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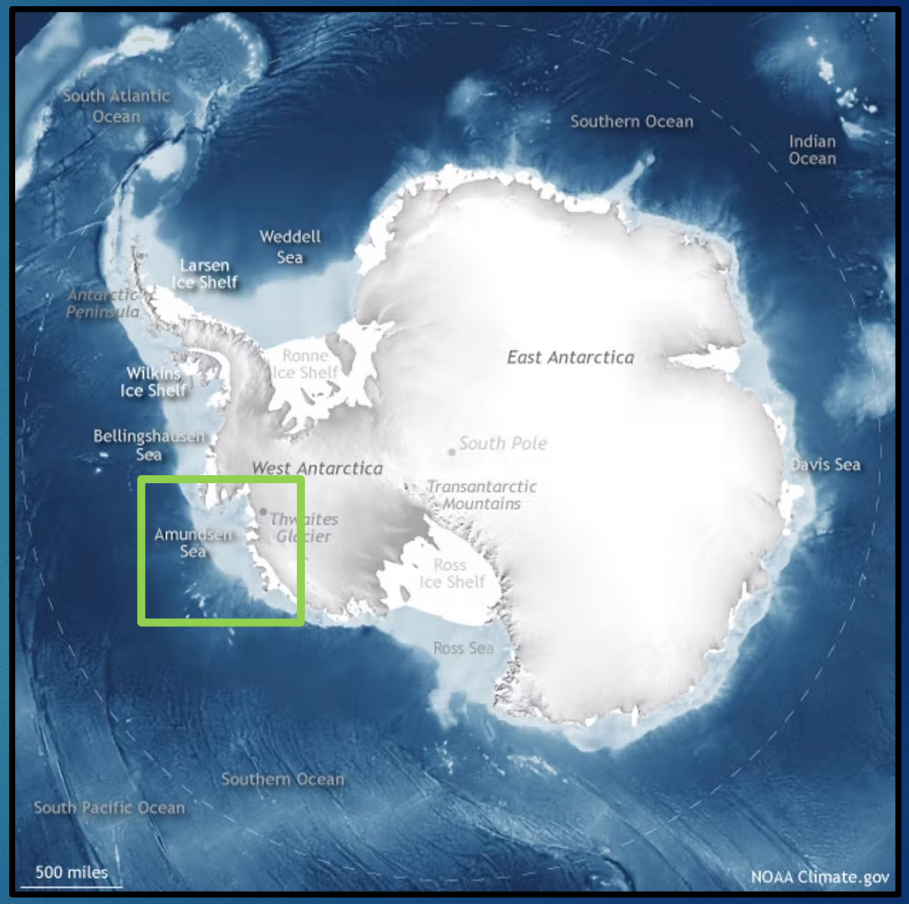
Outstanding Student & PhD candidate Presentation contest

Drivers and reversibility of abrupt ocean state transitions in the Amundsen Sea

Justine CAILLET[1], Nicolas JOURDAIN[1], Pierre MATHIOT[1], Hartmut HELLMER[2], Jérémie MOUGINOT[1]

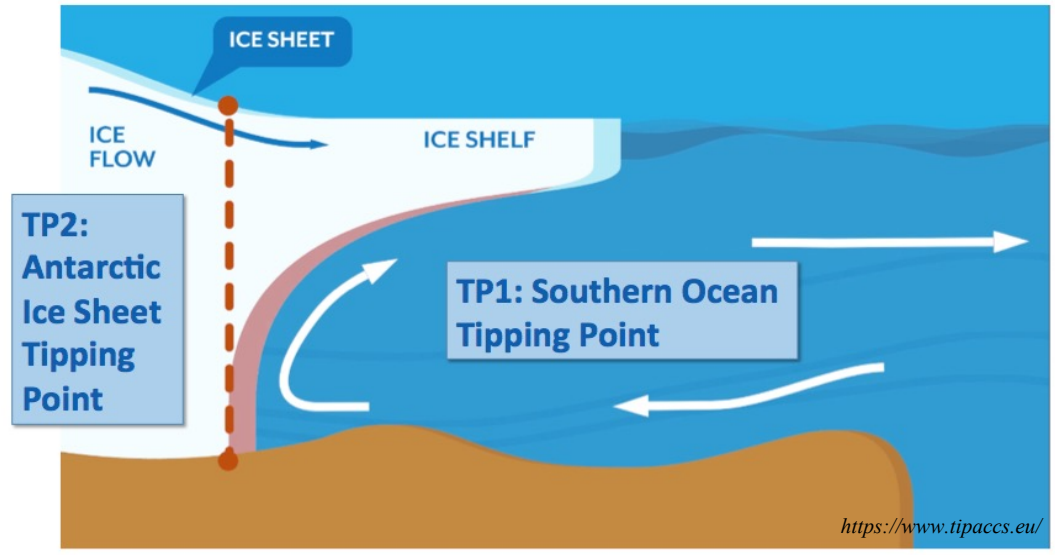
[1]Univ. Grenoble Alpes, CNRS, IRD, Grenoble INP, IGE, 38000 Grenoble, France
[2]Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany



