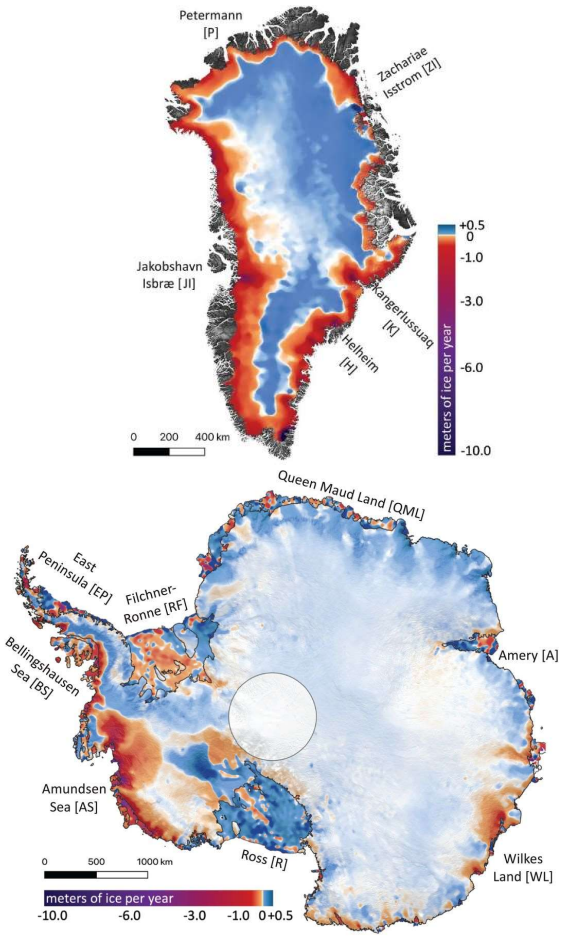
OCEAN:ICE

OCEAN-CRYOSPHERE EXCHANGES IN ANTARCTICA: IMPACTS ON CLIMATE AND THE EARTH SYSTEM

