Influence of surface mass balance on the high-end sea-level commitment from the Antarctic ice sheet

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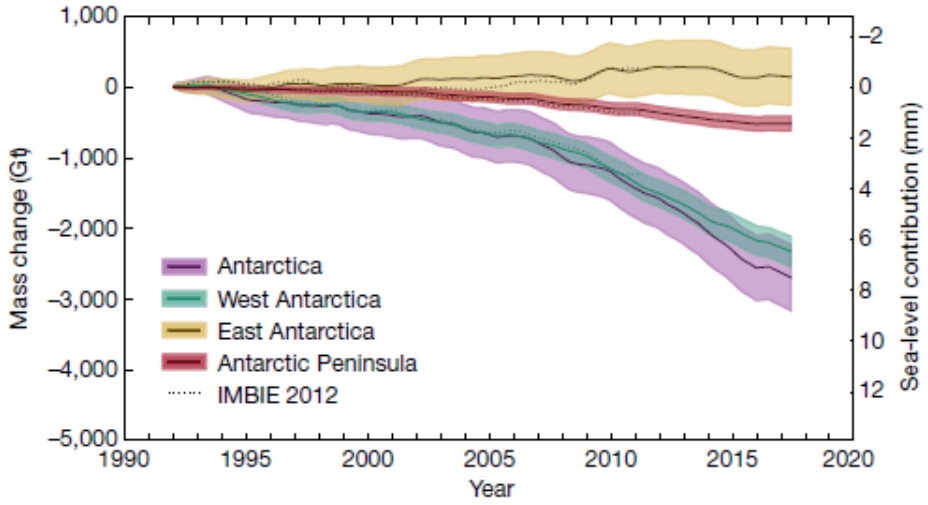
AN UNCERTAIN ANTARCTIC FUTURE

Competing processes under a warming climate

- ↑ sub-shelf melt
- ↑ snow accumulation
- ↑ surface runoff

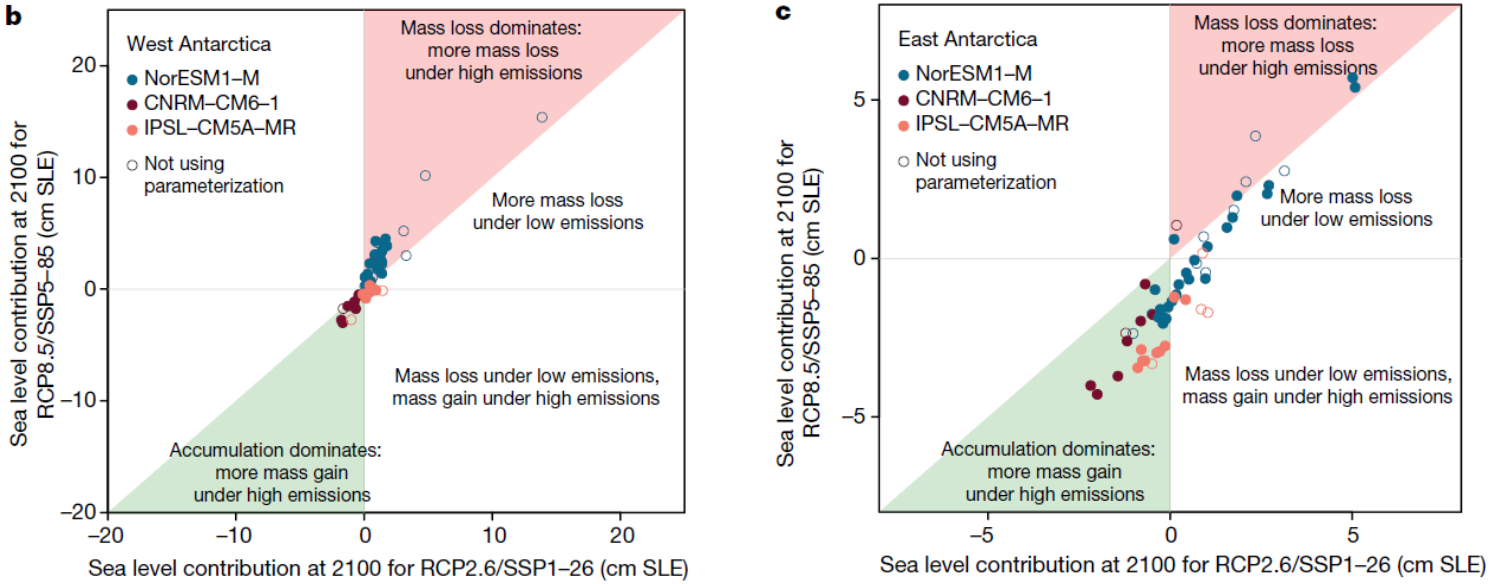
→ What will be the balance between them in the future?

