

# If near-surface warming exceeds +7.5°C, the atmosphere will shift from a mitigating to an amplifying factor of Antarctic mass loss



## Disentangling the drivers of future Antarctic ice loss with a historically-calibrated ice-sheet model

OR What can the past decades tell us about future Antarctic ice loss?

Why?

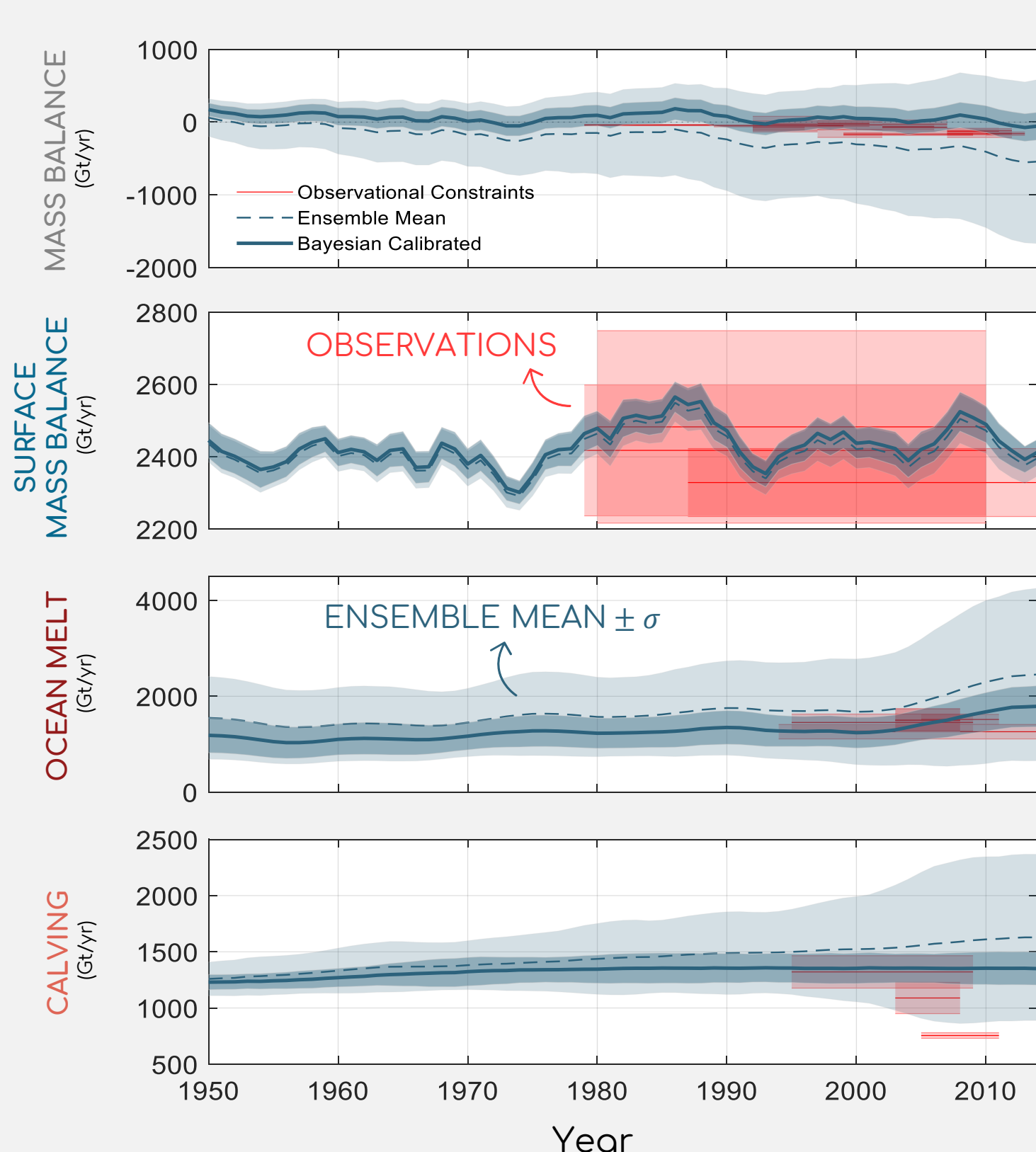
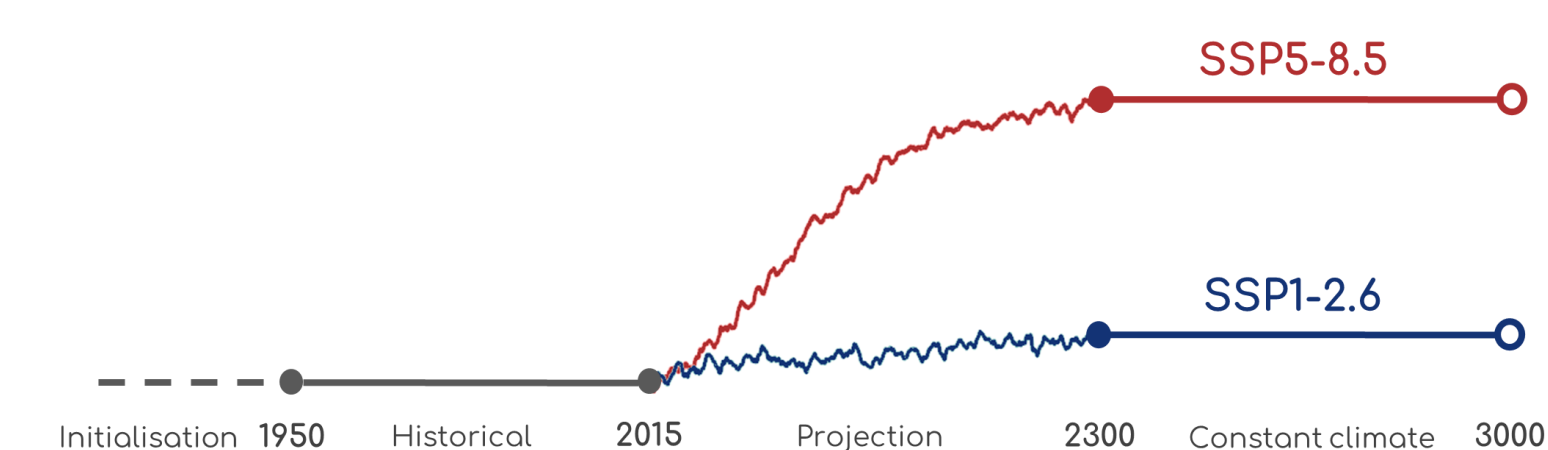
- Current Antarctic ice loss is mainly driven by the ocean, but its future evolution remains uncertain.
- Under a warming climate, we may expect an increase in competing processes



