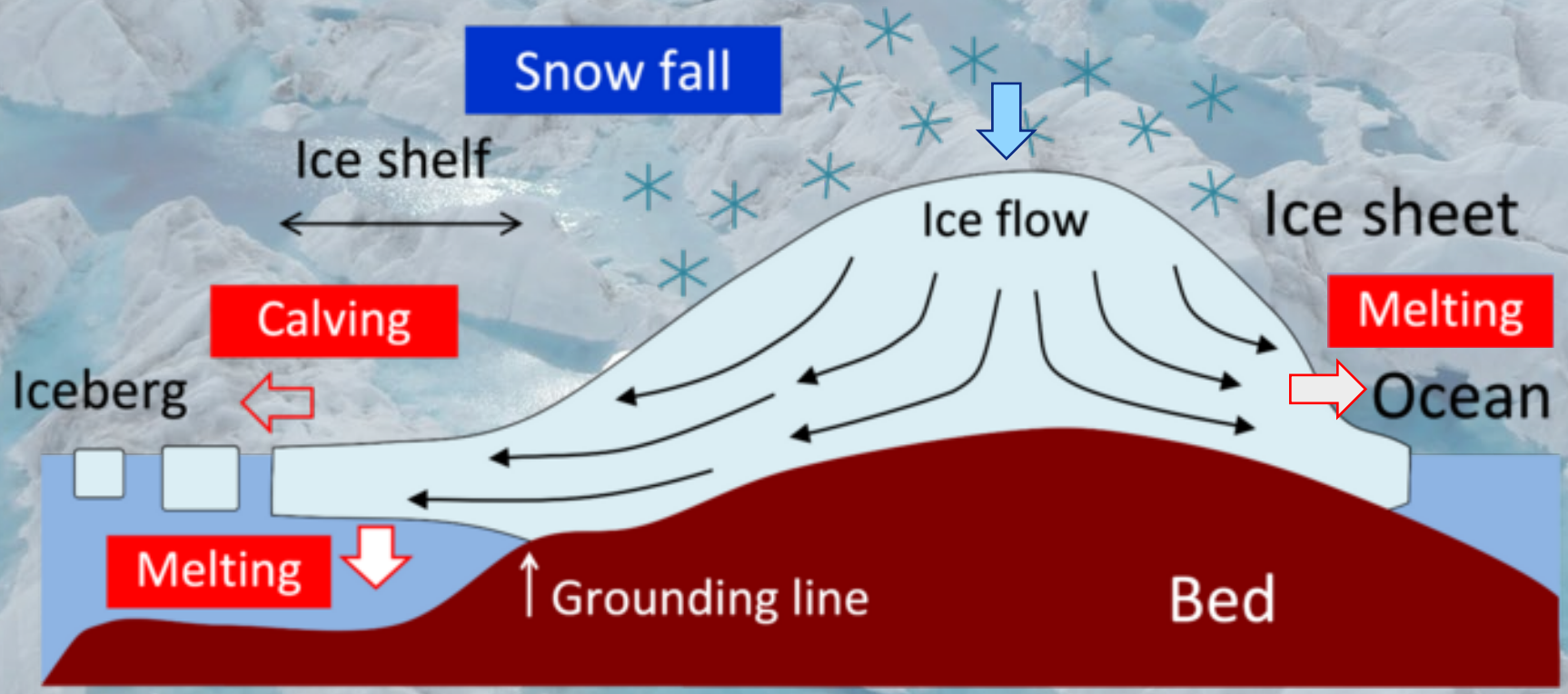
Monitoring the Greenland Ice Sheet

Andreas P. Ahlstrøm
Chief Research Consultant, MPG, PhD
GEUS - Geological Survey of Denmark and Greenland

PROMICE | GC-NET

GEUS

What is ice sheet mass balance?

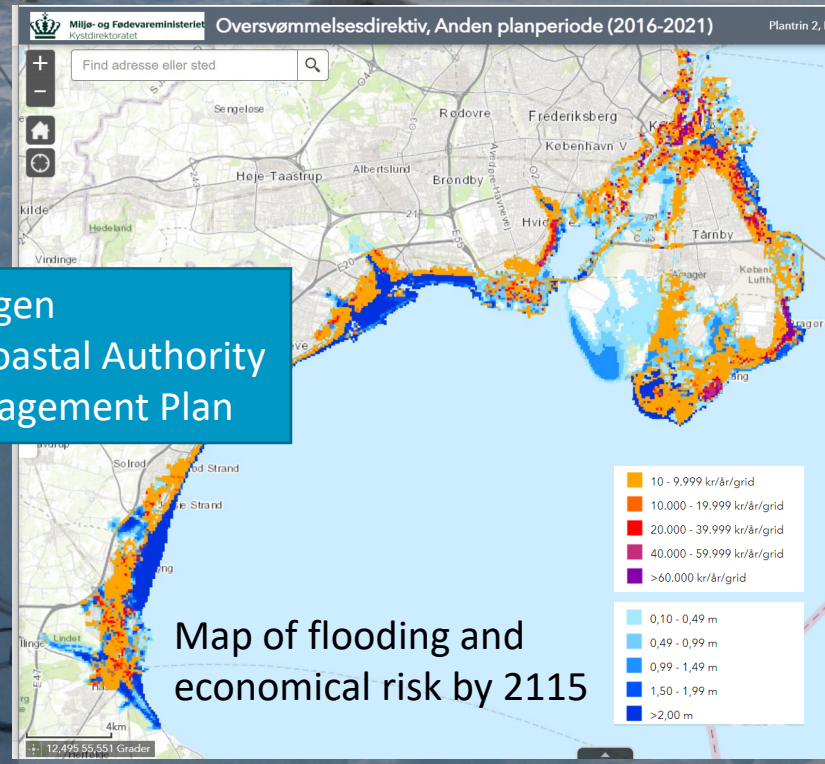


Mass balance of an ice sheet

Why monitor the Greenland ice sheet?

