Weddell Sea dense shelf water formation decrease linked to IPO shifts

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- **Antarctic Bottom Water** (AABW) fills out the bottom 40% of the ocean and **almost half** is formed in the **Weddell Sea**
- Observations suggest that **since 1992**, formation of Weddell Sea Dense Shelf and AABW has **decreased by 40%** and the recent shift to a **negative phase of the Interdecadal Pacific Oscillation** (IPO) may have strongly **contributed** to this decline.
- Yet, it remains unclear how recent shifts in the IPO have influenced AABW formation.

Isolating the IPO signal in the Antarctic margin region

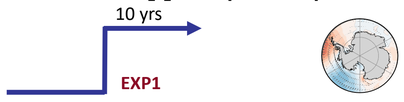
- **ACCESS-OM2-01** Kiss et al. (2020)
  - 1/10° global ocean-sea ice **model** with 75 z* levels
  - **forced** by JRA55-do**,** atmospheric **reanalysis** Tsujino et al. (2018)
  - investigate changes in dense shelf water formation rates during shifts in the IPO

Idealised IPO simulations

Repeat-year forcing[x,y,t] + IPO anomalies

3 experiments

(time series[t] × spatial pattern[x,y])



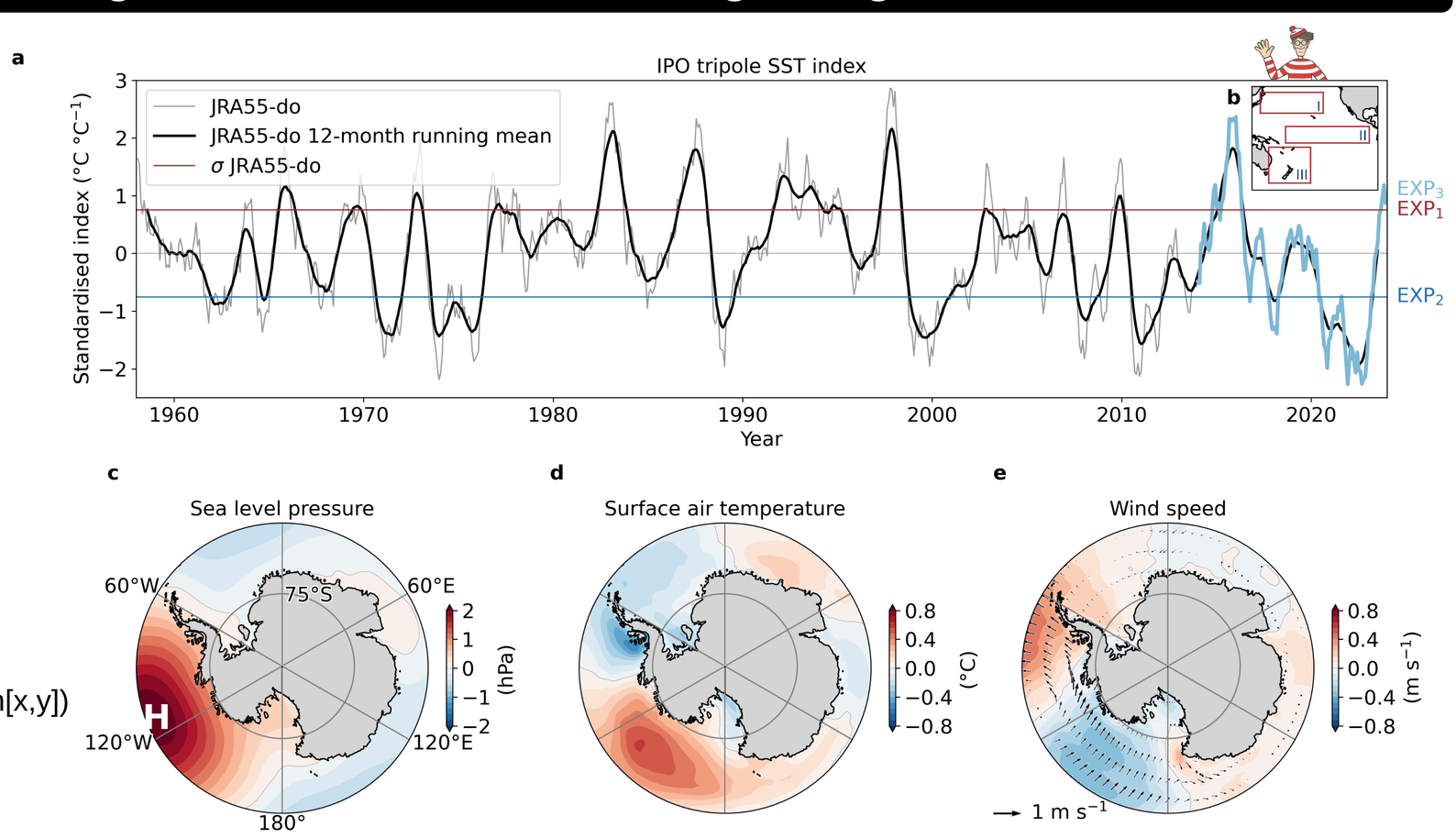


Fig. 1. *Experimental design of the perturbation simulations. (a) Time series of the IPO tripole SST index (°C). (b) Inset of IPO tripole regions, the index is calculated as region II – I + III.(c) IPO regression maps of sea level pressure (hPa) surface air temperature (°C) and wind speed (m s^{-2}).*

How strongly does the IPO impact dense shelf water formation?

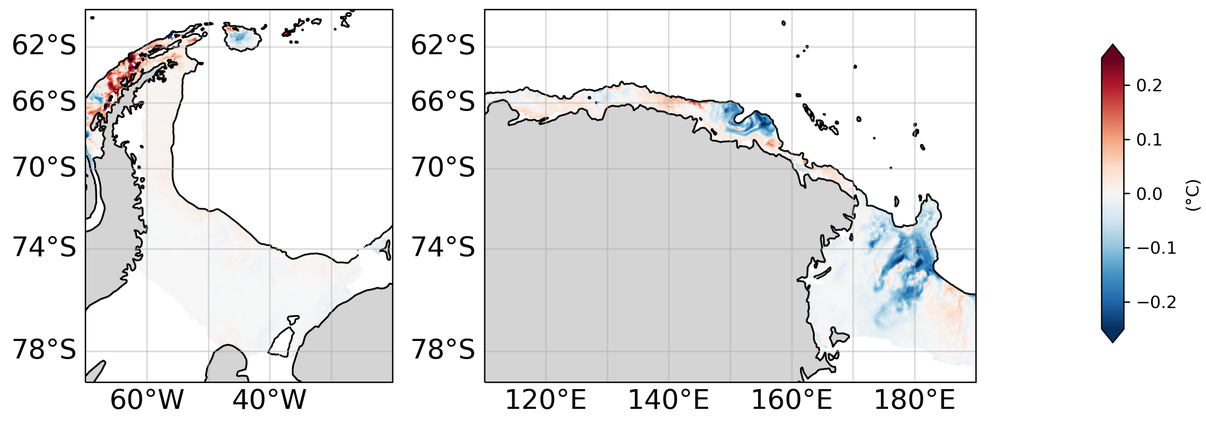


Fig. 2. *Subsurface (a) Weddell and (b) Ross Sea temperature anomalies in 2021-2022 in the interannual IPO simulation (°C) averaged over 100 m to the shelf bottom.*