How?

- We use the ice-sheet model **Kori** to run an ensemble of 100 simulations that covers uncertainties in ice-ocean and ice-atmosphere interactions.
- We perform a Bayesian calibration using satellite-based estimates of regional mass balance over the historical period.
- We then extend the calibrated ensemble to the end of the millennium using projections from a subset of CMIP6 climate models under low and high emissions scenarios.

What will be the balance between these competing processes and their influence on the evolution of the Antarctic ice sheet in the future?



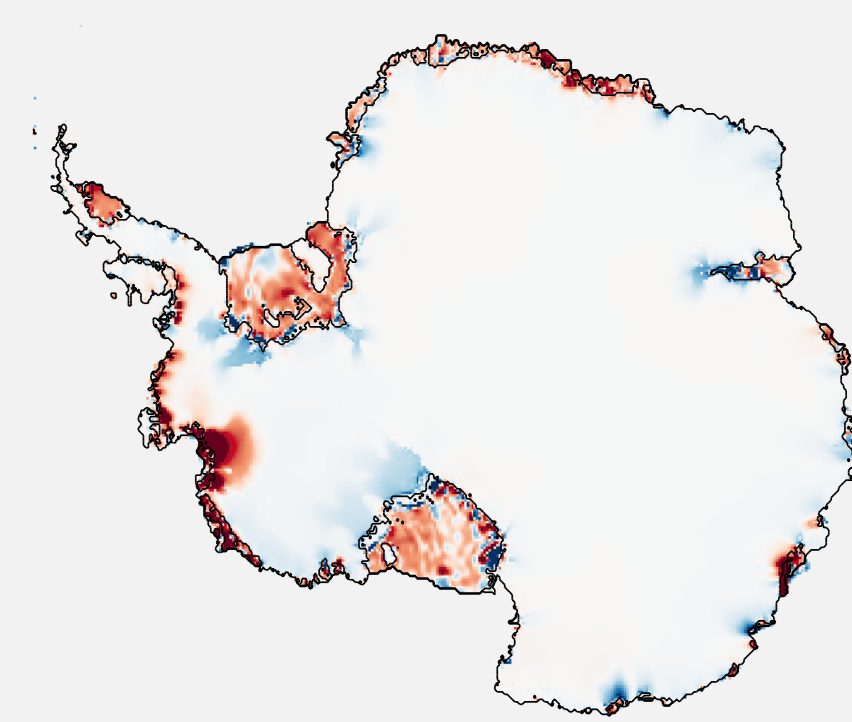
### CALIBRATION OF THE ENSEMBLE

Data used for the calibration: rates of ice sheet mass change (IMBIE - Otosaka et al., 2023)