PRESENT:



[From the IMBIE team, 2018]

FUTURE: ?



[From Edwards et al., 2021]

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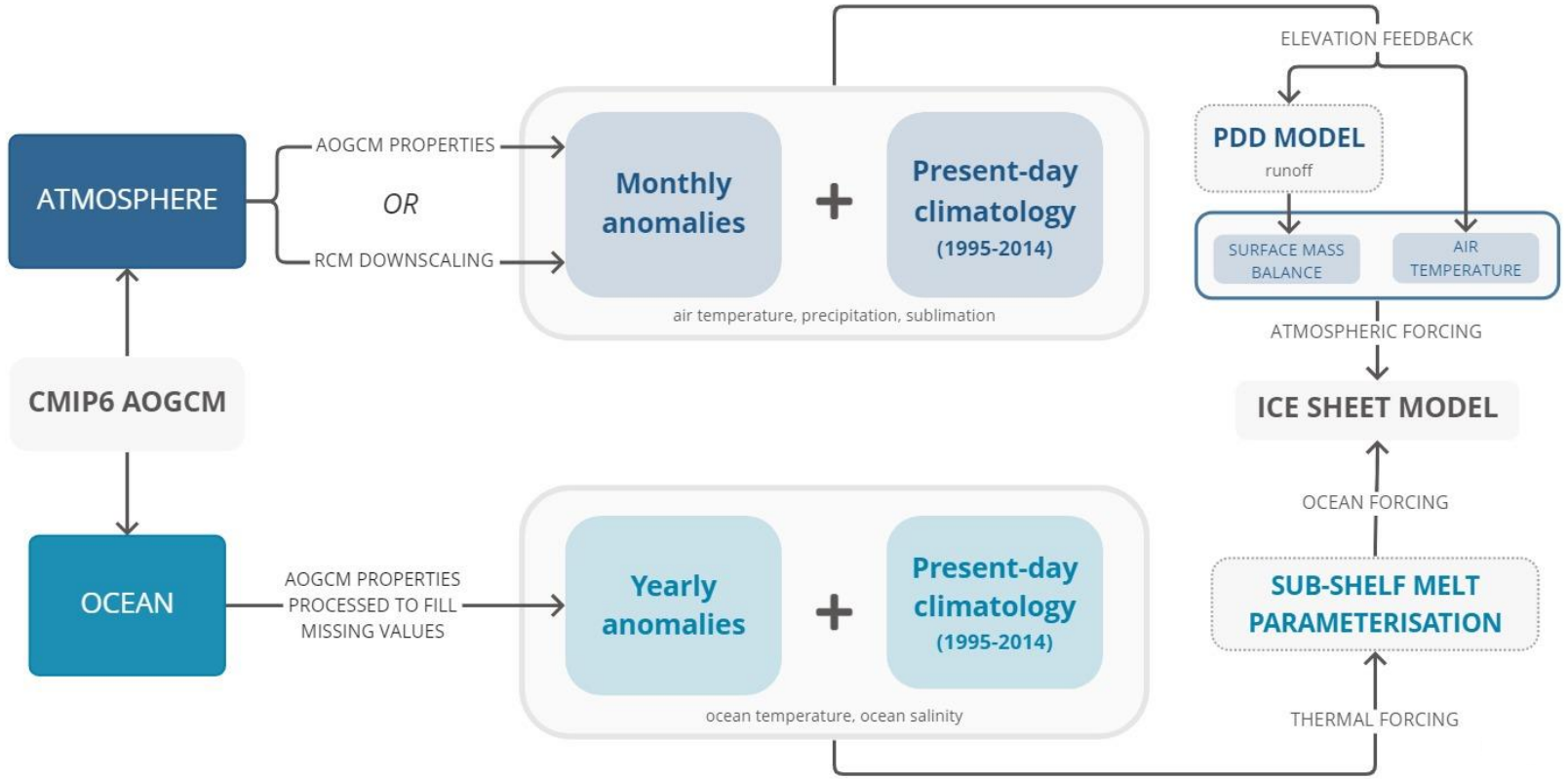
HOW?