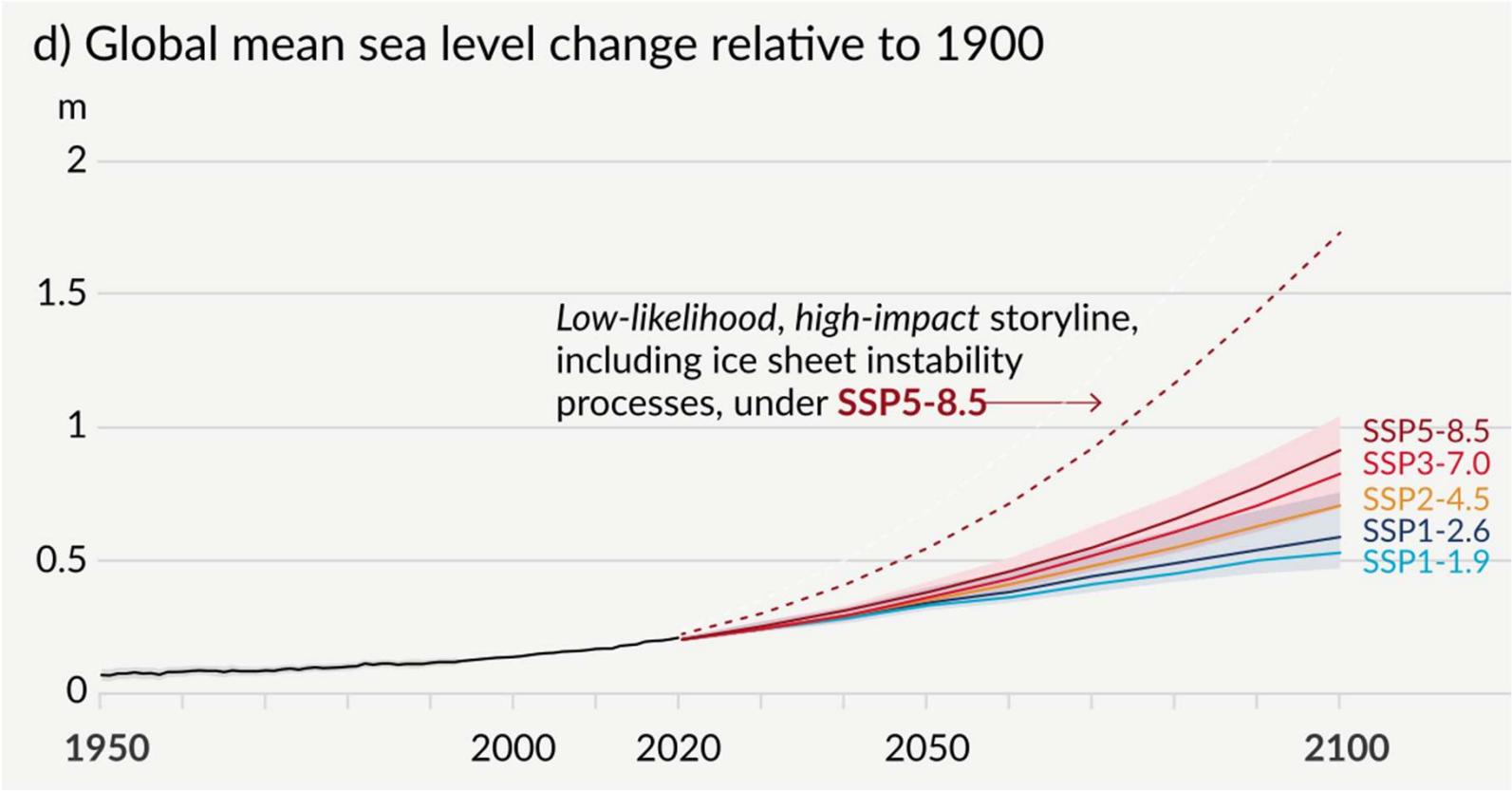
A 4 year (Nov 22) Horizon Europe/UKRI funded project involving 17 organisations and €8 M funding

