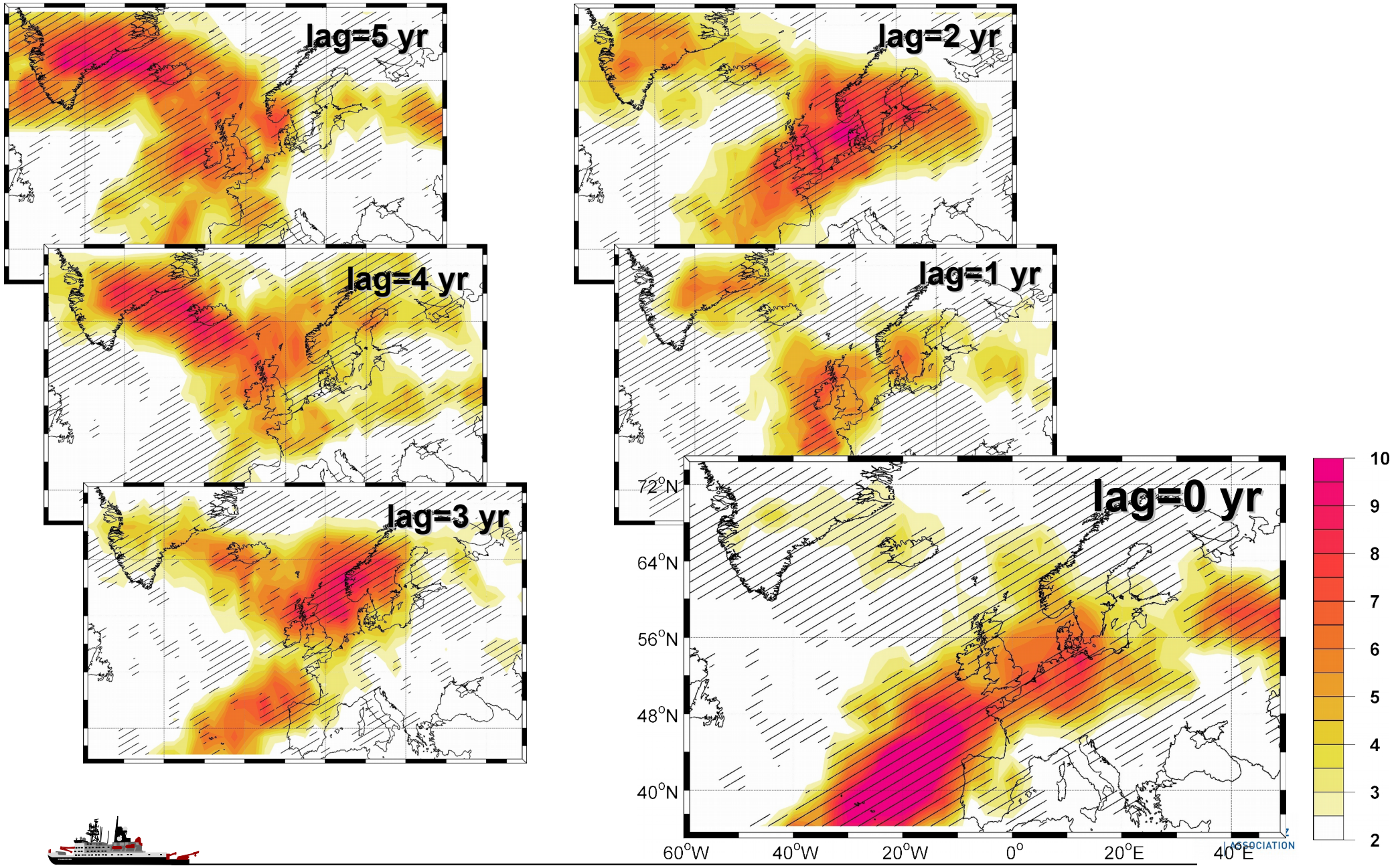


Modeled/Observed DJF Fram Strait Sea-Ice Export (FSSIE)