Different climate forcings:

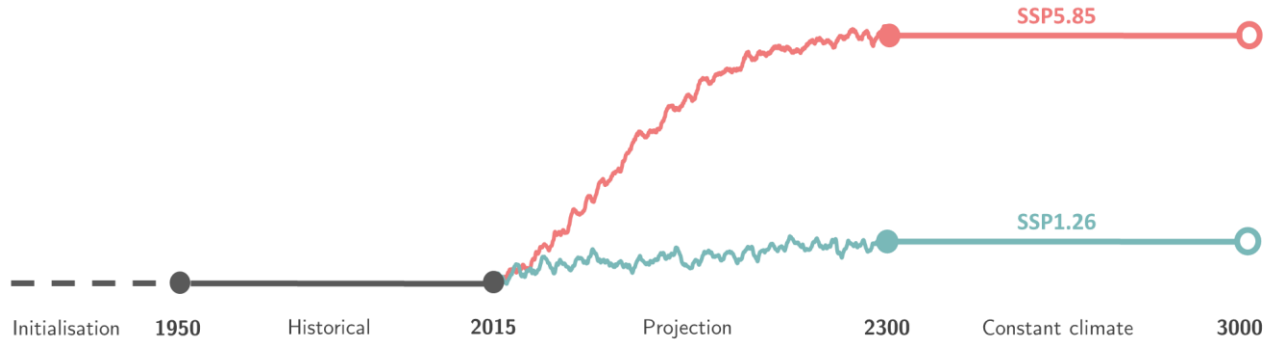
- MRI-ESM2-0
  - SSP1.26
  - SSP5.85
- IPSL-CM6A-LR
  - SSP5.85

For each of them:

- **Ensemble of simulations** covering **uncertainties** in **ice-ocean** and **ice-atmosphere** interactions



[From Coulon et al, in prep.]



[From Klose et al, in prep.]