DMI (COORDINATOR), BAS (UKRI LEAD), EPB, CNRS, AWI, NORCE, PIK, ETT, U.UTRECHT, U.READING, U.NORTHUMBRIA, U.BRISTOL, U.SOUTHAMPTON, U.BRUSSELS, U.GOTHENBURG, ENS-LMD, NPI

Future ice sheet mass loss is one of the greatest climate uncertainties

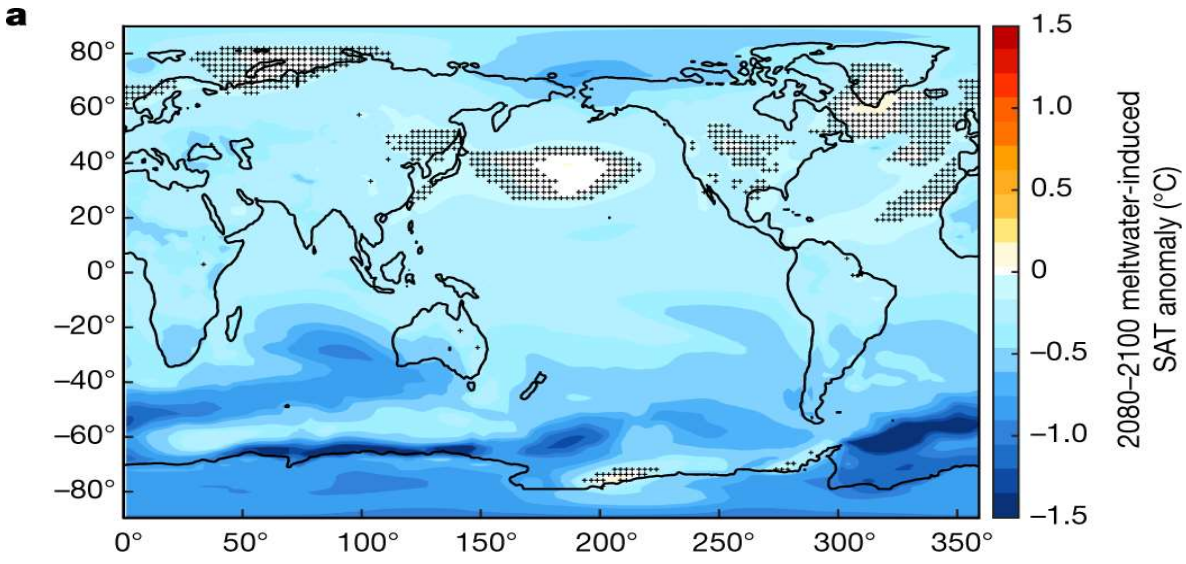


IceSat(-2) Mass loss (2003-19)
Smith et al., 2020, Science

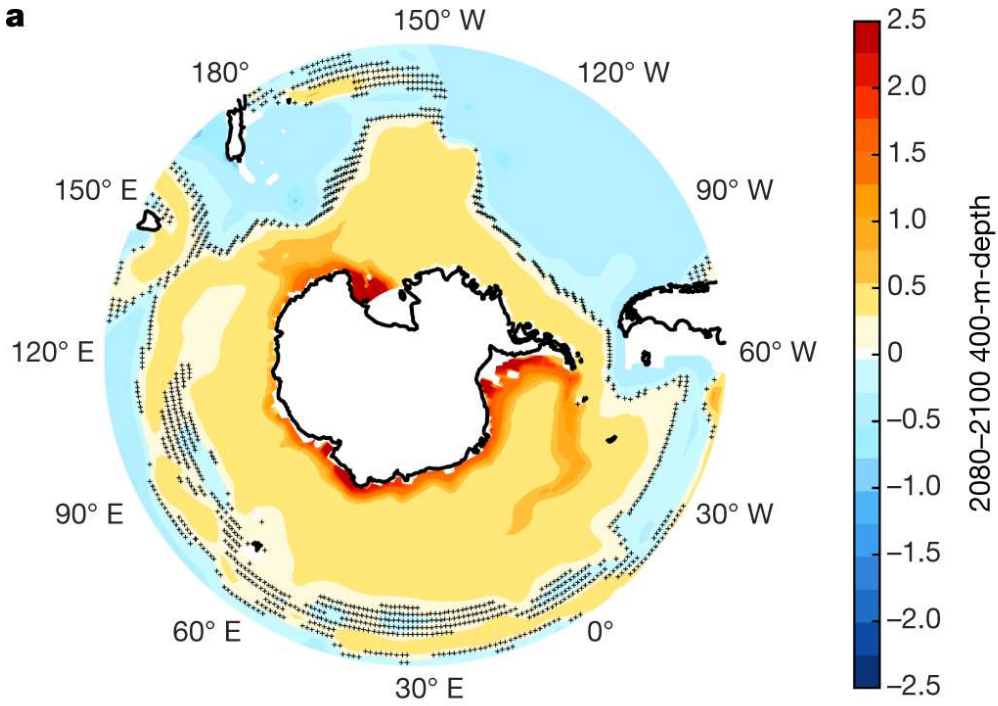


IPCC AR6 (2021), Summary for policy makers high impact storyline from an expert survey and structured expert judgement (i.e. not modelled)