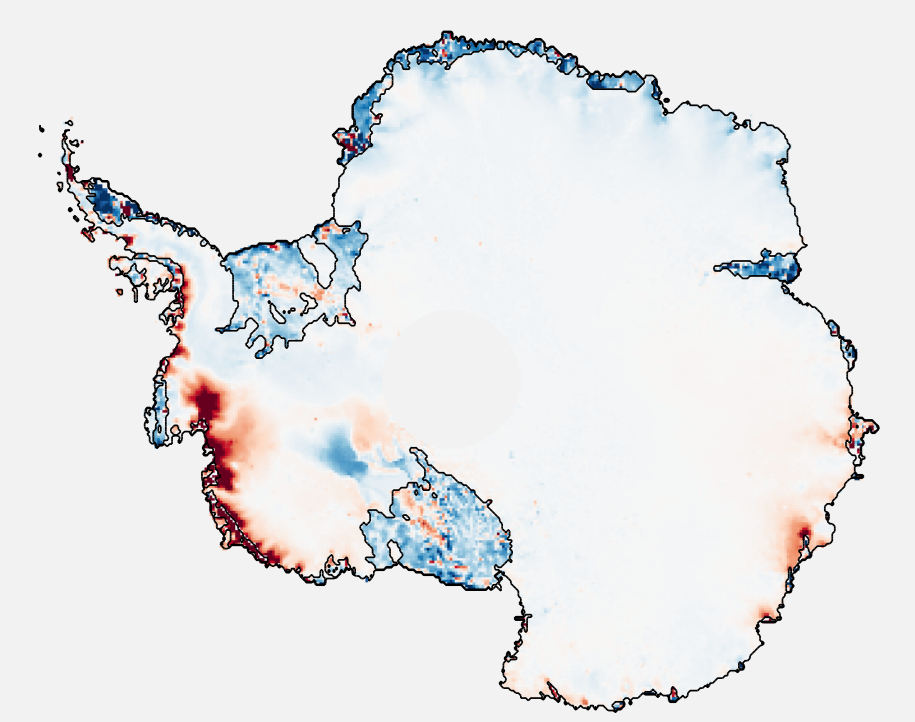
	WAIS (Gt/yr)	EAIS (Gt/yr)	Peninsula (Gt/yr)
1992 – 1996	$-37 \pm 19$	$-27 \pm 33$	$-7 \pm 11$
1997 – 2001	$-42 \pm 19$	$21 \pm 32$	$2 \pm 11$
2002 – 2006	$-64 \pm 20$	$21 \pm 34$	$-20 \pm 11$
2007 – 2011	$-129 \pm 23$	$19 \pm 36$	$-21 \pm 12$

- ✓ Calibrating allows to reduce the spread in ice-sheet response.
- ✓ The calibrated ensemble reproduces the historical trends in good agreement with observations