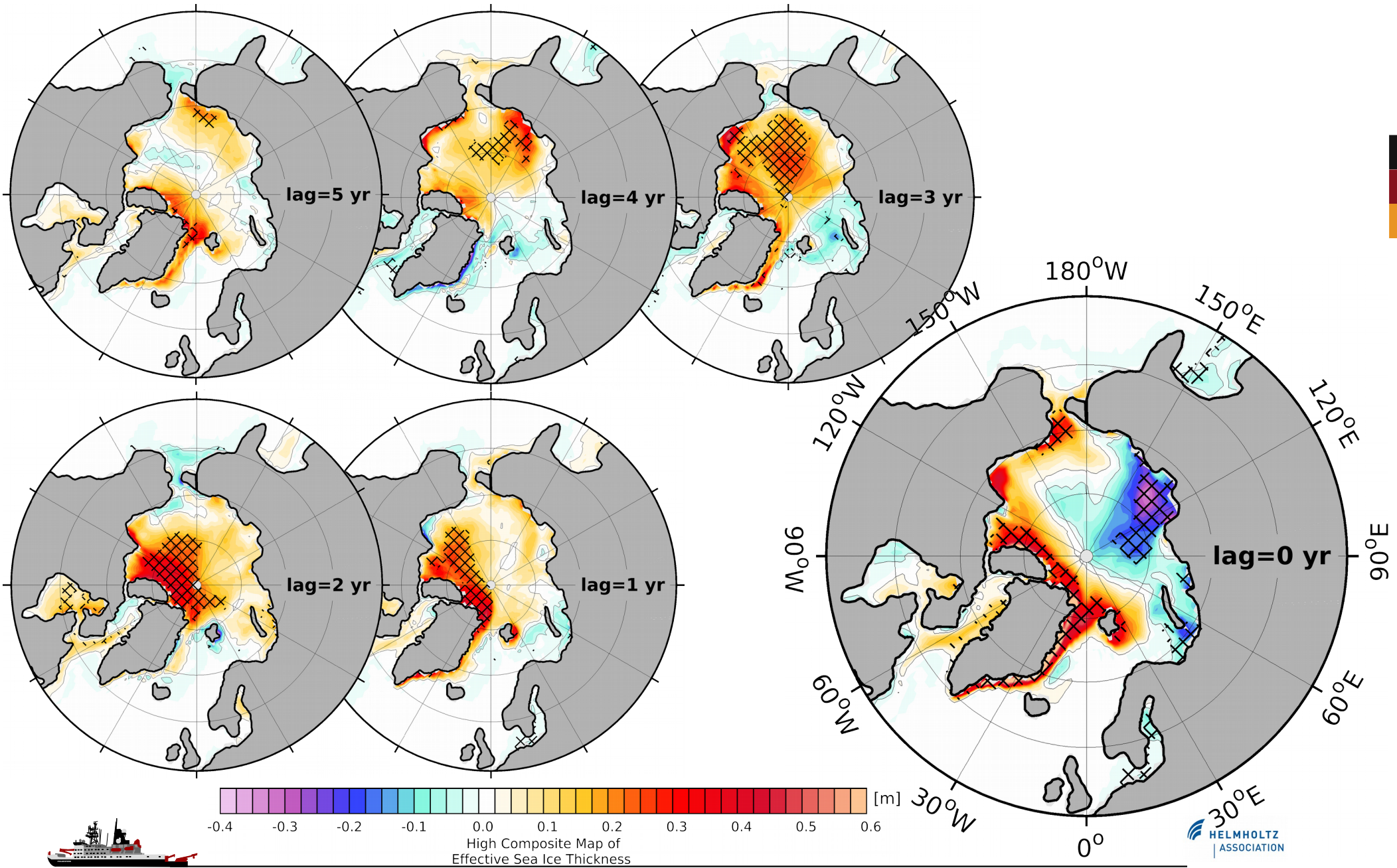


- **Modeled** (solid line) and **observed** (dashed line) FSSIE of Schmith and Hansen (2003)
- Red/blue: times when modeled FESOM FSSIE is above/below 75% of std. deviation

High-lag composite map of FSSIE & DJF atmospheric blocking frequency



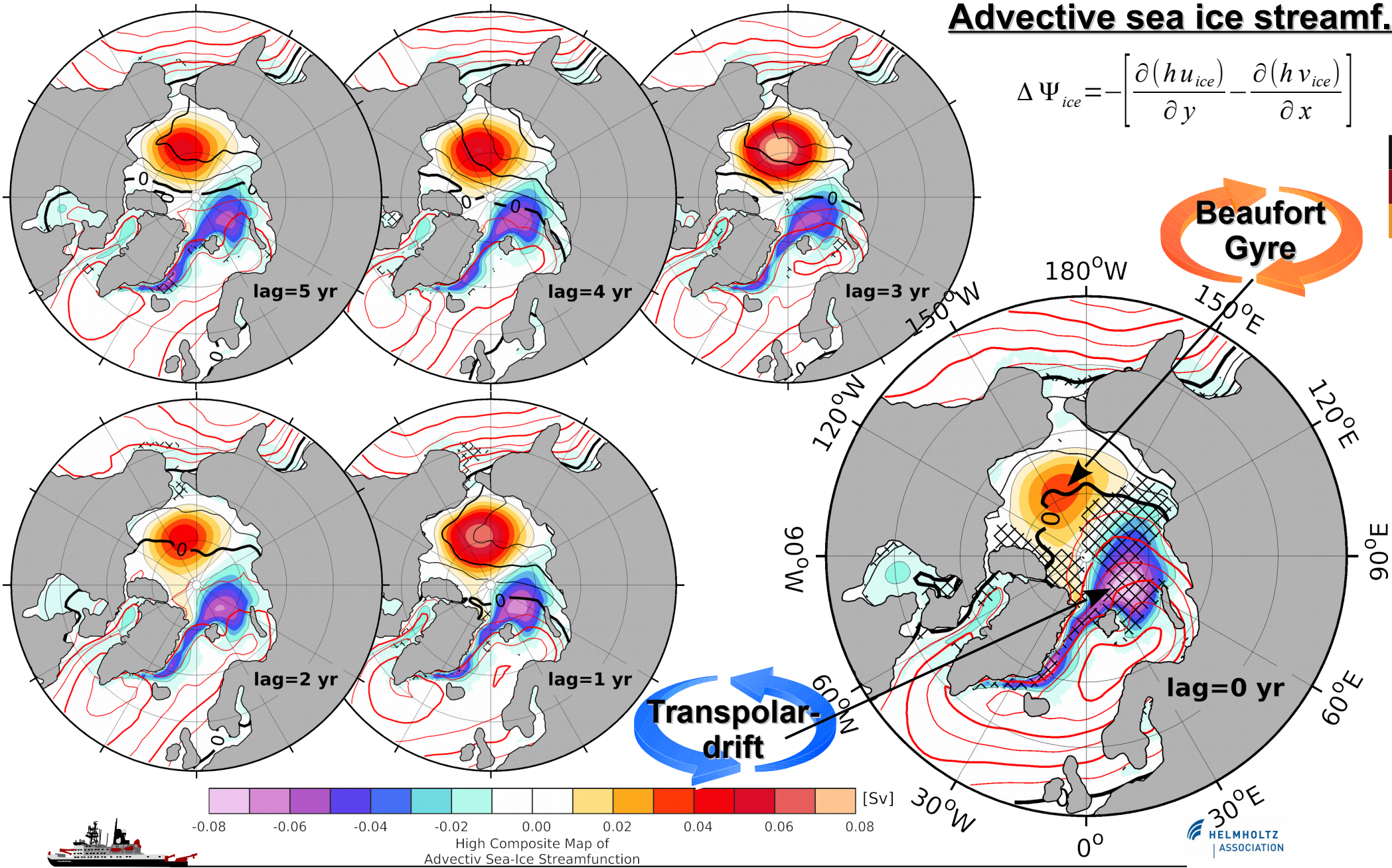
High-lag composite map of FSSIE & DJF anomalous sea-ice thickness