Antarctic feedbacks contribute to global impacts

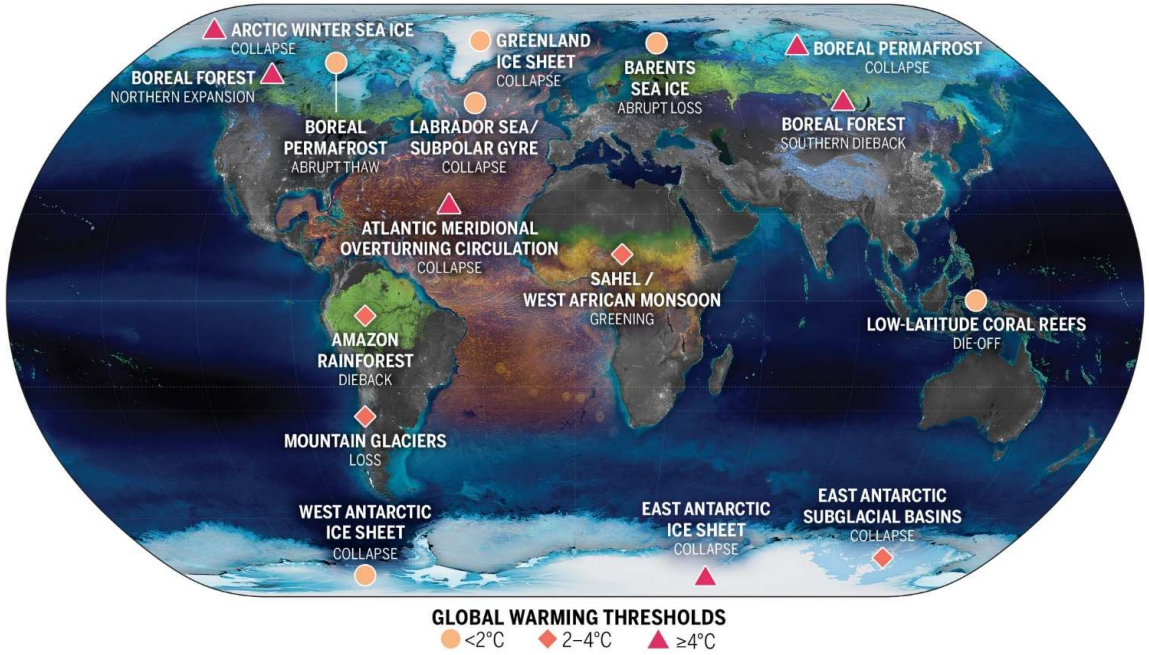


AIS freshwater input 'slows down' surface warming
Bronselaer et al., 2018

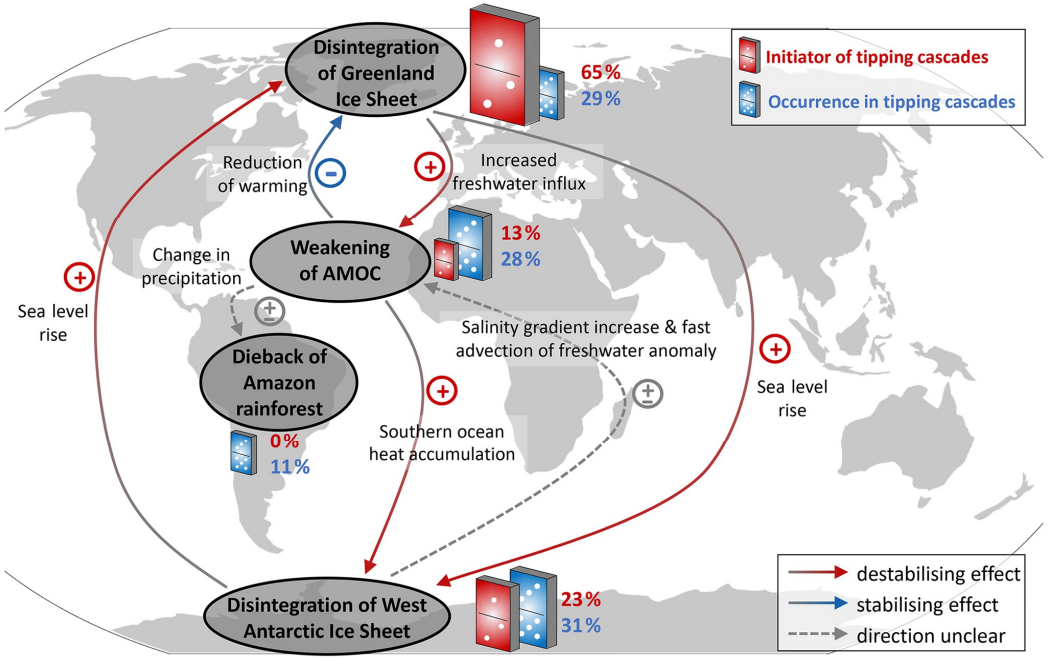


…and induced subsurface warming has potential for AIS melt feedbacks
Bronselaer et al., 2018

Tipping points



Potential tipping point thresholds McKay et al., (2022)