- Sensitive to climate change
- The Arctic warming 3-4 x faster
- Planning requires numbers
- Policymaking requires knowledge
- Scenarios depend on models

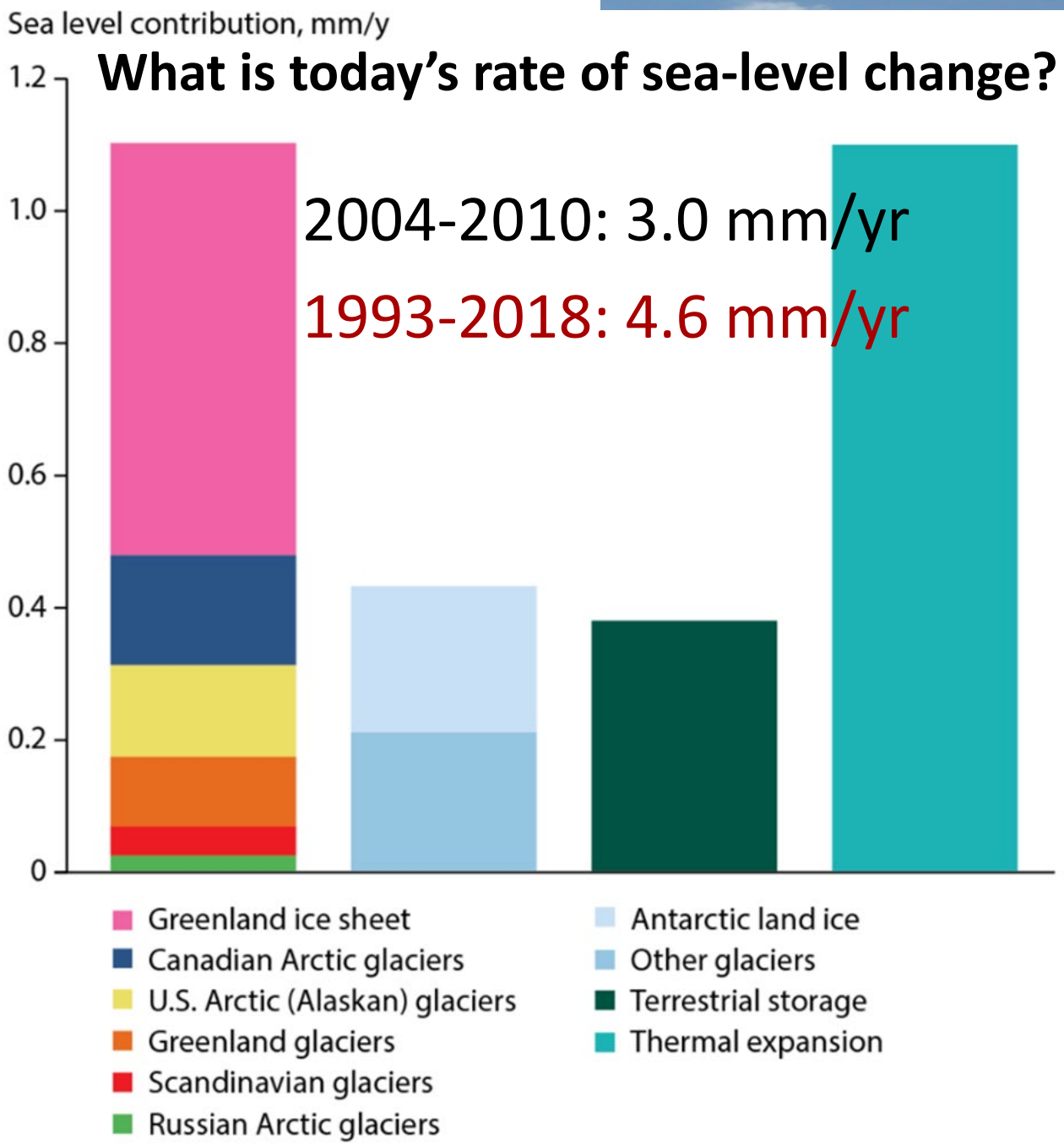
Scenarios (Strauss et al., 2015)
4 °C vs. 2 °C

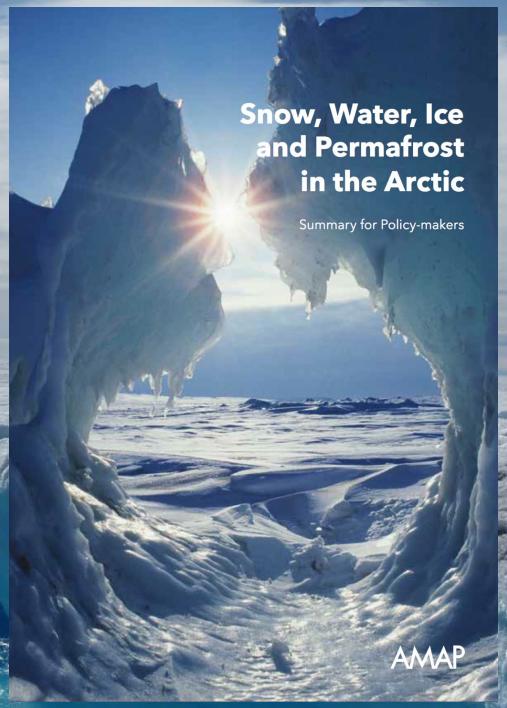


Copenhagen
Danish Coastal Authority
Risk Management Plan

Map of flooding and economical risk by 2115

What is today's rate of sea-level change?