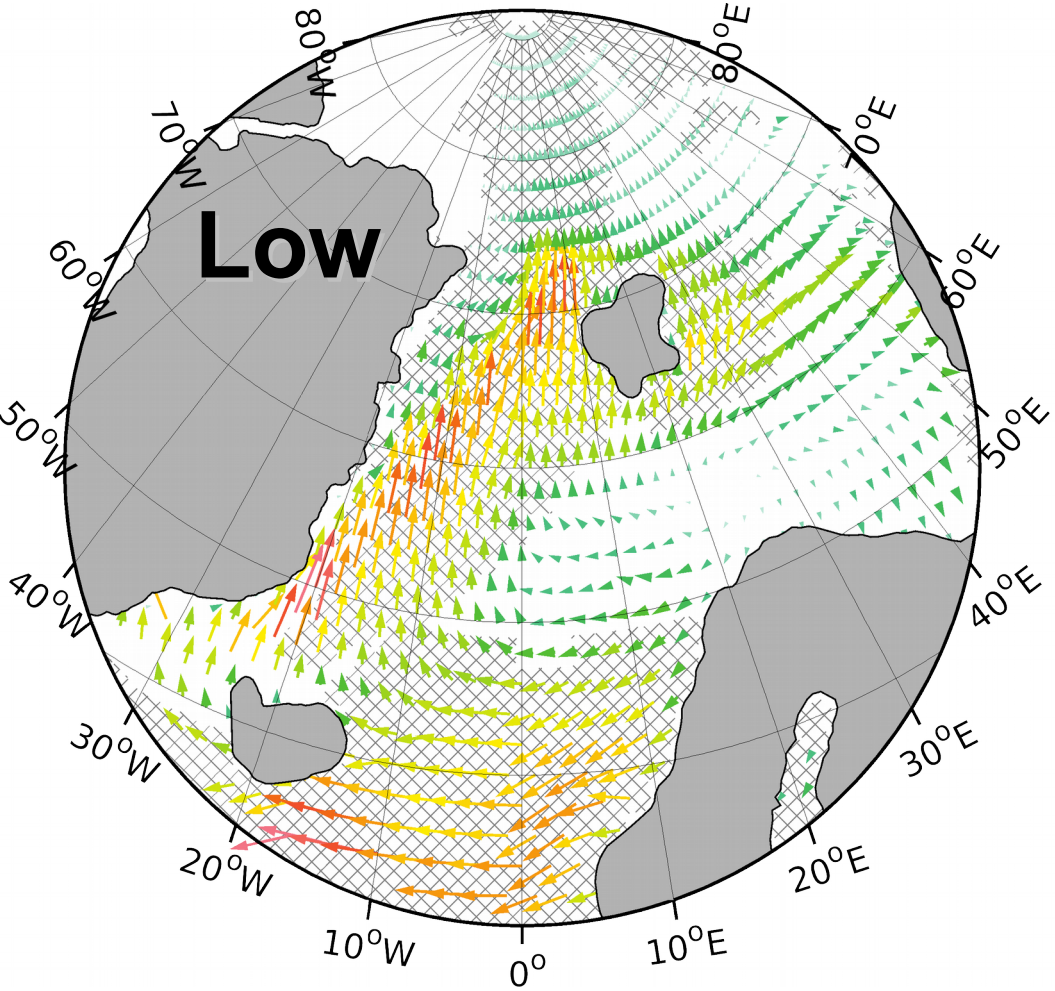
High-lag composite map of FSSIE & DJF advective sea-ice streamfunction