MODELLED – 2000-2015  
Bayesian calibrated mean

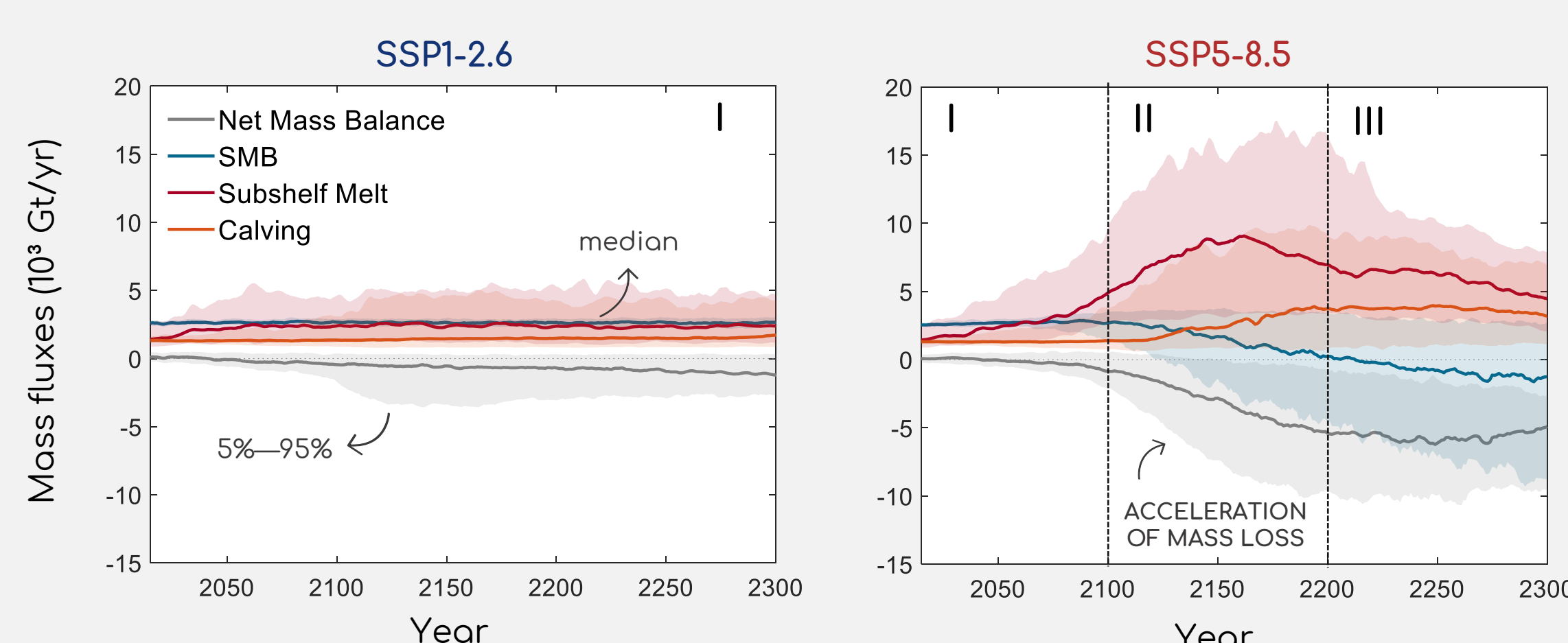
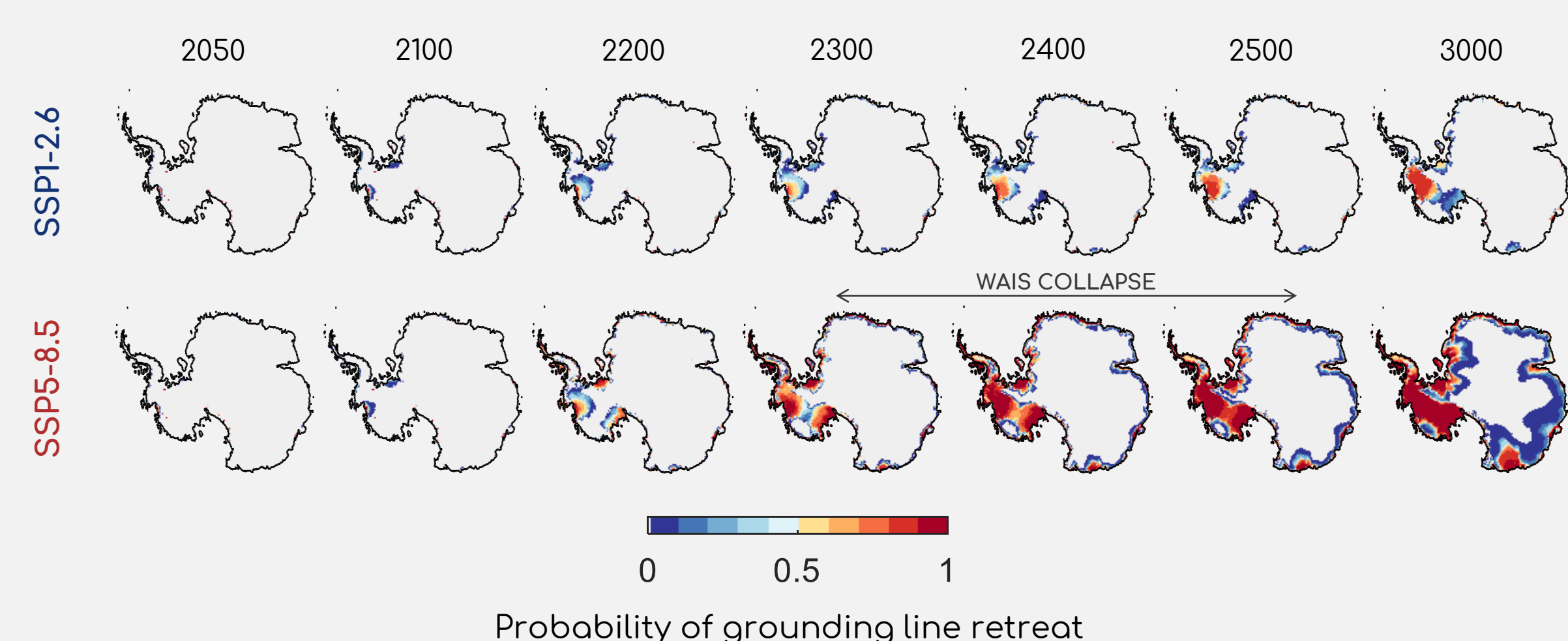