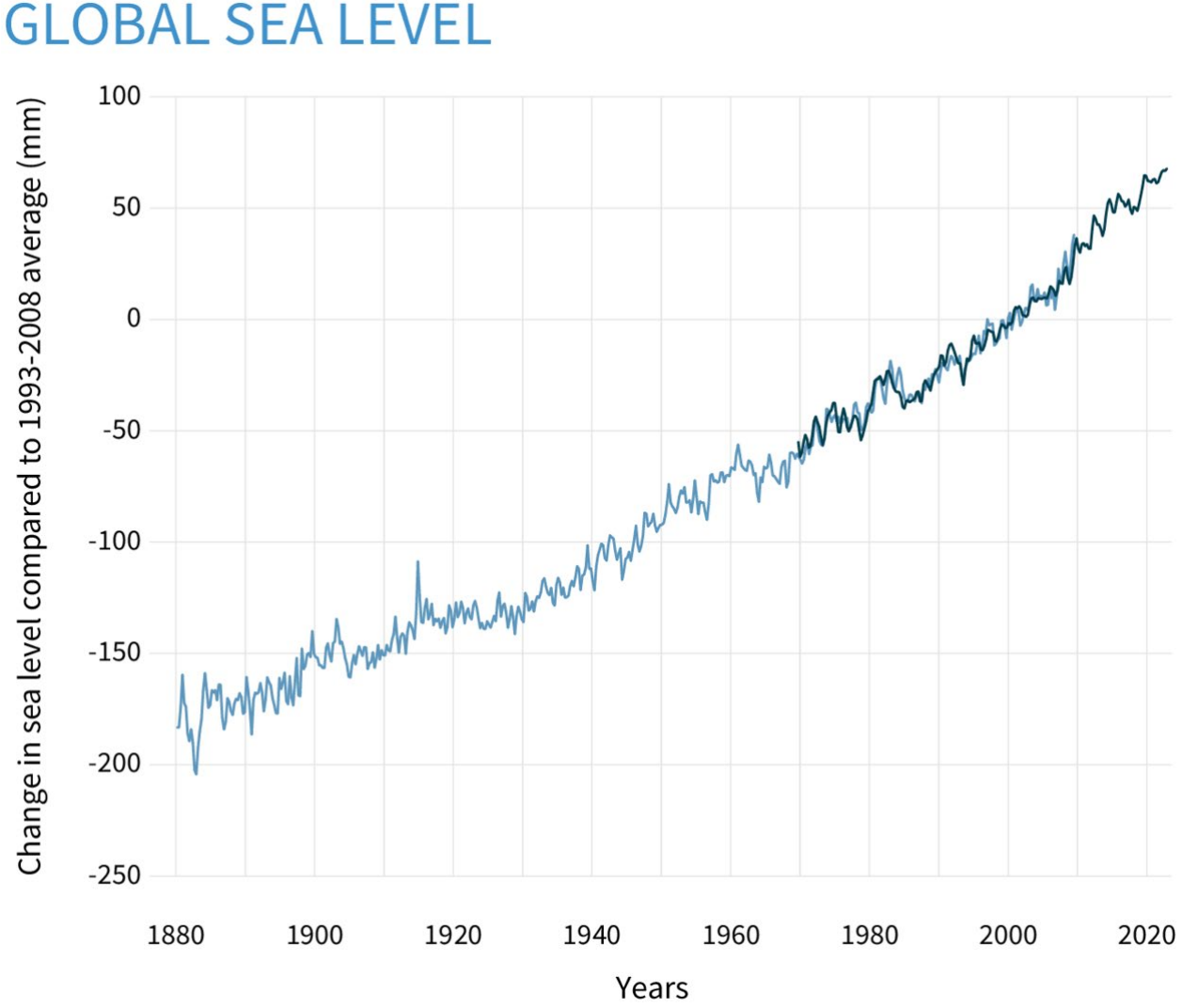


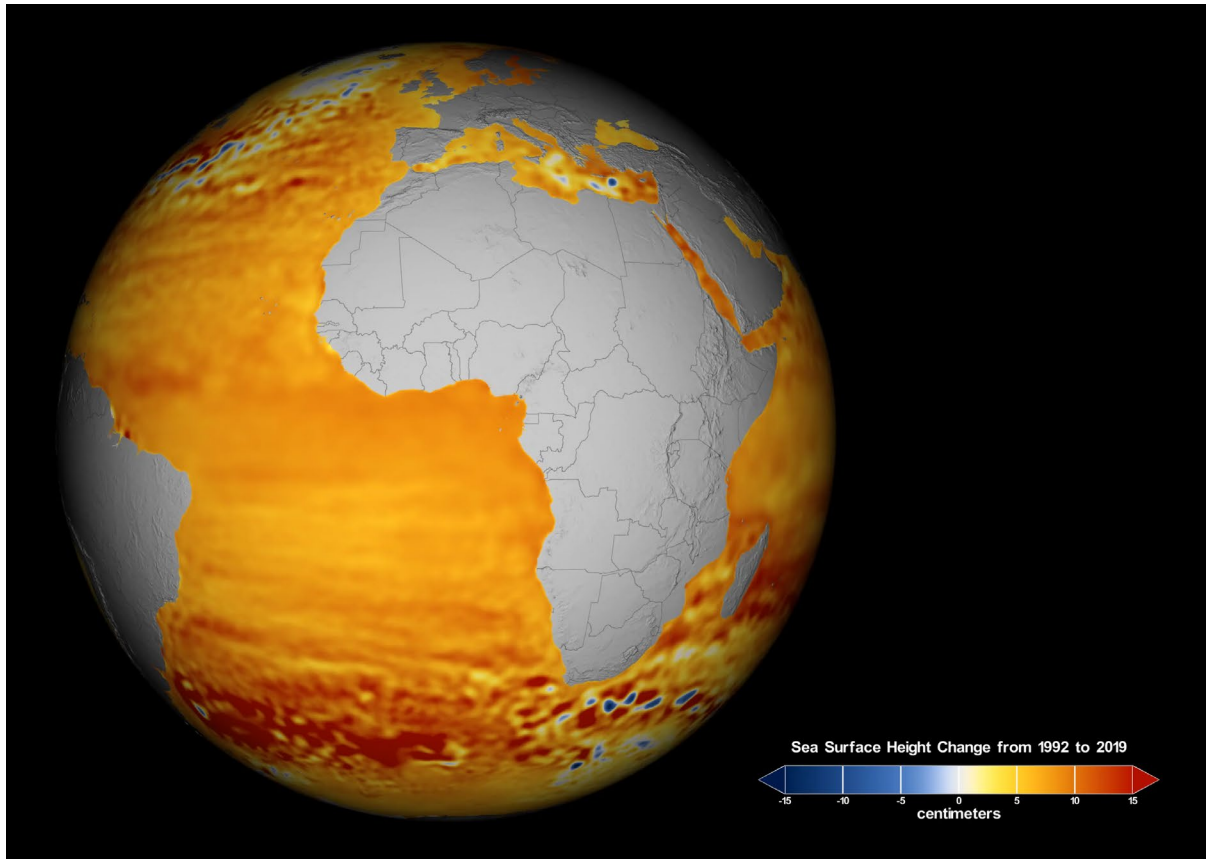
Comparison of Arctic sea level rates 2004–2010 with other global sea level components.