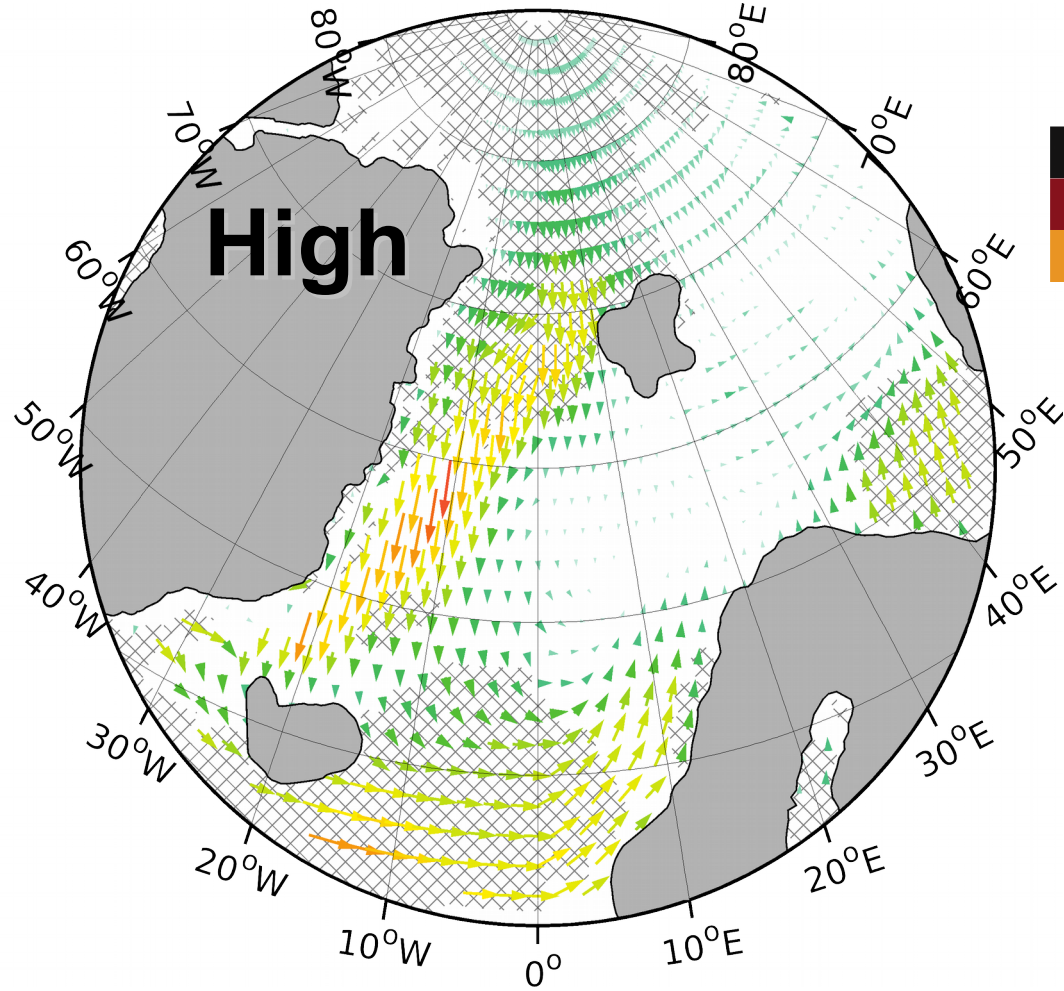
Advective sea ice streamf.

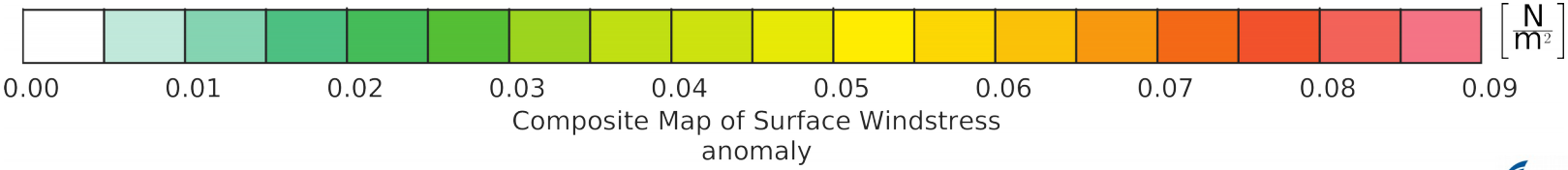
$$\Delta \Psi_{ice} = -\left[\frac{\partial (h u_{ice})}{\partial y} - \frac{\partial (h v_{ice})}{\partial x}\right]$$



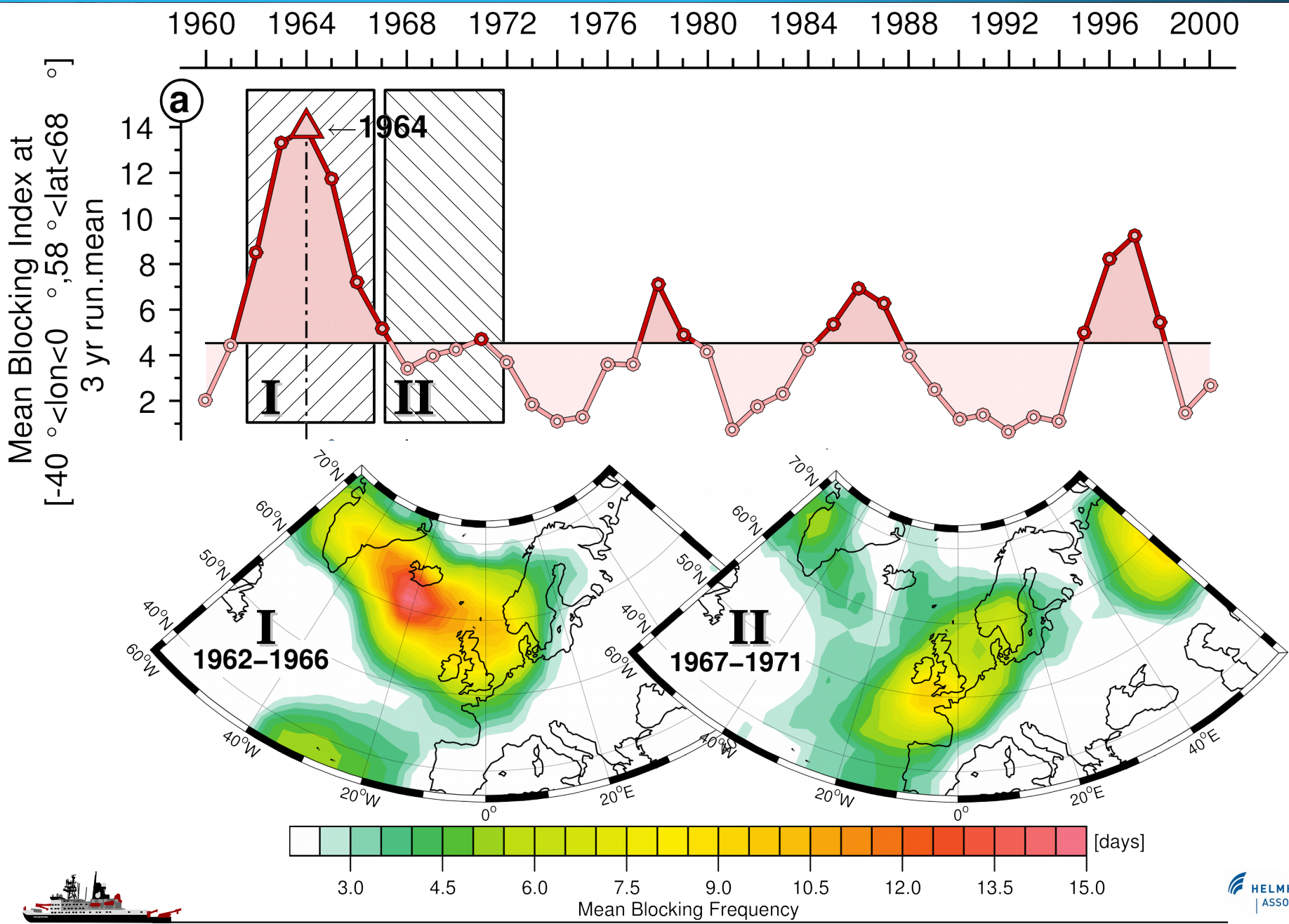
High/Low composite map of FSSIE & DJF surface wind stress