OBSERVED – 2003-2019  
[From Smith et al., 2020]

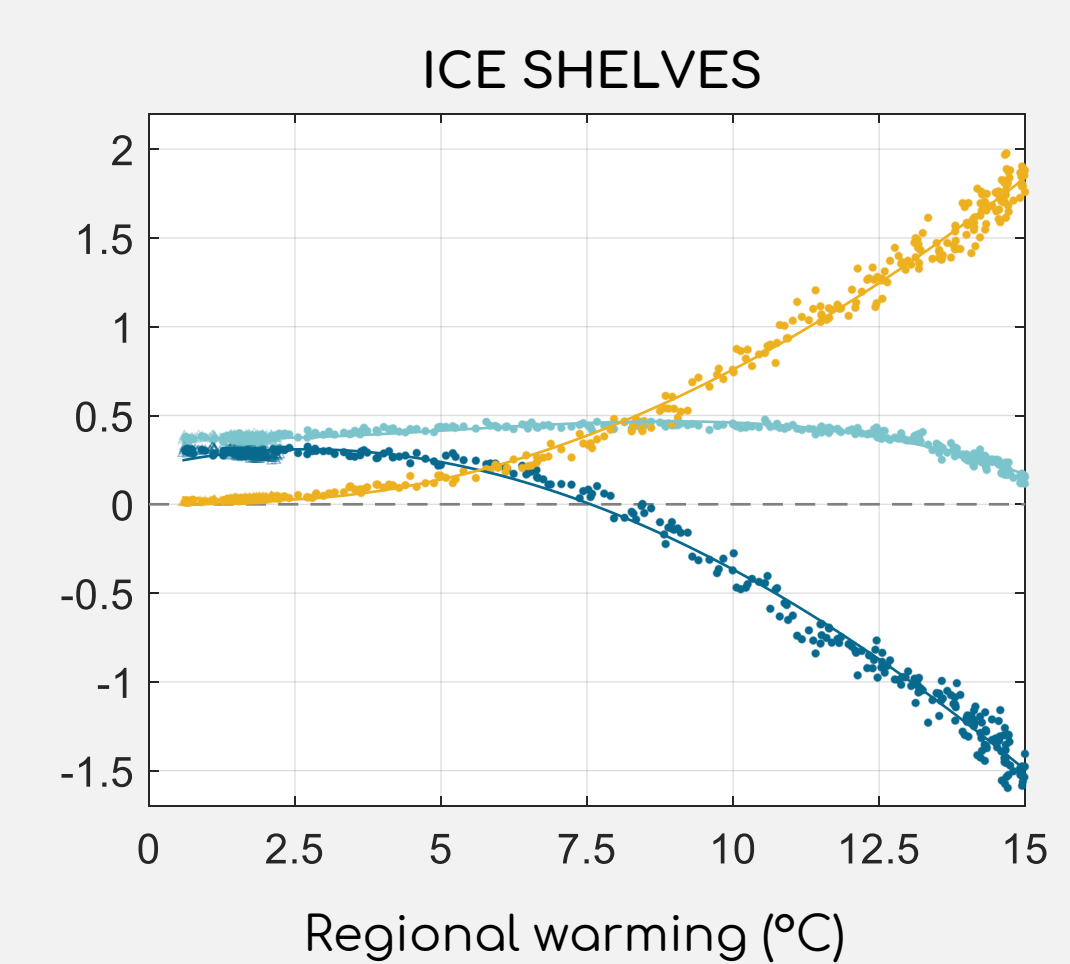
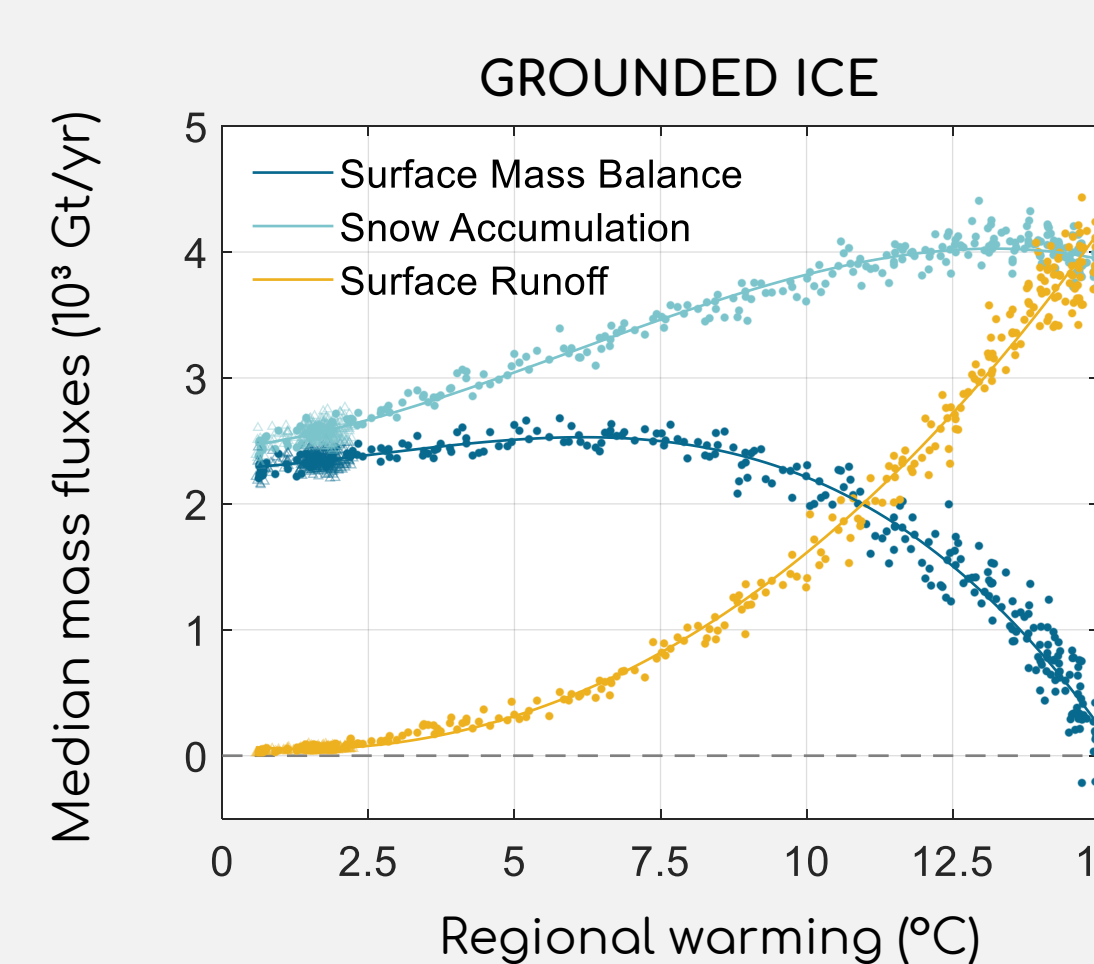


Mean elevation rate (m/yr)

### EVOLUTION OF THE CALIBRATED ENSEMBLE



- Short-term Antarctic ice loss is **driven by the ocean**, triggering significant retreat in West Antarctica, even under limited warming.
- Acceleration of ice loss in conjunction with a **decrease in surface mass balance**
- Sub-shelf melt decreases and mass loss becomes dominated by the atmosphere



**+7.5°C**  
regional  
warming

SMB mitigating potential decreases as the increase in surface runoff outweighs the increase in snow accumulation



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Protect  
CRYOSPHERE & SEA LEVEL