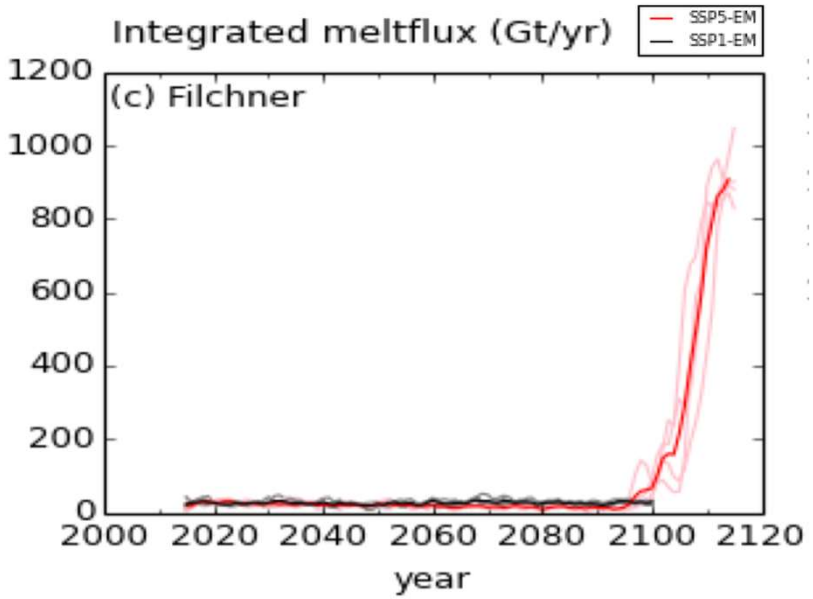
Conceptual tipping ‘cascades’ Wunderling et al., (2021)

Combines expertise in ice sheets, instability, ocean circulation and model development

Project changes in the land-based cryosphere to produce projections of SLR on a range of timescales

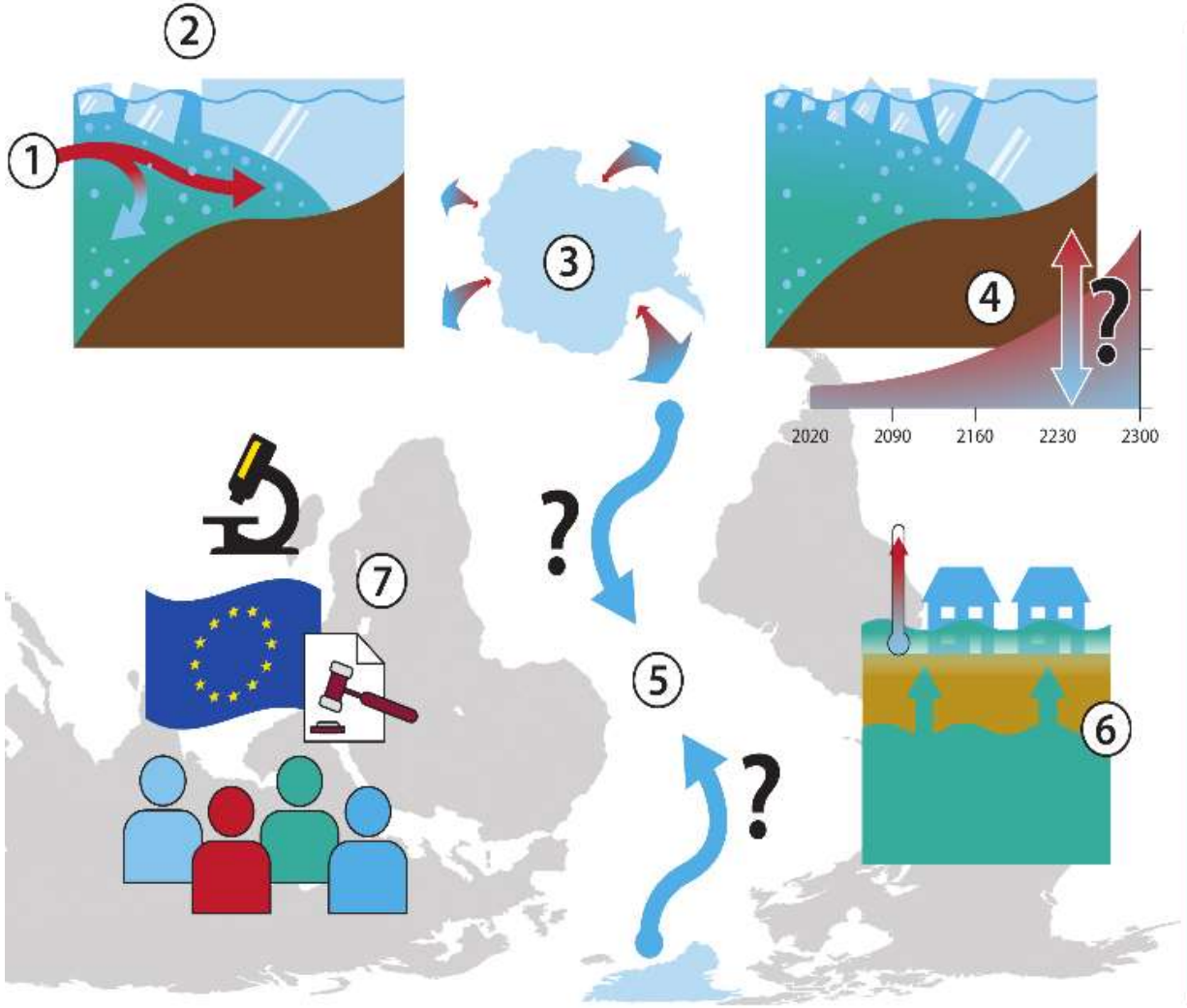
Assess the likelihood of large and abrupt near-future changes in the contribution of the Antarctic Ice Sheet to SLR