Atmospheric blocking and the 1970s Great Salinity Anomaly



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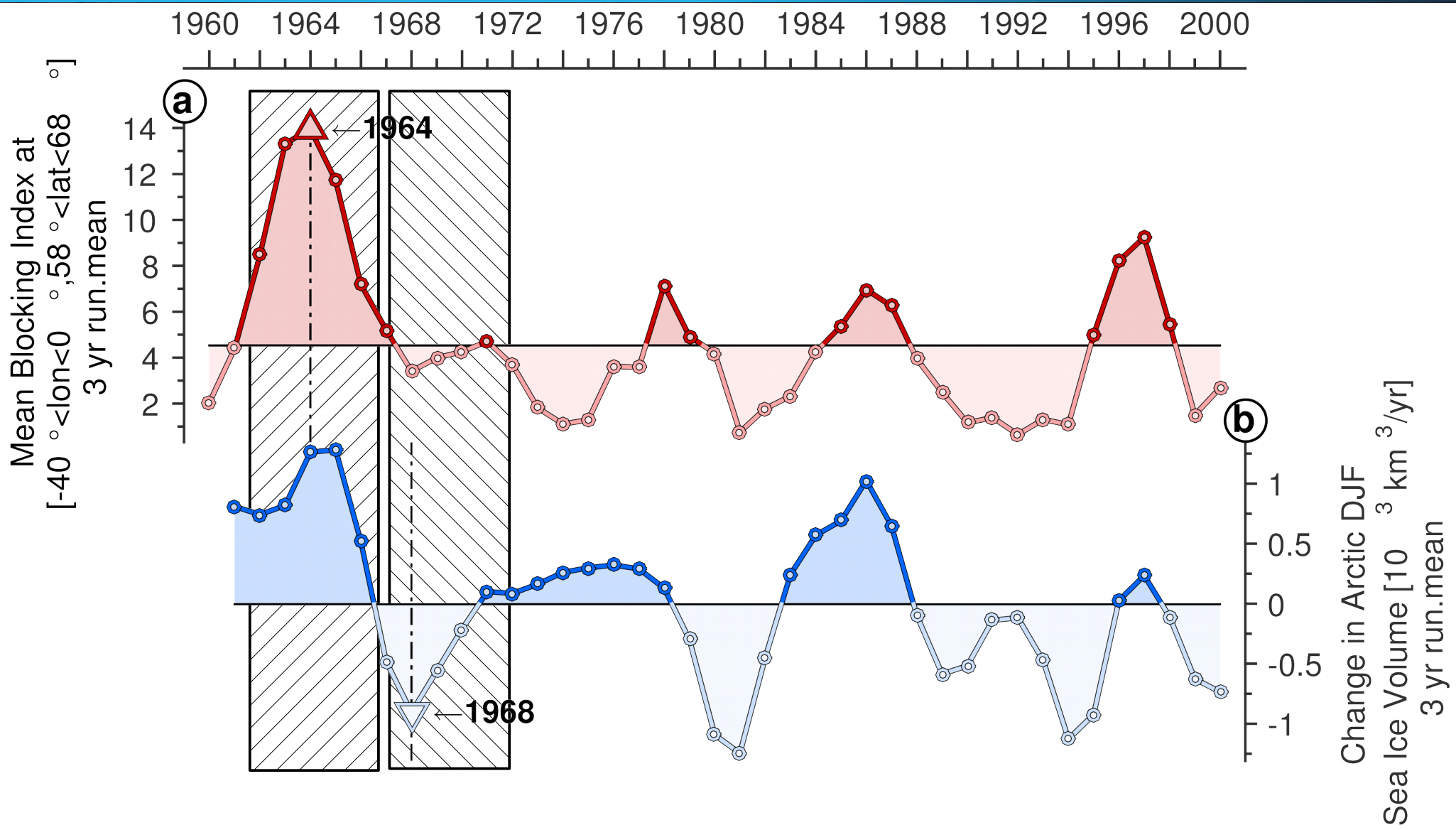