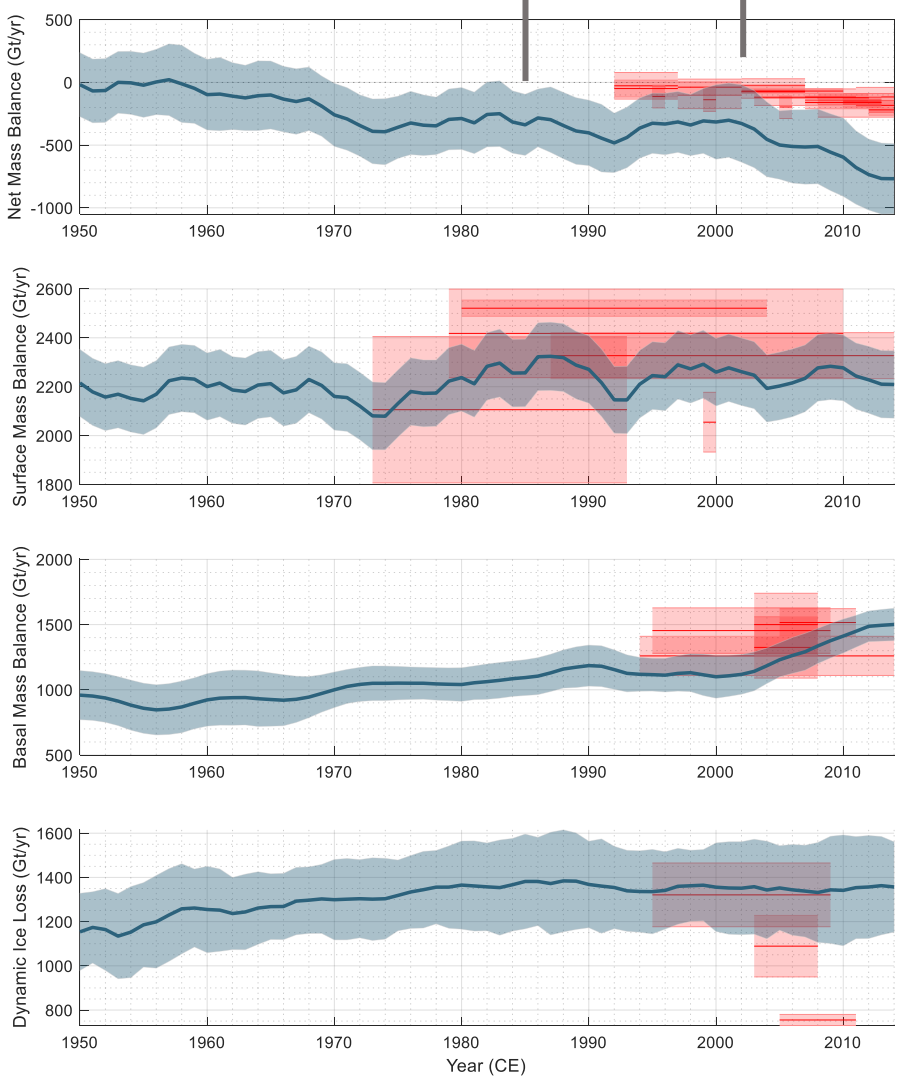
ENSEMBLE VALIDATION

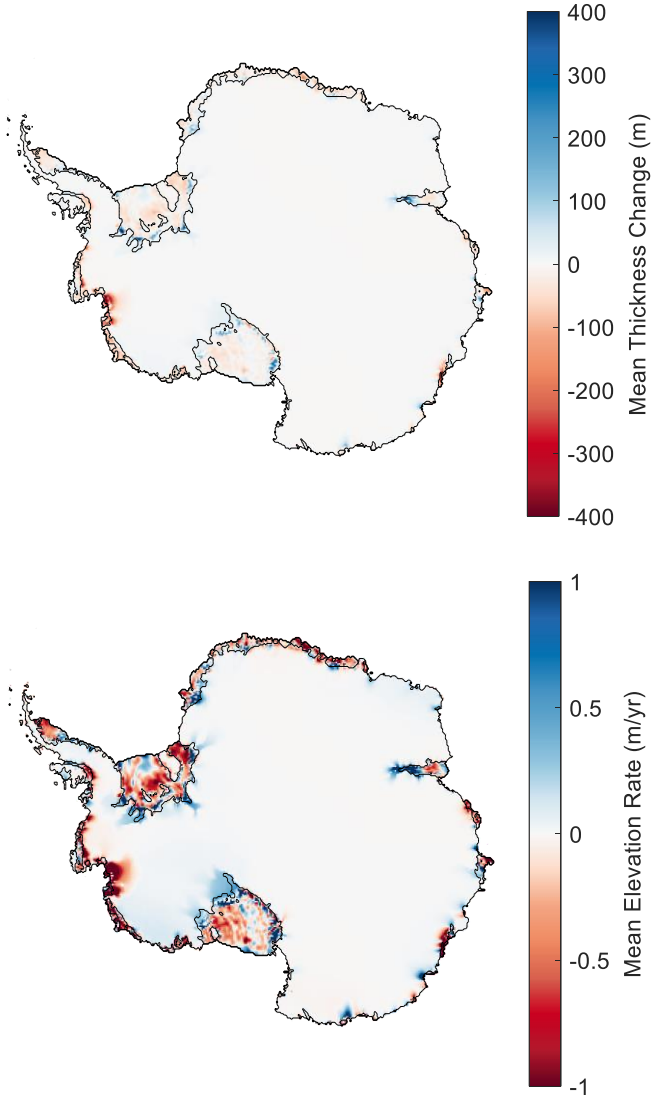
Satisfying behaviour over the historical period.