The TiPACCs project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 820575

Tipping Points in Antarctic Climate Components

CONTEXT

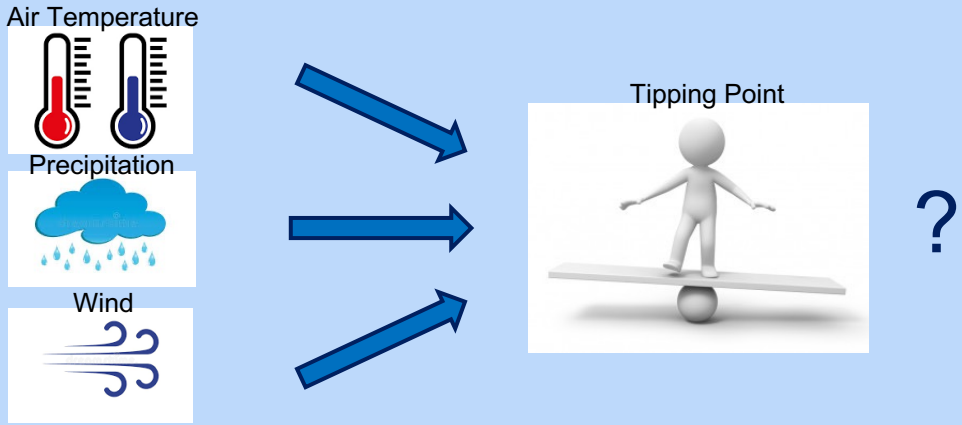


Tipping point = ***Abrupt*** *change* + ***Large*** *change* + ***Irreversible*** *change*

Oceanic tipping point in **Weddell Sea**
(Hellmer et al. 2012, 2017)

OBJECTIVES

- **Identifying,** under which atmospheric forcing conditions, **tipping points in the Amundsen Sea** could occur or have occurred