Quantify heat and carbon budgets in the Southern Ocean through an investigation of the key processes



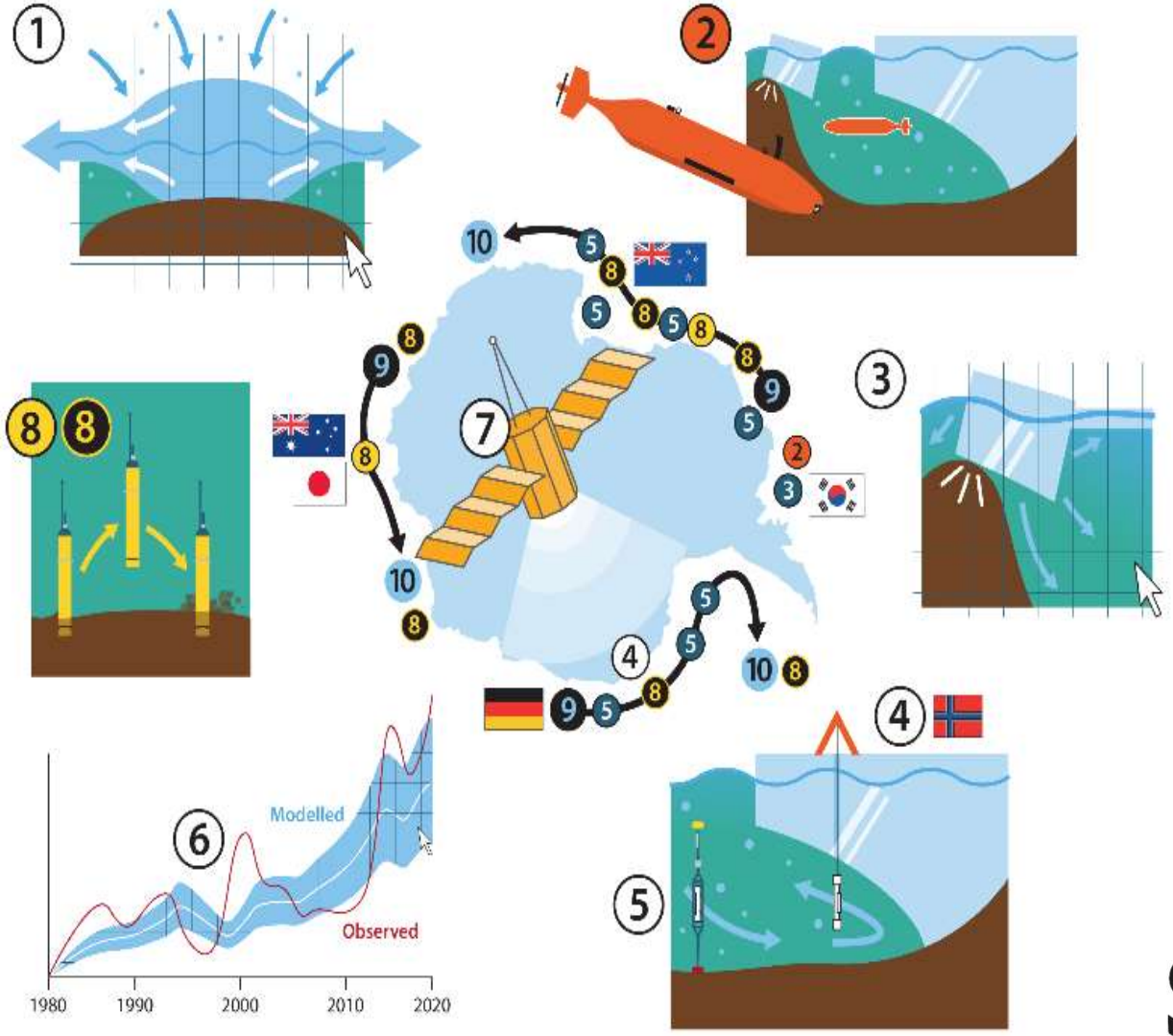
First dynamic ice sheet in a climate model
Siahaan et al., (2023)