→ How does it evolve on multi-centennial to millenial timescales?

ENSEMBLE MEAN

OBSERVATIONS





[From Coulon et al, in prep.]

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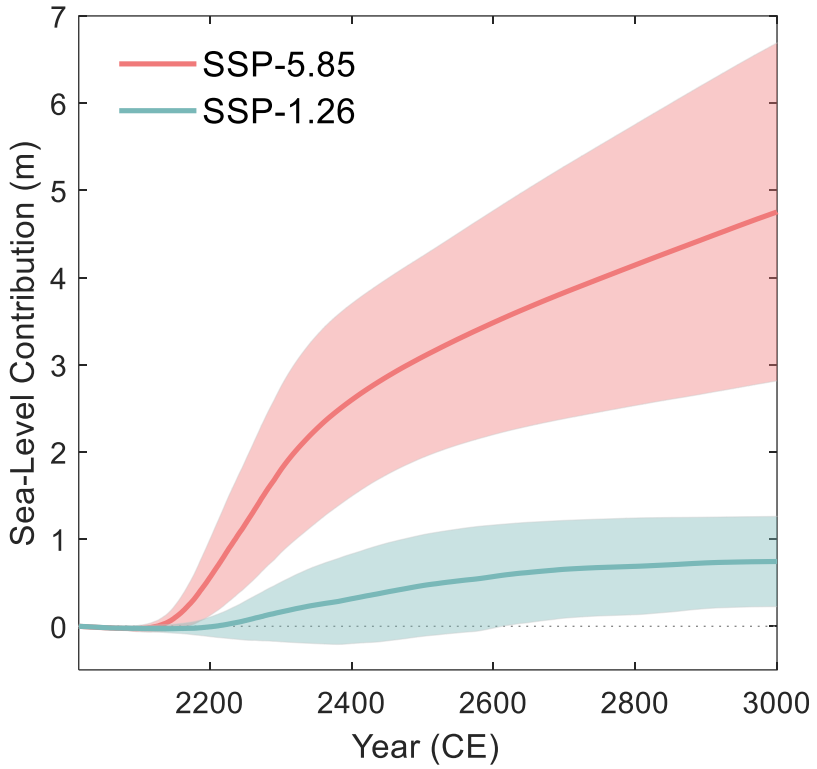
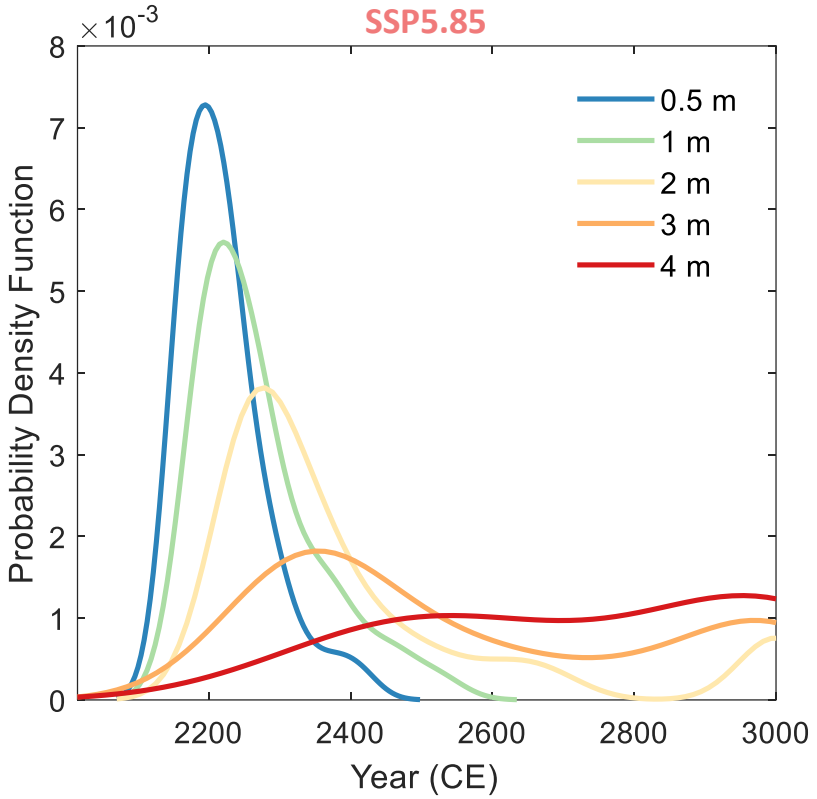