'Scandinavian glaciers' includes both Iceland and Svalbard. 'Other glaciers' includes, for example, Patagonian, Himalayan, African, and Indonesian land ice sources..

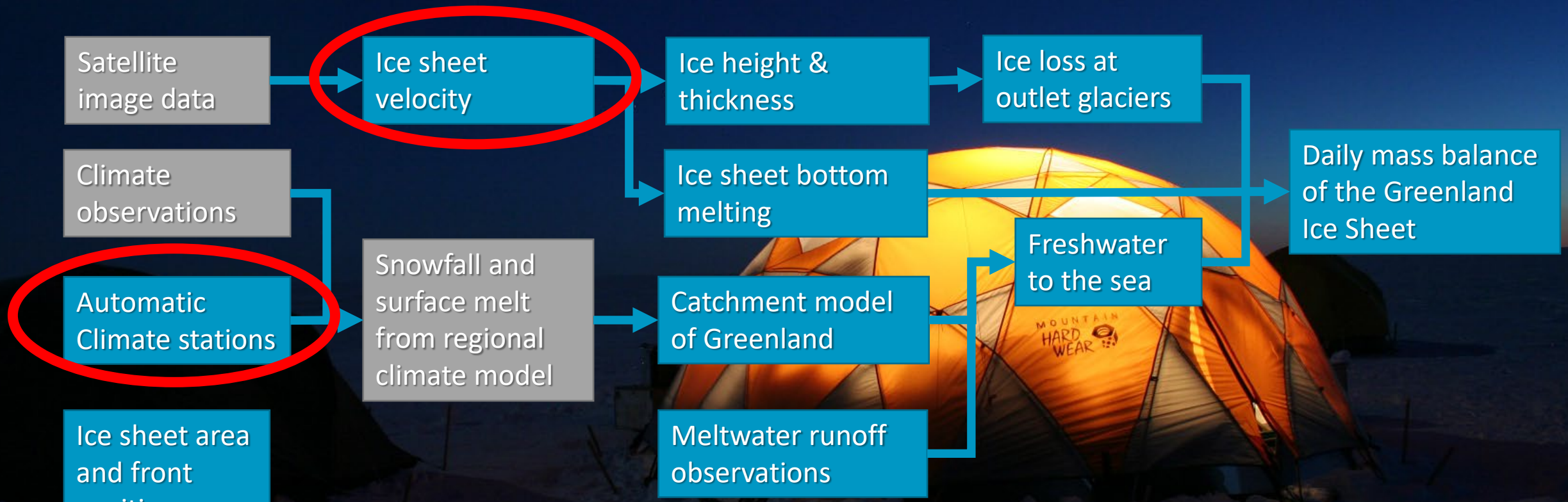
Figure 9.3 SWIPA 2017

Global (and local) sea level rise

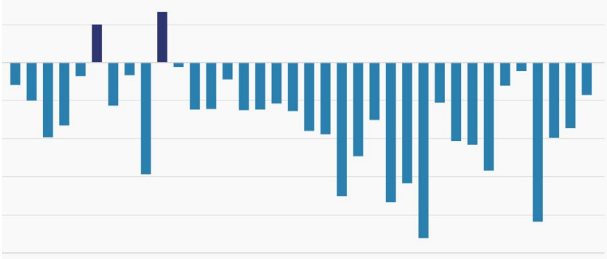




How we derive ice sheet mass balance



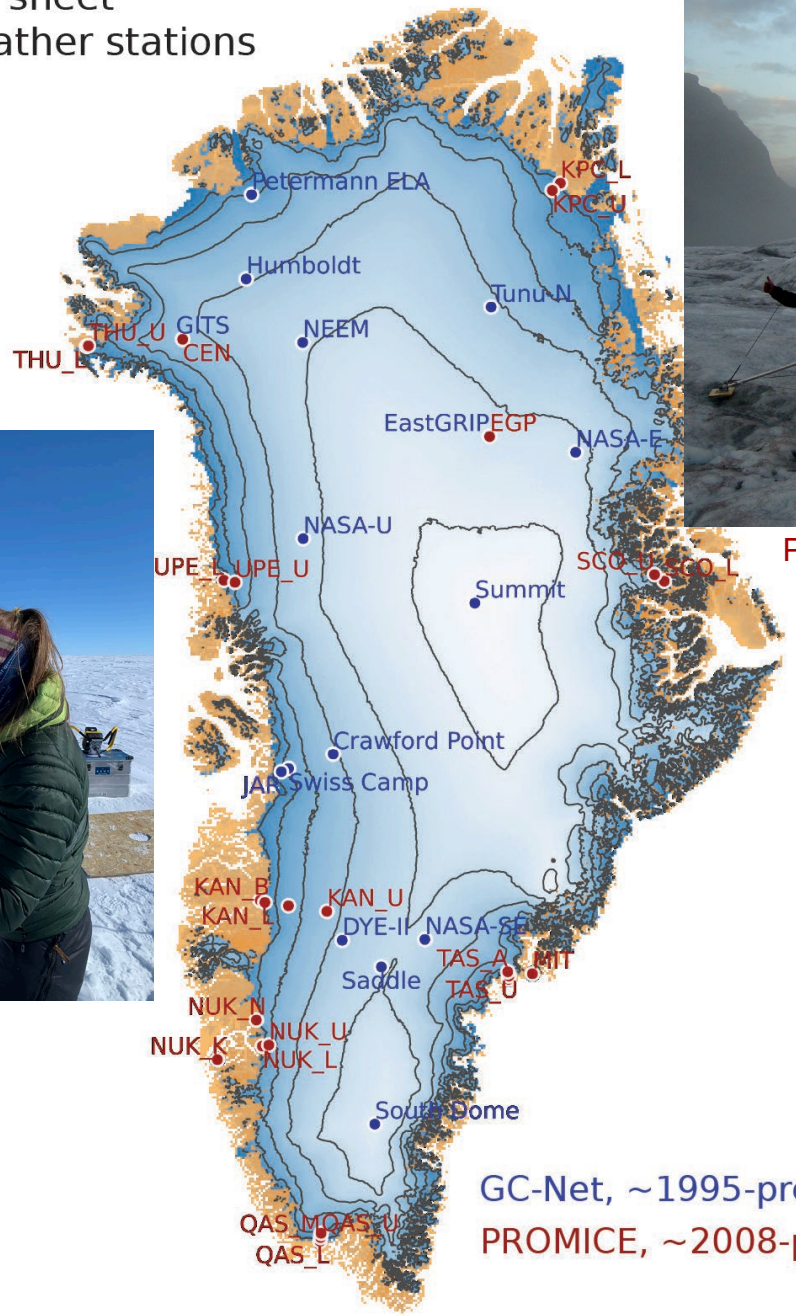
PROMICE | GC-NET

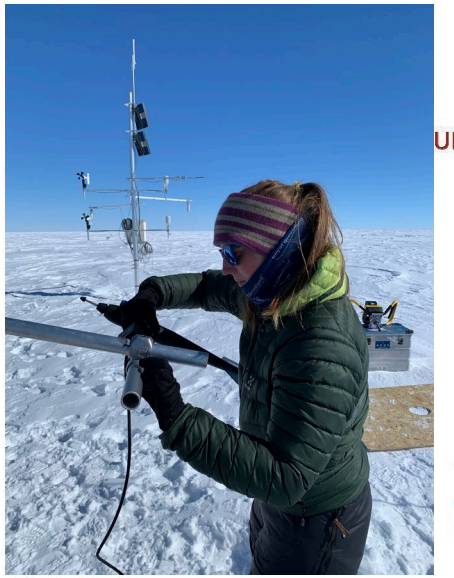


GEUS

Automatic climate stations

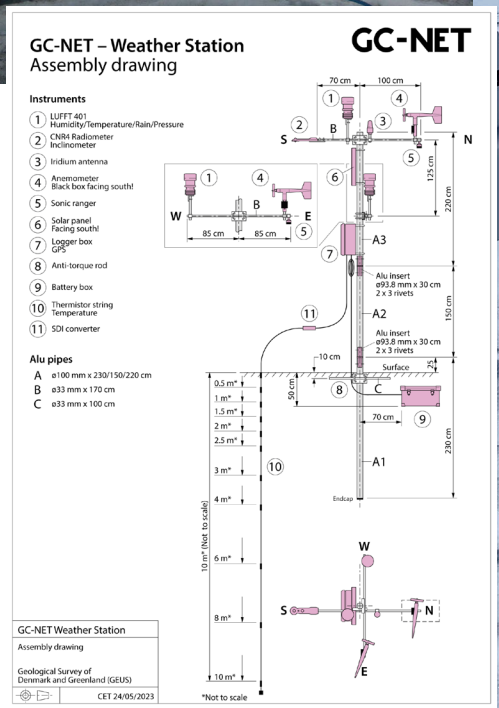
Greenland ice sheet
automatic weather stations