Impact of Antarctic and Southern Ocean processes and feedbacks on planet Earth



- 1: Examine interaction of subpolar ocean and heat delivery to;
- 2: Ice shelf dynamics, supporting;
- 3: Whole Antarctic ice sheet historical reconstruction and improvement in models and;
- 4: Future projections and understanding of ice sheet instability, which drives;
- 5: Analysis of ocean response to ice sheet melt and ultimately;
- 6: Modelling of ocean-ice feedbacks and impact on climate; which informs;
- 7: Climate assessments and advice to policymakers and public

Antarctic research elements



- Numerous observational and modelling studies o the processes underpinning ice sheet dynamics.
- Supported by multinational project partners providing logistical and scientific support to the project
- Explicit collaboration with SOOS, providing funding for new ice-ocean layers in SOOSmap (ETT)
- Co-host a SOOS community workshop on the harmonisation and integration of new and emerging polar observational technologies (2024?

SCAR

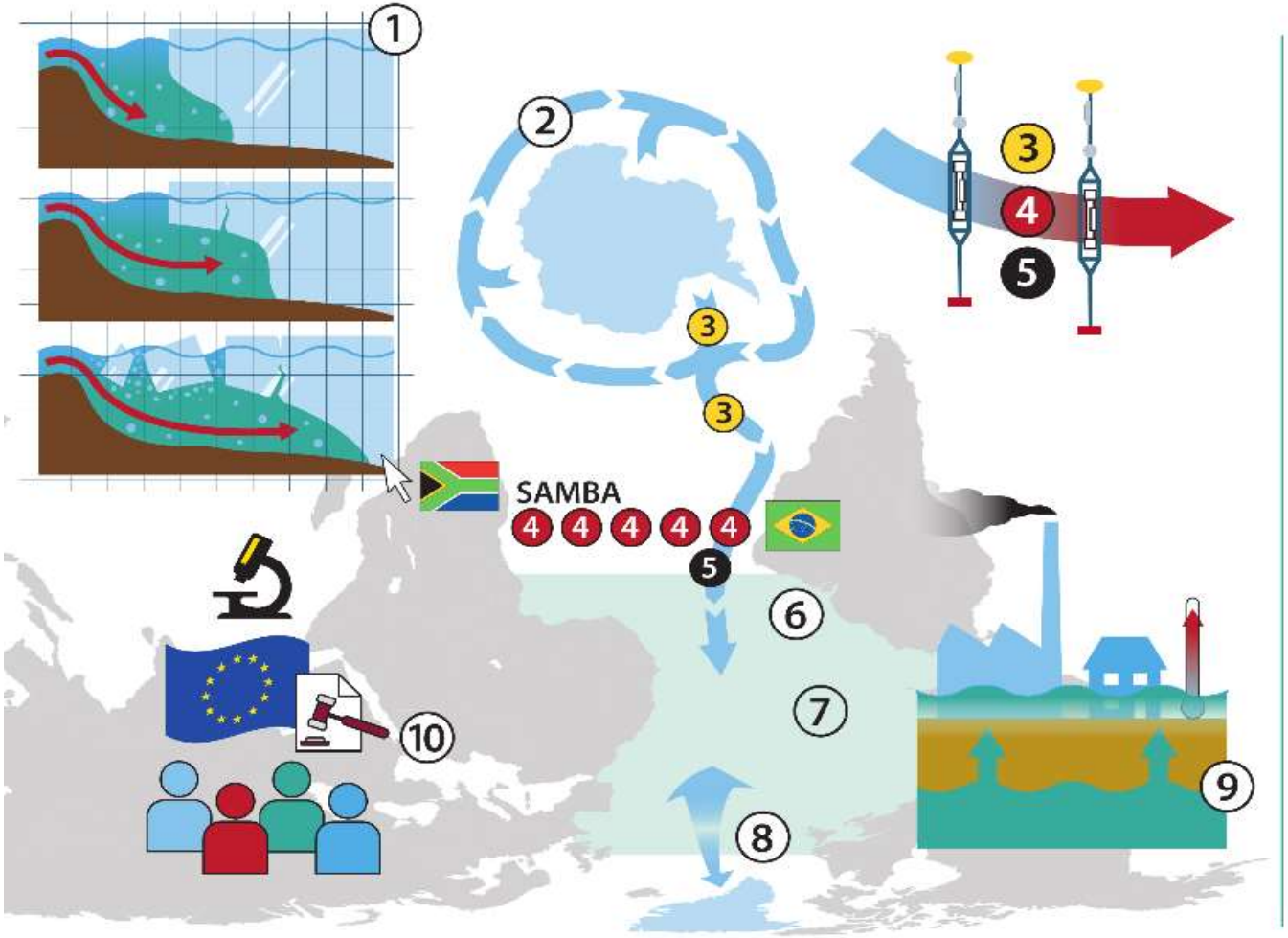
Copernicus

SOOS

SOUTHERN OCEAN OBSERVING SYSTEM

esa

Atlantic and global research elements



• The global elements of OCEAN:ICE observations emphasizes the Atlantic and Atlantic Meridional Overturning Circulation

• OCEAN:ICE explicitly partners with the SAMOC consortium in support of the South Atlantic SAMBA (AtlantOS) array (4, 5).

• Assess global impacts of Antarctic Ice Sheet melt feedbacks in coupled climate-ice sheet models, and coupled ice sheet-ocean models on 300-3000 year timescales