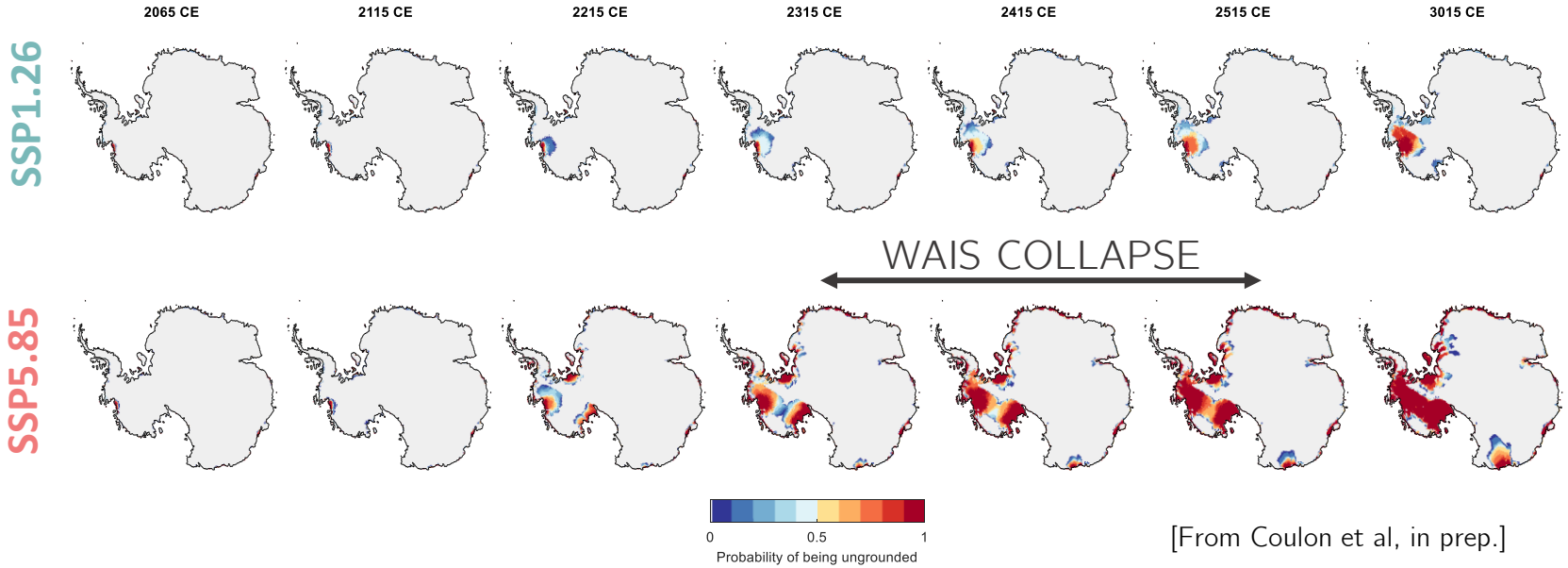
RESULTS

- <u>AFTER 2100 CE</u>: significant grounding line retreat in the ASE
- WAIS collapse expected to be **completed** between 2300 and 2500 CE under SSP5.85







[From Coulon et al, in prep.]