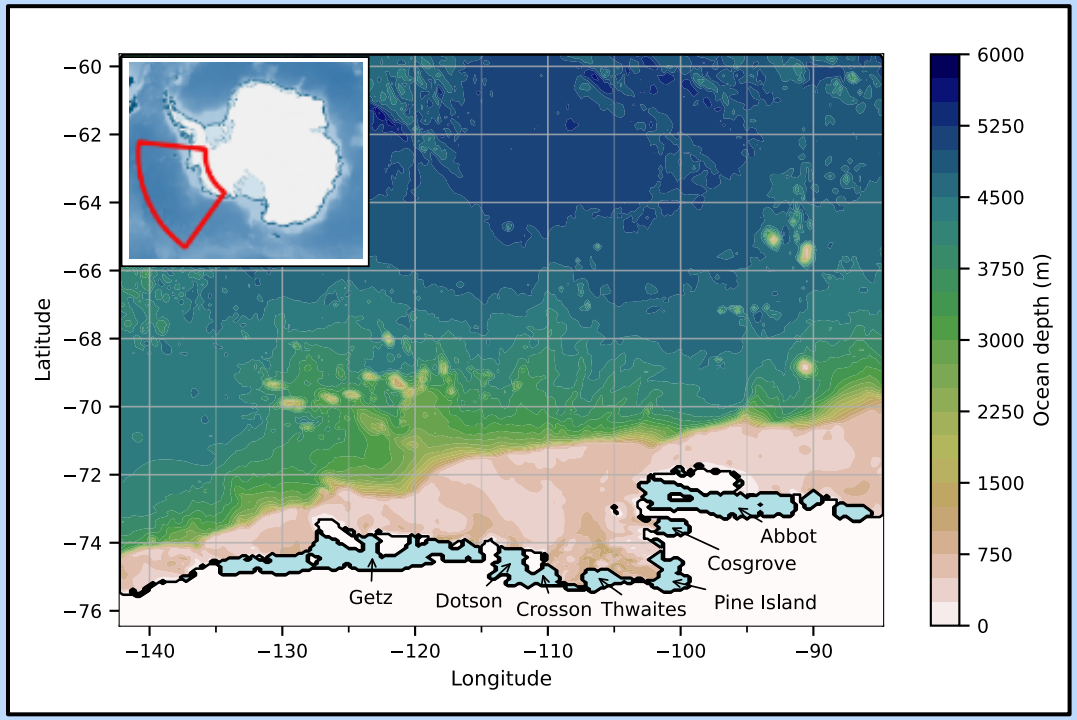


- **Identifying relevant processes**

http://www.unac.asso.fr https://fr.dreamstime.com https://www.stocklib.fr

MATERIALS & METHODS

Regional ocean modelling approach (NEMO)

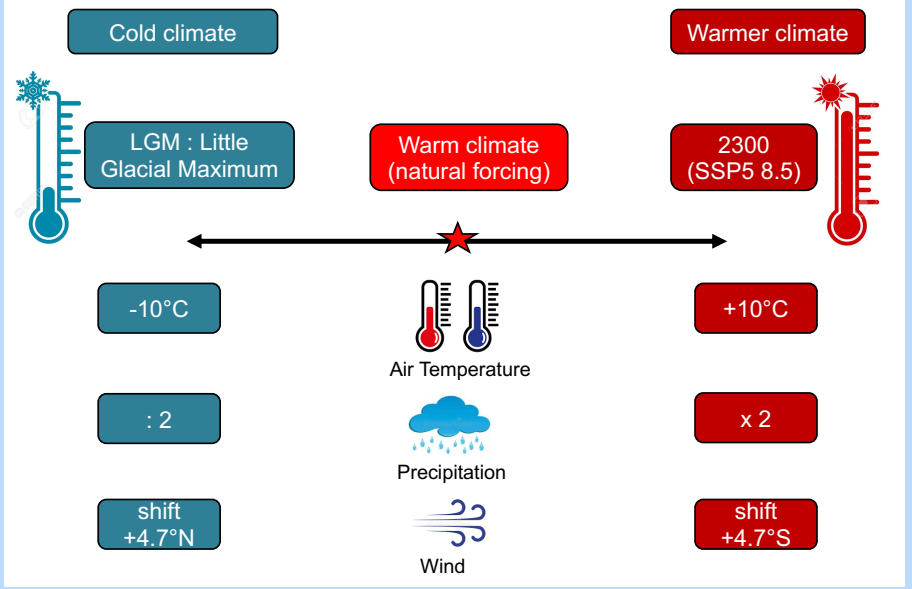


Coupled **oceanic** and **sea-ice** models
Parameterisation of ice-shelf melt rate

Atmospheric perturbations

Idealized
Surface freshwater, heat and momentum fluxes perturbed independently

Local
Only on continental shelf and slope (CDW maintained in front of the shelf)