GC-Net

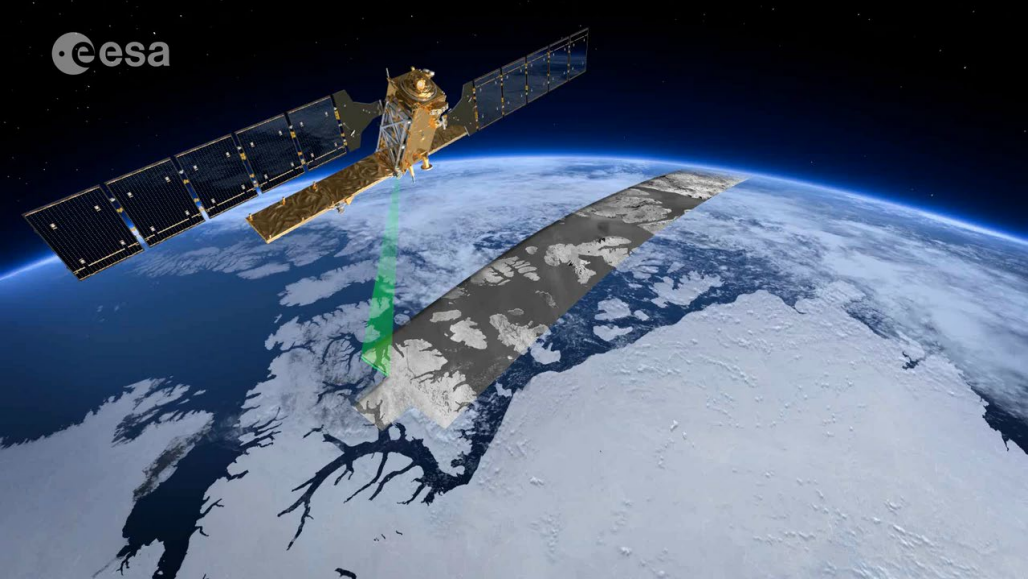
PROMICE



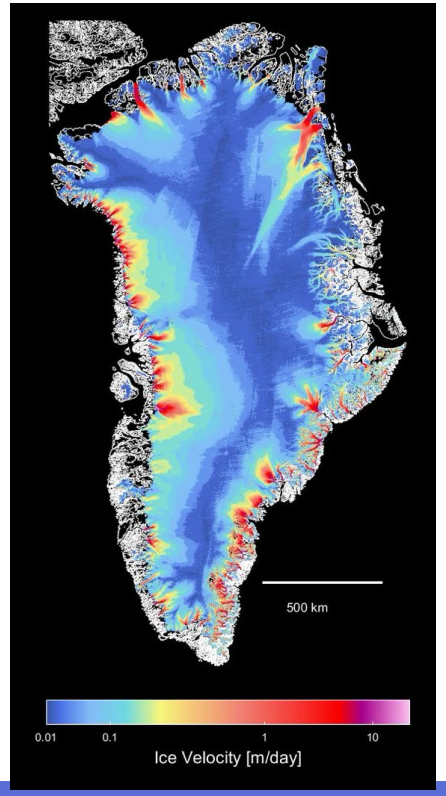
GC-Net, ~1995-present
PROMICE, ~2008-present