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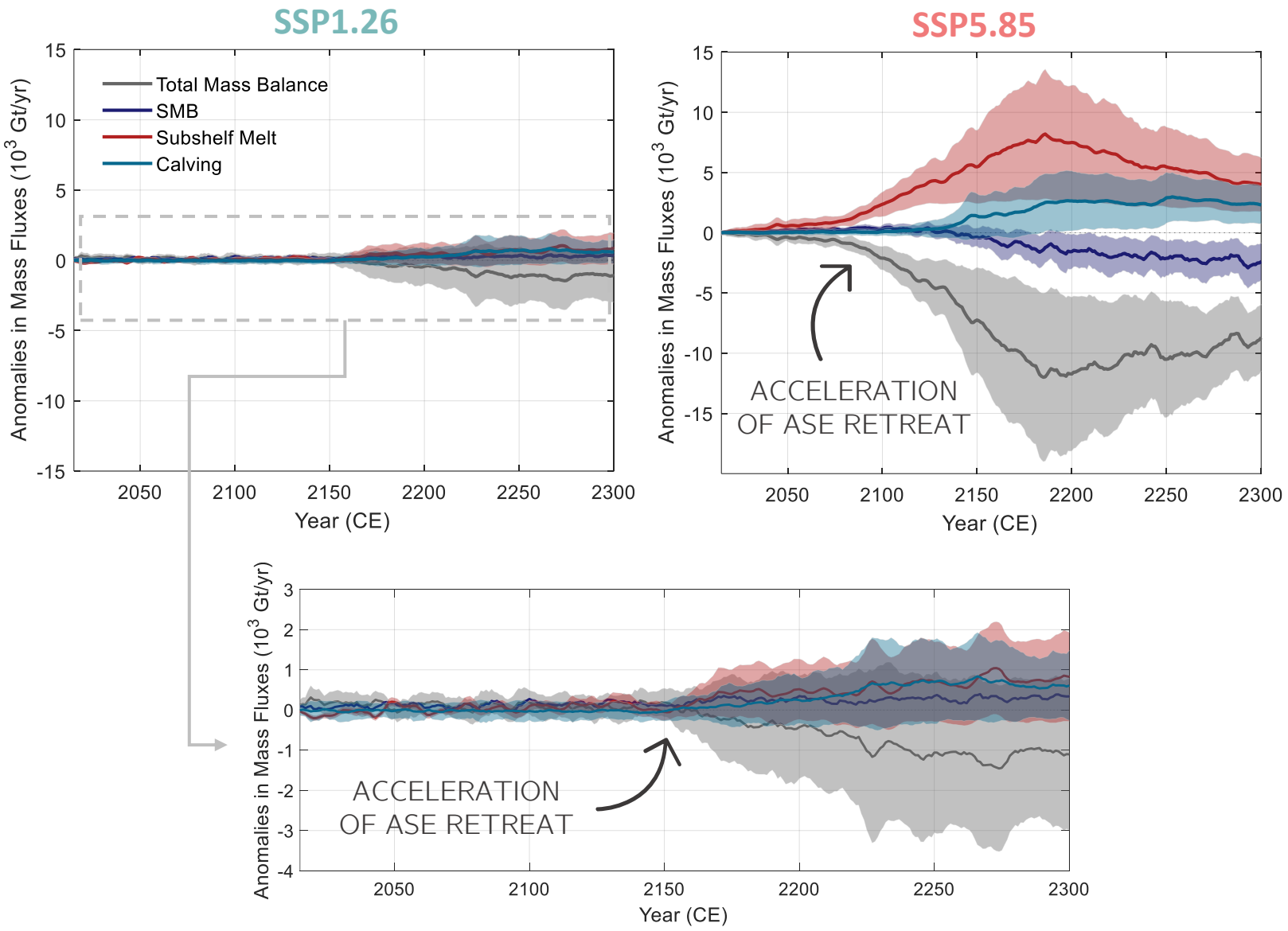
RESULTS

- Increase in sub-shelf melt → increase in ice discharge
- Sub-shelf melt largest contributor to uncertainties in future AIS mass changes



[From Coulon et al, in prep.]