POTENTIAL TIPPING POINTS

Abrupt & large change

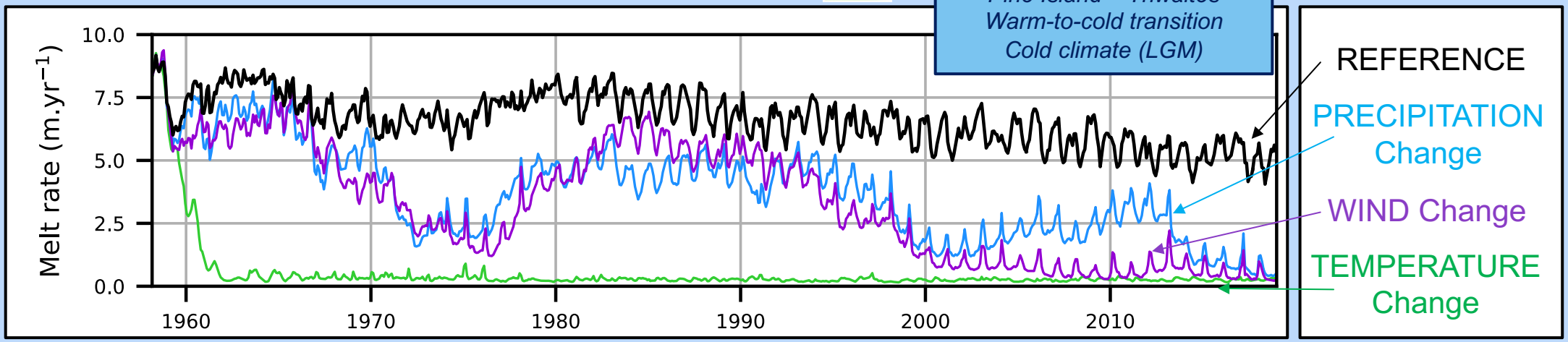
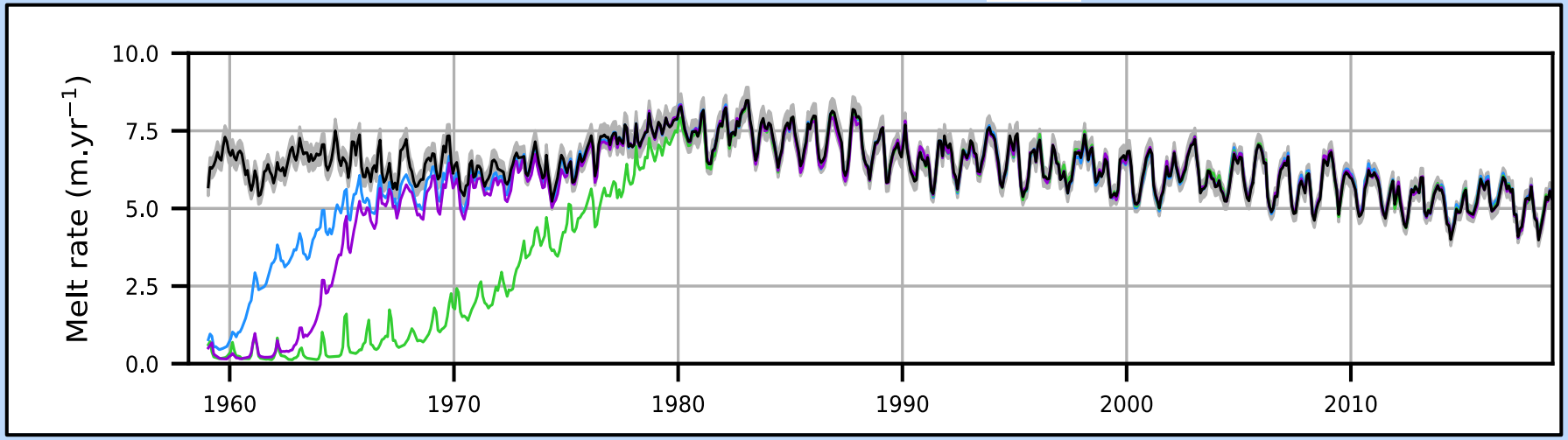


Figure
Pine Island – Thwaites
Warm-to-cold transition
Cold climate (LGM)