AtlantOS
Optimising and Enhancing the Integrated Atlantic Ocean Observing Systems

Summary of ambition

- First global climate projections made with an IPCC-class Earth system model including collapse of the Antarctic Ice Sheet
- New estimates of AIS freshwater flux
- Improved quantification of uncertainties in future AIS freshwater flux (& SLR)
- Greatly improved modelling of iceberg freshwater distribution
- Observation-based quantification of circum-Antarctic and meridional exchanges of heat and salt
- Novel observations and modelling of iceberg interaction with bathymetry and sea ice
- Unique observations within warm and cold ice shelf cavities
- Significantly extended prediction of Antarctic Ice Sheet surface runoff
- First observations of the primary AABW pathway from the Weddell Sea to the Atlantic
- First observations of basin wide South Atlantic AABW variability
- Supporting international assessments such as CMIP7, TipMIP, ISMIP, IPCC

Upcoming events

- ESA-EU CCI workshop bringing together in situ polar scientists with EO providers to discuss needs and coordination between the communities (Copenhagen, May 23)
- Observing the ocean round table – Ocean Race (Genoa, June 23)
- Breakout discussion session for Southern Ocean/cryosphere sessions at IUGG (Berlin, July 23)
- Convening a session on circumpolar Antarctic observations and support for modelling at SOOS symposium (Hobart, August 23)
- Summer school in Southern Ocean dynamics and climate change for ECRs (Corsica, May 24)

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