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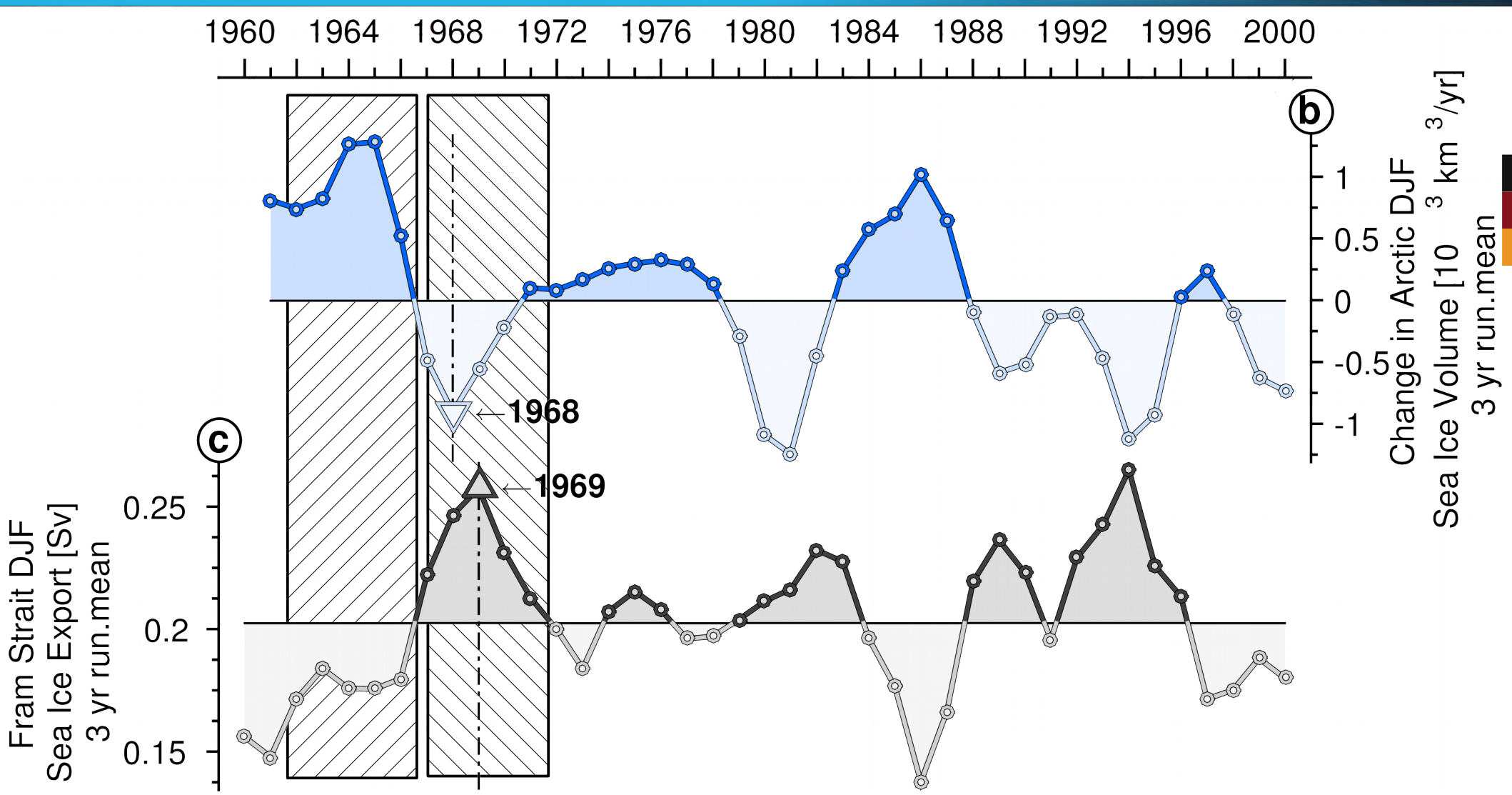

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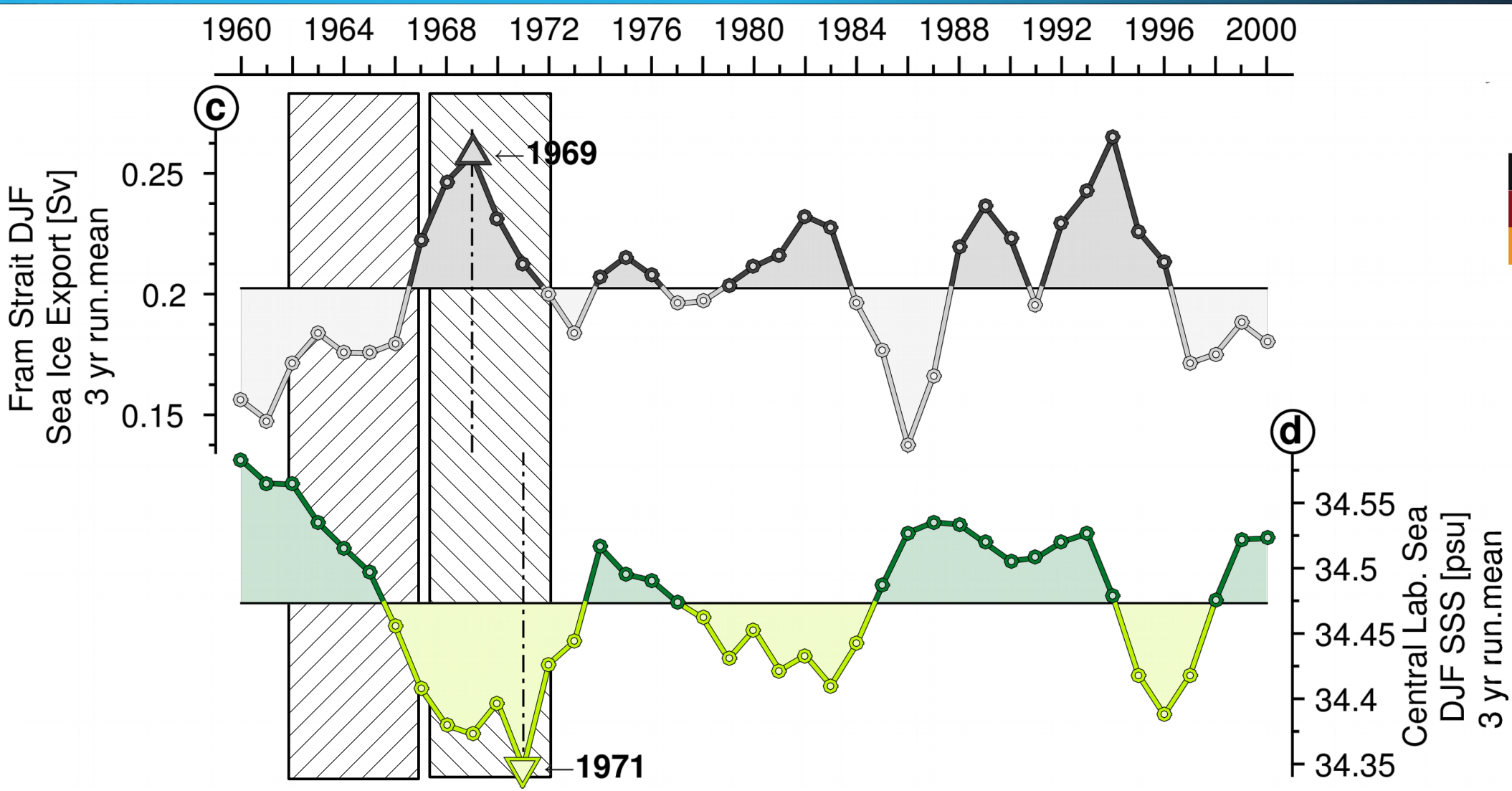