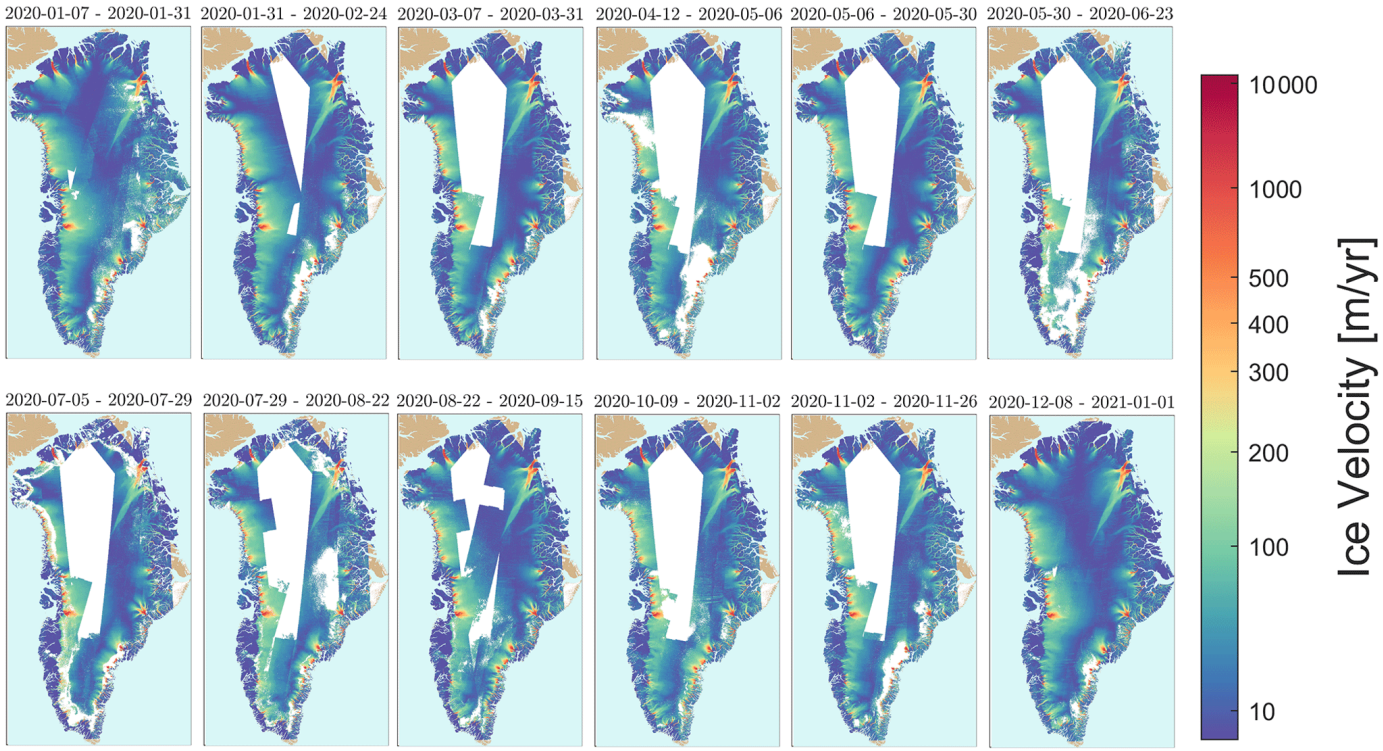
version 16 Aug, 2023

GEUS



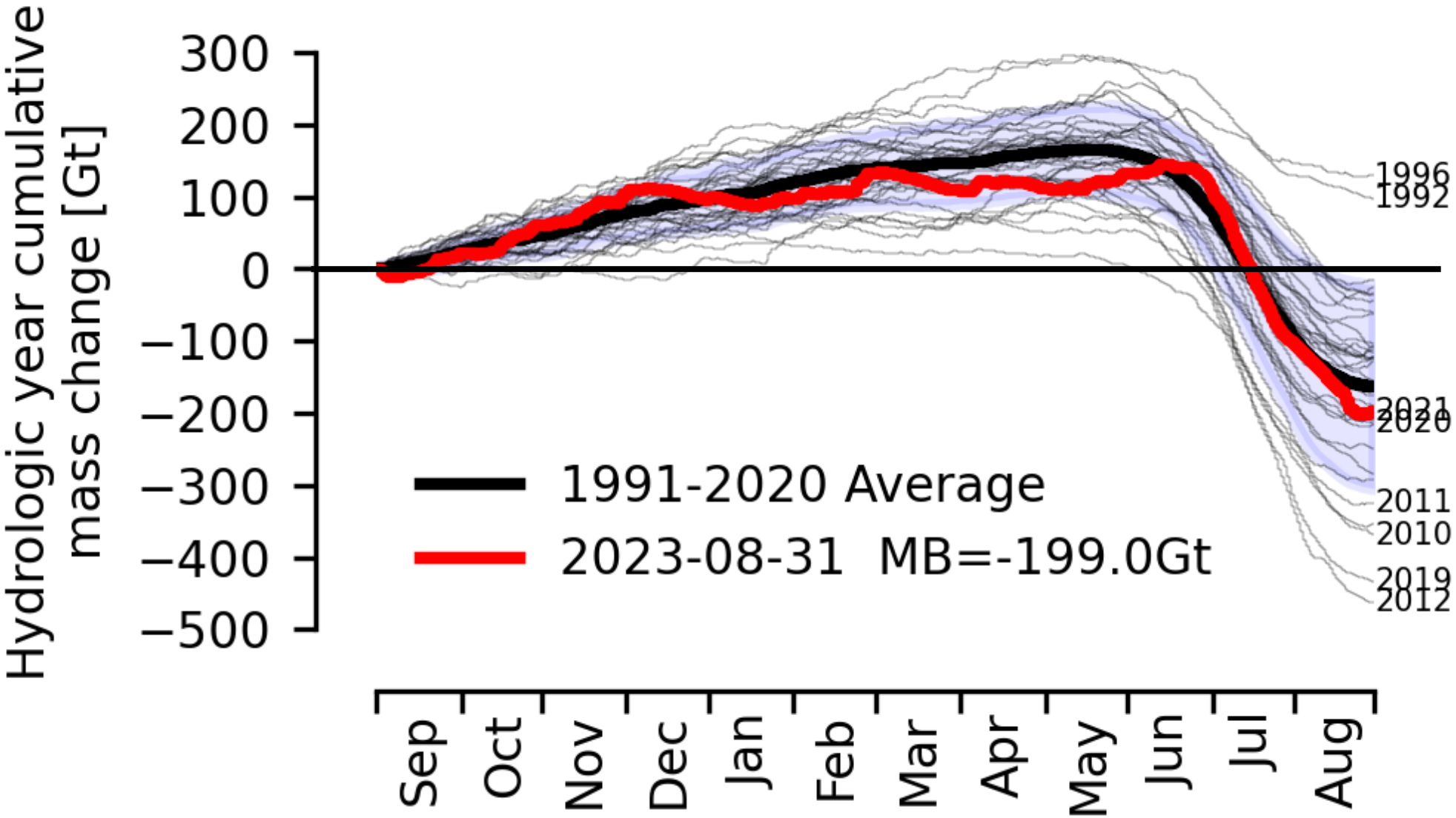
Mapping ice sheet velocity





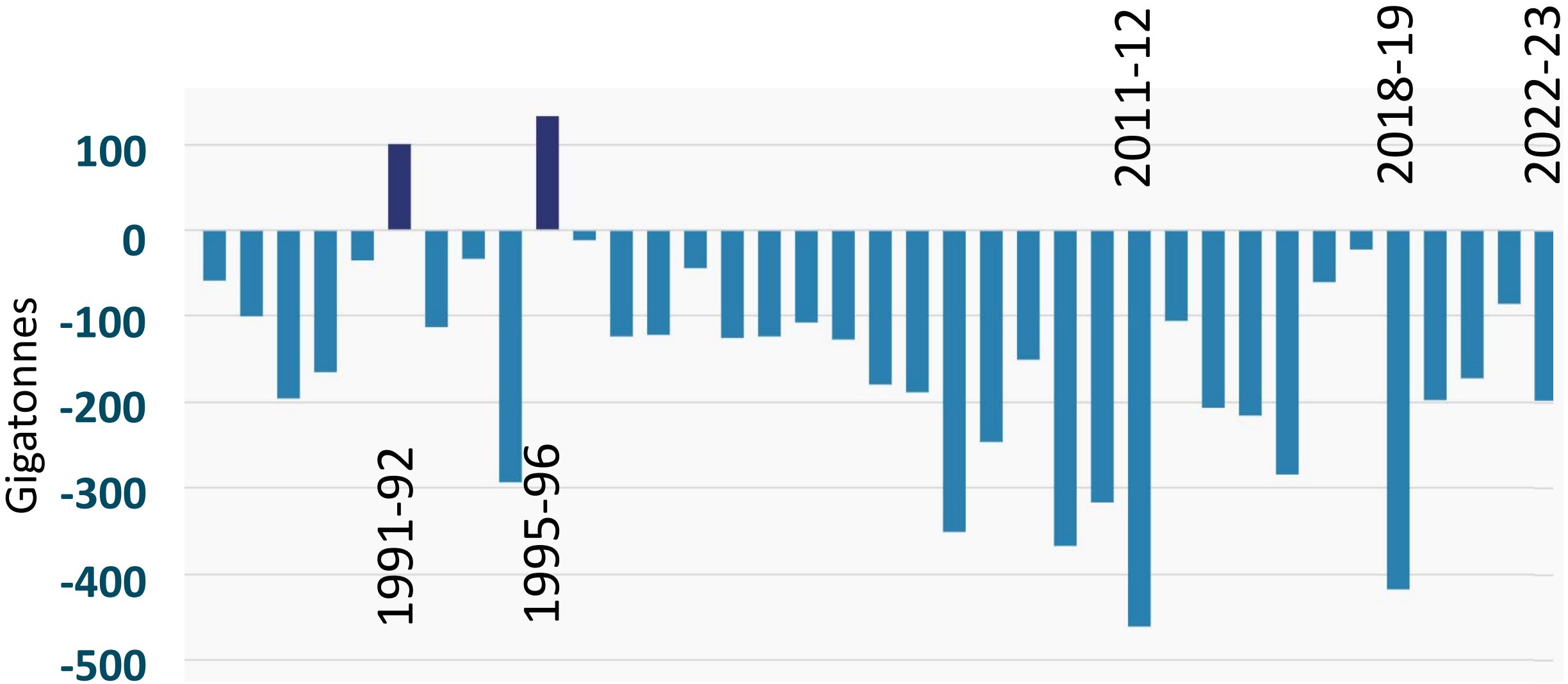
Total mass balance

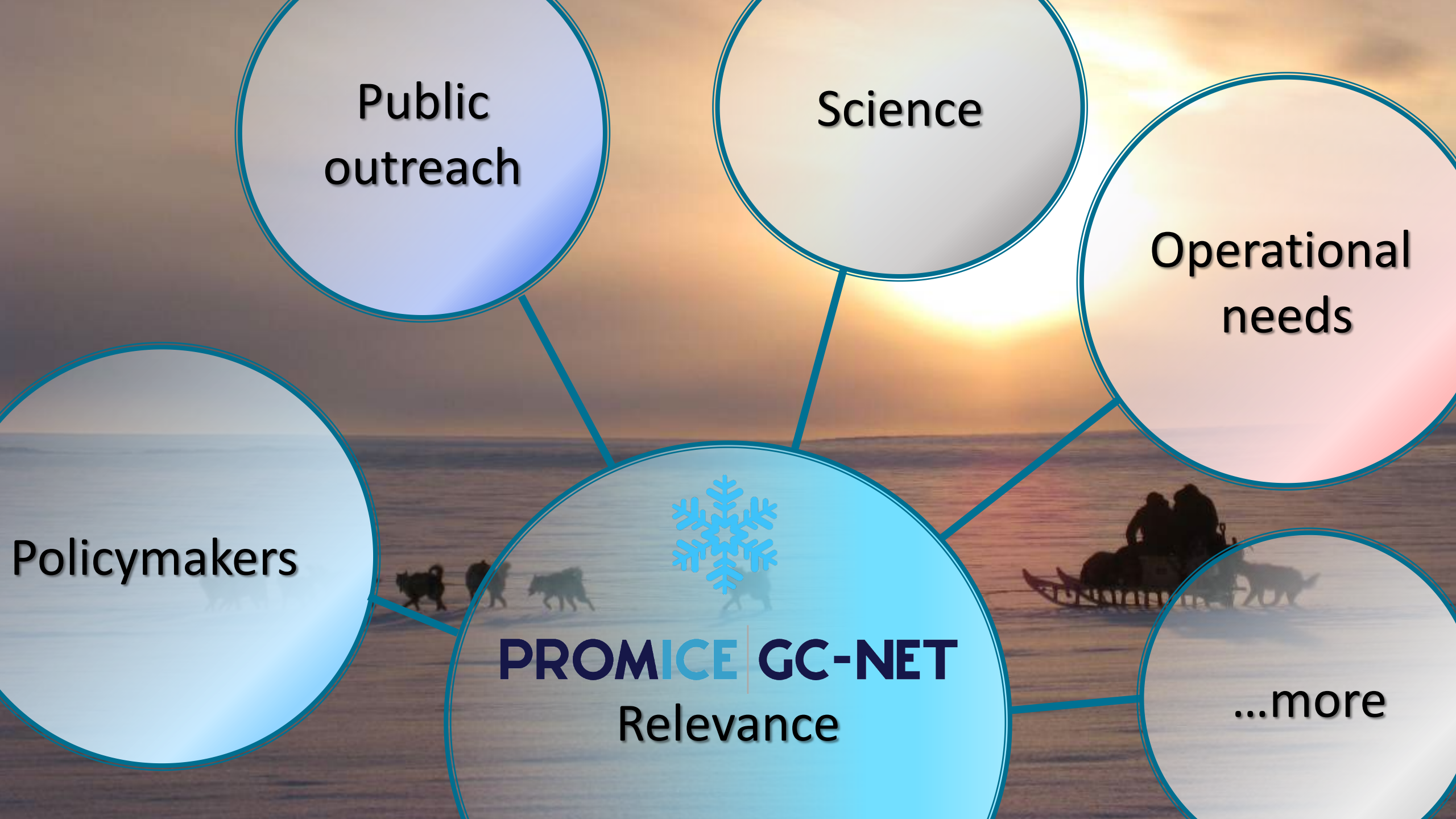
PROMICE | GC-NET



Total mass balance 1986-2023

PROMICE | GC-NET




Public outreach
Science
Operational needs
Policymakers
PROMICE | GC-NET
Relevance
...more

Synergies - examples

- International climate research
- Weather forecasting
- Hydropower feasibility
- Marine ecosystem modelling
- Monitoring permafrost geohazard
- Mineral exploration – green transition
- Accident Investigation Board
- Export of Greenlandic drinking water