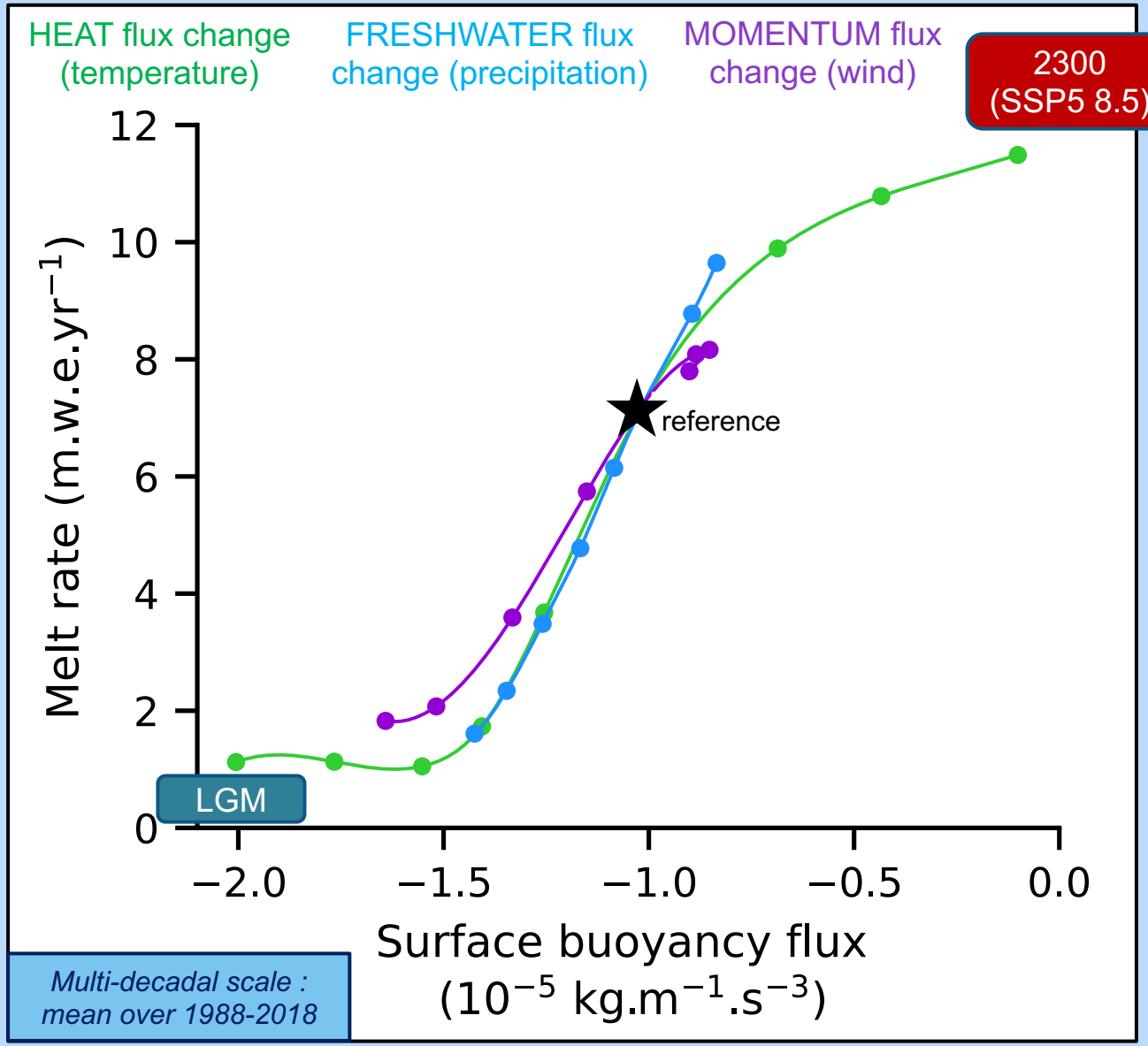
Irreversible change



No Tipping Point

Abrupt, **large** and **reversible** change for relative small atmospheric perturbations

PROCESSES



Surface Buoyancy Flux

surface BUOYANCY flux = combined effect of heat and freshwater fluxes on the surface density

- FRESHWATER flux : direct effect
- HEAT flux : indirect effect due to net sea-ice production
- MOMENTUM flux : indirect effect due to sea-ice advection toward deep ocean

Take-home messages

No tipping points in Amundsen Sea (range : LGM – 2300)
Abrupt, large and **reversible changes**

Transitions largely driven by **surface buoyancy fluxes** at multi-decadal scale

Change for relative small perturbations i.e., **climate –0.5°C relative to the present**
Cold Amundsen Sea cavities in pre-industrial period

Thank you for your attention !

for any questions : justine.caillet@univ-grenoble-alpes.fr

(Caillet et al., 2022, in prep.) - submission to JGR Ocean very soon

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