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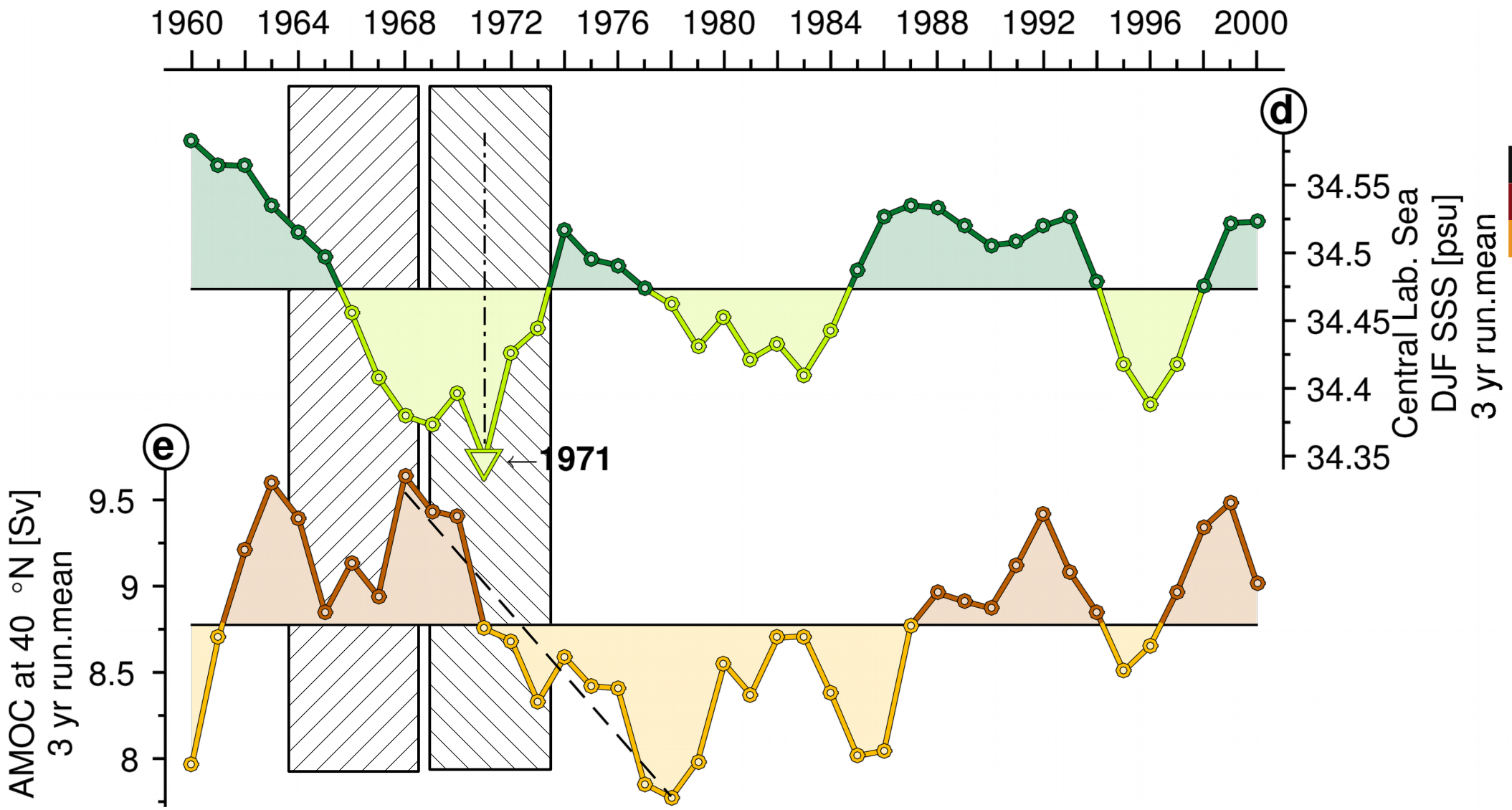