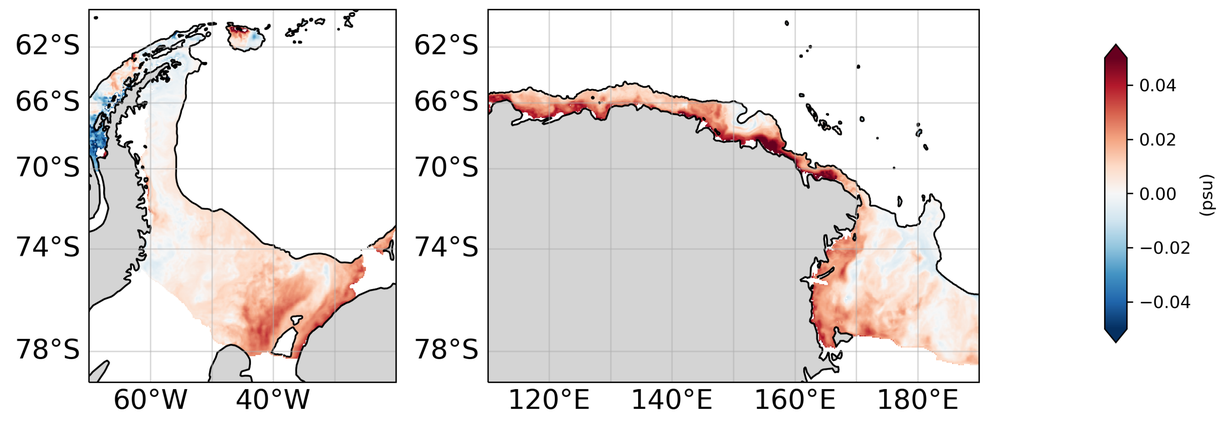


Fig. 3. *As in Fig. 2. but for salinity (psu).*

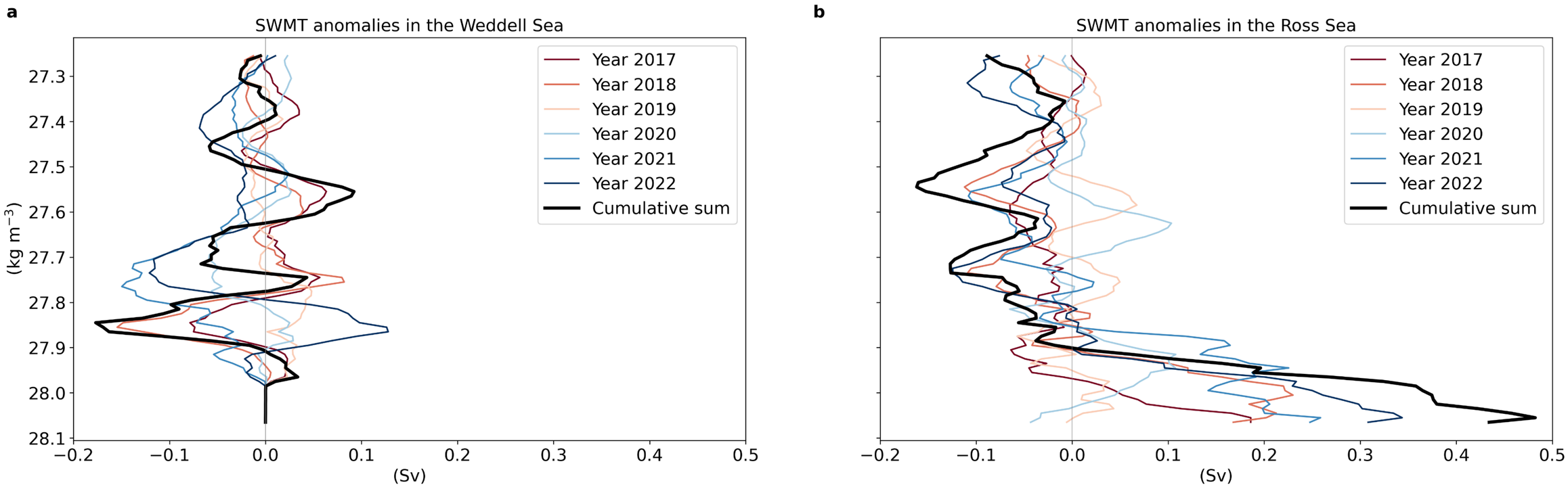


Fig. 3. ***a***, ***b***, *Time series of mean shelf temperature responses (10^{20} J).* ***c***, ***d***, *Poleward Ekman anomalies at the 1000 m isobath location (Sv).* ***e***, ***f***, *Main West Antarctic subsurface heat budget terms (10^{19} J).*