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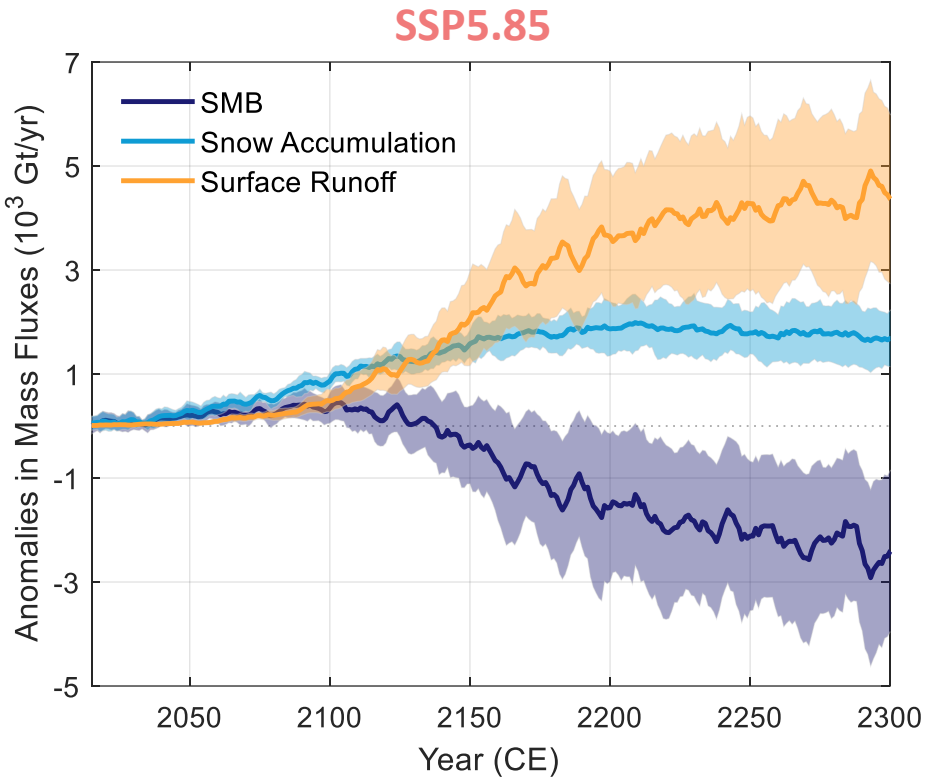
RESULTS

- SSP5.85:
  - Increase in surface runoff compensates increase in snow accumulation
    → SMB ↓

    → no longer mitigates the ice discharge



Major ice loss expected when increase in surface runoff outweighs increase in snow accumulation

[From Coulon et al, in prep.]

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CONCLUSIONS

- Sub-shelf melt largest contributor to uncertainties in future AIS mass changes
- Major ice loss expected when increase in surface runoff outweighs increase in snow accumulation

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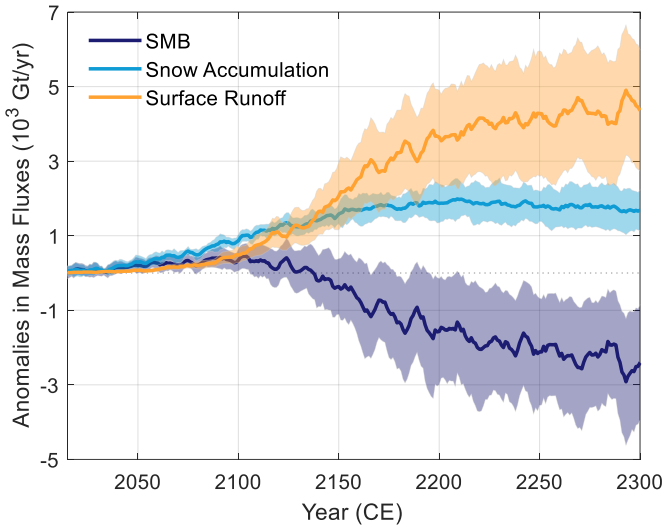
THANK YOU!

SSP5.85



SSP5.85