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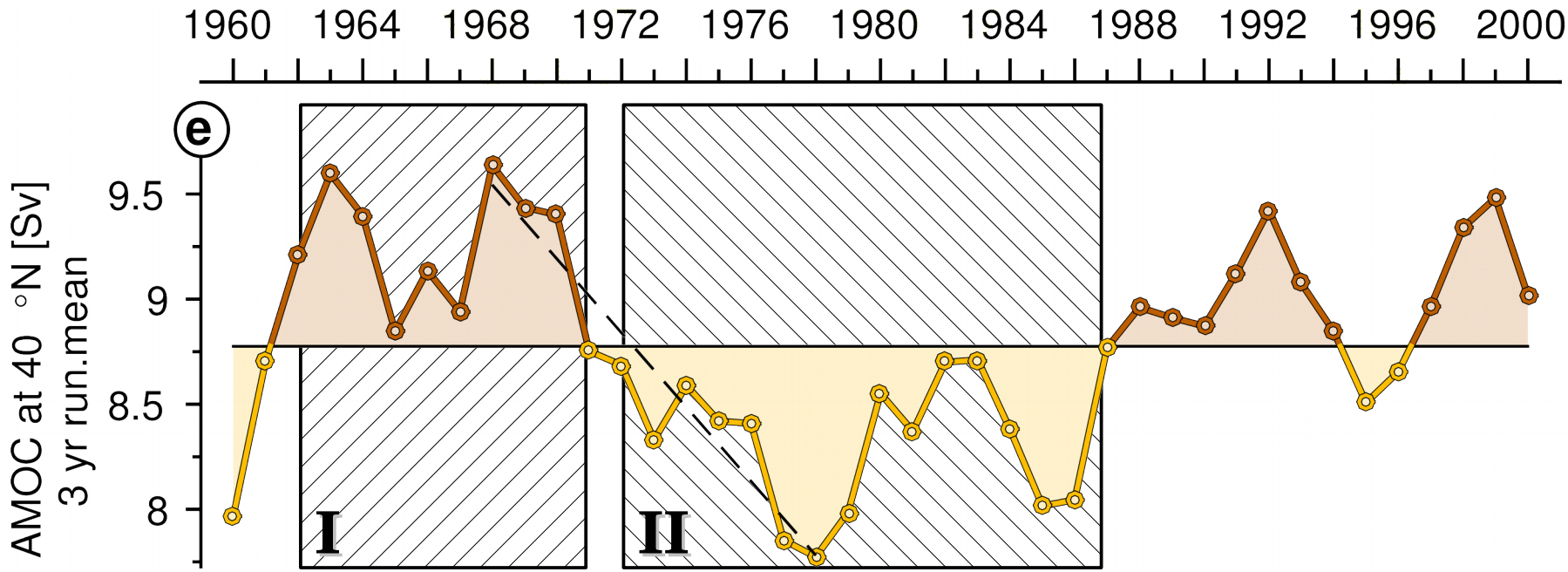

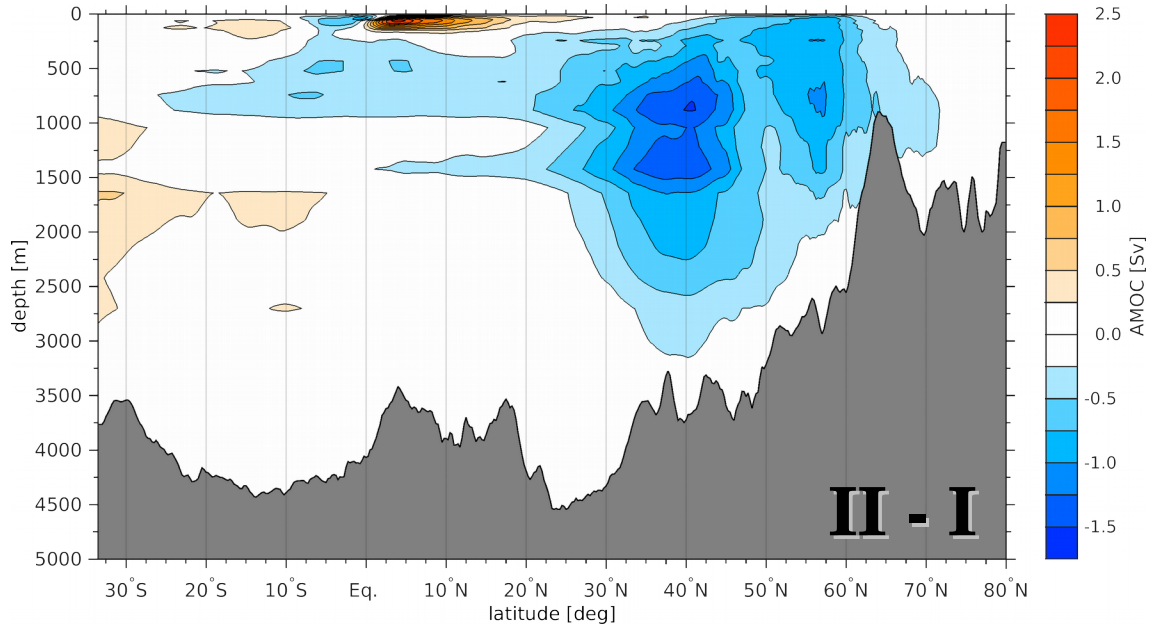

- Anomaly Atlantic Meridional Over-turning Circultion (AMOC) 1972-1986 minus 1962-1970

Summary

High FSSIE is connected with:

- Strongly reduced blocking activity over Greenland
- Weakening of the Beaufort Gyre, strengthening of the Transpolar Drift
- Southward directed anomalous wind stress over the Greenland Sea
- Strong Greenland Blocking leads to accumulation of Arctic Sea-ice

Possible 1970s mechanism:

strong Greenland blocking

accumulation of Arctic sea ice

weak Greenland blocking

high FSSIE

high freshwater input

cause 1970s GSA

decrease AMOC

Finish